Northeast Church Rock
95% Design Report

Appendix A:
General Design Information

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LIST OF ACRONYMS / ABBREVIATIONS

AOC	Administrative Settlement Agreement and Order on Consent for Design and Cost Recovery
ARAR	Applicable or Relevant and Appropriate Requirement
BMP	best management practice
CC	Construction Contractor
CSF	construction support facility
CY	cubic yard(s)
GSR	Green and Sustainable Remediation
ICIAP	Institutional Control Implementation Assurance Plan
LED	light emitting diode
LEED	Leadership in Energy and Environmental Design
Mill Site	Church Rock Mill Site
Mine Site	Northeast Church Rock Mine Site
MSOC	Mine Site outlet channel
NECR	Northeast Church Rock
NRC	US Nuclear Regulatory Commission
OM&M	Operations, Monitoring and Maintenance
PDSP	Phased Development Site Plan
PTW	principal threat waste
RA	Removal Action
RAL	removal action limit
RAO	Remedial Action Objective or Removal Action Objective
ROD	Record of Decision
SOW	Scope of Work
TDA	Tailings Disposal Area
USEPA	US Environmental Protection Agency

A.1 INTRODUCTION

This appendix to the Northeast Church Rock (NECR) 95% Design Report summarizes the general design information and includes:

- A description of the general section (Section 1) of the design drawings
- Reference to how the design addresses the Performance Standards contained in the Action Memorandum: Request for a Non-Time-Critical Removal Action at the Northeast Church Rock Site (2011 Action Memo; USEPA, 2011), the Record of Decision, United Nuclear Corporation Site (ROD; USEPA, 2013), and the Administrative Settlement Agreement and Order on Consent for Design and Cost Recovery (AOC; USEPA, 2015)
- A summary of the Removal Action (RA) elements and construction progression
- Green and Sustainable Remediation (GSR) considerations

A.2 PERFORMANCE STANDARDS

The Performance Standards presented here are defined 2011 Action Memo (USEPA, 2011), the ROD (USEPA, 2013), and the AOC (USEPA, 2015) including the Statement of Work attached as Appendix D to the AOC, and were developed to define attainment of the Removal Action and Remedial Action Objectives (RAOs) for the Selected Remedy. The Performance Standards include both general and specific standards applicable to the Selected Remedy work elements and associated work components. Table A.2-1 presents performance standards related to general design and explains how the design accomplishes these standards. In addition, each subsequent design appendix provides a similar performance standards table based on the table of performance standards included in the main text.

Table A.2-1: Performance Standards Applicable to General Design

Identifying Number*	Location of Performance Standard Requirement	Topic	Performance Standard	Comments
14	2015 AOC SOW, Paragraph 29 – Green Remediation Best Management Practices	Green Remediation Best Management Practices	Respondents shall incorporate applicable Best Management Practices for Green Remediation listed in ASTM-E2893-13 consistent with USEPA's policy Superfund Green Remediation Strategy (2010), found at http://www.epa.gov/superfund/greenremediation/sf-gr-strategy.pdf.	A general overview of GSR is discussed in Section A.5. The individual appendices include a description of GSR specific to the design components.
16	2015 AOC SOW, Paragraph 32 – Data Gaps	Data Gaps	If USEPA notifies Respondents that there are data gaps that must be addressed by field investigations or by additional analyses not specifically identified in this SOW, or if the Respondents identify such data gaps, then the Respondents shall submit to USEPA for review and approval an addendum to the PDSP that will include work plans for additional investigations and/or reports necessary as determined by USEPA to support the Design. Respondents shall perform the data gap investigations identified in the addendum to the PDSP once each work plan has been approved by USEPA. Respondents shall also submit reports documenting the results of each of the supplemental pre-design investigations within 60 days of completion of the investigation and receipt of any associated laboratory and/or geotechnical data.	An additional investigation was conducted after the 30% Design, a geotechnical evaluation of the Jetty area. This evaluation was conducted in November 2016 following USEPA approval of the work plan. The geotechnical evaluation report was submitted to USEPA with the interim deliverable for Appendix I on April 24, 2017, and is included as Attachment I.8 to Appendix I of the 95% Design Report. The results of laboratory testing conducted prior to April 2017 on samples collected from this investigation are included in Attachment I.8 to Appendix I. Laboratory testing results for geotechnical and agronomic testing conducted after April 2017 are summarized in Appendix H and Attachment U.2 to Appendix U, respectively.

Identifying Number*	Location of Performance Standard Requirement	Topic	Performance Standard	Comments
17	2015 AOC SOW, Paragraph 37 – Preliminary Design	Preliminary Design	Respondents shall submit to USEPA for review and approval a Preliminary Design based on the USEPA-approved preferred waste-Repository configuration when the design effort is approximately 30% complete but no later than 120 days from USEPA's approval of the Design Work Plan. Respondents shall include the following elements in their Preliminary Design: a. Finalized design assumptions and parameters from the Basis of Design/Design Criteria Report; b. Preliminary plans, drawings, and sketches, including design calculations; c. An outline of required specifications; d. A plan for additional field sampling, if needed; e. A traffic safety plan, including upgrades to local roads; f. A storm-water management plan; g. An air monitoring plan; h. A site control and security plan; i. A project delivery strategy; j. A preliminary construction schedule, including a schedule for applicable permit requirements; k. A material management plan that shall describe how all NECR Site mine waste, borrow material, backfill material, and cover material will be managed and transported. The material management plan shall include a map and description with coordinates of routes that will be used by heavy equipment and a map and description with coordinates of staging and stockpiling areas. For staging and stockpiling areas, the material management plan shall include a description of activities that will be associated with these areas; l. A description of how the principal threat waste will be segregated and a description of the facility or facilities being considered for disposal of Principal Threat Waste from the NECR Site; m. Detailed plans and specifications for backfilling and re-grading excavated areas of the NECR Site, which address the impacts of re-grading of storm water runoff on and downstream of the NECR Site; n. A permitting requirements and compliance plan that shall ensure all on-site activities meet the substantive (but not the administrative) requirements of environmental permitting regulations;	These items are addressed in the following parts of this report: a. Appendices B through I b. Plans in Volume 2, calculations in Attachments to Appendices B through I c. Appendix J d. Appendix I e. Appendix M f. Appendices E, F, and I g. Appendix Q h. Appendix M i. Main text j. Appendix K k. Appendices B, C, D and H l. Appendices B and C m. Appendix C n. Appendix N o. Appendix U p. Appendix G q. Appendix G r. Appendix V s. Appendix M, Q t. Appendices O and P u. Tables throughout the main text and appendices v. Appendix T w. Appendix U

Identifying Number*	Location of Performance Standard Requirement	Topic	Performance Standard	Comments
			o. A revegetation plan which shall describe the approach that Respondents shall take to revegetate the borrow areas, and other disturbed areas on the UNC Site; p. A water-balance model report that provides the following: A description of how water would behave in the short-term and over an extended period of time within the enhanced design of the tailings impoundment; and, if the water-balance model indicates that, as a result of Repository construction, there may be increased water seepage from the impoundment, analysis explaining how increased seepage would not adversely impact the existing groundwater; q. An evapotranspiration analysis which shall describe the complete water-balance model assumptions and calculations for the Repository cover system. Respondents' evaluation shall show the percolation response to design parameters such as rooting depth, the type of flora, cover thickness, cover soil properties, initial moisture content of the cover soils, and hydraulic conductivity; r. An outline of the construction quality assurance plan; s. Mitigation measures to minimize traffic, noise, dust and any other impacts to the community and environment t. Biological and cultural resources surveys or reports; u. A description of how the design complies with all Performance Standards, including ARARs; v. A description of procedures for cleanup verification at the NECR Site (including the step out areas), including an updated QAPP for verification sampling; and, w. A description of procedures for revegetation of the NECR Site, including the approach that Respondents shall use to revegetate the NECR Site and to maintain revegetated areas until vegetation is established.	
19	2015 AOC SOW, Paragraph 42 – Preliminary Design	Pre-Final Design	Respondents shall submit to USEPA for review and approval a Pre-Final Design which represents 95% completion. The Pre-Final Design shall be based on the USEPA approved Preliminary Design, or if one has been requested, the USEPA approved Intermediate Design, and shall include the following additional items:	These items are addressed in the following parts of this report: a. Appendix L b. Appendix X c. Appendix W d. Appendix R

Identifying Number*	Location of Performance Standard Requirement	Topic	Performance Standard	Comments
			a. A health and safety plan; b. An institutional control implementation and assurance plan ("ICIAP") that includes plans for implementing, maintaining, monitoring, and reporting on any institutional controls proposed in the design; c. A draft operation, monitoring, and maintenance plan; d. A release prevention/contingency plan; e. An emergency response plan; f. A construction quality assurance plan;	Incorporated into a. Appendix L b. Appendix V
20	2015 AOC SOW, Paragraph 43 – Preliminary Design	Pre-Final NECR Mine Cleanup Verification and Revegetation Plan	Respondents shall submit a Pre-Final NECR Mine Cleanup Verification and Revegetation Plan for the NECR Site that shall be a continuation and expansion of the Preliminary NECR Mine Cleanup Verification and Revegetation Plan, and any Intermediate Design.	The Pre-Final Cleanup Verification Plan is included as Appendix T and the Pre-Final Revegetation Plans are included in Appendix U
76, 79, 80	2011 Action Memo, Table A-1; 2013 ROD, Table 1 and Sections 2.9.2 and 2.9.5	Repository Design	40 CFR 192.02 (a) through (d). Control of residual radioactive materials. Refer to www.ecfr.gov.	The Repository cover and associated stormwater controls are designed to be effective for up to 1,000 years and at least 200 years, and to minimize reliance on active maintenance. The cover will attenuate radon flux to a rate of rate of 20 pCi/m^2-s, averaged over the surface and minimize infiltration into the existing Tailings Disposal Area (TDA). Also see appendices G and I.

*Refers to identifying numbers listed in Summary of ARARs, Performance Standards and Applicable NRC Design Requirements Table (provided in Attachment 1 to main text of the 95% Design Report)

A.3 ENGINEERING DESIGN DRAWINGS

The general section (Section 1) of the design drawings contains information related to site location, access, general location of existing and proposed facilities, site boundaries, survey control points, and standard symbols and abbreviations used in subsequent Drawings. The Section 1 drawings also depict the principal remedial components as well as the design Site topography and layout upon completion of the RA. The NECR engineering design drawings are contained in Volume II – Design Drawings. Drawings related to the general project information and the site overview are listed in Table A.3-1.

Table A.3-1: Engineering Design Drawings

Drawing No.	Drawing Title
1-01	Cover Sheet
1-02	Sheet Index
1-03	General Notes and Acronyms
1-04	Site Location Map
1-05	Principal Existing Condition, Site Features, and Survey Control
1-06	Existing Condition NECR Mine Site
1-07	Existing Condition UNC Site
1-08	Site Utilities
1-09	Principal Components and Limits of Disturbance
1-10	Final Reclaimed Topography

A.4 REMOVAL ACTION CONSTRUCTION PROGRESSION

The RA will comprise an Early Works element, the RA, a final demobilization and revegetation element, and a schedule-independent Pipeline Arroyo stabilization element, as summarized in the following sections. The preliminary RA schedule is included in Appendix K – Removal Action Schedule.

A.4.1 Early Works

The Early Works element includes preparation of the construction support facilities (CSFs), construction of access and haul roads, preparation of borrow areas, implementation of environmental monitoring, and implementation of stormwater and traffic controls.

A.4.1.1 Construction Support Facilities

The CSFs will be prepared for use during all phases of RA construction, and include security, construction laydown areas, construction water and fuel storage, Decontamination Area facilities (including vehicle decontamination pad, drainage controls, and personnel facilities such as showers, lockers and laundry), and facilities required for handling principal threat waste (PTW). The CSFs are shown on the Section 2 Drawings. Additional details regarding the CSFs are included in Appendix B – Construction Support Facilities.

Selected locations for the CSFs include the former mill facilities area of the Church Rock Mill Site (Mill Site), an area at the east end of the NECR Mine Site (Mine Site), and two proposed laydown yards: one west of the Tailings Disposal Area (TDA) and one immediately north of the Mill Site TDA. These areas are identified on the Drawings as:

- Former Mill Site Yard
- Mine Site Staging Area
- Repository Yard
- Optional Repository Yard

Additionally, support facilities are organized in areas using the following terms and definitions for the various work areas:

- Support: Area(s) free of contamination.
- Controlled: Area(s) with potential contamination.
- Exclusion: Area(s) with contamination subject to the RA (Mine Site and Repository).
- Decontamination Area: The transition area between the Controlled Area and the Support Area. This is where personnel enter and exit the Controlled Area and where most decontamination activities take place.

CSF construction activities will include:

- Site grading
- Infrastructure construction followed by placement of temporary support facilities
- Post-construction radiological surveys of staging areas and support facilities

A.4.1.2 Access and Haul Roads

Several access and haul roads will be constructed to support the RA. These road details are summarized below and shown on the Section 4 Drawings. Additional details regarding haul and access roads are included in Appendix D – Haul Routes.

Temporary access roads will be constructed to provide access to the CSFs in the Former Mill Site Yard and the Repository Yard(s).

A mine waste haul road will be constructed to haul mine waste excavated at the Mine Site to the Repository located at the Mill Site. The haul road will begin at the Mine Site and will be located roughly parallel to New Mexico Highway 566 (NM 566), until it crosses the highway near the north end of the TDA.

Haul roads will be constructed to access each of the four proposed borrow areas. Plans and profiles for the north, east, and west borrow haul roads are shown on the Section 4 Drawings. Haul road construction would be conducted from each borrow area to the edge of the TDA. Once on the TDA, borrow haul trucks would operate directly on the existing cover surface. Upon completion of the RA, areas of the Repository cover and the TDA cover subjected to haul traffic would be reconstructed to mitigate over-compaction of cover soils, or other damage that may occur from haul traffic.

The anticipated sequence of road construction will be:

- Access road construction, including stormwater controls
- Mine waste haul road construction, including stormwater controls
- Borrow haul road construction, including stormwater controls
- Reclamation of haul roads
- Post-construction radiological surveys of impacted areas of the NM 566, and haul and access roads,

A.4.1.3 Borrow Areas

Approximately 400,000 cubic yards (CY) of soil and rock are required for Repository construction plus approximately 200,000 CY of rock and other materials for stormwater structures, including general fill to meet surface design grades, for the cover system, and long-term stormwater controls. Four proposed on-site borrow areas have been identified to meet volume and material property requirements. These borrow areas are identified as the East, West, North, and South Borrow Areas, and are shown on the Section 8 Drawings. An additional proposed borrow source, the jetty excavation, was identified during the 95% NECR design. At least one of these borrow areas will be developed as they are needed for Repository construction. Other borrow areas will be developed as needed during the RA.

Other borrow sources include on-site stockpiles and off-site commercial pits or quarries. Additional details regarding the borrow materials are included in Appendix H – Borrow Areas.

A.4.2 Removal Action

The RA element consists of preparation of the Repository to receive mine waste, mine site removals, Repository cover construction, and construction of permanent stormwater controls at the Mill and Mine sites.

A.4.2.1 Repository

Mine waste will be placed in a Repository constructed on the TDA as shown on the Section 7 Drawings and summarized below. Additional details regarding the Repository design are included in Appendix G – Mine Waste Repository Design.

The existing radon barrier above the tailings in the TDA will be modified in-place to serve as the foundation layer for the Repository. The sequence for radon barrier improvement is as follows:

- Baseline gamma radiation survey
- Rock mulch and riprap removal

- Visual inspection of radon barrier to verify tailings were not exposed during the removal process
- If tailings have been exposed, conduct a post-excavation (one-minute) static gamma survey and excavate radon barrier in the vicinity of one of the branch swales so that the material can be placed back below the radon barrier
- Filling swales
- Radon barrier compaction

Following preparation of the radon barrier, the initial lifts of the perimeter stormwater berms will be constructed using clean borrow soils at the edge of waste. These berms will allow for containment of contact water within the Repository during waste placement. Waste will be spread in lifts for compaction. The perimeter slopes of the waste surface will be built as the material is placed and the stormwater berms can be raised, as needed, to provide clean cover material over the outer slopes of the waste.

Once the berms are no longer needed for stormwater control, the berms will be graded over the waste surface during placement of the soil cover layer.

Cover placement will be conducted after areas of the Repository reach their design capacity. The cover design entails an erosion protection layer consisting of a rock soil admixture layer overlying a soil layer. The thicknesses of these layers and the sizes of the rock used for erosion protection vary based on locations on the Repository, with an overall cover thickness (including erosion protection layers) of 4 feet.

A.4.2.2 Mine Site

The Mine Site removals are divided into six phases of excavation, with a total estimated volume of about 761,000 CY. Mine site removals will include:

- Excavation of soils within the Mine Site above bedrock and with measured activity concentrations above the 2.24 pCi/g radium-226 removal action limit (RAL) or uranium concentrations above 230 mg/kg
- Disposal of mine site debris
- Transportation of excavated materials to the Mill Site Repository location or off-site as required for PTW
- Confirmation surveys to demonstrate that remaining materials within the Mine Site have measured activity concentrations below USEPA action levels
- Construction and maintenance of temporary stormwater controls during removal activity
- Mine Site excavation area final grading
- Mine Site restoration

Additional details regarding Mine Site removals are included in Appendix C – Mine Site Removals Excavations and Demolition. Additional details regarding verification surveys are included in Appendix T – Cleanup Verification Plan. Additional details regarding temporary stormwater controls are included in Appendix E – Stormwater Management Plan, as well as the other parts of the design documents.

A.4.2.3 Permanent Stormwater Controls

A.4.2.3.1 Mine Site Stormwater Controls

As part of the RA, the Mine Site outlet channel (MSOC) will be modified to convey stormwater from the Mine Site to minimize scouring of the existing engineered channel and unimproved sections of the downstream Unnamed Arroyo No. 1. These modifications will contain the predicted 100-year flood so that it does not impact homes located near the MSOC (Unnamed

Arroyo No. 1). The proposed channel improvements are shown on the Section 6 Drawings and will be constructed upon completion of the mine site removals. Additional detail is included in Appendix F – Mine Site Stormwater Controls.

A.4.2.3.2 Mill Site Stormwater Controls

Permanent stormwater controls for the Mill Site Repository use existing swales and channels constructed for the TDA with improvements and supplemental controls where necessary. These stormwater controls, shown on the Section 9 Drawings, include:

- North Diversion Channel
- East Repository Channel and related sediment controls
- Repository southwest and west side drainage

The East Repository Channel and related sediment controls will be constructed early in the RA to provide upstream stormwater control and to avoid construction constraints due to limited space if they are constructed after waste placement. The remaining Mill Site stormwater controls will be constructed after waste placement is completed and it is verified that any downstream contamination in these areas has been mitigated. Additional detail is included in Appendix I – Mill Site Stormwater Controls.

A.4.3 Demobilization and Revegetation

Upon completion of the RA, areas subject to mine waste removals will be graded as shown in the Section 3 Drawings, borrow areas will be graded as shown in the Section 8 Drawings, and the Repository cover surface will be graded as shown in the Section 7 Drawings.

Haul roads, access roads, and ground areas used for CSFs within the Exclusion Area will also be subject to final cleanup and verification in accordance with Appendix T. Trailers and equipment used within the Exclusion Area will be scanned and decontaminated (if required). Reclamation would consist of removal of imported gravel surfacing, removal of temporary culverts and stormwater controls, and grading according to the final approved post-reclamation grading plans.

Revegetation will be conducted in accordance with the plans in Appendix U – Revegetation Plans.

A.4.4 Pipeline Arroyo Stabilization

The Pipeline Arroyo is an existing ephemeral arroyo that runs along the northwest side of the TDA. Stability of the Pipeline Arroyo is important for long-term viability of the Repository and the TDA, as lateral southeastward migration of the arroyo could create embankment erosion, with significant erosion resulting in release of mine waste or tailings. The Section 9 Drawings show the design for the reconstructed rock jetty with a riprap chute designed for floods up to the Probable Maximum Flood. Additional detail on the design for the reconstructed rock jetty is included in Appendix I – Mill Site Stormwater Controls.

A.5 GREEN AND SUSTAINABLE REMEDIATION CONSIDERATIONS

Section 4.2.1 of the 95% Design Report includes an overview of the GSR evaluation and applicable best management practices (BMPs) that have been selected for implementation at the NECR RA. Specific GSR concepts to various parts of the design are included in subsequent design appendices. Steps 1 and 2 of the BMP Process involves identifying potential applicable BMPs to each phase of cleanup activities (ASTM, 2016). Table A.5-1 presents potentially applicable BMPs to the NECR RA, which BMPs have been determined to be appropriate for implementation at the site and why some have not been considered.

Table A.5-1: BMPs Selected during Step 1 and Step 2 of the BMP Process with Projected Impact and Decision to Carry BMP into Implementation

BMP	Impact[1]	Selected for Implementation	Location in RDR	Comment
Use of energy star compliant equipment and premium-efficiency motors as available and prudent	Medium	Yes	B.7.1	
Purchase of renewable energy for CSFs. This includes using renewable energy (photovoltaic cells and/or small wind turbines) for power. Use electric generators in place of diesel/gasoline generators if it is possible to extend local power lines to site or purchase of green energy from utility (e.g., Blue Sky Program)	Medium	Yes	B.7.1	Use of alternative energy to supplement existing power will be suggested for contractors but will ultimately be at the discretion of the Construction Contractor (CC).
Transporting workers from centralized carpool and bus locations to the work site	Medium	Yes	B.7.2	
Maintaining a single point of entry/exit to the remedial area helps prevent re-contamination of areas previously remediated while minimizing required support facilities.	High	Yes	B.7.3	
Use of LEED-certified portable structures or if LEED-certified structures are not cost effective, utilize LEED principles when possible. This can include use of low energy light bulbs (i.e. LEDs), use of passive cooling instead of air conditioning when possible	Medium	Yes	B.7.1	Will include in specifications but will ultimately be at the discretion of the CC.
Minimize site grading for construction facilities and associated roads to reduce required construction equipment operating time, greenhouse gas emissions and fill material	High	Yes	B.7.1	Construction facility grading and site wide grading has been designed with the aim of minimizing required grading and cut/fill.
Use of 'Green' concrete with a percentage of fly ash if concrete is required	Medium	Yes	F.6.1, E.7.1	CSFs will not utilize concrete
Consolidate CSFs in one area to minimize disturbance of remedial area and reduce emissions used to drive from facility to facility	Low	Yes	B.7.3	
Plan for access roads to be used as permanent roads if needed, this reduces the requirement for construction of new roads at the end of the remedial activities	High	No		Access roads are not planned to be used as permanent roads.
Use alternative vehicles such as electric vehicles, hybrid vehicles and compressed natural gas vehicles to reduce on-site emissions and fuel use	Low	No		Such requirements would likely limit number of local contractors eligible for bidding.
Optimizing number of vehicles used for support activities	Medium	Yes	B.7.2	Construction contractors will be instructed to optimize vehicle use and size.
Use products with recycled and bio-based contents instead of petroleum based	Low	Yes	B.7.1	Construction contractors will be encouraged to use recycled products when possible.
Designate collection points for routine recycling of single-use items such as metal, plastic, and glass containers; paper and cardboard; and other items that may be recycled locally	Low	Yes	B.7.3	
Utilize existing facilities for construction support facilities when possible	Medium	Yes	B.7.1	
Plan excavation and placement to avoid moving material more than once, reducing the fuel and emissions created by multiple stock-piling and moving locations	Medium	Yes	D.6.3	
Sizing equipment correctly with the task needs thereby minimizing use of heavy equipment for small tasks	High	Yes	D.6	
Phasing of construction activities to avoid recontamination of remediated areas	High	Yes	C.4.6	
If possible, use rails in place of trucks shipping of contaminated waste	Low	No		No rail routes near site
Implementation of a no-idle policy and speed limit signs for all construction equipment and support vehicles	High	Yes	B.7.2	Idle restrictions will be required of construction contractors through Technical Specifications (Appendix J)
Routine, on-time maintenance of equipment to improve efficiency and prevent unnecessary breakdown requiring additional resources and transport for repairs	Medium	Yes	B.7.2	
Require new, energy efficient engines	Medium	Yes	B.7.2	Require use of Tier 2 non-road diesel engines or better. Concerns that stricter requirements would make local contractors uncompetitive, which represents a major GSR goal.
Use of ultra-low sulfur diesel in construction equipment and support vehicles, including use of biodiesel where possible	Medium	Yes	B.7.2	

BMP	Impact[1]	Selected for Implementation	Location in RDR	Comment
Requiring low-maintenance multistage filters for cleaner engine exhaust	Low	No		Vehicle requirements, as described above, will be utilized to reduce emissions.
Use biodegradable fabric to cover excavated areas which act to control erosion and serve as substrate for regrowth	Medium	Yes	U Section 2.4	
Reusing covers that secure and cover material in open trucks during off-site transport	Low	Yes	C.6.1	
Limit speeds (10-15 MPH) in order to reduce production of dust and improve fuel efficiency	High	Yes	D.6.1	
Where possible, use biodegradable tarps and mats for dust suppression rather than using water	Low	Yes	C.4.6/E.7.1	
Use phosphate-free detergents in place of organic solvents or acids for decontamination of equipment	Low	Yes	Appendix J	Use of phosphate-free detergents will be required in specifications.
Evaluate potential of using excavated areas as retention basins in final stormwater control plans	High	Yes	H.4.1.1	Soil excavated during the jetty improvement work will be utilized as clean fill.
Re-grade excavation areas to conform to pre-mining topography, rather than altering the site's natural setting, to improve the cover's long-term performance and protect local ecosystem services.	Medium	Yes	Appendix G	Where possible reclamation of disturbed areas will attempt to return disturbed areas to their natural state.
Where possible use products, packing material and disposable equipment that can be reused or recycled and where possible, are made of recycled materials	Low	Yes	B.7.1	
Stockpile uncontaminated soil for use as fill or other purposes	High	Yes	Appendix G	Design strategy aims to maximize use of uncontaminated cut when possible.
Salvage uncontaminated objects with potential recycle, resale or donation.	Medium	Yes	G.13.1	Erosion protection rock removed from TDA cover will be utilized for Repository cover.
Use local staff (including subcontractors) when possible to minimize transportation impacts	Medium	Yes	Appendix S	Local contractors will be given priority over non-local contractors
Maintaining a single point of entry/exit to the remedial area helps prevent re-contamination of areas previously remediated while minimizing required support facilities.	High	Yes	D.6.3	
Use of ultra-low sulfur diesel in construction equipment and support vehicles	Medium	Yes	B.7.2	
Minimize speed to reduce dust creation and minimize water use for dust suppression	Medium	Yes	B.7.2, D.6.3	
Consider use of rumble grates with a closed-loop graywater washing system to minimize tracking of contaminated sediment and soil offsite	Low	No		Decontamination procedure is more rigorous than use of rumble grates.
Optimize haul routes to minimize vehicle miles	Medium	Yes	B.6.3	
Installation of silt fences and basins and other stormwater BMPs to capture sediment runoff along sloped areas	Medium	Yes	Attachment E.1	
Construction of long-term structural controls such as earth dikes and swales to prevent up-gradient surface flow into excavated areas	Medium	Yes	Attachment E.1	
Segregating contaminated water from clean water to minimize volume of stormwater requiring treatment	High	Yes	E.7.3	
Diverting clean water away from pits and remediation activities to prevent potential contamination	High	Yes	E.7.3	CC will be responsible for fulfilling this BMP in their CSWPPP.
Select drought-resistant plants for the upper vegetative layer, to reduce maintenance needs	High	Yes	App G.13 & App U	
Use nonsynthetic nutritional soil amendments such as compost or biochar instead of chemical fertilizers	Medium	Yes	App G.13.1 & App U	
Use recycled materials for capillary breaks instead of natural rock to minimize ecosystem disturbance	Medium	Yes	App G.13.1	Site location would make importing recycled concrete not in line with emission reduction policies. Some rock for the Repository cover will be sourced from existing erosion protection rock on a previously used cover. When possible other rock and materials from the site will be utilized for temporary roads or laydown areas.

BMP	Impact[1]	Selected for Implementation	Location in RDR	Comment
Use geotextile fabric or drainage tubing composed of 100% recycled materials rather than virgin materials for lining, erosion control and drainage	Medium	Yes	App G.13.1	
Use uncontaminated soil, sediment or sand rather than importing soils if possible. If importing soils is necessary, consider using industrial waste products as partial substitutes for cap soil	High	Yes	Appendix H	
Blend amendments into a single mixture that can be applied above the cover through a one-step process rather than a series of applications, to minimize operation of front loaders and other heavy machinery	High	Yes	App G.13.2	
Operation, Monitoring and Maintenance (OM&M) Procedures: Use in-place soil depth indicators rather than manual depth probes to monitor cap thickness in order to minimize cover damage during inspection	Low	Yes	W.6.2.1	
OM&M Procedures: Use remotely controlled or non-invasive techniques to avoid cover damage and minimize field visits	Low	Yes	Appendix U	Revegetation monitoring will incorporate 'laser point bars' to acquire high resolution coverage data while minimizing disturbance and time.
OM&M Procedures: Integrate onsite structures to capture rainfall as a source of water for rinsing and decontaminating field equipment	Low	No		Decontamination procedures are minimal for site OM&M and utilizing on-site water well can provide more than enough water without requiring additional construction.
Use non-chemical solarizing techniques for soil preparation	Low	No		Seeding contractor does not recommend use of solarizing for particular soil and environment.
Use minimum slope while maintaining proper drainage to reduce the volume of fill material	High	Yes	G.13.3	
Use of nearest qualifying source for borrow material to reduce fuel emissions associated with increased transportation	High	Yes	H.4.1	While on-sight borrow sources that are closer to the Mine Site may exist, it was determined to be more in line with GSR principles to utilize previously disturbed borrow sources located on-site; however, haul distances have been minimized so that the nearest borrow source is utilized for each activity.
Sizing equipment correctly with the task needs thereby minimizing use of heavy equipment for small tasks	High	Yes	Appendix H	
Throughout project re-evaluate volume of borrow needed in order to avoid over excavating and transportation of borrow source	Low-High	Yes	H.5	
Restoration of land surface within a timely manner to minimize erosion and prevent growth of invasive species	High	Yes	H.5/G.13.3	
Enhancements of habitat, in the form of trees and other native landscaping to be completed following construction	Medium	Yes	H.5/G.13	
Minimizing soil and habitat disturbance of stormwater controls and effluent pipelines by aligning them with existing or proposed roadways	High	Yes	D.6.3	
Prioritize prevention of noxious weeds via inspections rather than reactive application of herbicides.	Medium	Yes	Appendix U	

1-Low, medium and high are relative designations that represent a qualitative judgment and is not meant to be a quantitative expression.

A.6 REFERENCES

ASTM International, 2016. ASTM Standard E2893-16, "Standard Guide for Greener Cleanups," ASTM International, West Conshohocken, PA, 2016, DOI: 10.1520/E2893-16E01, www.astm.org.

US Environmental Protection Agency (USEPA), 2011. Action Memorandum: Request for a Non-Time-Critical Removal Action at the Northeast Church Rock Mine Site, McKinley County, New Mexico, Pinedale Chapter of the Navajo Nation. Prepared for U.S. EPA Regions 6 and 9. September 29.

US Environmental Protection Agency (USEPA), 2013. Record of Decision, United Nuclear Corporation Site, McKinley County, New Mexico, EPA ID: NMD030443303. March 29.

US Environmental Protection Agency (USEPA), 2015. Administrative Settlement Agreement and Order on Consent for Design and Cost Recovery. April 27

Northeast Church Rock
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Appendix B:
Construction Support Facilities

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LIST OF ACRONYMS

AOC	Administrative Settlement Agreement and Order on Consent for Design and Cost Recovery
ARAR	Applicable or Relevant and Appropriate Requirements
BGS	below ground surface
BMP	best management practice
CC	Construction Contractor
CSF	construction support facility
CSWPPP	Construction Stormwater Pollution Prevention Plan
CY	cubic yard(s)
gpm	gallons per minute
GSR	Green and Sustainable Remediation
LED	light emitting diode
LEED	Leadership in Energy and Engineering Design
Mill Site	Church Rock Mill Site
Mine Site	Northeast Church Rock Mine Site
NECR	Northeast Church Rock
NRC	US Nuclear Regulatory Commission
PTW	principal threat waste
RA	Removal Action
RAO	Remedial Action Objective
ROD	Record of Decision
SF	square feet
TDA	Tailings Disposal Area
USDOT	US Department of Transportation
USEPA	US Environmental Protection Agency

B.1 INTRODUCTION

This appendix to the NECR 95% Design Report presents design information for the construction support facilities (CSFs) at the Northeast Church Rock Mine Site (Mine Site) and the Church Rock Mill Site (Mill Site). Specifically, this appendix discusses the layout, configuration, construction and removal (following use) of these facilities.

The CSFs will be located (1) at the east end of the Mine Site, (2) immediately west and/or north of the Repository, and (3) within the former mill facilities area of the Mil Site as illustrated on the Drawings. These facilities include Removal Action (RA) security, construction laydown areas, construction water and fuel storage, and Decontamination Area facilities (including vehicle decontamination pad, drainage controls, and personnel facilities such as showers, lockers and laundry). Facilities required for handling of principal threat waste (PTW) are also discussed herein.

Haul roads for access to support facilities and haul roads constructed to support mine waste excavation and disposal are discussed in Appendix D.

This 95% design presents the physical space required to accommodate the various CSFs and to meet the performance standards specified in the Administrative Settlement Agreement and Order on Consent for Design and Cost Recovery (AOC, USEPA, 2015).

This appendix:

- Demonstrates attainment of applicable standards identified in the Record of Decision (ROD; USEPA 2013).
- Explains the rationale for the proposed location and configuration of the construction support facilities.
- Depicts the designed configuration and layout of the construction support facilities.
- Discusses the sequence for site preparation and construction of the support facilities and subsequent removal of these facilities.
- Presents Green and Sustainable Remediation (GSR) considerations for this design component.

B.2 PERFORMANCE STANDARDS

The Performance Standards presented here are defined in the Action Memorandum: Request for a Non-Time-Critical Removal Action at the Northeast Church Rock Site (2011 Action Memo; USEPA, 2011), the Record of Decision, United Nuclear Corporation Site, (USEPA, 2013), and the Administrative Settlement Agreement and Order on Consent for Design and Cost Recovery (USEPA, 2015) including the Statement of Work attached as Appendix D to the AOC, and were developed to define attainment of the Removal Action and Remedial Action Objectives (RAOs) for the Selected Remedy. The Performance Standards include both general and specific standards applicable to the Selected Remedy work elements and associated work components. Table B.2-1 presents performance standards related to the construction support facilities and explains how the design accomplishes these standards.

Table B.2-1: Task Specific Performance Standards

Identifying Number*	Location of Performance Standard Requirement	Topic	Performance Standard	Comments
99	10 CFR 61.51(a)(2)	Site Controls and Security	10 CFR 61.42 Refer to www.ecfr.gov.	Site access control will prevent inadvertent intrusion from individuals during RA operations (see Section B.4).
41	2013 ROD, Section 2.9.5 – Site Controls and Security	Site Controls and Security	During response activities access will be restricted by construction of a temporary fence. Domestic livestock or unauthorized persons would not be allowed to enter.	Design provides site access controls. See Section B.4 and Section 2 Drawings
42	2013 ROD, Section 2.9.5 – Site Preparation Activities	Site Preparation	Include an underground utility survey to identify and/or verify the location of subsurface utilities in areas scheduled for consolidation and disposal; identification of heavy equipment routes; and temporary stockpiling activities. These temporary stockpiling activities refer to an area where mine waste will be placed in preparation for placement within the Tailings Disposal Area. A land survey will be completed to delineate the parts of the Tailings Disposal Area that will be used for mine waste disposal. Site construction activities necessary to prepare the site for mine waste placement will be completed. Existing structures such as culverts, catch basins, foundations, and vaults will be decontaminated where practical, disassembled for future use, demolished for removal, or included within the disposal area.	Requirement for utility survey is noted in Section B.4. Other requirements of this performance standard do not apply to Appendix B.
59	2013 ROD, Table 1	Repository Design	10 CFR §61.41 Protection of the general population from releases of radioactivity. Refer to www.ecfr.gov.	Support facilities are organized into areas for contamination control. See Section B.4.
4	2015 AOC SOW, Paragraph 19 – Site Controls and Security	Site Controls and Security	In the Design, Respondents shall include plans and specifications for security for the SA Site to prevent access by unauthorized humans and livestock during the construction of the remedy. Respondents shall include plans and specifications for a fence, cattle guards and other security features, as needed.	Design provides site access controls. See Section B.4 and Section 2 Drawings

Identifying Number*	Location of Performance Standard Requirement	Topic	Performance Standard	Comments
5	2015 AOC SOW, Paragraph 20 – Site Preparation Activities	Site Preparation	In the Design, Respondents shall include detailed plans and specifications for the following site preparation activities: a. An underground utility survey for the identification and verification of the location of subsurface utilities in SA Site areas that will be used for consolidation or disposal; b. A land survey that will delineate the parts of the Tailings Disposal Area that will be used for NECR Site contaminated soil and mine waste disposal; c. A description of construction activities to be undertaken on the portion of the SA Site that is at the UNC Site in order to prepare for placement of the NECR Site contaminated soil and mine waste in the Tailings Disposal Area; d. A description of the methods that will be used to decontaminate existing structures such as culverts, catch basins, foundations, and vaults; and, where decontamination is not practicable, a description of methods that shall be used to disassemble these structures, demolish and remove these structures, or include these structures within the Tailings Disposal Area.	a. Requirement for utility survey is noted in Section B.4. b. See Appendix J – Technical Specifications c. See Appendix G – Waste Repository Design d. See Appendix C – Mine Site Removal Excavations and Demolition and Appendix J – Technical Specifications
7	2015 AOC SOW, Paragraph 22 – Temporary On-Site Facilities	Temporary On-Site Facilities	In the Design, Respondents shall include detailed plans and specifications for temporary on-site facilities for project management and project control. Respondents shall include detailed plans and specifications for facilities that enable the decontamination of personnel and equipment, the storage of decontamination equipment (e.g., tools, salvageable equipment, passenger vehicles and heavy equipment), and the staging of contaminated soil and mine waste.	Design of support and decontamination facilities is addressed in Section B.4. PTW handling is addressed in Section B.4.5.
14	2015 AOC SOW, Paragraph 29 – Green Remediation Best Practices Management	Green Remediation Best Management Practices	Respondents shall incorporate applicable Best Management Practices for Green Remediation listed in ASTM-E2893-13 consistent with USEPA's policy Superfund Green Remediation Strategy (2010), found at http://www.epa.gov/superfund/greenremediation/sf-gr-strategy.pdf.	Addressed in Section B.6.
2	2015 AOC SOW, Paragraph 17 – Soil Transport and Management	Soil Transport and Management	In the Design, Respondents shall provide detailed plans and specifications explaining how mine waste from the NECR Site and other materials (including borrow, backfill, and cover materials) will be managed and transported. Respondents shall include details for ensuring that Principal Threat Waste from the NECR Site, as described in the 2011 Action Memo, is not transported to the UNC Site or disposed at the Tailings Disposal Area.	The CSFs described in this Appendix will be used by the Contractor to manage and transport the site materials. Specifics on handling of PTW are described in Appendices C and T.

*Refers to identifying numbers listed in Summary of ARARs, Performance Standards and Applicable NRC Design Requirements Table (provided in Attachment 1 to main text of the 95% Design Report)

B.3 ENGINEERING DESIGN DRAWINGS

The engineering design drawings are contained in Volume II – Design Drawings (Section 2). Drawings related to construction support facilities are listed in Table B.3-1.

Table B.3-1: Engineering Design Drawings

Drawing No.	Drawing Title
2-01	Early Works and Construction Support Facilities
2-02	Former Mill Site Yard
2-03	Repository Yards
2-04	Mine Site Yard
2-05	Details

B.4 CONSTRUCTION SUPPORT FACILITIES

Support facilities will be constructed during the early stages of the RA. Locations selected for the support facilities are within the Mine Site and Mill Site, but out of the way of the mine waste excavation and disposal activities of the RA. All facilities will be removed at the end of the RA, with the exception of pavement placed at the former mill site yard. Support facilities are designed to provide contamination control through segregation of contaminated and non-contaminated materials and activities. A summary table listing the required construction support facilities including functional description, size or required area, and location is included as Table B.4-1.

Selected locations for the CSFs include: (1) the former mill facilities area of the Mill Site, (2) an impacted area at the east end of the Mine Site, and (3) previously un-impacted areas immediately north and west of the TDA. These areas are identified on the Drawings as:

- Former Mill Site Yard
- Mine Site Staging Area
- Repository Yard
- Optional Repository Yard

Additionally, support facilities are organized in areas using the following terms and definitions for the various work areas:

- Support: Area(s) free of contamination.
- Controlled: Area(s) with potential contamination.
- Exclusion: Area(s) with contamination subject to the RA (Mine Site and Repository).
- Decontamination Area: The transition area between the Controlled Area and the Support Area. This is where personnel enter and exit the Controlled Area and where most decontamination activities take place.

The overall design of these facilities is based on the anticipated space requirements of the Construction Contractor (CC), information from previous investigations and studies, and historical knowledge of the Mine and Mill sites. It will be the selected CC's responsibility to meet the requirements identified in the specifications and to facilitate performance of the work. The layout of many, but not all, of the CSFs will be left to the CC's discretion; however, specific requirements for each area/facility will be included in a performance specification. Certain facilities, such as those that require collection and containment systems, will be located in designated areas, and constructed as shown on the Drawings. A support facility performance specification is included as part of Appendix J – Technical Specifications.

The primary stormwater control features for the CSFs planned as part of this 95% design are shown on the Section 2 Drawings and discussed in Section B.4.8.

Site preparation activities will include an underground utility survey and overhead utility awareness and mitigation as prudent. Best Management Practice (BMP) installations for sediment and stormwater controls will be installed prior to ground disturbing activities such as stripping and stockpiling of topsoil and organics.

The Controlled and Decontamination Areas will be subject to final clean-up and verification upon removal of materials, facilities and equipment accommodated during construction. Cleanup verification is discussed in Appendix T. Upon completion of final clean up and verification, the areas used for construction support facilities will be reclaimed to original condition, or as otherwise indicated by the approved design.

Table B.4-1: Summary of Construction Support Facilities

Area Designation	Function/Use	Location	Approximate Size	Notes/Comments
Security Shacks (North and South)	Access control to Site for all RA related traffic. Scale used for PTW transport and imported materials verification.	Former Mill Site Yard – Support Area	2,500 SF (x2)	Place scale back in service. Existing paved driveway will be used for daily personnel and visitor entry and exit. Entrance near the truck scale will be used for heavy equipment entry and exit. PTW trucks will enter using the paved driveway and exit via the truck scale.
Parking	Parking for daily personnel and visitors.	Former Mill Site Yard – Support Area	25,000 SF	Contractor's clean yard is located at the Repository Yard(s).
Construction Offices	Area for construction offices (for contractor foremen, site engineer, etc.) Will be used as the primary sign-in location for all Site visitors (does not include Site worker sign-in/out).	Former Mill Site Yard – Support Area	20,000 SF	Assumes use of portable trailers (ATCO or similar) of various sizes for office facilities and Conex boxes for storage facilities. Sufficient space for several trailers. CC will determine configuration.
Fuel Farm Area	This area will be used for bulk fuel storage for mobile fuel trucks. Located within the Support Area to facilitate deliveries without decontamination of delivery trucks. The area will be adjacent to the Support Area perimeter fence to facilitate filling of fuel trucks located within the Exclusion Area.	Former Mill Site Yard – Support Area	5,000 SF	Equipment fueling will be conducted with mobile fuel trucks. CC will be responsible for implementing spill containment measures according to an approved spill containment and cleanup plan (submitted by the CC). An additional fuel farm could be placed in the Repository Yard for fueling of Repository cover construction equipment. Sufficient space for placement and secondary containment of 5,000 to 10,000 gallons of fuel storage, plus room for fuel transfer.
Water Storage	This area will be used for bulk water storage. Located within the Support Area to facilitate filling of water trucks operating in the Support Area and the Exclusion Area.	Former Mill Site Yard – Support Area	5,000 SF	Assumes use of portable tanks and temporary pipe connection to the Mill Site well.
Parking and Yard	Area for: (1) Construction crew to be dropped off and picked up by shuttle vehicles, (2) Exclusion Area vehicle parking, and (3) construction support equipment, maintenance work, storage units, support trailers, etc.	Former Mill Site Yard – Controlled Area	50,000 SF	Light vehicles kept within the Exclusion Area will not require daily decontamination. Layout and utilization to be determined by CC.
Decontamination Shack	Decontamination equipment storage and maintenance area.	Former Mill Site Yard – Decontamination Area	2,500 SF	Assumes use of portable trailer (ATCO or similar) and Conex boxes for equipment storage and maintenance.
Crew Lunch Area	Area for: (1) Contractor trailers for crew lunches, safety meetings, etc., and (2) sanitary facilities.	Former Mill Site Yard – Support Area	10,000 SF	Assumes use of portable trailers (ATCO or similar). This area will be adjacent to the Personnel Decontamination Area to promote efficient flow of construction crew members through the decontamination facilities and to/from the lunch trailers and pick-up/drop-off area at shift change.
Crew Decontamination Area	Area for decontamination trailers and laundry facilities. Flow of personnel to/from this area will be controlled by fencing and gates. Construction crew will sign in/sign out when moving through decontamination trailer at lunch breaks and shift changes.	Former Mill Site Yard – Decontamination Area	10,000 SF	Decontamination facilities must include clean side (Support Area) and dirty side (Exclusion Area) change rooms for construction workers to change into and out of work coveralls and boots. Lockers must be available in each change room for each Site worker to store of personal items. The facilities also must include scanning equipment, a sign in/sign out area, clearly defined Controlled Area (potentially contaminated) and Support Area (clean) sides, and decontamination showers (to be used as necessary). Laundry facilities will be available in this area for weekly cleaning of worker coveralls. Gray water from the decontamination facilities will drain to decontamination pad sump.
Vehicle Decontamination Area (Primary)	Area for scanning and decontamination of vehicles and equipment leaving the Exclusion Area. This area is primarily covered with gravel surfacing and includes a smaller paved decontamination pad and sump, for collecting impacted water and separating sediment.	Former Mill Site Yard – Decontamination Area	20,000 SF	Should a driver or other personnel in this area require additional decontamination, they will report to the Personnel Decontamination Area. Decontamination drainage will be collected in the pad sump and transported to evaporation ponds for disposal. An asphalt pad is shown on the drawings to limit sump excavation in the former mill site area and minimize subsequent materials disposal in the Repository.
Security Shack – Mine	Security and check-in point for access to the work area from NM 566.	Mine Site Support Area – on NM 566	2,500 SF	
Vehicle and Equipment Contamination Control Point	Area for scanning and removal of loose contamination of heavy equipment and vehicles leaving the Mine Site. Dry decontamination methods only. Small support trailer will include an area where the driver can scan out and sign out.	Mine Site – Exclusion Area	10,000 SF	Intended for optional limited use of equipment that is difficult to transport to the primary decontamination area (i.e. tracked equipment). A water truck or storage tank will be used for a water source. Power will be needed for the support trailer. Decontamination drainage will be collected and transported to the evaporation ponds for disposal. Should a driver or other personnel in this area require additional decontamination he/she will need to report to the Personnel Decontamination Area. Foot traffic may also exit to the Mine Support Area from this point.
Mine Site Support Area	Area for: construction support equipment, maintenance work, storage units, support/office trailers, etc.,	Mine Site – outside of the removal areas along NM 566	10,000 SF	The area along NM 566 and inside the project gate can be used for optional Mine Site office trailers, parking, and additional storage. The highway will remain un-obstructed to the end for emergency access. This area also includes the turnaround for highway trucks being loaded across the barriers separating the PTW staging area.
PTW Staging Area	Area for stockpiling and loading PTW material into highway transport trucks for off-site disposal. Loaded trucks must remain clean or be decontaminated prior to leaving site. All highway trucks may use the Mill Yard scale to verify optimal loading.	Mine Site – Exclusion Area	133,000 SF	PTW waste is located in several discrete areas within the mine waste, limiting the practicality of direct load into off-site haul vehicles. Sufficient space is available in the Staging Area for stockpiling up to 35,000 CY of PTW, if needed. Load out operations in this location will conflict with haul operations to the Repository.
Contractor Clean Yards (north and west)	Clean laydown in the Support Area immediately north or west of the tailings disposal area to be used for construction materials storage, clean borrow or imported material stockpiles, construction support equipment, maintenance, storage units, support trailers, clean vehicle parking, etc.	Repository Yard(s) – Support Area	270,000 SF	Situated to segregate clean and contaminated support services. Layout and utilization will be left to CC's discretion.

CY – cubic yards, PTW – principal threat waste, RA – removal action, SF – square feet

B.4.1 Support Area Facilities

Support Area facilities and locations include the Former Mill Site Yard, the Mine Site support area that includes the transport turnaround area, and the Repository Yard(s) as shown on the Section 2 Drawings. The Former Mill Site Yard will include: access control, parking, construction and personnel management facilities, construction crew lunch, meeting, and transfer facilities, fuel storage, and PTW load out facilities (Section B.4.5). Facilities at the Mine Site will include: access control (gated entrance, parking, and security shack), truck loadout area. The Repository Yard(s) will include: access controls and the contractor's clean yard.

The Former Mill Site yard was selected for the above uses for its central location and existing infrastructure for access controls and utilities. A paved driveway entrance is currently in use for the Mill Site offices. This driveway will be used for daily construction crew and visitor traffic. A driveway entrance suitable for large vehicles and equipment exists at the north end of the yard. This entrance will be re-established and upgraded as needed to provide safe and secure entrance and egress from the Mill Site. Fencing and gates will be repaired and/or installed as needed to restrict unauthorized access. The scale will also be placed in service to verify imported or exported material quantities. The CC will be required to include scale maintenance and calibration in its mobilization activities. Grading and drainage improvements will be constructed, as required, to suit the facilities. Gravel surfacing will be required for vehicle travel lanes, parking, and office areas.

As shown on the Section 2 Drawings, a temporary gate will be placed near the end of NM 566, just west of Red Water Pond Road. The short segment of paved road beyond the temporary gate will be used for light vehicle parking, access control, office trailers, and PTW loadout on highway vehicles. A series of concrete barriers will separate the loadout area from the mine haul road to delineate the support area from the active haul road. Vehicle access to or from the Mine Site at this location will be restricted to emergency use and the limited mobilization or demobilization of heavy construction equipment that is intended for use within the mine area. Personnel or visitors that may require entrance to the Mine Site on foot (only) will be able to park and sign in at this location. Portable equipment will be used to scan personnel and visitors prior to exiting the Mine Site via the contamination control point. This support area is located within an area designated for surface removals, therefore the removals will be completed and confirmed before the support area facilities are established.

The Repository Yard was selected for use as the CC's clean yard based on proximity to the Repository and borrow areas. Maintaining segregation of borrow material haul trucks and mine waste haul trucks is critical for contamination control. Construction and use of the Repository Yard will require construction of an access road and access controls, drainage controls (including grading), and haul traffic segregation controls. There is also suitable space for a secondary yard immediately north of the Tailings Disposal Area (TDA) as shown on the Section 2 Drawings.

Existing infrastructure will be used for temporary water and power for offices and crew facilities. It is anticipated that the CC will use mobile trailers or other mobile structures for the majority of the CSFs. Securing temporary trailers or structures and connecting utilities will be in accordance with the recommendations of the manufacturer of each type of temporary structure. The technical specifications (Appendix J) will address the standards and requirements for temporary utilities, communications, sanitary facilities, fuel storage, and disposal of sanitary and domestic waste.

B.4.2 Water Supply

The Mill Site well will be used to supply water for decontamination, sanitary uses, and dust control. The well location is shown on the Section 2 Drawings and a well schematic is show on Figure B.2-1. The well is about 1,500-ft deep with an 8-inch casing. Current static water level is shown on Figure B.2-1. The existing well pump is 20HP, 3-Phase, 480V, with a 2-inch discharge pipe. The pump is currently set at about 700 feet below ground surface (BGS) with a water column of about 290 feet above the pump. There is a pipe that fell in the well several years ago that is blocking the deeper part of the well.

Well production varies depending on the discharge location as follows:

- Discharge to evaporation ponds: 45 gallons per minute (gpm)
- Discharge to domestic tank: 56 gpm
- Discharge to ground at well: 67 gpm

Typical water level during continuous pumping is about 525 feet BGS.

Projected water demand during construction is calculated in Appendix Q and ranges from 64 gpm to 102 gpm of continuous production. The current yield will need to be increased to meet this demand. The well yield would increase by installing a higher capacity pump with a larger discharge pipe. Calculations presented in Appendix Q indicate that 100 gpm could be achieved with a 20-HP pump and a 4- or 6-inch discharge. This indicates that a pump and discharge pipe upgrade would provide sufficient construction water. These mechanical upgrades to the well will be included as a construction task during the early works phase of the RA. Removal of the well obstruction noted above is not planned at this time.

As discussed in Appendix Q, on-site storage of water (water tanks) is required to meet water demand during construction. Portable water tanks will be placed in the Former Mill Site Yard and connected to the well with temporary high-density polyethylene piping. Water use and storage calculations are included in Appendix Q. Piping and layout configurations will be determined by the CC. Closed top tanks are preferable to a water management pond because they offer scalability and eliminate water losses from evaporation.

B.4.3 Decontamination Area Facilities

Decontamination facilities will be located at the Former Mill Site Yard and will include: access controls, a vehicle decontamination area, and a personnel decontamination area. Personnel decontamination will also be available for foot-traffic leaving the Mine Site exclusion area via the contamination control point and walking back to the mine site support area. These decontamination areas will be adjacent to one another, but separate to isolate personnel traffic from vehicular traffic and reduce the potential for accidents. The decontamination areas are designed to promote safe and efficient flow of personnel and vehicles between the Support and Controlled areas, which includes staging, access roads, and haul roads that support the RA construction. The personnel decontamination area is primarily intended for use by RA construction workers whose construction vehicles and equipment will be left within the Controlled Area for use during the RA. The vehicle decontamination area is intended for use only by vehicles that must leave the Controlled Area (such as demobilized construction equipment).

Access to and from the Exclusion work areas will be controlled through the Decontamination Area. Construction personnel and visitors will be required to pass through an access control office and gates. It is anticipated that construction personnel working within the Exclusion Areas will park in the Support Area, enter the Controlled Area, and be transferred by van or light truck to their equipment and/or work areas. To the extent practical, light vehicles will be kept in the Controlled Area for this purpose throughout construction.

The vehicle decontamination area is a gravel surfaced area segregated from the Controlled Area and the Support Area by chain link fencing. Within the gravel area, there will be an asphalt pavement pad with a water tight collection sump used for vehicle and equipment decontamination. The Decontamination Area is sized based on the anticipated construction equipment, and design details are shown on the Section 2 Drawings. The decontamination pad and sump will collect and contain water used for decontamination activities for collection and transport to the evaporation ponds. The final design configuration of the vehicle decontamination pad and sump is sized to store direct precipitation from the 10-year, 24-hour precipitation event with no outflow (refer to Section 4.8).

All vehicles and equipment that leave the Controlled Area will be scanned and if necessary, decontaminated, within the vehicle decontamination area. Portable decontamination equipment (such as pressure washers) is anticipated for this application.

Proposed decontamination action levels and procedures for vehicles, equipment, and personnel are discussed in Appendix M. Specific decontamination procedures and equipment selection will be the responsibility of the selected CC.

The personnel decontamination area will include equipment and facilities to accommodate scanning of site construction workers, with decontamination facilities available for use if and when they are needed. The facilities in this area will include: scanning equipment, showers, lockers (for changing from civilian clothes into work clothes and vice versa), and laundry facilities. It is anticipated that specialty construction trailers will be used for these facilities. Construction personnel will access “clean” and “dirty” lockers to store personal items and change into their work coveralls.

Personnel leaving the controlled work area will enter the personnel decontamination area to change out of potentially contaminated clothing. Workers then will undergo scanning. Workers who meet the scanning criteria will sign out and proceed to the Support Area. Workers failing to meet the scanning criteria will attempt to remove contamination from their undergarments. If a situation occurs where the contamination cannot be removed from a worker’s garments (i.e., denim pants, long underwear, etc.), the worker will remove those garments, shower, and pass to the clean side lockers where all workers will be required to store a clean change of clothes.

B.4.4 Controlled Area Facilities

Controlled facilities include the mine waste haul roads and facilities located at the Former Mill Site Yard. Controlled facilities at the Former Mill Site Yard will include: access control areas, parking, and contractor yards. Access control for the Controlled Area will be provided using fencing and gates as shown on the Section 2 Drawings. As noted above, primary access for personnel and equipment will be controlled through the Decontamination Area. A combination of permanent and temporary fencing will be utilized for perimeter control. This area is expected to be congested during construction, thus the primary access to the Mine Site will be via the haul road. This configuration also maximizes the segregation of public traffic and construction traffic. Access and haul roads are further discussed in Appendix D.

Space for a contractor’s yard is provided at the Former Mill Site Yard. It is anticipated that this location will be used for laydown and storage, equipment maintenance, and parking of vehicles and equipment kept within the Controlled Area during construction. This location was chosen based on proximity to the Decontamination and Support areas and to avoid congestion at the Mine Site. Heavy equipment and vehicles leaving the Mine Site or Repository will be scanned and loose contamination will be removed prior to entering the haul road. This will be conducted to reduce the potential for contaminating the haul and access roads. Contamination that cannot be removed with dry decontamination techniques (i.e. brushing) would be removed in the Decontamination Area prior to final release of vehicles or equipment from the site.

B.4.5 Exclusion Area Facilities

The Exclusion areas include the Mine Site and the Repository. As noted in Section B.4.4, the mine waste haul road is within the Controlled Area. Heavy equipment and vehicles leaving the Mine Site or Repository will be scanned and loose contamination will be removed prior to entering the haul road. The existing decontamination pad and sump are located at the east end of the Mine Site will not be used during the RA. Both the Mine Site and the Repository will have mud grates located along the haul road for trucks leaving these areas to travel over. Beyond the mud grates the haul trucks will be required to stop and be frisked at a contamination control checkpoint.

B.4.6 Principal Threat Waste Handling

PTW material will be verified and excavated concurrently with other mine waste as discussed in Appendix C. The PTW material identified for Phase 1 removal will be stockpiled and removal from the site is estimated to begin within 6 months of the completion of PTW excavation during Phase 1. Any additional previously unidentified PTW encountered during the remaining phases will be excavated and hauled to the PTW staging area for temporary storage until enough PTW volume has been excavated and stockpiled to make removal from the site economical, or by the end of the removals, whichever is earlier.

The PTW staging area will be located at the Mine Site as shown on the Drawings (2-01 and 2-04). The chosen PTW stockpile location is located in an area that: 1) minimizes transport distance from excavation location to stockpile to reduce the potential to contaminate haul roads; 2) is relatively protected from wind compared to other available areas; 3) is located away from support facilities with high personnel occupancy and activity; and 4) provides an efficient loading location for highway transport. There is sufficient room for storage of 36,000 CY of material at this location. Temporary stormwater runon/runoff controls and dust control measures will be implemented to mitigate the risk of releasing contaminated material. Management of stormwater during construction is addressed in Appendix E. The Contractor will field fit a 12-inch culvert along the haul road ditch to facilitate loadout from the stockpile location.

The PTW staging area is located to minimize conflicts within the active mine waste removal area, enhancing both safety and efficiency during excavation, however traffic controls for loading equipment crossing the mine haul road will be required. The PTW staging area is planned for interim stockpiling of material subject to laboratory testing to confirm PTW status. The schedule for PTW removal will be determined by the CC and will be influenced by the hauling capacity of the CC's chosen hauling contractor. PTW loading could occur as an activity that is conducted for a limited time period each day, for a limited number of half or full days per week, or as a continuous operation until complete. To account for this unknown, the RA schedule includes 50 construction days for PTW loading assuming that mine waste hauling may not be conducted simultaneously with PTW loading, for safety reasons (refer to Appendix K for schedule assumptions). However, these operations could be conducted simultaneously if the CC provides a traffic control plan that demonstrates the activities can be conducted in a safe manner.

The PTW material will be loaded, at the PTW staging area, into covered trucks or sealed intermodal shipping containers for transport to a processing facility or a USEPA-approved off-site Repository. Shipments will be manifested and placarded per US Department of Transportation (USDOT) requirements. Transport vehicles will enter the Support Area adjacent to the mine haul road and PTW staging area, where PTW will be loaded onto highway vehicles. Highway vehicles will not enter the mine exclusion area or the controlled area of the Mine Haul Road. The CC will be required to develop loading methods that minimize the need for truck or container decontamination. Upon completion of loading, trucks or intermodal containers will be inspected for external contamination prior to truck departure, or container staging, for transfer to highway vehicles. Highway vehicles may report to the truck scale at the former Mill Site to verify that the transport vehicle has been loaded to maximum capacity before leaving the Mill Site. Traffic control is discussed in Section B.5.2

USEPA mandated in the Non-time Critical Action Memo (USEPA, 2011) that PTW either be reprocessed to reclaim metals and radionuclides or be transported off-site to a licensed and controlled disposal facility meeting the performance standard, as defined by the USEPA, under the Off-Site Rule 40 CFR § 300.440 (USEPA, 2011). USEPA states in the 2013 ROD Section 1.4 (USEPA, 2013), that PTW from the Mine Site will not be disposed at the Mill Site. Upon approval of the RA Design, proposals will be obtained from the following facilities for off-site disposal of PTW:

- Energy Solutions White Mesa Mill, Blanding, UT – 212 miles from Northeast Church Rock (NECR)
- Waste Control Specialists Facility, Andrews, TX – 483 miles from NECR
- Energy Solutions Facility, Clive, UT – 576 miles from NECR

The following facilities will be considered alternates due to distance from the site:

- US Ecology Facility, Richland, WA – 1135 miles from NECR
- US Ecology Facility, Grand View, ID – 710 miles from NECR
- Clean Harbors Facility, Deer Trail, CO – 627 miles

B.5 TEMPORARY CONTROLS

B.5.1 Dust Control

Dust will be controlled primarily through the use of water, gravel surfacing, covers, and operational controls. The CSFs occupy flat surfaces which can be efficiently treated with water, gravel, and/or chemical agents. Dust control is addressed in more detail in Appendix Q.

PTW stockpiles may require more robust dust control than from using water or chemical agents. Dust control on active stockpile areas (where PTW is being placed or excavated) may be managed using water and small tracked equipment for moderate compaction. This will also include water application for dust control during excavation and loading. Inactive PTW stockpiles within the mine area, if any (where PTW is stored for longer than 14 days), will require stabilization per the Contractor's Construction Stormwater Pollution Prevention Plan (CSWPPP). The PTW stockpile in the PTW staging area will be covered during periods of inactivity (inactive for 48-hours or as otherwise defined in the Specifications). Temporary wind breaks along NM 566 will also be required during active operations in the PTW staging area to prevent windblown material from leaving the area.

B.5.2 Traffic Control

Traffic patterns have been designed to segregate worker traffic and visitor traffic from heavy equipment and construction traffic. The existing paved entrance will be used for workers and visitors. Personnel and visitors will enter and exit the Support Area via a secure entrance and park in a designated area near the construction offices. When PTW loading operations are in progress at the mine, empty highway trucks will enter the gated area and proceed to the loading and turnaround area. However, these vehicles will exit the site via the truck scale. Traffic control is addressed in more detail in Appendix M.

B.5.3 Construction Support Facilities Temporary Stormwater Controls

The proposed CSFs are shown in the Section 2 Drawings. The CSFs include the Exclusion Area and Support Area in the Former Mill Site Yard, the Repository Yard (located between the Former Mill Site Yard and the Pipeline Arroyo), and the optional Repository Yard (north of the Repository). Stantec designed the temporary stormwater controls for the CSF for the 10-year, 24-hour storm event, which is the New Mexico Department of Transportation design standard for roadside ditches (NMDOT, 2007).

The design concept for the CSF stormwater controls is to separate non-contact and contact stormwater through use of diversion ditches and retention ponds. Non-contact stormwater from catchments upgradient of the CSFs will be diverted around the CSFs in diversion ditches. The diversion ditch around the Former Mill Site Yard will be triangular in cross section, with a depth of 2.5 feet, which is designed to provide capacity to contain the peak 10-year storm discharge (see calculations in Attached D.1 of Appendix D). Catchment areas for the Repository Yard and Optional Repository Yard are small relative to the catchment above the Former Mill Yard Site, and diversion ditches for these facilities, if necessary, will be designed and constructed by the CC as part of the CSWPPP (see Appendix E).

The stormwater runoff within the proposed Exclusion Area at the Former Mill Site will be potentially impacted. The Exclusion Area will be graded to shed stormwater runoff to one of two retention ponds that will be located within the Exclusion Area. Stantec designed these retention ponds to have capacity to retain all rainfall falling within the Exclusion Area during the 10-year, 24-hour storm (see calculations in Attachment D.1 of Appendix D). The retention pond on the west side of the Exclusion Area is sized to 24,763 cubic feet and the retention pond on the east side is sized to 18,952 cubic feet. The CC will need to provide means to remove the stormwater from the retention ponds and dispose of it in the temporary stormwater basin (at the Mine Site), or at the evaporation ponds on the TDA, within 48 hours following the storm event.

Both of the Repository Yards are located within the 100-year floodplain on either side of Pipeline arroyo. If the Contractor will store fuel in either of the Repository Yards, the fuel tanks must be installed such that they will not release fuel to arroyo during 100-year storm events, or fuel storage must be moved to an acceptable location beyond the floodplain extents.

B.5.4 Verification and Reclamation

Upon completion of the RA, trailers and equipment used within the Exclusion Area will be scanned and decontaminated (if required). All ground areas used for CSFs within the Exclusion Area will also be subject to final cleanup and verification in accordance with Appendix T, prior to reclamation. Reclamation of the Former Mill Site Yard and the Repository Yards will include minor grading. The areas will then be ripped for reseeding according the approved revegetation plans. Revegetation will be conducted in accordance with Appendix U.

B.6 CONSTRUCTION SEQUENCING

The anticipated sequence for preparation, mobilization, and construction of the construction support facilities will be as follows:

1. Underground utility survey to identify and/or verify the location of subsurface utilities within the CSF areas.
2. Overhead utility survey and safety mitigation as needed.
3. Construction of water supply connections and storage.
4. BMP installations for sediment and stormwater controls.
5. Site preparation including stripping and stockpiling of topsoil and organics.
6. Grading and drainage improvements.
7. Construction of the access roads.
8. Cleanup (soil removal) from the Mine Site support area to establish the transport turnaround area.
9. Construction and mobilization of the access control trailer(s), fencing, and gates.
10. Initial Decontamination Area construction (decontamination office, drainage controls, and vehicle decontamination pad).
11. Mobilization of crew meeting/lunch trailers, restroom trailers, construction office trailers, an administration/storage trailer, and construction fuel and water storage and delivery systems.
12. Construction of area controls such as fencing, berms, or other controls to maintain separation between Support, Decontamination, and Exclusion areas.

B.7 GREEN AND SUSTAINABLE REMEDIATION CONSIDERATIONS

B.7.1 Construction Material Considerations

Site grading for the CSFs and associated roads will be minimized to the extent possible to reduce the required construction equipment operating time, greenhouse gas emissions, and fill material.

The use of LEED®-certified portable structures will be investigated and utilized if available and cost effective. The benefits of LEED®-certified portable structure use include the conservation of energy and water, reduction in greenhouse gas emissions and operating costs, improved health and safety of occupants, and reduction of waste sent to landfills.

If LEED®-certified portable structures cannot be found or are cost prohibitive, LEED® principles will be applied where feasible including utilization of Energy Star compliant equipment. This can include low energy light bulbs (e.g. LEDs), passive cooling and lighting when possible, trailers constructed using re-used and recycled materials wherever possible (i.e. insulation, metal and wood framing from retired trailers, recycled high-density polyethylene walls), and procedural/engineering controls for indoor air quality. Such controls for indoor air quality include but are not limited to ventilation (passive and/or active) and use of materials, adhesives, and paints with low percentage of volatile organic compounds.

Temporary facilities requiring power will be located near existing infrastructure to reduce the use of diesel generators. If connection to existing infrastructure is not possible, use of photovoltaic cells or small wind power will be investigated and utilized if practicable.

B.7.2 Construction Methods

The construction equipment used for the construction support facilities will be appropriately sized to reduce fuel consumption and greenhouse gas emissions. Dust suppression will be utilized throughout the area and on the access roads to decrease visible dust related emissions. Section B.4.8 discussed temporary stormwater controls and Appendix E identifies BMPs and specific sediment control measures that will be employed during construction for both sediment and stormwater control.

Emission reduction requirements are included in the Technical Specifications (Appendix J) and include:

- Restrictions on construction equipment idling: Work vehicles or work equipment shall not be allowed to idle longer than 5 minutes unless the vehicle/equipment is undergoing testing, servicing, repair, or diagnostic; the vehicle/equipment is in queue; the vehicle/equipment is accomplishing work for which it was designed; or there is a safety issue.
- Fuel requirements for vehicles and equipment: Ultra-low sulfur diesel fuel shall be used for all on and off-road operation of vehicles and construction equipment if available locally and is cost competitive.
- Non-road diesel powered construction equipment fleet requirements: All non-road diesel engines for construction equipment shall meet USEPA Tier 2 exhaust emission standards (EPA-420-B-16-022), however if these restrictions prevent utilization of local contractors Tier 1 exhaust emission standards may be considered.
- Worker transportation: The CC will be encouraged to identify carpooling and/or rideshare parking areas in centralized area(s) for workers to use to get to the site.

B.7.3 Low Impact Development/Sustainability

Consolidation of CSFs at the Former Mill Site Yard focuses construction and longer-term support activities in one previously impacted area. The route of the access and haul roads was optimized to minimize site disruption and vehicle mileage and to protect public health and safety on the existing highway. The routes chosen utilize existing or historical roads to the extent practical to limit additional habitat degradation.

Access roads and haul roads will be reclaimed upon completion of construction. Additionally, a primary point of entry/exit to the Exclusion Area will be maintained to help prevent re-contamination of areas already remediated or contamination of areas that were previously uncontaminated. This primary point of entry/exit also minimizes the required support facilities and associated infrastructure required for construction.

B.8 REFERENCES

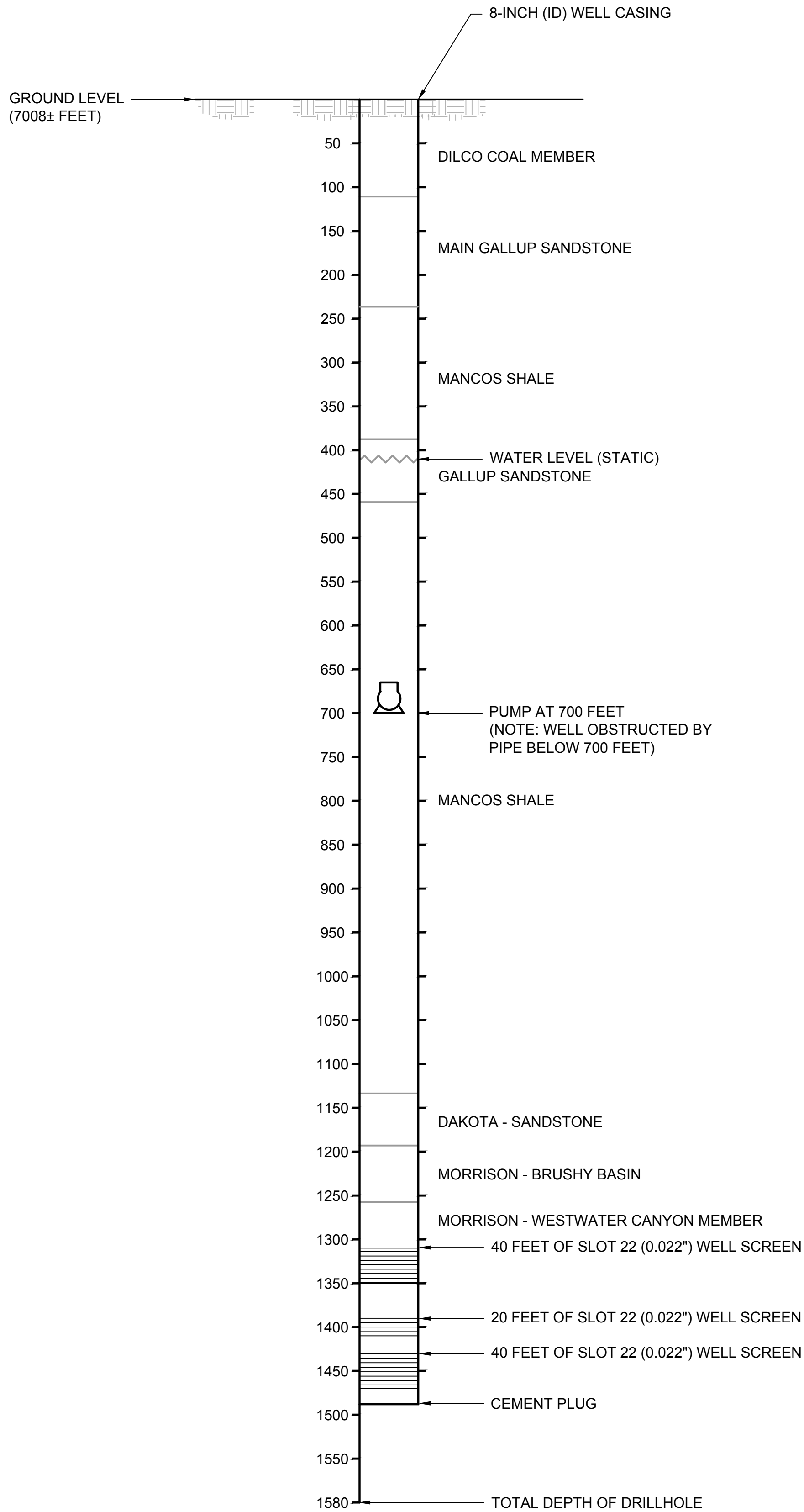
US Environmental Protection Agency (USEPA), 2011. Action Memorandum: Request for a Non-Time-Critical Removal Action at the Northeast Church Rock Mine Site, McKinley County, New Mexico, Pinedale Chapter of the Navajo Nation. Prepared for U.S. EPA Regions 6 and 9. September 29.

US Environmental Protection Agency (USEPA), 2013. Record of Decision, United Nuclear Corporation Site, McKinley County, New Mexico, EPA ID: NMD030443303. March 29.

US Environmental Protection Agency (USEPA), 2015. Administrative Settlement Agreement and Order on Consent for Design and Cost Recovery. April 27.

New Mexico Department of Transportation (NMDOT), 2007. Drainage Design Criteria for NMDOT Projects, Fourth Revision, June.

FIGURE



NOTE:

WELL DETAILS FROM CENTURY GEOPHYSICAL CORP. TULSA, OK 1976.

MWH. now part of Stantec

UNITED NUCLEAR CORPORATION AND NORTHEAST CHURCH ROCK MINE
McKINLEY COUNTY, NEW MEXICO

UNC MILL SITE WELL SCHEMATIC

FIGURE

B.2-1

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Northeast Church Rock
95% Design Report

Appendix C:
Mine Site Removal Excavations and Demolition

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LIST OF PHOTOS

LIST OF ACRONYMS / ABBREVIATIONS

AOC	Administrative Settlement Agreement and Order on Consent for Design and Cost Recover
ARAR	Applicable or Relevant and Appropriate Requirements
ASTM	American Society for Testing and Materials
BMP	best management practice
CC	Construction Contractor
CFR	Code of Federal Regulations
COC	constituent of concern
cpm	counts per minute
CY	cubic yard(s)
DCGLemc	derived concentration guidance level (elevated measurement comparison)
DCGLw	derived concentration guidance level (for wide area average of site)
EE/CA	Engineering Evaluation/Cost Analysis
FSL	field screening level
IRA	Interim Removal Action
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDC	minimum detection concentration
mg/kg	milligrams per kilogram
Mill Site	Church Rock Mill Site
Mine Site	Northeast Church Rock Mine Site
NECR	Northeast Church Rock
NEMSA	non-economic material storage area
NMEMND	New Mexico Energy, Minerals and Natural Resources Department
NRC	U.S. Nuclear Regulatory Commission
pCi/g	picocuries per gram
PDS	Pre-Design Studies
PTW	principal threat waste
RA	Removal Action
RAL	removal action level
RAO	Remedial Action Objective
ROD	Record of Decision
RSE	Removal Site Evaluation
SOW	Statement of Work
TPH	total petroleum hydrocarbons

UNC	United Nuclear Corporation
USEPA	US Environmental Protection Agency
USNRC	US Nuclear Regulatory Commission

C.1 INTRODUCTION

C.1.1 Project Background

The Northeast Church Rock (NECR) Mine Site (Mine Site) Removal Action (RA) consists of removal of mine spoils and debris (hereafter termed mine waste). Mine waste is defined by the 2011 Action Memo (USEPA, 2011) as soils and debris with Ra-226 concentrations above the field screening level (FSL) of 2.24 pCi/g. These materials will be excavated and disposed. Characterization of the Mine Site is provided in the Northeast Church Rock Mine Site RA Pre-Design Studies (PDS) Reports (MWH, 2014a and 2014b). This appendix provides the following information:

- Demonstration that the excavation plans for the Mine Site meet requirements of the Performance Standards identified in the Action Memo (USEPA, 2011), Record of Decision (ROD; USEPA, 2013), and the Administrative Settlement Agreement and Order on Consent for Design and Cost Recovery Statement of Work (AOC SOW; USEPA 2015).
- Calculations and assumptions for determination of mine waste volume, materials management strategies, estimated limits of excavations, and brief identification of temporary stormwater and erosion controls to be used during removal of impacted materials.
- Excavation and grading plans for removal of mine waste within the Mine Site.
- Processes for verifying regulatory cleanup levels have been achieved in the excavated areas.
- Considerations for Green and Sustainable Remediation.

C.2 PERFORMANCE STANDARDS

The Performance Standards presented here are defined in the Action Memorandum: Request for a Non-Time-Critical RA at the Northeast Church Rock Site (2011 Action Memo; USEPA, 2011), the ROD, United Nuclear Corporation Site (USEPA, 2013), and the AOC (USEPA, 2015) including the SOW attached as Appendix D to the AOC, and were developed to define attainment of the Remedial Action Objectives (RAOs) for the Selected Remedy. The Performance Standards include both general and specific standards applicable to the Selected Remedy work elements and associated work components. Table C.2-1 presents Performance Standards related to the Mine Site RA and how the design accomplishes these standards.

Table C.2-1: Task Specific Performance Standards

<table>
<tr><th>Identifying Number*</th><th>Location of Performance Standard Requirement</th><th>Topic</th><th>Performance Standard</th><th>Comments</th></tr>
<tr><td>83</td><td>2011 Action Memo, Table 4.1 – Field Screening Levels</td><td>Field Screening Levels</td><td>Table 4.1 Selected Field Screening Levels<table><tr><th>Contaminant of Potential Concern</th><th>Field Screening Level</th></tr><tr><td>Ra-226</td><td>2.24 pCi/g</td></tr><tr><td>Arsenic</td><td>3.7 mg/kg</td></tr><tr><td>Molybdenum</td><td>390 mg/kg</td></tr><tr><td>Selenium</td><td>390 mg/kg</td></tr><tr><td>Uranium</td><td>200 mg/kg</td></tr><tr><td>Vanadium</td><td>390 mg/kg</td></tr></table></td><td>Mine waste identified as material with field screening level (FSL) values for Ra-226 greater than 2.24 pCi/g. See Section C.4.4.</td></tr>
<tr><td>84</td><td>2011 Action Memo, Table 4.2 – Selected Action Levels</td><td>Action Levels</td><td>Table 4.2 Selected Action Levels<table><tr><th>Contaminant of Concern</th><th>Action Level</th></tr><tr><td>Ra-226</td><td>2.24 pCi/g</td></tr><tr><td>Uranium</td><td>230 mg/kg</td></tr></table></td><td>RAL for project is 2.24 pCi/g for Ra-226 and 230 mg/kg for uranium. See Section C.4.4.</td></tr>
<tr><td>90</td><td>2011 Action Memo, V.A.1, Bullet 4 – Excavation</td><td>Earthwork</td><td>Excavation. Excavation at the NECR Site and transportation of waste with concentrations of uranium and Ra-226 that exceed Action Levels to a repository at the UNC Mill Site for co-disposal at the existing Tailings Disposal Cells. This action is contingent on the U.S.EPA decision document for the surface contamination at the UNC Mill Site, and the NRC approval of a license amendment for the UNC Mill Site disposal cells. Depth of excavation will not exceed ten feet, except in areas susceptible to erosion or where placing clean backfill to current grade is not planned, or in areas where principal threat waste will be removed. Excavation within these areas will continue until confirmation sample results are below the Action Levels per MARSSIM procedures.</td><td>Mine waste will be removed to depths where Action Levels are below 2.24 pCi/g for Ra-226 and 230 mg/kg for uranium, or to contact with bedrock, but will not exceed 10 feet in depth in areas where clean fill will be placed to final grade. See Section C.4.4.</td></tr>
<tr><td>88</td><td>2011 Action Memo, V.A.1, Bullet 7 –</td><td>Confirmation Sampling</td><td>Confirmation Sampling. Conduct confirmation scanning, sampling and analysis to ensure that the action levels have been met in excavated areas.</td><td>Confirmation scanning, sampling and analysis are included in mine waste verification procedures. See</td></tr>
</table>

Identifying Number*	Location of Performance Standard Requirement	Topic	Performance Standard	Comments
	Confirmation Sampling			Section C.4.6 and Appendix T.
95	2011 Action Memo, Section V.A.1, Bullet 8 - Site Restoration	Site Restoration	Restoration activities will include the backfilling and regrading of excavation areas for erosion and storm water control. These areas will also be re-vegetated with native species.	Final restoration grading plans are shown in the Section 3 Drawings. The revegetation plan for the Mine Site is in Appendix U, Attachment U.1.
86	2011 Action Memo, V.A.1	Cleanup Verification	40 CFR §300.440 Procedures for planning and implementing off-site response actions. Refer to www.ecfr.gov.	Off-site response actions for principal threat waste (PTW) include excavation removal of PTW and transport to a processing facility or USEPA approved off-site disposal facility.
93	2011 Action Memo, V.A.1, Bullet 6 – Principal Threat Waste	Principal Threat Waste	Principal Threat Waste. Principal threat wastes are those source materials considered to be highly toxic or highly mobile which generally cannot be contained in a reliable manner or would present a significant risk to human health or the environment should exposure occur. At the NECR Mine Site, all wastes, containing either 200 pCi/g or more of Ra-226 and/or 500 mg/kg or more of total uranium present a significant risk to human health; therefore, this contaminated material is considered principal threat waste. To treat this Principal Threat Waste, this Action Memorandum calls for reprocessing of the Principal Threat Waste to reclaim metals and radionuclides. If reprocessing technologies are not technically feasible or are not available within a reasonable time frame as determined by the U.S. EPA, then the Principal Threat Waste will be disposed of in a facility that has been determined by U.S.EPA to be acceptable under the Off-site Rule, 40 CFR § 300.440.	PTW will be removed and transported to a processing facility or USEPA-approved offsite facility. See Section C.4.5.
96	2011 Action Memo, V.A.2	Confirmation Sampling	Contribution to remedial performance This RA would address the mine waste and soil contamination at the NECR Mine Site, to a depth of at least 10 feet. It is expected that this RA will remove the threat of direct or indirect contact with or inhalation of hazardous substances from the mine waste and soils at the NECR Mine Site. As noted above, the soils in the area east of Red Water Pond Road will be addressed in a separate RA. The EE/CA presented alternatives for surface and near-surface mine waste and soil to be addressed in a non-time-critical RA only. This RA does not address contamination that may remain at greater	Mine waste will be removed to depths where Action Levels are below 2.24 pCi/g for Ra-226 and 230 mg/kg for uranium, or to contact with bedrock, but will not exceed 10 feet in depth in areas where clean fill will be placed to final grade. See Section C.4.4.

Identifying Number*	Location of Performance Standard Requirement	Topic	Performance Standard	Comments
			depths. U.S. EPA has recently worked to assess groundwater for the NECR Mine Site and surrounding facilities, including historic releases from these facilities; however, the RA that is the subject of this memorandum does not address groundwater.	
23	2013 ROD, Section 1.4 - Receiving	Excavations/Demolition, Cleanup	Receiving. NECR Site waste that is transported to the UNC Site will be disposed in the Tailings Disposal Area if NRC approves a license amendment. The waste from the NECR Site will contain concentrations of uranium and radium 226 (Ra-226) that exceed Action Levels established in the 2011 NECR Site Non-Time-Critical Action Memorandum (hereinafter the 2011 NECR Site Action Memorandum). The 2011 NECR Site Action Memorandum provides that excavation at the NECR Site will not exceed ten feet, except in areas susceptible to erosion or where placing clean backfill to current grade is not planned, or in areas where principal threat waste will be removed. As stated earlier, principal threat waste is not a part of this Selected Remedy and will not be brought to the UNC Site. Excavation within these areas will continue until confirmation sample results are below the Action Levels established in the 2011 NECR Site Action Memorandum as determined using Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) procedures.	Mine waste will be removed to depths where Action Levels are below 2.24 pCi/g for Ra-226 and 230 mg/kg for uranium, to contact with bedrock, but will not exceed 10 feet in depth in areas where clean fill will be placed to final grade See Section C.4.4.
42	2013 ROD, Section 2.9.5 – Site Preparation Activities	Site Preparation	Include an underground utility survey to identify and/or verify the location of subsurface utilities in areas scheduled for consolidation and disposal; identification of heavy equipment routes; and temporary stockpiling activities. These temporary stockpiling activities refer to an area where mine waste will be placed in preparation for placement within the Tailings Disposal Area. A land survey will be completed to delineate the parts of the Tailings Disposal Area that will be used for mine waste disposal. Site construction activities necessary to prepare the site for mine waste placement will be completed. Existing structures such as culverts, catch basins, foundations, and vaults will be decontaminated where practical, disassembled for future use, demolished for removal, or included within the disposal area.	Site preparation activities include utilities surveys, haul roads and temporary stockpiles early works, installation of erosion controls, and cultural surveys. See Section C.4.2. Repository design is described in Appendix G. On-site debris will be excavated and disposed; it is anticipated the debris has no economic value. See Section C.4.4. Existing structures (or debris) will be excavated to 10 feet below the existing ground surface, or as required by the final grading plan, whichever is deeper, and placed in the Repository.

Identifying Number*	Location of Performance Standard Requirement	Topic	Performance Standard	Comments
				Structures that extend deeper than 10 feet below the existing ground surface, which can be verified by sampling and survey as non-contaminated, will be left in place and covered with a minimum of 12-inches of soil during final grading. See Section C.4.4.2.
45	2013 ROD, Section 2.9.5 – Waste Volume	Waste Volume	Approximately 871,000 cubic yards from the RA described in the 2011 Non-Time-Critical RA Memorandum for the NECR Site, 109,800 cubic yards from a RA at the NECR Site that predates the 2011 Non-Time-Critical RA Memorandum for the NECR Site, and an estimated 30,000 cubic yards to be excavated as part of a separate time-critical RA at the NECR Site will be interred at the Tailings Disposal Area and capped. Although the additional 109,800 and 30,000 cubic yards volume was not included in the EE/CA, the additional volume and associated cost are minimal compared to the overall volume and cost evaluated. In addition, the added expense is within the EE/CA's margin of error. Based on this, the additional volume and cost are considered included and addressed under this alternative. The waste acceptance criteria for mine waste that will be disposed at the UNC Site Tailings Disposal Area are 200 pCi/g or less of Ra-226 and/or 500 mg/kg or less of uranium.	Mine waste exceeding the RA limits (RALs), with the exception of waste meeting the definition of PTW, will be placed in the Repository to be located on the existing tailings impoundment. See Section C.4.6.
71	2013 ROD, Table 1	Waste Disposal	10 CFR 40, Appendix A, Criterion 2. Refer to www.ecfr.gov.	Mine waste exceeding the RALs will be excavated and placed in a single Repository on the existing tailings impoundment. See Section C.4.6.
69	2013 ROD, Table 1	Waste Disposal	10 CFR 61 52(a)(11). Land disposal facility operation and disposal site closure. Refer to www.ecfr.gov	Mine waste containing radioactive materials exceeding the RALs for Ra-226, will be placed in the Repository. A limited amount of soil, mine debris, and stripped vegetation that are not contaminated with radioactive materials may also be placed in the Repository. See Section C.4.6.

Identifying Number*	Location of Performance Standard Requirement	Topic	Performance Standard	Comments
2	2015 AOC SOW, Paragraph 17 - – Soil Transportation and Management	Soil Transport and Management	In the Design, Respondents shall provide detailed plans and specifications explaining how mine waste from the NECR Site and other materials (including borrow, backfill, and cover materials) will be managed and transported. Respondents shall include details for ensuring that Principal Threat Waste from the NECR Site, as described in the 2011 Action Memo, is not transported to the UNC Site or disposed at the Tailings Disposal Area.	Mine waste exceeding the RALs will be excavated and transported to the Repository. Mine waste characterized as PTW will be stockpiled for removal from the site. See Sections C.4.5 and C.4.6.
3	2015 AOC SOW, Paragraph 18 – Cleanup Verification	Cleanup Verification	In the Design, Respondents shall include procedures for cleanup verification (including confirmation sampling and scanning for COCs and COPCs) for the NECR Site. Respondents shall include procedures to verify that the NECR Site has achieved performance standards by presenting confirmation sample results that indicate that Action Levels have been met using Multi-Agency Radiation Survey and Site Investigation Manual ("MARSSIM") procedures for radiological COCs (Radium-226) and EPA-approved lab analysis for heavy metal COCs (uranium) confirmation soil samples.	Confirmation scanning, sampling and analysis are included in the cleanup verification procedures. See Section C.4.6 and Appendix T.
5	2015 AOC SOW Paragraph 20 – Site Preparation Activities	Site Preparation	In the Design, Respondents shall include detailed plans and specifications for the following site preparation activities: a. An underground utility survey for the identification and verification of the location of subsurface utilities in SA Site areas that will be used for consolidation or disposal; b. A land survey that will delineate the parts of the Tailings Disposal Area that will be used for NECR Site contaminated soil and mine waste disposal; c. A description of construction activities to be undertaken on the portion of the SA Site that is at the UNC Site in order to prepare for placement of the NECR Site contaminated soil and mine waste in the Tailings Disposal Area; d. A description of the methods that will be used to decontaminate existing structures such as culverts, catch basins, foundations, and vaults; and, where decontamination is not practicable, a description of methods that shall be used to disassemble these structures, demolish and remove these structures, or include these structures within the Tailings Disposal Area	a. See Appendix B – Construction Support Facilities b. See Appendix J – Technical Specifications c. See Appendix G – Mine Waste Repository Design d. Existing Mine Site debris will be excavated and demolished into transportable sizes for disposal. Placement of debris within the Repository will be conducted in accordance with the Technical Specifications. See Section C.4.4 and Appendix J.
12	2015 AOC SOW Paragraph 27	Site Restoration	In the Design, Respondents shall include detailed plans and specifications for restoration of the Tailings Disposal Area and borrow areas on the UNC Site and for restoration of the NECR Site.	Excavated areas will be regraded to promote positive drainage to existing drainages and minimize

Identifying Number*	Location of Performance Standard Requirement	Topic	Performance Standard	Comments
	– Site Restoration		Respondents shall also include plans and specifications for contouring to promote drainage, and for re-vegetation of the Tailings Disposal Area, borrow pits and NECR Site with native species. Respondents shall include plans and specifications for backfilling and regrading of disturbed (e.g., excavated) areas in the NECR Site and the UNC Site for erosion and storm water control, including re-vegetation of those areas with native species.	ponding of water. Disturbed slopes will be graded to provide long-term slope stability. Disturbed areas will be revegetated to mitigate against erosion. See Section C.5 and Appendix U.
14	2015 AOC SOW, Paragraph 29 – Green Remediation Best Management Practices	Green Remediation Best Management Practices	Respondents shall incorporate applicable Best Management Practices for Green Remediation listed in ASTM-E2893-13 consistent with EPA's policy Superfund Green Remediation Strategy (2010), found at http://www.epa.gov/superfund/greenremediation/sf-gr-strategy.pdf.	Proposed best management practices for green remediation for the Mine Site Excavation Plan are described at the end of this appendix. See Section C.6.

*Refers to identifying numbers listed in Summary of ARARs, Performance Standards and Applicable NRC Design Requirements Table (provided in Attachment 1 to main text of the 95% Design Report)

C.3 ENGINEERING DESIGN DRAWINGS

The engineering design drawings are contained in Volume II – Design Drawings (Section 3). Drawings related to the Mine Site removal excavations are listed in Table C.3-1.

Table C.3-1: Engineering Design Drawings

Drawing No.	Drawing Title
3-01	Existing Condition
3-02	Impacted Material Excavation Depths - Existing Ground to Neat Line
3-03	Removal Areas and Debris Map
3-04	Phase 1 Removal Areas – Principal Threat Waste
3-05	Phase 2 Removal Areas
3-06	Phase 3 Removal Areas
3-07	Phase 4 Removal Areas
3-08	Phase 5 Removal Areas
3-09	Phase 6 Removal Areas
3-10	Cut/Fill Depths – Neat Line To Final Grade
3-11	Final Grading
3-12	Temporary Plug Cross Sections and Typical Berm Detail

C.4 MINE SITE REMOVAL EXCAVATION

C.4.1 Design Basis for Removal

The Mine Site investigation data was used to develop the Mine Site excavation and grading design. The design basis for the Mine Site excavation and final grading plans is provided in Table C.4-1. The individual design basis items comply with regulatory requirements and/or generally accepted engineering practice and meet the overall project design criteria as provided in the Design Work Plan (MWH, 2016).

Table C.4-1: Mine Excavation and Final Grading Design Basis

Design Category	Design Basis	Design Reference
Archeological/Cultural Sites	Archaeological/Cultural surveys were completed in 2005, 2009, 2011 and 2017 in the vicinity of the mine. Any work encountering cultural resources must stop immediately until the appropriate parties have been notified.	New Mexico Energy, Minerals and Natural Resources Department, Mining and Minerals Division – Closeout Plan Guidelines for Existing Mines (NMEMND, 1996)
Mine Waste Removal	Mine waste, including debris, with concentrations exceeding the RAL of Radium-226 (2.24 pCi/g) or Uranium (230 kg/mg), are to be removed	2011 USEPA Action Memorandum: Request for a Non-Time-Critical RA at the Northeast Church Rock Site (USEPA, 2011)
Segregation of PTW	Mine waste materials with radium concentrations exceeding 200 pCi/g or more of Ra-226 and/or 500 mg/kg or more of total uranium are classified as PTW and must be segregated from the general mine site waste and disposed of offsite. The Mine Site excavation design identifies areas where PTW is present and provides areas for stockpiling of PTW material prior to shipment offsite.	2011 USEPA Action Memorandum: Request for a Non-Time-Critical RA at the Northeast Church Rock Site (USEPA, 2011)
Temporary Construction Stormwater/Erosion Controls Design Storm	Temporary construction stormwater/erosion controls for the Mine Site were developed using a 2-year, 24-hour design storm	Engineer's experience and judgment
Final Mine Site Grading	Mine Site excavation and final grading surfaces have been designed to provide stable slopes, with no slopes steeper than 3H:1V, unless founded in rock. Excavated slope lengths have been shortened where possible	New Mexico Energy, Minerals and Natural Resources Department, Mining and Minerals Division – Closeout Plan Guidelines for Existing Mines (NMEMND, 1996)
Long-Term Stormwater/Erosion Control	Excavated Mine Site removal areas will be final graded to provide for long-term slope stability as well as positive drainage into existing drainages, including the arroyo on the north end of the Mine Site Removal Area.	Consistent with industry standards, including Federal Emergency Management Agency and New Mexico Department of Transportation
Site Reclamation	Disturbed areas in and around the proposed Mine Site excavation areas will be reclaimed and revegetated	New Mexico Energy, Minerals and Natural Resources Department, Mining and Minerals Division – Closeout Plan Guidelines for Existing Mines (NMEMND, 1996)

C.4.2 Pre-Excavation Site Preparation

Pre-excavation site preparation activities include:

- Survey to identify and/or verify the location of subsurface utilities within the removal areas in accordance with the Performance Standards provided in the ROD (USEPA, 2013)

- Confirmation that power lines have been de-energized, and removal of overhead power lines within the work areas; any services still in use would be relocated prior to removal of the poles.
- Identification of Mine Site removal haul routes and temporary stockpile areas in accordance with the Performance Standards provided in the ROD (USEPA, 2013)
- Placement of temporary construction erosion and stormwater controls by the Construction Contractor (CC) to conform to the Technical Specifications. Temporary stormwater controls are described in Section C.4.6.7.
- Delineation (flagging) of exclusion areas around capped historical mine shafts in NECR-1 and NECR-2 areas. The NECR-1 and NECR-2 shafts are discussed further in Sections C.4.7.2 and C.4.7.3.

C.4.3 Air Quality Monitoring

Air quality monitoring will be completed in accordance with the Technical Specifications and applicable regulatory requirements. Perimeter air quality monitoring equipment will monitor emissions during site preparation, excavation and removal of mine waste, stockpiling and removal of principal threat waste (PTW) materials, and final grading and restoration activities. Appendix Q describes the air monitoring and dust control plan.

C.4.4 Excavation Volume Determination

Investigations have been completed within the Mine Site area to estimate the extent and quantity of mine waste and debris. The performance standard for identification and action levels of mine waste is defined by the 2011 Action Memo (USEPA, 2011) as soils and debris with Ra-226 concentrations above the FSL of 2.24 pCi/g. Static gamma surveys to identify the lateral extent of surface soils containing Ra-226 above the FSL (the FSL boundary) were conducted at the Mine Site in 2007 as part of the initial Removal Site Evaluation (RSE) (MWH, 2007) and in 2008 during the supplemental RSE (MWH, 2008). If asbestos material is encountered during excavations, both OSHA and NESHAP asbestos regulations will apply and be followed. Removal and placement volumes will be tracked on a regular basis during the RA. Processes for material tracking will be developed with a site-wide material balance for the project. Excavated volumes will be tracked on approximately a monthly basis by topographic surveys to verify the volumes of material that have been excavated. The methods and frequency of survey measurements will be determined by the selected Contractor and will depend on the type of work completed.

C.4.4.1 Mine Waste for Removal

An initial Mine Site removal volume was estimated as part of the 2014 Mine Site PDS Report (MWH, 2014b). Information obtained from sampling, field screening, and laboratory analyses of the Mine Site material, was used to determine volumes of soil and mine debris. A PDS conceptual excavation surface was developed based on the borehole logs, field screening and laboratory test results, connecting the lowest elevations of the impacted material (above the RAL) within each borehole. Additional excavation of material below the RAL was included in this removal volume to provide for positive drainage and grading within the excavation areas. These excavation surfaces were compared to the existing ground topography surface to estimate an excavation volume of 783,000 cubic yards (CY). This volume included an estimated 19,000 CY of PTW. Excluding the PTW volume, a net soil removal volume of 764,000 CY results. This volume includes the perimeter areas that were designated for surface removals of between 0 and 1 foot. This PDS removal soil volume was reduced by 5 percent to 725,800 CY to account for compaction in the Repository and an estimated 25,600 CY of debris volume was included in the PDS estimated removal volume.

As part of the design, Stantec reviewed and re-interpreted the available borehole, field, and laboratory data to confirm the depths of contamination within each borehole and created a neat-line excavation surface to account for removal of materials above the RAL. The neat-line surface was created using the depth to material below the RAL, within each borehole, as well as removal of one foot of material in areas where surface scanning results indicated surficial contamination. This neat-line excavation surface has excluded removal of contaminated material within identified bedrock per the performance standards and does not include adjustments for final grading and drainage.

The horizontal extent of the neat-line surface is shown on Drawing 3-02 with isopach contours of the excavation depths below existing ground surface. The neat-line volume is based on available information, including borehole and test pit logs, field screening and laboratory testing results, rock outcrop mapping, and engineering judgment. Where investigations did not extend to clean material, engineering judgment was used, including evaluation of local stratigraphy within the test holes.

The neat-line excavation surface was compared to the existing ground topography, resulting in a neat-line excavation volume of 725,240 CY. This excavation volume includes material above the RAL, is inclusive of PTW, and includes the shallow surface removals around the perimeter of the deeper excavations. Based on surface scanning results, a one-foot depth of removal is estimated for the surface removal areas (outside of areas with removals greater than 1 foot), which results in approximately 135,190 CY of contaminated surface soils, or about 19 percent of the total (725,240 CY). The anticipated removal volume is presented by mine site areas in Table C.4-2. These volumes were modified slightly, from the NECR Mine Site Removal Volume Estimate Memo (Stantec, 2017), due to changes in the proposed excavation surface.

The PTW volume estimate was increased from the 2014 PDS estimate based on review of the borehole and testing information where PTW was encountered. To estimate the volume that would be placed in the Repository, the PTW volume (32,200 CY) was subtracted from the neat-line excavation volume, and the net volume was then reduced by 5 percent to 658,388 CY to account for the compaction effort during placement.

Table C.4-2: Summary of Estimated Neat-Line Removal Volumes by Area

Area ID	Excavation Area Description	Estimated Neat-Line Soil Removal Volume (CY)	Average Estimated Depth of Removal (ft)	Maximum Estimated Depth of Removal (ft)
1	Vent Holes 3 and 8	14,763	1	1
2	Boneyard and Non-Economic Material Storage Area	37,005	2	20
3	Sandfill No. 2, NECR-2, NECR-2 Drainage, and Sandfill No. 3	67,138	2	20
4	Area North of Sediment Pond and Pond 3	13,771	2	12
5	TPH Stockpile	5,425	4	13
6	Sediment Pad	23,086	4	23
7	Sandfill No. 1	40,917	3	21
8	NECR-1 and Pond 3 Drainage	422,473	13	47
9	Pond 1 Area	29,302	3	15
10	Pond 2 Area	7,758	2	21
11	TPH Stockpile Area	974	1	1
12	Pond 3 Area and Eastern Portion of Construction Access Track 4	34,272	3	24
13	Drainage East of Sandfill 1	28,356	1	8
	Total	725,240		

This estimated total volume in the table includes total petroleum hydrocarbon (TPH) impacted soil and PTW material, but does not include the Mine Site debris volumes, with the exception of the Boneyard (Area 2) and Pond 1 Area (Area 9) where 11,800 CY and 1,000 CY, respectively, of buried debris has been included in the neat-line excavation volume. The volume of PTW is discussed further in Section C.4.4. Mine Site debris volumes are discussed in the following sub-section.

C.4.4.2 Mine Site Debris Volume Determination

The 2014 PDS included a site reconnaissance survey within the Mine Site area to identify and quantify surface mine debris and structures, including concrete, building foundations, pipes, waste piles, and other scrap metal. Mine site debris is scattered throughout the Mine Site and is mostly located on the surface with the exception of the vent hole hoist foundations (Area 1) and the buried debris located within the Boneyard (landfill) Area (Area 2) and Pond 1 Area (Area 9) as discussed in the previous section. Details of this site reconnaissance are provided in the 2014 PDS Reports (MWH, 2014a and 2014b). This survey identified approximately 25,600 CY of mine debris, 12,800 CY of which have been accounted for in the mine waste volume determination. Stantec added a conservative estimate of an additional 10,000 CY of mine debris to account for trees and other vegetation that could be removed from the Mine Site during the RA. Mine site debris, including vegetation, may or may not be above the FSL and alternative means of disposal, other than the Repository, may be considered for materials that are below the FSL. Table C.4-3 summarizes the anticipated in-place volume of debris, once moved and placed within the Repository. Debris mapping is included on Drawing 3-03.

Subsurface anomalies identified in the 2011 Geophysical Report will be removed as encountered during the Mine Site Waste RA (Phases 1-6). This volume of material has been accounted for in the debris removal volume as discussed in Section C.4.3.2. Per recommendations in the 2011 Geophysical Anomaly Trenching Report (MWH, 2011b), "...there were no indications that the anomalies observed during the 2006 geophysical survey are, or were, potential sources of constituents of concern. Therefore, Stantec does not recommend further investigation, removal of materials, or treatment of soils related to the anomalies." Debris, with the exception of the capped vents located in Area 1 and the historical mine shafts located in the NECR-1 and NECR-2 areas, encountered at the ground surface or extending up to a depth of 10 feet below the existing ground surface, will be removed and hauled to the Repository for disposal. Any remaining debris or structures found remaining at a depth greater than ten feet below existing ground surface and verified by sampling and surveys for release for unrestricted use, will be left in place. An equipment and material release survey for surface contamination levels for unrestricted use, as specified in the U. S. Nuclear Regulatory Commission (USNRC) Regulatory Guide 8.30 will be performed for any debris left in place. Debris or structures left in place will be covered by a minimum of 12-inches of soil during final grading.

Should survey indicate that the debris found at 10 feet or deeper remains contaminated, further excavation and removal will be completed such that the removal depth extends at least to 10 feet below the proposed final grade for the surrounding area. Once excavated to this depth for removals, the area would be backfilled with approved material back to the proposed grade.

The existing shaft and vent structures extend deeper than 10 feet below existing grade. Each structure within the removal area will be evaluated for structural integrity and proper closure as they are encountered during the RAs. If it is determined that the shaft or vent is not properly sealed, or the structure is not deemed to be structurally sound, the seals will be repaired or replaced. Should the structure be determined to be structurally sound and properly capped and closed, the cap structure will remain in place, as-is, and be covered with a minimum of 12-inches of clean soil, following soil removals. If the in-place structure protrudes above the final regraded ground surface, additional clean soil shall be added to mound around the structure to ensure positive drainage down-gradient.

Table C.4-3: Estimated Mine Site Debris Volumes

Debris Type	Volume (CY)	Location(s)
Mixed/Buried	See note 1	Areas 2 and 9
Concrete	8,200	Various Areas
Wood	2,600	Various Areas
Metal	2,000	All Areas
Rubber	<10	Various Areas
Plastic	<10	Various Areas
Vegetation	10,000	All Areas
Total	22,800	

Note 1: Buried debris are accounted for in mine waste excavation volume.

The estimated 22,800 CY of Mine Site debris does not include the TPH stockpiles, which are located northwest of Ponds 1 and 2, nor the buried debris, which are accounted for in the Boneyard (Area 2) and Pond 1 (Area 9) mine waste removal volumes (see Table C.4-2) as discussed above. It is anticipated that the CC will address the mine debris early in the removal activities and will cut the debris into transportable sizes. If disposed of in the Repository, the debris will be further size-reduced (crushed) if necessary, spread in thin lifts, and filled over and around with mine waste soils after placement to minimize void spaces and associated settlement. The vegetation debris from the mine is proposed to be shredded and/or chipped at the mine site and then hauled for placement in the Repository. The shredded vegetation debris will be spread with soil and not permitted to be placed in nested layers. The debris volume was not reduced to account for compaction in the Repository, since some of the debris is not expected to change density as it is placed.

C.4.5 Principal Threat Waste

PTW is defined by the USEPA as "source materials considered to be highly toxic or highly mobile which generally cannot be contained in a reliable manner or would present a significant risk to human health or the environment should exposure occur" (USEPA, 2011). At the Mine Site, wastes with Ra-226 values greater than 200 pCi/g and/or greater than 500 milligrams per kilogram (mg/kg) of total uranium are considered PTW and were identified in five locations within four of the removal areas. The approximate locations of the PTW are shown on Drawings 3-03 and 3-04. PTW within 80 percent of the PTW RAL (160 pCi/g for Ra-226 and 400 mg/kg) will be targeted for offsite removal so that material above the PTW RAL is not placed in the Repository.

C.4.5.1 PTW Volumes by Area

PTW material was identified in four of the 13 impacted soil removal areas. The lateral and vertical extents of the PTW are estimated based on surface and sub-surface radiological survey and analytical results. To assist the CC with identification of potential PTW material, the PTW areas will be delineated, by survey, with boundary stakes prior to any removal activities from these areas. Actual lateral and vertical extents will be confirmed through excavation control. Estimated boundaries of each of the four PTW areas identified are shown on Drawings 3-03 and 3-04). The PTW material volume estimates are:

- Sediment Pad Area (Area 6) – 6,000 CY
- NECR-1 Area (Area 8) – 3,000 CY
- Pond 1 (Area 9) – 20,500 CY
- Pond 3 Area (Area 12) – 2,700 CY

Stantec recommends targeting the removal of material within 80 percent of the PTW RAL for conservancy. This minus 20 percent material volume is estimated to be only approximately 3,500 CY, in addition to the volumes above. This was estimated

by expanding the PTW removal areas, and corresponding depths, to include boreholes with test results within 80 percent of the PTW RAL. The additional volume of material within 80 percent of the PTW RAL is located in the Sediment Pad Area (194 CY), Sandfill 3 Area (1,745 CY), NEMSA Area (763 CY), and NECR-2 Area (841 CY). The PTW (and 80 percent PTW RAL) volumes will be confirmed during excavation and screening of the mine waste and may vary from the estimates above.

C.4.5.2 Management of Principal Threat Waste

Identification and segregation of the PTW will be performed using a combination of in situ and ex-situ gamma radiation level measurements as discussed in Section C.4.6 and further detailed in Appendix T. The 2011 Action Memo specifies PTW RALs as wastes at NECR containing either 200 pCi/g or more of Ra-226 and/or 500 mg/kg or more of total uranium. Since the soils at the Mine Site are impacted by uranium ore, which would be in secular equilibrium with associated decay products, the 500 mg/kg total uranium would be equivalent to about 165 pCi/g of Ra-226. Therefore, excavation and segregation of mine waste exceeding the 165 pCi/g Ra-226 RAL would also assure that uranium ore mine waste above the total uranium RAL of 500 mg/kg are segregated.

An action level for in situ gamma radiation excavation control survey in counts per minute (cpm) for PTW segregation will be determined using the site-specific correlation between direct gamma radiation levels and Ra-226 concentrations in soil as discussed for the excavation control. It is anticipated that PTW material be excavated in one-foot increments, both vertically downward and horizontally outward from the depths where PTW has been identified until the PTW has been removed (surface scanning shows material less than 80 percent of PTW RAL). Although areas have been identified, through characterization, as containing PTW material, as shown on Drawing 3-04, PTW may be encountered in, and be required to be removed from, other areas. Stantec anticipates that a full-time material radiological scanning technician will be required during excavation to confirm removal of the PTW material.

While excavating in areas that may contain PTW, should surface scanning indicate Ra-226 concentrations in the soils of within 80 percent of the PTW action level, or 132 pCi/g, the soils will be segregated by the CC and hauled to the PTW staging area (within the Mine Site in the former Trailer Park area near the end of Highway 556 - see Drawing 3-05). The proposed PTW staging area is described further in Appendix B. The CC will be responsible to verify removal of the PTW material within the Mine Site as well as provide segregated stockpiling of PTW material within the PTW staging area. A grab composite soil sample will be collected from the excavated material for confirmatory Ra-226 and total uranium analyses by a laboratory in accordance with the frequency and procedures provided in the project technical specifications given in Appendix J. Upon confirmation that the material exceeds the PTW RAL, the material will be given final designation as PTW and remain in the staging area until such time as it is loaded into highway trucks for transport to a USEPA-approved off-site disposal facility or the White Mesa Mill for further processing. Loading areas, clean vs. dirty truck access, and on-site haul routes for the PTW are discussed in Appendix B. Should the laboratory analyses indicate that the material is below the PTW RAL, the material will be relocated to a previously defined removal area for transport and placement within the Repository.

The removal of PTW material identified for Phase 1 removal will begin within six months of the completion of PTW removals during Phase 1. Phase 1 activities are discussed further in Section C.4.7.1. Any additional previously unidentified PTW encountered during the remaining phases will be excavated and hauled to the PTW staging area for temporary storage until enough PTW volume has been excavated and stockpiled to make removal from the site economical, or by the end of the removals, whichever is earlier.

Temporary stormwater run-on will be controlled via diversion channels capturing water up-gradient from the PTW staging area and diverting it along the west and east side of the staging area, emptying into the existing drainage north of the highway via two culverts running under the road. Stormwater run-off from the staging area will be captured in a temporary stormwater catchment pond, located along the northeast edge of the staging area. This pond will be excavated during Phase 1, with contaminated excavated material temporarily relocated to the NECR-1 area for removal to the Repository in Phase 3. Material below the RAL will be stockpiled on site for future use, including localized grading and backfill of the pond upon cleanup completion.

Due to the location of the proposed PTW staging area within the valley east of the mine site proper, the staging area is relatively protected from wind on the south, west and east. The Contractor will need to provide a barrier for prevention contamination of the surrounding area to the north due to windblown PTW material. It is anticipated that this barrier would be an earthen barrier, snow fence or similar. In addition, it will be the responsibility of the Contractor to provide dust suppression water over the PTW staging area in accordance with best management practices (BMPs) and the Technical Specifications.

C.4.6 Excavation Control and Methods

The following list provides the anticipated excavation methods for the Mine Site RA. These methods align with generally accepted excavation practices used for mining remediation projects.

- Excavations should be completed from high to low elevations (i.e. downhill), utilizing a horizontal working surface whenever possible.
- Removal should begin by excavating to the initial specified depths shown on Drawing 3-02 and then following confirmation scanning, excavation would either be determined to be complete or would proceed incrementally until material radiological levels are shown to be below Action Levels or until bedrock is encountered.
- To the extent possible, excavated mine waste materials and debris exceeding the RALs should be loaded directly into haul trucks, transported, and placed within the Church Rock Mill Site (Mill Site) Repository. The exception will be PTW materials that will be excavated and hauled to the PTW staging area to be loaded into highway trucks.
- The temporary PTW staging area should be maintained in accordance with generally accepted construction practices, including practices for stormwater controls, dust suppression, and good housekeeping. The stockpile will be kept moist to limit dust generation and the Contractor will be required to install wind breaks (i.e. snow fence or a sediment wall) on the north side of the PTW storage area to prevent wind-blown material from leaving the work area. PTW materials stored in the temporary staging area, not actively being worked for longer than 14 days, will require temporary stabilization to prevent erosion and wind-blown contamination.
- Surface water and stormwater management should be in accordance with the Construction Stormwater Management Plan for the Mine Site as described in Appendix E. The plan identifies BMPs that should be implemented by the selected Contractor during construction to control, divert, and manage surface water as well as mitigate sediment transport.
- Verification will be performed to demonstrate excavated areas meet cleanup levels and that additional contaminant delineation has been completed during the Mine Site removal, in accordance with the project performance standards. Verification procedures are described in Appendix T.
- Mine waste excavation should be performed using standard excavating equipment and haul trucks.
- Excavations should be scheduled, if possible, during drier periods of the year to minimize the potential for flooding of work areas.
- Final regrading of excavated areas should be performed to provide for positive drainage to existing waterways and minimize ponding of waters within the Mine Site. Fill materials required to make final grading are anticipated to be sourced from clean overburden soils from within the Mine Site area. Fill should be placed, moisture conditioned, and compacted in lifts in accordance with project technical specifications.

An Excavation Control Plan (Attachment T.1) has been developed for the Mine Site RA and is included as part of the Cleanup Verification Plan (Appendix T). The objective of excavation control is to support removal of waste at the Mine Site that exceeds the RALs established in the 2011 Action Memo. The excavation control surveys will be conducted consistent with Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), Section 5.4, Remedial Action Support Surveys, to support and monitor effectiveness of remediation to achieve residual soil radioactivity to RALs. The 2011 Action Memo specifies RALs for Ra-226 at 2.24 pCi/g and for total uranium at 230 mg/kg for removal of mine waste at the Mine Site. Since the soils at the Mine Site are impacted by uranium ore, which would be in secular equilibrium with associated decay products, the 230 mg/kg total

uranium is equivalent to about 76 pCi/g of Ra-226. Therefore, removal of mine waste exceeding the 2.24 pCi/g Ra-226 RAL would also assure that uranium ore mine waste above the total uranium RAL of 230 mg/kg is removed.

In situ direct gamma radiation surveys will provide real-time information and enable excavation control for efficient removal of impacted soil to the RALs, as compared to soil sampling. The excavation control will be performed by conducting direct gamma radiation scan and static surveys. The direct gamma surveys provide the Ra-226 level in soil as equivalent cpm correlated to the RAL for Ra-226 concentration in soil is in pCi/g. The RAL in cpm will be determined for the gamma survey detectors using the site specific correlation for Ra-226 concentration in soil to detector cpm developed for the RSEs and updated and used for Interim RAs (IRAs), as discussed in detail in the Cleanup Verification Plan (Appendix T). The direct gamma radiation survey will be conducted using a 2x2 NaI(Tl) scintillation detector interfaced with a Ludlum 2221 Scaler/Rate meter, similar to the instrumentation used for the Site RSEs, IRAs and PDS. This selected instrumentation will meet the static survey minimum detection concentration (MDC) at less than 50 percent of the 1.24 pCi/g Ra-226 derived concentration guidance level (DCGLw), and the scan MDC at less than 50 percent of the 2.0 Ra-226 DCGLemc for the Mine Site. The Cleanup Verification Plan (Appendix T) also describes the survey instrument in detail.

The lateral and vertical extent of the mine waste above the RALs has been characterized and established in the 2014 PDS (MWH, 2014a and 2014b), as well as in the following RSE documents:

- Removal Site Evaluation Report (MWH, 2007)
- Supplemental Removal Site Evaluation Report (MWH, 2008)
- Removal Site Evaluation Report, Red Water Pond Road (MWH, 2010)
- Supplemental Removal Site Evaluation Report, East Drainage Area (MWH, 2011a)

The removal areas are shown on the Section 3 Drawings. The excavations will consist of initial removal of the mine waste to the estimated depths in each area of mine site shown on the drawings. Following the initial excavation, a scan gamma radiation survey will be conducted in the excavated areas to identify any residual levels of Ra-226 soils above the RALs. If necessary, the residual gamma radiation levels will be verified with static survey based on the levels from the gamma survey. This method will be repeated until the excavated area shows levels below the RALs. In addition to providing the impacted soil excavation support, the excavation control survey will help determine if the area is ready for the final status survey.

C.4.7 Sequencing

Stantec developed a Mine Site excavation sequence. The mine waste excavation was broken down into 13 different removal areas. This proposed sequence is preliminary and will be finalized by the selected earthworks Contractor prior to execution of the work. The proposed mine waste excavation and removal sequence is provided in the Section 3 Drawings and is discussed in the following subsections.

Main objectives for the mine excavation activities are:

- Maintain a safe work environment
- Removal of soil materials within the Mine Site above the 2.24 pCi/g Ra-226 RAL above bedrock
- Transport excavated mine waste and debris exceeding the RALs to the Mill Site Repository location, or off-site as required, meeting Performance Standards included in the ROD (USEPA, 2013)
- Confirmation surveys to demonstrate that remaining materials within the Mine Site fall below USEPA Action Levels
- Containment of contact surface water during removals, including run-on and runoff flows within the Mine Site boundaries

- Minimization of construction traffic within previously cleaned areas (maintain a removal haul access track to the cleaned upper portions of the Mine Site valley)
- Diversion of clean run-on water around areas where mine waste is being removed

C.4.7.1 Phase 1 Removal

Prior to initiating Phase 1 Removals, impacted materials in the vicinity of the support/PTW loading area along the haul road, will be excavated and moved to the Mine Site temporarily to develop the PTW staging area. Gamma scans will be used to confirm any existing surficial material has been removed prior to hauling of PTW to the area. Phase 1 Removal includes the removal of the PTW material identified in the 2014 Mine Site PDS (MWH, 2014b) and shown on Drawing 3-04. As mentioned previously, PTW has been defined by the USEPA in 2011 as "source materials considered to be highly toxic or highly mobile which generally cannot be contained in a reliable manner or would present a significant risk to human health or the environment should exposure occur." As discussed in detail in Section C.4.4, PTW material was identified in the following areas:

- NECR-1
- Sediment Pad Area
- Pond 1
- Pond 3
- Sandfill 3 (80 percent PTW RAL)
- NEMSA (80 percent PTW RAL)
- NECR-2 (80 percent PTW RAL)

Based on surface scanning and subsurface samples, the PTW is located near the surface at NECR-1 and within Pond 3. PTW was identified from near surface to depths of 15 feet in Pond 1 and from near surface to approximately 7.5 feet within the Sediment Pad footprint. Additional near-PTW RAL material within Sandfill 3, NEMSA, and NECR-2 is near surface (0-1.5 feet). Stantec recommends the excavation and removal of PTW in each of these areas as part of Phase 1. PTW (including material within 80 percent PTW RAL) will be hauled to the PTW staging area to await confirmatory laboratory testing results prior to loading highway trucks. Overburden materials from these areas will be stockpiled near the removal locations for haulage and placement in the Repository (if above RAL) or for localized grading (if below RAL).

As part of Phase 1, the surficial (one foot) removal of contaminated material in the highway truck loadout and turnaround (see Area 13, Drawing 3-04), north of the proposed staging area and south of Highway 556, will need to be completed. This will be required prior to establishment of the support area facilities in this area. This shallow removal is expected to result in only a small volume of material. The material can be stockpiled nearby, within the Mine Site, if the Repository has not yet been prepared for materials.

C.4.7.2 Phase 2 Removal

Phase 2 Removal includes the following areas shown on Drawing 3-05: (1) Vent Holes 3 and 8, (2) Boneyard, (3) Sandfill No, 2 and No. 3, (4) Area North of Sediment Pond, and (5) Sandfill No. 1.

Activities in this phase include removal (and demolition if required) of near-surface mine waste as well as concrete and masonry structures (as shown in Photo C.4-1) in and around Vent Holes 3 and 8 (Area 1) on the northwest side of the mine area as shown on Drawing 3-05. Based on surface radiological survey information, mine waste within this area is located near-surface to an estimated depth of one foot.

Mine waste and debris exceeding the RALs will be transported to the Repository along an existing dirt track (Construction Access Track 1 on Drawing 3-05) from the Vent Shaft Area to a track (Construction Access Track 2 on Drawing 3-04) along the

Mine Site valley and to the proposed haul road (discussed in Appendix D). Construction Access Track 1 is aligned with an existing single-track and will need to be widened and graded to allow safer and easier access for haul trucks. An estimated 14,763 CY of mine waste and several thousand CY of debris are anticipated to be removed from the Vent Shaft Area. Temporary stormwater controls are not anticipated for this specific area as there is not a large run-on catchment. It is anticipated, however, that the CC will install temporary erosion control features, as discussed in Appendix E and in accordance with the Technical Specifications, as well as work from higher elevation to lower elevation to minimize runoff from impacted areas over completed removal areas.

Phase 2 Removal will also include removal of mine waste from the two "legs" of the Boneyard Area (Area 2) in the far southwest reaches of the Mine Site area, as shown in Drawing 3-05. The debris are primarily buried below grade in this area. The northwestern leg of the Boneyard Area includes areas with surface and buried debris including pipes, scrap metal, concrete, and wood. This debris will be removed and debris exceeding the RALs will be placed within the Mill Site Repository along with the mine waste. Photo C.4-2 shows buried debris within the Boneyard Area. Vent hole 6 is located outside the removal area for the Boneyard and to the south. Vent Holes 9 & 10 are located west of the Boneyard and outside the cleanup areas, on Section 34.

The southeastern leg of the Boneyard Area is not known to contain debris, and only mine waste soils will be removed. Mine waste removal is estimated to range from surface clean-up within the southeastern leg, to excavation depths of approximately 10 feet in the northwestern leg.

Mine waste and debris exceeding the RALs removed from the Boneyard Area will be transported to the Repository via Construction Access Track 2 and the proposed haul road, as described in Appendix D. An estimated total of 37,005 CY of mine waste will be removed from the Boneyard Area. The CC will install temporary erosion control measures and complete mine waste removal moving from the upper elevations (south and west), to lower elevations (north and east). Runoff from this area will drain to Pond 3, which serves as the main temporary stormwater collection point, or retention basin, during construction as discussed in Section C.4.6.7.

Mine waste, including concrete and masonry structures within Sandfill No. 2, NECR-2, NECR-2 Drainage Area, and Sandfill No. 3 (shown as Area 3 on Drawing 3-05) will be excavated and removed as part of Phase 2. Based on soil radiological surveys, Stantec estimates that mine waste will be removed to varying depths, with a maximum depth of 20 feet in the southeast portion of Area 3. Stantec recommends that the CC excavate and remove mine waste from upgradient to downgradient (roughly south to north), while maintaining positive drainage back to the south to prevent run-on and runoff from flowing over impacted, then clean areas. Mine waste exceeding the RALs will be transported to the Repository via Construction Access Track 3, Construction Access Track 2, and the proposed Haul Road. Approximately 67,138 CY of mine waste will be removed from this area. The CC will be responsible for temporary erosion controls as well as ensuring that runoff from impacted areas does not flow over remediated areas. Runoff from this area will flow to the Pond 3 temporary construction stormwater collection basin. Vent hole 7 is located within the Sandfill 3 area.

A previously capped historical mine shaft is located within the NECR-2 footprint and shown on the drawings. Formal documentation of the dimensions, elevation, and decommissioning was not available; however, anecdotal evidence indicates that the shaft has been plugged and a concrete cap was constructed. Due to uncertainty of the exact elevation, location, decommissioning and capping conditions, a 50-foot diameter exclusion area will be marked and observed at all times during NECR-2 excavation activities to prevent equipment from damaging the structure. The Contractor will carefully excavate material within the exclusion area until the mine shaft cap is encountered. Once the cap is encountered, Stantec will evaluate the condition of the cap and develop a plan for modification of the excavation plan, or modification of the cap, if required.

Mine waste in the area north and west of the Pond 3 and Sediment Pad Area (shown as Area 4 on Drawing 3-05 will also be removed as part of this phase. Soil surveys in this area indicate that mine waste is mainly surficial; it is anticipated that the upper one foot (an estimated 13,771 CY) of material will be removed within the area. In addition, an existing diversion channel within Area 4 will be modified to allow upstream flows to be diverted around the Sediment Pad and Pond 3 areas during work in those

areas. Modification of the drainage channel is anticipated to include earthwork activities to clean out the existing channel to provide capacity for diversion of upstream flows.

Mine waste within the Sandfill No. 1 area (shown as Area 7 on Drawing 3-05) will also be removed during Phase 2. Soil survey results indicate that mine waste is near surface to a depth of approximately 6 feet, with a small area of mine waste reaching to a depth of approximately 21 feet in the northern half of Sandfill No. 1. Mine waste exceeding the RALs will be transported to the Repository via Construction Access Track 4 and the proposed Haul Road. This area is located on a hill and the run-on catchment area is small, therefore temporary stormwater controls will not be required. Runoff from this removal area would flow to the temporary diversion channel to be located on the uphill side of the Mine Waste haul road. This diversion would convey water northwest to the first containment pond (S01) to be located along the haul road for collection and removal to the evaporation ponds. The CC will be responsible for installation of temporary erosion control measures and ensuring that contact water does not flow over areas where removals have been completed.

C.4.7.3 Phase 3 Removal

Phase 3 activity will include removal in the Sediment Pad area (Area 6) and the NECR-1 stockpile (Area 8). Based on soil surveys, Stantec estimates that mine waste within the Sediment Pad Area will be removed to a maximum depth of 23 feet (approximately 23,086 CY of mine waste). Excavated materials will be transported to the haul road via Construction Access Track 2. Approximately 6,000 CY of the total quantity of mine waste removed from the Sediment Pad Area are expected to meet the definition of PTW and will require removal and transport off-site as discussed in Section C.5.2. Upstream stormwater flows will be diverted to the north around the Sediment Pad Area in the diversion channel (Area 4) built during Phase 2.

The second area included in Phase 3 is the NECR-1 stockpile (Area 8 on Drawing 3-06). This area extends to the northern property line and will require temporary construction access (50-foot easement) onto the Navajo Nation property to the north to complete the removal excavation. This stockpile was previously consolidated into a smaller footprint during the IRA completed in 2007. In addition, TPH materials located near Area 8 were removed and placed in the TPH stockpiles located in Area 5 (to be removed in Phase 4) as part of the 2012 IRA (MWH, 2014a). Any remaining TPH material encountered within the NECR-1 footprint will also be removed to bedrock during this Phase and placed in the Repository.

Construction access to this area will be provided via a temporary construction access track along the northern toe of the NECR-1 stockpile, within the 50-foot temporary easement (see Drawing 3-06) or alternatively via Construction Access Track 2. The temporary construction access track will include a stormwater containment berm and channel running along the downstream side of the track to mitigate drainage off-site. This stormwater containment channel will capture flow from NECR-1 footprint and convey it to a temporary stormwater collection basin upstream of the armored arroyo on the north edge of the Mine Site, as shown in the Drawing 3-06.

Based on subsurface soil investigation results, Stantec assumes that the entire NECR-1 stockpile will need to be removed. The NECR stockpile has a maximum removal depth of approximately 47 feet. An estimated 422,473 CY of impacted soil and rock will be removed during this activity. It is estimated that approximately 3,000 CY of PTW material is included in the total quantity of mine waste to be removed from this area. This PTW material will be disposed off-site as discussed in Section C.5.2. The approximate location of the PTW within the NECR-1 area is shown in Drawing 3-05. Final determination of the extents of this PTW material will be required during removal activities and will be completed in accordance with procedures provided in Section C.5.2.

A previously capped historical mine shaft is located within the NECR-1 footprint as shown on the drawings. Review of available documentation indicates that this concrete-lined shaft has a diameter of 14 feet and reaches to a depth of 1,788 feet. As is the case with the historical shaft in the NECR-2 area, formal documentation of the elevation, or decommissioning was not available; however, anecdotal evidence indicates that the shaft has been plugged and a concrete cap was constructed. Due to uncertainty of the exact elevation, location, decommissioning, and capping conditions, a 50-foot diameter exclusion area shall be marked and observed from the commencement of removal activities until the NECR-1 excavation reaches an elevation of 7091 ft, which is assumed as 10 feet above the top of the mine shaft cap. At that time, the Contractor will carefully continue excavation until

the mine shaft cap is encountered. Once the cap is encountered, Stantec will evaluate the condition of the cap and develop a plan for modification of the excavation plan, or modification of the cap, if required.

Since the NECR-1 stockpile serves as a portion of the southeastern abutment for the Pond 3 embankment, a significant portion of the embankment will be removed. The clean embankment materials will be stockpiled for use during final site grading. Hydrologic studies of the Pond 3 basin indicate, once impacted NECR-1 materials have been excavated, the remaining berm height and corresponding Pond 3 capacity will be sufficient to provide storage of impacted upstream flows during construction. Based on site hydrologic studies, the height of the remaining portion of the Pond 3 embankment will be sufficient to provide storage of impacted upstream runoff flows during construction.

Mine waste exceeding the RALs removed from the NECR-1 stockpile will be transported to the Repository via Construction Access Track 2 and the proposed Haul Road. A temporary stormwater diversion berm or channel will be constructed along the upstream edge of the NECR-1 stockpile as shown in Drawing 3-06. This diversion structure would channel runoff upstream of the NECR-1 stockpile into Pond 3 to prevent contact water from flowing over the remediated NECR-1 area. This diversion structure will remain in place until Pond 3 removals are complete in Phase 5.

C.4.7.4 Phase 4 Removal

Phase 4 includes the TPH stockpiles (Areas 5 and 11) and Ponds 1 and 2 (Areas 9 and 10, respectively). Removal activities will include the covered TPH materials, concrete, mulched trees and other vegetation, and scrap metal stockpiles to the south of Pond 3 (shown in Drawing 3-07 as Area 5). There is an estimated volume of 5,425 CY of TPH material within the covered stockpiles. Concrete, tree limbs, and scrap metal volumes are included in the debris volumes provided in Section C.4.3.2. Photo C.4-3 shows the TPH, concrete, and tree debris stockpiles. The scrap metal pile (not shown in this photo) is to the left of the tree debris stockpile.

Once the material stockpiles have been removed, mine waste (to an estimated depth of 1 foot) underlying and in the area of the stockpiles will be excavated and removed (Area 11). An estimated 974 CY of mine waste will be removed from this area. Runoff from this area drains to Pond 3 and no additional temporary stormwater diversions will be required. Excavated stockpile and mine waste exceeding the RALs will be transported to the Repository via Construction Access Track 2 and the proposed Haul Road.

Phase 4 activities will also include excavation and removal of mine waste in existing Ponds 1 and 2 (Areas 9 and 10, respectively). These ponds are south of the TPH stockpiles area with each of the ponds impounded on the northern side by the existing berm road (Construction Access Track 4) as shown on Drawing 3-07. Based on results of subsurface surveys, Stantec estimates that mine waste range up to approximately 15 feet in depth within Pond 1 and up to a depth of approximately 10 feet in Pond 2. An estimated 29,302 CY and 7,758 CY will be removed from Ponds 1 and 2, respectively. The Pond 1 work area is expected to contain approximately 20,500 CY of PTW material. Excavation and management of the PTW material is discussed in Section C.5.2.

Stantec proposes to begin excavation of the mine waste within Pond 1 because steeper terrain in Pond 2 hinders access into the pond. Excavated mine waste exceeding the RALs from Pond 1 will be removed and transported to the Repository via the existing berm road (Construction Access Track 4), as shown on Drawing 3-07. Once mine waste has been removed from Pond 1, Stantec proposes to move clean fill from the berm road north of Ponds 1 and 2 and place it within Pond 1 to establish positive drainage from the Pond 1 area. As clean material is moved from the berm road, accessibility to Pond 2 for removal of mine waste will improve. Mine waste exceeding the RALs excavated from Pond 2 will be transported to the Repository via Construction Access Track 4 and the proposed Haul Road. Once the mine waste has been removed from Pond 2, additional clean fill from the berm road will be excavated and placed in lifts in Pond 2 to establish positive drainage from the pond.

At present, run-on water reporting to Ponds 1 and 2 is contained within each of the ponds. This will remain the case until excavation of the Construction Access Track 4 road berm and material placement within Ponds 1 and 2 is completed allowing drainage north into the TPH area and eventually into Pond 3.

C.4.7.5 Phase 5 Removal

Phase 5 removal will include excavation of mine waste from within the Pond 3 area as well as the area along the eastern portion of Construction Access Track 2 (Area 12 on Drawing 3-08) to the Mine Site gate. Based on results of the subsurface radiologic survey, Stantec estimates that mine waste reaches a maximum depth of approximately 24 feet in this area. Soils surveys indicated the presence of an estimated 2,700 CY of PTW material within the Pond 3 work area.

Pond 3 is proposed to serve as the primary stormwater collection location for the Mine Site catchment during construction. Prior to removal of mine waste within Pond 3 a temporary diversion plug will be constructed within the existing drainage upstream of Pond 3 to divert run-on water into the diversion channel, modified in Phase 2, north around Pond 3. In addition, impounded water, if any, will require removal, likely via pump truck, and will be transported and discharged into the evaporation ponds on the reclaimed tailings impoundment. In addition, eroded sediment that accumulates in the pond during construction will also be removed during this phase. The process of removing mine waste from upgradient to downgradient (generally southwest to northeast) will also minimize the amount of impacted stormwater.

Once mine waste and eroded sediments have been removed from Pond 3, removal will continue to the northeast along Construction Access Track 2 to the existing Mine Site gate. Soil surveys indicate that only surface soils along the construction track are impacted; therefore, an excavation depth of one foot is assumed. Up to approximately 34,272 CY of mine waste will be removed from Pond 3 and eastern portion of Construction Access Track 2.

Once mine waste has been removed from the Pond 3 and the eastern portion of Construction Access Track 2, the remaining Pond 3 embankment (clean material) will be removed and used for final grading within the Mine Site. The removal of this embankment will allow drainage reporting to Pond 3 to continue northeast, through the reclaimed NECR-1 area, to discharge into the lined arroyo along the northern border of the property.

C.4.7.6 Phase 6 Removal

The final removal phase involves the removal of impacted surface soils from the drainage east of Sandfill No. 1, as well as removal of mine waste within the removal haul access track running up the Mine Site valley, as shown within Area 13 on Drawing 3-09. This removal area extends north across New Mexico Highway 566 to the northern mine property boundary. Stantec estimates 28,356 CY of mine waste will be removed from this area. This mine waste exceeding the RALs will be transported along the proposed Haul Road to the Repository. Mine waste removal within the road right-of-way, if required, will be determined based on scanning results in the vicinity, as previously described.

C.4.7.7 Mine Waste Removal Verification

Once mine waste has been removed from a defined area, a verification radiological scanning survey, as well as sample collection and laboratory testing will be completed to confirm that mine waste has been removed. Verification activities will be completed for each remedial area in accordance with the MARSSIM procedures. Details of the mine waste removal verification procedures are provided in the Cleanup Verification Plan in Appendix T. Any material exceeding the RAL that will be left in place 10 feet below the final grade will be scanned, marked with a geotextile barrier, and geo-located.

C.4.7.8 Mine Site Removal Area Temporary Stormwater Controls

The existing Pond 3 at the Mine Site will be used to contain contact water during the removal process. Pond 3 is impounded by an embankment dam constructed of clean soil, with a current storage capacity of nearly 2.2 million cubic feet. The dam crest will be lowered by approximately six feet during Phase 2 removals, but the pond will still maintain adequate capacity to retain contact water until removals are completed. The Section 3 Drawings show other temporary stormwater controls that will be installed during the Mine Site RA. These controls are intended to be installed and removed during specific phases of construction (as shown on the Drawings) once contaminated material is removed from certain excavation areas. Table C.4-4 lists the installation and removal of temporary stormwater controls by construction phase. In addition to these temporary stormwater controls, a permanent grade control structure will be installed during Phase 3 at the inlet of the channel. Details for this structure are shown in Section 6 of the Drawings.

Table C.4-4: List of Mine Site Temporary Stormwater Controls by Phase

Removal Phase	Temporary Control	Objective
1	Install a temporary stormwater collection basin in Area 8 near the start of the Mine Site Outlet Channel.	Contain stormwater from the channel, where the RA is completed, from entering Area 8, which is under active removal.
3	Install a temporary diversion berm or collection channel separating Area 8 (NECR-1 and Pond 3 Drainage) and Area 12 (Pond 3 Area and Mine Site Excavation Haul Route).	Prevent stormwater runoff from Area 12, which is impacted, from entering Area 8, which is under active removal.
4	Install a temporary diversion berm across the eastern edge of Area 6 (Sediment Pad), extending from Area 3 (Sandfill No. 2) to the arroyo.	Divert stormwater from upgradient areas where the RA is complete to the arroyo.
5	Install a temporary earthen "Plug" in the arroyo near the inlet to Area 12 (Pond 3).	Prevent non-contact stormwater in arroyo from entering Pond 3, which is under active removal.
6	Remove all temporary stormwater controls	Allow natural stormwater drainage to occur after removal for all areas is complete.

Temporary stormwater controls for the Mine Site also must include BMPs to prevent erosion from excavated areas and unprotected slopes. These BMPs are to be defined in the Construction Stormwater Management Plan. Appendix E provides general guidelines for the Contractor to prepare the Construction Stormwater Management Plan.

C.4.7.9 Mine Site Removal Area Final Grading

Final grading of clean materials within the Mine Site excavation area will be completed once verification of removal of mine waste from the Mine Site area has been made. The final grading design optimizes (balances) cutting and filling of the remaining clean materials within the Mine Site excavation area to provide for a finished ground surface that meets the long-term drainage and slope stability requirements for the project. Specifically, the final graded design will allow for positive drainage into existing waterways and arroyos, maintain excavated and fill slopes at 3H:1V or shallower, unless founded in rock, and minimize excavated slope lengths as appropriate. The final graded design surface is provided in Drawing 3-11.

C.5 MINE SITE RESTORATION

C.5.1 Anticipated Removal Schedule

The estimated duration for removal and disposal of the mine waste at the Mine Site is one and a half to two years. This estimated duration will be further refined in consultation with the selected CC based on their proposed methods. A proposed project schedule is discussed in Appendix K.

C.5.2 Localized Final Regrading

Once mine waste has been removed from the removal areas, the CC may be required to complete localized regrading to establish positive drainage to the lined arroyo on the north edge of the Mine Site. Based on the design bottom of excavation contours, minimal final grading is anticipated. If removal excavations extend deeper than planned, clean fill may be required to establish positive drainage from the site. Clean fill material, if required to provide positive drainage, could be sourced from the Pond 3 embankment or the Construction Access Track 4 embankment located north of Ponds 1 and 2. Final design grading plans for the Mine Site are shown on Drawing 3-11.

C.5.3 Mine Site Area Restoration

As required by the 2015 AOC SOW (USEPA, 2015), the Mine Site mine waste excavation and remediation requires restoration of remediated Mine Site areas. These restoration activities include revegetation and grading to mitigate against erosion, as well as provide stormwater control. Proposed revegetation activities and details are provided in Appendix U.

C.6 BEST MANAGEMENT PRACTICES FOR GREEN REMEDIATION

The areas where Green and Sustainable Remediation has been evaluated for the removal design relate to: (1) construction materials (characteristics, manufacturing and transportation considerations), (2) construction methods, and (3) low impact/sustainability measures during construction. The 'BMP Process', as outlined in the 'Standard for Greener Cleanups' (ASTM, 2016), has been followed to select and prioritize BMPs for implementation during remedial action. The BMPs relating to Mine Site Removal and Excavations and Demolition are listed below, for a complete description of the BMP Process and list of all GSR BMPs see Section 4 of the Main RD document and Appendix A (Section A.5).

C.6.1 Construction Materials

Green and Sustainable Remediation BMPs for construction materials include promoting use of recycled, recyclable and biodegradable products, as well as products with a minimal environmental footprint. Technical specifications will be written to encourage and/or require contractors to use these types of materials (e.g. biodegradable fabric or tarps, biodiesel, recycled construction materials) when possible. Where using biodegradable or recycled/recyclable products is not feasible, contractors will be encouraged to use environmentally friendly products (e.g. phosphate-free detergents for equipment decontamination, ultra-low sulfur diesel) to the extent possible. Technical specifications will also encourage material re-use and salvage, such as re-using covers that secure and cover material in open trucks during off-site transport or using uncontaminated soil as fill or other restoration purposes.

C.6.2 Construction Methods

Construction method BMPs for mine site excavation and demolition include practices that promote efficient equipment use, sequencing activities to avoid recontamination of remediated areas and minimize rework, maintain the integrity of the natural setting and protect the local ecosystem. Equipment will be required to receive regular maintenance to improve efficiency and prevent unnecessary breakdown requiring additional resources and transport for repairs. In addition, throughout the RA continuous adjustment of excavation and placement planning shall occur to maximize use of actual amounts of cut/fill available to avoid excessive use of borrow sources. Excavated areas will be graded to conform to pre-mining topography and will be revegetated in a timely manner to limit erosion and re-work.

Emission reduction requirements are included in the Technical Specifications (Appendix J) and include:

- Restrictions on construction equipment idling: Work vehicles or work equipment shall not be allowed to idle longer than 5 minutes unless the vehicle/equipment is undergoing testing, servicing, repair, or diagnostics; the vehicle/equipment is in queue; the vehicle/equipment is accomplishing work for which it was designed; or there is a safety issue.
- Fuel requirements for vehicles and equipment: Ultra-low sulfur diesel fuel shall be used for all on and off-road operation of vehicles and construction equipment if available locally and is cost competitive.
- Non-road diesel powered construction equipment fleet requirements: All non-road diesel engines for construction equipment shall meet USEPA Tier 2 exhaust emission standards (EPA-420-B-16-022), however if these restrictions prevent utilization of local contractors Tier 1 exhaust emission standards may be considered.

C.6.3 Low Impact Development/Sustainability

Low impact/sustainability measures to be implemented during the RA consist of minimizing equipment and vehicles use where possible, planning activities to maximize efficiency, sizing equipment correctly, and potentially using temporary design features for final design elements. The design will minimize haul route lengths to the extent possible to reduce equipment use as well as water use for dust control. Where possible, buses will be used for operator transport and supervisors will be encouraged to plan activities to minimize vehicle use. The selected contractor will be asked to minimize the volume of waste hauled off-site by effectively separating uncontaminated waste, contaminated waste (non-PTW) and PTW to minimize loads taken to the Mill Site and to the off-site disposal facility. Excavation and placement of mine waste will be planned prior to beginning work to minimize moving stockpiles and work locations in order to reduce fuel consumption and greenhouse/dust emissions. The excavation and

placement plan will also be evaluated throughout the project to maximize use of actual cut/fill volumes and avoid excessive use of borrow sources. The selected contractor will be encouraged to size equipment correctly to task needs thereby minimizing use of heavy equipment for small tasks. The design may also evaluate the potential of using excavated areas as retention basins in final stormwater control plans.

C.7 REFERENCES

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PHOTOS

Photo C.4-1: Concrete Structures at Vent Hole Shaft Area

Photo C.4-2: Buried Debris in Boneyard Area

Photo C.4-3: Material Stockpiles South of Pond 3

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Appendix D:
Haul Routes

MWH® now part of Stantec

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ATTACHMENTS

LIST OF ACRONYMS / ABBREVIATIONS

AOC	Administrative Settlement Agreement and Order on Consent for Design and Cost Recovery
ARAR	Applicable or Relevant and Appropriate Requirement
BMP	best management practice
CC	Construction Contractor
cfs	cubic feet per second
CSF	construction support facility
CY	cubic yard
GSR	Green and Sustainable Remediation
Mill Site	Church Rock Mill Site
Mine Site	Northeast Church Rock Mine Site
MPH	miles per hour
NMDOT	New Mexico Department of Transportation
PTW	principal threat waste
RAO	remedial action objective or removal action objective
ROD	Record of Decision
SOW	Statement of Work
SWPPP	Stormwater Pollution Prevention Plan
TDA	Tailings Disposal Area
USEPA	US Environmental Protection Agency

D.1 INTRODUCTION

This appendix to the Northeast Church Rock 95% Design Report presents the layout and design of temporary haul and access roads at the Northeast Church Rock Mine Site (Mine Site) and the Church Rock Mill Site (Mill Site). Temporary roads have been designed for three types of use. The first is the haul road to transport mine waste from the Mine Site to the Repository at the Mill Site. The second are haul roads to transport borrow material from designated borrow areas to the Repository at the Mill Site for use in cover construction. The third are access roads to construction support facilities (CSFs). Design of CSFs is discussed in Appendix B of the 95% Design Report.

This appendix:

- Provides 95% design plans, profiles, and design details for access and haul roads.
- Demonstrates attainment of the applicable standards identified in the Record of Decision (ROD) (USEPA, 2013).
- Explains the rationale for the proposed access and haul road alignments.
- Discusses sequencing for site preparation, construction, and reclamation of these roads.
- Presents Green and Sustainable Remediation (GSR) considerations.

D.2 PERFORMANCE STANDARDS

The Performance Standards presented here are defined in the Action Memorandum: Request for a Non-Time-Critical Removal Action at the Northeast Church Rock Site (2011 Action Memo; USEPA, 2011), the ROD, United Nuclear Corporation Site, (USEPA, 2013), and the Administrative Settlement Agreement and Order on Consent for Design and Cost Recovery (AOC; USEPA, 2015) including the Statement of Work (SOW) attached as Appendix D to the AOC, and were developed to define attainment of the Removal Action and Remedial Action Objectives (RAOs) for the Selected Remedy. The Performance Standards include both general and specific standards applicable to the Selected Remedy work elements and associated work components. Table D.2-1 presents performance standards related to the haul roads and explains how the design accomplishes these standards.

Table D.2-1: Task Specific Performance Standards

Identifying Number*	Location of Performance Standard Requirement	Topic	Performance Standard	Comments
2	2015 AOC SOW, Paragraph 17 – Soil Transportation and Management	Soil Transport and Management	In the Design, Respondents shall provide detailed plans and specifications explaining how mine waste from the NECR Site and other materials (including borrow, backfill, and cover materials) will be managed and transported. Respondents shall include details for ensuring that Principal Threat Waste from the NECR Site, as described in the 2011 Action Memo, is not transported to the UNC Site or disposed at the Tailings Disposal Area.	Mine waste and clean borrow materials will be transported by truck along the haul roads described in this appendix. Mine waste excavation is addressed in Appendix C. Principal threat waste (PTW) will be transported off-site for disposal. Appendix B addresses the design and layout of PTW handling facilities.
14	2015 AOC SOW, Paragraph 29 – Green Remediation Best Management Practices	Green Remediation Best Management Practices	Respondents shall incorporate applicable Best Management Practices for Green Remediation listed in ASTM-E2893-13 consistent with USEPA's policy Superfund Green Remediation Strategy (2010), found at http://www.epa.gov/superfund/greenremediation/sf-gr-strategy.pdf.	Addressed in Section D.6

*Refers to identifying numbers listed in Summary of ARARs, Performance Standards and Applicable NRC Design Requirements Table (provided in Attachment 1 to main text of the 95% Design Report)

D.3 ENGINEERING DESIGN DRAWINGS

The relevant engineering design drawings are contained in Volume II – Design Drawings (Section 4). Drawings related to the haul roads are listed in Table D.3-1.

Table D.3-1: Engineering Design Drawings

Drawing No.	Drawing Title
4-01	Haul Road Overall Plan
4-02	Haul Road Plan Index
4-03	Mine Waste Haul Road Plan and Profile (1 of 4)
4-04	Mine Waste Haul Road Plan and Profile (2 of 4)
4-05	Mine Waste Haul Road Plan and Profile (3 of 4)
4-06	Mine Waste Haul Road Plan and Profile (4 of 4)
4-07	Mine Waste Haul Road Spur Plan and Profile
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4-11	Mine Waste Haul Road Drainage Control Plan (1 of 2)
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4-13	Borrow Haul Roads
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4-18	Typical Cross Sections and Details (1 of 2)
4-19	Typical Cross Sections and Details (2 of 2)
4-20	Details

D.4 HAUL ROAD DESIGN

D.4.1 Common Design Elements

For the 95% design, it is assumed that 30-cubic-yard capacity articulated dump trucks will be used to transport both mine waste and borrow material. Example trucks of this type include the Caterpillar 745, Terex TA40, and Volvo A40, which are well-suited for variable terrain and space constrained areas such as the Mine Site and the Repository.

A combination of one-lane and two-lane road widths will be used. For this design, the running surface for one-lane haul traffic is sized at twice the haul vehicle width and the running surface for two-lane haul traffic is sized at 3.5 times the haul vehicle width. This is consistent with guidelines for mine haul road design presented by Tannant and Regensburg (2001). Typical haul vehicle width for the example equipment listed above is 11.25 feet, resulting in one-lane and two-lane running surface widths of 22.5 feet and 39.4 feet, respectively. A summary of the haul road design basis is presented in Table D.4-1.

Table D.4-1: Haul and Access Road Design Basis

Road	Design Vehicle	Traveled Way Width	Max. Grade	Prism Detail	Ditch Detail	Speed Limit
Mine Waste Haul Road (1-lane)	30 CY articulated truck (11.25 ft wide)	22.5 feet	8%	2% cross-slope to ditch, no crown; gravel surfacing	1ft depth, 1.5H:1V sides	20 MPH
Mine Waste Haul Road (2-lane)	30 CY articulated truck	39.4 feet	8%	2% cross-slope to ditch, no crown, gravel surfacing	1ft depth, 1.5H:1V sides	20 MPH
Access Roads	30 CY articulated truck	22.5 feet	8%	2% cross-slope to ditch, no crown, gravel surfacing	1ft depth, 1.5H:1V sides	20 MPH
Borrow Haul Roads	30 CY articulated truck	39.4 feet	9.2%	no-ditch, 2% crown	1ft depth, 1.5H:1V sides	20 MPH

CY – cubic yard, MPH – miles per hour

Site preparation activities will include an underground utility survey and overhead utility awareness and safety mitigation. A walk-over gamma scan of the mine waste haul routes between the NECR Mine Site and UNC Mill Site will be conducted prior to construction to verify no contamination is present along the haul routes. Best Management Practice (BMP) installations for sediment and stormwater controls will be installed prior to ground disturbing activities such as stripping and stockpiling of topsoil and organics. The Construction Contractor (CC) will be responsible for controlling sediment tracking from access roads onto public roads during construction. BMPs used for sediment tracking control will be determined by the CC, and may include gravel surfacing, mud grates, rock aprons, and sweeping. These measures will be described in the Contractor's Construction Stormwater Pollution Prevention Plan (CSWPPP).

Haul and access roads will be constructed from native materials as a cut-to-fill, with excavated material from the uphill side placed as fill on the downhill side. Shallow native soils consist primarily of sandy clays and sandy silts which are suitable for temporary haul road construction, but are likely to require regular maintenance by the CC. Material needed to fill gully crossings or other low areas will be generated by road cuts in close proximity to the needed fill. Temporary cut and fill slopes are designed at 1.5V:1H. The Technical Specifications (Appendix J) require haul road fills to be compacted to 95 percent standard Proctor density. Additional geotechnical characterization of the native materials for final design is not anticipated, as these are temporary roads that will be maintained regularly during construction operations. During construction, the native materials will be evaluated by the Field Engineer (defined in Appendix V) and slopes may be flattened in areas where highly erodible materials are encountered, or steepened in rock cuts or rocky material. Samples of cut materials will be collected early during construction to determine Proctor densities. Additional sampling and testing may occur during construction if material changes are encountered.

Gravel surfacing is specified for mine waste haul roads, the Repository access road, and the Pipeline Canyon Road temporary realignment. Because aggregate material must be imported from significant distances, gravel surfacing has not been specified for borrow haul roads. Performance standards for dust control and maintenance of a safe and efficient running surface on all roads are included in the Technical Specifications. The CC may elect to include additional gravel surfacing for dust control, and during construction gravel surfacing may be needed to mitigate areas where soft or muddy conditions develop. Dust control is addressed in separately in Appendix Q (Air Monitoring Plan).

Culverts will be constructed at gully and arroyo crossings to convey flow beneath haul and access roads. Design information specific to temporary construction stormwater controls is presented in Section D.4.6.

Safety berms will be provided and maintained on the banks of haul roads where a drop-off exists of sufficient grade or depth to cause a vehicle to overturn or endanger persons in equipment. Berms will be at least mid-axle height of the largest self-propelled mobile equipment that usually travels the roadway.

D.4.2 Mine Waste Haul Road

The mine waste haul road shown on the Drawings will be used to haul mine waste excavated at the Mine Site to the Repository located at the Mill Site. The haul road will begin at the east end of the Mine Site, immediately adjacent to the existing entrance at the terminus of New Mexico State Highway 566 (NM 566). The haul road will be located roughly parallel to NM 566, until it crosses the highway near the north end of the Mill Site Tailings Disposal Area (TDA). This will be the only point where haul trucks contact NM 566. The typical haul road offset from NM 566 is about 300 feet. Upon crossing NM 566, the haul road will be located on the alignment of an existing access road to the north end of the North Cell of the TDA. Haul trucks will access the Repository at the northwest corner of the TDA. The mine waste and clean borrow haul roads will not intersect.

The mine waste haul road can be described in three segments. Refer to the Drawings for alignments and road stations (STA). Segment 1 (STA 0+00 to 21+00) is a two-lane rolling segment that begins at the Mine Site and runs parallel to NM 566 to an existing rock cut above the approximately 90 degree curve in NM 566. The road transitions from two lanes to one between STA 21+00 and 22+00. Segment 2 (STA 22+00 to 35+50) is a one-lane decline in relatively steep terrain from the intersection of the rock cut to the intersection with NM 566. The road transitions back to two lanes from STA 35+50 to 36+00. Segment 3 (STA 36+00 to 48+89) is a two-lane segment from the intersection with NM 566 to the Repository. The one-lane segment is used to reduce the construction footprint of the haul road in the steeper terrain. This segment is considered one-lane in terms of available width for passing vehicles. Turnouts are included to allow haul trucks to pass each other for efficient haul operation. Gravel surfacing is specified for the mine waste haul road.

Stormwater controls for the mine waste haul road are designed to segregate contact and non-contact runoff. The haul road will be constructed with a ditch and stormwater pond system to collect and contain contact runoff from the haul road surface. Containment will be accomplished with unlined sediment ponds at locations shown on the Drawings (refer to Drawings 4-10 and 4-11). The CC's CSWPPP will require that water and sediment from these ponds will be collected within 48 hours of storm events and hauled to the Mine Site for disposal within the temporary stormwater basin (see Appendix C). It is anticipated that a 3,000 to 4,000 gallon capacity vacuum truck or similar equipment will be used for this purpose. The Drawings include 95% design details for haul road stormwater controls.

Within the footprint of the Repository, the TDA surface cover layer will be removed to expose the radon barrier for moisture conditioning and compaction prior to placement of mine waste. Mine waste haul trucks will not be allowed to operate directly on the surface of the radon barrier. Haul trucks will only be allowed to operate where the TDA surface cover has not yet been removed, or on mine waste that has been placed over the prepared radon barrier.

D.4.2.1 State Highway Crossing

A traffic safety and contamination control system is necessary for the intersection of the mine waste haul road and NM 566. A manually operated temporary traffic light and contamination control system will be employed during working hours for traffic safety at the crossing. These features are presented in in Appendix M.

Coordination with New Mexico Department of Transportation (NMDOT) for approval and operation of this haul road crossing was initiated during the 95% design phase and is ongoing as described in Appendix M.

Upon construction completion, impacted areas of NM 566 will be inspected for structural damage. Any damage to the pavement or underlying road prism resulting from haul operations will be corrected to the satisfaction of NMDOT.

D.4.3 Borrow Haul Roads

Haul roads will be constructed to access each of the four proposed borrow areas, utilizing existing access roads as much as possible. Plans and profiles for the north, east, and west borrow haul roads are shown on the Drawings. Borrow haul roads will have two-lane running widths. These roads will be constructed at existing grade with as little cut-to-fill as practical. Ditches have not been included for these roads. Localized ponding may occur after rainfall events and will be allowed to infiltrate. Gravel surfacing, intermittent ditches, culverts and other BMP's will be field fit by the CC as needed to address intermittent drainage issues along the borrow haul roads.

Haul road construction will be conducted from each borrow area to the edge of the TDA. Once on the TDA, borrow haul trucks will operate directly on the existing cover surface. The current TDA cover surface is a rock mulch suitable for haul traffic. Leaving the existing rock mulch surface in place provides dust control and eliminates the need to use borrow material to construct these road segments.

To maintain the integrity of the existing TDA cover outside the limits of the Repository, the Technical Specifications require the CC to establish and delineate designated haul routes on the TDA cover and to restrict construction traffic to within these designated routes. Within the footprint of the Repository, traffic patterns will be determined by the CC. However, borrow haul trucks will only be allowed to operate where the existing TDA surface cover has not been removed. During cover placement over mine waste, a clean running surface must be maintained at all times to avoid the need to decontaminate borrow haul trucks. As cover construction on the Repository progresses, the CC will be required to establish and maintain designated haul routes on the newly placed cover, similar to the requirements for the existing TDA cover. Upon construction completion, areas of the Repository cover and the TDA cover subjected to haul traffic will be reconstructed to mitigate over-compaction of cover soils, or other damage that may occur from haul traffic.

Temporary haul road crossings will be required where haul trucks must cross existing TDA drainage channels and cover swales. Details for these crossings are shown on the Drawings.

D.4.4 Access Roads

Temporary access roads will be constructed or located to provide access to the CSFs in the Former Mill Site Yard and the Repository Yard(s) (see Appendix B). These roads will have a one-lane running surface width and will be located, to the extent practical, on the alignments of existing or abandoned roads to minimize construction impacts.

The access road to the Former Mill Site Yard connects to the Mine Site, via the mine waste haul road. This road will utilize similar drainage controls as the mine waste haul road for segregation and control of contact runoff.

The access road to the Repository Yard(s) will require construction of a new access point from NM 566, south of the mine waste haul road crossing. A temporary realignment of Pipeline Canyon Road will be constructed at NM 566 immediately north of the mine waste haul road crossing to provide public access to Pipeline Canyon Road. Coordination with NMDOT and other stakeholder agencies for approval of this temporary access road is being conducted. Additional traffic control discussion is presented in Appendix M.

D.4.5 Dust Control

An Air Monitoring Plan is presented in Appendix Q. Appendix Q includes the requirements for CC dust control during construction.

D.4.6 Temporary Stormwater Controls

The Section 4 Drawings show temporary stormwater controls for the haul road. In addition to these temporary stormwater controls, the CC will be responsible for implementing BMPs according to its CSWPPP, as discussed in Appendix E.

The design concept for the haul roads and CSF stormwater controls is to separate non-contact stormwater from contact stormwater through use of roadside ditches, culverts, and stormwater ponds. Contact stormwater from the haul roads will drain into the roadside ditches and then be conveyed in the ditches to one of several stormwater ponds (Drawings Section 4). Culverts are designed to convey stormwater from non-contact catchments under the haul roads and roadside ditches. Stantec designed stormwater controls for the haul road for the 10-year, 24-hour storm event, which is the New Mexico Department of Transportation design standard for roadside ditches (NMDOT, 2007). These stormwater controls are further described in the subsections below and a calculation brief for the stormwater controls is provided in Attachment D.1.

D.4.6.1 Roadside Ditches

The roadside ditches will be constructed along the interior side of the haul road to collect surface runoff and divert water to sediment ponds for controlled collection of contact water during operations. The roadside ditches will be triangular in cross section, with a design depth of 2 feet, which is designed to provide capacity to convey the peak discharge from the 10-year, 24-hour storm event. Since no erosion protection is planned for these temporary ditches, the CC will be required to inspect the ditches for erosion damage within 48 hours of a precipitation event and repair any structural damage that would hinder performance during future precipitation events.

D.4.6.2 Stormwater Ponds

Eleven stormwater ponds will serve as collection points for contact water diverted by the roadside ditches. The required volume of the stormwater ponds varies depending on the drainage area associated with each pond. The required stormwater pond volumes range from 3,000 to over 13,000 cubic feet. The CC will need to collect water and sediment from these ponds within 48 hours of storm events for disposal within the temporary stormwater basin at the Mine Site (see Appendix C). The CC also may need to periodically remove accumulated sediment in the stormwater ponds to maintain the pond capacities.

D.4.6.3 Culverts

Twelve culverts will collect stormwater from non-contact catchments that cross the haul road, convey it under the road, and release it downgradient of the road. The culverts will be 24-inch diameter corrugated metal pipe, or an approved equivalent material. Multiple culverts are required at some locations to convey the 10-year storm peak flow. Where the haul road crosses the Pipeline Arroyo, the design specifies four culverts, with a total capacity of 105 cubic feet per second (cfs). Conveying the 10-year storm peak flow (1,100 cfs) through barrel culverts is not practical at this location. An additional four culverts will convey stormwater across the east borrow and north borrow haul roads. Two culverts convey stormwater flowing in Branch Swale B and Branch Swale C, and two culverts convey stormwater flowing through the Mill Site diversion channels. The branch swale culverts will be 12-inch diameter corrugated metal pipe, or an approved equivalent material, and the Mill Site diversion culverts will be 24-inch diameter corrugated metal pipe, or an approved equivalent material.

Soil excavation and removal is required at some locations within Drainage Basins 0, 1, and 2. For construction sequencing, the haul road and drainage control plan facilities will be constructed prior to soil removal excavation within these basins. Surface water runoff from this area is currently allowed to pass downstream and will be diverted to a culvert as part of the drainage control plan. However, BMPs will need to be implemented according to the CC's CSWPPP during operations in this area to provide intermittent stormwater containment and prevent the uncontrolled release of contact water.

D.4.7 Haul Road Verification and Reclamation

Upon the completion of the Removal Action, roads used for hauling mine waste (including associated ditches, sediment ponds, or other associated features) will be subject to verification and clean up in accordance with Appendix T. Verification will also be conducted on affected portions of NM 566 in accordance with Appendix T.

Upon completion of verification and clean up, the roads will be reclaimed. Reclamation will consist of removal of imported gravel surfacing, removal of culverts, and grading according to the final approved post-reclamation grading plans. Revegetation will be conducted in accordance with Appendix U.

D.5 CONSTRUCTION SEQUENCING

The anticipated sequence for preparation, mobilization, and construction of the haul roads is as follows:

1. Underground utility survey to identify and/or verify the location of subsurface utilities along the alignments.
2. Overhead utility survey and safety mitigation as needed.
3. BMP installations for sediment and stormwater controls along haul routes.
4. Site surface preparation including stripping and stockpiling of topsoil and organics.
5. Construction of roads and associated drainage features.
6. Construction of safety berms where required.
7. Construction of fencing and gates.
8. Continuous implementation of the CSWPPP during the RA.

The anticipated sequence for reclamation and demobilization of the haul roads is as follows:

1. Verification and cleanup in accordance with Appendix T.
2. Removal of temporary fencing and gates.
3. Culvert removal, drainage restoration and surface regarding.
4. Revegetation and BMP installations for sediment and erosion control.
5. Removal of construction related equipment and materials from the site.

D.6 GREEN AND SUSTAINABLE REMEDIATION CONSIDERATIONS

The areas where GSR has been evaluated for the haul roads design relate to: (1) construction materials (characteristics, manufacturing and transportation considerations), (2) construction methods, and (3) low impact/sustainability measures during construction. The 'BMP Process', as outlined in the 'Standard for Greener Cleanups' (ASTM, 2016), has been followed to select and prioritize BMPs for implementation during remedial action. The BMPs relating to Haul Routes are listed below; for a complete description of the BMP Process and list of all GSR BMPs see Section 4 of the 95% Design Report and Appendix A (Section A.5).

D.6.1 Construction Material Considerations

Road lengths will be minimized to the extent possible to reduce the required construction equipment operating time, greenhouse gas emissions, fill material, and habitat disruption. Roads will be constructed from in-situ native soils to reduce material haul distances and use of imported materials.

Use of water for dust suppression will be minimized by utilizing alternate dust suppressant methods and techniques when possible including gravel surfacing, application of magnesium chloride (or other approved suppressants) on main haul and transport routes and minimization of vehicle speed (20 MPH).

Temporary stormwater ditches constructed along haul roads for collection of run-off are designed with no erosion protection (i.e. liners or riprap) in keeping with BMPs, specifically the use of 'less refined materials from local sources in place of refined materials' such as riprap and liners (ASTM, 2016). This will reduce fuel utilization and associated emissions which would result from sourcing riprap on-site or importation and placement of a liner system. When possible, accumulated sediment in the end-point stormwater ponds will be utilized for erosion repairs on temporary ditches along haul roads.

D.6.2 Construction Methods

Construction equipment will be appropriately sized to reduce fuel consumption and greenhouse gas emissions. Dust suppression will be utilized in the area and on the access roads to decrease visible dust related emissions. The primary point of entry/exit to the Exclusion Area will be constructed in line with BMPs for creation of a stabilized construction entrance/exit in order to minimize tracking of dirt/mud onto public roads and to reduce dust. Appendix E identifies BMPs and specific sediment control measures and stabilized entrance/exit construction methods that will be employed during construction for both sediment and stormwater control.

D.6.3 Low Impact Development/Sustainability

Access and haul routes were optimized to minimize site disruption, vehicle mileage, and to protect public health and safety. When possible, existing roads have been used for haul routes and site-wide access roads. Minimizing vehicle mileage and limiting speeds is a high yield action as it limits fuel consumption, minimizes emissions of both greenhouse gasses and dust and increases site safety by reducing likelihood of both minor and serious crashes. Additionally, a primary stabilized point of entry/exit to the work areas will be constructed according to BMPs (Appendix E, Section E.6.4) in order to prevent re-contamination of areas already remediated, prevent contamination of areas that were previously uncontaminated and prevent tracking of site soil onto public roads. This primary point of entry/exit also minimizes the required support facilities and associated infrastructure.

Access and haul roads chosen utilize existing or historical roads to the extent practical to limit additional disturbance and reduce amount of cut/fill and grading required. Access and haul roads will be reclaimed and revegetated as quickly as possible upon completion of construction.

D.7 REFERENCES

ASTM International, 2016. ASTM Standard E2893-16, “Standard Guide for Greener Cleanups,” ASTM International, West Conshohocken, PA, 2016, DOI: 10.1520/E2893-16E01, www.astm.org.

New Mexico Department of Transportation (NMDOT), 2007. Drainage Design Criteria for NMDOT Projects, Fourth Revision, June.

Tannant, D.D. and B. Regensburg, 2001. Guidelines for Mine Haul Road Design.

US Environmental Protection Agency (USEPA), 2011. Action Memorandum: Request for a Non-Time-Critical Removal Action at the Northeast Church Rock Mine Site, McKinley County, New Mexico, Pinedale Chapter of the Navajo Nation. Prepared for U.S. EPA Regions 6 and 9. September 29.

US Environmental Protection Agency (USEPA) Region 6, 2013. Record of Decision for Operable Unit OU02, Surface Soil Operable Unit, United Nuclear Corporation Site, McKinley County, New Mexico. March 29.

US Environmental Protection Agency (USEPA), 2015. Administrative Settlement Agreement and Order on Consent for Design and Cost Recovery, United Nuclear Corporation Superfund Site and Northeast Church Rock Mine Removal Site, McKinley County, New Mexico. April 27.

ATTACHMENT D.1

Sizing Calculations for Temporary Stormwater Controls for Mine Waste Haul Road and Construction Support Facilities

Client:	*General Electric/United Nuclear Corporation*	**Sheet:**	*1* of *6*
Project:	*NECR 95% Design*	**Date:**	*09/13/2017*
Description:	*Design of Haul Road Stormwater Controls*	**Job No:**	*10508639*

ATTACHMENT D.1: TEMPORARY STORMWATER CONTROLS FOR MINE WASTE HAUL ROAD AND CONSTRUCTION SUPPORT FACILITIES

Revisioning

Rev.	Date	Description	By	Checked	Date
0	*5/13/2016*	*Preliminary (30%) Design*	*T. Steen*	*N. Haws*	*6/6/2016*
1	*9/29/2017*	*95% Design*	*S. Murphy*	*N. Haws*	*9/7/2017*
2	*4/9/2018*	*95% Design (minor revisions)*	*S. Murphy*	*N. Haws*	*4/9/2018*

Revisions

Issue Date	Description
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Location and Format

Electronic copies of these calculations are located on the project team site.

Calculations were generated using the following software:

- HEC-HMS – Hydrologic Modeling System. Version 4.1 July 2015. U.S. Army Corps of Engineers Hydraulic Engineering Center
- Microsoft Excel 2013

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Objective

Client:	*General Electric/United Nuclear Corporation*	**Sheet:**	*2* **of** *6*
Project:	*NECR 95% Design*	**Date:**	*09/13/2017*
Description:	*Design of Haul Road Stormwater Controls*	**Job No:**	*10508639*

The objective of these calculations is to evaluate the 95% design for stormwater controls for the mine waste haul road that would be constructed for the Northeast Church Rock (NECR) Removal Action (RA).

Background

The proposed Mine Waste Haul Road for the NECR RA runs from the Mine Site to the proposed repository area at the Mill Site. The design includes temporary roadside ditches, stormwater ponds, and culverts to limit co-mingling of contact and non-contact stormwater as described in Appendix E of the NECR Design Report and as shown in the Design Drawings (Section 2 and 4).

Applicable Codes and Standards

Stantec used the following criteria for the design of the temporary haul road stormwater controls.

Design Storm Event

Stantec selected the 10-year event for the design of the temporary haul road stormwater controls. Potential risks associated with large storm events where the road may be overtopped are considered acceptable as performing repairs is likely more economic than designing large structures. Hauling operations may be temporarily affected in the event of road failure.

Road Side Ditches and Diversion Ditches

- The road side ditches must have capacity to convey the peak design discharge from surface runoff from the haul roads and any contributing native catchments that cannot be reasonably diverted away from the ditches.
- Where practical, the design must prevent co-mingling of stormwater runoff from the haul road and stormwater runoff from upgradient, non-contact catchments through the use of culvert crossings. Where separation of runoff waters would not be practical, the design must include capacity in the haul road ditches to convey runoff from upgradient catchments.
- Diversion ditches with earthen berms shall be used where appropriate to divert non-contact stormwater runoff.
- The side slopes of the channels should be 1.5:1 (Horizontal:Vertical) or flatter.
- The ditches can be sized without freeboard considerations.

Stormwater Ponds

- Stormwater ponds should be sized to retain the total volume of runoff delivery by the upstream roadside ditch during the 10-year, 24-hour storm event.
- Stormwater ponds may require maintenance and pumping after storm events to maintain capacity to retain additional runoff from subsequent storm events.

Culvert Crossings

- Culverts must be sized to convey the stormwater runoff from upgradient catchments.
- The minimum cover for each culvert should be 3 ft to provide protection from haul road traffic.

Methods

Stormwater Runoff

Stantec estimated peak stormwater flow rates and runoff volumes for the 10-year, 24-hour storm event using the United States Army Corps of Engineers (USACE) Hydrologic Engineering Center's – Hydrologic Modeling System (HEC-HMS) version 4.1, build 1542. Catchment delineations for the model are shown in **Attachment I.1 Figure I.1-1S** and catchment areas are listed in **Attachment I.1 Table A5**. Stantec developed the 10-year storm hyetograph using the center-peaking alternative block technique with the depth-duration frequency curve built from the National Oceanic and Atmospheric Association (NOAA) Precipitation Data Frequency Server (PDFS) (Bonnin et al., 2011) using the methods described in Attachment I-1 of Appendix I. The estimated total depth for the 10-year, 24-hour storm is 1.91 inches and the calculated cumulated hyetograph ordinates are listed in **Attachment I.1 Table B2** and shown in **Attachment I.1 Figure 5.** Because the hyetograph for the 10-year, 24-hour storm was developed with using the alternative block method, the simulated hydrograph for the 10-year 24-hour event includes the maximum peak flow for storms of lesser durations.

Stantec used the Green Ampt method to simulate rainfall losses and the Clark Unit Hydrograph method to simulate hydrograph transforms at the catchment outlets. The Green-Ampt and Clark Unit Hydrograph parameters for each catchment are listed in **Attachment I.1 Table C.5**. Attachment I-1 of Appendix I described the methods for estimating these parameters.

Ditch Sizing

Stantec computed the hydraulics in the roadside ditches and diversion ditches using the Manning's Equations with the assumption of steady, normal flow at the peak 10-year flow:

$$Q = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

Where:

Q = peak design discharge (cubic feet per second [cfs])
A = channel cross-sectional area (square feet [ft^2]
R = channel hydraulic radius = A/P, where P is the wetted perimeter
n = Manning roughness

Stantec then computed the maximum flow depths using the geometric relationships for the area and wetted perimeter of the channel. Stantec approximated Manning's roughness for the ditches to be 0.03, which assumes the ditches are relatively straight and are maintained to be clean and free of debris or accumulated sediment.

Stormwater Retention Pond Sizing

Stantec sized the stormwater ponds to contain the estimated runoff volume from the 10-year, 24-hour storm. This assumes the Construction Contractor (CC) will evacuate the ponds within 48 hours after large storm events. The two stormwater ponds in the Exclusion Area were sized for the full storm depth, without accounting for rainfall losses in the catchment.

Culvert Sizing

Stantec computed culvert capacities for both inlet and outlet control conditions. For inlet control, Stantec used the submerged inlet control equation (Schall et al. 2012):

$$\frac{HW_i}{D} = c\left[\frac{K_u Q}{AD^{0.5}}\right]^2 + Y + K_S S$$

Where:

- HW_i = headwater above invert of culvert (ft)
- D = culvert diameter (ft)
- c = inlet control constant = 0.0553 for submerged circular corrugated metal pipe (CMP) with projecting inlet
- K_u = unit conversion coefficient = 1.0 for US customary units
- Q = flow rate (ft^3/s)
- A = culvert inlet area (ft^2)
- Y = inlet control constant = 0.54 for circular CM pipe with projecting inlet
- K_S = slope correction coefficient = -0.5 for non-mitered outlets
- S = culvert slope

For outlet control, Stantec calculated the flow for a given headwater condition (HW) using entrance, friction, and exit loss relationships:

$$HW = h_o + H - S_o L \quad \text{and} \quad H = \left[1 + k_e + \left(\frac{29n^2L}{R^{1.33}}\right)\right]\left[\frac{V^2}{2g}\right]$$

Where:

- k_e = entrance loss coefficient = 0.9 for corrugated metal pipe projecting out of backfill
- n = manning's roughness coefficient
- L = length of culvert (ft)
- R = full-flowing hydraulic radius of culvert (ft)
- V = full-flowing velocity in culvert
- h_o = tailwater depth = normal depth, y_n (assumed) or D

For outlet control of a culvert in outlet control flowing partially flow, Stantec used the following approximation for Headwater Elevation (Schall et al. 2012):

$$HW_{approx} = max\left\{\frac{d_c+D}{2},\ h_0\right\} + H - S_0L$$

Where:

- d_c = critical depth
- D = pipe diameter
- h_o = tailwater depth above outlet invert = normal depth, y_n (assumed)
- H = hydraulic head required at inlet (ft)
- L = length of culvert (ft)

Stantec determined critical depth (d_c) from an iterative method using the two following equations derived from knowing that critical depth occurs when the specific energy is at a minimum:

$$16Q[\frac{2}{g}\sin\left(\frac{\theta_c}{2}\right)]^{\frac{1}{2}} = D^{5/2}[\theta_c - \sin(\theta_c)]^{3/2}$$

$$d_c = \frac{D}{2}[1 - \cos\left(\frac{\theta_c}{2}\right)]$$

Where:

- d_c = critical depth (ft)
- D = pipe diameter (ft)
- θ_c = water surface angle (radians)

For design, Stantec used the maximum inlet headwater elevation to evaluate whether the culvert is inlet or outlet controlled.

Assumptions

Statntec used the following criteria for these calculations:

- The slope of the road side ditches would coincide with the slope of the haul road.
- Culverts are CMP with a Manning's roughness value of 0.027.
- The culverts would be installed with the inlet projecting out of backfill materials.
- The culverts would be straight with no bends and a constant slope.
- The maximum allowable headwater above culverts adjacent to the roadside ditch is 2 feet above the culvert inlet, leaving approximately 1-ft of freeboard between the road surface and the surface of the headwater.
- Stormwater ponds would be evacuated within 48 hours following large storm events.

Results

Roadside Ditches

The minimum depth required for roadside ditches would be generally less than 1 foot (with 1.5:1 side slopes) to pass, and Stantec selected a standard depth of 2 feet. The roadside ditch geometric design parameters are listed in **Table 1** and calculation worksheets are provided in Attachment A.

Diversion Ditches

The peak flow depth for the 10-yr storm ranges from 0.8 feet to 2.7 feet deep with 1.5:1 channel side slopes. Stantec selected a standard depth of 2 feet, however, two drainage ditches must be deeper than 2 feet deep. The two largest drainage basins, 1b and 28, require a 3 foot depth and 2.5 foot depth, respectively. Diversion Ditch 1A has also been adjusted to 3 feet to match Diversion Ditch 1B. The diversion ditch depths can be found in **Table 2**.

Stormwater Ponds

The required stormwater pond volumes generally range from 3,943 cubic feet (cf) to 13,420 cf along the haul road. The average size is about 6,173 cf. The two stormwater ponds in the Exclusion Area are 18,952 cf and 24,763 cf. Two stormwater ponds that will be combined with culverts are 7,919 cf and 4,200 cf. Minimum sizing for stormwater ponds is shown in **Table 3**.

Culverts

Stantec selected standard culvert diameter of 2 feet, but culverts C13 and C14 were given a diameter of 1 foot due to restrictions imposed by the size of the branch swale channels. The standard sizing and design freeboard is shown in **Table 4**. The culvert calculation worksheet is provided in Attachment A. Culverts shall have a standard minimum slope of 1.75 percent with the exception of culverts C11, C12, and C14, which are designed to have a slope matching the natural drainage slope which may be less than 1 percent.

References

Bonnin, G.M., D. Martin, B. Lin, T. Parzybok, M. Yekta, and D. Riley, 2011. Precipitation-Frequency Atlas of the United States. NOAA Atlas 14, Volume 1, Version 5.0: Semiarid Southwest (Arizona, Southeast California, Nevada,

New Mexico, Utah). Accessed online February 2016 at: http://www.nws.noaa.gov/oh/hdsc/PF_documents/Atlas14_Volume1.pdf

Schall, James D., Philip L. Thompson, Steve M. Zerges, Roger T. Kilgore, and Johnny L. Morris, 2012. Hydraulic Design of Highway Culverts, 3rd Edition. Ayres Associates. Office of Bridge Technology, Federal Highway Administration (FHWA). Report No FHWA-HIF-12-026 HDS 5. April.

TABLES

Table 1: Roadside Ditch Design Summary

Approximate Station		Drainage Basin(s)	Length of Channel	Total Q (10-Year Runoff)	Terminal Stormwater Pond ID	Side Slope Angle	10-yr Peak Flow Depth	Selected Channel Height
From	To		ft	cfs			ft	ft
0	450	0	450	2.1	S01	1.5	0.5	2.0
1040	450	2	590	13.2	S01	1.5	0.9	2.0
1040	1410	4	370	6.5	S02	1.5	0.9	2.0
1590	1410	6	180	4.1	S02	1.5	0.5	2.0
1590	1900	7	310	5.3	S03	1.5	0.6	2.0
1900	2320	8	420	1.1	S04	1.5	0.5	2.0
2320	2580	10	260	2.4	S05	1.5	0.6	2.0
2580	2960	11, 12	380	2.8	S06	1.5	1.0	2.0
2980	1000(Spur)	14, 15	320	7.6	S07	1.5	1.4	2.0
1000(Spur)	500(Spur)	17, 18	500	3.3	S08	1.5	0.8	2.0
500(Spur)	100(Spur)	19	280	1.1	S09	1.5	0.4	2.0
0(Spur)	100(Spur)	23	220	3.1	S09	1.5	0.9	2.0
3100	3610	25	510	2.0	S10	1.5	0.5	2.0
3610	4640	27	1030	3.6	S11	1.5	1.1	2.0

Table 2: Diversion Ditch Design Summary

Diversion Ditch ID	10-yr Maximum Flow Depth ft	Selected Channel Depth ft	Side Slope Angle ft/ft
1a	1.6	3.0	1.5
1b	2.7	3.0	1.5
2	1.5	2.0	1.5
3a	1.3	2.0	1.5
3b	1.4	2.0	1.5
4	2.4	2.5	1.5

Table 3: Stormwater Pond Design Summary

Stormwater Pond ID	Approximate Station	Drainage Basin(s)	Volume (cf)	Notes
S-01	4+50	0,2	13,420	Adjacent to Culvert C02
S-02	14+10	4, 6	7,919	Adjacent to Culvert C03
S-03	19+00	7	3,943	Adjacent to Road
S-04	23+00	8	4,035	Adjacent to Road
S-05	25+80	10	3,395	Adjacent to Road
S-06	29+80	11, 12	4,200	Adjacent to Culvert C05
S-07	10+00 (Spur)	14, 15	8,705	Adjacent to Road
S-08	5+00 (Spur)	17, 18	4,413	Adjacent to Road
S-09	0+90 (Spur)	19, 23	5,268	Adjacent to Road
S-10	36+00	25	4,075	Drainage from Road
S-11	46+40	27	8,532	Drainage from Road
S-12	N/A	West of Decon Zone	24,763	West of Exclusion Zone
S-13	N/A	East of Decon Zone	18,952	East of Exclusion Zone

Table 4: Culvert Design Summary

Culvert ID	Approximate Station ft	Watershed Model ID	Drainage Basin(s)	Design Diameter inch	Number of Pipe(s)	Design Slope ft/ft	10-yr Peak Flow cfs	10-yr Peak Freeboard ft
C-01	2+20	Haul Road-update	1a	24	1	2%	13.2	2.97
C-02	5+50	Haul Road-update	1b	24	3	3%	52.4	2.24
C-03	10+90	Haul Road-update	3	24	1	5%	2.9	3.92
C-04	14+50	Haul Road-update	5	24	1	5%	5.3	5.81
C-05	23+80	Haul Road-update	9	24	1	5%	8.2	3.59
C-06	30+20	Haul Road-update	13	24	1	5%	8.0	5.61
C-07	9+40 (Spur)	Haul Road-update	16	24	1	5%	8.9	3.52
C-08	2+50 (Spur)	Haul Road-update	20, 21	24	1	5%	19.5	1.84
C-09	0+30 (Spur)	Haul Road-update	22, 28	24	3	5%	72.8	0.67
C-10	36+50	Haul Road-update	13, 26	24	1	3%	16.3	2.47
C-11	44+80	Pipeline Design	J-R12ds*	24	4	0.37%	281 (5-yr)	87 cfs capacity
C-12	48+40	Mill Design	J-RC01ds*	24	3	0.1%	37.8	1.67
C-13	5+38 (East Borrow Road)	Mill Design	J-SCds*	12	4	5%	14.3	1.34
C-14	4+30 (East Borrow Road)	Mill Design	J-RC05ds*	12	3	1%	8.1	0.97
C-15	0+50 (East Borrow Road)	Mill Design	J-ND04us*	24	2	4%	45.5	0.06
C-16	24+50 (North Borrow Road)	Mill Design	J-RC03ds*	24	2	2%	26.2	2.98

*Note that Culverts C-11 to C-15 use the peak flow from elements of different hydrologic models

ATTACHMENT A

CALCULATION WORKSHEETS

Calculation Worksheet for Roadside Ditches and Diversion Ditches

Drainage Basin(s)	Total Q (10-Year Runoff)	Approximate Station		Length of Channel	Terminal Sediment Pond ID	Manning n	Average Slope	Side Slope Angle	Minimum Channel Depth	Selected Channel Depth	Flow Area	Wetted Perimeter	Hydraulic Radius	Top Width	Velocity	Froude #
	cfs	From	To	ft			ft/ft		ft	ft	ft^2	ft	ft	ft	ft/s	
0	2.1	0	450	450	S01	0.03	0.074	1.5	0.5	2.0	0.4	1.9	0.2	6.0	5.0	3.29
2	6.5	450	1040	590	S01	0.03	0.046	1.5	0.9	2.0	1.2	3.2	0.4	6.0	5.5	2.18
4	4.1	1040	1410	370	S02	0.03	0.023	1.5	0.9	2.0	1.1	3.1	0.4	6.0	3.8	1.56
6	1.1	1410	1590	180	S02	0.03	0.023	1.5	0.5	2.0	0.4	1.9	0.2	6.0	2.7	1.84
7	2.8	1590	1900	310	S03	0.03	0.074	1.5	0.6	2.0	0.5	2.1	0.2	6.0	5.3	3.16
8	1.9	1900	2320	420	S04	0.03	0.074	1.5	0.5	2.0	0.4	1.9	0.2	6.0	4.8	3.31
10	2.4	2320	2580	260	S05	0.03	0.041	1.5	0.6	2.0	0.6	2.3	0.3	6.0	4.1	2.31
11, 12	2.8	2580	2960	380	S06	0.03	0.004	1.5	1.0	2.0	1.6	3.7	0.4	6.0	1.8	0.61
14, 15	7.6	2980	1000(Spur)	320	S07	0.03	0.005	1.5	1.4	2.0	3.0	5.1	0.6	6.0	2.5	0.61
17, 18	3.3	1000(Spur)	500(Spur)	500	S08	0.03	0.025	1.5	0.8	2.0	0.9	2.8	0.3	6.0	3.7	1.68
19	1.1	500(Spur)	100(Spur)	400	S09	0.03	0.057	1.5	0.4	2.0	0.3	1.6	0.2	6.0	3.8	3.08
23	3.1	0(Spur)	100(Spur)	100	S09	0.03	0.008	1.5	0.9	2.0	1.3	3.4	0.4	6.0	2.4	0.89
25	2.0	3100	3610	510	S10	0.03	0.078	1.5	0.5	2.0	0.4	1.9	0.2	6.0	5.0	3.39
27	3.6	3700	4889	1189	S11	0.03	0.004	1.5	1.1	2.0	1.9	4.0	0.5	6.0	1.9	0.59
28	72.8	-	-	-	Div Berm 4	0.03	0.032	1.5	2.4	2.5	8.3	8.5	1.0	7.5	8.7	1.47
21	8.7	-	-	-	Div Berm 3a	0.03	0.011	1.5	1.3	2.0	2.5	4.7	0.5	6.0	3.5	0.94
20	10.7	-	-	-	Div Berm 3b	0.03	0.011	1.5	1.4	2.0	3.0	5.1	0.6	6.0	3.6	0.91
1a	13.2	-	-	-	Div Berm 1a	0.03	0.0094	1.5	0.8	2.0	1.0	3.0	0.3	6.0	2.4	1.00
1b	52.4	-	-	-	Div Berm 1b	0.03	0.00865	1.5	2.7	3.0	10.6	9.6	1.1	9.0	4.9	0.80
16, 24	17.6	-	-	-	Div Berm 2	0.03	0.008	1.5	1.8	2.0	4.8	6.5	0.7	6.0	3.7	0.72

Notes

5 Year, 24 Hour peak discharge used to estimate design flow

Minimum channel sizing based on Manning's equation to contain 5 year peak flow (no freeboard)

$$Q = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

Side slopes are assumed to be 1.5:1 (H:V)

Normal Manning's n = 0.030 for channels that are clean, straight, full stage, no rifts or deep pools (Chow, 1959)

Approximate station and average channel slope based on NORTHEAST CHURCH ROCK PROJECT 95% DESIGN DRAWINGS (10/30/2017)

Chow, V.T., 1959. Open-Channel Hydraulics. McGraw-Hill Civil Engineering Series.

Calculation Worksheet for Culverts

Culvert ID	Q (cfs)	Approximate Length of Culvert	Approximate Slope of Culvert (S)	Elevation Change	Number of Pipes	Q per pipe	Submerged Y	Submerged c	Ku	Ks	Design Diameter	Submerged HW for inlet
	cfs	ft	ft/ft	ft		cfs					in	ft
C01	13.16499	200	0.02	4	1	13.16499	0.54	0.0553	1	-0.5	24	2.03
C02	52.377	200	0.03	6	3	17.459	0.54	0.0553	1	-0.5	24	2.76
C03	2.9433	70	0.05	3.5	1	2.9433	0.54	0.0553	1	-0.5	24	1.08
C04	5.33286	55	0.05	2.75	1	5.33286	0.54	0.0553	1	-0.5	24	1.19
C05	8.232	40	0.05	2	1	8.232	0.54	0.0553	1	-0.5	24	1.41
C06	8.04455	50	0.05	2.5	1	8.04455	0.54	0.0553	1	-0.5	24	1.39
C07	8.94948	40	0.05	2	1	8.94948	0.54	0.0553	1	-0.5	24	1.48
C08	19.48018	40	0.05	2	1	19.48018	0.54	0.0553	1	-0.5	24	3.16
C09	72.8	40	0.05	2	3	24.26667	0.54	0.0553	1	-0.5	24	4.33
C10	16.26736	40	0.033	1.32	1	16.26736	0.54	0.0553	1	-0.5	24	2.53
C11	281.539	100	0.004	0.37	4	70.38475	0.54	0.0553	1	-0.5	24	28.83
C13	14.324	47.5	0.05	2.375	4	3.581	0.54	0.0553	1	-0.5	12	1.66
C14	8.064	47.5	0.01	0.475	3	2.688	0.54	0.0553	1	-0.5	12	1.18
C15	45.506	85	0.04	3.4	2	22.753	0.54	0.0553	1	-0.5	24	3.94
C12	37.765	70	0.001	0.07	3	12.58833	0.54	0.0553	1	-0.5	24	1.97
C16	26.221	70	0.02	1.4	2	13.1105	0.54	0.0553	1	-0.5	24	2.02

Culvert ID	Q (cfs)	Length of Culvert	Slope of Culvert (S)	Elevation Change	Number of Pipes	Q per pipe	Ku	Ks	Pipe Size	Normal Depth y_n	Critical theta	Critical Depth y_c	Barrel Velocity (V)	Hydraulic Radius, R	Full Perimeter	Full Velocity	Full Hydraulic Radius	ke	Roughness, n	Headloss, H	Exit Depth	$(y_c+D)/2$	HWo normal depth	HWo Approx
	cfs	ft	ft/ft	ft		cfs			in	ft	rad	ft	ft/s	ft	ft	ft/s	ft			ft	ft		ft	ft
C01	13.2	200	0.02	4	1	13.2	1	-0.5	24	1.42	3.76	1.31	5.52	0.60	6.28	4.19	0.50	0.9	0.027	3.42	1.42	1.65	0.8	1.1
C02	52.4	200	0.03	6	3	17.5	1	-0.5	24	1.54	4.24	1.52	6.71	0.61	6.28	5.56	0.50	0.9	0.027	6.01	1.54	1.76	1.6	1.8
C03	2.9	70	0.05	3.5	1	2.9	1	-0.5	24	0.47	2.32	0.60	5.25	0.28	6.28	0.94	0.50	0.9	0.027	0.08	0.47	1.30	-3.0	-2.1
C04	5.3	55	0.05	2.75	1	5.3	1	-0.5	24	0.63	2.77	0.81	6.22	0.36	6.28	1.70	0.50	0.9	0.027	0.22	0.63	1.41	-1.9	-1.1
C05	8.2	40	0.05	2	1	8.2	1	-0.5	24	0.80	3.19	1.02	7.02	0.43	6.28	2.62	0.50	0.9	0.027	0.43	0.80	1.51	-0.8	-0.1
C06	8.0	50	0.05	2.5	1	8.0	1	-0.5	24	0.79	3.16	1.01	6.97	0.42	6.28	2.56	0.50	0.9	0.027	0.46	0.79	1.50	-1.2	-0.5
C07	8.9	40	0.05	2	1	8.9	1	-0.5	24	0.84	3.28	1.07	7.17	0.44	6.28	2.85	0.50	0.9	0.027	0.51	0.84	1.53	-0.7	0.0
C08	19.5	40	0.05	2	1	19.5	1	-0.5	24	1.35	4.40	1.59	8.63	0.59	6.28	6.20	0.50	0.9	0.027	2.41	1.35	1.79	1.8	2.2
C09	72.8	40	0.05	2	3	24.26	1	-0.5	24	1.63	4.82	1.74	8.86	0.61	6.28	7.72	0.50	0.9	0.027	3.73	1.63	1.87	3.4	3.6
C10	16.3	40	0.033	1.32	1	16.3	1	-0.5	24	1.38	4.08	1.45	7.05	0.59	6.28	5.18	0.50	0.9	0.027	1.68	1.38	1.73	1.7	2.1
C11	281.5	100	0.004	0.37	4	70.4	1	-0.5	24	2.00	6.09	2.00	22.40	0.50	6.28	22.40	0.50	0.9	0.027	56.29	2.00	2.00	57.9	57.9
C13	14.3	47.5	0.05	2.375	4	3.6	1	-0.5	12	0.76	4.47	0.81	5.56	0.30	3.14	4.56	0.25	0.9	0.027	2.66	0.76	0.90	1.1	1.2
C14	8.1	47.5	0.01	0.475	3	2.7	1	-0.5	12	1.00	3.98	0.70	3.42	0.25	3.14	3.42	0.25	0.9	0.027	1.50	1.00	0.85	2.0	1.9
C15	45.5	85	0.04	3.4	2	22.8	1	-0.5	24	1.73	4.69	1.70	7.89	0.60	6.28	7.24	0.50	0.9	0.027	5.23	1.73	1.85	3.6	3.7
C12	37.8	70	0.001	0.07	3	12.6	1	-0.5	24	2.00	3.70	1.28	4.01	0.50	6.28	4.01	0.50	0.9	0.027	1.40	2.00	1.64	3.3	3.0
C16	26.2	70	0.02	1.4	2	13.11	1	-0.5	24	1.41	3.76	1.30	5.52	0.59	6.28	4.17	0.5	0.9	0.027	1.52	1.41	1.65	1.5	1.8

Culvert ID	Headwater ELo	Control	Max headwater EL	Allowable HW above crown	ELa	Design Clearance	Freeboard
	ft		ft	ft	ft	ft	ft
C01	1.1	INLET	2.03	2.00	4.00	1.97	2.97
C02	1.8	INLET	2.76	2.00	4.00	1.24	2.24
C03	-2.1	INLET	1.08	2.00	4.00	2.92	3.92
C04	-1.1	INLET	1.19	5.00	7.00	5.81	5.81
C05	-0.1	INLET	1.41	2.00	4.00	2.59	3.59
C06	-0.5	INLET	1.39	5.00	7.00	5.61	5.61
C07	0.0	INLET	1.48	2.00	4.00	2.52	3.52
C08	2.2	INLET	3.16	2.00	4.00	0.84	1.84
C09	3.6	INLET	4.33	2.00	4.00	-0.33	0.67
C10	2.1	INLET	2.53	2.00	4.00	1.47	2.47
C11	57.9	OUTLET	57.89	2.00	4.00	-53.89	-52.89
C13	1.2	INLET	1.66	2.00	3.00	1.34	2.34
C14	2.0	OUTLET	1.18	2.00	3.00	1.82	2.82
C15	3.7	INLET	3.94	2.00	4.00	0.06	1.06
C12	3.3	OUTLET	1.97	2.00	4.00	2.03	3.03
C16	1.8	INLET	2.02	2.00	4.00	1.98	2.98

Northeast Church Rock
95% Design Report

Appendix E:
Stormwater Management Plan

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF ATTACHMENTS

LIST OF ACRONYMS / ABBREVIATIONS

AOC	Administrative Settlement Agreement and Order on Consent for Design and Cost Recovery
BMP	best management practice
CASQA	California Stormwater Quality Association
CGP	Construction General Permit
CSWPPP	Construction Stormwater Pollution Prevention Plan
ESA	Endangered Species Act
Mill Site	Church Rock Mill Site
Mine Site	Northeast Church Rock Mine Site
NHPA	National Historic Preservation Act
NOI	Notice of Intent
NOT	Notice of Termination
NPDES	National Pollutant Discharge Elimination System
RA	Removal Action or Remedial Action
RAO	Remedial Action Objective
ROD	Record of Decision
SWMP	Stormwater Management Plan
TDA	Tailings Disposal Area
TMDL	Total Maximum Daily Load
US	United States
USACE	US Army Corps of Engineers
USC	United States Code
USEPA	US Environmental Protection Agency

E.1 BACKGROUND

This appendix presents the Stormwater Management Plan that the Construction Contractor (CC) will follow for the Removal Action (RA). The Stormwater Management Plan (SWMP) provides a framework for how stormwater and other surface water will be managed to limit the release of contact stormwater, sediment, pollutants, and deleterious debris to downstream areas during and following the RA. The US Environmental Protection Agency (USEPA) is the National Pollutant Discharge Elimination System (NPDES) permitting authority for the project area and requires CCs to obtain coverage under the USEPA NPDES General Permit for Discharges from Construction Activities (USEPA, 2017a, the "CGP"), effective February 16, 2017. This plan provides requirements for the contractor to comply with criteria in the USEPA CGP. To obtain coverage under the USEPA CGP, the CC must prepare a Construction Stormwater Pollution Prevention Plan (CSWPPP) that presents stormwater management protocols and procedures specific to the RA. The CSWPPP will reference this SWMP for general stormwater management practices and will identify the best management practices (BMPs) applicable to scheduled construction activities. This SWMP also provides a catalog of best management practices for reducing adverse impacts of stormwater during and following the RA.

The RA includes excavating potentially contaminated soils at the Mine Site and constructing a Repository at the Mill Site for mine waste along with capping the Repository and constructing permanent stormwater controls. Surface water and stormwater with potential to contact mine wastes (contact water) will be captured and isolated from co-mingling with surface water and stormwater that has not contacted mine waste (non-contact water) or other potential contaminated materials. As the RA progresses, surface water and stormwater in the removal areas can be allowed to shed to natural drainages. The CC will manage stormwater in active construction areas and the removal areas in accordance with their CSWPPP. The CSWPPP will be updated periodically by the CC as construction progresses to account for changing site conditions during the RA. Sections E.4 and E.5 provide foundation information and requirements to support preparation of the CC's CSWPPP and to be in compliance with the USEPA CGP. The 95% Design Report main text, design drawings and appendices C, D, F, I, J, O and P provide information on the existing conditions at the Mine Site and Mill Site and relevant information on permanent and interim designs for stormwater controls. The CC should refer to this information when preparing the CSWPPP.

The Section 5 Drawings show the disturbed areas where BMPs will need implemented for construction and construction support areas. In addition, certain temporary stormwater controls are specified and shown on the drawings for the following areas:

- Construction Support Facilities – see Appendix B and Section 2 of the Design Drawings
- Mine Site Removal Areas – see Appendix C and Section 3 of the Design Drawings
- Mine Waste Haul Road – see Appendix D and Section 4 of the Design Drawings
- Mill Site Repository Area – see Appendix G and Section 7 of the Design Drawings
- Mine Site Revegetation Plan – see Appendix U and Section 10 of the Design Drawings

E.2 TASK-SPECIFIC PERFORMANCE STANDARDS

The Performance Standards presented here are defined in the Action Memorandum: Request for a Non-Time-Critical Removal Action at the Northeast Church Rock Site (2011 Action Memo; USEPA, 2011), the Record of Decision, United Nuclear Corporation Site, (ROD; USEPA, 2013), and the Administrative Settlement Agreement and Order on Consent for Design and Cost Recovery (AOC; USEPA, 2015) including the Statement of Work attached as Appendix D to the AOC, and were developed to define attainment of the Removal Action and Remedial Action Objectives (RAOs) for the Selected Remedy. The Performance Standards include both general and specific standards applicable to the Selected Remedy work elements and associated work components. Table E.2-1 presents Performance Standards related to the stormwater management plan and temporary stormwater controls and explains how the design accomplishes these standards.

Table E.2-1: Performance Standards Applicable to Management of Stormwater During Construction

Identifying Number*	Location of Performance Standard Requirement	Topic	Performance Standard	Comments
26	2013 ROD, Section 2.9.1 Bullet 3	Repository Design	Remediation Action Objectives • Prevent the migration of concentrations of contaminants located in the soil, mine waste, and tailings contained within the Tailings Disposal Area to ground water where the migration of those contaminants would result in ground water concentrations that exceed remediation goals established in EPA's 1988 ROD for the Ground Water Operable Unit (including any amendment), and, through this action, prevent human and ecological receptors from being exposed to ground water with concentrations of contaminants that exceed remediation goals established in the 1988 ROD, including any amendment.	Designs are provided for temporary controls to isolate and contain contact surface stormwater within construction areas and minimize infiltration of contact stormwater within the Tailings Disposal Area (TDA). The Repository design and limiting the associated impacts to groundwater are further discussed in Appendix G.
29	2013 ROD, Section 2.9.2 Bullet 3	Repository Design	2.9.2 Remediation Goals • Migration of contaminants from the Tailings Disposal Area shall not result in ground water concentrations that exceed remediation goals established in EPA's 1988 ROD for the Ground Water Operable Unit, including any amendment.	Designs are provided for temporary controls to isolate and contain contact surface stormwater within construction areas and minimize infiltration of contact stormwater within the TDA. The Repository design and limiting the associated impacts to groundwater are further discussed in Appendix G.
43	2013 ROD, Section 2.9.5 – Storm Water and Erosion Control	Storm Water and Erosion Control	Disturbed areas will be graded to reduce scouring and erosion potential using gentle slopes, terraces, earthen ridges and catch drains (swales) as necessary. These controls will also be used to minimize the potential for ponded water, reduce the risk of percolation from ponded water, and divert water away from open disposal locations, construction areas, and exposed mine waste. The drainage patterns in the disturbed areas will be	This appendix discusses specific temporary construction stormwater controls that will be implemented to prevent co-mingling of contact and non-contact stormwater. These controls include ditches, diversion berms, culverts, retention ponds and other site-specific engineering controls. BMPs for

Identifying Number*	Location of Performance Standard Requirement	Topic	Performance Standard	Comments
			integrated with the existing topography and drainage patterns to the extent possible. During construction activities, stormwater controls may include stormwater control channels (header), weirs, spillways, catch basins, check dams, and sediment basins. These controls will be implemented to maintain a safe working environment, to protect human health and the environment, mitigate off-site migration of mine waste, and protect response construction actions.	construction stormwater controls are also provided in this appendix.
59	2013 ROD, Table 1	Repository Design	10 CFR 61.41 Protection of the general population from releases of radioactivity. Refer to www.ecfr.gov.	This appendix discusses temporary stormwater controls intended to isolate and contain contact stormwater and prevent its release and mixing with non-contact water. This appendix also outlines BMPs that the CC is to incorporate into its CSWPP. Also outlined are requirements to provide monitoring and maintenance as required so that controls function as intended.
49	2013 ROD, Table 1	Environmental Monitoring	10 CFR 61.53(c) Environmental Monitoring During the land disposal facility site construction and operation, the licensee shall maintain a monitoring program. Measurements and observations must be made and recorded to provide data to evaluate the potential health and environmental impacts during both the construction and the operation of the facility and to enable the evaluation of long-term effects and the need for mitigative measures. The monitoring system must be capable of providing early warning of releases of radionuclides from the disposal site before they leave the site boundary.	During construction of the Repository, the CSWPPP will identify required observations and mitigation measures to address problems related to controlling stormwater and sediment from leaving the project work areas. The CSWPPP will be prepared based on the details and requirements outlined in this appendix.
10	2015 AOC SOW, Paragraph 25 – Storm Water and Erosion Control	Storm Water and Erosion Control	In the Design, Respondents shall include detailed plans and specifications for storm-water and erosion control. Respondents' Design shall include detailed plans and specifications for contouring (e.g., grading) of construction areas to prevent, to the extent practicable, storm-water scouring. Respondents' Design shall also include detailed plans and specifications for the use of landscaping techniques such as gentle slopes, terraces, earthen ridges and catch	The design includes both permanent and temporary stormwater controls. Permanent stormwater controls would be installed to control erosion from stormwater that could negatively impact the Mine Site or Repository. These permanent stormwater controls are described in Appendix F and Appendix I. This appendix discusses

Identifying Number*	Location of Performance Standard Requirement	Topic	Performance Standard	Comments
			drains (swales). Respondents shall produce detailed plans and specifications for using such controls to minimize, to the extent practicable, the potential for ponded water, and to divert water away from open disposal locations, construction areas, exposed contaminated soil and mine waste at construction areas and impacted areas disturbed by the work. Respondents' detailed plans and specifications shall call for integrating drainage patterns in the disturbed areas with the existing topography and drainage patterns. Respondents' detailed plans and specifications shall provide that during construction activities storm-water controls shall be used. Such controls may include, among other controls, storm-water control channels (header), weirs, spillways, catch basins, check dams, and sediment basins. Respondents' plans and specifications shall provide that such controls shall be implemented to maintain a safe working environment, to protect human health and the environment, to prevent off-site migration of contaminated soil and mine waste, and to protect response action construction.	temporary stormwater controls to be installed during construction to separate non-contact and contact stormwater and to control erosion and sediment loss from areas disturbed during construction. This appendix also provides a SWMP that outlines minimum BMPs that the CC must include in its CSWPPP and that must be implemented during construction.
14	2015 AOC SOW, Paragraph 29 – Green Remediation Best Management Practices	Green Remediation Best Management Practices	Respondents shall incorporate applicable Best Management Practices for Green Remediation listed in ASTM-E2893-13 consistent with EPA's policy Superfund Green Remediation Strategy (2010), found at http://www.epa.gov/superfund/greenremediation/sf-gr-strategy.pdf.	Section E.6 of this appendix discusses green remediation best management practices.

*Refers to identifying numbers listed in Summary of ARARs, Performance Standards and Applicable NRC Design Requirements Table (provided in Attachment 1 to main text of the 95% Design Report)

E.3 ENGINEERING DESIGN DRAWINGS

The engineering design drawings for the temporary stormwater controls and BMPs are contained in Volume II – Design Drawings (Section 5). The complete set of Drawings related to the temporary stormwater controls and BMPs are listed in Table E.3-1.

Table E.3-1: Engineering Design Drawings

Drawing No.	Drawing Title
5-01	Mine Site Temporary Stormwater Controls*
5-02	Mill Site and Borrow Areas Temporary Stormwater Controls

* Drawing excluded from LAR submittal.

E.4 USEPA NPDES PERMITTING REQUIREMENTS

The USEPA is the NPDES permitting authority in New Mexico for construction projects that disturb one or more acres of land. This plan provides requirements for the CC to comply with criteria in the USEPA CGP. The USEPA requires the following steps to obtain coverage under the USEPA CGP and information is provided in detail based on the following:

1. Verify that the USEPA is the permitting authority per Appendix B of the USEPA CGP.
2. Comply with Endangered Species Act (ESA) requirements: Demonstrate that the project meets one of the criteria listed in Appendix D of the USEPA 2017 CGP associated with protection of federally listed threatened and endangered species and federally designated critical habitat.
3. Complete the Historic Property Screening Process: Follow procedures in Appendix E of the USEPA CGP for the protection of historic properties.
4. Develop a CSWPPP.
5. Submit a Notice of Intent (NOI) using the USEPA's NPDES eReporting Tool (CGP-NeT).

E.4.1 Permitting Authority

The first step to obtaining permit coverage under the USEPA CGP is to verify that USEPA is the permitting authority. Part B.6 of Appendix B in the USEPA CGP lists the following areas of coverage that include the project site where the USEPA is the permitting authority:

- NMR100000: State of New Mexico, except Indian Country.
- NMR101000: Indian country within the State of New Mexico, except Navajo Reservation Lands that are covered under Arizona permit AZR10I000 and Ute Mountain Reservation Lands that are covered under Colorado permit COR10I000.

E.4.2 Endangered Species Act Requirements

To be eligible for coverage under the USEPA CGP the project must comply with ESA requirements. The project must meet one of the criteria listed in Appendix D of the USEPA CGP Appendix P of the 95% Design includes a summary of the Natural Resources Reports (vegetation and wildlife) prepared to date. Figure P.1-1 exhibits the surveyed areas. The Contractor can use the previous surveys and the Environmental Review to select the appropriate eligibility criteria.

E.4.3 Historic Property Screening Process

The Historic Property Screening Process in Appendix E of the USEPA CGP must be completed prior to submittal of the NOI. The screening process determines if the installation of stormwater controls and best management practices on the project site has the potential to effect historic properties and is required for compliance with Section 106 of the National Historic Preservation Act (NHPA). Appendix O of the 95% Design summarizes the Cultural Resources Reports prepared to date. Figure O.1-1 exhibits the previously surveyed areas. The Contractor can use the previous surveys and the Environmental Review to select the appropriate eligibility criteria.

E.4.4 CSWPPP

A CSWPPP template and other guidance is available on the USEPA NPDES website (https://www.epa.gov/npdes/stormwater-discharges-construction-activities#aboutpermitting). The CSWPPP requirements are discussed in detail in Section E.5.

E.4.5 Notice of Intent

To obtain permit coverage, the NOI can be submitted online using the USEPA's NPDES eReporting Tool (CGP-NeT) at https://cdxnodengn.epa.gov/oeca-cgp-web/action/login. The NOI requires the following information:

- Operator Information
- Project/Site Information
- Discharge Information
- Chemical Treatment Information
- Endangered Species Information
- Historic Property Information
- Certification by an Authorized Representative

The CSWPPP must be completed prior to obtaining the NOI. The USEPA requires submittal of the NOI at least 14 days prior to the start of construction. The NOI must be signed by an authorized representative as defined in Part I.11.1 of Appendix I in the USEPA CGP.

E.4.6 Notice of Termination

Once the project is complete or the site has been transferred to another operator, a Notice of Termination (NOT) must be submitted online using the CGP-NeT system (https://cdxnodengn.epa.gov/oeca-cgp-web/action/login). The project must meet the requirements in Part 8.2.1 of the USEPA CGP prior to submittal. The NOT requires the following information:

- Permit Information
- Operator Information
- Project/Site Information
- Certification by an Authorized Representative (as defined in Part I.11.1 of Appendix I in the USEPA CGP)

All BMPs must be removed and the disturbed areas must meet final stabilization requirements per Part 2.2.14b of the USEPA CGP as defined below:

- Establish uniform, perennial vegetation (i.e., evenly distributed, without large bare areas) that provides 70 percent or more of the cover that is provided by vegetation native to local undisturbed areas, and/or
- Implement permanent non-vegetative stabilization measures to provide effective cover.

E.5 CONSTRUCTION STORMWATER POLLUTION PREVENTION PLAN

The USEPA CGP requires that CCs develop a CSWPPP and implement BMPs to minimize the release of contact stormwater, sediment, pollutants, and deleterious debris to downstream water bodies. This section provides guidelines and framework information to support preparation of the CSWPPP. The USEPA has a CSWPPP template and other guidance available on the USEPA NPDES website (https://www.epa.gov/npdes/stormwater-discharges-construction-activities#aboutpermitting). The following sub-sections summarize the required CSWPPP elements per the USEPA CGP requirements and parallel the USEPA SWPPP template format (USEPA, 2017b). Section E.6 identifies BMPs that may be utilized during construction. The CC's CSWPPP will draw from this SWMP to identify stormwater control procedures and BMPs specific to the phased construction activities. Stantec may also require other BMPs to address specific concerns observed in the field.

The Design Drawings (Sections 2, 3, 4, 5, 7 and 10) contain designs and descriptions for temporary stormwater controls that must be incorporated into the CSWPPP. Many temporary controls must be installed and/or decommissioned during specific RA phases as described in this appendix and shown in the drawings referenced above. The CSWPPP must also outline BMPs to reduce the potential for commingling contact and non-contact waters to the maximum extent practical. Attachment E.1 contains BMPs that the CC may include in the CSWPPP. The CC must determine the need to implement these and other BMPs as the RA progresses, as approved by the Supervising Contractor. The CSWPPP and engineering design drawings (Drawings 5-01 and 5-02) are intended to be base maps for living documents that must be continuously updated by the CC as construction progresses and site conditions change.

E.5.1 Project Information

The CSWPPP must include the contact information for the Contractor and for all subcontractors that will be involved in construction activities on the site. In addition, a Stormwater Team must be identified and include name, position and contact information and identify responsibilities for each, including which members of the team will be responsible for conducting inspections. Other responsibilities include implementing and updating the CSWPPP, installing and maintaining stormwater controls and performing corrective actions. All members of the Stormwater Team must have ready access to an electronic or paper copy of the CSWPPP. Refer to Section E.5.6.1 and Part 6 of the USEPA CGP for relevant information on staff training.

E.5.2 Site Evaluation and Design Development

The CSWPPP must define site characteristics and the type of construction to be performed. Prior to preparation of the CSWPPP the site should be evaluated to address site conditions appropriately to prevent stormwater pollution. The following principles should be followed when preparing the CSWPPP:

- Protect natural features (streams, wetlands, trees, critical habitat, steep slopes, highly erodible soils).
- Phase construction activity to minimize amount of disturbed area.
- Time activities to limit impact from seasonal climate changes or weather events.
- Preserve existing vegetation.
- Control stormwater flowing onto and through the project site.
- Install downslope and sideslope perimeter controls before land-disturbing activity occurs.
- Maintain undisturbed areas until it is necessary for construction to proceed. Cover or stabilize disturbed areas as soon as possible.
- Inspect and maintain stormwater controls.

Additional guidance for preparation of the CSWPPP can be found on the USEPA website and in the USEPA guidance document "Developing Your Stormwater Pollution Prevention Plan: A Guide for Construction Sites" (USEPA, 2007). The following sections include elements required in the CC's CSWPPP and parallel the USEPA SWPPP template format (USEPA, 2017b).

E.5.2.1 Site Information

The CSWPPP must include the following site information:

- Project location
- Description of construction activities
- Total project area
- Total disturbed area
- Maximum area to be disturbed at one time
- Sequence and estimated dates of construction activities
    - For each phase include estimated start and end dates of construction, estimated dates for stabilization, and estimated date when stormwater controls will be removed
- Identification of pollutant generating activities
- Construction support activities
- Identification of authorized non-stormwater discharges

E.5.2.2 Discharge Information

All points of discharge from the site must be identified. For each point of discharge, the first Water of the United States (US) that receives stormwater must be identified. Three Waters of the US are located within the project vicinity. These waters are identified as Unnamed Arroyo No. 1, Unnamed Arroyo No. 2, and Pipeline Arroyo and are shown on the Design Drawings. These waters are tributary to the Rio Puerco.

For each Water of the US identified, the CSWPPP must specify if the receiving water is listed as "impaired" or if a Total Maximum Daily Load (TMDL) has been completed. The USEPA has developed a Discharge Mapping Tool to determine if there are surface waters on the site that are impaired or have a TMDL (see https://www.epa.gov/npdes/epas-stormwater-discharge-mapping-tools). It is also required to specify if the receiving waters are Tier 2, Tier 2.5 or Tier 3 Waters of the US. Appendix F of the USEPA CGP provides guidance on obtaining information for classification of Tier 2, Tier 2.5 and Tier 3 Waters of the US.

E.5.2.3 Sequence of Major Activities

The CSWPPP should include a sequence of major activities and schedule for installing and implementing stormwater, sediment, and pollution prevention controls. The sequence should show the order in which activities will be performed and should adhere to the general guidelines outlined in Section 5 of the Design Drawings. The CC should use this general phasing as a basis for a phasing plan that minimizes disturbance to vegetated areas, minimizes the amount of cut and fill, and limits impacts to sensitive areas (e.g. steep slopes, erodible soils, and existing drainages).

E.5.2.4 Site Map

The Contractor will develop a CSWPPP to include a site map that contains the following information as specified in the USEPA CGP:

- Boundaries of the disturbance area and construction activities, including the Mine Site (Appendix C and Section 3 Drawings), vehicle access (Appendix D and Section 4 Drawings), construction support facilities (Appendix B and Section 2 Drawings), borrow areas (Appendix H and Section 8) and locations of structures and impervious surfaces.
- Locations where construction activities will occur, including:
  - Locations where earth-disturbing activities will occur (note any phasing), including any demolition activities
  - Approximate slopes before and after major grading activities (note any steep slopes [as defined in Appendix A of the USEPA CGP])
  - Locations where sediment, soil, or other construction materials will be stockpiled
  - Any Water of the U.S. crossings
  - Designated points where vehicles will exit onto paved roads
  - Locations of structures and other impervious surfaces upon completion of construction
  - Locations of on-site and off-site construction support activity areas covered by this the USEPA CGP (see Part 1.2.1c)
- Locations of all Waters of the US and wetlands on site and within one mile downstream of the site's discharge point. Also identify if any are listed as impaired, or are identified as a Tier 2, Tier 2.5, or Tier 3 water.
- Areas of federally listed critical habitat within the site and/or at discharge locations (not applicable).
- Type and extent of pre-construction cover on the site (e.g., vegetative cover, forest, pasture, pavement, structures).
- Topography and drainage patterns of stormwater and authorized non-stormwater before and after major grading activities.
- Stormwater and authorized non-stormwater discharge locations, including:
  - Locations where stormwater and/or authorized non-stormwater will be discharged to storm drain inlets and
  - Locations where stormwater or authorized non-stormwater will be discharged directly to Waters of the US.
- Locations of all potential pollutant-generating activities identified in Part 7.2.3.g of the USEPA CGP.
- Locations of stormwater controls and BMPs, including natural buffer areas and any shared controls utilized to comply with the USEPA CGP.
- Locations where polymers, flocculants, or other treatment chemicals will be used and stored (if applicable).

E.5.3 Incorporate Federal, State, and Local Regulations

The USEPA CGP requires the following documentation to be included in the CSWPPP to demonstrate compliance:

- ESA Protection: The project must meet one of the criteria listed in Appendix D of the USEPA CGP (see Section E.4.2) to demonstrate compliance with the ESA.
- Historic Preservation: The Historic Property Screening Process in Appendix E of the USEPA CGP must be completed to demonstrate compliance with Section 106 of the NHPA (see Section E.4.3).
- Safe Drinking Water Act Underground Injection Control Requirements (see Part 7.2.9 of the USEPA CGP).

In addition, the project will comply with US Army Corps of Engineers (USACE) Section 404 Permit requirements. No other federal, state, or local permits are required for the work as allowed under 42 USC 9621e(1); however, the CSWPPP should meet the substantive requirements associated with these permits. Appendix N of the 95% Design Report summarizes applicable federal, state, and local regulations.

E.5.4 Erosion and Sediment Controls

The Contractor's CSWPPP must include the total area to be impacted by construction activities. The plan must also evaluate how construction activities would alter stormwater runoff volumes and flows and identify drainage outlets and accumulation areas for stormwater and sediment. The CC must use guidance provided by USEPA NPDES program for this evaluation and must also refer to temporary stormwater controls drawings shown in Sections 2, 3, 4, 5, 7 and 10 of the Design Drawings.

The CSWPPP should include designs for construction stormwater controls based on the initial site evaluation (described in Section E.5.2). The site map will show the controls. The controls will include measures to (1) reduce erosion and sediment runoff, (2) prevent release of pollutants, and (3) manage stormwater. Section E.6 and Attachment E.1 identifies potentially applicable BMPs for controls. The following factors must be accounted for in the design of stormwater controls per USEPA CGP:

- The expected amount, frequency, intensity, and duration of precipitation.
- The nature of stormwater runoff and run-on at the site, including factors such as expected flow from impervious surfaces, slopes, and site drainage features. Stormwater controls must be designed to control stormwater volume, velocity, and peak flow rates to minimize discharges of pollutants in stormwater and to minimize channel and stream bank erosion and scour in the immediate vicinity of discharge points.
- The soil type and range of soil particle sizes expected to be present on the site.

This information is available in the 95% Design Report and can be provided to the Contractor by Stantec.

Controls to reduce erosion and sediment runoff include stabilization measures for disturbed areas and structural controls to divert runoff and control sediment. Erosion and sediment controls are implemented during construction to control soil loss from the construction site into the receiving waters. Such controls should remain in place until vegetation has established or other permanent controls are in place.

The USEPA CGP requires that sediment basins be sized to provide at least 3,600 cubic feet of storage per acre or the calculated runoff from the 2-year, 24-hour storm (see Appendix H or the USEPA CGP). In some instances, this design uses a stricter requirement; for example, the temporary retention basins for the mine waste haul road are sized for the calculated runoff from the 10-year, 24-hour storm.

The following erosion and sediment controls shall be addressed in the CSWPPP per the USEPA CGP:

- Perimeter controls
- Sediment track-out
- Stockpiled sediment or soil
- Minimization of dust
- Minimize steep slope disturbances
- Topsoil management
- Soil compaction
- Storm drain inlet protection
- Stormwater conveyance channels
- Sediment basins
- Chemical treatment

- Dewatering practices
- Other stormwater controls

E.5.4.1 Natural Buffers or Equivalent Sediment Controls

Natural buffers or equivalent sediment controls are required for projects that disturb areas within 50-feet of a Water of the US. The project has three Waters of the US located within the project boundaries (see Section E.5.2.2). Work will be conducted in Unnamed Arroyo No. 1, Unnamed Arroyo No.2, and within Pipeline Arroyo. Due to the proximity of these Waters of the US, the CC must select a compliance alternative to meet the buffer requirements as specified in USEPA CGP 2.2.1 and 7.2.6.b.i and Appendix G. The contractor may also qualify for one of the exceptions in Part 2.2.1.b of the USEPA CGP.

E.5.4.2 Site Stabilization

The USEPA CGP requires that stabilization be initiated immediately where construction activities have permanently stopped or will be inactive for 14 or more calendar days. For projects disturbing 5 or more acres of land at one time, the stabilization must be completed as soon as practicable but no more than 7 calendar days after stabilization has been initiated. Stabilization schedule and information describing the vegetative and/or non-vegetative practices that will be used to stabilize disturbed areas must be provided in the CSWPPP. The stabilization practices must meet the following minimum criteria per Part 2.2.14b of the USEPA CGP as defined below:

- Establish uniform, perennial vegetation (i.e., evenly distributed, without large bare areas) that provides 70 percent or more of the cover that is provided by vegetation native to local undisturbed areas and/or
- Implement permanent non-vegetative stabilization measures to provide effective cover.

E.5.5 Pollution Prevention Standards

All pollutant generating activities must be identified on the site. For each activity, pollutants that could be exposed to rainfall or snowmelt and potentially be discharged in stormwater must be inventoried. Potential areas for spills and leaks that may contribute pollutants to stormwater must also be taken into account per Part 7.2.3.g of the USEPA CGP. Additional information regarding potential pollutant generating activities must be addressed in the CSWPPP for the following items (if applicable):

- Spill prevention and response
- Fueling and maintenance of equipment or vehicles
- Washing of equipment and vehicles
- Storage, handling, and disposal of building products, materials, and wastes
- Building products
- Pesticides, herbicides, insecticides, fertilizers, and landscape materials
- Diesel fuel, oil, hydraulic fluids, other petroleum products, and other chemicals
- Hazardous or toxic waste
- Construction and domestic waste
- Sanitary waste
- Washing of applicators and containers used for paint, concrete or other materials
- Fertilizers
- Other pollution prevention practices

E.5.6 Inspection, Maintenance and Corrective Action Plan

The CC's CSWPPP must include a plan for regularly inspecting and maintaining the controls per Part 4 of the USEAP CGP. The CC will document inspection, maintenance and corrective action activities. Template inspection and corrective action forms are available on the USEPA NPDES website at https://www.epa.gov/npdes/construction-general-permit-resources-tools-and-templates#inspection. The CC can use these forms, or other forms with equivalent information, to document the inspection.

The inspection, maintenance and corrective action plan should include visual inspections of disturbed areas and stormwater control features, including inspection of control features in inactive or reclaimed work areas per Part 4.5 of the USEPA CGP. Temporary and permanent erosion and sediment control BMPs should be maintained and repaired as needed to assure continued performance of their intended function. Maintenance and repair should be conducted in accordance with each particular BMP's specifications.

The inspection, maintenance and corrective action plan must specify that site inspections be conducted during normal working hours:

- At least once every seven (7) days

OR

- At least once every 14 days and within 24 hours of a 0.25 inch or greater rain event, or the occurrence of runoff from snowmelt sufficient to cause a discharge.

Increased frequency is required if the site is discharging to impaired waters or to Tier 2, Tier 2.5 or Tier 3 Waters. Inspections may be reduced for areas that are stabilized, the site has frozen conditions, or the site is in an arid, semi-arid or drought stricken area.

The inspections must be conducted by a "qualified person". A "qualified person" is defined by the USEPA as "a person knowledgeable in the principles and practice of erosion and sediment controls and pollution prevention, who possesses the appropriate skills and training to assess conditions at the construction site that could impact stormwater quality, and the appropriate skills and training to assess the effectiveness of any stormwater controls selected and installed to meet the requirements of the [USEPA CGP]".

The inspection, maintenance and corrective action plan must also require that temporary erosion and sediment controls be removed prior to submittal of the NOT, or after the temporary controls are no longer needed. The CC should remove trapped sediment and consolidate it with the mine wastes if necessary. The CC should permanently stabilize disturbed soil or vegetation resulting from removal of controls.

E.5.6.1 Training

Proper stormwater training is essential for successful implementation of the CSWPPP. It is important for personnel to understand the USEPA CGP permit requirements and deadlines and how these relate to their job duties. The CSWPPP shall document all stormwater trainings that have been conducted and personnel that have attended the trainings. At a minimum, members of the Stormwater Team (see Section E.5.1) that conduct the following activities must be trained prior to the start of construction activities (USEPA CGP Part 6):

- Personnel who are responsible for the design, installation, maintenance, and/or repair of stormwater controls (including pollution prevention measures).
- Personnel who are responsible for conducting inspections and taking corrective actions.
- Personnel responsible for the application and storage of treatment chemicals (if applicable).

At a minimum, members of the Stormwater Team must be trained to understand the following as it relates to their job duties:

- The permit deadlines associated with installation, maintenance, and removal of stormwater controls and with stabilization.
- The location of all stormwater controls on the site required by this permit, and how they are to be maintained.
- The proper procedures to follow with respect to the permit's pollution prevention requirements.
- When and how to conduct inspections, record applicable findings, and take corrective actions.

E.5.7 Certification and Submittal

The CSWPPP must be signed by the CC's authorized representative. An authorized representative must meet the requirements as defined in Part I.11.1 of Appendix I in the USEPA CGP. Delegation of authority forms may be completed as part of the CSWPPP to allow authorized individuals to sign inspections reports and other information pertaining to the CSWPPP. Subcontractors should also sign the Subcontractor Certification located in Appendix G of the USEPA SWPPP template (USEPA, 2017b).

E.6 BEST MANAGEMENT PRACTICES GUIDELINES

This section summarizes stormwater erosion and sediment control BMPs along with some common BMPs that are appropriate for this project. The CSWPPP may specify additional or alternative BMPs with Stantec's approval. Attachment E.1 includes a catalog of the BMPs outlined below. This BMP catalog is from the California Stormwater BMP Handbook Portal: Construction (CASQA, 2015) and provides information on applications, installation, and limitations. BMPs will be inspected per the Inspection, Maintenance and Corrective Action Plan requirements outlined in Section E.5.6. Routine maintenance and repair should be conducted in accordance with each particular BMP's specifications. Maintenance and corrective action must be initiated immediately upon discovery, and work completed by close of next business day. If corrective action requires new/replacement BMP or significant repair, work must be completed making the BMP operational no later than seven calendar days from the time of discovery.

E.6.1 Erosion Control

BMPs for erosion control include the following:

- Scheduling (EC-1). Develop a written plan that includes sequencing of construction activities and the implementation of BMPs while taking local climate into consideration. The purpose of the schedule is to reduce the amount and duration of soil exposed to erosion by wind, rain, runoff.
- Preservation of existing vegetation (EC-2). Plan construction activities so as to preserve existing vegetation and minimize the removal and injury to existing trees, vines, shrubs, and grasses that protect the soil from erosion. Areas where construction will not be conducted must be clearly identified with temporary fencing or equivalent measures.
- Mulching (EC-3, EC-6, or EC-8). Mulching should be used to prevent high runoff velocities, trap sediment, and protect surfaces, including newly seeded areas. Mulch should be free from noxious weeds and invasive species.
- Geotextiles and mats (EC-7). An erosion control mat is material placed on disturbed areas or slopes to aid in erosion control and promote the establishment of vegetative cover. The CC should use erosion control mats in newly seeded areas where slow vegetation growth is expected. In accordance with GSR principles, geotextiles and mats should be made of biodegradable materials that can act as substrate to regrowth.
- Earth dikes and drainage swales (EC-9). Diversion dikes and swales are berms and depressions that channelize or divert flow. The CC can use diversion dikes and swales to direct contact stormwater runoff into a controlled collection area or to divert non-contact stormwater around disturbed or contaminated areas.
- Slope drain (EC-11). A slope drain is a temporary pipe that runs downslope. The CC can use slope drains to convey water down unstabilized, steep slopes. The pipe must be anchored, and the pipe must be frequently inspected and maintained to confirm that it can function properly. The pipe must be inspected after each significant (greater than 0.5-inch) rainfall to repair joint damage and remove pipe clogs.
- Soil preparation/roughening (EC-15). Surface roughening consists of creating along-contour depressions that slow surface flow and allow sediment deposition on slopes. The CC should use surface roughening along with seeding and mulching. Surface roughening should not be used for rocky slopes or slopes with fine sands or silts.
- Seeding and temporary vegetation. Temporary seeding should be applied to disturbed areas that have not been worked for 14 days or more, unless the CC provides alternative effective measures to control erosion. Disturbed areas include denuded areas, soil stockpiles, dikes, berms, temporary embankments, and excavation slopes. The CC may need to install erosion control matting, swales, or berms to protect newly seeded areas. Refer to the Mine Site Revegetation Plan Appendix U and Section 10 of the Design Drawings for details on seed mixes.

E.6.2 Sediment Control

BMPs for sediment control include the following:

- **Silt fence (SE-1).** Silt fences can be used to reduce sediment loss on disturbed slopes. The CC should construct silt fences at the toes of slopes and adjacent to channels and streams with the potential to receive sediment from construction activities. The CC should inspect silt fences at least weekly and after heavy storm events (0.25 inches in 30 minutes or a 24 hour total greater than 0.5 inches). The CC should remove sediment upstream of the silt fence once the depth of sediment reaches approximately half the fence height. Due to windy site conditions, silt fence, if used, should be heavily reinforced, and regular maintenance will be required.
- **Sediment basin (SE-2).** A sediment basin is a temporary basin formed by excavation with an outlet that slowly releases stored water so that sediment can settle out before the runoff is released. The CC can use detention basins to reduce flow rates and provide sediment removal from stormwater. The CC should inspect detention basins at least bi-weekly. At a minimum, sediment basins should be inspected weekly. Additional inspections should be conducted prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- **Sediment trap (SE-3).** A sediment trap is a temporary ponding area that slows runoff and captures sediment. The CC can install sediment traps within a drainage way or at a point of discharge. The sediment trap should be inspected frequently to check for reduced efficiency. Corrective measures should be taken if the sediment trap does not dewater completely within 96 hours or less.
- **Check dam (SE-4).** A check dam is a small temporary dam constructed across a swale or ditch with the intent of slowing the flow velocity. The CC should install rock check dams perpendicular to the flow-line of temporary stormwater diversion channels. Dams in permanent stormwater channels may require inspection prior to installation of channel revetment. The CC should install check dams in channels that drain areas less than 10 acres, do not have extended base flows, and where the expected in-channel flow does not exceed 5 cubic foot per second.
- **Fiber rolls or straw wattle (SE-5).** A fiber roll or straw wattle is a geotextile fabric cylinder filled with straw. The CC should install straw wattles along contours on sloping grade to limit migration of fine sediment and inhibit rilling and rutting of the slope surfaces until an appropriate cover has been constructed. Straw wattles should be spaced a maximum of 20 feet apart on slopes 4:1 (H:V) or flatter, 15 feet apart on slopes between 4:1 and 2:1 (H:V) and 10 feet apart on slopes 2:1 (H:V) or greater. The CC should inspect straw wattles with a frequency defined in the CSWPPP and following storm events. Wattles should be replaced if straw debris is outside of the geotextile encasement downgradient of the wattle.
- **Straw bale barrier (SE-9).** The CC should place straw bales perpendicular to the flow-line at the confluence of both temporary and permanent diversion channels. The CC should anchor the straw bales using stakes or posts. Straw bales should be replaced at least every three months. The CC should also replace straw bales if straw is distributed downstream of the bale, indicating that the bale ties are no longer capable of maintaining the integrity and shape of the straw bale.

E.6.3 Wind Erosion Control

BMPs for wind erosion control include the following:

- **Wind erosion/dust control (WE-1).** Dust control consists of applying water to prevent or minimize dust produced by construction activities. Covering of stockpiles or small areas is an alternative to applying water. The CC should take care not to overwater thus potentially causing erosion and track-out.

E.6.4 Tracking Control

BMPs for tracking control include the following:

- **Stabilized construction entrance/exit (TC-1).** A stabilized construction entrance is a point of entrance/exit to a construction site that is stabilized to reduce the tracking of mud and dirt onto public roads by construction vehicles. The CC should utilize corrugated steel panels to enhance sediment removal from construction vehicles. Stabilized

construction entrance should be inspected weekly with aggregate removed, separated and disposed of sediment if the entrance/exit is clogged with sediment. Local roadways adjacent to the construction site are to be inspected daily for evidence of trackout. If trackout is observed Contractor is to sweep or vacuum to remove the visible accumulated sediment.

E.6.5 Waste Management & Materials Control

BMPs for waste management and materials control include the following:

- Stockpile management (WM-3). Stockpile management procedures and practices reduce and/or eliminate air and stormwater pollution. The CC should avoid the use of plastic materials and photodegradable plastics as they are difficult to manage in the wind, can increase runoff volume, and they break down faster in sunlight. Stockpiles should be located a minimum of 50 feet from any concentrated flows of stormwater or drainage ways. All stockpiles must be protected from stormwater run-on using temporary perimeter controls (e.g. silt fence, fiber rolls, etc.). Contractor must implement appropriate wind erosion controls for all stockpiled materials.
- Hazardous waste management (WM-6). Training employees and subcontractors will help to prevent and/or reduce the discharge of pollutants to stormwater from hazardous waste. Topics to be covered in the training include proper material use and waste disposal.
- Contaminated soil management (WM-7). Measures must be taken to prevent or reduce the discharge of pollutants from contaminated soils to stormwater. Conducting pre-construction surveys, inspecting excavations regularly and remediating contaminated soils promptly can help with prevention and reduction.
- Sanitary/septic waste management (WM-9). Properly managing sanitary and septic waste prevents the discharge of pollutants to stormwater. The CC should provide convenient, well-maintained facilities and arrange for regular service and disposal. Temporary sanitary facilities should be located away from drainage facilities, watercourses, and from traffic circulation. If possible, place portable facilities a minimum of 50 feet away from drainage and traffic areas. Temporary facilities should be secured to prevent overturning due to high winds.

E.7 BEST MANAGEMENT PRACTICES FOR GREEN REMEDIATION

The areas where Green and Sustainable Remediation has been evaluated for the mine waste Repository design relate to: (1) construction materials (characteristics, manufacturing and transportation considerations), (2) construction methods, and (3) low impact/sustainability measures during construction. The 'BMP Process', as outlined in the 'Standard for Greener Cleanups' (ASTM, 2016), has been followed to select and prioritize BMPs for implementation during remedial action. The BMPs relating to Stormwater Management Plan are listed below, for a complete description of the BMP Process and list of all GSR BMPs see Section 4 of the Main RD document and Appendix A (Section A.5).

E.7.1 Construction Materials

Green and Sustainable Remediation considerations involving construction materials include requiring use of green concrete for channels and culverts (via technical specifications) and use of on-site, non-contaminated materials (soil and rock) for riprap and construction of berm sub-grades to limit fuel consumption and emissions due to import of off-site materials. Biodegradable fabrics will be utilized for erosion control blankets and mats.

E.7.2 Construction Methods

Green and Sustainable Remediation considerations involving construction methods include requiring CCs to use correctly sized construction equipment to avoid higher greenhouse gas and dust emissions resulting from oversized construction equipment. Use of silt fences, basins and other stormwater BMPs (Attachment E.1) will be required to reduce contamination of uncontaminated areas, thus reducing the overall footprint of the project and associated emissions and fuel use.

E.7.3 Low Impact/Sustainability Measures

Low impact/sustainability measures include using temporary stormwater controls (described in this appendix and in the Section 5 Drawings) to segregate contaminated water from non-impacted water. Disturbed slopes in work areas would be protected by implementation of BMPs including temporary seeding, erosion control mats and silt fences.

E.8 REFERENCES

ASTM International, 2016. ASTM Standard E2893-16, "Standard Guide for Greener Cleanups," ASTM International, West Conshohocken, PA, 2016, DOI: 10.1520/E2893-16E01, www.astm.org.

California Stormwater Quality Association (CASQA), 2015. California Stormwater BMP Handbook Portal: Construction.

US Environmental Protection Agency (USEPA), 2007. Developing your stormwater pollution prevention plan: a guide for construction sites. Washington, DC.

US Environmental Protection Agency (USEPA), Region 6 and Region 9, 2011. Action Memorandum: Request for a Non-Time-Critical Removal Action at the Northeast Church Rock Site, McKinley County, New Mexico, Pinedale Chapter of the Navajo Nation. September 29.

US Environmental Protection Agency (USEPA) Region 6, 2013. Record of Decision, United Nuclear Corporation Site, McKinley County, New Mexico. Operable Unit OU2: Surface Soil Operable Unit. March 29.

US Environmental Protection Agency (USEPA), Region 6 and Region 9, 2015. Administrative Settlement Agreement and Order on Consent for Design and Cost Recovery, Appendix D: Statement of Work. April 27.

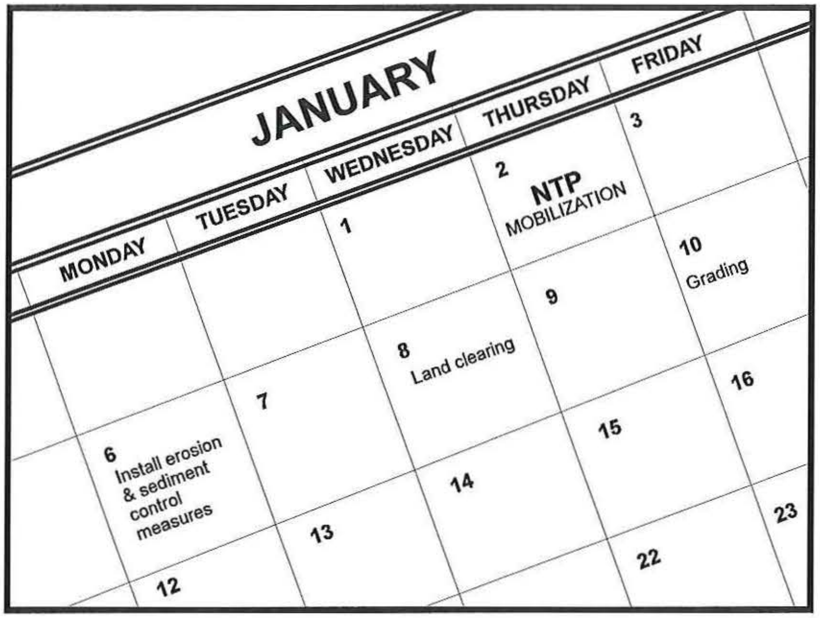
US Environmental Protection Agency (USEPA), 2017a. National Pollutant Discharge Elimination System General Permit for Discharges from Construction Activities. February 16.

US Environmental Protection Agency (USEPA), 2017b. Stormwater Pollution Prevention Plan (SWPPP) Template, Version 2.1.

ATTACHMENT E.1

Selected BMPs from California Stormwater Quality Association (CASQA)

California Stormwater BMP Handbook Portal: Construction (CASQA, 2015)



Description and Purpose

Scheduling is the development of a written plan that includes sequencing of construction activities and the implementation of BMPs such as erosion control and sediment control while taking local climate (rainfall, wind, etc.) into consideration. The purpose is to reduce the amount and duration of soil exposed to erosion by wind, rain, runoff, and vehicle tracking, and to perform the construction activities and control practices in accordance with the planned schedule.

Suitable Applications

Proper sequencing of construction activities to reduce erosion potential should be incorporated into the schedule of every construction project especially during rainy season. Use of other, more costly yet less effective, erosion and sediment control BMPs may often be reduced through proper construction sequencing.

Limitations

- Environmental constraints such as nesting season prohibitions reduce the full capabilities of this BMP.

Implementation

- Avoid rainy periods. Schedule major grading operations during dry months when practical. Allow enough time before rainfall begins to stabilize the soil with vegetation or physical means or to install sediment trapping devices.

- Plan the project and develop a schedule showing each phase of construction. Clearly show how the rainy season relates

Categories

EC	Erosion Control	☑
SE	Sediment Control	☒
TC	Tracking Control	☒
WE	Wind Erosion Control	☒
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

to soil disturbing and re-stabilization activities. Incorporate the construction schedule into the SWPPP.

- Include on the schedule, details on the rainy season implementation and deployment of:
  - Erosion control BMPs
  - Sediment control BMPs
  - Tracking control BMPs
  - Wind erosion control BMPs
  - Non-stormwater BMPs
  - Waste management and materials pollution control BMPs
- Include dates for activities that may require non-stormwater discharges such as dewatering, sawcutting, grinding, drilling, boring, crushing, blasting, painting, hydro-demolition, mortar mixing, pavement cleaning, etc.
- Work out the sequencing and timetable for the start and completion of each item such as site clearing and grubbing, grading, excavation, paving, foundation pouring utilities installation, etc., to minimize the active construction area during the rainy season.
  - Sequence trenching activities so that most open portions are closed before new trenching begins.
  - Incorporate staged seeding and re-vegetation of graded slopes as work progresses.
  - Schedule establishment of permanent vegetation during appropriate planting time for specified vegetation.
- Non-active areas should be stabilized as soon as practical after the cessation of soil disturbing activities or one day prior to the onset of precipitation.
- Monitor the weather forecast for rainfall.
- When rainfall is predicted, adjust the construction schedule to allow the implementation of soil stabilization and sediment treatment controls on all disturbed areas prior to the onset of rain.
- Be prepared year round to deploy erosion control and sediment control BMPs. Erosion may be caused during dry seasons by un-seasonal rainfall, wind, and vehicle tracking. Keep the site stabilized year round, and retain and maintain rainy season sediment trapping devices in operational condition.
- Apply permanent erosion control to areas deemed substantially complete during the project's defined seeding window.

Costs

Construction scheduling to reduce erosion may increase other construction costs due to reduced economies of scale in performing site grading. The cost effectiveness of scheduling techniques should be compared with the other less effective erosion and sedimentation controls to achieve a cost effective balance.

Inspection and Maintenance

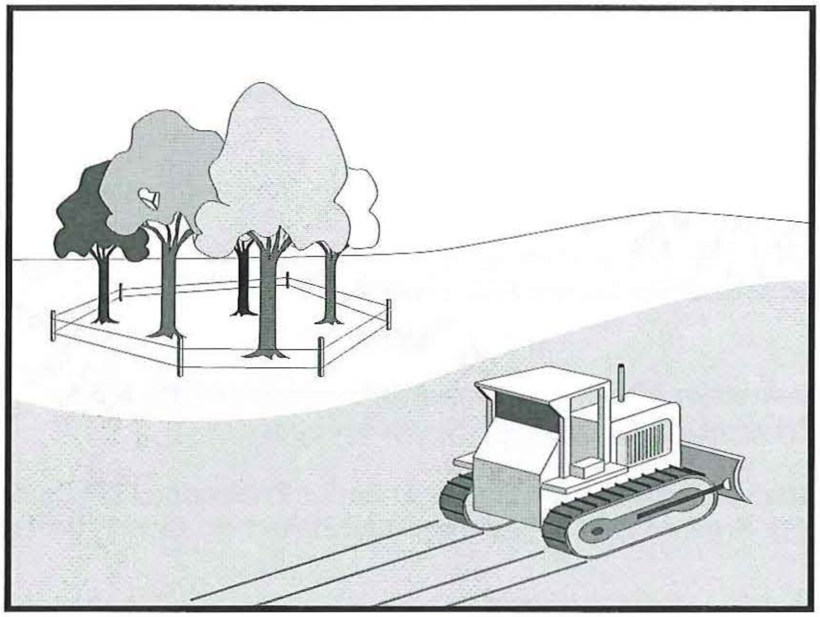
- Verify that work is progressing in accordance with the schedule. If progress deviates, take corrective actions.
- Amend the schedule when changes are warranted.
- Amend the schedule prior to the rainy season to show updated information on the deployment and implementation of construction site BMPs.

References

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities Developing Pollution Prevention Plans and Best Management Practices (EPA 832-R-92-005), U.S. Environmental Protection Agency, Office of Water, September 1992.

Preservation Of Existing Vegetation EC-2



Categories

EC	Erosion Control	☑
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
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Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

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CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

Description and Purpose

Carefully planned preservation of existing vegetation minimizes the potential of removing or injuring existing trees, vines, shrubs, and grasses that protect soil from erosion.

Suitable Applications

Preservation of existing vegetation is suitable for use on most projects. Large project sites often provide the greatest opportunity for use of this BMP. Suitable applications include the following:

- Areas within the site where no construction activity occurs, or occurs at a later date. This BMP is especially suitable to multi year projects where grading can be phased.
- Areas where natural vegetation exists and is designated for preservation. Such areas often include steep slopes, watercourse, and building sites in wooded areas.
- Areas where local, state, and federal government require preservation, such as vernal pools, wetlands, marshes, certain oak trees, etc. These areas are usually designated on the plans, or in the specifications, permits, or environmental documents.
- Where vegetation designated for ultimate removal can be temporarily preserved and be utilized for erosion control and sediment control.

Limitations

- Requires forward planning by the owner/developer, contractor, and design staff.
- Limited opportunities for use when project plans do not incorporate existing vegetation into the site design.
- For sites with diverse topography, it is often difficult and expensive to save existing trees while grading the site satisfactory for the planned development.

Implementation

The best way to prevent erosion is to not disturb the land. In order to reduce the impacts of new development and redevelopment, projects may be designed to avoid disturbing land in sensitive areas of the site (e.g., natural watercourses, steep slopes), and to incorporate unique or desirable existing vegetation into the site's landscaping plan. Clearly marking and leaving a buffer area around these unique areas during construction will help to preserve these areas as well as take advantage of natural erosion prevention and sediment trapping.

Existing vegetation to be preserved on the site must be protected from mechanical and other injury while the land is being developed. The purpose of protecting existing vegetation is to ensure the survival of desirable vegetation for shade, beautification, and erosion control. Mature vegetation has extensive root systems that help to hold soil in place, thus reducing erosion. In addition, vegetation helps keep soil from drying rapidly and becoming susceptible to erosion. To effectively save existing vegetation, no disturbances of any kind should be allowed within a defined area around the vegetation. For trees, no construction activity should occur within the drip line of the tree.

Timing

- Provide for preservation of existing vegetation prior to the commencement of clearing and grubbing operations or other soil disturbing activities in areas where no construction activity is planned or will occur at a later date.

Design and Layout

- Mark areas to be preserved with temporary fencing. Include sufficient setback to protect roots.
  - Orange colored plastic mesh fencing works well.
  - Use appropriate fence posts and adequate post spacing and depth to completely support the fence in an upright position.
- Locate temporary roadways, stockpiles, and layout areas to avoid stands of trees, shrubs, and grass.
- Consider the impact of grade changes to existing vegetation and the root zone.
- Maintain existing irrigation systems where feasible. Temporary irrigation may be required.
- Instruct employees and subcontractors to honor protective devices. Prohibit heavy equipment, vehicular traffic, or storage of construction materials within the protected area.

Costs

There is little cost associated with preserving existing vegetation if properly planned during the project design, and these costs may be offset by aesthetic benefits that enhance property values. During construction, the cost for preserving existing vegetation will likely be less than the cost of applying erosion and sediment controls to the disturbed area. Replacing vegetation inadvertently destroyed during construction can be extremely expensive, sometimes in excess of $10,000 per tree.

Inspection and Maintenance

During construction, the limits of disturbance should remain clearly marked at all times. Irrigation or maintenance of existing vegetation should be described in the landscaping plan. If damage to protected trees still occurs, maintenance guidelines described below should be followed:

- Verify that protective measures remain in place. Restore damaged protection measures immediately.
- Serious tree injuries shall be attended to by an arborist.
- Damage to the crown, trunk, or root system of a retained tree shall be repaired immediately.
- Trench as far from tree trunks as possible, usually outside of the tree drip line or canopy. Curve trenches around trees to avoid large roots or root concentrations. If roots are encountered, consider tunneling under them. When trenching or tunneling near or under trees to be retained, place tunnels at least 18 in. below the ground surface, and not below the tree center to minimize impact on the roots.
- Do not leave tree roots exposed to air. Cover exposed roots with soil as soon as possible. If soil covering is not practical, protect exposed roots with wet burlap or peat moss until the tunnel or trench is ready for backfill.
- Cleanly remove the ends of damaged roots with a smooth cut.
- Fill trenches and tunnels as soon as possible. Careful filling and tamping will eliminate air spaces in the soil, which can damage roots.
- If bark damage occurs, cut back all loosened bark into the undamaged area, with the cut tapered at the top and bottom and drainage provided at the base of the wood. Limit cutting the undamaged area as much as possible.
- Aerate soil that has been compacted over a trees root zone by punching holes 12 in. deep with an iron bar, and moving the bar back and forth until the soil is loosened. Place holes 18 in. apart throughout the area of compacted soil under the tree crown.
- Fertilization
  - Fertilize stressed or damaged broadleaf trees to aid recovery.
  - Fertilize trees in the late fall or early spring.

- Apply fertilizer to the soil over the feeder roots and in accordance with label instructions, but never closer than 3 ft to the trunk. Increase the fertilized area by one-fourth of the crown area for conifers that have extended root systems.

- Retain protective measures until all other construction activity is complete to avoid damage during site cleanup and stabilization.

References

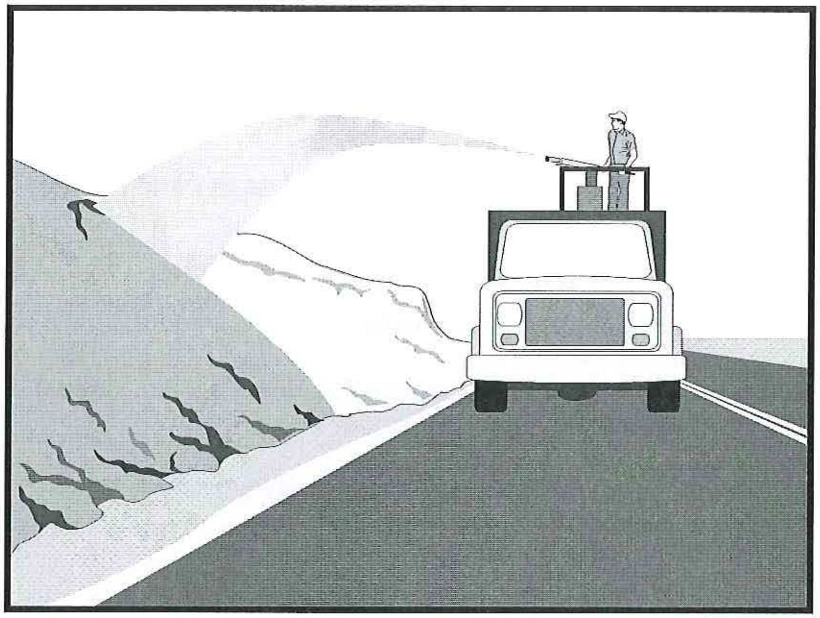
County of Sacramento Tree Preservation Ordinance, September 1981.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Water Quality Management Plan for The Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.

Hydraulic Mulch EC-3



Categories

EC	Erosion Control	☑
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	☒
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-4 Hydroseeding

EC-5 Soil Binders

EC-6 Straw Mulch

EC-7 Geotextiles and Mats

EC-8 Wood Mulching

EC-14 Compost Blanket

EC-16 Non-Vegetative Stabilization

Description and Purpose

Hydraulic Mulch consists of various types of fibrous materials mixed with water and sprayed onto the soil surface in slurry form to provide a layer of temporary protection from wind and water erosion.

Suitable Applications

Hydraulic mulch as a temporary, stand alone, erosion control BMP is suitable for disturbed areas that require temporary protection from wind and water erosion until permanent soil stabilization activities commence. Examples include:

- Rough-graded areas that will remain inactive for longer than permit-required thresholds (e.g., 14 days) or otherwise require stabilization to minimize erosion or prevent sediment discharges.
- Soil stockpiles.
- Slopes with exposed soil between existing vegetation such as trees or shrubs.
- Slopes planted with live, container-grown vegetation or plugs.
- Slopes burned by wildfire.

Hydraulic mulch can also be applied to augment other erosion control BMPs such as:

- In conjunction with straw mulch (see EC-6 Straw Mulch) where the rate of hydraulic mulch is reduced to 100-500 lbs per acre and the slurry is applied over the straw as a tackifying agent to hold the straw in place.
- Supplemental application of soil amendments, such as fertilizer, lime, gypsum, soil bio-stimulants or compost.

Limitations

In general, hydraulic mulch is not limited by slope length, gradient or soil type. However, the following limitations typically apply:

- Most hydraulic mulch applications, particularly bonded fiber matrices (BFMs), require at least 24 hours to dry before rainfall occurs.
- Temporary applications (i.e., without a vegetative component) may require a second application in order to remain effective for an entire rainy season.
- Treatment areas must be accessible to hydraulic mulching equipment.
- Availability of water sources in remote areas for mixing and application.
- As a stand-alone temporary BMP, hydraulic mulches may need to be re-applied to maintain their erosion control effectiveness, typically after 6-12 months depending on the type of mulch used.
- Availability of hydraulic mulching equipment may be limited just prior to the rainy season and prior to storms due to high demand.
- Cellulose fiber mulches alone may not perform well on steep slopes or in course soils.
- This BMP consists of a mixture of several constituents (e.g., fibers/mulches, tackifiers, and other chemical constituents), some of which may be proprietary and may come pre-mixed by the manufacturer. The water quality impacts of these constituents are relatively unknown and some may have water quality impacts due to their chemical makeup. Refer to specific chemical properties identified in the product Material Safety Data Sheet; products should be evaluated for project-specific implementation by the SWPPP Preparer. Refer to factsheet EC-05 for further guidance on selecting soil binders.

Implementation

- Where feasible, it is preferable to prepare soil surfaces prior to application by roughening embankments and fill areas with a crimping or punching type roller or by track walking.
- The majority of hydraulic mulch applications do not necessarily require surface/soil preparation (See EC-15 Soil Preparation) although in almost every case where re-vegetation is included as part of the practice, soil preparation can be beneficial. One of the advantages of hydraulic mulch over other erosion control methods is that it can be applied in areas where soil preparation is precluded by site conditions, such as steep slopes, rocky soils, or inaccessibility.

- Avoid mulch over spray onto roads, sidewalks, drainage channels, existing vegetation, etc.
- Hydraulic mulching is generally performed utilizing specialized machines that have a large water-holding/mixing tank and some form of mechanical agitation or other recirculation method to keep water, mulch and soil amendments in suspension. The mixed hydraulic slurry can be applied from a tower sprayer on top of the machine or by extending a hose to areas remote from the machine.
- Where possible apply hydraulic mulch from multiple directions to adequately cover the soil. Application from a single direction can result in shadowing, uneven coverage and failure of the BMP.
- Hydraulic mulch can also include a vegetative component, such as seed, rhizomes, or stolons (see EC-4 Hydraulic Seed).
- Typical hydraulic mulch application rates range from 2,000 pounds per acre for standard mulches (SMs) to 3,500 pounds per acre for BFMs. However, the required amount of hydraulic mulch to provide adequate coverage of exposed topsoil may appear to exceed the standard rates when the roughness of the soil surface is changed due to soil preparation methods (see EC-15 Soil Preparation) or by slope gradient.
- Other factors such as existing soil moisture and soil texture can have a profound effect on the amount of hydraulic mulch required (i.e. application rate) applied to achieve an erosion-resistant covering.
- Avoid use of mulch without a tackifier component, especially on slopes.
- Mulches used in the hydraulic mulch slurry can include:
  - Cellulose fiber
  - Thermally-processed wood fibers
  - Cotton
  - Synthetics
  - Compost (see EC-14, Compost Blanket)
- Additional guidance on the comparison and selection of temporary slope stabilization methods is provided in Appendix F of the Handbook.

Categories of Hydraulic Mulches

Standard Hydraulic Mulch (SM)

Standard hydraulic mulches are generally applied at a rate of 2,000 pounds per acre and are manufactured containing around 5% tackifier (i.e. soil binder), usually a plant-derived guar or psyllium type. Most standard mulches are green in color derived from food-color based dyes.

Hydraulic Matrices (HM) and Stabilized Fiber Matrices (SFM)
Hydraulic matrices and stabilized fiber matrices are slurries which contain increased levels of tackifiers/soil binders; usually 10% or more by weight. HMs and SFMs have improved performance compared to a standard hydraulic mulch (SM) because of the additional percentage of tackifier and because of their higher application rates, typically 2,500 – 4,000 pounds per acre. Hydraulic matrices can include a mixture of fibers, for example, a 50/50 blend of paper and wood fiber. In the case of an SFM, the tackifier/soil binder is specified as a polyacrylamide (PAM).

Bonded Fiber Matrix (BFM)
Bonded fiber matrices (BFMs) are hydraulically-applied systems of fibers, adhesives (typically guar based) and chemical cross-links. Upon drying, the slurry forms an erosion-resistant blanket that prevents soil erosion and promotes vegetation establishment. The cross-linked adhesive in the BFM should be biodegradable and should not dissolve or disperse upon re-wetting. BFMs are typically applied at rates from 3,000 to 4,000 lbs/acre based on the manufacturer's recommendation. BFMs should not be applied immediately before, during or immediately after rainfall or if the soil is saturated. Depending on the product, BFMs typically require 12 to 24 hours to dry and become effective.

Mechanically-Bonded Fiber Matrices (MBFM)
Mechanically-bonded fiber matrices (MBFMs) are hydraulically applied systems similar to BFM that use crimped synthetic fibers and PAM and are typically applied to a slope at a higher application rate than a standard BFM.

Hydraulic Compost Matrix (HCM)
Hydraulic compost matrix (HCM) is a field-derived practice whereby finely graded or sifted compost is introduced into the hydraulic mulch slurry. A guar-type tackifier can be added for steeper slope applications as well as any specified seed mixtures. A HCM can help to accelerate seed germination and growth. HCMs are particularly useful as an in-fill for three-dimensional re-vegetation geocomposites, such as turf reinforcement mats (TRM) (see EC-7 Geotextiles and Mats).

Costs
Average installed costs for hydraulic mulch categories are is provided in Table 1, below.

Table 1
HYDRAULIC MULCH BMPs
INSTALLED COSTS

BMP	Installed Cost/Acre
Standard Hydraulic Mulching (SM)	$1,700 - $3,600 per acre
Hydraulic Matrices (HM) and Stabilized Fiber Matrices	
Guar-based	$2,000 - $4,000 per acre
PAM-based	$2,500 - $5,610 per acre
Bonded Fiber Matrix (BFM)	$3,900 - $6,900 per acre
Mechanically Bonded Fiber Matrix (MBFM)	$4,500 - $6,000 per acre
Hydraulic Compost Matrix (HCM)	$3,000 - $3,500 per acre

Source: Cost information received from individual product manufacturers solicited by Geosyntec Consultants (2004)

Inspection and Maintenance

- Maintain an unbroken, temporary mulched ground cover throughout the period of construction when the soils are not being reworked.
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Areas where erosion is evident should be repaired and BMPs re-applied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require re-application of BMPs.
- Compare the number of bags or weight of applied mulch to the area treated to determine actual application rates and compliance with specifications.

References

Soil Stabilization BMP Research for Erosion and Sediment Controls: Cost Survey Technical Memorandum, State of California Department of Transportation (Caltrans), July 2007.

Controlling Erosion of Construction Sites, Agricultural Information #347, U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) (formerly Soil Conservation Service – SCS).

Guides for Erosion and Sediment Control in California, USDA Soils Conservation Service, January 1991.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Sedimentation and Erosion Control, An Inventory of Current Practices Draft, US EPA, April 1990.

Soil Erosion by Water, Agriculture Information Bulletin #513, U.S. Department of Agriculture, Soil Conservation Service.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

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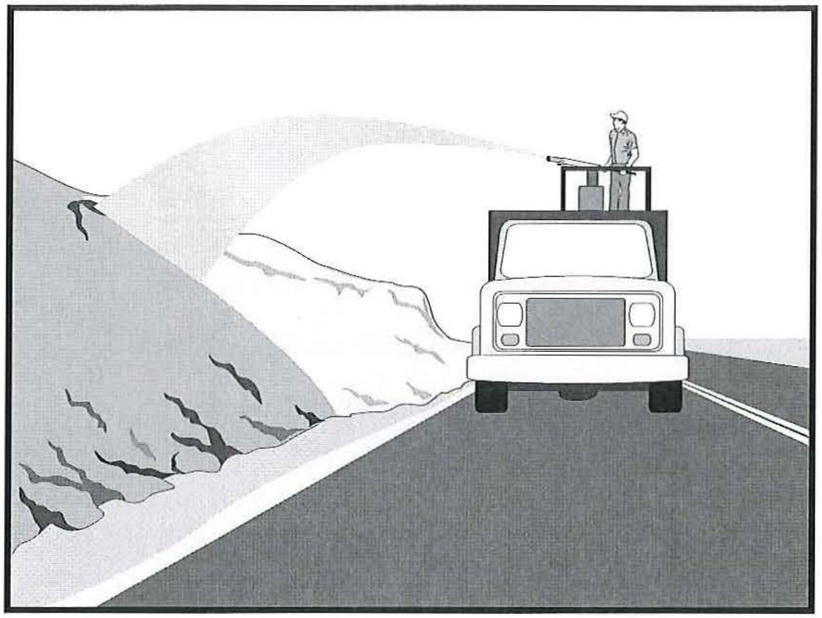

Categories

EC	Erosion Control	☑
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	☒
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-3 Hydraulic Mulch

EC-4 Hydroseeding

EC-5 Soil Binders

EC-7 Geotextiles and Mats

EC-8 Wood Mulching

EC-14 Compost Blanket

Description and Purpose

Straw mulch consists of placing a uniform layer of straw and incorporating it into the soil with a studded roller or crimper, or anchoring it with a tackifier or stabilizing emulsion. Straw mulch protects the soil surface from the impact of rain drops, preventing soil particles from becoming dislodged.

Suitable Applications

Straw mulch is suitable for disturbed areas requiring temporary protection until permanent stabilization is established. Straw mulch can be specified for the following applications:

- As a stand-alone BMP on disturbed areas until soils can be prepared for permanent vegetation. The longevity of straw mulch is typically less than six months.
- Applied in combination with temporary seeding strategies
- Applied in combination with permanent seeding strategies to enhance plant establishment and final soil stabilization
- Applied around containerized plantings to control erosion until the plants become established to provide permanent stabilization

Limitations

Availability of straw and straw blowing equipment may be limited just prior to the rainy season and prior to storms due to high demand.

- There is a potential for introduction of weed seed and unwanted plant material if weed-free agricultural straw is not specified.
- Straw mulch applied by hand is more time intensive and potentially costly.
- Wind may limit application of straw and blow straw into undesired locations.
- May have to be removed prior to permanent seeding or prior to further earthwork.
- "Punching" of straw does not work in sandy soils, necessitating the use of tackifiers.
- Potential fugitive dust control issues associated with straw applications can occur. Application of a stabilizing emulsion or a water stream at the same time straw is being blown can reduce this problem.
- Use of plastic netting should be avoided in areas where wildlife may be entrapped and may be prohibited for projects in certain areas with sensitive wildlife species, especially reptiles and amphibians.

Implementation

- Straw should be derived from weed-free wheat, rice, or barley. Where required by the plans, specifications, permits, or environmental documents, native grass straw should be used.
- Use tackifier to anchor straw mulch to the soil on slopes.
- Crimping, punch roller-type rollers, or track walking may also be used to incorporate straw mulch into the soil on slopes. Track walking can be used where other methods are impractical.
- Avoid placing straw onto roads, sidewalks, drainage channels, sound walls, existing vegetation, etc.
- Straw mulch with tackifier should not be applied during or immediately before rainfall.
- Additional guidance on the comparison and selection of temporary slope stabilization methods is provided in Appendix F of the Handbook.

Application Procedures

- When using a tackifier to anchor the straw mulch, roughen embankment or fill areas by rolling with a crimping or punching-type roller or by track walking before placing the straw mulch. Track walking should only be used where rolling is impractical.
- Apply straw at a rate of between 3,000 and 4,000 lb/acre, either by machine or by hand distribution and provide 100% ground cover. A lighter application is used for flat surfaces and a heavier application is used for slopes.
- Evenly distribute straw mulch on the soil surface.
- Anchoring straw mulch to the soil surface by "punching" it into the soil mechanically (incorporating) can be used in lieu of a tackifier.

- Methods for holding the straw mulch in place depend upon the slope steepness, accessibility, soil conditions, and longevity.
  - A tackifier acts to glue the straw fibers together and to the soil surface. The tackifier should be selected based on longevity and ability to hold the fibers in place. A tackifier is typically applied at a rate of 125 lb/acre. In windy conditions, the rates are typically 180 lb/acre.
  - On very small areas, a spade or shovel can be used to punch in straw mulch.
  - On slopes with soils that are stable enough and of sufficient gradient to safely support construction equipment without contributing to compaction and instability problems, straw can be "punched" into the ground using a knife blade roller or a straight bladed coulter, known commercially as a "crimper."

Costs

Average annual cost for installation and maintenance is included in the table below. Application by hand is more time intensive and potentially more costly.

BMP	Unit Cost per Acre
Straw mulch, crimped or punched	$2,458-$5,375
Straw mulch with tackifier	$1,823-$4,802

Source: Cost information received from individual product suppliers solicited by Geosyntec Consultants (2004).

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Areas where erosion is evident should be repaired and BMPs re-applied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require re-application of BMPs.
- The key consideration in inspection and maintenance is that the straw needs to last long enough to achieve erosion control objectives. Straw mulch as a stand-alone BMP is temporary and is not suited for long-term erosion control.
- Maintain an unbroken, temporary mulched ground cover while disturbed soil areas are inactive. Repair any damaged ground cover and re-mulch exposed areas.
- Reapplication of straw mulch and tackifier may be required to maintain effective soil stabilization over disturbed areas and slopes.

References

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Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

Controlling Erosion of Construction Sites, Agricultural Information Bulletin #347, U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) (formerly Soil Conservation Service – SCS).

Guides for Erosion and Sediment Control in California, USDA Soils Conservation Service, January 1991.

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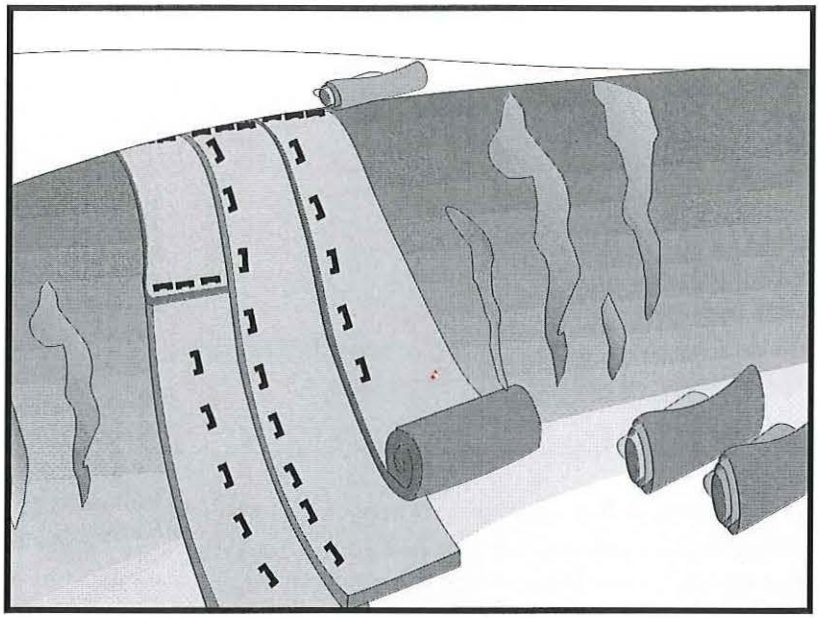

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Potential Alternatives

EC-3 Hydraulic Mulch

EC-4 Hydroseeding

Description and Purpose

Mattings, or Rolled Erosion Control Products (RECPs), can be made of natural or synthetic materials or a combination of the two. RECPs are used to cover the soil surface to reduce erosion from rainfall impact, hold soil in place, and absorb and hold moisture near the soil surface. Additionally, RECPs may be used to stabilize soils until vegetation is established or to reinforce non-woody surface vegetation.

Suitable Applications

RECPs are typically applied on slopes where erosion hazard is high and vegetation will be slow to establish. Mattings are also used on stream banks, swales and other drainage channels where moving water at velocities between 3 ft/s and 6 ft/s are likely to cause scour and wash out new vegetation, and in areas where the soil surface is disturbed and where existing vegetation has been removed. RECPs may also be used when seeding cannot occur (e.g., late season construction and/or the arrival of an early rain season). RECPs should be considered when the soils are fine grained and potentially erosive. RECPs should be considered in the following situations.

- Steep slopes, generally steeper than 3:1 (H:V)
- Slopes where the erosion potential is high
- Slopes and disturbed soils where mulch must be anchored
- Disturbed areas where plants are slow to develop

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- Channels with flows exceeding 3.3 ft/s
- Channels to be vegetated
- Stockpiles
- Slopes adjacent to water bodies

Limitations

- RECP installed costs are generally higher than other erosion control BMPs, limiting their use to areas where other BMPs are ineffective (e.g. channels, steep slopes).
- RECPs may delay seed germination, due to reduction in soil temperature.
- RECPs are generally not suitable for excessively rocky sites or areas where the final vegetation will be mowed (since staples and netting can catch in mowers). If a staple or pin cannot be driven into the soil because the underlying soil is too hard or rocky, then an alternative BMP should be selected.
- If used for temporary erosion control, RECPs should be removed and disposed of prior to application of permanent soil stabilization measures.
- The use of plastic should be limited to covering stockpiles or very small graded areas for short periods of time (such as through one imminent storm event) until more environmentally friendly measures, such as seeding and mulching, may be installed.
    - Plastic sheeting is easily vandalized, easily torn, photodegradable, and must be disposed of at a landfill.
    - Plastic sheeting results in 100% runoff, which may cause serious erosion problems in the areas receiving the increased flow.
- RECPs may have limitations based on soil type, slope gradient, or channel flow rate; consult the manufacturer for proper selection.
- Not suitable for areas that have foot traffic (tripping hazard) – e.g., pad areas around buildings under construction.
- RECPs that incorporate a plastic netting (e.g. straw blanket typically uses a plastic netting to hold the straw in place) may not be suitable near known wildlife habitat. Wildlife can become trapped in the plastic netting.
- RECPs may have limitations in extremely windy climates. However, when RECPs are properly trenched at the top and bottom and stapled in accordance with the manufacturer's recommendations, problems with wind can be minimized.

Implementation

Material Selection

- Natural RECPs have been found to be effective where re-vegetation will be provided by re-seeding. The choice of material should be based on the size of area, side slopes, surface conditions such as hardness, moisture, weed growth, and availability of materials.

- Additional guidance on the comparison and selection of temporary slope stabilization methods is provided in Appendix F of the Handbook.

- The following natural and synthetic RECPs are commonly used:

Geotextiles

- Material can be a woven or a non-woven polypropylene fabric with minimum thickness of 0.06 in., minimum width of 12 ft and should have minimum tensile strength of 150 lbs (warp), 80 lbs (fill) in conformance with the requirements in ASTM Designation: D 4632. The permittivity of the fabric should be approximately 0.07 sec^{-1} in conformance with the requirements in ASTM Designation: D4491. The fabric should have an ultraviolet (UV) stability of 70 percent in conformance with the requirements in ASTM designation: D4355. Geotextile blankets must be secured in place with wire staples or sandbags and by keying into tops of slopes to prevent infiltration of surface waters under geotextile. Staples should be made of minimum 11 gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.

- Geotextiles may be reused if they are suitable for the use intended.

Plastic Covers

- Generally plastic sheeting should only be used as stockpile covering or for very small graded areas for short periods of time (such as through one imminent storm event). If plastic sheeting must be used, choose a plastic that will withstand photo degradation.

- Plastic sheeting should have a minimum thickness of 6 mils, and must be keyed in at the top of slope (when used as a temporary slope protection) and firmly held in place with sandbags or other weights placed no more than 10 ft apart. Seams are typically taped or weighted down their entire length, and there should be at least a 12 in. to 24 in. overlap of all seams. Edges should be embedded a minimum of 6 in. in soil (when used as a temporary slope protection).

- All sheeting must be inspected periodically after installation and after significant rainstorms to check for erosion, undermining, and anchorage failure. Any failures must be repaired immediately. If washout or breakages occur, the material should be re-installed after repairing the damage to the slope.

Erosion Control Blankets/Mats

- Biodegradable RECPs are typically composed of jute fibers, curled wood fibers, straw, coconut fiber, or a combination of these materials. In order for an RECP to be considered 100% biodegradable, the netting, sewing or adhesive system that holds the biodegradable mulch fibers together must also be biodegradable. See typical installation details at the end of this fact sheet.

- **Jute** is a natural fiber that is made into a yarn that is loosely woven into a biodegradable mesh. The performance of jute as a stand-alone RECP is low. Most other RECPs outperform jute as a temporary erosion control product and therefore jute is not commonly used. It is designed to be used in conjunction with vegetation. The material is supplied in rolled strips, which should be secured to the soil with U-shaped staples or stakes in accordance with manufacturers' recommendations.

- **Excelsior** (curled wood fiber) blanket material should consist of machine produced mats of curled wood excelsior with 80 percent of the fiber 6 in. or longer. The excelsior blanket should be of consistent thickness. The wood fiber must be evenly distributed over the entire area of the blanket. The top surface of the blanket should be covered with a photodegradable extruded plastic mesh. The blanket should be smolder resistant without the use of chemical additives and should be non-toxic and non-injurious to plant and animal life. Excelsior blankets should be furnished in rolled strips, a minimum of 48 in. wide, and should have an average weight of 0.8 lb/yd^2, ±10 percent, at the time of manufacture. Excelsior blankets must be secured in place with wire staples. Staples should be made of minimum 11 gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.

- **Straw blanket** should be machine produced mats of straw with a lightweight biodegradable netting top layer. The straw should be attached to the netting with biodegradable thread or glue strips. The straw blanket should be of consistent thickness. The straw should be evenly distributed over the entire area of the blanket. Straw blanket should be furnished in rolled strips a minimum of 6.5 ft wide, a minimum of 80 ft long and a minimum of 0.5 lb/yd^2. Straw blankets must be secured in place with wire staples. Staples should be made of minimum 11 gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.

- **Wood fiber blanket** is composed of biodegradable fiber mulch with extruded plastic netting held together with adhesives. The material is designed to enhance re-vegetation. The material is furnished in rolled strips, which must be secured to the ground with U-shaped staples or stakes in accordance with manufacturers' recommendations.

- **Coconut fiber blanket** should be a machine produced mat of 100 percent coconut fiber with biodegradable netting on the top and bottom. The coconut fiber should be attached to the netting with biodegradable thread or glue strips. The coconut fiber blanket should be of consistent thickness. The coconut fiber should be evenly distributed over the entire area of the blanket. Coconut fiber blanket should be furnished in rolled strips with a minimum of 6.5 ft wide, a minimum of 80 ft. long and a minimum of 0.5 lb/yd^2. Coconut fiber blankets must be secured in place with wire staples. Staples should be made of minimum 11 gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.

- **Coconut fiber mesh** is a thin permeable membrane made from coconut or corn fiber that is spun into a yarn and woven into a biodegradable mat. It is designed to be used in conjunction with vegetation and typically has longevity of several years. The material is supplied in rolled strips, which must be secured to the soil with U-shaped staples or stakes in accordance with manufacturers' recommendations.

- **Straw coconut fiber blanket** should be machine produced mats of 70 percent straw and 30 percent coconut fiber with a biodegradable netting top layer and a biodegradable bottom net. The straw and coconut fiber should be attached to the netting with biodegradable thread or glue strips. The straw coconut fiber blanket should be of consistent thickness. The straw and coconut fiber should be evenly distributed over the entire area of the blanket. Straw coconut fiber blanket should be furnished in rolled strips a minimum of 6.5 ft wide, a minimum of 80 ft long and a minimum of 0.5 lb/yd^2. Straw coconut fiber blankets must be secured in place with wire staples. Staples should be made of minimum 11 gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.

- Non-biodegradable RECPs are typically composed of polypropylene, polyethylene, nylon or other synthetic fibers. In some cases, a combination of biodegradable and synthetic fibers is used to construct the RECP. Netting used to hold these fibers together is typically non-biodegradable as well.

  - **Plastic netting** is a lightweight biaxially oriented netting designed for securing loose mulches like straw or paper to soil surfaces to establish vegetation. The netting is photodegradable. The netting is supplied in rolled strips, which must be secured with U-shaped staples or stakes in accordance with manufacturers' recommendations.

  - **Plastic mesh** is an open weave geotextile that is composed of an extruded synthetic fiber woven into a mesh with an opening size of less than ¼ in. It is used with re-vegetation or may be used to secure loose fiber such as straw to the ground. The material is supplied in rolled strips, which must be secured to the soil with U-shaped staples or stakes in accordance with manufacturers' recommendations.

  - **Synthetic fiber with netting** is a mat that is composed of durable synthetic fibers treated to resist chemicals and ultraviolet light. The mat is a dense, three dimensional mesh of synthetic (typically polyolefin) fibers stitched between two polypropylene nets. The mats are designed to be re-vegetated and provide a permanent composite system of soil, roots, and geomatrix. The material is furnished in rolled strips, which must be secured with U-shaped staples or stakes in accordance with manufacturers' recommendations.

  - **Bonded synthetic fibers** consist of a three dimensional geomatrix nylon (or other synthetic) matting. Typically it has more than 90 percent open area, which facilitates root growth. It's tough root reinforcing system anchors vegetation and protects against hydraulic lift and shear forces created by high volume discharges. It can be installed over prepared soil, followed by seeding into the mat. Once vegetated, it becomes an invisible composite system of soil, roots, and geomatrix. The material is furnished in rolled strips that must be secured with U-shaped staples or stakes in accordance with manufacturers' recommendations.

  - **Combination synthetic and biodegradable RECPs** consist of biodegradable fibers, such as wood fiber or coconut fiber, with a heavy polypropylene net stitched to the top and a high strength continuous filament geomatrix or net stitched to the bottom. The material is designed to enhance re-vegetation. The material is furnished in rolled strips,

which must be secured with U-shaped staples or stakes in accordance with manufacturers' recommendations.

Site Preparation

- Proper soil preparation is essential to ensure complete contact of the RECP with the soil. Soil Roughening is not recommended in areas where RECPs will be installed.
- Grade and shape the area of installation.
- Remove all rocks, clods, vegetation or other obstructions so that the installed blankets or mats will have complete, direct contact with the soil.
- Prepare seedbed by loosening 2 to 3 in. of topsoil.

Seeding/Planting

Seed the area before blanket installation for erosion control and re-vegetation. Seeding after mat installation is often specified for turf reinforcement application. When seeding prior to blanket installation, all areas disturbed during blanket installation must be re-seeded. Where soil filling is specified for turf reinforcement mats (TRMs), seed the matting and the entire disturbed area after installation and prior to filling the mat with soil.

Fertilize and seed in accordance with seeding specifications or other types of landscaping plans. The protective matting can be laid over areas where grass has been planted and the seedlings have emerged. Where vines or other ground covers are to be planted, lay the protective matting first and then plant through matting according to design of planting.

Check Slots

Check slots shall be installed as required by the manufacturer.

Laying and Securing Matting

- Before laying the matting, all check slots should be installed and the seedbed should be friable, made free from clods, rocks, and roots. The surface should be compacted and finished according to the requirements of the manufacturer's recommendations.
- Mechanical or manual lay down equipment should be capable of handling full rolls of fabric and laying the fabric smoothly without wrinkles or folds. The equipment should meet the fabric manufacturer's recommendations or equivalent standards.

Anchoring

- U-shaped wire staples, metal geotextile stake pins, or triangular wooden stakes can be used to anchor mats and blankets to the ground surface.
- Wire staples should be made of minimum 11 gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.
- Metal stake pins should be 0.188 in. diameter steel with a 1.5 in. steel washer at the head of the pin, and 8 in. in length.
- Wire staples and metal stakes should be driven flush to the soil surface.

Installation on Slopes

Installation should be in accordance with the manufacturer's recommendations. In general, these will be as follows:

- Begin at the top of the slope and anchor the blanket in a 6 in. deep by 6 in. wide trench. Backfill trench and tamp earth firmly.
- Unroll blanket down slope in the direction of water flow.
- Overlap the edges of adjacent parallel rolls 2 to 3 in. and staple every 3 ft (or greater, per manufacturer's specifications).
- When blankets must be spliced, place blankets end over end (shingle style) with 6 in. overlap. Staple through overlapped area, approximately 12 in. apart.
- Lay blankets loosely and maintain direct contact with the soil. Do not stretch.
- Staple blankets sufficiently to anchor blanket and maintain contact with the soil. Staples should be placed down the center and staggered with the staples placed along the edges. Steep slopes, 1:1 (H:V) to 2:1 (H:V), require a minimum of 2 staples/yd^2. Moderate slopes, 2:1 (H:V) to 3:1 (H:V), require a minimum of 1 ½ staples/yd^2. Check manufacturer's specifications to determine if a higher density staple pattern is required.

Installation in Channels

Installation should be in accordance with the manufacturer's recommendations. In general, these will be as follows:

- Dig initial anchor trench 12 in. deep and 6 in. wide across the channel at the lower end of the project area.
- Excavate intermittent check slots, 6 in. deep and 6 in. wide across the channel at 25 to 30 ft intervals along the channels.
- Cut longitudinal channel anchor trenches 4 in. deep and 4 in. wide along each side of the installation to bury edges of matting, whenever possible extend matting 2 to 3 in. above the crest of the channel side slopes.
- Beginning at the downstream end and in the center of the channel, place the initial end of the first roll in the anchor trench and secure with fastening devices at 12 in. intervals. Note: matting will initially be upside down in anchor trench.
- In the same manner, position adjacent rolls in anchor trench, overlapping the preceding roll a minimum of 3 in.
- Secure these initial ends of mats with anchors at 12 in. intervals, backfill and compact soil.
- Unroll center strip of matting upstream. Stop at next check slot or terminal anchor trench. Unroll adjacent mats upstream in similar fashion, maintaining a 3 in. overlap.

- Fold and secure all rolls of matting snugly into all transverse check slots. Lay mat in the bottom of the slot then fold back against itself. Anchor through both layers of mat at 12 in. intervals, then backfill and compact soil. Continue rolling all mat widths upstream to the next check slot or terminal anchor trench.
- Alternate method for non-critical installations: Place two rows of anchors on 6 in. centers at 25 to 30 ft. intervals in lieu of excavated check slots.
- Staple shingled lap spliced ends a minimum of 12 in. apart on 12 in. intervals.
- Place edges of outside mats in previously excavated longitudinal slots; anchor using prescribed staple pattern, backfill, and compact soil.
- Anchor, fill, and compact upstream end of mat in a 12 in. by 6 in. terminal trench.
- Secure mat to ground surface using U-shaped wire staples, geotextile pins, or wooden stakes.
- Seed and fill turf reinforcement matting with soil, if specified.

Soil Filling (if specified for turf reinforcement mat (TRM))

Installation should be in accordance with the manufacturer's recommendations. Typical installation guidelines are as follows:

- After seeding, spread and lightly rake ½-3/4 inches of fine topsoil into the TRM apertures to completely fill TRM thickness. Use backside of rake or other flat implement.
- Alternatively, if allowed by product specifications, spread topsoil using lightweight loader, backhoe, or other power equipment. Avoid sharp turns with equipment.
- Always consult the manufacturer's recommendations for installation.
- Do not drive tracked or heavy equipment over mat.
- Avoid any traffic over matting if loose or wet soil conditions exist.
- Use shovels, rakes, or brooms for fine grading and touch up.
- Smooth out soil filling just exposing top netting of mat.

Temporary Soil Stabilization Removal

- Temporary soil stabilization removed from the site of the work must be disposed of if necessary.

Costs

Installed costs can be relatively high compared to other BMPs. Approximate costs for installed materials are shown below:

Rolled Erosion Control Products		Installed Cost per Acre (2004)[1]	Estimated Cost per Acre (2009)[2]
Biodegradable	Jute Mesh	$6,000-$7,000	$6,600-$7,700
	Curled Wood Fiber	$8,000-$10,500	$8,800-$11,050
	Straw	$8,000-$10,500	$8,800-$11,050
	Wood Fiber	$8,000-$10,500	$8,800-$11,050
	Coconut Fiber	$13,000-$14,000	$14,300-$15,400
	Coconut Fiber Mesh	$30,000-$33,000	$33,000-$36,300
	Straw Coconut Fiber	$10,000-$12,000	$11,000-$13,200
Non-Biodegradable	Plastic Netting	$2,000-$2,200	$2,200-$2,220
	Plastic Mesh	$3,000-$3,500	$3,300-$3,850
	Synthetic Fiber with Netting	$34,000-$40,000	$37,400-$44,000
	Bonded Synthetic Fibers	$45,000-$55,000	$49,500-$60,500
	Combination with Biodegradable	$30,000-$36,000	$33,000-$39,600

1. Source: Cost information received from individual product manufacturers solicited by Geosyntec Consultants (2004).
2. 2009 costs reflect a 10% escalation over year 2004 costs. Escalation based on informal survey of industry trends. Note: Expected cost increase is offset by competitive economic conditions.

Inspection and Maintenance

- RECPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Areas where erosion is evident shall be repaired and BMPs reapplied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require reapplication of BMPs.
- If washout or breakage occurs, re-install the material after repairing the damage to the slope or channel.
- Make sure matting is uniformly in contact with the soil.
- Check that all the lap joints are secure.
- Check that staples are flush with the ground.

References

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005

Erosion Control Pilot Study Report, State of California Department of Transportation (Caltrans), June 2000.

Guides for Erosion and Sediment Controls in California, USDA Soils Conservation Service, January 1991.

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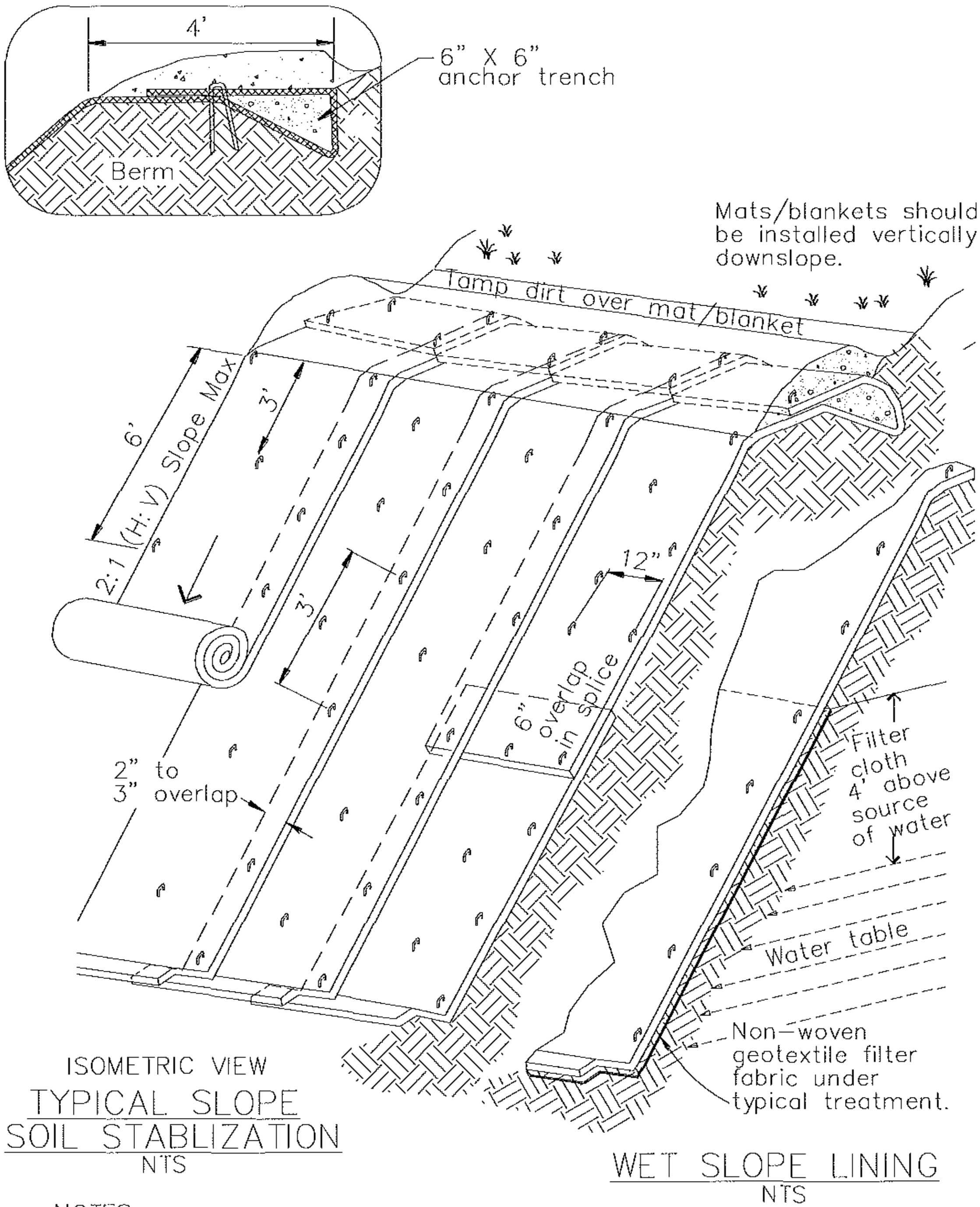
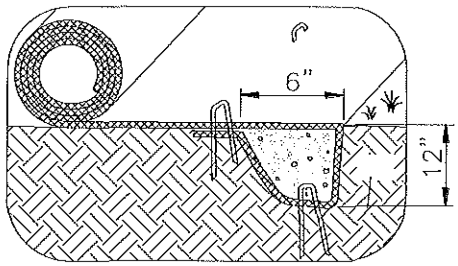


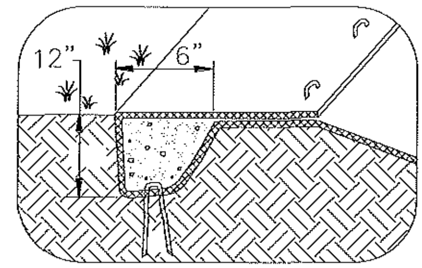
NOTES:

1. Slope surface shall be free of rocks, clods, sticks and grass. Mats/blankets shall have good soil contact.
2. Lay blankets loosely and stake or staple to maintain direct contact with the soil. Do not stretch.
3. Install per manufacturer's recommendations

TYPICAL INSTALLATION DETAIL



INITIAL CHANNEL ANCHOR TRENCH
NTS



TERMINAL SLOPE AND CHANNEL ANCHOR TRENCH
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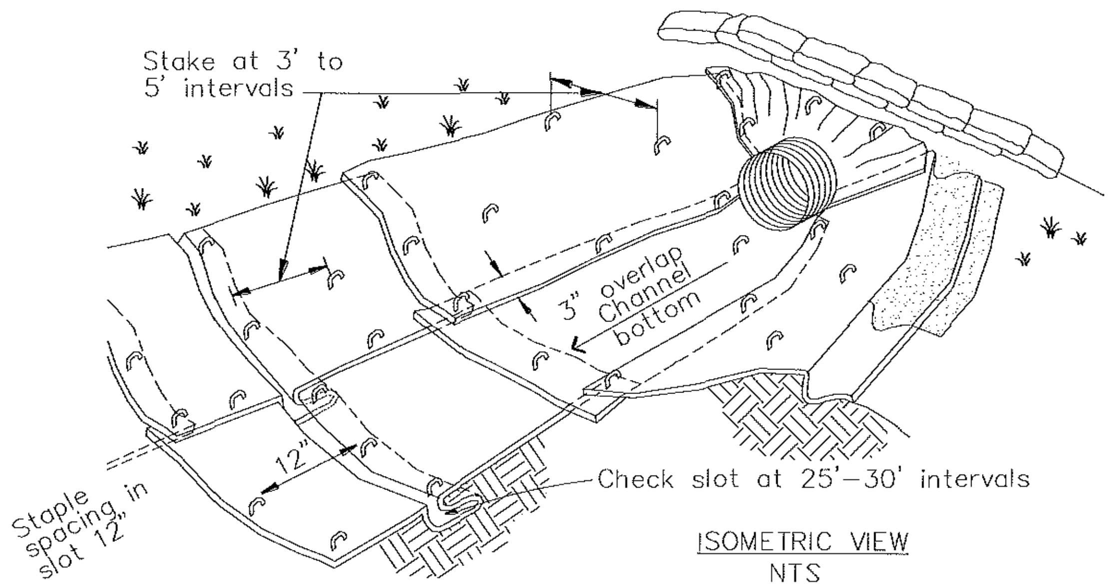
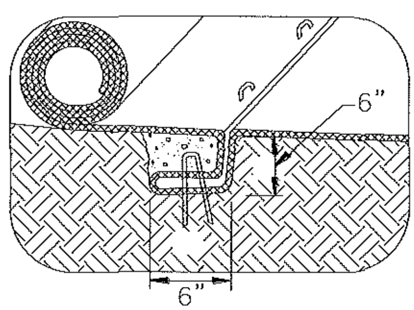
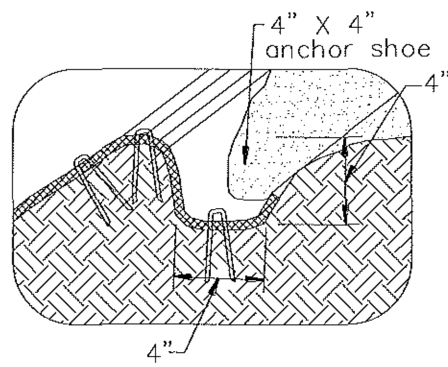


ISOMETRIC VIEW
NTS



INTERMITTENT CHECK SLOT
NTS



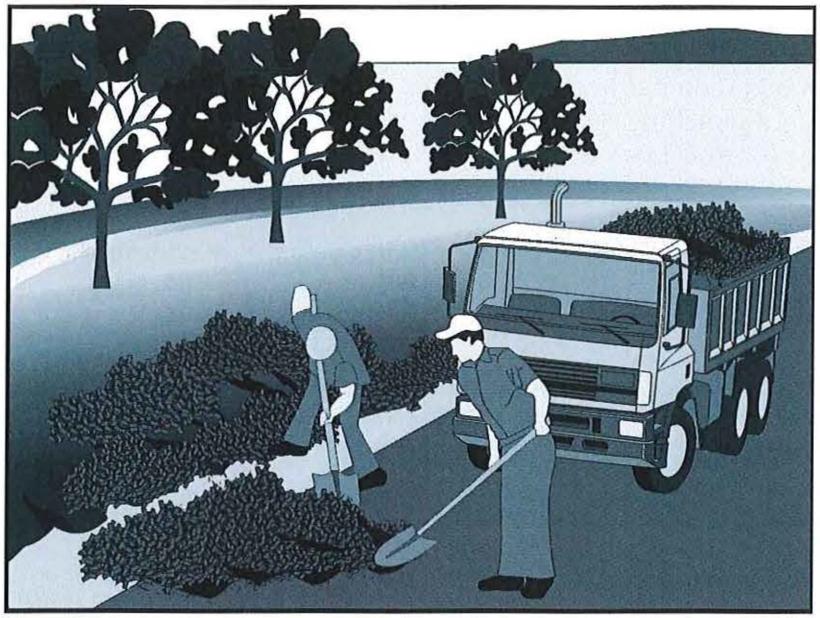
LONGITUDINAL ANCHOR TRENCH
NTS

NOTES:
1. Check slots to be constructed per manufacturers specifications.
2. Staking or stapling layout per manufacturers specifications.
3. Install per manufacturer's recommendations

TYPICAL INSTALLATION DETAIL

Wood Mulching

EC-8



Categories		
EC	Erosion Control	☑
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	☒
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-3 Hydraulic Mulch

EC-4 Hydroseeding

EC-5 Soil Binders

EC-6 Straw Mulch

EC-7 Geotextiles and Mats

Description and Purpose

Wood mulching consists of applying a mixture of shredded wood mulch, bark or compost to disturbed soils. The primary function of wood mulching is to reduce erosion by protecting bare soil from rainfall impact, increasing infiltration, and reducing runoff.

Suitable Applications

Wood mulching is suitable for disturbed soil areas requiring temporary protection until permanent stabilization is established.

Limitations

- Not suitable for use on slopes steeper than 3:1 (H:V). Best suited to flat areas or gentle slopes or 5:1 (H:V) or flatter.
- Wood mulch and compost may introduce unwanted species.
- Not suitable for areas exposed to concentrated flows.
- May need to be removed prior to further earthwork.

Implementation

Mulch Selection

There are many types of mulches. Selection of the appropriate type of mulch should be based on the type of application, site conditions, and compatibility with planned or future uses.

Application Procedures

Prior to application, after existing vegetation has been removed, roughen embankment and fill areas by rolling with a device such as a punching type roller or by track walking. The construction application procedures for mulches vary significantly depending upon the type of mulching method specified. Two methods are highlighted here:

- Green Material: This type of mulch is produced by the recycling of vegetation trimmings such as grass, shredded shrubs, and trees. Methods of application are generally by hand although pneumatic methods are available.
  - Green material can be used as a temporary ground cover with or without seeding.
  - The green material should be evenly distributed on site to a depth of not more than 2 in.
- Shredded Wood: Suitable for ground cover in ornamental or revegetated plantings.
  - Shredded wood/bark is conditionally suitable. See note under limitations.
  - Distribute by hand or use pneumatic methods.
  - Evenly distribute the mulch across the soil surface to a depth of 2 to 3 in.
- Avoid mulch placement onto roads, sidewalks, drainage channels, existing vegetation, etc.

Costs

Average annual cost for installation and maintenance (3-4 months useful life) is around $4,000 per acre, but cost can increase if the source is not close to the project site.

Inspection and Maintenance

- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Areas where erosion is evident shall be repaired and BMPs reapplied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require reapplication of BMPs.
- Regardless of the mulching technique selected, the key consideration in inspection and maintenance is that the mulch needs to last long enough to achieve erosion control objectives. If the mulch is applied as a stand alone erosion control method over disturbed areas (without seed), it should last the length of time the site will remain barren or until final re-grading and revegetation.
- Where vegetation is not the ultimate cover, such as ornamental and landscape applications of bark or wood chips, inspection and maintenance should focus on longevity and integrity of the mulch.
- Reapply mulch when bare earth becomes visible.

References

Controlling Erosion of Construction Sites Agriculture Information Bulletin #347, U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) (formerly Soil Conservation Service – SCS).

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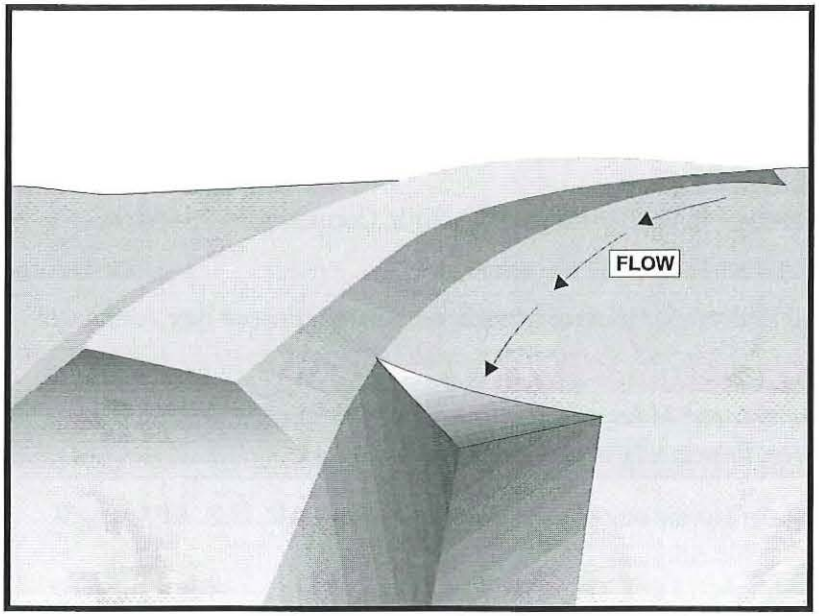

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Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

An earth dike is a temporary berm or ridge of compacted soil used to divert runoff or channel water to a desired location. A drainage swale is a shaped and sloped depression in the soil surface used to convey runoff to a desired location. Earth dikes and drainage swales are used to divert off site runoff around the construction site, divert runoff from stabilized areas and disturbed areas, and direct runoff into sediment basins or traps.

Suitable Applications

Earth dikes and drainage swales are suitable for use, individually or together, where runoff needs to be diverted from one area and conveyed to another.

- Earth dikes and drainage swales may be used:
  - To convey surface runoff down sloping land
  - To intercept and divert runoff to avoid sheet flow over sloped surfaces
  - To divert and direct runoff towards a stabilized watercourse, drainage pipe or channel
  - To intercept runoff from paved surfaces
  - Below steep grades where runoff begins to concentrate
  - Along roadways and facility improvements subject to flood drainage

- At the top of slopes to divert runon from adjacent or undisturbed slopes
- At bottom and mid slope locations to intercept sheet flow and convey concentrated flows
- Divert sediment laden runoff into sediment basins or traps

Limitations

Dikes should not be used for drainage areas greater than 10 acres or along slopes greater than 10 percent. For larger areas more permanent drainage structures should be built. All drainage structures should be built in compliance with local municipal requirements.

- Earth dikes may create more disturbed area on site and become barriers to construction equipment.
- Earth dikes must be stabilized immediately, which adds cost and maintenance concerns.
- Diverted stormwater may cause downstream flood damage.
- Dikes should not be constructed of soils that may be easily eroded.
- Regrading the site to remove the dike may add additional cost.
- Temporary drains and swales or any other diversion of runoff should not adversely impact upstream or downstream properties.
- Temporary drains and swales must conform to local floodplain management requirements.
- Earth dikes/drainage swales are not suitable as sediment trapping devices.
- It may be necessary to use other soil stabilization and sediment controls such as check dams, plastics, and blankets, to prevent scour and erosion in newly graded dikes, swales, and ditches.
- Sediment accumulation, scour depressions, and/or persistent non-stormwater discharges can result in areas of standing water suitable for mosquito production in drainage swales.

Implementation

The temporary earth dike is a berm or ridge of compacted soil, located in such a manner as to divert stormwater to a sediment trapping device or a stabilized outlet, thereby reducing the potential for erosion and offsite sedimentation. Earth dikes can also be used to divert runoff from off site and from undisturbed areas away from disturbed areas and to divert sheet flows away from unprotected slopes.

An earth dike does not itself control erosion or remove sediment from runoff. A dike prevents erosion by directing runoff to an erosion control device such as a sediment trap or directing runoff away from an erodible area. Temporary diversion dikes should not adversely impact adjacent properties and must conform to local floodplain management regulations, and should not be used in areas with slopes steeper than 10%.

Slopes that are formed during cut and fill operations should be protected from erosion by runoff. A combination of a temporary drainage swale and an earth dike at the top of a slope can divert

runoff to a location where it can be brought to the bottom of the slope (see EC-11, Slope Drains). A combination dike and swale is easily constructed by a single pass of a bulldozer or grader and compacted by a second pass of the tracks or wheels over the ridge. Diversion structures should be installed when the site is initially graded and remain in place until post construction BMPs are installed and the slopes are stabilized.

Diversion practices concentrate surface runoff, increasing its velocity and erosive force. Thus, the flow out of the drain or swale must be directed onto a stabilized area or into a grade stabilization structure. If significant erosion will occur, a swale should be stabilized using vegetation, chemical treatment, rock rip-rap, matting, or other physical means of stabilization. Any drain or swale that conveys sediment laden runoff must be diverted into a sediment basin or trap before it is discharged from the site.

General

- Care must be applied to correctly size and locate earth dikes, drainage swales. Excessively steep, unlined dikes, and swales are subject to erosion and gully formation.
- Conveyances should be stabilized.
- Use a lined ditch for high flow velocities.
- Select flow velocity based on careful evaluation of the risks due to erosion of the measure, soil types, overtopping, flow backups, washout, and drainage flow patterns for each project site.
- Compact any fills to prevent unequal settlement.
- Do not divert runoff onto other property without securing written authorization from the property owner.
- When possible, install and utilize permanent dikes, swales, and ditches early in the construction process.
- Provide stabilized outlets.

Earth Dikes

Temporary earth dikes are a practical, inexpensive BMP used to divert stormwater runoff. Temporary diversion dikes should be installed in the following manner:

- All dikes should be compacted by earth moving equipment.
- All dikes should have positive drainage to an outlet.
- All dikes should have 2:1 or flatter side slopes, 18 in. minimum height, and a minimum top width of 24 in. Wide top widths and flat slopes are usually needed at crossings for construction traffic.
- The outlet from the earth dike must function with a minimum of erosion. Runoff should be conveyed to a sediment trapping device such as a Sediment Trap (SE-3) or Sediment Basin

(SE-2) when either the dike channel or the drainage area above the dike are not adequately stabilized.

- Temporary stabilization may be achieved using seed and mulching for slopes less than 5% and either rip-rap or sod for slopes in excess of 5%. In either case, stabilization of the earth dike should be completed immediately after construction or prior to the first rain.

- If riprap is used to stabilize the channel formed along the toe of the dike, the following typical specifications apply:

Channel Grade	Riprap Stabilization
0.5-1.0%	4 in. Rock
1.1-2.0%	6 in. Rock
2.1-4.0%	8 in. Rock
4.1-5.0%	8 in. -12 in. Riprap

- The stone riprap, recycled concrete, etc. used for stabilization should be pressed into the soil with construction equipment.

- Filter cloth may be used to cover dikes in use for long periods.

- Construction activity on the earth dike should be kept to a minimum.

Drainage Swales

Drainage swales are only effective if they are properly installed. Swales are more effective than dikes because they tend to be more stable. The combination of a swale with a dike on the downhill side is the most cost effective diversion.

Standard engineering design criteria for small open channel and closed conveyance systems should be used (see the local drainage design manual). Unless local drainage design criteria state otherwise, drainage swales should be designed as follows:

- No more than 5 acres may drain to a temporary drainage swale.

- Place drainage swales above or below, not on, a cut or fill slope.

- Swale bottom width should be at least 2 ft

- Depth of the swale should be at least 18 in.

- Side slopes should be 2:1 or flatter.

- Drainage or swales should be laid at a grade of at least 1 percent, but not more than 15 percent.

- The swale must not be overtopped by the peak discharge from a 10-year storm, irrespective of the design criteria stated above.

- Remove all trees, stumps, obstructions, and other objectionable material from the swale when it is built.
- Compact any fill material along the path of the swale.
- Stabilize all swales immediately. Seed and mulch swales at a slope of less than 5 percent, and use rip-rap or sod for swales with a slope between 5 and 15 percent. For temporary swales, geotextiles and mats (EC-7) may provide immediate stabilization.
- Irrigation may be required to establish sufficient vegetation to prevent erosion.
- Do not operate construction vehicles across a swale unless a stabilized crossing is provided.
- Permanent drainage facilities must be designed by a professional engineer (see the local drainage design criteria for proper design).
- At a minimum, the drainage swale should conform to predevelopment drainage patterns and capacities.
- Construct the drainage swale with a positive grade to a stabilized outlet.
- Provide erosion protection or energy dissipation measures if the flow out of the drainage swale can reach an erosive velocity.

Costs

- Cost ranges from $15 to $55 per ft for both earthwork and stabilization and depends on availability of material, site location, and access.
- Small dikes: $2.50 - $6.50/linear ft; Large dikes: $2.50/yd^3.
- The cost of a drainage swale increases with drainage area and slope. Typical swales for controlling internal erosion are inexpensive, as they are quickly formed during routine earthwork.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Inspect ditches and berms for washouts. Replace lost riprap, damaged linings or soil stabilizers as needed.
- Inspect channel linings, embankments, and beds of ditches and berms for erosion and accumulation of debris and sediment. Remove debris and sediment and repair linings and embankments as needed.
- Temporary conveyances should be completely removed as soon as the surrounding drainage area has been stabilized or at the completion of construction

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Erosion and Sediment Control Handbook, S.J. Goldman, K. Jackson, T.A. Bursetynsky, P.E., McGraw Hill Book Company, 1986.

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National Management Measures to Control Nonpoint Source Pollution from Urban Areas, United States Environmental Protection Agency, 2002.

Southeastern Wisconsin Regional Planning Commission (SWRPC). Costs of Urban Nonpoint Source Water Pollution Control Measures. Technical Report No. 31. Southeastern Wisconsin Regional Planning Commission, Waukesha, WI. 1991

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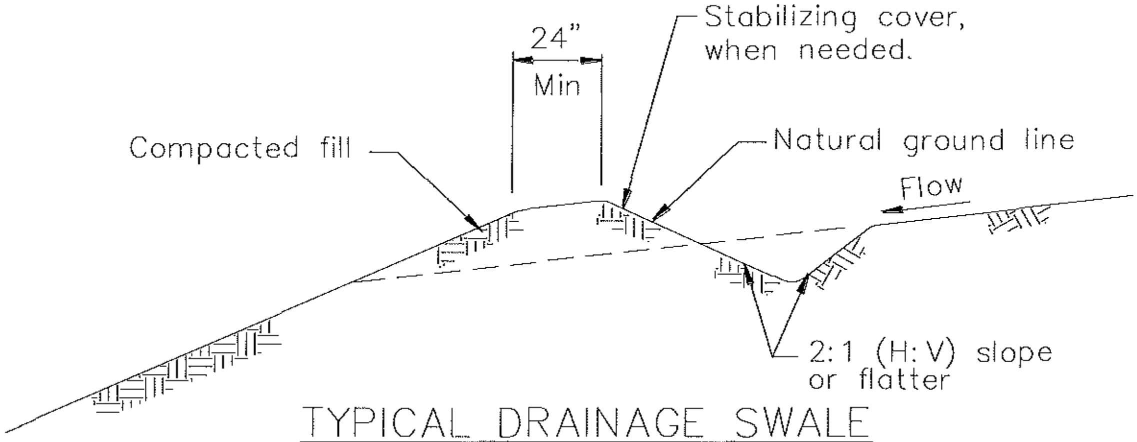
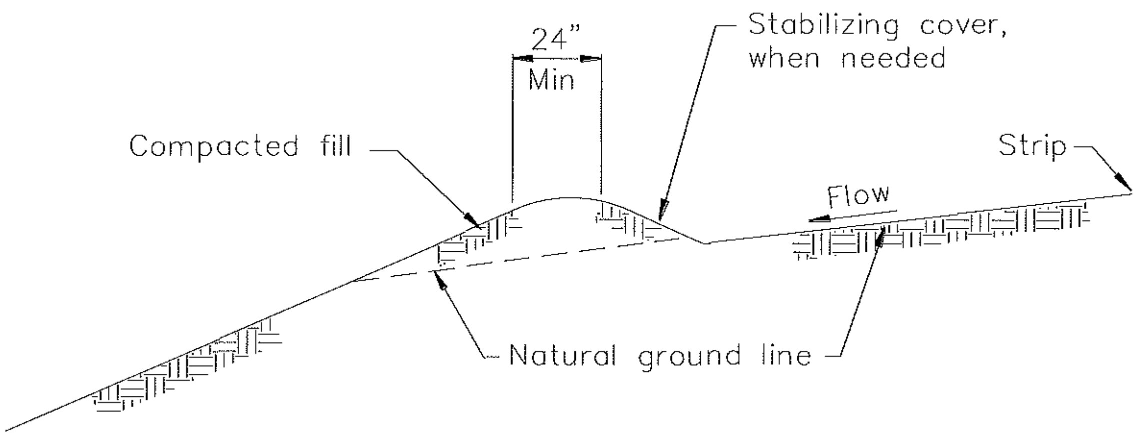


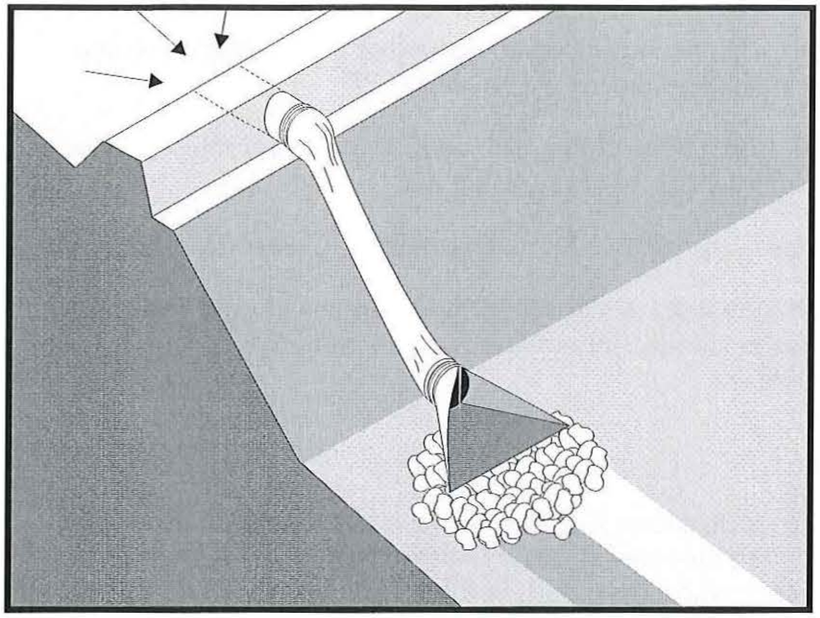
TYPICAL DRAINAGE SWALE
NOT TO SCALE

NOTES:

1. Stabilize inlet, outlets and slopes.
2. Properly compact the subgrade.



TYPICAL EARTH DIKE
NOT TO SCALE



Categories

EC	Erosion Control	☑
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-9 Earth Dike, Drainage Swales

Description and Purpose

A slope drain is a pipe used to intercept and direct surface runoff or groundwater into a stabilized watercourse, trapping device, or stabilized area. Slope drains are used with earth dikes and drainage ditches to intercept and direct surface flow away from slope areas to protect cut or fill slopes.

Suitable Applications

- Where concentrated flow of surface runoff must be conveyed down a slope in order to prevent erosion.
- Drainage for top of slope diversion dikes or swales.
- Drainage for top of cut and fill slopes where water can accumulate.
- Emergency spillway for a sediment basin.

Limitations

Installation is critical for effective use of the pipe slope drain to minimize potential gully erosion.

- Maximum drainage area per slope drain is 10 acres. (For large areas use a paved chute, rock lined channel, or additional pipes.)
- Severe erosion may result when slope drains fail by overtopping, piping, or pipe separation.

- During large storms, pipe slope drains may become clogged or over charged, forcing water around the pipe and causing extreme slope erosion.

- If the sectional downdrain is not sized correctly, the runoff can spill over the drain sides causing gully erosion and potential failure of the structure.

- Dissipation of high flow velocities at the pipe outlet is required to avoid downstream erosion.

- Sediment accumulation, scour depressions, and/or persistent non-stormwater discharges can result in areas of standing water suitable for mosquito production in energy dissipaters associated with slope drain outlets.

Implementation

General

The slope drain is applicable for any construction site where concentrated surface runoff can accumulate and must be conveyed down the slope in order to prevent erosion. The slope drain is effective because it prevents the stormwater from flowing directly down the slope by confining all the runoff into an enclosed pipe or channel. Due to the time lag between grading slopes and installation of permanent stormwater collection systems and slope stabilization measures, temporary provisions to intercept runoff are sometimes necessary. Particularly in steep terrain, slope drains can protect unstabilized areas from erosion.

Installation

The slope drain may be a rigid pipe, such as corrugated metal, a flexible conduit, or a lined terrace drain with the inlet placed on the top of a slope and the outlet at the bottom of the slope. This BMP typically is used in combination with a diversion control, such as an earth dike or drainage swale at the top of the slope.

The following criteria must be considered when siting slope drains.

- Permanent structures included in the project plans can often serve as construction BMPs if implemented early. However, the permanent structure must meet or exceed the criteria for the temporary structure.

- Inlet structures must be securely entrenched and compacted to avoid severe gully erosion.

- Slope drains must be securely anchored to the slope and must be adequately sized to carry the capacity of the design storm and associated forces.

- Outlets must be stabilized with riprap, concrete or other type of energy dissipator, or directed into a stable sediment trap or basin. See EC-10, Velocity Dissipation Devices.

- Debris racks are recommended at the inlet. Debris racks located several feet upstream of the inlet can usually be larger than racks at the inlet, and thus provide enhanced debris protection and less plugging.

- Safety racks are also recommended at the inlet and outlet of pipes where children or animals could become entrapped.

- Secure inlet and surround with dikes to prevent gully erosion and anchor pipe to slope.

- When using slope drains, limit drainage area to 10 acres per pipe. For larger areas, use a rock lined channel or a series of pipes.

- Size to convey at least the peak flow of a 10-year storm. The design storm is conservative due to the potential impact of system failures.

- Maximum slope generally limited to 2:1 (H:V) as energy dissipation below steeper slopes is difficult.

- Direct surface runoff to slope drains with interceptor dikes. See BMP EC-9, Earth Dikes and Drainage Swales. Top of interceptor dikes should be 12 in. higher than the top of the slope drain.

- Slope drains can be placed on or buried underneath the slope surface.

- Recommended materials include both metal and plastic pipe, either corrugated or smooth wall. Concrete pipe can also be used.

- When installing slope drains:

  - Install slope drains perpendicular to slope contours.

  - Compact soil around and under entrance, outlet, and along length of pipe.

  - Securely anchor and stabilize pipe and appurtenances into soil.

  - Check to ensure that pipe connections are watertight.

  - Protect area around inlet with filter cloth. Protect outlet with riprap or other energy dissipation device. For high energy discharges, reinforce riprap with concrete or use reinforced concrete device.

  - Protect outlet of slope drains using a flared end section when outlet discharges to a flexible energy dissipation device.

  - A flared end section installed at the inlet will improve flow into the slope drain and prevent erosion at the pipe entrance. Use a flared end section with a 6 in. minimum toe plate to help prevent undercutting. The flared section should slope towards the pipe inlet.

Design and Layout

The capacity for temporary drains should be sufficient to convey at least the peak runoff from a 10-year rainfall event. The pipe size may be computed using the Rational Method or a method established by the local municipality. Higher flows must be safely stored or routed to prevent any offsite concentration of flow and any erosion of the slope. The design storm is purposely conservative due to the potential impacts associated with system failures.

As a guide, temporary pipe slope drains should not be sized smaller than shown in the following table:

Minimum Pipe Diameter (Inches)	Maximum Drainage Area (Acres)
12	1.0
18	3.0
21	5.0
24	7.0
30	10.0

Larger drainage areas can be treated if the area can be subdivided into areas of 10 acres or less and each area is treated as a separate drainage. Drainage areas exceeding 10 acres must be designed by a Registered Civil Engineer and approved by the agency that issued the grading permit.

Materials:

Soil type, rainfall patterns, construction schedule, local requirements, and available supply are some of the factors to be considered when selecting materials. The following types of slope drains are commonly used:

- **Rigid Pipe:** This type of slope drain is also known as a pipe drop. The pipe usually consists of corrugated metal pipe or rigid plastic pipe. The pipe is placed on undisturbed or compacted soil and secured onto the slope surface or buried in a trench. Concrete thrust blocks must be used when warranted by the calculated thrust forces. Collars should be properly installed and secured with metal strappings or watertight collars.

- **Flexible Pipe**: The flexible pipe slope drain consists of a flexible tube of heavy duty plastic, rubber, or composite material. The tube material is securely anchored onto the slope surface. The tube should be securely fastened to the metal inlet and outlet conduit sections with metal strappings or watertight collars.

- **Section Downdrains**: The section downdrain consists of pre-fabricated, section conduit of half round or third round material. The sectional downdrain performs similar to a flume or chute. The pipe must be placed on undisturbed or compacted soil and secured into the slope.

- **Concrete-lined Terrace Drain:** This is a concrete channel for draining water from a terrace on a slope to the next level. These drains are typically specified as permanent structures and if installed early, can serve as slope drains during construction, which should be designed according to local drainage design criteria.

Costs

- Cost varies based on pipe selection and selected outlet protection.

Corrugated Steel Pipes, Per Foot	
Size	Supplied and Installed Cost (No Trenching Included)
12"	$19.60 per LF
15"	$22.00
18"	$26.00
24"	$32.00
30"	$50.00
PVC Pipes, Per Foot	
Size	Supplied and Installed Cost (No Trenching Included)
12"	$24.50
14"	$49.00
16"	$51.00
18"	$54.00
20"	$66.00
24"	$93.00
30"	$130.00

Inspection and Maintenance

- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Inspect BMPs subjected to non-stormwater discharges daily while non-stormwater discharges occur. Minimize areas of standing water by removing sediment blockages and filling scour depressions.

- Inspect outlet for erosion and downstream scour. If eroded, repair damage and install additional energy dissipation measures. If downstream scour is occurring, it may be necessary to reduce flows being discharged into the channel unless other preventative measures are implemented.

- Insert inlet for clogging or undercutting. Remove debris from inlet to maintain flows. Repair undercutting at inlet and if needed, install flared section or rip rap around the inlet to prevent further undercutting.

- Inspect pipes for leakage. Repair leaks and restore damaged slopes.

- Inspect slope drainage for accumulations of debris and sediment.

- Remove built up sediment from entrances and outlets as required. Flush drains if necessary; capture and settle out sediment from discharge.
- Make sure water is not ponding onto inappropriate areas (e.g., active traffic lanes, material storage areas, etc.).
- Pipe anchors must be checked to ensure that the pipe remains anchored to the slope. Install additional anchors if pipe movement is detected.

References

Draft – Sedimentation and Erosion Control, An Inventory of Current Practices, U.S.E.P.A., April 1990.

Metzger, M.E. 2004. Managing mosquitoes in stormwater treatment devices. University of California Division of Agriculture and Natural Resources, Publication 8125. On-line: http://anrcatalog.ucdavis.edu/pdf/8125.pdf

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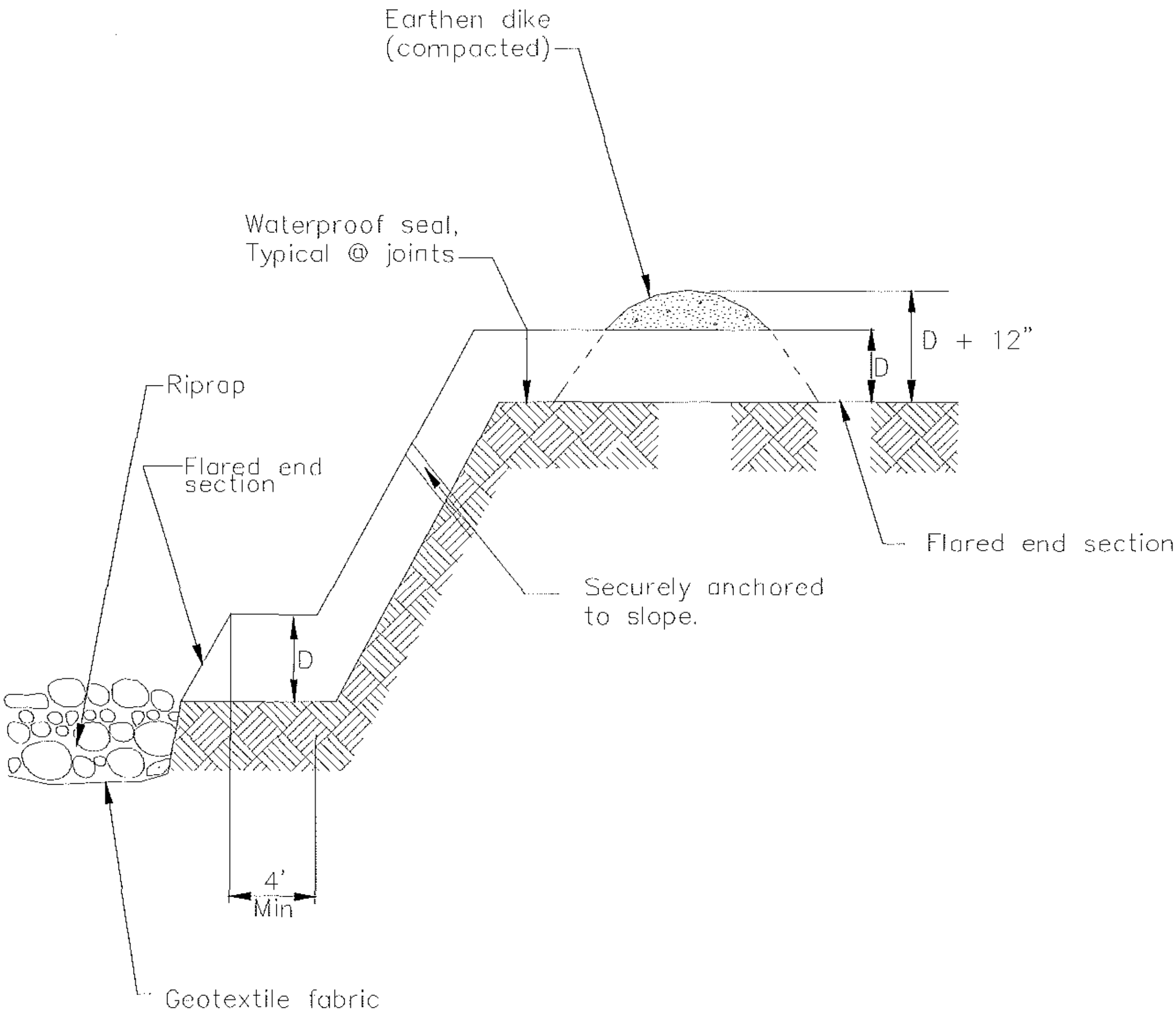
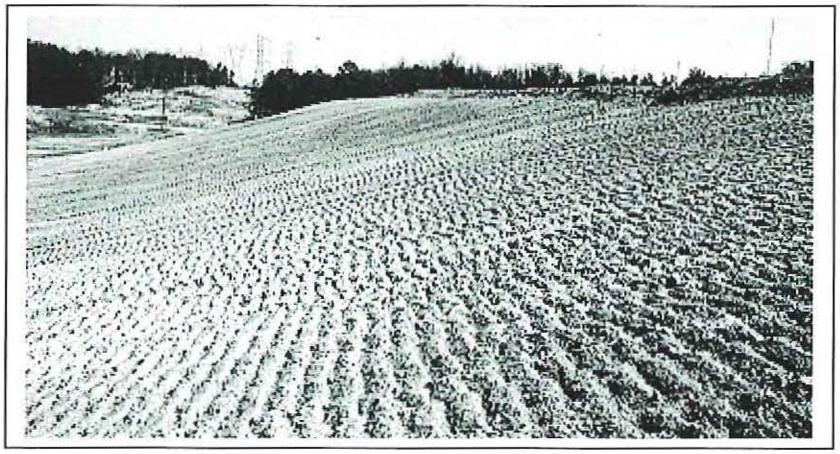


TYPICAL SLOPE DRAIN

NOT TO SCALE

Soil Preparation/Roughening EC-15



Categories

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Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-3 Hydraulic Mulch

EC-5 Soil Binders

EC-7 Geotextiles and Mats

Description and Purpose

Soil Preparation/Roughening involves assessment and preparation of surface soils for BMP installation. This can include soil testing (for seed base, soil characteristics, or nutrients), as well as roughening surface soils by mechanical methods (including sheepsfoot rolling, track walking, scarifying, stair stepping, and imprinting) to prepare soil for additional BMPs, or to break up sheet flow. Soil Preparation can also involve tilling topsoil to prepare a seed bed and/or incorporation of soil amendments, to enhance vegetative establishment.

Suitable Applications

Soil preparation: Soil preparation is essential to proper vegetative establishment. In particular, soil preparation (i.e. tilling, raking, and amendment) is suitable for use in combination with any soil stabilization method, including RECPs or sod. Soil preparation should not be confused with roughening.

Roughening: Soil roughening is generally referred to as track walking (sometimes called imprinting) a slope, where treads from heavy equipment run parallel to the contours of the slope and act as mini terraces. Soil preparation is most effective when used in combination with erosion controls. Soil Roughening is suitable for use as a complementary process for controlling erosion on a site. Roughening is not intended to be used as a stand-alone BMP, and should be used with perimeter controls, additional erosion control measures, grade breaks, and vegetative establishment for maximum effectiveness. Roughening is intended to only affect surface soils and should not compromise slope stability or overall compaction. Suitable applications for soil roughening include:

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- Along any disturbed slopes, including temporary stockpiles, sediment basins, or compacted soil diversion berms and swales.

- Roughening should be used in combination with hydraulically applied stabilization methods, compost blanket, or straw mulch; but should not be used in combination with RECPs or sod because roughening is intended to leave terraces on the slope.

Limitations

- Preparation and roughening must take place prior to installing other erosion controls (such as hydraulically applied stabilizers) or sediment controls (such as fiber rolls) on the faces of slopes.

- In such cases where slope preparation is minimal, erosion control/revegetation BMPs that do not require extensive soil preparation - such as hydraulic mulching and seeding applications - should be employed.

- Consideration should be given to the type of erosion control BMP that follows surface preparation, as some BMPs are not designed to be installed over various types of tillage/roughening, i.e., RECPs (erosion control blankets) should not be used with soil roughening due to a "bridging" effect, which suspends the blanket above the seed bed.

- Surface roughness has an effect on the amount of mulch material that needs to be applied, which shows up as a general increase in mulch material due to an increase in surface area (Topographic Index -see EC-3 Hydraulic Mulching).

Implementation

- Additional guidance on the comparison and selection of temporary slope stabilization methods is provided in Appendix F of the Handbook.

General

A roughened surface can significantly reduce erosion. Based on tests done at the San Diego State Erosion Research Laboratory, various roughening techniques on slopes can result in a 12 - 76% reduction in the erosion rate versus smooth slopes.

Materials

Minimal materials are required unless amendments and/or seed are added to the soil. The majority of soil roughening/preparation can be done with equipment that is on hand at a normal construction site, such as bull dozers and compaction equipment.

Installation Guidelines

Soil Preparation

- Where appropriate or feasible, soil should be prepared to receive the seed by disking or otherwise scarifying the surface to eliminate crust, improve air and water infiltration and create a more favorable environment for germination and growth.

- Based upon soil testing conducted, apply additional soil amendments (e.g. fertilizers, additional seed) to the soil to help with germination. Follow EC-4, Hydroseeding, when selecting and applying seed and fertilizers.

Cut Slope Roughening:

- Stair-step grade or groove the cut slopes that are steeper than 3:1.
- Use stair-step grading on any erodible material soft enough to be ripped with a bulldozer. Slopes consisting of soft rock with some subsoil are particularly suited to stair-step grading.
- Make the vertical cut distance less than the horizontal distance, and slightly slope the horizontal position of the "step" in toward the vertical wall.
- Do not make individual vertical cuts more than 2 feet (0.6 m) high in soft materials or more than 3 feet (0.9 m) high in rocky materials.
- Groove the slope using machinery to create a series of ridges and depressions that run across the slope, on the contour.

Fill Slope Roughening:

- Place on fill slopes with a gradient steeper than 3:1 in lifts not to exceed 8 inches (0.2 m), and make sure each lift is properly compacted.
- Ensure that the face of the slope consists of loose, uncompacted fill 4-6 inches (0.1-0.2 m) deep.
- Use grooving or tracking to roughen the face of the slopes, if necessary.
- Do not blade or scrape the final slope face.

Roughening for Slopes to be Mowed:

- Slopes which require mowing activities should not be steeper than 3:1.
- Roughen these areas to shallow grooves by track walking, scarifying, sheepsfoot rolling, or imprinting.
- Make grooves close together (less than 10 inches), and not less than 1 inch deep, and perpendicular to the direction of runoff (i.e., parallel to the slope contours).
- Excessive roughness is undesirable where mowing is planned.

Roughening With Tracked Machinery:

- Limit roughening with tracked machinery to soils with a sandy textural component to avoid undue compaction of the soil surface.
- Operate tracked machinery up and down the slope to leave horizontal depressions in the soil. Do not back-blade during the final grading operation.
- Seed and mulch roughened areas as soon as possible to obtain optimum seed germination and growth.

Costs
Costs are based on the additional labor of tracking or preparation of the slope plus the cost of any required soil amendment materials.

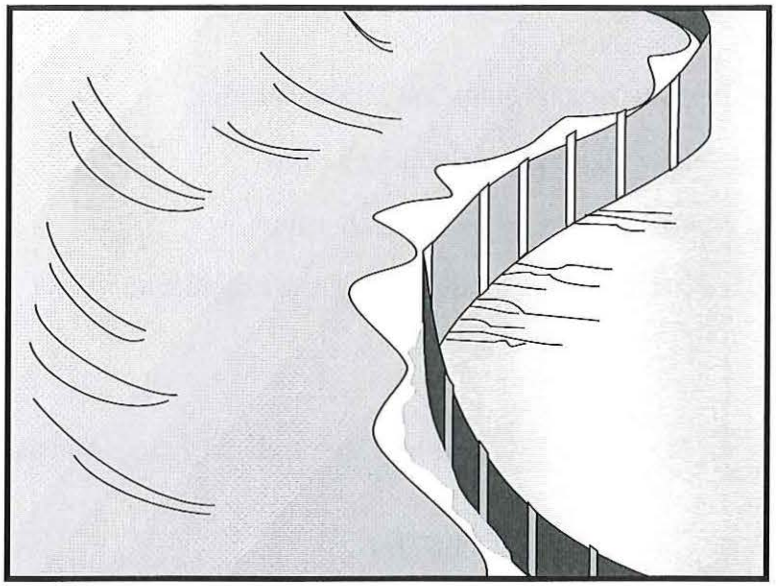
Inspection and Maintenance
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Check the seeded slopes for signs of erosion such as rills and gullies. Fill these areas slightly above the original grade, then reseed and mulch as soon as possible.
- Inspect BMPs weekly during normal operations, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

References
Soil Stabilization BMP Research for Erosion and Sediment Controls: Cost Survey Technical Memorandum, State of California Department of Transportation (Caltrans), July 2007.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

Silt Fence

SE-1



Categories		
EC	Erosion Control	
SE	Sediment Control	☑
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Description and Purpose

A silt fence is made of a woven geotextile that has been entrenched, attached to supporting poles, and sometimes backed by a plastic or wire mesh for support. The silt fence detains water, promoting sedimentation of coarse sediment behind the fence. Silt fence does not retain soil fine particles like clays or silts.

Suitable Applications

Silt fences are suitable for perimeter control, placed below areas where sheet flows discharge from the site. They could also be used as interior controls below disturbed areas where runoff may occur in the form of sheet and rill erosion and around inlets within disturbed areas (SE-10). Silt fences should not be used in locations where the flow is concentrated. Silt fences should always be used in combination with erosion controls. Suitable applications include:

- At perimeter of a project.
- Below the toe or down slope of exposed and erodible slopes.
- Along streams and channels.
- Around temporary spoil areas and stockpiles.
- Around inlets.
- Below other small cleared areas.

Targeted Constituents	
Sediment (coarse sediment)	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-5 Fiber Rolls

SE-6 Gravel Bag Berm SE-12 Manufactured Linear Sediment Controls

SE-13 Compost Socks and Berms

SE-14 Biofilter Bags

Limitations

- Do not use in streams, channels, drain inlets, or anywhere flow is concentrated.
- Do not use in locations where ponded water may cause a flooding hazard.
- Do not use silt fence to divert water flows or place across any contour line.
- Improperly installed fences are subject to failure from undercutting, overtopping, or collapsing.
- Must be trenched and keyed in.
- Not intended for use as a substitute for Fiber Rolls (SE-5), when fiber rolls are being used as a slope interruption device.
- Do not use on slopes subject to creeping, slumping, or landslides.

Implementation

General

A silt fence is a temporary sediment barrier consisting of woven geotextile stretched across and attached to supporting posts, trenched-in, and, depending upon the strength of fabric used, supported with plastic or wire mesh fence. Silt fences trap coarse sediment by intercepting and detaining sediment-laden runoff from disturbed areas in order to promote sedimentation behind the fence.

The following layout and installation guidance can improve performance and should be followed:

- Silt fence should be used in combination with erosion controls up-slope in order to provide the most effective sediment control.
- Silt fence alone is not effective at reducing turbidity. (Barrett and Malina, 2004)
- Designers should consider diverting sediment laden water to a temporary sediment basin or trap. (EPA, 2012)
- Use principally in areas where sheet flow occurs.
- Install along a level contour, so water does not pond more than 1.5 ft at any point along the silt fence.
- Provide sufficient room for runoff to pond behind the fence and to allow sediment removal equipment to pass between the silt fence and toes of slopes or other obstructions. About 1200 ft^2 of ponding area should be provided for every acre draining to the fence.
- Efficiency of silt fences is primarily dependent on the detention time of the runoff behind the control. (Barrett and Malina, 2004)
- The drainage area above any fence should not exceed a quarter of an acre. (Rule of Thumb-100-feet of silt fence per 10,000 square feet of disturbed area.) (EPA 2012)

- The maximum length of slope draining to any point along the silt fence should be 100 ft per foot of silt fence.

- Turn the ends of the filter fence uphill to prevent stormwater from flowing around the fence.

- Leave an undisturbed or stabilized area immediately down slope from the fence where feasible.

- Silt fences should remain in place until the disturbed area draining to the silt fence is permanently stabilized, after which, the silt fence fabric and posts should be removed and properly disposed.

- J-Hooks, which have ends turning up the slope to break up long runs of fence and provide multiple storage areas that work like mini-retention areas, may be used to increase the effectiveness of silt fence.

- Be aware of local regulations regarding the type and installation requirements of silt fence, which may differ from those presented in this fact sheet.

Design and Layout

In areas where high winds are anticipated the fence should be supported by a plastic or wire mesh. The geotextile fabric of the silt fence should contain ultraviolet inhibitors and stabilizers to provide longevity equivalent to the project life or replacement schedule.

- Layout in accordance with the attached figures.

- For slopes that contain a high number of rocks or large dirt clods that tend to dislodge, it may be necessary to protect silt fence from rocks (e.g., rockfall netting) ensure the integrity of the silt fence installation.

Standard vs. Heavy Duty Silt Fence

Standard Silt Fence

- Generally applicable in cases where the area draining to fence produces moderate sediment loads.

Heavy Duty Silt Fence

- Heavy duty silt fence usually has 1 or more of the following characteristics, not possessed by standard silt fence.
  - Fabric is reinforced with wire backing or additional support.
  - Posts are spaced closer than pre-manufactured, standard silt fence products.
- Use is generally limited to areas affected by high winds.
- Area draining to fence produces moderate sediment loads.

Materials

Standard Silt Fence

- Silt fence material should be woven geotextile with a minimum width of 36 in. The fabric should conform to the requirements in ASTM designation D6461.

- Wooden stakes should be commercial quality lumber of the size and shape shown on the plans. Each stake should be free from decay, splits or cracks longer than the

thickness of the stake or other defects that would weaken the stakes and cause the stakes to be structurally unsuitable.

- Staples used to fasten the fence fabric to the stakes should be not less than 1.75 in. long and should be fabricated from 15 gauge or heavier wire. The wire used to fasten the tops of the stakes together when joining two sections of fence should be 9 gauge or heavier wire. Galvanizing of the fastening wire will not be required.

Heavy-Duty Silt Fence

- Some silt fence has a wire backing to provide additional support, and there are products that may use prefabricated plastic holders for the silt fence and use metal posts instead of wood stakes.

Installation Guidelines – Traditional Method

Silt fences are to be constructed on a level contour. Sufficient area should exist behind the fence for ponding to occur without flooding or overtopping the fence.

- A trench should be excavated approximately 6 in. wide and 6 in. deep along the line of the proposed silt fence (trenches should not be excavated wider or deeper than necessary for proper silt fence installation).

- Bottom of the silt fence should be keyed-in a minimum of 12 in.

- Posts should be spaced a maximum of 6 ft apart and driven securely into the ground a minimum of 18 in. or 12 in. below the bottom of the trench.

- When standard strength geotextile is used, a plastic or wire mesh support fence should be fastened securely to the upslope side of posts using heavy–duty wire staples at least 1 in. long. The mesh should extend into the trench.

- When extra-strength geotextile and closer post spacing are used, the mesh support fence may be eliminated.

- Woven geotextile should be purchased in a long roll, then cut to the length of the barrier. When joints are necessary, geotextile should be spliced together only at a support post, with a minimum 6 in. overlap and both ends securely fastened to the post.

- The trench should be backfilled with native material and compacted.

- Construct the length of each reach so that the change in base elevation along the reach does not exceed 1/3 the height of the barrier; in no case should the reach exceed 500 ft.

- Cross barriers should be a minimum of 1/3 and a maximum of ½ the height of the linear barrier.

- See typical installation details at the end of this fact sheet.

Installation Guidelines - Static Slicing Method

- Static Slicing is defined as insertion of a narrow blade pulled behind a tractor, similar to a plow blade, at least 10 inches into the soil while at the same time pulling silt geotextile fabric into the ground through the opening created by the blade to the depth of the blade. Once the geotextile is installed, the soil is compacted using tractor tires.
- This method will not work with pre-fabricated, wire backed silt fence.
- Benefits:
    - Ease of installation (most often done with a 2 person crew).
    - Minimal soil disturbance.
    - Better level of compaction along fence, less susceptible to undercutting
    - Uniform installation.
- Limitations:
    - Does not work in shallow or rocky soils.
    - Complete removal of geotextile material after use is difficult.
    - Be cautious when digging near potential underground utilities.

Costs

- It should be noted that costs vary greatly across regions due to available supplies and labor costs.
- Average annual cost for installation using the traditional silt fence installation method (assumes 6 month useful life) is $7 per linear foot based on vendor research. Range of cost is $3.50 - $9.10 per linear foot.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Repair undercut silt fences.
- Repair or replace split, torn, slumping, or weathered fabric. The lifespan of silt fence fabric is generally 5 to 8 months.
- Silt fences that are damaged and become unsuitable for the intended purpose should be removed from the site of work, disposed, and replaced with new silt fence barriers.
- Sediment that accumulates in the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches 1/3 of the barrier height.
- Silt fences should be left in place until the upgradient area is permanently stabilized. Until then, the silt fence should be inspected and maintained regularly.

- Remove silt fence when upgradient areas are stabilized. Fill and compact post holes and anchor trench, remove sediment accumulation, grade fence alignment to blend with adjacent ground, and stabilize disturbed area.

References

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Monitoring Data on Effectiveness of Sediment Control Techniques, Proceedings of World Water and Environmental Resources Congress, Barrett M. and Malina J. 2004.

National Management Measures to Control Nonpoint Source Pollution from Urban Areas, United States Environmental Protection Agency, 2002.

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Sedimentation and Erosion Control Practices, and Inventory of Current Practices (Draft), USEPA, 1990.

Southeastern Wisconsin Regional Planning Commission (SWRPC). Costs of Urban Nonpoint Source Water Pollution Control Measures. Technical Report No. 31. Southeastern Wisconsin Regional Planning Commission, Waukesha, WI. 1991.

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Stormwater Management Manual for The Puget Sound Basin, Washington State Department of Ecology, Public Review Draft, 1991.

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U.S. Environmental Protection Agency (USEPA). Stormwater Management for Industrial Activities: Developing Pollution Prevention Plans and Best Management Practices. U.S. Environmental Protection Agency, Office of Water, Washington, DC, 1992.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.

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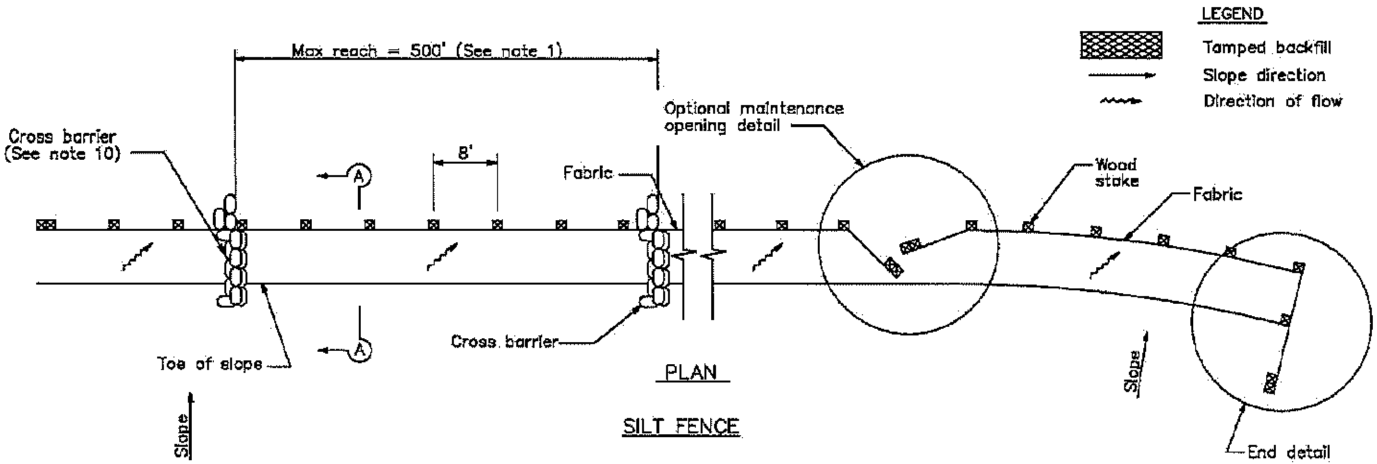
Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

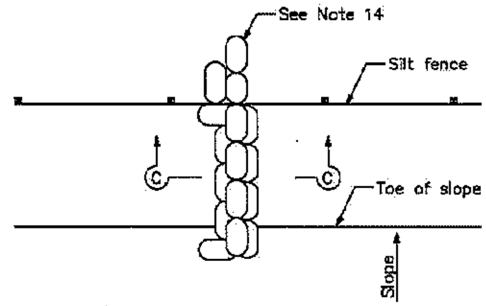


PLAN

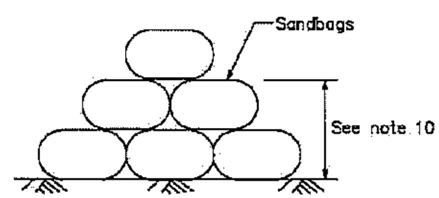
SILT FENCE

NOTES

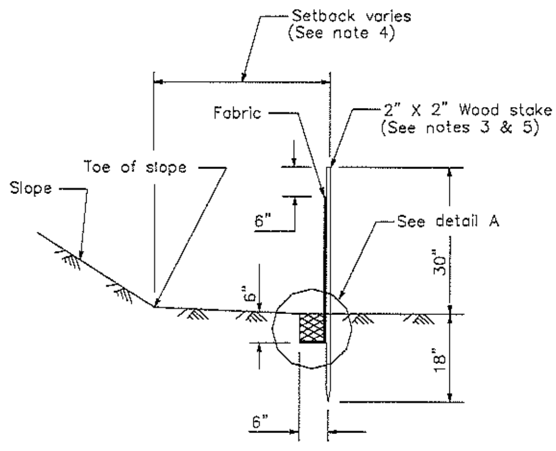
1. Construct the length of each reach so that the change in base elevation along the reach does not exceed 1/3 the height of the linear barrier. In no case shall the reach length exceed 500'.
2. The last 8'–0" of fence shall be turned up slope.
3. Stake dimensions are nominal.
4. Dimension may vary to fit field condition.
5. Stakes shall be spaced at 8'–0" maximum and shall be positioned on downstream side of fence.
6. Stakes to overlap and fence fabric to fold around each stake one full turn. Secure fabric to stake with 4 staples.
7. Stakes shall be driven tightly together to prevent potential flow–through of sediment at joint. The tops of the stakes shall be secured with wire.
8. For end stake, fence fabric shall be folded around two stakes one full turn and secured with 4 staples.
9. Minimum 4 staples per stake. Dimensions shown are typical.
10. Cross barriers shall be a minimum of 1/3 and a maximum of 1/2 the height of the linear barrier.
11. Maintenance openings shall be constructed in a manner to ensure sediment remains behind silt fence.
12. Joining sections shall not be placed at sump locations.
13. Sandbag rows and layers shall be offset to eliminate gaps.
14. Add 3–4 bags to cross barrier on downgradient side of silt fence as needed to prevent bypass or undermining and as allowable based on site limits of disturbance.



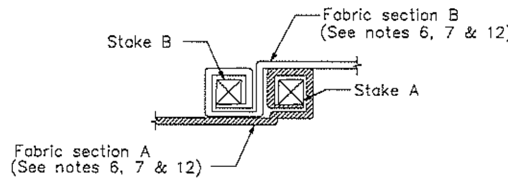
CROSS BARRIER DETAIL



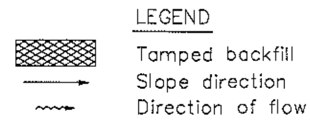
SECTION C–C

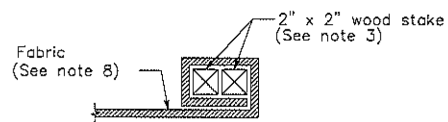


SECTION A–A

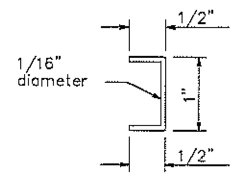


JOINING SECTION DETAIL (TOP VIEW)



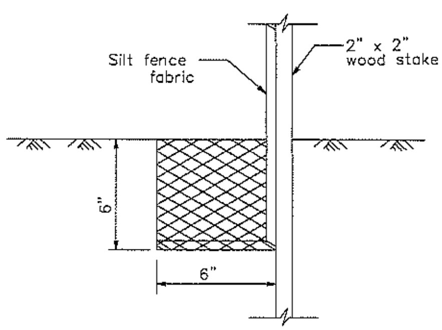


END STAKE DETAIL (TOP VIEW)

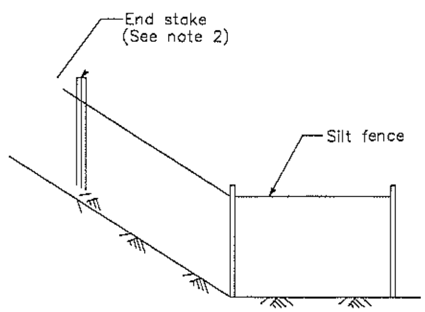


STAPLE DETAIL

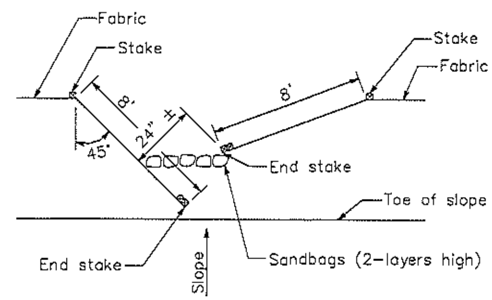
(SEE NOTE 9)



DETAIL A

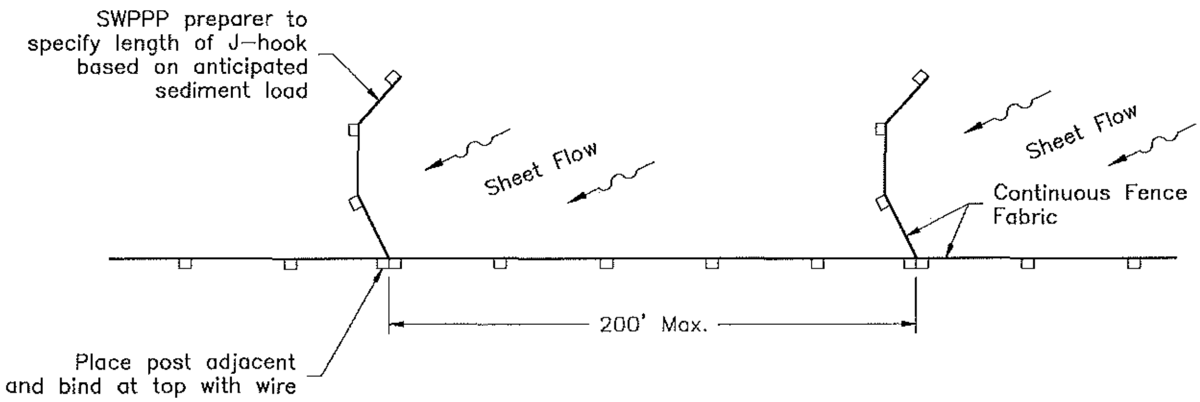


END DETAIL



OPTIONAL MAINTENANCE OPENING DETAIL

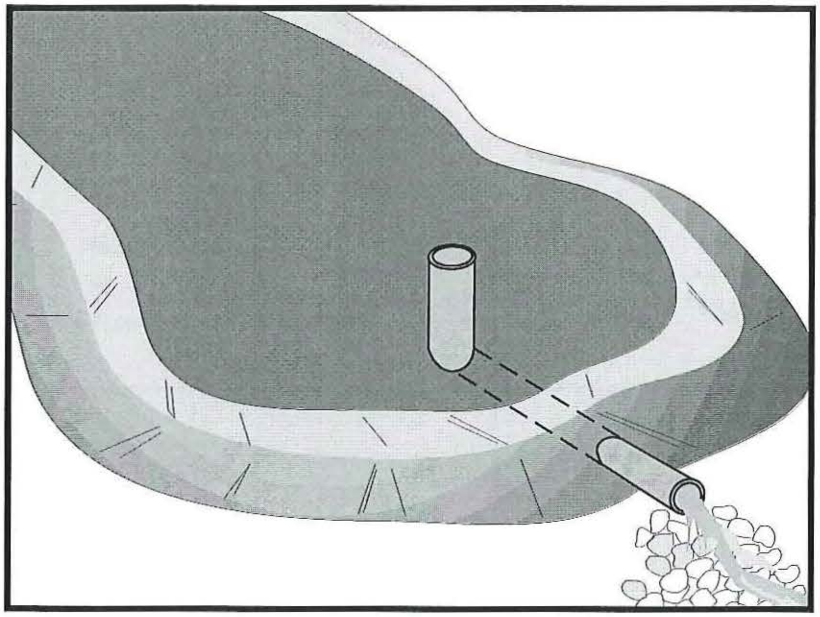
(SEE NOTE 11)


SWPPP preparer to specify length of J–hook based on anticipated sediment load
Sheet Flow
Sheet Flow
Continuous Fence Fabric
200' Max.
Place post adjacent and bind at top with wire

Plan

J–HOOK

Sediment Basin



Categories

EC	Erosion Control	
SE	Sediment Control	☑
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	☑
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-3 Sediment Trap (for smaller areas)

Description and Purpose

A sediment basin is a temporary basin formed by excavation or by constructing an embankment so that sediment-laden runoff is temporarily detained under quiescent conditions, allowing sediment to settle out before the runoff is released.

Sediment basin design guidance presented in this fact sheet is intended to provide options, methods, and techniques to optimize temporary sediment basin performance and basin sediment removal. Basin design guidance provided in this fact sheet is not intended to guarantee basin effluent compliance with numeric discharge limits (numeric action levels or numeric effluent limits for turbidity). Compliance with discharge limits requires a thoughtful approach to comprehensive BMP planning, implementation, and maintenance. Therefore, optimally designed and maintained sediment basins should be used in conjunction with a comprehensive system of BMPs that includes:

- Diverting runoff from undisturbed areas away from the basin

- Erosion control practices to minimize disturbed areas on-site and to provide temporary stabilization and interim sediment controls (e.g., stockpile perimeter control, check dams, perimeter controls around individual lots) to reduce the basin's influent sediment concentration.

At some sites, sediment basin design enhancements may be required to adequately remove sediment. Traditional

(a.k.a. "physical") enhancements such as alternative outlet configurations or flow deflection baffles increase detention time and other techniques such as outlet skimmers preferentially drain flows with lower sediment concentrations. These "physical" enhancement techniques are described in this fact sheet. To further enhance sediment removal particularly at sites with fine soils or turbidity sensitive receiving waters, some projects may need to consider implementing Active Treatment Systems (ATS) whereby coagulants and flocculants are used to enhance settling and removal of suspended sediments. Guidance on implementing ATS is provided in SE-11.

Suitable Applications

Sediment basins may be suitable for use on larger projects with sufficient space for constructing the basin. Sediment basins should be considered for use:

- Where sediment-laden water may enter the drainage system or watercourses
- On construction projects with disturbed areas during the rainy season
- At the outlet of disturbed watersheds between 5 acres and 75 acres and evaluated on a site by site basis
- Where post construction detention basins are required
- In association with dikes, temporary channels, and pipes used to convey runoff from disturbed areas

Limitations

Sediment basins must be installed only within the property limits and where failure of the structure will not result in loss of life, damage to homes or buildings, or interruption of use or service of public roads or utilities. In addition, sediment basins are attractive to children and can be very dangerous. Local ordinances regarding health and safety must be adhered to. If fencing of the basin is required, the type of fence and its location should be shown in the SWPPP and in the construction specifications.

- As a general guideline, sediment basins are suitable for drainage areas of 5 acres or more, but not appropriate for drainage areas greater than 75 acres. However, the tributary area should be evaluated on a site by site basis.
- Sediment basins may become an "attractive nuisance" and care must be taken to adhere to all safety practices. If safety is a concern, basin may require protective fencing.
- Sediment basins designed according to this fact sheet are only effective in removing sediment down to about the silt size fraction. Sediment-laden runoff with smaller size fractions (fine silt and clay) may not be adequately treated unless chemical (or other appropriate method) treatment is used in addition to the sediment basin.
- Basins with a height of 25 ft or more or an impounding capacity of 50 ac-ft or more must obtain approval from California Department of Water Resources Division of Safety of Dams (http://www.water.ca.gov/damsafety/).

- Water that stands in sediment basins longer than 96 hours may become a source of mosquitoes (and midges), particularly along perimeter edges, in shallow zones, in scour or below-grade pools, around inlet pipes, along low-flow channels, and among protected habitats created by emergent or floating vegetation (e.g. cattails, water hyacinth), algal mats, riprap, etc.

- Basins require large surface areas to permit settling of sediment. Size may be limited by the available area.

Implementation

General

A sediment basin is a controlled stormwater release structure formed by excavation or by construction of an embankment of compacted soil across a drainage way, or other suitable location. It is intended to trap sediment before it leaves the construction site. The basin is a temporary measure expected to be used during active construction in most cases and is to be maintained until the site area is permanently protected against erosion or a permanent detention basin is constructed.

Sediment basins are suitable for nearly all types of construction projects. Whenever possible, construct the sediment basins before clearing and grading work begins. Basins should be located at the stormwater outlet from the site but not in any natural or undisturbed stream. A typical application would include temporary dikes, pipes, and/or channels to convey runoff to the basin inlet.

Many development projects in California are required by local ordinances to provide a stormwater detention basin for post-construction flood control, desilting, or stormwater pollution control. A temporary sediment basin may be constructed by rough grading the post-construction control basins early in the project.

Sediment basins if properly designed and maintained can trap a significant amount of the sediment that flows into them. However, traditional basins do not remove all inflowing sediment. Therefore, they should be used in conjunction with erosion control practices such as temporary seeding, mulching, diversion dikes, etc., to reduce the amount of sediment flowing into the basin.

Planning

To improve the effectiveness of the basin, it should be located to intercept runoff from the largest possible amount of disturbed area. Locations best suited for a sediment basin are generally in lower elevation areas of the site (or basin tributary area) where site drainage would not require significant diversion or other means to direct water to the basin but outside jurisdictional waterways. However, as necessary, drainage into the basin can be improved by the use of earth dikes and drainage swales (see BMP EC-9). . The basin should not be located where its failure would result in the loss of life or interruption of the use or service of public utilities or roads.

Construct before clearing and grading work begins when feasible.

- Do not locate the basin in a jurisdictional stream.

- Basin sites should be located where failure of the structure will not cause loss of life, damage to homes or buildings, or interruption of use or service of public roads or utilities.
- Basins with a height of 25 ft or more or an impounding capacity of 50 ac-ft must obtain approval from the Division of Dam Safety. Local dam safety requirements may be more stringent.
- Limit the contributing area to the sediment basin to only the runoff from the disturbed soil areas. Use temporary concentrated flow conveyance controls to divert runoff from undisturbed areas away from the sediment basin.
- The basin should be located: (1) by excavating a suitable area or where a low embankment can be constructed across a swale, (2) where post-construction (permanent) detention basins will be constructed, and (3) where the basins can be maintained on a year-round basis to provide access for maintenance, including sediment removal and sediment stockpiling in a protected area, and to maintain the basin to provide the required capacity.

Design

When designing a sediment basin, designers should evaluate the site constraints that could affect the efficiency of the BMP. Some of these constraints include: the relationship between basin capacity, anticipated sediment load, and freeboard, available footprint for the basin, maintenance frequency and access, and hydraulic capacity and efficiency of the temporary outlet infrastructure. Sediment basins should be designed to maximize sediment removal and to consider sediment load retained by the basin as it affects basin performance.

Three Basin Design Options (Part A) are presented below along with a Typical Sediment/Detention Basin Design Methodology (Part B). Regardless of the design option that is selected, designers also need to evaluate the sediment basin capacity with respect to sediment accumulation (See "*Step 3. Evaluate the Capacity of the Sediment Basin*"), and should incorporate approaches identified in "*Step 4. Other Design Considerations*" to enhance basin performance.

A) Basin Design Options:

Option 1:

Design sediment basin(s) using the standard equation:

$$A_s = \frac{1.2Q}{V_s} \qquad \text{(Eq. 1)}$$

Where:

A_s = Minimum surface area for trapping soil particles of a certain size

V_s = Settling velocity of the design particle size chosen (V_s = 0.00028 ft/s for a design particle size of 0.01 mm at 68°F)

1.2 = Factor of safety recommended by USEPA to account for the reduction in basin efficiency caused due to turbulence and other non ideal conditions.

$Q = CIA$ (Eq.2)

Where

Q = Peak basin influent flow rate measured in cubic feet per second (ft^3/s)

C = Runoff coefficient (unitless)

I = Peak rainfall intensity for the 10-year, 6-hour rain event (in/hr)

A = Area draining into the sediment basin in acres

The design particle size should be the smallest soil grain size determined by wet sieve analysis, or the fine silt sized (0.01 mm [or 0.0004 in.]) particle, and the Vs used should be 100 percent of the calculated settling velocity.

This sizing basin method is dependent on the outlet structure design or the total basin length with an appropriate outlet. If the designer chooses to utilize the outlet structure to control the flow duration in the basin, the basin length (distance between the inlet and the outlet) should be a minimum of twice the basin width; the depth should not be less than 3 ft nor greater than 5 ft for safety reasons and for maximum efficiency (2 ft of sediment storage, 2 ft of capacity). If the designer chooses to utilize the basin length (with appropriate basin outlet) to control the flow duration in the basin, the basin length (distance between the inlet and the outlet) should be a specifically designed to capture 100% of the design particle size; the depth should not be less than 3 ft nor greater than 5 ft for safety reasons and for maximum efficiency (2 ft of sediment storage, 2 ft of capacity).

Basin design guidance provided herein assumes standard water properties (e.g., estimated average water temperature, kinematic viscosity, etc.) as a basis of the design. Designers can use an alternative design (Option 3) with site specific water properties as long as the design is as protective as Option 1.

The design guidance uses the peak influent flow rate to size sediment basins. Designers can use an alternative design (Option 3) with site specific average flow rates as long as the design is as protective as Option 1.

The basin should be located on the site where it can be maintained on a year-round basis and should be maintained on a schedule to retain the 2 ft of capacity.

Option 2:

Design pursuant to local ordinance for sediment basin design and maintenance, provided that the design efficiency is as protective or more protective of water quality than Option 1.

Option 3:

The use of an equivalent surface area design or equation provided that the design efficiency is as protective or more protective of water quality than Option 1.

B) Typical Sediment/Detention Basin Design Methodology:

Design of a sediment basin requires the designer to have an understanding of the site constraints, knowledge of the local soil (e.g., particle size distribution of potentially contributing soils), drainage area of the basin, and local hydrology. Designers should not assume that a sediment basin for location A is applicable to location B. Therefore, designers can use this factsheet as guidance but will need to apply professional judgment and knowledge of the site to design an effective and efficient sediment basin. The following provides a general overview of typical design methodologies:

Step 1. Hydrologic Design

- Evaluate the site constraints and assess the drainage area for the sediment basin. Designers should consider on- and off-site flows as well as changes in the drainage area associated with site construction/disturbance. To minimize additional construction during the course of the project, the designer should consider identifying the maximum drainage area when calculating the basin dimensions.

- If a local hydrology manual is not available it is recommended to follow standard rational method procedures to estimate the flow rate. The references section of this factsheet provides a reference to standard hydrology textbooks that can provide standard methodologies. If local rainfall depths are not available, values can be obtained from standard precipitation frequency maps from NOAA (downloaded from http://www.wrcc.dri.edu/pcpnfreq.html).

Step 2. Hydraulic Design

- Calculate the surface area required for the sediment basin using Equation 1. In which the flow rate is estimated for a 10-yr 6-hr event using rational method procedure listed in local hydrology manual and Vs is estimated using Stokes Law presented in Equation 3.

$$V_s = 2.81d^2 \qquad \text{(Eq.3)}$$

Where

V_s = Settling velocity in feet per second at 68°F

d = diameter of sediment particle in millimeters (smallest soil grain size determined by wet sieve analysis or fine silt (0.01 mm [or 0.0004 in.])

- In general the basin outlet design requires an iterative trial and error approach that considered the maximum water surface elevation, the elevation versus volume (stage-storage) relationship, the elevation verses basin outflow (a.k.a.-discharge) relationship, and the estimated inflow hydrograph. To adequately design the basins to settle sediment, the outlet configuration and associated outflow rates can be estimated by numerous methodologies. The following provides some guidance for design the basin outlet:
  - An outlet should have more than one orifice.
  - An outlet design typically utilizes multiple horizontal rows of orifices (approximately 3 or more) with at least 2 orifices per row (see Figures 1 and 2 at the end of this fact sheet).

- Orifices can vary in shape.
- Select the appropriate orifice diameter and number of perforations per row with the objective of minimizing the number of rows while maximizing the detention time.
- The diameter of each orifice is typically a maximum of 3-4 inches and a minimum of 0.25-0.5 inches.
- If a rectangular orifice is used, it is recommended to have minimum height of 0.5 inches and a maximum height of 6 inches.
- Rows are typically spaced at three times the diameter center to center vertically with a minimum distance of approximately 4 inches on center and a maximum distance of 1 foot on center.
- To estimate the outflow rate, each row is calculated separately based on the flow through a single orifice then multiplied by the number of orifices in the row. This step is repeated for each of the rows. Once all of the orifices are estimated, the total outflow rate versus elevation (stage-discharge curve) is developed to evaluate the detention time within the basin.
- Flow through a single orifice can be estimated using an Equation 4:

$$Q = BC' A(2gH)^{0.5} \qquad \text{(Eq.4)}$$

  Where
  Q = Outflow rate in ft^3/s
  C′ = Orifice coefficient (unitless)
  A = Area of the orifice (ft^2)
  g = acceleration due to gravity (ft^3/s)
  H = Head above the orifice (ft)
  B = Anticipated Blockage or clogging factor (unitless), It is dependent on anticipated sediment and debris load, trash rack configuration etc, so the value is dependent on design engineers professional judgment and/or local requirements (B is never greater than 1 and a value of 0.5 is generally used)

  - Care must be taken in the selection of orifice coefficient ("C′"); 0.60 is most often recommended and used. However, based on actual tests, Young and Graziano (1989), "Outlet Hydraulics of Extended Detention Facilities for Northern Virginia Planning District Commission", recommends the following:
    - C′ = 0.66 for thin materials; where the thickness is equal to or less than the orifice diameter, or
    - C′ = 0.80 when the material is thicker than the orifice diameter
- If different sizes of orifices are used along the riser then they have to be sized such that not more than 50 percent of the design storm event drains in one-third of the drawdown time (to provide adequate settling time for events smaller than the design storm event)

and the entire volume drains within 96 hours or as regulated by the local vector control agency. If a basin fails to drain within 96 hours, the basin must be pumped dry.

- Because basins are not maintained for infiltration, water loss by infiltration should be disregarded when designing the hydraulic capacity of the outlet structure.

- Floating Outlet Skimmer: The floating skimmer (see Figure 3 at the end of this fact sheet is an alternative outlet configuration (patented) that drains water from upper portion of the water column. This configuration has been used for temporary and permanent basins and can improve basin performance by eliminating bottom orifices which have the potential of discharging solids. Some design considerations for this alternative outlet device includes the addition of a sand filter or perforated under drain at the low point in the basin and near the floating skimmer. These secondary drains allow the basin to fully drain. More detailed guidelines for sizing the skimmer can be downloaded from http://www.fairclothskimmer.com/.

- Hold and Release Valve: An ideal sediment/detention basin would hold all flows to the design storm level for sufficient time to settle solids, and then slowly release the storm water. Implementing a reliable valve system for releasing detention basins is critical to eliminate the potential for flooding in such a system. Some variations of hold and release valves include manual valves, bladder devices or electrically operated valves. When a precipitation event is forecast, the valve would be close for the duration of the storm and appropriate settling time. When the settling duration is met (approximately 24 or 48 hours), the valve would be opened and allow the stormwater to be released at a rate that does not resuspend settled solids and in a non-erosive manner. If this type of system is used the valve should be designed to empty the entire basin within 96 hours or as stipulated by local vector control regulations.

Step 3. Evaluate the Capacity of the Sediment Basin

- Typically, sediment basins do not perform as designed when they are not properly maintained or the sediment yield to the basin is larger than expected. As part of a good sediment basin design, designers should consider maintenance cycles, estimated soil loss and/or sediment yield, and basin sediment storage volume. The two equations below can be used to quantify the amount of soil entering the basin.

- The Revised Universal Soil Loss Equation (RUSLE, Eq.5) can be used to estimate annual soil loss and the Modified Universal Soil Equation (MUSLE, Eq.6) can be used to estimate sediment yield from a single storm event.

$$A = R \times K \times LS \times C \times P \qquad \text{(Eq.5)}$$

$$Y = 95(Q \times q_p)^{0.56} \times K \times LS \times C \times P \qquad \text{(Eq.6)}$$

Where:

A = annual soil loss, tons/acre-year

R = rainfall erosion index, in 100 ft.tons/acre.in/hr

K = soil erodibility factor, tons/acre per unit of R

LS = slope length and steepness factor (unitless)

C = vegetative cover factor (unitless)

P = erosion control practice factor (unitless)

Y = single storm sediment yield in tons

Q = runoff volume in acre-feet

q_p = peak flow in cfs

- Detailed descriptions and methodologies for estimating the soil loss can be obtained from standard hydrology text books (See References section).
- Determination of the appropriate equation should consider construction duration and local environmental factors (soils, hydrology, etc.). For example, if a basin is planned for a project duration of 1 year and the designer specifies one maintenance cycle, RUSLE could be used to estimate the soil loss and thereby the designer could indicate that the sediment storage volume would be half of the soil loss value estimated. As an example for use of MUSLE, a project may have a short construction duration thereby requiring fewer maintenance cycles and a reduced sediment storage volume. MUSLE would be used to estimate the anticipated soil loss based on a specific storm event to evaluate the sediment storage volume and appropriate maintenance frequency.
- The soil loss estimates are an essential step in the design and it is essential that the designer provide construction contractors with enough information to understand maintenance frequency and/or depths within the basin that would trigger maintenance. Providing maintenance methods, frequency and specification should be included in design bid documents such as the SWPPP Site Map.
- Once the designer has quantified the amount of soil entering the basin, the depth required for sediment storage can be determined by dividing the estimated sediment loss by the surface area of the basin.

Step 4. Other Design Considerations

- Consider designing the volume of the settling zone for the total storm volume associated with the 2-year event or other appropriate design storms specified by the local agency. This volume can be used as a guide for sizing the basin without iterative routing calculations. The depth of the settling zone can be estimated by dividing the estimated 2-yr storm volume by the surface area of the basin.
- The basin volume consists of two zones:
  - A sediment storage zone at least 1 ft deep.
  - A settling zone at least 2 ft deep.

- The basin depth must be no less than 3 ft (not including freeboard).

- Proper hydraulic design of the outlet is critical to achieving the desired performance of the basin. The outlet should be designed to drain the basin within 24 to 96 hours (also referred to as "drawdown time"). The 24-hour limit is specified to provide adequate settling time; the 96-hour limit is specified to mitigate vector control concerns.

- Confirmation of the basin performance can be evaluated by routing the design storm (10-yr 6-hr, or as directed by local regulations) through the basin based on the basin volume (stage-storage curve) and the outlet design (stage-discharge curve based on the orifice configuration or equivalent outlet design).

- Sediment basins, regardless of size and storage volume, should include features to accommodate overflow or bypass flows that exceed the design storm event.

  - Include an emergency spillway to accommodate flows not carried by the principal spillway. The spillway should consist of an open channel (earthen or vegetated) over undisturbed material (not fill) or constructed of a non-erodible riprap (or equivalent protection) on fill slopes.

  - The spillway control section, which is a level portion of the spillway channel at the highest elevation in the channel, should be a minimum of 20 ft in length.

- Rock, vegetation or appropriate erosion control should be used to protect the basin inlet, outlet, and slopes against erosion.

- The total depth of the sediment basin should include the depth required for sediment storage, depth required for settling zone and freeboard of at least 1 foot or as regulated by local flood control agency for a flood event specified by the local agency.

- The basin alignment should be designed such that the length of the basin is more than twice the width of the basin; the length should be determined by measuring the distance between the inlet and the outlet. If the site topography does not allow for this configuration baffles should be installed so that the ratio is satisfied. If a basin has more than one inflow point, any inflow point that conveys more than 30 percent of the total peak inflow rate has to meet the required length to width ratio.

- An alternative basin sizing method proposed by Fifield (2004) can be consulted to estimate an alternative length to width ratio and basin configuration. These methods can be considered as part of Option 3 which allows for alternative designs that are protective or more protective of water quality.

- Baffles (see Figure 4 at the end of this fact sheet) can be considered at project sites where the existing topography or site constraints limit the length to width ratio. Baffles should be constructed of earthen berms or other structural material within the basin to divert flow in the basin, thus increasing the effective flow length from the basin inlet to the outlet riser. Baffles also reduce the change of short circuiting and allows for settling throughout the basin.

- Baffles are typically constructed from the invert of the basin to the crest of the emergency spillway (i.e., design event flows are meant to flow around the baffles and flows greater than the design event would flow over the baffles to the emergency spillway).
- Use of other materials for construction of basin baffles (such as silt fence) may not be appropriate based on the material specifications and will require frequent maintenance (maintain after every storm event). Maintenance may not be feasible when required due to flooded conditions resulting from frequent (i.e., back to back) storm events. Use of alternative baffle materials should not deviate from the intended purpose of the material, as described by the manufacturer.
- Sediment basins are best used in conjunction with erosion controls.
- Basins with an impounding levee greater than 4.5 ft tall, measured from the lowest point to the impounding area to the highest point of the levee, and basins capable of impounding more than 35,000 ft^3, should be designed by a Registered Civil Engineer. The design should include maintenance requirements, including sediment and vegetation removal, to ensure continuous function of the basin outlet and bypass structures.
- A forebay, constructed upstream of the basin, may be provided to remove debris and larger particles.
- The outflow from the sediment basin should be provided with velocity dissipation devices (see BMP EC-10) to prevent erosion and scouring of the embankment and channel.
- The principal outlet should consist of a corrugated metal, high density polyethylene (HDPE), or reinforced concrete riser pipe with dewatering holes and an anti-vortex device and trash rack attached to the top of the riser, to prevent floating debris from flowing out of the basin or obstructing the system. This principal structure should be designed to accommodate the inflow design storm.
- A rock pile or rock-filled gabions can serve as alternatives to the debris screen, although the designer should be aware of the potential for extra maintenance involved should the pore spaces in the rock pile clog.
- The outlet structure should be placed on a firm, smooth foundation with the base securely anchored with concrete or other means to prevent floatation.
- Attach riser pipe (watertight connection) to a horizontal pipe (barrel). Provide anti-seep collars on the barrel.
- Cleanout level should be clearly marked on the riser pipe.

Installation

- Securely anchor and install an anti-seep collar on the outlet pipe/riser and provide an emergency spillway for passing major floods (see local flood control agency).
- Areas under embankments must be cleared and stripped of vegetation.

- Chain link fencing should be provided around each sediment basin to prevent unauthorized entry to the basin or if safety is a concern.

Costs

The cost of a sediment basin is highly variable and is dependent of the site configuration. To decrease basin construction costs, designers should consider using existing site features such as berms or depressed area to site the sediment basin. Designers should also consider potential savings associated with designing the basin to minimize the number of maintenance cycles and siting the basin in a location where a permanent BMP (e.g., extended detention basin) is required for the project site.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level and as required by local requirements. It is recommended that at a minimum, basins be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Examine basin banks for seepage and structural soundness.

- Check inlet and outlet structures and spillway for any damage or obstructions. Repair damage and remove obstructions as needed.

- Check inlet and outlet area for erosion and stabilize if required.

- Check fencing for damage and repair as needed.

- Sediment that accumulates in the basin must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when sediment accumulation reaches one-half the designated sediment storage volume. Sediment removed during maintenance should be managed properly. The sediment should be appropriately evaluated and used or disposed of accordingly. Options include: incorporating sediment into earthwork on the site (only if there is no risk that sediment is contaminated); or off-site export/disposal at an appropriate location (e.g., sediment characterization and disposal to an appropriate landfill).

- Remove standing water from basin within 96 hours after accumulation.

- If the basin does not drain adequately (e.g., due to storms that are more frequent or larger than the design storm or other unforeseen site conditions), dewatering should be conducted in accordance with appropriate dewatering BMPs (see NS-2) and in accordance with local permits as applicable.

- To minimize vector production:

  - Remove accumulation of live and dead floating vegetation in basins during every inspection.

  - Remove excessive emergent and perimeter vegetation as needed or as advised by local or state vector control agencies.

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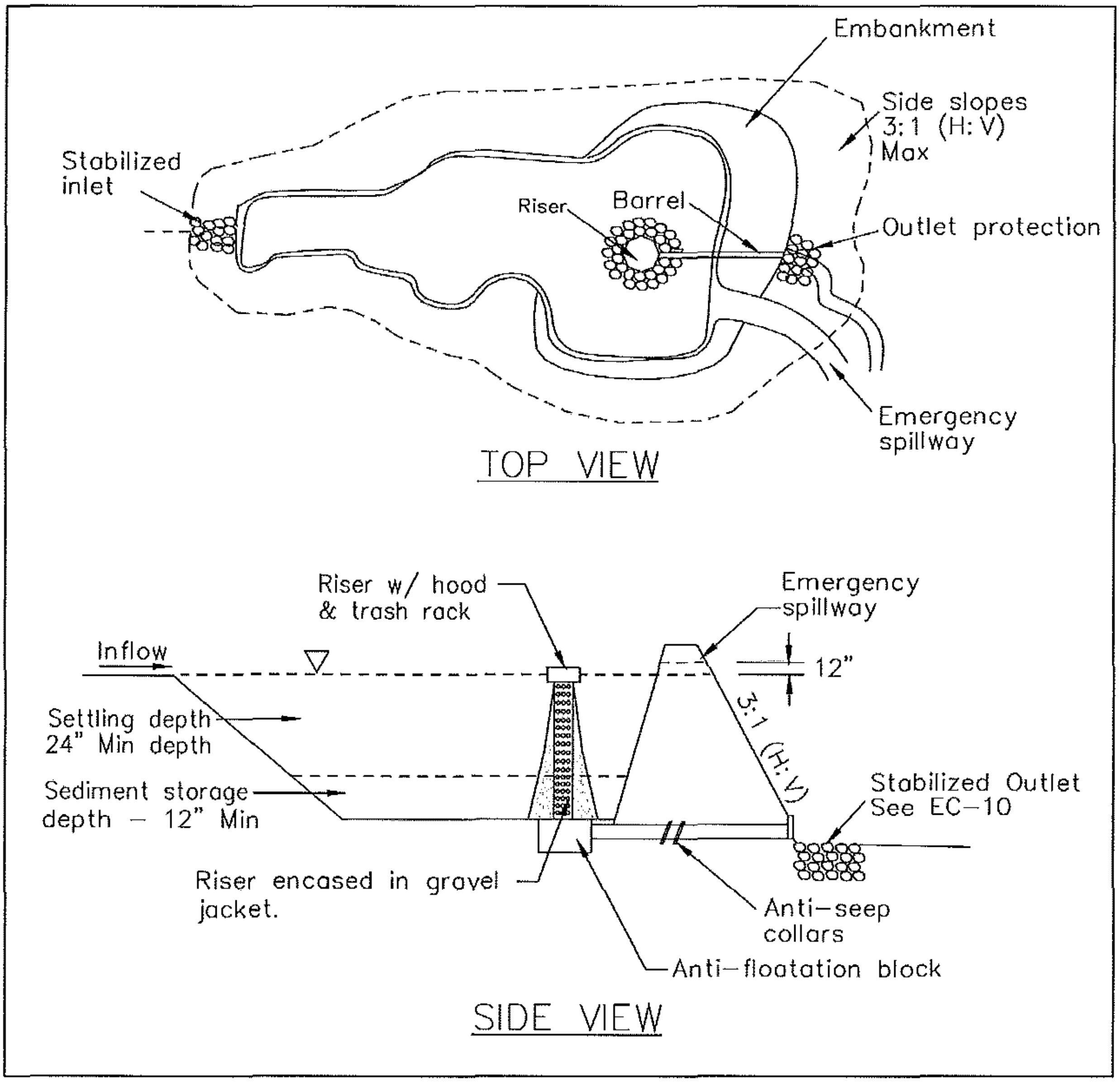


FIGURE 1: TYPICAL TEMPORARY SEDIMENT BASIN
MULTIPLE ORIFICE DESIGN
NOT TO SCALE

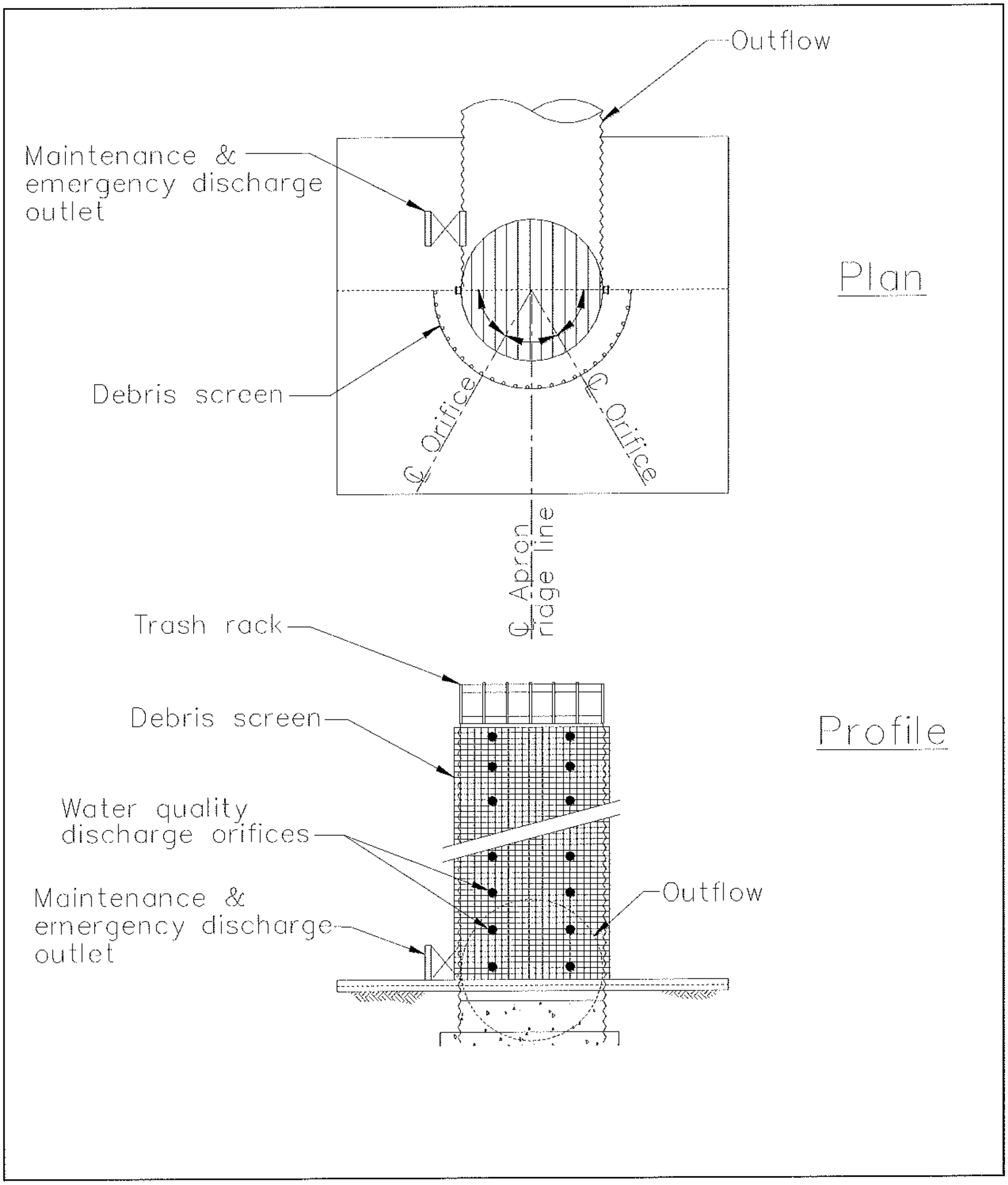
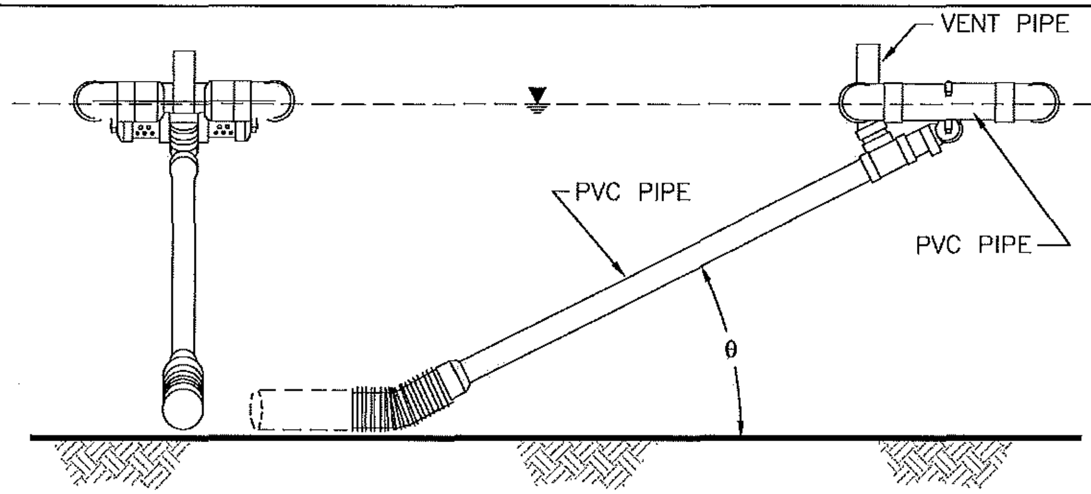


FIGURE 2: MULTIPLE ORIFICE OUTLET RISER

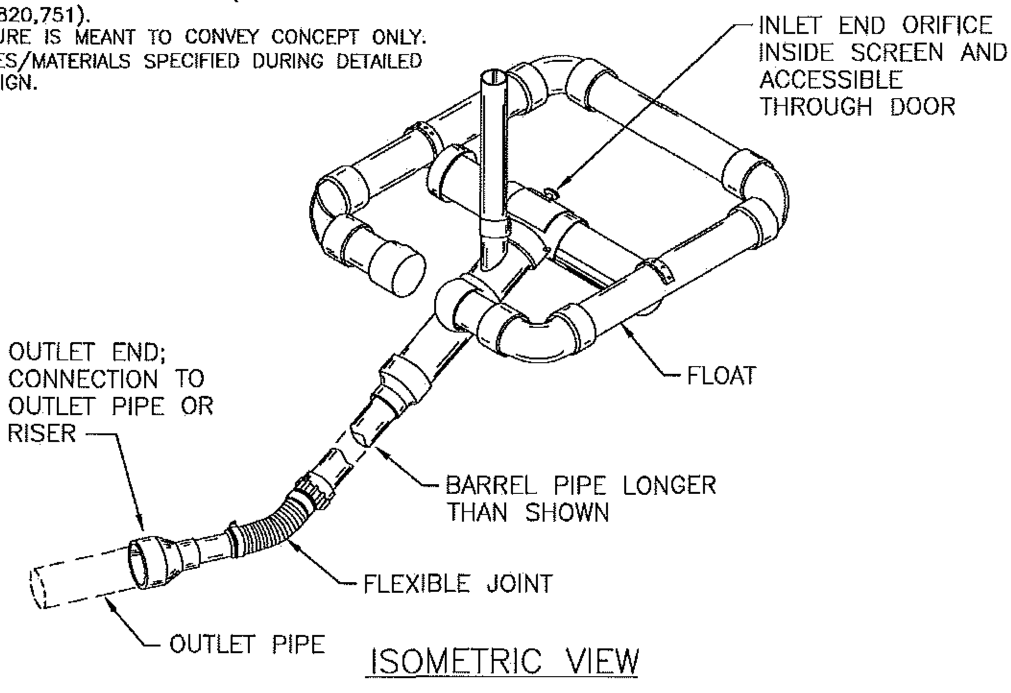
NOT TO SCALE



PROFILE

NOTES:

1. THE MOST IMPORTANT DESIGN PARAMETER IS THE CONTROL OF ORIFICE SIZE, WHICH CAN CONTROL DESIRED DEWATERING TIME. THE LONGER THE DEWATERING TIME, THE BETTER THE QUALITY OF WATER DISCHARGED FROM THE SEDIMENT BASIN.
2. DESIGN BY W. FAIRCLOTH (PATENT #5,820,751).
3. FIGURE IS MEANT TO CONVEY CONCEPT ONLY. SIZES/MATERIALS SPECIFIED DURING DETAILED DESIGN.



ISOMETRIC VIEW

FIGURE 3: TYPICAL SKIMMER

NOT TO SCALE

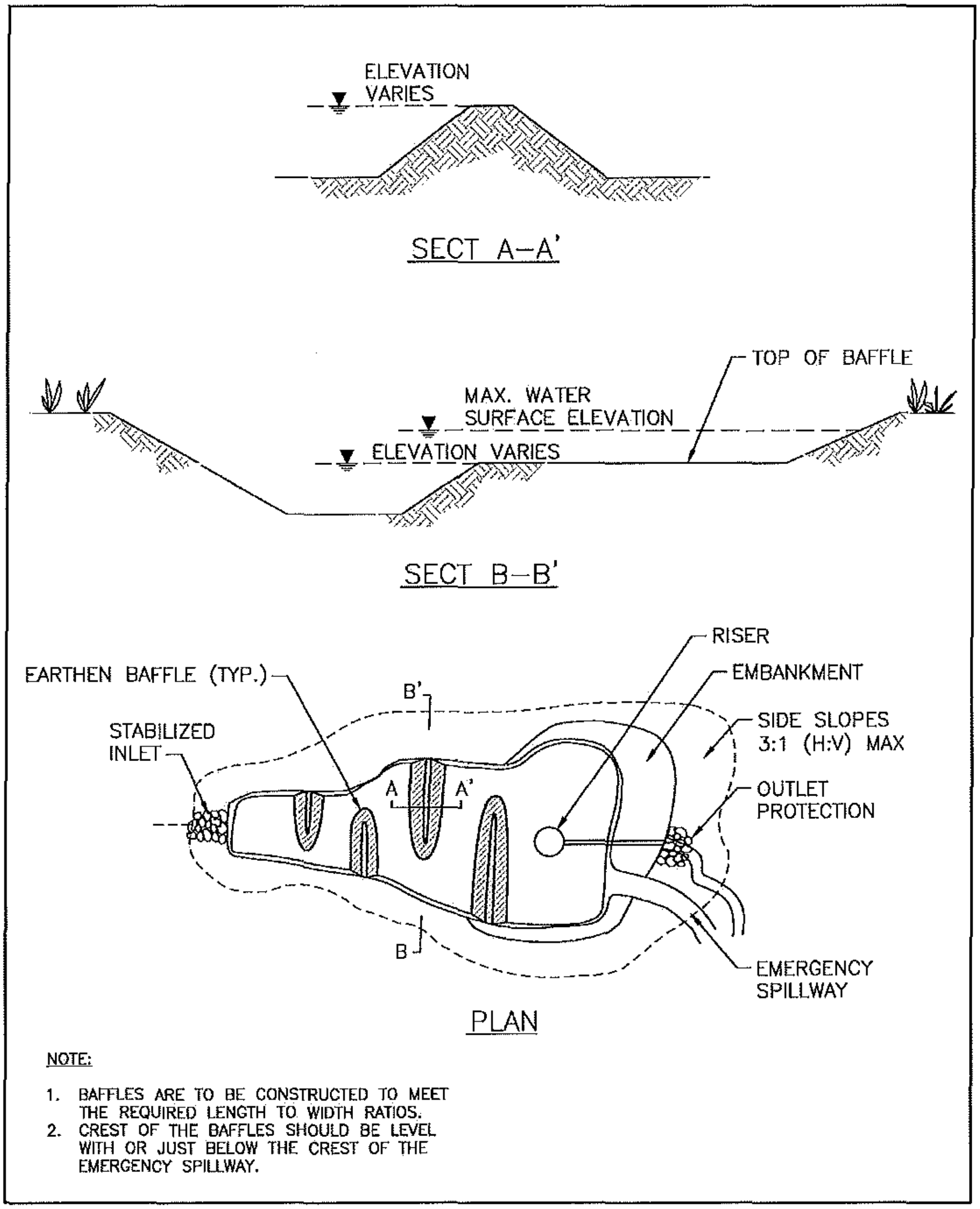
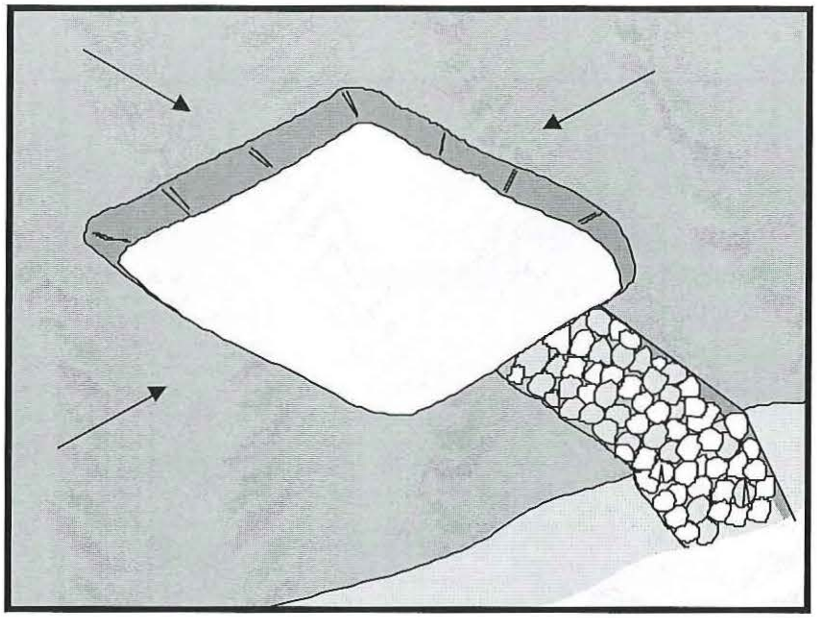


FIGURE 4: TYPICAL TEMPORARY SEDIMENT BASIN
WITH BAFFLES
NOT TO SCALE

Sediment Trap SE-3



Categories

EC	Erosion Control	
SE	Sediment Control	☑
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	☑
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-2 Sediment Basin (for larger areas)

Description and Purpose

A sediment trap is a containment area where sediment-laden runoff is temporarily detained under quiescent conditions, allowing sediment to settle out or before the runoff is discharged by gravity flow. Sediment traps are formed by excavating or constructing an earthen embankment across a waterway or low drainage area.

Trap design guidance provided in this fact sheet is not intended to guarantee compliance with numeric discharge limits (numeric action levels or numeric effluent limits for turbidity). Compliance with discharge limits requires a thoughtful approach to comprehensive BMP planning, implementation, and maintenance. Therefore, optimally designed and maintained sediment traps should be used in conjunction with a comprehensive system of BMPs.

Suitable Applications

Sediment traps should be considered for use:

- At the perimeter of the site at locations where sediment-laden runoff is discharged offsite.
- At multiple locations within the project site where sediment control is needed.
- Around or upslope from storm drain inlet protection measures.
- Sediment traps may be used on construction projects where the drainage area is less than 5 acres. Traps would be

placed where sediment-laden stormwater may enter a storm drain or watercourse. SE-2, Sediment Basins, must be used for drainage areas greater than 5 acres.

- As a supplemental control, sediment traps provide additional protection for a water body or for reducing sediment before it enters a drainage system.

Limitations

- Requires large surface areas to permit infiltration and settling of sediment.
- Not appropriate for drainage areas greater than 5 acres.
- Only removes large and medium sized particles and requires upstream erosion control.
- Attractive and dangerous to children, requiring protective fencing.
- Conducive to vector production.
- Should not be located in live streams.

Implementation

Design

A sediment trap is a small temporary ponding area, usually with a gravel outlet, formed by excavation or by construction of an earthen embankment. Its purpose is to collect and store sediment from sites cleared or graded during construction. It is intended for use on small drainage areas with no unusual drainage features and projected for a quick build-out time. It should help in removing coarse sediment from runoff. The trap is a temporary measure with a design life of approximately six months to one year and is to be maintained until the site area is permanently protected against erosion by vegetation and/or structures.

Sediment traps should be used only for small drainage areas. If the contributing drainage area is greater than 5 acres, refer to SE-2, Sediment Basins, or subdivide the catchment area into smaller drainage basins.

Sediment usually must be removed from the trap after each rainfall event. The SWPPP should detail how this sediment is to be disposed, such as in fill areas onsite, or removal to an approved offsite dump. Sediment traps used as perimeter controls should be installed before any land disturbance takes place in the drainage area.

Sediment traps are usually small enough that a failure of the structure would not result in a loss of life, damage to home or buildings, or interruption in the use of public roads or utilities. However, sediment traps are attractive to children and can be dangerous. The following recommendations should be implemented to reduce risks:

- Install continuous fencing around the sediment trap or pond. Consult local ordinances regarding requirements for maintaining health and safety.
- Restrict basin side slopes to 3:1 or flatter.

Sediment trap size depends on the type of soil, size of the drainage area, and desired sediment removal efficiency (see SE-2, Sediment Basin). As a rule of thumb, the larger the basin volume

the greater the sediment removal efficiency. Sizing criteria are typically established under the local grading ordinance or equivalent. The runoff volume from a 2-year storm is a common design criteria for a sediment trap. The sizing criteria below assume that this runoff volume is 0.042 acre-ft/acre (0.5 in. of runoff). While the climatic, topographic, and soil type extremes make it difficult to establish a statewide standard, the following criteria should trap moderate to high amounts of sediment in most areas of California:

- Locate sediment traps as near as practical to areas producing the sediment.
- Trap should be situated according to the following criteria: (1) by excavating a suitable area or where a low embankment can be constructed across a swale, (2) where failure would not cause loss of life or property damage, and (3) to provide access for maintenance, including sediment removal and sediment stockpiling in a protected area.
- Trap should be sized to accommodate a settling zone and sediment storage zone with recommended minimum volumes of 67 yd^3/acre and 33 yd^3/acre of contributing drainage area, respectively, based on 0.5 in. of runoff volume over a 24-hour period. In many cases, the size of an individual trap is limited by available space. Multiple traps or additional volume may be required to accommodate specific rainfall, soil, and site conditions.
- Traps with an impounding levee greater than 4.5 ft tall, measured from the lowest point to the impounding area to the highest point of the levee, and traps capable of impounding more than 35,000 ft^3, should be designed by a Registered Civil Engineer. The design should include maintenance requirements, including sediment and vegetation removal, to ensure continuous function of the trap outlet and bypass structures.
- The outlet pipe or open spillway must be designed to convey anticipated peak flows.
- Use rock or vegetation to protect the trap outlets against erosion.
- Fencing should be provided to prevent unauthorized entry.

Installation
Sediment traps can be constructed by excavating a depression in the ground or creating an impoundment with a small embankment. Sediment traps should be installed outside the area being graded and should be built prior to the start of the grading activities or removal of vegetation. To minimize the area disturbed by them, sediment traps should be installed in natural depressions or in small swales or drainage ways. The following steps must be followed during installation:

- The area under the embankment must be cleared, grubbed, and stripped of any vegetation and root mat. The pool area should be cleared.
- The fill material for the embankment must be free of roots or other woody vegetation as well as oversized stones, rocks, organic material, or other objectionable material. The embankment may be compacted by traversing with equipment while it is being constructed.
- All cut-and-fill slopes should be 3:1 or flatter.
- When a riser is used, all pipe joints must be watertight.

- When a riser is used, at least the top two-thirds of the riser should be perforated with 0.5 in. diameter holes spaced 8 in. vertically and 10 to 12 in. horizontally. See SE-2, Sediment Basin.

- When an earth or stone outlet is used, the outlet crest elevation should be at least 1 ft below the top of the embankment.

- When crushed stone outlet is used, the crushed stone used in the outlet should meet AASHTO M43, size No. 2 or 24, or its equivalent such as MSHA No. 2. Gravel meeting the above gradation may be used if crushed stone is not available.

Costs

Average annual cost per installation and maintenance (18 month useful life) is $0.73 per ft^3 ($1,300 per drainage acre). Maintenance costs are approximately 20% of installation costs.

Inspection and Maintenance

- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Inspect outlet area for erosion and stabilize if required.

- Inspect trap banks for seepage and structural soundness, repair as needed.

- Inspect outlet structure and spillway for any damage or obstructions. Repair damage and remove obstructions as needed.

- Inspect fencing for damage and repair as needed.

- Inspect the sediment trap for area of standing water during every visit. Corrective measures should be taken if the BMP does not dewater completely in 96 hours or less to prevent vector production.

- Sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the trap capacity. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed of at an appropriate location.

- Remove vegetation from the sediment trap when first detected to prevent pools of standing water and subsequent vector production.

- BMPs that require dewatering shall be continuously attended while dewatering takes place. Dewatering BMPs per NS-2 shall be implemented at all times during dewatering activities.

References

Brown, W., and T. Schueler. The Economics of Stormwater BMPs in the Mid-Atlantic Region. Prepared for Chesapeake Research Consortium, Edgewater, MD, by the Center for Watershed Protection, Ellicott City, MD, 1997.

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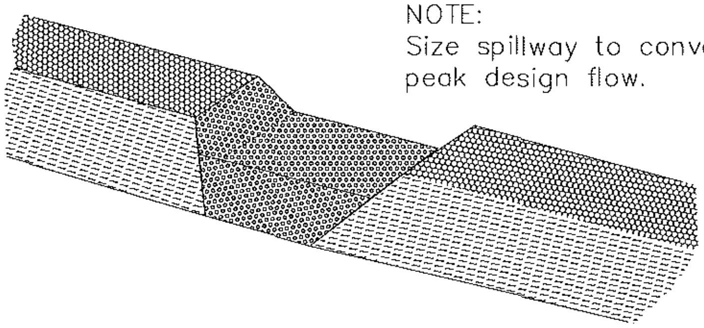
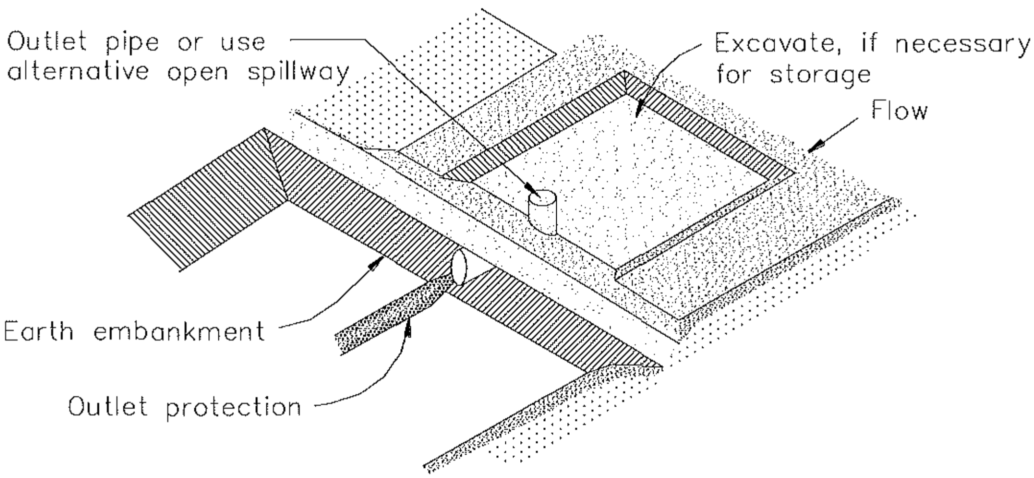
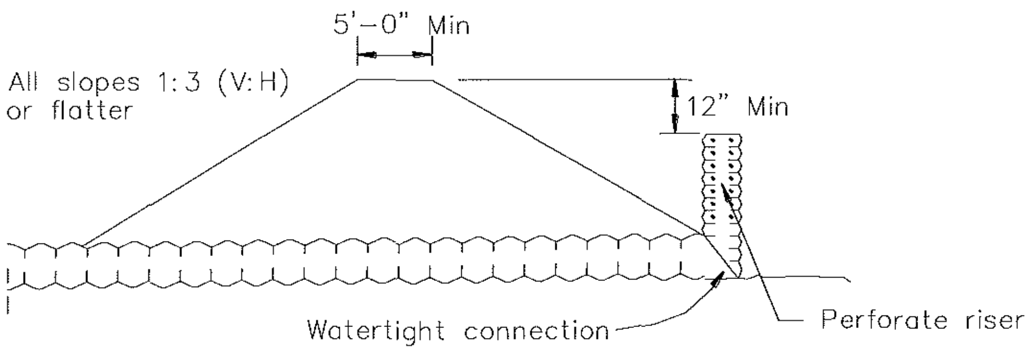


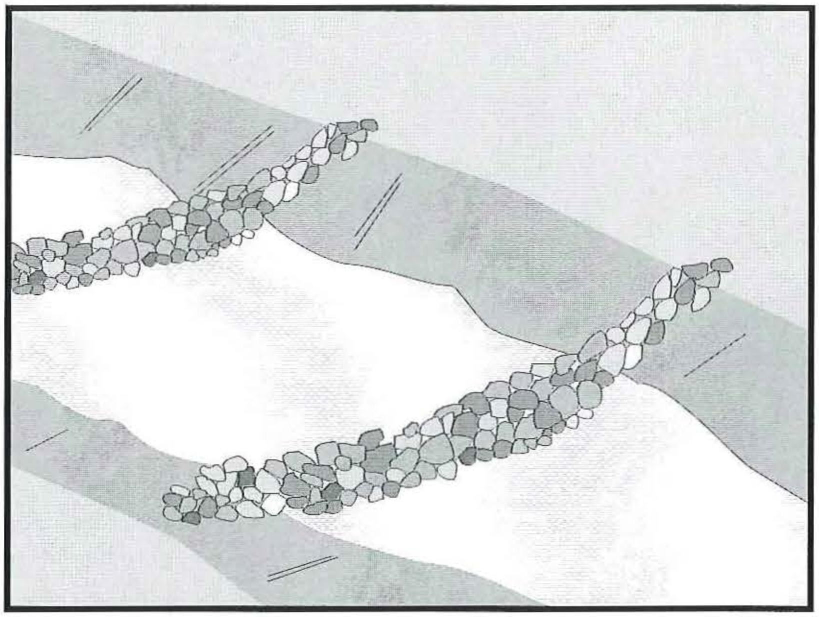
TYPICAL OPEN SPILLWAY





EMBANKMENT SECTION THRU RISER

TYPICAL SEDIMENT TRAP
NOT TO SCALE



Categories

EC	Erosion Control	☒
SE	Sediment Control	☑
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-5 Fiber Rolls

SE-6 Gravel Bag Berm

SE-8 Sandbag Barrier

SE-12 Manufactured Linear Sediment Controls

SE-14 Biofilter Bags

Description and Purpose

A check dam is a small barrier constructed of rock, gravel bags, sandbags, fiber rolls, or other proprietary products, placed across a constructed swale or drainage ditch. Check dams reduce the effective slope of the channel, thereby reducing scour and channel erosion by reducing flow velocity and increasing residence time within the channel, allowing sediment to settle.

Suitable Applications

Check dams may be appropriate in the following situations:

- To promote sedimentation behind the dam.
- To prevent erosion by reducing the velocity of channel flow in small intermittent channels and temporary swales.
- In small open channels that drain 10 acres or less.
- In steep channels where stormwater runoff velocities exceed 5 ft/s.
- During the establishment of grass linings in drainage ditches or channels.
- In temporary ditches where the short length of service does not warrant establishment of erosion-resistant linings.
- To act as a grade control structure.

Limitations

- Not to be used in live streams or in channels with extended base flows.
- Not appropriate in channels that drain areas greater than 10 acres.
- Not appropriate in channels that are already grass-lined unless erosion potential or sediment-laden flow is expected, as installation may damage vegetation.
- Require extensive maintenance following high velocity flows.
- Promotes sediment trapping which can be re-suspended during subsequent storms or removal of the check dam.
- Do not construct check dams with straw bales or silt fence.
- Water suitable for mosquito production may stand behind check dams, particularly if subjected to daily non-stormwater discharges.

Implementation

General

Check dams reduce the effective slope and create small pools in swales and ditches that drain 10 acres or less. Using check dams to reduce channel slope reduces the velocity of stormwater flows, thus reducing erosion of the swale or ditch and promoting sedimentation. Thus, check dams are dual-purpose and serve an important role as erosion controls as well as as sediment controls. Note that use of 1-2 isolated check dams for sedimentation will likely result in little net removal of sediment because of the small detention time and probable scour during longer storms. Using a series of check dams will generally increase their effectiveness. A sediment trap (SE-3) may be placed immediately upstream of the check dam to increase sediment removal efficiency.

Design and Layout

Check dams work by decreasing the effective slope in ditches and swales. An important consequence of the reduced slope is a reduction in capacity of the ditch or swale. This reduction in capacity should be considered when using this BMP, as reduced capacity can result in overtopping of the ditch or swale and resultant consequences. In some cases, such as a "permanent" ditch or swale being constructed early and used as a "temporary" conveyance for construction flows, the ditch or swale may have sufficient capacity such that the temporary reduction in capacity due to check dams is acceptable. When check dams reduce capacities beyond acceptable limits, either:

- Don't use check dams. Consider alternative BMPs, or.
- Increase the size of the ditch or swale to restore capacity.

Maximum slope and velocity reduction is achieved when the toe of the upstream dam is at the same elevation as the top of the downstream dam (see "Spacing Between Check Dams" detail at the end of this fact sheet). The center section of the dam should be lower than the edge sections (at least 6 inches), acting as a spillway, so that the check dam will direct flows to the center of

the ditch or swale (see "Typical Rock Check Dam" detail at the end of this fact sheet). Bypass or side-cutting can occur if a sufficient spillway is not provided in the center of the dam.

Check dams are usually constructed of rock, gravel bags, sandbags, and fiber rolls. A number of products can also be used as check dams (e.g. HDPE check dams, temporary silt dikes (SE-12)), and some of these products can be removed and reused. Check dams can also be constructed of logs or lumber, and have the advantage of a longer lifespan when compared to gravel bags, sandbags, and fiber rolls. Check dams should not be constructed from straw bales or silt fences, since concentrated flows quickly wash out these materials.

Rock check dams are usually constructed of 8 to 12 in. rock. The rock is placed either by hand or mechanically, but never just dumped into the channel. The dam should completely span the ditch or swale to prevent washout. The rock used should be large enough to stay in place given the expected design flow through the channel. It is recommended that abutments be extended 18 in. into the channel bank. Rock can be graded such that smaller diameter rock (e.g. 2-4 in) is located on the upstream side of larger rock (holding the smaller rock in place); increasing residence time.

Log check dams are usually constructed of 4 to 6 in. diameter logs, installed vertically. The logs should be embedded into the soil at least 18 in. Logs can be bolted or wired to vertical support logs that have been driven or buried into the soil.

See fiber rolls, SE-5, for installation of fiber roll check dams.

Gravel bag and sand bag check dams are constructed by stacking bags across the ditch or swale, shaped as shown in the drawings at the end of this fact sheet (see "Gravel Bag Check Dam" detail at the end of this fact sheet).

Manufactured products, such as temporary silt dikes (SE-12), should be installed in accordance with the manufacturer's instructions. Installation typically requires anchoring or trenching of products, as well as regular maintenance to remove accumulated sediment and debris.

If grass is planted to stabilize the ditch or swale, the check dam should be removed when the grass has matured (unless the slope of the swales is greater than 4%).

The following guidance should be followed for the design and layout of check dams:

- Install the first check dam approximately 16 ft from the outfall device and at regular intervals based on slope gradient and soil type.
- Check dams should be placed at a distance and height to allow small pools to form between each check dam.
- For multiple check dam installation, backwater from a downstream check dam should reach the toes of the upstream check dam.
- A sediment trap provided immediately upstream of the check dam will help capture sediment. Due to the potential for this sediment to be resuspended in subsequent storms, the sediment trap should be cleaned following each storm event.

- High flows (typically a 2-year storm or larger) should safely flow over the check dam without an increase in upstream flooding or damage to the check dam.

- Where grass is used to line ditches, check dams should be removed when grass has matured sufficiently to protect the ditch or swale.

Materials

- Rock used for check dams should typically be 8-12 in rock and be sufficiently sized to stay in place given expected design flows in the channel. Smaller diameter rock (e.g. 2 to 4 in) can be placed on the upstream side of larger rock to increase residence time.

- Gravel bags used for check dams should conform to the requirements of SE-6, Gravel Bag Berms.

- Sandbags used for check dams should conform to SE-8, Sandbag Barrier.

- Fiber rolls used for check dams should conform to SE-5, Fiber Rolls.

- Temporary silt dikes used for check dams should conform to SE-12, Temporary Silt Dikes.

Installation

- Rock should be placed individually by hand or by mechanical methods (no dumping of rock) to achieve complete ditch or swale coverage.

- Tightly abut bags and stack according to detail shown in the figure at the end of this section (pyramid approach). Gravel bags and sandbags should not be stacked any higher than 3 ft.

- Upper rows or gravel and sand bags shall overlap joints in lower rows.

- Fiber rolls should be trenched in, backfilled, and firmly staked in place.

- Install along a level contour.

- HDPE check dams, temporary silt dikes, and other manufactured products should be used and installed per manufacturer specifications.

Costs

Cost consists of labor costs if materials are readily available (such as gravel on-site). If material must be imported, costs will increase. For other material and installation costs, see SE-5, SE-6, SE-8, SE-12, and SE-14.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Replace missing rock, bags, rolls, etc. Replace bags or rolls that have degraded or have become damaged.

- If the check dam is used as a sediment capture device, sediment that accumulates behind the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height.
- If the check dam is used as a grade control structure, sediment removal is not required as long as the system continues to control the grade.
- Inspect areas behind check dams for pools of standing water, especially if subjected to daily non-stormwater discharges.
- Remove accumulated sediment prior to permanent seeding or soil stabilization.
- Remove check dam and accumulated sediment when check dams are no longer needed.

References

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Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

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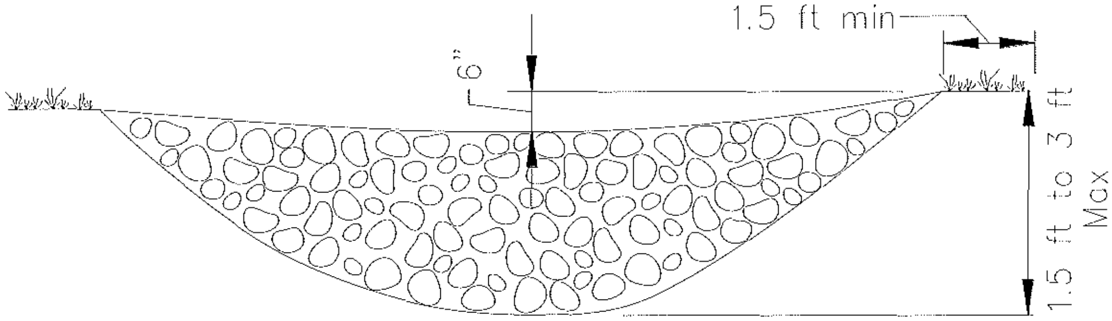
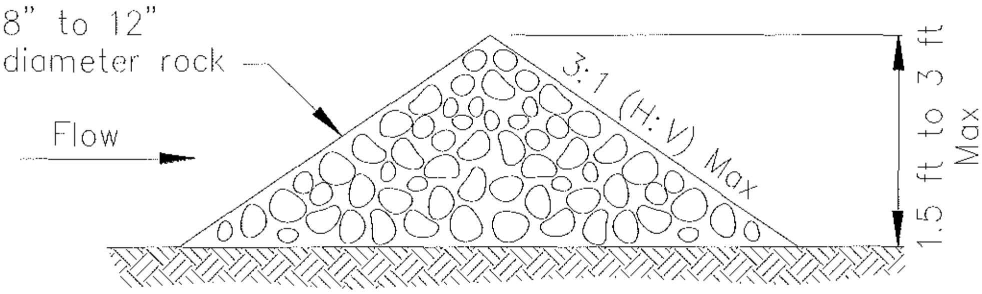
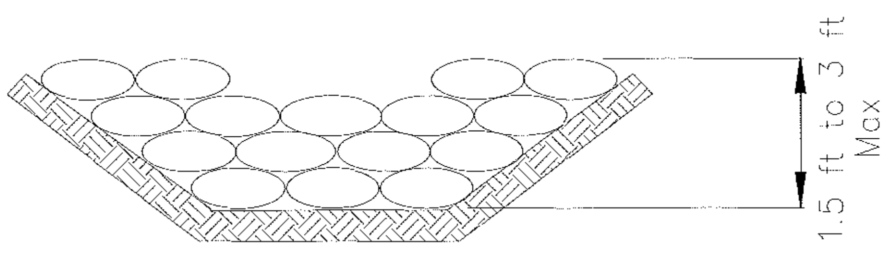


ELEVATION

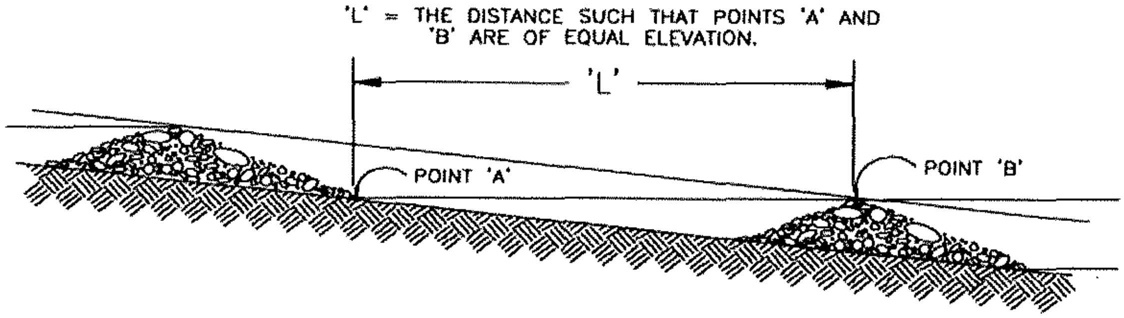


TYPICAL ROCK CHECK DAM SECTION

ROCK CHECK DAM
NOT TO SCALE

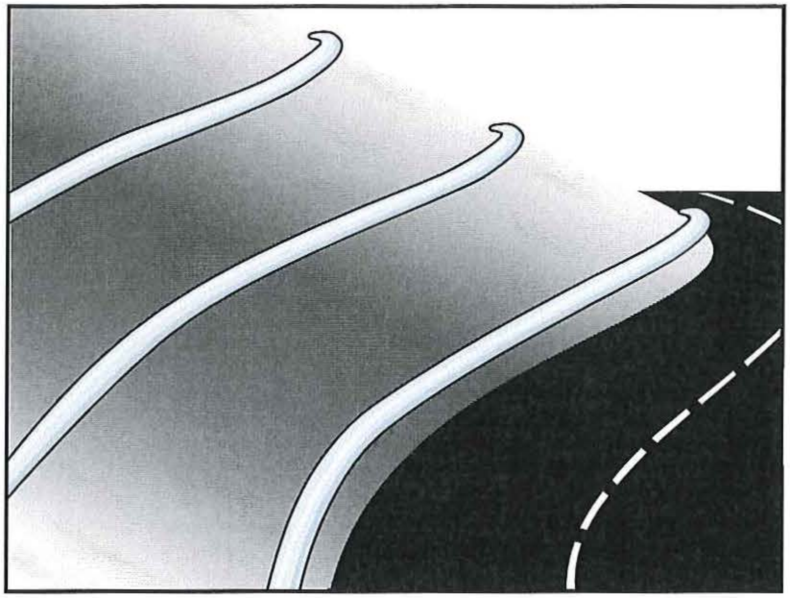


GRAVEL BAG CHECK DAM ELEVATION
NOT TO SCALE



SPACING BETWEEN CHECK DAMS

Fiber Rolls SE-5



Categories

EC	Erosion Control	☒
SE	Sediment Control	☑
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence

SE-6 Gravel Bag Berm

SE-8 Sandbag Barrier

SE-12 Manufactured Linear Sediment Controls

SE-14 Biofilter Bags

Description and Purpose

A fiber roll consists of straw, coir, or other biodegradable materials bound into a tight tubular roll wrapped by netting, which can be photodegradable or natural. Additionally, gravel core fiber rolls are available, which contain an imbedded ballast material such as gravel or sand for additional weight when staking the rolls are not feasible (such as use as inlet protection). When fiber rolls are placed at the toe and on the face of slopes along the contours, they intercept runoff, reduce its flow velocity, release the runoff as sheet flow, and provide removal of sediment from the runoff (through sedimentation). By interrupting the length of a slope, fiber rolls can also reduce sheet and rill erosion until vegetation is established.

Suitable Applications

Fiber rolls may be suitable:

- Along the toe, top, face, and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow.
- At the end of a downward slope where it transitions to a steeper slope.
- Along the perimeter of a project.
- As check dams in unlined ditches with minimal grade.
- Down-slope of exposed soil areas.
- At operational storm drains as a form of inlet protection.

- Around temporary stockpiles.

Limitations

- Fiber rolls are not effective unless trenched in and staked.
- Not intended for use in high flow situations.
- Difficult to move once saturated.
- If not properly staked and trenched in, fiber rolls could be transported by high flows.
- Fiber rolls have a very limited sediment capture zone.
- Fiber rolls should not be used on slopes subject to creep, slumping, or landslide.
- Rolls typically function for 12-24 months depending upon local conditions.

Implementation

Fiber Roll Materials

- Fiber rolls should be prefabricated.
- Fiber rolls may come manufactured containing polyacrylamide (PAM), a flocculating agent within the roll. Fiber rolls impregnated with PAM provide additional sediment removal capabilities and should be used in areas with fine, clayey or silty soils to provide additional sediment removal capabilities. Monitoring may be required for these installations.
- Fiber rolls are made from weed free rice straw, flax, or a similar agricultural material bound into a tight tubular roll by netting.
- Typical fiber rolls vary in diameter from 9 in. to 20 in. Larger diameter rolls are available as well.

Installation

- Locate fiber rolls on level contours spaced as follows:
  - Slope inclination of 4:1 (H:V) or flatter: Fiber rolls should be placed at a maximum interval of 20 ft.
  - Slope inclination between 4:1 and 2:1 (H:V): Fiber Rolls should be placed at a maximum interval of 15 ft. (a closer spacing is more effective).
  - Slope inclination 2:1 (H:V) or greater: Fiber Rolls should be placed at a maximum interval of 10 ft. (a closer spacing is more effective).
- Prepare the slope before beginning installation.
- Dig small trenches across the slope on the contour. The trench depth should be ¼ to 1/3 of the thickness of the roll, and the width should equal the roll diameter, in order to provide area to backfill the trench.

- It is critical that rolls are installed perpendicular to water movement, and parallel to the slope contour.
- Start building trenches and installing rolls from the bottom of the slope and work up.
- It is recommended that pilot holes be driven through the fiber roll. Use a straight bar to drive holes through the roll and into the soil for the wooden stakes.
- Turn the ends of the fiber roll up slope to prevent runoff from going around the roll.
- Stake fiber rolls into the trench.
  - Drive stakes at the end of each fiber roll and spaced 4 ft maximum on center.
  - Use wood stakes with a nominal classification of 0.75 by 0.75 in. and minimum length of 24 in.
- If more than one fiber roll is placed in a row, the rolls should be overlapped, not abutted.
- See typical fiber roll installation details at the end of this fact sheet.

Removal

- Fiber rolls can be left in place or removed depending on the type of fiber roll and application (temporary vs. permanent installation). Typically, fiber rolls encased with plastic netting are used for a temporary application because the netting does not biodegrade. Fiber rolls used in a permanent application are typically encased with a biodegradeable material and are left in place. Removal of a fiber roll used in a permanent application can result in greater disturbance.
- Temporary installations should only be removed when up gradient areas are stabilized per General Permit requirements, and/or pollutant sources no longer present a hazard. But, they should also be removed before vegetation becomes too mature so that the removal process does not disturb more soil and vegetation than is necessary.

Costs

Material costs for regular fiber rolls range from $20 - $30 per 25 ft roll.

Material costs for PAM impregnated fiber rolls range between 7.00-$9.00 per linear foot, based upon vendor research.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Repair or replace split, torn, unraveling, or slumping fiber rolls.
- If the fiber roll is used as a sediment capture device, or as an erosion control device to maintain sheet flows, sediment that accumulates in the BMP should be periodically removed

in order to maintain BMP effectiveness. Sediment should be removed when sediment accumulation reaches one-third the designated sediment storage depth.

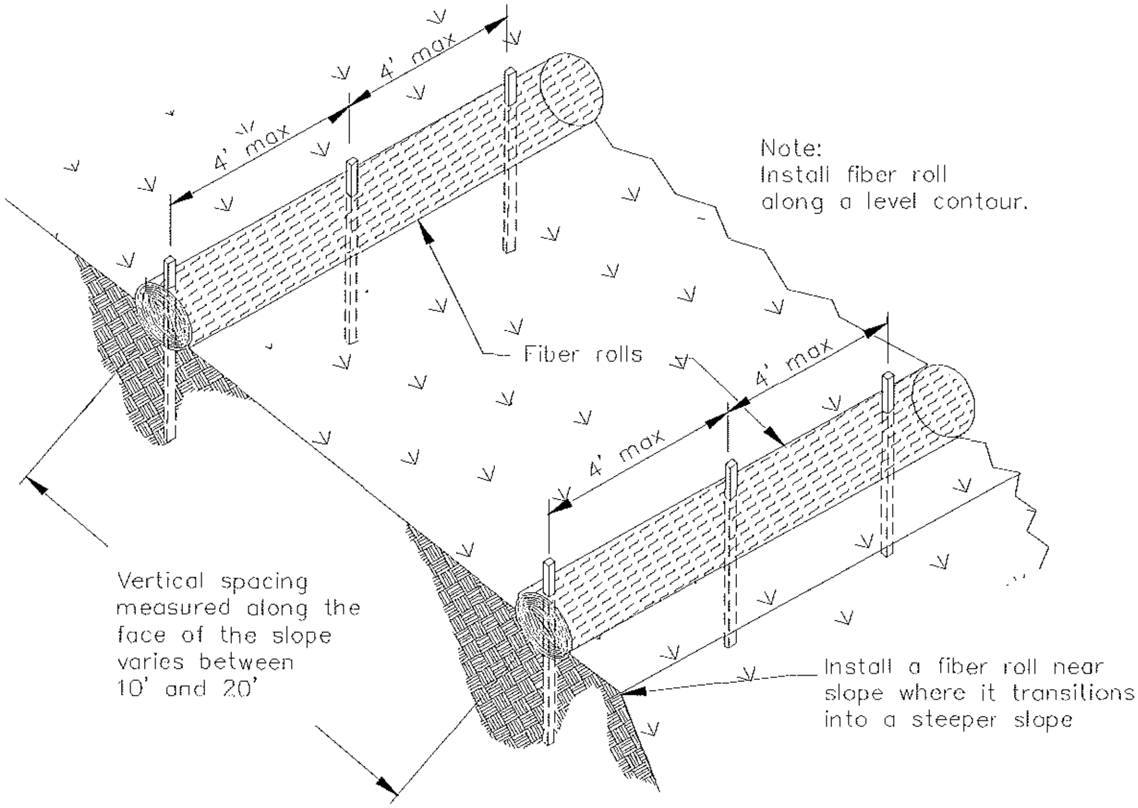
- If fiber rolls are used for erosion control, such as in a check dam, sediment removal should not be required as long as the system continues to control the grade. Sediment control BMPs will likely be required in conjunction with this type of application.

- Repair any rills or gullies promptly.

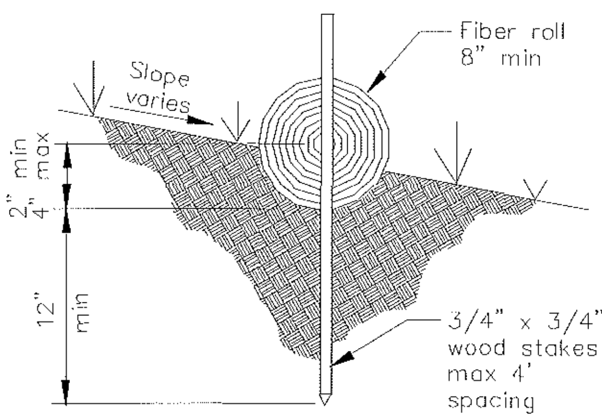
References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.



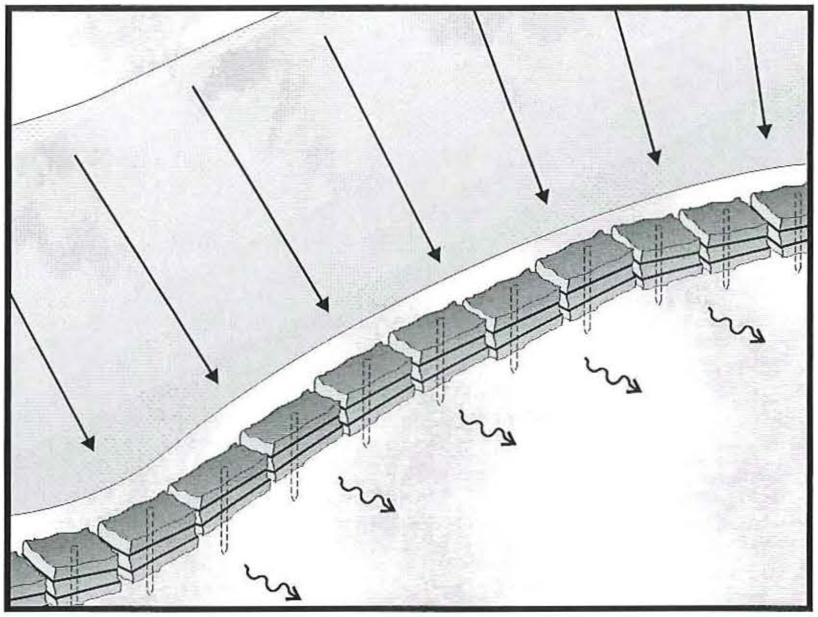
TYPICAL FIBER ROLL INSTALLATION
N.T.S.



ENTRENCHMENT DETAIL
N.T.S.

Straw Bale Barrier

SE-9



Categories

EC	Erosion Control	☒
SE	Sediment Control	☑
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence

SE-5 Fiber Rolls

SE-6 Gravel Bag Berm

SE-8 Sandbag Barrier

SE-12 Temporary Silt Dike

SE-14 Biofilter Bags

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Description and Purpose

A straw bale barrier is a series of straw bales placed on a level contour to intercept sheet flows. Straw bale barriers pond sheet-flow runoff, allowing sediment to settle out.

Suitable Applications

Straw bale barriers may be suitable:

- As a linear sediment control measure:
  - Below the toe of slopes and erodible slopes
  - As sediment traps at culvert/pipe outlets
  - Below other small cleared areas
  - Along the perimeter of a site
  - Down slope of exposed soil areas
  - Around temporary stockpiles and spoil areas
  - Parallel to a roadway to keep sediment off paved areas
  - Along streams and channels
- As linear erosion control measure:
  - Along the face and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow

- At the top of slopes to divert runoff away from disturbed slopes
- As check dams across mildly sloped construction roads

Limitations

Straw bale barriers:

- Are not to be used for extended periods of time because they tend to rot and fall apart
- Are suitable only for sheet flow on slopes of 10 % or flatter
- Are not appropriate for large drainage areas, limit to one acre or less
- May require constant maintenance due to rotting
- Are not recommended for concentrated flow, inlet protection, channel flow, and live streams
- Cannot be made of bale bindings of jute or cotton
- Require labor-intensive installation and maintenance
- Cannot be used on paved surfaces
- Should not to be used for drain inlet protection
- Should not be used on lined ditches
- May introduce undesirable non-native plants to the area

Implementation

General

A straw bale barrier consists of a row of straw bales placed on a level contour. When appropriately placed, a straw bale barrier intercepts and slows sheet flow runoff, causing temporary ponding. The temporary ponding provides quiescent conditions allowing sediment to settle. Straw bale barriers also interrupt the slope length and thereby reduce erosion by reducing the tendency of sheet flows to concentrate into rivulets, which erode rills, and ultimately gullies, into disturbed, sloped soils.

Straw bale barriers have not been as effective as expected due to improper use. These barriers have been placed in streams and drainage ways where runoff volumes and velocities have caused the barriers to wash out. In addition, failure to stake and entrench the straw bale has allowed undercutting and end flow. Use of straw bale barriers in accordance with this BMP should produce acceptable results.

Design and Layout

- Locate straw bale barriers on a level contour.
  - Slopes up to 10:1 (H:V): Straw bales should be placed at a maximum interval of 50 ft (a closer spacing is more effective), with the first row near the toe of slope.
  - Slopes greater than 10:1 (H:V): Not recommended.

- Turn the ends of the straw bale barrier up slope to prevent runoff from going around the barrier.

- Allow sufficient space up slope from the barrier to allow ponding, and to provide room for sediment storage.

- For installation near the toe of the slope, consider moving the barrier away from the slope toe to facilitate cleaning. To prevent flow behind the barrier, sand bags can be placed perpendicular to the barrier to serve as cross barriers.

- Drainage area should not exceed 1 acre, or 0.25 acre per 100 ft of barrier.

- Maximum flow path to the barrier should be limited to 100 ft.

- Straw bale barriers should consist of two parallel rows.

  - Butt ends of bales tightly

  - Stagger butt joints between front and back row

  - Each row of bales must be trenched in and firmly staked

- Straw bale barriers are limited in height to one bale laid on its side.

- Anchor bales with either two wood stakes or four bars driven through the bale and into the soil. Drive the first stake towards the butt joint with the adjacent bale to force the bales together.

- See attached figure for installation details.

Materials

- ***Straw Bale Size:*** Each straw bale should be a minimum of 14 in. wide, 18 in. in height, 36 in. in length and should have a minimum mass of 50 lbs. The straw bale should be composed entirely of vegetative matter, except for the binding material.

- ***Bale Bindings:*** Bales should be bound by steel wire, nylon or polypropylene string placed horizontally. Jute and cotton binding should not be used. Baling wire should be a minimum diameter of 14 gauge. Nylon or polypropylene string should be approximately 12 gauge in diameter with a breaking strength of 80 lbs force.

- ***Stakes:*** Wood stakes should be commercial quality lumber of the size and shape shown on the plans. Each stake should be free from decay, splits or cracks longer than the thickness of the stake, or other defects that would weaken the stakes and cause the stakes to be structurally unsuitable. Steel bar reinforcement should be equal to a #4 designation or greater. End protection should be provided for any exposed bar reinforcement.

Costs

Straw bales cost $5 - $7 each. Adequate labor should be budgeted for installation and maintenance.

Inspection and Maintenance

Maintenance

- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Straw bales degrade, especially when exposed to moisture. Rotting bales will need to be replaced on a regular basis.

- Replace or repair damaged bales as needed.

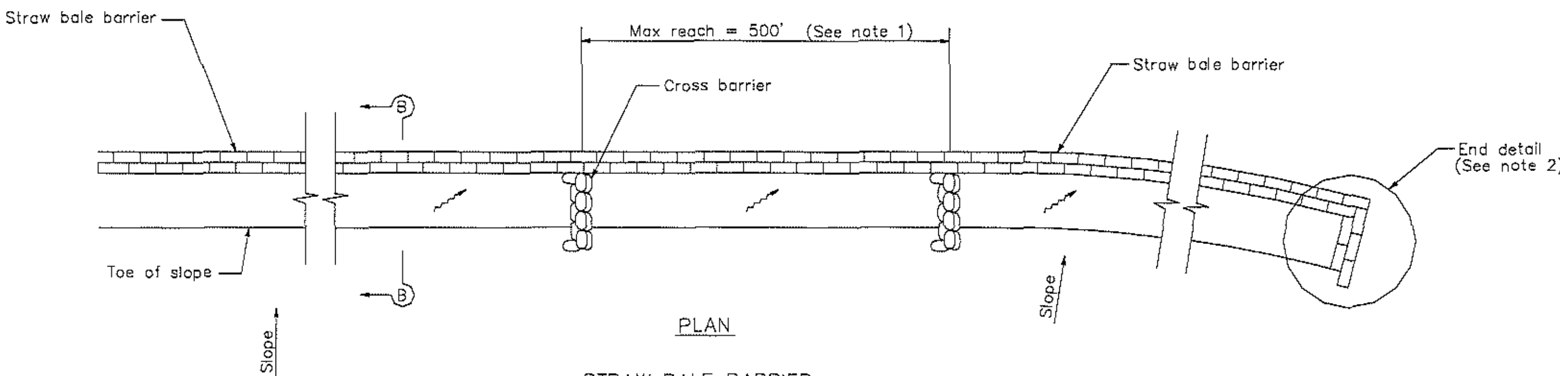
- Repair washouts or other damages as needed.

- Sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed at an appropriate location.

- Remove straw bales when no longer needed. Remove sediment accumulation, and clean, re-grade, and stabilize the area. Removed sediment should be incorporated in the project or disposed of.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.



PLAN

STRAW BALE BARRIER

NOTES

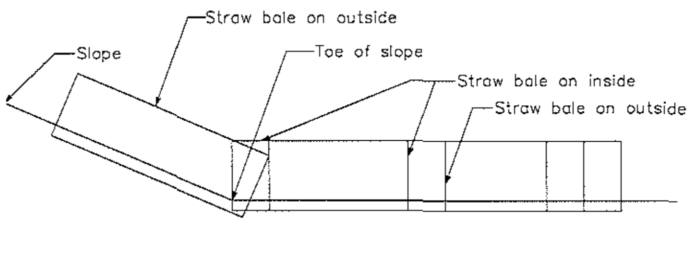
1. Construct the length of each reach so that the change in base elevation along the reach does not exceed 1/2 the height of the linear barrier. In no case shall the reach length exceed 500'.
2. The end of barrier shall be turned up slope.
3. Dimension may vary to fit field condition.
4. Stake dimensions are nominal.
5. Place straw bales tightly together.
6. Tamp embedment spoils against sides of installed bales.
7. Drive angled wood stake before vertical stake to ensure tight abutment to adjacent bale.
8. Sandbag cross barriers should be a min of 1/2 and a max of 2/3 the height of the linear barrier.
9. Sandbag rows and layers should be offset to eliminate gaps.

LEGEND

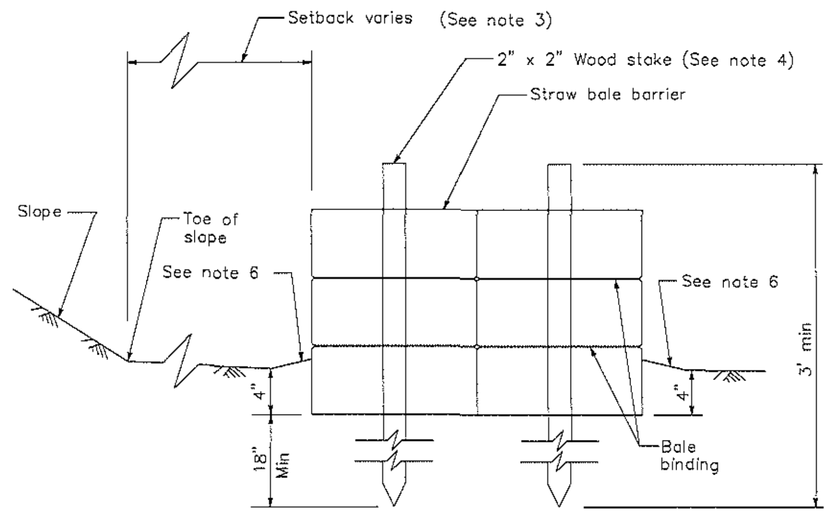
DIRECTION OF FLOW

LEGEND

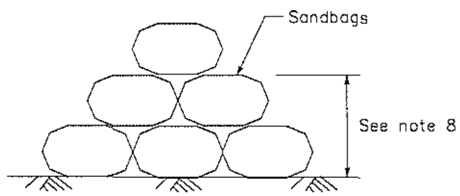
DIRECTION OF FLOW



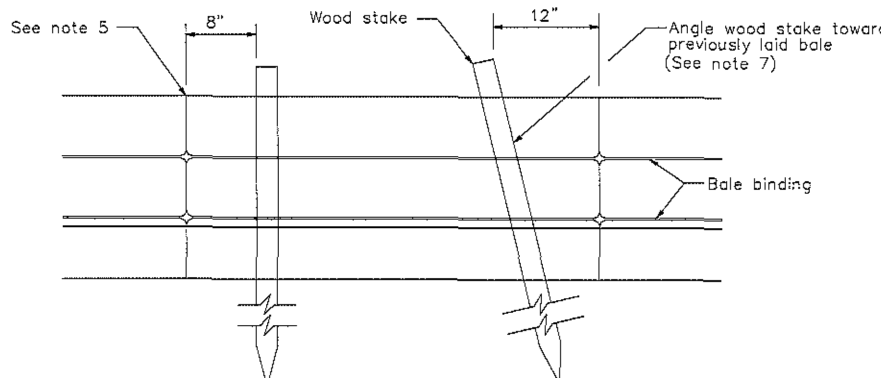
END DETAIL



SECTION B–B

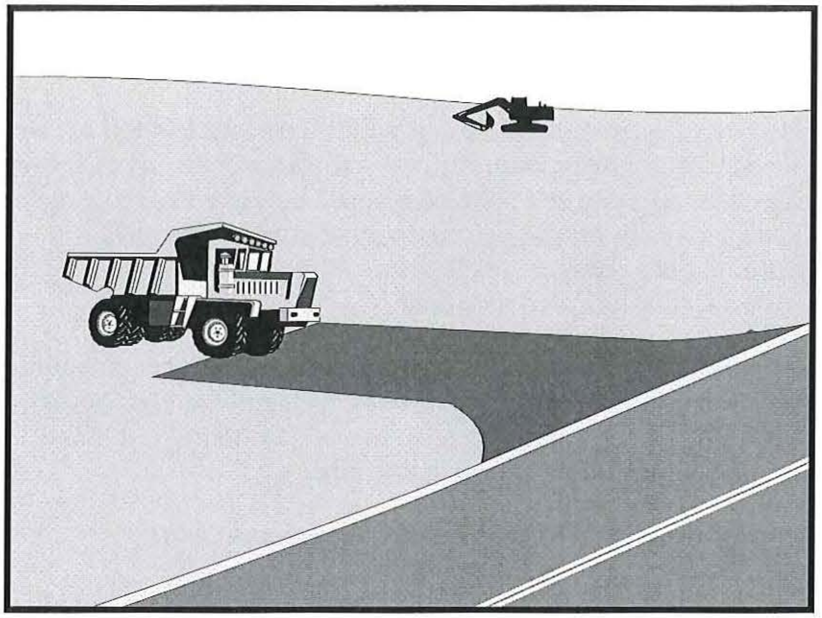


SANDBAG CROSS BARRIER



PROFILE

Stabilized Construction Entrance/Exit TC-1



Categories

EC	Erosion Control	☒
SE	Sediment Control	☒
TC	Tracking Control	☑
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

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Description and Purpose

A stabilized construction access is defined by a point of entrance/exit to a construction site that is stabilized to reduce the tracking of mud and dirt onto public roads by construction vehicles.

Suitable Applications

Use at construction sites:

- Where dirt or mud can be tracked onto public roads.
- Adjacent to water bodies.
- Where poor soils are encountered.
- Where dust is a problem during dry weather conditions.

Limitations

- Entrances and exits require periodic top dressing with additional stones.
- This BMP should be used in conjunction with street sweeping on adjacent public right of way.
- Entrances and exits should be constructed on level ground only.
- Stabilized construction entrances are rather expensive to construct and when a wash rack is included, a sediment trap of some kind must also be provided to collect wash water runoff.

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Implementation

General

A stabilized construction entrance is a pad of aggregate underlain with filter cloth located at any point where traffic will be entering or leaving a construction site to or from a public right of way, street, alley, sidewalk, or parking area. The purpose of a stabilized construction entrance is to reduce or eliminate the tracking of sediment onto public rights of way or streets. Reducing tracking of sediments and other pollutants onto paved roads helps prevent deposition of sediments into local storm drains and production of airborne dust.

Where traffic will be entering or leaving the construction site, a stabilized construction entrance should be used. NPDES permits require that appropriate measures be implemented to prevent tracking of sediments onto paved roadways, where a significant source of sediments is derived from mud and dirt carried out from unpaved roads and construction sites.

Stabilized construction entrances are moderately effective in removing sediment from equipment leaving a construction site. The entrance should be built on level ground. Advantages of the Stabilized Construction Entrance/Exit is that it does remove some sediment from equipment and serves to channel construction traffic in and out of the site at specified locations. Efficiency is greatly increased when a washing rack is included as part of a stabilized construction entrance/exit.

Design and Layout

- Construct on level ground where possible.
- Select 3 to 6 in. diameter stones.
- Use minimum depth of stones of 12 in. or as recommended by soils engineer.
- Construct length of 50 ft or maximum site will allow, and 10 ft minimum width or to accommodate traffic.
- Rumble racks constructed of steel panels with ridges and installed in the stabilized entrance/exit will help remove additional sediment and to keep adjacent streets clean.
- Provide ample turning radii as part of the entrance.
- Limit the points of entrance/exit to the construction site.
- Limit speed of vehicles to control dust.
- Properly grade each construction entrance/exit to prevent runoff from leaving the construction site.
- Route runoff from stabilized entrances/exits through a sediment trapping device before discharge.
- Design stabilized entrance/exit to support heaviest vehicles and equipment that will use it.

- Select construction access stabilization (aggregate, asphaltic concrete, concrete) based on longevity, required performance, and site conditions. Do not use asphalt concrete (AC) grindings for stabilized construction access/roadway.

- If aggregate is selected, place crushed aggregate over geotextile fabric to at least 12 in. depth, or place aggregate to a depth recommended by a geotechnical engineer. A crushed aggregate greater than 3 in. but smaller than 6 in. should be used.

- Designate combination or single purpose entrances and exits to the construction site.

- Require that all employees, subcontractors, and suppliers utilize the stabilized construction access.

- Implement SE-7, Street Sweeping and Vacuuming, as needed.

- All exit locations intended to be used for more than a two-week period should have stabilized construction entrance/exit BMPs.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMPs are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Inspect local roads adjacent to the site daily. Sweep or vacuum to remove visible accumulated sediment.

- Remove aggregate, separate and dispose of sediment if construction entrance/exit is clogged with sediment.

- Keep all temporary roadway ditches clear.

- Check for damage and repair as needed.

- Replace gravel material when surface voids are visible.

- Remove all sediment deposited on paved roadways within 24 hours.

- Remove gravel and filter fabric at completion of construction

Costs

Average annual cost for installation and maintenance may vary from $1,200 to $4,800 each, averaging $2,400 per entrance. Costs will increase with addition of washing rack, and sediment trap. With wash rack, costs range from $1,200 - $6,000 each, averaging $3,600 per entrance.

References

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

National Management Measures to Control Nonpoint Source Pollution from Urban Areas, USEPA Agency, 2002.

Proposed Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters, Work Group Working Paper, USEPA, April 1992.

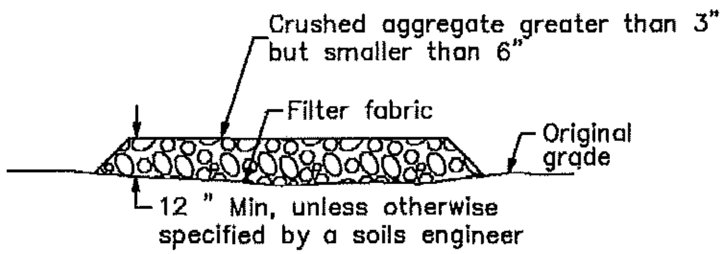
Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

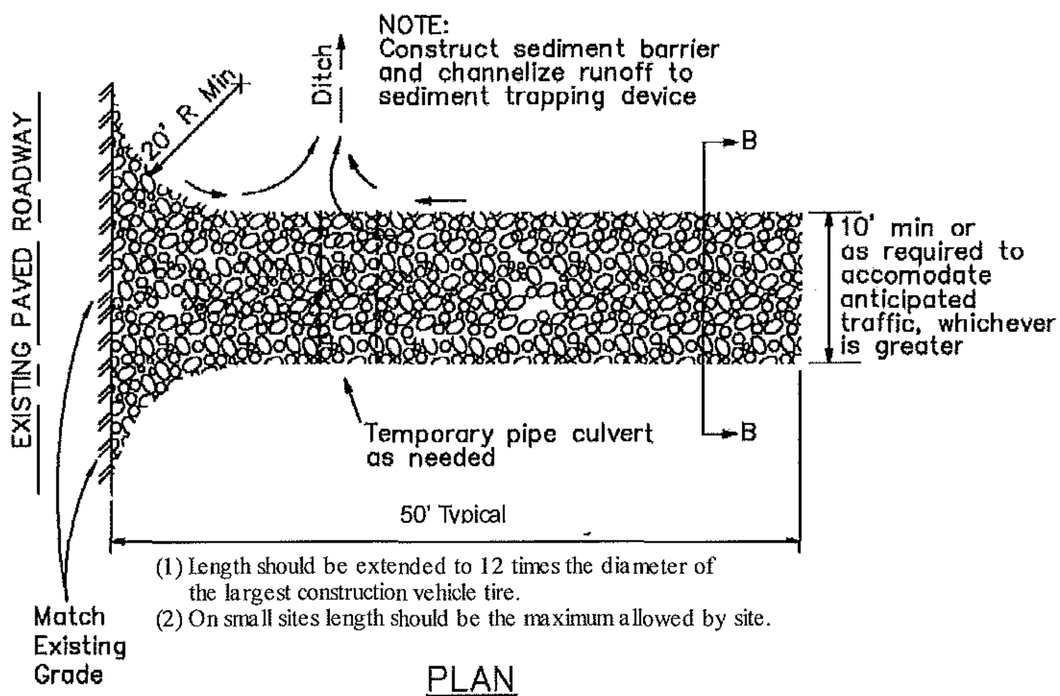
Virginia Erosion and Sedimentation Control Handbook, Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation, 1991.

Guidance Specifying Management Measures for Nonpoint Pollution in Coastal Waters, EPA 840-B-9-002, USEPA, Office of Water, Washington, DC, 1993.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.

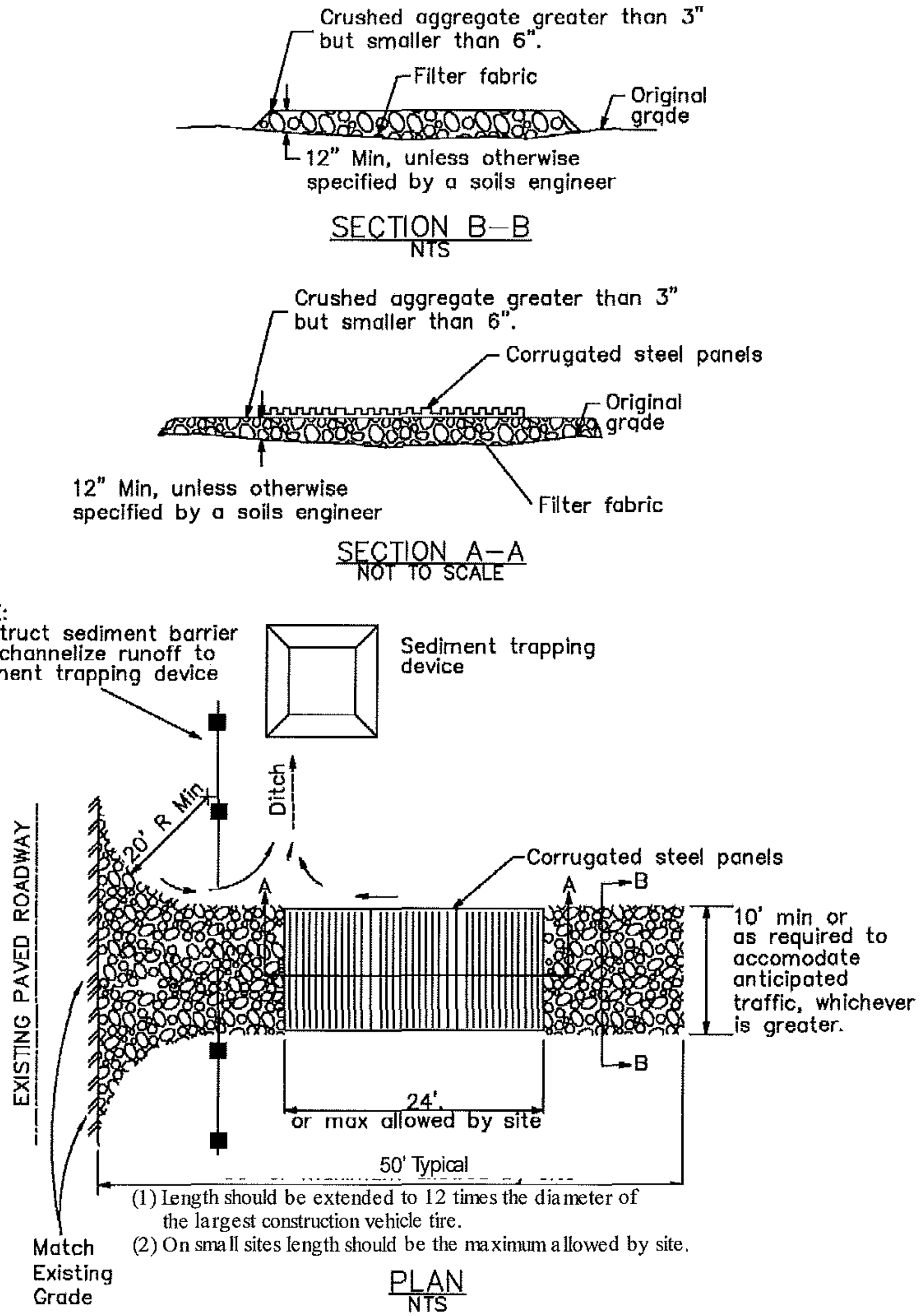


SECTION B–B
NTS



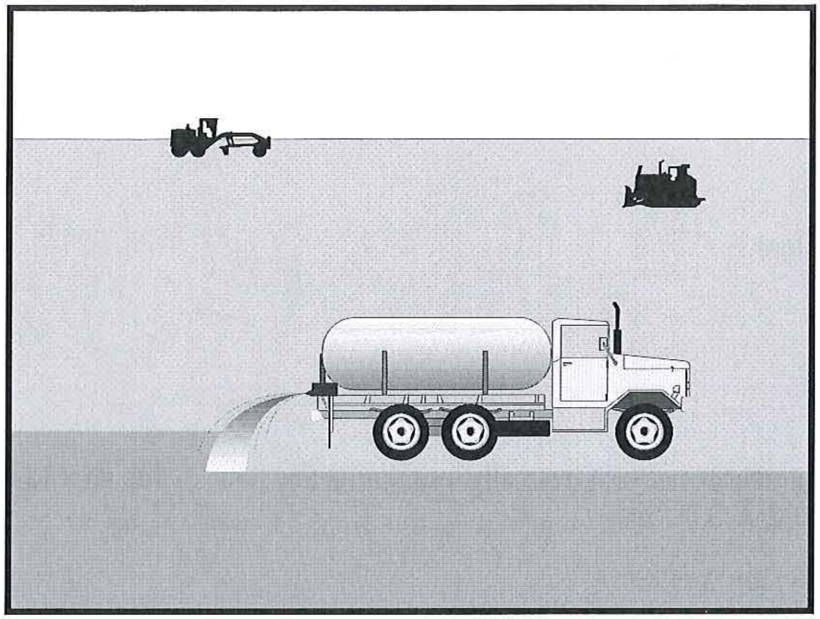
(1) Length should be extended to 12 times the diameter of the largest construction vehicle tire.
(2) On small sites length should be the maximum allowed by site.

PLAN
NTS


Crushed aggregate greater than 3" but smaller than 6".
Filter fabric
Original grade
12" Min, unless otherwise specified by a soils engineer
SECTION B-B
NTS
Crushed aggregate greater than 3" but smaller than 6".
Corrugated steel panels
Original grade
12" Min, unless otherwise specified by a soils engineer
Filter fabric
SECTION A-A
NOT TO SCALE
NOTE:
Construct sediment barrier and channelize runoff to sediment trapping device
Sediment trapping device
Ditch
20' R Min
EXISTING PAVED ROADWAY
Corrugated steel panels
A
A
B
B
10' min or as required to accomodate anticipated traffic, whichever is greater.
24', or max allowed by site
50' Typical
(1) Length should be extended to 12 times the diameter of the largest construction vehicle tire.
(2) On small sites length should be the maximum allowed by site.
Match Existing Grade
PLAN
NTS

Wind Erosion Control

WE-1



Categories

EC	Erosion Control	
SE	Sediment Control	☒
TC	Tracking Control	
WE	Wind Erosion Control	☑
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-5 Soil Binders

Description and Purpose

Wind erosion or dust control consists of applying water or other chemical dust suppressants as necessary to prevent or alleviate dust nuisance generated by construction activities. Covering small stockpiles or areas is an alternative to applying water or other dust palliatives.

California's Mediterranean climate, with a short "wet" season and a typically long, hot "dry" season, allows the soils to thoroughly dry out. During the dry season, construction activities are at their peak, and disturbed and exposed areas are increasingly subject to wind erosion, sediment tracking and dust generated by construction equipment. Site conditions and climate can make dust control more of an erosion problem than water based erosion. Additionally, many local agencies, including Air Quality Management Districts, require dust control and/or dust control permits in order to comply with local nuisance laws, opacity laws (visibility impairment) and the requirements of the Clean Air Act. Wind erosion control is required to be implemented at all construction sites greater than 1 acre by the General Permit.

Suitable Applications

Most BMPs that provide protection against water-based erosion will also protect against wind-based erosion and dust control requirements required by other agencies will generally meet wind erosion control requirements for water quality protection. Wind erosion control BMPs are suitable during the following construction activities:

- Construction vehicle traffic on unpaved roads
- Drilling and blasting activities
- Soils and debris storage piles
- Batch drop from front-end loaders
- Areas with unstabilized soil
- Final grading/site stabilization

Limitations

- Watering prevents dust only for a short period (generally less than a few hours) and should be applied daily (or more often) to be effective.
- Over watering may cause erosion and track-out.
- Oil or oil-treated subgrade should not be used for dust control because the oil may migrate into drainageways and/or seep into the soil.
- Chemical dust suppression agents may have potential environmental impacts. Selected chemical dust control agents should be environmentally benign.
- Effectiveness of controls depends on soil, temperature, humidity, wind velocity and traffic.
- Chemical dust suppression agents should not be used within 100 feet of wetlands or water bodies.
- Chemically treated subgrades may make the soil water repellant, interfering with long-term infiltration and the vegetation/re-vegetation of the site. Some chemical dust suppressants may be subject to freezing and may contain solvents and should be handled properly.
- In compacted areas, watering and other liquid dust control measures may wash sediment or other constituents into the drainage system.
- If the soil surface has minimal natural moisture, the affected area may need to be pre-wetted so that chemical dust control agents can uniformly penetrate the soil surface.

Implementation

Dust Control Practices

Dust control BMPs generally stabilize exposed surfaces and minimize activities that suspend or track dust particles. The following table presents dust control practices that can be applied to varying site conditions that could potentially cause dust. For heavily traveled and disturbed areas, wet suppression (watering), chemical dust suppression, gravel asphalt surfacing, temporary gravel construction entrances, equipment wash-out areas, and haul truck covers can be employed as dust control applications. Permanent or temporary vegetation and mulching can be employed for areas of occasional or no construction traffic. Preventive measures include minimizing surface areas to be disturbed, limiting onsite vehicle traffic to 15 mph or less, and controlling the number and activity of vehicles on a site at any given time.

Chemical dust suppressants include: mulch and fiber based dust palliatives (e.g. paper mulch with gypsum binder), salts and brines (e.g. calcium chloride, magnesium chloride), non-petroleum based organics (e.g. vegetable oil, lignosulfonate), petroleum based organics (e.g. asphalt emulsion, dust oils, petroleum resins), synthetic polymers (e.g. polyvinyl acetate, vinyls, acrylic), clay additives (e.g. bentonite, montimorillonite) and electrochemical products (e.g. enzymes, ionic products).

Site Condition	Dust Control Practices							
	Permanent Vegetation	Mulching	Wet Suppression (Watering)	Chemical Dust Suppression	Gravel or Asphalt	Temporary Gravel Construction Entrances/Equipment Wash Down	Synthetic Covers	Minimize Extent of Disturbed Area
Disturbed Areas not Subject to Traffic	X	X	X	X	X			X
Disturbed Areas Subject to Traffic			X	X	X	X		X
Material Stockpiles		X	X	X			X	X
Demolition			X			X	X	
Clearing/ Excavation			X	X				X
Truck Traffic on Unpaved Roads			X	X	X	X	X	
Tracking					X	X		

Additional preventive measures include:

- Schedule construction activities to minimize exposed area (see EC-1, Scheduling).
- Quickly treat exposed soils using water, mulching, chemical dust suppressants, or stone/gravel layering.
- Identify and stabilize key access points prior to commencement of construction.
- Minimize the impact of dust by anticipating the direction of prevailing winds.
- Restrict construction traffic to stabilized roadways within the project site, as practicable.
- Water should be applied by means of pressure-type distributors or pipelines equipped with a spray system or hoses and nozzles that will ensure even distribution.
- All distribution equipment should be equipped with a positive means of shutoff.
- Unless water is applied by means of pipelines, at least one mobile unit should be available at all times to apply water or dust palliative to the project.
- If reclaimed waste water is used, the sources and discharge must meet California Department of Health Services water reclamation criteria and the Regional Water Quality

Control Board (RWQCB) requirements. Non-potable water should not be conveyed in tanks or drain pipes that will be used to convey potable water and there should be no connection between potable and non-potable supplies. Non-potable tanks, pipes, and other conveyances should be marked, "NON-POTABLE WATER - DO NOT DRINK."

- Pave or chemically stabilize access points where unpaved traffic surfaces adjoin paved roads.
- Provide covers for haul trucks transporting materials that contribute to dust.
- Provide for rapid clean up of sediments deposited on paved roads. Furnish stabilized construction road entrances and wheel wash areas.
- Stabilize inactive areas of construction sites using temporary vegetation or chemical stabilization methods.

For chemical stabilization, there are many products available for chemically stabilizing gravel roadways and stockpiles. If chemical stabilization is used, the chemicals should not create any adverse effects on stormwater, plant life, or groundwater and should meet all applicable regulatory requirements.

Costs

Installation costs for water and chemical dust suppression vary based on the method used and the length of effectiveness. Annual costs may be high since some of these measures are effective for only a few hours to a few days.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities.
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Check areas protected to ensure coverage.
- Most water-based dust control measures require frequent application, often daily or even multiple times per day. Obtain vendor or independent information on longevity of chemical dust suppressants.

References

Best Management Practices and Erosion Control Manual for Construction Sites, Flood Control District of Maricopa County, Arizona, September 1992.

California Air Pollution Control Laws, California Air Resources Board, updated annually.

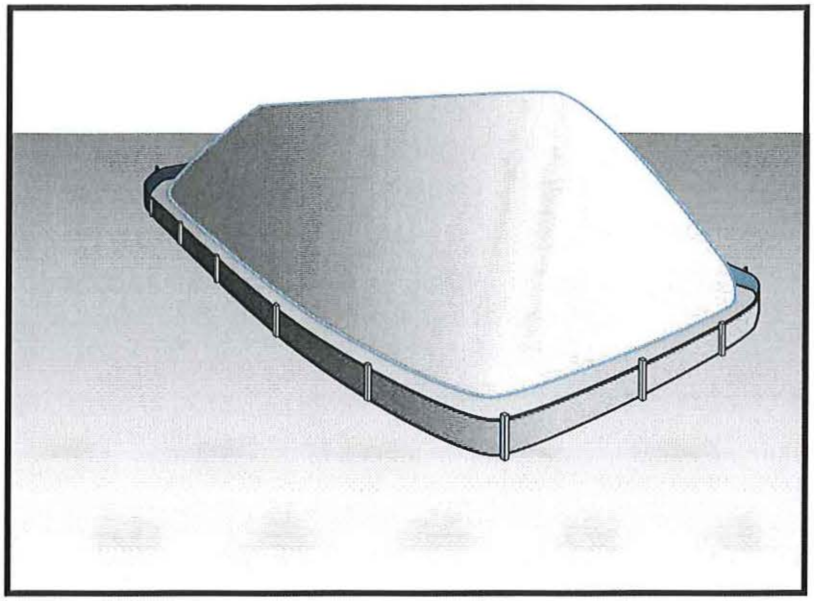
Construction Manual, Chapter 4, Section 10, "Dust Control"; Section 17, "Watering"; and Section 18, "Dust Palliative", California Department of Transportation (Caltrans), July 2001.

Prospects for Attaining the State Ambient Air Quality Standards for Suspended Particulate Matter (PM10), Visibility Reducing Particles, Sulfates, Lead, and Hydrogen Sulfide, California Air Resources Board, April 1991.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stockpile Management

WM-3



Categories		
EC	Erosion Control	
SE	Sediment Control	☒
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☒
WM	Waste Management and Materials Pollution Control	☑

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents	
Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

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Description and Purpose

Stockpile management procedures and practices are designed to reduce or eliminate air and stormwater pollution from stockpiles of soil, soil amendments, sand, paving materials such as portland cement concrete (PCC) rubble, asphalt concrete (AC), asphalt concrete rubble, aggregate base, aggregate sub base or pre-mixed aggregate, asphalt minder (so called "cold mix" asphalt), and pressure treated wood.

Suitable Applications

Implement in all projects that stockpile soil and other loose materials.

Limitations

- Plastic sheeting as a stockpile protection is temporary and hard to manage in windy conditions. Where plastic is used, consider use of plastic tarps with nylon reinforcement which may be more durable than standard sheeting.
- Plastic sheeting can increase runoff volume due to lack of infiltration and potentially cause perimeter control failure.
- Plastic sheeting breaks down faster in sunlight.
- The use of Plastic materials and photodegradable plastics should be avoided.

Implementation

Protection of stockpiles is a year-round requirement. To properly manage stockpiles:

- On larger sites, a minimum of 50 ft separation from concentrated flows of stormwater, drainage courses, and inlets is recommended.
- After 14 days of inactivity, a stockpile is non-active and requires further protection described below. All stockpiles are required to be protected as non-active stockpiles immediately if they are not scheduled to be used within 14 days.
- Protect all stockpiles from stormwater runon using temporary perimeter sediment barriers such as compost berms (SE-13), temporary silt dikes (SE-12), fiber rolls (SE-5), silt fences (SE-1), sandbags (SE-8), gravel bags (SE-6), or biofilter bags (SE-14). Refer to the individual fact sheet for each of these controls for installation information.
- Implement wind erosion control practices as appropriate on all stockpiled material. For specific information, see WE-1, Wind Erosion Control.
- Manage stockpiles of contaminated soil in accordance with WM-7, Contaminated Soil Management.
- Place bagged materials on pallets and under cover.
- Ensure that stockpile coverings are installed securely to protect from wind and rain.
- Some plastic covers withstand weather and sunlight better than others. Select cover materials or methods based on anticipated duration of use.

Protection of Non-Active Stockpiles

A stockpile is considered non-active if it either is not used for 14 days or if it is scheduled not to be used for 14 days or more. Stockpiles need to be protected immediately if they are not scheduled to be used within 14 days. Non-active stockpiles of the identified materials should be protected as follows:

Soil stockpiles

- Soil stockpiles should be covered or protected with soil stabilization measures and a temporary perimeter sediment barrier at all times.
- Temporary vegetation should be considered for topsoil piles that will be stockpiled for extended periods.

Stockpiles of Portland cement concrete rubble, asphalt concrete, asphalt concrete rubble, aggregate base, or aggregate sub base

- Stockpiles should be covered and protected with a temporary perimeter sediment barrier at all times.

Stockpiles of "cold mix"

- Cold mix stockpiles should be placed on and covered with plastic sheeting or comparable material at all times and surrounded by a berm.

Stockpiles of fly ash, stucco, hydrated lime

- Stockpiles of materials that may raise the pH of runoff (i.e., basic materials) should be covered with plastic and surrounded by a berm.

Stockpiles/Storage of wood (Pressure treated with chromated copper arsenate or ammoniacal copper zinc arsenate

- Treated wood should be covered with plastic sheeting or comparable material at all times and surrounded by a berm.

Protection of Active Stockpiles

A stockpile is active when it is being used or is scheduled to be used within 14 days of the previous use. Active stockpiles of the identified materials should be protected as follows:

- All stockpiles should be covered and protected with a temporary linear sediment barrier prior to the onset of precipitation.

- Stockpiles of "cold mix" and treated wood, and basic materials should be placed on and covered with plastic sheeting or comparable material and surrounded by a berm prior to the onset of precipitation.

- The downstream perimeter of an active stockpile should be protected with a linear sediment barrier or berm and runoff should be diverted around or away from the stockpile on the upstream perimeter.

Costs

For cost information associated with stockpile protection refer to the individual erosion or sediment control BMP fact sheet considered for implementation (For example, refer to SE-1 Silt Fence for installation of silt fence around the perimeter of a stockpile.)

Inspection and Maintenance

- Stockpiles must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- It may be necessary to inspect stockpiles covered with plastic sheeting more frequently during certain conditions (for example, high winds or extreme heat).

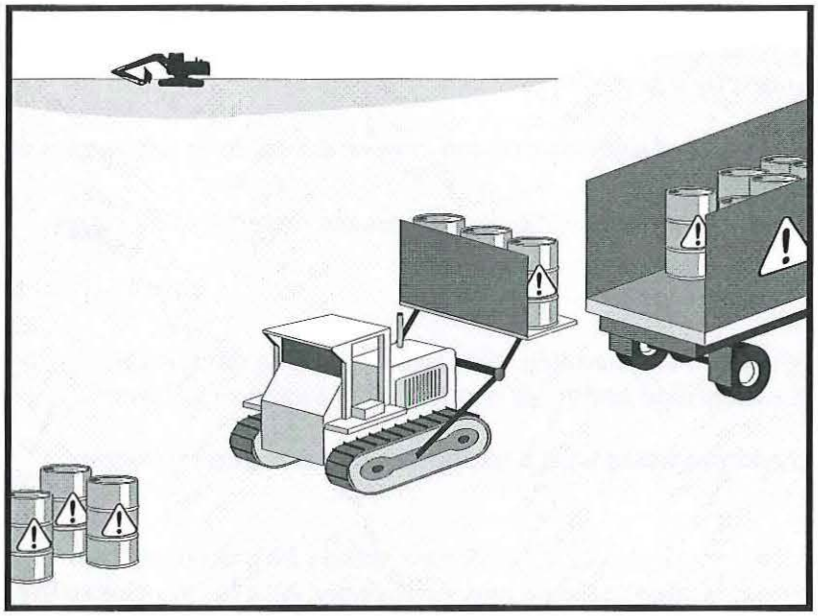
- Repair and/or replace perimeter controls and covers as needed to keep them functioning properly.

- Sediment shall be removed when it reaches one-third of the barrier height.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Hazardous Waste Management WM-6



Categories		
EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents	
Sediment	
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

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Description and Purpose

Prevent or reduce the discharge of pollutants to stormwater from hazardous waste through proper material use, waste disposal, and training of employees and subcontractors.

Suitable Applications

This best management practice (BMP) applies to all construction projects. Hazardous waste management practices are implemented on construction projects that generate waste from the use of:

- Petroleum Products
- Concrete Curing Compounds
- Palliatives
- Septic Wastes
- Stains
- Wood Preservatives
- Asphalt Products
- Pesticides
- Acids
- Paints
- Solvents
- Roofing Tar
- Any materials deemed a hazardous waste in California, Title 22 Division 4.5, or listed in 40 CFR Parts 110, 117, 261, or 302

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In addition, sites with existing structures may contain wastes, which must be disposed of in accordance with federal, state, and local regulations. These wastes include:

- Sandblasting grit mixed with lead-, cadmium-, or chromium-based paints
- Asbestos
- PCBs (particularly in older transformers)

Limitations

- Hazardous waste that cannot be reused or recycled must be disposed of by a licensed hazardous waste hauler.
- Nothing in this BMP relieves the contractor from responsibility for compliance with federal, state, and local laws regarding storage, handling, transportation, and disposal of hazardous wastes.
- This BMP does not cover aerially deposited lead (ADL) soils. For ADL soils refer to WM-7, Contaminated Soil Management.

Implementation

The following steps will help reduce stormwater pollution from hazardous wastes:

Material Use

- Wastes should be stored in sealed containers constructed of a suitable material and should be labeled as required by Title 22 CCR, Division 4.5 and 49 CFR Parts 172, 173, 178, and 179.
- All hazardous waste should be stored, transported, and disposed as required in Title 22 CCR, Division 4.5 and 49 CFR 261-263.
- Waste containers should be stored in temporary containment facilities that should comply with the following requirements:
  - Temporary containment facility should provide for a spill containment volume equal to 1.5 times the volume of all containers able to contain precipitation from a 25 year storm event, plus the greater of 10% of the aggregate volume of all containers or 100% of the capacity of the largest tank within its boundary, whichever is greater.
  - Temporary containment facility should be impervious to the materials stored there for a minimum contact time of 72 hours.
  - Temporary containment facilities should be maintained free of accumulated rainwater and spills. In the event of spills or leaks, accumulated rainwater and spills should be placed into drums after each rainfall. These liquids should be handled as a hazardous waste unless testing determines them to be non-hazardous. Non-hazardous liquids should be sent to an approved disposal site.
  - Sufficient separation should be provided between stored containers to allow for spill cleanup and emergency response access.

- Incompatible materials, such as chlorine and ammonia, should not be stored in the same temporary containment facility.

- Throughout the rainy season, temporary containment facilities should be covered during non-working days, and prior to rain events. Covered facilities may include use of plastic tarps for small facilities or constructed roofs with overhangs.

▪ Drums should not be overfilled and wastes should not be mixed.

▪ Unless watertight, containers of dry waste should be stored on pallets.

▪ Do not over-apply herbicides and pesticides. Prepare only the amount needed. Follow the recommended usage instructions. Over application is expensive and environmentally harmful. Apply surface dressings in several smaller applications, as opposed to one large application. Allow time for infiltration and avoid excess material being carried offsite by runoff. Do not apply these chemicals just before it rains. People applying pesticides must be certified in accordance with federal and state regulations.

▪ Paint brushes and equipment for water and oil based paints should be cleaned within a contained area and should not be allowed to contaminate site soils, watercourses, or drainage systems. Waste paints, thinners, solvents, residues, and sludges that cannot be recycled or reused should be disposed of as hazardous waste. When thoroughly dry, latex paint and paint cans, used brushes, rags, absorbent materials, and drop cloths should be disposed of as solid waste.

▪ Do not clean out brushes or rinse paint containers into the dirt, street, gutter, storm drain, or stream. "Paint out" brushes as much as possible. Rinse water-based paints to the sanitary sewer. Filter and reuse thinners and solvents. Dispose of excess oil-based paints and sludge as hazardous waste.

▪ The following actions should be taken with respect to temporary contaminant:

  - Ensure that adequate hazardous waste storage volume is available.

  - Ensure that hazardous waste collection containers are conveniently located.

  - Designate hazardous waste storage areas onsite away from storm drains or watercourses and away from moving vehicles and equipment to prevent accidental spills.

  - Minimize production or generation of hazardous materials and hazardous waste on the job site.

  - Use containment berms in fueling and maintenance areas and where the potential for spills is high.

  - Segregate potentially hazardous waste from non-hazardous construction site debris.

  - Keep liquid or semi-liquid hazardous waste in appropriate containers (closed drums or similar) and under cover.

- Clearly label all hazardous waste containers with the waste being stored and the date of accumulation.
- Place hazardous waste containers in secondary containment.
- Do not allow potentially hazardous waste materials to accumulate on the ground.
- Do not mix wastes.
- Use all of the product before disposing of the container.
- Do not remove the original product label; it contains important safety and disposal information.

Waste Recycling Disposal

- Select designated hazardous waste collection areas onsite.
- Hazardous materials and wastes should be stored in covered containers and protected from vandalism.
- Place hazardous waste containers in secondary containment.
- Do not mix wastes, this can cause chemical reactions, making recycling impossible and complicating disposal.
- Recycle any useful materials such as used oil or water-based paint.
- Make sure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.
- Arrange for regular waste collection before containers overflow.
- Make sure that hazardous waste (e.g., excess oil-based paint and sludge) is collected, removed, and disposed of only at authorized disposal areas.

Disposal Procedures

- Waste should be disposed of by a licensed hazardous waste transporter at an authorized and licensed disposal facility or recycling facility utilizing properly completed Uniform Hazardous Waste Manifest forms.
- A Department of Health Services certified laboratory should sample waste to determine the appropriate disposal facility.
- Properly dispose of rainwater in secondary containment that may have mixed with hazardous waste.
- Attention is directed to "Hazardous Material", "Contaminated Material", and "Aerially Deposited Lead" of the contract documents regarding the handling and disposal of hazardous materials.

Education

- Educate employees and subcontractors on hazardous waste storage and disposal procedures.
- Educate employees and subcontractors on potential dangers to humans and the environment from hazardous wastes.
- Instruct employees and subcontractors on safety procedures for common construction site hazardous wastes.
- Instruct employees and subcontractors in identification of hazardous and solid waste.
- Hold regular meetings to discuss and reinforce hazardous waste management procedures (incorporate into regular safety meetings).
- The contractor's superintendent or representative should oversee and enforce proper hazardous waste management procedures and practices.
- Make sure that hazardous waste is collected, removed, and disposed of only at authorized disposal areas.
- Warning signs should be placed in areas recently treated with chemicals.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- If a container does spill, clean up immediately.

Costs

All of the above are low cost measures.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events..
- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur
- Hazardous waste should be regularly collected.
- A foreman or construction supervisor should monitor onsite hazardous waste storage and disposal procedures.
- Waste storage areas should be kept clean, well organized, and equipped with ample cleanup supplies as appropriate for the materials being stored.
- Perimeter controls, containment structures, covers, and liners should be repaired or replaced as needed to maintain proper function.

- Hazardous spills should be cleaned up and reported in conformance with the applicable Material Safety Data Sheet (MSDS) and the instructions posted at the project site.
- The National Response Center, at (800) 424-8802, should be notified of spills of federal reportable quantities in conformance with the requirements in 40 CFR parts 110, 117, and 302. Also notify the Governors Office of Emergency Services Warning Center at (916) 845-8911.
- A copy of the hazardous waste manifests should be provided.

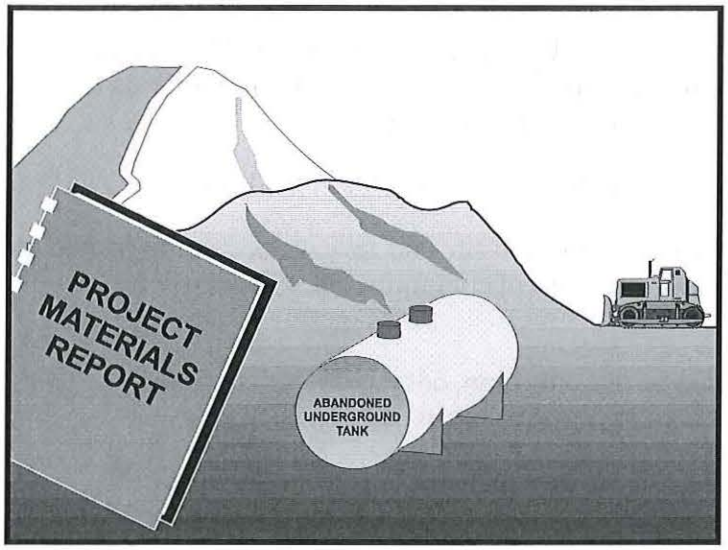
References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Processes, Procedures and Methods to Control Pollution Resulting from All Construction Activity, 430/9-73-007, USEPA, 1973.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

Description and Purpose

Prevent or reduce the discharge of pollutants to stormwater from contaminated soil and highly acidic or alkaline soils by conducting pre-construction surveys, inspecting excavations regularly, and remediating contaminated soil promptly.

Suitable Applications

Contaminated soil management is implemented on construction projects in highly urbanized or industrial areas where soil contamination may have occurred due to spills, illicit discharges, aerial deposition, past use and leaks from underground storage tanks.

Limitations

Contaminated soils that cannot be treated onsite must be disposed of offsite by a licensed hazardous waste hauler. The presence of contaminated soil may indicate contaminated water as well. See NS-2, Dewatering Operations, for more information.

The procedures and practices presented in this BMP are general. The contractor should identify appropriate practices and procedures for the specific contaminants known to exist or discovered onsite.

Implementation

Most owners and developers conduct pre-construction environmental assessments as a matter of routine. Contaminated soils are often identified during project planning and development with known locations identified in the plans, specifications and in the SWPPP. The contractor should review applicable reports and investigate appropriate call-outs in the

plans, specifications, and SWPPP. Recent court rulings holding contractors liable for cleanup costs when they unknowingly move contaminated soil highlight the need for contractors to confirm a site assessment is completed before earth moving begins.

The following steps will help reduce stormwater pollution from contaminated soil:

- Conduct thorough, pre-construction inspections of the site and review documents related to the site. If inspection or reviews indicated presence of contaminated soils, develop a plan before starting work.
- Look for contaminated soil as evidenced by discoloration, odors, differences in soil properties, abandoned underground tanks or pipes, or buried debris.
- Prevent leaks and spills. Contaminated soil can be expensive to treat and dispose of properly. However, addressing the problem before construction is much less expensive than after the structures are in place.
- The contractor may further identify contaminated soils by investigating:
  - Past site uses and activities
  - Detected or undetected spills and leaks
  - Acid or alkaline solutions from exposed soil or rock formations high in acid or alkaline forming elements
  - Contaminated soil as evidenced by discoloration, odors, differences in soil properties, abandoned underground tanks or pipes, or buried debris.
  - Suspected soils should be tested at a certified laboratory.

Education

- Have employees and subcontractors complete a safety training program which meets 29 CFR 1910.120 and 8 CCR 5192 covering the potential hazards as identified, prior to performing any excavation work at the locations containing material classified as hazardous.
- Educate employees and subcontractors in identification of contaminated soil and on contaminated soil handling and disposal procedures.
- Hold regular meetings to discuss and reinforce disposal procedures (incorporate into regular safety meetings).

Handling Procedures for Material with Aerially Deposited Lead (ADL)

- Materials from areas designated as containing (ADL) may, if allowed by the contract special provisions, be excavated, transported, and used in the construction of embankments and/or backfill.
- Excavation, transportation, and placement operations should result in no visible dust.
- Caution should be exercised to prevent spillage of lead containing material during transport.

- Quality should be monitored during excavation of soils contaminated with lead.

Handling Procedures for Contaminated Soils

- Minimize onsite storage. Contaminated soil should be disposed of properly in accordance with all applicable regulations. All hazardous waste storage will comply with the requirements in Title 22, CCR, Sections 66265.250 to 66265.260.
- Test suspected soils at an approved certified laboratory.
- Work with the local regulatory agencies to develop options for treatment or disposal if the soil is contaminated.
- Avoid temporary stockpiling of contaminated soils or hazardous material.
- Take the following precautions if temporary stockpiling is necessary:
  - Cover the stockpile with plastic sheeting or tarps.
  - Install a berm around the stockpile to prevent runoff from leaving the area.
  - Do not stockpile in or near storm drains or watercourses.
- Remove contaminated material and hazardous material on exteriors of transport vehicles and place either into the current transport vehicle or into the excavation prior to the vehicle leaving the exclusion zone.
- Monitor the air quality continuously during excavation operations at all locations containing hazardous material.
- Procure all permits and licenses, pay all charges and fees, and give all notices necessary and incident to the due and lawful prosecution of the work, including registration for transporting vehicles carrying the contaminated material and the hazardous material.
- Collect water from decontamination procedures and treat or dispose of it at an appropriate disposal site.
- Collect non-reusable protective equipment, once used by any personnel, and dispose of at an appropriate disposal site.
- Install temporary security fence to surround and secure the exclusion zone. Remove fencing when no longer needed.
- Excavate, transport, and dispose of contaminated material and hazardous material in accordance with the rules and regulations of the following agencies (the specifications of these agencies supersede the procedures outlined in this BMP):
  - United States Department of Transportation (USDOT)
  - United States Environmental Protection Agency (USEPA)
  - California Environmental Protection Agency (CAL-EPA)

- California Division of Occupation Safety and Health Administration (CAL-OSHA)
- Local regulatory agencies

Procedures for Underground Storage Tank Removals

- Prior to commencing tank removal operations, obtain the required underground storage tank removal permits and approval from the federal, state, and local agencies that have jurisdiction over such work.
- To determine if it contains hazardous substances, arrange to have tested, any liquid or sludge found in the underground tank prior to its removal.
- Following the tank removal, take soil samples beneath the excavated tank and perform analysis as required by the local agency representative(s).
- The underground storage tank, any liquid or sludge found within the tank, and all contaminated substances and hazardous substances removed during the tank removal and transported to disposal facilities permitted to accept such waste.

Water Control

- All necessary precautions and preventive measures should be taken to prevent the flow of water, including ground water, from mixing with hazardous substances or underground storage tank excavations. Such preventative measures may consist of, but are not limited to, berms, cofferdams, grout curtains, freeze walls, and seal course concrete or any combination thereof.
- If water does enter an excavation and becomes contaminated, such water, when necessary to proceed with the work, should be discharged to clean, closed top, watertight transportable holding tanks, treated, and disposed of in accordance with federal, state, and local laws.

Costs

Prevention of leaks and spills is inexpensive. Treatment or disposal of contaminated soil can be quite expensive.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Arrange for contractor's Water Pollution Control Manager, foreman, and/or construction supervisor to monitor onsite contaminated soil storage and disposal procedures.
- Monitor air quality continuously during excavation operations at all locations containing hazardous material.
- Coordinate contaminated soils and hazardous substances/waste management with the appropriate federal, state, and local agencies.

- Implement WM-4, Spill Prevention and Control, to prevent leaks and spills as much as possible.

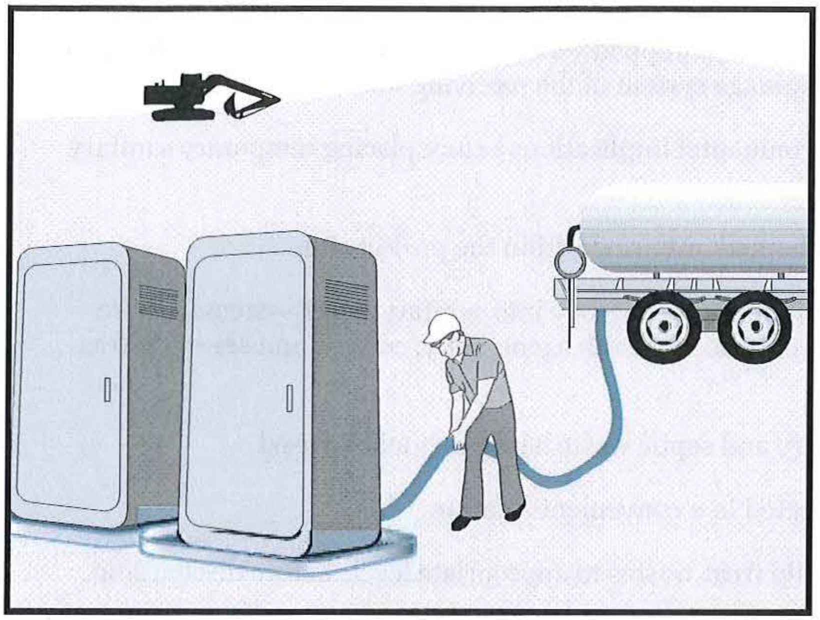
References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Processes, Procedures and Methods to Control Pollution Resulting from All Construction Activity, 430/9-73-007, USEPA, 1973.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	
Nutrients	☑
Trash	☑
Metals	
Bacteria	☑
Oil and Grease	
Organics	☑

Potential Alternatives

None

Description and Purpose

Proper sanitary and septic waste management prevent the discharge of pollutants to stormwater from sanitary and septic waste by providing convenient, well-maintained facilities, and arranging for regular service and disposal.

Suitable Applications

Sanitary septic waste management practices are suitable for use at all construction sites that use temporary or portable sanitary and septic waste systems.

Limitations

None identified.

Implementation

Sanitary or septic wastes should be treated or disposed of in accordance with state and local requirements. In many cases, one contract with a local facility supplier will be all that it takes to make sure sanitary wastes are properly disposed.

Storage and Disposal Procedures

- Temporary sanitary facilities should be located away from drainage facilities, watercourses, and from traffic circulation. If site conditions allow, place portable facilities a minimum of 50 feet from drainage conveyances and traffic areas. When subjected to high winds or risk of high winds, temporary sanitary facilities should be secured to prevent overturning.

- Temporary sanitary facilities must be equipped with containment to prevent discharge of pollutants to the stormwater drainage system of the receiving water.
- Consider safety as well as environmental implications before placing temporary sanitary facilities.
- Wastewater should not be discharged or buried within the project site.
- Sanitary and septic systems that discharge directly into sanitary sewer systems, where permissible, should comply with the local health agency, city, county, and sewer district requirements.
- Only reputable, licensed sanitary and septic waste haulers should be used.
- Sanitary facilities should be located in a convenient location.
- Temporary septic systems should treat wastes to appropriate levels before discharging.
- If using an onsite disposal system (OSDS), such as a septic system, local health agency requirements must be followed.
- Temporary sanitary facilities that discharge to the sanitary sewer system should be properly connected to avoid illicit discharges.
- Sanitary and septic facilities should be maintained in good working order by a licensed service.
- Regular waste collection by a licensed hauler should be arranged before facilities overflow.
- If a spill does occur from a temporary sanitary facility, follow federal, state and local regulations for containment and clean-up.

Education

- Educate employees, subcontractors, and suppliers on sanitary and septic waste storage and disposal procedures.
- Educate employees, subcontractors, and suppliers of potential dangers to humans and the environment from sanitary and septic wastes.
- Instruct employees, subcontractors, and suppliers in identification of sanitary and septic waste.
- Hold regular meetings to discuss and reinforce the use of sanitary facilities (incorporate into regular safety meetings).
- Establish a continuing education program to indoctrinate new employees.

Costs

All of the above are low cost measures.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Arrange for regular waste collection.

- If high winds are expected, portable sanitary facilities must be secured with spikes or weighed down to prevent over turning.

- If spills or leaks from sanitary or septic facilities occur that are not contained and discharge from the site, non-visible sampling of site discharge may be required. Refer to the General Permit or to your project specific Construction Site Monitoring Plan to determine if and where sampling is required.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Northeast Church Rock
95% Design Report

Appendix G:
Mine Waste Repository Design

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LIST OF ATTACHMENTS

LIST OF ACRONYMS / ABBREVIATIONS

AOC	Administrative Settlement Agreement and Order on Consent for Design and Cost Recovery
ARAR	Applicable or Relevant and Appropriate Requirement
ASTM	American Society for Testing and Materials
bgs	below ground surface
BMP	best management practice
CC	Construction Contractor
CPT	cone penetration test
CY	cubic yard(s)
DOE	US Department of Energy
DSHA	deterministic seismic hazard analysis
ET	evapotranspirative
FS	factor of safety
GE	General Electric
GSR	Green and Sustainable Remediation
HSA	hollow-stemmed auger
LAR	license amendment request
Mill Site	Church Rock Mill Site
Mine Site	Northeast Church Rock Mine Site
MWH	Montgomery Watson Harza
NAVFAC	Naval Facilities Engineering Command
NRC	US Nuclear Regulatory Commission
pcf	pounds per cubic foot
PDS	Pre-design studies
PGA	peak ground acceleration
PI	plasticity index
PSHA	probabilistic seismic hazard analysis
PTW	principal threat waste
RAO	Remedial Action Objective
ROD	Record of Decision
SHA	seismic hazard analysis
SOW	Statement of Work
SPT	standard penetration testing
TDA	Tailings Disposal Area

UNC	United Nuclear Corporation
USCS	Unified Soil Classification System
USEPA	US Environmental Protection Agency

G.1 INTRODUCTION

G.1.1 Repository Design Objectives

The design objectives for the Repository to be located on the Church Rock Mill Site (Mill Site) Tailings Disposal Area (TDA) were listed in Appendix A of the Design Work Plan (MWH, 2016). These design objectives are summarized below.

- Repository capacity designed for 1,000,000 (1M) cubic yards (CY) of mine waste. The design (with associated cover erosion control) will accommodate variations in the mine waste volume.
- Repository located on the north and central cells.
- Edge of Repository set back a minimum of 50 feet from the western embankment to limit traffic loading from haul traffic and stress from fill placement on the tailings impoundment.
- Minimize the rock size and volume required for the erosion protection layer on the Repository cover by limiting cover slope lengths and grades. Slope grades are to be designed to be between 2 and 5 percent.
- Fill thickness over the former borrow pits is to be limited to reduce the potential for differential settlement of the cover surface. The area of maximum fill thickness is to be located as far to the north as practical, with the western half of the central cell used for Repository capacity if necessary.
- Abrupt transition slopes, rock aprons at the toe of slopes, and additional diversion channels will be limited, with existing drainage channels and drainage swales on the existing cover used where possible. Flow path lengths for stormwater collection and conveyance from the TDA will be minimized.

G.1.2 Repository Design Summary

In addition to meeting the design objectives summarized above, the Repository design has been analyzed for long-term performance to maintain isolation of the mine waste within the Repository. This design appendix presents the supporting technical analyses for the Repository design. The technical analysis methods used are described in the Design Work Plan (MWH, 2016), and follow the analysis requirements of NUREG-1620 (NRC, 2003). The technical analyses and design objective discussions presented in this appendix are listed below.

- A description of preparation of the existing TDA radon barrier to be a foundation layer for the Repository
- A description of the mine waste placement sequence within the Repository
- Site specific seismic hazard analysis (SHA) for the Mill Site
- Slope stability analyses for the Repository
- Settlement analyses associated with mine waste placement, including discussion of immediate settlement, primary and secondary consolidation of underlying tailings, and seismic-induced settlement.
- Liquefaction analyses of the Repository and Repository foundation materials
- Cover cracking analyses of the existing radon barrier
- Stress influence evaluation from mine waste placement
- Evapotranspirative (ET) cover design including water-balance and infiltration modeling, erosion protection design, and radon modeling (by Dwyer Engineering, LLC)
- Evaluation of tailings pore water migration is provided under separate cover by Dwyer Engineering, LLC.

G.2 PERFORMANCE STANDARDS

The Performance Standards presented here are defined in the Action Memorandum: Request for a Non-Time-Critical Removal Action at the Northeast Church Rock Site (2011 Action Memo; USEPA, 2011), the Record of Decision, United Nuclear Corporation Site, (ROD; USEPA, 2013), and the Administrative Settlement Agreement and Order on Consent for Design and Cost Recovery (AOC; USEPA, 2015) including the Statement of Work (SOW) attached as Appendix D to the AOC, and were developed to define attainment of the Removal Action and Remedial Action Objectives (RAOs) for the Selected Remedy. The Performance Standards include both general and specific standards applicable to the Selected Remedy work elements and associated work components. Table G.2-1 presents Performance Standards related to the Repository design and construction and explains how the design accomplishes these standards.

Table G.2-1: Performance Standards Applicable to Waste Repository Design

Identifying Number*	Location of Performance Standard Requirement	Topic	Performance Standard	Comments
105	10 CFR 61.23(g)	Licensing	10 CFR 61.23(e) Standards for Issuance of a License. Refer to www.ecfr.gov.	The Repository is designed for long-term stability and the design criteria used to eliminate, to the extent practicable, the need for ongoing maintenance.
99	10 CFR 61.51(a)(2)	Site Controls and Security	10 CFR 61.42. Refer to www.ecfr.gov.	See Dwyer Cover System Design Report, Attachment G.7
94	2011 Action Memo, V.A.1., Bullet 1 – Repository Design	Repository Design	Design a repository for the contaminated material excavated and removed from the NECR Mine Site. Design specifications will comply with CERCLA requirements, specifically all ARARs. The design, at a minimum, will include a low permeability layer (liner) and a cap structure that will mitigate direct contact, limit water infiltration, and perform as a radon barrier.	The radon barrier (low-permeability layer) is described in Section G.5. The Repository cover (cap structure) is discussed in Section G.12 (see also Dwyer Cover System Design Report, Attachment G.7)
89	2011 Action Memo, V.A.1, Bullet 3 – Construction	Construction	Construct a repository that will contain the contaminated mine waste and soil excavated and removed from the NECR Mine Site in accordance with the approved design specifications. This action is contingent on the NRC approval of a license amendment for the UNC Mill Site disposal cells, and on EPA's decision document for the surface contamination at the UNC Mill Site.	The Repository design is being prepared with consideration for US Nuclear Regulatory Commission (NRC) license amendment requirements. The performance standards from the 2013 ROD (USEPA Region 6) are addressed later in this table.
87	2011 Action Memo, V.A.1., Bullet 5 – Closure	Closure	Closure of the repository once all NECR Mine Site contaminated waste rock and soil is disposed. Once all contaminated mine waste and soil is excavated from the NECR Mine Site, transported to the repository and disposed in the repository, the repository will be closed, and the cap will be put in place.	Sequencing for waste and cover placement is described in Section G.5 and shown on Drawings 7-01 through 7-03 of the Drawings. After construction is complete, the final cover will be placed over the Repository.

Identifying Number*	Location of Performance Standard Requirement	Topic	Performance Standard	Comments
80	2011 Action Memo, Table A-1; 2013 ROD Table 1 and Sections 2.9.2 and 2.9.5	Repository Design	40 CFR 192.02(a) and 02(b) Standards for the Control of Residual Radioactive Materials from Inactive Uranium Processing Sites. Refer to www.ecfr.gov.	See Dwyer Cover System Design Report, Attachment G.7
155	2011 Action Memo Table A-1, 2013 ROD Table 1	Closure	NMAC 20.9.6.9.A(3)(c) Closure and Post-Closure Requirements for Municipal and Special Waste Landfills and Monofills. See http://164.64.110.239/nmac/_titles.htm.	A description of the final cover and its placement is presented in Section G.12 (see also Dwyer Cover System Design Report, Attachment G.7) and the grading plan is shown on Drawings 7-01 through 7-03. The construction quality assurance plan is presented in Appendix V.
76, 79	2011 Action Memo, Table A-1; 2013 ROD Table 1 and Sections 2.9.2 and 2.9.5	Repository Design	40 CFR 192.02(c) and (d) Standards for the Control of Residual Radioactive Materials from Inactive Uranium Processing Sites. Refer to www.ecfr.gov.	See Dwyer Cover System Design Report, Attachment G.7
24	2013 ROD, Section 1.4 – Repository Design	Repository Design	Design a repository at the UNC Site for the contaminated material excavated and removed from the NECR Site. Design specifications will comply with CERCLA requirements including all applicable or relevant and appropriate requirements (ARARs). The design will include a cap structure that will mitigate direct contact, limit water infiltration, and perform as a radon barrier. Final design will determine actual configurations of cap and liner structure and will be submitted as part of a license amendment request to the Nuclear Regulatory Commission (NRC).	The Repository has been designed to receive the anticipated volume of material to be removed from the Northeast Church Rock Mine Site (Mine Site). The Repository cover (cap structure) is discussed in Section G.12 (see also Dwyer Cover System Design Report, Attachment G.7) and the radon barrier (low-permeability layer) is described in Section G.5. Parts of this design including this appendix, once finalized, will be submitted to NRC for review and approval as part of the License Amendment Request (LAR).
22	2013 ROD, Section 1.4 - Construction	Construction	Construct a repository at the UNC Site that will contain the contaminated mine waste and soil excavated and removed from the NECR Site in accordance with the approved design specifications. This action is contingent on the NRC approval of a license amendment for the UNC Site Tailings Disposal Area which comprises three covered tailing cells and two covered borrow pits. In addition, there are two open evaporation ponds located on the South Cell. That is, unless the NRC approves a	Parts of this design including this appendix, once finalized, will be submitted to NRC for review and approval as part of the LAR.

Identifying Number*	Location of Performance Standard Requirement	Topic	Performance Standard	Comments
			license amendment for the UNC Site Tailings Disposal Area, the construction described in this ROD will not go forward. If NRC disapproves the request for a license amendment, EPA will stop its efforts to dispose of the NECR Site waste at the UNC Site Tailings Disposal Area, and EPA will evaluate other alternatives for disposal of the NECR Site waste.	
26	2013 ROD, Section 2.9.1, Bullet 3	Repository Design	Remediation Action Objectives Prevent the migration of concentrations of contaminants located in the soil, mine waste, and tailings contained within the Tailings Disposal Area to ground water where the migration of those contaminants would result in ground water concentrations that exceed remediation goals established in EPA's 1988 ROD for the Ground Water Operable Unit (including any amendment), and, through this action, prevent human and ecological receptors from being exposed to ground water with concentrations of contaminants that exceed remediation goals established in the 1988 ROD, including any amendment.	See Dwyer Consolidation and Groundwater Evaluation Report.
27	2013 ROD, Section 2.9.2, Bullet 1	Repository Design	Radionuclides and their daughter products in soil, mine waste, and tailings contained within the Tailings Disposal Area will not release radon-222 emissions from residual radioactive material to the atmosphere in exceedance of an average release rate of 20 picocuries per square meter per second (pCi/m^2s) 16 [40 CFR §§ 192.02(b)(1) and 192.32(b)(1)(ii)].	See Dwyer Cover System Design Report, Attachment G.7
28	2013 ROD, Section 2.9.2, Bullet 2	Repository Design	Radionuclides and their daughter products in soil, mine waste, and tailings contained within the Tailings Disposal Area will not release radon-222 emissions from residual radioactive material to the atmosphere that will increase the annual average concentration of radon-222 in air at or above any location outside the disposal site by more than one-half picocurie per liter [40 CFR § 192.02(b)(2)].	See Dwyer Cover System Design Report, Attachment G.7
29	2013 ROD, Section 2.9.2, Bullet 3	Repository Design	Remediation Goals Migration of contaminants from the Tailings Disposal Area shall not result in ground water concentrations that exceed remediation goals established in EPA's	See Dwyer Consolidation and Groundwater Evaluation Report.

Identifying Number*	Location of Performance Standard Requirement	Topic	Performance Standard	Comments
			1988 ROD for the Ground Water Operable Unit, including any amendment.	
32	2013 ROD, Section 2.9.5 – Cap Design Criteria	Repository Design	Although the final design may vary, the major elements of the structure are not expected to be significantly different than those presented here. The cap design will be based on comprehensive planning, site-specific risk analysis, and ARARs. Cap design and cost estimates for Alternative 2 are based on the following elements:	See Dwyer Cover System Design Report, Attachment G.7
33	2013 ROD, Section 2.9.5 – Cap Design Criteria, Bullet 1	Repository Design	Cap longevity designed for a minimum of 200 years with minimal maintenance and for effectiveness up to one thousand years, to the extent reasonably achievable [40 CFR §§ 192.02(a),192.32(b)(1)(i), and 264.111(a)]	See Dwyer Cover System Design Report, Attachment G.7
34	2013 ROD, Section 2.9.5 – Cap Design Criteria, Bullet 2	Repository Design	A sufficient clean (uncontaminated) soil layer to provide assurance that releases in the form of Radon-220 and -222 will not exceed an average release rate of 20 picocuries per meter squared per second [40 CFR §§ 192.02(b)(1) and 192.32(b)(1)(ii)], and will not increase the annual average concentration of radon-220 and -222 in air at or above any location outside the disposal site by more than one-half picocurie per liter [40 CFR § 192.02(b)(2)]	See Dwyer Cover System Design Report, Attachment G.7
35	2013 ROD, Section 2.9.5 – Cap Design Criteria, Bullet 3	Repository Design	Cap construction to protect the mine waste, reduce the potential for leachate development, and prevent contaminated runoff by limiting infiltration of precipitation and by providing erosion protection and durability [40 CFR §§192.32(b)(1), 264.111(a), 264.111(b) 264.228(b)(1), 264.228(b)(3), and 264.228(b)(4)]	See Section G.12. Also see Dwyer Cover System Design Report, Attachment G.7
36	2013 ROD, Section 2.9.5 – Cap Design Criteria, Bullet 4	Repository Design	Cap slope, shape and drainage construction to ensure stability and minimize the effects of erosion, root intrusion, and animal destruction [40 CFR §§192.32(b)(1), 264.111(a), 264.111(b) 264.228(b)(1), 264.228(b)(3), and 264.228(b)(4)];	The shape of the Repository is designed with top slopes of 2 to 5% to minimize the effects of erosion. See Section G.12 for description of the cover design. See also Dwyer Cover System Design Report, Attachment G.7
37	2013 ROD, Section 2.9.5 – Cap Design Criteria, Bullet 5	Repository Design	Use of biosolids or top soil to facilitate vegetation growth	The revegetation plan for the Repository (Appendix U, Attachment U.2) includes the use of amendments such as composted cow or green

Identifying Number*	Location of Performance Standard Requirement	Topic	Performance Standard	Comments
				manure, or composted biosolids to promote vegetation growth.
38	2013 ROD, Section 2.9.5 – Cap Design Criteria, Bullet 6	Repository Design	…the use of vegetation to emulate the structure, function, diversity, and dynamics of the native community to maximize resilience and sustainability	The Repository will be revegetated after cover soil placement is completed. See also Revegetation Plan for the Repository (Appendix U, Attachment U.2) See also Dwyer Cover System Design Report, Attachment G.7
39	2013 ROD, Section 2.9.5 – Cap Design Criteria, Bullet 7	Repository Design	Erosion modeling to determine effectiveness of cap design	See Section G.12 and also see Dwyer Cover System Design Report, Attachment G.7
40	2013 ROD, Section 2.9.5 – Cap Design Criteria, Bullet 8	Repository Design	A low permeability layer (liner) will be placed between the NECR mine waste and the tailings currently disposed within the Tailings Disposal Area. This layer will be constructed to eliminate the possibility that the layer will collect water and produce a “bathtub effect”. This layer will be constructed of natural materials, not synthetic, to eliminate the sudden failure risk associated with punctures and rips. This layer will be compacted to meet a hydraulic conductivity of no more than 1 x 10^{-7} centimeters per second (cm/s). The liner will serve the following purposes: 1 – The liner will help protect workers doing construction. 2 – The liner will be an added level of protection for groundwater 3 – The liner will provide a stable foundation on which to place the NECR Site waste. 4 - The liner will form an added barrier, preventing exposure to the higher level of radioactivity found in the mill tailings that are currently disposed in the UNC Site Tailings Disposal Area.	The existing clay radon barrier will be modified in-place and serve as the “low-permeability layer” located between the mine waste and the existing tailings. This layer is described in Section G.5.1. Only the upper 6 inches of material (erosion protection layer) will be removed from the cover, prior to re-compaction of the radon barrier.
45	2013 ROD, Section 2.9.5, Waste Volume	Waste Volume	Approximately 871,000 cubic yards from the removal action described in the 2011 Non-Time-Critical Removal Action Memorandum for the NECR Site, 109,800 cubic yards from a removal action at the NECR Site that predates the 2011 Non-Time-Critical Removal Action Memorandum for the NECR Site, and an estimated 30,000 cubic yards to be excavated as part of a separate	The Repository design can be adjusted for a disposal volume of up to approximately 1.1M CY. Mine removal excavations are described in Appendix C. The estimated volume of material at the Mine Site, excluding the principal threat waste (PTW), will be moved to the Repository.

Identifying Number*	Location of Performance Standard Requirement	Topic	Performance Standard	Comments
			time-critical removal action at the NECR Site will be interred at the Tailings Disposal Area and capped. Although the additional 109,800 and 30,000 cubic yards volume was not included in the EE/CA, the additional volume and associated cost are minimal compared to the overall volume and cost evaluated. In addition, the added expense is within the EE/CA's margin of error. Based on this, the additional volume and cost are considered included and addressed under this alternative. The waste acceptance criteria for mine waste that will be disposed at the UNC Site Tailings Disposal Area are 200 pCi/g or less of Ra-226 and/or 500 mg/kg or less of uranium.	
58	2013 ROD Table 1	Repository Design	10 CFR 40 Appendix A, Criterion 1 Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material From Ores Processed Primarily for Their Source Material Content. Refer to www.ecfr.gov.	The siting of the Repository is based on the previously approved site of the licensed TDA. The Repository design minimizes erosion and maintains the current isolation of the tailings below from the mine waste to be placed.
63	2013 ROD Table 1	Repository Design	10 CFR 40 Appendix A, Criterion 3 Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material From Ores Processed Primarily for Their Source Material Content. Refer to www.ecfr.gov.	See Dwyer Cover System Design Report, Attachment G.7
62	2013 ROD Table 1	Repository Design	10 CFR 40 Appendix A, Criterion 4 Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material From Ores Processed Primarily for Their Source Material Content. Refer to www.ecfr.gov.	(a) See Appendix I – Mill Site Stormwater Controls. The upstream catchment area was fixed based on the location of the TDA. (b) Surrounding topography was also generally predetermined by the location of the TDA. (c) Repository slopes are no steeper than 5:1 and generally between 2 and 5 percent. (d) Cover erosion protection will be achieved with a rock admixture. See Section G.12 and also the Dwyer Cover System Design Report, Attachment G.7. The final cover surface will also be seeded for vegetation establishment according to the revegetation plan (see Appendix U, Attachment U.2)

Identifying Number*	Location of Performance Standard Requirement	Topic	Performance Standard	Comments
				The surface grading design is contoured to prevent concentrated runoff and direct flows to existing rock-lined swales. (e) Site-specific SHA is included as Attachment G.1 and analyses relevant to seismic events are presented in Sections G.7, G.8, G.9.4, and G.11. (f) The Repository is designed to shed stormwater to the perimeter of the existing TDA. Run-on flows are controlled by upstream diversion channels and these flows will not come in contact with the Repository. Discussion of cover erosion protection is presented in Attachment G.7 – Dwyer Cover System Design Report.
64	2013 ROD Table 1	Repository Design	10 CFR 40 Appendix A, Criterion 5 Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material From Ores Processed Primarily for Their Source Material Content. Refer to www.ecfr.gov.	See Dwyer Cover System Design Report, Attachment G.7
57	2013 ROD Table 1	Repository Design	10 CFR 40 Appendix A, Criterion 6 Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material From Ores Processed Primarily for Their Source Material Content. Refer to www.ecfr.gov.	See Dwyer Cover System Design Report, Attachment G.7 Also, for 6(1) see Section G.12.4 6(2) see Section G.12.3 6(3) The final cover will not be placed in phases. Radon testing will be conducted following completion of the cover. 6(4) Results of the radon testing will be included with the As-Built Report for the Repository.
59	2013 ROD Table 1	Repository Design	10 CFR 61.41. Refer to www.ecfr.gov.	See Appendix T.
55	2013 ROD Table 1	Performance Objectives	10 CFR 61.44. Refer to www.ecfr.gov.	See Appendix I regarding long-term stability of the stormwater control features around the Repository. Regarding the Repository cover, See Dwyer Cover System Design Report, Attachment G.7

Identifying Number*	Location of Performance Standard Requirement	Topic	Performance Standard	Comments
60	2013 ROD Table 1	Repository Design	10 CFR 61 51(a)(1), 51(a)(4), 51(a)(5) and 51(a)(6). Refer to www.ecfr.gov.	(a)(1) The Repository is designed to provide long-term isolation of the mine waste, with avoidance of long-term active maintenance. This includes use of the probable maximum precipitation as the design storm event for erosion protection analyses. (a)(4) The ET cover is designed to minimize infiltration through to the mine spoils and the surface grading is designed to direct water away from the TDA. (a)(5) See Appendix I - Mill Site Storm Water Controls (a)(6) The mounded surface of the Repository promotes the shedding of surface runoff, with surface slopes and settlement analyses indicating no negative slope grades (depressions) from cover settlement. See also Dwyer Cover System Design Report, Attachment G.7
46	2013 ROD, Table 1	Closure	10 CFR 61.52(a)(9). Refer to www.ecfr.gov.	Closure and stabilization of the Repository will be completed with cover surface erosion protection rock and vegetation. See Section G.12 and the Dwyer Cover System Design Report, (Attachment G.7) for cover design details. See also the Revegetation Plan for the Repository (Appendix U, Attachment U.2).
68	2013 ROD Table 1	Waste Disposal	10 CR 61 52(a)(10). Refer to www.ecfr.gov.	Areas of the existing TDA cover that will be trafficked during construction will be restored following completion of the Repository. Existing stormwater channels will be either maintained or improved (Appendix I).
69	2013 ROD, Table 1	Waste Disposal	10 CFR 61 52(a)(11). Refer to www.ecfr.gov.	Materials designated for removal from the Mine Site, with the exception of materials classified as PTW, will be disposed of in the Repository.
49	2013 ROD, Table 1	Environmental Monitoring	10 CFR 61.53(c) Environmental Monitoring During the land disposal facility site construction and operation, the licensee shall maintain a monitoring program. Measurements and observations must be made and recorded to provide data to	The pre-final design includes a monitoring program for the operation of the Repository and the associated stormwater control features. Observations will be made during periodic inspections to evaluate

Identifying Number*	Location of Performance Standard Requirement	Topic	Performance Standard	Comments
			evaluate the potential health and environmental impacts during both the construction and the operation of the facility and to enable the evaluation of long-term effects and the need for mitigative measures. The monitoring system must be capable of providing early warning of releases of radionuclides from the disposal site before they leave the site boundary.	performance of the cover, provide early warning of potential problems and identify issues that may require mitigative measures.
72	2013 ROD Table 1 and Section 2.9.5 Cap Design, Bullets 1, 3, and 4.	Closure	40 CFR 264.111(a). Refer to www.ecfr.gov.	See Appendix I regarding maintenance of the stormwater control features around the Repository. Regarding the Repository cover see Section G.12 and the Dwyer Cover System Design Report, Attachment G.7
74	2013 ROD, Table 1 and Section 2.9.5, Cap Design Criteria, Bullets 3 and 4	Storm Water and Erosion Control	40 CFR 264.228(b)(4). Refer to www.ecfr.gov.	Run-on to the Repository site is managed by the upstream diversion channel which diverts storm flows north and south of the TDA. Runoff from the cover will be collected in the existing stormwater channels and swales located around the Repository. Regarding erosion and damage to the Repository cover, see Dwyer Cover System Design Report, Attachment G.7
75	2013 ROD Table 1 and Sections 2.9.2 and 2.9.5	Repository Design	40 CFR 192.32(b)(1). Refer to www.ecfr.gov. (2) The requirements of § 192.32(b)(1) shall not apply to any portion of a licensed and/or disposal site which contains a concentration of radium-226 in land, averaged over areas of 100 square meters, which, as a result of uranium byproduct material, does not exceed the background level by more than: (i) 5 picocuries per gram (pCi/g), averaged over the first 15 centimeters (cm) below the surface, and (ii) 15 pCi/g, averaged over 15 cm thick layers more than 15 cm below the surface	(1)(i), See Dwyer Cover System Design Report (Attachment G.7) regarding design life of the Repository cover. (ii) See Dwyer Cover System Design Report, Attachment G.7 (2) See Dwyer Cover System Design Report, Attachment G.7
1	2015 AOC SOW, Paragraph 16 – Design of the	Repository Design	Respondents shall design a Repository at the Tailings Disposal Area for permanent disposal of approximately 1,000,000 cubic yards of contaminated soil and mine waste	The Repository design can be adjusted for a disposal volume of up to approximately 1.1 million CY. The Performance Standards are

Identifying Number*	Location of Performance Standard Requirement	Topic	Performance Standard	Comments
	UNC Site Repository		material with contamination that meets or exceeds the Performance Standards.	addressed throughout the design documents.
5	2015 AOC SOW, Paragraph 20 – Site Preparation Activities	Site Preparation	In the Design, Respondents shall include detailed plans and specifications for the following site preparation activities: a. An underground utility survey for the identification and verification of the location of subsurface utilities in SA Site areas that will be used for consolidation or disposal; b. A land survey that will delineate the parts of the Tailings Disposal Area that will be used for NECR Site contaminated soil and mine waste disposal; c. A description of construction activities to be undertaken on the portion of the SA Site that is at the UNC Site in order to prepare for placement of the NECR Site contaminated soil and mine waste in the Tailings Disposal Area; d. A description of the methods that will be used to decontaminate existing structures such as culverts, catch basins, foundations, and vaults; and, where decontamination is not practicable, a description of methods that shall be used to disassemble these structures, demolish and remove these structures, or include these structures within the Tailings Disposal Area.	a. See Appendix B – Early Works and Construction Support Facilities b. A series of aerial and land surveys have been conducted over the last 10 years. The most recent set of survey data was collected during the pre-design studies (PDS). These data sets have been combined for use in this design. c. See Appendix B –Construction Support Facilities and Appendix D – Haul Roads. Additional detail on design and construction of the Repository is provided throughout this appendix. d. See Appendix C – Mine Waste Removal Excavations and Demolition
11	2015 AOC SOW, Paragraph 26 – Acceptance Criteria	Administrative	For the part of the Tailings Disposal Area that is to contain the mine waste from the NECR Site and for the part of the current tailings cell that may be disturbed during implementation of the remedy, Respondents shall include, in their Design, detailed plans and specifications to meet and demonstrate compliance with Acceptance Criteria consistent with Section 5.1 of NUREG 1620.	Radon and gamma attenuation is addressed in the Dwyer Cover System Design Report (Attachment G.7) and Section G.12.4 of this appendix.
14	2015 AOC SOW, Paragraph 29 – Green Remediation Best Management Practices	Green Remediation Best Management Practices	Respondents shall incorporate applicable Best Management Practices for Green Remediation listed in ASTM-E2893-13 consistent with EPA's policy *Superfund Green Remediation Strategy* {2010}, found at http://www.epa.gov/superfund/greenremediation/sf-gr-strategy.pdf.	See Section G.13.
56	2013 ROD, Table 1	Radiation Protection	10 CFR 40, Appendix A, Criterion 6A. Refer to www.ecfr.gov.	The radon barrier over the byproduct materials will not be removed. It will

Identifying Number*	Location of Performance Standard Requirement	Topic	Performance Standard	Comments
				be compacted in- place. See Section G.5.1.
18	2015 AOC SOW, Paragraph 38 – Potential Impacts on Ground Water Remediation	Groundwater	Respondent shall describe any potential impacts of the Design on the on-going ground water remediation infrastructure at the UNC Site, and a proposed approach to address such impacts.	The existing groundwater remediation infrastructure is shown on the utilities drawing in the Section 1 Drawings. The haul road from the North and South Borrow areas can be adjusted to prevent conflict with, or damage to, the existing wells in operation at the time of construction.

*Refers to identifying numbers listed in Summary of ARARs, Performance Standards and Applicable NRC Design Requirements Table (provided in Attachment 1 to main text of the 95% Design Report)

G.3 ENGINEERING DESIGN DRAWINGS

The engineering design drawings for the Repository are contained in Volume II – Design Drawings (Section 7). The complete set of Drawings related to the Repository are listed in Table G.3-1 and referenced by sheet number in the text.

Table G.3-1: Engineering Design Drawings

Drawing No.	Drawing Title
7-01	Repository Subgrade - Existing Radon Barrier
7-02	Repository Mine Waste Fill by Removal Phase and Temporary Stormwater Control Berms (Sheet 1 of 2)
7-03	Repository Mine Waste Fill by Removal Phase and Temporary Stormwater Control Berms (Sheet 2 of 2)
7-04	Repository Mine Waste Fill Profile by Removal Phase
7-05	Repository Top of Mine Waste and Cover Grading Plan
7-06	Repository Profiles
7-07	Repository Final Cover Grading Plan
7-08	Cover Surface Erosion Protection
7-09	Repository Cover Details

G.4 DESIGN BACKGROUND

G.4.1 Design Data

The section summarizes the analyses of the Repository design. Each analysis relies on data collected during the Mill Site Pre-Design studies (PDS; MWH, 2014a) as well as other sources of information specifically referenced. The Repository layout with a waste volume of 1.05M CY and shown on Drawing 7-07 was used for the analyses. As described in the introduction, the Repository design was developed based on the approved design objectives described in Appendix A of the Design Work Plan (MWH, 2016). The fill thicknesses over specific locations on the TDA are based on the design fill elevations for the proposed layout. The cross sections for the slope stability models are based on the layout shown on the Drawings.

The material properties used in the 95% Design analyses are based primarily on the geotechnical laboratory data from the PDS. Assumptions have been applied, specific locations selected, or parts of the data set used in some cases, for various types of materials for conservative input on specific analyses. Average values were used as the base-case scenario for all material properties in all analyses. A sensitivity analysis was conducted for each individual analysis, and the parameter(s) that most influenced the results was found and varied to assess the impact on the overall results. Details of the sensitivity analyses can be found in the Attachments G.2 through G.6.Repository

G.4.2 Design Basis

The design basis for the Repository is provided in Table G.4-1. The individual design basis items comply with regulatory requirements and/or generally accepted engineering practice and meet the overall project design criteria as provided in the Design Work Plan (MWH, 2016).

Table G.4-1: Repository Design Basis

Design Category	Design Basis	Design Reference
Seismic Hazard	Design life to be 1,000 years to the extent reasonably achievable, and at least 200 years	US Environmental Protection Agency (USEPA) (40 CFR 192) US Nuclear Regulatory Commission (NRC) (10 CFR Appendix A to Part 100 A) (NRC, 2013)
Slope Stability	FS (static) = 1.5. FS (pseudo-static) = 1.0. FS (Probable Maximum Flood) = 1.2 Design Horizontal Seismic Coefficient = 2/3 of the max peak ground acceleration, determined from the seismic hazard analysis Critical conditions determined by cross-sections including maximum slope steepness, maximum slope height, existing embankment, and global stability.	NUREG 1620, Section 2.2 (NRC, 2003) NRC Regulatory Guide 3.11, Section C (NRC, 2008) Technical Approach Document, Revision II, Section 6.2 (DOE, 1989)
Settlement	Maintain positive cover drainage long-term, prevent ponding or reverse grades One-dimensional settlement analyses performed at multiple locations Results of the calculations summed to determine maximum potential cover settlement Two-dimensional sections generated through the one-dimensional settlement profiles to identify long-term maximum and minimum slopes of the Repository cover and maximum differential settlement.	NUREG 1620, Section 2.3(1) (NRC, 2003) NAVFAC 7.01, Chapter 5, Sections 3 and 4 (Department of the Navy, 1986) NUREG 1620, Section 2.2(3i) (NRC, 2003)

Design Category	Design Basis	Design Reference
	Seismically induced displacement is calculated and documented.	
Stress Influence/Cover Cracking	Prevent ponding or settlement beyond the edge of the Repository cover; identify extent of necessary improvements to the existing TDA cover (if any) Minimize differential settlement of the underlying tailings which may affect the existing radon barrier that would be detrimental to Repository performance or stability Calculate horizontal strain of the existing radon barrier based on calculated cover settlements Calculated horizontal strain < maximum allowable strain of the radon barrier	NAVFAC 7.01, Chapter 4, (Department of the Navy, 1986) NUREG 1620, Section 2.1, 2.3. 2.5 (NRC, 2003) Technical Approach Document, Rev. II, Section 6.3.3 (DOE, 1989) Horizontal Movements Related to Subsidence (Lee and Shen, 1969)
Liquefaction	The factor of safety against liquefaction should be greater than 1.0 (NRC, 2008)	NUREG 1620, Section 2.4 (NRC, 2003) NRC Regulatory Guide 3.11, Section C (NRC, 2008) Liquefaction Susceptibility of Fine-Grained Soils (Bray et al., 2009) Soil Liquefaction During Earthquakes (Idriss and Boulanger, 2008) Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops of Evaluation of Liquefaction Resistance of Soils (Youd et al., 2001)
Cover Design	See Attachments G.7 (Dwyer Cover Design Report, Dwyer Engineering, LLC) and G.8 (Rock Cover Design)	

G.5 REPOSITORY DESIGN AND CONSTRUCTION

G.5.1 Repository Subgrade Preparation

The existing radon barrier above the tailings in the TDA will be prepared to serve as the foundation layer for the Repository. The erosion protection layer overlying the radon barrier (consisting of a nominal 6-inch-thick layer of soil and rock) will be removed and reused for Repository cover construction. The erosion protection layer and existing rock (D_{50}=1.5 inches) in the swales within the Repository footprint will also be removed. The rock from the swales will either be combined with the rock taken from the erosion protection layer and reused on the new cover or used for erosion protection on other areas of the site. The residual soil from the existing erosion protection layer will be reused for Repository cover construction, to fill in the swales located on the existing cover, or for general fill around the Repository.

As summarized in Table G.2-1, from the RAOs section of USEPA (2013), "a low-permeability layer (liner) will be placed between the NECR mine waste and the tailings currently disposed within the Tailings Disposal Area." The existing radon barrier over the tailings in the TDA is planned to comprise this layer. The design criteria for this layer (from USEPA, 2013) include providing a stable foundation for mine waste placement in the Repository and a zone of separation from the underlying tailings. USEPA (2013) states that "This layer will be compacted to meet a hydraulic conductivity of no more than 1 x 10^{-7} centimeters per second" while also stating that "This layer will be constructed to eliminate the possibility that the layer will collect water and produce a 'bathtub effect'." These two statements indicate the desire for a low hydraulic conductivity within this layer, but not creating a hydraulic barrier that creates a zone of saturation at the top of the layer (the bathtub effect).

From review of the TDA reclamation plan, as-built reports, and tests results on radon barrier material in MWH (2014a), the radon barrier material cannot achieve a saturated hydraulic conductivity of less than 1x10^{-7} cm/sec, even under controlled laboratory conditions. However, a hydraulic conductivity of less than 1x10^{-7} cm/sec can be achieved under unsaturated conditions. One of the radon barrier samples (sample TI-CS01-04) was tested for unsaturated flow characteristics (MWH, 2014a). Analysis of the resulting soil water characteristic curve (see Figure G.5-1) and estimating the unsaturated hydraulic conductivity curve from relationships in van Genuchten (1980) show a decrease in hydraulic conductivity by several orders of magnitude from saturated to unsaturated conditions (see Figure G.5-2). From these calculations and using the geomean of the measured hydraulic conductivity of the radon barrier for samples remolded to 95 percent compaction (4.6 x 10^{-6} cm/sec; MWH, 2014a), a hydraulic conductivity of 1x10^{-7} cm/sec is achieved at a matric suction greater than 0.75 bars of negative pressure which correlates to a volumetric water content of equal to or less than 26 percent. The maximum measured optimum moisture content for the radon barrier is 15 percent gravimetric water content (sample TI-CS04-04A; MWH, 2014a) which is equivalent to a volumetric water content of 26 percent. The specifications will require the radon barrier to be compacted to 95 percent relative compaction per standard Proctor, at a water content less than the optimum water content to achieve an unsaturated hydraulic conductivity of less than 1x10^{-7} cm/sec. With the mine waste and Repository cover in place, the flux of meteoric water through the Repository would be sufficiently low that no zone of saturation would develop on the surface of the radon barrier, and the radon barrier would remain in an unsaturated condition (see Attachment G.7). The ET performance of the Repository cover would aid in maintaining unsaturated conditions in the radon barrier and achieve the hydraulic conductivity and "no bathtub" design criteria outlined in USEPA (2013).

To achieve a stable foundation for mine waste placement and maintain a zone of separation from the underlying tailings, the following preparation tasks for the existing radon barrier beneath the footprint of the Repository are outlined.

Rock mulch and riprap removal. The rock mulch on the surface of the radon barrier would be excavated and stockpiled for use on the Repository cover. Rock mulch excavation will be conducted carefully to minimize removal of radon barrier material. Riprap currently lining the swales would also be removed. The swales would be filled to grade with the soil portion of the existing rock mulch, which will be separated by screening. The excavated surface of the radon barrier would be regraded where necessary to smooth the surface for compaction.

Radon barrier compaction. The radon barrier surface would be compacted using a method specification (consisting of a minimum number of passes with specific compaction equipment). The method specification would be developed from a test fill, with the number of passes determined to achieve 95 percent of standard Proctor dry density for the material in the top 6 inches of the radon barrier. The method specification would be checked with additional test fills if there is a variation in the radon barrier material or if the Construction Contractor (CC) changes compaction equipment. Additional reworking or excavation or ripping into the radon barrier is not recommended due to the potential for contact with and exposure of underlying tailings. Material properties of the radon barrier are described in the As-Built Reclamation Reports (Canonie, 1991, 1992, 1994, and 1995; Smith, 1996a, 1996b, and 1997)) from construction of the radon barrier, as well as in the test pit sampling of the cover in the PDS report (MWH, 2014a). A discussion of the radon barrier material properties is included in Section G.6.

Water application. Water would be added, as necessary, for dust control during rock mulch removal and radon barrier compaction. Water would be applied to the compacted radon barrier surface for dust control during initial mine waste hauling and placement.

Prior to removal of the erosion protection material from the cover of the existing TDA within the Repository, a baseline gamma radiation survey will be conducted on the surface. The survey will provide a location-specific ambient background level for comparison with the completed Repository cover (see Section G.12.4). The gamma survey will consist of a GPS-based one minute static survey at each node of a 150-foot square grid over the Repository area. The gamma radiation levels will be measured in exposure rate (uR/hr). The static gamma radiation survey will be conducted consistent with the static survey procedure described in Appendix T (Attachment T.2 Final Status Survey Plan) using a 2x2 NaI(Tl) scintillation detector interfaced with a scaler/rate meter. The scaler/rate meter will be integrated with a DGPS/controller to log the radiation levels and their corresponding position coordinates. Following removal of the erosion protection layer and prior to re-compaction of the radon barrier surface, a visual inspection of the cover will be completed to verify that tailings were not exposed during the removal process. The tailings are generally gray in color while the surficial materials are typically brown. This inspection will be completed prior to initiating compaction of the layer and prior to placement of mine waste in the Repository. If the visual inspection indicates tailings have been exposed, a post-excavation (one-minute) static gamma survey, similar to the baseline survey, can be performed to determine extent of the material exposed. If tailings are exposed in the process, the radon barrier would be excavated in the vicinity of one of the branch swales so that the material can be placed back below the radon barrier. The radon barrier extends down beneath the erosion protection in each of the branch swales. Removing the radon barrier within one of the swales would provide storage volume beneath the grade of the surrounding radon barrier.

G.5.2 Mine Waste Placement Sequence

Following preparation of the radon barrier, clean borrow soils will be used to construct perimeter stormwater berms at the edge of the mine waste placement area within the Repository. These berms will allow for containment of contact water within the Repository during waste placement (additional detail in G.5.3). As construction progresses, these berms will be incorporated into the construction of the soil cover layer. The stormwater containment berm design is described in Section G.5.3.1.

Excavated mine waste will be hauled from the Mine Site, and initially placed and compacted directly on the prepared radon barrier. The mine waste will be placed from the north to south across the Repository and will be spread in lifts for compaction. The perimeter slopes of the compacted mine waste surface will be extended as the mine waste surface is raised and the perimeter stormwater berms can be adjusted to maintain containment of contact water runoff from the outer slopes of the Repository. Once fill has been placed for the 2nd mine removal phase, subsequent fill phases should begin to mimic the final slope configuration so that the Repository can be completed with less volume, if necessary.

The Mine Site removal sequence is divided into six phases as shown on the Section 3 Drawings. Drawings 7-02 through 7-04 show, in concept, plan and section views of where each of the five phases (excluding the PTW phase) of removal from the Mine Site would be placed within the Repository. Three locations [Sandfill 1 (Area 7), Sediment Pad (Area 6), and Pond 1 (Area 9)] at the Mine Site have mine waste activity levels (for radium-226) greater than the weighted average (by volume) of the overall volume of mine waste. A summary of the activity levels for the mine removals is presented in Table G.5-1. The volume of these three areas combined account for less than 13 percent of the estimated total volume of mine waste to be placed in the

Repository. The activity levels were estimated from the analytical data in the PDS report, excluding the PTW. Of the 5 phases of removal and placement proposed, the majority of the volume is included in Phase 3. Areas 6, 7, and 9 (Sediment Pad, Sandfill 1, and Pond 1) would be removed in three different phases (Phases 2, 3, and 4). These three volumes would therefore will be dispersed within the other lower activity materials removed and then placed during that same phase. Further, the specifications for Mine Waste Excavation and Disposal limit the placement of the materials from these three Mine areas to greater than 200 feet from the outer slope of the Repository.

Table G.5-1: Mine Waste Weighted Average Activity Levels by Volume

Mine Removal Phase	Area(s)	Average of 75th Percentile Activity (pCi/g)	Estimated Removal Volume (CY)
2	1	2.4	14,763
2	2	26.7	37,005
2	3	11.4	67,138
2	4	5.2	13,771
2	7	50.5	40,917
3	6	86.3	23,086
3	8	24.2	422,473
4	5 and 11	9.8	6,399
4	9	85.2	29,302
4	10	10.2	7,758
5	12	7.1	34,272
6	13	6.5	28,356
		Weighted Average by Volume (75th percentile vales) = 26.5 pCi/g	

As described in Section G.12, the designed ET cover thickness is based on infiltration retention and evapotranspiration. This cover thickness has been analyzed for acceptable rates of radon-222 emanation at the cover surface, based on the weighted average (by volume) radium-226 activity levels of the mine waste. Refer to Attachment G.8 for specifics on the radon emanation calculations.

The Design Drawings (Section 7) show a Repository layout for storage of approximately 1.03M CY. The design capacity for the Repository is based on the removal estimate for soil and debris (waste) from the Mine Site described in Appendix C. The placement sequence allows for flexibility in the final volume by making adjustments to the top surface (at approximately 2 percent slope) and how this surface ties into the existing TDA cover on the south side of the Repository. The 1.03M CY capacity provides for approximately 30% contingency storage.

G.5.3 Stormwater Controls

The Repository design and layout has been incorporated into the existing site stormwater features of the previously reclaimed TDA. This has been accomplished by sloping the cover surface to existing Branch Swale C located on the east and south sides

of the Repository. On the north side, surface flow from the Repository will be directed into the North Cell Drainage Channel, which directs flow around the TDA from the east side to the north side and outlets to the Pipeline Arroyo. On the west side of the Repository, following construction of the Repository cover, clean fill will be added to the existing TDA cover, with similar erosion protection (rock admixture) to the Repository cover, to convey surface flow from the new cover to the crest of the TDA embankment and down into the existing Runoff Control Ditch. The Runoff Control Ditch will be modified, and the riprap will be enlarged.

On the southwest side of the Repository cover, clean fill will be required to fill in existing Branch Swale D, which currently drains to the northeast. Stormwater off the Repository will flow away from the new cover to the southwest. The surface of this fill area will include a similar erosion protection layer to the Repository cover. Flow from this small catchment area of the Repository will be directed onto the existing TDA cover and to existing Branch Swale H which flows to the south. Branch Swale H is planned to be reestablished once the evaporation ponds are decommissioned and removed. The Section 9 Drawings show the stormwater control designs for the Repository and they are described in Appendix I.

G.5.3.1 Stormwater Management during Construction

Stormwater control berms, constructed with clean borrow soil, will be used to contain contact water within the Repository footprint. These perimeter berms will be incorporated into the cover soils placed over the mine waste. The primary purpose for the stormwater controls will be to contain stormwater in contact with the mine waste within the Repository boundaries. The controls will include a clean soil berm placed along the perimeter of the Repository footprint that extends beyond the elevation of waste placement. The berm is sized to provide capacity for retention of the selected design storm event runoff volume, with an additional one foot of freeboard. Stantec selected the 10-year, 24-hour storm event as the design storm for the perimeter stormwater berms, based on the relatively short Repository construction period.

The perimeter berms will be constructed with clean fill in compacted lifts. The condition of the berms will be inspected and maintained by the CC during Repository construction for appropriate freeboard and discharge capacity and repaired or modified as necessary. The berms will be raised, as needed, as the waste surface is raised to maintain freeboard above the waste surface. Clean fill on the outside of the berms will also serve as interim cover over the mine waste so that stormwater in contact with the outer slopes is no longer considered contact water and can be allowed to be discharged as clean stormwater.

Temporary stormwater controls for the Repository and other areas of the Mill Site will include best management practices (BMPs) to prevent erosion from excavated areas and unprotected slopes. Proposed locations for the BMPs on the Repository are shown on the Section 5 Drawings. These measures will be required prior to establishment of vegetation on the cover. These BMPs are to be defined in the Stormwater Management Plan (Appendix E) which provides guidelines for the preparation of the Construction Stormwater Pollution Prevention Plan.

G.5.4 Potential Impacts to Ongoing Groundwater Remediation

Piping used by General Electric/United Nuclear Corporation (GE/UNC) site personnel at the pumping wells, the active sampling wells, and the bioventing area have been identified and are shown on the Site Utilities drawing in the Section 1 Drawings. Proposed haul roads and site improvements have been designed to account for the locations of the existing groundwater infrastructure and to minimize conflicts with existing operations during construction. Monitoring wells located near proposed areas of disturbance (particularly in the vicinity of the South Borrow Area) will be protected with visible barriers to prevent damage to the wells from construction traffic.

G.6 MATERIAL PROPERTIES

The material properties presented below represent the base case scenario used in the individual design analyses (i.e., stability, settlement, liquefaction, and cover cracking). Any variations to these material properties are discussed in the calculation briefs for each design analysis. Material strength parameters were used in the stability analysis, and the calculated total stress friction angles are discussed further in Appendix G.2, Slope Stability Analysis.

The Mill Site PDS investigation encountered the following materials within the TDA: general fill, erosion protection admixture, radon barrier (clay), tailings, alluvium, and various bedrock units (including coal, shale, and sandstone). Some of these units were further subdivided according to notation in the borehole logs, results of CPT logs, and results of laboratory analysis. The Mine Site PDS investigation included laboratory testing of mine spoils material.

The material identifications used in the analyses are discussed below and are as follows: erosion protection, cover soil, mine waste, radon barrier, general fill, coarse tailings, fine tailings, coarse/fine tailings, coarse alluvium, and fine alluvium. Table G.6-1 presents the material properties associated with each of these materials used in the analyses.

Erosion Protection

The erosion protection layer will be the uppermost layer of the proposed Repository. It will be constructed by placing a mixture of cover soil (67 percent by volume) and aggregate (33 percent by volume). Properties for this material were developed based on the material properties of the cover soil and testing results (specific gravity) from on-site aggregate stockpiles. Other assumptions regarding the erosion protection are as follows:

- It is assumed that this material will be placed at 90 percent relative compaction per standard Proctor.
- The aggregate in the erosion protection layer will have properties similar to those found in on-site stockpiles and tested as part of the PDS (MWH, 2014a).
- Due to the mixed nature of this material, it is assumed that the fines content of this material will be equal to 67 percent of that contained in the cover soil.
- This material will have a lower long-term moisture content than the cover soil due to the increased aggregate content.

Cover Soil

The cover soil consists of the material that will be placed over the mine waste as part of the Repository ET cover. It will be excavated from on-site borrow sources identified in the Mill Site PDS (MWH, 2014a) or from similar material to be excavated for the jetty construction. These borrow sources were investigated during the Mill Site PDS and samples obtained from the borrow areas were classified as clayey and silty sands and low-plasticity clays. Fines contents ranged from 38 to 78 percent and plasticity index (PI) values range from 3 to 23 (MWH, 2014a). The Dilco Hill Borrow Area is not a preferred borrow source and, at this time, there are no plans to use that material during the RA. Therefore, results of analyses performed on samples originating in the Dilco Hill Borrow Area were excluded when calculating the cover soil material properties. Other assumptions regarding the cover soil are as follows:

- The cover soil will be placed in a state of compaction similar to the in-situ conditions within the borrow areas.
- Specifications for the ET cover will require the soil be placed at 90 percent relative compaction per standard Proctor and have a water content no more than minus 3 percent from optimum water content,

Mine Spoils

Mine spoils consist of the material that will be removed from the Mine Site and placed into the Repository during the RA. Material properties of the mine spoils were estimated by averaging the results of laboratory tests performed on samples of mine spoils collected during the Mine Site PDS (MWH, 2014b). Mine spoils material was not tested for fines content and Atterberg limits. Therefore, due to the similarity between the geotechnical properties of these materials, it is assumed that the mine spoils material

has the same fines content and Atterberg limits as the cover soils in the proposed borrow areas. The dry unit weights have a percent difference on average of 3.7 percent and the specific gravities have a percent difference of 1.1. In the absence of laboratory data, assuming other geotechnical properties are also similar is a reasonable approach. Other assumptions regarding the mine spoils are as follows:

- Mine spoils index properties are similar to the cover materials and are assumed to have the same fines content and PI as the cover soil.
- Mine spoils will be placed in horizontal lifts at 90 percent relative compaction per Standard Proctor.

Radon Barrier

The existing radon barrier over the TDA consists of low-plasticity clay with fines contents ranging from 51 to 69 percent (MWH, 2014a). Prior to construction of the Repository, the radon barrier within the footprint of the proposed Repository will be reconditioned and improved. Activities to improve the radon barrier will include: stripping the upper erosion protection material, separating unsuitable materials (organics and erosion protection rock), moisture conditioning the surface of the radon barrier material, and re-compaction of the radon barrier material. The radon barrier will be compacted to 95 percent relative compaction per Standard Proctor at a water content of less than a maximum of minus 1 percent of the optimum water content.

Strength Parameters of Cover, Mine Spoils, and Radon Barrier

Triaxial testing was not performed on the borrow material, mine spoils, or radon barrier material; therefore, strength parameters (cohesion, c, and friction angle, ϕ) for these materials were based on strength parameters obtained from triaxial testing on a sample of embankment material from borehole TI-B3 at 21 feet below ground surface (bgs). The average in-place dry densities were calculated to be 103.5 pcf, 106.5 pcf, and 104.7 pcf for the borrow material (Cover), mine spoils, and radon barrier materials, respectively. These values were compared to the Embankment material average in-place dry density of 105.3 pounds per cubic foot (pcf). The average fines content and PI of the embankment material are 50 percent and 13.5 percent, respectively. The average fines content and PI of the cover material (and assumed mine spoils) is 53 percent and 12 percent, respectively. The average fines content and PI of the radon barrier are 59 percent and 16 percent, respectively. Given the percent fines, PI, and liquid limit of these materials, each would classify as CL according to USCS (Unified Soil Classification System). Literature values (Lambe & Whitman, 1969, Figure 21.4) show that typical effective friction angles range from 28 degrees to 35 degrees for normally consolidated clays classified as CL with a similar plasticity index to the materials described above. Therefore, the triaxial shear strength test results of the embankment material (effective friction angle of 32 degrees) is considered representative of each of these three materials based on comparison of material index properties (i.e., dry density, fines content, and PI) and literature values.

General Fill

General fill was encountered in the TDA during the Mill Site PDS subsurface investigation. The existing fill material properties were calculated from the average of the laboratory test results from samples obtained from the existing impoundment material described as 'fill'. The fill samples were generally classified as CL, but some were classified as SM and SC. Laboratory testing indicates that this material is sandy and low-plasticity clays with fines contents ranging from 35 to 72 percent and PIs ranging from 17 to 20.

Triaxial testing was not performed on the existing fill material, so the strength parameters (c and ϕ) for the fill material were also based on triaxial testing on a sample of embankment material from borehole TI-B3 at 21 feet bgs. The embankment material has a slightly higher density and fines content than the existing fill material, and slightly lower PI value than the existing fill material. Based on these relationships between the two materials, it was assumed that the strength properties of the fill material would also be slightly lower (Figure 21.4 from Lambe and Whitman, 1969). The cohesion value was assumed to be zero, and the phi values were assumed to be 10 percent less than the embankment material phi values, resulting in a phi value of 29 degrees. This correlates well to the lower end of phi values shown in Lambe and Whitman (Figure 21.4) for PI values of approximately 20 percent. Since some of the fill material samples were classified as SM and SC, typical phi values for fine sands were also considered. As shown in Lambe and Whitman (1969) Figure 11.11, the phi value for fine sands with an initial void

ratio of 0.67, would also be approximately 30 degrees. Based on literature values, an assumed phi value of 29 degrees is a conservative assumption given the known material properties of the existing fill.

Tailings

Tailings produced by the UNC uranium mill were deposited in the TDA. They range from silty and clayey sands to sandy clays and high plasticity clays. The fines content of tailings samples analyzed during the Mill Site PDS ranged from 7 to 97 percent and the fine-grained particles ranged from non-plastic to a PI of 61. Due to this wide range of material properties, the tailings have been subdivided into three categories: coarse tailings, fine tailings, and coarse/fine tailings.

During the milling process, a significant amount of sulfate was introduced into the tailings (from the sulfuric acid used for acidification), causing gypsum to precipitate. The concentration of gypsum in the tailings varies with grain size, with the greatest amount of gypsum likely present in the fine-grained tailings.

The presence of gypsum is known to affect certain geotechnical laboratory test results, specifically particle-size distribution and water content. Results of water content tests performed on samples containing gypsum are often artificially elevated due to the loss of molecular water within the gypsum. For this reason, samples containing gypsum should be dried at a lower temperature to remove the soil (pore) moisture without removing the molecular water from the sample.

As presented in the Mill Site PDS (MWH, 2014a), some of the tailings samples were analyzed at the standard temperature (110°C). Other samples were analyzed at both the reduced temperature recommended by ASTM (60°C) and the standard temperature. The reason for the reduced temperature drying was the presence of gypsum in the samples. At the standard temperature (110°C), gypsum will decompose and release molecular water. This molecular water is fundamentally different than the pore water that defines water content. The lower temperature will evaporate the pore water without decomposing the gypsum. The results of analyses performed on samples at both temperatures were used to develop a correlation between the artificially elevated water contents measured during the tests performed at the standard temperature and the more appropriate results from samples dried at the lower temperature. The higher temperature drying yielded water contents 0.5percent to 3 percent larger than the lower temperature drying (due to the loss of water contained in molecular bonds). Tests that were only conducted at 110°C were therefore decreased by the same ratio that was observed empirically in samples tested at both temperatures. This process and the correlation between these values are discussed in more detail in the Mill Site PDS (MWH, 2014a). The water content, specific gravity, and unit weight values used to represent the fine tailings and coarse/fine tailings in the design analyses were obtained from averaging the results of samples performed at 60°C, as well as the adjusted results of tests performed at 110°C.

Coarse Tailings

Tailings identified as coarse tailings were generally unsaturated and exhibited higher tip resistance and sleeve friction during cone penetration tests (CPTs) than the fine-grained tailings. Coarse tailings are sandy *and* have a fines content of less than 40 percent. Atterberg limits testing performed on coarse tailings indicated that the fines in all samples were non-plastic. The coarse-grained tailings material properties were calculated from the average of the laboratory test results on the samples labeled 'coarse tailings' from the impoundment samples. The friction angle was determined from triaxial testing from a sample at borehole location TI-B1 at a depth of 27 feet, where coarse grained tailings were identified, and is considered representative of the coarse tailings based on material index properties.

Fine Tailings

Fine tailings exhibited lower tip resistances during CPTs than those exhibited by coarser tailings. CPT sleeve frictions of the fine tailings were also lower than those exhibited by coarser tailings and were often near zero. Fine tailings are clayey, have fines contents ranging from 69 to 97 percent, and PIs ranging from 27 to 61. The fine-grained tailings material properties were calculated from the average of the laboratory test results on the samples labeled 'fine tailings' from the impoundment samples, using the results of water content, specific gravity, and unit weight performed at 60°C, as discussed previously. The friction angle for the fine tailings material was determined from triaxial testing from a sample at borehole location TI-B1 at a depth of 31

feet, where fine-grained tailings were identified, and is considered representative of the fine-grained tailings within the impoundment.

Coarse/Fine Tailings

Tailings samples containing between 40 and 65 percent fines were identified as coarse/fine tailings. Coarse/fine tailings are classified as clayey sands and sandy clays according to the USCS. Coarse/fine tailings samples analyzed during the Mill Site PDS had fines contents ranging from 48 to 57 percent and PIs ranging from 17 to 24. Tailings samples identified as coarse/fine tailings were generally near 100 percent saturation (83 to 99 percent). Triaxial testing was not performed on the coarse/fine tailings material and strength parameters were not applied to this material. The use of strength parameters (friction angle and cohesion) is only applicable to the stability analysis, and this material was not used in the stability analysis. As discussed further in Attachment G.2, layers of coarse/fine tailings were conservatively assumed to be fine tailings.

Alluvium

The TDA was constructed on top of unconsolidated alluvium which overlies bedrock. The alluvium consists of a mixture of sand, silt, clay, and to a lesser amount, gravel. The fines content of alluvium samples analyzed during the Mill Site PDS ranged from 17 to 91 percent and the fine-grained particles ranged from non-plastic to a PI of 31. Due to this wide range of material properties, the alluvium has been subdivided into two categories for applicable analyses: coarse alluvium and fine alluvium.

Coarse Alluvium

Alluvium samples with fines content less than 50 percent were identified as coarse alluvium. Generally, coarse alluvium is unsaturated silty or clayey sands with non-plastic fines. Coarse alluvium samples submitted for laboratory analysis contained 17 to 50 percent fines.

Fine Alluvium

Alluvium samples with fines content greater than 50 percent were identified as fine alluvium. Generally, Fine alluvium is sandy or lean clays with plastic fines. Fine alluvium samples submitted for laboratory analysis contained 61 to 91 percent fines with PIs ranging from 0 (non-plastic) to 31.

Tailings Impoundment Dam (Embankment)

The existing tailings impoundment dam (embankment) was classified as a sandy or silty clay to a clayey sand with a fines content ranging from 14 to 42 percent and a plasticity index ranging from 9 to 18 percent. The material properties were determined from the average of laboratory test results from samples collected in the embankment (labeled as 'dam') to a depth of 40 feet. The friction angle was based on triaxial testing from a sample taken from borehole location TI-B3 in the embankment material at a depth of 21 feet and is considered representative of the embankment material. The cohesion was conservatively assumed to be zero for the analyses. The friction angle was also compared to literature values in Lambe and Whitman (Figure 21.4, 1969). The average, 60th percentile, and maximum plasticity index values the embankment material (13 percent, 14 percent, and 18 percent, respectively) correlate to friction angles ranging from approximately 34 degrees to 31 degrees based on the trendline. The data used to generate the trendline fall above and below the line, but typically correlate to friction angles ranging from 37 degrees to 30 degrees for a plasticity index range of 13 percent to 18 percent, respectively.

Bedrock

Bedrock (sandstone) material properties were determined from information included in the boring logs as well as from the average of laboratory test results from samples labeled as 'sandstone' and/or 'claystone'. The cohesion value for the underlying bedrock was based on penetration resistance (blows/ft) data on the sandstone material, taken from the boring logs. A correlation between the penetration resistance and unconfined compressive strength was used to determine the cohesion value (Lambe and Whitman, 1969).

Table G.6-1: Summary of Material Properties

Material	Specific Gravity, Gs	Void Ratio, e	Relative Compaction (%)	Dry Density (pcf)	Max Dry Density (pcf)	Optimum Water Content (%)	Moist Unit Weight (pcf)	Water Content (%)	Effective Friction Angle (°)	Total Friction Angle (°)	Fines Content (%)	Plasticity Index (PI) (%)	Coefficient of Consolidation, Cc	Comment/Justification
Erosion Protection (rock)	2.71	0.45	90	117.0	130.0	-	122.9	5.0	-	-	-	-	-	Assumed maximum dry density and optimum water content. Assume 90 percent of maximum dry density and water content was calculated from optimum water content minus 3 percent.
Cover (soil)	2.69	0.62	90	103.5	115.0	13.8	114.7	10.8	32	-	53	12	0.086	Average maximum dry density and optimum water content from laboratory test results on borrow samples, excluding Dilco Hill. Calculated dry density from 90 percent maximum dry density and water content calculated from optimum water content minus 3 percent. Phi based on sample TI-B3 at 21 feet (median value of 3 tests), similar properties to borrow (i.e. fines and PI). Specification to be set at 90 percent of standard Proctor compaction.
Mine Spoils	2.66	0.56	90	106.5	118.3	12.3	116.4	9.3	32	-	53	12	0.086	Average maximum dry density and optimum water content from laboratory test results on mine samples. Calculated dry density as 90 percent of maximum dry density and water content calculated from optimum water content minus 3 percent. Strength based on embankment samples; density of recompacted mine spoils similar to the embankment fill. Specification to be set at a minimum of 90 percent of standard Proctor compaction.
Radon Barrier	2.68	0.51	95	110.5	116.3	13.7	122.3	10.7	32	-	59	16	-	Average maximum dry density and optimum water content from laboratory test results on radon barrier samples. Calculated dry density as 95 percent maximum dry density and water content as average of in-place water content of 'radon barrier' samples. Strength based on embankment CU samples, tested with similar properties to the radon barrier data (cover). Specification to be set at 95 percent of standard Proctor compaction and maximum of -1 percent to optimum water content.
Existing Fill	2.69	0.67	-	100.7	-	-	113.8	13.0	29	-	48	19	0.086	Average of results from laboratory test results for Impoundment - Samples labeled as "fill". Fill samples generally classified as CL, some SM, SC. Strength based on embankment fill, use lower value since density is lower than proposed fill and embankment samples
Coarse Tailings	2.67	0.71	-	97.5	-	-	108.1	10.9	34	-	21	0	0.084	Average of results from laboratory test results for Impoundment - Samples labeled as "coarse tailings", strength from B1 at 27 feet.
Coarse/Fine Tailings	2.72	0.90	-	89.2	-	-	116.0	30.0	-	-	52	20		Average of results from laboratory test results for Impoundment - Samples labeled as "coarse/fine tailings".
Fine Tailings	2.70	1.35	-	71.7	-	-	107.6	50.1	33	19	83	43	0.408	Average of results from laboratory test results for Impoundment - Samples labeled as "fine tailings", strength from B1 at 31 feet.
Alluvium (All)	2.72	0.73	-	97.9	-	-	114.8	17.3	22	-	57	22	0.090	Average of results from laboratory test results for Impoundment - Samples labeled as "alluvium", strength based on clay alluvium from B3 at 56 feet. Used for stability analyses only.
Alluvium (Coarse)	2.71	0.73	-	96.9	-	-	111.0	14.6	-	-	-	-	-	Average of results from laboratory test results for Impoundment - Samples labeled as "alluvium". Coarse alluvium defined as alluvium samples with less than 50% fines.
Alluvium (Fine)	2.74	0.72	-	99.4	-	-	120.7	21.4	-	-	-	-	-	Average of results from laboratory test results for Impoundment - Samples labeled as "alluvium". Fine alluvium defined as alluvium samples with greater than 50% fines.
Dam	2.66	0.55	-	107.0	-	-	119.1	11.3	32	-	45	13	-	Average of results from laboratory test results for Impoundment - Samples labeled as "dam" to a depth of 40 feet at B3.
Bedrock				107.2			124.4	16.0						From laboratory testing on 3 samples of sandstone; Cohesion = 4000.

G.7 SEISMIC HAZARD ANALYSIS

A site-specific probabilistic seismic hazard analysis (PSHA) and a deterministic seismic hazard analysis (DSHA) were conducted to develop seismic design criteria for the Repository. The complete seismic hazard analysis report is included as Attachment G.1. The probabilistic seismic hazard analysis is based on a seismotectonic model and source characterization of the Mill Site and surrounding area. The study evaluated an area within a 124-mile (200-km) radius surrounding the Mill Site. The SHA was performed to estimate the seismic hazard at the project site within a probabilistic and deterministic framework by characterizing potential seismic sources. The peak ground acceleration (PGA) calculated in this PSHA was used during design to evaluate liquefaction potential, seismic settlement, and slope stability for the Repository. A summary of the PSHA results are provided in Table G.7-1. A mean PGA value of 0.30 was used in the analyses for the 95% design.

Table G.7-1: Summary of PSHA Results

Return Period (years)	V_{s30} (ft/s)	V_{s30} (m/s)	Mean PGA (g)
10,000	902	275	0.30
	1,348	420	0.28
	1,857	566	0.25

1. V_{S30} = shear wave velocity in the upper 30 meters.
2. g = acceleration due to gravity

G.8 SLOPE STABILITY ANALYSES

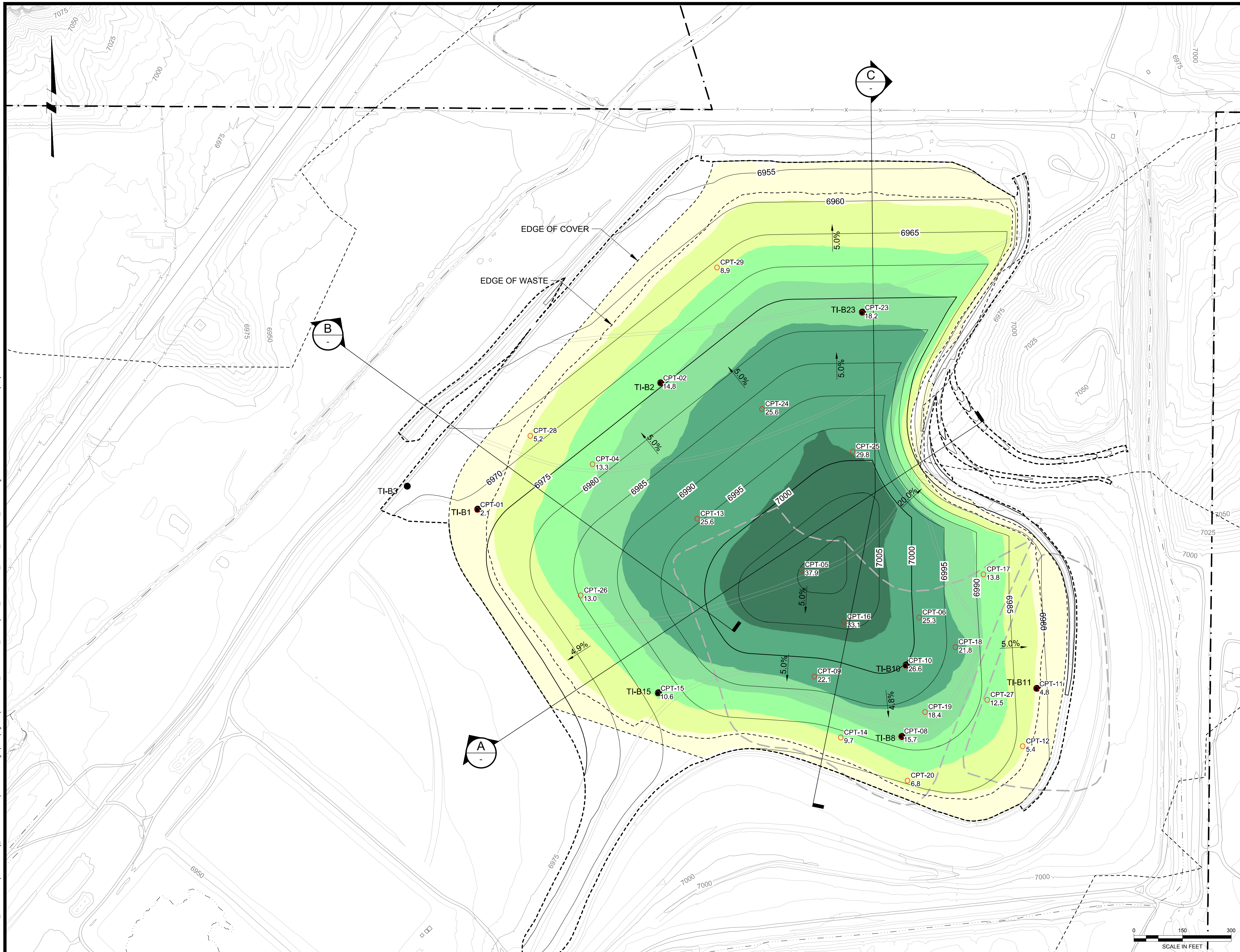
Static and pseudo-static slope stability analyses were conducted for the Repository. The slope stability analysis calculation brief, which includes a figure showing the cross-sections locations used for the analyses, is included as Attachment G.2. Three cross-sections were selected for stability analyses (shown on Figure G.8-1). The cross sections were selected as representative of the maximum loading conditions, critical slope geometry, and maximum fill height for the Repository. The cross-sections are located along the Repository slopes to represent loading conditions on the existing TDA and embankment, to evaluate design slopes of the final Repository cover slopes, and to evaluate the global stability of the final Repository and existing TDA embankment. Limit equilibrium slope stability analyses were performed using the GeoStudio software SLOPE/W (Geoslope International, 2016). Material properties and the geometry and stratigraphy of the selected cross-sections were based on the results of previous field investigations and laboratory analyses conducted during the PDS. The analysis evaluated both circular and block-type failure surfaces along the selected cross-sections.

The critical (lowest) calculated factors of safety for both static and pseudo-static loading conditions for each of the cross sections from the model outputs were evaluated against the required design factors of safety given by the US Nuclear Regulatory Commission (NRC) design guidance documents. A summary of the static and pseudo-static slope stability results are provided in Table G.8-1. The calculated factors of safety are greater than the recommended minimum factors of safety for each case evaluated. Additional slip surfaces and factors of safety are presented and summarized in Attachment G.2 for deep failures to bedrock, shallow failures, and failures that toe at the bottom of the cover and/or embankment for each analysis.

Table G.8-1: Summary of Slope Stability Results

Cross Section	Failure Type	Loading Condition	Minimum Required Factor of Safety [1]	Calculated Factor of Safety
Cross Section A – Southwest Slope	Circular	Static	1.5	9.9
		Pseudo-Static	1.0	1.8
Cross Section A – Northeast Slope	Circular	Static	1.5	2.8
		Pseudo-Static	1.0	1.3
	Block	Static	1.5	2.8
		Pseudo-Static	1.0	1.3
Cross Section B – Repository Slope	Circular	Static	1.5	8.1
		Pseudo-Static	1.0	1.7
Cross Section B – Existing Dam	Circular	Static	1.5	2.4
		Pseudo-Static	1.0	1.2
Cross Section B – Arroyo Flood	Circular	Static	1.2	2.6
Cross Section C – North Slope	Circular	Static	1.5	3.2
		Pseudo-Static	1.0	1.7
Cross Section C – North Slope (Entry/exit)	Circular	Pseudo-Static	1.0	1.7
Cross Section C – Arroyo Flood	Circular	Static	1.2	2.6
Cross Section C – South Slope	Circular	Static	1.5	10.3
		Pseudo-Static	1.0	1.8

1. NRC Regulatory Guide 3.11 (NRC, 2008)



LEGEND:

7200	EXISTING GROUND SURFACE CONTOUR & ELEVATION, FEET
7200	PROPOSED SURFACE CONTOUR & ELEVATION, FEET
	EXISTING ROAD
	EXISTING DRAINAGE
	FENCE
	BOUNDARY OF REPOSITORY
	FORMER BORROW PIT BOUNDARY
CPT-17	CPT LOCATION
TI-B15	BORING LOCATION
A	SLOPE STABILITY CROSS SECTIONS (SEE 6.2)

REPOSITORY FILL THICKNESS

NUMBER	MIN (FT)	MAX (FT)	COLOR
1	0.0	5.0	
2	5.0	10.0	
3	10.0	15.0	
4	15.0	20.0	
5	20.0	30.0	
6	30.0	42.0	

DESIGNED S DOWNEY
CHECKED M DAVIS
APPROVED J CUMBERS

MWH. now part of Stantec

UNITED NUCLEAR CORPORATION AND NORTHEAST CHURCH ROCK MINE
McKINLEY COUNTY, NEW MEXICO

REPOSITORY LAYOUT

FIGURE
G.8-1
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G.9 SETTLEMENT ANALYSES

The settlement analyses conducted for the Repository includes immediate settlement, primary consolidation, secondary consolidation, and seismic induced settlement. The analyses were conducted to evaluate settlement due to placement of the mine waste and cover material on the existing TDA. The settlement analyses calculation briefs, except for seismically-induced settlement, are provided as Attachment G.3. The seismically-induced settlement calculation brief is provided as Attachment G.4. Figure G.8-1 shows the borehole and CPT locations, and the fill thicknesses used to conduct the analyses. The proposed surfaces for the top of mine waste and top of cover for the Repository were used to determine the proposed thickness of fill at each CPT and/or borehole location within the Repository. These fill thicknesses were used to determine the increase in stress within the Repository at each location.

Based on the filling plan progressing from north to south, the north slope of the Repository will be filled to design waste grade during early stages of filling. The north slope of the Repository would be completed several months before completion of fill placement in the southeast corner. During placement to the design waste grade and covering with a temporary cover of clean soil, settlement will be monitored, by survey while fill placement continues in other areas of the Repository. Settlement monitoring data will be collected during the construction period and compared to the predicted consolidation settlements to verify that no additional grading mitigation measures are necessary prior to completion of the final cover.

G.9.1 Immediate Settlement

Immediate settlement was calculated for one-dimensional settlement, following the guidelines presented in the NAVFAC 7.01 design manual (Department of the Navy, 1986), based on guidance in NUREG-1620 (NRC, 2003). The immediate settlement of the TDA surface near the perimeter of fill placement was evaluated to address potential impacts of cover cracking of the existing radon barrier as a result of differential settlement. Immediate settlement of the upper unsaturated materials (including the radon barrier) would occur rapidly and incrementally with each layer of mine waste and will therefore not impact the long-term performance of the Repository cover. Cover cracking of the existing radon barrier is discussed in Section G.10.

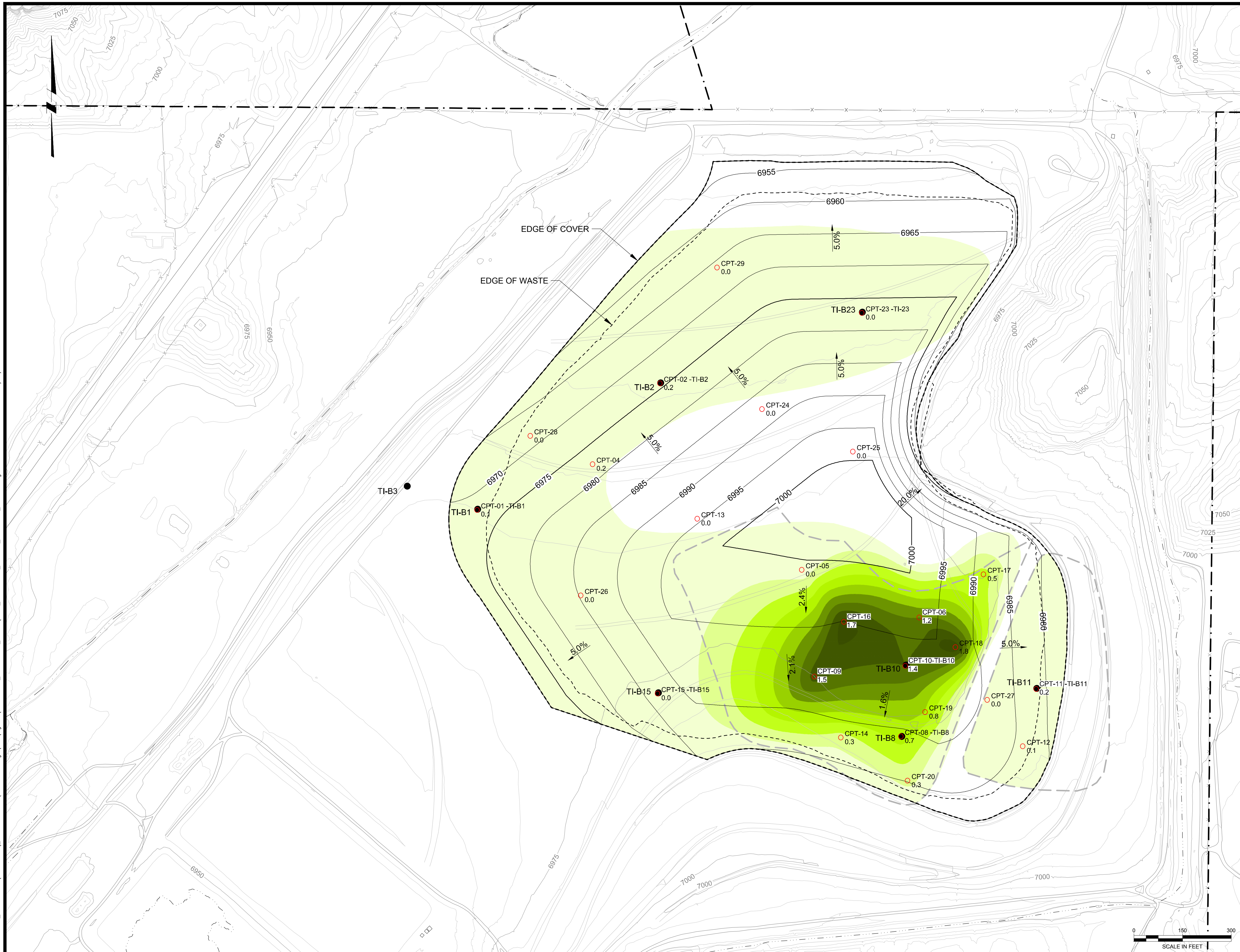
Immediate settlement was calculated at three locations (B15/CPT-15, CPT-26, and B1/CPT-01) on the southwest slope of the Repository. These locations were selected because they are closest to the area where the Repository fill will transition directly to an area where the existing radon barrier will remain in-place and unmodified. The primary focus for evaluating the immediate settlement is to determine the contribution to differential settlement near the perimeter. Within the interior of the Repository the immediate settlement will occur incrementally as fill is placed and will not affect the Repository. The results of the immediate settlement analysis were used to determine the extent of the impacts from Repository construction on the existing TDA cover. A summary of the results of the immediate settlement analysis are present in Table G.9-1.

Table G.9-1: Summary of Immediate Settlement Results

Location	Immediate Settlement (ft)
CPT-01	0.1
CPT-15	1.0
CPT-26	0.6

G.9.2 Primary Consolidation

Settlement during and following active construction of the Repository is anticipated to result from primary consolidation caused by fill placement and the resulting dissipation of porewater pressures in the fine-grained tailings. Primary consolidation was calculated using a one-dimensional consolidation settlement analysis following the guidelines presented in the NAVFAC design manual 7.01 (Department of the Navy, 1986) and based on guidance in NUREG-1620 (NRC, 2003). Each of the 25 CPT locations within the Repository footprint were used to estimate the primary consolidation. The soil profiles were created using



LEGEND:

7200	EXISTING GROUND SURFACE CONTOUR & ELEVATION, FEET
7200	PROPOSED SURFACE CONTOUR & ELEVATION, FEET
	EXISTING ROAD
	EXISTING DRAINAGE
	FENCE
	BOUNDARY OF REPOSITORY
	FORMER BORROW PIT BOUNDARY
CPT-17	CPT LOCATION
TI-B15	BORING LOCATION

CONSOLIDATION SETTLEMENT

NUMBER	MIN (FT)	MAX (FT)	COLOR
1	0.0	0.2	
2	0.2	0.4	
3	0.4	0.6	
4	0.6	0.8	
5	0.8	1.0	
6	1.0	1.2	
7	1.2	1.4	
8	1.4	1.6	
9	1.6	1.8	
10	1.8	2.0	

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APPROVED J CUMBERS

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REPOSITORY LAYOUT
AND SETTLED CONTOURS

FIGURE
G.9-1
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data from CPT and borehole testing locations conducted during the PDS (see Figure G.8-1). Consolidation was calculated using the fill thickness from the Repository design at the locations of the CPT hole locations. Seven of the 25 locations included boreholes paired with the CPT.

Because only the fine-grained tailings are near saturation, the primary consolidation calculations only include settlement results for fine-grained tailings. In locations where the estimated settlement is presented as 0.0, a near saturated layer or no fine-grained tailings layers were encountered. The primary consolidation was estimated for each location where fine-grained tailings were encountered in the subsurface profile, if the profile information along with the laboratory data, indicate the fine tailings are near saturation (85 percent degree of saturation or greater). Additionally, in locations where interlayered fine and coarse tailings were encountered, the overall thickness of this material was assumed to behave as fine tailings to present a more conservative estimate of primary consolidation settlement totals for the location. The calculated primary consolidation at each location is summarized in Table G.9-2, and the calculations are included in Attachment G.3.

Table G.9-2: Summary of Primary, Secondary, and Total Consolidation Results

Location	Primary Consolidation (ft)	Secondary Consolidation (ft)	Total Primary and Secondary Consolidation Settlement (ft)
CPT-01 (TI-B1)	0.02	0.05	0.1
CPT-02 (TI-B2)	0.13	0.03	0.2
CPT-04	0.17	0.04	0.2
CPT-05	0.00	0.00	0.0
CPT-06	1.03	0.22	1.3
CPT-08 (TI-B8)	0.51	0.21	0.7
CPT-09	1.13	0.34	1.5
CPT-10 (TI-B10)	1.08	0.29	1.4
CPT-11 (TI-B11)	0.08	0.14	0.2
CPT-12	0.02	0.03	0.1
CPT-13	0.00	0.00	0.0
CPT-14	0.20	0.05	0.3
CPT-15 (TI-B15)	0.00	0.00	0.0
CPT-16	1.34	0.32	1.7
CPT-17	0.40	0.09	0.5
CPT-18	1.45	0.35	1.8
CPT-19	0.59	0.21	0.8
CPT-20	0.19	0.12	0.3
CPT-23 (TI-23)	0.00	0.00	0.0
CPT-24	0.00	0.00	0.0
CPT-25	0.00	0.00	0.0
CPT-26	0.00	0.00	0.0
CPT-27	0.00	0.00	0.0
CPT-28	0.00	0.00	0.0
CPT-29	0.00	0.00	0.0

G.9.3 Secondary Consolidation

Settlement estimates for the completed ET cover surface resulting from secondary consolidation (creep) are also included in the estimated overall total settlement. Secondary consolidation was calculated using a one-dimensional settlement analysis following the guidelines presented in the NAVFAC design manual 7.01 (Department of the Navy, 1986) and based on guidance in NUREG-1620 (NRC, 2003). The same soil profiles used for primary consolidation were used to estimate the secondary consolidation at 25 locations within the Repository footprint. The soil profiles were created using data from CPT and borehole testing locations conducted during the PDS. The secondary consolidation was calculated for each fine-grained tailings layer in each CPT vertical soil profile location. The summation of the secondary consolidation in each fine-grained tailings layer at one location resulted in the total estimated secondary consolidation at that location. The secondary consolidation calculations include estimates of secondary consolidation for locations where the fine-grained tailings are near saturation. The calculated secondary consolidation at each location is presented in Table G.9-2. In locations where the estimated settlement is presented as 0.0, a saturated or near saturated fine-tailings layer was not encountered. The overall total (primary plus secondary) consolidation estimates are also presented in Table G.9-2.

Figure G.9-1 shows the estimated total amounts of consolidation settlement expected to occur during the construction period as well as over the design life of the Repository. Immediate settlement is not included in the totals shown on Figure G.9-1 since immediate settlement will occur prior to the completion of the cover. In addition, a percentage of the consolidation settlement totals shown on the figure will occur prior to completion of the final surface of the cover as fill is placed. Therefore, the amounts shown represent upper limits for the post-construction settlement totals. The figure presents total estimated settlements based on profiles from the CPT and borehole locations as well as settled surface contours showing expected changes to the cover surface grading if the estimated total settlement were to occur. The contouring indicates changes to the design slopes will occur on the south facing slope and a portion of the east facing slope (over the east and south edge of the former borrow pit). However, based on the calculations, predicted settlements will not result in slope reversal or areas of ponding on the cover.

G.9.4 Seismic Settlement

Seismic settlement calculations were prepared to estimate the potential settlement that may occur within the footprint of the proposed Repository as a result of the design seismic event. Analysis of one-dimensional stratigraphic profiles was performed using the design seismic event which was characterized by the parameters presented in the PSHA (see Attachment G.1). The seismic settlement analysis used data collected during CPTs, hollow-stem auger (HSA) drilling, and laboratory testing from the PDS to estimate the magnitude of potential seismic settlement within the footprint of the proposed Repository.

Six one-dimensional stratigraphic profiles were developed and analyzed as part of the seismic settlement analysis. These six locations correspond with locations where shear wave velocities were measured during CPT. The stratigraphic profiles were developed based on conditions observed during the Mill Site PDS (MWH, 2014a) field investigation and modified to reflect proposed Repository construction (placement of mine waste and the Repository cover). During the Mill Site PDS field investigation, eight boreholes were "paired" with, and drilled adjacent to, CPT locations. Seven of these paired locations are within the footprint of the proposed Mill Site Repository, and shear wave velocity measurements were recorded during CPT at six of those locations. A summary of the seismic settlement analyses results is presented in Table G.9-3 and the calculation brief is included as Attachment G.4. These amounts of settlement are considered within the tolerable limits (6 to 12 inches) of seismic deformation for tailings impoundments described in NUREG-1620 (NRC, 2003).

Table G.9-3: Potential Seismic Settlement Resulting from the Design Seismic Event

Borehole ID	Seismic Settlement (ft)
TI-B1/CPT-01	0.07
TI-B2/CPT-02	0.12
TI-B8/CPT-08	0.08
TI-B10/CPT-10	0.12
TI-B11/CPT-11	0.13
TI-B15/CPT-15	0.09

G.10 COVER (RADON BARRIER) CRACKING ANALYSES AND STRESS INFLUENCE

G.10.1 Cover (Radon Barrier) Cracking

The differential settlement at the most likely location for cover cracking (along the tie-in between the proposed Repository and the existing TDA cover) was used to estimate the potential for cover cracking of the existing radon barrier. The cover cracking analysis calculation brief is included as Attachment G.5. The analysis was performed for the southwest edge of the proposed Repository, where the new cover ends on the existing TDA cover. Similar to the immediate settlement, these locations were selected because they are closest to the area where the Repository fill will transition directly to an area where the existing radon barrier will remain in-place and unmodified. Cover cracking of the exiting radon barrier is calculated using the location with the maximum anticipated differential settlement between the new cover and the existing cover. Around the remainder of the Repository perimeter, the new cover extends to an existing swale or drainage channel on the east and south or to the west apron which extends to the top of the dam. On the north edge of the Repository, the new cover will extend beyond the limits of regraded tailings (Canonie, 1991) and to approximately the top of the North Drainage Channel. The purpose of the analysis is to determine if the stress increase from the fill placement results in detrimental differential settlement at the edge of the Repository that will negatively affect the radon barrier outside the Repository.

Using the overall total combined predicted settlements (immediate, primary consolidation, secondary consolidation, and seismic induced settlement) for subsurface profiles from TI-B15/CPT-15, CPT-26, and TI-B1/CPT-01, differential settlement was estimated between the southwest slope of the Repository and the radon barrier located immediately beyond the edge of the Repository. For CPT-26, where seismic settlement was not estimated, the estimate for the seismic settlement from TI-B15/CPT-15 was used in the total. These three locations are beyond (TI-B1/CPT1) or near the edge of waste placement (TI-B15/CPT-15, CPT-26) where the new cover material will transition directly to the existing radon barrier. The maximum differential settlement was estimated for each point over the distance to the edge of the proposed cover.

Table G.10-1: Estimated Differential Settlement and Cover Cracking Potential near the Edge of the Repository

Borehole ID	Estimated Total Differential Settlement (ft)	Horizontal Distance to Edge of Cover (ft)	Resulting Slope Reduction (%)	Horizontal Strain (%)
TI-B1/CPT-01	0.26	80	0.33	0.009
TI-B15/CPT-15	1.17	180	0.65	0.008
CPT-26	0.67	210	0.32	0.003

To evaluate the potential for cracking in the existing radon barrier a relationship between tensile strain and PI of the soil is used (Morrison-Knudson, 1993). The PI value for the existing radon attenuation layer was estimated to be 16 percent, calculated as the average of the measured PIs of ten radon barrier samples collected during the PDS (MWH, 2014a). Using this value for PI, the minimum estimated horizontal tensile strain that will induce cracking is 0.10 percent. The resulting slope reduction from the estimated maximum differential settlement predicted near the edge of the Repository was then used to calculate horizontal movement for the 21-inch-thick radon barrier in the central cell. The horizontal movement was then doubled based on Gourc et al. (2010) and Rajesh and Viswanadham (2010). The values of peak horizontal movement were then used to estimate peak horizontal strain, which was calculated to be less than 0.01 percent or one-tenth of the maximum allowable horizontal strain to prevent cracking for the three locations evaluated. These results indicate cover cracking will not occur for the proposed conditions.

G.10.2 Stress Influence Analysis

The shape of the Repository concentrates the greatest fill thicknesses in the middle of the layout, with thickness decreasing from the center to the perimeter. Due to the gently sloping surface of the Repository and only minimal fill thickness around the

perimeter, induced stresses beyond the edge of the Repository (due to fill placement within the Repository footprint) are expected to be minimal and would not influence the areas of the TDA outside of the Repository footprint. Due to the configuration of the Repository, there would be no compressive stresses that would extend outward from the edges of the Repository.

G.11 LIQUEFACTION

The potential for liquefaction of saturated tailings and alluvium beneath the proposed Repository during the design seismic event was evaluated for the 95% Design. The analysis was performed for the most critical condition (a design seismic event after completion of Repository construction) and based on the subsurface profile at the time the PDS field sampling was conducted. The liquefaction analysis calculation brief is included as Attachment G.6, with the method and results summarized below.

The liquefaction triggering analysis evaluated the potential for liquefaction of saturated tailings or underlying alluvium beneath the Repository, which may result in damage to the existing TDA radon barrier or compromising the effectiveness of the Repository in isolating mine waste. A liquefaction screening evaluation (Bray et al., 2009) was performed to identify zones of tailings or soil that may be susceptible to liquefaction. One-dimensional profiles were developed for analysis, based on conditions observed during the Mill Site PDS field investigation and modified to reflect proposed loading conditions. Identified zones of potentially susceptible materials within these profiles, as identified by the screening analysis, were evaluated for liquefaction potential using simplified liquefaction triggering analysis methods (Idriss and Boulanger, 2008; Youd et al., 2001).

The liquefaction triggering analysis used data collected during the CPT program, drilling and standard penetration testing (SPT), and laboratory testing to calculate the factor of safety (FS) against liquefaction for potentially susceptible zones of saturated material below the Repository. The primary liquefaction analysis used the results of CPTs. SPT results, where available, were used to provide secondary data against which the results of the CPT-based analyses were checked. The liquefaction triggering analyses incorporated supplemental data from laboratory testing and were performed according to the methods outlined in Idriss and Boulanger (2008) and Youd et al. (2001). The FS was calculated as the average of the FS values calculated by each of the analysis methods.

The liquefaction screening evaluation identified eight samples, out of 33 samples screened, that were moderately susceptible to liquefaction. The remaining 25 samples that were screened were not susceptible to liquefaction. Of the samples representing zones that were saturated or nearly saturated, two zones had minimum average calculated FS values below the acceptable FS criteria (per NRC, 2008) of 1.0 (at 0.9). These zones consisted of fine-grained tailings relatively deep in the tailings profile (33 to 45 feet depth) within Borrow Pit 1 (from borings B8 and B10).

The interlayered nature of the materials in Borrow Pit 1, and the proximity of the samples with low-FS values to each other, indicate that this zone of potential liquefaction represents a small percentage of the overall Repository foundation. The depth of these zones is also significantly below the depth of critical failure surfaces generated from pseudo-static slope stability analysis, along selected cross-sections, that include these zones.

The potential for liquefaction of the tailings or alluvium beneath the Repository footprint was evaluated using accepted screening and analysis methods. The potential for liquefaction only applies to materials that are saturated or nearly saturated and in a relatively loose condition. Due to the unsaturated condition of most of the underlying tailings and alluvium beneath the Repository footprint, the screening and analysis identified only two zones of materials at depth in Borrow Pit 1 that were moderately susceptible to liquefaction. The depth and localized nature of these two zones pose a risk for minor amounts of additional post-earthquake consolidation settlement, but no slope stability concerns are anticipated.

Liquefaction-induced settlement was estimated using the results of the liquefaction analysis and field data. Liquefaction-induced settlement occurs following a seismic event during which liquefaction occur. The soil may experience a volume change as the excess pore water dissipates and the soil particles rearrange themselves. The method used for estimating this volume change is outlined in Idriss and Boulanger (2008), Section 4.4 “Post-liquefaction Reconsolidation Settlement”. The liquefaction induced settlement calculations and results are included in Attachment G.6. Based on the field data and the results of the calculations, the potential for liquefaction-induced settlement at the site is contained in a localized area and occurs at a depth where surficial expression and damage to the radon barrier or ET cover is considered unlikely.

G.12 COVER DESIGN

The cover system design report prepared by Dwyer Engineering, LLC is included as Attachment G.7. The cover system design report includes analyses for erosional stability of the cover, ET cover design, water balance, infiltration, radon emanation, and bio-intrusion. The consolidation and groundwater evaluation report by Dwyer Engineering, LLC includes the tailings pore water migration calculations. The cover design consists of an erosion protection layer including rock overlying a soil layer. The thicknesses of these layers and the sizes of the rock used for erosion protection vary based on locations on the Repository. The layout for the different erosion protection layers and the cover design details for the three different Dwyer Engineering cover sections are shown on Drawing 7-09 in the Section 7 Drawings.

G.12.1 Cover Materials

Materials to be used for the cover will consist of: (1) soil from the onsite borrow areas, and (2) erosion protection rock both reused from the existing TDA cover and imported from an offsite rock quarry or quarries. Borrow materials are described in Appendix H. The ET cover has been modeled and designed based on the soil properties of the on-site borrow areas. Construction specifications (Appendix J) have been developed to provide quality assurance and material consistency for the materials from the borrow areas that are used for cover construction. Based on the relatively uniform geotechnical properties of the soils from the four borrow areas and the topsoil stockpile, soils from any of these sources may be used in any order, for cover construction. Mixing of the borrow soil materials is not required. A comparison of available borrow sources is included in Appendix H, Section H.4.1.9.3 and Figures H.4-1 and H.4-2. Rock to be used for the erosion protection layer on the cover will vary in size (1.5 to 3 inches), depending on location and slope length. The erosion protection layer will consist of a mixture of soil and 33 percent rock by volume. The rock will meet NRC requirements for durability or be appropriately upsized. Upsizing will depend on the rock source selected for construction. Previous geotechnical testing of the borrow soils and durability testing of candidate rock sources for the project are summarized in Appendix H.

G.12.2 Erosion Protection Design

The Dwyer Engineering, LLC report included as Attachment G.7 includes the erosion protection designs for the ET cover admixture and the perimeter fill material (transition areas) located on the west and southwest sides of the Repository. Erosion protection designs for the 20% slope located on the east side of the Repository are included in Attachment G.8. Due to the steepness, this slope was designed as a riprap slope rather than as an ET cover with an admixture layer. However, in order to match the vegetation to be incorporated on the other areas of the cover, the 1.5-inch gravel will be mixed with 15% soil by volume and seeded with the cover seed mix. The rock alone provides full erosional stability. The incorporation of vegetation in this area is intended to match the overall vegetated cover surface and provide additional transpiration on the slope. The rock size for the 20% slope is a minimum D_{50} of 1.5. inches and is similar to the design rock sizes for other areas of the Repository (D_{50} of 3 inches or less) due to the length of the slope and the small catchment area.

G.12.3 Radon Flux Measurements

The Repository cover is designed and constructed to limit the release of radon-222 (radon) to the atmosphere, not exceeding an average release rate of 20 picocuries per square meter per second (pCi/m^{2}s). The ET cover design report (Attachment G.7) includes radon emanation calculations for the cover. Following completion of the erosion protection layer, radon emission testing will be conducted to verify that the design and construction of the cover is effective at limiting radon flux using the method described in 40 CFR part 61, Appendix B, Method 115. Section 2 of Method 115 describes the radon flux measurements.

Consistent with Method 115, a single set of radon flux measurements will be made over the entire Repository. The Repository will be considered a region within the existing TDA. Method 115 specifies a minimum of 100 measurements for a region. Radon flux measurements over the Repository will be made at 102 equally spaced locations (grid nodes of 150-foot square grid cast over the Repository). A radon measurement procedure, similar to the detailed measurement procedure provided in Appendix A of USEPA 520/5-85-0029 will be used to measure the radon flux on the Repository. This radon flux measurement procedure involves adsorption of radon on activated charcoal in large-area canisters. The radon canisters will be placed on the surface of the pile and allowed to collect radon for 24-hour period. The radon flux measurements will not be initiated within 24 hours of a

rainfall and will not be performed if the ambient temperature is below 35°F or if the ground is frozen. The radon collected on the charcoal will then be measured by gamma-ray spectroscopy.

The mean of the radon flux measurements will be calculated for verification of the 20 pCi/m²s radon emission performance standard for the Repository region. Results of the individual radon flux measurements with locations will be included in the as-built report for the Repository.

G.12.4 Repository Cover Gamma Exposure Rate Measurement

Criterion 6(1) of 10 CFR Part 40, Appendix A specifies that: “Direct gamma exposure from the tailings or wastes should be reduced to background levels." A direct gamma radiation survey will be performed following placement of the ET cover to verify that the direct gamma exposure attains the required ambient background levels. The results of this survey will be compared to the survey conducted prior to removal of the erosion protection layer on the existing TDA. The direct gamma radiation survey will be performed at the same 102 locations as the radon flux measurement locations described in the previous section. The direct gamma radiation survey will be conducted during radon canister placement for radon emission testing. The gamma survey will consist of a one-minute static gamma measurement at each location over the Repository area. The gamma radiation levels will be measured in exposure rate (uR/hr). The static gamma radiation survey will be conducted consistent with the static survey described in Appendix T.2 (Final Status Survey) using a 2x2 NaI(Tl) scintillation detector interfaced with a scaler/rate meter. The mean of the direct gamma exposure rates will be calculated for comparison to the background levels. Results of the individual direct gamma exposure rate measurements with locations will be included in the as-built report for the Repository.

G.13 GREEN AND SUSTAINABLE REMEDIATION CONSIDERATIONS

The areas where Green and Sustainable Remediation (GSR) has been evaluated for the mine waste Repository design relate to: (1) construction materials (characteristics, manufacturing and transportation considerations), (2) construction methods, and (3) low impact/sustainability measures during construction. The 'BMP Process', as outlined in the 'Standard for Greener Cleanups' (ASTM, 2016), has been followed to select and prioritize BMPs for implementation during remedial action. The BMPs relating to Mine Waste Repository Design are listed below, for a complete description of the BMP Process and list of all GSR BMPs see Section 4 of the Main RD document and Appendix A (Section A.5).

G.13.1 Construction Material Considerations

The borrow soils for the cover, as described in this appendix and Attachment G.7 will be sourced locally to the Repository. Based on similarities in the borrow properties by area, preference will be given to the shortest haul distances to limit emissions during cover construction. The smaller (1.5-inch) rock to be used in the Repository cover will come from recycling existing erosion protection rock on the TDA cover. This material will be stripped from the surface, within the footprint of the Repository, and screened from soil before being applied and mixed into the new cover. Other rock and materials stockpiled at the site will be used for construction of temporary roads or laydown areas, to the extent possible, to limit the need to import materials.

The ET cover has been designed with a seed mix of select drought-resistant plants for the upper vegetative layer, to reduce maintenance needs. The seed mix for the Repository is described in Appendix U. Preference will be given to using non-synthetic nutritional soil amendments such as compost instead of chemical fertilizers for the plant growth layer. If temporary erosion control measures (BMPs) are required around the Repository, preference will be given to 100 percent recycled materials rather than virgin materials for erosion controls.

G.13.2 Construction Methods

The upper, erosion protection layer of the cover (rock, soil, and growth amendment) can be mixed in place using specialized equipment, rather than through a series of steps to place thinner layers of premixed materials, which will require more haul and placement traffic to place the materials. This approach could minimize operations of front loaders and other heavy machinery during cover placement. As described in Appendix D, new roads to the Repository will be minimized to the extent possible to reduce the required construction equipment operating time, greenhouse gas emissions, fill material, and habitat disruption. Roads will be constructed from in-situ native soils to reduce material haul distances and use of imported materials. Construction equipment will be appropriately sized to reduce fuel consumption and greenhouse gas emissions. Dust suppression will be utilized in the Repository area and along the access roads to decrease visible dust related emissions. Section G.5.3.1 discusses temporary stormwater controls for the Repository area, and Appendix E identifies BMPs and specific sediment control measures that will be employed during construction for both sediment and stormwater control.

G.13.3 Low Impact Development/Sustainability

For an equally protective design, limiting the overall size (footprint) of the Repository is a key consideration of GSR, since the larger the overall footprint of the Repository is, the more materials will be required to construct it. However, construction of the Repository on the existing TDA, as well as the use of two previously disturbed borrow areas and primarily existing roads, limits the disturbance to undisturbed land. Additionally, the improvement and reuse (in-place) of the existing radon barrier that will become the foundation of the Repository limits the need for additional haulage to bring in a clean base layer of soil for the Repository. Access and haul routes are optimized to minimize site disruption, vehicle mileage, and to protect public health and safety. Minimizing vehicle mileage and limiting speeds is a high yield action as it limits fuel consumption, minimizes emissions of both greenhouse gasses and dust and increases site safety by reducing likelihood of both minor and serious crashes. Access and haul roads chosen utilize existing or historical roads to the extent practical to limit additional habitat degradation and reduce amount of cut/fill and grading required. Access and haul roads will be reclaimed and revegetated as quickly as possible upon completion of construction.

G.14 REFERENCES

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FIGURES

Figure G.5-1 Radon Barrier Sample TI-CS01-04A (MWH, 2014a)
Soil Water Characteristic Curve

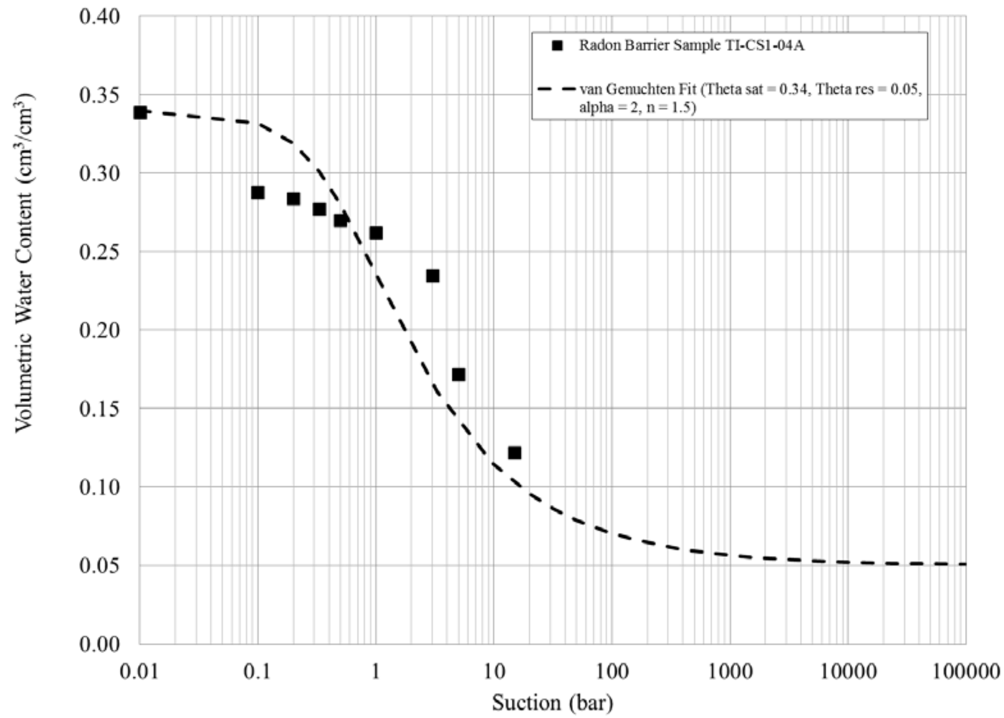
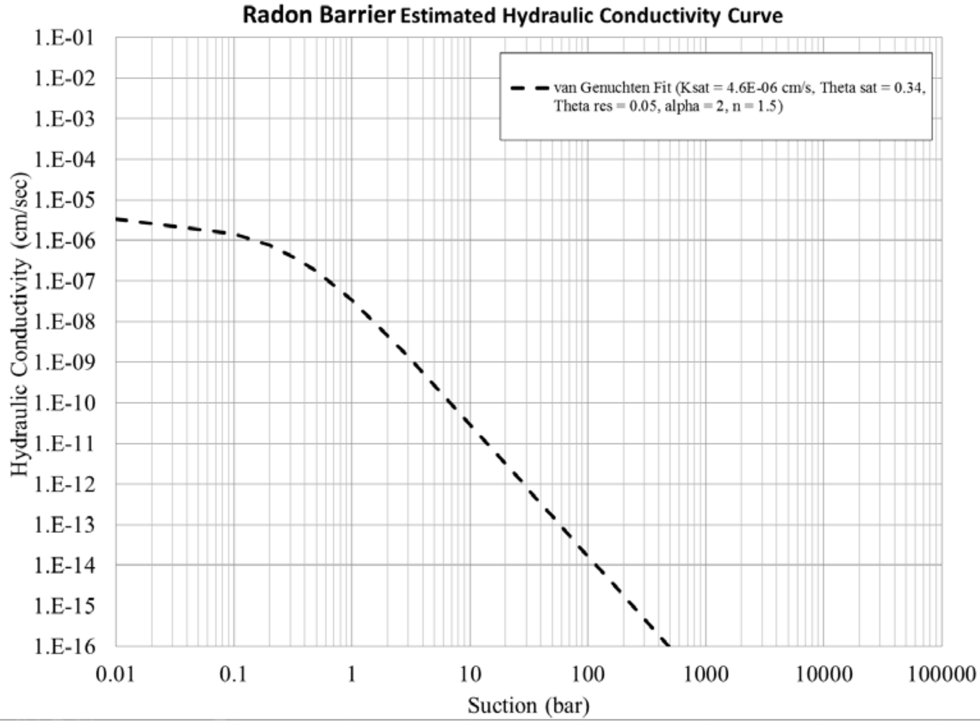


Figure G.5-2
Radon Barrier Estimated Hydraulic Conductivity Curve



ATTACHMENT G.1
Seismic Hazard Analysis

Northeast Church Rock 95% Design Report

Attachment G.1: Seismic Hazard Analysis

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LIST OF ACRONYMS / ABBREVIATIONS

ANSS	Advanced National Seismic System
CEUS	Central and Eastern United States
CFR	Code of Federal Regulations
CP	Colorado Plateau
CPT	Cone Penetration Testing
DSHA	Deterministic Seismic Hazard Analysis
ft/s	feet per second
GMPE	Ground Motion Prediction Equation
ka	kilo-annum
km	kilometer
k.y.	thousand years
LLNL	Lawrence Livermore National Lab
m/s	meters per second
mm/yr	millimeters per year
m.y.	million years
Mill Site	Northeast Church Rock Mill Site
NEIC	USGS National Earthquake Information Center
NGA	Next Generation of Attenuation
NRC	US Nuclear Regulatory Agency
NSHMP	National Seismic Hazard Mapping Program
PDE	Preliminary Determination of Epicenters
PGA	Peak Ground Acceleration
PSHA	Probabilistic Seismic Hazard Analysis
SHA	Seismic Hazard Assessment
UHS	Uniform Hazard Spectra
USEPA	US Environmental Protection Agency
USGS	US Geological Survey
WUS	Western United States

1.0 INTRODUCTION

This report presents results of a site-specific probabilistic seismic hazard analysis (PSHA) and deterministic seismic hazard analysis (DSHA) to develop site-wide seismic design criteria at the Church Rock Mill Site (Mill Site). The Mill Site is approximately 16 miles (26 km) northeast of Gallup, New Mexico at approximately 35.65° N latitude and 108.50° W longitude.

The probabilistic seismic hazard analysis is based on a seismotectonic model and source characterization of the Mill Site and surrounding area. The study evaluated a 124-mile (200-km) radius surrounding the Mill Site. For purposes of this report, this area is termed the “study area” (Figure 1-1).

The seismotectonic model identified two general seismic sources in the study area: 1) seismicity of the Colorado Plateau (CP), and 2) crustal faults. Each source zone was characterized to establish input parameters for the seismic hazard analyses. The PSHA was performed using HAZ43 (2014) software developed by Dr. Norman Abrahamson. Long-term design recommendations were developed based on the results from this PSHA and previous seismic investigations at the site.

1.1 Background and Purpose

The seismic hazard assessment (SHA) was performed to estimate the seismic hazard at the project site within a probabilistic and deterministic framework by characterizing potential seismic sources. This analysis assessed the site-specific seismic hazard using Ground Motion Prediction Equations (GMPEs) to estimate seismically-induced ground motions at the Mill Site. Seismic hazard analyses were previously conducted by Lawrence Livermore National Lab (LLNL) in 1994 for the design of the uranium mill and the tailings site (NRC 1997). This deterministic analysis resulted in a peak ground acceleration (PGA) of 0.196 g for a magnitude of 6.25, based on the presence of two lineaments named the Pipeline Canyon and Wingate.

1.2 Approach

The site-specific evaluation presented herein used data from faults and earthquakes occurring within a 124-mile (200-km) radius of the Mill Site to develop seismic source characterization for the seismic hazard analyses. Stantec compiled an earthquake catalog of historical seismicity and information on specific faults to develop the seismic source models for the two seismic sources described above. The PSHA considered the defined seismic sources with the goal of identifying the major contributor(s) to the site-wide seismic hazard. Stantec performed a DSHA to evaluate ground motions associated with crustal faults likely to contribute to the site-wide seismic hazard.

1.3 Design Criteria

US Environmental Protection Agency (USEPA) (40 CFR 192) and the US Nuclear Regulatory Commission (NRC) (10 CFR Appendix A to Part 100 A) (NRC, 2013) guidance requires the design life for the reclaimed facility to be 1,000 years to the extent reasonably achievable, and at least 200 years. An event with a 10,000-year return period has a 2 percent probability of exceedance during a 200-year period and less than a 10 percent probability of exceedance in a 1,000-year period. Therefore, the PGA calculated using a 10,000-year return period is conservative, but appropriate for the (long-term) seismic design criteria for the Mill Site.

The PGA calculated in this PSHA will be used to evaluate long-term liquefaction potential and slope stability of the repository.

2.0 GEOLOGIC SETTING

2.1 Regional Setting

The Mill Site is located within the CP physiographic province in northwestern New Mexico. The CP is a broad, roughly circular region of relative structural stability. The contemporary seismicity of the CP was investigated by Wong and Humphrey (1989), based on seismic monitoring. Their study characterized the seismicity of the plateau as small to moderate magnitude with a low to moderate rate of widely distributed earthquakes with hypocentral depths of 9 to 12 miles (15 to 20 km). The area is characterized by generally northwest-striking normal faulting.

A 124-mile (200-km) radius surrounding the Mill Site almost all falls within the CP. However, directly to the east of the Mill Site is the Rio Grande Rift. The Rio Grande Rift system extends from southern New Mexico almost to the Colorado border with Wyoming. The rift system developed under compressional forces during the Laramide orogeny. Regional fluvial erosion and deposition, and local regional extension, modified the region such that it now consists of a series of grabens, or fault-bound down-dropped tectonic basins. Additional information on the area's geology and geomorphic features are presented in a Geohydrologic Report (Canonie, 1987), the Approved Reclamation Plan (Canonie, 1991), and Appendix I of the 95% Design Report.

2.2 Site Geology

A Geohydrologic Report (Canonie Environmental, 1987) presents the geologic setting at the Mill Site. The Mill Site is situated on alluvial valley fill, sandstones, and shales of Cretaceous age. The stratigraphic units identified in the Mill Site area in descending order are:

- Alluvium
- Dilco Coal Member of the Crevasse canyon Formation
- Upper Gallup Sandstone, divided into:
    - Zone 3, upper sandstone
    - Zone 2, shale and coal
    - Zone 1, lower sandstone
- Upper D - Cross Tongue Member of the Mancos Shale

The alluvium and the Upper Gallup Sandstone zones are in direct contact with the existing tailings.

3.0 SEISMOTECTONIC SETTING AND HISTORICAL SEISMICITY

3.1 Historical Seismicity

The seismic hazard assessment for the Mill Site includes a review of historical earthquakes within the study area. The historical earthquake record for the study area contains earthquakes from 1887 through 2016 and provides a general overview of the seismicity of the study area. The historical seismic events were compiled from two sources: the Petersen Catalog (Petersen et al., 2014), which was used to compile earthquakes in the project region from the beginning of the catalog (1887 in the project region) to 2012; and the Advanced National Seismic System (ANSS) Comprehensive Catalog (ComCat), which was used to compile events in the region after 2012. The use of the catalogs is discussed further in Section 3.2.

Seismicity [events with moment magnitude (M_w) greater than or equal to 2.5 ($M_w \geq 2.5$)] within the study area is shown in Figure 1-1. Due to diffuse events occurring within a 124-mile (200-km) radius of the Mill Site, the study area with respect to seismicity was expanded to include the entire CP as shown in Figure 3-1. The earliest recorded event included in the catalog occurred in 1887. The largest event in the catalog is a M_w 6.5. Events described in this report are given in moment magnitude unless specified otherwise.

The following paragraphs summarize development of the earthquake catalog used for the SHA.

3.2 Catalogs of Earthquake Data

3.2.1 Petersen Catalog

Stantec used catalogs from the US Geological Survey (USGS) National Seismic Hazard Mapping Program (NSHMP) for the Western United States (WUS) and Central and Eastern United States (CEUS) (Petersen et al., 2014) to compile information regarding historical earthquakes within the CP and 124 miles (200 km) of the Mill Site. Petersen et al. (2014) compiled the catalogs for the WUS and CEUS by reviewing and combining other available catalogs. Petersen et al. (2014) used their interpretation of catalog reliability to eliminate duplicate records when earthquakes were listed in more than one catalog. Since attenuation relations, completeness, and magnitude conversion rules vary regionally, Petersen et al. (2014) built two catalogs generally following the approach used by the CEUS-SSCn (NRC et al., 2012): a catalog for WUS and a catalog for the CEUS. Petersen et al. (2014) converted both catalogs to M_w from the original magnitude recorded.

Within the study area, the Petersen et al. (2014) database includes historical seismic events from 1887 through 2012 for the WUS and events from 1967 through 2012 for the CEUS. Both catalogs contain events with $M_w \geq 2.5$. AutoCAD software was used to delineate the CP physiographic province and identify only those events within this province. Further steps taken to develop the final catalog are discussed below. The catalog includes 412 events from the Petersen et al. (2014) database.

3.2.2 ComCat

Earthquake information from the WUS and CEUS catalogs was supplemented by a search of the ANSS ComCat, also maintained by the USGS. The ComCat was used to obtain additional earthquake information from January 1, 2013 through March 8, 2016. The ComCat contains data from networks that contribute to the ANSS database as well as historical data from the USGS National Earthquake Information Center's (NEIC) Preliminary Determination of Epicenters (PDE) catalog (http://earthquake.usgs.gov/earthquakes/eqarchives/epic/). The Search Earthquake Archives tool available on the USGS website (http://earthquake.usgs.gov/earthquakes/search/) was used to delineate a 124-mile (200-km) radius around the Mill Site to identify only those events within the seismic study area. The final catalog includes one ComCat event.

3.2.3 Combined Catalog and Magnitude Bias Correction

The ComCat and Petersen catalogs were combined to create a final declustered catalog for the SHA. The Petersen catalog reports magnitude as expected moment magnitude $E[M_W]$ (Petersen et al., 2014). The conversion of the magnitude to $E[M_W]$ for

the one event from the ComCat was completed following the guidance presented in CEUS-SSCn (NRC et al., 2012). This approach is identical to that used in the development of the Petersen catalog.

The catalog includes expected magnitude E[M_W], magnitude uncertainty, and a counting factor termed N* (or N-star) for each event. The counting factor N* was used to compute unbiased earthquake rates following guidance presented in CEUS-SSCn (NRC et al., 2012). Earthquake recurrence parameters were computed using the maximum likelihood approach by using the N* factor instead of the observed counts. This approach was used for the CEUS-SSCn, which had variable levels of catalog completeness as a function of magnitude (NRC et al., 2012).

3.2.4 Man-made Earthquakes

Since December 2013, five mining explosions occurred within the 124-mile (200 km) radius of the Mill Site. These explosions were recorded as having magnitudes greater than 2.5 but less than 3.0. These events were not included in the catalog. It should be noted that the Petersen catalog also does not include man-made events.

Previous editions of the USGS Seismic Hazard Maps did not include earthquakes attributed to human activity. However, recent increases in man-made seismicity have prompted a change in the way these induced earthquakes are handled. The USGS released a one-year seismic hazard forecast for the Central and Eastern United States from induced and natural earthquakes (Peterson, 2016). Seventeen areas of potentially induced seismicity were considered.

The Church Rock Project Site is located more than 200 km from the nearest induced seismicity site, Raton Basin (Colorado-New Mexico) Induced Seismicity. Seismicity located at this distance would not have a significant impact on the PGA at the Mill Site.

3.3 Magnitude Conversion

The events included in the Petersen catalog were provided in M_w; therefore, it was only necessary to convert the single event from the ComCat to M_w. This conversion was completed by following the approach used to compile the Petersen catalog and guidance provided in CEUS-SSCn (NRC et al., 2012).

The earthquake catalog used in recurrence calculations for this PSHA includes the combined Petersen et al. (2014) catalog and the single event from the ComCat. The final catalog includes 413 earthquakes. These earthquakes are shown on Figure 3-1.

Earthquakes included in the final catalog for the computation of recurrence parameters generally have small magnitudes, with over 99 percent of the earthquakes having a $M_w < 5.0$ (Figure 3-1).

3.4 Developing Recurrence Parameters

Recurrence parameters are required to characterize seismic activity in the study area to estimate probabilistic ground motions for the Mill Site. With the exception of about 30 km on the eastern-most side of the radius, the majority of the 124-mile (200-km) radius falls within the CP physiographic province. This includes one event in the Southern Rocky Mountain physiographic province and 13 events in the Basin and Range physiographic province. The event in the Southern Rocky Mountain province is a magnitude 2.8 and is approximately 120 miles from the Mill Site. This event was not included in the analysis. The 13 events in the Basin and Range physiographic province are within 10 km of existing faults and the faults are located at such a distance (greater than 93 miles, or 150 km) that contribution to the seismic hazard would be minimal. Only one areal source zone was delineated, the CP, as discussed in Section 4.2. The entire CP physiographic province was used to develop the recurrence parameters.

3.4.1 Assessment of Catalog Completeness

An assessment of the completeness of the earthquake catalog was necessary to estimate a recurrence rate for earthquakes. One way to test completeness is to plot the rate of the earthquakes (number of events greater than a specified magnitude

divided by the time period) as a function of time, starting at present time and moving back towards the beginning of the catalog. If the rate of earthquakes is represented by a stationary Poisson process (the rate -λ_m- does not change with time) for the study area, which is the typical assumption, then the rate of earthquakes should remain constant for the portions of the catalog that have complete reporting.

The evaluation was performed using the Stepp (1972) method, which includes generating completeness plots to visually inspect the rate of events over the years. Due to the diffuse seismicity within 124-mile (200-km) of the study area, the catalog was expanded to include the entire CP physiographic province. Based on this evaluation, the catalog is considered complete for the date and magnitude ranges shown in Table 3-1. The catalog completeness plots developed for this study are shown in Figure 3-2.

3.4.2 Estimation of the Recurrence Parameters

After completeness intervals for each magnitude range were developed, the recurrence parameters were computed. This frequency is commonly characterized using the Gutenberg-Richter relationship, which is linear when the magnitude is plotted against the frequency of events on a semi-logarithmic scale. The magnitude-frequency relation expressed in its cumulative form is:

$$\log N(M) = a - bM$$

where M is the magnitude and N is the cumulative frequency of earthquakes greater than magnitude M. The calculation of cumulative frequency of earthquakes used the N* value (a counting factor used to compute unbiased rates) instead of observed counts. Recurrence relationships were then estimated using the maximum likelihood procedure developed by Weichert (1980). The maximum likelihood line is characterized by the slope of the line, or b-value, and the log N value at a magnitude of zero (a-value). For this study, a minimum magnitude of 3.0 was used to develop the recurrence parameters. The inputs used to calculate the recurrence parameters are summarized in Table 3-2. Recurrence parameters (a- and b-values) were developed for each seismic source zone, as discussed in Section 4.2.

4.0 SEISMIC SOURCE CHARACTERIZATION

The seismic source model includes crustal fault sources and the seismicity of the CP. These sources are described below.

4.1 Faults

A "capable fault" is defined by the NRC in 10 CFR Appendix A to Part 100, *Seismic and Geologic Siting Criteria for Nuclear Power Plants,* as a fault that has exhibited one or more of the following characteristics:

1. Movement at or near the ground surface at least once within the past 35,000 years or movement of a recurring nature within the past 500,000 years.
2. Macro-seismicity (magnitude 3.5 or greater) instrumentally determined with records of sufficient precision to demonstrate a direct relationship with the fault.
3. A structural relationship to a capable fault according to characteristics (1) or (2) above such that movement on one could be reasonably expected to be accompanied by movement on the other.

The NRC in 10 CFR Appendix A to Part 100 also indicates the minimum fault length to be considered in evaluating seismicity at a site. The minimum fault lengths with respect to distance from the site are as follows:

Distance from Site	Minimum Length of Fault to be Considered
0-20	1
20-50	5
50-100	10
100-150	20
150-200	40

4.1.1 Fault Sources

The existence and location of faults with Quaternary displacement were primarily identified using the USGS Quaternary Fault and Fold database (USGS, 2017). Faults identified with potential Quaternary-age offset that exist within a 200-mile (320-km) radius of the Mill Site are shown in Figure 2-1.

Crustal faults identified within a 200-mile (320-km) radius of the study area that satisfied the minimum fault length criteria above were included in this seismic study. This is a conservative approach because incorporating in this study all identified faults with Quaternary displacement would include faults with movement over the past 2.6 million years, whereas the NRC only requires incorporation of capable faults, which are defined in Section 4.1.1 as a fault that has shown movement within the past 35,000 to 500,000 years. Overall, 42 Quaternary faults were considered in the seismic hazard analysis and the fault parameters are provided in Table 4-1.

The USGS separates faults with Quaternary displacement into classes. These classes are provided below, as described by USGS (2017).

- For a Class A fault, geologic evidence demonstrates the existence of a Quaternary fault of tectonic origin, whether the fault is exposed by mapping or inferred from liquefaction or other deformational features.
- For a Class B fault, geologic evidence demonstrates the existence of Quaternary deformation, but either 1) the fault might not extend deeply enough to be a potential source of significant earthquakes, or 2) the currently available

geologic evidence is too strong to confidently assign the feature to Class C but not strong enough to assign it to Class A.

- For a Class C fault, geologic evidence is insufficient to demonstrate: 1) the existence of tectonic faulting, or 2) Quaternary slip or deformation associated with the feature.
- For a Class D fault, geologic evidence demonstrates that the feature is not a tectonic fault or feature; this category includes features such as joints, landslides, erosional or fluvial scarps, or other landforms resembling fault scarps but of demonstrable non-tectonic origin.

The faults with Quaternary displacement included in this analysis are either Class A or Class B.

Characteristics of individual faults, including subsurface orientation, depth, slip rate, and age were obtained where possible from the USGS Quaternary Fault and Fold Database (USGS, 2017). A comprehensive list of fault characteristics used in the PSHA are included in the following subsections and inputs used in the PSHA are summarized in Table 4-2. Published fault characteristics were used when available. Typical seismogenic depths in the Western United States range from 20 ± 5 km (Bott et al., 2003). However, since there is limited information on seismogenic depths near the site, a conservative seismogenic depth of 25 km was selected for the faults considered in this analysis. The probability of activity is the probability that a fault is seismogenic. For purposes of this analysis, the majority of the faults were assigned a probability of activity of 1.0; however, Class B faults were assigned a probability of activity of 0.5. The moment magnitude (M_w) was calculated for each fault using the Wells and Coppersmith (1994) magnitude-rupture area relationship for normal faults. This relationship is:

$$M_w = 4.07 + 0.98 * \log(A)$$

where M_w is the moment magnitude and A is the rupture area in square kilometers.

4.1.2 Bright Angel Fault Zone

The Bright Angel Fault Zone is approximately 200 miles (321 km) west of the Mill Site. This fault zone comprises northeast-trending faults cutting through Paleozoic rock, with movement predominantly in the normal sense as inferred from topography and exposed features (Pearthree, 1997). Quaternary deposits are sparse in the area, with no documented displacement of Quaternary alluvium; however, some fault scarps exhibit strong geomorphic expression, indicating possible Quaternary activity within this system. Although Quaternary movement has not been conclusively demonstrated in the general area, moderate historical seismic activity has occurred. A slip rate less than 0.2 mm/yr was assumed based on the lack of evidence for Quaternary movement. Dip angles range from 76 to 87 degrees and from 45 to 80 degrees, depending on the depth of the strata in question (Pearthree, 1997). Steeper dip angles were measured in Paleozoic strata, whereas shallower angles were measured for Precambrian rock strata located at greater depths within the Grand Canyon. A maximum magnitude of M_W 7.3 was calculated using the Wells and Coppersmith (1994) magnitude-rupture area relationship using a maximum rupture length of 74 km.

4.1.3 Cebollita Mesa Fault

The Cebollita Mesa Fault is approximately 66 miles (107 km) southeast of the Mill Site. This west-dipping normal fault has apparently young movement (less than 15 ka) (Machette and Jochems, 2016c). No dating has been performed on the scarps to refine the timing, slip rate, or recurrence. However, it is suggested that the rate is less than 0.2 mm/yr based on recent offset of 1.9 to 2.0 m, resulting from strain accumulation over 15 to 120 k.y. A maximum magnitude of M_W 6.3 was calculated for a fault length of 13 km using the Wells and Coppersmith (1994) magnitude-surface rupture length relationship. Dip angles were assumed to be 50 ± 15 degrees based on the regional fault dip angle (Petersen et al. 2014).

4.1.4 Concho Fault

The Concho Fault is approximately 99 miles (160 km) southwest of the Mill site. The fault zone, located on the Mogollon Slope near the southern edge of the Colorado Plateau, consists of a discontinuous system of northwestern-trending faults that displace Mesozoic bedrock and upper to lower Pliocene basalt flows (Pearthree, 1998a). Complex surface faulting is prevalent throughout

the fault zone, including multiple short fault scarps. Activity along the faults likely occurred during the middle to late Quaternary, although timing of the most recent movement is less certain. A slip rate of 0.019 to 0.040 mm/yr was estimated based on 30 m of displacement over the last 0.75 to 1.6 m.y. (Pearthree, 1998a). Both oblique normal and left-lateral movement have been inferred for this fault. Based on surface displacement, a dip to the northeast was inferred and the regional dip angle of 50 ± 15 degrees was assumed (Petersen et al. 2014). A maximum magnitude of M_W 7.1 was calculated for a fault length of 39 km using the Wells and Coppersmith (1994) magnitude-rupture area relationship.

4.1.5 Continental Divide Fault

The Continental Divide Fault is approximately 63 miles (101 km) south of the Mill Site. Little is known about this northeast-trending suspect fault (Class B). A normal sense of slip was reported by Machette and Jochems (2016e). This feature appears to offset the southern part of the North Plains lava field. The dip direction was inferred from the escarpment, which faces southeast. A slip rate of less than 0.2 mm/yr was estimated based on a 2 to 3 m high scarp in Quaternary age basalt (Machette and Jochems, 2016e). A maximum magnitude of M_W 6.5 was calculated for a fault length of 17 km using the Wells and Coppersmith (1994) magnitude-surface rupture length relationship. The dip angle was assumed to be 50 ± 15 degrees (Petersen et al. 2014).

4.1.6 County Dump Fault

The County Dump Fault is approximately 99 miles (160 km) southeast of the Mill Site. Located in the northern part of the Albuquerque-Belen basin, this north-trending normal fault dips to the east at an angle of 75 to 85 degrees and offsets upper Santa Fe Group deposits, well-developed calcic soils of the Llano de Albuquerque, and basalt deposits near the Albuquerque Volcanoes (Haller et al., 2015b). Repeated surface faulting has resulted in a subdued fault scarp across the Llano de Albuquerque, with a recorded height of 24 m and a maximum width of 800 m. Based on thermoluminescence aging and detailed soil analyses, the most recent activity along the surface of the fault was estimated to be about 24 ka. A slip rate of 0.015 to 0.024 mm/yr was estimated based on 24 m of displacement over the last 1 to 1.6 m.y. (Haller et al., 2015b). A maximum magnitude of M_W 7.0 was calculated using the Wells and Coppersmith (1994) magnitude-rupture area relationship, based on a maximum rupture length of 35 km.

4.1.7 Coyote Wash Fault

The Coyote Wash Fault is approximately 98 miles (158 km) southwest of the Mill Site. Similar to the Concho Fault, this fault zone is located on the Mogollon Slope between the Little Colorado River and the southern margin of the Colorado Plateau, cutting through both Mesozoic bedrock and upper to lower Pliocene basalt flows. The discontinuous system of northwest-trending faults generally dip to the southwest, with oblique normal and left-lateral movement inferred based on fault geometry, structural characteristics, and regional relations (Pearthree, 1998b). For this assessment, the regional dip angle of 50 ± 15 degrees was assumed (Petersen et al. 2014). A maximum magnitude of M_W 7.1 was calculated for rupture length of 42 km using the Wells and Coppersmith (1994) magnitude-rupture area relationship, based on a maximum.

4.1.8 Embudo Fault

The Embudo Fault is approximately 145 miles (233 km) northeast of the Mill Site along the northern and western sides of the Picuris Mountains. This near-vertical fault is an important component of the Rio Grande rift, as it accommodates differential movement of the San Luis Basin to the north and the Española Basin to the south, which dip to the east and west, respectively (Kelson et al. 2015c). For this assessment, the dip angle was assumed to be 90 degrees (vertical). The main fault strand has primarily exhibited left-lateral, strike-slip movement, whereas a normal sense of slip has been documented elsewhere along the fault where the strike direction is predominantly to the northeast. Evidence of likely repeated ruptures during the late Quaternary has been observed in Quaternary deposits along the northeastern section of the fault. A slip rate of 0.10 mm/yr was reported based on 102 m of offset in Pliocene basalt near the town of Pilar, NM over the last 1 m.y. (Kelson et al. 2015c). A maximum magnitude of M_W 7.0 was calculated using the Wells and Coppersmith (1994) magnitude-rupture area relationship, based on a maximum rupture length of 40 km.

4.1.9 Faults Near Cochiti Pueblo

The system of faults near Cochiti Pueblo is approximately 114 miles (183 km) west of the Mill Site. Numerous faults exist in this area, including the Borrego, Peralta, Camada, Sile, Domingo, and Cochiti faults. The normal faults trend to the north-northwest and form a low-relief accommodation zone between the west-dipping Española basin to the north and east-dipping Albuquerque basin to the south (Personius and Jochems, 2016j). Offset of the lower Pleistocene Bandelier Tuff has been reported, indicating movement along the faults since the early Pleistocene, with estimated slip rates of approximately 0.042 to 0.167 mm/yr based on reported 50 to 200 m offsets over 1.2 m.y. (Personius and Jochems, 2016j). The fault dips to the west (Sawyer and Minor, 2006) at angles ranging between 60 and 75 degrees. A maximum magnitude of M_W 7.0 was calculated for a rupture length of 32 km using the Wells and Coppersmith (1994) magnitude-rupture area relationship.

4.1.10 Gallina Fault

The Gallina Fault is approximately 98 miles (157 km) northeast of the Mill Site and forms the western boundary of the Gallina-Archuleta arch. This normal fault dips at a high to nearly vertical angle towards the west and east, as suggested based on the rugged topography of the area (Kelson and Jochems, 2015). Because the actual dip angles are unknown, the fault was assumed to have the following variation in dip angles: 70 degrees to the east, 90 degrees (vertical), and 70 degrees to the west. Although there is no documented evidence for Quaternary activity, diffuse contemporary microseismicity within the Gallina-Archuleta arch may be indicative of late Quaternary activity along the fault (Kelson and Jochems, 2015). Because of the lack of geological evidence for Quaternary displacement, the slip rate is assumed to be less than 0.2 mm/yr. A maximum magnitude of M_W 7.0 was calculated using the Wells and Coppersmith (1994) magnitude-rupture area relationship, based on a maximum rupture length of 39 km.

4.1.11 Hickman Fault

The Hickman Fault is approximately 81 miles (130 km) southeast of the Mill Site. This north to northeast trending fault forms an apparent scarp on unconsolidated Quaternary deposits and may control the course of Newton Draw, a north-flowing ephemeral drainage. Chamberlin et al. (1994) reported the Hickman fault as a high angle dip-slip normal fault. This normal fault dips to the west (Machette and Jochems, 2016b) and has a reported slip rate of less than 0.2 mm/yr. A maximum magnitude of M_W 6.1 was calculated for a fault length of 9 km using the Wells and Coppersmith (1994) magnitude-surface rupture length relationship. The dip angles assumed in this assessment were 60, 75, and 90 degrees (vertical), given the high angle reported by Chamberlin et al. (1994).

4.1.12 Hubbell Spring Fault

The Hubbell Spring Fault is approximately 119 miles (192 km) southeast of the Mill Site. The fault, which forms the western edge of the Hubbell bench, comprises numerous north-striking, normal faults with well-expressed scarps 4 to 30 m high in late to early Pleistocene deposits (Haller and Personius, 2015). Based on measurement of shallow exposures, the fault dips to the west at angles ranging from 48 to 85 degrees. A slip rate between 0.2 and 1.0 mm/yr was reported based on 28 to 83 m of vertical surface displacement over 80 to 130 k.y. (Haller and Personius, 2015). A maximum magnitude of M_W 7.3 was calculated for a rupture length of 74 km using the Wells and Coppersmith (1994) magnitude-rupture area relationship.

4.1.13 Intrabasin Faults on the Llano de Albuquerque

The Intrabasin Faults on the Llano de Albuquerque are approximately 98 miles (158 km) southeast of the Mill Site. These relatively short normal faults are, for the most part, completely covered by sand such that scarps are subdued and discontinuously exposed (Jochems and Personius, 2016b). However, the fault locations have been delineated based on linear scarps, aligned drainages, and ephemeral ponds evident in aerial photographs. Although Quaternary displacement is unknown for most of the faults, slip rates of approximately 0.002 to 0.015 mm/yr were estimated based on 3 to 12 m offsets of the Llano de Albuquerque over about 0.8 to 1.8 m.y. (Jochems and Personius, 2016b). A maximum magnitude of M_W 7.4 was calculated using the Wells and Coppersmith (1994) magnitude-rupture area relationship, based on a maximum rupture length of 101 km.

4.1.14 Jemez-San Ysidro Fault

The Jemez-San Ysidro Fault is approximately 94 miles (152 km) east of the Mill Site. This normal fault is separated into three continuous sections: the Jemez (northern) section, the San Ysidro (central) section, and the Calabacillas (southern) section (Jochems et al., 2016; Kelson et al., 2015h; Koning et al., 2015). The Jemez section strikes to the northeast and is marked by a prominent scarp across Virgin Mesa, which lies atop 1.2 to 1.3 Ma Bandelier tuff. Short fault scarps and fault exposures in middle and late Pleistocene alluvial deposits are characteristic of the San Ysidro section, with measured offsets of 2 to 11 m. The Calabacillas section (or Calabacillas fault) is marked by broad, dissected fault scarps with heights of 10 to 30 m on the Llano de Albuquerque, as well as some exposure in upper Santa Fe Group sediments. Slip rates range from 0.009 to 0.054 mm/yr, with the greatest rates along the Calabacillas section, based on displacement between 6 m and 50 m in material ranging in age from 0.5 Ma to 1.3 Ma (Koning et al., 2015). The dip varies from near vertical along the Jemez section, to 58 to 70 degrees east along the San Ysidro section, to 60 to 90 degrees east along the Calabacillas section. For this assessment, the dip angle was assumed to range from 58 degrees east to 90 degrees (vertical). A maximum magnitude of M_W 7.4 was calculated using the Wells and Coppersmith (1994) magnitude-rupture area relationship, based on a maximum rupture length of 96 km.

4.1.15 Jornada Draw Fault

The Jornada Draw Fault is approximately 189 miles (304 km) southeast of the Mill Site. Activity along this normal fault has resulted in low, subtle scarps on Quaternary deposits that mark the trace of the fault. Other factors delineating the fault include the eastward termination and offset of Tertiary bedrock and tectonically induced physiography along the hanging wall side of the fault (Machette and Jochems, 2015d,e,f). Slip rates range from 0.018 to 0.1 mm/yr across the three sections of the fault, based on reported displacements between 9 to 30 m over 300-500 k.y. The fault dips to the east and northeast, with a reported dip angle of 60 degrees to the east for the northern section (Machette and Jochems, 2015d). Dip angles were not reported for the central and southern sections, therefore the range of angles assumed in this assessment were 60 ± 15 degrees to the east. A maximum magnitude of M_W 7.3 was calculated for a rupture length of 65 km using the Wells and Coppersmith (1994) magnitude-rupture area relationship.

4.1.16 La Bajada Fault

The La Bajada Fault is approximately 122 miles (197 km) east of the Mill Site and separates the Santo Domingo basin from the Española basin while marking the eastern edge of the Rio Grande rift. Much of the normal fault's length (primarily the northern portion) is marked by a well-developed escarpment that is several hundred meters high and faces westward (Personius and Jochems, 2016a). Quaternary activity is evident based on offset upper Pliocene and lower Pleistocene volcanic rocks; however, no scarps are evident in surficial deposits, indicating a lack of activity over the past several hundred thousand years. Estimated slip rates range from 0.079 to 0.11 mm/yr based on 90 to 250 m of displacement over 1.1 to 2.7 m.y. (Personius and Jochems, 2016a). The fault dips to the west at an angle between 55 and 90 degrees. A maximum magnitude of M_W 7.1 was calculated using the Wells and Coppersmith (1994) magnitude-rupture area relationship, based on a maximum rupture length of 48 km.

4.1.17 La Jencia Fault

The La Jencia Fault is approximately 121 miles (195 km) southeast of the Mill Site. The northwest-striking normal fault forms the eastern boundary of the Magdalena Mountains and the Bear Mountains, and is the tectonic margin between these mountains and the La Jencia basin located just to the east (Machette and Chamberlin, 2016). Slip rates were estimated to range from 0.033 to 0.045 mm/yr based on 5 m of displacement over 110 to 150 k.y. along the northern section of the fault. Dip generally is to the east and northeast at angles between 70 and 90 degrees as measured within 3 to 4 m of the surface; dip angles may be significantly shallower at greater depths (Machette et al., 2016a). A maximum magnitude of M_W 6.9 was calculated using the Wells and Coppersmith (1994) magnitude-rupture area relationship, based on a maximum rupture length of 34 km.

4.1.18 Leupp Faults

The Leupp Faults are approximately 149 miles (239 km) west of the Mill Site at the eastern edge of the San Francisco volcanic field in northern Arizona. These normal faults primarily strike towards the northwest through Paleozoic and Mesozoic bedrock, middle Pleistocene basalt, and Quaternary alluvium (Pearthree, 1998d). No known scarps exist in the Quaternary alluvium,

although relatively subdued scarps have been documented in the bedrock and basalt. Because no data is available to estimate a slip rate, rates less than 0.2 mm/yr have been inferred based on documented slip rates of regional Quaternary faults (Pearthree, 1998d). Dip directions of east, northeast, and southwest were reported by Pearthree (1998d), though no dip angles were specified; therefore, for this assessment, dip angles were assumed to be 50 degrees to the west, 90 degrees (vertical), and 50 degrees to the east. A maximum magnitude of M_W 7.4 was calculated using the Wells and Coppersmith (1994) magnitude-rupture area relationship, based on a maximum rupture length of 32 km.

4.1.19 Loma Pelada Fault

The Loma Pelada Fault is approximately 119 miles (192 km) southeast of the Mill Site and forms the western margin of the Rio Grande rift where it meets the Sierra Ladrones and northern Lemitar Mountains. Near its northern end, this normal fault offsets Quaternary alluvium, though most of the activity along the length of the fault is evident through fault scarping and offsets in the Sierra Ladrones Formation (Personius and Jochems, 2016f). A slip rate of approximately 0.1 mm/yr was estimated based on 13 m of displacement in 130 ka Pleistocene deposits. The fault dips to the east with measured angles ranging from 60 to 80 degrees. A maximum magnitude of M_W 7.1 was calculated using the Wells and Coppersmith (1994) magnitude-rupture area relationship, based on a maximum rupture length of 44 km.

4.1.20 Manzano Fault

The Manzano Fault is approximately 126 miles (203 km) southeast of the Mill Site along the eastern margin of the Rio Grande rift and the Albuquerque-Belen basin. The fault is buried along the majority of its length and is primarily marked by the front of the Manzano Mountains, which form a steep, west-facing escarpment (Personius and Jochems, 2016g). Slip rates were assumed to be less than 0.2 mm/yr due to the lack of documented prominent scarps, as well as no known studies of fault offset. The normal fault dips to the west, and the dip angle was assumed to be 50 ± 15 degrees (Petersen et al. 2014) for the purposes of this assessment. A maximum magnitude of M_W 7.3 was calculated for a rupture length of 54 km using the Wells and Coppersmith (1994) magnitude-rupture area relationship.

4.1.21 McCormick Ranch Faults

The McCormick Ranch Faults are approximately 114 miles (184 km) southeast of the Mill Site in the Albuquerque basin of the Rio Grande rift. These intrabasin, normal faults trend to the north and northeast and form numerous horst and graben blocks in the area (Personius and Jochems, 2016i). Linear scarps and depressions mark the various faults, which are partially buried in eolian sand. Offsets of 5 to 20 m have been documented for upper Santa Fe Group sediments over about 1.2 m.y., resulting in slip rates from 0.004 to 0.017 mm/yr. Dip to the east and west was reported by Personius and Jochems (2016i); because no dip angles were reported, angles of 50 degrees to the east, 90 degrees (vertical), and 50 degrees to the west were assumed for this assessment. A maximum magnitude of M_W 6.5 ± 0.3 was calculated using the Wells and Coppersmith (1994) magnitude-rupture area relationship, based on a maximum rupture length of 13 km.

4.1.22 Nacimiento Fault

The Nacimiento Fault is approximately 77 miles (124 km) southeast of the Mill Site. The Nacimiento fault is an east-dipping normal fault bordering the Nacimiento uplift, an 80 km long, 10 to 16 km wide uplift related to Laramide deformation. This fault has two sections. Woodward (1987) mapped the Nacimiento and Pajarito faults along the western margin of the Sierra Nacimiento. He noted the lack of continuity between these faults near San Miguel Canyon section boundary, about 3 km southeast of the village of San Miguel. Wong and others (1995) considered potential fault rupture scenarios that included rupture on either a northern section or a southern section and on both sections together. This analysis includes a segmented rupture on the northern or southern segment with a weight of 0.8 and an unsegmented rupture on the complete fault with a weight of 0.2. The fault has a reported slip rate of less than 0.2 mm/yr (Kelson et al., 2015e; 2015f). This slip rate on the northern segment is supported by the assumption of 5 m of displacement that occurred in the late Pleistocene. The slip rate on the southern section was conservatively estimated by Wong et al. (1995), to range between 0.01 to 0.23 mm/yr with a preferred value of 0.02 mm/yr. These values were used in this study for the southern section with weightings of 0.2 for a slip rate of 0.01 mm/yr, 0.6 for the preferred value of 0.2 mm/yr, and 0.2 for the 0.23 mm/yr.

For the unsegmented fault rupture, a maximum magnitude of M_W 7.4 was calculated for a northern segment with a fault length of 82 km using the Wells and Coppersmith (1994) magnitude-surface rupture length relationship. The dips were assumed to be 45, 65, and 90 degrees as this spanned the range given for the northern and southern segments, 45 to 90 degrees (Kelson et al., 2015e and 2015f).

4.1.22.1 Northern Segment

A maximum magnitude of M_W 6.9 was calculated for the northern segment with a fault length of 36 km using the Wells and Coppersmith (1994) magnitude-surface rupture length relationship. In this assessment, the dips were assumed to be 45, 50, and 60 degrees as the reported range was 45 to 60 degrees (Kelson et al., 2015e).

4.1.22.2 Southern Segment

A maximum magnitude of M_W 7.0 was calculated for the southern segment with a fault length of 45 km using the Wells and Coppersmith (1994) magnitude-surface rupture length relationship. The dips were assumed to be 75, 80, and 90 degrees as the reported range was 75 to 90 degrees (Kelson et al., 2015f).

4.1.23 Nambe Fault

The Nambe Fault is approximately 144 miles (232 km) east of the Mill Site. This poorly-understood fault is expressed as several north-striking normal faults along the western edge of the Sangre de Cristo Mountains north of Santa Fe, NM. The fault is thought to separate Precambrian rocks of the mountains to the east from Miocene rift-fill sediments in the Española basin to the west, though the exact nature of the contact between these two materials remains unknown. Displacement of 150-ka gravels has previously been inferred from aerial photographs, although this has neither been confirmed nor precluded (Kelson, 1996). Slip rates were assigned based on regional slip rates in the Rio Grande rift, yielding a range of 0.01 to 0.23 mm/yr with a preferred value of 0.02 mm/yr (Kelson, 1996); for this assessment, the preferred value was assigned a weight of 0.6, whereas the upper and lower end of the range (0.01 and 0.23 mm/yr) were assigned weights of 0.2. The dip was reported by Kelson (1996) as being to the west and east; because no dip angles were reported, angles of 50 degrees to the west, 90 degrees (vertical), and 50 degrees to the east were assumed for this assessment. A maximum magnitude of M_W 7.1 was calculated using the Wells and Coppersmith (1994) magnitude-rupture area relationship, based on a maximum rupture length of 48 km.

4.1.24 Northern Sangre de Cristo Fault

The Northern Sangre de Cristo Fault is approximately 198 miles (319 km) northeast of the Mill Site. This north-northwest striking normal fault forms the boundary between the Sangre de Cristo/Culebra Range and the San Luis basin of the Rio Grande rift in southern Colorado. The fault contains four main sections (listed from north to south): the Crestone section, the Zapata section, the Blanca section, and the San Luis section. The Crestone section exhibits prominent but discontinuous west-facing scarps on late Quaternary deposits (Kirkham and Haller, 2015). These continue into the Zapata section, becoming less numerous further south along this section yet still indicative of repeated late Quaternary activity (Kirkham and Haller, 2012a). Along the Blanca section, scarps as high as 28.3 m associated with a prominent graben 2.1 km in length exist on glacial and alluvial deposits (Kirkham, 2012). Activity is also evident along the San Luis section, with escarpments as high as 35 m along the fault (Kirkham and Haller, 2012b). Age/offset information for calculating slip rates only exists for the Crestone section, though all sections fall into the low slip-rate category (i.e., less than 0.2 mm/yr). For the Crestone section, a maximum slip rate of 0.164 mm/yr was estimated based on 4.5 m of surface offset over 27.4 k.y., though the reported average slip rate is only 0.044mm/yr (Kirkham and Haller, 2015). All sections of the fault dip to the west or southwest at angles estimated to be about 60 degrees in some areas. Because the dip angle is uncertain along much of the fault, the regional fault dip angle of 50 ± 15 degrees was assumed (Petersen et al. 2014) in this assessment. A maximum magnitude of M_W 7.7 was calculated using the Wells and Coppersmith (1994) magnitude-rupture area relationship, based on a maximum rupture length of 168 km.

4.1.25 Pajarito Fault Zone

The Pajarito Fault Zone is approximately 121 miles (195 km) east of the Mill Site near Los Alamos, NM. The southern portion of the normal fault, which has been extensively studied, comprises broadly distributed faults, fissures, and folds striking to the

north and offsetting early Quaternary volcanic rocks, as well as younger alluvium (Haller et al., 2015a). Prominent, west-facing scarps exist along the length of the fault traces, with heights as great as 200 m. The fault system as a whole is as wide as 10 km and accommodates much of the Quaternary east-west extension of the Española basin in the area. Slip rates were estimated to range from 0.033 to 0.167 mm/yr based on 40 to 200 m of displacement of the Bandelier Tuff (1.2 Ma). Although Haller et al. (2015a) reported dip to the east for the entire fault, data fully characterizing the surface and subsurface are lacking and it is believed that the fault zone may be listric below depths of 10 km. For this assessment, the regional dip angle of 50 ± 15 degrees was assumed (Petersen et al. 2014). A maximum magnitude of M_W 7.2 was calculated using the Wells and Coppersmith (1994) magnitude-rupture area relationship, based on a maximum rupture length of 49 km.

4.1.26 Picuris-Pecos Fault

The Picuris-Pecos Fault, identified by USGS as a Class B fault, is approximately 148 miles (238 km) east of the Mill Site within the Sangre de Cristo Mountains of New Mexico. This north-northeast striking normal fault is well-expressed and known to have undergone displacement during Precambrian, Pennsylvanian, late Cretaceous, and possibly Neogene times; however, no evidence has been documented indicating displacement of Quaternary deposits, partly due to an overall lack of such deposits in the locally rugged terrain (Kelson and Jochems, 2016a). Previous conservative estimates of slip rates, based on analysis of both regional slip rates and the geomorphic expression of the Picuris-Pecos fault, ranged from 0.01 to 0.45 mm/yr with a preferred value of 0.05 mm/yr. For this assessment, the preferred value was given a weight of 0.6 whereas the upper and lower end of the range were assigned weights of 0.2. In general, the fault dips nearly vertically; for the purposes of this assessment, the fault was assigned dip angles of 70 degrees west, 90 degrees (vertical), and 70 degrees east. A maximum magnitude of M_W 7.4 was calculated using the Wells and Coppersmith (1994) magnitude-rupture area relationship, based on a maximum rupture length of 98 km.

4.1.27 Pojoaque Fault Zone

The Pojoaque Fault Zone is approximately 137 miles (221 km) east of the Mill Site in the Española Basin. This poorly-understood fault zone comprises multiple north-striking normal faults over approximately a 5-km-wide area. The location of the fault and activity are uncertain, and little geomorphic expression is evident where faults have been traced. Possible Quaternary activity is suggested based on fault orientation and association with the Velarde graben (Kelson and Personius, 1996). Estimated slip rates based on regional slip rates in the Rio Grande rift range from 0.01 to 0.23 mm/yr, with a preferred value of 0.02 mm/yr (Kelson and Personius, 1996). The dip of the fault has been noted as down to both the east and west at a high angle, although the overall sense of displacement dips to the west. For this assessment, the fault was assumed to have dip angles of 60 degrees west, 90 degrees (vertical), and 60 degrees east. A maximum magnitude of M_W 7.1 was calculated using the Wells and Coppersmith (1994) magnitude-rupture area relationship, based on a maximum rupture length of 48 km.

4.1.28 San Felipe Fault Zone

The San Felipe Fault Zone is approximately 102 miles (164 km) east of the Mill Site in the Santo Domingo basin of the Rio Grande rift. Numerous north-trending normal faults make up the two sections of this fault zone, with the western, east-dipping faults comprising the Santa Ana section, and the eastern, west-dipping faults comprising the Algodones section (Personius et al., 2016a,b). The faults form the San Felipe graben, offsetting 2.4 to 2.6 Ma volcanic basalt flows. Fault expression is greatest in the basalt flows of the San Felipe volcanic field, whereas faults located in Santa Fe Group sedimentary rocks are poorly expressed (Personius et al., 2016a,b). Estimated slip rates range from 0.035 to 0.05 mm/yr based on 90 to 120 m of displacement in the San Felipe basalt over 2.4 to 2.6 m.y. Dip angles of 64 to 74 degrees to the west were reported for the Algodones section, whereas angles of 60 to 90 degrees to the east were reported for the Santa Ana section; for this assessment, assumed dip angles for the unsegmented fault were 60 degrees east, 90 degrees (vertical), and 64 degrees west. A maximum magnitude of M_W 7.4 was calculated for a rupture length of 89 km using the Wells and Coppersmith (1994) magnitude-rupture area relationship.

4.1.29 Sand Hill Fault Zone

The Sand Hill Fault Zone is approximately 93 miles (150 km) east of the Mill Site and is one of several faults that form part of the active western boundary of the Rio Grande rift in the region. This north-trending, normal fault cuts through early Pleistocene sand and gravel of the upper Santa Fe group, with younger surficial deposits atop the fault that do not exhibit faulting. In general, there is a lack of fault scarps, and the fault strands are marked by sand dikes that are more resistant to erosion than the surrounding Santa Fe Group sediments. Based on the lack of scarps, as well as low known slip rates for other faults in the region, a general slip-rate category of less than 0.2 mm/yr was assigned to this fault (Personius and Jochems, 2016b). The fault dips to the east at angles ranging from 54 to 82 degrees as measured from surface exposures. A maximum magnitude of M_W 7.0 ± 0.3 was calculated using the Wells and Coppersmith (1994) magnitude-rupture area relationship based on a maximum rupture length of 36 km.

4.1.30 San Andres Mountains Fault

The San Andres Mountains Fault is approximately 193 miles (311 km) southeast of the Mill Site. This normal fault trends to the north along the eastern boundary of the San Andres Mountains where they meet the Tularosa basin. Uplift of the San Andres Mountains can be attributed to this fault, as shown by exposed Precambrian and Paleozoic rocks along the footwall of the fault (Machette and Jochems, 2015a; 2015b; 2015c). Faulting of middle to late Quaternary surficial deposits is evident via mostly continuous scarps along the fault trace, as well as some discontinuous scarps along northern portions of the fault. Estimated slip rates range from 0.002 mm/yr along the northern section of the fault to 0.21 mm/yr along the central and southern sections, based on scarps heights from 2 to 15 m in middle to late Pleistocene deposits (northern section) and Picacho alluvium (central and southern sections). The fault dips to the east; due to a lack of measured dip angles, values were assumed for this assessment based on the regional fault dip angle of 50 ± 15 degrees. A maximum magnitude of M_W 7.6 was calculated using the Wells and Coppersmith (1994) magnitude-rupture area relationship based on a maximum rupture length of 114 km.

4.1.31 Santa Fe Fault

The Santa Fe Fault is approximately 95 miles (153 km) southeast of the Mill Site along the western margin of the Rio Grande rift and separates the rift from the Colorado Plateau. Documented offset of upper Santa Fe Group sediments is indicative of significant activity during the Pliocene and early Pleistocene on this north-trending, normal fault. Although no surficial deposit scarps have been observed, the fault forms a bedrock escarpment along its northern half (Personius and Jochems, 2015). A low slip rate of approximately 0.008 mm/yr was estimated based on 30 m of displacement of basalt deposits over about 3.7 m.y. The fault dips to the east at an angle ranging from 45 to 80 degrees. A maximum magnitude of M_W 6.9 was calculated using the Wells and Coppersmith (1994) magnitude-rupture area relationship, based on a maximum rupture length of 30 km.

4.1.32 Socorro Canyon Fault Zone

The Socorro Canyon Fault Zone is approximately 130 miles (210 km) southeast of the Mill Site. This normal fault consists of two sections, northern and southern, which define the eastern margin of the Socorro and northern Lemitar Mountains along the western edge of the Rio Grande Valley. About 208 m of displacement of a 4.0 Ma basalt is evident, although displacement during the Pliocene through Pleistocene likely is less than 300 m. Discontinuous and obscure scarps are present along parts of the northern section, including many that are mostly buried by colluvium or possible landslide debris, whereas scarps along the southern section are more continuous (Machette and Chamberlin, 2015; Machette et al., 2016b). Although little offset or age data exist for the northern section of the fault, slip rates along the southern section are estimated to range from 0.03 to 0.6 mm/yr based on movement ranging from 30 m over 1 m.y. to 0.6 m over only 100 years (estimated modern rate of deformation, possibly a result of draping). The fault dips to the east at angles ranging from 36 degrees to 90 degrees (vertical) along both sections of the fault. A maximum magnitude of M_W 7.1 was calculated using the Wells and Coppersmith (1994) magnitude-rupture area relationship, based on a maximum rupture length of 49 km.

4.1.33 Southern Sangre de Cristo Fault

The Southern Sangre de Cristo Fault is approximately 169 miles (272 km) northeast of the Mill Site, forming the boundary between the Sangre de Cristo Mountains and the San Luis basin in New Mexico and between San Pedro Mesa and San Luis

Valley in Colorado (Kelson et al., 2015a,b,d,g). The normal fault is subdivided into five sections (listed from north to south): the San Pedro Mesa section, the Urraca section, the Questa section, the Hondo section, and the Cañon section. Much of the length of the San Pedro Mesa section is buried by Quaternary landslide deposits, although discontinuous scarps can be seen among and between the deposits (Kelson et al., 2015a,b,d,g). Other sections of the fault contain prominent scarps on late Pleistocene and (possibly) Holocene alluvial fans originating from the Sangre de Cristo Mountains. Reported slip rates range from 0.01 to 0.23 mm/yr, although two primary ranges in vertical displacement rates have been estimated for much of the fault: a post-middle Pleistocene rate of 0.03 to 0.06 mm/yr and a post-Pliocene rate of 0.12 to 0.23 mm/yr (Kelson et al., 2015a,b,d,g; Kelson et al., 1998). The dip for fault sections is to the west at an angle of approximately 60 degrees. A maximum magnitude of M_W 7.5 was calculated using the Wells and Coppersmith (1994) magnitude-rupture area relationship, based on a maximum rupture length of 99 km.

4.1.34 Tijeras-Cañoncito Fault System

The Tijeras-Cañoncito Fault System is approximately 121 miles (195 km) east of the Mill Site and forms the structural boundary separating the Española basin of the Rio Grande rift from the Great Plains tectonic province. This fault strikes to the northeast and shows evidence of left-lateral, normal movement. Displacement of Quaternary deposits has been observed in surface sediments along the Canyon section of the fault, which exhibits prominent scarps as well as juxtaposition of different rock types. Alternatively, the Galisteo section appears to have no geomorphic expression associated with late Quaternary fault movement (Kelson and Jochems, 2016b,c). Slip rates are reported to range from 0.02 to 0.72 mm/yr, with a preferred value of 0.09 mm/yr. For this assessment, the preferred value was assigned a weight of 0.6, whereas the upper and lower end of the reported range of slip rates were given weights of 0.2. Dip along this fault is nearly vertical. A maximum magnitude of M_W 7.3 was calculated using the Wells and Coppersmith (1994) magnitude-rupture area relationship based on a maximum rupture length of 79 km.

4.1.35 Unnamed Fault of Bonita Canyon

The Unnamed fault of Bonita Canyon is approximately 55 miles (88 km) southeast of the Mill Site. The suspect fault of Bonita Canyon is identified as a Class B fault and there are no detailed studies of the normal fault. However, fault scarp-like features have been mapped on the early Quaternary Twin Craters and El Calderon basalt flows of El Malpais lava field. No measurement of offset across the fault has been reported. It is undetermined if the scarps are formed on an early Quaternary age landscape, and therefore this fault is assigned a slip rate less than 0.2 mm/yr (Machette and Jochems, 2016d). Because the dip direction is unknown, the input into the PSHA was varied as follows: 50 degrees to the east, 90 degrees (vertical), and 50 degrees to the west. A maximum magnitude of M_W 6.1 was calculated for a fault length of 9 km using the Wells and Coppersmith (1994) magnitude-surface rupture length relationship.

4.1.36 Unnamed Faults along San Mateo Mountains

The Unnamed Faults along San Mateo Mountains are approximately 145 miles (233 km) southeast of the Mill Site. This group of normal faults strike to the north near the eastern margin of the San Mateo Mountains. Relatively small west-facing scarps are apparent along the fault and contrast the down-to-the-east slope of the piedmont surfaces through which the fault cuts (Machette and Jochems, 2016a). Slips rates were estimated to range from 0.009 to 0.011 mm/yr based on the maximum documented scarp height of 8 m formed on the Palomas Formation over approximately 700 to 900 k.y. As previously noted, dip is to the west at angles assumed to coincide with the regional fault dip angle of 50 ± 15 degrees (Petersen et al. 2014). A maximum magnitude of M_W 7.1 was calculated for a rupture length of 41 km using the Wells and Coppersmith (1994) magnitude-rupture area relationship.

4.1.37 Unnamed Faults near Albuquerque Volcanoes

The Unnamed Faults near Albuquerque Volcanoes are approximately 101 miles (162 km) southeast of the Mill Site in the middle of the Albuquerque-Belen basin of the Rio Grande rift. Most of these north-trending, normal faults cut through upper Santa Fe Group sediments that lie beneath volcanic basalt flows dated to between 155 to 218 ka, although at least two faults offset the basalt as evidenced by prominent, linear scarps (Personius and Jochems, 2016d). These scarps are about 1 to 2 m in height, resulting in an estimated slip rate of 0.005 to 0.013 mm/yr based on the age of the basalt flows. Faults dip to both the east and

the west; for this assessment, dip angles were assumed to be 50 degrees east, 90 degrees (vertical), and 50 degrees west. A maximum magnitude of M_W 6.9 was calculated using the Wells and Coppersmith (1994) magnitude-rupture area relationship, based on a maximum rupture length of 34 km.

4.1.38 Unnamed Faults near Star Heights

The Unnamed Faults near Star Heights are approximately 101 miles (163 km) east of the Mill Site in the northern part of the Albuquerque-Belen basin. These intrabasin, normal faults strike to the north, offsetting upper Santa Fe Group sediments, the Llano de Albuquerque, and younger piedmont deposits (Personius and Jochems, 2016c). Scarps on the Llano de Albuquerque are relatively broad and 15 to 20 m in height, whereas scarps on the Piedmont deposits are relatively steep and 5 to 10 m in height. A slip-rate category of less than 0.2 mm/yr was inferred by Personius and Jochems (2016c) based on the broad scarps observed on the Llano de Albuquerque. The faults generally dip to the east at an angle of 70 degrees. A maximum magnitude of M_W 6.7 was calculated using the Wells and Coppersmith (1994) magnitude-rupture area relationship based on a maximum rupture length of 18 km.

4.1.39 Unnamed Faults of El Malpais Lava Field

The Unnamed faults of El Malpais lava field are approximately 55 miles (89 km) southeast of the Mill Site. Four groups of suspect faults, which the USGS classifies as Class B, form numerous fissures and cracks in early Quaternary basalt flow of El Malpais lava field. There is some debate whether the faults are of tectonic origin. The longest feature, named La Rendija by Levish et al. (1992), is 26 km long. As with the majority of the faults in the CP, the sense of slip is normal, but the dip direction is listed as west, northwest, and east (Machette and Jochems, 2016f). Therefore, the dip direction was varied 50 degrees to the east, 90 degrees (vertical), and 50 degrees to the west. Only the longest feature was included in the PSHA, as the other features were less than 5 km long. A maximum magnitude of M_W 6.7 was calculated for a fault length of 26 km using the Wells and Coppersmith (1994) magnitude-surface rupture length relationship.

4.1.40 Unnamed Faults on the Llano de Manzano

The Unnamed Faults on the Llano de Manzano are approximately 126 miles (203 km) southeast of the Mill Site. These normal faults strike to the northeast and offset the Llano de Manzano by about 5 to 10 m in multiple locations, as shown by subdued scarps that are discontinuously preserved and covered by eolian sand. Although most of the faults are intrabasin faults, the southernmost faults potentially mark the eastern margin of the Rio Grande rift (Jochems and Personius, 2016a). Slip rates were estimated to range from 0.005 to 0.02 mm/yr based on 5 to 20 m of displacement of the Llano de Manzano over approximately 1 m.y. The faults are reported to dip to both the east and west; for this assessment, dip angles were assumed to be 50 degrees to the east, 90 degrees (vertical), and 50 degrees to the west. A maximum magnitude of M_W 7.2 was calculated using the Wells and Coppersmith (1994) magnitude-rupture area relationship, based on a maximum rupture length of 68 km.

4.1.41 Vernon Fault Zone

The Vernon Fault Zone is approximately 109 miles (176 km) southwest of the Mill Site on an erosion surface sloping north from the boundary of the Colorado Plateau towards the Little Colorado River. Left-lateral and normal movement through Mesozoic bedrock, Miocene volcanic rocks, and upper to lower Pleistocene basalt has been inferred for these northwest-trending faults based on fault geometry and topography, although specific amounts of displacement remain unknown (Pearthree, 1998c). Scarps are known to be somewhat subdued and of low to moderate height, although no specific scarp data has been reported. Because of a lack of reported slip rate data, the faults were assigned a slip-rate category less than 0.2 mm/yr. The faults dip to the northeast, and dip angles were assumed for this assessment based on the regional fault dip angle of 50 ± 15 degrees (Petersen et al. 2014). A maximum magnitude of M_W 7.3 was calculated using the Wells and Coppersmith (1994) magnitude-rupture area relationship, based on a maximum rupture length of 57 km.

4.1.42 West Joyita Fault Zone

The West Joyita Fault Zone is approximately 132 miles (212 km) southeast of the Mill Site along the eastern margin of the Rio Grande rift. The zone of normal faults is poorly expressed over much of its area, except on the west flank of the northernmost

Joyita Hills where upper Santa Fe Group sediments are clearly juxtaposed with Paleozoic rock (Personius and Jochems, 2016e). Although much of the fault zone is buried by middle Pleistocene and younger rocks, offset greater than 150 m has been documented in the early Pleistocene Sierra Ladrones Formation in the northern portion of the zone. A slip rate category of less than 0.2 mm/yr was assigned to these faults based on reported offset/age estimates. The fault dips generally to the west at angles ranging from 41 to 80 degrees based on dip data for the southern end of the zone. A maximum magnitude of M_W 7.1 was calculated using the Wells and Coppersmith (1994) magnitude-rupture area relationship, based on a maximum rupture length of 48 km.

4.1.43 Zia Fault

The Zia Fault is approximately 98 miles (157 km) east of the Mill Site. This intrabasin, normal fault trends to the north and is well exposed in the Santa Fe Group sediment of the Zia badlands. To the south, broad, dissected scarps are evident on the Llano de Albuquerque and younger surficial deposits (Personius and Haller, 2015). Slip rates ranging from 0.055 to 0.103 mm/yr were estimated based on 6.5 m of offset of Santa Fe Group sediments over 63 to 119 k.y. The faults dip to the east, and dip angles were assumed for this assessment based on the regional fault dip angle of 50 ± 15 degrees (Petersen et al. 2014). A maximum magnitude of M_W 7.0 was calculated using the Wells and Coppersmith (1994) magnitude-rupture area relationship, based on a maximum rupture length of 32 km.

4.2 Colorado Plateau Areal Source

The seismic hazard from background events unassociated with known faults was assessed by first looking at the 124-mile (200-km) radius around the Mill Site. The majority of this radius fell within the CP physiographic province (Figure 2-1). The areal source zone was then expanded to include the entire CP (Figure 3-1).

Boundaries of the areal source zone were developed based on regional geology, tectonic regime, and similar patterns of historical seismicity. The CP boundary (Figure 3-2) was based on observed seismicity and the delineation provided by Sbar (1982). Catalog seismicity within the source zone was used to estimate the Gutenberg-Richter a and b parameters. Earthquake locations within each zone are assumed to be uniformly located within the space. Parameters for defining seismicity within each source zone include the following: minimum and maximum depth, activity rate (number of events per year > M_{min}) and b-value estimated from the historical seismicity catalog for the zone, probability of activity, and parameters for rupture length estimation based on magnitude.

The Mill Site is located within the CP, as shown on Figure 1-1. This zone exhibits relatively sparse concentrations of earthquake events. As discussed in Section 3.3, 413 events were included in the catalog between 1887 and 2016 within the CP source zone. The largest earthquake event within the CP source zone developed for this project was a M_w 6.5 event that occurred on November 14, 1901, approximately 292 miles (470 km) from the Mill Site. Based on the historical seismicity, the closest event was an M_w 4.7 event that occurred on January 5, 1976, approximately 16 miles (26 km) from the Mill Site.

As discussed previously, the a- and b-values for the Gutenberg-Richter recurrence relationship were estimated using the maximum likelihood method developed by Weichert (1980) and the collected seismicity for the project-specific CP source zone. The estimated b-value for the CP is 0.84 and the calculated activity rate is 0.19 earthquake events per year greater than M_w 5.0. In order to include epistemic uncertainty in the recurrence parameters, the a-value was held constant while the b-value was varied ±0.05 units. Figure 4-1 shows the fit of the recurrence relationship to the seismicity data used in the development of the a and b parameters, along with a representation of the truncated exponential recurrence relationship used in the PSHA. A maximum magnitude of 6.5 is the largest earthquake in the study area and a standard error of ±0.25 was added for an upper estimate of M_w of 6.75. This is consistent with the maximum magnitude of M_w 6.75 for the CP, as discussed by Wong and Olig (1998). The maximum depth of events specified for the CP is 15.5 miles (25 km).

4.3 Shear Wave Velocity

The shear wave velocity was estimated in the top 100 feet (30 meters, V_{S30}) of the original ground surface. The tailings were not considered in estimating the shear wave velocity because this site-wide SHA was performed to estimate peak accelerations at

the original ground surface. As previously mentioned, the Mill Site is situated on an alluvial valley and the subsurface profile can vary from 30 m of soil (alluvium) to 30 m of rock (Sandstone). Therefore, the shear wave velocity was estimated for both an alluvium site and a soft rock site. The following paragraphs summarize the method used to calculate and estimate a site-specific shear wave velocity for use in the seismic hazard analysis.

ConeTec measured the shear-wave velocity via cone penetration testing (CPT) in November 2013. Because the CPT was limited to soft soils, most of the measurements are within the existing tailings and alluvium, not the sandstone. RCPT-11 extended to a depth of 26 meters, with the top 9 meters within existing tailings and approximately 17 meters of alluvium. For the CPT performed as part of this investigation, location RCPT-11 encountered the maximum depth of alluvium. The shear wave velocity for this CPT location in the alluvium varied from 202 to 292 m/s. The Boore (2004) regression coefficients were used to extrapolate the velocity data in the alluvium to a depth of 30 meters. This resulted in a V_{S30} equal to 275 m/s.

No site-specific shear wave velocity measurements are available for the sandstone; therefore, published values for sandstone were used. Wills and Clahan (2006) published mean V_{s30} values for a variety of California geological units. The shear wave velocity was measured at six sites underlain by Cretaceous sandstone by Wills and Clahan (2006). The authors provide a mean V_{s30} of 566 m/s for this material. The sandstone underlying the site is Cretaceous, and therefore, a V_{S30} value of 566 m/s was used in this analysis.

Site-specific V_{s30} values used in the seismic hazard analyses are as follows: 275 m/s for the alluvium, 566 m/s for the sandstone, and 420 m/s (the average of the alluvium and sandstone V_{s30} values). The three V_{s30} values were selected to represent the range of alluvium thickness within the foundation, which varied between approximately 0 and 100 feet thick.

5.0 GROUND MOTION PREDICTION EQUATIONS

GMPEs are applied to earthquakes to estimate ground motion at the Mill Site. GMPEs are mathematical expressions that define how seismic waves propagate from the source to the site. Several factors combine to decreased amplitude or intensity as the wave travels to the site, including refraction, reflection, diffraction, geometric spreading, and absorption.

GMPEs estimate ground motion as a function of magnitude, distance, and site conditions (e.g. soil, rock, or V_{s30}). The relationships are derived by fitting equations to data obtained by strong-motion instruments for a specific region.

Current Next Generation of Attenuation (NGA) West 2 relationships were used for the crustal faults and the areal source zone: Abrahamson, et al. (2014), Boore, et al. (2014), Campbell and Bozorgnia (2014), and Chiou and Youngs (2014). Idriss (2014) was not used due to limitations on the maximum distance and minimum V_{S30} value. The maximum applicable distance for Idriss (2014) is limited to 93 miles (150 km) and the V_{S30} value for the GMPE is limited to a minimum of 450 m/s.

The GMPEs were equally weighted. It should be noted that the GMPEs implemented in this study were developed using the most current information, and these models have been shown to be applicable worldwide. Table 5-1 lists the relationships and the associated weights.

6.0 PROBABILISTIC SEISMIC HAZARD ANALYSIS

The following sections describe the PSHA methods, inputs for analysis, and results.

6.1 PSHA Code and Methods

The methods for PSHA was developed by Cornell (1968), and was used to provide a framework in which uncertainties in size, location, and rate of recurrence of earthquakes can be considered to provide a probabilistic understanding of seismic hazard.

A PSHA can be described as a procedure of four steps (Kramer 1996):

- Identification and characterization of earthquake sources, along with the assignment of a probability distribution to each source zone
- Characterization of earthquake recurrence
- Estimation of ground motion produced at the site by earthquakes of any possible size occurring at any possible point in each source zone
- Calculation of the probability that the ground motion parameter will be exceeded during a particular time period given uncertainties in earthquake location, earthquake size and ground motion parameters

Calculations for this report were performed using the computer code HAZ43b, developed by Dr. Norman Abrahamson. Earlier versions of this code were verified under the PEER PSHA Code Verification Workshop (Thomas et al., 2010).

6.2 PSHA Inputs

The PSHA considered a combination of areal and fault sources. Exponential relationships were developed to characterize the seismicity of the areal source zone. Historical seismicity was used to characterize activity based on Gutenberg-Richter relationships within the CP seismic zone that are shown in Figure 3-1. The areal source is described in Section 4.2 and the GMPEs considered are explained in Section 5.0.

Additional input parameters [depth to (1.0 km/s) ($Z_{1.0}$) and depth to (2.5 km/s) ($Z_{2.5}$)] were estimated from the input V_{s30} value. Each of these values are summarized in Table 6-1.

6.2.1 Areal Source Zones

Characteristics of the CP areal source zone included in this analysis are described in Section 4.2. The earthquake recurrence for the areal source zone was based on the rate of historical seismicity within this zone and does not include Gaussian smoothing. The estimation of the recurrence parameters for the areal source zone was presented in Section 4.2. Although recurrence parameters were developed considering events with magnitudes as low as M_w 3.0, a minimum magnitude of M_w 5.0 was used in the probabilistic analysis, as events with magnitudes less than M_w 5.0 are unlikely to generate a significant hazard at the Mill Site. The maximum magnitude assigned to the areal source zone was M_w 6.75.

6.2.2 Fault Sources

Quaternary faults that fell within a 200-mile (322-km) radius were included in the analysis. In general, fault sources beyond 200-miles were judged to not contribute to the seismic hazard, due to their site-to-source distance and likely dominant contribution of the areal background source. The mapped fault lineation (USGS, 2017) was simplified in the analysis by tracing the mapped lineation and redrawing the faults as they appear in Figure 2-1. To account for uncertainty in estimating the maximum magnitude of these faults, the maximum magnitude in the PSHA were varied by ±0.3 magnitude units, with the central values (calculated maximum magnitude value) weighted with 0.6, and the upper and lower values weighted with 0.2.

Fault recurrence were modeled as both characteristic and maximum magnitude. Characteristic events were assigned a probability of 0.7 and the maximum magnitude model was weighted 0.3. The weighting was set to balance out the two different models.

Additional information on the fault parameters for the PSHA, including dip, slip rate, depth, type of fault, and weighting, is included in Table 4-2.

6.3 Probabilistic Seismic Hazard Analysis Results

Ground motions at the Mill Site were calculated for the average horizontal component of motion in terms of PGA. In order to bracket the PGA and account for uncertainty in the site-specific V_{s30}, the PGA was calculated for the range of V_{s30} values presented in Section 4.3.3. The results are summarized in Table 6-2.

The PSHA is used to calculate the annual frequency of exceeding a specified ground motion level. Results of the PSHA are typically presented in terms of ground motion as a function of annual exceedance probability. Figure 6-1 shows the total hazard curve plotted for the lower bound V_{s30} of 902 ft/s (275 m/s), which resulted in the highest mean PGA. At the 10,000-year return period, the hazard is controlled by the background earthquake from the CP areal source zone. Crustal faults have little effect on the total hazard due to the distance from the site. The Uniform Hazard Spectra (UHS) was computed for the 10,000 and 2,500-year return periods and for each of the V_{S30} values. The UHS are shown in Figure 6-2.

The hazard was deaggregated to evaluate the magnitude and distance contributions to the mean PGA for each V_{S30} value. The deaggregation of the hazard allows the probability density to be calculated for selected distance and magnitude bins. The deaggregated hazard is shown on Figures 6-3 through 6-5. The plots also include mean magnitude, mean distance, and mean epsilon values. Based on the deaggregation, the hazard is generally dominated by earthquakes greater than M_w 5.0 located less than 19 miles (30 km) from the site. In summary, the deaggregation results for the three shear wave velocities are as follows:

- For a V_{S30} = 902 ft/s (275 m/s), the mean magnitude was calculated to be M_w 5.8 at a mean distance of 26 km (Figure 6-3), and the modal magnitude was calculated to be M_w 5.5 at modal distance of 12.4 miles (20 km).
- For a V_{S30} = 1,348 ft/s (420 m/s), the mean magnitude was calculated to be M_w 5.8 at a mean distance of 25 km (Figure 6-4), and the modal magnitude was calculated to be M_w 5.5 at modal distance of 12.4 miles (20 km).
- For a V_{S30} = 1,857 ft/s (566 m/s), the mean magnitude was calculated to be M_w 5.8 at a mean distance of 25 km (Figure 6-5), and the modal magnitude was calculated to be M_w 5.5 at modal distance of 12.4 miles (20 km).

7.0 DETERMINISTIC SEISMIC HAZARD ANALYSIS

The DSHA can be described as a procedure of four steps (Kramer 1996):

1. Identification and characterization of earthquake sources capable of producing significant ground motions at the site
2. Selection of source to site distance parameter for each source zone, consistent with attenuation relationship selected
3. Selection of controlling earthquake
4. Hazard at the site is formally defined, in terms of ground motions produced at the site by the controlling earthquake

Calculations for this report were performed using a spreadsheet developed by PEER (2015). The Excel spreadsheet calculates the weighted average of the natural logarithm of the spectral values from the GMPEs. The same GMPEs and weighting used in the PSHA were used in the DSHA. The deterministic evaluation also excludes the Idriss (2014) relationship due to the limitation on minimum V_{S30}.

DSHA methods require source parameters for location, geometry, orientation, sense of slip, and maximum magnitude. No information is required on recurrence or slip rates. Thus for the DSHA, potential sources were evaluated only as 100 percent active (or 100 percent inactive) with no consideration of slip rate. There are no mapped faults within 50 km of the site. The two closest faults to the site are the Unnamed Faults of the El Malpais Lava Field and the Unnamed Fault of Bonita Canyon, which are both approximately 90 km from the site. However, both of these faults are Class B faults and were each assigned a probability of activity of 0.5. Therefore, these faults were not included in the deterministic analysis. The seismic sources evaluated in the DSHA included: the unsegmented Nacimiento fault, the Interbasin faults on the Llano de Albuquerque, the unsegmented Jemez-San Ysidro fault, and the unsegmented San Felipe fault. These unsegmented faults are approximately 150 km from the site, with estimated rupture lengths greater than 80 km.

The lowest V_{S30} of 275 m/s was used in the DSHA calculations.

7.1 Deterministic Inputs

The input parameters for the NGA-West 2 relationships are summarized in Table 7-1.

7.2 Deterministic Seismic Hazard Analysis Results

The weighted average of the median and 84th percentile (median+1σ) acceleration values for 5 percent damping are summarized in Table 7-2. The deterministic spectra for the median and 84th percentile are shown in Figure 7-1. The DSHA results for the four considered faults are similar with PGA values for the 84th percentile ranging from 0.04 to 0.07 g, with the Nacimiento fault resulting in ground motions only slightly higher than the other three faults.

8.0 RESULTS AND COMPARISON WITH PREVIOUS STUDIES

The results of this site-wide SHA indicate the mean PGA for long-term conditions is estimated to range from 0.25 g to 0.30 g. The PGA values are associated with an average return period of 10,000 years, or a probability of exceedance of 2 percent to 10 percent for a design life of 200 to 1,000 years, respectively. The V_{s30} values used for the analysis ranged from 902 ft/s to 1,857 ft/s (275 m/s to 566 m/s). Selection of the PGA or a pseudostatic coefficient used for long-term design of the repository shall be performed during design and be based on the results presented in Table 6-2. For all considered V_{S30} values, the controlling earthquake is estimated as magnitude 5.5 at a distance of 12.4 miles (20 km).

Comparing the DSHA results to the PSHA results for a V_{S30} of 275 m/s (Figure 8-1), the UHS for the 10,000-year return period is well above the 84th percentile of the Nacimiento fault, which had the highest ground motions of the sources considered in the DSHA. The 2,475-year return period UHS is above the 84th percentile for the Nacimiento fault for spectral periods up to 2 seconds. Overall, the PGA from the 10,000-year event for a V_{S30} of 275 m/s is 0.30 g.

Results of this site-specific PSHA were compared to previous analyses conducted for the site by LLNL (NRC 1997). Results of the LLNL analyses indicate a deterministically-derived PGA of 0.196 g for a magnitude 6.25 event. This PGA is lower than the PGA for the 10,000-year return period for the three considered V_{S30} values and considering background seismicity. It is speculated that the PGA reported by LLNL was for soft rock (V_{S30} of 760 m/s) and not the existing subsurface of alluvium, as was used in this study.

Additionally, results of this site-specific PSHA were compared to USGS 2014 NSHMP gridded hazard curves. The USGS 2014 NSHMP indicate a PGA of 0.08 g for a return period of 2,475 years at a V_{S30} of 760 m/s, which is less than this study's calculation of 0.14 to 0.18 g for the same return period and V_{S30} of 275 to 566 m/s, respectively.

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TABLES

Table 3-1: Time Periods for Complete Event Reporting

Magnitude Range	Period of Complete Reporting	
2.5≤M<3.0	2000	2016
3≤M<3.5	1985	2016
3.5≤M<4.0	1965	2016
4.0≤M<4.5	1965	2016
4.5≤M<5.0	1960	2016
5.0≤M	1885	2016

Table 3-2: Colorado Plateau – Magnitude Bins and Cumulative N* Values

Magnitude Bin	Cumulative N* value	Cumulative Observed Counts
2.5≤M<3.0	149.39	142
3≤M<3.5	169.44	160
3.5≤M<4.0	110.70	103
4.0≤M<4.5	42.87	40
4.5≤M<5.0	15.97	15
5.0≤M<5.5	12.18	11
5.5≤M<6.0	5.92	5
6.0≤M<6.5	2.41	2
6.5≤M<7.0	1.21	1

Table 4-1: Faults Included in Analysis

Fault Name	Distance from Site	Maximum Magnitude
Cebollita Mesa	107	6.3
Continental Divide	101	6.5
Hickman	130	6.1
Nacimiento	124	7.4
Unnamed fault of Bonita Canyon	88	6.1
Unnamed faults of El Malpais lava field	89	6.7

Table 4-2: PSHA Input Parameters

No.	Fault	Fault Number [1]	Distance from Site (km)	Rupture Model	Probability of Activity	Sense of Slip	Time Since Most Recent Deformation	Max Rupture Length (km)	Seismogenic Depth (km)	Dip	M_{max} [2]	Weighting	Slip Rate (mm/yr)	Weighted Mean of Slip Rate	Recurrence Model	b-value
1	Bright Angel fault zone	991	321	Unsegmented	1	N	<1.6 Ma	74	25	45 SE 66 SE 87 SE	7.0 7.3 7.6	0.2 0.6 0.2	0.001 (0.2) 0.1 (0.6) 0.2 (0.2)	0.10	Characteristic (0.7) Maximum Magnitude (0.3)	0.84
2	Cebollita Mesa fault	2140	107	Unsegmented	1	N	<15 ka	13	25	35 W 50 W 65 W	6.3 6.6 6.9	0.2 0.6 0.2	0.001 (0.2) 0.1 (0.6) 0.2 (0.2)	0.10	Characteristic (0.7) Maximum Magnitude (0.3)	0.84
3	Concho fault	1014	160	Unsegmented	1	N/SS	<750 ka	39	25	35 SE 50 SE 65 SE	6.8 7.1 7.4	0.2 0.6 0.2	0.019 (0.2) 0.03 (0.6) 0.04 (0.2)	0.03	Characteristic (0.7) Maximum Magnitude (0.3)	0.84
4	Continental Divide fault (Class B)	2145	101	Unsegmented	1	N	<1.6 Ma	17	25	35 SE 50 SE 65 SE	6.5 6.8 7.1	0.2 0.6 0.2	0.001 (0.2) 0.1 (0.6) 0.2 (0.2)	0.10	Characteristic (0.7) Maximum Magnitude (0.3)	0.84
5	County Dump fault	2038	160	Unsegmented	1	N	<130 ka	35	25	75 E 80 E 85 E	6.7 7.0 7.3	0.2 0.6 0.2	0.015 (0.2) 0.02 (0.6) 0.024 (0.2)	0.02	Characteristic (0.7) Maximum Magnitude (0.3)	0.84
6	Coyote Wash fault	1015	158	Unsegmented	1	N/SS	<750 ka	42	25	35 SW 50 SW 65 SW	6.8 7.1 7.4	0.2 0.6 0.2	0.001 (0.2) 0.1 (0.6) 0.2 (0.2)	0.10	Characteristic (0.7) Maximum Magnitude (0.3)	0.84
7	Embudo fault	2007	233	Unsegmented	1	SS/N	<130 ka	40	25	90	6.7 7.0 7.3	0.2 0.6 0.2	0.001 (0.2) 0.1 (0.6) 0.2 (0.2)	0.10	Characteristic (0.7) Maximum Magnitude (0.3)	0.84
8	Faults near Cochiti Pueblo	2142	183	Unsegmented	1	N	<1.6 Ma	32	25	60 W 65 W 75 W	6.7 7.0 7.3	0.2 0.6 0.2	0.042 (0.2) 0.11 (0.6) 0.17 (0.2)	0.11	Characteristic (0.7) Maximum Magnitude (0.3)	0.84
9	Gallina fault	2001	157	Unsegmented	1	N	<1.6 Ma	39	25	70 E 90 70 W	6.7 7.0 7.3	0.2 0.6 0.2	0.001 (0.2) 0.1 (0.6) 0.2 (0.2)	0.10	Characteristic (0.7) Maximum Magnitude (0.3)	0.84
10	Hickman fault	2136	130	Unsegmented	1	N	<130 ka	9	25	60 W 75 W 90 W	6.2 6.5 6.8	0.2 0.6 0.2	0.001 (0.2) 0.1 (0.6) 0.2 (0.2)	0.10	Characteristic (0.7) Maximum Magnitude (0.3)	0.84
11	Hubbell Spring fault	2120	192	Unsegmented	1	N	<15 ka	74	25	48 W 66 W 85 W	7.0 7.3 7.6	0.2 0.6 0.2	0.2 (0.2) 0.6 (0.6) 1 (0.2)	0.60	Characteristic (0.7) Maximum Magnitude (0.3)	0.84
12	Intrabasin faults on the Llano de Albuquerque	2121	158	Unsegmented	1	N	<750 ka	101	25	50 E 90 50 W	7.1 7.4 7.7	0.2 0.6 0.2	0.002 (0.2) 0.009 (0.6) 0.015 (0.2)	0.01	Characteristic (0.7) Maximum Magnitude (0.3)	0.84
13	Jemez-San Ysidro fault	2029	152	Unsegmented	1	N	<15 ka	96	25	58 E 75 E 90	7.1 7.4 7.7	0.2 0.6 0.2	0.009 (0.2) 0.031 (0.6) 0.054 (0.2)	0.03	Characteristic (0.7) Maximum Magnitude (0.3)	0.84
14	Jornada Draw fault	2056	304	Unsegmented	1	N	<750 ka	65	25	45 E 60 E 75 E	7.0 7.3 7.6	0.2 0.6 0.2	0.018 (0.2) 0.06 (0.6) 0.1 (0.2)	0.06	Characteristic (0.7) Maximum Magnitude (0.3)	0.84
15	La Bajada fault	2032	197	Unsegmented	1	N	<1.6 Ma	48	25	55 W 70 W 90 W	6.8 7.1 7.4	0.2 0.6 0.2	0.079 (0.2) 0.095 (0.6) 0.11 (0.2)	0.09	Characteristic (0.7) Maximum Magnitude (0.3)	0.84

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Table 4-2 cont.: PSHA Input Parameters

No.	Fault	Fault Number [1]	Distance from Site (km)	Rupture Model	Probability of Activity	Sense of Slip	Time Since Most Recent Deformation	Max Rupture Length (km)	Seismogenic Depth (km)	Dip	M_{max} [2]	Weighting	Slip Rate (mm/yr)	Weighted Mean of Slip Rate	Recurrence Model	b-value
										70 E	6.6	0.2	0.033 (0.2)		Characteristic (0.7)	
16	La Jencia fault	2109	195	Unsegmented	1	N	<15 ka	34	25	80 E	6.9	0.6	0.039 (0.6)	0.04	Maximum Magnitude (0.3)	0.84
										90 E	7.2	0.2	0.045 (0.2)			
										50 W	6.6	0.2	0.001 (0.2)		Characteristic (0.7)	
17	Leupp faults	1017	239	Unsegmented	1	N	<750 ka	32	25	90	6.9	0.6	0.1 (0.6)	0.10	Maximum Magnitude (0.3)	0.84
										50 E	7.2	0.2	0.2 (0.2)			
										60 E	6.8	0.2	0.001 (0.2)		Characteristic (0.7)	
18	Loma Pelada fault	2113	192	Unsegmented	1	N	<130 ka	44	25	70 E	7.1	0.6	0.1 (0.6)	0.10	Maximum Magnitude (0.3)	0.84
										85 E	7.4	0.2	0.2 (0.2)			
										35 W	7.0	0.2	0.001 (0.2)		Characteristic (0.7)	
19	Manzano fault	2119	203	Unsegmented	1	N	<750 ka	54	25	50 W	7.3	0.6	0.1 (0.6)	0.10	Maximum Magnitude (0.3)	0.84
										65 W	7.6	0.2	0.2 (0.2)			
										50 E	6.2	0.2	0.004 (0.2)		Characteristic (0.7)	
20	McCormick Ranch faults	2135	184	Unsegmented	1	N	<750 ka	13	25	90	6.5	0.6	0.011 (0.6)	0.01	Maximum Magnitude (0.3)	0.84
										50 W	6.8	0.2	0.017 (0.2)			
				Segmented (0.8)	1					45 E	6.8	0.2	0.001 (0.2)		Characteristic (0.7)	
		2002a	148	Northern segment		N	<1.6 Ma	36	25	50 E	7.1	0.6	0.1 (0.6)	0.10	Maximum Magnitude (0.3)	
										60 E	7.4	0.2	0.2 (0.2)			
										75 E	6.8	0.2	0.01 (0.2)		Characteristic (0.7)	
21	Nacimiento fault	2002b	146	Southern segment		N	<750 ka	45	25	80 E	7.1	0.6	0.2 (0.6)	0.17	Maximum Magnitude (0.3)	0.84
										90 E	7.4	0.2	0.23 (0.2)			
										45 E	7.1	0.2	0.001 (0.2)		Characteristic (0.7)	
		2002a,b	146	Unsegmented (0.2)	1	N	<750 ka	82	25	65 E	7.4	0.6	0.1 (0.6)	0.10	Maximum Magnitude (0.3)	
										90 E	7.7	0.2	0.2 (0.2)			
										50 E	6.8	0.2	0.01 (0.2)		Characteristic (0.7)	
22	Nambe fault	2024	232	Unsegmented	1	N	<1.6 Ma	48	25	90	7.1	0.6	0.02 (0.6)	0.06	Maximum Magnitude (0.3)	0.84
										50 W	7.4	0.2	0.23 (0.2)			
										35 W	7.4	0.2	0.001 (0.2)		Characteristic (0.7)	
23	Northern Sangre de Cristo fault	2321	319	Unsegmented	1	N	<15 ka	168	25	50 W	7.7	0.6	0.044 (0.6)	0.06	Maximum Magnitude (0.3)	0.84
										65 W	8.0	0.2	0.164 (0.2)			
										35 E	6.9	0.2	0.033 (0.2)		Characteristic (0.7)	
24	Pajarito fault zone	2008	195	Unsegmented	1	N	<15 ka	49	25	50 E	7.2	0.6	0.1 (0.6)	0.10	Maximum Magnitude (0.3)	0.84
										65 E	7.5	0.2	0.167 (0.2)			
										70 W	7.1	0.2	0.01 (0.2)		Characteristic (0.7)	
25	Picuris-Pecos fault (Class B)	2023	238	Unsegmented	1	N	<1.6 Ma	98	25	90	7.4	0.6	0.05 (0.6)	0.12	Maximum Magnitude (0.3)	0.84
										70 E	7.7	0.2	0.45 (0.2)			
										60 E	6.8	0.2	0.01 (0.2)		Characteristic (0.7)	
26	Pojoaque fault zone	2010	221	Unsegmented	1	N	<1.6 Ma	48	25	90	7.1	0.6	0.02 (0.6)	0.06	Maximum Magnitude (0.3)	0.84
										60 W	7.4	0.2	0.23 (0.2)			
										60 E	7.1	0.2	0.035 (0.2)		Characteristic (0.7)	
27	San Felipe fault zone	2030	164	Unsegmented	1	N	<1.6 Ma	89	25	90	7.4	0.6	0.043 (0.6)	0.04	Maximum Magnitude (0.3)	0.84
										64 W	7.7	0.2	0.05 (0.2)			
										54 E	6.7	0.2	0.001 (0.2)		Characteristic (0.7)	
28	Sand Hill fault zone	2039	150	Unsegmented	1	N	<1.6 Ma	36	25	68 E	7.0	0.6	0.1 (0.6)	0.10	Maximum Magnitude (0.3)	0.84
										82 E	7.3	0.2	0.2 (0.2)			

Table 4-2 cont.: PSHA Input Parameters

No.	Fault	Fault Number [1]	Distance from Site (km)	Rupture Model	Probability of Activity	Sense of Slip	Time Since Most Recent Deformation	Max Rupture Length (km)	Seismogenic Depth (km)	Dip	M_{max} [2]	Weighting	Slip Rate (mm/yr)	Weighted Mean of Slip Rate	Recurrence Model	b-value
29	San Andres Mountains fault	2053	311	Unsegmented	1	N	<130 ka	114	25	35 E 50 E 65 E	7.3 7.6 7.9	0.2 0.6 0.2	0.002 (0.2) 0.06 (0.6) 0.21 (0.2)	0.08	Characteristic (0.7) Maximum Magnitude (0.3)	0.84
30	Santa Fe fault	2123	153	Unsegmented	1	N	<1.6 Ma	30	25	45 E 60 E 80 E	6.6 6.9 7.2	0.2 0.6 0.2	0.001 (0.2) 0.008 (0.6) 0.2 (0.2)	0.05	Characteristic (0.7) Maximum Magnitude (0.3)	0.84
31	Socorro Canyon fault zone	2108	210	Unsegmented	1	N	<130 ka	49	25	36 E 63 E 90	6.8 7.1 7.4	0.2 0.6 0.2	0.03 (0.2) 0.15 (0.6) 0.6 (0.2)	0.22	Characteristic (0.7) Maximum Magnitude (0.3)	0.84
32	Southern Sangre de Cristo fault	2017	272	Unsegmented	1	N	<15 ka	99	25	60 W	7.2 7.5 7.8	0.2 0.6 0.2	0.01 (0.2) 0.12 (0.6) 0.23 (0.2)	0.12	Characteristic (0.7) Maximum Magnitude (0.3)	0.84
33	Tijeras-Cañoncito fault system	2033	195	Unsegmented	1	SS	<130 ka	79	25	90	7.0 7.3 7.6	0.2 0.6 0.2	0.02 (0.2) 0.09 (0.6) 0.72 (0.2)	0.20	Characteristic (0.7) Maximum Magnitude (0.3)	0.84
34	Unnamed fault of Bonita Canyon (Class B)	2144	88	Unsegmented	1	N	<1.6 Ma	9	25	50 W 90 50 W	6.1 6.4 6.7	0.2 0.6 0.2	0.001 (0.2) 0.1 (0.6) 0.2 (0.2)	0.10	Characteristic (0.7) Maximum Magnitude (0.3)	0.84
35	Unnamed faults along San Mateo Mountains	2131	233	Unsegmented	1	N	<750 ka	41	25	35 W 50 W 65 W	6.8 7.1 7.4	0.2 0.6 0.2	0.009 (0.2) 0.01 (0.6) 0.011 (0.2)	0.01	Characteristic (0.7) Maximum Magnitude (0.3)	0.84
36	Unnamed faults of El Malpais lava field (Class B)	2146	89	Unsegmented	1	N	<1.6 Ma	26	25	45 W 90 45 E	6.5 6.8 7.1	0.2 0.6 0.2	0.001 (0.2) 0.1 (0.6) 0.2 (0.2)	0.10	Characteristic (0.7) Maximum Magnitude (0.3)	0.84
37	Unnamed faults near Albuquerque Volcanoes	2049	162	Unsegmented	1	N	<750 ka	34	25	50 E 90 50 W	6.6 6.9 7.2	0.2 0.6 0.2	0.005 (0.2) 0.009 (0.6) 0.013 (0.2)	0.01	Characteristic (0.7) Maximum Magnitude (0.3)	0.84
38	Unnamed faults near Star Heights	2048	163	Unsegmented	1	N	<750 ka	18	25	70 E	6.4 6.7 7.0	0.2 0.6 0.2	0.001 (0.2) 0.1 (0.6) 0.2 (0.2)	0.100	Characteristic (0.7) Maximum Magnitude (0.3)	0.84
39	Unnamed faults on the Llano de Manzano	2117	203	Unsegmented	1	N	<750 ka	68	25	50 E 90 50 W	6.9 7.2 7.5	0.2 0.6 0.2	0.005 (0.2) 0.013 (0.6) 0.02 (0.2)	0.01	Characteristic (0.7) Maximum Magnitude (0.3)	0.84
40	Vernon fault zone	1016	176	Unsegmented	1	N/SS	<750 ka	57	25	35 NE 50 NE 65 NE	7.0 7.3 7.6	0.2 0.6 0.2	0.001 (0.2) 0.1 (0.6) 0.2 (0.2)	0.10	Characteristic (0.7) Maximum Magnitude (0.3)	0.84
41	West Joyita fault zone	2110	212	Unsegmented	1	N	<1.6 Ma	48	25	41 W 60 W 80 W	6.8 7.1 7.4	0.2 0.6 0.2	0.001 (0.2) 0.1 (0.6) 0.2 (0.2)	0.10	Characteristic (0.7) Maximum Magnitude (0.3)	0.84
42	Zia fault	2046	157	Unsegmented	1	N	<15 ka	32	25	35 E 50 E 65 E	6.7 7.0 7.3	0.2 0.6 0.2	0.055 (0.2) 0.078 (0.6) 0.1 (0.2)	0.08	Characteristic (0.7) Maximum Magnitude (0.3)	0.84
	Colorado Plateau Areal Source		0	Areal Source	1	N			25	50	6.75	Activity Rates a-value	0.34 0.19 0.11 3.49		Exponential (1.0)	0.79(0.2) 0.84(0.6) 0.89(0.2)

Notes:
1. Following number scheme used by USGS.
2. Maximum magnitudes estimated using the empirical relation of Wells and Coppersmith (1994) for Normal Faults based on rupture area.

Table 5-1: GMPEs used in the PSHA

GMPE	Weight
Abrahamson et al. (2014)	0.25
Boore et al. (2014)	0.25
Campbell and Bozorgnia (2014)	0.25
Chiou and Youngs (2014)	0.25

Table 6-1: PSHA Input Parameters

Input Parameter	Value		
V_{S30} ft/s (m/s)	902 ft/s (275 m/s)	1,378 ft/s (420 m/s)	1,857 ft/s (566 m/s)
$Z_{1.0}$ (km)	0.472 km	0.337 km	0.166 km
$Z_{2.5}$ (km)	1.941 km	1.196 km	0.850 km

Table 6-2: PSHA Results

• Return Period	• V_{s30} • (ft/s)	• V_{s30} • (m/s)	• Mean PGA • (g)
• 10,000	• 902	• 275	• 0.30
	• 1,348	• 420	• 0.28
	• 1,857	• 566	• 0.25

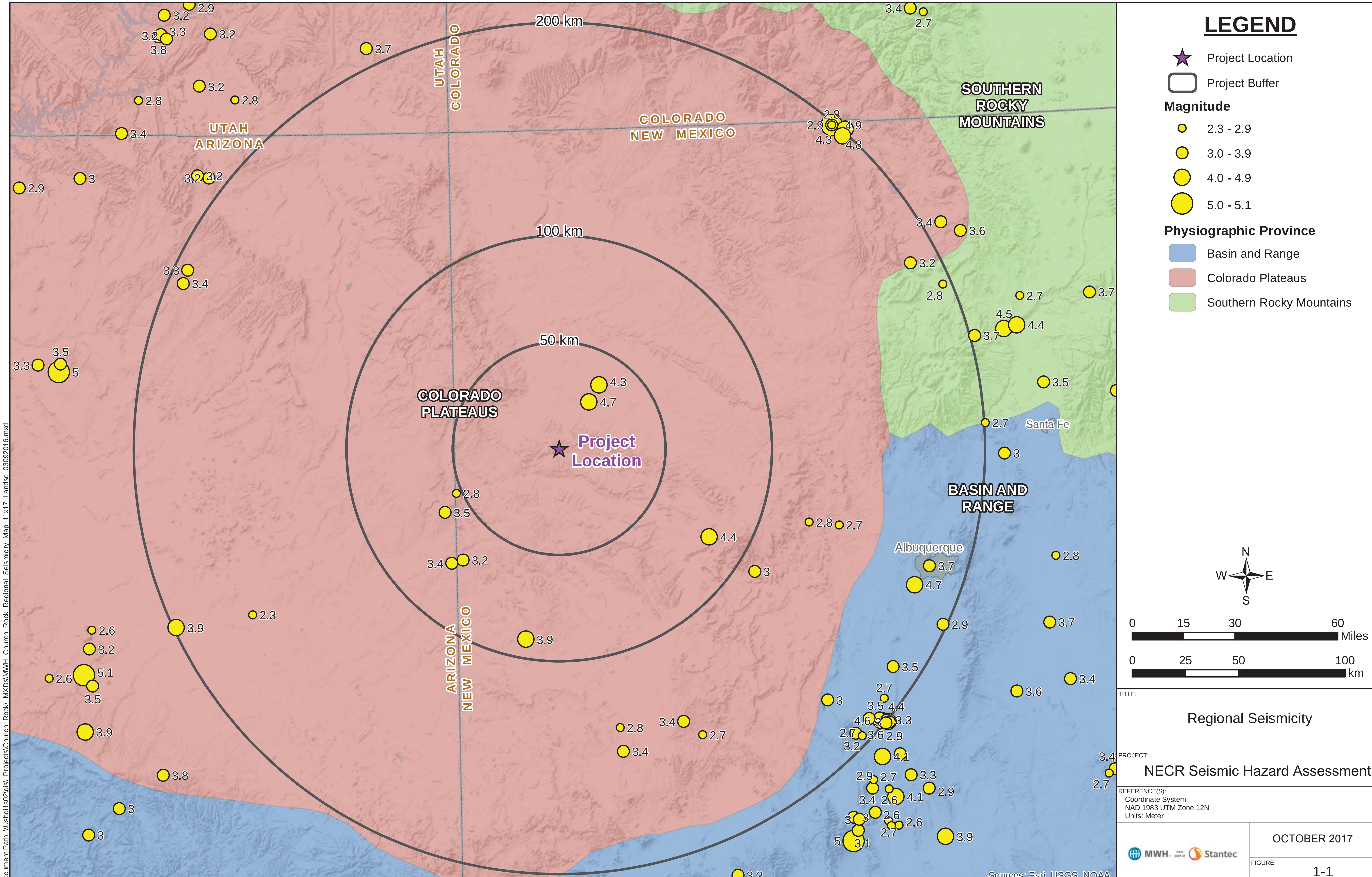
Table 7-1: Deterministic Inputs and GMPEs

Deterministic Input Parameter	Intrabasin Faults of the Llano Albuquerque	Nacimiento Fault	San Felipe Fault	Jemez- San Ysidro Fault
M_W	7.4	7.4	7.4	7.4
R_{RUP} (km)	158	124	164	152
R_{JB} (km)	158	124	164	152
R_X (km)	158	124	164	152
V_{S30} (m/s)	275	275	275	275
Hanging Wall	NO	NO	NO	NO
Fault Mechanism	Normal	Normal	Normal	Normal
Dip (deg)	50	50	50	75
Z_{TOR} (km)	0	0	0	0
Z_{HYP} (km)	10.3 (Default)	10.3	10.3 (Default)	10.3 (Default)
$Z_{1.0}$ (km)	0.47 (Default)	0.47	0.47 (Default)	0.47 (Default)
$Z_{2.5}$ (km)	1.94 (Default)	1.94	1.94 (Default)	1.94 (Default)
W (km)	33	33	33	33
V_{s30} Flag	Estimated	Estimated	Estimated	Estimated
Region	Global	Global	Global	Global
GMPE	ASK14, BSSA14, CB14, and CY14	ASK14, BSSA14, CB14, and CY14	ASK14, BSSA14, CB14, and CY14	ASK14, BSSA14, CB14, and CY14

Table 7-2: Deterministic PGA Values

Seismic Source	Magnitude	R_{RUP} Distance (km)	PGA (g)	
			50th Percentile (Median)	84th Percentile **(Median+1σ)**
Intrabasin Faults of the Llano Albuquerque	7.4	158	0.03	0.05
Nacimiento Fault	7.4	124	0.04	0.07
San Felipe Fault	7.4	164	0.02	0.04
Jemez- San Ysidro Fault	7.4	152	0.03	0.05

FIGURES



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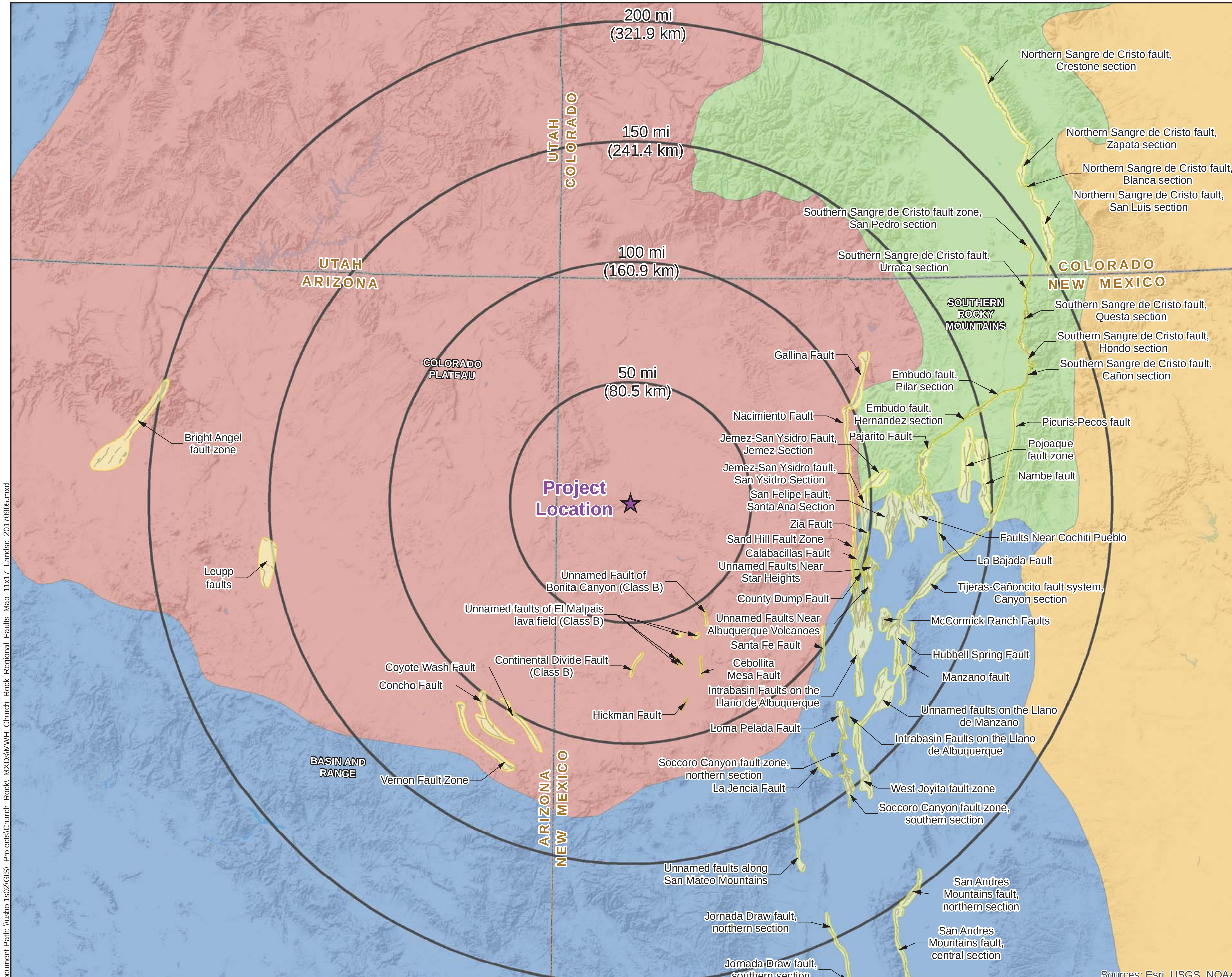


LEGEND

- ★ Project Location
- Fault
- Fault Area (Delineated for Presentation Purposes Only)

Physiographic Province

- Basin and Range
- Colorado Plateau
- GREAT PLAINS
- Southern Rocky Mountains

N
W E
S

0 25 50 100 Miles

0 40 80 160 km

TITLE:

Regional Faults

PROJECT:

NECR Seismic Hazard Assessment

REFERENCE(S):

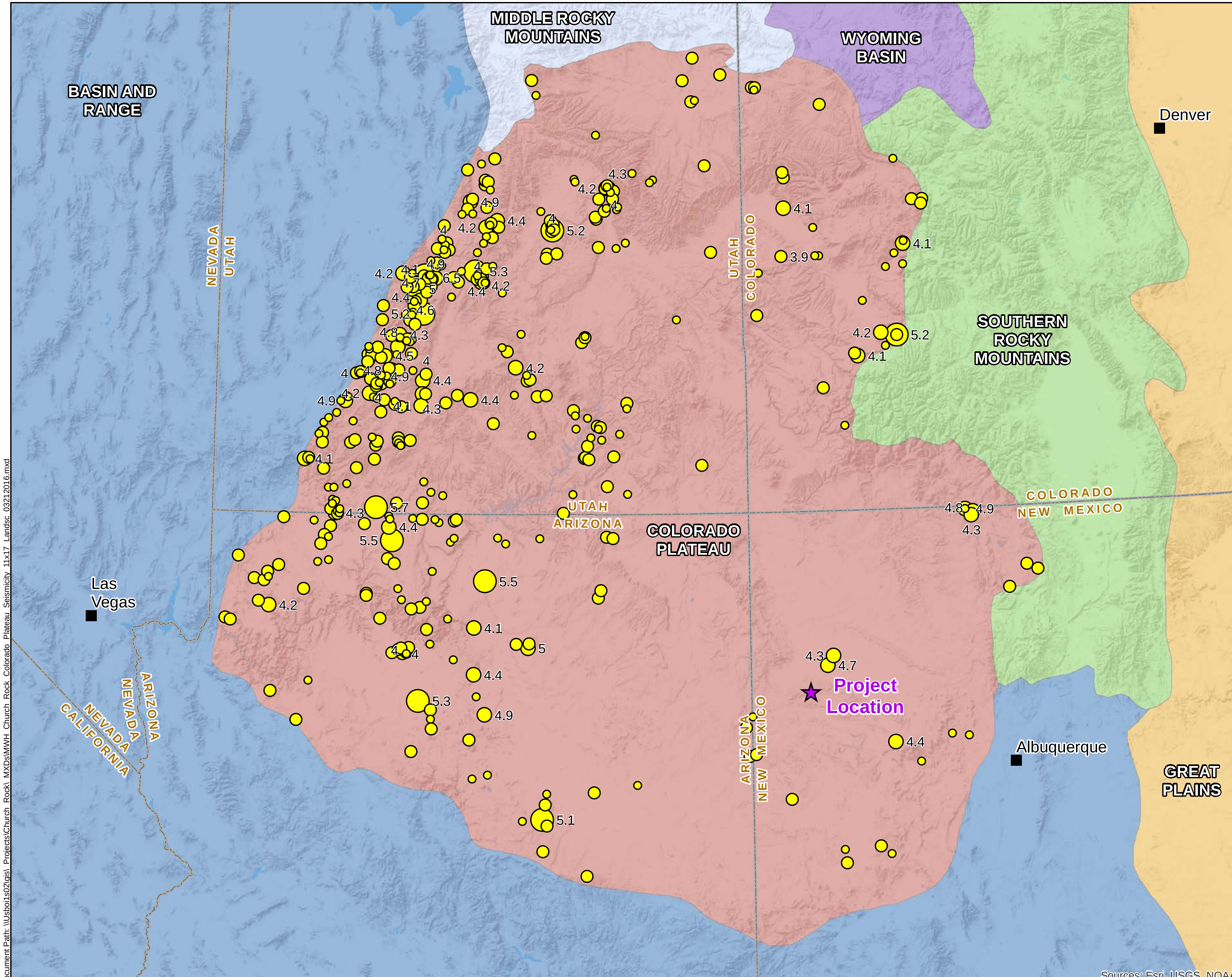
Coordinate System:
NAD 1983 HARN StatePlane New Mexico West FIPS 3003 Feet
Units: Foot US

MWH. now part of Stantec

OCTOBER 2017

FIGURE:

2-1



LEGEND

- Project Location
- City

Magnitude

- 2.3 - 3.0
- 3.1 - 4.0
- 4.1 - 5.0
- 5.1 - 6.0
- 6.1 - 6.5

Physiographic Province

- Basin and Range
- Colorado Plateau
- Great Plains
- Middle Rocky Mountains
- Southern Rocky Mountains
- Wyoming Basin

N S E W

0 25 50 100 Miles

0 40 80 160 km

TITLE:

Seismicity of the Colorado Plateau

PROJECT:

NECR Seismic Hazard Assessment

REFERENCE(S):

Coordinate System:
NAD 1983 UTM Zone 12N
Units: Meter

MWH now part of Stantec

OCTOBER 2017

FIGURE: 3-1

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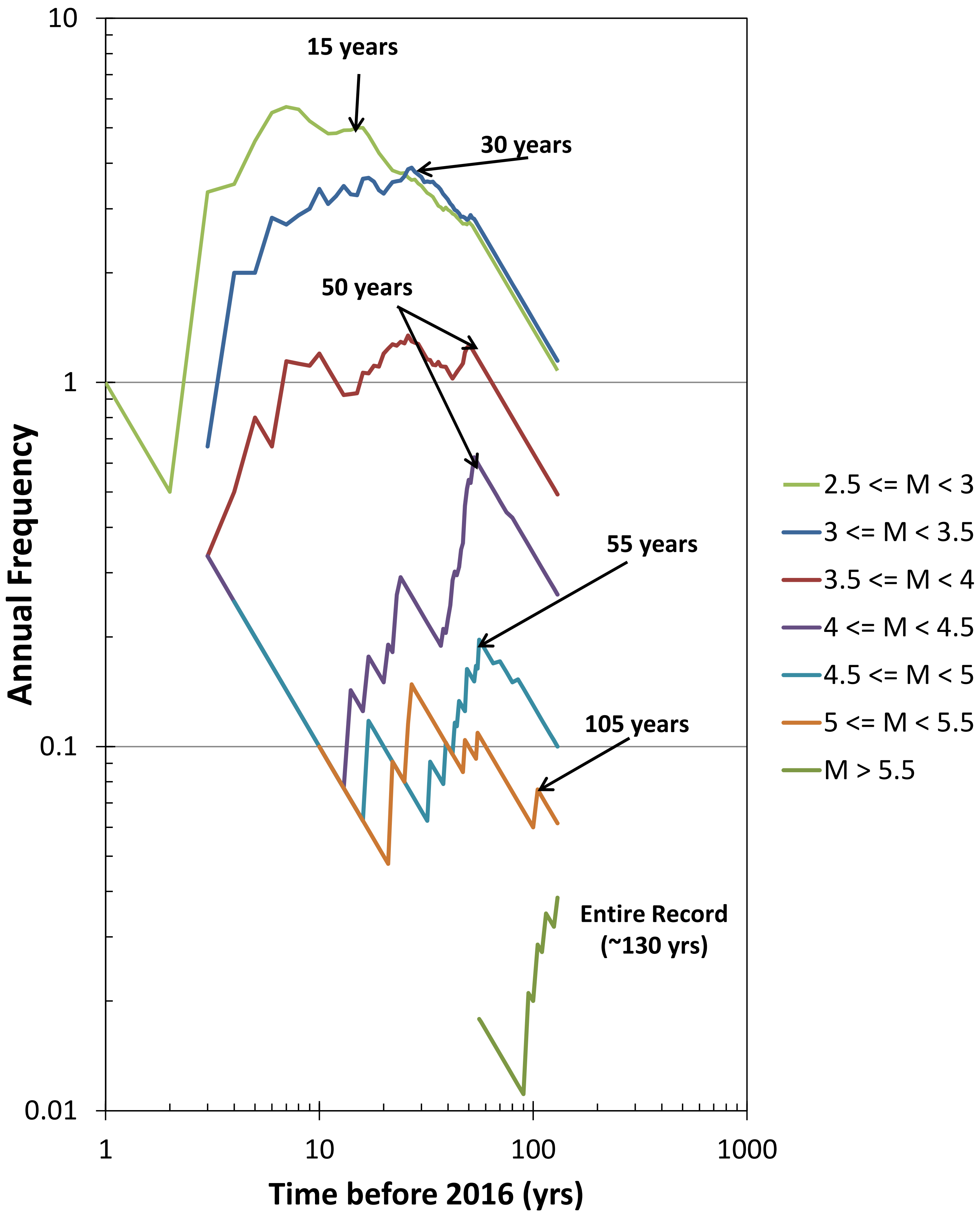
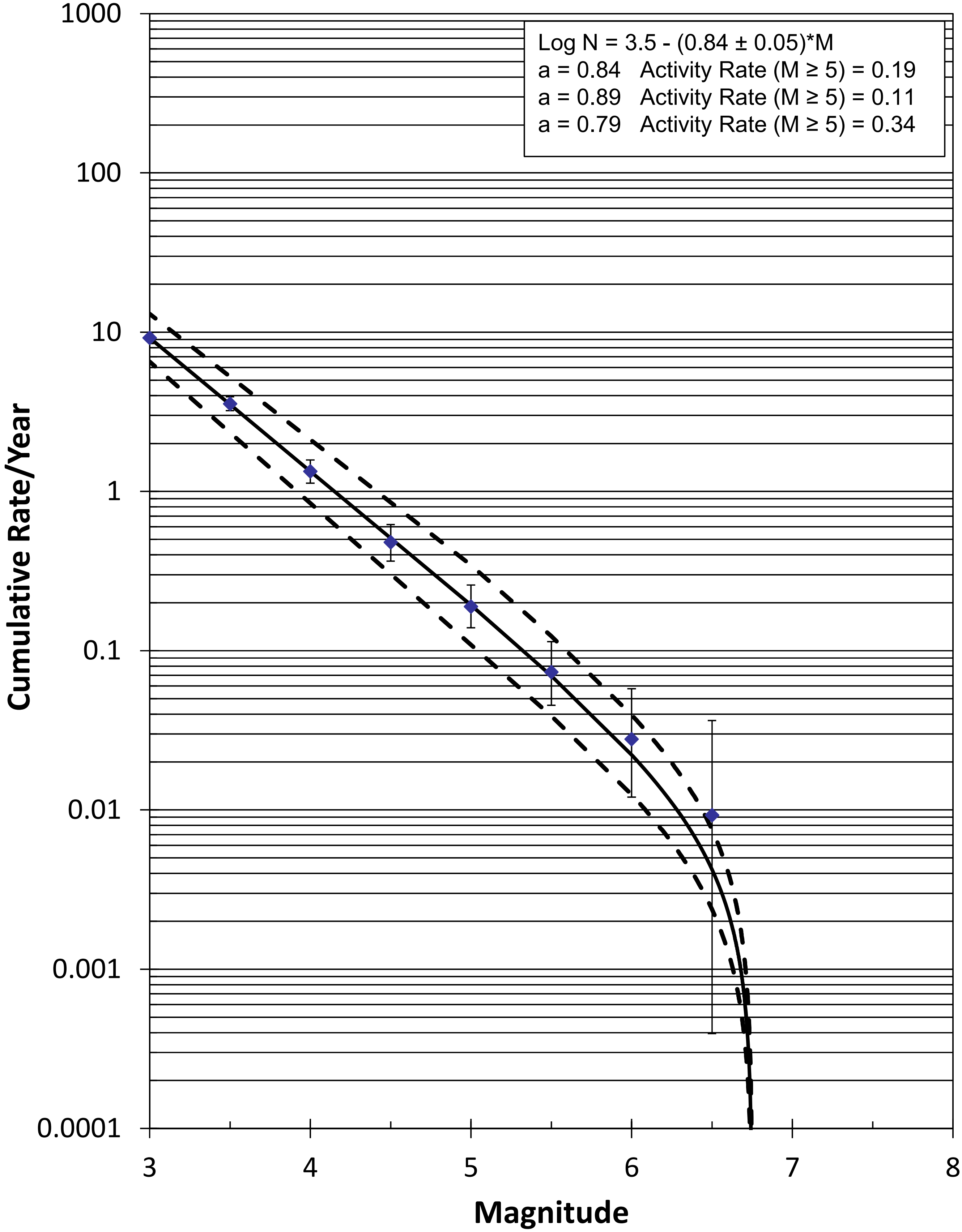


		PROJECT NECR SEISMIC HAZARD ASSESSMENT	MWH now part of Stantec
		TITLE CATALOG COMPLETENESS PLOTS	DATE / FIGURE 3-2 FILENAME



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PROJECT
NECR SEISMIC HAZARD ASSESSMENT

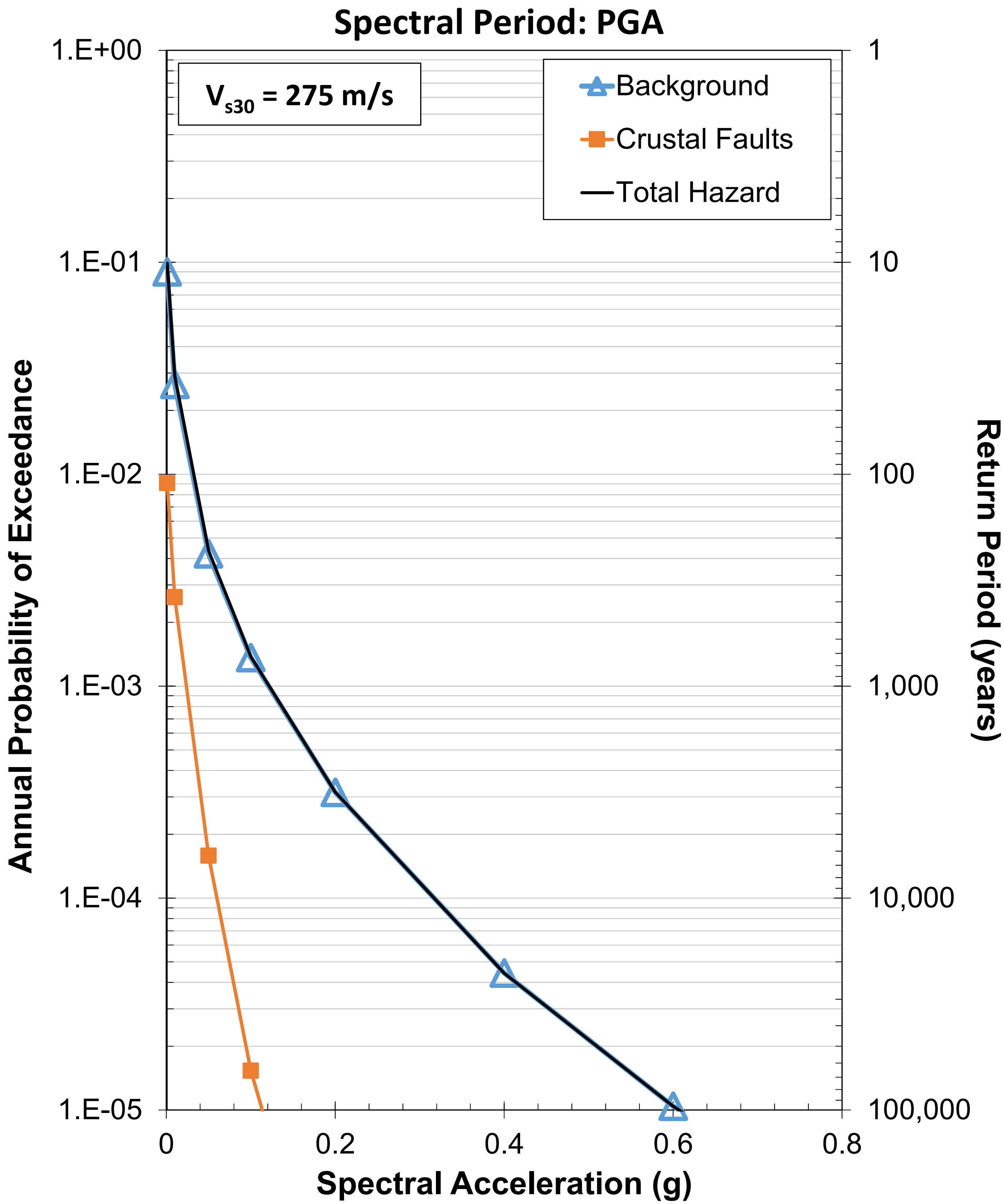
TITLE
GUTENBERG-RICHTER RELATIONSHIP
COLORADO PLATEAU

MWH now part of Stantec

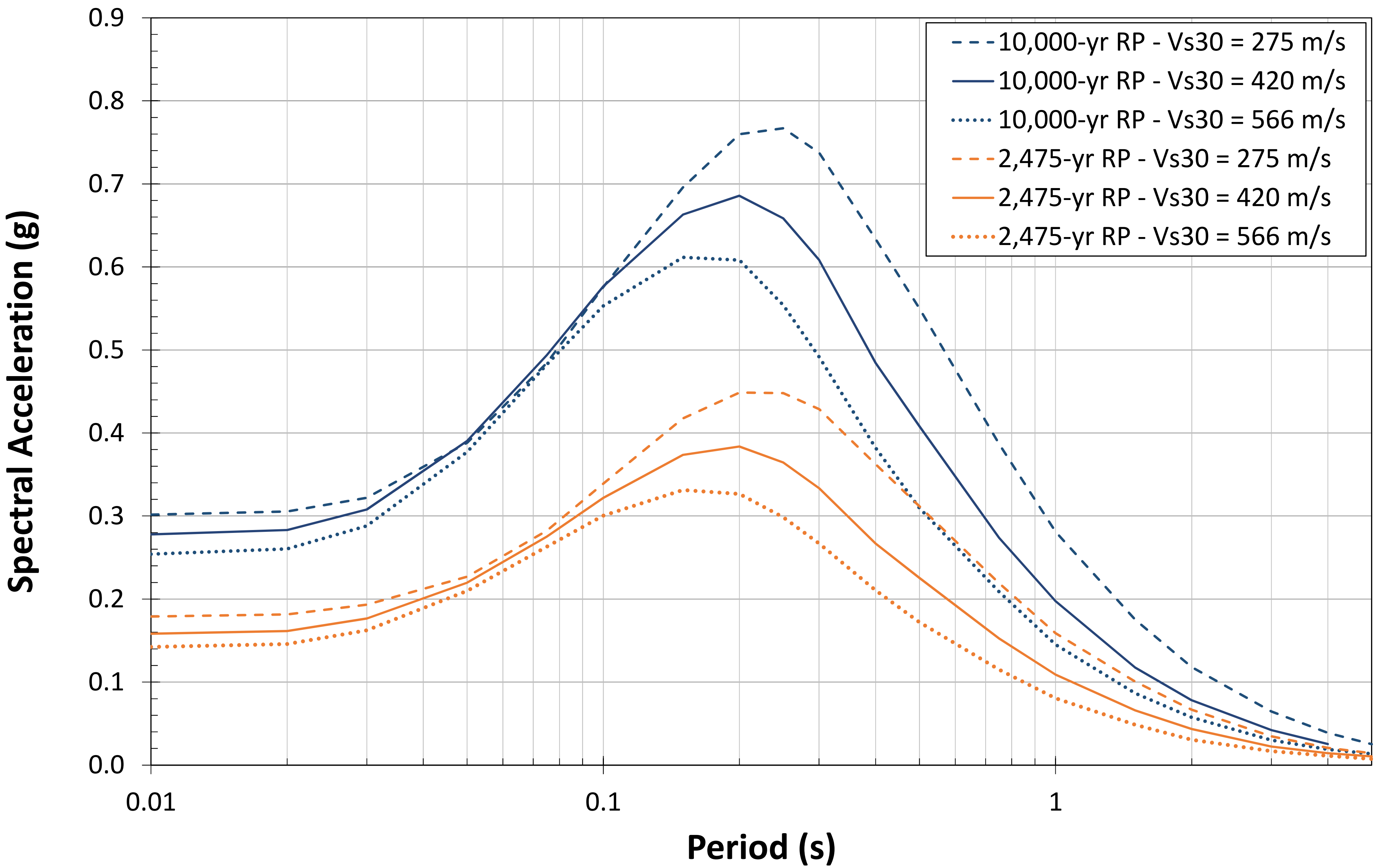
DATE

FIGURE 4-1

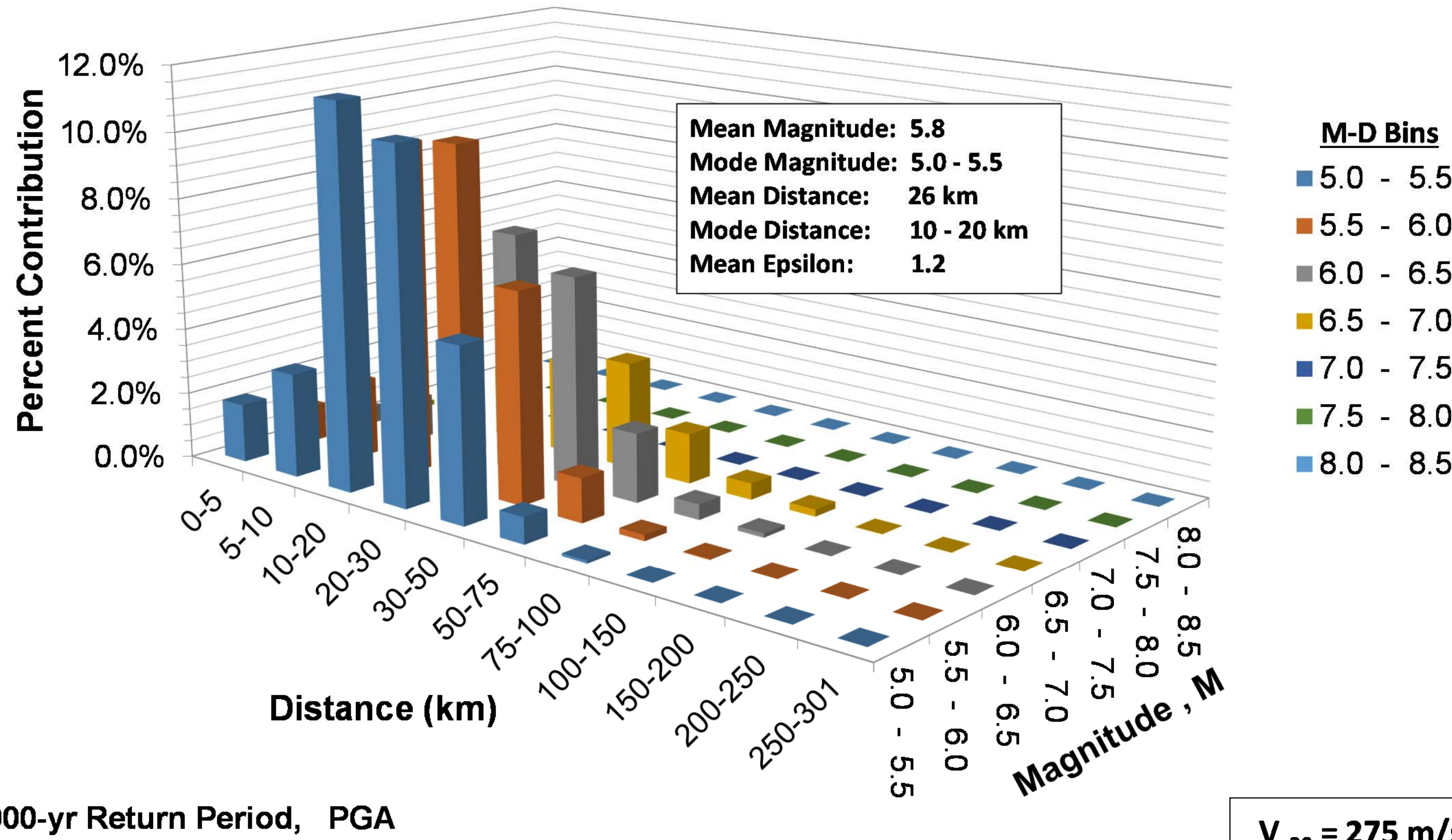
FILENAME



		PROJECT NECR SEISMIC HAZARD ASSESSMENT	MWH now part of Stantec
		TITLE PEAK GROUND ACCELERATION SEISMIC SOURCE CONTRIBUTION	DATE / FILENAME — FIGURE 6-1



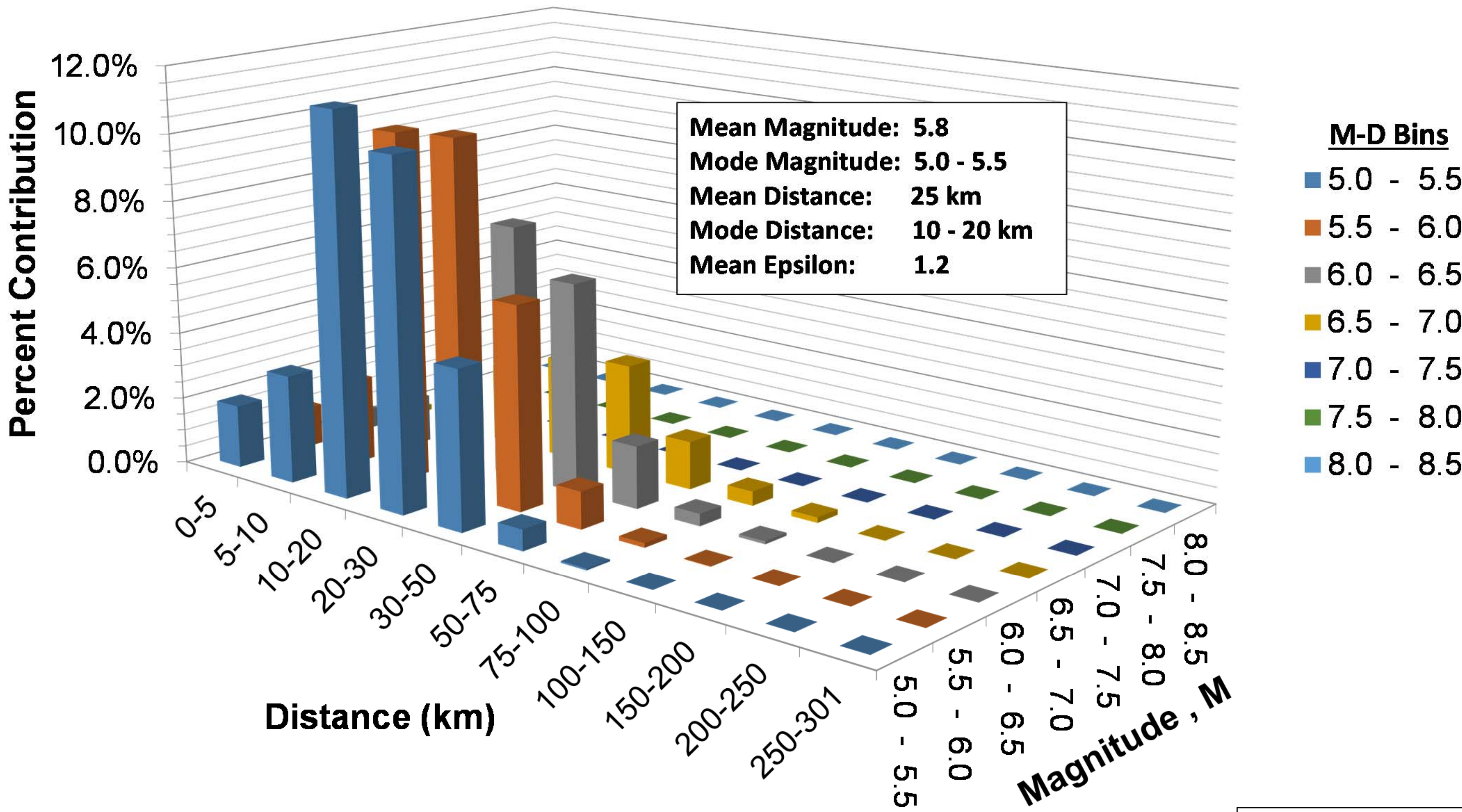
PROJECT NECR SEISMIC HAZARD ASSESSMENT	MWH now part of Stantec	
TITLE UNIFORM HAZARD SPECTRA COMPARISON OF Vs30	DATE OCT 2017	FIGURE 6-2
	FILENAME	



V_{s30} = 275 m/s

PROJECT	NECR SEISMIC HAZARD ASSESSMENT
TITLE	DEAGGREGATION OF PGA 10,000-YEAR RETURN PERIOD (Vs30 = 275 m/s)
DATE	OCT 2017
FIGURE	FIGURE 6-3
FILENAME	

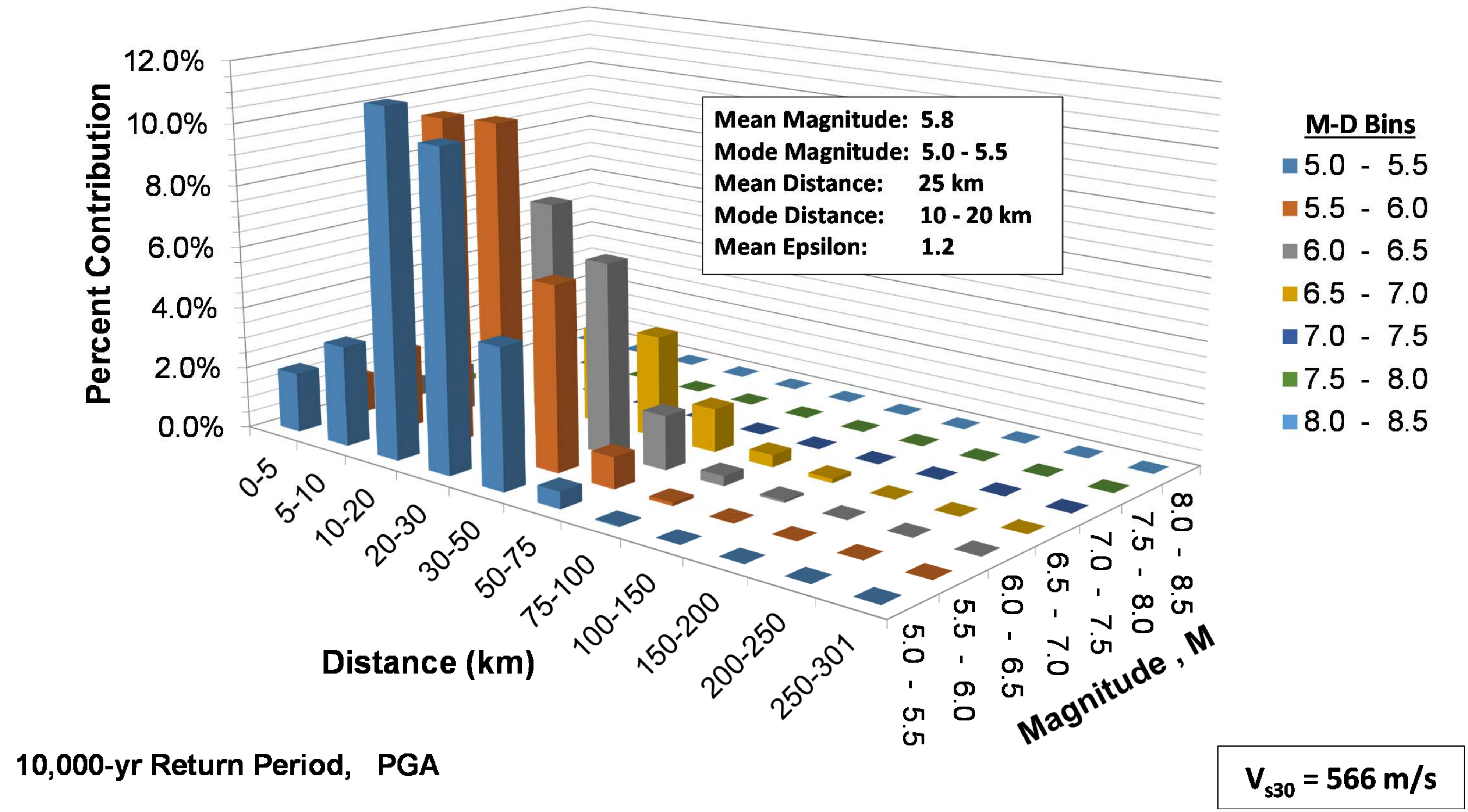
MWH now part of Stantec



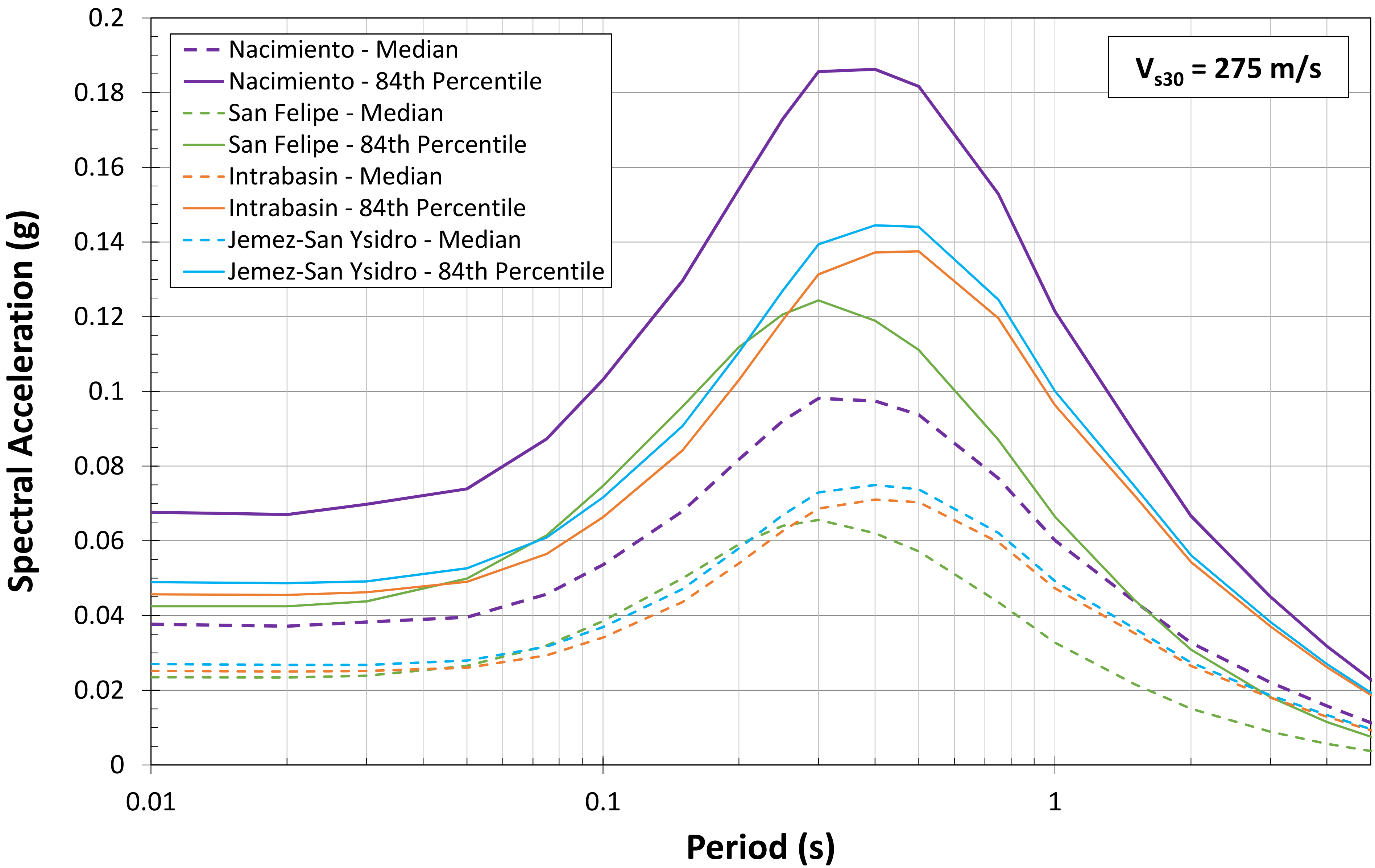
10,000-yr Return Period, PGA

V_{s30} = 420 m/s

PROJECT NECR SEISMIC HAZARD ASSESSMENT	MWH now part of Stantec	
TITLE DEAGGREGATION OF PGA 10,000-YEAR RETURN PERIOD (Vs30 = 420 m/s)	DATE OCT 2017	FIGURE 6-4
	FILENAME	



PROJECT NECR SEISMIC HAZARD ASSESSMENT	MWH now part of Stantec	
TITLE DEAGGREGATION OF PGA 10,000-YEAR RETURN PERIOD (Vs30 = 566 m/s)	DATE OCT 2017	FIGURE 6-5
	FILENAME	



PROJECT
NECR SEISMIC HAZARD ASSESSMENT

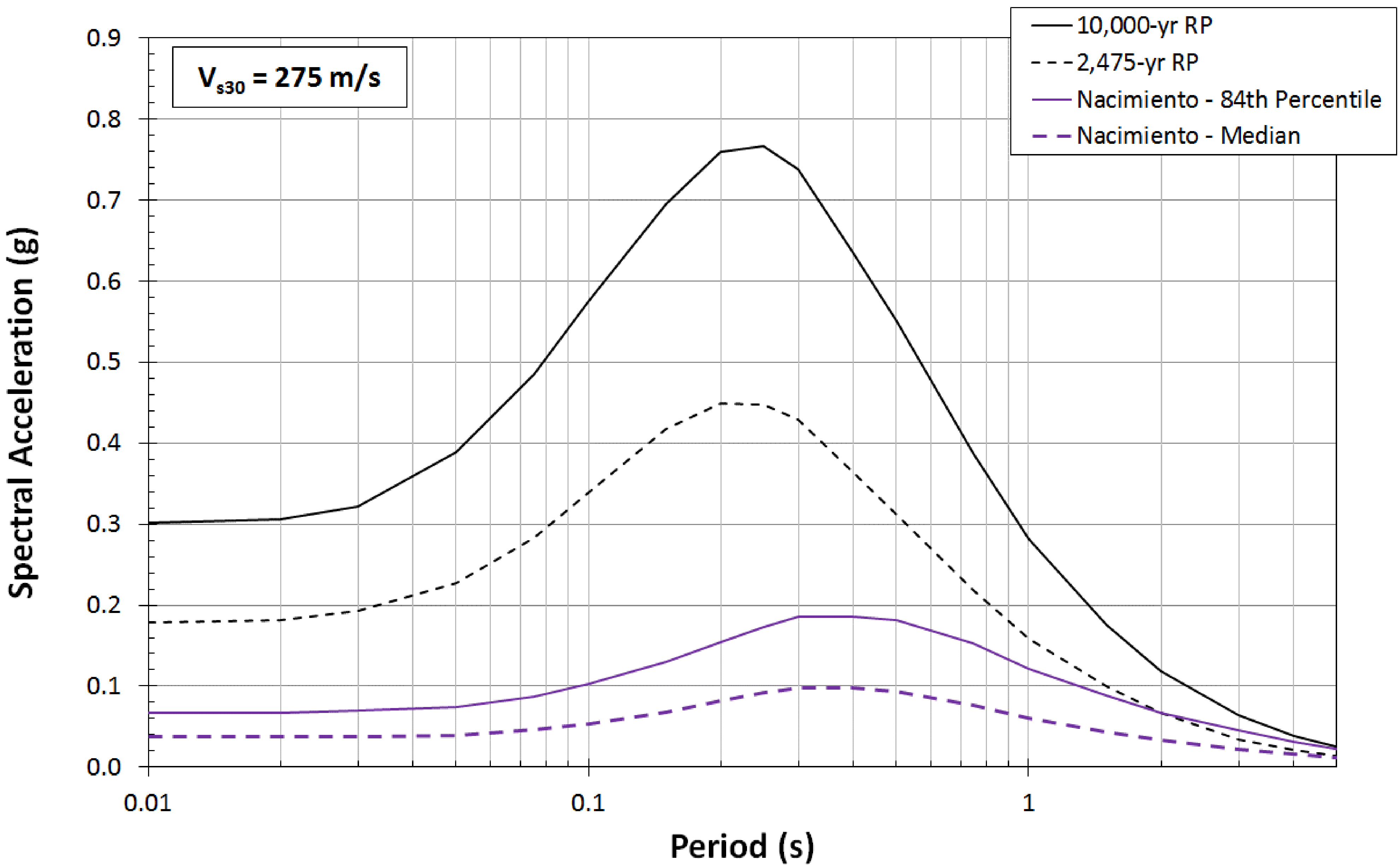
TITLE
DETERMINISTIC RESPONSE SPECTRA – MEDIAN & 84th PERCENTILE FOR Vs30 = 275 m/s

MWH now part of Stantec

DATE
OCT 2017

FIGURE 7-1

FILENAME



PROJECT	NECR SEISMIC HAZARD ASSESSMENT
TITLE	COMPARISON OF DETERMINSITIC RESPONSE SPECTRA & UHS FOR Vs30 = 275 m/s
DATE	OCT 2017
	FIGURE 8-1
FILENAME	

MWH now part of Stantec

ATTACHMENT G.2
Repository Stability Analysis

Client:	*General Electric (GE)*	**Sheet:**	*1* **of** *10*
Project:	*NECR 95% Design*	**Date:**	*08/04/2017*
Description:	*Mill Site Repository Stability Analyses*	**Job No:**	*233001048*

ATTACHMENT G.2: MINE WASTE REPOSITORY STABILITY ANALYSIS

Revisioning

Rev.	Date	Description	By	Checked	Date
0	*5/26/2016*	*Repository Stability Analyses*	*S. Moore*	*M. Witler*	*6/14/2016*
1	*07/19/2017*	*95% Design*	*S. Downey*	*S. Abbaszadeh*	*7/25/2017*

Location and Format

Electronic copies of these calculations are located on the Stantec internal project teamsite.

The following calculations were generated using the following software:

GeoStudio (Slope/w) 2016, Version 8.16.1.13452
Microsoft Excel 2013

Table of Contents

Objective

This calculation brief documents the input data, methods, assumptions, and results of the static and pseudo-static slope stability analyses on the Church Rock Mill Site (Mill Site) repository after placement of the fill material and final cover material on the existing impoundment.

Background

This analysis was performed as part of the design of the Removal Action (RA) at the Northeast Church Rock Mine Site (Mine Site) and the related Remedial Action (RA) at the Mill Site. The Mine Site and Mill Site are located in close

proximity to one another, approximately 16 miles northeast of Gallup, in McKinley County, New Mexico. They are located on adjacent Sections approximately one-half mile apart. The sites are temporarily being treated as one facility for purposes of the RA. The combined site is referred to as the "Settlement Agreement Site" (SA Site).

Site History

The NECR mine is a historical uranium mine operated by United Nuclear Corporation (UNC). Mining development began in 1967 and ended in 1982. While the mine operated, it served as the principal mineral source for the UNC uranium mill. The uranium mill and its adjacent disposal cells make up the UNC Superfund Site (the "UNC Mill Site"). Remedial activities addressing source control and on-site surface reclamation are being implemented by General Electric/United Nuclear Corporation (GE/UNC) under the direction of the U.S. Nuclear Regulatory Commission (NRC), pursuant to the UNC facility's NRC license, and integrated with the US Environmental Protection Agency's (USEPA's) selected remedy for the groundwater.

The tailings disposal area (TDA) is an unlined facility bounded by an embankment and subdivided by cross-dikes into three cells, which are identified as the South Cell, Central Cell, and North Cell. An estimated 3.5 million tons of tailings were pumped in slurry from the mill to the TDA.

Proposed Remedial Action

The proposed repository will be constructed on top of the existing TDA and will incorporate controlled placement of mine waste on top of the existing TDA cover/radon barrier and a final evapotranspirative (ET) cover placed over the mine waste. Improvements to the existing TDA cover/radon barrier within the footprint of the proposed repository will be completed prior to placement of mine waste. **Figure 1** shows the location and grading of the proposed repository.

The design for the selected repository alternative will be evaluated as part of a NRC license amendment request for the existing licensed facility. The repository features that affect the licensed facility will meet the performance standards outlined in NRC regulations and areas of the existing facility affected by the repository construction will be evaluated for compliance. However, existing conditions of the facility not affected by the proposed repository were not evaluated as part of this analysis, as they are managed by the existing NRC license.

Site Description

The natural stratigraphy at the Mill Site is divided into two main components: the surficial unconsolidated deposits (alluvium) and the underlying consolidated bedrock units. The alluvium consists of a mixture of sand, silt, and clay with minor portions of gravel. Alluvial thicknesses at the site are usually around 50 feet, but exceed 120 feet in some locations. Generally, the uppermost bedrock unit at the site is the Upper Gallup Sandstone, though in some locations it is overlain by coal or the Mancos shale (MWH, 2014a).

The TDA was constructed on top of the native alluvium and deposition of tailings via slurry within the TDA resulted in an interbedded accumulation of tailings. TDA closure construction began in 1989 and was completed in 1995. Closure construction included placement of an interim cover (general fill) from 1989 through 1991 followed by placement of the final cover (radon barrier and erosion protection layer) from 1993 through 1995.

Measurements taken in alluvial monitoring wells show an alluvial groundwater table in the vicinity of the TDA at approximately 6,867 feet above mean sea level (amsl), which indicates that the alluvium is unsaturated above this elevation. Additionally, subsurface investigations of the TDA indicate that there is not a consistent static water level within the tailings or the alluvium above approximately 6,867 feet amsl. However, localized perched zones of saturation exist within the low-permeability, fine-grained tailings. These zones of saturation do not appear to extend beyond the fine-grained tailings into the higher-permeability coarse-grained tailings.

Site Investigation

In 2013, MWH performed pre-design studies (PDS) at the Mill Site and Mine Site to supplement previous site investigations and collect data necessary to perform the Remedial Design (RD). Activities performed as part of the Mill Site PDS included: surveying, cone penetration tests (CPTs), drilling, standard penetration tests (SPTs), excavation and soil sampling, and subsequent laboratory testing through the tailings material. Geotechnical data collected during the PDS are presented in the PDS reports (MWH, 2014a and MWH, 2014b) and summarized in **Attachment A**. A list of the materials encountered within the TDA during the PDS is presented in the Model Inputs section below. Geotechnical properties for these materials, the assumed phreatic surface, and discussion of one-dimensional stratigraphic profiles developed for the stability analysis are also presented in the Model Inputs section.

Applicable Codes and Standards

NUREG 1620, Section 2.2 (NRC, 2003)
USNRC Regulatory Guide 3.11, Section C (NRC, 2008)
Technical Approach Document, Revision II, Section 6.2 (DOE, 1989)

Methods

General

The slope stability analysis evaluated the potential for slope failure within the proposed repository. One-dimensional soil profiles were developed for the analysis, based on conditions observed during the Mill Site PDS investigation and were updated to reflect the proposed repository construction. The analysis used data collected during the PDS field investigation which included CPTs, Hollow Stem Auger drilling, SPTs, and laboratory testing to calculate the factor of safety (FS) against slope failure within the repository.

Slope stability analyses are typically conducted for scenarios that represent critical conditions. Cross sections were evaluated for: (1) the existing embankment (dam) on the west and north sides of the impoundment, (2) steepest repository final cover slopes, and (3) global stability of the final repository and existing embankment. Three cross sections were selected and evaluated for the slope stability analyses. A figure showing the cross section locations is included as **Figure 2**.

Cross section A was selected through the southwest slope of the repository and continuing through the center of the repository, where the height of fill will be highest compared to the existing ground surface. The cross section location was selected based on where the height of fill will be the greatest and through the steep side slope (20 percent) on the northeast side of the impoundment.

Cross section B was selected through the existing embankment on the northwest side of the repository and along the northwest facing slope. This location was chosen to evaluate the existing embankment to the west of the repository as well as the western slope of the repository.

Cross section C was selected through the existing embankment on the north side of the repository, through the center of the repository and continuing beyond the southern boundary of the repository. This location was chosen for the global stability of the existing embankment and repository.

Slope Stability Modeling

The limit equilibrium slope stability analyses were performed using the computer software Slope/w version 8.16.1.13452 (Geo-Slope International, 2016). The Morgenstern-Price method (Morgenstern and Price, 1965) with a half-sine function for inter-slice forces was used for performing the calculations in Slope/w. This method uses both circular and non-circular shear surfaces and satisfies both moment and force equilibrium.

Grid and radius definitions were used to determine the failure surfaces. A block failure definition was used on the steeper slope (20 percent) in cross section A. The pore water pressures utilized as inputs to the stability analyses were defined using a piezometric line in the cross sections. The groundwater level was estimated from PDS borehole data (MWH, 2014a) and alluvial well data from January 2016 (water levels provided by Chester Engineers, included as **Attachment B**). The existing embankment depth in cross section B was estimated from historical data and figures (Hemphill, 1969). Each cross section was analyzed for long-term static and pseudo-static seismic loading conditions. The minimum slip surface depth was set to 3 feet for all scenarios. The static conditions of cross-sections B and C were also analyzed for the Probable Maximum Flood (PMF) condition. The material properties and other assumptions associated with these conditions are discussed below in the Model Inputs Section.

Design Criteria

The critical (lowest) calculated factors of safety for both static and pseudo-static loading conditions for each of the cross sections from the model outputs were evaluated against the required design factors of safety given by the NRC design guidance documents. The minimum acceptable factors of safety were adopted from the regulatory guides listed in the Applicable Codes and Standards section (NRC, 2003; NRC, 2008; and DOE, 1989). The following lists the applicable scenarios and their respective minimum acceptable factors of safety used in this analysis from the guidance documents:

Scenario	Minimum Factor of Safety
Long-term static stability	1.5
Long-term static stability with flood stability	1.2
Long-term seismic stability	1.0

Model Inputs

Material Properties

Material strength parameters and other properties used for the slope stability analyses are based on results from laboratory testing of samples collected during the PDS. The laboratory test results are summarized in Table 3-4 of the Church Rock Mill Site PDS Report (MWH, 2014a) and are also included in **Attachment A**. The parameters used as a base-case scenario for each material are discussed in the main text of Appendix G, Section G.6 and summarized in Table 1.

The material properties used for the base case analysis were taken as the average of all samples for a given material and parameter, with the exception of the friction angle. The lowest effective stress friction angle from laboratory triaxial testing was used for each material and the cohesion was assumed to be zero, to be conservative. For the slope stability analysis, the coarse and fine alluvium layers were not differentiated because there was not enough information from the CPT or boreholes near the analysis cross sections to properly define the contact between the two units. Therefore, the alluvium layer was modeled as a uniform unit with strength properties of the fine alluvium which is lower than that of the coarse alluvium.

For the pseudo-static analyses, the total stress friction angle was used for the fine-grained materials. It was assumed that the other materials would behave as drained materials in the occurrence of a seismic event, and the effective stress friction angles were used for all other materials. The total stress friction angle was calculated using two methods for the fine-grained tailings material. Calculations for the total stress friction angle are included in **Attachment C**. The first method used the peak (failure) points from the sample being placed under three different confining stresses. The peak points were determined from triaxial consolidated undrained (CU) laboratory test data obtained during the PDS. The friction angle was calculated for each confining stress peak point using the equation shown below, and then the three resulting friction angle values were averaged.

$$\sin\phi = \frac{q}{p}$$ (Lambe and Whitman, 1969, pg. 141)

where:

$$p = \frac{\sigma_1 + \sigma_3}{2}$$

$$q = \frac{\sigma_1 - \sigma_3}{2}$$

where:
ϕ is the friction angle, degrees
p and q are the coordinates of a stress point in a given state of stress, psf
σ_1 is the major principal stress, psf
σ_3 is the minor principal stress, psf

The second method plotted the peak points used the line of best fit between the three points. After plotting, the data showed a negative cohesion value (negative y-intercept). Since a negative cohesion value is meaningless, the intercept was set to zero, which is then conservative because it decreases the slope of the line and, therefore, decreases the calculated friction angle. The equation from the line of best fit was then used to determine the friction angle using the equation shown below.

$$\sin\phi = \tan\alpha$$ (Lambe and Whitman, 1969, pg. 141)

where tan (α) is the slope of the straight line approximation through the peak points of the stress-strain curves.

The two methods calculated the total stress friction angles within 0.4 degrees for the fine-grained tailings material (18.9 and 19.3). A value of 19 degrees was used in the pseudo-static analyses for this material.

The material properties used in the stability analysis are summarized in **Table 1**. A table summarizing the samples and properties used from the PDS to estimate the material properties of each material type are included in **Attachment A**.

Seismic Coefficient

Stability analyses under seismic conditions were performed as pseudo-static analyses, where a horizontal acceleration or seismic coefficient is applied to the entire model. This seismic coefficient, in a very simplified manner, simulates the horizontal accelerations that are applied to the structure during an earthquake. A site-specific probabilistic seismic hazard analysis was performed for this project, where the lower bound V_{s30} resulted in the highest estimated mean peak ground acceleration (PGA) of 0.30g (see Appendix G, Attachment G.1). The design seismic coefficient of 67 percent (2/3) of the PGA was used for the pseudo static stability analysis, resulting in a design seismic coefficient of 0.20g (NRC, 2003).

The cross sections were analyzed for long-term static and pseudo-static loading conditions. According to NUREG-1620, Rev. 1, a pseudo-static analysis is acceptable in lieu of a dynamic analysis if the strength parameters used in the analysis are conservative, the materials are not subject to significant loss of strength and development of high pore pressures under dynamic loads, the design seismic coefficient is 0.20 or less, and the resulting minimum FS suggests an adequate margin, as provided in NRC Regulatory Guide 3.11 (NRC, 2008). A pseudo-static analysis was used due to a seismic coefficient of 0.20g and conservative strength parameters used in the analyses. As discussed in the material properties section above and the sensitivity analyses section below, strength parameters selected were conservative, and were also varied to determine the material property effects on the seismic analyses.

Stratigraphic Profiles

During the Mill Site PDS, eight CPTs were paired with boreholes to correlate CPT results with direct observation of the materials encountered. Seven of these "paired" CPT locations are within the footprint of the proposed repository, as shown on **Figure 1**. The CPT data combined with the profiles from the borehole logs were used to define the thickness and texture of the soil layers, as well as the location of the contact between the tailings and underlying alluvium. The relationships used to define the tailings-alluvium contact are described in the Mill Site PDS (MWH, 2014a) and also in Appendix G, Attachment G.3.

These subsurface profiles were modified using the proposed repository design to reflect proposed conditions after repository construction. The one-dimensional profiles from the CPT and borehole logs were used to create a three-dimensional surface in AutoCAD (CAD) for the top of bedrock surface, bottom of tailings surface, and existing grade surface (MWH, 2014a). Sections were cut through the surfaces in CAD to create the cross-sections used in the slope stability analysis. Locations and depths of additional material contacts (i.e., existing fill, coarse tailings, fine tailings, and alluvium) were interpreted from the CPT and borehole logs nearest to the cross section location. The depths were interpolated between CPT and boring locations along each cross section. The cover was assumed to be 3.5 feet thick, and the radon barrier was assumed to be 1.5 feet thick for all sections. The existing fill varies in depth and underlies the cover and radon barrier materials. The locations and depths of the additional material contacts (i.e., coarse vs. fine tailings) are discussed below. A figure of each cross section showing the stratigraphic profiles is included in **Attachment D**, before the results for each respective cross section.

Cross Section A Cross section A is oriented from southwest to northeast through each end of the repository and is nearest to boring and CPT locations TI-B15/CPT-15, CPT-05, and CPT-25. A brief description of findings from these investigation is presented below.

TI-B15 and CPT-15
Silty sand (coarse) tailings were encountered approximately 3 feet bgs according to the boring log for TI-B15. At approximately 27 feet below ground surface (bgs), clayey (fine-grained) tailings were encountered. At 30 feet bgs, alluvium was encountered as a dark brown silty sand material. The CPT investigation reflects the boring log with coarse tailings present from approximately 3 feet bgs to 30 feet bgs, overlying alluvium at 30 ft bgs. A thin layer of fine tailings were included in the slope stability analysis to be conservative.

CPT-05
It was determined from the CPT data at location CPT-05 that coarse tailings were encountered from 6 feet bgs to approximately 10 feet bgs. Alluvium material was encountered directly below the coarse tailings.

CPT-25
Tailings were not encountered at CPT-25 location. The CPT penetrated 2.5 feet bgs, which was determined to be cover and fill material.

Based on the CAD surfaces and CPT and boring log data, it was determined that tailings were present in the repository in the southwest portion of the cross section. At approximately mid-point of the cross section, tailings material is not present and the existing radon barrier and a thin layer of existing fill material was assumed to be directly overlying the alluvium.

Cross Section B
Cross section B is oriented from northwest to southeast through the existing embankment to approximately the middle of the repository. Boring and CPT locations TI-B1/CPT-01, CPT-28, CPT-04, CPT-13, and CPT-26 were considered to estimate tailings material contact details and depths for Cross Section B. A brief description of findings from these investigation is presented below.

TI-B1 and CPT-01
Sandy (coarse) tailings were encountered at approximately 18 feet bgs according to both the borehole log and CPT data. The tailings encountered at approximately 29 feet bgs were very fine grained according to the boring log. The CPT data also assumed fine tailings from 29 feet bgs to approximately 34 feet bgs, where alluvium was encountered.

CPT-28
At CPT-28, coarse tailings were encountered from approximately 13 feet bgs to 24 feet bgs. The thickness of the coarse tailings is consistent between CPT-01 and CPT-28, and was used as the approximate thickness in the cross section near the embankment.

CPT-04
Coarse tailings were encountered from approximately 9 feet bgs to 15 feet bgs. Fine tailings were encountered from approximately 15 feet bgs to 19 feet bgs. As a comparison between CPT-28 and CPT-04, the fine tailings material gets thicker further away from the existing embankment.

CPT-13 and CPT-26
These locations were analyzed together, since cross section B is located between the two locations. It was assumed that the stratigraphy could be interpolated between the two locations. CPT-13 data shows that only cover/fill material was encountered at this location, and no tailings were encountered. CPT-26 shows a significant layer of coarse tailings from 12 feet bgs to 25 feet bgs. The thickness of the tailings were assumed to be approximately 7 to 8 feet thick at this location.

Based on the CAD surfaces and CPT and boring log data, there are two separate deposits of tailings material within cross section B. One deposit is present on the northwest side of cross section B, inside of the existing embankment; the other is present from approximately the middle of the repository to the southeast edge of the repository. The deposits are separated by alluvium and bedrock that rises steeply in elevation, and then dips back down towards the southeast. Cross section B captures a portion of the tailings located on the southeast side of the repository.

Cross Section C
Cross section C traverses north to south across each end of the repository boundary and was analyzed for global stability of the repository. Locations TI-B23/CPT-23, CPT-25, CPT-16, CPT-09, and CPT-14 were considered for material contact details and depths for Cross Section C. A brief description of findings from these investigation is presented below.

TI-B23/CPT-23
A thin layer (less than 1 foot thick) of fine tailings with sand was encountered at 13.4 feet bgs. Silty sand (coarse) tailings were encountered from 14.2 feet bgs to 16 feet bgs. At 16 feet bgs, alluvium material was encountered to the bottom of the CPT at 44 feet, where refusal was met.

CPT-25
As discussed in Cross Section A, CPT-25 did not encounter tailings material.

CPT-16
Coarse tailings were encountered from approximately 9 feet bgs to 14 feet bgs. A thick layer of fine tailings was encountered from 14 feet bgs to 43 feet bgs.

CPT-09
Coarse tailings were encountered from approximately 7 feet bgs to 15 feet bgs. A thick layer of fine tailings was again encountered from approximately 15 feet bgs to 44 feet bgs.

CPT-14
Coarse tailings were encountered from approximately 9 feet bgs to 15 feet bgs. Fine tailings were encountered from approximately 15 feet bgs to 21 feet bgs.

The coarse tailings across CPT-16, -09, and -14 are fairly consistent at 5 to 8 feet thick. The fine tailings are thickest at CPT-16 and CPT-09 at 29 feet thick, but taper dramatically from CPT-09 to CPT-14 from 29 feet to 6 feet thick. Combining the CAD data with the boring log and CPT data, there are two separate deposits of tailings material within cross section C. The thick deposit of tailings is located on the south end, whereas a thin deposit (approximately 3 feet thick) of fine tailings overlying coarse tailings is present on the north end.

Groundwater

Groundwater was encountered during drilling in two of the boreholes (TI-B10 and TI-B11) within the footprint of the proposed repository. In both boreholes, the groundwater elevation was approximately 6,885 feet amsl. Groundwater was also encountered at about 6,903 feet amsl while drilling in boring B3 (drilled through the dam). In addition, alluvial wells 509D and EPA 23 (measured on 1/4/2016) show an alluvial ground water elevation of approximately 6,867 feet amsl. In the stability analyses, the groundwater is assumed to be at or slightly above 6,900 ft amsl. The selected groundwater elevation is higher than those encountered during historical investigations.

The stability of the repository and embankment dam is also analyzed for the probable maximum flood (PMF) event as discussed in **Appendix I**. The PMF estimated that the floodplain extents will overtop the pipeline arroyo adjacent to the repository, and encroach the west and north edge of the TDA and base of the repository. The PMF extents affected cross sections B and C, and these cross sections were analyzed with a scenario including a phreatic surface at the floodplain extents to the PMF (approximately elevation 6,955 ft amsl and 6,958 ft amsl in cross sections B and C, respectively).

A plan view and cross section showing the PMF floodplain extents is included in **Attachment E**. The groundwater well levels provided to Stantec by Chester Engineers in 2016 is included in **Attachment B**.

Sensitivity Analyses

A sensitivity analysis is performed to evaluate the impact of the embankment material strength parameters in the pseudo-static analysis, cross section B. This analysis is selected as the worst-case scenario because it yielded to lowest FS and therefore is expected to be more sensitive to lowered material strengths and varying material properties. Material properties and strengths were varied for the embankment materials only, since the critical slip surface passes exclusively through the embankment materials.

The material index properties (dry density and water content) are varied from the 30th percentile values, median, and average (base case) for the embankment material. As mentioned before, the lowest friction angle from the PDS laboratory samples of embankment material was used in the base case analysis, instead of the average value. Also, the cohesion was conservatively assumed to be zero, despite triaxial testing on the embankment samples showing the material had cohesion values between 130 and 200 pounds per square foot (psf). The effective stress friction angle (strength parameter) of the embankment material was also varied in one degree increments from 28 degrees to 32 degrees. These strength values correlated to literature values for the embankment material based on PI's ranging from 60th percentile to 30th percentile values, respectively. The material properties used in the sensitivity analysis are included in Table 3.

Model Inputs Summary

The materials were modeled with the Mohr-Coulomb failure criteria, except for the bedrock material. The sandstone bedrock material was modeled as impenetrable based on the results from SPT blow counts. According to Lambe and Whitman (1969), a blow count of greater than 32 blows per foot correlates to a strength of greater than 4,000 psf. The blow count data for the sandstone material averaged 50 blows per 1.5 inches; therefore, the bedrock was assumed to have a high enough strength to be modeled as impenetrable in the slope stability analyses, and slope failures are not anticipated to extend through the sandstone bedrock. The material parameters used as inputs in the stability analyses models are summarized in **Table 2**. The stability analyses used the effective stress friction angles, with the exception of using the total stress friction angle for the fine-grained tailings material in the pseudo-static analyses.

As discussed in the previous section, a seismic coefficient of 0.20g was used as the seismic load horizontal coefficient for the pseudo static stability analysis.

Pore-water pressures were drawn in as a piezometric line in each model at the elevation discussed above in the Groundwater section of Model Inputs (approximately 6,900 ft amsl). In cases where the arroyo flooding condition was analyzed, the flood-level piezometric line was applied in the model at the elevations specified previously for each cross section.

Results

The calculated FS results of the base case stability analyses for cross sections A, B, and C are presented in **Table 4**. Output files from Slope/w showing slip surfaces and factors of safety for each scenario are included in **Attachment D**.

The sensitivity analysis showed that varying the dry density, water content, and friction angle had little to no effect on the calculated FS for the analyzed scenarios. The slip surface location changed slightly, and the resulting FS was reduced from 1.2 to 1.1 when the 30th percentile values were used for the dry density and water content. The output files for the sensitivity analysis are also included in **Attachment D**.

Conclusions

The cross sections selected represented three different locations and failure surfaces in the proposed repository. Cross-sections were evaluated for: (1) the existing embankment (dam) on the west and north sides of the impoundment, (2) steepest repository final cover slopes, and (3) global stability of the final repository and existing embankment. The geometries chosen represent critical conditions (i.e., highest embankment and steepest slope)

The average, median, 30th percentile and 60th percentile values for all material properties were evaluated. Average properties were used as the base case scenario, and a sensitivity analysis was conducted on a critical section where the resulting FS was low, but still above the minimum required values. In the sensitivity analysis, material properties were varied, as well as material strength parameters.

Based on the stability analyses using the methods and material parameters presented above, the representative cross sections meet or exceed the minimum FS requirements for static and pseudo-static loading conditions for all scenarios considered, including the PMF. The calculated FS for Cross Section B, pseudo static analysis was low (1.2), but still acceptable. The Slope/W output figures for static and pseudo-static loading conditions are included in **Attachment D**.

Attachments

Figure 1 – Borehole and CPT Locations
Figure 2 – Repository Layout and Cross-Sections

Attachment A – Impoundment Laboratory Results from Pre-Design Studies (MWH, 2014a and MWH, 2014b)
Attachment B – Recorded Water Levels at the Church Rock Site (Chester Engineers, 2016)
Attachment C – Total Stress Friction Angle Spreadsheet Calculations
Attachment D – Slope/W Output Files
Attachment E – PMF Extents

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TABLES

Table 1: Summary of Base Case Material Properties Used in Slope Stability Analysis

Material	Specific Gravity, Gs	Relative Compaction (%)[1]	Dry Unit Wt (pcf)	Moist Unit Wt (pcf)[2]	Water Content (%)	Effective Friction Angle (°)	Total Friction Angle (°)	Fines Content (%)	PI (%)
Cover (soil)	2.69	90	103.5	114.7	10.8	32	28	53	12
Mine Spoils	2.66	90	106.5	116.4	9.3	32	28	53[4]	12[4]
Radon Barrier	2.68	95	110.5	122.3	10.7	32	28	59	16
Existing Fill	2.69	-	100.7	113.8	13.0	29	25	48	19
Coarse Tailings	2.67	-	97.5	108.1	10.9	34	28	21	0
Fine Tailings	2.70	-	71.7	107.6[3]	50.1	33	19	83	43
Alluvium (All)	2.72	-	97.9	114.8	17.3	22	20	57	22
Dam	2.66	-	107.0	119.1	11.3	32	28	45	13
Bedrock			107.2	124.4	16.0				

Notes:

pcf = pounds per cubic foot, PI = plasticity index

All values are the average of laboratory testing results from the PDS (MWH, 2014a, b), unless otherwise noted.

[1]Assumed

[2]Calculated

[3]Assumes material is fully saturated

[4]Assumed to be the same as cover soil

Table 2: Material Parameters Used in Slope Stability Analysis

Material Identification	Moist Unit Weight (pcf)	Cohesion (psf)	Effective Stress Friction Angle (°)	Total Stress Friction Angle (°)[1]
Borrow - New Cover	114.7	0	32	-
Mine Spoils	116.4	0	32	-
Radon Barrier Recompacted (1.5-feet)	122.3	0	32	-
Existing fill	113.8	0	29	-
Coarse Tailings	108.1	0	34	-
Fine Tailings	107.6	0	33	19
Alluvium	114.8	0	22	-
Dam (Embankment)	119.1	0	32	-
Bedrock	Impenetrable			

pcf = pounds per cubic foot, psf = pounds per square foot

[1]Total stress friction angle is only applicable to the fine tailings material

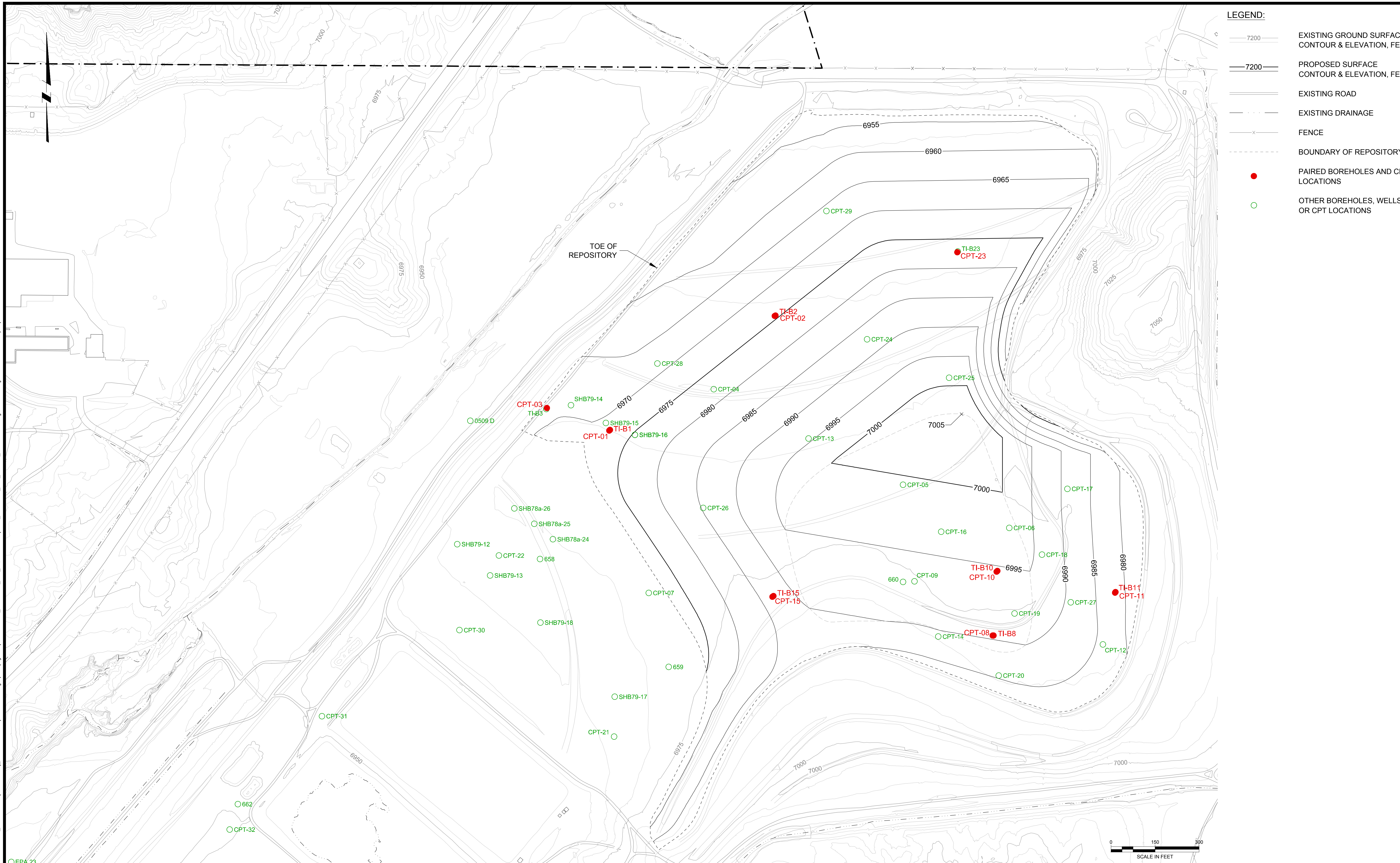
Table 3: Embankment Material Parameters Used in Sensitivity Analysis

Sensitivity	Water content (by mass, %)	Dry density (pcf)	Calculated Moist Unit Wt (pcf)	PI (%)	Effective Friction Angle (°)
30th percentile	7.3	105.5	113.1	10	35
Median	12.0	107.6	120.5	12	34
Average	11.3	107.0	119.1	13	33
60th Percentile	14.2	108.4	123.7	14	32

Table 4: Slope Stability Analyses Results

<table>
<tr><th>Cross Section</th><th>Failure Type</th><th>Loading Condition</th><th>Required Factor of Safety</th><th>Calculated Factor of Safety</th></tr>
<tr><td rowspan="2">Cross Section A – Southwest Slope</td><td rowspan="2">Circular</td><td>Static</td><td>1.5</td><td>9.9</td></tr>
<tr><td>Pseudo-Static</td><td>1.0</td><td>1.8</td></tr>
<tr><td rowspan="4">Cross Section A – Northeast Slope</td><td rowspan="2">Circular</td><td>Static</td><td>1.5</td><td>2.8</td></tr>
<tr><td>Pseudo-Static</td><td>1.0</td><td>1.3</td></tr>
<tr><td rowspan="2">Block</td><td>Static</td><td>1.5</td><td>2.8</td></tr>
<tr><td>Pseudo-Static</td><td>1.0</td><td>1.3</td></tr>
<tr><td rowspan="2">Cross Section B – Repository Slope</td><td rowspan="2">Circular</td><td>Static</td><td>1.5</td><td>8.1</td></tr>
<tr><td>Pseudo-Static</td><td>1.0</td><td>1.7</td></tr>
<tr><td rowspan="2">Cross Section B – Existing Dam</td><td rowspan="2">Circular</td><td>Static</td><td>1.5</td><td>2.4</td></tr>
<tr><td>Pseudo-Static</td><td>1.0</td><td>1.2</td></tr>
<tr><td>Cross Section B – Arroyo Flood</td><td>Circular</td><td>Static</td><td>1.2</td><td>2.6</td></tr>
<tr><td rowspan="2">Cross Section C – North Slope</td><td rowspan="2">Circular</td><td>Static</td><td>1.5</td><td>3.2</td></tr>
<tr><td>Pseudo-Static</td><td>1.0</td><td>1.7</td></tr>
<tr><td>Cross Section C – North Slope (Entry/exit)</td><td>Circular</td><td>Pseudo-Static</td><td>1.0</td><td>1.7</td></tr>
<tr><td>Cross Section C – Arroyo Flood</td><td>Circular</td><td>Static</td><td>1.2</td><td>2.6</td></tr>
<tr><td rowspan="2">Cross Section C – South Slope</td><td rowspan="2">Circular</td><td>Static</td><td>1.5</td><td>10.3</td></tr>
<tr><td>Pseudo-Static</td><td>1.0</td><td>1.8</td></tr>
</table>

FIGURES



PLOT DATE:10/30/2017 11:02 AM BY:KWREED

DESIGNED	S DOWNEY
CHECKED	S ABBASZADEH
APPROVED	J CUMBERS

MWH. now part of Stantec

unc

UNITED NUCLEAR CORPORATION AND NORTHEAST CHURCH ROCK MINE
McKINLEY COUNTY, NEW MEXICO

PROPOSED GRADING WITH BOREHOLE AND CPT LOCATIONS

FIGURE
1

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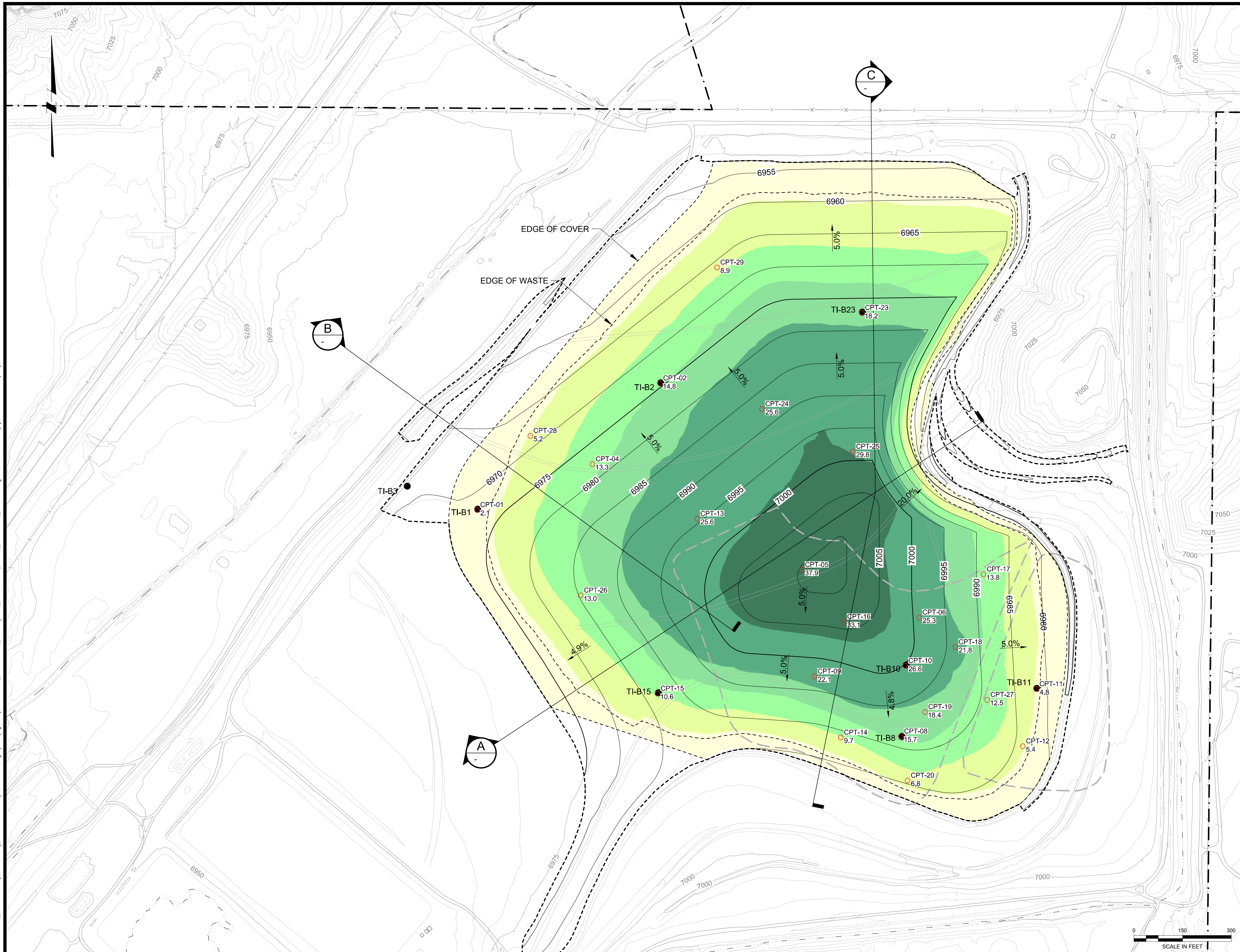
OCT, 2017



LEGEND:

7200	EXISTING GROUND SURFACE CONTOUR & ELEVATION, FEET
7200	PROPOSED SURFACE CONTOUR & ELEVATION, FEET
	EXISTING ROAD
	EXISTING DRAINAGE
	FENCE
	BOUNDARY OF REPOSITORY
	FORMER BORROW PIT BOUNDARY
CPT-17	CPT LOCATION
TI-B15	BORING LOCATION
A	SLOPE STABILITY CROSS SECTIONS

REPOSITORY FILL THICKNESS

NUMBER	MIN (FT)	MAX (FT)	COLOR
1	0.0	5.0	
2	5.0	10.0	
3	10.0	15.0	
4	15.0	20.0	
5	20.0	30.0	
6	30.0	42.0	

DESIGNED S DOWNEY
CHECKED M DAVIS
APPROVED J CUMBERS

MWH. now part of Stantec

UNITED NUCLEAR CORPORATION AND NORTHEAST CHURCH ROCK MINE
McKINLEY COUNTY, NEW MEXICO

REPOSITORY FILL THICKNESS
AND STABILITY CROSS SECTION LOCATIONS

FIGURE
2
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OCT, 2017

pw:\\amervpwin103.mwhglobal.com:AM_PROJECTS02\Documents_General Electric\GE NECR Design\Civil\Figures\2016-3-30_REPOSITORY_COVER\NECR_REPOSITORY_COVER_THICKNESS_FIG 8-1.dwg LAYOUT: COVER (2) PLOT DATE: 10/30/2017 11:06 AM BY: KWREED

ATTACHMENT A

IMPOUNDMENT LABORATORY RESULTS FROM PRE-DESIGN STUDIES (MWH, 2014A AND B)

Table 3-1 Summary of Geotechnical Laboratory Data - Cover Samples

Cover Layer	Sample	Sample Type [1]	Sample Depth Interval (in)		Material Description [2]	USCS [2]	USDA Classification [3]	Water Content (by mass) (%)	Specific Gravity	Standard Proctor (max. dd@opt. w.c.) (pcf @ %)	Atterberg Limits (%) [5]			USCS % Gravel	USCS % Sand	% Passing No. 200 Sieve (fines)	% Silt	USDA % Clay (<0.002 mm)	L.A. Abrasion [6] (% loss)	Sodium Soundness [7] (% loss)	Absorption [8] (%)	Pinhole Dispersion [9]	Remolded Saturated Hydraulic Conductivity [10] (cm/sec)			Confining Stress (psi)	SWCC: -5 bar Water Content (by mass) (%) [10]	SWCC: Saturated Water Content (by mass) (%) [11]
											LL	PL	PI										90%	95%	100%			
Admix. (Gravel/ Soil Mixture)	TI - CS01 - 02A	Bulk	0	11	Clayey Gravel with Sand		Loam							33.3	23.4	43.3	28.0	15.3										
	TI - CS02 - 02A	Bulk	0	10	Clayey Gravel with Sand		Clay Loam		2.81 [4]					36.9	17.0	46.1	28.8	17.3	3.8	0.37	1.06							
	TI - CS03 - 02A	Bulk	0	6	Clayey Gravel with Sand		Loam							53.6	18.7	27.7	18.1	9.6										
	TI - CS04 - 02A	Bulk	0	10	Clayey Gravel with Sand		Loam							53.6	18.2	28.2	18.0	10.2										
	TI - CS05 - 02A	Bulk	0	9	Sandy Lean Clay		Loam							13.9	34.4	51.7	31.2	20.5										
	TI - CS06 - 02A	Bulk	0	7	Clayey Gravel with Sand		Loam		2.77 [4]					48.4	18.5	33.1	23.4	9.7	5.7	0.14	1.91							
	TI - CS07 - 02A	Bulk	0	20	Sandy Lean Clay	CL	Loam	7.8			28	13	15	1.1	41.0	60.9	42.4	18.5										
	TI - CS08 - 02A	Bulk	0	8	Clayey Gravel with Sand		Loam							56.7	18.5	24.8	17.2	7.6										
	TI - CS09 - 02A	Bulk	0	9	Clayey Gravel		Loam		2.78 [4]					53.6	14.2	32.2	21.2	11.0	5.1	1.17	1.55							
	TI - CS10 - 02A	Bulk	0	7	Clayey Gravel with Sand		Loam							41.4	19.7	38.9	26.1	12.8										
	TI - CS11 - 02A	Bulk	0	9	Clayey Gravel with Sand		Sandy Loam							30.7	30.1	39.2	26.1	13.1										
	TI - CS12 - 02A	Bulk	0	14	Sandy Lean Clay	CL	Loam	9.1			33	13	20	1.3	28.8	69.9	43.5	26.4										
Radon barrier (clay layer)	TI - CS03 - 04A	Bulk	6	24	Sandy Lean Clay	CL	Loam	6.0			28	14	14	6.3	38.7	55.0	36.1	18.9										
	TI - CS06 - 04A	Bulk	7	24	Sandy Lean Clay	CL	Loam	11.0			30	13	17	6.7	34.2	59.1	40.2	18.9										
	TI - CS10 - 04A	Bulk	7	25	Sandy Lean Clay	CL	Loam	7.7			29	14	15	2.3	39.5	58.2	36.9	21.3										
	TI - CS08 - 04A	Bulk	8	28	Sandy Lean Clay	CL	Loam	8.1	2.67	119.4 @ 11.9	27	12	15	11.3	35.0	53.7	36.7	17.0					9.1E-06	1.1E-05	1.5E-06	24		
	TI - CS05 - 04A	Bulk	9	24	Sandy Lean Clay	CL	Loam	9.6			29	12	17	1.3	37.3	61.4	42.0	19.4										
	TI - CS09 - 04A	Bulk	9	26	Sandy Lean Clay	CL	Loam	7.7			28	13	15	4.0	38.1	57.9	40.0	17.9										
	TI - CS11 - 04A	Bulk	9	24	Sandy Lean Clay	CL	Clay Loam	8.6	2.68	115.0 @ 14.9	32	13	19	5.1	28.4	66.5	40.7	25.8					7.6E-08	1.4E-07	1.0E-07	24		
	TI - CS02 - 04A	Bulk	10	24	Sandy Lean Clay	CL	Sandy Clay Loam	11.4			28	12	16	3.6	44.7	51.7	30.4	21.3										
	TI - CS04 - 04A	Bulk	10	24	Sandy Lean Clay	CL	Clay Loam	15.0	2.68	113.5 @ 15.0	35	15	20	0.9	35.0	68.2	37.2	26.9					4.6E-06	6.2E-06	2.3E-07	8		
	TI - CS01 - 04A	Bulk	11	24	Sandy Lean Clay	CL	Loam	9.2	2.68	117.3 @ 13.0	29	15	14	2.0	39.8	58.2	39.0	19.2				ND3	3.0E-04	4.6E-05	7.8E-07	8	8.6 / 9.6	21.7 / 19.0

Notes: 1. Sample Types: Bulk = bucket/grab sample

2. USCS = Unified Soil Classification Sysytem, material descriptions are based on field observations, and refined with laboratory data, if available. USCS classifications are provided only where sufficient laboratory data are available. CL = low plasticity clay

3. USDA = United States Department of Agriculture, USDA classifications are based on the sand/silt/clay fraction of the sample and on USDA grain-size designations.

4. Bulk saturated surface dry (SSD) specific gravity of the gravel fraction, average of three results (ASTM C127).

5. LL = liquid limit, PL = plastic limit, PI = plasticity index

6. L.A. abrasion results are percent loss, by mass, for 100 revolutions.

7. Weighted percent loss for the 3/4-inch to 3/8-inch size range

8. Average of three results for the gravel fraction of the cover gravel/soil mixture samples

9. Pinhole dispersion test (ASTM method A) conducted on a specimen remolded to approximately 95% of the maximum standard Proctor density at optimum water content. ND3 = slightly to moderately dispersive clays that erode slowly under 2-inch or 7-inch head.

10. Flexible wall permeameter tests conducted on specimens remolded to approximately 90, 95 and 100% of the maximum standard Proctor density and tested at the confining stresses shown in the table.

11. SWCC test conducted on material passing the No. 10 sieve, remolded to approximately 95% of the maximum standard Proctor density and optimum water content. SWCC tests performed with pairs of specimens for each test.

Table 3-4 Summary of Geotechnical Laboratory Data - Mill Site Impoundment

Area	Boring	Sample Type (9)	Sample Depth Interval (ft.)		Material Description (1)		USCS (1)	Water content (by mass, %) 110C	Water content (by mass, %) 60C	saturation (%)	SWCC - Saturated water content (by mass, %) (2)	SWCC - Specimen dry density (pcf) (2)	Dry density (pcf), 110C	Dry density (pcf), 60C	Specific gravity, 110C	Specific gravity, 60C	LL	Atterberg limits (%) PL	PI	USCS % gravel (size)	USCS % sand (size)	% Passing No. 200 sieve	% Silt (size)	USDA % clay (size <0.002 mm)	Saturated Hydraulic conductivity (cm/sec) (3)	Hydraulic conductivity confining stress (psi)	Consolidation (Cc) (7)	Collapse potential (%) (inundation load (psf))	Triaxial (12) (peak friction angle (ϕ) (degrees), cohesion (psf), where applicable)
CENTRAL	TI-B1	CA	36	36.5	Alluvium Clayey Sand	coarse		21.0	19.9	76%	36.3 / 33.2	85.2 / 88.0	97.3		2.73					0.0	62.5	37.5	32.8	4.7	1.7E-06	32	0.059		
CENTRAL	TI-B1	ST	45	46	Alluvium Clayey Sand	coarse		22	21.2				106.0														0.058		34.4
CENTRAL	TI-B10	CA	91	91.5	Alluvium Clayey Sand	coarse		18.6					105.6		2.66														
CENTRAL	TI-B15	CA	41	41.5	Alluvium Clayey Sand	coarse		11.4	10.1				87.1	88.1															
CENTRAL	TI-B15	CA	66	66.5	Alluvium Clayey Sand	coarse		12.7	11.8				100.7	101.5															
CENTRAL	TI-B11	CA	81	81.5	Alluvium Clayey Sand with Gravel	coarse		11.0					107.6		2.76					12.9	65.6	21.5	9.9	11.6					
CENTRAL	TI-B10	CA	46	46.5	Alluvium Silty Sand	coarse		9.9					95.4		2.74					0.0	65.8	34.2	23.4	10.8					
CENTRAL	TI-B10	ST	55	56	Alluvium Silty Sand	coarse		14.1			25.7 / 24.8	98.0 / 99.9	100.8												2.4E-05	72	0.139		
CENTRAL	TI-B10	CA	71	71.5	Alluvium Silty Sand	coarse		18.1					100.8																
CENTRAL	TI-B11	ST	56	57	Alluvium Silty Sand	coarse	SM	16.2			31.0 / 30.8	90.6 / 92.8	77.9		2.64		NP			0.0	60.4	39.6	31.9	7.7	5.6E-04	72	0.129		
CENTRAL	TI-B11	CA	66	66.5	Alluvium Silty Sand	coarse		14.2					96.2																
BORROW PIT 1	TI-B8	CA	56	56.5	Alluvium Silty Sand	coarse	SM	12.6					97.6		2.70		NP			0.0	57.0	43.0	30.9	12.1					
CENTRAL	TI-B15	CA (top)	31	31.5	Alluvium Silty Sand	coarse		22.3	21.3																				
CENTRAL	TI-B15	CA (bottom)	31	31.5	Alluvium Silty Sand	coarse	SM	17.1					101.8		2.71		NP			6.2	51.9	41.9	25.9	16.0					
NORTH CELL	TI-B2	CA	15	15.5	Alluvium Silty Sand	coarse		6.9					90.4		2.68														
NORTH CELL	TI-B2	CA	21	21.5	Alluvium Silty Sand	coarse		7.0					91.4		2.74					0.0	82.9	17.1	11.5	5.6					
CENTRAL	TI-B10	CA	66	66.5	Alluvium Silty Sand / Sandy Silt	coarse	SM/ML	13.8					94.5				NP			0.0	50.1	49.9	33.4	16.5					
NORTH CELL	TI-B23	ST	26	27	Alluvium Lean Clay	fine	CL	21.6					101.7		2.73		49	18	31	0.0	8.8	91.2	43.8	47.5			0.046		
DAM	TI-B3	ST	56	57	Alluvium Lean Clay	fine	CL	22.1	21.1				105.3	106.2	2.72		43	14	29	0.0	11.7	88.3	48.4	39.9				-1.5 (7,204)	22.2, 494
CENTRAL	TI-B1	CA	41	41.5	Alluvium Lean Clay with Sand	fine	CL	26.7					98.6				31	15	16	0.0	18.2	81.8	54.7	27.1	1.2E-07	35			
BORROW PIT 1	TI-B8	CA	46	46.5	Alluvium Lean Clay with Sand	fine	CL	21.9					95.2		2.72		30	16	14	0.0	27.9	72.1	55.6	16.5					
NORTH CELL	TI-B2	CA	26	26.5	Alluvium Lean Clay with Sand	fine	CL	23.5					93.2				34	16	18	0.0	20.9	79.1	51.5	27.6					
CENTRAL	TI-B11	CA	61	61.5	Alluvium Sandy Clay	fine		16.0					95.4							0.0	38.7	61.3	44.1	17.2					
NORTH CELL	TI-B23	ST	17.25	17.5	Alluvium Sandy Clay	fine		22.5					101.9		2.73					0.0	31.1	68.9	46.5	22.5					
CENTRAL	TI-B15	CA (top)	46	46.5	Alluvium Sandy Silt	fine		25.8	24.0																				
CENTRAL	TI-B15	CA (bottom)	46	46.5	Alluvium Sandy Silt	fine	ML	17.3					99.3		2.81		NP			0.0	37.0	63.0	55.7	7.3					
CENTRAL	TI-B15	CA	56	56.5	Alluvium Silty Clay	fine		11.7	10.5				104.2	105.3															
DAM	TI-B3	CA	61	61.5	Alluvium Silty Clay	fine		25.8					99.0							0.0	22.0	78.0	54.9	23.1					
CENTRAL	TI-B10	ST (top)	10	11	Coarse Tailings			9.7	9.1				110	110.5	2.63	2.65													
CENTRAL	TI-B10	ST (bottom)	10	11	Coarse Tailings	Clayey Sand		9.0			20.7 / 21.5	102.6 / 101.2	96.8							0.2	71.9	27.9	16.6	11.3	4.3E-04	34	0.094		
CENTRAL	TI-B10	CC-AC (4) (top)	12.5	14	Coarse Tailings			6.7	6.3						2.61	2.64													
CENTRAL	TI-B10	CC-AC (4) (bot)	12.5	14	Coarse Tailings	Clayey Sand		7.5			31.3 / 31.4	85.0 / 85.0	99.1							0.7	71.5	27.8	18.9	8.9	6.7E-05	36			
CENTRAL	TI-B10	CA	15	15.5	Coarse Tailings			9.3					103.0																
CENTRAL	TI-B10	CA	16	16.5	Coarse Tailings	Silty Sand	SM	6.5					100.0		2.65		NP			2.4	82.3	15.3	10.2	5.1					
CENTRAL	TI-B10	ST	32	32.5	Coarse Tailings		SM	15.4					100.1		2.67		NP			0.0	83.1	16.9	12.6	4.3					
CENTRAL	TI-B1	CA	20.5	21	Coarse Tailings			6.1	5.7																				
CENTRAL	TI-B1	CA	21	21.5	Coarse Tailings	Poorly Graded Sand w/ Clay		7.5			21.9 / 19.8	96.5 / 99.6	105.5							0.0	90.7	9.3	5.5	3.8	3.7E-04	18	0.024		
CENTRAL	TI-B1	ST	27	27.5	Coarse Tailings		SP	4.0					97.6		2.67		NP			0.0	92.7	7.3	5.2	2.1	2.9E-03	14			34.9
CENTRAL	TI-B1	CA	30	30.5	Coarse Tailings			13.9	13.5																				
CENTRAL	TI-B1	CA	30.5	31	Coarse Tailings			14.6			29.6 / 33.8	84.2 / 83.6	91.6												3.0E-07	25	0.092		
CENTRAL	TI-B1	CA (top)	31	31.5	Coarse Tailings			0.8	0.4																				
CENTRAL	TI-B8	CA	25	25.5	Coarse Tailings			9.0	8.4				103.7	104.2	2.72	2.72													
CENTRAL	TI-B8	CA (5)	25.5	26	Coarse Tailings			6.2			25.7	94.6	99.6							0.0	87.9	12.7	7.9	4.8	3.6E-04	46			
CENTRAL	TI-B8	CA (5)	26	26.5	Coarse Tailings	Silty Sand	SM	16.8			27.0	94.8	91.7				NP			0.0	76.0	24.0	19.0	5.0					
CENTRAL	TI-B8	ST (top)	35	36	Coarse Tailings			14.3	13.6				90.9	91.4	2.66	2.67													
CENTRAL	TI-B8	ST (bottom)	35	36	Coarse Tailings			16.5			31.2 / 39.3	89.3 / 82.3	89.6		2.67										1.6E-05	43			
CENTRAL	TI-B15	CA	6	6.5	Coarse Tailings			5.4					101.1							0.0	87.5	12.5	9.8	2.7					
CENTRAL	TI-B15	CA	11	11.5	Coarse Tailings			6.8					93.8																
CENTRAL	TI-B15	CC-AC	13.5	14	Coarse Tailings		SM	19.0	18.4						2.68		NP			0.0	69.6	30.4	22.6	7.8					
CENTRAL	TI-B15	ST	15.5	16	Coarse Tailings		SM	14.2					90.4		2.66		NP			0.0	54.9	15.1	10.1	5.0	8.3E-04	38	0.126		
CENTRAL	TI-B15	CA	21	21.5	Coarse Tailings		SM	12.7					99.8		2.68		NP			0.0	80.6	19.4	13.3	6.1					
CENTRAL	TI-B15	CC-AC	28.5	29.5	Coarse Tailings		SM	19.3							2.66		NP			0.0	65.4	34.6	24.4	10.2					
NORTH CELL	TI-B23	ST	15.5	15.75	Coarse Tailings			20.7	19.6				87.7		2.77					0.0	62.8	37.2	34.1	3.1					
CENTRAL	TI-B10	ST	21.5	22.5	Coarse/Fine Tailings		CL	28.1	*26.7*				91.9	*92.9*			43	19	24	0.0	43.0	57.0	51.4	5.6			0.111		
CENTRAL	TI-B1	CC-AC	32	33	Coarse/Fine Tailings		CL	29.3	*27.8*								33	16	17	0.0	46.7	53.3	37.4	15.9					
CENTRAL	TI-B10	CA	36	36.5	Coarse/Fine Tailings	Clayey Sand / Sandy Clay	SC/CL	33.9	*32.2*	94%			86.7	*87.8*	2.68	*2.72*	36	16	20	0.0	50.6	49.4	31.1	18.3					
CENTRAL	TI-B8	ST (bottom)	41	42	Coarse/Fine Tailings	Clayey Sand / Sandy Clay	SC/CL	35.6	34.3		33.1 / 31.6	88.7 / 90.7	82.8	83.6			35	16	19	0.0	51.2	48.8	40.7	8.1	1.3E-07	53	0.262		
CENTRAL	TI-B8	CC-AC (top)	43.5	44.5	Coarse/Fine Tailings			31.2	29.3				91.0	92.3															
DAM	TI-B3	ST (top)	35	36	Dam Clayey Sand (dam)			10.5	10.2																				
DAM	TI-B3	ST (bottom)	35	36	Dam Clayey Sand (dam)		SC	14.7					102.2		2.67		23	14	9	2.1	50.2	47.7	30.9	16.8				-0.7 (4,608)	33.7, 135
DAM	TI-B3	ST	21	22	Dam Sandy Clay (dam)		CL	16.0					111.1				30	12	18	0.0	32.8	67.2	41.7	25.5				-0.03 (2,709)	32.2, 195
DAM	TI-B3	CA	26	26.5	Dam Sandy Clay (dam)			12.0					106.8				25	13	12										
DAM	TI-B3	CA	31	31.5	Dam Sandy Clay (dam)			16.1					108.4																
DAM	TI-B3	CA	11	11.5	Dam Silty Sand (dam)			5.1					108.4		2.64					5.4	74.7	19.9	13.5	6.4					
DAM	TI-B3	CA	16	16.5	Dam Silty Sand (dam)			4.7					105.3															-2.8 (2,236)	
DAM	TI-B3	CA	41	41.5	Dam Sandy Clay (dam)			21.5					90.6							0.0	33.8	66.2	41.7	24.5					
DAM	TI-B3	CA	45.5	46	Dam Sandy Clay (dam)			17.0	17.7				110.1	109.4															29.3, 293
DAM	TI-B3	CA	46	46.5	Dam Sandy Clay (dam)			18.0					104.8				28	13	15										
CENTRAL	TI-B11	ST	15	16	Fill Clayey Sand (Fill)			8.2			16.0 / 16.3	117.7 / 116.6	110.4		2.67					3.9	57.6	38.5	24.6	13.9	2.5E-05	38	0.085		
NORTH CELL	TI-B2	CA	11	11.5	Fill Clayey Sand (fill)			24.5					75.9		2.73					0.0	65.4	34.6	30.3	4.3					
CENTRAL	TI-B1	CA	16	16.5	Fill Lean Clay with Sand (Fill)		CL	16.2					104.7				33	13	20	0.3	27.2	72.5	42.9	29.6					
CENTRAL	TI-B11	CA	6	6.5	Fill Sandy Clay (Fill)			8.6					93.5																
CENTRAL	TI-B11	CA	21	21.5	Fill Sandy Clay (Fill)			12.3					107.6																
CENTRAL	TI-B11	ST	30.5	31.5	Fill Sandy Clay (Fill)		CL	13.7					112.4				30	13	17	7.1	41.3	51.6	33.9	17.7	9.0E-07	51	0.059		
NORTH CELL	TI-B2	CA	6	6.5	Fill Silty Sand with Gravel (Fill)			7.7					100.4		2.68					26.9	29.9	43.2	30.7	12.5					
CENTRAL	TI-B10	CA	25.75	26	Fine Tailings			43.7	41.0																				

Table 3-4 Summary of Geotechnical Laboratory Data - Mill Site Impoundment **(continued)**

Area	Boring	Sample Type [9]	Sample Depth Interval (ft.)		Material Description [1]		USCS [1]	Water content (by mass, %) 110C	Water content (by mass, %) 60C	saturation (%)	SWCC - Saturated water content (by mass, %)[2]	SWCC - Specimen dry density (pcf)[2]	Dry density (pcf), 110C	Dry density (pcf), 60C	Specific gravity, 110C	Specific gravity, 60C	Atterberg limits (%) LL	PL	PI	USCS % gravel (size)	USCS % sand (size)	% Passing No. 200 sieve	% Silt (size)	USDA % clay (size <0.002 mm)	Saturated Hydraulic conductivity (cm/sec)[3]	Hydraulic conductivity confining stress (psi)	Consolidation (Cc)[7]	Collapse potential (%) (inundation load (psf))	Triaxial[12] (peak friction angle (ϕ') (degrees), cohesion (psf), where applicable)
CENTRAL	TI-B10	CA	26	26.5	Fine Tailings	Fat Clay	CH	60.4	*57.4*				63.1	*64.3*	2.71	*2.80*	74	27	47	0.0	10.0	90.0	82.6	7.4					
CENTRAL	TI-B10	ST	30.3	30.7	Fine Tailings		CH	47.7	*45.3*	92%			72.2	*73.4*	2.71	*2.78*	57	22	35	0.0	24.3	75.7	68.4	7.3					
CENTRAL	TI-B10	ST (top)	40	41	Fine Tailings	Fat Clay with Sand		47.3	45.7				70.5	73.7	2.54	2.56													
CENTRAL	TI-B10	ST (bottom)	40	41	Fine Tailings	Fat Clay with Sand	CH	49.7	*47.2*		47.7 / 55.7	75.3 / 67.9	73.3	*74.5*			61	21	40	0.0	20.7	79.3	46.5	32.9	2.9E-08	58	0.315		
CENTRAL	TI-B11	ST	51.5	52.5	Fine Tailings		CH	63.0	*59.9*	95%			62.5	*63.7*	2.75	*2.84*	91	30	61	0.0	2.7	97.3	90	7.3	3.1E-08	67	0.482		
CENTRAL	TI-B1	CA (bottom)	31	31.5	Fine Tailings		CL		41.6	94%				76.5	2.68	*2.69*	44	17	27	0.0	30.9	69.1	54.6	14.5					33.3
CENTRAL	TI-B10	CA	35	35.5	Fine Tailings			50.2	*47.7*				71.3	*72.5*															
CENTRAL	TI-B10	CA	35.5	36	Fine Tailings			54.2	51.4																				
CENTRAL	TI-B11	CA	45.5	46	Fine Tailings			117.2	88.7																				
CENTRAL	TI-B8	ST	30	31	Fine Tailings		CH	65.1	*61.8*				61.5	*62.7*			74	25	49	0.0	9.2	90.8	81.2	9.6			0.426		
CENTRAL	TI-B8	ST	31	31.5	Fine Tailings			44.3	41.4																				
CENTRAL	TI-B8	ST (top)	41	42	Fine Tailings			41.8	*39.7*	**100%**			79.2	*80.4*	2.60	2.63													
CENTRAL	TI-B8	CC-AC [6] (bot)	43.5	44.5	Fine Tailings			45.6	*43.3*	96%	47.9 / 49.0	74.4 / 73.6	73.6	*74.8*						0.0	14.5	85.5	74.7	10.8	3.0E-08	61			
BORROW PIT 1	TI-B8	CC-AC	44.5	45	Fine Tailings										2.59	2.60													
NORTH CELL	TI-B2	CC-AC	13.5	14.5	Fine Tailings	Sandy Clay		41.7	*39.6*											0.0	23.1	76.9	49.2	27.7					
CENTRAL	TI-B10	CC	106.9	107.3	Sandstone			14.2					109.1												1.4E-07	115			
CENTRAL	TI-B11	CA	100	100.2	Sandstone			21.1					103.9												1.3E-05	112			
NORTH CELL	TI-B23	CA	45.2	45.7	Sandstone			13.8					108.7												2.4E-07	43			
NORTH CELL	TI-B2	BULK	38.4	38.7	Sandstone			13.5					X																
BORROW PIT 1	TI-B8	BULK	63.5	64	Shale			X					X												X	X			
NORTH CELL	TI-B23	CA [8]	65.5	66	Shale			10.2					103.0												9.7E-08	62			

Notes: 1. Material descriptions are based on field observations, and refined with laboratory data, if available. USCS classifications are provided only where sufficient laboratory data are available.
2. SWCC tests conducted with pairs of specimens for each test.
3. Flexible wall permeameter tests conducted at confining pressures representing confining stresses for the proposed design fill. Confining stresses were estimated as the existing overburden stress on the specimens (depth times total unit weight of material above) plus the maximum anticipated fill height for the location times the estimated unit weight of fill.
4. Specimen remolded to the in-situ water content and density of the Shelby tube sample from 10-12.5 for the SWCC.
5. Remolded SWCC and permeability tests conducted on a 50-50 mixture of the materials from these two specimens, remolded to the average measured density of the two CA samples.
6. SWCC specimen remolded to the in-situ water content and density of the Shelby tube sample from 41-42 feet.
7. Compression indices estimated using the maximum anticipated loading during fill placement and the range of loading during testing. Initial void ratios are calculated using the average specific gravity for all samples of 2.70.
8. Shale sample had multiple horizontal fractures and was likely disturbed during sampling.

9. Sample Types: CC = continuous core, CC-AC = continuous core in acrylic liner, top/bottom indicates the specimen was taken from the top or bottom of the sample interval
10. Values in italics were calculated based on the relationship (WC60=0.951(WC110)-.0611) between the water content results measured for 15 tailings samples at the two oven temperatures.*
11. Shaded cells are alluvium.
12. Consolidated undrained (CU) triaxial shear, staged loading of one specimen with pore pressure measurements

ST = 3" diam. Shelby tube, CA = California sample
R = remolded, nc = Cc not calculated, because fill will not be placed in this location
X = testing not possible due to sample disturbance
LL = liquid limit, PL = plastic limit, PI = plasticity index

Table 3-5 Summary of Geotechnical Laboratory Data - Borrow Areas

Area	Sample	Sample Type [1]	Sample Depth Interval (ft)		Material Description [2]	USCS [2]	USDA Classification [3]	Water Content (by mass, %)	Dry Density (pcf)	Porosity	Specific Gravity	Standard Proctor (max. dd@opt. w.c.), (pcf @ %)	Atterberg Limits (%) [4] LL	PL	PI	USCS % Gravel	USCS % Sand	% Passing No. 200 Sieve (fines)	% Silt	USDA % Clay (<0.002 mm)	Pinhole Dispersion [5,6]	Remolded Saturated Hydraulic Conductivity (cm/sec) [7] 80%	85%	90%	SWCC: -5 bar Water Content (by mass, %) [8]	SWCC: Saturated Water Content (by mass, %) [8]
West Borrow	WB-B1-01A	CA	3.0	3.5	Clayey Sand			3.8	88.8	46.7	2.67															
	WB-B1-03A	CA	11.0	11.5	Clayey Sand	SC	Sandy Loam	6.4	111.0	33.3	2.67		28	18	10	2.8	48.6	48.6	32.8	15.8						
	WB-B1-06	Bulk	5.0	10.0	Silty, Clayey Sand	SC-SM	Sandy Loam				2.64	112.5 @ 13.7	26	20	6	0.8	52.3	46.9	31.0	15.9	ND3	7.2E-04	5.8E-04	2.1E-04	6.6 / 6.2	31.7 / 32.4
	WB-B2-02A	CA	5.5	6.0	Clayey Sand	SC	Sandy Loam	5.6	87.1	47.8	2.67					8.6	53.5	37.9	23.8	14.1						
	WB-B2-05	Bulk	10.0	20.0	Clayey Sand	SC	Sandy Loam						26	17	9	9.9	46.3	43.8	27.7	16.1	ND3	8.5E-05	1.2E-04	6.4E-05	6.4 / 6.7	30.9 / 33.7
	WB-B5-001B	CA	3.0	3.5	Clayey Sand			3.7	92.5	44.3	2.66															
	WB-B5-002A	CA	6.0	6.5	Silty, Clayey Sand	SC-SM	Sandy Loam	5.1	86.9	47.7	2.66		24	17	7	0.0	56.3	43.7	27.8	15.9						
	WB-B5-005	Bulk	0.0	10.0	Silty, Clayey Sand	SC-SM	Sandy Loam					117.3 @ 12.7				0.0	61.6	38.4	22.8	15.6						
East Borrow	EB-B2-001A	CA	3.0	3.5	Weath. Sandstone			5.8	107.1	35.8	2.67															
	EB-B3-003B	CA	10.5	11.0	Sandy Lean Clay	CL	Sandy Loam	6.0	83.1	50.7	2.70		26	15	11	0.0	46.3	53.7	34.9	18.8						
	EB-B4-02A	CA	6.0	6.5	Sandy Lean Clay	CL	Sandy Loam	5.4	80.7	51.2	2.65					0.0	48.5	51.5	33.9	17.6						
	EB-B4-06	Bulk	10.0	20.0	Silty, Clayey Sand	SC-SM	Sandy Loam				2.67	117.1 @ 12.9	23	17	6	0.0	50.5	49.5	32.0	17.5	ND3	8.7E-04	9.0E-04	4.4E-04	4.6 / 4.2	30.8 / 29.8
	EB-B5-02B	CA	5.5	6.0	Clayey Sand	SC	Sandy Loam	6.7	93.8	44.4	2.71		27	15	12	8.8	45.7	45.5	28.8	16.7						
	EB-B6-01B	CA	3.0	3.5	Sandy Clay			7.6	91.2	46.1	2.71															
	EB-B6-03	Bulk	0.0	10.0	Lean Clay with Sand	CL	Clay Loam					114.8 @ 14.1				0.0	26.6	73.4	44.3	29.1	ND3	2.3E-04	3.6E-05	2.9E-05	9.4 / 9.3	32.8 / 32.2
	EB-B6-04A	CA	11.0	11.5	Sandy Lean Clay	CL	Sandy Clay Loam	8.6	95.2	43.3	2.69		31	13	18	0.0	31.1	68.9	43.8	25.1						
South Borrow	SB-B1-01A	CA	3.5	4.0	Sandy Lean Clay	CL	Sandy Loam	7.1	91.4	49.3	2.89					0.0	43.1	56.9	39.2	17.7						
	SB-B1-03A	CA	11.0	11.5	Sandy Lean Clay	CL	Sandy Clay Loam	6.6	82.6	50.7	2.69		31	15	16	0.0	46.7	53.3	32.9	20.4						
	SB-B1-04	Bulk	0.0	25.0	Sandy Lean Clay	CL	Sandy Clay Loam				2.70	115.5 @ 14.2	33	14	19	0.0	42.6	57.4	30.7	26.7	ND1	2.3E-04	5.7E-05	1.4E-04	6.4 / 5.9	31.9 / 30.3
	SB-B2-02B	CA	5.5	6.0	Sandy Lean Clay	CL	Loam	7.7	80.1	52.6	2.70		36	15	21	0.0	29.8	70.2	45.4	24.8						
	SB-B3-02A	CA	6.0	6.5	Lean Clay with Sand	CL	Clay Loam	10.2	84.3	49.7	2.69		40	17	23	0.0	21.6	78.4	46.2	32.2						
	SB-B4-01	Bulk	0.0	15.0	Sandy Lean Clay	CL	Sandy Clay Loam	7.1			2.67	114.1 @ 14.4	33	15	18	0.8	39.6	59.6	35.7	23.9	ND3	3.4E-04	2.0E-04	7.4E-05	9.1 / 8.6	29.6 / 33.5
North Borrow	NB-B1-03B	CA	10.5	11.0	Silty Sand	SM	Sandy Loam	5.4	84.4	49.5	2.68		25	22	3	0.0	55.6	44.4	30.3	14.1						
	NB-B2-01B	CA	3.0	3.5	Silty Sand	SM	Sandy Loam	4.9	81.9	50.3	2.64		27	23	4	0.0	51.2	48.8	33.9	15.0						
	NB-B2-04	Bulk	0.0	10.0	Sandy, Silty Clay	CL-ML	Sandy Loam					113.9 @ 14.5	26	19	7	0.0	49.0	51.0	32.5	18.5	ND3	4.0E-04	2.7E-04	7.5E-05	4.9 / 4.7	29.5 / 29.9
Dilco Hill	DH-B1-01B	CA	3.0	3.5	Silty Sand			3.5	88.8	46.6	2.66															
	DH-B1-03	Bulk	0.0	10.0	Sandy, Silty Clay	CL-ML	Sandy Loam	5.4			2.67	117.5 @ 13.8	25	19	6	2.0	47.4	50.6	35.0	15.6	ND4	6.3E-04	7.1E-04	2.5E-04	4.2 / 4.1	39.6 / 35.0
	DH-B1-10	Bulk	35.0	45.0	Lean Clay with Sand	CL	Loam	10.3			2.38					1.5	20.9	77.6	60.9	16.7	ND3	1.6E-04	2.5E-05	3.2E-06	5.8 / 6.0	25.7 / 24.5
	DH-B2-03	CA	15.0	15.5	Silty Clay with Sand	CL-ML	Sandy Loam	10.5	96.7	39.2	2.55		29	24	5	0.0	27.7	72.3	66.9	5.4						
	DH-B3-05	Bulk	20.0	30.0	Sandy Lean Clay	CL	Loam	7.3			2.66	116.3 @ 13.0	29	18	11	2.5	34.6	62.9	45.5	17.4						

Notes: 1. Sample Types: CA = California sample, Bulk = bucket/grab sample

2. USCS = Unified Soil Classification Sysytem, material descriptions are based on field observations, and refined with laboratory data, if available. USCS classifications are provided only where sufficient laboratory data are available. CL = low plasticity clay

3. USDA = United States Department of Agriculture, USDA classifications are based on the sand/silt/clay fraction of the sample and on USDA grain-size designations.

4. LL = liquid limit, PL = plastic limit, PI = plasticity index

5. With the exception of DH-B1-03, which was tested at a density based on the natural in-situ density measured from the CA samples, specimens were remolded to approximately 85% of standard Proctor density and between the estimated natural and optimum water contents for the soil.

6. ND1 = nondispersive clay with very slight to no colloidal erosion under 15-inch or 40-inch head; ND4, ND3 = slightly to moderately dispersive clays that erode slowly under 2-inch or 7-inch head (ASTM test method A)

7. Specimens remolded to approximately 80%, 85%, and 90% of maximum standard Proctor dry density and between the estimated natural and optimum water contents for the soil.

8. Specimens remolded to approximately 85% of maximum standard Proctor dry density and between the estimated natural and optimum water contents for the soil. SWCC tests performed with pairs of speciments for each test.

Table 3-6 Summary of Geotechnical Laboratory Data - Site Stockpiles

Area	Sample	Sample Type [1]	Material Description	USCS [2]	Specific Gravity	Atterberg Limits (%) [4] LL	PL	PI	USCS % Gravel	USCS % Sand	% Passing No. 200 Sieve (fines)	L.A. Abrasion (% loss) [5]	Sodium Sulfate Soundness (% loss) [6]	Absorption (%) [7]	Unconfined Compressive Strength (psi) [8]	Splitting Tensile Strength (psi) [8]
Stockpiles	Topsoil-01	Bulk	Sandy Clay	CL	2.68	33	10	23	2.6	32.4	65.0					
	Topsoil-02	Bulk	Sandy Clay	CL	2.71	39	12	27	0.5	26.8	72.7					
	TI-SP1-01	Bulk	Crusher Fines						1.9	80.8	17.3					
	TI-SP2-01A	Bulk	Erosion Protection Gravel		2.78 [3]				93.0	6.3	0.7	5.7	8.26	1.868		
	TI-SP2-01C	Bulk	Erosion Protection Gravel						83.3	4.9	11.8					
	TI-SP3-01A	Bulk	Road Base (gravel with sand)						67.4	24.6	8.0					
	TI-SP4-01A	Bulk	Erosion Protection Gravel		2.75 [3]				98.0	1.2	0.8	6.1	10.47	2.091		
	TI-SP6 (56A)	Bulk	9-inch riprap												20,780 and 23,630	1,320 and 1,400
	TI-SP6 (56B)	Bulk	9-inch riprap												19,100 and 14,440	1,530 and 1,720

Notes: 1. Bulk = bucket/grab sample

2. USCS = Unified Soil Classification Sysytem, material descriptions are based on field observations, and refined with laboratory data, if available.
USCS classifications are provided only where sufficient laboratory data are available. CL = low plasticity clay

3. Average of three bulk saturated surface dry (SSD) specific gravity results for the rock samples (ASTM C127)

4. LL = liquid limit, PL = plastic limit, PI = plasticity index

5. L.A. Abrasion results are percent loss, by mass, for 100 revolutions.

6. Weighted percentage loss for 0.75 to 1.5-inch size range

7. Average of three absorption results

8. Specimens were collected from the 9-inch stockpile and cored for strength testing.

Table 3-6 Geotechnical Test Results

Sample ID[1]	Sample Location	Sample Type	Sample Depth Interval		Gravimetric Water content	Dry Density	Specific gravity	Standard Proctor	
		Units:	top (ft bgs)	bottom (ft bgs)	(% by mass)	(pcf)	(g/cm^3)	max. dry density (pcf)[3]	optimum water content (%)
NECR1-CC01	NECR-1	Bulk	10	20			2.68	120.7	11.9
NECR1-CC17		CA[2]	5.5	6	4.9	92.3			
NECR1-CC17		CA	10.5	11	6.2	96.5			
NECR1-CC17		CA	15.5	16	2	106.7			
NECR1-CC17		CA	20.5	21	19.1	95.8			
NECR1-CC17		Bulk	0	10				120.3	11.3
NECR1-CC17		Bulk	10	20				125.1	10
NECR2-CC05	NECR-2	Bulk	0	10				118.8	11.9
NECR2-CC07		Bulk	0	10			2.71	117.8	11.6
NECR2-CC05		CA	2.5	3	8.1	93.7			
NECR2-CC05		CA	5	5.5	10	D[3]			
NECR2-CC06		CA	3.5	4	4.7	101.1			
NECR2-CC07		CA	6	6.5	2.7	101			
NECR2-CC07		CA	5.5	6	4.5	101.3			
NECR2-CC07		CA	10	10.5	4.1	97.1			
NECR2-CC01		CA	5.5	6	7.4	99.1			
NECR2-CC06		CA	3	3.5	5	103.4			
N2D-CC01	NECR-2 Drainage	Bulk	0	10				115.6	13.4
N2D-CC01		CA	3.5	4	8.6	91.2			
N2D-CC01		CA	6	6.5	4.7	87.2			
N2D-CC01		CA	11	11.5	4	91.8			
NMSA-CC02	NEMSA	CA	3	3.5	8.1	110.6			
NMSA-CC02		CA	6	6.5	20	97.5			
NMSA-CC02		CA	10.5	11	15	86.6			
NMSA-CC04		Bulk	0	15			2.66	125.2	9.8
P2-CC04	Pond 2	Bulk	0	3			2.66	102.0	20.6
P3-CC07	Pond 3	Bulk	0	5			2.63	109.7	13.7
SF2-CC01	Sandfill 2	Bulk	0	10			2.65	121.5	10.5
SF3-CC01	Sandfill 3	Bulk	0	10			2.68	121.7	11.1
SF3-CC01		CA	3.5	4	17	99.3			
SF3-CC01		CA	6	6.5	10.5	96.4			
SF3-CC01		CA	11	11.5	8.2	83.5			
SP-CC13	Sediment Pad	CA	5.5	6	10.2	101.4			
SP-CC13		CA	11	11.5	3.5	100.8			
SP-CC13		CA	15.5	16	6.9	97.5			
SP-CC13		Bulk	0	15			2.62	120.6	11.5

Notes:

pcf=pounds per cubic foot

1. Samples collected October-December 2013 during the Pre-Design Studies
2. CA = 2-inch diameter California sample, Bulk = 5-gallon bucket sample
3. Maximum dry density listed includes rock correction
4. D = Disturbed, moisture content only

ATTACHMENT B

RECORDED WATER LEVELS AT THE CHURCH ROCK SITE (CHESTER ENGINEERS, 2016)

Well ID	Measurement Date	Measurement Time	Historical Reference Elev	Water Level Depth	Water Level Elev
0509 D	1/4/2016	8:37	6949.44	82.89	6866.55
EPA 23	1/4/2016	9:30	6926.31	59.52	6866.79
GW 1	1/4/2016	14:20	6916.46	65.01	6851.45
GW 2	7/6/2015	14:25	6912.88	58.96	6853.92
GW 3	7/7/2015	10:50	6910.04	56	6854.04
632	1/4/2016	12:35	6903.49	48.05	6855.44
EPA 25	1/5/2016	10:35	6903.38	56.62	6846.76
EPA 27	1/12/1999		6910.95	55.45	6855.5
EPA 28	1/4/2016	15:20	6917.86	65.83	6852.03
624	1/4/2016	16:35	6898.57	53.61	6844.96

Note: Water levels provided by email from Chester Engineers, on April 20, 2016.

ATTACHMENT C

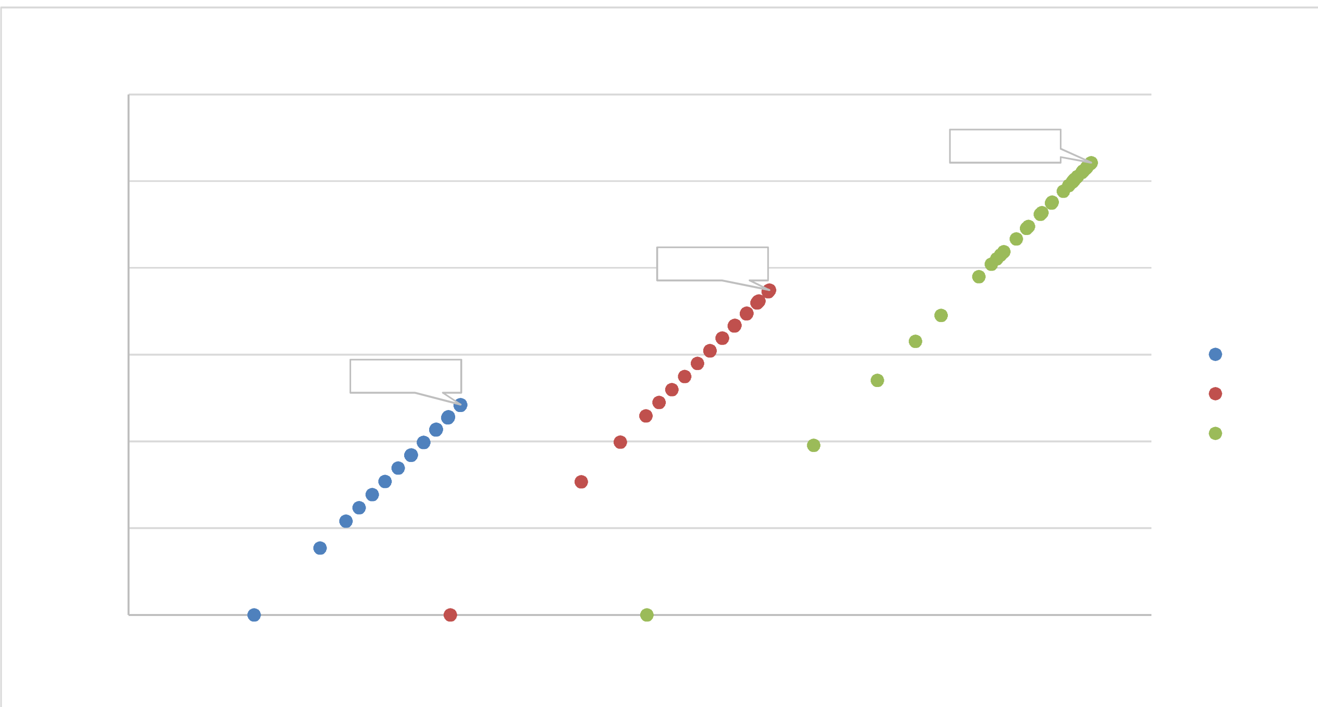
TOTAL STRESS FRICTION ANGLE SPREADSHEET CALCULATIONS

Fine Tailings - Total Stress Internal Friction Angle Calculation

By: S. Downey
Date: 7/19/2017

Purpose:
Resolve the total stress internal friction angle based on laboratory results obtained from the PDS investigation (MWH, 2014). Two approaches were used to calculate the total stress friction angle. The first approach calculates the friction angle from each confining stress, and then averages the three friction angles. The second approach plots the peak values from each confining stress and finds the line of best fit with a y-intercept of 0 or greater. The equation from the line of best fit is then used to determine the total stress friction angle.

Approach 1:
-Found peak vertical stress values associated with peak confining stresses
-Used Lambe & Whitman equation with peak values of each sample
-Found the average of the three Lambe & Whitman values

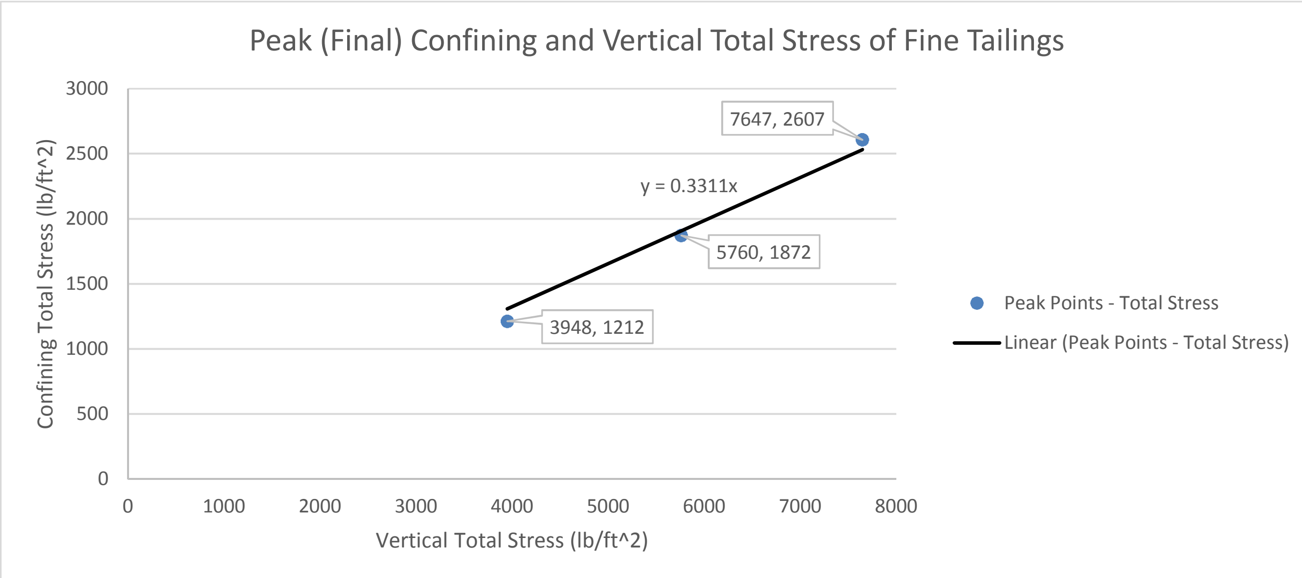


$$\sin\phi = \frac{q}{p}$$ (Lambe and Whitman, 1969, pg. 141)

; q = peak (final) confining stress
p = peak (final) vertical stress
ϕ = total stress internal friction angle

Sample	p (lb/ft^2)	q (lb/ft^2)	ϕ (deg.)
A	3948	1212	18
B	5760	1872	19
C	7647	2607	20
		Avg. ϕ (deg.) =	**19**

Approach 2:
-Found peak vertical stress values associated with peak confining stresses
-Plotted peak values of each sample
-Established a best fit line with a conservative y-intercept of 0
-Used slope value from the best fit line equation in Lambe & Whitman equation

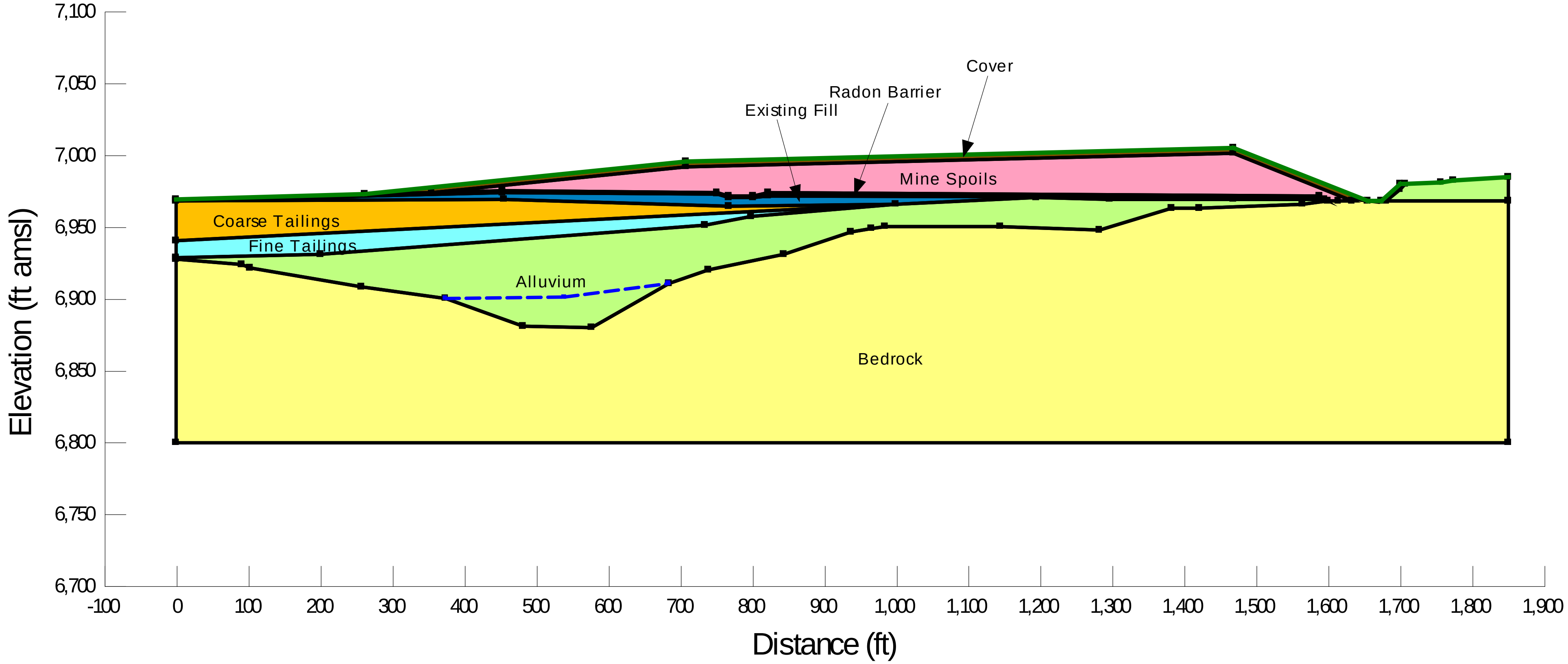


$\sin\phi = \tan\alpha$ (Lambe and Whitman, 1969, pg. 141) ; tan α = slope of best fit line

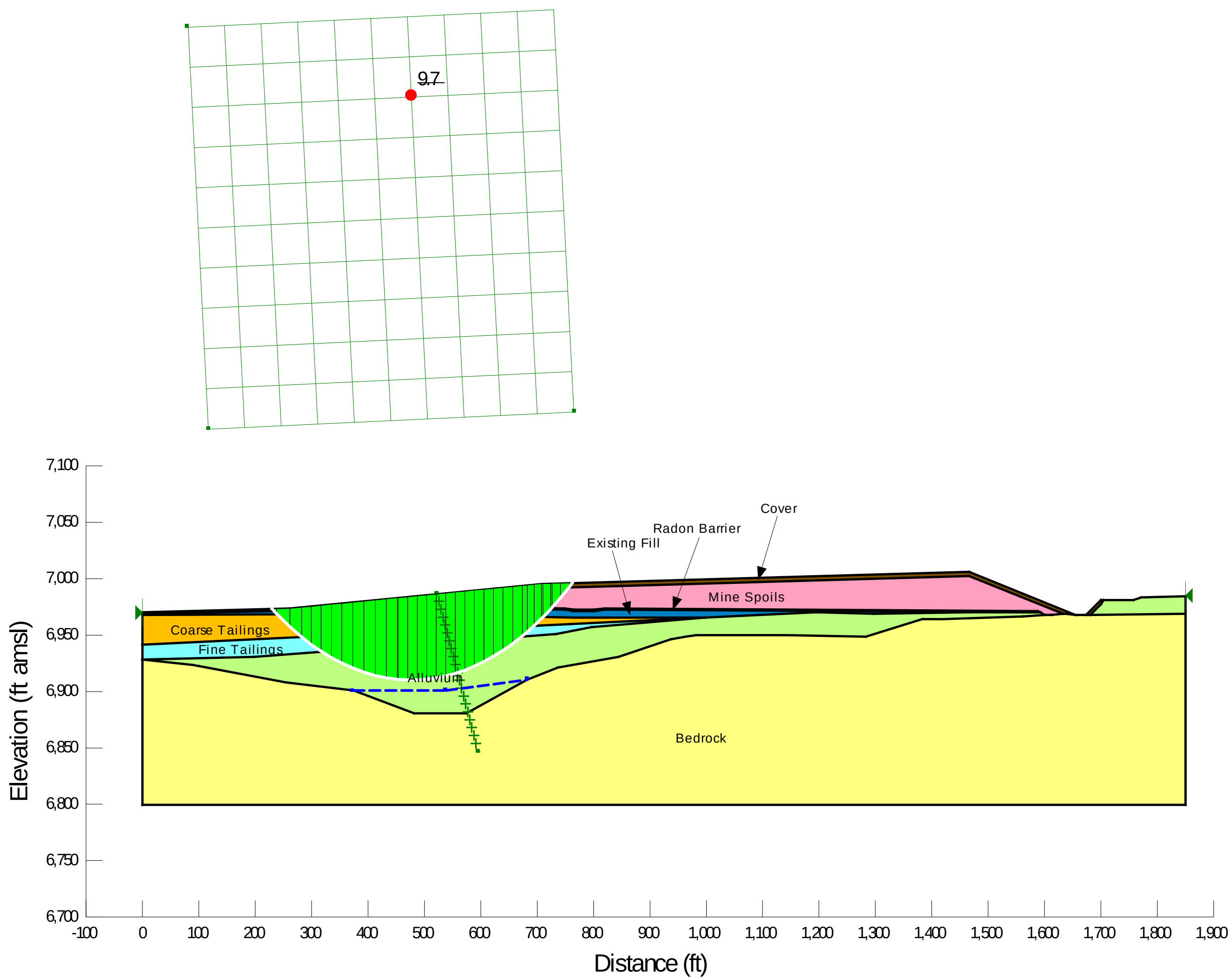
Best Fit Line Equation	Best Fit Line Slope	ϕ (deg.)
0.3311x	0.3311	19

ATTACHMENT D

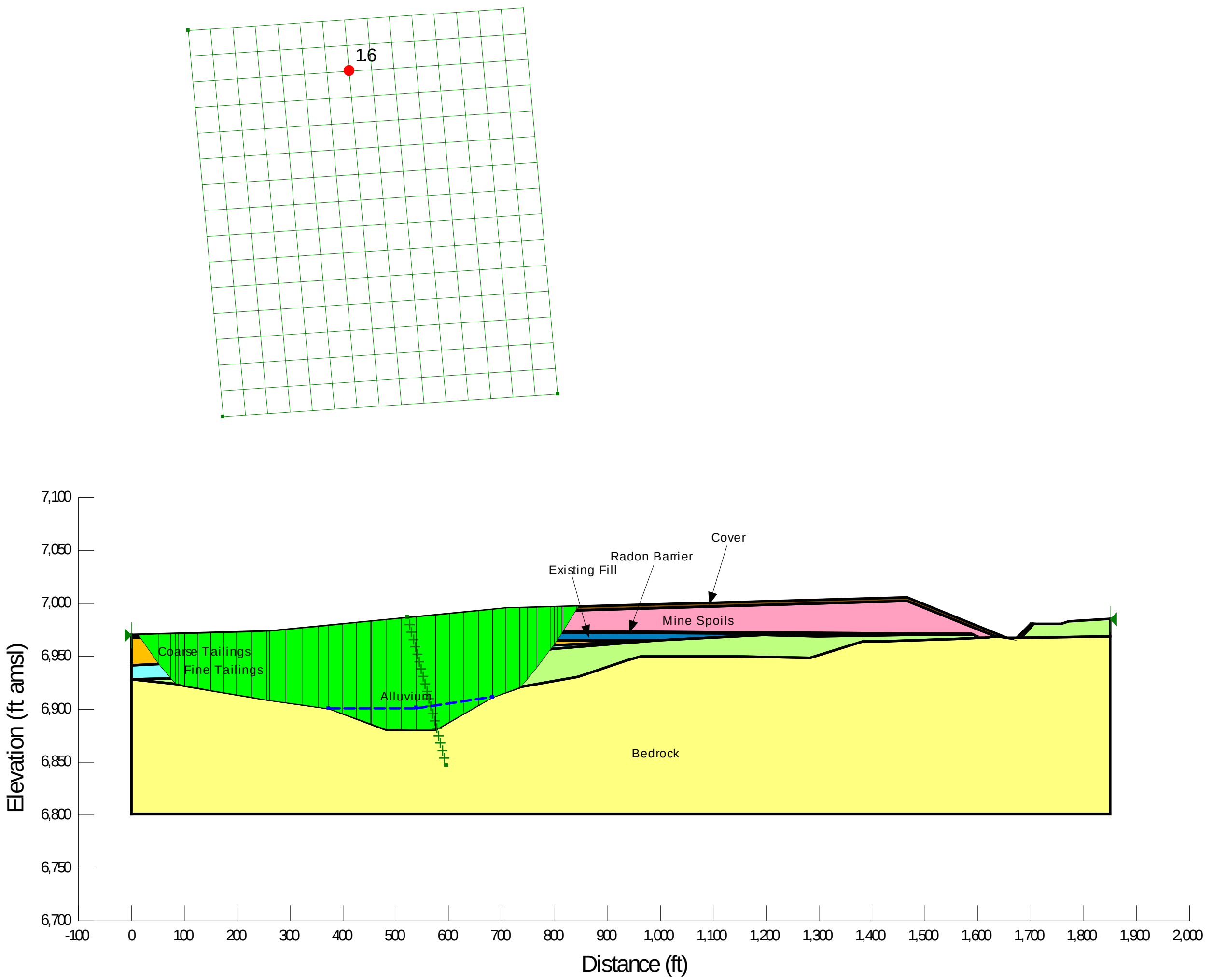
SLOPE/W OUTPUT FILES



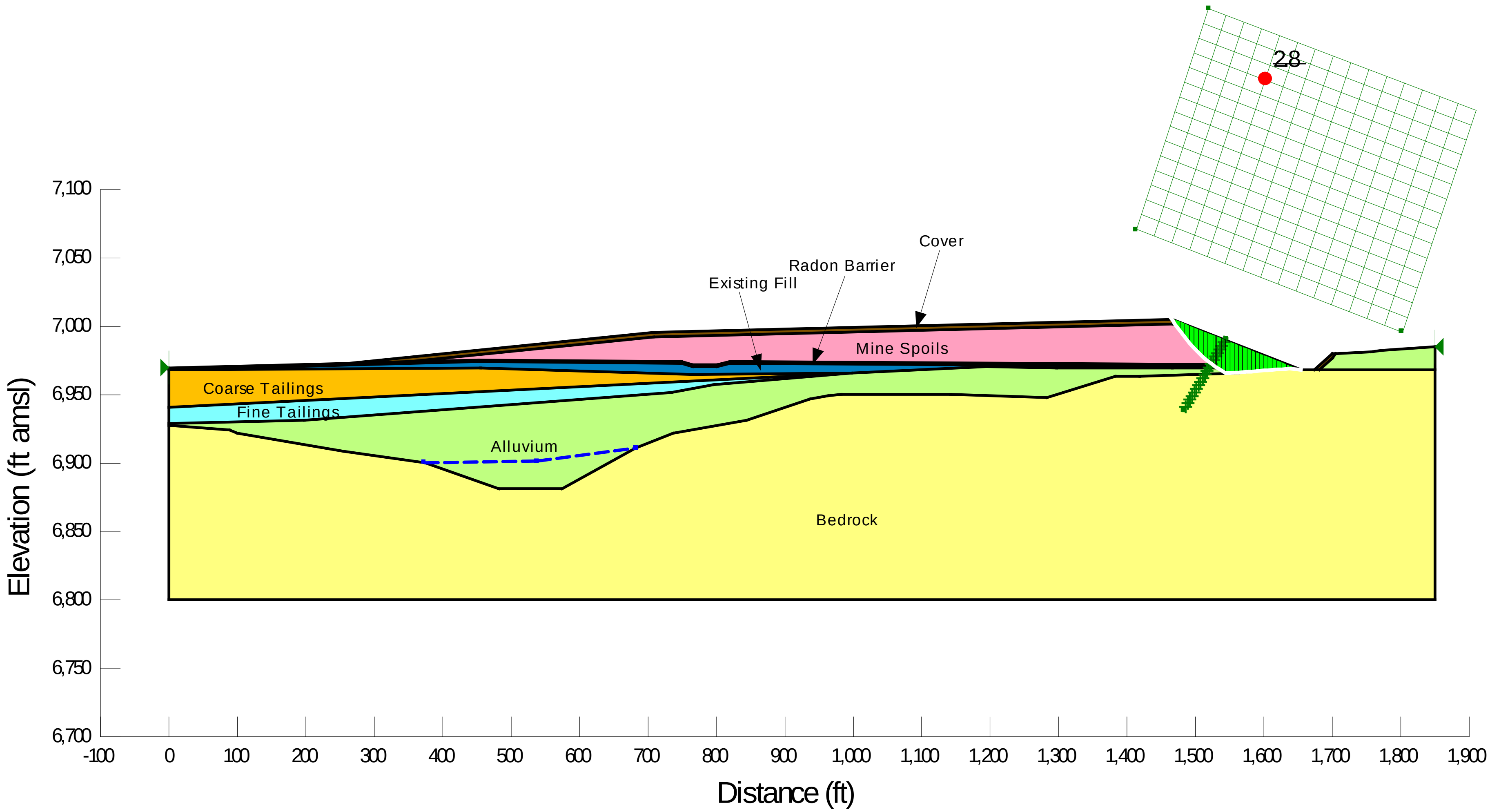
Cross Section A
Geometry



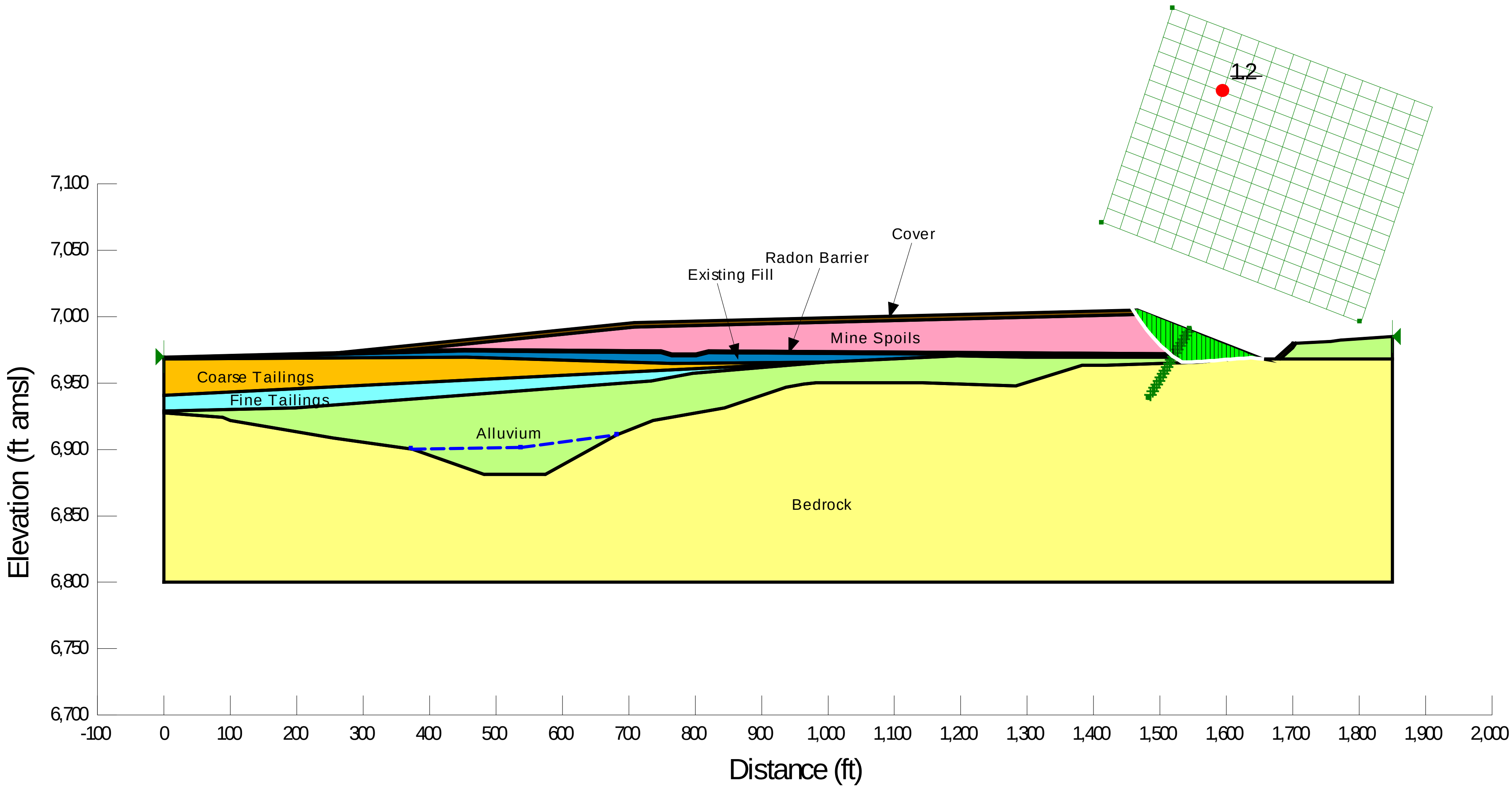
Cross Section A
Static Analysis – Southwest Slope



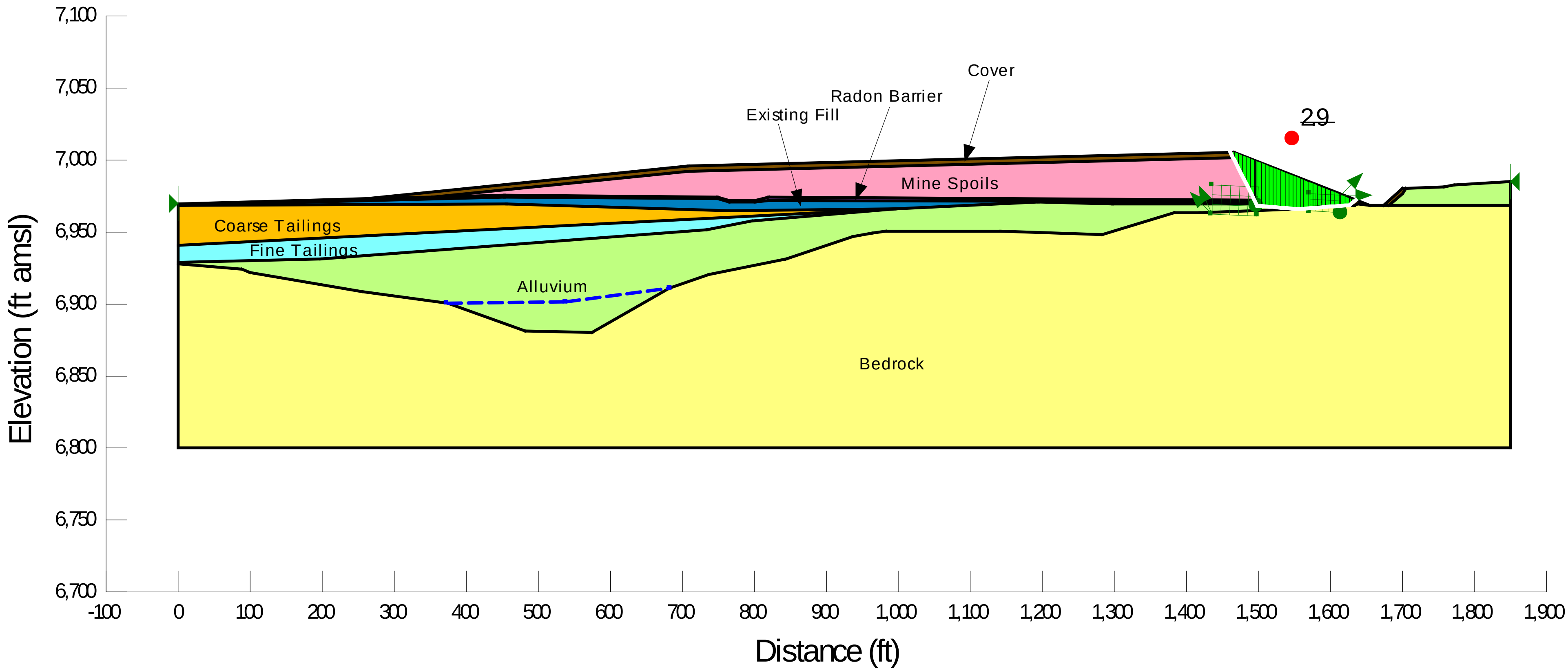
Cross Section A
Pseudo-Static Analysis – Southwest Slope



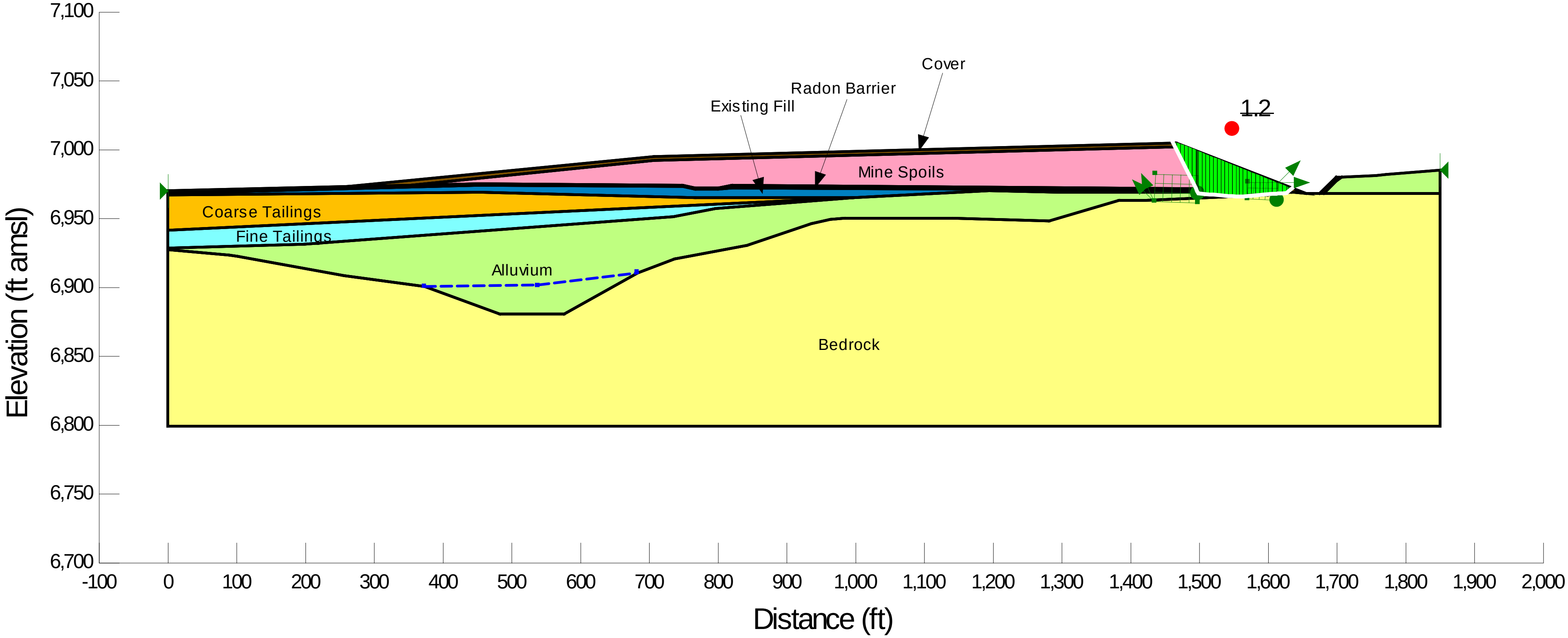
Cross Section A
Static Analysis – Northeast Slope



Cross Section A
Pseudo-Static Analysis – Northeast Slope

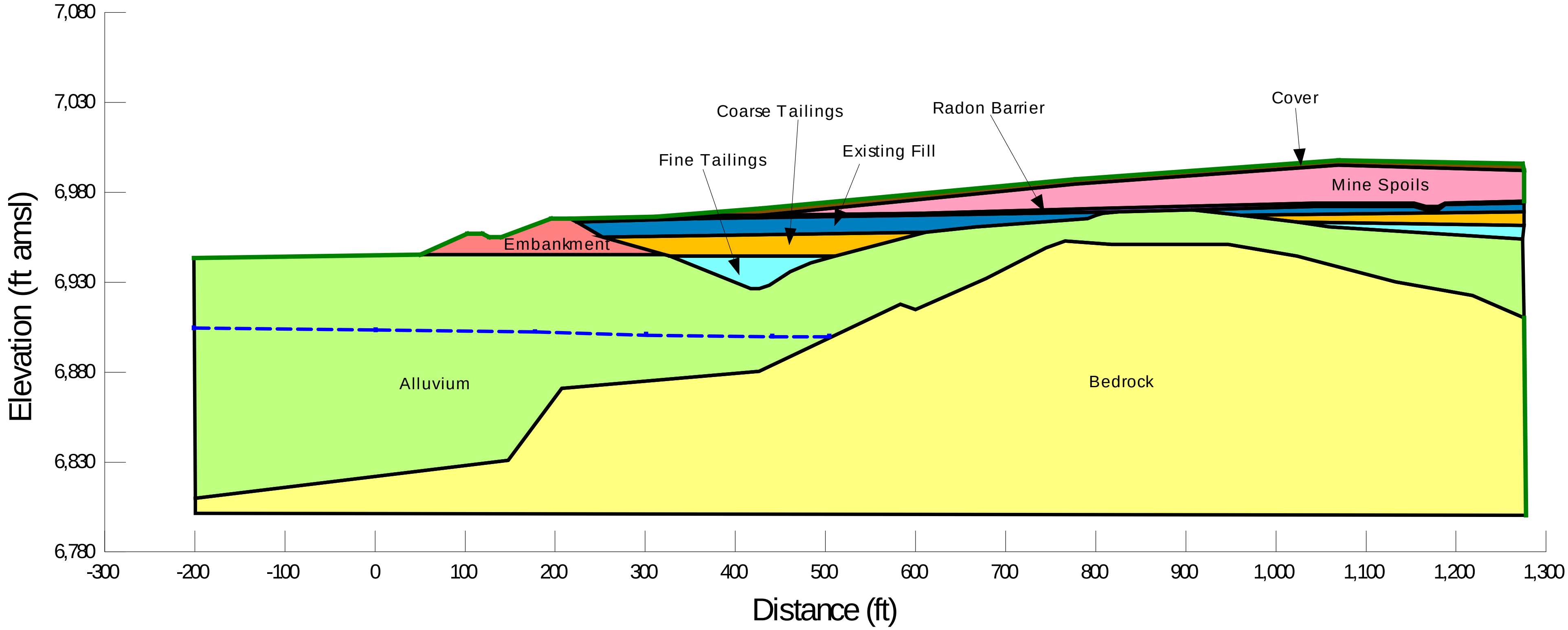


Cross Section A
Static Analysis – Northeast Slope – Block Failure

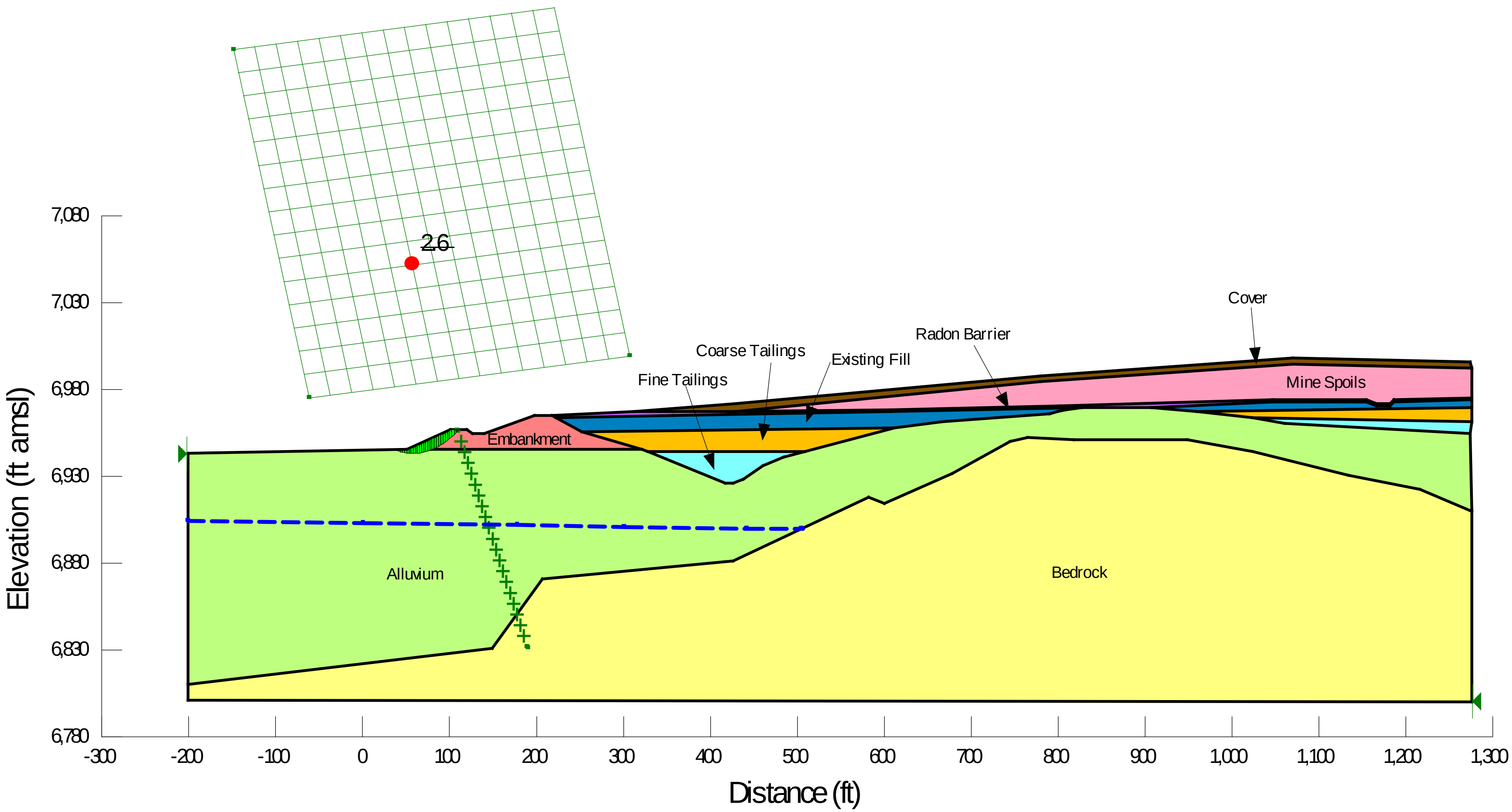


Cross Section A

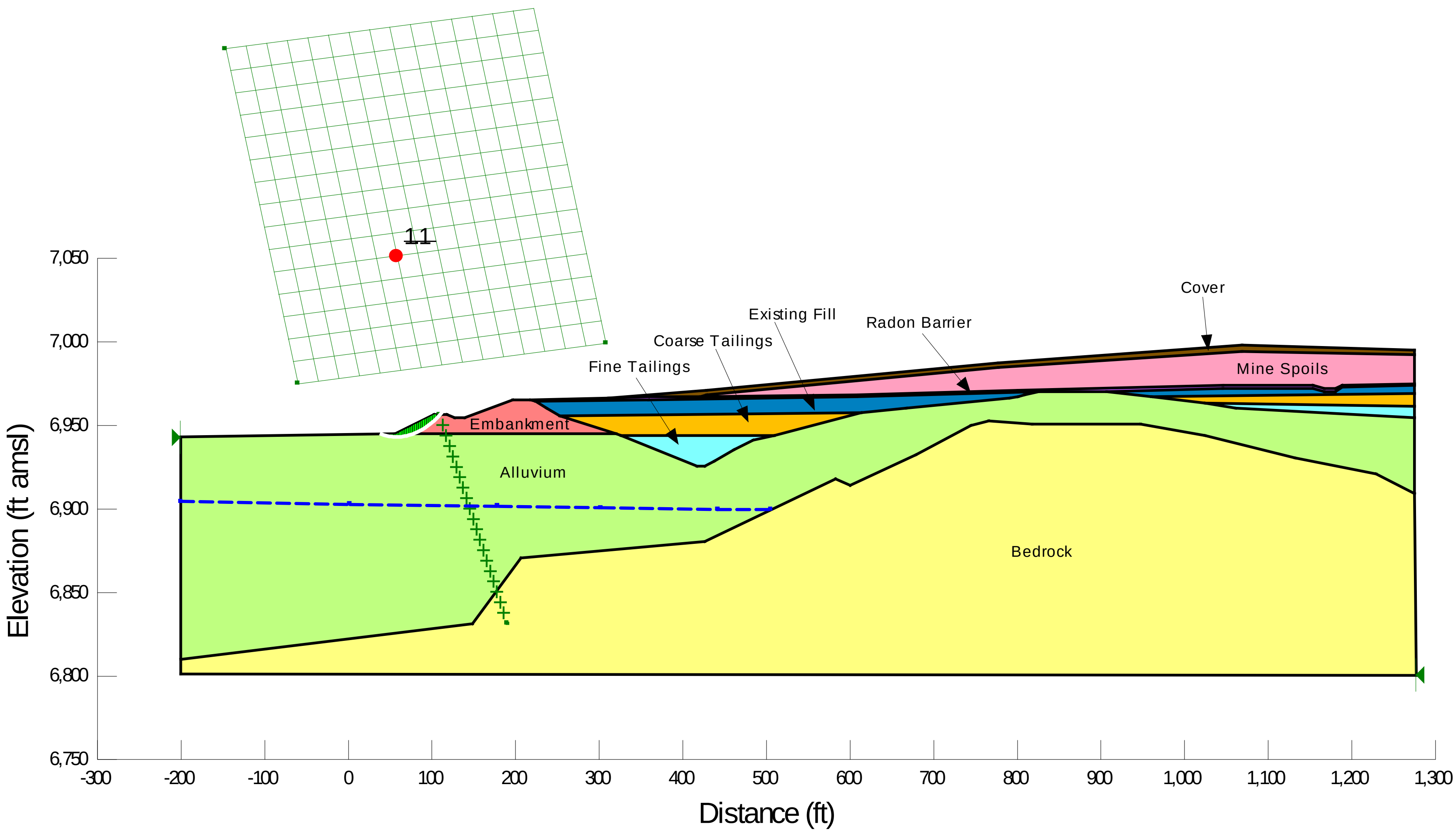
Pseudo-Static Analysis – Northeast Slope – Block Failure



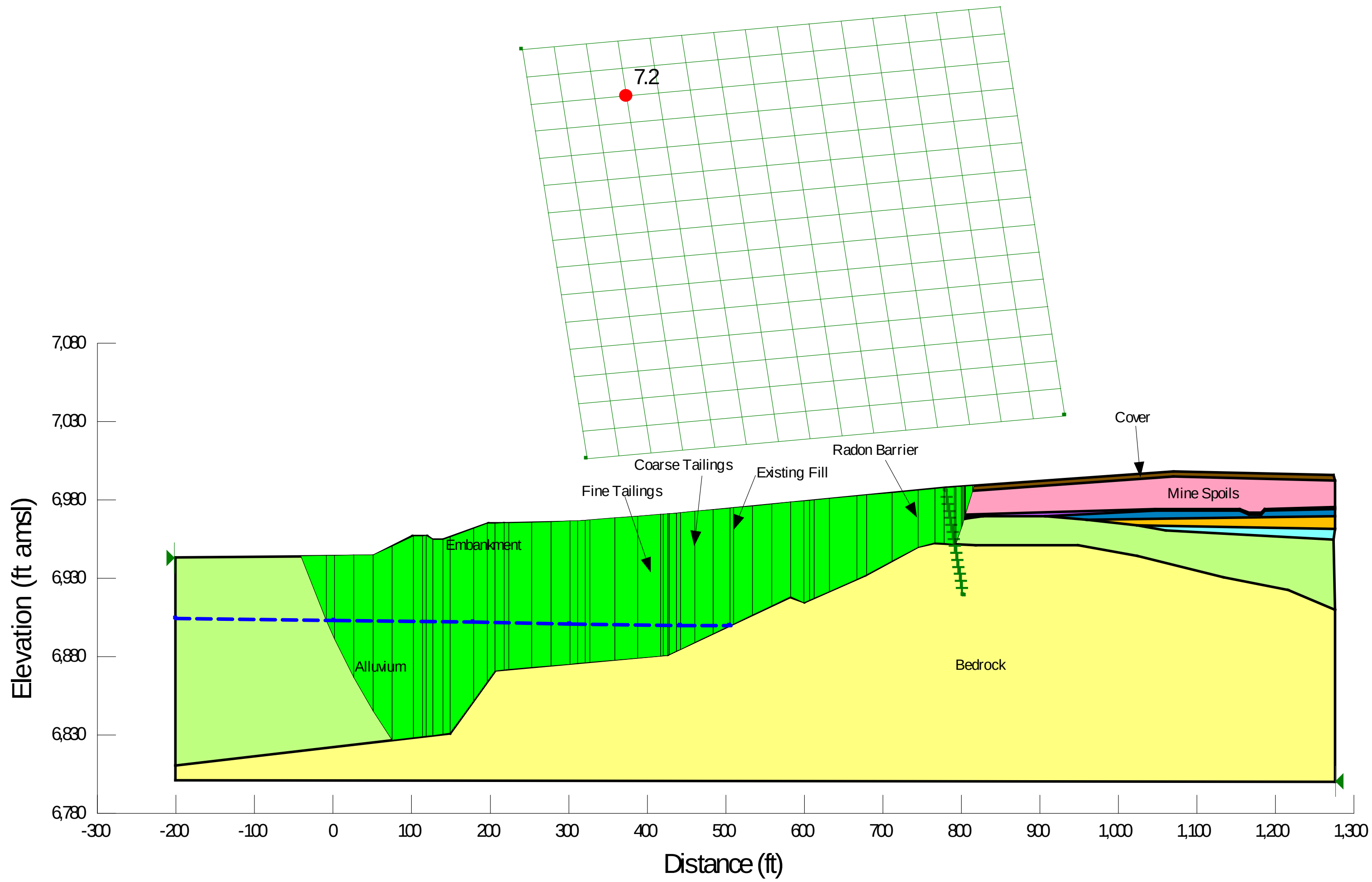
Cross Section B
Geometry



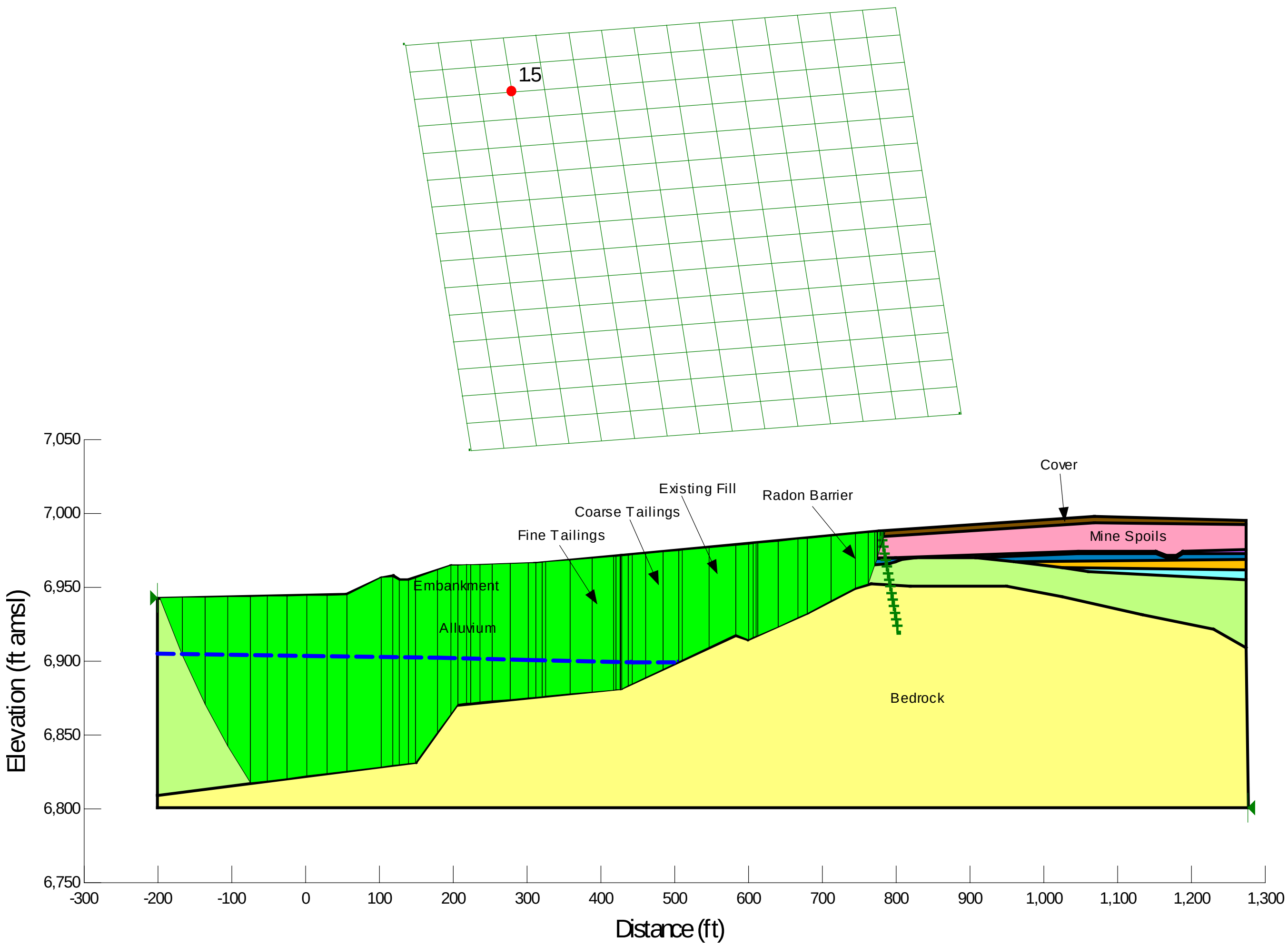
Cross Section B
Static Analysis – Overall Slope



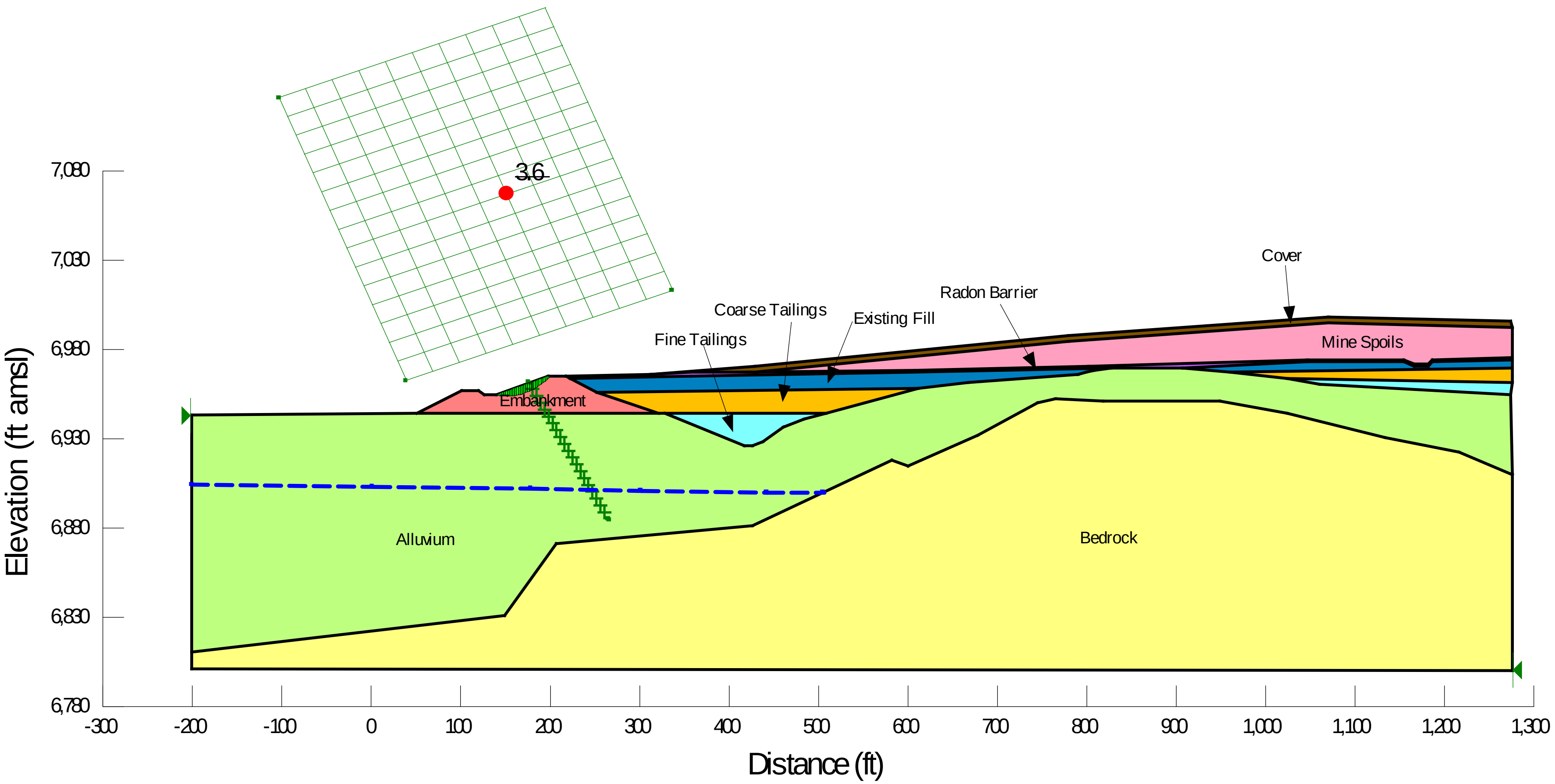
Cross Section B
Pseudo-Static Analysis – Overall Slope



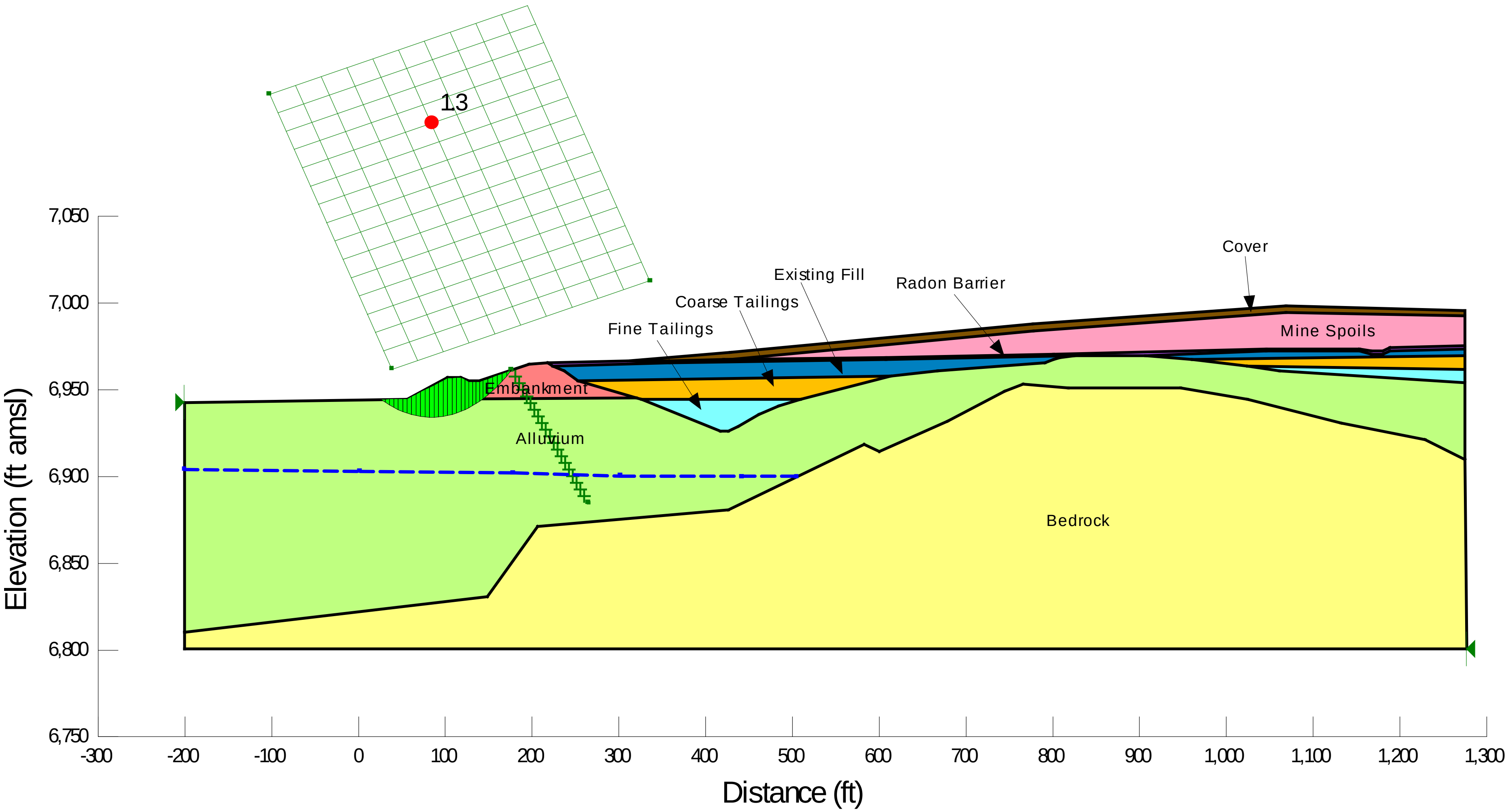
Cross Section B
Static Analysis – Repository Slope



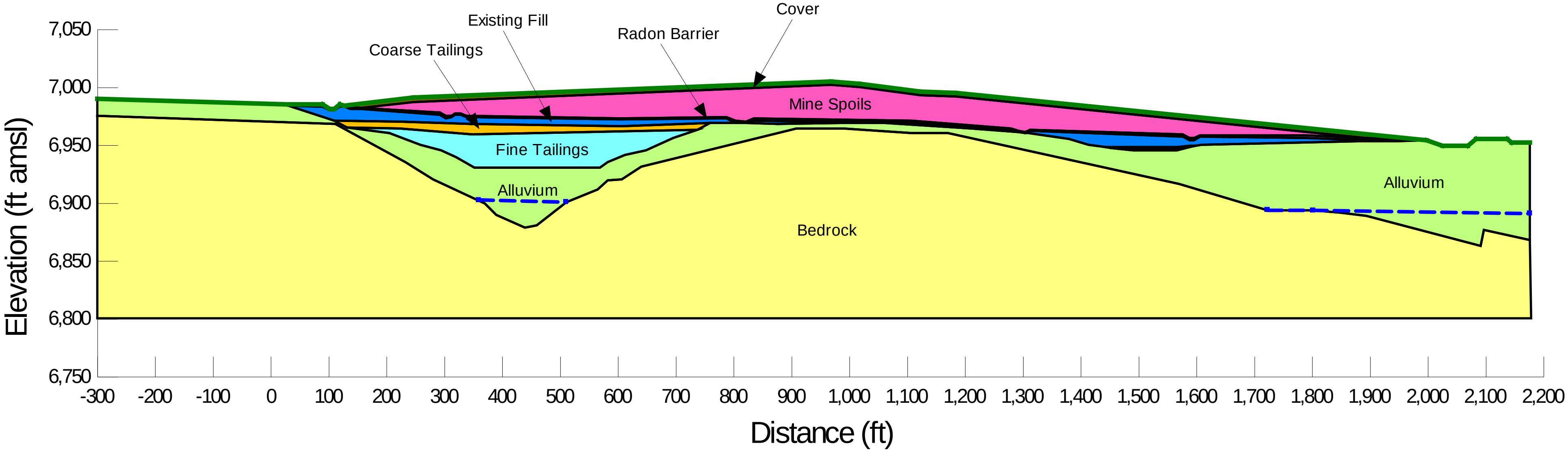
Cross Section B
Pseudo-Static Analysis – Repository Slope



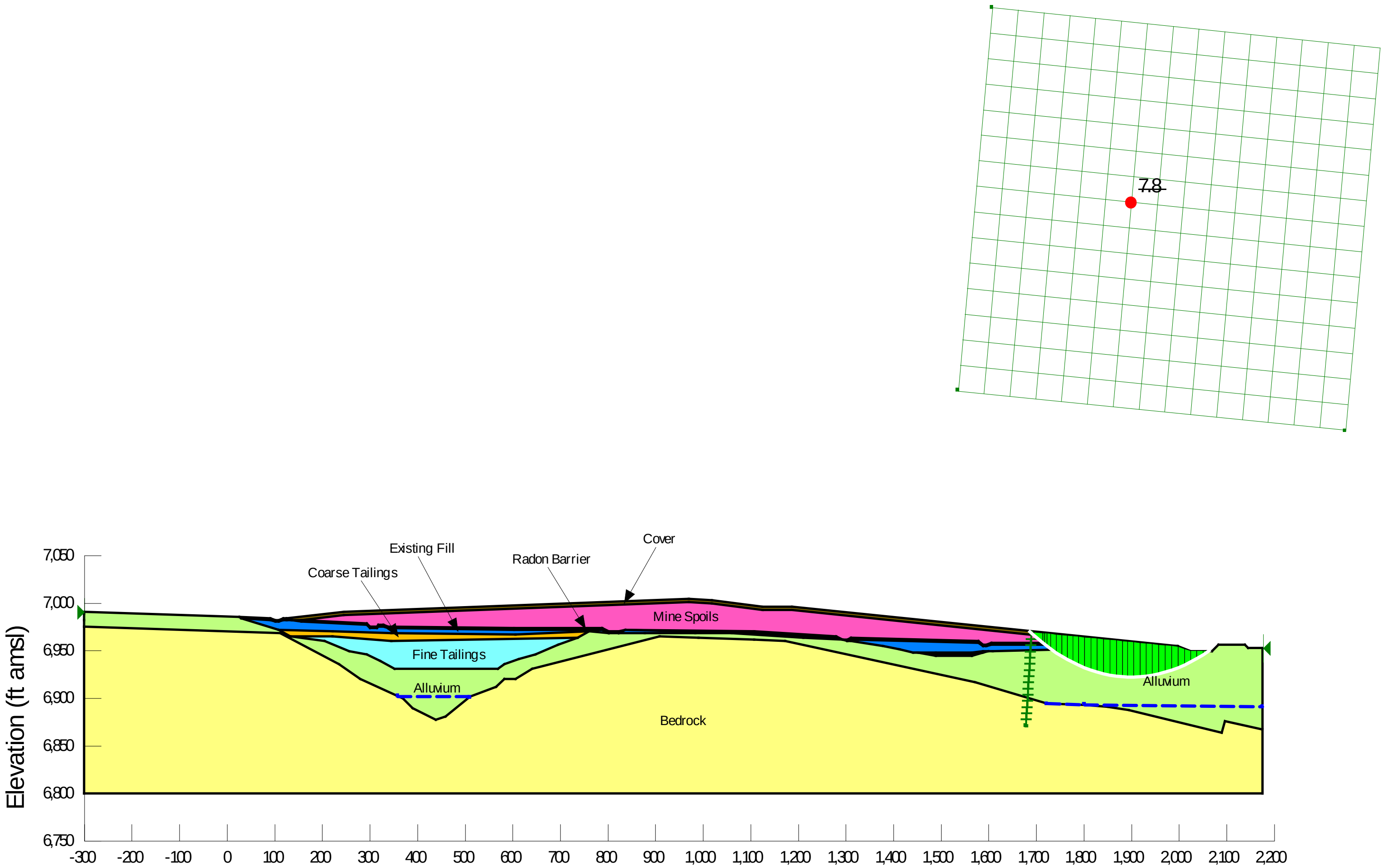
Cross Section B
Static Analysis – Existing Embankment (Dam)



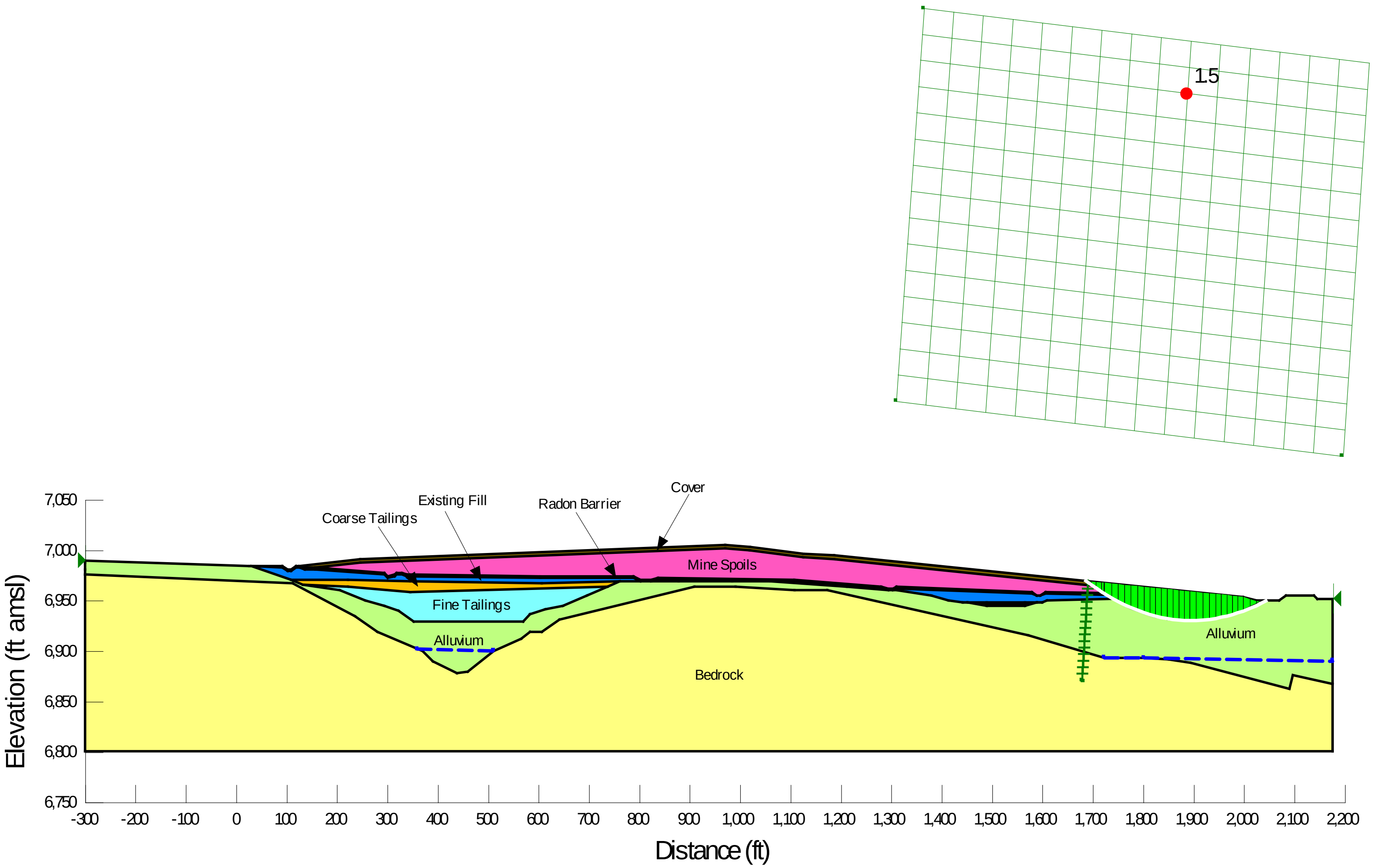
Cross Section B
Pseudo-Static Analysis – Existing Embankment (Dam)



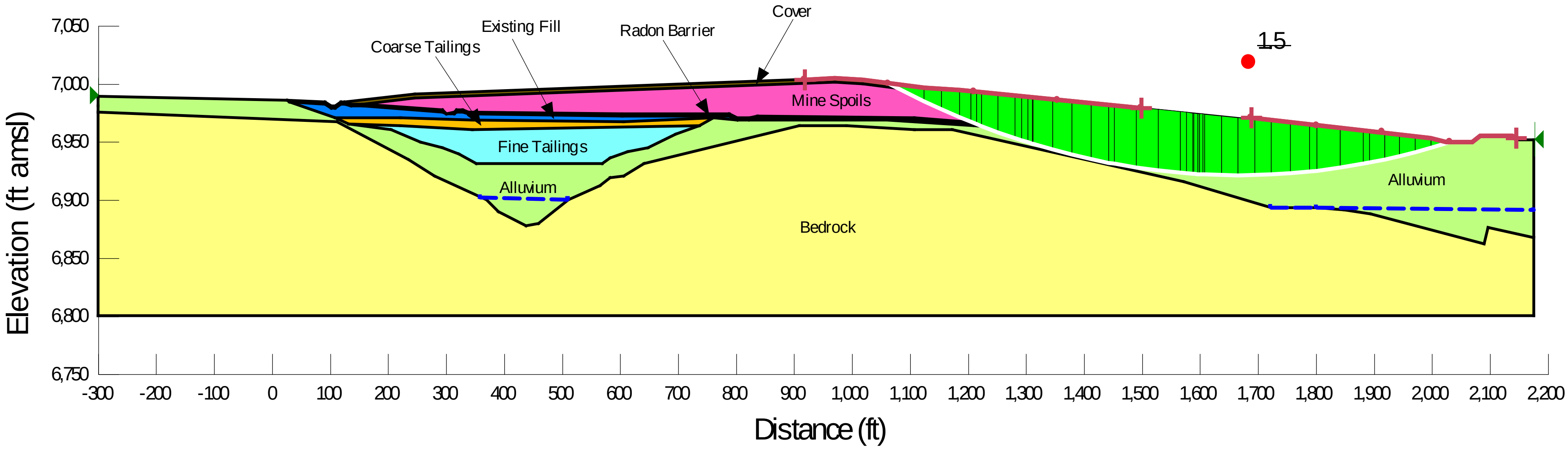
Cross Section C
Geometry



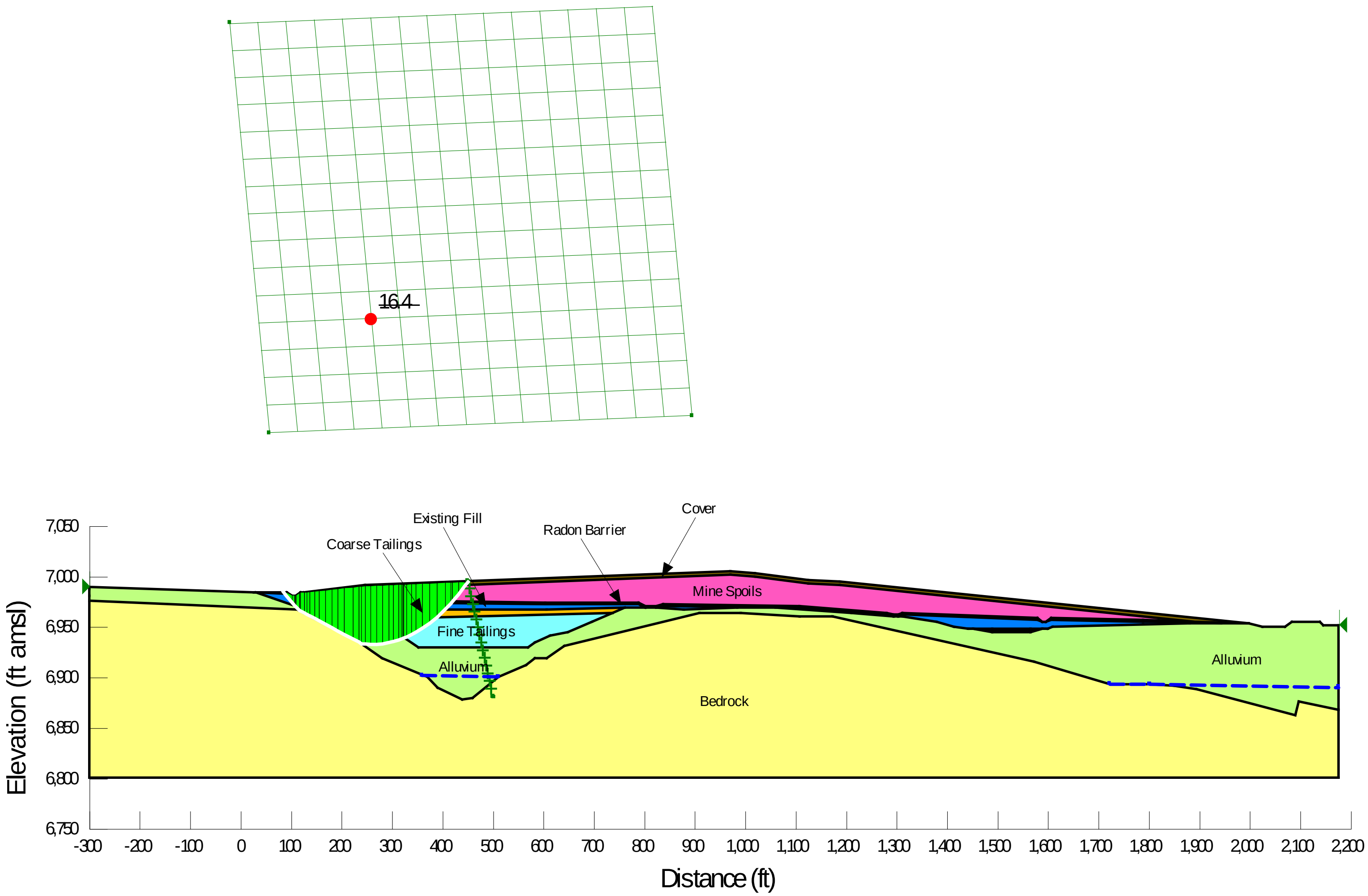
Cross Section C
Static Analysis – North Slope



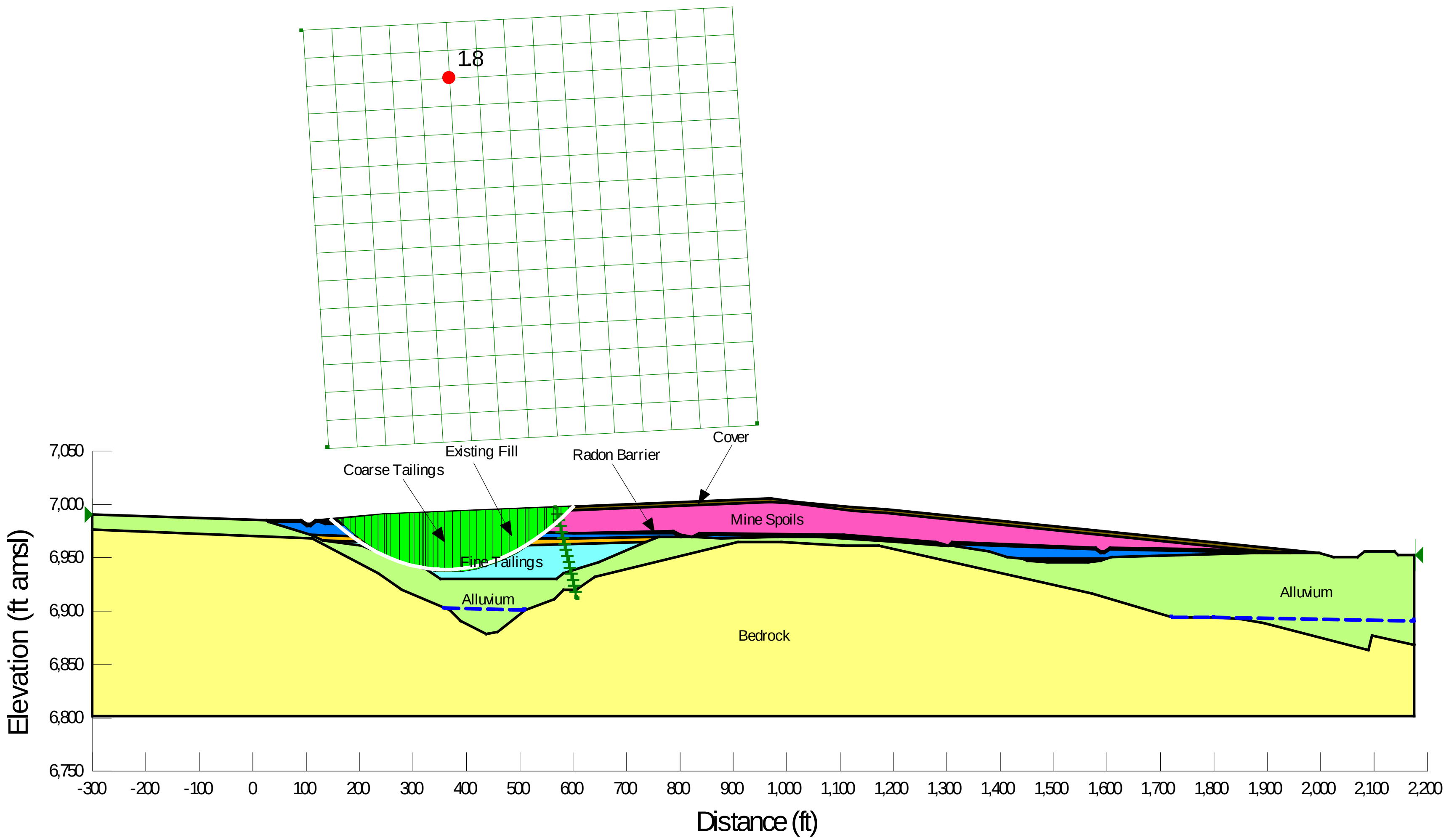
Cross Section C
Pseudo-Static Analysis – North Slope



Cross Section C
Pseudo-Static Analysis – North Slope – Entry/Exit



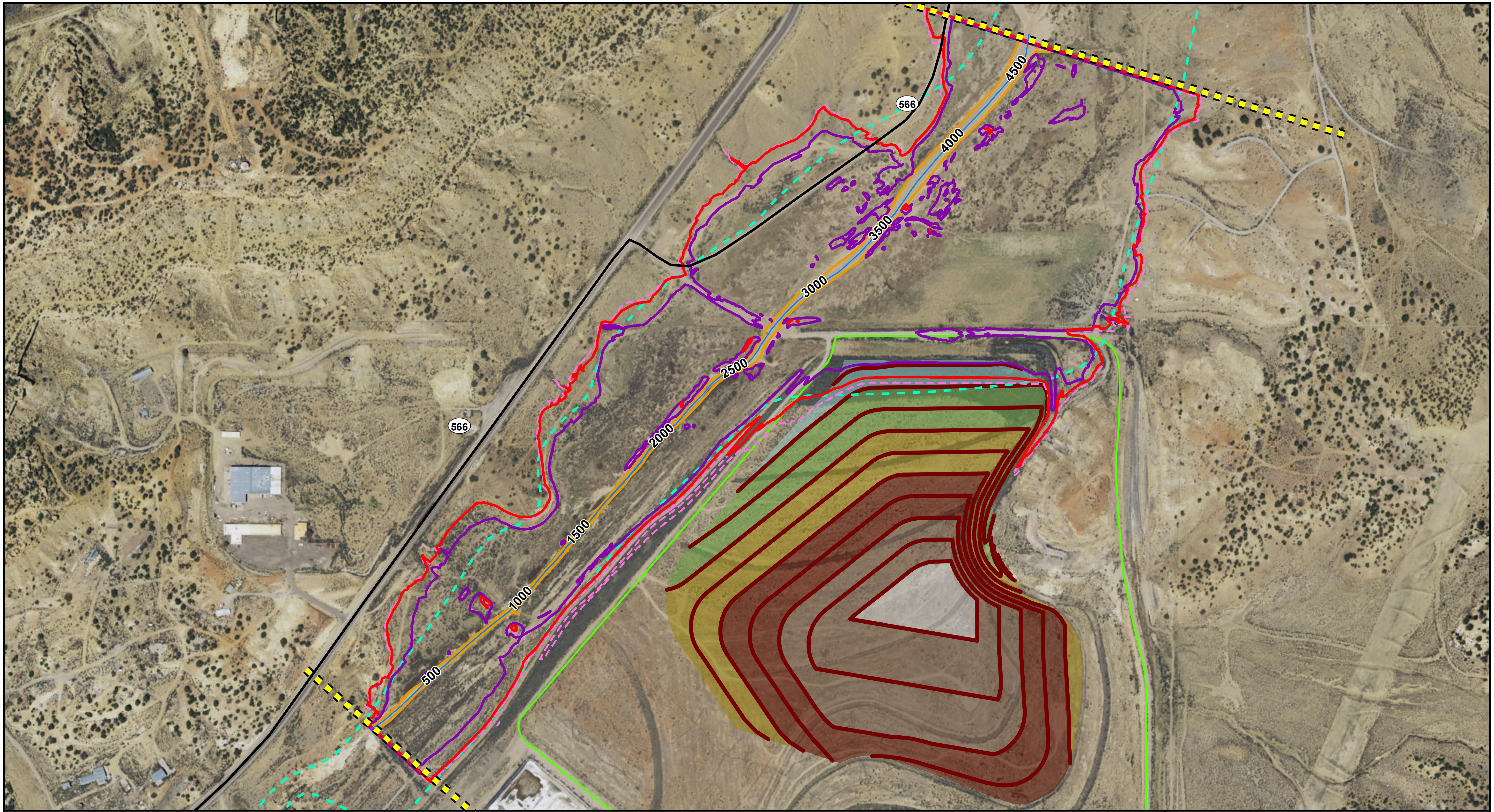
Cross Section C
Static Analysis – South Slope



Cross Section C
Pseudo-Static Analysis – South Slope

ATTACHMENT E

PMF EXTENTS



Legend

- Proposed Repository Area (5' Contour Interval)
- Upper & Lower Extents of Study
- Pipeline Road
- Upper Pipeline Arroyo Thalweg
- PMF Flood Extents from Canonie (1991)
- TDA-North Cell
- PMF Flood Extents
- 100 Year Event Flood Extents
- 5 Year Event Flood Extents
- PMF Flood Extents (Maximum Roughness)

N
W E
S

0 250 500 1,000 1,500
Feet

FIGURE I-6.3:

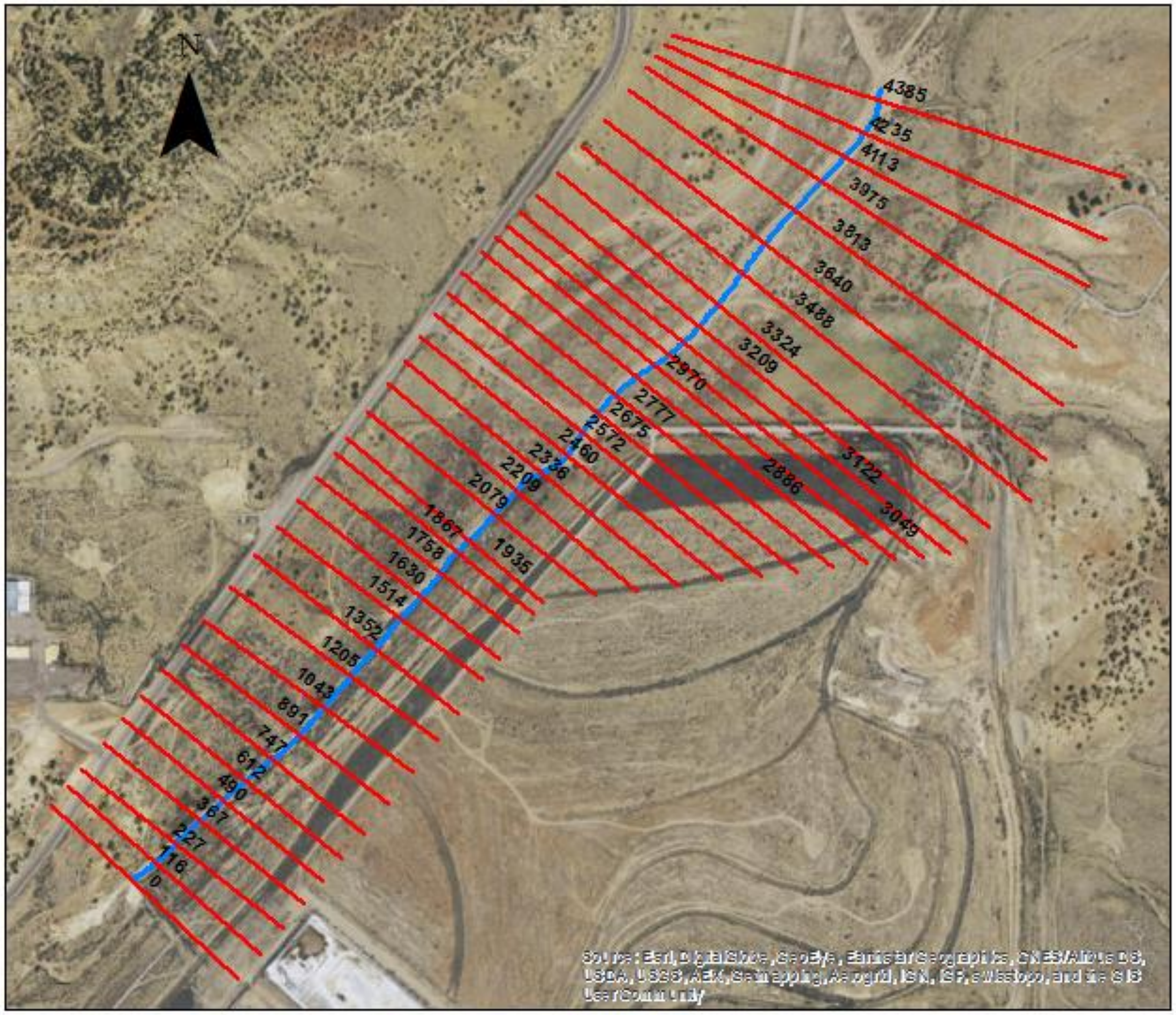
Estimated Pipeline Arroyo Flood Extents

Northeast Church Rock

, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS

MWH

Date Revised: 5/18/2016

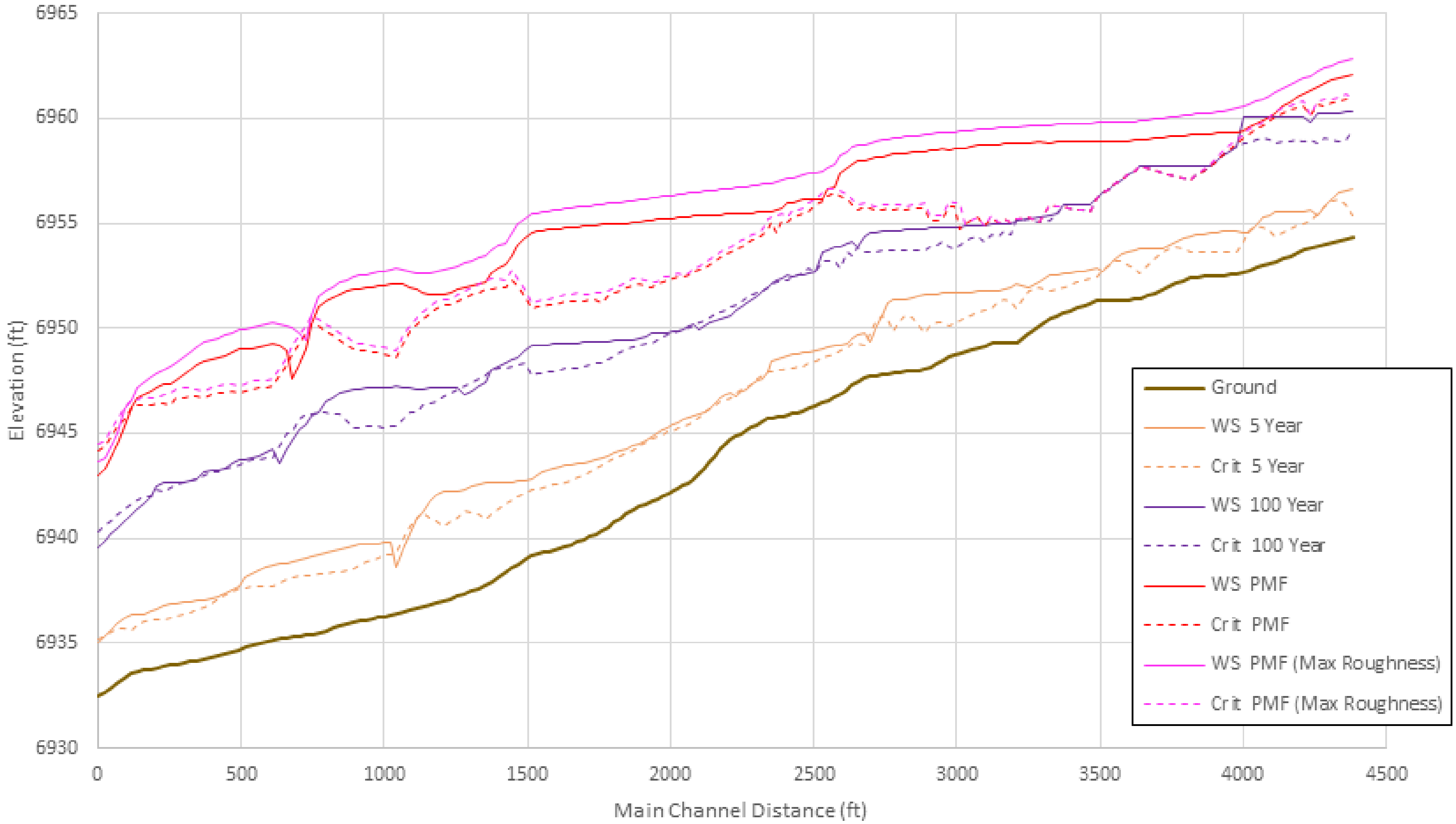


Legend

Cross Sections

Upper Pipeline Arroyo Thalweg

0 250 500 1,000 1,500
Feet


6965
6960
6955
6950
6945
6940
6935
6930
Elevation (ft)
0
500
1000
1500
2000
2500
3000
3500
4000
4500
Main Channel Distance (ft)
Ground
WS 5 Year
Crit 5 Year
WS 100 Year
Crit 100 Year
WS PMF
Crit PMF
WS PMF (Max Roughness)
Crit PMF (Max Roughness)

ATTACHMENT G.3
Repository Settlement Analysis

MWH now part of Stantec

CALCULATIONS

Client:	*GE*	**Sheet:**	*1* **of** *8*
Project:	*NECR 95% Design*	**Date:**	*10/31/17*
Description:	*Repository Settlement*	**Job No:**	*10508639*

ATTACHMENT G.3: REPOSITORY SETTLEMENT ANALYSIS

Revisioning

Rev.	Date	Description	By	Checked	Date
0	*5/31/2016*	*30% Design*	*S. Moore*	*J. Cumbers*	*6/29/2016*
1	*July 2017*	*95% Design*	*S. Downey*	*M. Davis*	*10/11/2017*

Location and Format

Electronic copies of these calculations are located on the Stantec internal project teamsite.

The following calculations were generated using the following software:

Microsoft Excel 2013

Table of Contents

Objective

The purpose of this calculation brief is to document the input data, assumptions, procedures, and results of the consolidation and immediate settlement analyses for the proposed Church Rock Mill Site (Mill Site) repository due to the waste and cover material that will be placed on the existing tailings impoundment. The analyses include immediate settlement and primary and secondary consolidation. Seismic settlement is addressed in a separate calculation brief (Attachment G.4 of Appendix G) and liquefaction-induced settlement is addressed in the liquefaction calculation brief (Attachment G.6 of Appendix G).

Background

This analysis was performed as part of the design of the Removal Action (RA) at the Northeast Church Rock Mine Site (Mine Site) and the related Remedial Action (RA) at the Church Rock Mill Site (Mill Site). The Mine Site and Mill Site are located in close proximity to one another, approximately 16 miles northeast of Gallup, in McKinley County, New Mexico. They are located on adjacent Sections approximately one-half mile apart. The sites are temporarily being treated as one facility for purposes of the RA. The combined site is referred to as the “Settlement Agreement Site” (SA Site).

Site History

The NECR mine is a historical uranium mine operated by United Nuclear Corporation (UNC). Mining development began in 1967 and ended in 1982. While the mine operated, it served as the principal mineral source for the UNC uranium mill. The uranium mill and its adjacent disposal cells make up the UNC Superfund Site (the “UNC Mill Site”). Remedial activities addressing source control and on-site surface reclamation are being implemented by General Electric/United Nuclear Corporation (GE/UNC) under the direction of the U.S. Nuclear Regulatory Commission (NRC), pursuant to the UNC facility's NRC license, and integrated with the US Environmental Protection Agency’s (USEPA’s) selected remedy for the groundwater.

The Tailings Disposal Area (TDA) is an unlined facility bounded by an embankment and subdivided by cross-dikes into three cells, which are identified as the South Cell, Central Cell, and North Cell. An estimated 3.5 million tons of tailings were pumped in slurry from the mill to the TDA.

Proposed Remedial Action

The proposed repository will be constructed on top of the existing TDA and will incorporate controlled placement of mine waste on top of the existing TDA cover/radon barrier and a final evapotranspirative (ET) cover placed over the mine waste. Improvements to the existing TDA cover/radon barrier within the footprint of the proposed repository will be completed prior to placement of mine waste. **Figure 1** shows the location and grading of the proposed repository.

The design for the selected repository alternative will be evaluated as part of a NRC license amendment request for the existing licensed facility. The repository features that affect the licensed facility will meet the performance standards outlined in NRC regulations and areas of the existing facility affected by the repository construction will be evaluated for compliance. However, existing conditions of the facility not affected by the proposed repository were not evaluated as part of this analysis, as they are managed by the existing NRC license.

Site Description

The natural stratigraphy at the Mill Site is divided into two main components: the surficial unconsolidated deposits (alluvium) and the underlying consolidated bedrock units. The alluvium consists of a mixture of sand, silt, and clay with minor portions of gravel. Alluvial thicknesses at the site are usually around 50 feet, but exceed 120 feet in some locations. Generally, the uppermost bedrock unit at the site is the Upper Gallup Sandstone, though in some locations it is overlain by coal or the Mancos shale.

The TDA was constructed on top of the native alluvium and deposition of tailings via slurry within the TDA resulted in an interbedded accumulation of tailings. TDA closure construction began in 1989 and was completed in 1995. Closure construction included placement of an interim cover (general fill) from 1989 through 1991 followed by placement of the final cover (radon barrier and erosion protection layer) from 1993 through 1995.

Measurements taken in alluvial monitoring wells show an alluvial groundwater table in the vicinity of the TDA at approximately 6,867 feet above mean sea level (amsl), which indicates that the alluvium is unsaturated above this elevation. Additionally, subsurface investigations of the TDA indicate that there is not a consistent static water level within the tailings or the alluvium above approximately 6,867 feet amsl. However, localized perched zones of saturation exist within the low-permeability, fine-grained tailings. These zones of saturation do not appear to extend beyond the

fine-grained tailings into the higher-permeability coarse-grained tailings.

Site Investigation

In 2013, MWH performed pre-design studies (PDS) at the Mill Site and Mine Site to supplement previous site investigations and collect data necessary to perform the Remedial Design (RD). Activities performed as part of the Mill Site PDS included: surveying, cone penetration tests (CPTs), drilling, standard penetration tests (SPTs), excavation and soil sampling, and subsequent laboratory testing. Geotechnical data collected during the PDS are presented in the PDS reports (MWH, 2014a and MWH, 2014b) and summarized in **Attachment A**. A list of the materials encountered within the TDA during the PDS is presented in the Assumptions section below. Geotechnical properties for these materials and discussion of one-dimensional stratigraphic profiles developed for the settlement analysis are also presented in the Assumptions section.

Applicable Codes and Standards

NAVFAC Section 7.1 (Department of the Navy, 1986)
NUREG-1620 (NRC, 2003)

Methods

One-dimensional (1-D) consolidation analyses were conducted for the tailings and existing fill/cover material in the Mill Site repository footprint to estimate total potential future settlement of the tailings and existing fill/cover material after placement of the waste material and final cover. Data from CPT and borehole testing locations from the PDS (MWH, 2014a and MWH, 2014b) were used for the settlement analysis.

The CPT data, in combination with the borehole logs, were used to determine the thickness of the layers and contact locations between different materials encountered. Eight boreholes were drilled adjacent to eight of the CPT locations to correlate and verify the CPT data with direct observation of the materials encountered from the borehole logs. Seven of these paired locations, located within the repository footprint, were used to analyze and verify the CPT data. The relationships observed in the paired CPT/borehole locations were then used to analyze the data from the CPT-only locations. Vertical soil profiles were created from the CPT/borehole data for each of the 25 CPT locations within the repository and were used in the 1-D consolidation analyses.

Primary and secondary consolidation analyses were conducted for the fine-grained tailings layers under the assumption that the fine-grained tailings layers are saturated, although in several locations the fine-grained tailings are unsaturated. The coarse-grained tailings were excluded from the calculations because the coarse-grained tailings are unsaturated. The alluvium is unsaturated like most of the tailings and the stresses from the mine spoils and cover placement will not induce consolidation settlement in the unsaturated alluvium that will impact the repository. Therefore, the alluvium was also excluded from the calculations. Immediate settlement was calculated for the cover and fill materials to the base of coarse-grained tailings in areas where the repository cover slope will transition directly to the existing radon barrier (CPT-15, CPT-26, and CPT-01). Immediate settlement was estimated using the NAVFAC method (Department of the Navy, 1986). Immediate elastic compression is not expected to influence the performance of the final cover system because it will occur in very small increments as the TDA is being filled incrementally with mine spoils and cover material. Any settlement that does occur from immediate elastic compression will be corrected for by the placement of mine waste in lifts, and will not be noticeable once the final cover is placed.

Material Properties and Stratigraphic Profiles

Material Properties

Material strength parameters used for the settlement analysis were based on parameters from laboratory testing of materials at the site during the PDS. The laboratory test results are located in Table 3-4 of the Mill Site PDS Report (MWH, 2014a). The parameters used as a base-case scenario for each material are discussed in the main text of Appendix G, Section G.6 and are summarized in **Table 1** included in this appendix. The CPT and borehole locations are shown on **Figure 1**.

The material properties used for the base case analysis were taken as the average of all samples for a given material and parameter. The compression index values, C_c, were also taken as an average of all samples for a given material. As discussed previously, primary and secondary consolidation analyses were conducted for only the fine-grained tailings layers. Therefore, the C_c value of the fine-grained tailings is the only C_c value applied in the settlement analysis.

A sensitivity analysis was conducted to determine the critical material property and evaluate the effects of varying this property on the total calculated settlement at each CPT location. The material index properties (dry density and water content) were varied from the base case (average) to the 30th percentile values. The compression index, C_c, was also varied from the base case value to the 60th percentile value. The total settlement is directly proportional to the C_c value, so increasing the C_c value results in an increased settlement. The critical material property for the settlement analysis was found to be the C_c value for the fine-grained tailings material. This property was varied to the 60th percentile value of 0.448 for the sensitivity analysis.

Stratigraphic Profiles

Soil profiles were used to estimate the settlement at various locations within the repository footprint. CPT data combined with profiles from borehole logs were used to determine the thickness of the material layers (cover/fill, coarse- or fine-grained tailings, and alluvium), as well as the contact between the different layers in each soil profile. The cone resistance and electrical resistivity measurements were used to identify contact locations between the cover/fill material, coarse tailings, fine tailings, and underlying alluvium. The cone sleeve resistance, f_s, and resistivity were plotted with depth to identify a trend or correlation between material contacts. The material contacts were verified with the borehole logs for seven paired locations, and the correlations were then used for the remaining CPT-only locations. The CPT profile plots used for interpretation are included as **Attachment A**. The borehole logs used are included as **Attachment B**. The CPT logs and complete CPT report are included in the PDS report but are not attached here.

The paired borehole and CPT locations were used to evaluate CPT properties for comparison with visual classification from the borehole logs. The trends for sleeve resistance and resistivity were semi-quantitatively used to identify the layers of fine tailings, coarse tailings and alluvium, using the paired borehole/CPT locations of B1, B2, B8, B10, B11, B15, and B23.

The cover/fill material exhibited the highest cone resistances and resistivity values. The coarse tailings had similar resistivity values to the cover/fill material, but exhibited lower overall average cone resistance values. The cone resistance values for the cover/fill material typically was greater than 2.0 tons per square foot (tsf), whereas the cone resistance values for the coarse tailings material typically ranged from about 0.5 to 2.0 tsf. While these values denoted the typical range, the limits varied depending on the CPT data, typically reducing the range (i.e., 0.5 to 1.0 tsf). These limits for the coarse tailings cone resistance values are shown on each CPT profile by a vertical green line. The resistivity values of the cover/fill material and coarse tailings were typically in the range of 630 to 700 ohm-m, however some coarse tailings resistivity measurements were as low as zero.

The fine tailings were identified based on the combination of the sleeve resistances, f_s, of less than 0.5 tsf and low or zero resistivity measurements. The lower limit of the coarse tailings sleeve resistance limit shown by the vertical green

line on the CPT profiles also denotes the upper limit of the fine tailings sleeve resistances. At CPT-1, sleeve resistances in the fines ranged up to 1.8 tsf, however the fines content of the fine-grained tailings at this location was on the order of 53 to 69 percent, which was generally less than the fines content for fine-grained tailings at other locations.

Sixteen of the 25 CPTs encountered fine-grained tailings in contact with the alluvium. Typically, sleeve resistance values increased from approximately 0.2-0.3 tsf in the fine-grained tailings to 0.7-1.0 tsf or greater in the underlying alluvial material. Resistivity increased from zero ohm-m in the fine-grained tailings to approximately 450-650 ohm-m in the alluvium. In five of the 25 CPTs (CPT-05, CPT-15, CPT-23, CPT-26, CPT-28), coarse-grained tailings were in contact with the underlying alluvial material. The sleeve resistance provided the most distinct pattern at the transition from coarse-grained tailings to the alluvium. The resistance increased from about 0.5-1.5 tsf in the coarse-grained tailings to 1.5-2.5 tsf in the alluvium. The remaining four CPT locations (CPT-13, CPT-24, CPT-25, and CPT-27) did not contain tailings material and encountered either cover/fill material and alluvium, or just alluvium.

Layer thicknesses were limited to a minimum depth of 2 feet to minimize the number of layers in each soil layer profile. To be conservative, profiles that showed potential lenses of small, intermittent coarse- and fine-grained tailings were assumed to be one layer of fine tailings. Fine-grained tailings were assumed to be fully saturated, with the exception of two locations (CPT-23 and CPT-29), and the compression index (Cc) values measured in the lab were used to estimate total primary consolidation. Profiles of CPT holes were interpreted based on the profiles from the paired CPT/boreholes locations and the locations within the TDA. Based on the CPT interpretation and boring logs, it was determined that the fine-grained tailings at locations CPT-23 (TI-B23) and CPT-29 are unsaturated and, therefore, settlement will not occur at these two locations.

Stress increases for the settlement calculations are based on the repository cover thickness, and the proposed thickness of the mine spoils at each specific location, determined from the design grading plan.

Settlement totals include primary and secondary consolidation in the fine-grained tailings. These calculations excluded the coarse-grained tailings and alluvium. Immediate settlement included settlement totals for the radon barrier material and coarse-grained tailings (the unsaturated materials).

Calculations

Primary Consolidation

Settlement of the fine-grained tailings resulting from fill placement of the mine waste and cover is assumed to initiate as loading begins and progress to completion as the porewater pressures within the fine-grained tailings dissipate. Primary consolidation was calculated using the following equation:

$$S = \frac{C_c H}{1 + e_0} \log \frac{\sigma'_f}{\sigma'_i}$$

where:

- S = settlement (ft)
- C_c = compression index
- H = thickness of tailings layer (ft)
- e_0 = initial void ratio of tailings
- σ'_I = initial average effective overburden pressure (psf)
- σ'_f = final effective vertical pressure (psf)

The total estimated primary consolidation was calculated for the fine-grained tailings layer in each CPT vertical soil profile location.

Secondary Consolidation

Additional settlement is expected to occur due to creep (secondary consolidation). For secondary consolidation, the secondary consolidation coefficient, C_α, was estimated from a time-compression curve. This curve was plotted using laboratory test data from consolidation tests performed on fine-grained tailings at borehole locations TI-B8, TI-B10, and TI-B11 (these plots will be included in the Pre-final Design). The elapsed time (log time) and dial reading data for each load step were plotted in excel to obtain the time-compression curve, and C_α was estimated by the slope of the final portion of the curve. The secondary consolidation was then calculated at each CPT location using the following equation:

$$S_s = C_\alpha * H * \log\left(\frac{t_2}{t_1}\right)$$

where:

- S_s = secondary settlement (ft)
- C_α = secondary consolidation coefficient
- H = layer thickness of the fine-grained tailings (ft)
- t_2 = time from t_1 (yrs)
- t_1 = time to complete primary consolidation (yrs)

The consolidation tests were performed at four load increments, and the C_α value was calculated for each of the four load increments in each consolidation test. The average C_α values were then calculated from each similar load increment from the consolidation tests at different locations. The C_α value used in the settlement calculations depended on the final effective stress at the mid-point of the fine-grained tailings layer at each CPT location. The average calculated C_α values and the range of stresses to which they apply are shown in **Table 2**.

The time to complete primary consolidation, t_1, was estimated using data in the Central Cell Interim Stabilization As-Built Report (Canonie, 1992). Canonie recorded settlement data prior to construction activities and continued monitoring for several months after completing the interim soil cover construction, totaling 280 days of monitoring. Canonie reported that the data showed that 90 percent of primary consolidation had occurred at the end of 280 days of monitoring. The data suggests that monitoring was terminated too soon to determine when primary consolidation would have been complete. Stantec estimates from graphical interpretation using the Square-Root-of-Time Method that primary consolidation would have been completed by approximately 458 days. A second calculation was conducted using the time rate of consolidation theory, which estimates that consolidation would have been completed by 588 days. These calculations can be found in **Attachment E**. Since the data from the previous reclamation cover construction indicates that primary consolidation would have lasted more than 280 days, this settlement analysis assumed 280 days as a conservative estimate. It is anticipated that the tailings will complete the new primary consolidation in a shorter duration than previously since the material has been consolidating for nearly 30 years already and the new fill load will be significantly larger than the fill place previously for the current cover system. The secondary consolidation was calculated at a time (t_2) of 200 years from the completion of primary consolidation. The primary and secondary consolidation spreadsheet calculations are included in **Attachment C**.

Immediate Settlement

Immediate settlement of the unsaturated upper layers of the TDA beneath the repository will occur while the waste is placed and compacted. Therefore immediate settlement is not anticipated to contribute to the long-term performance of the new repository cover. However, immediate settlement was estimated in order to evaluate the potential for cover cracking of the existing radon barrier in locations where fill will be placed adjacent to areas of the radon barrier where fill will not be placed. Immediate settlement was estimated for the existing unsaturated cover, fill, and tailings, near areas where the repository cover slope will transition directly to the existing radon barrier. This was done for three locations near the southwest edge of the repository (B15/CPT-15, CPT-26, and B01/CPT-01). Around the perimeter of the repository, in the remainder of the areas, the cover will extend either to an existing swale or channel, or beyond the

edge of the radon barrier. The estimate of immediate settlement was completed using a similar approach to that described in NAVFAC (Department of the Navy, 1986). The immediate settlement is estimated by the following equation:

$$\delta_v = \Delta q * B * \frac{\left(1-\nu^2\right)}{E} * I$$

where:

Δq = applied uniform pressure, kips per square foot (ksf)
B = width of the loaded area (ft)
I = combined shape and rigidity factor
ν = Poisson's ratio
E = modulus of elasticity (ksf)

The proposed thickness of the repository mine waste and cover materials were used to estimate Δq at each of the three selected CPT locations. The southwest slope of the repository where the three CPT holes are located was divided into three 250-foot sections (by width). The width of the loaded area, B, was assumed to be 250 feet for each of the calculations since the three borings were drilled at approximately equidistant spacing along the entire 750 feet of fill slope in contact with the existing cover. Therefore, the slope was divided into thirds and the profiles from each borehole or CPT were applied to a 250 foot section. The three borings used to complete the calculations were B15/CPT-15, CPT-26, and B01/CPT-01.

The vertical soil profiles were used to determine the thicknesses of each layer to the base of the coarse-grained tailings material. The CPT cone resistance (q_c) data with depth was used to estimate the modulus of elasticity, E, for the profiles. A correlation between E and q_c (McCarthy, 1998) was applied to each layer material, depending on the soil type. An average E value was then estimated for each material type based on the CPT. Published values of E by material type were also to calculate a weighted average of E for the profile. These weighted averages were compared with the values calculated from the cone resistances and the lower E values were selected for the settlement calculation, to present a more conservative total result.

The value of ν was estimated for each layer using a typical range of values from (McCarthy, 1998), and was based on both soil type and the estimated E value. The shape and rigidity factor, I, was taken from the NAVFAC table (Table 1, Section 7.1), assuming a circular (flexible) shape and rigidity, calculated on the edge of the shape. This is based on the locations of interest being on the edge of the repository. This approach and selection of the I value is assumed to be conservative since the shape of the fill is gently sloping and the shape factor in the references is for a circular vertical load (such as a tank) which would concentrate more load at the perimeter than the repository does.

The immediate settlement spreadsheet calculations are included in **Attachment D**.

Results

A settlement analysis was conducted to estimate future settlement after placement of the mine waste and final cover. The total settlement estimates ranged in value from 0.00 feet to 1.8 feet, by location. The primary and secondary consolidation at each CPT location is summarized in **Table 3**. The post-settlement surface is attached on **Figure 1**. The spreadsheet calculations of the settlement analysis are provided in **Attachment C**.

The sensitivity analysis conducted on the settlement analysis resulted in a slight increase in settlement values when using the 60th percentile value for the fine-grained tailings C_c. The total settlement estimates ranged in value from 0.0 feet to 1.9 feet, by location. These results show that varying the critical property, C_c of the fine-grained tailings, had little effect on the calculated total settlement values. The primary and secondary consolidation at each location resulting from the sensitivity analysis are summarized in **Table 4.**

The immediate settlement calculations estimated 1.0 feet at CPT-15, 0.6 feet at CPT-26, and 0.1 feet at CPT-01.

Conclusions

Evaluation of total long-term settlement due to waste and final cover placement indicates potential future settlement of the cover ranging from 0 to 1.8 feet. The estimated settlement of the cover is small enough that slope reversal and ponding are not expected to occur on the final cover surface. **Figure 1** shows the post-settlement surface and **Figure 2** shows cross-sections confirming that slope reversal and ponding are not expected to occur.

Attachments

Figure 1 – Estimated Consolidation and Settled Isopach Contours
Figure 2 – Settled Surface Cross-Sections

Attachment A – Paired borehole logs
Attachment B – CPT profile interpretations
Attachment C – Consolidation spreadsheet calculations
Attachment D – Immediate settlement calculations
Attachment E – Estimated time to complete primary consolidation

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TABLES

Table 1: Material Properties

Material	Specific Gravity, G_s	Dry Unit Weight, γ_d (pcf)	Moist Unit Weight, γ_m (pcf)	Water Content, w (%)	Void Ratio, e	Compression Index, C_c
Coarse-grained tailings	2.67	97.5	108.1	10.9	0.71	0.084
Fine-grained tailings	2.70	71.7	107.6	50.1	1.35	0.408
Cover soil	2.69	115.0	114.7[1]	10.8	0.62[2]	0.086
Mine spoils	2.66	118.3	116.4[1]	9.3	0.56[2]	0.086
Erosion protection	2.71	130.0	122.9	5.0	0.45[2]	NA[3]

[1] Moist unit weights for cover soil, mine waste, and erosion protection materials were calculated at 90 percent relative compaction, $\gamma_{m90}=0.9*(\gamma_d+\gamma_d*w)$

[2] Void ratio for cover soil, mine waste, and erosion protection materials were calculated at 90 percent relative compaction, $e_{90}=\{[1-(0.9*\gamma_d/G_s*\gamma_w)]/(0.9*\gamma_d/G_s*\gamma_w)\}$

[3]It was assumed the erosion protection layer will not settle, and assuming a compression index value for this material was unnecessary.

Table 2: Secondary Consolidation Coefficient Values for Load Increments

Effective Stress	C_α
<1650 psf	0.0017
1650 – 3250 psf	0.0036
3250 – 6500 psf	0.0047
6500 – 13000 psf	0.0087

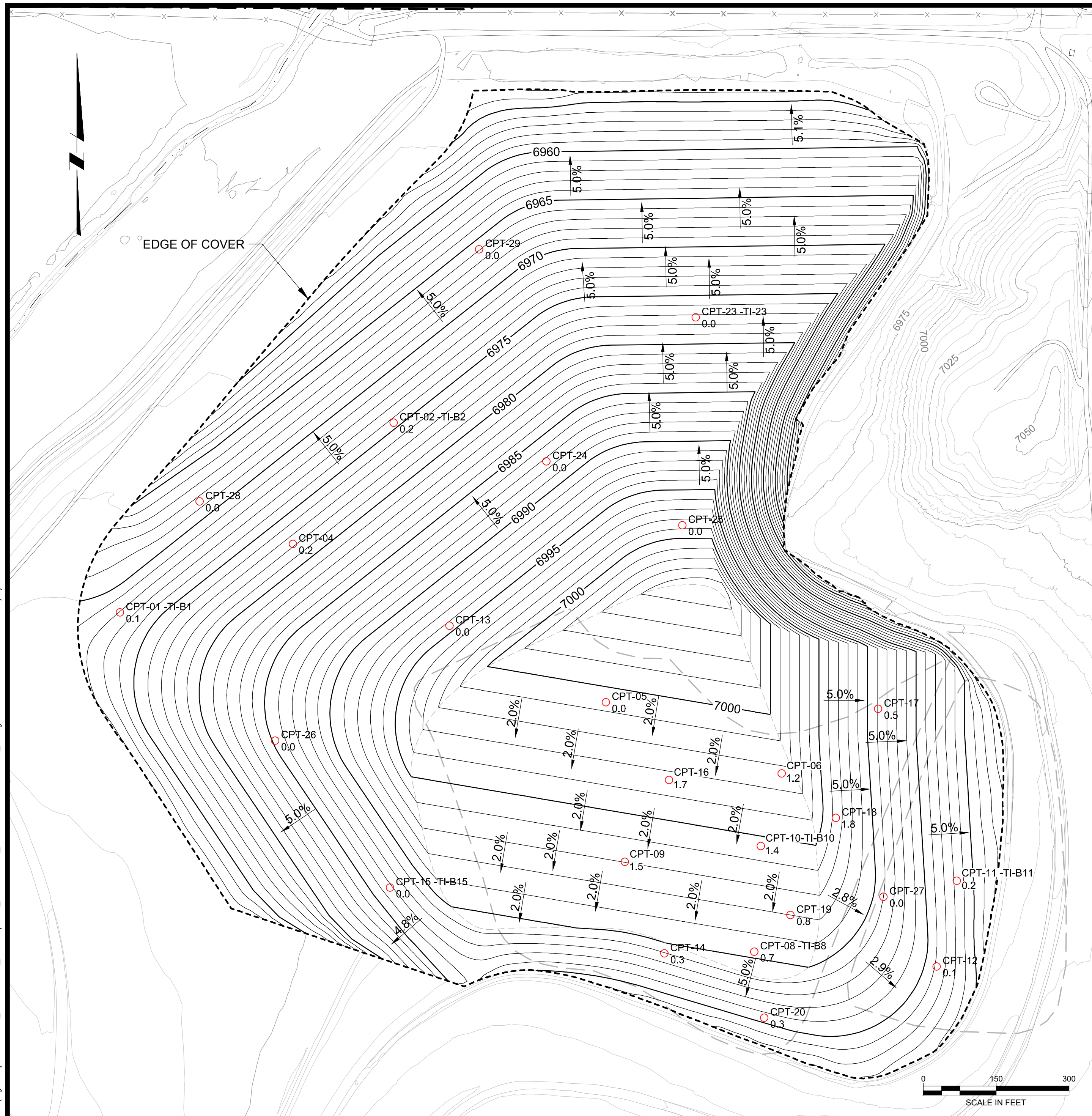
Table 3: Settlement Summary

Location	Primary Consolidation (ft)	Secondary Consolidation (ft)	Total Settlement (ft)
CPT-01 (TI-B1)	0.02	0.05	**0.1**
CPT-02 (TI-B2)	0.13	0.03	**0.2**
CPT-04	0.17	0.04	**0.2**
CPT-05	0.00	0.00	**0.0**
CPT-06	1.03	0.22	**1.2**
CPT-08 (TI-B8)	0.51	0.21	**0.7**
CPT-09	1.13	0.34	**1.5**
CPT-10 (TI-B10)	1.08	0.29	**1.4**
CPT-11 (TI-B11)	0.08	0.14	**0.2**
CPT-12	0.02	0.03	**0.1**
CPT-13	0.00	0.00	**0.0**
CPT-14	0.20	0.05	**0.3**
CPT-15 (TI-B15)	0.00	0.00	**0.0**
CPT-16	1.34	0.32	**1.7**
CPT-17	0.40	0.09	**0.5**
CPT-18	1.45	0.35	**1.8**
CPT-19	0.59	0.21	**0.8**
CPT-20	0.19	0.12	**0.3**
CPT-23 (TI-23)	0.00	0.00	**0.0**
CPT-24	0.00	0.00	**0.0**
CPT-25	0.00	0.00	**0.0**
CPT-26	0.00	0.00	**0.0**
CPT-27	0.00	0.00	**0.0**
CPT-28	0.00	0.00	**0.0**
CPT-29	0.00	0.00	**0.0**

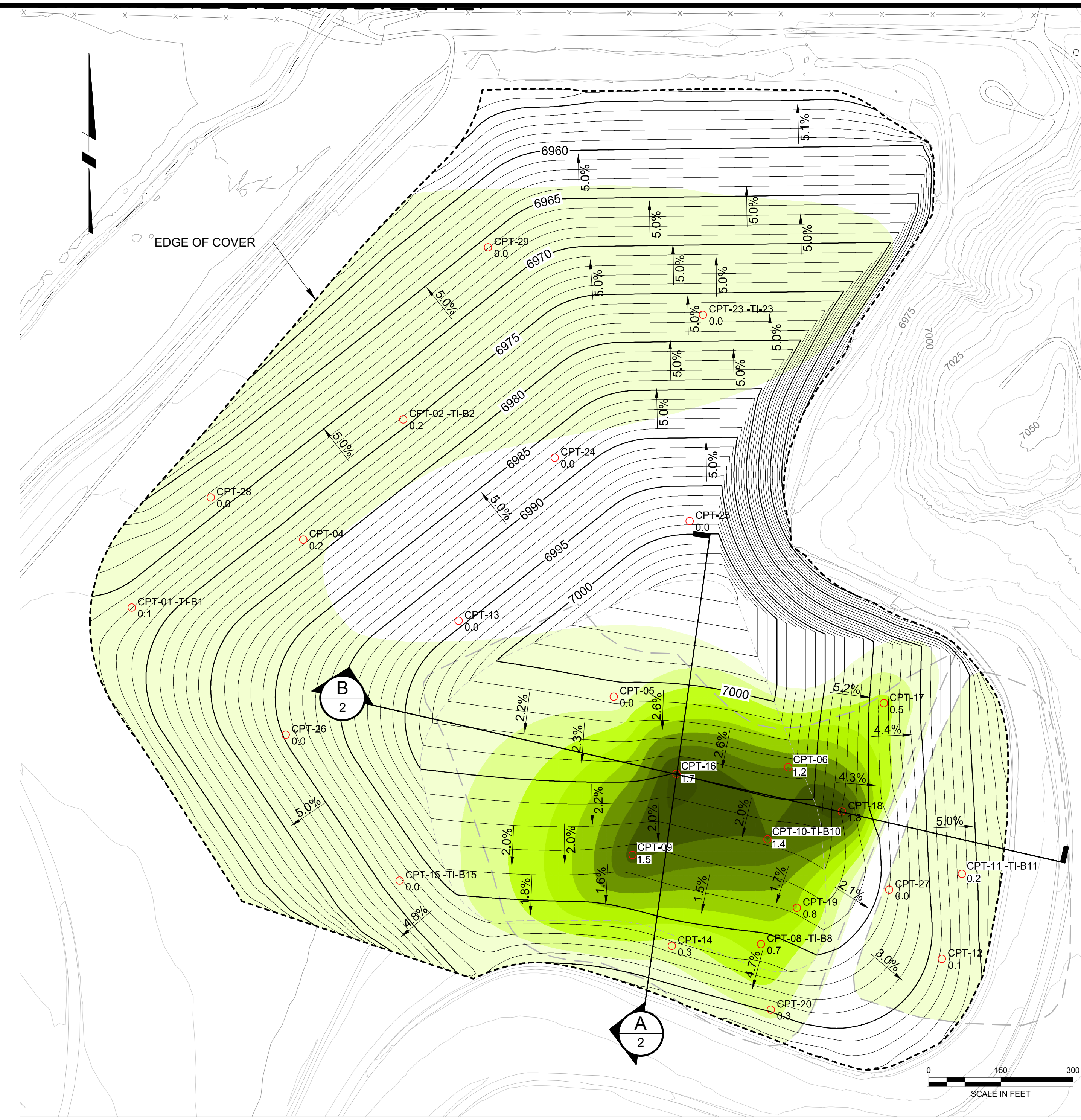
Table 4: Sensitivity Analysis Settlement Summary

Location	Primary Consolidation (ft)	Secondary Consolidation (ft)	Total Settlement (ft)
CPT-01 (TI-B1)	0.03	0.05	**0.1**
CPT-02 (TI-B2)	0.14	0.03	**0.2**
CPT-04	0.19	0.04	**0.2**
CPT-05	0.00	0.00	**0.0**
CPT-06	1.13	0.22	**1.3**
CPT-08 (TI-B8)	0.56	0.21	**0.8**
CPT-09	1.24	0.34	**1.6**
CPT-10 (TI-B10)	1.18	0.29	**1.5**
CPT-11 (TI-B11)	0.09	0.14	**0.2**
CPT-12	0.02	0.03	**0.1**
CPT-13	0.00	0.00	**0.0**
CPT-14	0.22	0.05	**0.3**
CPT-15 (TI-B15)	0.00	0.00	**0.0**
CPT-16	1.47	0.32	**1.8**
CPT-17	0.44	0.09	**0.5**
CPT-18	1.59	0.35	**1.9**
CPT-19	0.64	0.21	**0.9**
CPT-20	0.21	0.12	**0.3**
CPT-23 (TI-23)	0.00	0.00	**0.0**
CPT-24	0.00	0.00	**0.0**
CPT-25	0.00	0.00	**0.0**
CPT-26	0.00	0.00	**0.0**
CPT-27	0.00	0.00	**0.0**
CPT-28	0.00	0.00	**0.0**
CPT-29	0.00	0.00	**0.0**

FIGURES



DESIGN CONTOURS AND TOTAL ESTIMATED CONSOLIDATION SETTLEMENT



CONSOLIDATION SETTLEMENT AND SETTLED SURFACE CONTOURS

LEGEND:

- 7200 — EXISTING GROUND SURFACE CONTOUR & ELEVATION, FEET
- 7200 — PROPOSED SURFACE CONTOUR & ELEVATION, FEET
- EXISTING ROAD
- EXISTING DRAINAGE
- FENCE
- BOUNDARY OF REPOSITORY
- BORROW PIT BOUNDARY
- CPT-26 1.8 — ESTIMATED TOTAL SETTLEMENT (FT)

SETTLEMENT DEPTHS			
Number	MIN (FT)	MAX (FT)	Color
1	0.0	0.2	
2	0.2	0.4	
3	0.4	0.6	
4	0.6	0.8	
5	0.8	1.0	
6	1.0	1.2	
7	1.2	1.4	
8	1.4	1.6	
9	1.6	1.8	
10	1.8	2.0	

NOTE(S):

1. THE ESTIMATED SETTLEMENT TOTALS INCLUDE PRIMARY CONSOLIDATION AND SECONDARY CONSOLIDATION IN THE FINE-GRAINED TAILINGS.

DESIGNED S DOWNEY
CHECKED C FOWLER
APPROVED S DOWNEY

MWH now part of Stantec

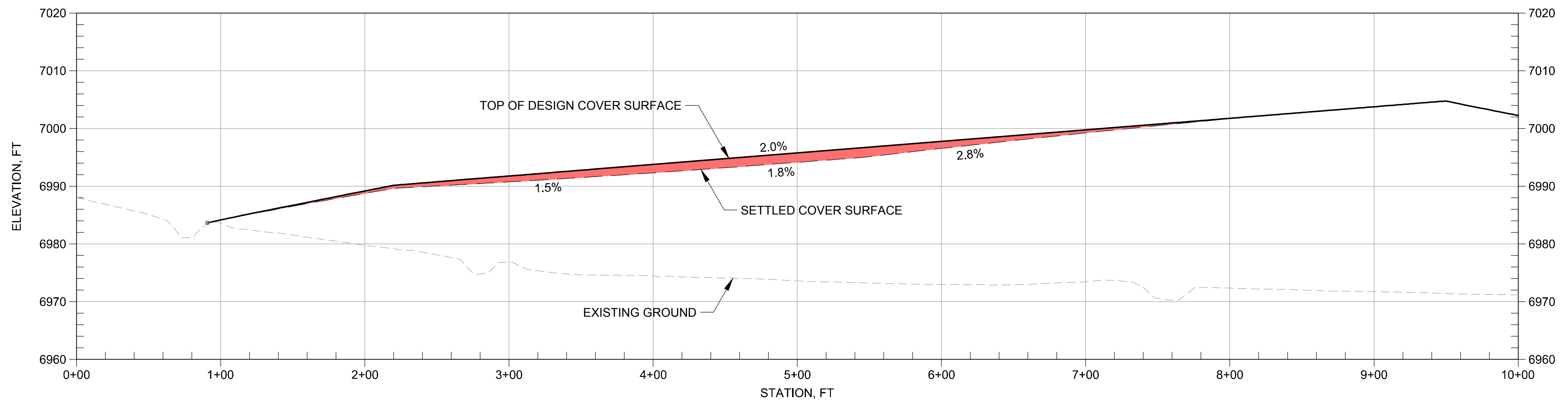
UNITED NUCLEAR CORPORATION AND NORTHEAST CHURCH ROCK MINE
McKINLEY COUNTY, NEW MEXICO

TOTAL ESTIMATED CONSOLIDATION SETTLEMENT

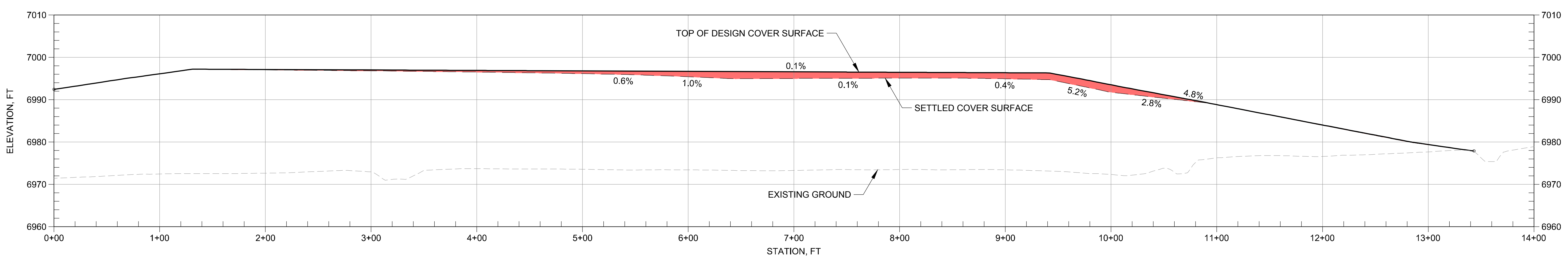
FIGURE 1

10508639

JULY, 2017



A
-
CROSS SECTION A



B
-
CROSS SECTION B

LEGEND:

AREAS OF SETTLEMENT

DESIGNED S DOWNEY

CHECKED C FOWLER

APPROVED S DOWNEY

MWH now part of Stantec

UNITED NUCLEAR CORPORATION AND NORTHEAST CHURCH ROCK MINE
McKINLEY COUNTY, NEW MEXICO

TOTAL ESTIMATED CONSOLIDATION SETTLEMENT
CROSS SECTIONS

FIGURE
2
10508639
JULY, 2017

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ATTACHMENT A

PAIRED BOREHOLE LOGS

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B1**

CONTRACTOR INFORMATION	DRILL RIG INFORMATION		BOREHOLE INFORMATION	
DRILLING COMPANY: NATIONAL	DRILLING RIG: CME 85 HD	BIT TYPE: N/A	CASING DEPTH: N/A	START: 11/21/2013
DRILLER: M. CAIN	DRILLING METHOD: HSA/CC	AUGER O.D.: 8.25"	SURFACE ELEV. (FT): 6969.7	FINISH: 11/21/2013
DRILLER'S HELPER: J. RAMIREZ	HAMMER TYPE: AUTO	HOLE DIAM.: 8.25"	DEPTH TO BEDROCK (FT): N/A	
LOGGED BY: R. SCHAUT	HAMMER WT: 140 lb	CORE DIAM.: 3.0"	TOTAL DEPTH (FT): 70.0	

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
0	14"				NA	(0' - 8") SILTY CLAY (FILL) - Light brown, soft, moist silty clay, trace to few very fine to fine sand.												
						(8" - 12") ROCK - 1/2" to 3" crushed basalt.												
1						(1' - 18.5') SILTY CLAY WITH SAND (FILL) - Dark brown, firm to hard, slightly moist silty clay, little to some very fine to fine sand, occasional coarse sand and gravel (upper ~5' may be compacted radon barrier).												
2																		
3						[0 - 5' Core not retained.]												
4																		
5	24"	CA 18"	1C	8														
			1B	9														
6			1A	11														
		AC	2															
7																		
8																		
9																		
10	30"	CA 18"	3C	10		[Below ~10', occasional elevated rad readings indicating possible sand tailings mixed with silty clay fill.]												
			3B	12														
11			3A	14		(~11' - ~11.5') 1/2" to 1" gravel observed.												
		AC	4															
12																		
13																		

LEGEND:
CA = CALIFORNIA SAMPLE (2-INCH OD)
ST = SHELBY TUBE (3-INCH OD)
AC = ACRYLIC LINER
HSA = HOLLOW-STEM AUGER
CC = CONTINUOUS CORE
NR = NO RECOVERY

NOTES:
Rad levels measured with Ludlum Model 2 meter. Hole backfilled with cement/bentonite grout.

MWH

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B1**

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	30"	AC	4		NA												
14						(~13 - ~14') - Sand Tailings - see description below, slightly elevated rad readings.]											
15	32"	CA 18"	5C	5													
			5B	6													
16			5A	10			CL	16.2	104.7		33/13/20	0.3	27.2	72.5			
		AC	6														
17																	
18																	
19						(18.5' - 34.3') SAND TAILINGS - Pale gray, dense, moist, fine to medium sand tailings, slightly elevated rad levels.											
20	36"	CA 18"	7C	19													
			7B	22				6.1									
21			7A	24				7.5	105.5			0.0	90.7	9.3	3.7E-4		
22		AC	8														
23																	
24																	
25	30"	ST 28"	9														
26																	
27								4.0	97.6	2.67	NP	0.0	92.7	7.3	2.9E-3		34.9
		AC	10														

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Rad levels measured with Ludlum Model 2 meter. Hole backfilled with cement/bentonite grout.

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	FIELD SAMPLE RECOVERY DATA								LABORATORY TEST DATA									
28	30"	AC	10		NA													
29																		
						(29.6' - 34.3') Very fine grained sand tailings, abundant clayey zones.												
30	36"	CA 18"	11C	5					13.9									
			11B	5					14.6	91.6						3.0E-7	0.092	
31			11A	4														
							CL		41.6	76.5	2.69	44/17/27	0.0	30.9	69.1			33.3
32		AC	12				CL		27.8			33/16/17	0.0	46.7	53.3			
33																		
34																		
						(34.3' - ~41') CLAYEY SAND - Loose to medium dense, very moist to wet, very fine-grained clayey sand, increasing clay content with depth.												
35	40"	CA 18"	13C	7														
			13B	20														
36			13A	22		(35' - 36.5') High blow counts due to rock in CA shoe.			21.0	97.3	2.73		0.0	62.5	37.5	1.7E-6	0.059	
		AC	14B															
37																		
		AC	14A															
38																		
39																		
40	42"	CA 18"	15C	3														
			15B	5														
41			15A	5		(~41' - ~45') SANDY CLAY - Very moist to wet sandy clay, sand is very fine-grained.	CL		26.7	98.6		31/15/16	0.0	18.2	81.8	1.2E-7		
42																		

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Rad levels measured with Ludlum Model 2 meter. Hole backfilled with cement/bentonite grout.

MWH

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B1**

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
42	42"	AC	16		NA													
45	40"	ST 30"	17			(~45' - 54') CLAYEY SAND - Loose to medium dense, very moist to wet, very fine-grained clayey sand, decreasing clay content with depth.			22.0	106.0							.058	34.4
50	42"	CA 18"	18C	4														
			18B	5														
			18A	7														
54						(54' - 68.2') SILTY CLAY - Dark brown, firm, very moist to wet silty clay, trace to few very fine sand.												
55	60"	CA 18"		6														
			19B	7														
			19A	10														

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Rad levels measured with Ludlum Model 2 meter. Hole backfilled with cement/bentonite grout.

CLIENT:

PROJ. LOC.: GALLUP, NM

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B1**

FIELD SAMPLE RECOVERY DATA									LABORATORY TEST DATA										
DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	60"				NA													
60	60"	CA 18"		5														
			20B	8														
61			20A	12														
65	60"	CA 18"		5														
			21B	7														
66			21A	11														
68						(68.2' - E.O.B.) SILTY SAND - Brown, silty, moist very fine to fine sand.												
70						E.O.B. at 70.0'												

LEGEND:

- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Rad levels measured with Ludlum Model 2 meter. Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B2**

CONTRACTOR INFORMATION	DRILL RIG INFORMATION		BOREHOLE INFORMATION	
DRILLING COMPANY: NATIONAL	DRILLING RIG: CME 85 HD	BIT TYPE: N/A	CASING DEPTH: N/A	START: 11/20/2013
DRILLER: M. CAIN	DRILLING METHOD: HSA/CC	AUGER O.D.: 8.25"	SURFACE ELEV. (FT): 6959.9	FINISH: 11/21/2013
DRILLER'S HELPER: J. RAMIREZ	HAMMER TYPE: AUTO	HOLE DIAM.: 8.25"	DEPTH TO BEDROCK (FT): 33.5	
LOGGED BY: R. SCHAUT	HAMMER WT: 140 lb	CORE DIAM.: 3.0"	TOTAL DEPTH (FT): 38.7	

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
0	8"					(0" - 3") SILTY CLAY - Brown, soft, silty clay, dry, trace few very fine to fine sand.												
						(3" - 6") ROCK - 1/2" to 3" crushed basalt.												
1		CA 17"	1B	13 / 11		(6" - ~2.5') SILTY CLAY - Dark brown, hard, slightly moist silty clay, few to little very fine sand, occasional coarse sand.												
2			1A	18		[0' - 5' Core not retained.]												
3						(~2.5' - 7.3') SILTY SAND WITH GRAVEL - Pale yellow, dense, dry to slightly moist silty very fine to medium sand with coarse sand and gravel.												
5	42"	CA 15"	2B	23 / 22														
6			2A	18					7.7	100.4	2.68		26.9	29.9	43.2			
		AC	3															
7.3		AC	4			(7.3' - 12.8') CLAYEY SAND - Predominantly brown, medium dense, slightly moist to moist clayey fine to medium sand, abundant clay "pockets" throughout. May be sand tailings mixed with site soils.												
10	40"	CA 18"	5C	6														
			5B	7														
11			5A	7					24.5	75.9	2.73		0.0	65.4	34.6			
		AC	6															
		AC	7															
13						(12.8' - 15') SAND TAILINGS - Pale gray, moist sand												

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Rad levels measured with Ludlum Model 2 meter. Hole backfilled with cement/bentonite grout.
At 8:30 AM on 11/21/13, water was measured at 38.3' bgs (may be due to overnight precipitation).

MWH	CLIENT: GE / UNC	BORING LOG	BOREHOLE ID: TI-B2
PROJ. LOC.: GALLUP, NM	NECR - PRE DESIGN STUDY INVESTIGATION		

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	40"	AC	7			tailings, very fine silty sand from 12.8' to 13.2', fine to medium sand from 13.2' to 15'.			39.6				0.0	23.1	76.9			
14																		
15	42"	CA 18"	8C	5		(15' - 25.7') SILTY SAND - Brown, medium dense, moist silty very fine to fine sand, occasional roots. Appears to be natural "alluvium." Occasional dark brown clay lenses. Rad levels ~ background.			6.9	90.4	2.68							
			8B	5														
16			8A	7														
		AC	9															
17																		
		AC	10															
18																		
19																		
20	42"	CA 18"	11C	4														
			11B	4														
21			11A	6					7.0	91.4	2.74		0.0	82.9	17.1			
		AC	12															
22																		
		AC	13															
23																		
24																		
25	48"	CA 18"	14C	5														
			14B	6														
26			14A	6		(25.7' - 33.5') SILTY CLAY - Dark brown, moist, firm to hard, silty clay, trace to few very fine to fine sand, occasional coarse sand.	CL		23.5	93.2		34/16/18	0.0	20.9	79.1			
27																		

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Rad levels measured with Ludlum Model 2 meter. Hole backfilled with cement/bentonite grout.
At 8:30 AM on 11/21/13, water was measured at 38.3' bgs (may be due to overnight precipitation).

MWH

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B2**

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
28	48"																	
30	54"	CA 18"	15C	6														
			15B	11														
31			15A	12														
32						(32' - 33.5') Softer (soft to firm).												
33.5						(33.5' - 38.7') WEATHERED SANDSTONE - Mottled pale yellow and reddish orange, moist, fissile, lightly cemented, very fine to fine sand.												
35	48"	NR		50/ 1"														
38.5					16	Bag sample of SS Core.			13.5	X								
38.7						E.O.B. = 38.7' (Practical Auger Refusal)												

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Rad levels measured with Ludlum Model 2 meter. Hole backfilled with cement/bentonite grout.
At 8:30 AM on 11/21/13, water was measured at 38.3' bgs (may be due to overnight precipitation).

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B3**

CONTRACTOR INFORMATION	DRILL RIG INFORMATION		BOREHOLE INFORMATION	
DRILLING COMPANY: NATIONAL	DRILLING RIG: CME 85 HD	BIT TYPE: N/A	CASING DEPTH: N/A	START: 11/19/2013
DRILLER: M. CAIN	DRILLING METHOD: HSA/CC	AUGER O.D.: 8.25"	SURFACE ELEV. (FT): 6968.6	FINISH: 11/19/2013
DRILLER'S HELPER: J. RAMIREZ	HAMMER TYPE: AUTO	HOLE DIAM.: 8.25"	DEPTH TO BEDROCK (FT): N/A	
LOGGED BY: R. SCHAUT	HAMMER WT: 140 lb	CORE DIAM.: 3.0"	TOTAL DEPTH (FT): 70.0	

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
0	31"					(0' - 0.8') SANDY CLAY - Brown, hard, slightly moist sandy clay, silty, sand is fine-grained.												
0.8						(0.8' - 10.8') GRAVELLY SAND - Pale yellow, dense, slightly moist gravelly very fine to medium sand.												
5	33"	CA 7"		18		[Sample loose - not retained.]												
5.5				50/ 6"														
10	50"	CA 18"	1C	30														
10.5			1B	34														
11			1A	43		(10.8' - 16.8') SILTY SAND - Yellow/orange, dense, moist very fine to fine sand, silty, occasional gravel.			5.1	108.4	2.64		5.4	74.7	19.9			

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hold backfilled with cement/bentonite grout. At 7:45 AM on 11/20/14, water was measured at 65.8' bgs.

MWH

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B3**

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
13.5	50"																
15	38"	CA 18"	2C	18													
15.5			2B	21													
16			2A	28				4.7	105.3								
16.8						(16.8' - 46.5') SANDY CLAY - Dark brown, firm to hard, moist sandy clay, very fine to fine sand.											
20	50"	ST 28.5"	3														
21							CL	16.0	111.1		30/12/18	0.0	32.8	67.2			32.2, 195
22.6						(22.6' - 26') More sand and gravel.											
25	52"	CA 18"	4C	10													
25.5			4B	12													
26			4A	16			CL	12.0	106.8		25/13/12						

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hold backfilled with cement/bentonite grout. At 7:45 AM on 11/20/14, water was measured at 65.8' bgs.

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B3**

FIELD SAMPLE RECOVERY DATA | LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
28	52"																	
29																		
30	58"	CA 18"	5C	10														
			5B	10														
31			5A	19					16.1	108.4								
						(31.5' - 36') More sand: Sandy/Silty Clay.												
32																		
33																		
34																		
35	48"	ST 28"	6						10.5									
							SC		14.7	102.2	2.67	23/14/9	2.1	50.2	47.7			33.7, 135
36																		
37																		
38																		
39																		
40	57"	CA 18"	7C	3		(~40') Becomes very moist to wet.												
			7B	7														
41			7A	6					21.5	90.6			0.0	33.8	66.2			
42																		

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hold backfilled with cement/bentonite grout. At 7:45 AM on 11/20/14, water was measured at 65.8' bgs.

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	57"																	
43																		
44																		
45	48"	CA 17"		6														
			8B	7					17.0	110.1								29.3, 293
46			8A	12					18.0	104.8		28/13/15						
						(46.5' - ~55') SILTY/CLAYEY SAND - Brown, loose, very moist to wet, silty/clayey very fine sand.												
47																		
48																		
49																		
50	27"	CA 17"	9C	2		["B" and "C" samples are best.]												
			9B	3														
51			9A	6														
52																		
53																		
54																		
55	30"	ST 24"	10			(~55' - 57.3') SILTY CLAY - Dark brown, firm to hard, wet silty clay, few to little very fine sand.												
56																		
							CL		22.1	105.3	2.72	43/14/29	0.0	11.7	88.3			22.2, 494
57																		

LEGEND:
CA = CALIFORNIA SAMPLE (2-INCH OD)
ST = SHELBY TUBE (3-INCH OD)
AC = ACRYLIC LINER
HSA = HOLLOW-STEM AUGER
CC = CONTINUOUS CORE
NR = NO RECOVERY

NOTES:
Hold backfilled with cement/bentonite grout. At 7:45 AM on 11/20/14, water was measured at 65.8' bgs.

MWH

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B3**

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
57.3	30"					(57.3' - 61.9') SILTY SAND - Brown, loose, wet, silty very fine to fine sand.												
60	33"	CA 18"	11C	3														
			11B	5														
61			11A	4					25.8	99.0			0.0	22.0	78.0			
61.9						(61.9' - E.O.B.) SILTY CLAY - Dark brown, firm to hard, wet silty clay, trace to few very fine to fine sand.												
65	32"	ST 28"	12															
70						E.O.B. at 70'												

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hold backfilled with cement/bentonite grout. At 7:45 AM on 11/20/14, water was measured at 65.8' bgs.

CLIENT:

PROJ. LOC.: GALLUP, NM

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B8**

CONTRACTOR INFORMATION	DRILL RIG INFORMATION		BOREHOLE INFORMATION	
DRILLING COMPANY: NATIONAL	DRILLING RIG: CME 85 HD	BIT TYPE: N/A	CASING DEPTH: N/A	START: 12/3/2013
DRILLER: M. CAIN	DRILLING METHOD: HSA/CC	AUGER O.D.: 8.25"	SURFACE ELEV. (FT): 6976.1	FINISH: 12/4/2013
DRILLER'S HELPER: L. ALDAZ	HAMMER TYPE: AUTO	HOLE DIAM.: 8.25"	DEPTH TO BEDROCK (FT): 60.5	
LOGGED BY: R. SCHAUT	HAMMER WT: 140 lb	CORE DIAM.: 3.0"	TOTAL DEPTH (FT): 65.5	

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
0–7						(0' - ~7') SANDY CLAY - Dark brown, slightly moist sandy clay, silty, sand is very fine to fine-grained, occasional coarse sand and fine gravel. (0' - 20' No sampling. Material descriptions based on cuttings and should be considered approximate.)												
7–13						(~7' - ~18') SAND TAILINGS - Predominantly pale yellowish brown, fine to medium grained, slightly moist, some clayey material.												

Depth scale: 1 2 3 4 5 6 7 8 9 10 11 12 13

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

MWH

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B8**

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
14																		
15																		
16																		
17																		
18						(~18' - 20.7') SANDY CLAY - Dark brown, firm to hard, slighly moist sandy clay, very fine to fine sand, few to little coarse sand and fine gravel.												
19																		
20	36"					Begin sampling at 20'												
		AC	8															
21						(20.7' - 26.3') SAND TAILINGS - Pale yellow, medium dense, slightly moist to moist, fine to medium sand tailings, silty.												
22																		
23																		
24																		
25	54"	CA 18"	2C	7					9.0	103.7	2.72							
			2B	7					6.2	99.6			0.0	87.9	12.7	3.6E-4		
26			2A	10			SM		16.8	91.7		NP	0.0	76.0	24.0			
		AC	3B			(26.3' - ~31') FINE TAILINGS - Soft to firm, moist. (26.3' - 28.8') - Pale yellowish brown, few to little very fine sand.												
27																		
		AC	3A															

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B8**

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
28	54"	AC	3A															
29						(28.8' - 31') Pale gray, no sand.												
30	24"	ST 23"	4				CH		61.8	62.7		74/25/49	0.0	9.2	90.8		0.43	
31						(~31' - ~32.5') SAND TAILINGS - Pale yellowish brown, medium dense, moist, fine to medium sand, trace silt.			41.4									
32.5		AC	5			(~32.5' - 35') FINE TAILINGS WITH SAND - Pale gray, soft, moist, very fine to fine sand.												
35	30"	ST 28"	6			(35' - 38.6') CLAYEY/SILTY SAND TAILINGS - Pale yellowish gray, soft, moist, very fine to fine sand.			14.3	90.9	2.66							
35.5									16.5	89.6	2.67					1.6E-5		
37.5		AC	7															
38.6						(38.6' - 44.5') FINE TAILINGS - Pale gray, firm, moist, trace to few very fine sand.												
40	37"	ST 27"	8															
41									39.7	80.4	2.63							
41.5							SC / CL		34.3	83.6		35/16/19	0.0	51.2	48.8	1.3E-7	0.262	
42																		

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

	FIELD SAMPLE RECOVERY DATA								LABORATORY TEST DATA									
DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	37"	AC	9			(42.5' - 43.7') More sand (little to some).												
43																		
									29.3	92.3								
44									43.3	74.8			0.0	14.5	85.5	3.0E-8		
						(44.5' - 60.5') SILTY/CLAYEY SAND - Predominantly yellowish brown, medium dense, moist silty/clayey very fine to fine sand with abundant clay zones (as shown), occasional coarse sand throughout.					2.60							
45	48"	CA 18"	10C	6														
			10B	9		(44.5' - 47.5') Silty clay with sand.												
46			10A	10			CL		21.9	95.2	2.72	30/16/14	0.0	27.9	72.1			
47																		
48																		
49						(49' - 50') Reddish brown.												
50	40"	CA 18"		9														
			11B	10														
51			11A	12														
52																		
53																		
						(53.4' - 55') Silty clay with sand.												
54																		
55	42"	CA 18"	12C	8														
			12B	8														
56			12A	8			SM		12.6	97.6	2.70	NP	0.0	57.0	43.0			
57																		

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM

CLIENT: NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B8**

FIELD SAMPLE RECOVERY DATA | LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	42"																	
58																		
59						(58.7' - 59.5') Silty clay with sand.												
						(59.5' - 60') Reddish brown, fine to medium sand.												
60	48"	CA 18"	13C	16														
			13B	22		(60.5' - 61') COAL - sandy.												
61			13A	50/ 4"		(61' - E.O.B.) SHALE - Dark grayish brown, hard to very hard, moist, silty, trace very fine sand.												
62																		
63					14	(bagged core)												
64	12"					At 64' - becomes fissile, very hard, brittle, more sand (few to little).												
65		CA 2"	15	50/ 2"		65.2' E.O.B. (Practical Auger Refusal at 65.0')												
66																		
67																		
68																		
69																		
70																		
71																		

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

MWH

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B10**

CONTRACTOR INFORMATION	DRILL RIG INFORMATION		BOREHOLE INFORMATION	
DRILLING COMPANY: NATIONAL	DRILLING RIG: CME 85 HD	BIT TYPE: N/A	CASING DEPTH: N/A	START: 11/26/2013
DRILLER: M. CAIN	DRILLING METHOD: HSA/CC	AUGER O.D.: 8.25"	SURFACE ELEV. (FT): 6973.3	FINISH: 11/27/2013
DRILLER'S HELPER: J. RAMIREZ	HAMMER TYPE: AUTO	HOLE DIAM.: 8.25"	DEPTH TO BEDROCK (FT): 105.0	
LOGGED BY: R. SCHAUT	HAMMER WT: 140 lb	CORE DIAM.: 3.0"	TOTAL DEPTH (FT): 108.2	

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
0	21"					(0' - 0.6') SANDY CLAY - Light brown, soft, very moist sandy clay, very fine sand, some roots, silty.												
						(0.6' - 0.9') ROCK - 1/2" to 3" crushed basalt.												
1						(0.9' - 6.8') SANDY CLAY - Dark brown, hard, slighly moist to moist sandy clay, very fine to fine sand, occasional coarse sand to fine gravel, silty.												
2																		
3																		
4																		
5	45"	CA 17"		12														
			1B	13														
6			1A	19														
7						(6.8' - 18.9') SILTY SAND TAILINGS - Pale yellowish gray, loose to medium dense, moist, fine to medium, silty sand tailings, occasional more clayey/silty zones.												
8																		
9																		
10	33"	ST 27.5"	2						9.7	110.0	2.63							
									9.0	96.8			0.2	71.9	27.9	4.3E-4	0.094	
11																		
12																		
		AC	3						6.7		2.61							
13									7.5	99.1			0.7	71.5	27.8	6.7E-5		

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B10**

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	33"	AC	3														
14																	
15	42"	CA 18"	4C	5				9.3	103.0								
			4B	5													
16			4A	5			SM	6.5	100.0	2.65	NP	2.4	82.3	15.3			
		AC	5B														
17																	
		AC	5A														
18																	
19						(18.9' - 24.4') FINE TAILINGS - Pale gray, soft, moist, trace to few fine to medium sand.											
20	36"	ST 30"	6														
21																	
							CL	26.7	92.9		43/19/24	0.0	43.0	57.0		0.111	
22																	
		AC	7														
23																	
24																	
						(24.4' - 25.7') SAND TAILINGS - Pale yellowish gray, loose, moist to very moist, fine to medium sand.											
25	42"	CA 18"	8C	2													
			8B	2													
						(25.7' - ~31') FINE TAILINGS - Pale gray, soft, moist to very moist, trace to few fine to medium sand.		41.0									
26			8A	3			CH	57.4	64.3	2.80	74/27/47	0.0	10.0	90.0			
		AC	9B														
27																	
		AC	9A														

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
28	42"	AC	9A														
30	42"	ST 27"	10				CH	45.3	73.4	2.78	57/22/35	0.0	24.3	75.7			
31						(~31' - 33.2') SAND TAILINGS - See description for 24.4' - 25.7'.											
32							SM	15.4	100.1	2.67	NP	0.0	83.1	16.9			
		AC	11														
33.2						(33.2' - 44.6') FINE TAILINGS - Pale gray, soft, moist to very moist.											
35	48"	CA 18"	12C	2				47.7	72.5								
			12B	2				51.4									
36			12A	2			SC / CL	32.2	87.8	2.72	36/16/20	0.0	50.6	49.4			
		AC	13B			(36.3' - 37.8') Some very fine to fine sand.											
		AC	13A														
40	30"	ST 30"	14					45.7	73.7	2.56							
							CH	47.2	74.5		61/21/40	0.0	20.7	79.3	2.9E-8	0.315	
42																	

LEGEND:
CA = CALIFORNIA SAMPLE (2-INCH OD)
ST = SHELBY TUBE (3-INCH OD)
AC = ACRYLIC LINER
HSA = HOLLOW-STEM AUGER
CC = CONTINUOUS CORE
NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B10**

	FIELD SAMPLE RECOVERY DATA								LABORATORY TEST DATA										
DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	30"	ST 30" AC	14 / 15															
43																		
44						(44.3' - 44.6') Appears finer grained (clayey), lighter gray, more moist.												
						(44.6' - 62.5') SILTY SAND - Light brown, medium dense, moist, silty very fine to fine sand, occasional coarse sand and fine gravel.												
45	42"	CA 17"		12														
			16B	12														
46			16A	14					9.9	95.4	2.74		0.0	65.8	34.2			
47																		
48																		
49																		
50	48"	CA 18"	17B	10														
			17A	11														
51				14														
52																		
53																		
54																		
55	42"	ST 17"	18						14.1	100.8						2.4E-5	0.139	
56						(~56' - 57.5') Gravelly.												
						(Shelby Tube refusal at 56.5')												
57																		

LEGEND:
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- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM

CLIENT: NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B10**

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	42"																
58																	
59																	
60	39"	CA 18"		11													
			19B	11													
61			19A	14													
62																	
						(62.5' - 65.2') WEATHERED SANDSTONE (?) - Hard, moist, gravelly.											
63																	
64																	
65	48"	CA 18"		14													
			20B	14		(65.2' - 82') SILTY SAND - See description above for 44.6' - 62.5'.											
66			20A	15			SM / ML	13.8	94.5		NP	0.0	50.1	49.9			
67																	
68																	
69																	
70	30"	CA 18"		4													
			21B	6		(70.5' - 71.5') Moist to very moist, increased clay.											
71			21A	10				18.1	100.8								

LEGEND:
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- ST = SHELBY TUBE (3-INCH OD)
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- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM

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NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B10**

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
72	30"																	
73																		
74																		
75	42"	CA 18"		5														
			22B	7														
76			22A	11														
77																		
78																		
79																		
80	36"	CA 18"		9		(80' - 82') Gravelly (sandstone fragments)												
			23B	14														
81			23A	17														
82						(82' - 85.5') WEATHERED SANDSTONE - Mottled red/gray/brown, moist, fine to medium weathered sandstone.												
83																		
84	NA	3"	24	50/ 3"														
85	50"																	
86						(85.5' - 105') CLAYEY SAND - Dark brown, firm, very moist to wet, fine to medium clayey sand, occasional sandstone fragments.												

LEGEND:
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- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B10**

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	50"																	
87																		
88																		
89																		
90	40"	CA 18"		7		[CA sampler wet 11/26/13.] [Water measured at approximately 90.2' bgs at 9:30 11/27/13.]												
			25B	12														
91			25A	10					18.6	105.6	2.66							
92																		
						[Core barrel wet 11/27/13.]												
93																		
94																		
95	52"	NR		1														
				5														
96				8														
97																		
						[Core barrel wet.]												
98																		
99																		
100	44"																	
101																		

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B10**

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	44"																	
102																		
						[Core barrel wet.]												
103																		
104																		
105	36"					(105' - E.O.B.) WEATHERED SANDSTONE - Pale yellowish brown, very dense, very moist, very fine to fine sandstone, some cemented zones.												
106						[Core barrel wet.]												
107					26	(106.9' - 107.3') Bagged core sample.			14.2	109.1						1.4E-7		
108		1"		50/ 1.5"	27	(107.9' - 108') Bagged core sample. (108') CA sample not retained.												
						E.O.B. = 108.2 ft at 9:00 on 11/27/13 (practical auger refusal)												
109																		
110																		
111																		
112																		
113																		
114																		
115																		

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
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- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
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NOTES:
Hole backfilled with cement/bentonite grout.

MWH PROJ. LOC.: GALLUP, NM	CLIENT: GE / UNC — NECR - PRE DESIGN STUDY INVESTIGATION	BORING LOG	BOREHOLE ID: **TI-B11**

CONTRACTOR INFORMATION	DRILL RIG INFORMATION		BOREHOLE INFORMATION	
DRILLING COMPANY: NATIONAL	DRILLING RIG: CME 85 HD	BIT TYPE: N/A	CASING DEPTH: N/A	START: 12/2/2013
DRILLER: M. CAIN	DRILLING METHOD: HSA/CC	AUGER O.D.: 8.25"	SURFACE ELEV. (FT): 6977.3	FINISH: 12/3/2013
DRILLER'S HELPER: J. RAMIREZ	HAMMER TYPE: AUTO	HOLE DIAM.: 8.25"	DEPTH TO BEDROCK (FT): 96.9	
LOGGED BY: R. SCHAUT	HAMMER WT: 140 lb	CORE DIAM.: 3.0"	TOTAL DEPTH (FT): 103.0	

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
0	19"					(0' - 0.6') SANDY CLAY - Brown, soft, moist to very moist sandy clay, very fine to fine sand, roots, silty.												
						(0.6' - 0.9') ROCK - 1/2" to 3" crushed basalt, silty clay in voids.												
1						(0.9' - 10.3') SANDY CLAY - Dark brown, hard, slightly moist sandy clay, very fine to fine sand, occasional coarse sand and gravel up to 1.5".												
5	30"	CA 17"	1C	12														
			1B	16														
6			1A	15					8.6	93.5								
10	42"	CA 18"	2C	7														
			2B	7		(10.3' - 12') SILTY SAND - Light brown, medium dense, slightly moist, silty very fine to fine sand.												
11			2A	8														
12						(12' - 15') SANDY CLAY - Dark brown, firm to hard, slightly moist sandy clay, very fine to fine sand, occasional gravel up to 3" size.												
13																		

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

MWH

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B11**

FIELD SAMPLE RECOVERY DATA | LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	42"																	
14																		
15	45"	ST 13"	3			(15' - 18') CLAYEY SAND - Light yellowish brown, medium dense, slightly moist, fine to medium clayey sand, occasional gravel up to 1".			8.2	110.4	2.67		3.9	57.6	38.5	2.5E-5	0.09	
16																		
17																		
18						(18' - 32.9') SANDY CLAY - Predominantly dark brown, hard, slighly moist sandy clay, silty, very fine to medium sand, few to little coarse sand and gravel up to ~1" size.												
19						(19.2' - 19.4') Sand, very fine to fine.												
20	48"	CA 18"	4C	4														
			4B	7														
21			4A	10					12.3	107.6								
22																		
23																		
24																		
25	56"	CA 18"	5C	7														
			5B	8														
26			5A	13														
27																		

LEGEND:
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- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM

CLIENT: NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B11**

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
28	56"																
29																	
30	47"	ST 21"	6														
							CL	13.7	112.4		30/13/17	7.1	41.3	51.6	9.0E-7	0.06	
31																	
32																	
33						(32.9' - 34') SAND (TAILINGS?) - Pale yellowish gray, slightly moist, fine to medium sand.											
34	NA					(34' - 45.5') SANDY CLAY WITH GRAVEL - Dark brown, firm to hard, moist sandy clay with very fine to coarse sand and gravel up to ~3", some metallic and fibrous debris.											
35						[34' - 38' Drilling through metallic debris (appers to be metal siding). Center bit required to penetrate debris. No core collected. CA sample attempted at 34' and 35' - no penetration or recovery.]											
36																	
37																	
38																	
39																	
40	51"	CA 3"		25		[Metallic debris in CA shoe - no sample.]											
				27													
41				22													
42																	

LEGEND:
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- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
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NOTES:
Hole backfilled with cement/bentonite grout.

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
43	51"																
45	60"	CA 18"	7C	7		(Photo 310 at 46'.)											
			7B	7		(45.5' - 53.9') FINE TAILINGS - Mottled orange and dark greenish gray (to 50'), pale yellowish gray (50' - 53.9'), firm, moist tailings.		88.7									
46			7A	8		[Photo 311 at 46.5'.]											
50	43"	ST 28"	8														
							CH	59.9	63.7	2.84	91/30/61	0.0	2.7	97.3	3.1E-8	0.48	
52		AC	9			[Photo 312 at 52.5']											
54						(53.9' - 55') SILTY CLAY - Dark brown, hard, moist silty clay, trace very fine sand.											
55	48"	ST 25"	10			(55' - 77.5') SILTY SAND - Yellowish brown, medium dense, slighly moist to moist, silty, very fine to fine sand.											
56							SM	16.2	77.9	2.64	NP	0.0	60.4	39.6	5.6E-4	0.129	
57																	

LEGEND:
CA = CALIFORNIA SAMPLE (2-INCH OD)
ST = SHELBY TUBE (3-INCH OD)
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NOTES:
Hole backfilled with cement/bentonite grout.

CLIENT:

PROJ. LOC.: GALLUP, NM

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B11**

	FIELD SAMPLE RECOVERY DATA								LABORATORY TEST DATA										
DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	48"																	
		AC	11															
58																		
59																		
60	48"	CA 17"		9														
			12B	11														
61			12A	12		(61.1' - 62.1') Sandy clay.			16.0	95.4			0.0	38.7	61.3			
62																		
63						(63.1' - 64') Sandy clay.												
64																		
65	49"	CA 18"	13C	7														
			13B	7														
66			13A	12					14.2	96.2								
67																		
68																		
69																		
70	44"	CA 18"	14C	7														
			14B	9														
71			14A	10														

LEGEND:
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NOTES:
Hole backfilled with cement/bentonite grout.

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
72	44"					(71.5' - 73.5') Abundant clayey sand zones.											
75	38"	CA 18"	15C	7													
			15B	8													
76			15A	11													
77.5					16	(77.5' - 78') WEATHERED SANDSTONE - Rusty red, moist, fine to medium grained. (Sample #16 is bagged core.)											
78						(78' - 96.9') GRAVELLY SAND - Mottled rusty red/brown/yellow, dense, moist fine to medium sand, silty throughout, some clayey zones, abundant coarse material from coarse sand up to 3" gravel comprised of cemented sandstone.											
80	42"	CA 18"	17C	16													
			17B	21													
81			17A	21				11.0	107.6	2.76		12.9	65.6	21.5			
85	36"	CA 17"	18C	18													
			18B	21													
86			18A	19													

LEGEND:
CA = CALIFORNIA SAMPLE (2-INCH OD)
ST = SHELBY TUBE (3-INCH OD)
AC = ACRYLIC LINER
HSA = HOLLOW-STEM AUGER
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NOTES:
Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B11**

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	36"					(~86.7' - 87.2) Clayey.												
87																		
88																		
89																		
90	48"	NR		3		(~90' to 96.9') Becomes very moist to wet.												
				5														
91				6														
92						(92' - 92.5') Clayey.												
						[Core barrel is wet.]												
93																		
94																		
95	55"	CA 14"	19B	13														
			19A	20														
96				18														
97						(96.9' - E.O.B.) WEATHERED SANDSTONE - Pale yellowish brown, very dense, moist to very moist, fissile, fine-grained, weakly cemented.												
98					21	(98' - 98.3') Bagged core sample.												
99																		
100		CA 2"	20A	50/ 2"					21.1	103.9						1.3E-5		
101																		

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B11**

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
102																		
						(102.5' - 103') Reddish brown, strongly cemented sandstone.												
103						E.O.B. at 103.0' at 10:00 (practical auger refusal)												
104																		
105																		
106																		
107																		
108																		
109																		
110																		
111																		
112																		
113																		
114																		
115																		

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

MWH PROJ. LOC.: GALLUP, NM	CLIENT: NECR - PRE DESIGN STUDY INVESTIGATION	BORING LOG — BOREHOLE ID: **TI-B15**

CONTRACTOR INFORMATION	DRILL RIG INFORMATION		BOREHOLE INFORMATION	
DRILLING COMPANY: NATIONAL	DRILLING RIG: CME 85 HD	BIT TYPE: N/A	CASING DEPTH: N/A	START: 12/5/2013
DRILLER: M. CAIN	DRILLING METHOD: HSA/CC	AUGER O.D.: 8.25"	SURFACE ELEV. (FT): 6976.8	FINISH: 12/5/2013
DRILLER'S HELPER: L. ALDAZ	HAMMER TYPE: AUTO	HOLE DIAM.: 8.25"	DEPTH TO BEDROCK (FT): N/A	
LOGGED BY: R. SCHAUT	HAMMER WT: 140 lb	CORE DIAM.: 3.0"	TOTAL DEPTH (FT): 71.5	

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
0	18"					(0' - 0.5') SANDY CLAY - Brown, soft, moist to very moist sandy clay, very find sand, roots.												
						(0.5' - 0.8') ROCK - Crushed basalt, up to 3" size, sandy clay in voids.												
1						(0.8' - ~3') SANDY CLAY - Dark yellowish brown, hard, moist sandy clay, very fine to fine sand.												
3						(~3' - 30') SILTY SAND TAILINGS - Pale yellowish gray, loose to medium dense, moist, fine to medium sand.												
5	30"	CA 18"	1C	10														
			1B	11														
6			1A	12					5.4	101.1			0.0	87.5	12.5			
		AC	2															
10	30"	CA 18"		3														
			3B	3														
11			3A	3					6.8	93.8								
		AC	4															
13																		

LEGEND:
CA = CALIFORNIA SAMPLE (2-INCH OD)
ST = SHELBY TUBE (3-INCH OD)
AC = ACRYLIC LINER
HSA = HOLLOW-STEM AUGER
CC = CONTINUOUS CORE
NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM

CLIENT: NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B15**

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	30"	AC	4			(13.5' - 13.8') Silty sand tailings.	SM		19.0		2.68	NP	0.0	69.6	30.4			
15	32"	ST 27"	5				SM		14.2	90.4	2.66	NP	0.0	54.9	15.1	8.3E-4	0.126	
		AC	6															
						(~19.5' to ~25') Becomes slightly finer grained (very fine to medium sand), slightly clayey.												
20	28"	CA 18"	7C	3														
			7B	2														
21			7A	4			SM		12.7	99.8	2.68	NP	0.0	80.6	19.4			
		AC	8															
25	27"	ST 23"	9															
27		AC	10			(~27' and below) Becomes clayey.												

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM

CLIENT: NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B15**

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
28	27"	AC	10			(~28.5' - 30') Very fine to fine sand	SM	19.3		2.66	NP	0.0	65.4	34.6			
30	36"	CA 18"	11C	6		(30' - ~32') SILTY SAND - Dark brown, medium dense, moist silty sand, very fine to fine sand.											
			11B	7													
31			11A	10			SM	22.3 17.1	101.8	2.71	NP	6.2	51.9	41.9			
32		AC	12			(~32' - 38') SILTY CLAY - Dark brown, firm to hard, moist silty clay, trace to few very fine to fine sand.											
35	40"	CA 18"	13C	8													
			13B	12													
36			13A	15													
38						(38' - 45') CLAYEY SAND - Yellowish brown, medium dense, moist clayey very fine to fine sand, silty, occasional 1-6" sandy clay zones.											
40	48"	CA 18"		10													
			14B	9													
41			14A	12				11.4	87.1								

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	48"																	
43																		
44																		
45	26"	CA 18"	15C	13		(45' - 50') SANDY SILT - Dark yellowish brown, hard, moist, very fine to fine sand, occasional clayey sand zones.												
			15B	25														
46			15A	26					25.8									
									17.3	99.3	2.81	NP	0.0	37.0	63.0			
47																		
48																		
49																		
50	24"	CA 18"	16C	6		(50' - 52') CLAYEY SAND - Yellowish brown, medium dense, moist, very fine to fine sand, silty.												
			16B	8														
51			16A	11														
52						(52' - 65') SILTY CLAY - Dark yellowish brown, firm to hard, moist silty clay, trace to few very fine to fine sand, occasional thin (1-6") clayey sand zones.												
53						(~53' - 55') Very hard, very dense clay.												
54																		
55	18"	CA 18"	17C	10														
			17B	11														
56			17A	12					11.7	104.2								
57																		

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

MWH

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B15**

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	18"																	
58																		
59																		
60	60"	CA 18"	18C	8														
			18B	11														
61			18A	15														
62																		
63																		
64																		
65	40"	CA 18"		6		(65' - E.O.B.) CLAYEY SAND - Yellowish brown, medium dense, moist, very fine to fine clayey sand, silty, occasional 1-3" zones of sandy clay.												
			19B	8														
66			19A	10					12.7	100.7								
67																		
68																		
69																		
70		CA 18"		7														
			20B	6														
71			20A	9														
						E.O.B. 71.5' at 14:30												

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B23**

CONTRACTOR INFORMATION	DRILL RIG INFORMATION		BOREHOLE INFORMATION	
DRILLING COMPANY: NATIONAL	DRILLING RIG: CME 85 HD	BIT TYPE: N/A	CASING DEPTH: N/A	START: 12/6/2013
DRILLER: M. CAIN	DRILLING METHOD: HSA/CC	AUGER O.D.: 8.25"	SURFACE ELEV. (FT): 6959.3	FINISH: 12/6/2013
DRILLER'S HELPER: L. ALDAZ	HAMMER TYPE: AUTO	HOLE DIAM.: 8.25"	DEPTH TO BEDROCK (FT): 43.0	
LOGGED BY: R. SCHAUT	HAMMER WT: 140 lb	CORE DIAM.: 3.0"	TOTAL DEPTH (FT): 70.5	

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
0	39"					(0' - 0.6') SANDY CLAY - Light brown, soft, moist, very fine to fine sand, roots.												
0.6						(0.6' - 0.9') ROCK - Crushed basalt, 1/2" - 3", sandy clay in voids.												
0.9						(0.9' - 5') SANDY CLAY - Firm to hard, slighly moist to moist, sandy clay, very fine to fine sand, occasional coarse sand and very fine gravel.												
5	44"	CA 18"	1C	12		(5' - 7') SILTY SAND WITH GRAVEL - Light brown, medium dense, slightly moist to moist, silty very fine to fine sand with little to some gravel to 2".												
			1B	14														
			1A	10														
7						(7' - 13.4') SANDY CLAY - See 0.9' to 5' above.												
10	42"	CA 16"		5														
			2B	4														
			2A	6														

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

MWH

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B23**

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	42"																	
14						(13.4' - 14.2') FINE TAILINGS WITH SAND - Pale gray, soft to firm, moist with very fine to fine sand tailings.												
						(14.2' - ~16') SILTY SAND TAILINGS - Pale yellowish gray, loose, moist, fine to medium sand.												
15	25"	ST 28"	3						20.7	87.7	2.77		0.0	62.8	37.2			
16						(~16' - 20.3') SANDY CLAY - Dark yellowish brown, firm, moist, very fine to fine sand.												
17									22.5	101.9	2.73		0.0	31.1	68.9			
		AC	4															
18																		
19																		
20	36"	CA 18"	5C	5														
			5B	6		(20.3' - 23') SILTY SAND - Yellowish brown, medium dense, moist, silty very fine to fine sand.												
21			5A	7														
22																		
23						(23' - 38.6') SILTY CLAY - Predominantly dark yellowish brown, firm to hard, moist silty clay with varying amount of sand as shown, occasional coarse sand to very fine gravel throughout. (23' - 27.5') Trace to few sand.												
24																		
25	39"	ST 30"	6															
26							CL		21.6	101.7	2.73	49/18/31	0.0	8.8	91.2		0.05	
27																		
						(27.5' - 30') Little to some sand.												

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
28	39"																	
29																		
30	44"	CA 18"		5		(30' - 30.5') Gravelly.												
			7B	6		(30.5' - ~33.5') Little to some sand.												
31			7A	8														
32																		
33																		
						(~33.5' - ~34.3') Clayey sand, very fine to fine.												
34						(~34.3' - 38.6') Few to little sand.												
35	42"	ST 28"	8															
36																		
37																		
38																		
39						(38.6' - 40.3') CLAYEY SAND - Yellowish brown, medium dense, moist, very fine to fine sand, silty.												
40	25"	CA 18"		6														
			9B	9		(40.3' - 43') SILTY CLAY WITH SAND - Dark yellowish brown, firm to hard, moist, silty clay with little to some very fine to fine sand.												
41			9A	12														
42																		

LEGEND:
CA = CALIFORNIA SAMPLE (2-INCH OD)
ST = SHELBY TUBE (3-INCH OD)
AC = ACRYLIC LINER
HSA = HOLLOW-STEM AUGER
CC = CONTINUOUS CORE
NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B23**

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	25"																	
43						(43' - 65.5') SANDSTONE - Mostly very pale yellowish gray, moist, mostly non-or weakly cemented very fine to fine sand, some very hard, strongly cemented, fissile zones as shown, some clay zones as shown ("Zone 3"?). (43' - 43.6') Strongly cemented, fissile. (43.6' - 44') Clay - yellowish brown, firm to hard, moist, slightly silty.												
45	32"	CA 8"	10A	13 50/ 3"		(44' - 45.5') strongly cemented, fissile. (45.5' - 46.2') Clayey sand, yellowish brown.			13.8	108.7						2.4E-7		
47						(~47' - ~48') Very hard, strongly cemented, fissile.												
48	16"																	
49		CA NR		50/ 4"														
50	29"																	
55	33"	CA 3"	11A	50/ 5"		(~55' - 63') Coarser (fine to medium).												
56						(~56' - 56.8') Color is reddish yellow.												
57																		

Depth scale: 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

MWH

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B23**

FIELD SAMPLE RECOVERY DATA | LABORATORY TEST DATA

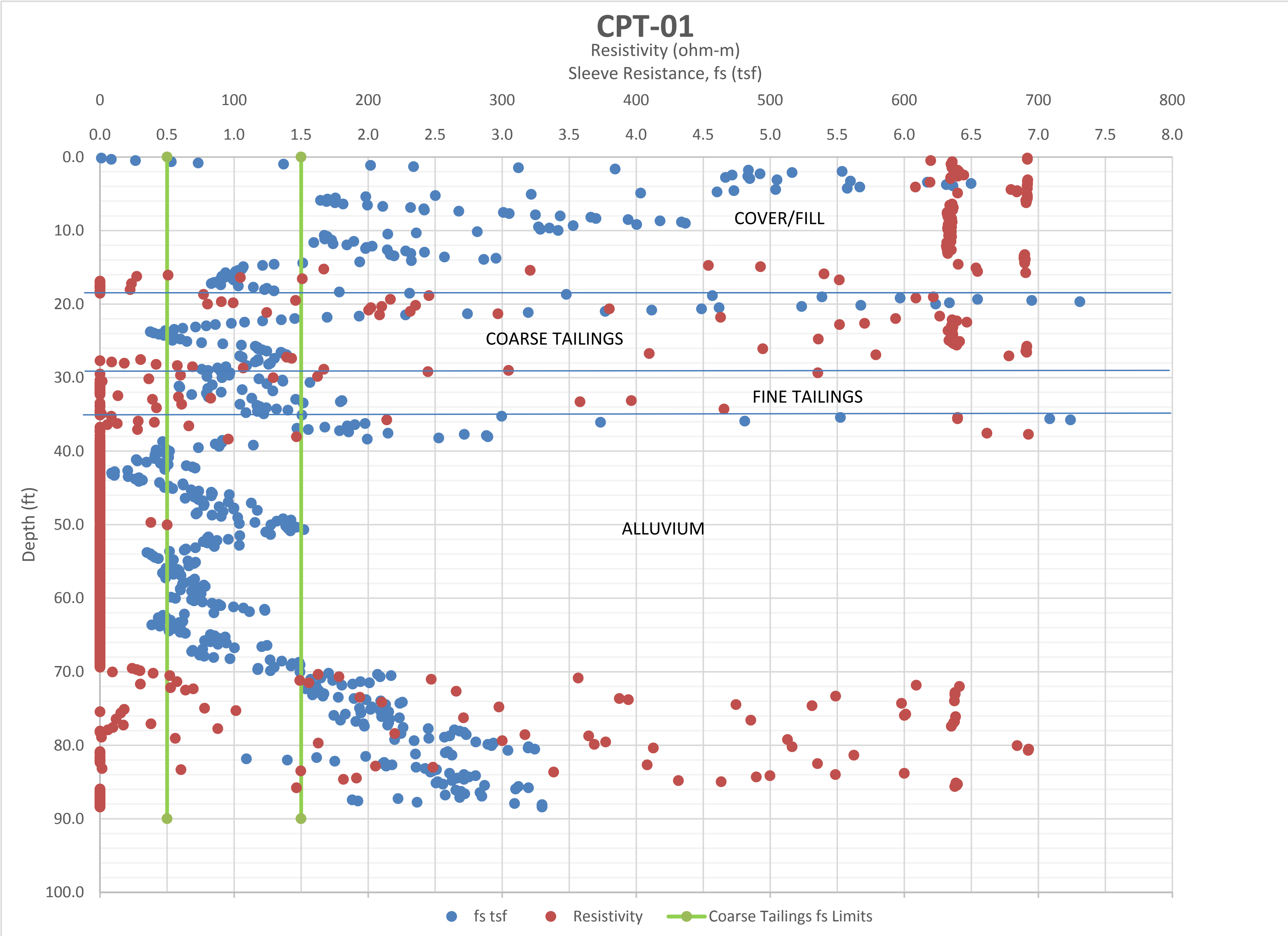
DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	33"																	
58																		
59																		
60	24"	CA 3"	12A	50/ 4"														
61																		
62																		
63						(~63 - 65.5') COAL - Black, hard, dry to slightly moist, fissile.												
64																		
65	30"	CA 13"	13B	24														
			13A	50/ 4.5"		(65.5' - E.O.B.) SHALE - Gray, very hard, slightly moist shale, trace silt, non- to weakly-cemented ("Zone 2"?).			10.2	103.0						9.7E-8		
66																		
67																		
68																		
69																		
70		CA 4"	14	50/ 5"														
						E.O.B. 70.5' @ 13:50												
71																		

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

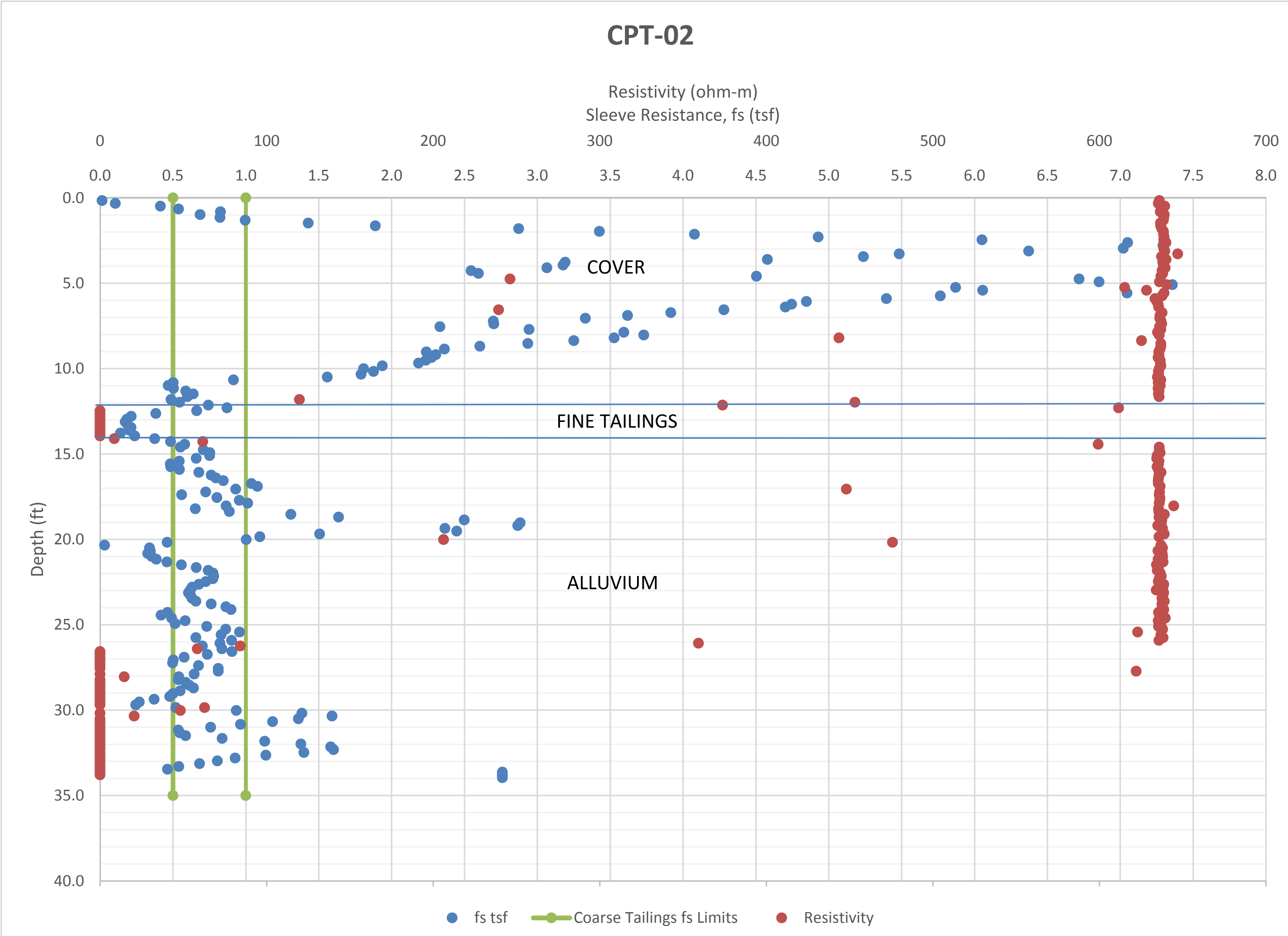
NOTES:
Hole backfilled with cement/bentonite grout.

ATTACHMENT B

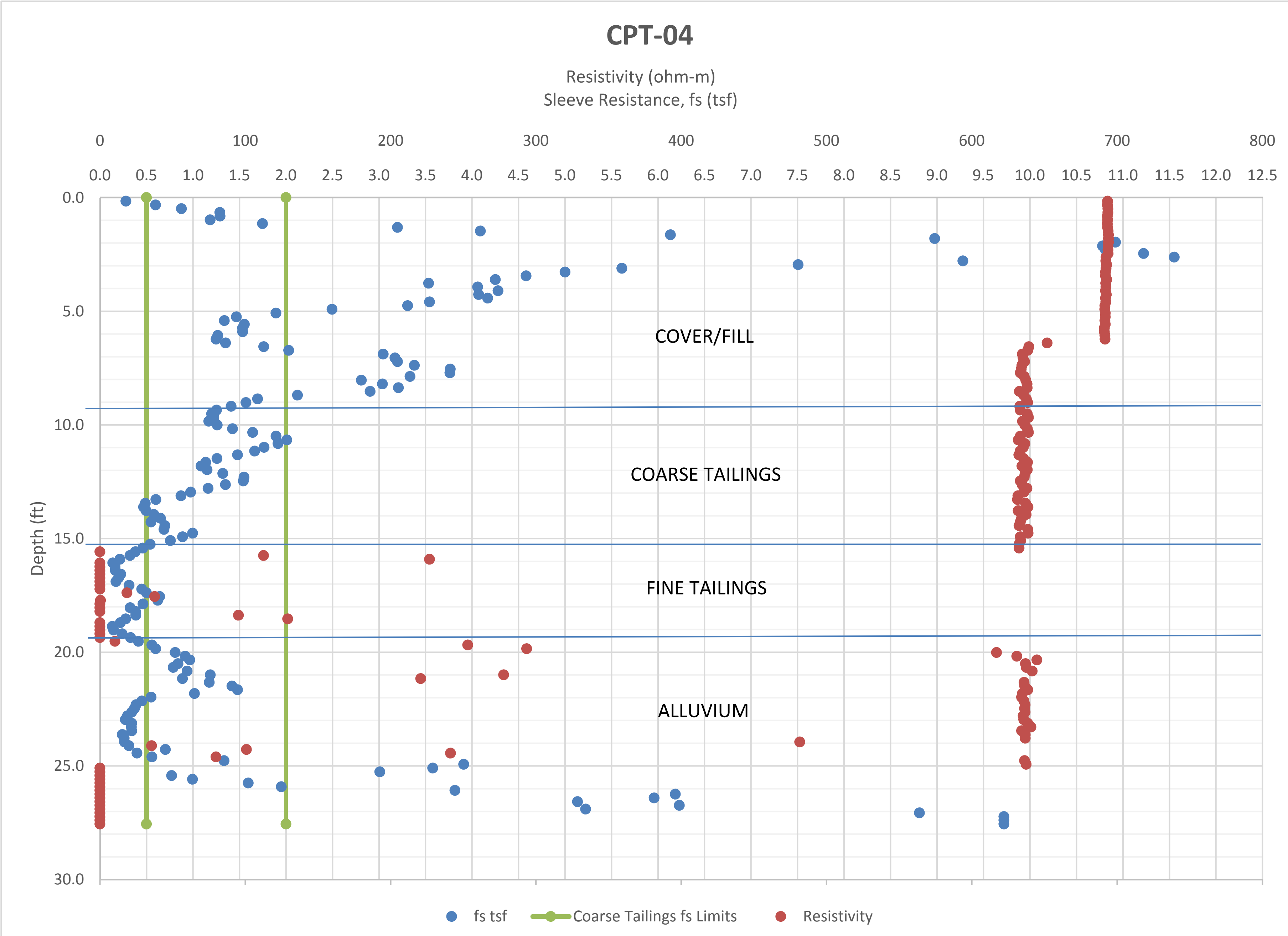
CPT PROFILE INTERPRETATIONS

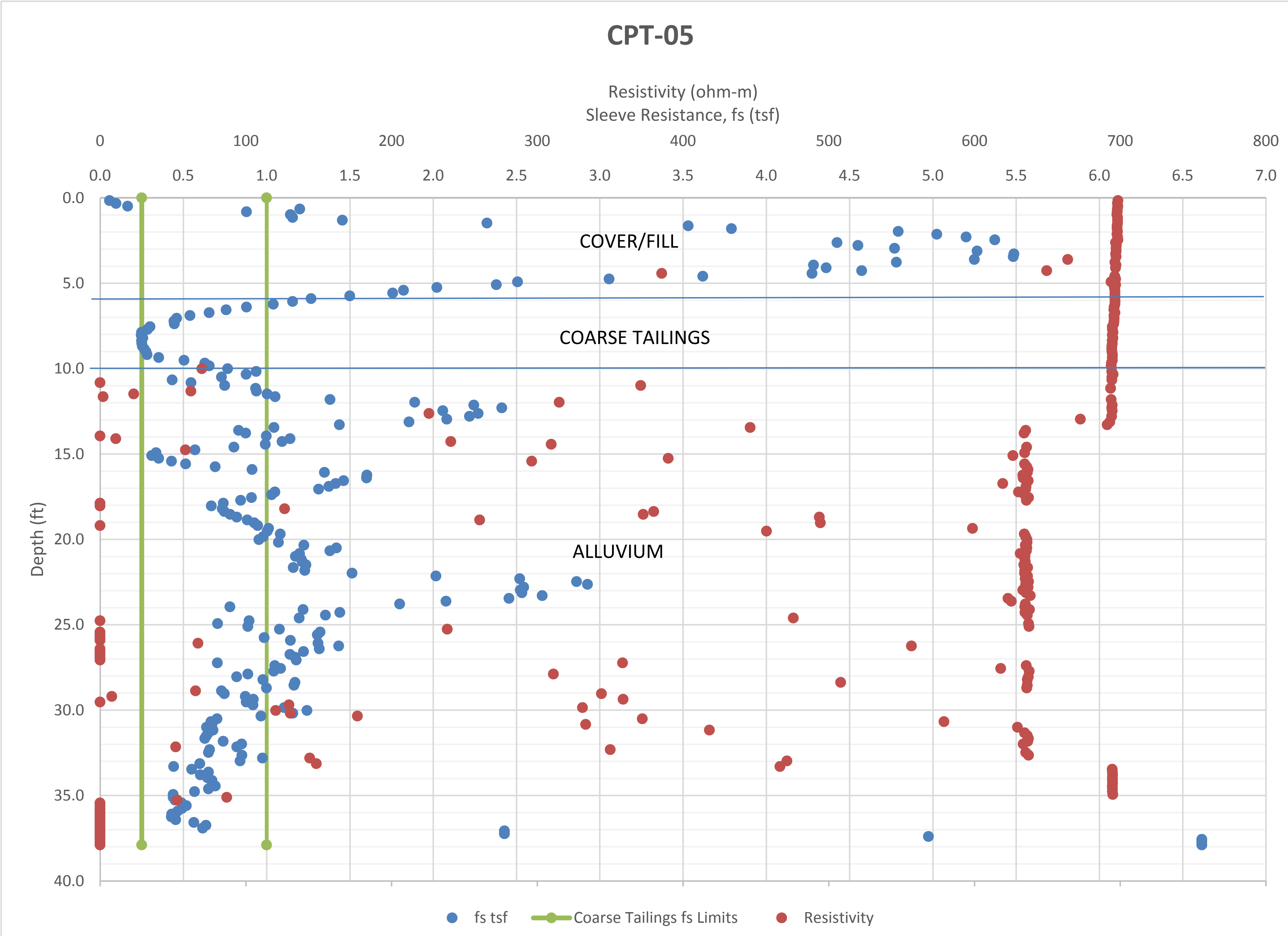


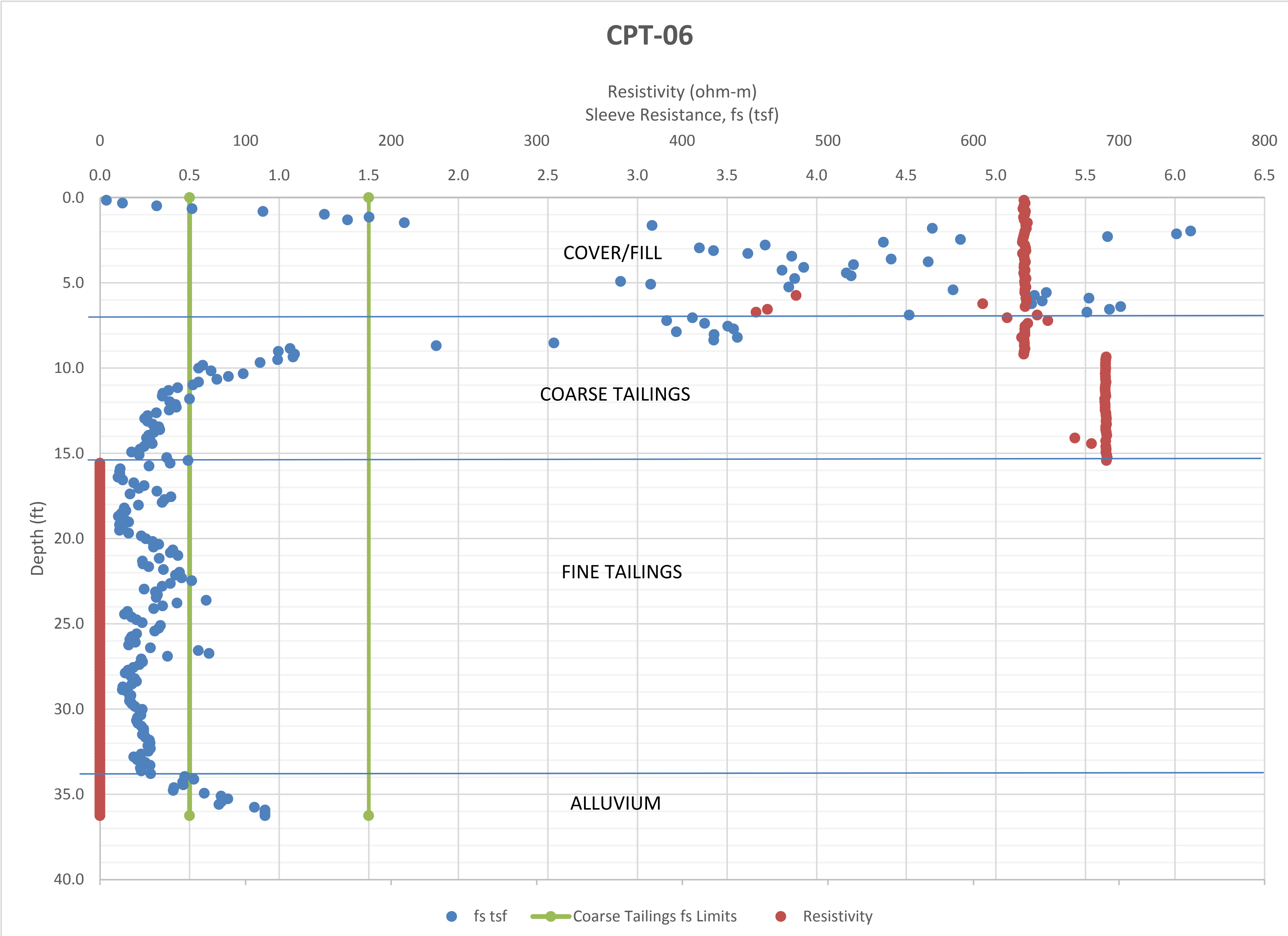
CPT-01
Resistivity (ohm-m)
Sleeve Resistance, fs (tsf)
0
100
200
300
400
500
600
700
800
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
Depth (ft)
COVER/FILL
COARSE TAILINGS
FINE TAILINGS
ALLUVIUM
fs tsf
Resistivity
Coarse Tailings fs Limits

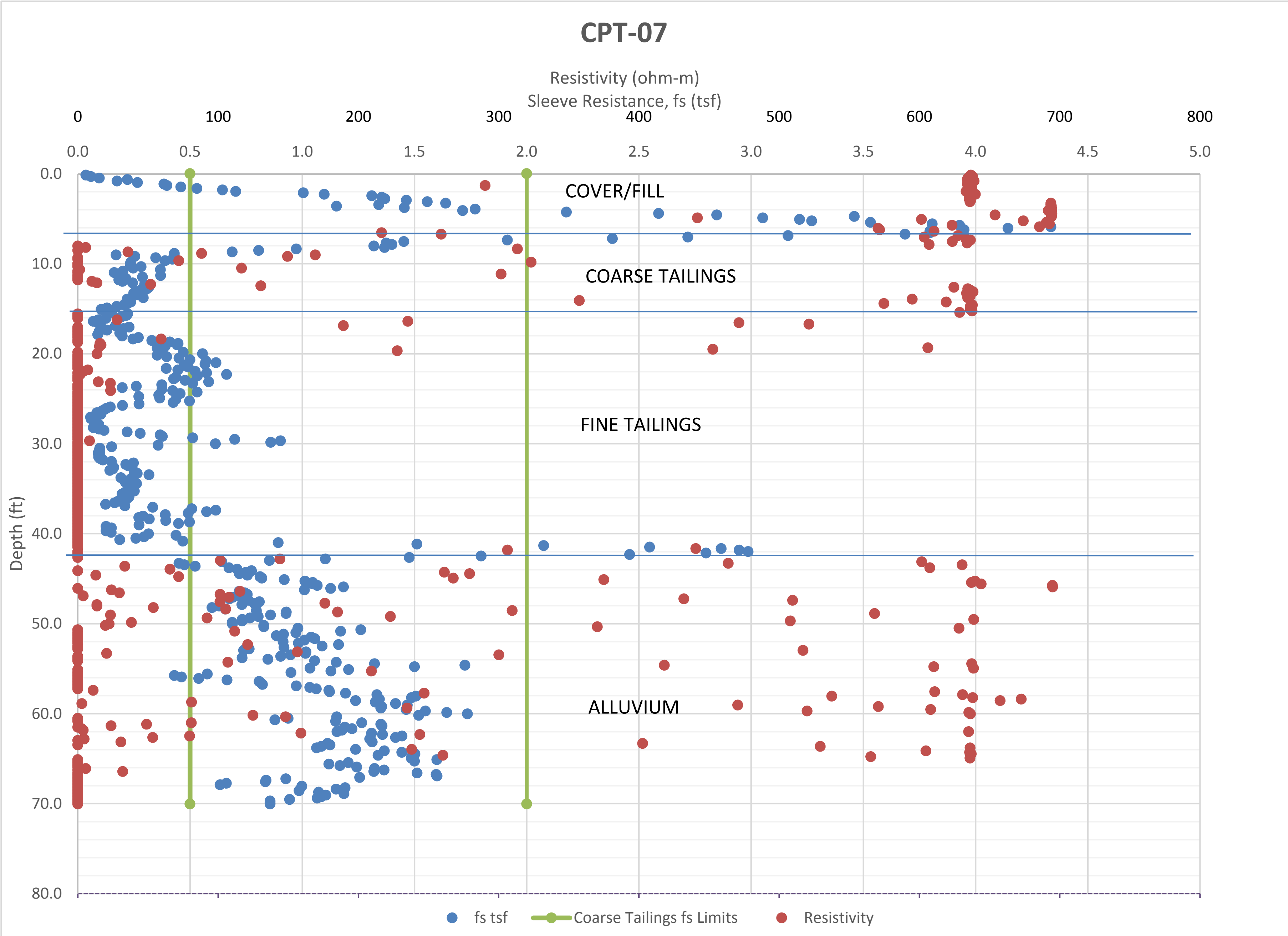


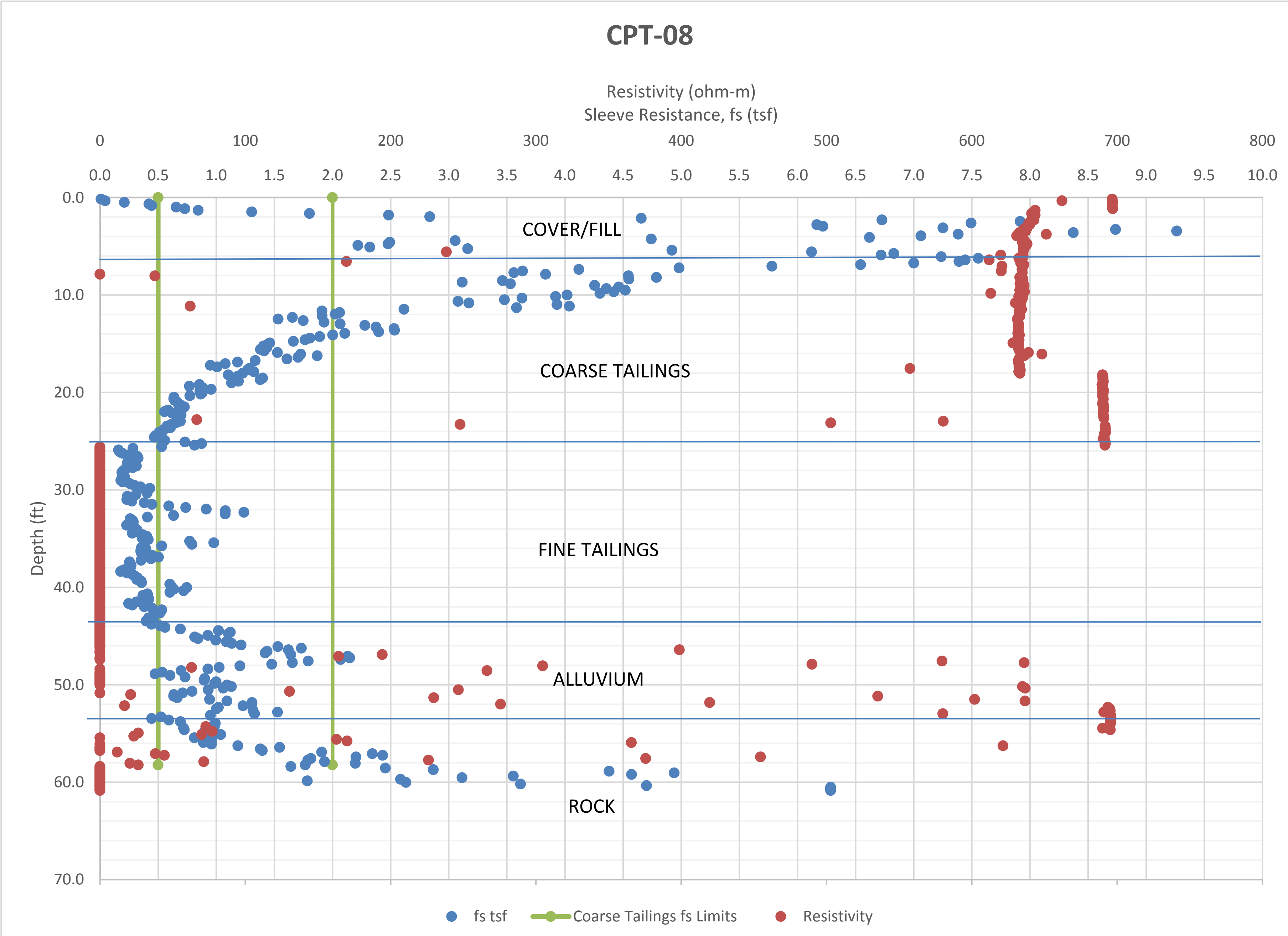
CPT-02
Resistivity (ohm-m)
Sleeve Resistance, fs (tsf)
0
100
200
300
400
500
600
700
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
Depth (ft)
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
COVER
FINE TAILINGS
ALLUVIUM
fs tsf
Coarse Tailings fs Limits
Resistivity

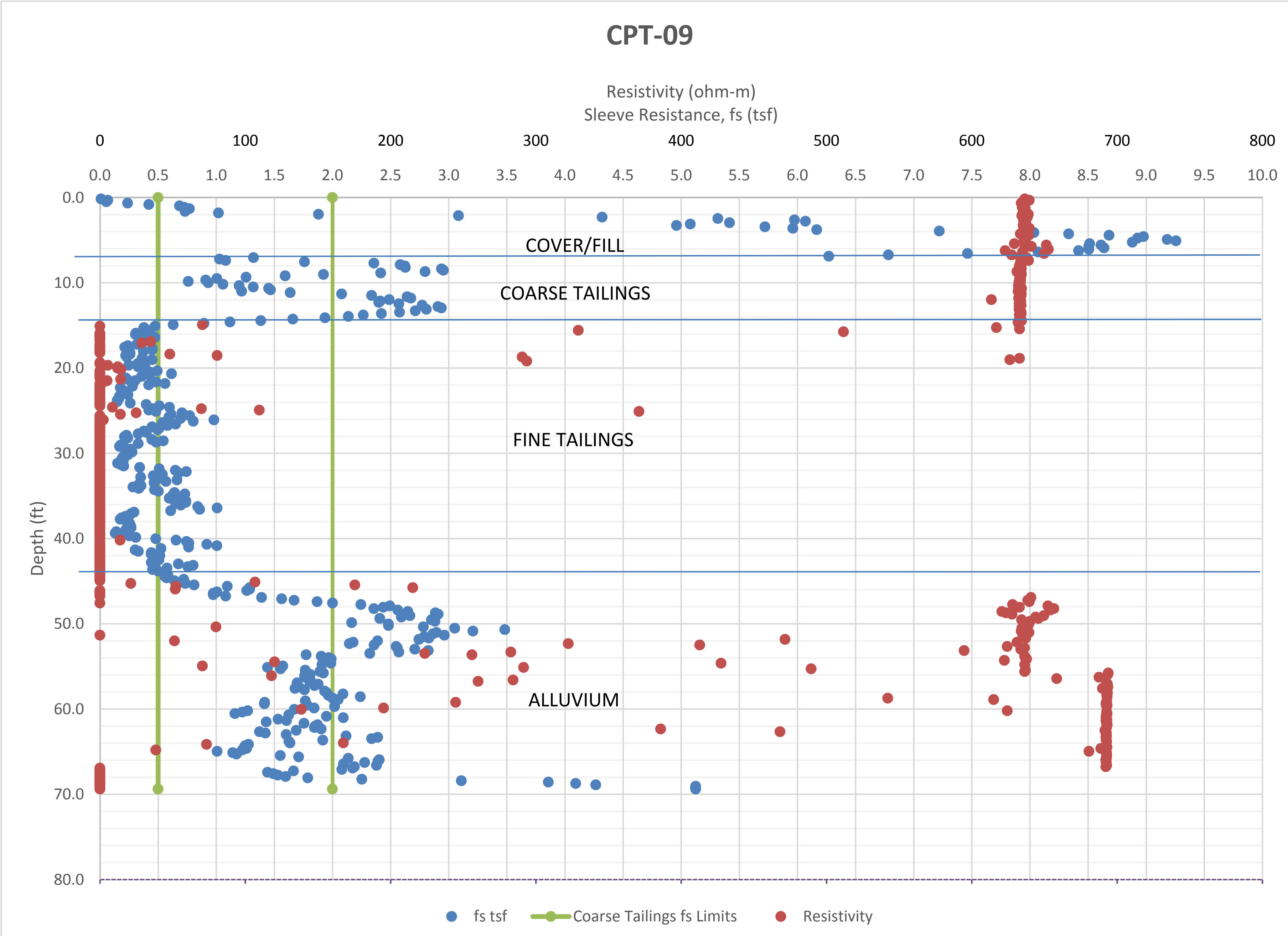

CPT-04
Resistivity (ohm-m)
Sleeve Resistance, fs (tsf)
0
100
200
300
400
500
600
700
800
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.5
9.0
9.5
10.0
10.5
11.0
11.5
12.0
12.5
Depth (ft)
0.0
5.0
10.0
15.0
20.0
25.0
30.0
COVER/FILL
COARSE TAILINGS
FINE TAILINGS
ALLUVIUM
fs tsf
Coarse Tailings fs Limits
Resistivity

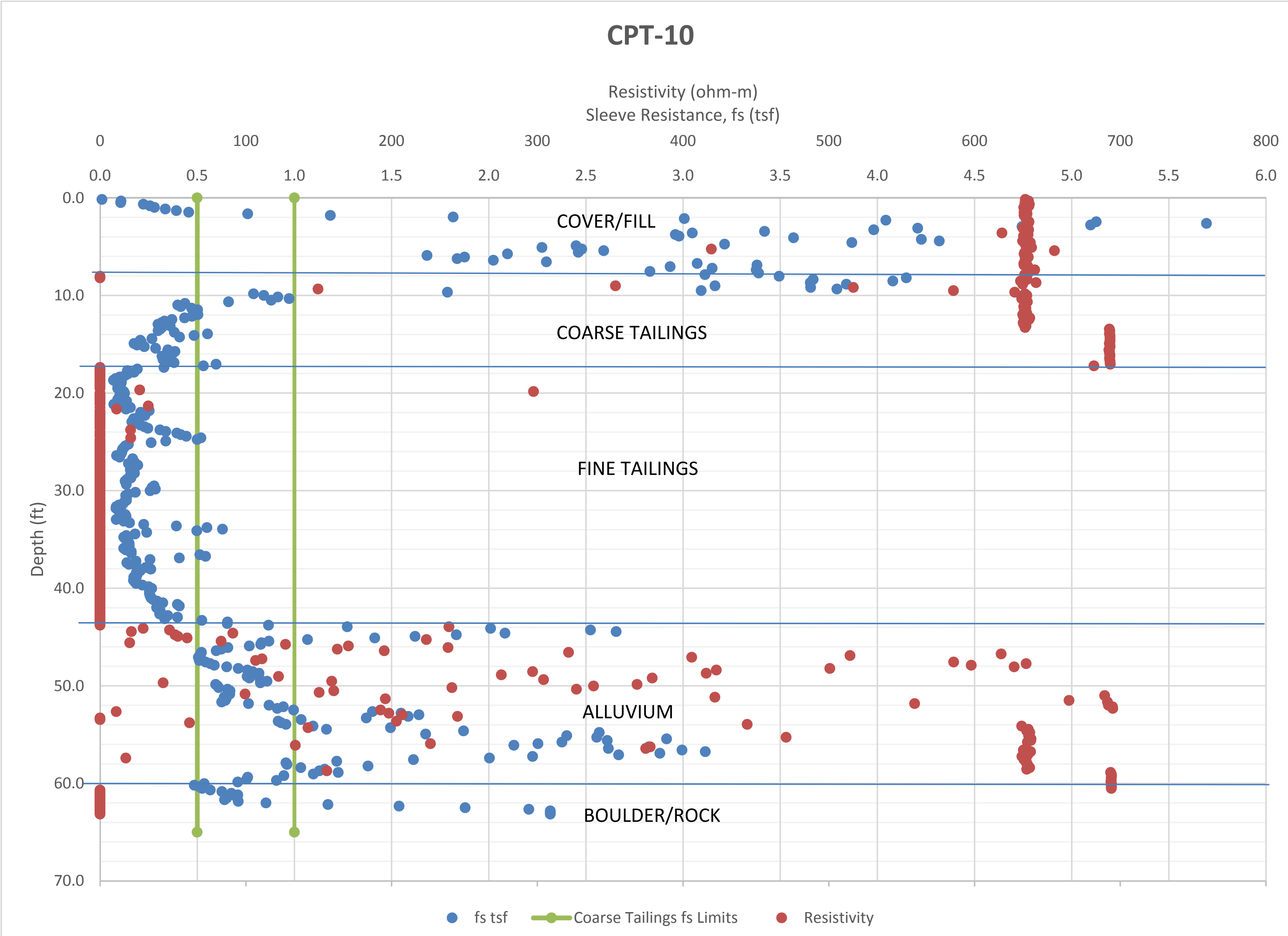

CPT-05
Resistivity (ohm-m)
Sleeve Resistance, fs (tsf)
0
100
200
300
400
500
600
700
800
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
Depth (ft)
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
COVER/FILL
COARSE TAILINGS
ALLUVIUM
fs tsf
Coarse Tailings fs Limits
Resistivity


CPT-06
Resistivity (ohm-m)
Sleeve Resistance, fs (tsf)
0
100
200
300
400
500
600
700
800
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
Depth (ft)
COVER/FILL
COARSE TAILINGS
FINE TAILINGS
ALLUVIUM
fs tsf
Coarse Tailings fs Limits
Resistivity

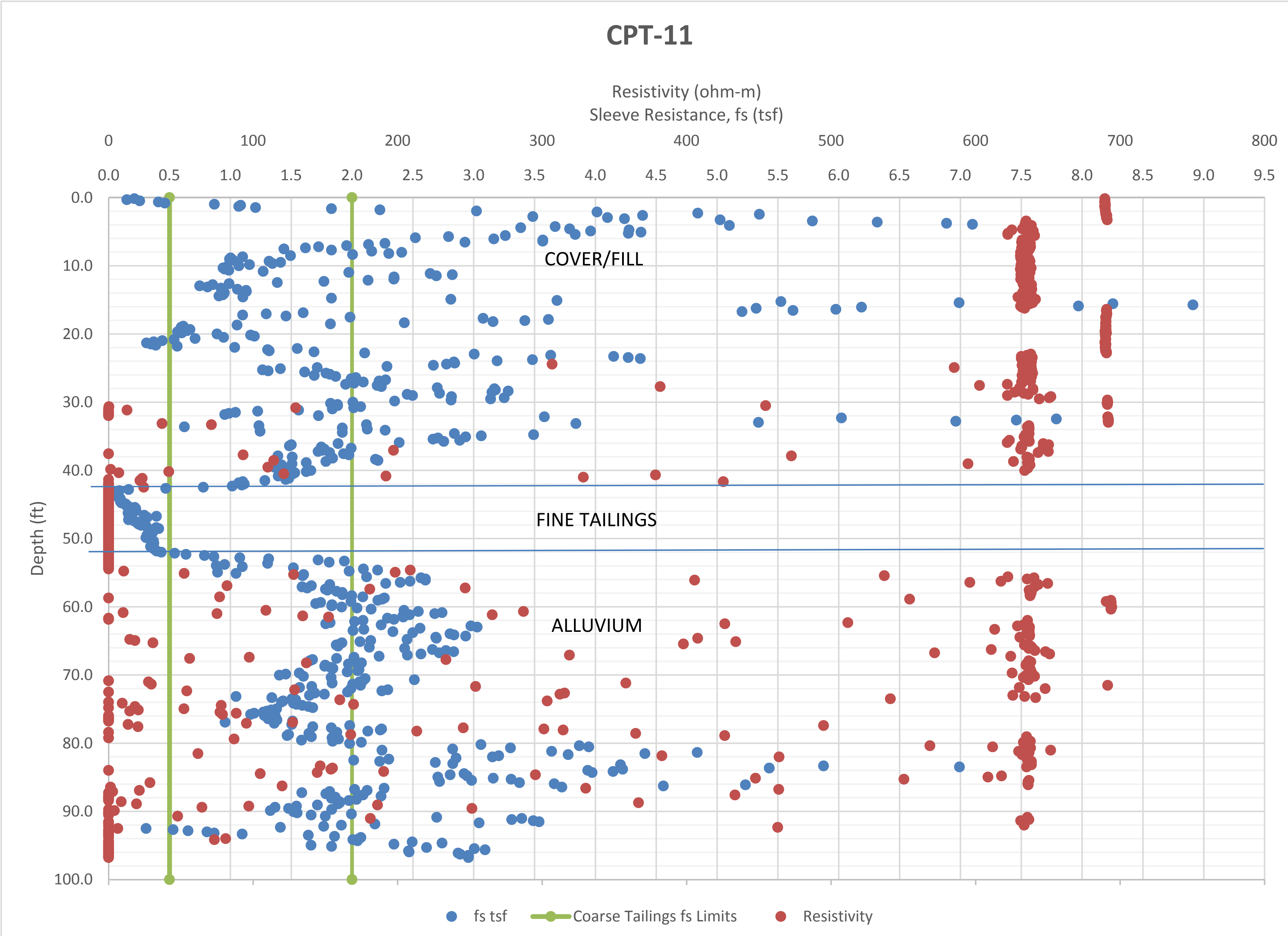

CPT-07
Resistivity (ohm-m)
Sleeve Resistance, fs (tsf)
0
100
200
300
400
500
600
700
800
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Depth (ft)
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
COVER/FILL
COARSE TAILINGS
FINE TAILINGS
ALLUVIUM
fs tsf
Coarse Tailings fs Limits
Resistivity


CPT-08
Resistivity (ohm-m)
Sleeve Resistance, fs (tsf)
0
100
200
300
400
500
600
700
800
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.5
9.0
9.5
10.0
Depth (ft)
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
COVER/FILL
COARSE TAILINGS
FINE TAILINGS
ALLUVIUM
ROCK
fs tsf
Coarse Tailings fs Limits
Resistivity

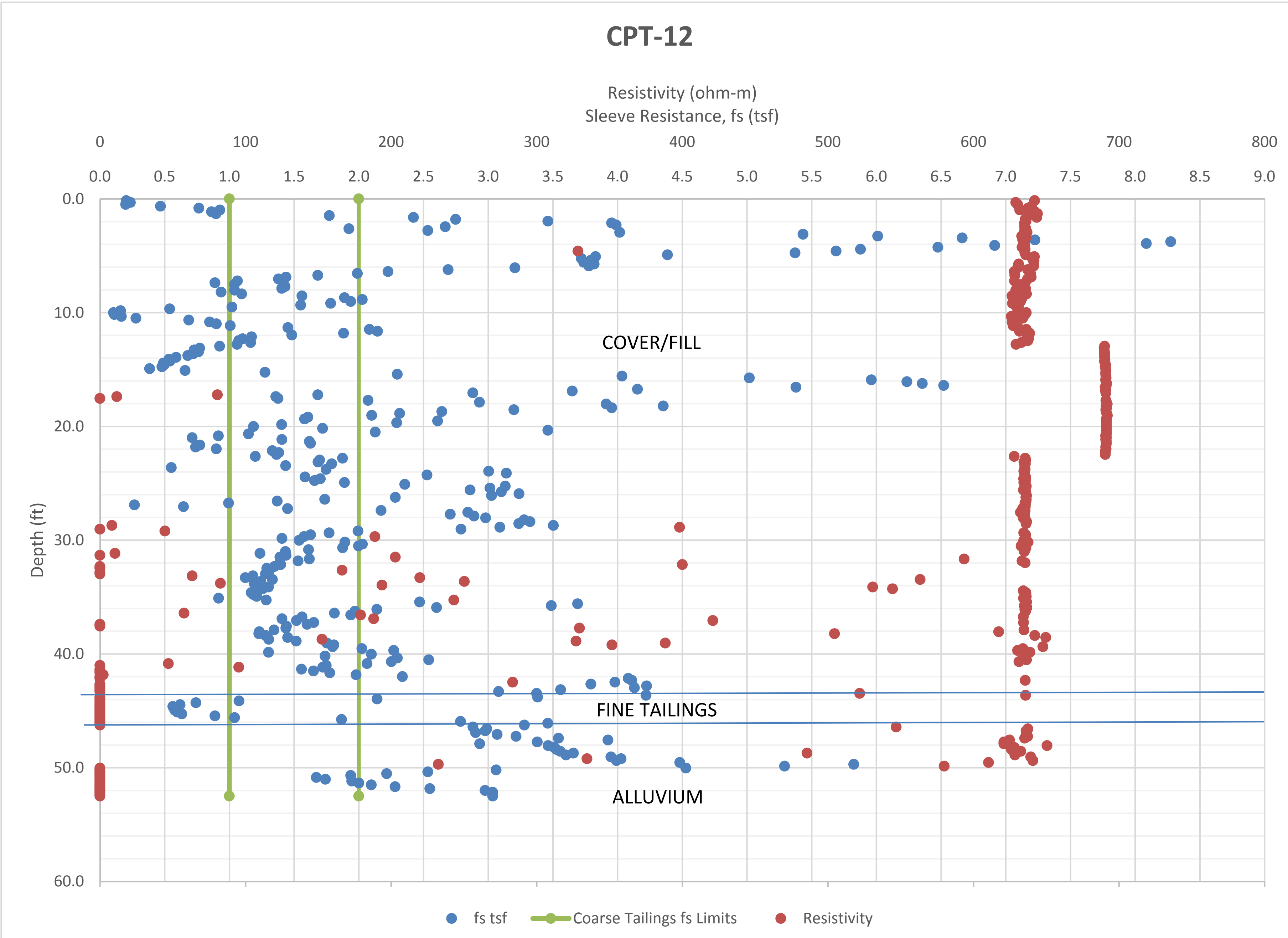

CPT-09
Resistivity (ohm-m)
Sleeve Resistance, fs (tsf)
0
100
200
300
400
500
600
700
800
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.5
9.0
9.5
10.0
Depth (ft)
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
COVER/FILL
COARSE TAILINGS
FINE TAILINGS
ALLUVIUM
fs tsf
Coarse Tailings fs Limits
Resistivity



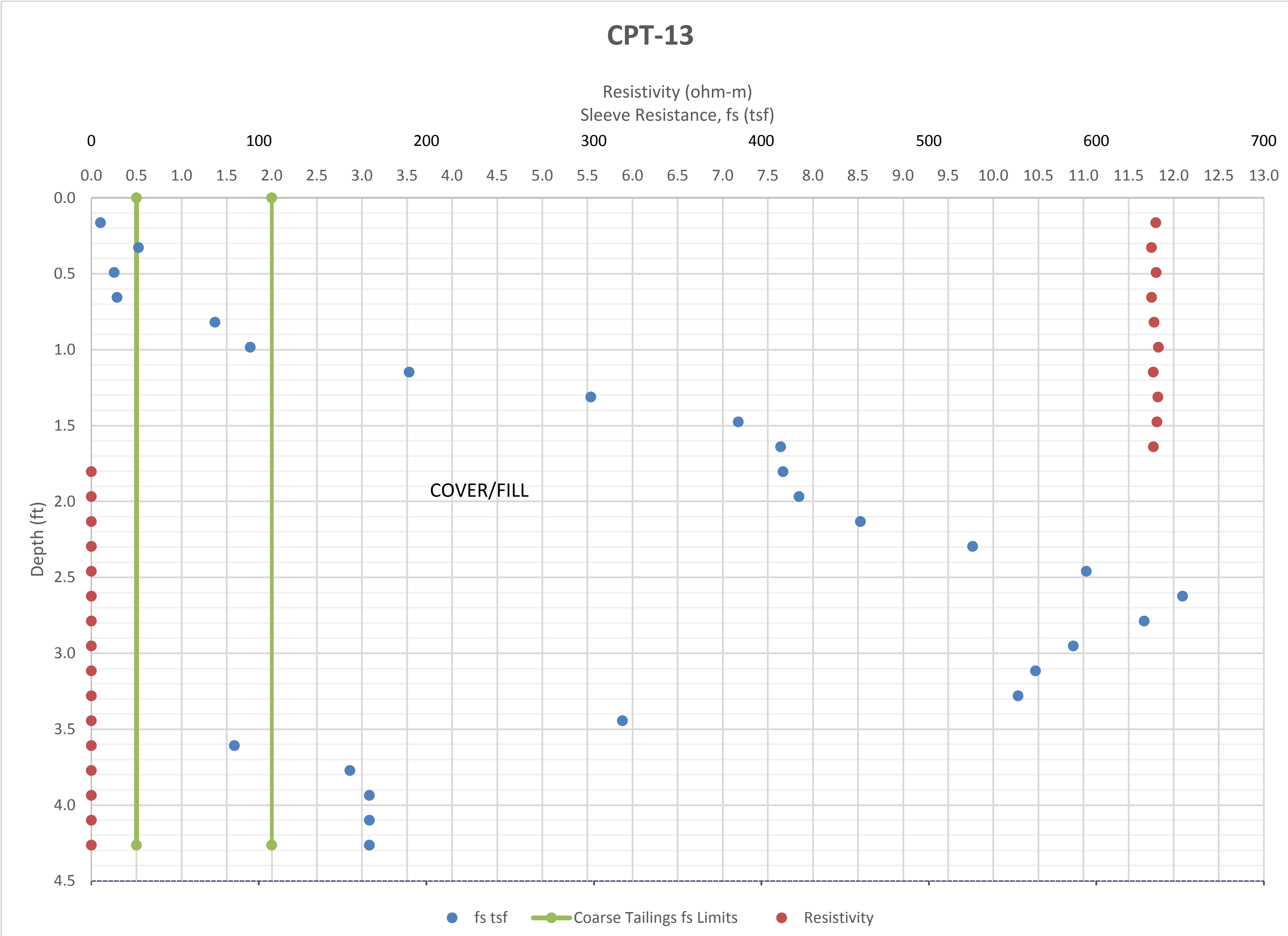
CPT-10
Resistivity (ohm-m)
Sleeve Resistance, fs (tsf)
0
100
200
300
400
500
600
700
800
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
Depth (ft)
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
COVER/FILL
COARSE TAILINGS
FINE TAILINGS
ALLUVIUM
BOULDER/ROCK
fs tsf
Coarse Tailings fs Limits
Resistivity



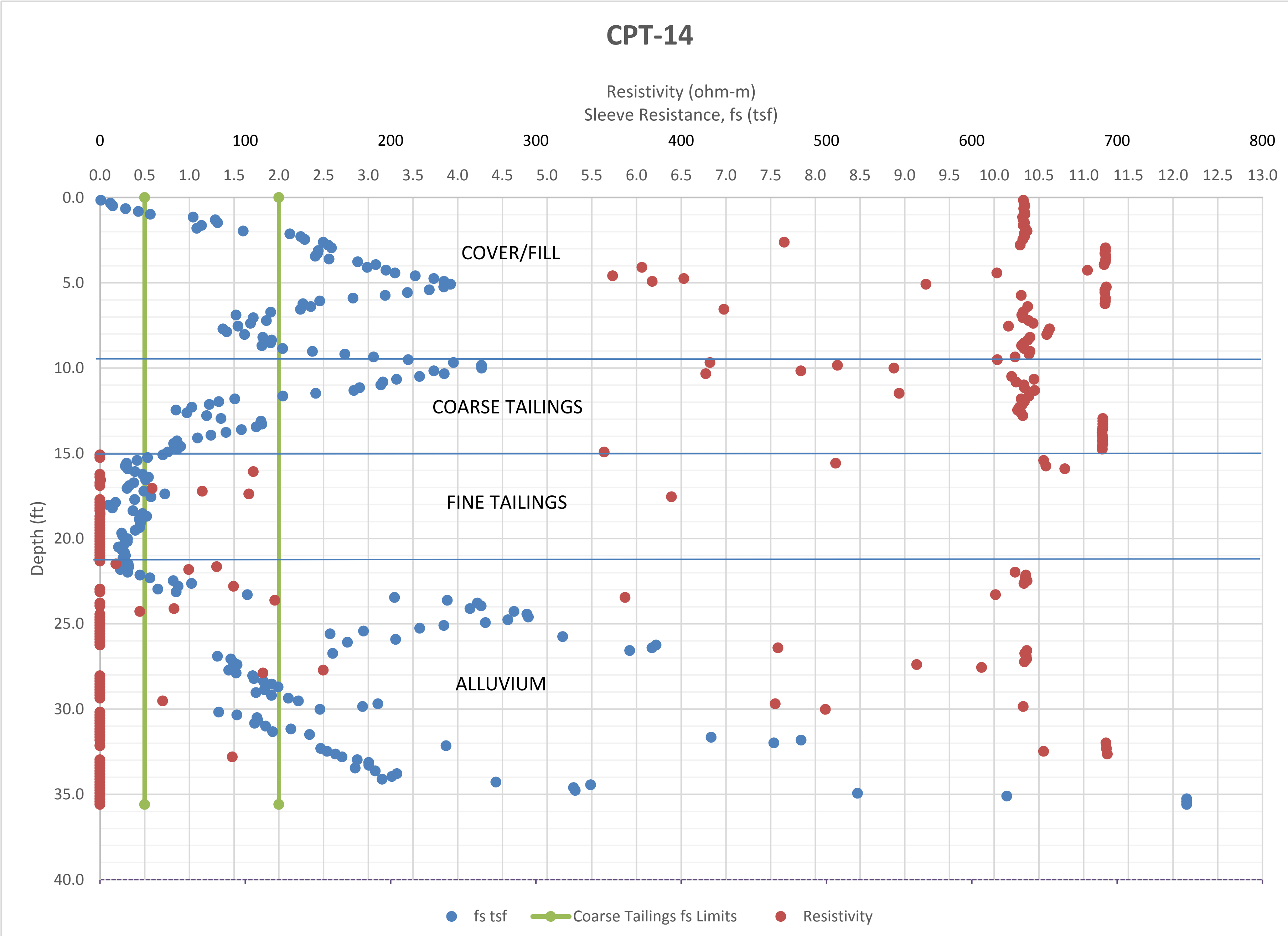
CPT-11
Resistivity (ohm-m)
Sleeve Resistance, fs (tsf)
0
100
200
300
400
500
600
700
800
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.5
9.0
9.5
Depth (ft)
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
COVER/FILL
FINE TAILINGS
ALLUVIUM
fs tsf
Coarse Tailings fs Limits
Resistivity

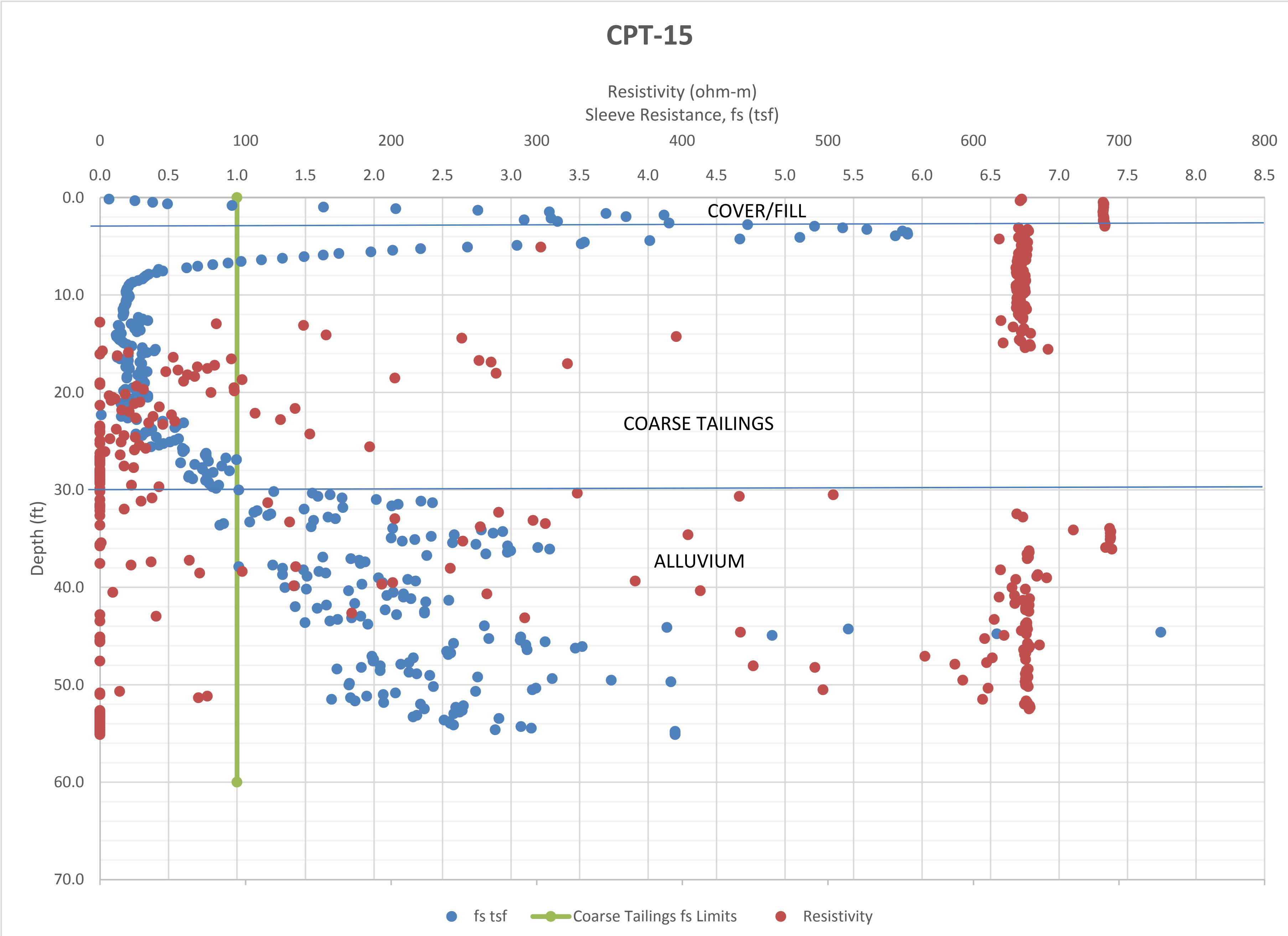


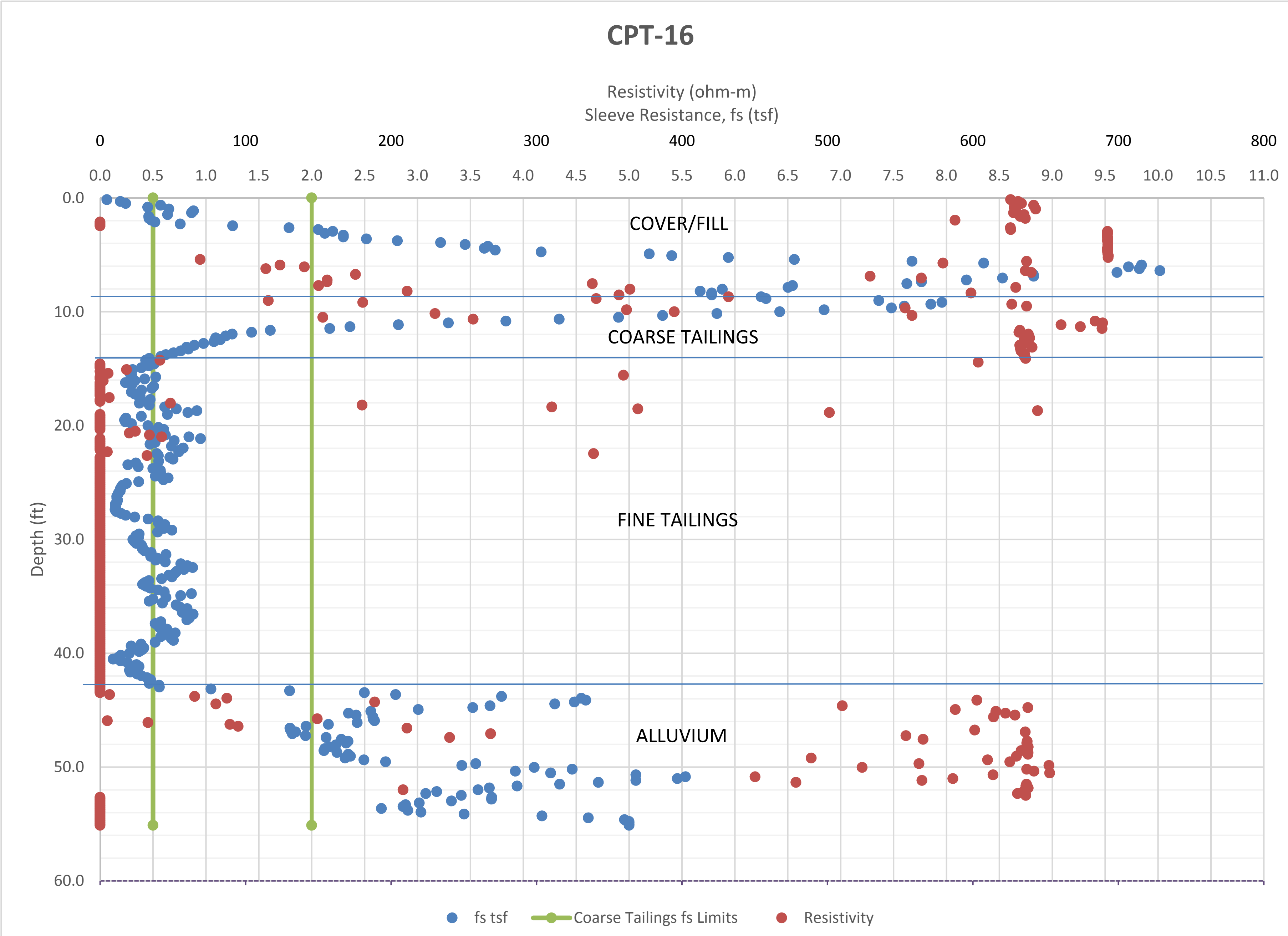
CPT-12
Resistivity (ohm-m)
Sleeve Resistance, fs (tsf)
0
100
200
300
400
500
600
700
800
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.5
9.0
Depth (ft)
0.0
10.0
20.0
30.0
40.0
50.0
60.0
COVER/FILL
FINE TAILINGS
ALLUVIUM
fs tsf
Coarse Tailings fs Limits
Resistivity



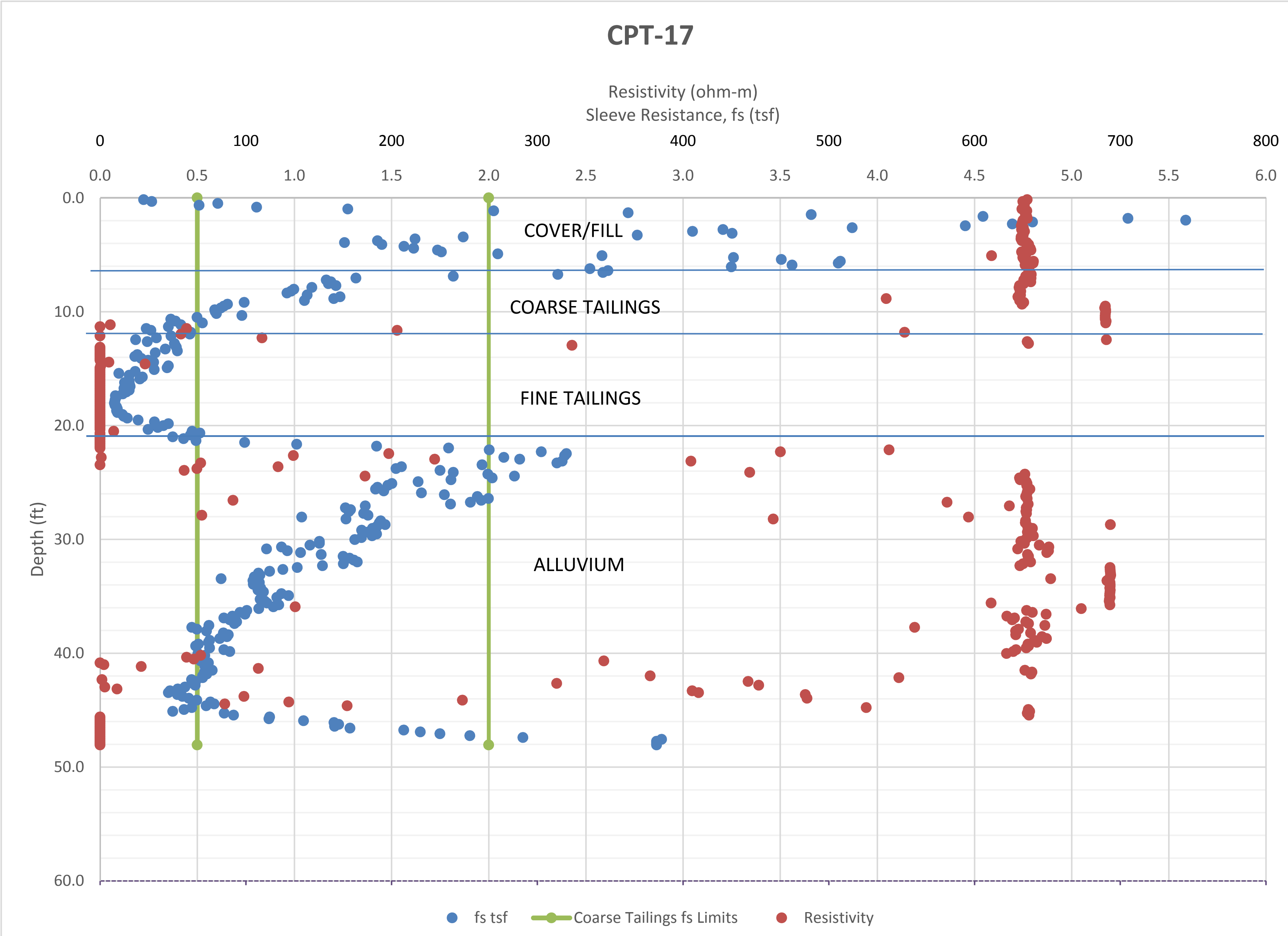
CPT-13
Resistivity (ohm-m)
Sleeve Resistance, fs (tsf)
0 100 200 300 400 500 600 700
0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5 10.0 10.5 11.0 11.5 12.0 12.5 13.0
Depth (ft)
0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5
COVER/FILL
fs tsf
Coarse Tailings fs Limits
Resistivity

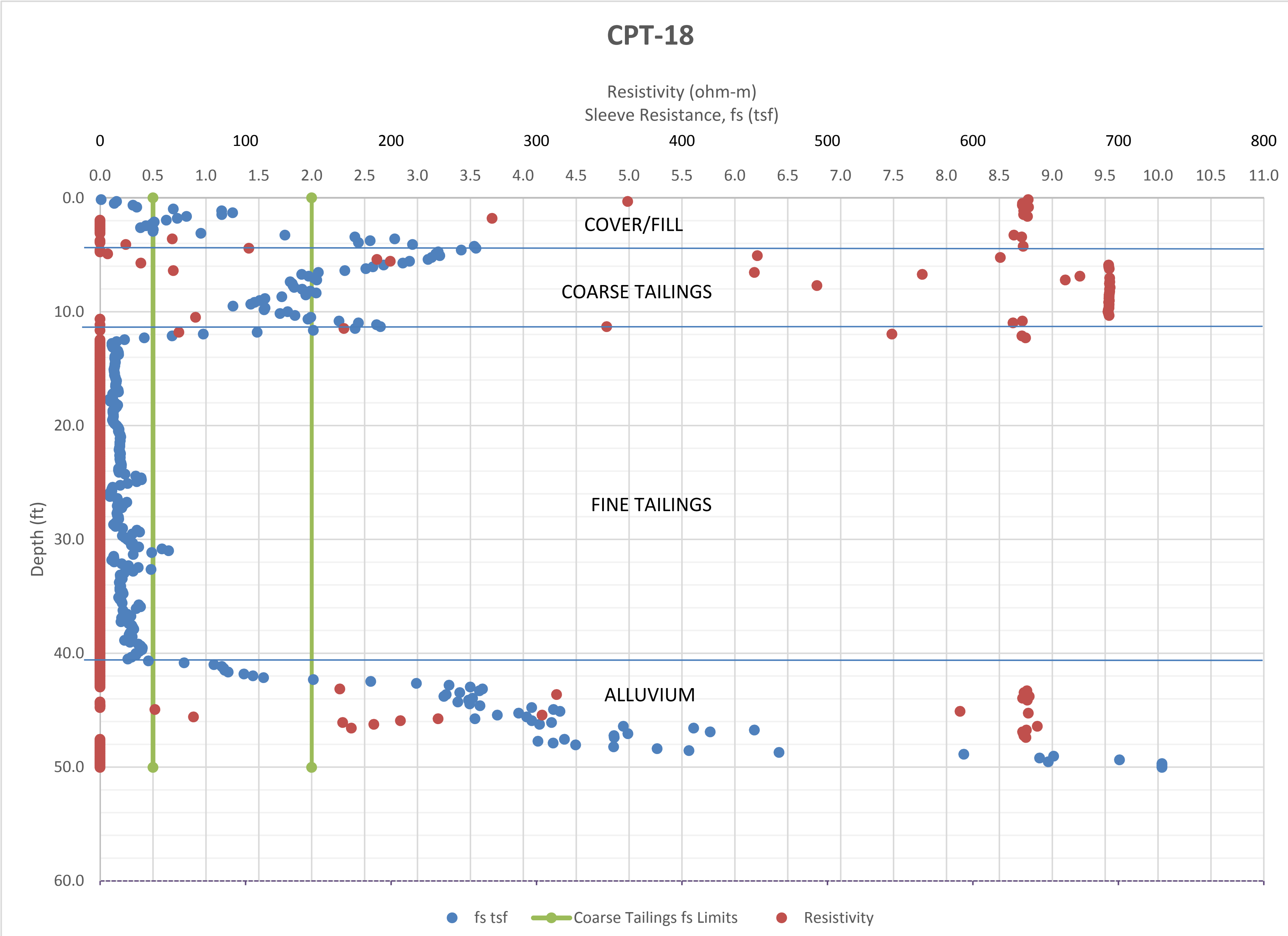

CPT-14
Resistivity (ohm-m)
Sleeve Resistance, fs (tsf)
0
100
200
300
400
500
600
700
800
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.5
9.0
9.5
10.0
10.5
11.0
11.5
12.0
12.5
13.0
Depth (ft)
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
COVER/FILL
COARSE TAILINGS
FINE TAILINGS
ALLUVIUM
fs tsf
Coarse Tailings fs Limits
Resistivity


CPT-15
Resistivity (ohm-m)
Sleeve Resistance, fs (tsf)
0 100 200 300 400 500 600 700 800
0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5
Depth (ft)
0.0 10.0 20.0 30.0 40.0 50.0 60.0 70.0
COVER/FILL
COARSE TAILINGS
ALLUVIUM
fs tsf
Coarse Tailings fs Limits
Resistivity

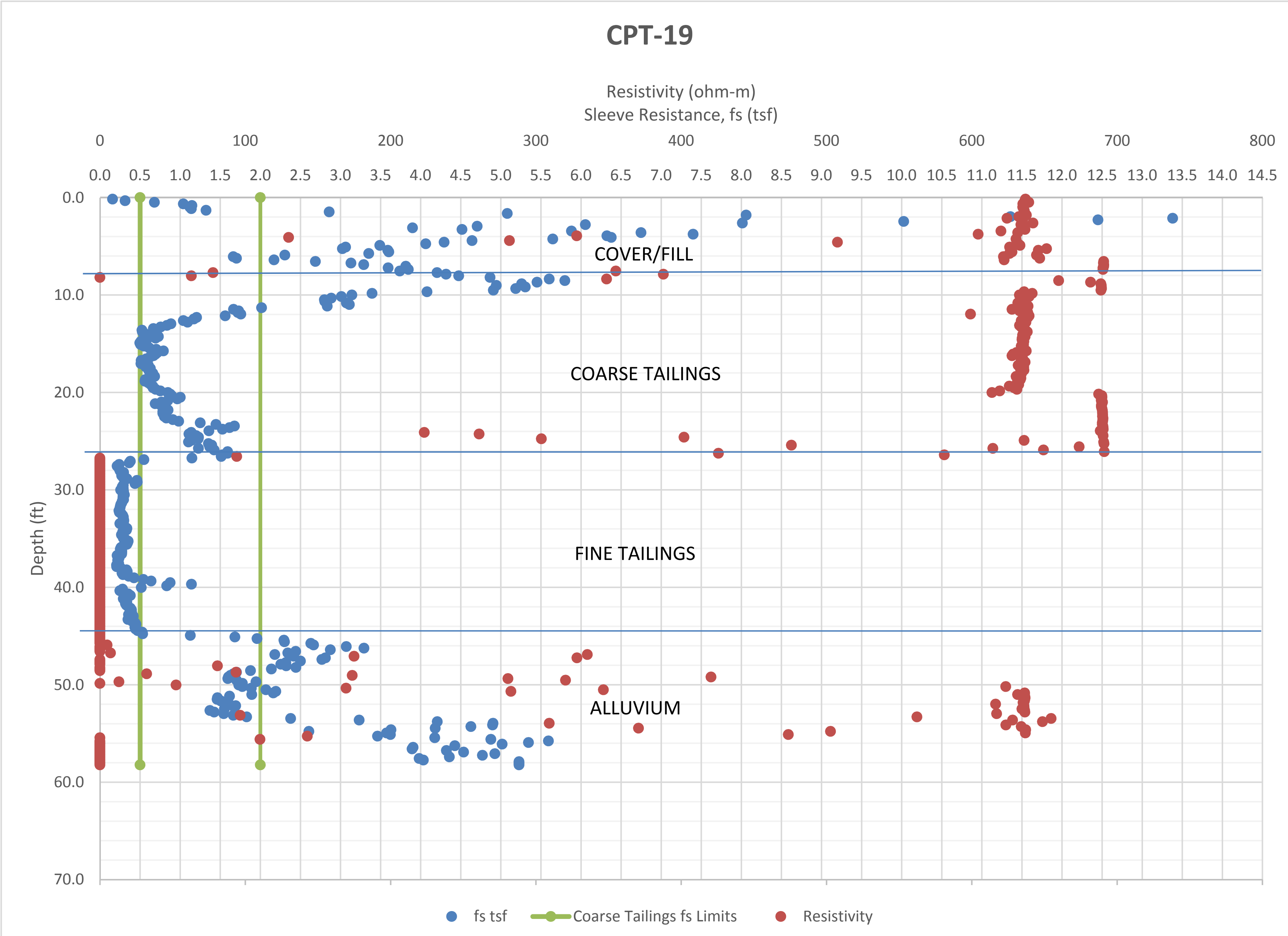


CPT-16
Resistivity (ohm-m)
Sleeve Resistance, fs (tsf)
0
100
200
300
400
500
600
700
800
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.5
9.0
9.5
10.0
10.5
11.0
Depth (ft)
0.0
10.0
20.0
30.0
40.0
50.0
60.0
COVER/FILL
COARSE TAILINGS
FINE TAILINGS
ALLUVIUM
fs tsf
Coarse Tailings fs Limits
Resistivity

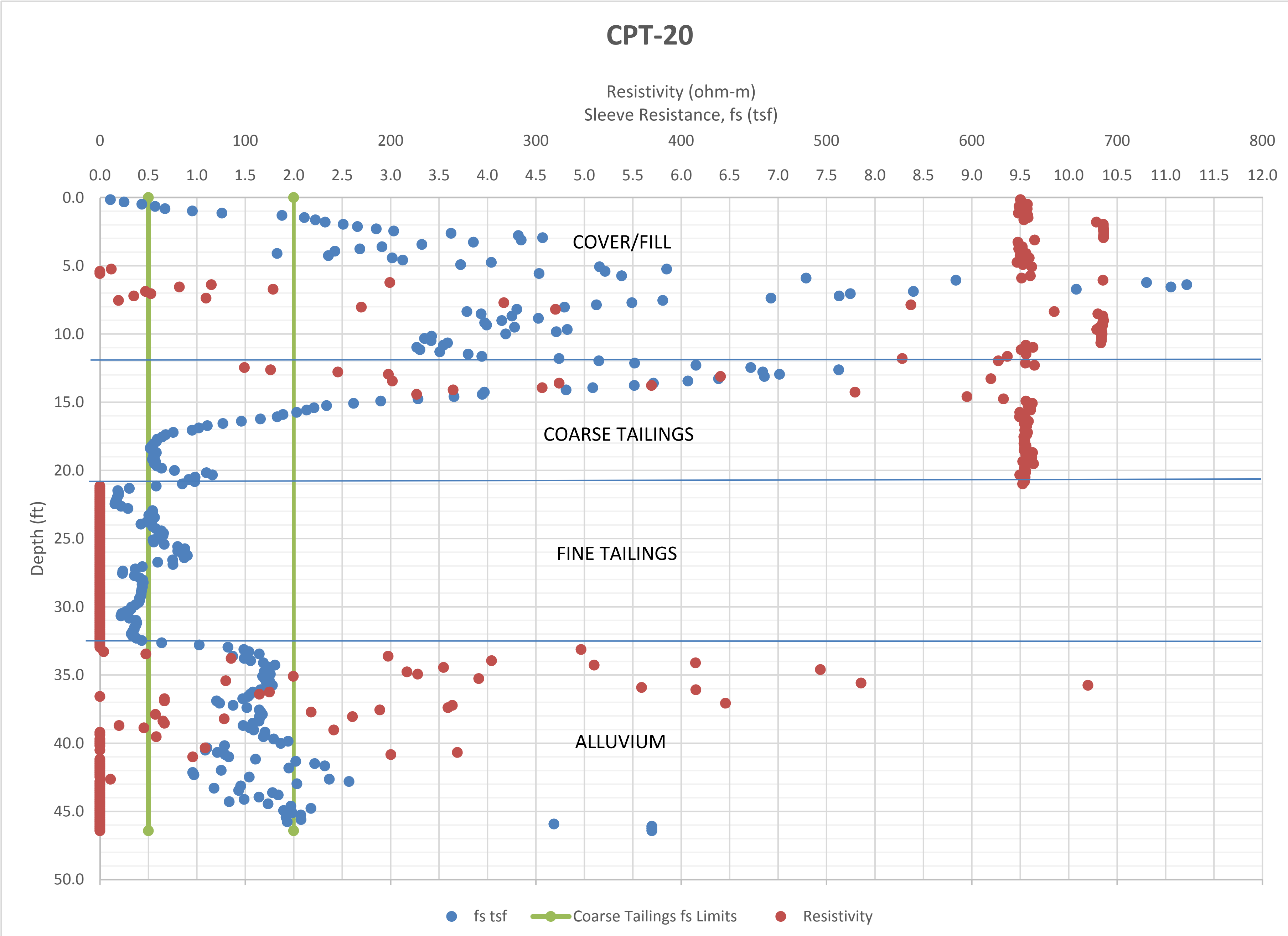

CPT-17
Resistivity (ohm-m)
Sleeve Resistance, fs (tsf)
0
100
200
300
400
500
600
700
800
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
Depth (ft)
0.0
10.0
20.0
30.0
40.0
50.0
60.0
COVER/FILL
COARSE TAILINGS
FINE TAILINGS
ALLUVIUM
fs tsf
Coarse Tailings fs Limits
Resistivity

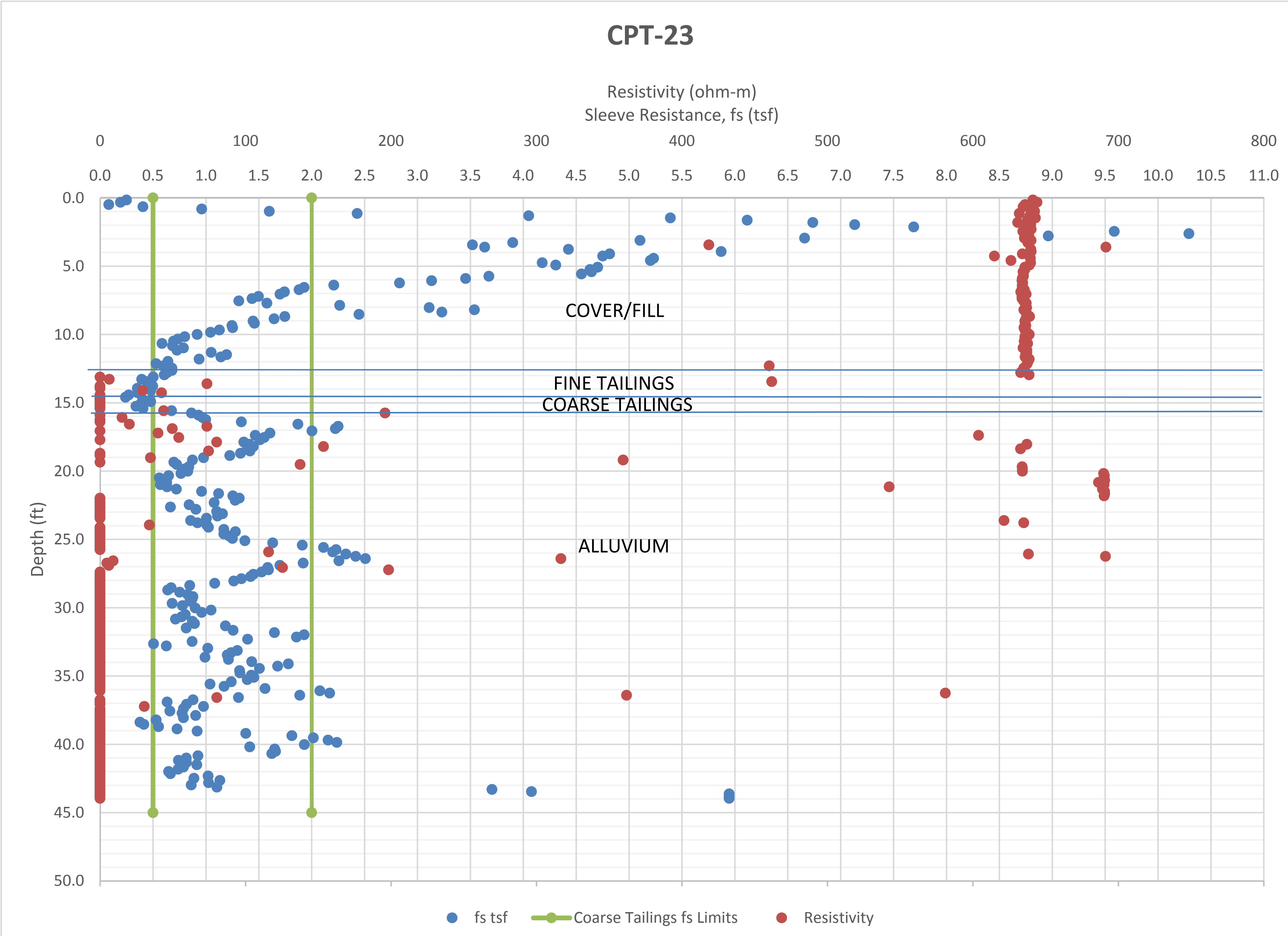


CPT-18
Resistivity (ohm-m)
Sleeve Resistance, fs (tsf)
0 100 200 300 400 500 600 700 800
0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5 10.0 10.5 11.0
Depth (ft)
0.0
10.0
20.0
30.0
40.0
50.0
60.0
COVER/FILL
COARSE TAILINGS
FINE TAILINGS
ALLUVIUM
fs tsf
Coarse Tailings fs Limits
Resistivity

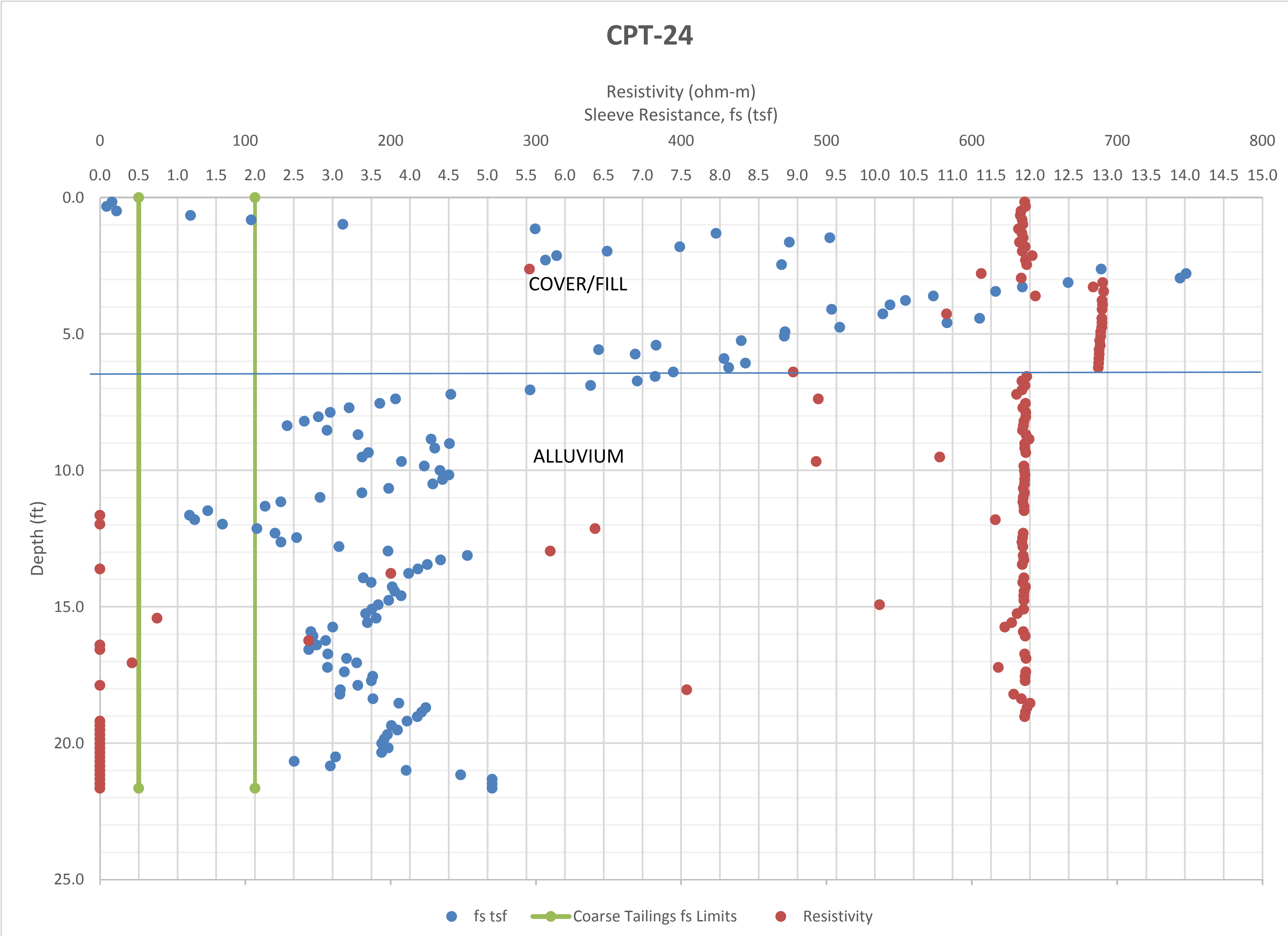


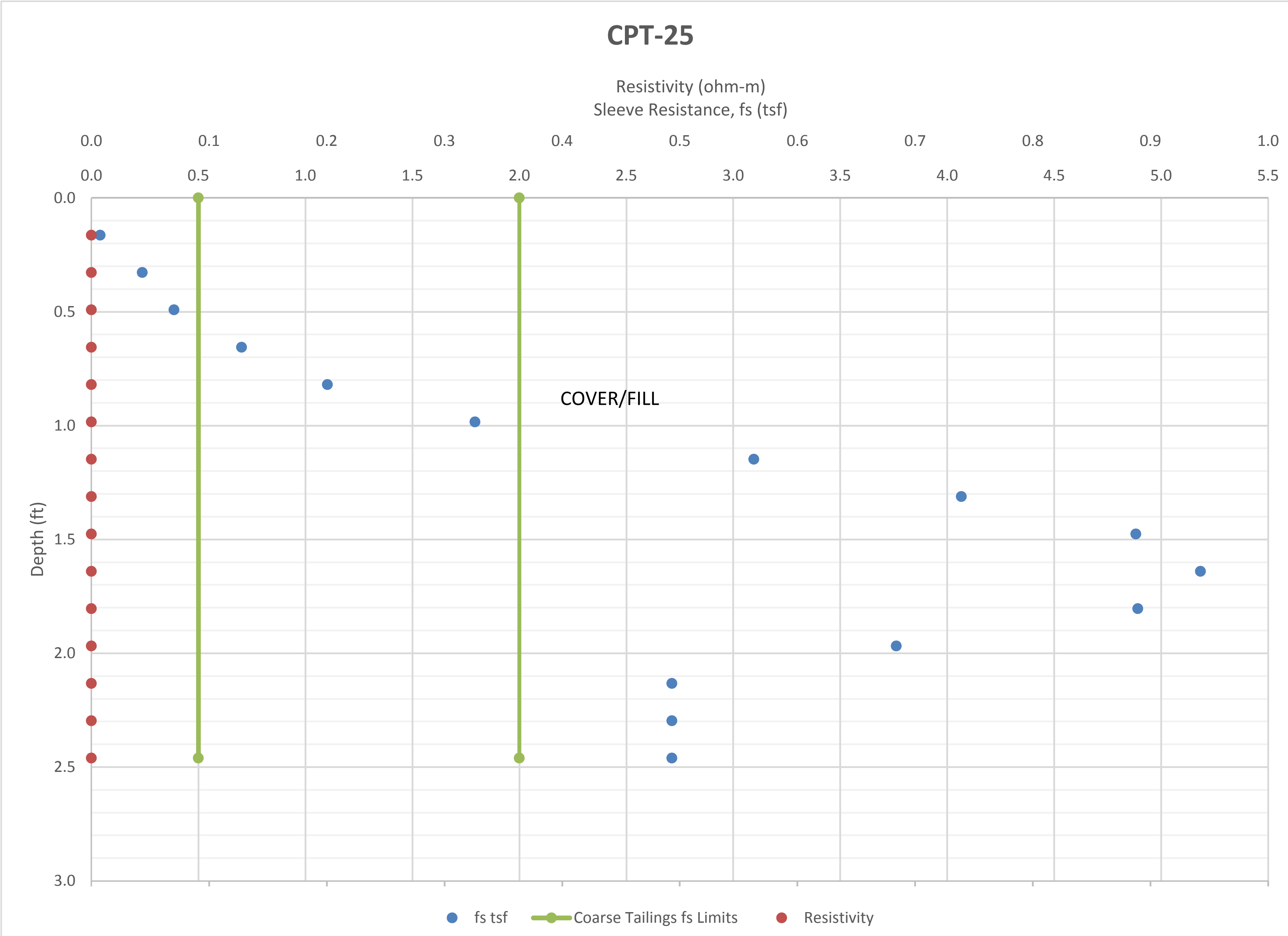
CPT-19
Resistivity (ohm-m)
Sleeve Resistance, fs (tsf)
0 100 200 300 400 500 600 700 800
0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5 10.0 10.5 11.0 11.5 12.0 12.5 13.0 13.5 14.0 14.5
Depth (ft)
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
COVER/FILL
COARSE TAILINGS
FINE TAILINGS
ALLUVIUM
fs tsf
Coarse Tailings fs Limits
Resistivity

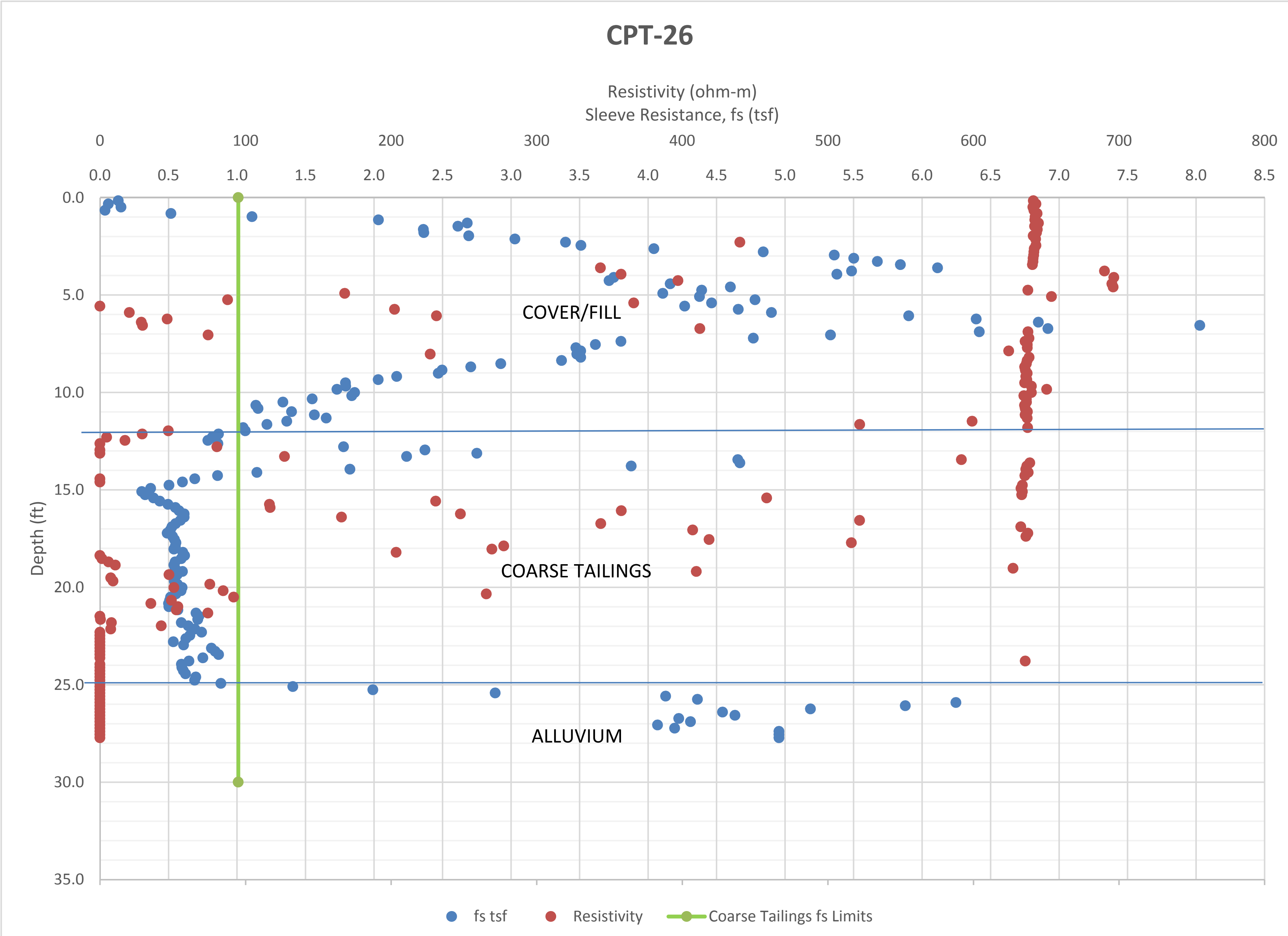

CPT-20
Resistivity (ohm-m)
Sleeve Resistance, fs (tsf)
0
100
200
300
400
500
600
700
800
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.5
9.0
9.5
10.0
10.5
11.0
11.5
12.0
Depth (ft)
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
COVER/FILL
COARSE TAILINGS
FINE TAILINGS
ALLUVIUM
fs tsf
Coarse Tailings fs Limits
Resistivity



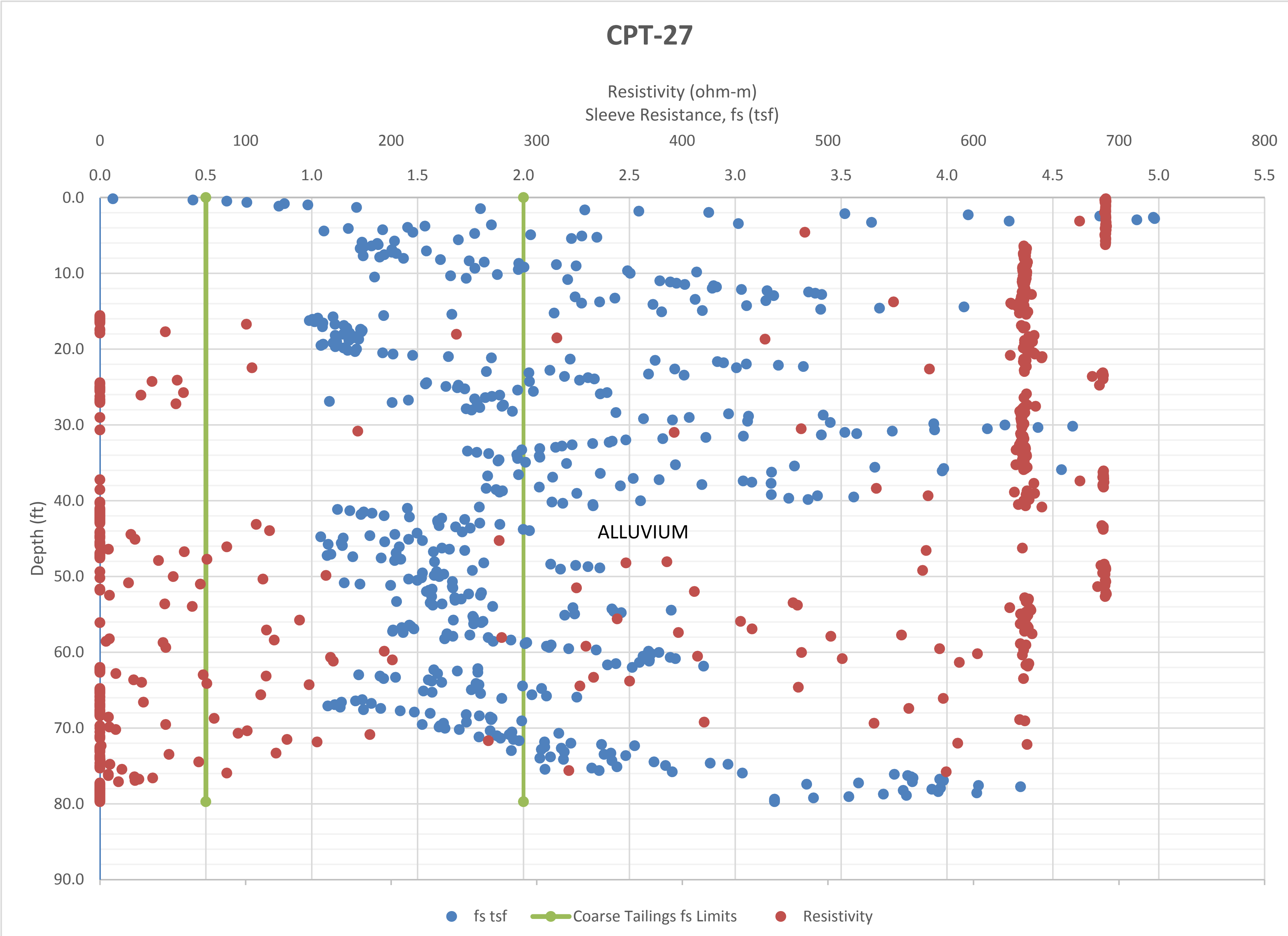
CPT-23
Resistivity (ohm-m)
Sleeve Resistance, fs (tsf)
0 100 200 300 400 500 600 700 800
0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5 10.0 10.5 11.0
Depth (ft)
0.0 5.0 10.0 15.0 20.0 25.0 30.0 35.0 40.0 45.0 50.0
COVER/FILL
FINE TAILINGS
COARSE TAILINGS
ALLUVIUM
fs tsf
Coarse Tailings fs Limits
Resistivity

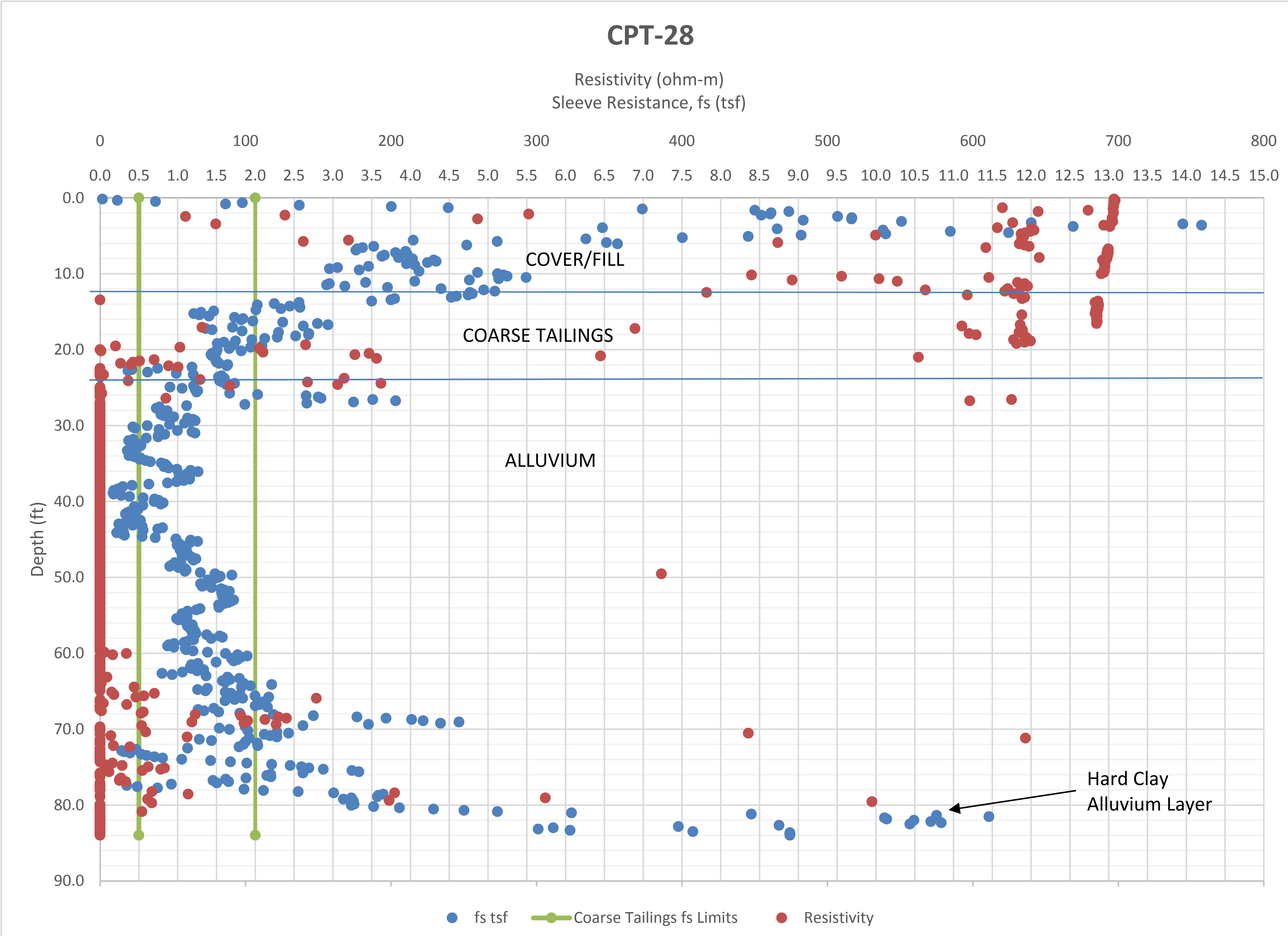

CPT-24
Resistivity (ohm-m)
Sleeve Resistance, fs (tsf)
0
100
200
300
400
500
600
700
800
0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5 10.0 10.5 11.0 11.5 12.0 12.5 13.0 13.5 14.0 14.5 15.0
Depth (ft)
0.0
5.0
10.0
15.0
20.0
25.0
COVER/FILL
ALLUVIUM
fs tsf
Coarse Tailings fs Limits
Resistivity

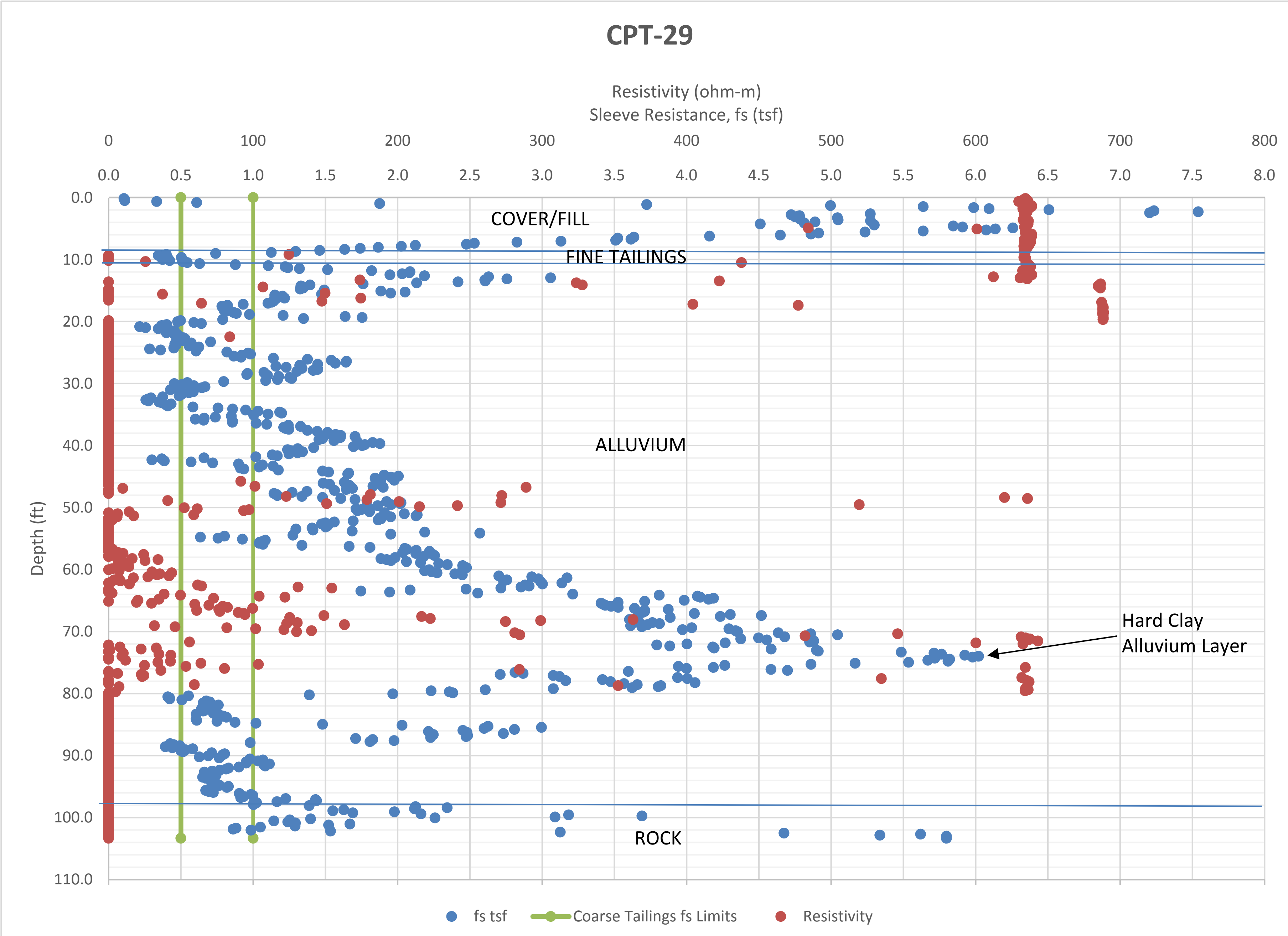

CPT-25
Resistivity (ohm-m)
Sleeve Resistance, fs (tsf)
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5
Depth (ft)
0.0 0.5 1.0 1.5 2.0 2.5 3.0
COVER/FILL
fs tsf
Coarse Tailings fs Limits
Resistivity



CPT-26
Resistivity (ohm-m)
Sleeve Resistance, fs (tsf)
0
100
200
300
400
500
600
700
800
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.5
Depth (ft)
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
COVER/FILL
COARSE TAILINGS
ALLUVIUM
fs tsf
Resistivity
Coarse Tailings fs Limits


CPT-27
Resistivity (ohm-m)
Sleeve Resistance, fs (tsf)
0
100
200
300
400
500
600
700
800
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
Depth (ft)
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
ALLUVIUM
fs tsf
Coarse Tailings fs Limits
Resistivity


CPT-28
Resistivity (ohm-m)
Sleeve Resistance, fs (tsf)
0 100 200 300 400 500 600 700 800
0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5 10.0 10.5 11.0 11.5 12.0 12.5 13.0 13.5 14.0 14.5 15.0
Depth (ft)
0.0 10.0 20.0 30.0 40.0 50.0 60.0 70.0 80.0 90.0
COVER/FILL
COARSE TAILINGS
ALLUVIUM
Hard Clay
Alluvium Layer
fs tsf
Coarse Tailings fs Limits
Resistivity



CPT-29
Resistivity (ohm-m)
Sleeve Resistance, fs (tsf)
0
100
200
300
400
500
600
700
800
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
Depth (ft)
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
110.0
COVER/FILL
FINE TAILINGS
ALLUVIUM
Hard Clay
Alluvium Layer
ROCK
fs tsf
Coarse Tailings fs Limits
Resistivity

ATTACHMENT C

CONSOLIDATION SPREADSHEET CALCULATIONS

Notes

t_0 corresponds to beginning of mine spoils and final cover placement — Assumes 99% of consolidation due to existing stress conditions has taken place

t_1 corresponds to completion of settlement due to waste and cover placement.

SOIL PROPERTIES

TAILINGS

	Specific Gravity, G_s	
2.67	Specific gravity of coarse tailings, $G_{s\text{-}CT}$	Average of results from laboratory testing of samples classified as "coarse tailings"
2.70	Specific gravity of fine tailings, $G_{s\text{-}FT}$	Average of results from laboratory testing of samples classified as "fine tailings"
	Dry Unit Weight, γ_d	
97.5	In-situ dry unit weight of coarse tailings at t_0, $\gamma_{d0\text{-}CT}$ (pcf)	Average of results from laboratory testing of samples classified as "coarse tailings"
71.7	In-situ dry unit weight of fine tailings at t_0, $\gamma_{d0\text{-}FT}$ (pcf)	Average of results from laboratory testing of samples classified as "fine tailings"
	Saturated Unit Weight, γ_{sat}	
123.4	In-situ saturated unit weight of coarse tailings at t_0, $\gamma_{sat0\text{-}CT}$ (pcf)	Calculated
107.5	In-situ saturated unit weight of fine tailings at t_0, $\gamma_{sat0\text{-}FT}$ (pcf)	Calculated
	Moist Unit Weight, γ_m	
108.1	Moist unit weight of coarse tailings, $\gamma_{m\text{-}CT}$ (pcf)	Calculated
107.6	Moist unit weight of fine tailings, $\gamma_{m\text{-}FT}$ (pcf)	Calculated, assuming 100% saturation
	Void Ratio, e	
0.71	Void ratio of coarse tailings at t_0, $e_{0\text{-}CT}$	Calculated
1.35	Void ratio of fine tailings at t_0, $e_{0\text{-}FT}$	Calculated
	Saturated Water Content, w_{Sat}	
27.8%	Saturated water content of coarse tailings at t_0, $w_{sat0\text{-}CT}$ (%)	Average of 12 specimens tested for SWCC
50.1%	Saturated water content of fine tailings at t_0, $w_{sat0\text{-}FT}$ (%)	Average of 4 specimens tested for SWCC
	Water Content of Moist Tailings, w_m	
10.9%	Water content of moist coarse tailings, $w_{m\text{-}CT}$ (%)	Average of results from laboratory testing of samples classified as "coarse tailings"
50.1%	Water content of moist fine tailings, $w_{m\text{-}FT}$ (%)	Assumes 100% saturation of fine tailings
	Compression Index, C_c	
0.084	Compression index of coarse tailings, $C_{c\text{-}CT}$	Average of 4 results from laboratory testing of samples classified as "coarse tailings"
0.408	Compression index of fine tailings, $C_{c\text{-}FT}$	Average of 3 results from laboratory testing of samples classified as "fine tailings"
	Other	
62.4	Unit Weight of Water, γ_w	

MINE SPOILS AND COVER MATERIALS

	Specific Gravity, G_s	
2.71	Specific gravity of cover soil with rock admixture, $G_{s\text{-}rock\text{-}mix}$	Average of results of laboratory testing performed on samples from erosion protection gravel stockpiles and all borrow sources, weighted for 33% rock in the mixture
2.69	Specific gravity of cover soil, $G_{s\text{-}cover}$	Average of results of laboratory testing performed on samples from all borrow sources, except the Dilco Hill borrow source
2.66	Specific gravity of mine spoils, $G_{s\text{-}spoils}$	Average of results of laboratory testing performed on samples from mine spoils
	Unit Weight, γ	
130.0	Maximum dry unit weight of cover soil with rock admixture, $\gamma_{rock\text{-}mix\text{-}max}$ (pcf)	Assumed, based on the properties of materials and 33% rock by volume
122.9	Moist unit weight of cover soil with rock admixture at 90% relative compaction, $\gamma_{rock\text{-}mix\text{-}90}$ (pcf)	Calculated
115.0	Maximum dry unit weight of cover soil $\gamma_{cover\text{-}max}$ (pcf)	Average of results of laboratory Proctor testing performed on samples from all borrow sources, except the Dilco Hill borrow source
114.7	Moist unit weight of cover soil at 90% relative compaction, $\gamma_{cover90}$ (pcf)	Calculated
118.3	Maximum dry unit weight of mine spoils, $\gamma_{spoils\text{-}max}$ (pcf)	Average of results of laboratory testing performed on samples from mine spoils
116.4	Moist unit weight of mine spoils at 90% relative compaction, $\gamma_{spoils90}$ (pcf)	Calculated
	Void Ratio, e	
0.45	Void Ratio of cover soil with rock admixture at 90% relative compaction, $e_{rock\text{-}mix\text{-}90}$	Calculated
0.62	Void Ratio of cover soil at 90% relative compaction, $e_{cover90}$	Calculated
0.56	Void Ratio of mine spoils at 90% relative compaction, $e_{spoils90}$	Calculated
	Long-Term Moisture Content, w	
5.0%	Long-term moisture content of cover soil with rock admixture, $w_{rock\text{-}mix}$ (%)	Assumed to be the same as the cover soil, average from the borrow samples

10.8%	Long-term moisture content of cover soil, w_{cover} (%)	Average minus 3% of optimum, of results of laboratory Proctor testing performed on samples from all borrow sources, except the Dilco Hill borrow source
9.3%	Long-term moisture content of mine spoils, w_{spoils} (%)	Average minus 3% of optimum water content based on results of laboratory testing performed on samples from mine spoils
Compression Index, C_c		
	Compression index of cover soil with rock admixture, $C_{c\text{-rock-mix}}$ (%)	Assumed to be the same as coarse tailings
0.086	Compression index of cover soil, $C_{c\text{-cover}}$ (%)	Assumed to be the same as mine spoils
0.086	Compression index of mine spoils, $C_{c\text{-spoils}}$ (%)	Average of 5 results of laboratory testing performed on samples from alluvium located beneath the tailings impoundment.
ALLUVIUM MATERIAL		
Specific Gravity, G_s		
2.72		Average of results of laboratory testing performed on samples of alluvium
Unit Weight, γ		
97.9	Dry unit weight of alluvium $\gamma_{alluvium}$ (pcf)	Average of results of laboratory testing performed on samples of alluvium
114.8	Moist unit weight of alluvium, $\gamma_{m\text{-alluvium}}$ (pcf)	Calculated
Void Ratio, e		
0.73		Calculated
In-place Moisture Content, w		
17.3		Average of results of laboratory testing performed on samples of alluvium
Compression Index, C_c		
0.09		Average of 5 results from laboratory testing performed on samples of alluvium
SECONDARY COMPRESSION INDEX		
Secondary Compression Index, C_α		
0.0017	For loads < 1650 psf	Average of 3 consolidation test results from laboratory testing performed on fine tailings (TI-B8, TI-B10, and TI-B11)
0.0036	For loads < 3250 psf, but > 1650 psf	Average of 3 consolidation test results from laboratory testing performed on fine tailings (TI-B8, TI-B10, and TI-B11)
0.0047	For loads < 6500 psf, but > 3250 psf	Average of 3 consolidation test results from laboratory testing performed on fine tailings (TI-B8, TI-B10, and TI-B11)
0.0087	For loads < 13000 psf, but > 6500 psf	Average of 2 consolidation test results from laboratory testing performed on fine tailings (TI-B10, and TI-B11)

NECR TAILINGS IMPOUNDMENT SETTLEMENT ANALYSIS - CPT-01(TI-B1)

LOCATION INFORMATION

1,692,256	Northing coordinate of CPT sounding	
2,524,535	Easting coordinate of CPT sounding	
6,972.1	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover design grading plan AutoCAD file
6,970.0	Existing Ground Surface Elevation (ft amsl)	From AutoCAD file
6,935.7	Elevation of Base of Tailings (ft amsl)	From AutoCAD file

FINAL COVER

2.1	Thickness of Erosion Protection Layer (ft)	B1 is beyond edge of waste
0.0	Thickness of General Fill Cover (ft)	B1 is beyond edge of waste

PRIMARY CONSOLIDATION

Soil Layer	Material Type	Unit Weight, γ (pcf)	Compression Index, C_c	Void Ratio at t_0, e_0	Elevation at Top of Layer at t_0, $z_{i\text{-}top0}$ (ft amsl)	Elevation at Midpoint of Layer at t_0, $z_{i\text{-}mid0}$ (ft amsl)	Elevation at Bottom of Layer at t_0, $z_{i\text{-}bott0}$ (ft amsl) [1]	Thickness of Layer at t_0, H (ft)	Effective Stress at Midpoint of Layer at t_0, $\sigma'_{i\text{-}mid0}$ (psf)	Effective Stress at Bottom of Layer at t_0, $\sigma'_{i\text{-}bott0}$ (psf)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-}mid1}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-}bott1}$ (psf)	Consolidation of Layer from t_0 to t_1 due to Placement of Mine Spoils and Final Cover, $\delta_{ci\text{-}t1}$ (ft)	% Settlement	Void Ratio at t_1, e_1	Change in Void Ratio, Δe
1	Erosion Protection	122.9	0.000	0.45	6972.1	6971.0	6970.0	2.1	N/A	N/A	128.9	257.9	0.00	0.0%	0.45	0.00
3	Cover	114.7	0.086	0.62	6970.0	6960.7	6951.5	18.5	1058.5	2117.1	1316.4	2374.9	0.00	0.0%	0.62	0.00
4	Coarse Tailings	108.1	0.084	0.71	6951.5	6946.0	6940.4	11.1	2717.2	3317.3	2975.0	3575.1	0.00	0.0%	0.62	-0.09
5	Fine Tailings	107.6	0.408	1.35	6940.4	6938.1	6935.7	4.7	3570.2	3823.1	3828.1	4081.0	0.02	0.5%	0.61	-0.74
											TOTAL SETTLEMENT:		0.02			

SECONDARY CONSOLIDATION

0.8	Time for completion of primary settlement, t_1 (years)
200.0	Time from completion of primary settlement, t_2 (years)

Soil Layer	Material Type	Secondary Compression Index, C_a	Thickness of Layer at t_0, H (ft)	Secondary Consolidation, S_s (ft)
5	Fine Tailings	0.0047	4.7	0.05
		TOTAL SETTLEMENT:		0.05

NECR TAILINGS IMPOUNDMENT SETTLEMENT ANALYSIS - CPT-02(TI-B2)

LOCATION INFORMATION

1,692,647	Northing coordinate of CPT sounding	
2,525,098	Easting coordinate of CPT sounding	
6,974.4	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover design grading plan AutoCAD file
6,960.2	Existing Ground Surface Elevation (ft amsl)	From AutoCAD file
6,945.2	Elevation of Base of Tailings (ft amsl)	From AutoCAD file

FINAL COVER

1.5	Thickness of Erosion Protection Layer (ft)	Assumed
2.5	Thickness of General Fill Cover (ft)	Assumed

PRIMARY CONSOLIDATION

Soil Layer	Material Type	Unit Weight, γ (pcf)	Compression Index, C_c	Void Ratio at t_0, e_0	Elevation at Top of Layer at t_0, $z_{i\text{-}top0}$ (ft amsl)	Elevation at Midpoint of Layer at t_0, $z_{i\text{-}mid0}$ (ft amsl)	Elevation at Bottom of Layer at t_0, $z_{i\text{-}bott0}$ (ft amsl) [1]	Thickness of Layer at t_0, H (ft)	Effective Stress at Midpoint of Layer at t_0, $\sigma'_{i\text{-}mid0}$ (psf)	Effective Stress at Bottom of Layer at t_0, $\sigma'_{i\text{-}bott0}$ (psf)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-}mid1}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-}bott1}$ (psf)	Consolidation of Layer from t_0 to t_1 due to Placement of Mine Spoils and Final Cover, $\delta_{ci\text{-}t1}$ (ft)	% Settlement	Void Ratio at t_1, e_1	Change in Void Ratio, Δe
1	Erosion Protection	122.9	0.000	0.45	6974.4	6973.7	6972.9	1.5	N/A	N/A	92.1	184.3	0.00	0.0%	0.45	0.00
2	Cover	114.7	0.086	0.62	6972.9	6971.7	6970.4	2.5	N/A	N/A	327.6	471.0	0.00	0.0%	0.62	0.00
3	Mine Spoils	116.4	0.086	0.56	6970.4	6965.0	6959.7	10.8	N/A	N/A	1097.8	1724.6	0.00	0.0%	0.56	0.00
4	Cover	114.7	0.086	0.62	6959.7	6953.5	6947.4	12.3	705.4	1410.9	2430.1	3135.5	0.00	0.0%	0.62	0.00
5	Fine Tailings	107.6	0.408	1.35	6947.4	6946.3	6945.2	2.2	1529.3	1647.7	3253.9	3372.3	0.13	5.7%	0.53	-0.82
											TOTAL SETTLEMENT:		**0.13**			

SECONDARY CONSOLIDATION

0.8	Time for completion of primary settlement, t_1 (years)
200.0	Time from completion of primary settlement, t_2 (years)

Soil Layer	Material Type	Secondary Compression Index, C_a	Thickness of Layer at t_0, H (ft)	Secondary Consolidation, S_s (ft)
5	Fine Tailings	0.0047	2.2	0.03
		TOTAL SETTLEMENT:		**0.03**

NECR TAILINGS IMPOUNDMENT SETTLEMENT ANALYSIS - CPT-04

LOCATION INFORMATION

1,692,397	Northing coordinate of CPT sounding	
2,524,891	Easting coordinate of CPT sounding	
6,977.8	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover design grading plan AutoCAD file
6,965.0	Existing Ground Surface Elevation (ft amsl)	From AutoCAD file
6,945.2	Elevation of Base of Tailings (ft amsl)	From AutoCAD file

FINAL COVER

1.5	Thickness of Erosion Protection Layer (ft)	Assumed
2.5	Thickness of General Fill Cover (ft)	Assumed

PRIMARY CONSOLIDATION

Soil Layer	Material Type	Unit Weight, γ (pcf)	Compression Index, C_c	Void Ratio at t_0, e_0	Elevation at Top of Layer at t_0, $z_{i\text{-}top0}$ (ft amsl)	Elevation at Midpoint of Layer at t_0, $z_{i\text{-}mid0}$ (ft amsl)	Elevation at Bottom of Layer at t_0, $z_{i\text{-}bott0}$ (ft amsl) [1]	Thickness of Layer at t_0, H (ft)	Effective Stress at Midpoint of Layer at t_0, $\sigma'_{i\text{-}mid0}$ (psf)	Effective Stress at Bottom of Layer at t_0, $\sigma'_{i\text{-}bott0}$ (psf)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-}mid1}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-}bott1}$ (psf)	Consolidation of Layer from t_0 to t_1 due to Placement of Mine Spoils and Final Cover, $\delta_{ci\text{-}t1}$ (ft)	% Settlement	Void Ratio at t_1, e_1	Change in Void Ratio, Δe
1	Erosion Protection	122.9	0.000	0.45	6977.8	6977.0	6976.3	1.5	N/A	N/A	92.1	184.3	0.00	0.0%	0.45	0.00
2	Cover	114.7	0.086	0.62	6976.3	6975.0	6973.8	2.5	N/A	N/A	327.6	471.0	0.00	0.0%	0.62	0.00
3	Mine Spoils	116.4	0.086	0.56	6973.8	6969.1	6964.5	9.3	N/A	N/A	1010.1	1549.3	0.00	0.0%	0.56	0.00
4	Cover	114.7	0.086	0.62	6964.5	6959.7	6955.0	9.5	543.9	1087.8	2093.2	2637.1	0.00	0.0%	0.62	0.00
5	Coarse Tailings	108.1	0.084	0.71	6955.0	6952.0	6949.0	6.0	1412.2	1736.6	2961.5	3285.9	0.00	0.0%	0.62	-0.09
6	Fine Tailings	107.6	0.408	1.35	6949.0	6947.1	6945.2	3.8	1942.9	2149.1	3492.1	3698.4	0.17	4.4%	0.55	-0.80
											TOTAL SETTLEMENT:		0.17			

SECONDARY CONSOLIDATION

0.8	Time for completion of primary settlement, t_1 (years)
200.0	Time from completion of primary settlement, t_2 (years)

Soil Layer	Material Type	Secondary Compression Index, C_a	Thickness of Layer at t_0, H (ft)	Secondary Consolidation, S_s (ft)
6	Fine Tailings	0.0047	3.8	0.04
		TOTAL SETTLEMENT:		0.04

NECR TAILINGS IMPOUNDMENT SETTLEMENT ANALYSIS - CPT-05

LOCATION INFORMATION

1,692,072	Northing coordinate of CPT sounding	
2,525,535	Easting coordinate of CPT sounding	
6,999.4	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover design grading plan AutoCAD file
6,973.0	Existing Ground Surface Elevation (ft amsl)	From AutoCAD file
6,963.0	Elevation of Base of Tailings (ft amsl)	From AutoCAD file

FINAL COVER

1.1	Thickness of Erosion Protection Layer (ft)	Assumed
2.9	Thickness of General Fill Cover (ft)	Assumed

PRIMARY CONSOLIDATION

Soil Layer	Material Type	Unit Weight, γ (pcf)	Compression Index, C_c	Void Ratio at t_0, e_0	Elevation at Top of Layer at t_0, $z_{i\text{-top0}}$ (ft amsl)	Elevation at Midpoint of Layer at t_0, $z_{i\text{-mid0}}$ (ft amsl)	Elevation at Bottom of Layer at t_0, $z_{i\text{-bott0}}$ (ft amsl) [1]	Thickness of Layer at t_0, H (ft)	Effective Stress at Midpoint of Layer at t_0, $\sigma'_{i\text{-mid0}}$ (psf)	Effective Stress at Bottom of Layer at t_0, $\sigma'_{i\text{-bott0}}$ (psf)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-mid1}}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-bott1}}$ (psf)	Consolidation of Layer from t_0 to t_1 due to Placement of Mine Spoils and Final Cover, $\delta_{ci\text{-}t1}$ (ft)	% Settlement	Void Ratio at t_1, e_1	Change in Void Ratio, Δe
1	Erosion Protection	122.9	0.000	0.45	6999.4	6998.8	6998.2	1.1	N/A	N/A	69.1	138.2	0.00	0.0%	0.45	0.00
2	Cover	114.7	0.086	0.62	6998.2	6996.8	6995.3	2.9	N/A	N/A	304.5	470.8	0.00	0.0%	0.62	0.00
3	Mine Spoils	116.4	0.086	0.56	6995.3	6983.9	6972.5	22.8	N/A	N/A	1798.0	3125.2	0.00	0.0%	0.56	0.00
4	Cover	114.7	0.086	0.62	6972.5	6969.8	6967.0	5.5	317.0	634.1	3442.2	3759.3	0.00	0.0%	0.62	0.00
5	Coarse Tailings	108.1	0.084	0.71	6967.0	6965.0	6963.0	4.0	851.4	1068.8	3976.7	4194.0	0.00	0.0%	0.62	-0.09
												TOTAL SETTLEMENT:	**0.00**			

SECONDARY CONSOLIDATION

0.8	Time for completion of primary settlement, t_1 (years)
200.0	Time from completion of primary settlement, t_2 (years)

Soil Layer	Material Type	Secondary Compression Index, C_a	Thickness of Layer at t_0, H (ft)	Secondary Consolidation, S_s (ft)
NA	Fine Tailings	0.0000	0.0	0.00
			TOTAL SETTLEMENT:	**0.00**

NECR TAILINGS IMPOUNDMENT SETTLEMENT ANALYSIS - CPT-06

LOCATION INFORMATION

1,691,925	Northing coordinate of CPT sounding	
2,525,897	Easting coordinate of CPT sounding	
6,997.7	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover design grading plan AutoCAD file
6,974.2	Existing Ground Surface Elevation (ft amsl)	From AutoCAD file
6,940.0	Elevation of Base of Tailings (ft amsl)	From AutoCAD file

FINAL COVER

1.1	Thickness of Erosion Protection Layer (ft)	Assumed
2.9	Thickness of General Fill Cover (ft)	Assumed

PRIMARY CONSOLIDATION

Soil Layer	Material Type	Unit Weight, γ (pcf)	Compression Index, C_c	Void Ratio at t_0, e_0	Elevation at Top of Layer at t_0, $z_{i\text{-top0}}$ (ft amsl)	Elevation at Midpoint of Layer at t_0, $z_{i\text{-mid0}}$ (ft amsl)	Elevation at Bottom of Layer at t_0, $z_{i\text{-bott0}}$ (ft amsl) [1]	Thickness of Layer at t_0, H (ft)	Effective Stress at Midpoint of Layer at t_0, $\sigma'_{i\text{-mid0}}$ (psf)	Effective Stress at Bottom of Layer at t_0, $\sigma'_{i\text{-bott0}}$ (psf)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-mid1}}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-bott1}}$ (psf)	Consolidation of Layer from t_0 to t_1 due to Placement of Mine Spoils and Final Cover, $\delta_{ci\text{-}t1}$ (ft)	% Settlement	Void Ratio at t_1, e_1	Change in Void Ratio, Δe
1	Erosion Protection	122.9	0.000	0.45	6997.7	6997.1	6996.6	1.1	N/A	N/A	67.6	135.1	0.00	0.0%	0.45	0.00
2	Cover	114.7	0.086	0.62	6996.6	6995.1	6993.7	2.9	N/A	N/A	301.4	467.7	0.00	0.0%	0.62	0.00
3	Mine Spoils	116.4	0.086	0.56	6993.7	6983.7	6973.7	20.0	N/A	N/A	1629.9	2792.1	0.00	0.0%	0.56	0.00
4	Cover	114.7	0.086	0.62	6973.7	6970.5	6967.3	6.4	367.0	733.9	3159.1	3526.0	0.00	0.0%	0.62	0.00
5	Coarse Tailings	108.1	0.084	0.71	6967.3	6963.2	6959.0	8.3	1182.7	1631.4	3974.8	4423.5	0.00	0.0%	0.62	-0.09
6	Fine Tailings	107.6	0.408	1.35	6959.0	6949.5	6940.0	19.0	2654.1	3676.7	5446.2	6468.9	1.03	5.4%	0.53	-0.82
											TOTAL SETTLEMENT:		**1.03**			

SECONDARY CONSOLIDATION

0.8	Time for completion of primary settlement, t_1 (years)
200.0	Time from completion of primary settlement, t_2 (years)

Soil Layer	Material Type	Secondary Compression Index, C_a	Thickness of Layer at t_0, H (ft)	Secondary Consolidation, S_s (ft)
6	Fine Tailings	0.0047	19.0	0.22
		TOTAL SETTLEMENT:		**0.22**

NECR TAILINGS IMPOUNDMENT SETTLEMENT ANALYSIS - CPT-08(TI-B8)

LOCATION INFORMATION

1,691,558	Northing coordinate of CPT sounding	
2,525,841	Easting coordinate of CPT sounding	
6,990.3	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover design grading plan AutoCAD file
6,976.0	Existing Ground Surface Elevation (ft amsl)	From AutoCAD file
6,931.6	Elevation of Base of Tailings (ft amsl)	From AutoCAD file

FINAL COVER

1.1	Thickness of Erosion Protection Layer (ft)	Assumed
2.9	Thickness of General Fill Cover (ft)	Assumed

PRIMARY CONSOLIDATION

Soil Layer	Material Type	Unit Weight, γ (pcf)	Compression Index, C_c	Void Ratio at t_0, e_0	Elevation at Top of Layer at t_0, z_{i-top0} (ft amsl)	Elevation at Midpoint of Layer at t_0, z_{i-mid0} (ft amsl)	Elevation at Bottom of Layer at t_0, $z_{i-bott0}$ (ft amsl) [1]	Thickness of Layer at t_0, H (ft)	Effective Stress at Midpoint of Layer at t_0, σ'_{i-mid0} (psf)	Effective Stress at Bottom of Layer at t_0, $\sigma'_{i-bott0}$ (psf)	Effective Stress at Midpoint of Layer at t_1, σ'_{i-mid1} (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i-bott1}$ (psf)	Consolidation of Layer from t_0 to t_1 due to Placement of Mine Spoils and Final Cover, δ_{ci-t1} (ft)	% Settlement	Void Ratio at t_1, e_1	Change in Void Ratio, Δe
1	Erosion Protection	122.9	0.000	0.45	6990.3	6989.7	6989.2	1.1	N/A	N/A	67.6	135.1	0.00	0.0%	0.45	0.00
2	Cover	114.7	0.086	0.62	6989.2	6987.7	6986.3	2.9	N/A	N/A	301.4	467.7	0.00	0.0%	0.62	0.00
3	Mine Spoils	116.4	0.086	0.56	6986.3	6980.9	6975.5	10.7	N/A	N/A	1091.2	1714.6	0.00	0.0%	0.56	0.00
4	Cover	114.7	0.086	0.62	6975.5	6972.3	6969.1	6.4	369.5	739.0	2084.1	2453.6	0.00	0.0%	0.62	0.00
5	Coarse Tailings	108.1	0.084	0.71	6969.1	6959.5	6949.8	19.3	1782.4	2825.8	3497.0	4540.5	0.00	0.0%	0.62	-0.09
6	Fine Tailings	107.6	0.408	1.35	6949.8	6940.7	6931.6	18.2	3805.2	4784.6	5519.8	6499.2	0.51	2.8%	0.57	-0.78
											TOTAL SETTLEMENT:		0.51			

SECONDARY CONSOLIDATION

0.8	Time for completion of primary settlement, t_1 (years)
200.0	Time from completion of primary settlement, t_2 (years)

Soil Layer	Material Type	Secondary Compression Index, C_a	Thickness of Layer at t_0, H (ft)	Secondary Consolidation, S_s (ft)
6	Fine Tailings	0.0047	18.2	0.21
		TOTAL SETTLEMENT:		0.21

NECR TAILINGS IMPOUNDMENT SETTLEMENT ANALYSIS - CPT-09

LOCATION INFORMATION

1,691,743	Northing coordinate of CPT sounding	
2,525,574	Easting coordinate of CPT sounding	
6,993.0	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover design grading plan AutoCAD file
6,975.5	Existing Ground Surface Elevation (ft amsl)	From AutoCAD file
6,930.0	Elevation of Base of Tailings (ft amsl)	From AutoCAD file

FINAL COVER

1.1	Thickness of Erosion Protection Layer (ft)	Assumed
2.9	Thickness of General Fill Cover (ft)	Assumed

PRIMARY CONSOLIDATION

Soil Layer	Material Type	Unit Weight, γ (pcf)	Compression Index, C_c	Void Ratio at t_0, e_0	Elevation at Top of Layer at t_0, $z_{i\text{-}top0}$ (ft amsl)	Elevation at Midpoint of Layer at t_0, $z_{i\text{-}mid0}$ (ft amsl)	Elevation at Bottom of Layer at t_0, $z_{i\text{-}bott0}$ (ft amsl) [1]	Thickness of Layer at t_0, H (ft)	Effective Stress at Midpoint of Layer at t_0, $\sigma'_{i\text{-}mid0}$ (psf)	Effective Stress at Bottom of Layer at t_0, $\sigma'_{i\text{-}bott0}$ (psf)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-}mid1}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-}bott1}$ (psf)	Consolidation of Layer from t_0 to t_1 due to Placement of Mine Spoils and Final Cover, $\delta_{ci\text{-}t1}$ (ft)	% Settlement	Void Ratio at t_1, e_1	Change in Void Ratio, Δe
1	Erosion Protection	122.9	0.000	0.45	6993.0	6992.5	6991.9	1.1	N/A	N/A	67.6	135.1	0.00	0.0%	0.45	0.00
2	Cover	114.7	0.086	0.62	6991.9	6990.5	6989.0	2.9	N/A	N/A	301.4	467.7	0.00	0.0%	0.62	0.00
3	Mine Spoils	116.4	0.086	0.56	6989.0	6982.0	6975.0	14.0	N/A	N/A	1282.2	2096.7	0.00	0.0%	0.56	0.00
4	Cover	114.7	0.086	0.62	6975.0	6971.8	6968.6	6.4	367.7	735.4	2464.4	2832.1	0.00	0.0%	0.62	0.00
5	Coarse Tailings	108.1	0.084	0.71	6968.6	6964.4	6960.2	8.4	1189.6	1643.7	3286.2	3740.4	0.00	0.0%	0.62	-0.09
6	Fine Tailings	107.6	0.408	1.35	6960.2	6945.1	6930.0	30.2	3268.8	4893.9	5365.5	6990.5	1.13	3.7%	0.56	-0.79
											TOTAL SETTLEMENT:		1.13			

SECONDARY CONSOLIDATION

0.8	Time for completion of primary settlement, t_1 (years)
200.0	Time from completion of primary settlement, t_2 (years)

Soil Layer	Material Type	Secondary Compression Index, C_a	Thickness of Layer at t_0, H (ft)	Secondary Consolidation, S_s (ft)
6	Fine Tailings	0.0047	30.2	0.34
		TOTAL SETTLEMENT:		0.34

NECR TAILINGS IMPOUNDMENT SETTLEMENT ANALYSIS - CPT-10(TI-B10)

LOCATION INFORMATION

1,691,776	Northing coordinate of CPT sounding	
2,525,854	Easting coordinate of CPT sounding	
6,994.6	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover design grading plan AutoCAD file
6,973.6	Existing Ground Surface Elevation (ft amsl)	From AutoCAD file
6,930.0	Elevation of Base of Tailings (ft amsl)	From AutoCAD file

FINAL COVER

1.1	Thickness of Erosion Protection Layer (ft)	Assumed
2.9	Thickness of General Fill Cover (ft)	Assumed

PRIMARY CONSOLIDATION

Soil Layer	Material Type	Unit Weight, γ (pcf)	Compression Index, C_c	Void Ratio at t_0, e_0	Elevation at Top of Layer at t_0, $z_{i\text{-}top0}$ (ft amsl)	Elevation at Midpoint of Layer at t_0, $z_{i\text{-}mid0}$ (ft amsl)	Elevation at Bottom of Layer at t_0, $z_{i\text{-}bott0}$ (ft amsl) [1]	Thickness of Layer at t_0, H (ft)	Effective Stress at Midpoint of Layer at t_0, $\sigma'_{i\text{-}mid0}$ (psf)	Effective Stress at Bottom of Layer at t_0, $\sigma'_{i\text{-}bott0}$ (psf)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-}mid1}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-}bott1}$ (psf)	Consolidation of Layer from t_0 to t_1 due to Placement of Mine Spoils and Final Cover, $\delta_{ci\text{-}t1}$ (ft)	% Settlement	Void Ratio at t_1, e_1	Change in Void Ratio, Δe
1	Erosion Protection	122.9	0.000	0.45	6994.6	6994.0	6993.5	1.1	N/A	N/A	67.6	135.1	0.00	0.0%	0.45	0.00
2	Cover	114.7	0.086	0.62	6993.5	6992.0	6990.6	2.9	N/A	N/A	301.4	467.7	0.00	0.0%	0.62	0.00
3	Mine Spoils	116.4	0.086	0.56	6990.6	6981.8	6973.1	17.5	N/A	N/A	1485.8	2503.9	0.00	0.0%	0.56	0.00
4	Cover	114.7	0.086	0.62	6973.1	6970.0	6967.0	6.1	349.7	699.3	2853.5	3203.2	0.00	0.0%	0.62	0.00
5	Coarse Tailings	108.1	0.084	0.71	6967.0	6961.2	6955.4	11.6	1326.4	1953.6	3830.3	4457.4	0.00	0.0%	0.62	-0.09
6	Fine Tailings	107.6	0.408	1.35	6955.4	6942.7	6930.0	25.4	3320.4	4687.2	5824.2	7191.0	1.08	4.2%	0.55	-0.80
											TOTAL SETTLEMENT:		1.08			

SECONDARY CONSOLIDATION

0.8	Time for completion of primary settlement, t_1 (years)
200.0	Time from completion of primary settlement, t_2 (years)

Soil Layer	Material Type	Secondary Compression Index, C_a	Thickness of Layer at t_0, H (ft)	Secondary Consolidation, S_s (ft)
6	Fine Tailings	0.0047	25.4	0.29
			TOTAL SETTLEMENT:	0.29

NECR TAILINGS IMPOUNDMENT SETTLEMENT ANALYSIS - CPT-11(TI-B11)

LOCATION INFORMATION

1,691,704	Northing coordinate of CPT sounding	
2,526,258	Easting coordinate of CPT sounding	
6,981.7	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover design grading plan AutoCAD file
6,977.4	Existing Ground Surface Elevation (ft amsl)	From AutoCAD file
6,920.0	Elevation of Base of Tailings (ft amsl)	From AutoCAD file

FINAL COVER

1.1	Thickness of Erosion Protection Layer (ft)	Assumed
2.9	Thickness of General Fill Cover (ft)	Assumed

PRIMARY CONSOLIDATION

Soil Layer	Material Type	Unit Weight, γ (pcf)	Compression Index, C_c	Void Ratio at t_0, e_0	Elevation at Top of Layer at t_0, $z_{i\text{-top0}}$ (ft amsl)	Elevation at Midpoint of Layer at t_0, $z_{i\text{-mid0}}$ (ft amsl)	Elevation at Bottom of Layer at t_0, $z_{i\text{-bott0}}$ (ft amsl) [1]	Thickness of Layer at t_0, H (ft)	Effective Stress at Midpoint of Layer at t_0, $\sigma'_{i\text{-mid0}}$ (psf)	Effective Stress at Bottom of Layer at t_0, $\sigma'_{i\text{-bott0}}$ (psf)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-mid1}}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-bott1}}$ (psf)	Consolidation of Layer from t_0 to t_1 due to Placement of Mine Spoils and Final Cover, $\delta_{ci\text{-}t1}$ (ft)	% Settlement	Void Ratio at t_1, e_1	Change in Void Ratio, Δe
1	Erosion Protection	122.9	0.000	0.45	6981.7	6981.2	6980.6	1.1	N/A	N/A	67.6	135.1	0.00	0.0%	0.45	0.00
2	Cover	114.7	0.086	0.62	6980.6	6979.2	6977.7	2.9	N/A	N/A	301.4	467.7	0.00	0.0%	0.62	0.00
3	Mine Spoils	116.4	0.086	0.56	6977.7	6977.3	6976.9	0.8	N/A	N/A	512.8	557.9	0.00	0.0%	0.56	0.00
4	Cover	114.7	0.086	0.62	6976.9	6954.4	6931.9	45.0	2582.0	5164.1	3139.9	5722.0	0.00	0.0%	0.62	0.00
5	Fine Tailings	107.6	0.408	1.35	6931.9	6926.0	6920.0	11.9	5804.4	6444.8	6362.3	7002.7	0.08	0.7%	0.61	-0.74
											TOTAL SETTLEMENT:		**0.08**			

SECONDARY CONSOLIDATION

0.8	Time for completion of primary settlement, t_1 (years)
200.0	Time from completion of primary settlement, t_2 (years)

Soil Layer	Material Type	Secondary Compression Index, C_a	Thickness of Layer at t_0, H (ft)	Secondary Consolidation, S_s (ft)
5	Fine Tailings	0.0047	11.9	0.14
		TOTAL SETTLEMENT:		**0.14**

NECR TAILINGS IMPOUNDMENT SETTLEMENT ANALYSIS - CPT-12

LOCATION INFORMATION

1,691,527	Northing coordinate of CPT sounding	
2,526,216	Easting coordinate of CPT sounding	
6,983.8	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover design grading plan AutoCAD file
6,978.9	Existing Ground Surface Elevation (ft amsl)	From AutoCAD file
6,932.4	Elevation of Base of Tailings (ft amsl)	From AutoCAD file

FINAL COVER

1.1	Thickness of Erosion Protection Layer (ft)	Assumed
2.9	Thickness of General Fill Cover (ft)	Assumed

PRIMARY CONSOLIDATION

Soil Layer	Material Type	Unit Weight, γ (pcf)	Compression Index, C_c	Void Ratio at t_0, e_0	Elevation at Top of Layer at t_0, $z_{i\text{-}top0}$ (ft amsl)	Elevation at Midpoint of Layer at t_0, $z_{i\text{-}mid0}$ (ft amsl)	Elevation at Bottom of Layer at t_0, $z_{i\text{-}bott0}$ (ft amsl) [1]	Thickness of Layer at t_0, H (ft)	Effective Stress at Midpoint of Layer at t_0, $\sigma'_{i\text{-}mid0}$ (psf)	Effective Stress at Bottom of Layer at t_0, $\sigma'_{i\text{-}bott0}$ (psf)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-}mid1}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-}bott1}$ (psf)	Consolidation of Layer from t_0 to t_1 due to Placement of Mine Spoils and Final Cover, $\delta_{ci\text{-}t1}$ (ft)	% Settlement	Void Ratio at t_1, e_1	Change in Void Ratio, Δe
1	Erosion Protection	122.9	0.000	0.45	6983.8	6983.3	6982.7	1.1	N/A	N/A	67.6	135.1	0.00	0.0%	0.45	0.00
2	Cover	114.7	0.086	0.62	6982.7	6981.3	6979.8	2.9	N/A	N/A	301.4	467.7	0.00	0.0%	0.62	0.00
3	Mine Spoils	116.4	0.086	0.56	6979.8	6979.1	6978.4	1.4	N/A	N/A	548.5	629.3	0.00	0.0%	0.56	0.00
4	Cover	114.7	0.086	0.62	6978.4	6956.7	6934.9	43.5	2496.3	4992.6	3125.7	5622.0	0.00	0.0%	0.62	0.00
5	Fine Tailings	107.6	0.408	1.35	6934.9	6933.7	6932.4	2.5	5127.1	5261.7	5756.5	5891.0	0.02	0.9%	0.61	-0.74
											TOTAL SETTLEMENT:		**0.02**			

SECONDARY CONSOLIDATION

0.8	Time for completion of primary settlement, t_1 (years)
200.0	Time from completion of primary settlement, t_2 (years)

Soil Layer	Material Type	Secondary Compression Index, C_a	Thickness of Layer at t_0, H (ft)	Secondary Consolidation, S_s (ft)
5	Fine Tailings	0.0047	2.5	0.03
		TOTAL SETTLEMENT:		**0.03**

NECR TAILINGS IMPOUNDMENT SETTLEMENT ANALYSIS - CPT-13

LOCATION INFORMATION

1,692,229	Northing coordinate of CPT sounding	
2,525,213	Easting coordinate of CPT sounding	
6,994.4	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover design grading plan AutoCAD file
6,969.2	Existing Ground Surface Elevation (ft amsl)	From AutoCAD file
-	Elevation of Base of Tailings (ft amsl)	From AutoCAD file

FINAL COVER

1.1	Thickness of Erosion Protection Layer (ft)	Assumed
2.9	Thickness of General Fill Cover (ft)	Assumed

PRIMARY CONSOLIDATION

Soil Layer	Material Type	Unit Weight, γ (pcf)	Compression Index, C_c	Void Ratio at t_0, e_0	Elevation at Top of Layer at t_0, $z_{i\text{-top}0}$ (ft amsl)	Elevation at Midpoint of Layer at t_0, $z_{i\text{-mid}0}$ (ft amsl)	Elevation at Bottom of Layer at t_0, $z_{i\text{-bott}0}$ (ft amsl) [1]	Thickness of Layer at t_0, H (ft)	Effective Stress at Midpoint of Layer at t_0, $\sigma'_{i\text{-mid}0}$ (psf)	Effective Stress at Bottom of Layer at t_0, $\sigma'_{i\text{-bott}0}$ (psf)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-mid}1}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-bott}1}$ (psf)	Consolidation of Layer from t_0 to t_1 due to Placement of Mine Spoils and Final Cover, $\delta_{ci\text{-}t1}$ (ft)	% Settlement	Void Ratio at t_1, e_1	Change in Void Ratio, Δe
1	Erosion Protection	122.9	0.000	0.45	6994.4	6993.8	6993.3	1.1	N/A	N/A	67.6	135.1	0.00	0.0%	0.45	0.00
2	Cover	114.7	0.086	0.62	6993.3	6991.8	6990.4	2.9	N/A	N/A	301.4	467.7	0.00	0.0%	0.62	0.00
3	Mine Spoils	116.4	0.086	0.56	6990.4	6979.6	6968.7	21.6	N/A	N/A	1726.6	2985.4	0.00	0.0%	0.56	0.00
4	Cover	114.7	0.086	0.62	6968.7	6966.9	6965.1	3.6	208.3	416.5	3193.7	3401.9	0.00	0.0%	0.62	0.00
												TOTAL SETTLEMENT:	0.00			

SECONDARY CONSOLIDATION

0.8	Time for completion of primary settlement, t_1 (years)
200.0	Time from completion of primary settlement, t_2 (years)

Soil Layer	Material Type	Secondary Compression Index, C_a	Thickness of Layer at t_0, H (ft)	Secondary Consolidation, S_s (ft)
NA	Fine Tailings	0.0000	0.0	0.00
			TOTAL SETTLEMENT:	0.00

NECR TAILINGS IMPOUNDMENT SETTLEMENT ANALYSIS - CPT-14

LOCATION INFORMATION

1,691,554	Northing coordinate of CPT sounding	
2,525,656	Easting coordinate of CPT sounding	
6,988.9	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover design grading plan AutoCAD file
6,979.7	Existing Ground Surface Elevation (ft amsl)	From AutoCAD file
6,957.3	Elevation of Base of Tailings (ft amsl)	From AutoCAD file

FINAL COVER

1.1	Thickness of Erosion Protection Layer (ft)	Assumed
2.9	Thickness of General Fill Cover (ft)	Assumed

PRIMARY CONSOLIDATION

Soil Layer	Material Type	Unit Weight, γ (pcf)	Compression Index, C_c	Void Ratio at t_0, e_0	Elevation at Top of Layer at t_0, $z_{i\text{-}top0}$ (ft amsl)	Elevation at Midpoint of Layer at t_0, $z_{i\text{-}mid0}$ (ft amsl)	Elevation at Bottom of Layer at t_0, $z_{i\text{-}bott0}$ (ft amsl) [1]	Thickness of Layer at t_0, H (ft)	Effective Stress at Midpoint of Layer at t_0, $\sigma'_{i\text{-}mid0}$ (psf)	Effective Stress at Bottom of Layer at t_0, $\sigma'_{i\text{-}bott0}$ (psf)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-}mid1}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-}bott1}$ (psf)	Consolidation of Layer from t_0 to t_1 due to Placement of Mine Spoils and Final Cover, $\delta_{ci\text{-}t1}$ (ft)	% Settlement	Void Ratio at t_1, e_1	Change in Void Ratio, Δe
1	Erosion Protection	122.9	0.000	0.45	6988.9	6988.4	6987.8	1.1	N/A	N/A	67.6	135.1	0.00	0.0%	0.45	0.00
2	Cover	114.7	0.086	0.62	6987.8	6986.4	6984.9	2.9	N/A	N/A	301.4	467.7	0.00	0.0%	0.62	0.00
3	Mine Spoils	116.4	0.086	0.56	6984.9	6982.0	6979.2	5.7	N/A	N/A	801.1	1134.5	0.00	0.0%	0.56	0.00
4	Cover	114.7	0.086	0.62	6979.2	6974.6	6970.0	9.2	526.0	1052.1	1660.5	2186.6	0.00	0.0%	0.62	0.00
5	Coarse Tailings	108.1	0.084	0.71	6970.0	6966.8	6963.5	6.5	1403.5	1754.9	2538.0	2889.4	0.00	0.0%	0.62	-0.09
6	Fine Tailings	107.6	0.408	1.35	6963.5	6960.4	6957.3	6.3	2091.2	2427.5	3225.7	3562.0	0.20	3.3%	0.57	-0.78
												TOTAL SETTLEMENT:	**0.20**			

SECONDARY CONSOLIDATION

0.8	Time for completion of primary settlement, t_1 (years)
200.0	Time from completion of primary settlement, t_2 (years)

Soil Layer	Material Type	Secondary Compression Index, C_a	Thickness of Layer at t_0, H (ft)	Secondary Consolidation, S_s (ft)
6	Fine Tailings	0.0036	6.3	0.05
		TOTAL SETTLEMENT:		**0.05**

NECR TAILINGS IMPOUNDMENT SETTLEMENT ANALYSIS - CPT-15(TI-15)

LOCATION INFORMATION

1,691,690	Northing coordinate of CPT sounding	
2,525,091	Easting coordinate of CPT sounding	
6,986.7	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover design grading plan AutoCAD file
6,976.6	Existing Ground Surface Elevation (ft amsl)	From AutoCAD file
6,946.7	Elevation of Base of Tailings (ft amsl)	From AutoCAD file

FINAL COVER

1.1	Thickness of Erosion Protection Layer (ft)	Assumed
2.9	Thickness of General Fill Cover (ft)	Assumed

PRIMARY CONSOLIDATION

Soil Layer	Material Type	Unit Weight, γ (pcf)	Compression Index, C_c	Void Ratio at t_0, e_0	Elevation at Top of Layer at t_0, $z_{i\text{-}top0}$ (ft amsl)	Elevation at Midpoint of Layer at t_0, $z_{i\text{-}mid0}$ (ft amsl)	Elevation at Bottom of Layer at t_0, $z_{i\text{-}bott0}$ (ft amsl) [1]	Thickness of Layer at t_0, H (ft)	Effective Stress at Midpoint of Layer at t_0, $\sigma'_{i\text{-}mid0}$ (psf)	Effective Stress at Bottom of Layer at t_0, $\sigma'_{i\text{-}bott0}$ (psf)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-}mid1}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-}bott1}$ (psf)	Consolidation of Layer from t_0 to t_1 due to Placement of Mine Spoils and Final Cover, $\delta_{ci\text{-}t1}$ (ft)	% Settlement	Void Ratio at t_1, e_1	Change in Void Ratio, Δe
1	Erosion Protection	122.9	0.000	0.45	6986.7	6986.2	6985.6	1.1	N/A	N/A	67.6	135.1	0.00	0.0%	0.45	0.00
2	Cover	114.7	0.086	0.62	6985.6	6984.2	6982.7	2.9	N/A	N/A	301.4	467.7	0.00	0.0%	0.62	0.00
3	Mine Spoils	116.4	0.086	0.56	6982.7	6979.4	6976.1	6.6	N/A	N/A	851.0	1234.2	0.00	0.0%	0.56	0.00
4	Cover	114.7	0.086	0.62	6976.1	6975.1	6974.0	2.1	123.0	246.0	1357.2	1480.2	0.00	0.0%	0.62	0.00
5	Coarse Tailings	108.1	0.084	0.71	6974.0	6960.3	6946.7	27.4	1724.6	3203.3	2958.9	4437.5	0.00	0.0%	0.62	-0.09
											TOTAL SETTLEMENT:		0.00			

SECONDARY CONSOLIDATION

0.8	Time for completion of primary settlement, t_1 (years)
200.0	Time from completion of primary settlement, t_2 (years)

Soil Layer	Material Type	Secondary Compression Index, C_a	Thickness of Layer at t_0, H (ft)	Secondary Consolidation, S_s (ft)
NA	Fine Tailings	0.0000	0.0	0.00
		TOTAL SETTLEMENT:		0.00

NECR TAILINGS IMPOUNDMENT SETTLEMENT ANALYSIS - CPT-16

LOCATION INFORMATION

1,691,911	Northing coordinate of CPT sounding	
2,525,665	Easting coordinate of CPT sounding	
6,996.6	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover design grading plan AutoCAD file
6,973.3	Existing Ground Surface Elevation (ft amsl)	From AutoCAD file
6,930.2	Elevation of Base of Tailings (ft amsl)	From AutoCAD file

FINAL COVER

1.1	Thickness of Erosion Protection Layer (ft)	Assumed
2.9	Thickness of General Fill Cover (ft)	Assumed

PRIMARY CONSOLIDATION

Soil Layer	Material Type	Unit Weight, γ (pcf)	Compression Index, C_c	Void Ratio at t_0, e_0	Elevation at Top of Layer at t_0, $z_{i\text{-top0}}$ (ft amsl)	Elevation at Midpoint of Layer at t_0, $z_{i\text{-mid0}}$ (ft amsl)	Elevation at Bottom of Layer at t_0, $z_{i\text{-bott0}}$ (ft amsl) [1]	Thickness of Layer at t_0, H (ft)	Effective Stress at Midpoint of Layer at t_0, $\sigma'_{i\text{-mid0}}$ (psf)	Effective Stress at Bottom of Layer at t_0, $\sigma'_{i\text{-bott0}}$ (psf)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-mid1}}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-bott1}}$ (psf)	Consolidation of Layer from t_0 to t_1 due to Placement of Mine Spoils and Final Cover, $\delta_{ci\text{-}t1}$ (ft)	% Settlement	Void Ratio at t_1, e_1	Change in Void Ratio, Δe
1	Erosion Protection	122.9	0.000	0.45	6996.6	6996.1	6995.5	1.1	N/A	N/A	67.6	135.1	0.00	0.0%	0.45	0.00
2	Cover	114.7	0.086	0.62	6995.5	6994.1	6992.6	2.9	N/A	N/A	301.4	467.7	0.00	0.0%	0.62	0.00
3	Mine Spoils	116.4	0.086	0.56	6992.6	6982.7	6972.8	19.9	N/A	N/A	1623.6	2779.5	0.00	0.0%	0.56	0.00
4	Cover	114.7	0.086	0.62	6972.8	6968.7	6964.7	8.1	463.3	926.6	3242.8	3706.1	0.00	0.0%	0.62	0.00
5	Coarse Tailings	108.1	0.084	0.71	6964.7	6961.4	6958.2	6.5	1278.0	1629.4	4057.6	4409.0	0.00	0.0%	0.62	-0.09
6	Fine Tailings	107.6	0.408	1.35	6958.2	6944.2	6930.2	28.0	3137.2	4645.0	5916.7	7424.5	1.34	4.8%	0.54	-0.81
											TOTAL SETTLEMENT:		**1.34**			

SECONDARY CONSOLIDATION

0.8	Time for completion of primary settlement, t_1 (years)
200.0	Time from completion of primary settlement, t_2 (years)

Soil Layer	Material Type	Secondary Compression Index, C_a	Thickness of Layer at t_0, H (ft)	Secondary Consolidation, S_s (ft)
6	Fine Tailings	0.0047	28.0	0.32
		TOTAL SETTLEMENT:		**0.32**

NECR TAILINGS IMPOUNDMENT SETTLEMENT ANALYSIS - CPT-17

LOCATION INFORMATION

1,692,058	Northing coordinate of CPT sounding	
2,526,096	Easting coordinate of CPT sounding	
6,988.9	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover design grading plan AutoCAD file
6,975.6	Existing Ground Surface Elevation (ft amsl)	From AutoCAD file
6,955.0	Elevation of Base of Tailings (ft amsl)	From AutoCAD file

FINAL COVER

1.1	Thickness of Erosion Protection Layer (ft)	Assumed
2.9	Thickness of General Fill Cover (ft)	Assumed

PRIMARY CONSOLIDATION

Soil Layer	Material Type	Unit Weight, γ (pcf)	Compression Index, C_c	Void Ratio at t_0, e_0	Elevation at Top of Layer at t_0, $z_{i\text{-}top0}$ (ft amsl)	Elevation at Midpoint of Layer at t_0, $z_{i\text{-}mid0}$ (ft amsl)	Elevation at Bottom of Layer at t_0, $z_{i\text{-}bott0}$ (ft amsl) [1]	Thickness of Layer at t_0, H (ft)	Effective Stress at Midpoint of Layer at t_0, $\sigma'_{i\text{-}mid0}$ (psf)	Effective Stress at Bottom of Layer at t_0, $\sigma'_{i\text{-}bott0}$ (psf)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-}mid1}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-}bott1}$ (psf)	Consolidation of Layer from t_0 to t_1 due to Placement of Mine Spoils and Final Cover, $\delta_{ci\text{-}t1}$ (ft)	% Settlement	Void Ratio at t_1, e_1	Change in Void Ratio, Δe
1	Erosion Protection	122.9	0.000	0.45	6988.9	6988.4	6987.8	1.1	N/A	N/A	67.6	135.1	0.00	0.0%	0.45	0.00
2	Cover	114.7	0.086	0.62	6987.8	6986.4	6984.9	2.9	N/A	N/A	301.4	467.7	0.00	0.0%	0.62	0.00
3	Mine Spoils	116.4	0.086	0.56	6984.9	6980.0	6975.1	9.8	N/A	N/A	1039.6	1611.4	0.00	0.0%	0.56	0.00
4	Cover	114.7	0.086	0.62	6975.1	6972.2	6969.2	5.9	338.2	676.4	1949.6	2287.8	0.00	0.0%	0.62	0.00
5	Coarse Tailings	108.1	0.084	0.71	6969.2	6966.2	6963.1	6.1	1004.5	1332.6	2615.9	2944.0	0.00	0.0%	0.62	-0.09
6	Fine Tailings	107.6	0.408	1.35	6963.1	6959.1	6955.0	8.2	1772.3	2212.0	3383.7	3823.4	0.40	4.9%	0.54	-0.81
											TOTAL SETTLEMENT:		0.40			

SECONDARY CONSOLIDATION

0.8	Time for completion of primary settlement, t_1 (years)
200.0	Time from completion of primary settlement, t_2 (years)

Soil Layer	Material Type	Secondary Compression Index, C_a	Thickness of Layer at t_0, H (ft)	Secondary Consolidation, S_s (ft)
6	Fine Tailings	0.0047	8.2	0.09
		TOTAL SETTLEMENT:		0.09

NECR TAILINGS IMPOUNDMENT SETTLEMENT ANALYSIS - CPT-18

LOCATION INFORMATION

1,691,833	Northing coordinate of CPT sounding	
2,526,009	Easting coordinate of CPT sounding	
6,993.6	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover design grading plan AutoCAD file
6,972.4	Existing Ground Surface Elevation (ft amsl)	From AutoCAD file
6,930.0	Elevation of Base of Tailings (ft amsl)	From AutoCAD file

FINAL COVER

1.1	Thickness of Erosion Protection Layer (ft)	Assumed
2.9	Thickness of General Fill Cover (ft)	Assumed

PRIMARY CONSOLIDATION

Soil Layer	Material Type	Unit Weight, γ (pcf)	Compression Index, C_c	Void Ratio at t_0, e_0	Elevation at Top of Layer at t_0, $z_{i\text{-top0}}$ (ft amsl)	Elevation at Midpoint of Layer at t_0, $z_{i\text{-mid0}}$ (ft amsl)	Elevation at Bottom of Layer at t_0, $z_{i\text{-bott0}}$ (ft amsl) [1]	Thickness of Layer at t_0, H (ft)	Effective Stress at Midpoint of Layer at t_0, $\sigma'_{i\text{-mid0}}$ (psf)	Effective Stress at Bottom of Layer at t_0, $\sigma'_{i\text{-bott0}}$ (psf)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-mid1}}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-bott1}}$ (psf)	Consolidation of Layer from t_0 to t_1 due to Placement of Mine Spoils and Final Cover, $\delta_{ci\text{-}t1}$ (ft)	% Settlement	Void Ratio at t_1, e_1	Change in Void Ratio, Δe
1	Erosion Protection	122.9	0.000	0.45	6993.6	6993.1	6992.5	1.1	N/A	N/A	67.6	135.1	0.00	0.0%	0.45	0.00
2	Cover	114.7	0.086	0.62	6992.5	6991.1	6989.6	2.9	N/A	N/A	301.4	467.7	0.00	0.0%	0.62	0.00
3	Mine Spoils	116.4	0.086	0.56	6989.6	6980.8	6971.9	17.8	N/A	N/A	1501.4	2535.2	0.00	0.0%	0.56	0.00
4	Cover	114.7	0.086	0.62	6971.9	6969.8	6967.8	4.1	234.7	469.4	2769.8	3004.5	0.00	0.0%	0.62	0.00
5	Coarse Tailings	108.1	0.084	0.71	6967.8	6964.2	6960.6	7.2	859.6	1249.8	3394.8	3785.0	0.00	0.0%	0.62	-0.09
6	Fine Tailings	107.6	0.408	1.35	6960.6	6945.3	6930.0	30.6	2894.7	4539.5	5429.8	7074.7	1.45	4.7%	0.54	-0.81
												TOTAL SETTLEMENT:	**1.45**			

SECONDARY CONSOLIDATION

0.8	Time for completion of primary settlement, t_1 (years)
200.0	Time from completion of primary settlement, t_2 (years)

Soil Layer	Material Type	Secondary Compression Index, C_a	Thickness of Layer at t_0, H (ft)	Secondary Consolidation, S_s (ft)
6	Fine Tailings	0.0047	30.6	0.35
			TOTAL SETTLEMENT:	**0.35**

NECR TAILINGS IMPOUNDMENT SETTLEMENT ANALYSIS - CPT-19

LOCATION INFORMATION

1,691,633	Northing coordinate of CPT sounding	
2,525,915	Easting coordinate of CPT sounding	
6,992.0	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover design grading plan AutoCAD file
6,975.3	Existing Ground Surface Elevation (ft amsl)	From AutoCAD file
6,930.0	Elevation of Base of Tailings (ft amsl)	From AutoCAD file

FINAL COVER

1.1	Thickness of Erosion Protection Layer (ft)	Assumed
2.9	Thickness of General Fill Cover (ft)	Assumed

PRIMARY CONSOLIDATION

Soil Layer	Material Type	Unit Weight, γ (pcf)	Compression Index, C_c	Void Ratio at t_0, e_0	Elevation at Top of Layer at t_0, $z_{i\text{-top0}}$ (ft amsl)	Elevation at Midpoint of Layer at t_0, $z_{i\text{-mid0}}$ (ft amsl)	Elevation at Bottom of Layer at t_0, $z_{i\text{-bott0}}$ (ft amsl) [1]	Thickness of Layer at t_0, H (ft)	Effective Stress at Midpoint of Layer at t_0, $\sigma'_{i\text{-mid0}}$ (psf)	Effective Stress at Bottom of Layer at t_0, $\sigma'_{i\text{-bott0}}$ (psf)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-mid1}}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-bott1}}$ (psf)	Consolidation of Layer from t_0 to t_1 due to Placement of Mine Spoils and Final Cover, $\delta_{ci\text{-}t1}$ (ft)	% Settlement	Void Ratio at t_1, e_1	Change in Void Ratio, Δe
1	Erosion Protection	122.9	0.000	0.45	6992.0	6991.4	6990.9	1.1	N/A	N/A	67.6	135.1	0.00	0.0%	0.45	0.00
2	Cover	114.7	0.086	0.62	6990.9	6989.4	6988.0	2.9	N/A	N/A	301.4	467.7	0.00	0.0%	0.62	0.00
3	Mine Spoils	116.4	0.086	0.56	6988.0	6981.4	6974.8	13.2	N/A	N/A	1234.2	2000.8	0.00	0.0%	0.56	0.00
4	Cover	114.7	0.086	0.62	6974.8	6970.6	6966.3	8.5	488.6	977.3	2489.4	2978.1	0.00	0.0%	0.62	0.00
5	Coarse Tailings	108.1	0.084	0.71	6966.3	6957.5	6948.7	17.6	1926.2	2875.1	3927.0	4875.9	0.00	0.0%	0.62	-0.09
6	Fine Tailings	107.6	0.408	1.35	6948.7	6939.4	6930.0	18.7	3883.8	4892.5	5884.6	6893.3	0.59	3.1%	0.57	-0.78
											TOTAL SETTLEMENT:		**0.59**			

SECONDARY CONSOLIDATION

0.8	Time for completion of primary settlement, t_1 (years)
200.0	Time from completion of primary settlement, t_2 (years)

Soil Layer	Material Type	Secondary Compression Index, C_a	Thickness of Layer at t_0, H (ft)	Secondary Consolidation, S_s (ft)
6	Fine Tailings	0.0047	18.7	0.21
		TOTAL SETTLEMENT:		**0.21**

NECR TAILINGS IMPOUNDMENT SETTLEMENT ANALYSIS - CPT-20

LOCATION INFORMATION

1,691,422	Northing coordinate of CPT sounding	
2,525,862	Easting coordinate of CPT sounding	
6,985.5	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover design grading plan AutoCAD file
6,979.1	Existing Ground Surface Elevation (ft amsl)	From AutoCAD file
6,947.7	Elevation of Base of Tailings (ft amsl)	From AutoCAD file

FINAL COVER

1.1	Thickness of Erosion Protection Layer (ft)	Assumed
2.9	Thickness of General Fill Cover (ft)	Assumed

PRIMARY CONSOLIDATION

Soil Layer	Material Type	Unit Weight, γ (pcf)	Compression Index, C_c	Void Ratio at t_0, e_0	Elevation at Top of Layer at t_0, $z_{i\text{-}top0}$ (ft amsl)	Elevation at Midpoint of Layer at t_0, $z_{i\text{-}mid0}$ (ft amsl)	Elevation at Bottom of Layer at t_0, $z_{i\text{-}bott0}$ (ft amsl) [1]	Thickness of Layer at t_0, H (ft)	Effective Stress at Midpoint of Layer at t_0, $\sigma'_{i\text{-}mid0}$ (psf)	Effective Stress at Bottom of Layer at t_0, $\sigma'_{i\text{-}bott0}$ (psf)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-}mid1}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-}bott1}$ (psf)	Consolidation of Layer from t_0 to t_1 due to Placement of Mine Spoils and Final Cover, $\delta_{ci\text{-}t1}$ (ft)	% Settlement	Void Ratio at t_1, e_1	Change in Void Ratio, Δe
1	Erosion Protection	122.9	0.000	0.45	6985.5	6984.9	6984.4	1.1	N/A	N/A	67.6	135.1	0.00	0.0%	0.45	0.00
2	Cover	114.7	0.086	0.62	6984.4	6982.9	6981.5	2.9	N/A	N/A	301.4	467.7	0.00	0.0%	0.62	0.00
3	Mine Spoils	116.4	0.086	0.56	6981.5	6980.0	6978.6	2.8	N/A	N/A	633.2	798.7	0.00	0.0%	0.56	0.00
4	Cover	114.7	0.086	0.62	6978.6	6972.7	6966.8	11.8	676.8	1353.5	1475.4	2152.2	0.00	0.0%	0.62	0.00
5	Coarse Tailings	108.1	0.084	0.71	6966.8	6962.3	6957.8	9.0	1841.7	2329.9	2640.4	3128.6	0.00	0.0%	0.62	-0.09
6	Fine Tailings	107.6	0.408	1.35	6957.8	6952.7	6947.7	10.1	2874.2	3418.5	3672.9	4217.2	0.19	1.8%	0.59	-0.76
											TOTAL SETTLEMENT:		0.19			

SECONDARY CONSOLIDATION

0.8	Time for completion of primary settlement, t_1 (years)
200.0	Time from completion of primary settlement, t_2 (years)

Soil Layer	Material Type	Secondary Compression Index, C_a	Thickness of Layer at t_0, H (ft)	Secondary Consolidation, S_s (ft)
6	Fine Tailings	0.0047	10.1	0.12
		TOTAL SETTLEMENT:		0.12

NECR TAILINGS IMPOUNDMENT SETTLEMENT ANALYSIS - CPT-23(TI-23)

LOCATION INFORMATION

1,692,864	Northing coordinate of CPT sounding	
2,525,720	Easting coordinate of CPT sounding	
6,977.3	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover design grading plan AutoCAD file
6,959.5	Existing Ground Surface Elevation (ft amsl)	From AutoCAD file
6,943.5	Elevation of Base of Tailings (ft amsl)	From AutoCAD file

FINAL COVER

1.5	Thickness of Erosion Protection Layer (ft)	Assumed
2.5	Thickness of General Fill Cover (ft)	Assumed

PRIMARY CONSOLIDATION

Soil Layer	Material Type	Unit Weight, γ (pcf)	Compression Index, C_c	Void Ratio at t_0, e_0	Elevation at Top of Layer at t_0, $z_{i\text{-}top0}$ (ft amsl)	Elevation at Midpoint of Layer at t_0, $z_{i\text{-}mid0}$ (ft amsl)	Elevation at Bottom of Layer at t_0, $z_{i\text{-}bott0}$ (ft amsl) [1]	Thickness of Layer at t_0, H (ft)	Effective Stress at Midpoint of Layer at t_0, $\sigma'_{i\text{-}mid0}$ (psf)	Effective Stress at Bottom of Layer at t_0, $\sigma'_{i\text{-}bott0}$ (psf)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-}mid1}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-}bott1}$ (psf)	Consolidation of Layer from t_0 to t_1 due to Placement of Mine Spoils and Final Cover, $\delta_{ci\text{-}t1}$ (ft)	% Settlement	Void Ratio at t_1, e_1	Change in Void Ratio, Δe
1	Erosion Protection	122.9	0.000	0.45	6977.3	6976.5	6975.8	1.5	N/A	N/A	92.1	184.3	0.00	0.0%	0.45	0.00
2	Cover	114.7	0.086	0.62	6975.8	6974.5	6973.3	2.5	N/A	N/A	327.6	471.0	0.00	0.0%	0.62	0.00
3	Mine Spoils	116.4	0.086	0.56	6973.3	6966.1	6959.0	14.2	N/A	N/A	1299.9	2128.9	0.00	0.0%	0.56	0.00
4	Cover	114.7	0.086	0.62	6959.0	6952.6	6946.1	12.9	739.7	1479.3	2868.6	3608.3	0.00	0.0%	0.62	0.00
5*	Fine Tailings	107.6	0.408	1.35	6946.1	6945.7	6945.3	0.8	43.0	86.1	3651.3	3694.4	0.00	0.0%	1.35	0.00
6	Coarse Tailings	108.1	0.084	0.71	6945.3	6944.4	6943.5	1.8	183.4	280.7	3791.7	3889.0	0.00	0.0%	0.71	0.00
											TOTAL SETTLEMENT:		**0.00**			

Notes:

*Assumed that the fine tailings layer is unsaturated at this location and no settlement will occur

SECONDARY CONSOLIDATION

0.8	Time for completion of primary settlement, t_1 (years)
200.0	Time from completion of primary settlement, t_2 (years)

Soil Layer	Material Type	Secondary Compression Index, C_a	Thickness of Layer at t_0, H (ft)	Secondary Consolidation, S_s (ft)
5	Fine Tailings	0.0047	0.8	0.00
		TOTAL SETTLEMENT:		**0.00**

NECR TAILINGS IMPOUNDMENT SETTLEMENT ANALYSIS - CPT-24

LOCATION INFORMATION

1692567.3	Northing coordinate of CPT sounding	
2525413	Easting coordinate of CPT sounding	
6987.33	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover design grading plan AutoCAD file
6962.28	Existing Ground Surface Elevation (ft amsl)	From AutoCAD file
-	Elevation of Base of Tailings (ft amsl)	From AutoCAD file

FINAL COVER

1.5	Thickness of Erosion Protection Layer (ft)	Assumed
2.5	Thickness of General Fill Cover (ft)	Assumed

PRIMARY CONSOLIDATION

Soil Layer	Material Type	Unit Weight, γ (pcf)	Compression Index, C_c	Void Ratio at t_0, e_0	Elevation at Top of Layer at t_0, $z_{i\text{-}top0}$ (ft amsl)	Elevation at Midpoint of Layer at t_0, $z_{i\text{-}mid0}$ (ft amsl)	Elevation at Bottom of Layer at t_0, $z_{i\text{-}bott0}$ (ft amsl) [1]	Thickness of Layer at t_0, H (ft)	Effective Stress at Midpoint of Layer at t_0, $\sigma'_{i\text{-}mid0}$ (psf)	Effective Stress at Bottom of Layer at t_0, $\sigma'_{i\text{-}bott0}$ (psf)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-}mid1}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-}bott1}$ (psf)	Consolidation of Layer from t_0 to t_1 due to Placement of Mine Spoils and Final Cover, $\delta_{ci\text{-}t1}$ (ft)	% Settlement	Void Ratio at t_1, e_1	Change in Void Ratio, Δe
1	Erosion Protection	122.9	0.000	0.45	6987.3	6986.6	6985.8	1.5	N/A	N/A	92.1	184.3	0.00	0.0%	0.45	0.00
2	Cover	114.7	0.086	0.62	6985.8	6984.6	6983.3	2.5	N/A	N/A	327.6	471.0	0.00	0.0%	0.62	0.00
3	Mine Spoils	116.4	0.086	0.56	6983.3	6972.6	6961.8	21.6	N/A	N/A	1725.1	2979.3	0.00	0.0%	0.56	0.00
4	Cover	114.7	0.086	0.62	6961.8	6958.6	6955.3	6.4	369.1	738.1	3348.4	3717.4	0.00	0.0%	0.62	0.00
											TOTAL SETTLEMENT:		0.00			

SECONDARY CONSOLIDATION

0.8	Time for completion of primary settlement, t_1 (years)
200.0	Time from completion of primary settlement, t_2 (years)

Soil Layer	Material Type	Secondary Compression Index, C_a	Thickness of Layer at t_0, H (ft)	Secondary Consolidation, S_s (ft)
NA	Fine Tailings	0.0000	0.0	0.00
		TOTAL SETTLEMENT:		0.00

NECR TAILINGS IMPOUNDMENT SETTLEMENT ANALYSIS - CPT-25

LOCATION INFORMATION

1,692,436	Northing coordinate of CPT sounding	
2,525,693	Easting coordinate of CPT sounding	
6,998.6	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover design grading plan AutoCAD file
6,969.3	Existing Ground Surface Elevation (ft amsl)	From AutoCAD file
-	Elevation of Base of Tailings (ft amsl)	From AutoCAD file

FINAL COVER

1.1	Thickness of Erosion Protection Layer (ft)	Assumed
2.9	Thickness of General Fill Cover (ft)	Assumed

PRIMARY CONSOLIDATION

Soil Layer	Material Type	Unit Weight, γ (pcf)	Compression Index, C_c	Void Ratio at t_0, e_0	Elevation at Top of Layer at t_0, $z_{i\text{-}top0}$ (ft amsl)	Elevation at Midpoint of Layer at t_0, $z_{i\text{-}mid0}$ (ft amsl)	Elevation at Bottom of Layer at t_0, $z_{i\text{-}bott0}$ (ft amsl) [1]	Thickness of Layer at t_0, H (ft)	Effective Stress at Midpoint of Layer at t_0, $\sigma'_{i\text{-}mid0}$ (psf)	Effective Stress at Bottom of Layer at t_0, $\sigma'_{i\text{-}bott0}$ (psf)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-}mid1}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-}bott1}$ (psf)	Consolidtion of Layer from t_0 to t_1 due to Placement of Mine Spoils and Final Cover, $\delta_{ci\text{-}t1}$ (ft)	% Settlement	Void Ratio at t_1, e_1	Change in Void Ratio, Δe
1	Erosion Protection	122.9	0.000	0.45	6998.6	6998.1	6997.5	1.1	N/A	N/A	67.6	135.1	0.00	0.0%	0.45	0.00
2	Cover	114.7	0.086	0.62	6997.5	6996.1	6994.6	2.9	N/A	N/A	301.4	467.7	0.00	0.0%	0.62	0.00
3	Mine Spoils	116.4	0.086	0.56	6994.6	6981.9	6969.1	25.5	N/A	N/A	1953.0	3438.2	0.00	0.0%	0.56	0.00
4	Cover	114.7	0.086	0.62	6969.1	6969.1	6969.1	0.0	0.0	0.0	3438.2	3438.2	0.00	0.0%	0.62	0.00
											TOTAL SETTLEMENT:		0.00			

SECONDARY CONSOLIDATION

0.8	Time for completion of primary settlement, t_1 (years)
200.0	Time from completion of primary settlement, t_2 (years)

Soil Layer	Material Type	Secondary Compression Index, C_a	Thickness of Layer at t_0, H (ft)	Secondary Consolidation, S_s (ft)
NA	Fine Tailings	0.0000	0.0	0.00
		TOTAL SETTLEMENT:		0.00

NECR TAILINGS IMPOUNDMENT SETTLEMENT ANALYSIS - CPT-26

LOCATION INFORMATION

1691992.5	Northing coordinate of CPT sounding	
2524854.3	Easting coordinate of CPT sounding	
6985.2	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover design grading plan AutoCAD file
6972.7	Existing Ground Surface Elevation (ft amsl)	From AutoCAD file
6947.2	Elevation of Base of Tailings (ft amsl)	From AutoCAD file

FINAL COVER

1.1	Thickness of Erosion Protection Layer (ft)	Assumed
2.9	Thickness of General Fill Cover (ft)	Assumed

PRIMARY CONSOLIDATION

Soil Layer	Material Type	Unit Weight, γ (pcf)	Compression Index, C_c	Void Ratio at t_0, e_0	Elevation at Top of Layer at t_0, $z_{i\text{-top0}}$ (ft amsl)	Elevation at Midpoint of Layer at t_0, $z_{i\text{-mid0}}$ (ft amsl)	Elevation at Bottom of Layer at t_0, $z_{i\text{-bott0}}$ (ft amsl) [1]	Thickness of Layer at t_0, H (ft)	Effective Stress at Midpoint of Layer at t_0, $\sigma'_{i\text{-mid0}}$ (psf)	Effective Stress at Bottom of Layer at t_0, $\sigma'_{i\text{-bott0}}$ (psf)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-mid1}}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-bott1}}$ (psf)	Consolidation of Layer from t_0 to t_1 due to Placement of Mine Spoils and Final Cover, $\delta_{ci\text{-}t1}$ (ft)	% Settlement	Void Ratio at t_1, e_1	Change in Void Ratio, Δe
1	Erosion Protection	122.9	0.000	0.45	6985.2	6984.7	6984.1	1.1	N/A	N/A	67.6	135.1	0.00	0.0%	0.45	0.00
2	Cover	114.7	0.086	0.62	6984.1	6982.7	6981.2	2.9	N/A	N/A	301.4	467.7	0.00	0.0%	0.62	0.00
3	Mine Spoils	116.4	0.086	0.56	6981.2	6976.7	6972.2	9.0	N/A	N/A	989.7	1511.6	0.00	0.0%	0.56	0.00
4	Cover	114.7	0.086	0.62	6972.2	6966.2	6960.2	12.0	688.1	1376.1	2199.7	2887.7	0.00	0.0%	0.62	0.00
5	Coarse Tailings	108.1	0.084	0.71	6960.2	6953.7	6947.2	13.0	2079.0	2781.8	3590.6	4293.4	0.00	0.0%	0.62	-0.09
											TOTAL SETTLEMENT:		0.00			

SECONDARY CONSOLIDATION

0.8	Time for completion of primary settlement, t_1 (years)
200.0	Time from completion of primary settlement, t_2 (years)

Soil Layer	Material Type	Secondary Compression Index, C_a	Thickness of Layer at t_0, H (ft)	Secondary Consolidation, S_s (ft)
NA	Fine Tailings	0.0000	0.0	0.00
		TOTAL SETTLEMENT:		0.00

NECR TAILINGS IMPOUNDMENT SETTLEMENT ANALYSIS - CPT-27

LOCATION INFORMATION

1691670.7	Northing coordinate of CPT sounding	
2526106.9	Easting coordinate of CPT sounding	
6989.0	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover design grading plan AutoCAD file
6977.0	Existing Ground Surface Elevation (ft amsl)	From AutoCAD file
-	Elevation of Base of Tailings (ft amsl)	From AutoCAD file

FINAL COVER

1.1	Thickness of Erosion Protection Layer (ft)	Assumed
2.9	Thickness of General Fill Cover (ft)	Assumed

PRIMARY CONSOLIDATION

Soil Layer	Material Type	Unit Weight, γ (pcf)	Compression Index, C_c	Void Ratio at t_0, e_0	Elevation at Top of Layer at t_0, $z_{i\text{-}top0}$ (ft amsl)	Elevation at Midpoint of Layer at t_0, $z_{i\text{-}mid0}$ (ft amsl)	Elevation at Bottom of Layer at t_0, $z_{i\text{-}bott0}$ (ft amsl) [1]	Thickness of Layer at t_0, H (ft)	Effective Stress at Midpoint of Layer at t_0, $\sigma'_{i\text{-}mid0}$ (psf)	Effective Stress at Bottom of Layer at t_0, $\sigma'_{i\text{-}bott0}$ (psf)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-}mid1}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-}bott1}$ (psf)	Consolidation of Layer from t_0 to t_1 due to Placement of Mine Spoils and Final Cover, $\delta_{ci\text{-}t1}$ (ft)	% Settlement	Void Ratio at t_1, e_1	Change in Void Ratio, Δe
1	Erosion Protection	122.9	0.000	0.45	6989.0	6988.5	6987.9	1.1	N/A	N/A	67.6	135.1	0.00	0.0%	0.45	0.00
2	Cover	114.7	0.086	0.62	6987.9	6986.5	6985.0	2.9	N/A	N/A	301.4	467.7	0.00	0.0%	0.62	0.00
3	Mine Spoils	116.4	0.086	0.56	6985.0	6980.8	6976.5	8.5	N/A	N/A	962.2	1456.6	0.00	0.0%	0.56	0.00
4	Cover	114.7	0.086	0.62	6976.5	6969.3	6962.0	14.5	831.4	1662.8	2288.0	3119.5	0.00	0.0%	0.62	0.00
											TOTAL SETTLEMENT:		0.00			

SECONDARY CONSOLIDATION

0.8	Time for completion of primary settlement, t_1 (years)
200.0	Time from completion of primary settlement, t_2 (years)

Soil Layer	Material Type	Secondary Compression Index, C_a	Thickness of Layer at t_0, H (ft)	Secondary Consolidation, S_s (ft)
NA	Fine Tailings	0.0000	0.0	0.00
		TOTAL SETTLEMENT:		0.00

NECR TAILINGS IMPOUNDMENT SETTLEMENT ANALYSIS - CPT-28

LOCATION INFORMATION

1692484.7	Northing coordinate of CPT sounding	
2524698.6	Easting coordinate of CPT sounding	
6968.5	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover design grading plan AutoCAD file
6963.7	Existing Ground Surface Elevation (ft amsl)	From AutoCAD file
6937.3	Elevation of Base of Tailings (ft amsl)	From AutoCAD file

FINAL COVER

2.3	Thickness of Erosion Protection Layer (ft)	Assumed
1.7	Thickness of General Fill Cover (ft)	Assumed

PRIMARY CONSOLIDATION

Soil Layer	Material Type	Unit Weight, γ (pcf)	Compression Index, C_c	Void Ratio at t_0, e_0	Elevation at Top of Layer at t_0, $z_{i\text{-}top0}$ (ft amsl)	Elevation at Midpoint of Layer at t_0, $z_{i\text{-}mid0}$ (ft amsl)	Elevation at Bottom of Layer at t_0, $z_{i\text{-}bott0}$ (ft amsl) [1]	Thickness of Layer at t_0, H (ft)	Effective Stress at Midpoint of Layer at t_0, $\sigma'_{i\text{-}mid0}$ (psf)	Effective Stress at Bottom of Layer at t_0, $\sigma'_{i\text{-}bott0}$ (psf)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-}mid1}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-}bott1}$ (psf)	Consolidation of Layer from t_0 to t_1 due to Placement of Mine Spoils and Final Cover, $\delta_{ci\text{-}t1}$ (ft)	% Settlement	Void Ratio at t_1, e_1	Change in Void Ratio, Δe
1	Erosion Protection	122.9	0.000	0.45	6968.5	6967.3	6966.2	2.3	N/A	N/A	138.2	276.4	0.00	0.0%	0.45	0.00
2	Cover	114.7	0.086	0.62	6966.2	6965.4	6964.5	1.7	N/A	N/A	373.9	471.4	0.00	0.0%	0.62	0.00
3	Mine Spoils	116.4	0.086	0.56	6964.5	6963.9	6963.2	1.3	N/A	N/A	545.0	618.6	0.00	0.0%	0.56	0.00
4	Cover	114.7	0.086	0.62	6963.2	6957.0	6950.8	12.5	714.4	1428.8	1333.0	2047.3	0.00	0.0%	0.62	0.00
5	Coarse Tailings	108.1	0.084	0.71	6950.8	6944.1	6937.3	13.5	2156.0	2883.3	2774.6	3501.9	0.00	0.0%	0.62	-0.09
											TOTAL SETTLEMENT:		0.00			

SECONDARY CONSOLIDATION

0.8	Time for completion of primary settlement, t_1 (years)
200.0	Time from completion of primary settlement, t_2 (years)

Soil Layer	Material Type	Secondary Compression Index, C_a	Thickness of Layer at t_0, H (ft)	Secondary Consolidation, S_s (ft)
NA	Fine Tailings	0.0000	0.0	0.00
		TOTAL SETTLEMENT:		0.00

NECR TAILINGS IMPOUNDMENT SETTLEMENT ANALYSIS - CPT-29

LOCATION INFORMATION

1693003.9	Northing coordinate of CPT sounding	
2525274.5	Easting coordinate of CPT sounding	
6965.9	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)	From cover design grading plan AutoCAD file
6957.5	Existing Ground Surface Elevation (ft amsl)	From AutoCAD file
6948.0	Elevation of Base of Tailings (ft amsl)	From AutoCAD file

FINAL COVER

2.3	Thickness of Erosion Protection Layer (ft)	Assumed
1.7	Thickness of General Fill Cover (ft)	Assumed

PRIMARY CONSOLIDATION

Soil Layer	Material Type	Unit Weight, γ (pcf)	Compression Index, C_c	Void Ratio at t_0, e_0	Elevation at Top of Layer at t_0, $z_{i\text{-}top0}$ (ft amsl)	Elevation at Midpoint of Layer at t_0, $z_{i\text{-}mid0}$ (ft amsl)	Elevation at Bottom of Layer at t_0, $z_{i\text{-}bott0}$ (ft amsl) [1]	Thickness of Layer at t_0, H (ft)	Effective Stress at Midpoint of Layer at t_0, $\sigma'_{i\text{-}mid0}$ (psf)	Effective Stress at Bottom of Layer at t_0, $\sigma'_{i\text{-}bott0}$ (psf)	Effective Stress at Midpoint of Layer at t_1, $\sigma'_{i\text{-}mid1}$ (psf)	Effective Stress at Bottom of Layer at t_1, $\sigma'_{i\text{-}bott1}$ (psf)	Consolidation of Layer from t_0 to t_1 due to Placement of Mine Spoils and Final Cover, $\delta_{ci\text{-}t1}$ (ft)	% Settlement	Void Ratio at t_1, e_1	Change in Void Ratio, Δe
1	Erosion Protection	122.9	0.000	0.45	6965.9	6964.8	6963.6	2.3	N/A	N/A	141.3	282.6	0.00	0.0%	0.45	0.00
2	Cover	114.7	0.086	0.62	6963.6	6962.8	6961.9	1.7	N/A	N/A	380.0	477.5	0.00	0.0%	0.62	0.00
3	Mine Spoils	116.4	0.086	0.56	6961.9	6959.5	6957.0	4.9	N/A	N/A	765.1	1052.8	0.00	0.0%	0.56	0.00
4	Cover	114.7	0.086	0.62	6957.0	6953.0	6949.0	8.0	458.7	917.4	1511.5	1970.2	0.00	0.0%	0.62	0.00
5*	Fine Tailings	107.6	0.408	1.35	6949.0	6948.5	6948.0	1.0	971.5	1025.6	2024.3	2078.4	0.00	0.0%	1.35	0.00
											TOTAL SETTLEMENT:		0.00			

Notes:

*Assumed that the fine tailings layer is unsaturated at this location and no settlement will occur

SECONDARY CONSOLIDATION

0.8	Time for completion of primary settlement, t_1 (years)
200.0	Time from completion of primary settlement, t_2 (years)

Soil Layer	Material Type	Secondary Compression Index, C_a	Thickness of Layer at t_0, H (ft)	Secondary Consolidation, S_s (ft)
5	Fine Tailings	0.0036	1.0	0.00
		TOTAL SETTLEMENT:		0.00

ATTACHMENT D

IMMEDIATE SETTLEMENT CALCULATIONS

NECR TAILINGS IMPOUNDMENT SETTLEMENT ANALYSIS - CPT-15 Settlement

IMMEDIATE SETTLEMENT

CPT Profile Information

	Thickness (ft)	E (ksf)	ν	γ (psf)	
Erosion Protection (repository)	1.1			122.9	
Cover Fill (repository)	2.9			114.7	
Mine Spoils (repository)	6.6			116.4	
Radon Barrier (existing)	2.1	450	0.3	122.3	Hard, moist, sandy clay
Existing Fill (existing)	0.0			113.8	
Coarse Tailings (existing)	27.4	150	0.3	108.1	Silty sand tailings
		McCarthy (1998)	McCarthy (1998)		

Total Fill Height 10.6 above radon barrier

Soil Properties (McCarthy, 1998):

Soil Type	E/N	E/qc
Silts, sand silts, slightly cohesive silt-sand mixtures	4	1.5
Clean, Fine to med, sands and slightly silty sands	7	2
Coarse sands and sands with little gravel	10.0	3
Sandy gravels and gravel	12.0	4

$$\delta v = (\Delta q) * B * (1-v^2)/E * I$$

NAVFAC (1989), section 7.1-211

Modulus of Elasticity, E (ksf)
Weighted average 172 by depth/thickness of layers

Poisson's Ratio, v
Weighted average 0.3 McCarthy (1998)

Influence Factor, I 0.64

Δq = 1235 psf
Δq = 1.23 ksf
B = 250 ft

I = 0.64 From NAVFAC chart, assuming a circular (flexible) shape and rigidity, calculated on the edge

Solution: δv = **1.0** ft

Estimate E:

Layer No.	Soil Description	z (ft)	Δz (ft)	E/qc	qc (ksf)	E (ksf)	Avg E (ksf) per layer
1	Ex. Cover	0.16	0.16	1.5	77.9	116.8	
2	Ex. Cover	0.33	0.16	1.5	136.9	205.4	
3	Ex. Cover	0.49	0.16	1.5	306.8	460.3	
4	Ex. Cover	0.66	0.16	1.5	397.6	596.4	
5	Ex. Cover	0.82	0.16	1.5	418.2	627.4	
6	Ex. Cover	0.98	0.16	1.5	403.7	605.6	
7	Ex. Cover	1.15	0.16	1.5	388.0	582.1	
8	Ex. Cover	1.31	0.16	1.5	352.7	529.1	449.1
9	Ex. Cover	1.48	0.16	1.5	344.7	517.1	
10	Ex. Cover	1.64	0.16	1.5	351.3	527.0	
11	Ex. Cover	1.80	0.16	1.5	323.7	485.5	
12	Ex. Cover	1.97	0.16	1.5	268.1	402.1	
13	Ex. Cover	2.13	0.16	1.5	241.1	361.6	
14	Ex. Cover	2.30	0.16	1.5	229.2	343.8	
15	Ex. Cover	2.46	0.16	1.5	251.0	376.5	
16	Coarse Tailings	2.62	0.16	2.0	220.2	440.3	
17	Coarse Tailings	2.79	0.16	2.0	256.4	512.8	

18	Coarse Tailings	2.95	0.16	2.0	305.1	610.1
19	Coarse Tailings	3.12	0.16	2.0	377.3	754.5
20	Coarse Tailings	3.28	0.16	2.0	421.6	843.1
21	Coarse Tailings	3.44	0.16	2.0	430.2	860.3
22	Coarse Tailings	3.61	0.16	2.0	431.4	862.9
23	Coarse Tailings	3.77	0.16	2.0	421.6	843.2
24	Coarse Tailings	3.94	0.16	2.0	400.9	801.8
25	Coarse Tailings	4.10	0.16	2.0	372.4	744.8
26	Coarse Tailings	4.27	0.16	2.0	342.8	685.6
27	Coarse Tailings	4.43	0.16	2.0	307.9	615.7
28	Coarse Tailings	4.59	0.16	2.0	291.3	582.7
29	Coarse Tailings	4.76	0.16	2.0	272.4	544.8
30	Coarse Tailings	4.92	0.16	2.0	249.3	498.6
31	Coarse Tailings	5.09	0.16	2.0	231.8	463.6
32	Coarse Tailings	5.25	0.16	2.0	201.6	403.2
33	Coarse Tailings	5.41	0.16	2.0	185.0	370.1
34	Coarse Tailings	5.58	0.16	2.0	170.7	341.4
35	Coarse Tailings	5.74	0.16	2.0	159.5	318.9
36	Coarse Tailings	5.91	0.16	2.0	146.7	293.4
37	Coarse Tailings	6.07	0.16	2.0	132.1	264.3
38	Coarse Tailings	6.23	0.16	2.0	121.9	243.9
39	Coarse Tailings	6.40	0.16	2.0	113.3	226.5
40	Coarse Tailings	6.56	0.16	2.0	104.0	207.9
41	Coarse Tailings	6.73	0.16	2.0	96.0	192.0
42	Coarse Tailings	6.89	0.16	2.0	85.2	170.3
43	Coarse Tailings	7.05	0.16	2.0	76.4	152.8
44	Coarse Tailings	7.22	0.16	2.0	71.0	142.0
45	Coarse Tailings	7.38	0.16	2.0	66.5	133.1
46	Coarse Tailings	7.55	0.16	2.0	59.5	118.9
47	Coarse Tailings	7.71	0.16	2.0	54.6	109.1
48	Coarse Tailings	7.87	0.16	2.0	49.6	99.2
49	Coarse Tailings	8.04	0.16	2.0	48.4	96.9
50	Coarse Tailings	8.20	0.16	2.0	46.7	93.3
51	Coarse Tailings	8.37	0.16	2.0	45.0	90.0
52	Coarse Tailings	8.53	0.16	2.0	43.4	86.8
53	Coarse Tailings	8.69	0.16	2.0	40.9	81.7
54	Coarse Tailings	8.86	0.16	2.0	40.2	80.4
55	Coarse Tailings	9.02	0.16	2.0	40.4	80.7
56	Coarse Tailings	9.19	0.16	2.0	39.9	79.8
57	Coarse Tailings	9.35	0.16	2.0	39.5	78.9
58	Coarse Tailings	9.51	0.16	2.0	39.1	78.1
59	Coarse Tailings	9.68	0.16	2.0	37.4	74.7
60	Coarse Tailings	9.84	0.16	2.0	37.0	74.1
61	Coarse Tailings	10.01	0.16	2.0	39.5	78.9
62	Coarse Tailings	10.17	0.16	2.0	37.7	75.5
63	Coarse Tailings	10.33	0.16	2.0	35.4	70.7
64	Coarse Tailings	10.50	0.16	2.0	33.7	67.3
65	Coarse Tailings	10.66	0.16	2.0	33.1	66.2
66	Coarse Tailings	10.83	0.16	2.0	32.8	65.5
67	Coarse Tailings	10.99	0.16	2.0	32.4	64.9
68	Coarse Tailings	11.15	0.16	2.0	31.7	63.5
69	Coarse Tailings	11.32	0.16	2.0	31.0	62.0
70	Coarse Tailings	11.48	0.16	2.0	30.8	61.6
71	Coarse Tailings	11.65	0.16	2.0	30.2	60.4
72	Coarse Tailings	11.81	0.16	2.0	30.5	60.9
73	Coarse Tailings	11.97	0.16	2.0	29.2	58.4
74	Coarse Tailings	12.14	0.16	2.0	27.0	53.9
75	Coarse Tailings	12.30	0.16	2.0	23.4	46.8
76	Coarse Tailings	12.47	0.16	2.0	16.3	32.5
77	Coarse Tailings	12.63	0.16	2.0	12.4	24.9

78	Coarse Tailings	12.80	0.16	2.0	15.2	30.5	
79	Coarse Tailings	12.96	0.16	2.0	20.6	41.2	
80	Coarse Tailings	13.12	0.16	2.0	24.8	49.6	
81	Coarse Tailings	13.29	0.16	2.0	26.3	52.5	
82	Coarse Tailings	13.45	0.16	2.0	22.3	44.6	
83	Coarse Tailings	13.62	0.16	2.0	19.6	39.3	
84	Coarse Tailings	13.78	0.16	2.0	25.8	51.6	
85	Coarse Tailings	13.94	0.16	2.0	27.2	54.4	
86	Coarse Tailings	14.11	0.16	2.0	28.2	56.3	
87	Coarse Tailings	14.27	0.16	2.0	28.9	57.9	
88	Coarse Tailings	14.44	0.16	2.0	30.1	60.2	145.0
89	Coarse Tailings	14.60	0.16	2.0	30.0	59.9	
90	Coarse Tailings	14.76	0.16	2.0	29.6	59.3	
91	Coarse Tailings	14.93	0.16	2.0	27.3	54.7	
92	Coarse Tailings	15.09	0.16	2.0	22.9	45.8	
93	Coarse Tailings	15.26	0.16	2.0	23.2	46.4	
94	Coarse Tailings	15.42	0.16	2.0	22.4	44.9	
95	Coarse Tailings	15.58	0.16	2.0	23.3	46.7	
96	Coarse Tailings	15.75	0.16	2.0	15.4	30.7	
97	Coarse Tailings	15.91	0.16	2.0	13.8	27.5	
98	Coarse Tailings	16.08	0.16	2.0	24.9	49.8	
99	Coarse Tailings	16.24	0.16	2.0	27.6	55.2	
100	Coarse Tailings	16.40	0.16	2.0	25.9	51.8	
101	Coarse Tailings	16.57	0.16	2.0	25.8	51.5	
102	Coarse Tailings	16.73	0.16	2.0	25.9	51.9	
103	Coarse Tailings	16.90	0.16	2.0	26.6	53.2	
104	Coarse Tailings	17.06	0.16	2.0	26.6	53.2	
105	Coarse Tailings	17.22	0.16	2.0	30.6	61.2	
106	Coarse Tailings	17.39	0.16	2.0	34.6	69.2	
107	Coarse Tailings	17.55	0.16	2.0	29.3	58.5	
108	Coarse Tailings	17.72	0.16	2.0	28.8	57.6	
109	Coarse Tailings	17.88	0.16	2.0	23.4	46.8	
110	Coarse Tailings	18.04	0.16	2.0	30.2	60.3	
111	Coarse Tailings	18.21	0.16	2.0	32.4	64.9	
112	Coarse Tailings	18.37	0.16	2.0	38.3	76.6	
113	Coarse Tailings	18.54	0.16	2.0	36.6	73.2	
114	Coarse Tailings	18.70	0.16	2.0	28.6	57.1	
115	Coarse Tailings	18.86	0.16	2.0	18.4	36.8	
116	Coarse Tailings	19.03	0.16	2.0	14.9	29.7	
117	Coarse Tailings	19.19	0.16	2.0	22.6	45.3	
118	Coarse Tailings	19.36	0.16	2.0	33.4	66.8	
119	Coarse Tailings	19.52	0.16	2.0	33.8	67.6	
120	Coarse Tailings	19.68	0.16	2.0	32.5	65.0	
121	Coarse Tailings	19.85	0.16	2.0	30.9	61.7	
122	Coarse Tailings	20.01	0.16	2.0	28.7	57.4	
123	Coarse Tailings	20.18	0.16	2.0	22.4	44.7	
124	Coarse Tailings	20.34	0.16	2.0	22.1	44.1	
125	Coarse Tailings	20.51	0.16	2.0	20.1	40.2	
126	Coarse Tailings	20.67	0.16	2.0	22.8	45.5	
127	Coarse Tailings	20.83	0.16	2.0	28.8	57.6	
128	Coarse Tailings	21.00	0.16	2.0	27.9	55.7	
129	Coarse Tailings	21.16	0.16	2.0	29.6	59.1	
130	Coarse Tailings	21.33	0.16	2.0	31.3	62.6	
131	Coarse Tailings	21.49	0.16	2.0	32.4	64.8	
132	Coarse Tailings	21.65	0.16	2.0	32.8	65.5	
133	Coarse Tailings	21.82	0.16	2.0	34.4	68.8	
134	Coarse Tailings	21.98	0.16	2.0	34.7	69.5	
135	Coarse Tailings	22.15	0.16	2.0	35.6	71.3	
136	Coarse Tailings	22.31	0.16	2.0	37.2	74.4	
137	Coarse Tailings	22.47	0.16	2.0	40.2	80.4	

138	Coarse Tailings	22.64	0.16	2.0	6.0	12.0	
139	Coarse Tailings	22.80	0.16	2.0	46.2	92.3	
140	Coarse Tailings	22.97	0.16	2.0	40.5	80.9	
141	Coarse Tailings	23.13	0.16	2.0	26.1	52.3	
142	Coarse Tailings	23.29	0.16	2.0	19.6	39.1	
143	Coarse Tailings	23.46	0.16	2.0	22.0	44.0	
144	Coarse Tailings	23.62	0.16	2.0	21.9	43.7	
145	Coarse Tailings	23.79	0.16	2.0	17.2	34.3	
146	Coarse Tailings	23.95	0.16	2.0	20.5	41.0	
147	Coarse Tailings	24.11	0.16	2.0	28.2	56.5	
148	Coarse Tailings	24.28	0.16	2.0	32.1	64.2	
149	Coarse Tailings	24.44	0.16	2.0	34.6	69.2	
150	Coarse Tailings	24.61	0.16	2.0	31.4	62.7	
151	Coarse Tailings	24.77	0.16	2.0	19.6	39.3	
152	Coarse Tailings	24.93	0.16	2.0	28.9	57.7	
153	Coarse Tailings	25.10	0.16	2.0	21.7	43.5	
154	Coarse Tailings	25.26	0.16	2.0	29.9	59.8	
155	Coarse Tailings	25.43	0.16	2.0	41.6	83.1	
156	Coarse Tailings	25.59	0.16	2.0	37.9	75.8	
157	Coarse Tailings	25.75	0.16	2.0	35.0	70.0	
158	Coarse Tailings	25.92	0.16	2.0	28.9	57.7	
159	Coarse Tailings	26.08	0.16	2.0	17.6	35.2	
160	Coarse Tailings	26.25	0.16	2.0	32.7	65.4	

NECR TAILINGS IMPOUNDMENT SETTLEMENT ANALYSIS - CPT-26 Settlement

IMMEDIATE SETTLEMENT

CPT Profile Information

	Thickness (ft)	E (ksf)	ν	γ (psf)	
Erosion Protection (repository)	1.1			122.9	
Cover Fill (repository)	2.9			114.7	
Mine Spoils (repository)	9.0			116.4	
Radon Barrier (existing)	2.5	450	0.3	122.3	Hard, moist, sandy clay
Existing Fill (existing)	9.5	680	0.35	113.8	Silty sand, sandy clay w/ gravel
Coarse Tailings (existing)	13.0	150	0.3	108.1	Silty sand tailings
		McCarthy (1998)	McCarthy (1998)		

Total Fill Height 13.0 above radon barrier

Soil Properties (McCarthy, 1998)**:**

Soil Type	E/N	E/qc
Silts, sand silts, slightly cohesive silt-sand mixtures	4	1.5
Clean, Fine to med, sands and slightly silty sands	7	2
Coarse sands and sands with little gravel	10.0	3
Sandy gravels and gravel	12.0	4

$$\delta v = (\Delta q) * B * (1-v^2)/Eu * I$$

NAVFAC (1989), section 7.1-211

Modulus of Elasticity, E (ksf)
Weighted average 381 by depth/thickness of layers

Poisson's Ratio, v
Weighted average 0.3 McCarthy (1998)

Influence Factor, I 0.64

Δq = 1512 psf
Δq = 1.51 ksf
B = 250 ft

I = 0.64 From NAVFAC chart, assuming a circular (flexible) shape and rigidity, calculated on the edge

Solution: $\boxed{\delta v = 0.6 \text{ ft}}$

Estimate E:

Layer	Soil Description	z (ft)	Δz (ft)	E/qc	qc (ksf)	E (ksf)	Avg E (ksf) per layer
1	Ex. Cover	0.16404	0.16404	1.5	40.160	60.24	
2	Ex. Cover	0.32808	0.16404	1.5	56.980	85.47	
3	Ex. Cover	0.49212	0.16404	1.5	127.480	191.22	
4	Ex. Cover	0.65616	0.16404	1.5	129.520	194.28	
5	Ex. Cover	0.8202	0.16404	1.5	200.640	300.96	
6	Ex. Cover	0.98424	0.16404	1.5	414.920	622.38	
7	Ex. Cover	1.14828	0.16404	1.5	398.480	597.72	
8	Ex. Cover	1.31232	0.16404	1.5	333.220	499.83	363.9
9	Ex. Cover	1.47636	0.16404	1.5	273.820	410.73	
10	Ex. Cover	1.6404	0.16404	1.5	251.120	376.68	
11	Ex. Cover	1.80444	0.16404	1.5	270.620	405.93	
12	Ex. Cover	1.96848	0.16404	1.5	305.680	458.52	
13	Ex. Cover	2.13252	0.16404	1.5	318.040	477.06	
14	Ex. Cover	2.29656	0.16404	1.5	272.920	409.38	
15	Ex. Cover	2.4606	0.16404	1.5	245.140	367.71	
16	Ex. Fill	2.62464	0.16404	3.0	290.000	870	
17	Ex. Fill	2.78868	0.16404	3.0	365.980	1097.94	
18	Ex. Fill	2.95272	0.16404	3.0	375.280	1125.84	
19	Ex. Fill	3.11676	0.16404	3.0	383.700	1151.1	
20	Ex. Fill	3.2808	0.16404	3.0	386.240	1158.72	

21	Ex. Fill	3.44484	0.16404	3.0	336.140	1008.42	
22	Ex. Fill	3.60888	0.16404	3.0	330.920	992.76	
23	Ex. Fill	3.77292	0.16404	3.0	272.280	816.84	
24	Ex. Fill	3.93696	0.16404	3.0	225.760	677.28	
25	Ex. Fill	4.101	0.16404	3.0	216.060	648.18	
26	Ex. Fill	4.26504	0.16404	3.0	275.980	827.94	
27	Ex. Fill	4.42908	0.16404	3.0	454.200	1362.6	
28	Ex. Fill	4.59312	0.16404	3.0	589.960	1769.88	
29	Ex. Fill	4.75716	0.16404	3.0	559.740	1679.22	
30	Ex. Fill	4.9212	0.16404	3.0	470.260	1410.78	
31	Ex. Fill	5.08524	0.16404	3.0	361.140	1083.42	
32	Ex. Fill	5.24928	0.16404	3.0	252.520	757.56	
33	Ex. Fill	5.41332	0.16404	3.0	191.460	574.38	
34	Ex. Fill	5.57736	0.16404	3.0	225.240	675.72	
35	Ex. Fill	5.7414	0.16404	3.0	272.040	816.12	
36	Ex. Fill	5.90544	0.16404	3.0	346.740	1040.22	
37	Ex. Fill	6.06948	0.16404	3.0	353.620	1060.86	
38	Ex. Fill	6.23352	0.16404	3.0	427.300	1281.9	
39	Ex. Fill	6.39756	0.16404	3.0	464.140	1392.42	
40	Ex. Fill	6.5616	0.16404	3.0	440.160	1320.48	
41	Ex. Fill	6.72564	0.16404	3.0	371.200	1113.6	
42	Ex. Fill	6.88968	0.16404	3.0	319.960	959.88	
43	Ex. Fill	7.05372	0.16404	3.0	245.000	735	
44	Ex. Fill	7.21776	0.16404	3.0	195.040	585.12	
45	Ex. Fill	7.3818	0.16404	3.0	187.900	563.7	679.7
46	Ex. Fill	7.54584	0.16404	3.0	168.900	506.7	
47	Ex. Fill	7.70988	0.16404	3.0	186.360	559.08	
48	Ex. Fill	7.87392	0.16404	3.0	183.440	550.32	
49	Ex. Fill	8.03796	0.16404	3.0	163.540	490.62	
50	Ex. Fill	8.202	0.16404	3.0	164.560	493.68	
51	Ex. Fill	8.36604	0.16404	3.0	162.660	487.98	
52	Ex. Fill	8.53008	0.16404	3.0	149.400	448.2	
53	Ex. Fill	8.69412	0.16404	3.0	132.320	396.96	
54	Ex. Fill	8.85816	0.16404	3.0	115.240	345.72	
55	Ex. Fill	9.0222	0.16404	3.0	115.100	345.3	
56	Ex. Fill	9.18624	0.16404	3.0	106.820	320.46	
57	Ex. Fill	9.35028	0.16404	3.0	100.060	300.18	
58	Ex. Fill	9.51432	0.16404	3.0	100.700	302.1	
59	Ex. Fill	9.67836	0.16404	3.0	96.880	290.64	
60	Ex. Fill	9.8424	0.16404	3.0	90.640	271.92	
61	Ex. Fill	10.00644	0.16404	3.0	86.300	258.9	
62	Ex. Fill	10.17048	0.16404	3.0	95.980	287.94	
63	Ex. Fill	10.33452	0.16404	3.0	78.140	234.42	
64	Ex. Fill	10.49856	0.16404	3.0	69.980	209.94	
65	Ex. Fill	10.6626	0.16404	3.0	83.500	250.5	
66	Ex. Fill	10.82664	0.16404	3.0	88.600	265.8	
67	Ex. Fill	10.99068	0.16404	3.0	87.580	262.74	
68	Ex. Fill	11.15472	0.16404	3.0	74.580	223.74	
69	Ex. Fill	11.31876	0.16404	3.0	62.200	186.6	
70	Ex. Fill	11.4828	0.16404	3.0	54.680	164.04	
71	Ex. Fill	11.64684	0.16404	3.0	52.520	157.56	
72	Ex. Fill	11.81088	0.16404	3.0	47.420	142.26	
73	Ex. Fill	11.97492	0.16404	3.0	37.740	113.22	
74	Coarse Tailings	12.13896	0.16404	2.0	37.480	74.96	
75	Coarse Tailings	12.303	0.16404	2.0	38.620	77.24	
76	Coarse Tailings	12.46704	0.16404	2.0	43.600	87.2	
77	Coarse Tailings	12.63108	0.16404	2.0	42.840	85.68	
78	Coarse Tailings	12.79512	0.16404	2.0	37.860	75.72	
79	Coarse Tailings	12.95916	0.16404	2.0	52.900	105.8	

80	Coarse Tailings	13.1232	0.16404	2.0	174.260	348.52
81	Coarse Tailings	13.28724	0.16404	2.0	170.440	340.88
82	Coarse Tailings	13.45128	0.16404	2.0	230.720	461.44
83	Coarse Tailings	13.61532	0.16404	2.0	187.760	375.52
84	Coarse Tailings	13.77936	0.16404	2.0	94.340	188.68
85	Coarse Tailings	13.9434	0.16404	2.0	99.440	198.88
86	Coarse Tailings	14.10744	0.16404	2.0	62.980	125.96
87	Coarse Tailings	14.27148	0.16404	2.0	32.640	65.28
88	Coarse Tailings	14.43552	0.16404	2.0	25.120	50.24
89	Coarse Tailings	14.59956	0.16404	2.0	27.660	55.32
90	Coarse Tailings	14.7636	0.16404	2.0	52.400	104.8
91	Coarse Tailings	14.92764	0.16404	2.0	64.620	129.24
92	Coarse Tailings	15.09168	0.16404	2.0	70.500	141
93	Coarse Tailings	15.25572	0.16404	2.0	76.860	153.72
94	Coarse Tailings	15.41976	0.16404	2.0	81.200	162.4
95	Coarse Tailings	15.5838	0.16404	2.0	88.340	176.68
96	Coarse Tailings	15.74784	0.16404	2.0	97.140	194.28
97	Coarse Tailings	15.91188	0.16404	2.0	103.900	207.8
98	Coarse Tailings	16.07592	0.16404	2.0	106.320	212.64
99	Coarse Tailings	16.23996	0.16404	2.0	104.780	209.56
100	Coarse Tailings	16.404	0.16404	2.0	99.040	198.08
101	Coarse Tailings	16.56804	0.16404	2.0	92.680	185.36
102	Coarse Tailings	16.73208	0.16404	2.0	89.240	178.48
103	Coarse Tailings	16.89612	0.16404	2.0	87.320	174.64
104	Coarse Tailings	17.06016	0.16404	2.0	85.280	170.56
105	Coarse Tailings	17.2242	0.16404	2.0	84.000	168
106	Coarse Tailings	17.38824	0.16404	2.0	86.040	172.08
107	Coarse Tailings	17.55228	0.16404	2.0	85.020	170.04
108	Coarse Tailings	17.71632	0.16404	2.0	88.080	176.16
109	Coarse Tailings	17.88036	0.16404	2.0	88.080	176.16
110	Coarse Tailings	18.0444	0.16404	2.0	85.660	171.32
111	Coarse Tailings	18.20844	0.16404	2.0	89.240	178.48
112	Coarse Tailings	18.37248	0.16404	2.0	94.840	189.68
113	Coarse Tailings	18.53652	0.16404	2.0	90.260	180.52
114	Coarse Tailings	18.70056	0.16404	2.0	91.140	182.28
115	Coarse Tailings	18.8646	0.16404	2.0	90.640	181.28
116	Coarse Tailings	19.02864	0.16404	2.0	89.860	179.72
117	Coarse Tailings	19.19268	0.16404	2.0	87.320	174.64
118	Coarse Tailings	19.35672	0.16404	2.0	86.560	173.12
119	Coarse Tailings	19.52076	0.16404	2.0	82.980	165.96
120	Coarse Tailings	19.6848	0.16404	2.0	83.360	166.72
121	Coarse Tailings	19.84884	0.16404	2.0	79.680	159.36
122	Coarse Tailings	20.01288	0.16404	2.0	78.780	157.56
123	Coarse Tailings	20.17692	0.16404	2.0	79.420	158.84
124	Coarse Tailings	20.34096	0.16404	2.0	81.960	163.92
125	Coarse Tailings	20.505	0.16404	2.0	81.960	163.92
126	Coarse Tailings	20.66904	0.16404	2.0	84.900	169.8
127	Coarse Tailings	20.83308	0.16404	2.0	85.540	171.08
128	Coarse Tailings	20.99712	0.16404	2.0	83.760	167.52
129	Coarse Tailings	21.16116	0.16404	2.0	84.780	169.56
130	Coarse Tailings	21.3252	0.16404	2.0	82.600	165.2
131	Coarse Tailings	21.48924	0.16404	2.0	78.140	156.28
132	Coarse Tailings	21.65328	0.16404	2.0	72.920	145.84
133	Coarse Tailings	21.81732	0.16404	2.0	77.120	154.24
134	Coarse Tailings	21.98136	0.16404	2.0	77.240	154.48
135	Coarse Tailings	22.1454	0.16404	2.0	68.840	137.68
136	Coarse Tailings	22.30944	0.16404	2.0	57.100	114.2
137	Coarse Tailings	22.47348	0.16404	2.0	68.080	136.16
138	Coarse Tailings	22.63752	0.16404	2.0	82.600	165.2

158.4

139	Coarse Tailings	22.80156	0.16404	2.0	90.380	180.76	
140	Coarse Tailings	22.9656	0.16404	2.0	87.440	174.88	
141	Coarse Tailings	23.12964	0.16404	2.0	65.780	131.56	
142	Coarse Tailings	23.29368	0.16404	2.0	53.800	107.6	
143	Coarse Tailings	23.45772	0.16404	2.0	45.120	90.24	
144	Coarse Tailings	23.62176	0.16404	2.0	49.720	99.44	
145	Coarse Tailings	23.7858	0.16404	2.0	48.960	97.92	
146	Coarse Tailings	23.94984	0.16404	2.0	35.820	71.64	
147	Coarse Tailings	24.11388	0.16404	2.0	32.380	64.76	
148	Coarse Tailings	24.27792	0.16404	2.0	43.600	87.2	
149	Coarse Tailings	24.44196	0.16404	2.0	41.040	82.08	
150	Coarse Tailings	24.606	0.16404	2.0	48.320	96.64	
151	Coarse Tailings	24.77004	0.16404	2.0	58.120	116.24	
152	Coarse Tailings	24.93408	0.16404	2.0	72.920	145.84	
153	Coarse Tailings	25.09812	0.16404	2.0	95.100	190.2	

NECR TAILINGS IMPOUNDMENT SETTLEMENT ANALYSIS - CPT-01 Settlement

IMMEDIATE SETTLEMENT

CPT Profile Information

	Thickness (ft)	E (ksf)	ν	γ (psf)	
Erosion Protection (repository)	2.1			122.9	
Cover Fill (repository)	0.0			114.7	
Mine Spoils (repository)	0.0			116.4	
Radon Barrier (existing)	2.5	450	0.3	122.3	Hard, moist, sandy clay
Existing Fill (existing)	16.0	680	0.35	113.8	
Coarse Tailings (existing)	11.1	150	0.3	108.1	Silty sand tailings
		McCarthy (1998)	McCarthy (1998)		

Total Fill Height 2.1 above radon barrier

Soil Properties (McCarthy, 1998)**:**

Soil Type	E/N	E/qc
Silts, sand silts, slightly cohesive silt-sand mixtures	4	1.5
Clean, Fine to med, sands and slightly silty sands	7	2
Coarse sands and sands with little gravel	10.0	3
Sandy gravels and gravel	12.0	4

$\delta v = (\Delta q) * B * (1-v^2)/E * I$ NAVFAC (1989), section 7.1-211

Modulus of Elasticity, E (ksf)

Weighted average 462 by depth/thickness of layers

Poisson's Ratio, v

Weighted average 0.3 McCarthy (1998)

Influence Factor, I 0.64

Δq =	258.1	psf
Δq =	0.26	ksf
B =	250	ft
I =	0.64	From NAVFAC chart, assuming a circular (flexible) shape and rigidity, calculated on the edge

Solution: δv = **0.1** ft

Estimate E:

Layer	Soil Description	z (ft)	Δz (ft)	E/qc	qc (ksf)	E (ksf)	Avg E (ksf) per layer
1	Ex. Cover	0.16404	0.16404	1.5	32.260	48.39	
2	Ex. Cover	0.32808	0.16404	1.5	84.140	126.21	
3	Ex. Cover	0.49212	0.16404	1.5	138.060	207.09	
4	Ex. Cover	0.65616	0.16404	1.5	225.500	338.25	
5	Ex. Cover	0.8202	0.16404	1.5	312.820	469.23	
6	Ex. Cover	0.98424	0.16404	1.5	333.860	500.79	
7	Ex. Cover	1.14828	0.16404	1.5	381.540	572.31	
8	Ex. Cover	1.31232	0.16404	1.5	380.120	570.18	505.5
9	Ex. Cover	1.47636	0.16404	1.5	424.100	636.15	
10	Ex. Cover	1.6404	0.16404	1.5	442.080	663.12	
11	Ex. Cover	1.80444	0.16404	1.5	449.340	674.01	
12	Ex. Cover	1.96848	0.16404	1.5	435.320	652.98	
13	Ex. Cover	2.13252	0.16404	1.5	402.300	603.45	
14	Ex. Cover	2.29656	0.16404	1.5	469.240	703.86	
15	Ex. Cover	2.4606	0.16404	1.5	543.940	815.91	
16	Ex. Fill	2.62464	0.16404	3.0	628.440	1885.32	
17	Ex. Fill	2.78868	0.16404	3.0	761.660	2284.98	
18	Ex. Fill	2.95272	0.16404	3.0	861.220	2583.66	
19	Ex. Fill	3.11676	0.16404	3.0	885.940	2657.82	
20	Ex. Fill	3.2808	0.16404	3.0	892.700	2678.1	

21	Ex. Fill	3.44484	0.16404	3.0	890.400	2671.2
22	Ex. Fill	3.60888	0.16404	3.0	836.740	2510.22
23	Ex. Fill	3.77292	0.16404	3.0	769.440	2308.32
24	Ex. Fill	3.93696	0.16404	3.0	767.520	2302.56
25	Ex. Fill	4.101	0.16404	3.0	764.600	2293.8
26	Ex. Fill	4.26504	0.16404	3.0	719.340	2158.02
27	Ex. Fill	4.42908	0.16404	3.0	674.720	2024.16
28	Ex. Fill	4.59312	0.16404	3.0	635.460	1906.38
29	Ex. Fill	4.75716	0.16404	3.0	568.660	1705.98
30	Ex. Fill	4.9212	0.16404	3.0	460.940	1382.82
31	Ex. Fill	5.08524	0.16404	3.0	359.220	1077.66
32	Ex. Fill	5.24928	0.16404	3.0	258.400	775.2
33	Ex. Fill	5.41332	0.16404	3.0	163.540	490.62
34	Ex. Fill	5.57736	0.16404	3.0	113.840	341.52
35	Ex. Fill	5.7414	0.16404	3.0	92.040	276.12
36	Ex. Fill	5.90544	0.16404	3.0	79.420	238.26
37	Ex. Fill	6.06948	0.16404	3.0	72.160	216.48
38	Ex. Fill	6.23352	0.16404	3.0	81.460	244.38
39	Ex. Fill	6.39756	0.16404	3.0	80.180	240.54
40	Ex. Fill	6.5616	0.16404	3.0	76.620	229.86
41	Ex. Fill	6.72564	0.16404	3.0	84.140	252.42
42	Ex. Fill	6.88968	0.16404	3.0	96.760	290.28
43	Ex. Fill	7.05372	0.16404	3.0	107.340	322.02
44	Ex. Fill	7.21776	0.16404	3.0	126.200	378.6
45	Ex. Fill	7.3818	0.16404	3.0	148.900	446.7
46	Ex. Fill	7.54584	0.16404	3.0	151.940	455.82
47	Ex. Fill	7.70988	0.16404	3.0	134.480	403.44
48	Ex. Fill	7.87392	0.16404	3.0	138.180	414.54
49	Ex. Fill	8.03796	0.16404	3.0	153.860	461.58
50	Ex. Fill	8.202	0.16404	3.0	153.740	461.22
51	Ex. Fill	8.36604	0.16404	3.0	151.180	453.54
52	Ex. Fill	8.53008	0.16404	3.0	183.440	550.32
53	Ex. Fill	8.69412	0.16404	3.0	186.240	558.72
54	Ex. Fill	8.85816	0.16404	3.0	178.980	536.94
55	Ex. Fill	9.0222	0.16404	3.0	156.800	470.4
56	Ex. Fill	9.18624	0.16404	3.0	157.940	473.82
57	Ex. Fill	9.35028	0.16404	3.0	144.180	432.54
58	Ex. Fill	9.51432	0.16404	3.0	136.020	408.06
59	Ex. Fill	9.67836	0.16404	3.0	141.240	423.72
60	Ex. Fill	9.8424	0.16404	3.0	142.900	428.7
61	Ex. Fill	10.00644	0.16404	3.0	124.800	374.4
62	Ex. Fill	10.17048	0.16404	3.0	111.280	333.84
63	Ex. Fill	10.33452	0.16404	3.0	98.420	295.26
64	Ex. Fill	10.49856	0.16404	3.0	90.000	270
65	Ex. Fill	10.6626	0.16404	3.0	84.780	254.34
66	Ex. Fill	10.82664	0.16404	3.0	75.200	225.6
67	Ex. Fill	10.99068	0.16404	3.0	70.500	211.5
68	Ex. Fill	11.15472	0.16404	3.0	70.740	212.22
69	Ex. Fill	11.31876	0.16404	3.0	73.420	220.26
70	Ex. Fill	11.4828	0.16404	3.0	74.060	222.18
71	Ex. Fill	11.64684	0.16404	3.0	68.080	204.24
72	Ex. Fill	11.81088	0.16404	3.0	67.300	201.9
73	Ex. Fill	11.97492	0.16404	3.0	148.760	446.28
74	Ex. Fill	12.13896	0.16404	3.0	228.560	685.68
75	Ex. Fill	12.303	0.16404	3.0	304.920	914.76
76	Ex. Fill	12.46704	0.16404	3.0	348.760	1046.28
77	Ex. Fill	12.63108	0.16404	3.0	377.580	1132.74
78	Ex. Fill	12.79512	0.16404	3.0	381.540	1144.62
79	Ex. Fill	12.95916	0.16404	3.0	371.580	1114.74
80	Ex. Fill	13.1232	0.16404	3.0	347.240	1041.72

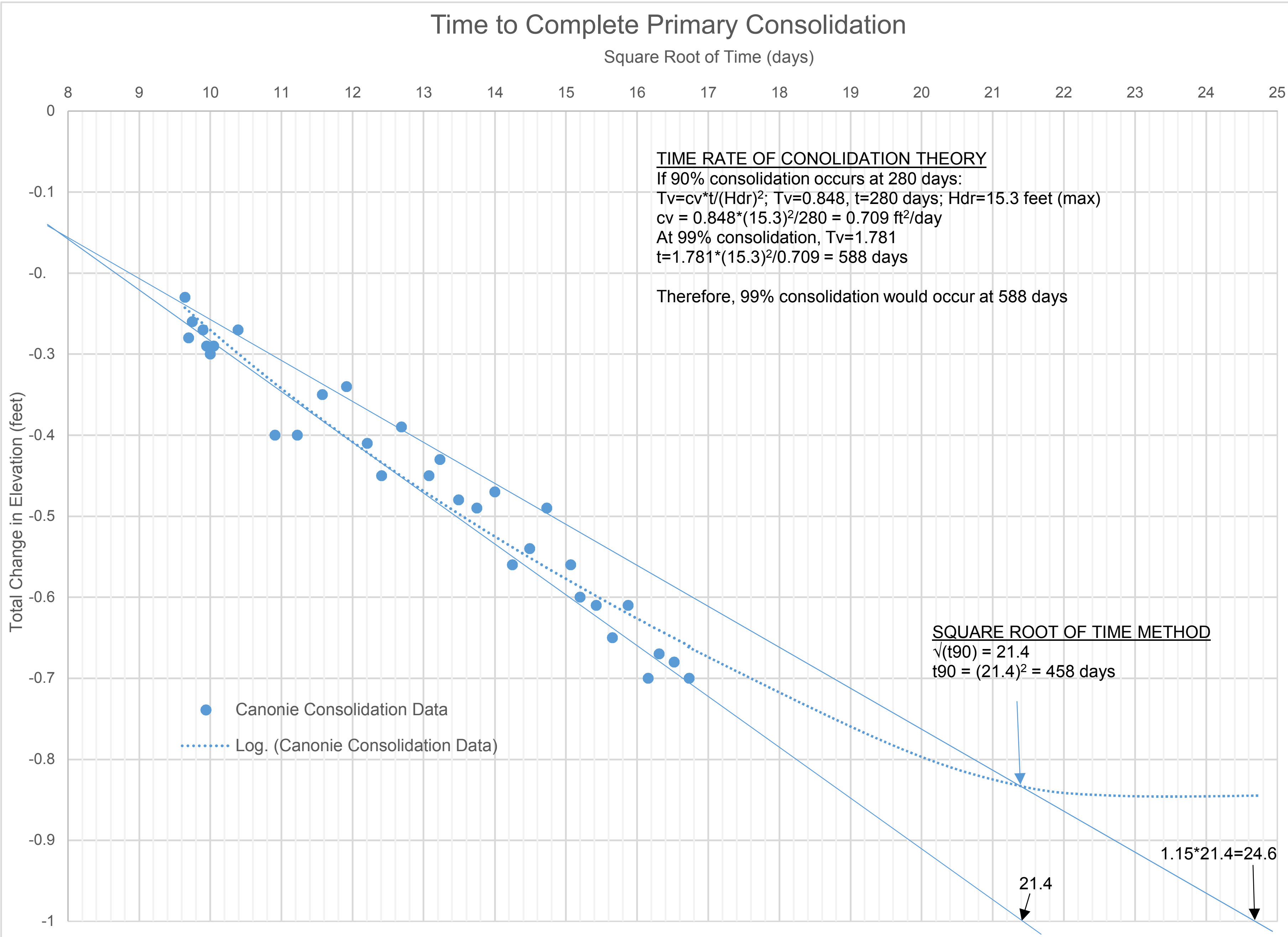
661.3

81	Ex. Fill	13.28724	0.16404	3.0	283.760	851.28
82	Ex. Fill	13.45128	0.16404	3.0	208.800	626.4
83	Ex. Fill	13.61532	0.16404	3.0	148.260	444.78
84	Ex. Fill	13.77936	0.16404	3.0	113.700	341.1
85	Ex. Fill	13.9434	0.16404	3.0	96.380	289.14
86	Ex. Fill	14.10744	0.16404	3.0	80.700	242.1
87	Ex. Fill	14.27148	0.16404	3.0	72.020	216.06
88	Ex. Fill	14.43552	0.16404	3.0	58.380	175.14
89	Ex. Fill	14.59956	0.16404	3.0	55.700	167.1
90	Ex. Fill	14.7636	0.16404	3.0	54.180	162.54
91	Ex. Fill	14.92764	0.16404	3.0	50.980	152.94
92	Ex. Fill	15.09168	0.16404	3.0	49.080	147.24
93	Ex. Fill	15.25572	0.16404	3.0	46.920	140.76
94	Ex. Fill	15.41976	0.16404	3.0	42.840	128.52
95	Ex. Fill	15.5838	0.16404	3.0	45.260	135.78
96	Ex. Fill	15.74784	0.16404	3.0	42.840	128.52
97	Ex. Fill	15.91188	0.16404	3.0	41.560	124.68
98	Ex. Fill	16.07592	0.16404	3.0	36.720	110.16
99	Ex. Fill	16.23996	0.16404	3.0	38.360	115.08
100	Ex. Fill	16.404	0.16404	3.0	44.360	133.08
101	Ex. Fill	16.56804	0.16404	3.0	45.260	135.78
102	Ex. Fill	16.73208	0.16404	3.0	42.060	126.18
103	Ex. Fill	16.89612	0.16404	3.0	41.820	125.46
104	Ex. Fill	17.06016	0.16404	3.0	56.600	169.8
105	Ex. Fill	17.2242	0.16404	3.0	55.460	166.38
106	Ex. Fill	17.38824	0.16404	3.0	53.160	159.48
107	Ex. Fill	17.55228	0.16404	3.0	62.840	188.52
108	Ex. Fill	17.71632	0.16404	3.0	65.900	197.7
109	Ex. Fill	17.88036	0.16404	3.0	67.820	203.46
110	Ex. Fill	18.0444	0.16404	3.0	68.080	204.24
111	Ex. Fill	18.20844	0.16404	3.0	66.160	198.48
112	Ex. Fill	18.37248	0.16404	3.0	75.080	225.24
113	Ex. Fill	18.53652	0.16404	3.0	404.860	1214.58
114	Coarse Tailings	18.70056	0.16404	2.0	756.680	1513.36
115	Coarse Tailings	18.8646	0.16404	2.0	883.660	1767.32
116	Coarse Tailings	19.02864	0.16404	2.0	910.940	1821.88
117	Coarse Tailings	19.19268	0.16404	2.0	888.360	1776.72
118	Coarse Tailings	19.35672	0.16404	2.0	894.360	1788.72
119	Coarse Tailings	19.52076	0.16404	2.0	906.480	1812.96
120	Coarse Tailings	19.6848	0.16404	2.0	872.560	1745.12
121	Coarse Tailings	19.84884	0.16404	2.0	844.400	1688.8
122	Coarse Tailings	20.01288	0.16404	2.0	796.840	1593.68
123	Coarse Tailings	20.17692	0.16404	2.0	743.300	1486.6
124	Coarse Tailings	20.34096	0.16404	2.0	694.860	1389.72
125	Coarse Tailings	20.505	0.16404	2.0	654.460	1308.92
126	Coarse Tailings	20.66904	0.16404	2.0	614.800	1229.6
127	Coarse Tailings	20.83308	0.16404	2.0	553.120	1106.24
128	Coarse Tailings	20.99712	0.16404	2.0	501.620	1003.24
129	Coarse Tailings	21.16116	0.16404	2.0	441.580	883.16
130	Coarse Tailings	21.3252	0.16404	2.0	388.280	776.56
131	Coarse Tailings	21.48924	0.16404	2.0	331.560	663.12
132	Coarse Tailings	21.65328	0.16404	2.0	288.100	576.2
133	Coarse Tailings	21.81732	0.16404	2.0	252.140	504.28
134	Coarse Tailings	21.98136	0.16404	2.0	226.520	453.04
135	Coarse Tailings	22.1454	0.16404	2.0	204.600	409.2
136	Coarse Tailings	22.30944	0.16404	2.0	190.320	380.64
137	Coarse Tailings	22.47348	0.16404	2.0	157.180	314.36
138	Coarse Tailings	22.63752	0.16404	2.0	139.960	279.92
139	Coarse Tailings	22.80156	0.16404	2.0	130.020	260.04
140	Coarse Tailings	22.9656	0.16404	2.0	112.680	225.36

141	Coarse Tailings	23.12964	0.16404	2.0	102.620	205.24	
142	Coarse Tailings	23.29368	0.16404	2.0	94.960	189.92	
143	Coarse Tailings	23.45772	0.16404	2.0	88.980	177.96	
144	Coarse Tailings	23.62176	0.16404	2.0	86.180	172.36	
145	Coarse Tailings	23.7858	0.16404	2.0	82.340	164.68	
146	Coarse Tailings	23.94984	0.16404	2.0	84.520	169.04	
147	Coarse Tailings	24.11388	0.16404	2.0	78.660	157.32	576.4
148	Coarse Tailings	24.27792	0.16404	2.0	87.820	175.64	
149	Coarse Tailings	24.44196	0.16404	2.0	90.380	180.76	
150	Coarse Tailings	24.606	0.16404	2.0	91.900	183.8	
151	Coarse Tailings	24.77004	0.16404	2.0	100.060	200.12	
152	Coarse Tailings	24.93408	0.16404	2.0	109.120	218.24	
153	Coarse Tailings	25.09812	0.16404	2.0	122.640	245.28	
154	Coarse Tailings	25.26216	0.16404	2.0	148.640	297.28	
155	Coarse Tailings	25.4262	0.16404	2.0	172.980	345.96	
156	Coarse Tailings	25.59024	0.16404	2.0	206.900	413.8	
157	Coarse Tailings	25.75428	0.16404	2.0	214.160	428.32	
158	Coarse Tailings	25.91832	0.16404	2.0	209.320	418.64	
159	Coarse Tailings	26.08236	0.16404	2.0	202.420	404.84	
160	Coarse Tailings	26.2464	0.16404	2.0	196.820	393.64	
161	Coarse Tailings	26.41044	0.16404	2.0	191.980	383.96	
162	Coarse Tailings	26.57448	0.16404	2.0	181.660	363.32	
163	Coarse Tailings	26.73852	0.16404	2.0	167.380	334.76	
164	Coarse Tailings	26.90256	0.16404	2.0	142.780	285.56	
165	Coarse Tailings	27.0666	0.16404	2.0	126.580	253.16	
166	Coarse Tailings	27.23064	0.16404	2.0	133.980	267.96	
167	Coarse Tailings	27.39468	0.16404	2.0	98.020	196.04	
168	Coarse Tailings	27.55872	0.16404	2.0	73.940	147.88	
169	Coarse Tailings	27.72276	0.16404	2.0	69.220	138.44	
170	Coarse Tailings	27.8868	0.16404	2.0	129.520	259.04	
171	Coarse Tailings	28.05084	0.16404	2.0	126.320	252.64	
172	Coarse Tailings	28.21488	0.16404	2.0	99.680	199.36	
173	Coarse Tailings	28.37892	0.16404	2.0	105.300	210.6	
174	Coarse Tailings	28.54296	0.16404	2.0	136.520	273.04	
175	Coarse Tailings	28.707	0.16404	2.0	137.540	275.08	
176	Coarse Tailings	28.87104	0.16404	2.0	131.940	263.88	
177	Coarse Tailings	29.03508	0.16404	2.0	130.780	261.56	
178	Coarse Tailings	29.19912	0.16404	2.0	116.640	233.28	
179	Coarse Tailings	29.36316	0.16404	2.0	100.580	201.16	
180	Coarse Tailings	29.5272	0.16404	2.0	125.300	250.6	
181	Coarse Tailings	29.69124	0.16404	2.0	120.080	240.16	

ATTACHMENT E

ESTIMATED TIME TO COMPLETE PRIMARY CONSOLIDATION


Time to Complete Primary Consolidation
Square Root of Time (days)
8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
0
-0.1
-0.
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
Total Change in Elevation (feet)
TIME RATE OF CONOLIDATION THEORY
If 90% consolidation occurs at 280 days:
Tv=cv*t/(Hdr)2; Tv=0.848, t=280 days; Hdr=15.3 feet (max)
cv = 0.848*(15.3)2/280 = 0.709 ft2/day
At 99% consolidation, Tv=1.781
t=1.781*(15.3)2/0.709 = 588 days
Therefore, 99% consolidation would occur at 588 days
SQUARE ROOT OF TIME METHOD
√(t90) = 21.4
t90 = (21.4)2 = 458 days
Canonie Consolidation Data
Log. (Canonie Consolidation Data)
21.4
1.15*21.4=24.6

ATTACHMENT G.4
Repository Seismic Settlement Analysis

Client:	*GE/UNC*	**Sheet:**	*1* **of** *13*
Project:	*Northeast Church Rock Mine Site Removal Action*	**Date:**	*08/09/2017*
Description:	*Seismic Settlement Analysis for the Mill Site Repository*	**Job No:**	*233001048*

ATTACHMENT G.4:
REPOSITORY SEISMIC SETTLEMENT ANALYSIS

Revisioning

Rev.	Date	Description	By	Checked	Date
0	*June 2016*	*Preliminary (30%) Design*	*S. McManus*	*N. Brink*	*27 May 2016*
1	*July 2017*	*95% Design*	*S. Downey*	*C.Weber*	*15 Sep 2017*

Location and Format

Electronic copies of these calculations are located on the Stantec internal project teamsite.

The following calculations were generated using the following software:

Microsoft Excel

Table of Contents

Objective

This calculation brief documents the inputs, assumptions, methods, results and conclusions of the seismic settlement analysis for the proposed Church Rock Mill Site (Mill Site) repository. This brief discusses settlement that may occur within the footprint of the proposed repository as a result of the design seismic event. Other components of settlement (immediate, primary, and secondary settlement) are discussed in Attachment G.3. Liquefaction induced settlement is discussed in Attachment G.6.

Background

This analysis has been performed as part of the design of the Removal Action (RA) at the Northeast Church Rock Mine Site (Mine Site) and the related Remedial Action (RA) at the Mill Site. The Mine Site and Mill Site are located in close proximity to one another, approximately 16 miles northeast of Gallup, in McKinley County, New Mexico. They are located on adjacent Sections approximately one-half mile apart. The sites are temporarily being treated as one facility for purposes of the RA. The combined site is referred to as the “Settlement Agreement Site” (SA Site).

Site History

The NECR mine is a historical uranium mine operated by United Nuclear Corporation (UNC). Mining development began in 1967 and ended in 1982. While the mine operated, it served as the principal mineral source for the UNC uranium mill. The uranium mill and its adjacent disposal cells make up the UNC Superfund Site (the “UNC Mill Site”). Remedial activities addressing source control and on-site surface reclamation are being implemented by UNC under the direction of the US Nuclear Regulatory Commission (NRC), pursuant to the UNC facility's NRC license, and integrated with the USEPA’s selected remedy for the groundwater.

The tailings disposal area (TDA) is an unlined facility bounded by an embankment and subdivided by cross-dikes into three cells, which are identified as the South Cell, Central Cell, and North Cell. An estimated 3.5 million tons of tailings were pumped as slurry from the UNC mill to the TDA.

Proposed Remedial Action

The proposed repository will be constructed on top of the existing TDA and will incorporate controlled placement of mine waste on top of the existing TDA cover/radon barrier and a final evapotranspirative (ET) cover placed over the mine waste. Improvements to the existing TDA cover/radon barrier within the footprint of the proposed repository will be completed prior to placement of mine waste. **Figure 1** shows the location and grading of the proposed repository.

The design for the selected repository alternative will be evaluated as part of a NRC license amendment request for the existing licensed facility. The repository features that affect the licensed facility will meet performance standards outlined in NRC regulations and areas of the existing facility affected by the repository construction will be evaluated for compliance. However, existing conditions of the facility not affected by the proposed repository were not evaluated as part of this analysis, as they are managed by the existing NRC license.

Site Description

The natural stratigraphy at the Mill Site is divided into two main components: the surficial unconsolidated deposits (alluvium) and the underlying consolidated bedrock units. The alluvium consists of a mixture of sand, silt, and clay with minor portions of gravel. Alluvial thicknesses at the site are usually around 50 feet, but exceed 120 feet in some locations. Generally, the uppermost bedrock unit at the site is the Upper Gallup Sandstone, though in some locations it is overlain by coal or the Mancos shale.

The TDA was constructed on top of the native alluvium and deposition of tailings via slurry within the TDA resulted in an interbedded accumulation of tailings. TDA closure construction began in 1989 and was completed in 1995. Closure construction included placement of an interim cover (general fill) from 1989 through 1991 followed by placement of the final cover (radon barrier and erosion protection layer) from 1993 through 1995.

Measurements taken in alluvial monitoring wells (see **Attachment E**) show an alluvial groundwater table in the vicinity of the TDA at approximately 6,867 feet above mean sea level (amsl), which indicates that the alluvium is unsaturated above this elevation. Additionally, subsurface investigations of the TDA indicate that there is not a consistent static water level within the tailings or the alluvium above approximately 6,867 feet amsl. However, localized perched zones of saturation exist within the low-permeability, fine-grained tailings. These zones of saturation do not appear to extend beyond the fine-grained tailings into the higher-permeability coarse-grained tailings.

Site Investigation

In 2013, MWH performed pre-design studies (PDS) at the Mill Site and Mine Site to supplement previous site investigations and collect pre-design data necessary to perform the Remedial Design (RD). Activities performed as part of the Mill Site PDS included: surveying, cone penetration tests (CPTs), drilling, standard penetration tests (SPTs), excavation and soil sampling, and subsequent laboratory testing. Geotechnical data collected during the PDS are presented in the PDS reports (MWH, 2014a and MWH, 2014b) and summarized in **Attachment A**. A list of the materials encountered within the TDA during the PDS is presented in the Assumptions section below. Geotechnical properties for these materials and discussion of one-dimensional stratigraphic profiles used in the seismic settlement analysis are also presented in the Assumptions section below.

Applicable Codes and Standards

Applicable regulatory guidance documents include the following:

- NUREG 1620, Section 2.3 (NRC, 2003)
- Naval Facilities Engineering Command (NAVFAC) Design Manual 7.01, Chapter 5, Sections 3 and 4 (NAVFAC, 1986)
- Technical Approach Document, Revision II, Section 6.3 (DOE, 1989).

Methods

General

The seismic settlement analysis evaluated the magnitude of potential settlement that may occur within the footprint of the proposed Mill Site repository as a result of the design seismic event. Analysis of one-dimensional stratigraphic profiles was performed according to the methods outlined in *Seismic Compression Analysis of As-Compacted Fill Soils with Variable Levels of Fines Content and Fines Plasticity* (Stewart et al., 2004). The design seismic event was characterized by the parameters presented in the UNC-NECR Seismic Hazard Analysis (see Appendix G to the Northeast Church Rock Mine Site Removal Action Design Report). The seismic settlement analysis used data collected during CPTs, hollow-stem auger (HSA) drilling, and laboratory testing to estimate the magnitude of potential seismic settlement within the footprint of the proposed Mill Site repository.

Six one-dimensional stratigraphic profiles were developed and analyzed as part of the seismic settlement analysis (see **Figure 2**). These stratigraphic profiles were developed based on conditions observed during the Mill Site PDS (MWH, 2014a) field investigation and modified to reflect proposed repository construction (placement of mine waste and the repository cover). During the Mill Site PDS field investigation, eight HSA boreholes were “paired” with, and drilled adjacent to, CPTs. Seven of these paired locations are located within the footprint of the proposed Mill Site repository and shear wave velocity measurements were recorded during CPTs at six of those locations. The information acquired

at these six locations was used to develop the aforementioned profiles. **Figure 1** presents the boreholes and CPTs drilled during the Mill Site PDS.

Subsurface materials considered in the seismic settlement analysis are identified in the Assumptions section below. Subsurface material properties relevant to the seismic settlement analysis and one-dimensional stratigraphic profiles evaluated in this analysis are also presented in the Assumptions section.

Analysis of One-Dimensional Profiles

The following equations were used to analyze the one-dimensional stratigraphic profiles for potential seismic settlement.

The stress reduction factor (r_d) and associated parameters are defined by the following equations (Stewart et al., 2004):

$$\text{For } z < 20\text{m: } r_d = \frac{\left[1 + \frac{a_1}{a_2(z)}\right]}{\left[1 + \frac{a_1}{a_3}\right]}$$

$$\text{For } z > 20\text{m: } r_d = \frac{\left[1 + \frac{a_1}{a_2(z=20)}\right]}{\left[1 + \frac{a_1}{a_3}\right]} - 0.0046 \cdot (z - 20)$$

$$a_1 = -23.013 - 2.949 \cdot \frac{PHA}{g} + 0.999 \cdot m + 0.0053 \cdot V_{s-12}$$

$$a_2(z) = 16.258 + 0.201 \cdot e^{0.341(-z + 0.0785 \cdot V_{s-12} + 7.586)}$$

$$a_3 = 16.258 + 0.201 \cdot e^{0.341(0.0785 \cdot V_{s-12} + 7.586)}$$

Where:

r_d: stress reduction factor, ratio of actual shear stress at depth vs. theoretical “rigid body” shear stress
PHA: peak horizontal acceleration
g: acceleration due to gravity
z: depth below ground surface (meters)
m: earthquake magnitude
V_{s-12}: average shear wave velocity in upper 12m of the site (meters/sec)
$a_2(z=20)$: $a_2(z)$ for z=20

The equivalent number of uniform strain cycles for the design seismic event is calculated as follows (Stewart et al., 2004):

$$N = \frac{\left[\dfrac{\exp(b_1 + b_2(m - m^*))}{10^{1.5m+16.05}}\right]^{-1/3}}{4.9 \cdot 10^6 \beta} + Sc_1 + rc_2$$

Where:

N: equivalent number of uniform strain cycles
b_1: 1.53 (Stewart et al., 2004)
b_2: 1.51 (Stewart et al., 2004)
c_1: 0.75 (Stewart et al., 2004)
c_2: 0.095 (Stewart et al., 2004)
β: 3.2 (Stewart et al., 2004)
m: 5.5 (Stewart et al., 2004)*
m: design earthquake magnitude
r: site-source distance (km)
S: 1.0 [equal to 0 if rock or shallow soil (<20m) underlies the fill and 1 if >20m soil underlies the fill (Stewart et al., 2004)]

Shear strain and related equations are as follows (Stewart et al., 2004):

$$\gamma = \frac{1 + g_1 \cdot e^{g_2 \cdot P}}{1 + g_1} P \cdot 100 \text{ (units of \%)}$$

$$\text{PI} \approx 0: \quad g_1 = 0.199 \cdot (\sigma'/p_a)^{0.231} \quad g_2 = 10850 \cdot (\sigma'/p_a)^{-0.410}$$

$$\text{PI} \approx 15: \quad g_1 = 0.194 \cdot (\sigma'/p_a)^{0.265} \quad g_2 = 7490 \cdot (\sigma'/p_a)^{-0.418}$$

$$\text{PI} \approx 30: \quad g_1 = 4.0 \quad g_2 = 1400$$

$$\gamma_{eff} \frac{G_{eff}}{G_{max}} = \frac{0.65 \cdot PHA \cdot \sigma_0 \cdot r_d}{g \cdot G_{max}} \equiv P$$

Where:

γ: shear strain
γ_{eff}: effective shear strain
PI: plasticity index
σ': effective stress
σ_0: total overburden pressure
p_a : atmospheric pressure (calculated for an average elevation of 5,600 feet for the site)
G_{eff}: effective shear modulus
G_{max}: small strain shear modulus

G_{max} is defined by the following equation (Robertson and Cabal, 2012):

$$G_{max} = \rho \cdot V_s^2$$

Where:

ρ: mass density of soil (γ/g)
V_s: shear wave velocity of the soil

The volumetric strain and associated parameters were calculated using the following equations (Stewart et al., 2004):

$$\varepsilon_v = \varepsilon_{v,N=15} \cdot C_N \cdot 2$$

$$\varepsilon_{v,N=15} = a(\gamma_c - \gamma_{tv})^b$$

$$C_N = R\ln(N) + c$$

$$c = 1 - \ln(15)\times R$$

Where:

ε_v: volumetric strain for design seismic event
C_N: normalized vertical strain
$\varepsilon_{v,N=15}$: volumetric strain at 15 cycles
a: material-specific constant (estimated based on relative compaction, soil type, fines content, and plasticity using Figures 6.5 – 6.7 in Stewart et. al, 2004. See Table 1.)
b: material-specific constant (estimated based on relative compaction, soil type, fines content, and plasticity using Figures 6.5 – 6.7 in Stewart et. al, 2004 See Table 1.)
γ_{tv}: threshold shear strain (estimated based on relative compaction, soil type, fines content, and plasticity using Figures 6.5 – 6.7 in Stewart et. al, 2004 See Table 1.)
γ_c: shear strain (same as shear strain, γ, listed above)
R: slope parameter (estimated as 0.36, 0.32, and 0.34 for soils with non-plastic fines, soils with low-plasticity fines, and soils with medium plasticity fines, respectively, as presented in Stewart et al., 2004 pages 86 through 89 See Table 1.)
c: slope parameter estimated from equation listed above

The vertical seismic settlement of a given layer of soil is the product of the volumetric strain for the design seismic event (ε_v) and the thickness of the soil layer (h):

$$\Delta_i = \varepsilon_v \cdot h$$

Material Properties

Subsurface Materials

Material strength parameters used for the settlement analysis were based on data from laboratory testing of materials at the site during the PDS. The laboratory test results are located in Table 3-4 of the Mill Site PDS Report (MWH, 2014a). The parameters used as a base-case scenario for each material are discussed in the main text of Appendix G, Section G.6 and are also summarized in **Table 1** included in this document. Properties for each material were estimated by averaging the results of laboratory tests performed on samples collected during the Mine Site and Mill Site PDS.

A sensitivity analysis was conducted to identify which material property most influences the results and evaluate the effects of varying this property on the total calculated settlement at each location analyzed. The material index properties (dry density and water content) were varied from the base case (average) to the 30th percentile values on individual materials and combined materials. When evaluating the 30th percentile index properties, the results of the seismic settlement analysis were found to be more sensitive to variation in the properties of the tailings materials (coarse, fine, and coarse/fine) than other materials, The 30th percentile material properties for the tailings used in the sensitivity analysis are summarized in **Table 2**.

The seismic settlement coefficients used in the settlement calculations were obtained from equations and figures in Stewart et al. (2004), as discussed previously in the Methods section. The coefficients ("a", "b", and γ_{tv}) for each material were based on the plasticity index of the material (low, moderate, or high plasticity), and varying the index properties to the 30th percentile values did not alter the plasticity of the material or the coefficients, as defined in Stewart et al. (2004). The coefficients were also based on the relative compaction (RC) and saturation (S) for each material. The coefficients and assumptions are discussed below.

Cover and Fill Materials

The cover soil, erosion protection material, and mine spoils are assumed to have similar fines content and plasticity based on the material index properties. The borrow sources that will be used for the cover soil were investigated during the PDS and samples obtained from the investigation were classified as clayey and silty sands and low plasticity clays. Fines content ranged from 38 to 78 percent and plasticity index ranged from 3 to 23. For the purpose of estimating the coefficients, it was assumed that the erosion protection and cover soil materials have moderate plasticity with a relative compaction of approximately 90 percent and an unknown saturation. This results in coefficients a and b of 2.0 and 0.65, respectively and a strain threshold value of 0.03 percent. It was assumed that the mine spoils would also have moderate plasticity with a RC of approximately 90 percent and a S of 90 percent, resulting in coefficients a and b of 1.0 and 0.75, respectively, and a strain threshold value of 0.02 percent.

It has been assumed that the long-term moisture content of the Radon Barrier will be equal to the average of the results of laboratory testing on the Radon Barrier samples (9.3 percent). The saturated moisture content of the Radon Barrier material is 16.1 percent (calculated from laboratory testing results). For the purpose of estimating the coefficients, it was conservatively assumed that the Radon Barrier will have a long-term degree of saturation of 70 percent. Assuming the radon barrier is a moderate plasticity soil with a saturation of 70 percent and a RC of approximately 90 percent, the coefficients a and b were assumed to be 0.65 and 0.75, respectively, with a strain threshold value of 0.02 percent.

The existing fill was encountered during the PDS investigation and was found to be a sandy and low-plasticity clay with fines contents ranging from 35 to 72 percent and PIs ranging from 17 to 20. As defined in Stewart et al. (2004), this material is classified as a moderate plasticity soil, and it was assumed to have a RC of approximately 90 percent with a S of 60 percent, resulting in coefficients a and b of 1.7 and 0.75, respectively, and a threshold strain value of 0.02 percent.

Tailings

Tailings produced by the UNC uranium mill were deposited in the TDA. They range from silty and clayey sands to sandy clays and high plasticity clays. The fines content of tailings samples analyzed during the Mill Site PDS ranged from 7 to 97 percent and the fine-grained particles ranged from non-plastic to a PI of 61. Due to this wide range of material properties, the tailings have been subdivided into three categories for the seismic settlement analysis: coarse tailings, fine tailings, and coarse/fine tailings. The coefficients selected for each material are discussed below.

The coefficients a and b for the coarse tailings were interpolated from values presented in Figures 6.4 and 6.5 of Stewart et al (2004) for soils with varying contents of non-plastic fines. This interpolation assumed that the fines content is equal to the average fines content from laboratory testing of coarse tailings (21 percent), a relative density of 60 percent, a relative compaction of 87 percent, and a saturation of 30 percent. This resulted in coefficients for a and b of 1.79 and 1.00, respectively, and a threshold strain value of 0.01 percent.

For the purpose of estimating coefficients for the fine tailings, it has been conservatively assumed that the fine tailings are high plasticity, 90 percent saturated (or more) and have a low relative compaction (87 percent). The coefficients were assumed to be 0.90 and 0.75 for a and b, respectively, and a threshold strain value of 0.06 percent.

Tailings samples identified as coarse/fine tailings were generally near 100 percent saturation (83 to 99 percent) and were assumed to be moderately plastic. For the purpose of estimating coefficients and the threshold strain value, it has been conservatively assumed that the coarse/fine tailings have a low relative compaction (84 percent) which is applicable to

any saturation value. This resulted in coefficients a and b of 2.00 and 0.65, respectively, and a threshold strain value of 0.03 percent.

Alluvium

The fines content of alluvium samples analyzed during the Mill Site PDS ranged from 17 to 91 percent and the fine-grained particles ranged from non-plastic to a PI of 31. Due to this wide range of material properties, the alluvium has been subdivided into two categories for the seismic settlement analysis: coarse alluvium and fine alluvium.

The coefficients for the coarse alluvium were interpolated from values presented in Tables 6.4 and 6.5 of Stewart et al. (2004) for soils with varying contents of non-plastic fines. This interpolation assumed that the fines content is equal to the average fines content from laboratory testing of coarse alluvium (36 percent) and a relative density of 60 percent. This resulted in coefficients a and b of 2.00 and 1.00, respectively, and a threshold strain value of 0.01 percent.

For the purpose of estimating coefficients of the fine alluvium, it has been assumed that the fine alluvium is highly plastic, has a degree of saturation of 90 percent (or more), and has a lower relative compaction (87 percent). This resulted in coefficients a and b of 0.90 and 0.75, respectively, and a threshold strain value of 0.06 percent.

Shear Wave Velocities

Shear wave velocities used in this analysis were estimated using the following assumptions:

- Shear wave velocities within existing soils are equal to those measured during the Mill Site PDS (MWH, 2014a) subsurface investigation (see **Attachment B**).
- The shear wave velocity for proposed repository fill is equal to 866 ft/sec. This is the average of the shear wave velocities measured in soil layers logged as general fill during the Mill Site PDS (MWH, 2014a) subsurface investigation (see **Table 3**).
- The average shear wave velocity in upper 12m of the site, V_{s-12}, is equal to 237 m/s. This is the average of the shear wave velocities measured in the upper 12m during the Mill Site PDS (MWH, 2014a) subsurface investigation.

General Assumptions

- The ground surface elevations for paired CPT and HSA boreholes have been estimated from the topographic survey using AutoCAD Civil3D.
- The design seismic event is the 10,000-year return period earthquake, which has a maximum peak ground acceleration (PGA) of 0.30g, a magnitude of 5.5, and a site-source distance of 20 km, as identified in the UNC-NECR Seismic Hazard Analysis (SHA; see Appendix G, Attachment G.1).
  Consolidation and the corresponding increase in saturation was not considered in the seismic settlement analysis. The majority of materials are tailings, and the coarse tailings material are not subject to consolidation since they are unsaturated (see Appendix G, Attachment G.3 for discussion on coarse tailings material). The effect of the increase in saturation in the fine tailings and fine/coarse tailings would be negligible due to the assumption in the analyses that these materials are near saturation (fine tailings are at least 90 percent saturated and coarse/fine tailings are at least 83 percent saturated). The saturation in Stewart et al. (2004) ranged from 60 to 90 percent for both high and moderate plasticity soils (fine tailings and coarse/fine tailings, respectively). As discussed previously, the fine tailings were assumed to have a 90 percent saturation value for selecting the coefficients, and the coarse/fine tailings were assumed to have a low relative compaction that applied to any saturation value for selecting the coefficients. This resulted in using the highest "a" value and lowest "b" value for each material. An increase in saturation (due to consolidation or otherwise) would not affect the selected a and b values for the tailings, thus no change in the results presented herein would be anticipated.

Stratigraphic Profiles

During the Mill Site PDS, eight CPTs were paired with boreholes to correlate CPT results with direct observation of the materials encountered. The borehole logs are presented in **Attachment C** and plots of the CPT measurements are presented in **Attachment D**. Seven of these “paired” CPT locations are within the footprint of the proposed Mill Site repository and shear wave velocity measurements were recorded during CPTs at six of those locations. The CPT data combined with the profiles from the borehole logs were used to define the thickness and texture of the soil layers, as well as the location of the contact between the tailings and underlying alluvium. The relationships used to define the tailings-alluvium contact are described in the Mill Site PDS (MWH, 2014a). These subsurface profiles were modified using the proposed repository design to reflect proposed repository construction (placement of mine waste and the repository cover). The final one-dimensional profiles (**Figure 2**) and associated shear wave velocity and CPT results (**Attachments B and D**) were used in the seismic settlement analysis.

Groundwater

Groundwater was encountered during drilling in two of the boreholes (TI-B10 and TI-B11) within the footprint of the proposed repository. In both of these boreholes the groundwater elevation was approximately 6,885 feet amsl. Groundwater was also encountered at about 6,903 feet amsl while drilling in boring B3 (drilled through the dam). In addition, alluvial wells 509D and EPA 23 (measured on 1/4/2016) show an alluvial ground water elevation of approximately 6,867 feet amsl. These elevations are below the bottom of the tailings and exceed the depth at which seismic settlement is likely to occur. Therefore, the seismic settlement analysis did not assume the presence of a consistent static water level within the TDA or the underlying alluvium. Water level measurements taken in the vicinity of the TDA are presented in **Attachment E**.

For the purpose of this analysis, it is assumed that localized perched zones of saturated tailings are present above the water levels in the alluvial wells and encountered while drilling. Saturated tailings are comprised mostly of the fine-grained tailings that exhibit a low hydraulic conductivity. It is assumed that hydrostatic conditions do not exist in the alluvium, above the static water levels observed while drilling the HSA boreholes or the nearby alluvial monitoring wells.

In some cases, the laboratory data does not support the assumption of saturation within the fine tailings. However, for the purposes of this analysis, it has been conservatively assumed that hydrostatic conditions are present in tailings at or above 85 percent saturation.

It is also assumed that pore pressure dissipation tests performed in the tailings were unable to reach equilibrium due to the low hydraulic conductivity of the tailings deposited in the TDA. Therefore, results of the pore pressure dissipation tests are likely to be artificially elevated and are poor indicators of saturation. Assumptions regarding perched zones of saturated tailings at each of the paired CPT/boreholes are based on the results of CPTs, observations during HSA drilling and sampling, and subsequent laboratory testing. These assumptions are presented below.

CPT-01 and TI-B1

- It is assumed that saturated tailings do not exist at this location.
- Dynamic pore pressures recorded by the CPT in the tailings at CPT-01 were not elevated, indicating that these tailings are unsaturated.
- Eight tailings samples from TI-B1 were analyzed for water contents. All but one of these samples had degrees of saturation below 85 percent (1 percent to 63 percent saturation).
- One tailings sample (from approximately 31.25 ft to 31.5 ft below ground surface [bgs]) was nearly saturated (94 percent saturation). However, it is assumed that this sample is not indicative of the soils in this area and was collected from a discontinuous layer of interbedded fine tailings for the following reasons:
    - Three samples from the approximately 1.25 ft of immediately overlying soil (30 ft to 31.25 ft bgs) did not exhibit this level of saturation (1 percent to 47 percent saturation).
    - Analysis of a soil sample from approximately one foot below this sample (32 ft to 33 ft bgs) did not exhibit this level of saturation (63 percent saturation).

  - The boring log for TI-B1 indicated that the soils from 18.5 ft to 34.3 ft bgs are coarse tailings, an observation that is supported by laboratory analysis (other samples in this layer had fines contents of 7 percent, 9 percent and 53 percent). However, the sample in question had a fines content of 69 percent and was identified as fine tailings.

CPT-02 and TI-B2

- It has been assumed that saturated tailings do not exist at this location.
- Dynamic pore pressures recorded by the CPT in this zone were not elevated, indicating that this zone is unsaturated.
- This assumption is supported by the degree of saturation calculated from laboratory testing results (77 percent saturation).

CPT-08 and TI-B8

- It has been assumed for this analysis that there are three localized perched zones of saturation (hydrostatic conditions) within the tailings at this location.
- These zones of saturation correspond to the layers of fine tailings observed during HSA drilling:
  - 26.3 ft to 31.0 ft bgs
  - 32.5 ft to 35.0 ft bgs
  - 38.6 ft to 44.5 ft bgs
- The uppermost zone that is assumed to be saturated (26.3 ft to 31.0 ft bgs) corresponds to a layer of fine tailings observed during HSA drilling at TI-B8. This assumption is based on the following:
  - Elevated dynamic pore pressures, one potential indicator of higher degrees of saturation, were measured from approximately 26.9 ft to 31.5 ft bgs during the CPT.
  - A sample from this layer was submitted for laboratory analysis, the results of which indicate that the material is fully saturated (100 percent saturation).
- The middle zone of assumed saturation (32.5 ft to 35.0 ft bgs) corresponds to a layer of fine tailings observed during HSA drilling at TI-B8. This assumption is based on the following:
  - Elevated dynamic pore pressures, one potential indicator of higher degrees of saturation, were measured from approximately 32.8 ft to 35.1 ft bgs during the CPT.
- The lowermost zone that is assumed to be saturated (38.6 ft to 44.5 ft bgs) corresponds to a layer of fine tailings observed during HSA drilling at TI-B8. This assumption is based on the following:
  - Elevated dynamic pore pressures, one potential indicator of higher degrees of saturation, were measured in this layer during the CPT.
  - Samples from this layer were submitted for laboratory analysis, the results of which indicate that the material is 93 percent to 99 percent saturated.
- Laboratory analysis of samples of the coarse tailings and coarse/fine tailings between the layers of fine tailings at TI-B8 indicated that these soils are unsaturated (44 percent to 67 percent saturation).
- The dynamic pore pressure measurements taken during CPT-08 also support this pattern of nearly-saturated layers of fine tailings, interbedded with layers of coarser unsaturated tailings.
- The pore pressure dissipation test performed at 31.7 ft bgs did not reach zero, which may indicate saturated conditions; however, the material is classified as a CH (USCS) and has a fines content of 91 percent. It is likely that dynamic pore pressures generated by the CPT probe shearing the soils were very slow to dissipate, resulting in misleading measurements during the pore pressure dissipation test.

CPT-10 and TI-B10

- At this location, it has been assumed for this analysis that free-draining layers of coarse tailings separate three perched zones of saturated tailings:
  - 18.9 ft to 24.4 ft bgs
  - 25.7 ft to 31.0 ft bgs

  - 33.2 ft to 44.6 ft bgs
- The uppermost zone that is assumed to be saturated (18.9 ft to 24.4 ft bgs) corresponds to a layer of fine tailings observed during HSA drilling at TI-B10. This assumption is based on the following:
  - Elevated dynamic pore pressures, one potential indicator of higher degrees of saturation, were measured from approximately 17.7 ft to 24.3 ft bgs during the CPT.
  - A sample from this layer was submitted for laboratory analysis, the results of which indicate that the material is 89 percent saturated.
- The uppermost and middle zones of assumed saturation are separated by a layer of unsaturated coarse tailings (24.4 ft to 25.7 ft bgs) identified during HSA drilling.
- The middle zone of assumed saturation (25.7 ft to 31.0 ft bgs) corresponds to a layer of fine tailings observed during HSA drilling at TI-B10. This assumption is based on the following:
  - Elevated dynamic pore pressures, one potential indicator of higher degrees of saturation, were measured in this layer during the CPT.
  - Samples from this layer were submitted for laboratory analysis, the results of which indicate that the material is 95 percent to 96 percent saturated.
- The middle and lowermost zones of assumed saturation are separated by a layer of unsaturated coarse tailings (31.0 ft to 33.2 ft bgs) identified during HSA drilling. A sample of this layer was submitted for laboratory analysis, the results of which indicate that the material is unsaturated (62 percent saturation).
- The lowermost zone of assumed saturation (33.2 ft to 44.6 ft bgs) spans two layers of fine tailings (33.2 ft to 36.3 ft bgs and 37.8 ft to 44.6 ft bgs) and the layer of coarse/fine tailings by which they are separated. This assumption is based on the following:
  - Elevated dynamic pore pressures, one potential indicator of higher degrees of saturation, were measured during the CPT at this location to a depth of 43.8 ft bgs.
  - Laboratory analysis of samples of these tailings indicated that these soils are 95 percent to 100 percent saturated.

CPT-11 and TI-B11

- It has been assumed that there is a localized perched zone of saturation (hydrostatic conditions) within the tailings at this location (44.5 ft to 53.9 ft bgs).
- This assumption corresponds to a layer of fine tailings observed during HSA drilling at TI-B11 and is based on the following:
  - Elevated dynamic pore pressures, one potential indicator of higher degrees of saturation, were measured from approximately 43.5 ft to 54.8 ft bgs during the CPT.
  - Laboratory analysis of samples of the fine tailings at TI-B11 indicated that these soils are 95 percent to 100 percent saturated.

CPT-15 and TI-B15

- It has been assumed that there are no saturated tailings at this location. This assumption is based on the following:
  - The tailings at this location are of a coarse nature and therefore have a higher hydraulic conductivity than fine-grained tailings.
  - Multiple samples of tailings from this location were submitted for laboratory analysis. Laboratory analysis indicated that the samples were unsaturated (22 percent to 58 percent saturation).

Other Stratigraphic Assumptions

- The 4-foot-thick ET cover will consist of two layers: (1) an erosion protection layer (14-27 inches thick) on top of (2) a layer of cover soil (21-34 inches thick).
- The top of the ET cover will be the same as the finished grade of the proposed repository grading plan (as shown in **Figure 1**).

- Improvement and reconditioning of the existing TDA cover and radon barrier within the footprint of the proposed repository will result in a minimum 18-inch-thick radon barrier. The existing erosion protection material will be removed from within the proposed repository footprint during this process. The finished grade of the improved radon barrier will be equal to existing grade.
- Mine waste will be placed from the top of the radon barrier (existing grade) to the bottom of the ET cover (4 ft below finished grade).

Calculations

Attachment F presents the seismic settlement analysis calculations.

Results

The seismic settlement analysis evaluated the magnitude of potential settlement that could occur within the footprint of the proposed Mill Site repository as a result of the design seismic event. Analysis of one-dimensional stratigraphic profiles was performed according to the methods outlined in *Seismic Compression Analysis of As-Compacted Fill Soils with Variable Levels of Fines Content and Fines Plasticity* (Stewart et al., 2004). The settlement ranged from 0.07 to 0.13 feet, by location. The results of the seismic settlement analysis are presented in **Table 4** and also included on **Figure 1**.

The sensitivity analysis conducted on the seismic settlement resulted in a slight increase in settlement values when using the 30th percentile values for dry density and water content for the evaluated materials, as compared to using the base case average values. The settlement ranged from 0.09 to 0.15 feet, by location. The results show that varying the material properties to the 30th percentile values had little effect on the calculated seismic settlement values. The settlement values at each location resulting from the sensitivity analysis are summarized in **Table 5**.

Conclusions

The results presented here are based on the current conditions of existing soils, anticipated conditions of repository fill placement, and the design seismic event. The estimated seismic settlements resulting from the design earthquake are small and future densification of existing soils caused by the repository construction may mitigate these effects, reducing the potential seismic settlement that could occur during an earthquake. The potential seismic settlement results are considered within the tolerable limits (6 to 12 inches) of seismic deformation for tailings impoundments described in NUREG-1620 (NRC, 2003).

Attachments

Figures

- Figure 1 – Borehole and CPT Locations for Seismic Settlement Analysis
- Figure 2 – One-Dimensional Stratigraphic Profiles

Attachments

- Attachment A – Laboratory Results from Pre-Design Studies (MWH, 2014a and MWH, 2014b)
- Attachment B – Measured Shear Wave Velocities in TDA and Underlying Alluvium (MWH, 2014a)
- Attachment C – Tailings Disposal Area Borehole Logs (MWH, 2014a)
- Attachment D – Tailings Disposal Area Cone Penetration Test Results (MWH, 2014a)
- Attachment E – Recorded Water Levels at the Church Rock Site (Chester Engineers, 2016)
- Attachment F – Seismic Settlement Analysis Calculations

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TABLES

Table 1: Material Properties Used in Seismic Settlement Analysis

Material Identification	Moist Unit Weight, γ_m (pcf)	Relative Compaction, C_r (% of Standard Proctor)	Fines Content, FC (%)	Plasticity Index, PI	a [2]	b [2]	γ_{tv} [2]	R [2]
Erosion Protection	122.9 [1]	90 [1]	37 [1]	12 [4]	2.00	0.65	0.03%	0.34
Cover Soil	114.7	90	53	12	2.00	0.65	0.03%	0.34
Mine Spoils	116.4	90 [1]	53 [4]	12 [4]	1.18	0.75	0.02%	0.34
Radon Barrier	122.3	95 [1]	59	16	0.65	0.75	0.02%	0.34
Existing Fill	113.8	90	48	19	1.70	0.75	0.02%	0.34
Coarse Tailings	108.1	N/A	21	0	1.79	1.00	0.01%	0.36
Coarse/Fine Tailings	116.0	N/A	52	20	2.00	0.65	0.03%	0.34
Fine Tailings	107.6 [3]	N/A	83	43	0.90	0.75	0.06%	0.25
Coarse Alluvium	111.0	N/A	36	0	2.00	1.00	0.01%	0.36
Fine Alluvium	120.7	N/A	76	22	0.90	0.75	0.06%	0.25

Notes:

All values are the average of laboratory testing results, unless otherwise noted.

[1] Assumed

[2] From Stewart et al., 2004 (pages 84 – 90).

[3] Assumes material is fully saturated

[4] Assumed to be the same as cover soil from the proposed borrow areas

Table 2: Material Properties Used in the Seismic Settlement Sensitivity Analysis

Material Identification	Water content (by mass, %)	Dry density (pcf)	Calculated Moist Unit Wt (pcf)
Coarse Tailings	6.8	91.7	97.9
Coarse/Fine Tailings	27.6	85.7	109.4
Fine Tailings	41.6	66.8	94.6

Table 3: Shear Wave Velocities Measured in General Fill at the Tailings Disposal Area

Borehole	Depth below Finished Ground Surface at Time of CPT (ft)	Soil Layer Thickness (ft)	Average Shear Wave Velocity, V_s (ft/sec)	Wave Travel Time Through Soil Layer (ms)
TI-B1/CPT-01	2.0 - 13.0	11.0	777.0	14.2
TI-B1/CPT-01	14.0 - 18.5	4.5	731.6	6.2
TI-B2/CPT-02	2.0 - 12.8	10.8	849.9	12.7
TI-B8/CPT-08	2.0 - 7.0	5.0	1177.0	4.2
TI-B8/CPT-08	18.0 - 20.7	2.7	786.4	3.4
TI-B10/CPT-10	2.0 - 6.8	4.8	926.0	5.2
TI-B11/CPT-11	2.0 - 44.5	42.5	890.5	47.7
TI-B15/CPT-15	2.0 - 3.0	1.0	680.0	1.5
Total Travel Time (ms):				**95.1**
Overall Average Shear Wave Velocity, Vs (ft/sec):				**866**

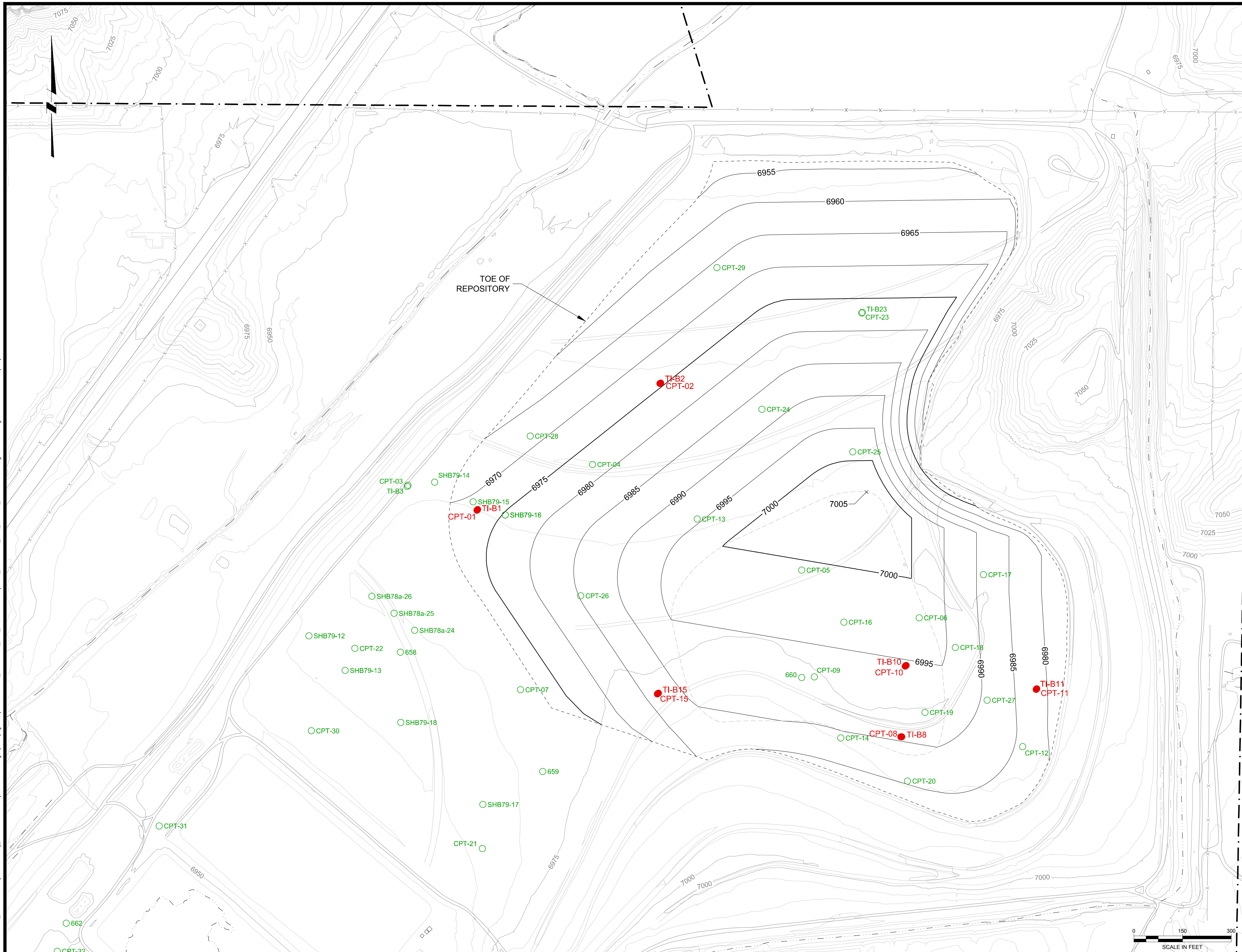
Table 4: Potential Seismic Settlement Caused by the Design Seismic Event

Borehole ID	Depth of Seismic Settlement (ft)
TI-B1/CPT-01	0.07
TI-B2/CPT-02	0.12
TI-B8/CPT-08	0.08
TI-B10/CPT-10	0.12
TI-B11/CPT-11	0.13
TI-B15/CPT-15	0.09

Table 5: Potential Seismic Settlement Sensitivity Results

Borehole ID	Depth of Seismic Settlement (ft)
TI-B1/CPT-01	0.09
TI-B2/CPT-02	0.13
TI-B8/CPT-08	0.09
TI-B10/CPT-10	0.15
TI-B11/CPT-11	0.13
TI-B15/CPT-15	0.12

FIGURES



LEGEND:

7200	EXISTING GROUND SURFACE CONTOUR & ELEVATION, FEET
7200	PROPOSED SURFACE CONTOUR & ELEVATION, FEET
	EXISTING ROAD
	EXISTING DRAINAGE
	FENCE
	BOUNDARY OF REPOSITORY
● (red)	PAIRED BOREHOLES AND CPT LOCATIONS USED FOR SEISMIC SETTLEMENT ANALYSIS
○ (green)	OTHER BOREHOLES, WELLS, OR CPT LOCATIONS

LOCATION	SETTLEMENT (FT)
CPT-01 / TI-B1	0.07
CPT-02 / TI-B2	0.12
CPT-08 / TI-B8	0.08
CPT-10 / TI-B10	0.12
CPT-11 / TI-B11	0.13
CPT-15 / TI-B15	0.09

DESIGNED S DOWNEY
CHECKED C WEBER
APPROVED J.CUMBERS

MWH now part of Stantec

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UNITED NUCLEAR CORPORATION AND NORTHEAST CHURCH ROCK MINE
McKINLEY COUNTY, NEW MEXICO

BOREHOLE AND CPT LOCATIONS
FOR SEISMIC SETTLEMENT ANALYSIS

FIGURE
1
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TI-B1/CPT-01

Depth below Existing Ground Surface at Time of CPT (ft)	Depth below Finished Ground Surface (ft)	Soil Type
-	0 - 1.5	Erosion Protection
-	1.5 - 2.1	Cover Soil
0.0 - 2.0	2.1 - 4.1	Radon Barrier
2.0 - 13.0	4.1 - 15.1	General Fill
13.0 - 15.0	15.1 - 16.1	Coarse Tailings
15.0 - 18.5	16.1 - 20.6	General Fill
18.5 - 34.3	20.6 - 36.4	Coarse Tailings
34.3 - 41.1	36.4 - 43.2	Coarse Alluvium
41.1 - 45.0	43.2 - 47.1	Fine Alluvium
45.0 - 54.0	47.1 - 56.1	Coarse Alluvium
54.0 - 68.2	56.1 - 70.3	Fine Alluvium
68.2 - 70.0	70.3 - 72.1	Coarse Alluvium

TI-B2/CPT-02

Depth below Existing Ground Surface at Time of CPT (ft)	Depth below Finished Ground Surface (ft)	Soil Type
-	0 - 1.5	Erosion Protection
-	1.5 - 3.5	Cover Soil
-	3.5 - 14.3	Mine Spoils
0.0 - 2.0	14.3 - 16.3	Radon Barrier
2.0 - 12.8	16.3 - 27.1	General Fill
12.8 - 15.0	27.1 - 29.3	Fine Tailings
15.0 - 25.7	29.3 - 40.0	Coarse Alluvium
25.7 - 33.5	40.0 - 47.8	Fine Alluvium

TI-B8/CPT-08

Depth below Existing Ground Surface at Time of CPT (ft)	Depth below Finished Ground Surface (ft)	Soil Type
-	0 - 1.5	Erosion Protection
-	1.5 - 3.5	Cover Soil
-	3.5 - 14.2	Mine Spoils
0.0 - 2.0	14.2 - 16.2	Radon Barrier
2.0 - 7.0	16.2 - 21.2	General Fill
7.0 - 18.0	21.2 - 32.2	Coarse Tailings
18.0 - 20.7	32.2 - 34.9	General Fill
20.7 - 26.3	34.9 - 40.5	Coarse Tailings
26.3 - 31.1	40.5 - 45.3	Fine Tailings
31.1 - 32.5	45.3 - 46.7	Coarse Tailings
32.5 - 35.0	46.7 - 49.2	Fine Tailings
35.0 - 38.6	49.2 - 52.8	Coarse/Fine Tailings
38.6 - 44.5	52.8 - 58.7	Fine Tailings
44.5+	58.7+	Coarse Alluvium

TI-B10/CPT-10

Depth below Existing Ground Surface at Time of CPT (ft)	Depth below Finished Ground Surface (ft)	Soil Type
-	0 - 1.5	Erosion Protection
-	1.5 - 3.5	Cover Soil
-	3.5 - 21.0	Mine Spoils
0.0 - 2.0	21.0 - 23.0	Radon Barrier
2.0 - 6.8	23.0 - 27.8	General Fill
6.8 - 18.9	27.8 - 39.9	Coarse Tailings
18.9 - 24.4	39.9 - 45.4	Fine Tailings
24.4 - 25.7	45.4 - 46.7	Coarse Tailings
25.7 - 31.0	46.7 - 52.0	Fine Tailings
31.0 - 33.2	52.0 - 54.2	Coarse Tailings
33.2 - 44.6	54.2 - 65.6	Fine Tailings
44.6+	65.6+	Coarse Alluvium

TI-B11/CPT-11

Depth below Existing Ground Surface at Time of CPT (ft)	Depth below Finished Ground Surface (ft)	Soil Type
-	0 - 1.5	Erosion Protection
-	1.5 - 3.5	Cover Soil
-	3.5 - 4.3	Mine Spoils
0.0 - 2.0	4.3 - 6.3	Radon Barrier
2.0 - 44.5	6.3 - 48.8	General Fill
44.5 - 53.9	48.8 - 58.2	Fine Tailings
53.9 - 55.0	58.2 - 59.3	Fine Alluvium
55.0 - 77.5	59.3 -81.8	Coarse Alluvium

TI-B15/CPT-15

Depth below Existing Ground Surface at Time of CPT (ft)	Depth below Finished Ground Surface (ft)	Soil Type
-	0 - 1.5	Erosion Protection
-	1.5 - 3.5	Cover Soil
-	3.5 - 5.1	Mine Spoils
0.0 - 2.0	5.1 - 7.1	Radon Barrier
2.0 - 3.0	7.1 - 8.1	General Fill
3.0 - 30.0	8.1 - 35.1	Coarse Tailings
30.0 - 38.0	35.1 - 43.1	Fine Alluvium
38.0 - 45.0	43.1 - 50.1	Coarse Alluvium
45.0 - 50.0	50.1 - 55.1	Fine Alluvium
50.0 - 52.0	55.1 - 57.1	Coarse Alluvium
52.0 - 65.0	57.1 - 70.1	Fine Alluvium

PROJECT UNITED NULEAR CORPERATION AND NORTHEAST CHURCH ROCK MINE

TITLE ONE-DIMENSIONAL STRATIGRAPHIC PROFILES

MWH

DATE May 2016

FIGURE 2

FILENAME Figure_2

ATTACHMENT A

LABORATORY RESULTS FROM PRE-DESIGN STUDIES (MWH, 2014A AND MWH, 2014B)

Table 3-1 Summary of Geotechnical Laboratory Data - Cover Samples

Cover Layer	Sample	Sample Type (1)	Sample Depth Interval (in)		Material Description (2)	USCS (2)	USDA Classification (3)	Water Content (by mass) (%)	Specific Gravity	Standard Proctor (max. dd@opt. w.c.) (pcf @ %)	Atterberg Limits (%) (5)			USCS % Gravel	USCS % Sand	% Passing No. 200 Sieve (fines)	% Silt	USDA % Clay (<0.002 mm)	L.A. Abrasion (6) (% loss)	Sodium Soundness (7) (% loss)	Absorption (8) (%)	Pinhole Dispersion (9)	Remolded Saturated Hydraulic Conductivity (10) (cm/sec)			Confining Stress (psi)	SWCC: -5 bar Water Content (by mass) (%) (10)	SWCC: Saturated Water Content (by mass) (%) (11)
											LL	PL	PI										90%	95%	100%			
Admix. (Gravel/ Soil Mixture)	TI - CS01 - 02A	Bulk	0	11	Clayey Gravel with Sand		Loam							33.3	23.4	43.3	28.0	15.3										
	TI - CS02 - 02A	Bulk	0	10	Clayey Gravel with Sand		Clay Loam		2.81 (4)					36.9	17.0	46.1	28.8	17.3	3.8	0.37	1.06							
	TI - CS03 - 02A	Bulk	0	6	Clayey Gravel with Sand		Loam							53.6	18.7	27.7	18.1	9.6										
	TI - CS04 - 02A	Bulk	0	10	Clayey Gravel with Sand		Loam							53.6	18.2	28.2	18.0	10.2										
	TI - CS05 - 02A	Bulk	0	9	Sandy Lean Clay		Loam							13.9	34.4	51.7	31.2	20.5										
	TI - CS06 - 02A	Bulk	0	7	Clayey Gravel with Sand		Loam		2.77 (4)					48.4	18.5	33.1	23.4	9.7	5.7	0.14	1.91							
	TI - CS07 - 02A	Bulk	0	20	Sandy Lean Clay	CL	Loam	7.8			28	13	15	1.1	41.0	60.9	42.4	18.5										
	TI - CS08 - 02A	Bulk	0	8	Clayey Gravel with Sand		Loam							56.7	18.5	24.8	17.2	7.6										
	TI - CS09 - 02A	Bulk	0	9	Clayey Gravel		Loam		2.78 (4)					53.6	14.2	32.2	21.2	11.0	5.1	1.17	1.55							
	TI - CS10 - 02A	Bulk	0	7	Clayey Gravel with Sand		Loam							41.4	19.7	38.9	26.1	12.8										
	TI - CS11 - 02A	Bulk	0	9	Clayey Gravel with Sand		Sandy Loam							30.7	30.1	39.2	26.1	13.1										
	TI - CS12 - 02A	Bulk	0	14	Sandy Lean Clay	CL	Loam	9.1			33	13	20	1.3	28.8	69.9	43.5	26.4										
Radon barrier (clay layer)	TI - CS03 - 04A	Bulk	6	24	Sandy Lean Clay	CL	Loam	6.0			28	14	14	6.3	38.7	55.0	36.1	18.9										
	TI - CS06 - 04A	Bulk	7	24	Sandy Lean Clay	CL	Loam	11.0			30	13	17	6.7	34.2	59.1	40.2	18.9										
	TI - CS10 - 04A	Bulk	7	25	Sandy Lean Clay	CL	Loam	7.7			29	14	15	2.3	39.5	58.2	36.9	21.3										
	TI - CS08 - 04A	Bulk	8	28	Sandy Lean Clay	CL	Loam	8.1	2.67	119.4 @ 11.9	27	12	15	11.3	35.0	53.7	36.7	17.0					9.1E-06	1.1E-05	1.5E-06	24		
	TI - CS05 - 04A	Bulk	9	24	Sandy Lean Clay	CL	Loam	9.6			29	12	17	1.3	37.3	61.4	42.0	19.4										
	TI - CS09 - 04A	Bulk	9	26	Sandy Lean Clay	CL	Loam	7.7			28	13	15	4.0	38.1	57.9	40.0	17.9										
	TI - CS11 - 04A	Bulk	9	24	Sandy Lean Clay	CL	Clay Loam	8.6	2.68	115.0 @ 14.9	32	13	19	5.1	28.4	66.5	40.7	25.8					7.6E-08	1.4E-07	1.0E-07	24		
	TI - CS02 - 04A	Bulk	10	24	Sandy Lean Clay	CL	Sandy Clay Loam	11.4			28	12	16	3.6	44.7	51.7	30.4	21.3										
	TI - CS04 - 04A	Bulk	10	24	Sandy Lean Clay	CL	Clay Loam	15.0	2.68	113.5 @ 15.0	35	15	20	0.9	35.0	68.2	37.2	26.9					4.6E-06	6.2E-06	2.3E-07	8		
	TI - CS01 - 04A	Bulk	11	24	Sandy Lean Clay	CL	Loam	9.2	2.68	117.3 @ 13.0	29	15	14	2.0	39.8	58.2	39.0	19.2				ND3	3.0E-04	4.6E-05	7.8E-07	8	8.6 / 9.6	21.7 / 19.0

Notes: 1. Sample Types: Bulk = bucket/grab sample
2. USCS = Unified Soil Classification Sysytem, material descriptions are based on field observations, and refined with laboratory data, if available. USCS classifications are provided only where sufficient laboratory data are available. CL = low plasticity clay
3. USDA = United States Department of Agriculture, USDA classifications are based on the sand/silt/clay fraction of the sample and on USDA grain-size designations.
4. Bulk saturated surface dry (SSD) specific gravity of the gravel fraction, average of three results (ASTM C127).
5. LL = liquid limit, PL = plastic limit, PI = plasticity index
6. L.A. abrasion results are percent loss, by mass, for 100 revolutions.
7. Weighted percent loss for the 3/4-inch to 3/8-inch size range
8. Average of three results for the gravel fraction of the cover gravel/soil mixture samples
9. Pinhole dispersion test (ASTM method A) conducted on a specimen remolded to approximately 95% of the maximum standard Proctor density at optimum water content. ND3 = slightly to moderately dispersive clays that erode slowly under 2-inch or 7-inch head.
10. Flexible wall permeameter tests conducted on specimens remolded to approximately 90, 95 and 100% of the maximum standard Proctor density and tested at the confining stresses shown in the table.
11. SWCC test conducted on material passing the No. 10 sieve, remolded to approximately 95% of the maximum standard Proctor density and optimum water content. SWCC tests performed with pairs of specimens for each test.

Table 3-4 Summary of Geotechnical Laboratory Data - Mill Site Impoundment

Area	Boring	Sample Type [9]	Sample Depth Interval (ft.)		Material Description [1]		USCS [1]	Water content (by mass, %) 110C	Water content (by mass, %) 60C	saturation (%)	SWCC - Saturated water content (by mass, %)[2]	SWCC - Specimen dry density (pcf)[2]	Dry density (pcf), 110C	Dry density (pcf), 60C	Specific gravity, 110C	Specific gravity, 60C	LL	Atterberg limits (%) PL	PI	USCS % gravel (size)	USCS % sand (size)	% Passing No. 200 sieve	% Silt (size)	USDA % clay (size <0.002 mm)	Saturated Hydraulic conductivity (cm/sec)[3]	Hydraulic conductivity confining stress (psi)	Consolidation (Cc)[7]	Collapse potential (%) (inundation load (psf))	Triaxial [12] (peak friction angle (ϕ') (degrees), cohesion (psf), where applicable)
CENTRAL	TI-B1	CA	36	36.5	Alluvium Clayey Sand	coarse		21.0	19.9	76%	36.3 / 33.2	85.2 / 88.0	97.3		2.73					0.0	62.5	37.5	32.8	4.7	1.7E-06	32	0.059		
CENTRAL	TI-B1	ST	45	46	Alluvium Clayey Sand	coarse		22	21.2				106.0														0.058		34.4
CENTRAL	TI-B10	CA	91	91.5	Alluvium Clayey Sand	coarse		18.6					105.6		2.66														
CENTRAL	TI-B15	CA	41	41.5	Alluvium Clayey Sand	coarse		11.4	10.1				87.1	88.1															
CENTRAL	TI-B15	CA	66	66.5	Alluvium Clayey Sand	coarse		12.7	11.8				100.7	101.5															
CENTRAL	TI-B11	CA	81	81.5	Alluvium Clayey Sand with Gravel	coarse		11.0					107.6		2.76					12.9	65.6	21.5	9.9	11.6					
CENTRAL	TI-B10	CA	46	46.5	Alluvium Silty Sand	coarse		9.9					95.4		2.74					0.0	65.8	34.2	23.4	10.8					
CENTRAL	TI-B10	ST	55	56	Alluvium Silty Sand	coarse		14.1			25.7 / 24.8	98.0 / 99.9	100.8												2.4E-05	72	0.139		
CENTRAL	TI-B10	CA	71	71.5	Alluvium Silty Sand	coarse		18.1					100.8																
CENTRAL	TI-B11	ST	56	57	Alluvium Silty Sand	coarse	SM	16.2			31.0 / 30.8	90.6 / 92.8	77.9		2.64		NP			0.0	60.4	39.6	31.9	7.7	5.6E-04	72	0.129		
CENTRAL	TI-B11	CA	66	66.5	Alluvium Silty Sand	coarse		14.2					96.2																
BORROW PIT 1	TI-B8	CA	56	56.5	Alluvium Silty Sand	coarse	SM	12.6					97.6		2.70		NP			0.0	57.0	43.0	30.9	12.1					
CENTRAL	TI-B15	CA (top)	31	31.5	Alluvium Silty Sand	coarse		22.3	21.3																				
CENTRAL	TI-B15	CA (bottom)	31	31.5	Alluvium Silty Sand	coarse	SM	17.1					101.8		2.71		NP			6.2	51.9	41.9	25.9	16.0					
NORTH CELL	TI-B2	CA	15	15.5	Alluvium Silty Sand	coarse		6.9					90.4		2.68														
NORTH CELL	TI-B2	CA	21	21.5	Alluvium Silty Sand	coarse		7.0					91.4		2.74					0.0	82.9	17.1	11.5	5.6					
CENTRAL	TI-B10	CA	66	66.5	Alluvium Silty Sand / Sandy Silt	coarse	SM/ML	13.8					94.5				NP			0.0	50.1	49.9	33.4	16.5					
NORTH CELL	TI-B23	ST	26	27	Alluvium Lean Clay	fine	CL	21.6					101.7		2.73		49	18	31	0.0	8.8	91.2	43.8	47.5			0.046		
DAM	TI-B3	ST	56	57	Alluvium Lean Clay	fine	CL	22.1	21.1				105.3	106.2	2.72		43	14	29	0.0	11.7	88.3	48.4	39.9				-1.5 (7,204)	22.2, 494
CENTRAL	TI-B1	CA	41	41.5	Alluvium Lean Clay with Sand	fine	CL	26.7					98.6				31	15	16	0.0	18.2	81.8	54.7	27.1	1.2E-07	35			
BORROW PIT 1	TI-B8	CA	46	46.5	Alluvium Lean Clay with Sand	fine	CL	21.9					95.2		2.72		30	16	14	0.0	27.9	72.1	55.6	16.5					
NORTH CELL	TI-B2	CA	26	26.5	Alluvium Lean Clay with Sand	fine	CL	23.5					93.2				34	16	18	0.0	20.9	79.1	51.5	27.6					
CENTRAL	TI-B11	CA	61	61.5	Alluvium Sandy Clay	fine		16.0					95.4							0.0	38.7	61.3	44.1	17.2					
NORTH CELL	TI-B23	ST	17.25	17.5	Alluvium Sandy Clay	fine		22.5					101.9		2.73					0.0	31.1	68.9	46.5	22.5					
CENTRAL	TI-B15	CA (top)	46	46.5	Alluvium Sandy Silt	fine		25.8	24.0																				
CENTRAL	TI-B15	CA (bottom)	46	46.5	Alluvium Sandy Silt	fine	ML	17.3					99.3		2.81		NP			0.0	37.0	63.0	55.7	7.3					
CENTRAL	TI-B15	CA	56	56.5	Alluvium Silty Clay	fine		11.7	10.5				104.2	105.3															
DAM	TI-B3	CA	61	61.5	Alluvium Silty Clay	fine		25.8					99.0							0.0	22.0	78.0	54.9	23.1					
CENTRAL	TI-B10	ST (top)	10	11	Coarse Tailings			9.7	9.1				110	110.5	2.63	2.65													
CENTRAL	TI-B10	ST (bottom)	10	11	Coarse Tailings	Clayey Sand		9.0			20.7 / 21.5	102.6 / 101.2	96.8							0.2	71.9	27.9	16.6	11.3	4.3E-04	34	0.094		
CENTRAL	TI-B10	CC-AC [4] (top)	12.5	14	Coarse Tailings			6.7	6.3						2.61	2.64													
CENTRAL	TI-B10	CC-AC [4] (bot)	12.5	14	Coarse Tailings	Clayey Sand		7.5			31.3 / 31.4	85.0 / 85.0	99.1							0.7	71.5	27.8	18.9	8.9	6.7E-05	36			
CENTRAL	TI-B10	CA	15	15.5	Coarse Tailings			9.3					103.0																
CENTRAL	TI-B10	CA	16	16.5	Coarse Tailings	Silty Sand	SM	6.5					100.0		2.65		NP			2.4	82.3	15.3	10.2	5.1					
CENTRAL	TI-B10	ST	32	32.5	Coarse Tailings		SM	15.4					100.1		2.67		NP			0.0	83.1	16.9	12.6	4.3					
CENTRAL	TI-B1	CA	20.5	21	Coarse Tailings			6.1	5.7																				
CENTRAL	TI-B1	CA	21	21.5	Coarse Tailings	Poorly Graded Sand w/ Clay		7.5			21.9 / 19.8	96.5 / 99.6	105.5							0.0	90.7	9.3	5.5	3.8	3.7E-04	18	0.024		
CENTRAL	TI-B1	ST	27	27.5	Coarse Tailings		SP	4.0					97.6		2.67		NP			0.0	92.7	7.3	5.2	2.1	2.9E-03	14			34.9
CENTRAL	TI-B1	CA	30	30.5	Coarse Tailings			13.9	13.5																				
CENTRAL	TI-B1	CA	30.5	31	Coarse Tailings			14.6			29.6 / 33.8	84.2 / 83.6	91.6												3.0E-07	25	0.092		
CENTRAL	TI-B1	CA (top)	31	31.5	Coarse Tailings			0.8	0.4																				
CENTRAL	TI-B8	CA	25	25.5	Coarse Tailings			9.0	8.4				103.7	104.2	2.72	2.72													
CENTRAL	TI-B8	CA [5]	25.5	26	Coarse Tailings			6.2			25.7	94.6	99.6							0.0	87.9	12.7	7.9	4.8	3.6E-04	46			
CENTRAL	TI-B8	CA [5]	26	26.5	Coarse Tailings	Silty Sand	SM	16.8			27.0	94.8	91.7				NP			0.0	76.0	24.0	19.0	5.0					
CENTRAL	TI-B8	ST (top)	35	36	Coarse Tailings			14.3	13.6				90.9	91.4	2.66	2.67													
CENTRAL	TI-B8	ST (bottom)	35	36	Coarse Tailings			16.5			31.2 / 39.3	89.3 / 82.3	89.6		2.67										1.6E-05	43			
CENTRAL	TI-B15	CA	6	6.5	Coarse Tailings			5.4					101.1							0.0	87.5	12.5	9.8	2.7					
CENTRAL	TI-B15	CA	11	11.5	Coarse Tailings			6.8					93.8																
CENTRAL	TI-B15	CC-AC	13.5	14	Coarse Tailings		SM	19.0	18.4						2.68		NP			0.0	69.6	30.4	22.6	7.8					
CENTRAL	TI-B15	ST	15.5	16	Coarse Tailings		SM	14.2					90.4		2.66		NP			0.0	54.9	15.1	10.1	5.0	8.3E-04	38	0.126		
CENTRAL	TI-B15	CA	21	21.5	Coarse Tailings		SM	12.7					99.8		2.68		NP			0.0	80.6	19.4	13.3	6.1					
CENTRAL	TI-B15	CC-AC	28.5	29.5	Coarse Tailings		SM	19.3							2.66		NP			0.0	65.4	34.6	24.4	10.2					
NORTH CELL	TI-B23	ST	15.5	15.75	Coarse Tailings			20.7	19.6				87.7		2.77					0.0	62.8	37.2	34.1	3.1					
CENTRAL	TI-B10	ST	21.5	22.5	Coarse/Fine Tailings		CL	28.1	*26.7*				91.9	*92.9*			43	19	24	0.0	43.0	57.0	51.4	5.6			0.111		
CENTRAL	TI-B1	CC-AC	32	33	Coarse/Fine Tailings		CL	29.3	*27.8*								33	16	17	0.0	46.7	53.3	37.4	15.9					
CENTRAL	TI-B10	CA	36	36.5	Coarse/Fine Tailings	Clayey Sand / Sandy Clay	SC/CL	33.9	*32.2*	94%			86.7	*87.8*	2.68	*2.72*	36	16	20	0.0	50.6	49.4	31.1	18.3					
CENTRAL	TI-B8	ST (bottom)	41	42	Coarse/Fine Tailings	Clayey Sand / Sandy Clay	SC/CL	35.6	34.3		33.1 / 31.6	88.7 / 90.7	82.8	83.6			35	16	19	0.0	51.2	48.8	40.7	8.1	1.3E-07	53	0.262		
CENTRAL	TI-B8	CC-AC (top)	43.5	44.5	Coarse/Fine Tailings			31.2	29.3				91.0	92.3															
DAM	TI-B3	ST (top)	35	36	Dam Clayey Sand (dam)			10.5	10.2																				
DAM	TI-B3	ST (bottom)	35	36	Dam Clayey Sand (dam)		SC	14.7					102.2		2.67		23	14	9	2.1	50.2	47.7	30.9	16.8				-0.7 (4,608)	33.7, 135
DAM	TI-B3	ST	21	22	Dam Sandy Clay (dam)		CL	16.0					111.1				30	12	18	0.0	32.8	67.2	41.7	25.5				-0.03 (2,709)	32.2, 195
DAM	TI-B3	CA	26	26.5	Dam Sandy Clay (dam)			12.0					106.8				25	13	12										
DAM	TI-B3	CA	31	31.5	Dam Sandy Clay (dam)			16.1					108.4																
DAM	TI-B3	CA	11	11.5	Dam Silty Sand (dam)			5.1					108.4		2.64					5.4	74.7	19.9	13.5	6.4					
DAM	TI-B3	CA	16	16.5	Dam Silty Sand (dam)			4.7					105.3															-2.8 (2,236)	
DAM	TI-B3	CA	41	41.5	Dam Sandy Clay (dam)			21.5					90.6							0.0	33.8	66.2	41.7	24.5					
DAM	TI-B3	CA	45.5	46	Dam Sandy Clay (dam)			17.0	17.7				110.1	109.4															29.3, 293
DAM	TI-B3	CA	46	46.5	Dam Sandy Clay (dam)			18.0					104.8				28	13	15										
CENTRAL	TI-B11	ST	15	16	Fill Clayey Sand (Fill)			8.2			16.0 / 16.3	117.7 / 116.6	110.4		2.67					3.9	57.6	38.5	24.6	13.9	2.5E-05	38	0.085		
NORTH CELL	TI-B2	CA	11	11.5	Fill Clayey Sand (fill)			24.5					75.9		2.73					0.0	65.4	34.6	30.3	4.3					
CENTRAL	TI-B1	CA	16	16.5	Fill Lean Clay with Sand (Fill)		CL	16.2					104.7				33	13	20	0.3	27.2	72.5	42.9	29.6					
CENTRAL	TI-B11	CA	6	6.5	Fill Sandy Clay (Fill)			8.6					93.5																
CENTRAL	TI-B11	CA	21	21.5	Fill Sandy Clay (Fill)			12.3					107.6																
CENTRAL	TI-B11	ST	30.5	31.5	Fill Sandy Clay (Fill)		CL	13.7					112.4				30	13	17	7.1	41.3	51.6	33.9	17.7	9.0E-07	51	0.059		
NORTH CELL	TI-B2	CA	6	6.5	Fill Silty Sand with Gravel (Fill)			7.7					100.4		2.68					26.9	29.9	43.2	30.7	12.5					
CENTRAL	TI-B10	CA	25.75	26	Fine Tailings			43.7	41.0																				

Table 3-4 Summary of Geotechnical Laboratory Data - Mill Site Impoundment (continued)

Area	Boring	Sample Type [9]	Sample Depth Interval (ft.)		Material Description [1]		USCS [1]	Water content (by mass, %) 110C	Water content (by mass, %) 60C	saturation (%)	SWCC - Saturated water content (by mass, %) [2]	SWCC - Specimen dry density (pcf) [2]	Dry density (pcf), 110C	Dry density (pcf), 60C	Specific gravity, 110C	Specific gravity, 60C	Atterberg limits (%) LL	PL	PI	USCS % gravel (size)	USCS % sand (size)	% Passing No. 200 sieve	% Silt (size)	USDA % clay (size <0.002 mm)	Saturated Hydraulic conductivity (cm/sec) [3]	Hydraulic conductivity confining stress (psi)	Consolidation (Cc) [7]	Collapse potential (%) (inundation load (psf))	Triaxial [12] (peak friction angle (φ') (degrees), cohesion (psf), where applicable)
CENTRAL	TI-B10	CA	26	26.5	Fine Tailings	Fat Clay	CH	60.4	*57.4*				63.1	*64.3*	2.71	*2.80*	74	27	47	0.0	10.0	90.0	82.6	7.4					
CENTRAL	TI-B10	ST	30.3	30.7	Fine Tailings		CH	47.7	*45.3*	92%			72.2	*73.4*	2.71	*2.78*	57	22	35	0.0	24.3	75.7	68.4	7.3					
CENTRAL	TI-B10	ST (top)	40	41	Fine Tailings	Fat Clay with Sand		47.3	45.7				70.5	73.7	2.54	2.56													
CENTRAL	TI-B10	ST (bottom)	40	41	Fine Tailings	Fat Clay with Sand	CH	49.7	*47.2*		47.7 / 55.7	75.3 / 67.9	73.3	*74.5*			61	21	40	0.0	20.7	79.3	46.5	32.9	2.9E-08	58	0.315		
CENTRAL	TI-B11	ST	51.5	52.5	Fine Tailings		CH	63.0	*59.9*	95%			62.5	*63.7*	2.75	*2.84*	91	30	61	0.0	2.7	97.3	90	7.3	3.1E-08	67	0.482		
CENTRAL	TI-B1	CA (bottom)	31	31.5	Fine Tailings		CL		41.6	94%				76.5	2.68	*2.69*	44	17	27	0.0	30.9	69.1	54.6	14.5					33.3
CENTRAL	TI-B10	CA	35	35.5	Fine Tailings			50.2	*47.7*				71.3	*72.5*															
CENTRAL	TI-B10	CA	35.5	36	Fine Tailings			54.2	51.4																				
CENTRAL	TI-B11	CA	45.5	46	Fine Tailings			117.2	88.7																				
CENTRAL	TI-B8	ST	30	31	Fine Tailings		CH	65.1	*61.8*				61.5	*62.7*			74	25	49	0.0	9.2	90.8	81.2	9.6			0.426		
CENTRAL	TI-B8	ST	31	31.5	Fine Tailings			44.3	41.4																				
CENTRAL	TI-B8	ST (top)	41	42	Fine Tailings			41.8	*39.7*	**100%**			79.2	*80.4*	2.60	2.63													
CENTRAL	TI-B8	CC-AC [6] (bot)	43.5	44.5	Fine Tailings			45.6	*43.3*	96%	47.9 / 49.0	74.4 / 73.6	73.6	*74.8*						0.0	14.5	85.5	74.7	10.8	3.0E-08	61			
BORROW PIT 1	TI-B8	CC-AC	44.5	45	Fine Tailings										2.59	2.60													
NORTH CELL	TI-B2	CC-AC	13.5	14.5	Fine Tailings	Sandy Clay		41.7	*39.6*											0.0	23.1	76.9	49.2	27.7					
CENTRAL	TI-B10	CC	106.9	107.3	Sandstone			14.2					109.1												1.4E-07	115			
CENTRAL	TI-B11	CA	100	100.2	Sandstone			21.1					103.9												1.3E-05	112			
NORTH CELL	TI-B23	CA	45.2	45.7	Sandstone			13.8					108.7												2.4E-07	43			
NORTH CELL	TI-B2	BULK	38.4	38.7	Sandstone			13.5					X																
BORROW PIT 1	TI-B8	BULK	63.5	64	Shale			X					X												X	X			
NORTH CELL	TI-B23	CA [8]	65.5	66	Shale			10.2					103.0												9.7E-08	62			

Notes: 1. Material descriptions are based on field observations, and refined with laboratory data, if available. USCS classifications are provided only where sufficient laboratory data are available.
2. SWCC tests conducted with pairs of specimens for each test.
3. Flexible wall permeameter tests conducted at confining pressures representing confining stresses for the proposed design fill. Confining stresses were estimated as the existing overburden stress on the specimens (depth times total unit weight of material above) plus the maximum anticipated fill height for the location times the estimated unit weight of fill.
4. Specimen remolded to the in-situ water content and density of the Shelby tube sample from 10-12.5 for the SWCC.
5. Remolded SWCC and permeability tests conducted on a 50-50 mixture of the materials from these two specimens, remolded to the average measured density of the two CA samples.
6. SWCC specimen remolded to the in-situ water content and density of the Shelby tube sample from 41-42 feet.
7. Compression indices estimated using the maximum anticipated loading during fill placement and the range of loading during testing. Initial void ratios are calculated using the average specific gravity for all samples of 2.70.
8. Shale sample had multiple horizontal fractures and was likely disturbed during sampling.

9. Sample Types: CC = continuous core, CC-AC = continuous core in acrylic liner, top/bottom indicates the specimen was taken from the top or bottom of the sample interval
10. Values in italics were calculated based on the relationship (WC60=0.951(WC110)-.0611) between the water content results measured for 15 tailings samples at the two oven temperatures.*
11. Shaded cells are alluvium.
12. Consolidated undrained (CU) triaxial shear, staged loading of one specimen with pore pressure measurements

ST = 3" diam. Shelby tube, CA = California sample
R = remolded, nc = Cc not calculated, because fill will not be placed in this location
X = testing not possible due to sample disturbance
LL = liquid limit, PL = plastic limit, PI = plasticity index

Table 3-5 Summary of Geotechnical Laboratory Data - Borrow Areas

Area	Sample	Sample Type [1]	Sample Depth Interval (ft)		Material Description [2]	USCS [2]	USDA Classification [3]	Water Content (by mass, %)	Dry Density (pcf)	Porosity	Specific Gravity	Standard Proctor (max. dd@opt. w.c.), (pcf @ %)	Atterberg Limits (%) [4]			USCS % Gravel	USCS % Sand	% Passing No. 200 Sieve (fines)	% Silt	USDA % Clay (<0.002 mm)	Pinhole Dispersion [5,6]	Remolded Saturated Hydraulic Conductivity (cm/sec) [7]			SWCC: -5 bar Water Content (by mass, %) [8]	SWCC: Saturated Water Content (by mass, %) [8]
													LL	PL	PI							80%	85%	90%		
West Borrow	WB-B1-01A	CA	3.0	3.5	Clayey Sand			3.8	88.8	46.7	2.67															
	WB-B1-03A	CA	11.0	11.5	Clayey Sand	SC	Sandy Loam	6.4	111.0	33.3	2.67		28	18	10	2.8	48.6	48.6	32.8	15.8						
	WB-B1-06	Bulk	5.0	10.0	Silty, Clayey Sand	SC-SM	Sandy Loam				2.64	112.5 @ 13.7	26	20	6	0.8	52.3	46.9	31.0	15.9	ND3	7.2E-04	5.8E-04	2.1E-04	6.6 / 6.2	31.7 / 32.4
	WB-B2-02A	CA	5.5	6.0	Clayey Sand	SC	Sandy Loam	5.6	87.1	47.8	2.67					8.6	53.5	37.9	23.8	14.1						
	WB-B2-05	Bulk	10.0	20.0	Clayey Sand	SC	Sandy Loam						26	17	9	9.9	46.3	43.8	27.7	16.1	ND3	8.5E-05	1.2E-04	6.4E-05	6.4 / 6.7	30.9 / 33.7
	WB-B5-001B	CA	3.0	3.5	Clayey Sand			3.7	92.5	44.3	2.66															
	WB-B5-002A	CA	6.0	6.5	Silty, Clayey Sand	SC-SM	Sandy Loam	5.1	86.9	47.7	2.66		24	17	7	0.0	56.3	43.7	27.8	15.9						
	WB-B5-005	Bulk	0.0	10.0	Silty, Clayey Sand	SC-SM	Sandy Loam					117.3 @ 12.7				0.0	61.6	38.4	22.8	15.6						
East Borrow	EB-B2-001A	CA	3.0	3.5	Weath. Sandstone			5.8	107.1	35.8	2.67															
	EB-B3-003B	CA	10.5	11.0	Sandy Lean Clay	CL	Sandy Loam	6.0	83.1	50.7	2.70		26	15	11	0.0	46.3	53.7	34.9	18.8						
	EB-B4-02A	CA	6.0	6.5	Sandy Lean Clay	CL	Sandy Loam	5.4	80.7	51.2	2.65					0.0	48.5	51.5	33.9	17.6						
	EB-B4-06	Bulk	10.0	20.0	Silty, Clayey Sand	SC-SM	Sandy Loam				2.67	117.1 @ 12.9	23	17	6	0.0	50.5	49.5	32.0	17.5	ND3	8.7E-04	9.0E-04	4.4E-04	4.6 / 4.2	30.8 / 29.8
	EB-B5-02B	CA	5.5	6.0	Clayey Sand	SC	Sandy Loam	6.7	93.8	44.4	2.71		27	15	12	8.8	45.7	45.5	28.8	16.7						
	EB-B6-01B	CA	3.0	3.5	Sandy Clay			7.6	91.2	46.1	2.71															
	EB-B6-03	Bulk	0.0	10.0	Lean Clay with Sand	CL	Clay Loam					114.8 @ 14.1				0.0	26.6	73.4	44.3	29.1	ND3	2.3E-04	3.6E-05	2.9E-05	9.4 / 9.3	32.8 / 32.2
	EB-B6-04A	CA	11.0	11.5	Sandy Lean Clay	CL	Sandy Clay Loam	8.6	95.2	43.3	2.69		31	13	18	0.0	31.1	68.9	43.8	25.1						
South Borrow	SB-B1-01A	CA	3.5	4.0	Sandy Lean Clay	CL	Sandy Loam	7.1	91.4	49.3	2.89					0.0	43.1	56.9	39.2	17.7						
	SB-B1-03A	CA	11.0	11.5	Sandy Lean Clay	CL	Sandy Clay Loam	6.6	82.6	50.7	2.69		31	15	16	0.0	46.7	53.3	32.9	20.4						
	SB-B1-04	Bulk	0.0	25.0	Sandy Lean Clay	CL	Sandy Clay Loam				2.70	115.5 @ 14.2	33	14	19	0.0	42.6	57.4	30.7	26.7	ND1	2.3E-04	5.7E-05	1.4E-04	6.4 / 5.9	31.9 / 30.3
	SB-B2-02B	CA	5.5	6.0	Sandy Lean Clay	CL	Loam	7.7	80.1	52.6	2.70		36	15	21	0.0	29.8	70.2	45.4	24.8						
	SB-B3-02A	CA	6.0	6.5	Lean Clay with Sand	CL	Clay Loam	10.2	84.3	49.7	2.69		40	17	23	0.0	21.6	78.4	46.2	32.2						
	SB-B4-01	Bulk	0.0	15.0	Sandy Lean Clay	CL	Sandy Clay Loam	7.1			2.67	114.1 @ 14.4	33	15	18	0.8	39.6	59.6	35.7	23.9	ND3	3.4E-04	2.0E-04	7.4E-05	9.1 / 8.6	29.6 / 33.5
North Borrow	NB-B1-03B	CA	10.5	11.0	Silty Sand	SM	Sandy Loam	5.4	84.4	49.5	2.68		25	22	3	0.0	55.6	44.4	30.3	14.1						
	NB-B2-01B	CA	3.0	3.5	Silty Sand	SM	Sandy Loam	4.9	81.9	50.3	2.64		27	23	4	0.0	51.2	48.8	33.9	15.0						
	NB-B2-04	Bulk	0.0	10.0	Sandy, Silty Clay	CL-ML	Sandy Loam					113.9 @ 14.5	26	19	7	0.0	49.0	51.0	32.5	18.5	ND3	4.0E-04	2.7E-04	7.5E-05	4.9 / 4.7	29.5 / 29.9
Dilco Hill	DH-B1-01B	CA	3.0	3.5	Silty Sand			3.5	88.8	46.6	2.66															
	DH-B1-03	Bulk	0.0	10.0	Sandy, Silty Clay	CL-ML	Sandy Loam	5.4			2.67	117.5 @ 13.8	25	19	6	2.0	47.4	50.6	35.0	15.6	ND4	6.3E-04	7.1E-04	2.5E-04	4.2 / 4.1	39.6 / 35.0
	DH-B1-10	Bulk	35.0	45.0	Lean Clay with Sand	CL	Loam	10.3			2.38					1.5	20.9	77.6	60.9	16.7	ND3	1.6E-04	2.5E-05	3.2E-06	5.8 / 6.0	25.7 / 24.5
	DH-B2-03	CA	15.0	15.5	Silty Clay with Sand	CL-ML	Sandy Loam	10.5	96.7	39.2	2.55		29	24	5	0.0	27.7	72.3	66.9	5.4						
	DH-B3-05	Bulk	20.0	30.0	Sandy Lean Clay	CL	Loam	7.3			2.66	116.3 @ 13.0	29	18	11	2.5	34.6	62.9	45.5	17.4						

Notes: 1. Sample Types: CA = California sample, Bulk = bucket/grab sample

2. USCS = Unified Soil Classification Sysytem, material descriptions are based on field observations, and refined with laboratory data, if available. USCS classifications are provided only where sufficient laboratory data are available. CL = low plasticity clay

3. USDA = United States Department of Agriculture, USDA classifications are based on the sand/silt/clay fraction of the sample and on USDA grain-size designations.

4. LL = liquid limit, PL = plastic limit, PI = plasticity index

5. With the exception of DH-B1-03, which was tested at a density based on the natural in-situ density measured from the CA samples, specimens were remolded to approximately 85% of standard Proctor density and between the estimated natural and optimum water contents for the soil.

6. ND1 = nondispersive clay with very slight to no colloidal erosion under 15-inch or 40-inch head; ND4, ND3 = slightly to moderately dispersive clays that erode slowly under 2-inch or 7-inch head (ASTM test method A)

7. Specimens remolded to approximately 80%, 85%, and 90% of maximum standard Proctor dry density and between the estimated natural and optimum water contents for the soil.

8. Specimens remolded to approximately 85% of maximum standard Proctor dry density and between the estimated natural and optimum water contents for the soil. SWCC tests performed with pairs of speciments for each test.

Table 3-6 Summary of Geotechnical Laboratory Data - Site Stockpiles

Area	Sample	Sample Type [1]	Material Description	USCS [2]	Specific Gravity	Atterberg Limits (%) [4] LL	PL	PI	USCS % Gravel	USCS % Sand	% Passing No. 200 Sieve (fines)	L.A. Abrasion (% loss) [5]	Sodium Sulfate Soundness (% loss) [6]	Absorption (%) [7]	Unconfined Compressive Strength (psi) [8]	Splitting Tensile Strength (psi) [8]
Stockpiles	Topsoil-01	Bulk	Sandy Clay	CL	2.68	33	10	23	2.6	32.4	65.0					
	Topsoil-02	Bulk	Sandy Clay	CL	2.71	39	12	27	0.5	26.8	72.7					
	TI-SP1-01	Bulk	Crusher Fines						1.9	80.8	17.3					
	TI-SP2-01A	Bulk	Erosion Protection Gravel		2.78 [3]				93.0	6.3	0.7	5.7	8.26	1.868		
	TI-SP2-01C	Bulk	Erosion Protection Gravel						83.3	4.9	11.8					
	TI-SP3-01A	Bulk	Road Base (gravel with sand)						67.4	24.6	8.0					
	TI-SP4-01A	Bulk	Erosion Protection Gravel		2.75 [3]				98.0	1.2	0.8	6.1	10.47	2.091		
	TI-SP6 (56A)	Bulk	9-inch riprap												20,780 and 23,630	1,320 and 1,400
	TI-SP6 (56B)	Bulk	9-inch riprap												19,100 and 14,440	1,530 and 1,720

Notes: 1. Bulk = bucket/grab sample

2. USCS = Unified Soil Classification Sysytem, material descriptions are based on field observations, and refined with laboratory data, if available.
USCS classifications are provided only where sufficient laboratory data are available. CL = low plasticity clay

3. Average of three bulk saturated surface dry (SSD) specific gravity results for the rock samples (ASTM C127)

4. LL = liquid limit, PL = plastic limit, PI = plasticity index

5. L.A. Abrasion results are percent loss, by mass, for 100 revolutions.

6. Weighted percentage loss for 0.75 to 1.5-inch size range

7. Average of three absorption results

8. Specimens were collected from the 9-inch stockpile and cored for strength testing.

Table 3-6 Geotechnical Test Results

Sample ID[1]	Sample Location	Sample Type	Sample Depth Interval		Gravimetric Water content	Dry Density	Specific gravity	Standard Proctor	
		Units:	top (ft bgs)	bottom (ft bgs)	(% by mass)	(pcf)	(g/cm^3)	max. dry density (pcf)[3]	optimum water content (%)
NECR1-CC01	NECR-1	Bulk	10	20			2.68	120.7	11.9
NECR1-CC17		CA[2]	5.5	6	4.9	92.3			
NECR1-CC17		CA	10.5	11	6.2	96.5			
NECR1-CC17		CA	15.5	16	2	106.7			
NECR1-CC17		CA	20.5	21	19.1	95.8			
NECR1-CC17		Bulk	0	10				120.3	11.3
NECR1-CC17		Bulk	10	20				125.1	10
NECR2-CC05	NECR-2	Bulk	0	10				118.8	11.9
NECR2-CC07		Bulk	0	10			2.71	117.8	11.6
NECR2-CC05		CA	2.5	3	8.1	93.7			
NECR2-CC05		CA	5	5.5	10	D[3]			
NECR2-CC06		CA	3.5	4	4.7	101.1			
NECR2-CC07		CA	6	6.5	2.7	101			
NECR2-CC07		CA	5.5	6	4.5	101.3			
NECR2-CC07		CA	10	10.5	4.1	97.1			
NECR2-CC01		CA	5.5	6	7.4	99.1			
NECR2-CC06		CA	3	3.5	5	103.4			
N2D-CC01	NECR-2 Drainage	Bulk	0	10				115.6	13.4
N2D-CC01		CA	3.5	4	8.6	91.2			
N2D-CC01		CA	6	6.5	4.7	87.2			
N2D-CC01		CA	11	11.5	4	91.8			
NMSA-CC02	NEMSA	CA	3	3.5	8.1	110.6			
NMSA-CC02		CA	6	6.5	20	97.5			
NMSA-CC02		CA	10.5	11	15	86.6			
NMSA-CC04		Bulk	0	15			2.66	125.2	9.8
P2-CC04	Pond 2	Bulk	0	3			2.66	102.0	20.6
P3-CC07	Pond 3	Bulk	0	5			2.63	109.7	13.7
SF2-CC01	Sandfill 2	Bulk	0	10			2.65	121.5	10.5
SF3-CC01	Sandfill 3	Bulk	0	10			2.68	121.7	11.1
SF3-CC01		CA	3.5	4	17	99.3			
SF3-CC01		CA	6	6.5	10.5	96.4			
SF3-CC01		CA	11	11.5	8.2	83.5			
SP-CC13	Sediment Pad	CA	5.5	6	10.2	101.4			
SP-CC13		CA	11	11.5	3.5	100.8			
SP-CC13		CA	15.5	16	6.9	97.5			
SP-CC13		Bulk	0	15			2.62	120.6	11.5

Notes:

pcf=pounds per cubic foot

1. Samples collected October-December 2013 during the Pre-Design Studies
2. CA = 2-inch diameter California sample, Bulk = 5-gallon bucket sample
3. Maximum dry density listed includes rock correction
4. D = Disturbed, moisture content only

ATTACHMENT B

MEASURED SHEAR WAVE VELOCITIES IN TDA AND UNDERLYING ALLUVIUM (MWH, 2014A)

CONETEC

Shear Wave Velocity Calculations

Job No.: 13-52118
Client: MWH Americas, Inc.
CPT No.: RCPT-01
Location Church Rock Mill Site TSF
Date: November 7, 2013

Geophone Offset: 0.66 (ft)
Source Offset: 1.50 (ft)

Test Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Incremental Distance (ft)	Time Interval (ms)	Interval Velocity (m/s)	Interval Depth (m)	Interval Velocity (ft/s)	Interval Depth (ft)
5.08	4.43	4.68						
10.01	9.35	9.47	4.79	6.36	230	2.10	754	6.9
15.09	14.44	14.51	5.04	6.12	251	3.62	824	11.9
20.01	19.36	19.41	4.90	6.81	219	5.15	720	16.9
25.10	24.44	24.49	5.07	7.19	215	6.67	705	21.9
30.02	29.36	29.40	4.91	7.68	195	8.20	639	26.9
40.03	39.37	39.40	10.00	13.12	232	10.47	762	34.4
45.11	44.46	44.48	5.08	6.58	235	12.77	772	41.9
50.03	49.38	49.40	4.92	6.19	242	14.30	794	46.9
55.12	54.46	54.48	5.08	6.72	231	15.82	757	51.9
60.04	59.38	59.40	4.92	7.42	202	17.35	663	56.9
65.12	64.47	64.49	5.08	7.64	203	18.87	666	61.9
70.05	69.39	69.41	4.92	6.65	225	20.40	740	66.9
75.13	74.47	74.49	5.08	5.30	292	21.92	959	71.9
79.72	79.07	79.08	4.59	5.17	271	23.40	888	76.8
85.14	84.48	84.49	5.41	5.95	277	24.92	910	81.8

ConeTec

Shear Wave Velocity Calculations

Job No.: 13-52118
Client: MWH Americas, Inc.
CPT No.: RCPT-02
Location Church Rock Mill Site TSF
Date: November 5, 2013

Geophone Offset: 0.66 (ft)
Source Offset: 1.50 (ft)

Test Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Incremental Distance (ft)	Time Interval (ms)	Interval Velocity (m/s)	Interval Depth (m)	Interval Velocity (ft/s)	Interval Depth (ft)
4.43	3.77	4.06						
10.99	10.33	10.44	6.38	6.82	285	2.15	936	7.1
15.09	14.44	14.51	4.07	7.31	170	3.77	557	12.4
20.01	19.36	19.41	4.90	4.91	304	5.15	998	16.9
25.10	24.44	24.49	5.07	5.67	273	6.67	894	21.9
30.02	29.36	29.40	4.91	5.69	263	8.20	864	26.9
33.96	33.30	33.33	3.93	3.09	389	9.55	1275	31.3

Shear Wave Velocity Calculations

Job No.: 13-52118
Client: MWH Americas, Inc.
CPT No.: RCPT-08
Location Church Rock Mill Site TSF
Date: November 7, 2013

Geophone Offset: 0.66 (ft)
Source Offset: 1.50 (ft)

Test Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Incremental Distance (ft)	Time Interval (ms)	Interval Velocity (m/s)	Interval Depth (m)	Interval Velocity (ft/s)	Interval Depth (ft)
5.08	4.43	4.68						
10.01	9.35	9.47	4.79	4.07	359	2.10	1177	6.9
15.09	14.44	14.51	5.04	5.91	260	3.62	853	11.9
20.01	19.36	19.41	4.90	6.06	247	5.15	809	16.9
25.10	24.44	24.49	5.07	6.67	232	6.67	761	21.9
30.02	29.36	29.40	4.91	8.27	181	8.20	594	26.9
35.10	34.45	34.48	5.08	8.65	179	9.72	587	31.9
40.35	39.70	39.73	5.25	8.20	195	11.30	639	37.1
46.26	45.60	45.63	5.90	8.61	209	13.00	685	42.7
50.03	49.38	49.40	3.77	2.97	388	14.47	1272	47.5
55.12	54.46	54.48	5.08	4.17	372	15.82	1220	51.9
60.04	59.38	59.40	4.92	3.79	396	17.35	1298	56.9

Shear Wave Velocity Calculations

Job No.: 13-52118
Client: MWH Americas, Inc.
CPT No.: RCPT-10
Location Church Rock Mill Site TSF
Date: November 6, 2013

Geophone Offset: 0.66 (ft)
Source Offset: 1.50 (ft)

Test Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Incremental Distance (ft)	Time Interval (ms)	Interval Velocity (m/s)	Interval Depth (m)	Interval Velocity (ft/s)	Interval Depth (ft)
5.08	4.43	4.68						
10.01	9.35	9.47	4.79	5.18	282	2.10	926	6.9
15.09	14.44	14.51	5.04	6.94	222	3.62	727	11.9
20.01	19.36	19.41	4.90	8.32	180	5.15	589	16.9
25.10	24.44	24.49	5.07	10.81	143	6.67	469	21.9
30.02	29.36	29.40	4.91	9.68	155	8.20	508	26.9
35.27	34.61	34.65	5.24	10.72	149	9.75	489	32.0
40.03	39.37	39.40	4.75	9.45	153	11.27	503	37.0
46.26	45.60	45.63	6.23	9.24	206	12.95	674	42.5
50.03	49.38	49.40	3.77	3.16	364	14.47	1194	47.5
55.12	54.46	54.48	5.08	3.37	459	15.82	1507	51.9
60.04	59.38	59.40	4.92	2.69	558	17.35	1829	56.9
63.16	62.50	62.52	3.12	2.06	461	18.57	1514	60.9

ConeTec

Shear Wave Velocity Calculations

Job No.: 13-52118
Client: MWH Americas, Inc.
CPT No.: RCPT-11
Location Church Rock Mill Site TSF
Date: November 7, 2013

Geophone Offset: 0.66 (ft)
Source Offset: 1.50 (ft)

Test Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Incremental Distance (ft)	Time Interval (ms)	Interval Velocity (m/s)	Interval Depth (m)	Interval Velocity (ft/s)	Interval Depth (ft)
5.08	4.43	4.68						
10.01	9.35	9.47	4.79	5.03	291	2.10	953	6.9
15.26	14.60	14.68	5.21	6.35	250	3.65	821	12.0
20.01	19.36	19.41	4.74	5.65	255	5.17	838	17.0
25.10	24.44	24.49	5.07	5.95	260	6.67	853	21.9
30.02	29.36	29.40	4.91	5.48	273	8.20	897	26.9
35.10	34.45	34.48	5.08	5.15	301	9.72	987	31.9
40.03	39.37	39.40	4.92	5.36	280	11.25	918	36.9
45.11	44.46	44.48	5.08	6.13	253	12.77	829	41.9
50.03	49.38	49.40	4.92	7.59	197	14.30	648	46.9
55.12	54.46	54.48	5.08	7.94	195	15.82	640	51.9
60.04	59.38	59.40	4.92	4.00	375	17.35	1229	56.9
65.29	64.63	64.65	5.25	4.81	332	18.90	1091	62.0
70.21	69.55	69.57	4.92	4.64	323	20.45	1060	67.1
75.13	74.47	74.49	4.92	4.90	306	21.95	1003	72.0
80.05	79.40	79.41	4.92	4.90	306	23.45	1005	76.9
85.14	84.48	84.49	5.08	4.12	376	24.97	1235	81.9
90.06	89.40	89.42	4.92	4.84	310	26.50	1016	86.9
95.14	94.49	94.50	5.08	3.11	499	28.02	1637	91.9

Shear Wave Velocity Calculations

Job No.: 13-52118
Client: MWH Americas, Inc.
CPT No.: RCPT-15
Location Church Rock Mill Site TSF
Date: November 6, 2013

Geophone Offset: 0.66 (ft)
Source Offset: 1.50 (ft)

Test Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Incremental Distance (ft)	Time Interval (ms)	Interval Velocity (m/s)	Interval Depth (m)	Interval Velocity (ft/s)	Interval Depth (ft)
5.08	4.43	4.68						
10.01	9.35	9.47	4.79	7.05	207	2.10	680	6.9
15.09	14.44	14.51	5.04	8.31	185	3.62	607	11.9
20.01	19.36	19.41	4.90	8.07	185	5.15	607	16.9
25.10	24.44	24.49	5.07	8.24	188	6.67	616	21.9
30.02	29.36	29.40	4.91	7.72	194	8.20	636	26.9
35.10	34.45	34.48	5.08	6.35	244	9.72	801	31.9
40.03	39.37	39.40	4.92	4.49	334	11.25	1095	36.9
45.93	45.28	45.30	5.90	5.41	333	12.90	1092	42.3
50.03	49.38	49.40	4.10	3.40	367	14.42	1206	47.3
55.12	54.46	54.48	5.08	4.45	348	15.82	1142	51.9

ATTACHMENT C

TAILINGS DISPOSAL AREA BOREHOLE LOGS (MWH, 2014A)

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B1**

CONTRACTOR INFORMATION	DRILL RIG INFORMATION		BOREHOLE INFORMATION	
DRILLING COMPANY: NATIONAL	DRILLING RIG: CME 85 HD	BIT TYPE: N/A	CASING DEPTH: N/A	START: 11/21/2013
DRILLER: M. CAIN	DRILLING METHOD: HSA/CC	AUGER O.D.: 8.25"	SURFACE ELEV. (FT): 6969.7	FINISH: 11/21/2013
DRILLER'S HELPER: J. RAMIREZ	HAMMER TYPE: AUTO	HOLE DIAM.: 8.25"	DEPTH TO BEDROCK (FT): N/A	
LOGGED BY: R. SCHAUT	HAMMER WT: 140 lb	CORE DIAM.: 3.0"	TOTAL DEPTH (FT): 70.0	

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
0	14"				NA	(0' - 8") SILTY CLAY (FILL) - Light brown, soft, moist silty clay, trace to few very fine to fine sand.												
						(8" - 12") ROCK - 1/2" to 3" crushed basalt.												
1						(1' - 18.5') SILTY CLAY WITH SAND (FILL) - Dark brown, firm to hard, slightly moist silty clay, little to some very fine to fine sand, occasional coarse sand and gravel (upper ~5' may be compacted radon barrier).												
2																		
3						[0 - 5' Core not retained.]												
4																		
5	24"	CA 18"	1C	8														
			1B	9														
6			1A	11														
		AC	2															
7																		
8																		
9																		
10	30"	CA 18"	3C	10		[Below ~10', occasional elevated rad readings indicating possible sand tailings mixed with silty clay fill.]												
			3B	12														
11			3A	14		(~11' - ~11.5') 1/2" to 1" gravel observed.												
		AC	4															
12																		
13																		

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Rad levels measured with Ludlum Model 2 meter. Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B1**

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	30"	AC	4		NA												
14						(~13 - ~14') - Sand Tailings - see description below, slightly elevated rad readings.]											
15	32"	CA 18"	5C	5													
			5B	6													
16			5A	10			CL	16.2	104.7		33/13/20	0.3	27.2	72.5			
		AC	6														
17																	
18																	
						(18.5' - 34.3') SAND TAILINGS - Pale gray, dense, moist, fine to medium sand tailings, slightly elevated rad levels.											
19																	
20	36"	CA 18"	7C	19													
			7B	22				6.1									
21			7A	24				7.5	105.5			0.0	90.7	9.3	3.7E-4		
22		AC	8														
23																	
24																	
25	30"	ST 28"	9														
26																	
27								4.0	97.6	2.67	NP	0.0	92.7	7.3	2.9E-3		34.9
		AC	10														

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Rad levels measured with Ludlum Model 2 meter. Hole backfilled with cement/bentonite grout.

MWH PROJ. LOC.: GALLUP, NM	CLIENT: NECR - PRE DESIGN STUDY INVESTIGATION	BORING LOG	BOREHOLE ID: TI-B1

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
28	30"	AC	10		NA													
29						(29.6' - 34.3') Very fine grained sand tailings, abundant clayey zones.												
30	36"	CA 18"	11C	5					13.9									
			11B	5					14.6	91.6						3.0E-7	0.092	
31			11A	4			CL		41.6	76.5	2.69	44/17/27	0.0	30.9	69.1			33.3
32		AC	12				CL		27.8			33/16/17	0.0	46.7	53.3			
33																		
34						(34.3' - ~41') CLAYEY SAND - Loose to medium dense, very moist to wet, very fine-grained clayey sand, increasing clay content with depth.												
35	40"	CA 18"	13C	7														
			13B	20														
36			13A	22		(35' - 36.5') High blow counts due to rock in CA shoe.			21.0	97.3	2.73		0.0	62.5	37.5	1.7E-6	0.059	
		AC	14B															
37		AC	14A															
38																		
39																		
40	42"	CA 18"	15C	3														
			15B	5														
41			15A	5		(~41' - ~45') SANDY CLAY - Very moist to wet sandy clay, sand is very fine-grained.	CL		26.7	98.6		31/15/16	0.0	18.2	81.8	1.2E-7		
42																		

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Rad levels measured with Ludlum Model 2 meter. Hole backfilled with cement/bentonite grout.

MWH

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B1**

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
42	42"	AC	16		NA													
45	40"	ST 30"	17			(~45' - 54') CLAYEY SAND - Loose to medium dense, very moist to wet, very fine-grained clayey sand, decreasing clay content with depth.			22.0	106.0							.058	34.4
50	42"	CA 18"	18C	4														
			18B	5														
			18A	7														
54						(54' - 68.2') SILTY CLAY - Dark brown, firm, very moist to wet silty clay, trace to few very fine sand.												
55	60"	CA 18"		6														
			19B	7														
			19A	10														

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Rad levels measured with Ludlum Model 2 meter. Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B1**

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	60"				NA													
58																		
59																		
60	60"	CA 18"		5														
			20B	8														
61			20A	12														
62																		
63																		
64																		
65	60"	CA 18"		5														
			21B	7														
66			21A	11														
67																		
68						(68.2' - E.O.B.) SILTY SAND - Brown, silty, moist very fine to fine sand.												
69																		
70						E.O.B. at 70.0'												
71																		

LEGEND:
CA = CALIFORNIA SAMPLE (2-INCH OD)
ST = SHELBY TUBE (3-INCH OD)
AC = ACRYLIC LINER
HSA = HOLLOW-STEM AUGER
CC = CONTINUOUS CORE
NR = NO RECOVERY

NOTES:
Rad levels measured with Ludlum Model 2 meter. Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM

CLIENT: NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B2**

CONTRACTOR INFORMATION	DRILL RIG INFORMATION		BOREHOLE INFORMATION	
DRILLING COMPANY: NATIONAL	DRILLING RIG: CME 85 HD	BIT TYPE: N/A	CASING DEPTH: N/A	START: 11/20/2013
DRILLER: M. CAIN	DRILLING METHOD: HSA/CC	AUGER O.D.: 8.25"	SURFACE ELEV. (FT): 6959.9	FINISH: 11/21/2013
DRILLER'S HELPER: J. RAMIREZ	HAMMER TYPE: AUTO	HOLE DIAM.: 8.25"	DEPTH TO BEDROCK (FT): 33.5	
LOGGED BY: R. SCHAUT	HAMMER WT: 140 lb	CORE DIAM.: 3.0"	TOTAL DEPTH (FT): 38.7	

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
0	8"					(0" - 3") SILTY CLAY - Brown, soft, silty clay, dry, trace few very fine to fine sand.												
						(3" - 6") ROCK - 1/2" to 3" crushed basalt.												
1		CA 17"	1B	13, 11		(6" - ~2.5') SILTY CLAY - Dark brown, hard, slightly moist silty clay, few to little very fine sand, occasional coarse sand.												
2			1A	18		[0' - 5' Core not retained.]												
3						(~2.5' - 7.3') SILTY SAND WITH GRAVEL - Pale yellow, dense, dry to slightly moist silty very fine to medium sand with coarse sand and gravel.												
5	42"	CA 15"	2B	23, 22														
6			2A	18					7.7	100.4	2.68		26.9	29.9	43.2			
		AC	3															
7		AC	4			(7.3' - 12.8') CLAYEY SAND - Predominantly brown, medium dense, slightly moist to moist clayey fine to medium sand, abundant clay "pockets" throughout. May be sand tailings mixed with site soils.												
10	40"	CA 18"	5C	6														
			5B	7														
11			5A	7					24.5	75.9	2.73		0.0	65.4	34.6			
		AC	6															
12		AC	7															
13						(12.8' - 15') SAND TAILINGS - Pale gray, moist sand												

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Rad levels measured with Ludlum Model 2 meter. Hole backfilled with cement/bentonite grout.
At 8:30 AM on 11/21/13, water was measured at 38.3' bgs (may be due to overnight precipitation as hole was left open overnight).

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B2**

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	40"	AC	7			tailings, very fine silty sand from 12.8' to 13.2', fine to medium sand from 13.2' to 15'.			39.6				0.0	23.1	76.9			
14																		
15	42"	CA 18"	8C	5		(15' - 25.7') SILTY SAND - Brown, medium dense, moist silty very fine to fine sand, occasional roots. Appears to be natural "alluvium." Occasional dark brown clay lenses. Rad levels ~ background.			6.9	90.4	2.68							
			8B	5														
16			8A	7														
		AC	9															
17																		
		AC	10															
18																		
19																		
20	42"	CA 18"	11C	4														
			11B	4														
21			11A	6					7.0	91.4	2.74		0.0	82.9	17.1			
		AC	12															
22																		
		AC	13															
23																		
24																		
25	48"	CA 18"	14C	5														
			14B	6														
26			14A	6		(25.7' - 33.5') SILTY CLAY - Dark brown, moist, firm to hard, silty clay, trace to few very fine to fine sand, occasional coarse sand.	CL		23.5	93.2		34/16/18	0.0	20.9	79.1			
27																		

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Rad levels measured with Ludlum Model 2 meter. Hole backfilled with cement/bentonite grout.
At 8:30 AM on 11/21/13, water was measured at 38.3' bgs (may be due to overnight precipitation as hole was left open overnight).

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B2**

	FIELD SAMPLE RECOVERY DATA								LABORATORY TEST DATA										
DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
28	48"																	
29																		
30	54"	CA 18"	15C	6														
			15B	11														
31			15A	12														
32						(32' - 33.5') Softer (soft to firm).												
33																		
33.5						(33.5' - 38.7') WEATHERED SANDSTONE - Mottled pale yellow and reddish orange, moist, fissile, lightly cemented, very fine to fine sand.												
35	48"	NR		50/ 1"														
36																		
37																		
38					16	Bag sample of SS Core.			13.5	X								
39						E.O.B. = 38.7' (Practical Auger Refusal)												
40																		
41																		
42																		

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Rad levels measured with Ludlum Model 2 meter. Hole backfilled with cement/bentonite grout.
At 8:30 AM on 11/21/13, water was measured at 38.3' bgs (may be due to overnight precipitation as hole was left open overnight).

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B8**

CONTRACTOR INFORMATION	DRILL RIG INFORMATION		BOREHOLE INFORMATION	
DRILLING COMPANY: NATIONAL	DRILLING RIG: CME 85 HD	BIT TYPE: N/A	CASING DEPTH: N/A	START: 12/3/2013
DRILLER: M. CAIN	DRILLING METHOD: HSA/CC	AUGER O.D.: 8.25"	SURFACE ELEV. (FT): 6976.1	FINISH: 12/4/2013
DRILLER'S HELPER: L. ALDAZ	HAMMER TYPE: AUTO	HOLE DIAM.: 8.25"	DEPTH TO BEDROCK (FT): 60.5	
LOGGED BY: R. SCHAUT	HAMMER WT: 140 lb	CORE DIAM.: 3.0"	TOTAL DEPTH (FT): 65.5	

FIELD SAMPLE RECOVERY DATA | LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
0–7						(0' - ~7') SANDY CLAY - Dark brown, slightly moist sandy clay, silty, sand is very fine to fine-grained, occasional coarse sand and fine gravel. (0' - 20' No sampling. Material descriptions based on cuttings and should be considered approximate.)												
7–13						(~7' - ~18') SAND TAILINGS - Predominantly pale yellowish brown, fine to medium grained, slightly moist, some clayey material.												

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

MWH

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B8**

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
14																	
15																	
16																	
17																	
18						(~18' - 20.7') SANDY CLAY - Dark brown, firm to hard, slighly moist sandy clay, very fine to fine sand, few to little coarse sand and fine gravel.											
19																	
20	36"					Begin sampling at 20'											
		AC	8														
21						(20.7' - 26.3') SAND TAILINGS - Pale yellow, medium dense, slightly moist to moist, fine to medium sand tailings, silty.											
22																	
23																	
24																	
25	54"	CA 18"	2C	7				9.0	103.7	2.72							
			2B	7				6.2	99.6			0.0	87.9	12.7	3.6E-4		
26			2A	10			SM	16.8	91.7		NP	0.0	76.0	24.0			
		AC	3B			(26.3' - ~31') FINE TAILINGS - Soft to firm, moist. (26.3' - 28.8') - Pale yellowish brown, few to little very fine sand.											
27																	
		AC	3A														

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B8**

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
28	54"	AC	3A															
29						(28.8' - 31') Pale gray, no sand.												
30	24"	ST 23"	4				CH		61.8	62.7		74/25/49	0.0	9.2	90.8		0.43	
31						(~31' - ~32.5') SAND TAILINGS - Pale yellowish brown, medium dense, moist, fine to medium sand, trace silt.			41.4									
32																		
33		AC	5			(~32.5' - 35') FINE TAILINGS WITH SAND - Pale gray, soft, moist, very fine to fine sand.												
34																		
35	30"	ST 28"	6			(35' - 38.6') CLAYEY/SILTY SAND TAILINGS - Pale yellowish gray, soft, moist, very fine to fine sand.			14.3	90.9	2.66							
									16.5	89.6	2.67					1.6E-5		
36																		
37																		
38		AC	7															
39						(38.6' - 44.5') FINE TAILINGS - Pale gray, firm, moist, trace to few very fine sand.												
40	37"	ST 27"	8															
41									39.7	80.4	2.63							
							SC / CL		34.3	83.6		35/16/19	0.0	51.2	48.8	1.3E-7	0.262	
42																		

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

MWH PROJ. LOC.: GALLUP, NM	CLIENT: GE / UNC NECR - PRE DESIGN STUDY INVESTIGATION	BORING LOG	BOREHOLE ID: **TI-B8**

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	37"	AC	9			(42.5' - 43.7') More sand (little to some).												
43																		
									29.3	92.3								
44									43.3	74.8			0.0	14.5	85.5	3.0E-8		
						(44.5' - 60.5') SILTY/CLAYEY SAND - Predominantly yellowish brown, medium dense, moist silty/clayey very fine to fine sand with abundant clay zones (as shown), occasional coarse sand throughout.					2.60							
45	48"	CA 18"	10C	6														
			10B	9		(44.5' - 47.5') Silty clay with sand.												
46			10A	10			CL		21.9	95.2	2.72	30/16/14	0.0	27.9	72.1			
47																		
48																		
49						(49' - 50') Reddish brown.												
50	40"	CA 18"		9														
			11B	10														
51			11A	12														
52																		
53						(53.4' - 55') Silty clay with sand.												
54																		
55	42"	CA 18"	12C	8														
			12B	8														
56			12A	8			SM		12.6	97.6	2.70	NP	0.0	57.0	43.0			
57																		

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM

CLIENT: NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B8**

FIELD SAMPLE RECOVERY DATA | LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	42"																	
58																		
59						(58.7' - 59.5') Silty clay with sand.												
						(59.5' - 60') Reddish brown, fine to medium sand.												
60	48"	CA 18"	13C	16														
			13B	22		(60.5' - 61') COAL - sandy.												
61			13A	50/ 4"		(61' - E.O.B.) SHALE - Dark grayish brown, hard to very hard, moist, silty, trace very fine sand.												
62																		
63					14	(bagged core)												
64	12"					At 64' - becomes fissile, very hard, brittle, more sand (few to little).												
65		CA 2"	15	50/ 2"		65.2' E.O.B. (Practical Auger Refusal at 65.0')												
66																		
67																		
68																		
69																		
70																		
71																		

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

MWH	CLIENT:		BOREHOLE ID:
PROJ. LOC.: GALLUP, NM	NECR - PRE DESIGN STUDY INVESTIGATION	BORING LOG	TI-B10

CONTRACTOR INFORMATION	DRILL RIG INFORMATION		BOREHOLE INFORMATION	
DRILLING COMPANY: NATIONAL	DRILLING RIG: CME 85 HD	BIT TYPE: N/A	CASING DEPTH: N/A	START: 11/26/2013
DRILLER: M. CAIN	DRILLING METHOD: HSA/CC	AUGER O.D.: 8.25"	SURFACE ELEV. (FT): 6973.3	FINISH: 11/27/2013
DRILLER'S HELPER: J. RAMIREZ	HAMMER TYPE: AUTO	HOLE DIAM.: 8.25"	DEPTH TO BEDROCK (FT): 105.0	
LOGGED BY: R. SCHAUT	HAMMER WT: 140 lb	CORE DIAM.: 3.0"	TOTAL DEPTH (FT): 108.2	

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
0	21"					(0' - 0.6') SANDY CLAY - Light brown, soft, very moist sandy clay, very fine sand, some roots, silty.												
						(0.6' - 0.9') ROCK - 1/2" to 3" crushed basalt.												
1						(0.9' - 6.8') SANDY CLAY - Dark brown, hard, slighly moist to moist sandy clay, very fine to fine sand, occasional coarse sand to fine gravel, silty.												
5	45"	CA 17"		12														
			1B	13														
6			1A	19														
7						(6.8' - 18.9') SILTY SAND TAILINGS - Pale yellowish gray, loose to medium dense, moist, fine to medium, silty sand tailings, occasional more clayey/silty zones.												
10	33"	ST 27.5"	2						9.7	110.0	2.63							
									9.0	96.8			0.2	71.9	27.9	4.3E-4	0.094	
12.5		AC	3						6.7		2.61							
13									7.5	99.1			0.7	71.5	27.8	6.7E-5		

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B10**

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	33"	AC	3														
15	42"	CA 18"	4C	5				9.3	103.0								
			4B	5													
16			4A	5			SM	6.5	100.0	2.65	NP	2.4	82.3	15.3			
		AC	5B														
		AC	5A														
19						(18.9' - 24.4') FINE TAILINGS - Pale gray, soft, moist, trace to few fine to medium sand.											
20	36"	ST 30"	6														
							CL	26.7	92.9		43/19/24	0.0	43.0	57.0		0.111	
		AC	7														
						(24.4' - 25.7') SAND TAILINGS - Pale yellowish gray, loose, moist to very moist, fine to medium sand.											
25	42"	CA 18"	8C	2													
			8B	2		(25.7' - ~31') FINE TAILINGS - Pale gray, soft, moist to very moist, trace to few fine to medium sand.		41.0									
26			8A	3			CH	57.4	64.3	2.80	74/27/47	0.0	10.0	90.0			
		AC	9B														
		AC	9A														

Depth scale: 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27

LEGEND:
CA = CALIFORNIA SAMPLE (2-INCH OD)
ST = SHELBY TUBE (3-INCH OD)
AC = ACRYLIC LINER
HSA = HOLLOW-STEM AUGER
CC = CONTINUOUS CORE
NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

MWH

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B10**

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
28	42"	AC	9A														
29																	
30	42"	ST 27"	10				CH	45.3	73.4	2.78	57/22/35	0.0	24.3	75.7			
31						(~31' - 33.2') SAND TAILINGS - See description for 24.4' - 25.7'.											
32							SM	15.4	100.1	2.67	NP	0.0	83.1	16.9			
		AC	11														
33						(33.2' - 44.6') FINE TAILINGS - Pale gray, soft, moist to very moist.											
34																	
35	48"	CA 18"	12C	2				47.7	72.5								
			12B	2				51.4									
36			12A	2			SC / CL	32.2	87.8	2.72	36/16/20	0.0	50.6	49.4			
						(36.3' - 37.8') Some very fine to fine sand.											
		AC	13B														
37																	
		AC	13A														
38																	
39																	
40	30"	ST 30"	14					45.7	73.7	2.56							
							CH	47.2	74.5		61/21/40	0.0	20.7	79.3	2.9E-8	0.315	
41																	
42																	

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

MWH

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B10**

FIELD SAMPLE RECOVERY DATA | LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
42.5	30"	ST 30" AC	14 / 15															
44.3						(44.3' - 44.6') Appears finer grained (clayey), lighter gray, more moist.												
44.6						(44.6' - 85.5') SILTY SAND - Light brown, medium dense, moist, silty very fine to fine sand, occasional coarse sand and fine gravel.												
45	42"	CA 17"		12														
45.5			16B	12														
46			16A	14					9.9	95.4	2.74		0.0	65.8	34.2			
50	48"	CA 18"	17B	10														
50.5			17A	11														
51				14														
55	42"	ST 17"	18						14.1	100.8						2.4E-5	0.139	
56						(~56' - 57.5') Gravelly.												
56.5						(Shelby Tube refusal at 56.5')												

Depth scale: 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B10**

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	42"																	
58																		
59																		
60	39"	CA 18"		11														
			19B	11														
61			19A	14														
62																		
						(62.5' - 65.2') Weathered Sandstone (?) - Hard, moist, gravelly.												
63																		
64																		
65	48"	CA 18"		14														
			20B	14			SM											
66			20A	15			/		13.8	94.5		NP	0.0	50.1	49.9			
							ML											
67																		
68																		
69																		
70	30"	CA 18"		4														
			21B	6		(70.5' - 71.5') Moist to very moist, increased clay.												
71			21A	10					18.1	100.8								

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM

CLIENT: NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B10**

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
72	30"																	
73																		
74																		
75	42"	CA 18"	22B	5														
			22A	7														
76				11														
77																		
78																		
79																		
80	36"	CA 18"	23B	9		(80' - 82') Gravelly (sandstone fragments)												
			23A	14														
81				17														
82						(82' - 85.5') Weathered Sandstone - Mottled red/gray/brown, moist, fine to medium weathered sandstone.												
83																		
84	NA	3"	24	50/ 3"														
85	50"																	
86						(85.5' - 105') CLAYEY SAND - Dark brown, firm, very moist to wet, fine to medium clayey sand, occasional sandstone fragments.												

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM	CLIENT: NECR - PRE DESIGN STUDY INVESTIGATION	BORING LOG	BOREHOLE ID: **TI-B10**

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	50"																	
87																		
88																		
89																		
90	40"	CA 18"		7		[CA sampler wet 11/26/13.] [Water measured at approximately 90.2' bgs at 9:30 11/27/13.]												
			25B	12														
91			25A	10					18.6	105.6	2.66							
92																		
						[Core barrel wet 11/27/13.]												
93																		
94																		
95	52"	NR		1														
				5														
96				8														
97																		
						[Core barrel wet.]												
98																		
99																		
100	44"																	
101																		

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	44"																	
102						[Core barrel wet.]												
103																		
104																		
105	36"					(105' - E.O.B.) WEATHERED SANDSTONE - Pale yellowish brown, very dense, very moist, very fine to fine sandstone, some cemented zones.												
106						[Core barrel wet.]												
107					26	(106.9' - 107.3') Bagged core sample.			14.2	109.1						1.4E-7		
108		1"		50/ 1.5"	27	(107.9' - 108') Bagged core sample. (108') CA sample not retained.												
						E.O.B. = 108.2 ft at 9:00 on 11/27/13 (practical auger refusal)												
109																		
110																		
111																		
112																		
113																		
114																		
115																		

LEGEND:
CA = CALIFORNIA SAMPLE (2-INCH OD)
ST = SHELBY TUBE (3-INCH OD)
AC = ACRYLIC LINER
HSA = HOLLOW-STEM AUGER
CC = CONTINUOUS CORE
NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

MWH

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B11**

CONTRACTOR INFORMATION	DRILL RIG INFORMATION		BOREHOLE INFORMATION	
DRILLING COMPANY: NATIONAL	DRILLING RIG: CME 85 HD	BIT TYPE: N/A	CASING DEPTH: N/A	START: 12/2/2013
DRILLER: M. CAIN	DRILLING METHOD: HSA/CC	AUGER O.D.: 8.25"	SURFACE ELEV. (FT): 6977.3	FINISH: 12/3/2013
DRILLER'S HELPER: J. RAMIREZ	HAMMER TYPE: AUTO	HOLE DIAM.: 8.25"	DEPTH TO BEDROCK (FT): 96.9	
LOGGED BY: R. SCHAUT	HAMMER WT: 140 lb	CORE DIAM.: 3.0"	TOTAL DEPTH (FT): 103.0	

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
0	19"					(0' - 0.6') SANDY CLAY - Brown, soft, moist to very moist sandy clay, very fine to fine sand, roots, silty.												
						(0.6' - 0.9') ROCK - 1/2" to 3" crushed basalt, silty clay in voids.												
1						(0.9' - 10.3') SANDY CLAY - Dark brown, hard, slightly moist sandy clay, very fine to fine sand, occasional coarse sand and gravel up to 1.5".												
2																		
3																		
4																		
5	30"	CA 17"	1C	12														
			1B	16														
6			1A	15					8.6	93.5								
7																		
8																		
9																		
10	42"	CA 18"	2C	7														
			2B	7		(10.3' - 12') SILTY SAND - Light brown, medium dense, slightly moist, silty very fine to fine sand.												
11			2A	8														
12						(12' - 15') SANDY CLAY - Dark brown, firm to hard, slightly moist sandy clay, very fine to fine sand, occasional gravel up to 3" size.												
13																		

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

MWH

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B11**

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	42"																	
14																		
15	45"	ST 13"	3			(15' - 18') CLAYEY SAND - Light yellowish brown, medium dense, slightly moist, fine to medium clayey sand, occasional gravel up to 1".			8.2	110.4	2.67		3.9	57.6	38.5	2.5E-5	0.09	
16																		
17																		
18						(18' - 32.9') SANDY CLAY - Predominantly dark brown, hard, slighly moist sandy clay, silty, very fine to medium sand, few to little coarse sand and gravel up to ~1" size.												
19						(19.2' - 19.4') Sand, very fine to fine.												
20	48"	CA 18"	4C	4														
			4B	7														
21			4A	10					12.3	107.6								
22																		
23																		
24																		
25	56"	CA 18"	5C	7														
			5B	8														
26			5A	13														
27																		

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
28	56"																
30	47"	ST 21"	6				CL	13.7	112.4		30/13/17	7.1	41.3	51.6	9.0E-7	0.06	
32.9						(32.9' - 34') SAND (TAILINGS?) - Pale yellowish gray, slightly moist, fine to medium sand.											
34	NA					(34' - 45.5') SANDY CLAY WITH GRAVEL - Dark brown, firm to hard, moist sandy clay with very fine to coarse sand and gravel up to ~3", some metallic and fibrous debris. [34' - 38' Drilling through metallic debris (appers to be metal siding). Center bit required to penetrate debris. No core collected. CA sample attempted at 34' and 35' - no penetration or recovery.]											
40	51"	CA 3"		25 27 22		[Metallic debris in CA shoe - no sample.]											

LEGEND:
CA = CALIFORNIA SAMPLE (2-INCH OD)
ST = SHELBY TUBE (3-INCH OD)
AC = ACRYLIC LINER
HSA = HOLLOW-STEM AUGER
CC = CONTINUOUS CORE
NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
42.5	51"																
45	60"	CA 18"	7C	7		(Photo 310 at 46'.)											
45.5			7B	7		(45.5' - 53.9') FINE TAILINGS - Mottled orange and dark greenish gray (to 50'), pale yellowish gray (50' - 53.9'), firm, moist tailings. [Photo 311 at 46.5'.]		88.7									
46			7A	8													
50	43"	ST 28"	8														
51.5							CH	59.9	63.7	2.84	91/30/61	0.0	2.7	97.3	3.1E-8	0.48	
52.5		AC	9			[Photo 312 at 52.5']											
53.9						(53.9' - 55') SILTY CLAY - Dark brown, hard, moist silty clay, trace very fine sand.											
55	48"	ST 25"	10			(55' - 77.5') SILTY SAND - Yellowish brown, medium dense, slighly moist to moist, silty, very fine to fine sand.											
56							SM	16.2	77.9	2.64	NP	0.0	60.4	39.6	5.6E-4	0.129	

LEGEND:
CA = CALIFORNIA SAMPLE (2-INCH OD)
ST = SHELBY TUBE (3-INCH OD)
AC = ACRYLIC LINER
HSA = HOLLOW-STEM AUGER
CC = CONTINUOUS CORE
NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

CLIENT:

PROJ. LOC.: GALLUP, NM

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B11**

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	48"	AC	11															
58																		
59																		
60	48"	CA 17"		9														
			12B	11														
61			12A	12		(61.1' - 62.1') Sandy clay.			16.0	95.4			0.0	38.7	61.3			
62																		
63						(63.1' - 64') Sandy clay.												
64																		
65	49"	CA 18"	13C	7														
			13B	7														
66			13A	12					14.2	96.2								
67																		
68																		
69																		
70	44"	CA 18"	14C	7														
			14B	9														
71			14A	10														

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
72	44"																	
						(71.5' - 73.5') Abundant clayey sand zones.												
73																		
74																		
75	38"	CA 18"	15C	7														
			15B	8														
76			15A	11														
77																		
					16	(77.5' - 78') WEATHERED SANDSTONE - Rusty red, moist, fine to medium grained. (Sample #16 is bagged core.)												
78						(78' - 96.9') GRAVELLY SAND - Mottled rusty red/brown/yellow, dense, moist fine to medium sand, silty throughout, some clayey zones, abundant coarse material from coarse sand up to 3" gravel comprised of cemented sandstone.												
79																		
80	42"	CA 18"	17C	16														
			17B	21														
81			17A	21					11.0	107.6	2.76		12.9	65.6	21.5			
82																		
83																		
84																		
85	36"	CA 17"	18C	18														
			18B	21														
86			18A	19														

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM

CLIENT: NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B11**

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	36"					(~86.7' - 87.2) Clayey.												
90	48"	NR		3, 5, 6		(~90' to 96.9') Becomes very moist to wet.												
92						(92' - 92.5') Clayey. [Core barrel is wet.]												
95	55"	CA 14"	19B, 19A	13, 20, 18														
97						(96.9' - E.O.B.) WEATHERED SANDSTONE - Pale yellowish brown, very dense, moist to very moist, fissile, fine-grained, weakly cemented.												
98					21	(98' - 98.3') Bagged core sample.												
100		CA 2"	20A	50/ 2"					21.1	103.9						1.3E-5		

LEGEND:
CA = CALIFORNIA SAMPLE (2-INCH OD)
ST = SHELBY TUBE (3-INCH OD)
AC = ACRYLIC LINER
HSA = HOLLOW-STEM AUGER
CC = CONTINUOUS CORE
NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM	CLIENT: NECR - PRE DESIGN STUDY INVESTIGATION	BORING LOG	BOREHOLE ID: TI-B11

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
102						(102.5' - 103') Reddish brown, strongly cemented sandstone.												
103						E.O.B. at 103.0' at 10:00 (practical auger refusal)												
104																		
105																		
106																		
107																		
108																		
109																		
110																		
111																		
112																		
113																		
114																		
115																		

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B15**

CONTRACTOR INFORMATION	DRILL RIG INFORMATION		BOREHOLE INFORMATION	
DRILLING COMPANY: NATIONAL	DRILLING RIG: CME 85 HD	BIT TYPE: N/A	CASING DEPTH: N/A	START: 12/5/2013
DRILLER: M. CAIN	DRILLING METHOD: HSA/CC	AUGER O.D.: 8.25"	SURFACE ELEV. (FT): 6976.8	FINISH: 12/5/2013
DRILLER'S HELPER: L. ALDAZ	HAMMER TYPE: AUTO	HOLE DIAM.: 8.25"	DEPTH TO BEDROCK (FT): N/A	
LOGGED BY: R. SCHAUT	HAMMER WT: 140 lb	CORE DIAM.: 3.0"	TOTAL DEPTH (FT): 71.5	

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
0	18"					(0' - 0.5') SANDY CLAY - Brown, soft, moist to very moist sandy clay, very find sand, roots.												
0.5						(0.5' - 0.8') ROCK - Crushed basalt, up to 3" size, sandy clay in voids.												
0.8						(0.8' - ~3') SANDY CLAY - Dark yellowish brown, hard, moist sandy clay, very fine to fine sand.												
3						(~3' - 30') SILTY SAND TAILINGS - Pale yellowish gray, loose to medium dense, moist, fine to medium sand.												
5	30"	CA 18"	1C	10														
			1B	11														
6			1A	12					5.4	101.1			0.0	87.5	12.5			
6.5		AC	2															
10	30"	CA 18"		3														
			3B	3														
11			3A	3					6.8	93.8								
11.5			4															

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	30"	AC	4			(13.5' - 13.8') Silty sand tailings.	SM		19.0		2.68	NP	0.0	69.6	30.4			
14																		
15	32"	ST 27"	5				SM		14.2	90.4	2.66	NP	0.0	54.9	15.1	8.3E-4	0.126	
16																		
17		AC	6															
18																		
19						(~19.5' to ~25') Becomes slightly finer grained (very fine to medium sand), slightly clayey.												
20	28"	CA 18"	7C	3														
			7B	2														
21			7A	4			SM		12.7	99.8	2.68	NP	0.0	80.6	19.4			
		AC	8															
22																		
23																		
24																		
25	27"	ST 23"	9															
26																		
27		AC	10			(~27' and below) Becomes clayey.												

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B15**

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
28	27"	AC	10			(~28.5' - 30') Very fine to fine sand	SM	19.3		2.66	NP	0.0	65.4	34.6			
30	36"	CA 18"	11C	6		(30' - ~32') SILTY SAND - Dark brown, medium dense, moist silty sand, very fine to fine sand.											
			11B	7													
31			11A	10			SM	22.3 / 17.1	101.8	2.71	NP	6.2	51.9	41.9			
32		AC	12			(~32' - 38') SILTY CLAY - Dark brown, firm to hard, moist silty clay, trace to few very fine to fine sand.											
35	40"	CA 18"	13C	8													
			13B	12													
36			13A	15													
38						(38' - 45') CLAYEY SAND - Yellowish brown, medium dense, moist clayey very fine to fine sand, silty, occasional 1-6" sandy clay zones.											
40	48"	CA 18"		10													
			14B	9													
41			14A	12				11.4	87.1								

LEGEND:
CA = CALIFORNIA SAMPLE (2-INCH OD)
ST = SHELBY TUBE (3-INCH OD)
AC = ACRYLIC LINER
HSA = HOLLOW-STEM AUGER
CC = CONTINUOUS CORE
NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B15**

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	48"																	
43																		
44																		
45	26"	CA 18"	15C	13		(45' - 50') SANDY SILT - Dark yellowish brown, hard, moist, very fine to fine sand, occasional clayey sand zones.												
			15B	25														
46			15A	26					25.8									
									17.3	99.3	2.81	NP	0.0	37.0	63.0			
47																		
48																		
49																		
50	24"	CA 18"	16C	6		(50' - 52') CLAYEY SAND - Yellowish brown, medium dense, moist, very fine to fine sand, silty.												
			16B	8														
51			16A	11														
52						(52' - 65') SILTY CLAY - Dark yellowish brown, firm to hard, moist silty clay, trace to few very fine to fine sand, occasional thin (1-6") clayey sand zones.												
53						(~53' - 55') Very hard, very dense clay.												
54																		
55	18"	CA 18"	17C	10														
			17B	11														
56			17A	12					11.7	104.2								
57																		

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

MWH

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B15**

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	18"																	
58																		
59																		
60	60"	CA 18"	18C	8														
			18B	11														
61			18A	15														
62																		
63																		
64																		
65	40"	CA 18"		6		(65' - E.O.B.) CLAYEY SAND - Yellowish brown, medium dense, moist, very fine to fine clayey sand, silty, occasional 1-3" zones of sandy clay.												
			19B	8														
66			19A	10					12.7	100.7								
67																		
68																		
69																		
70		CA 18"		7														
			20B	6														
71			20A	9														
						E.O.B. 71.5' at 14:30												

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

ATTACHMENT D

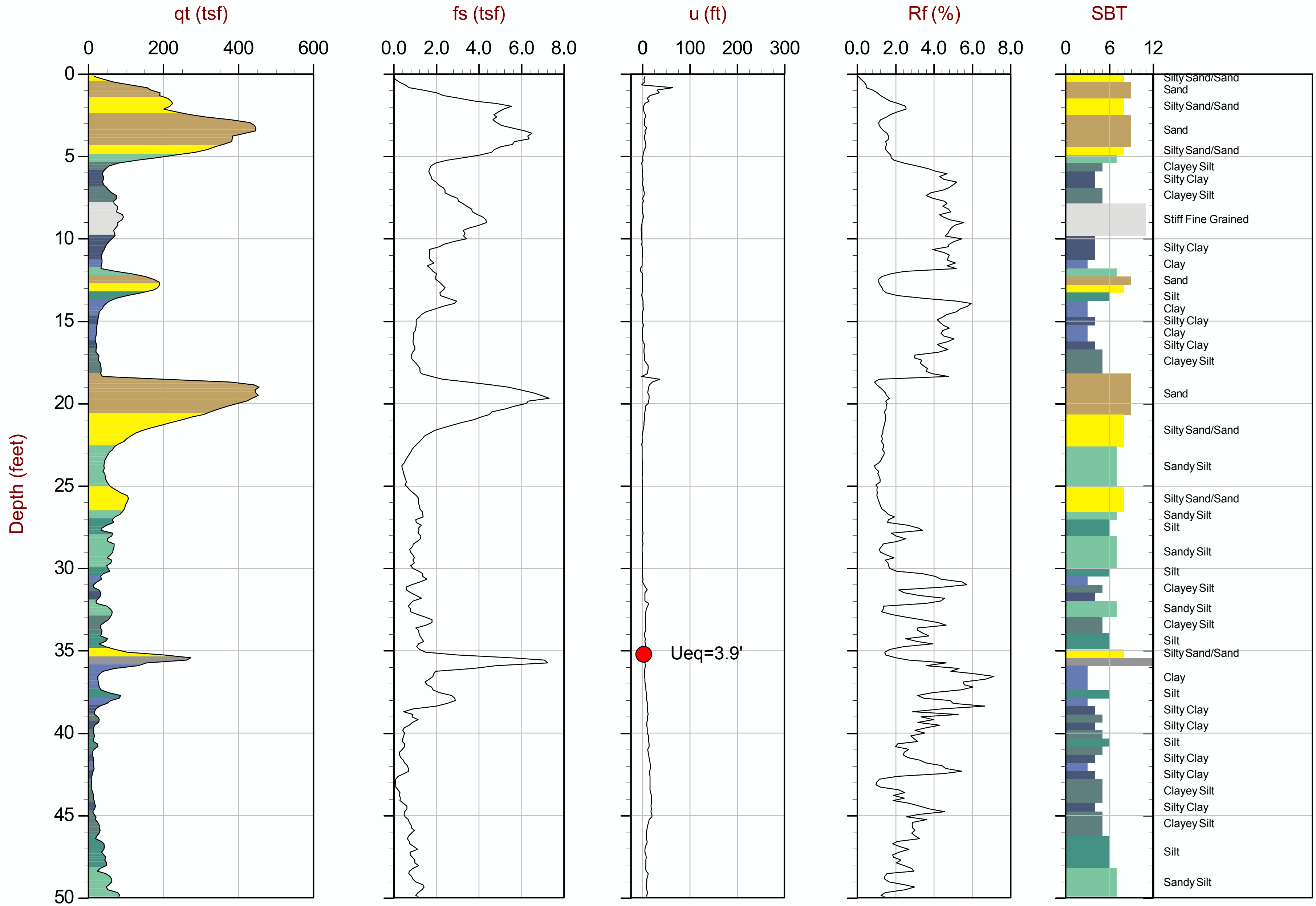
TAILINGS DISPOSAL AREA CONE PENETRATION TEST RESULTS (MWH, 2014A)

CONETEC

MWH Americas

Job No: 13-52118
Date: 11:07:13 15:36
Site: CHURCH ROCK MILL SITE TSF

Sounding: RCPT-01
Cone: 155:T1500F15U500



Max Depth: 26.950 m / 88.42 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.150 m

File: 13-52118_RP01.COR
Unit Wt: SBT Chart Soil Zones

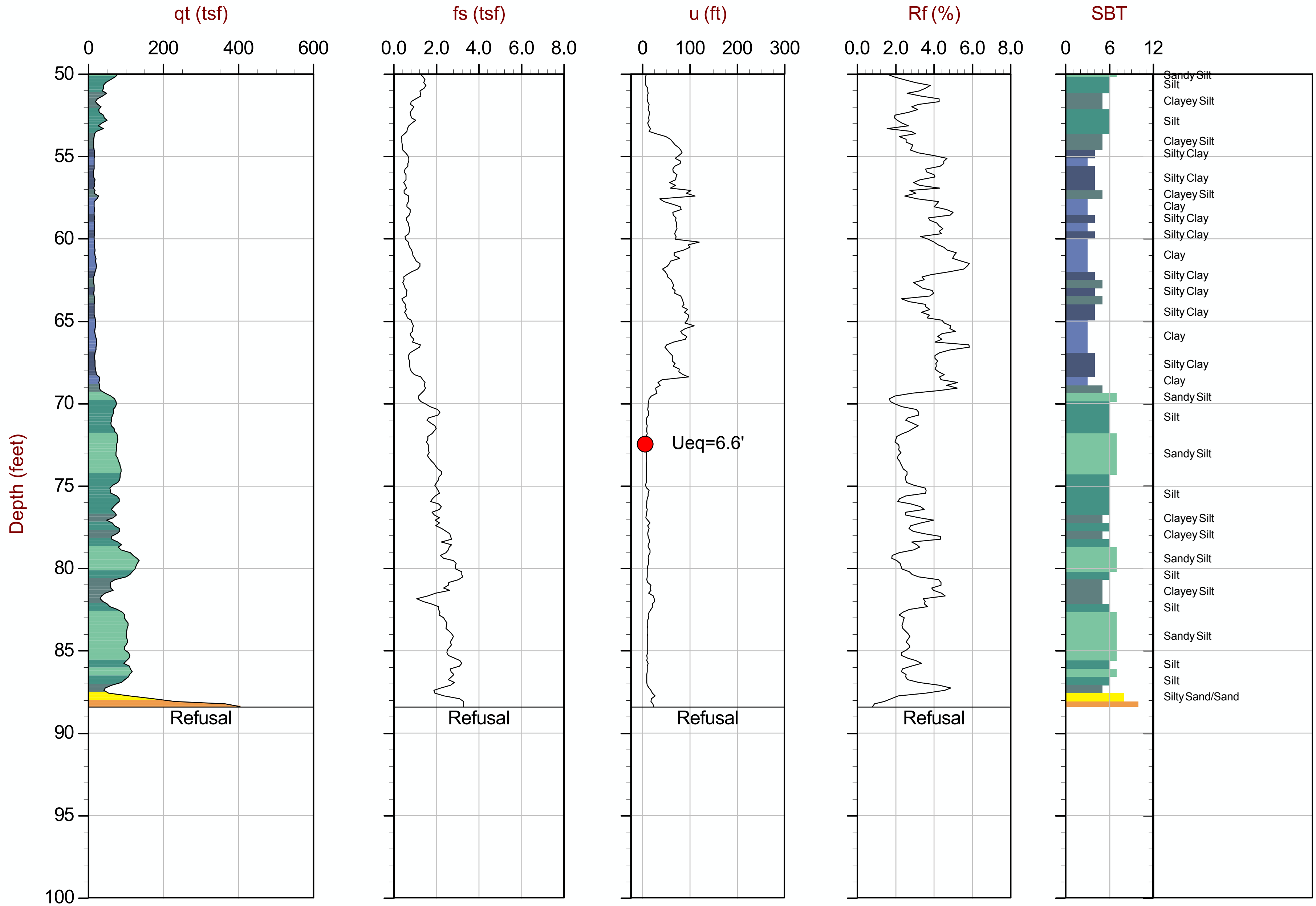
SBT: Lunne, Robertson and Powell, 1997
Coords: Lat: 35.649117 Long: -108.501667
Equilibrium Pore Pressure from Dissipation

CONETEC

MWH Americas

Job No: 13-52118
Date: 11:07:13 15:36
Site: CHURCH ROCK MILL SITE TSF

Sounding: RCPT-01
Cone: 155:T1500F15U500



Max Depth: 26.950 m / 88.42 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.150 m

File: 13-52118_RP01.COR
Unit Wt: SBT Chart Soil Zones

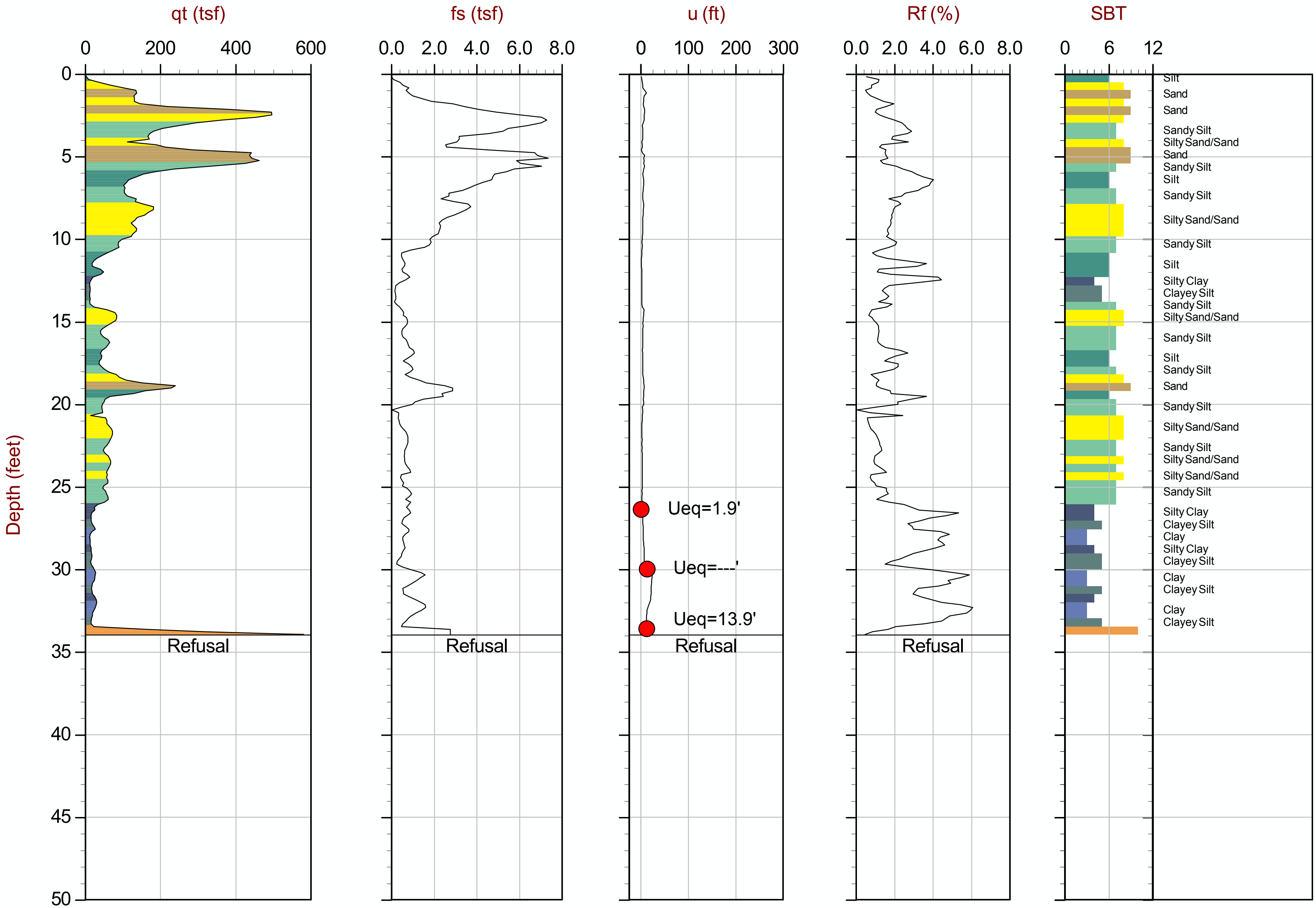
SBT: Lunne, Robertson and Powell, 1997
Coords: Lat: 35.649117 Long: -108.501667
Equilibrium Pore Pressure from Dissipation

CONETEC

MWH Americas

Job No: 13-52118
Date: 11:05:13 13:37
Site: CHURCH ROCK MILL SITE TSF

Sounding: RCPT-02
Cone: 155:T1500F15U500



Max Depth: 10.350 m / 33.96 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.150 m

File: 13-52118_RP02.COR
Unit Wt: SBT Chart Soil Zones

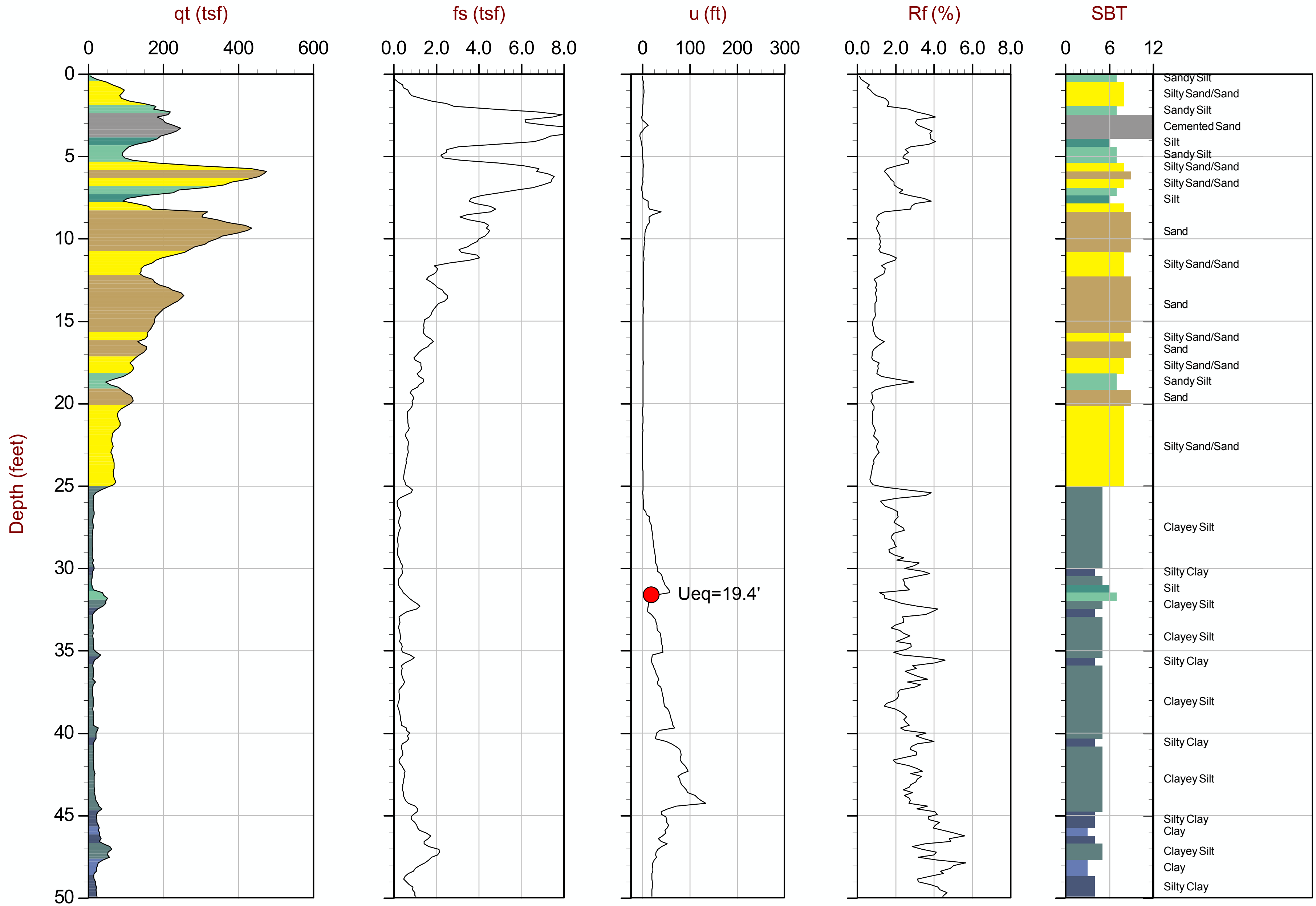
SBT: Lunne, Robertson and Powell, 1997
Coords: Lat: 35.650200 Long: -108.499750
Equilibrium Pore Pressure from Dissipation

CONETEC

MWH Americas

Job No: 13-52118
Date: 11:07:13 08:21
Site: CHURCH ROCK MILL SITE TSF

Sounding: RCPT-08
Cone: 155:T1500F15U500



Max Depth: 18.550 m / 60.86 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.150 m

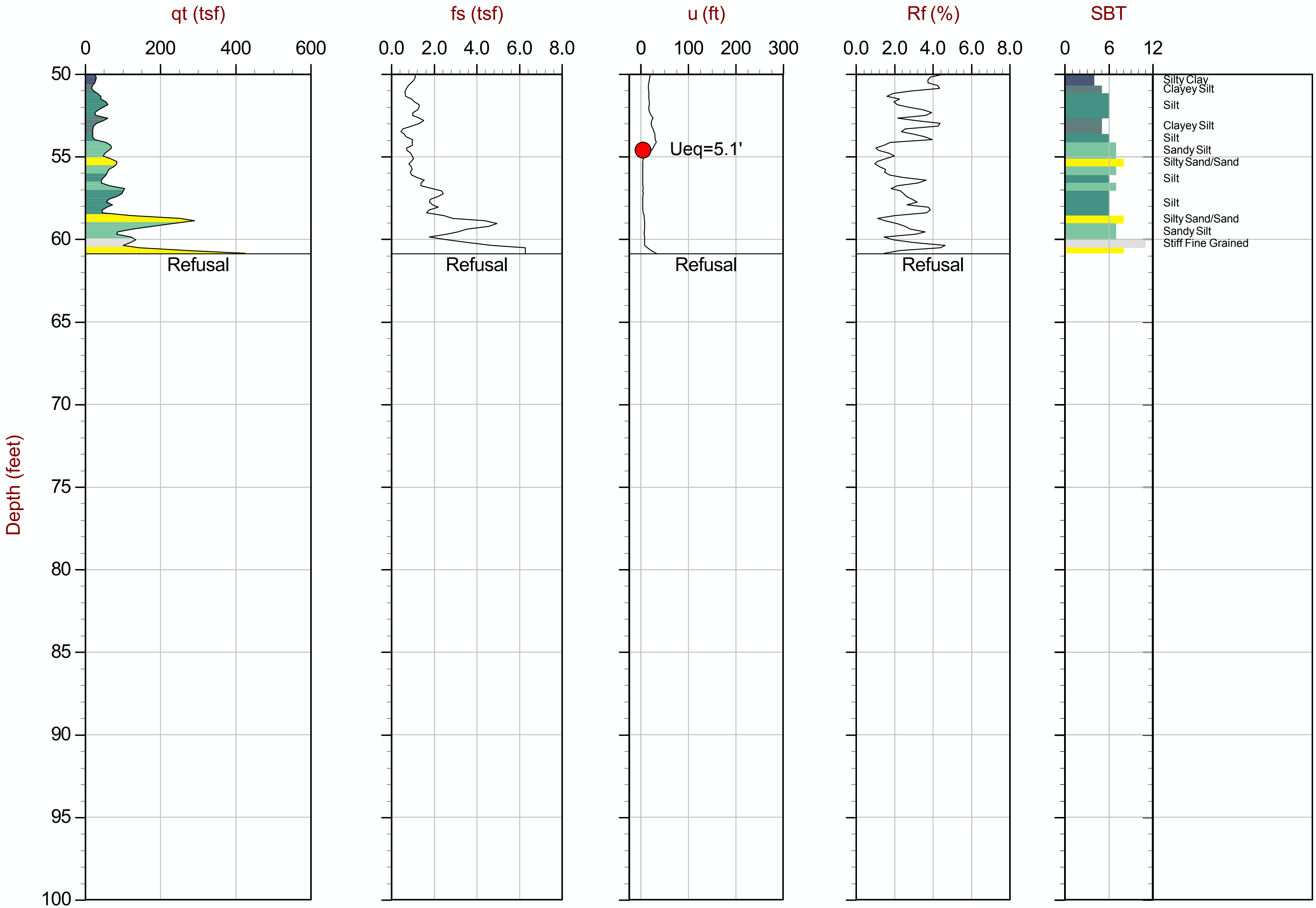
File: 13-52118_RP08.COR
Unit Wt: SBT Chart Soil Zones

SBT: Lunne, Robertson and Powell, 1997
Coords: Lat: 35.647250 Long: -108.497250
● Equilibrium Pore Pressure from Dissipation

CONETEC

MWH Americas

Job No: 13-52118
Date: 11:07:13 08:21
Site: CHURCH ROCK MILL SITE TSF
Sounding: RCPT-08
Cone: 155:T1500F15U500



Max Depth: 18.550 m / 60.86 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.150 m

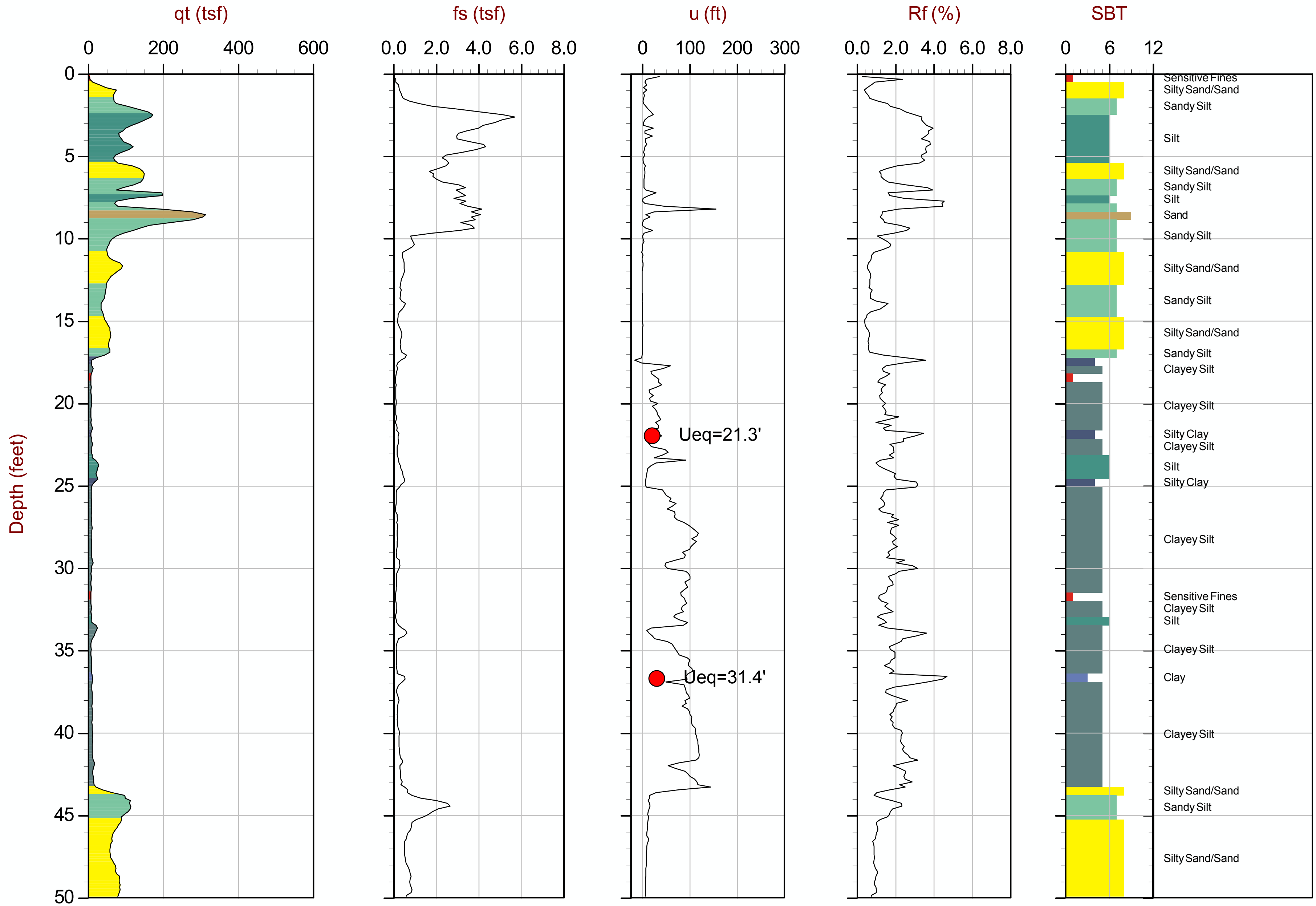
File: 13-52118_RP08.COR
Unit Wt: SBT Chart Soil Zones

SBT: Lunne, Robertson and Powell, 1997
Coords: Lat: 35.647250 Long: -108.497250
Equilibrium Pore Pressure from Dissipation

CONETEC

MWH Americas

Job No: 13-52118
Date: 11:06:13 10:23
Site: CHURCH ROCK MILL SITE TSF
Sounding: RCPT-10
Cone: 155:T1500F15U500



Max Depth: 19.250 m / 63.16 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.150 m

File: 13-52118_RP10.COR
Unit Wt: SBT Chart Soil Zones

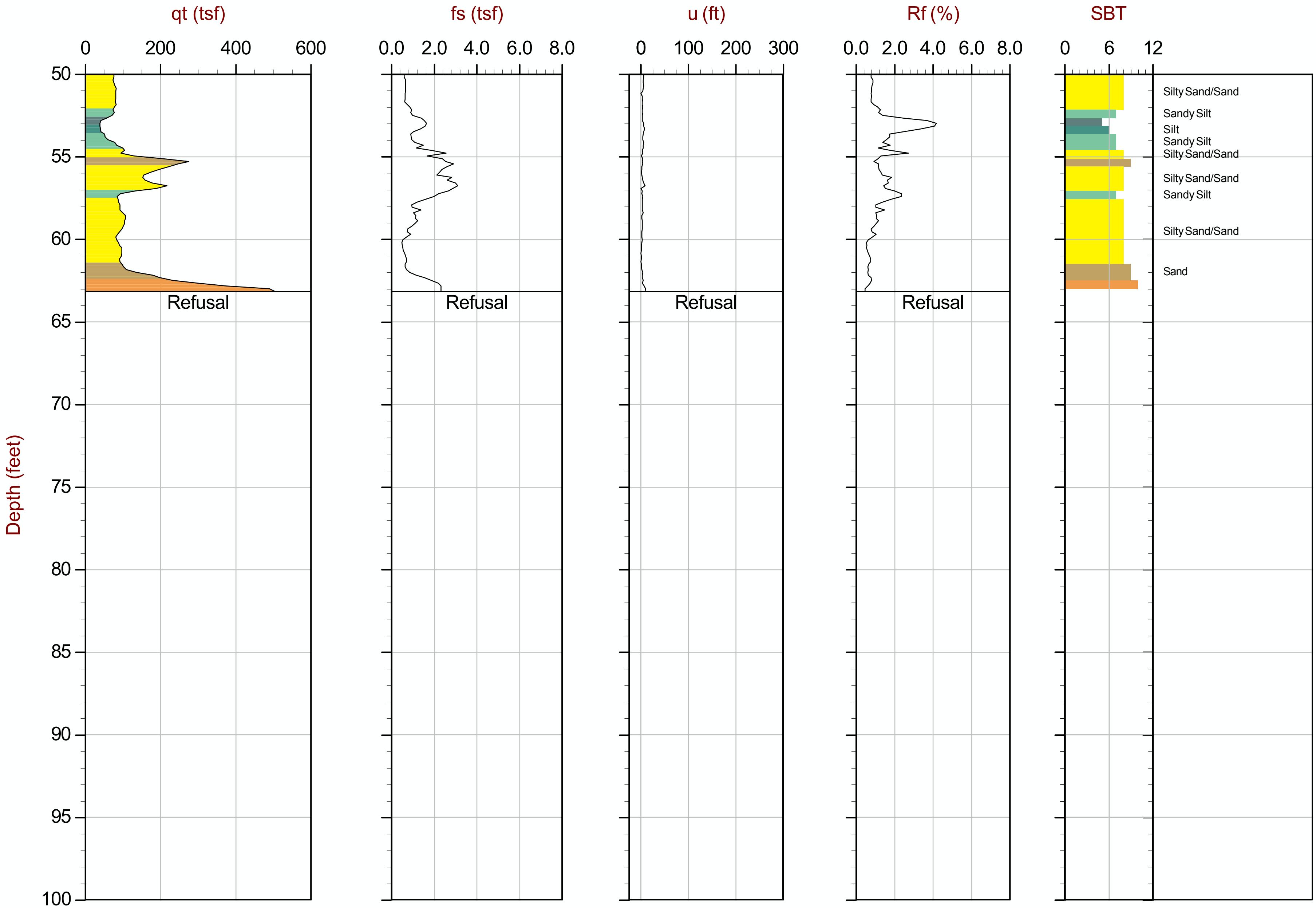
SBT: Lunne, Robertson and Powell, 1997
Coords: Lat: 35.647833 Long: -108.497217
Equilibrium Pore Pressure from Dissipation

ConeTec

MWH Americas

Job No: 13-52118
Date: 11:06:13 10:23
Site: CHURCH ROCK MILL SITE TSF

Sounding: RCPT-10
Cone: 155:T1500F15U500



Max Depth: 19.250 m / 63.16 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.150 m

File: 13-52118_RP10.COR
Unit Wt: SBT Chart Soil Zones

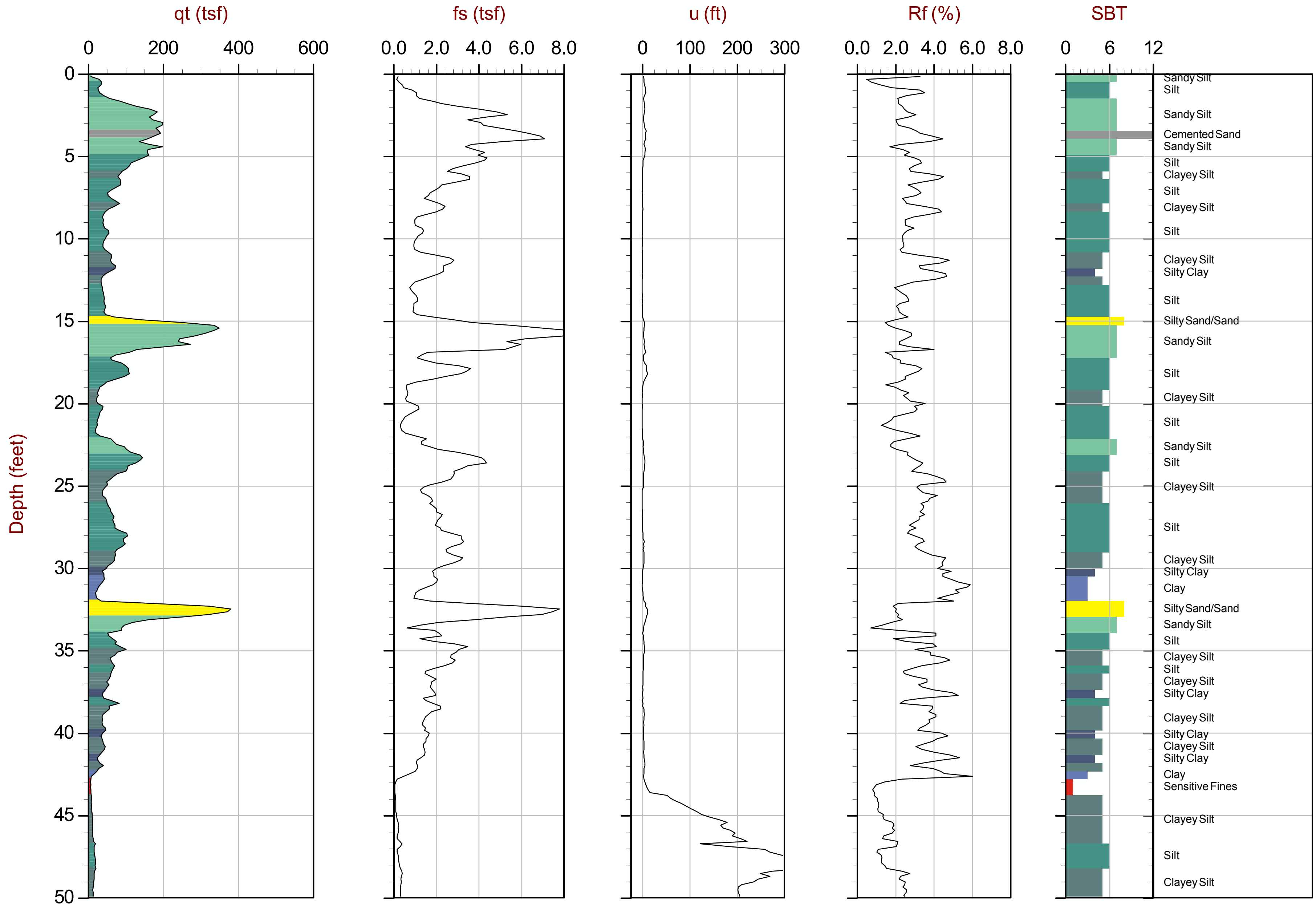
SBT: Lunne, Robertson and Powell, 1997
Coords: Lat: 35.647833 Long: -108.497217
Equilibrium Pore Pressure from Dissipation

CONETEC

MWH Americas

Job No: 13-52118
Date: 11:07:13 12:13
Site: CHURCH ROCK MILL SITE TSF

Sounding: RCPT-11
Cone: 155:T1500F15U500



Max Depth: 29.500 m / 96.78 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.150 m

File: 13-52118_RP11.COR
Unit Wt: SBT Chart Soil Zones

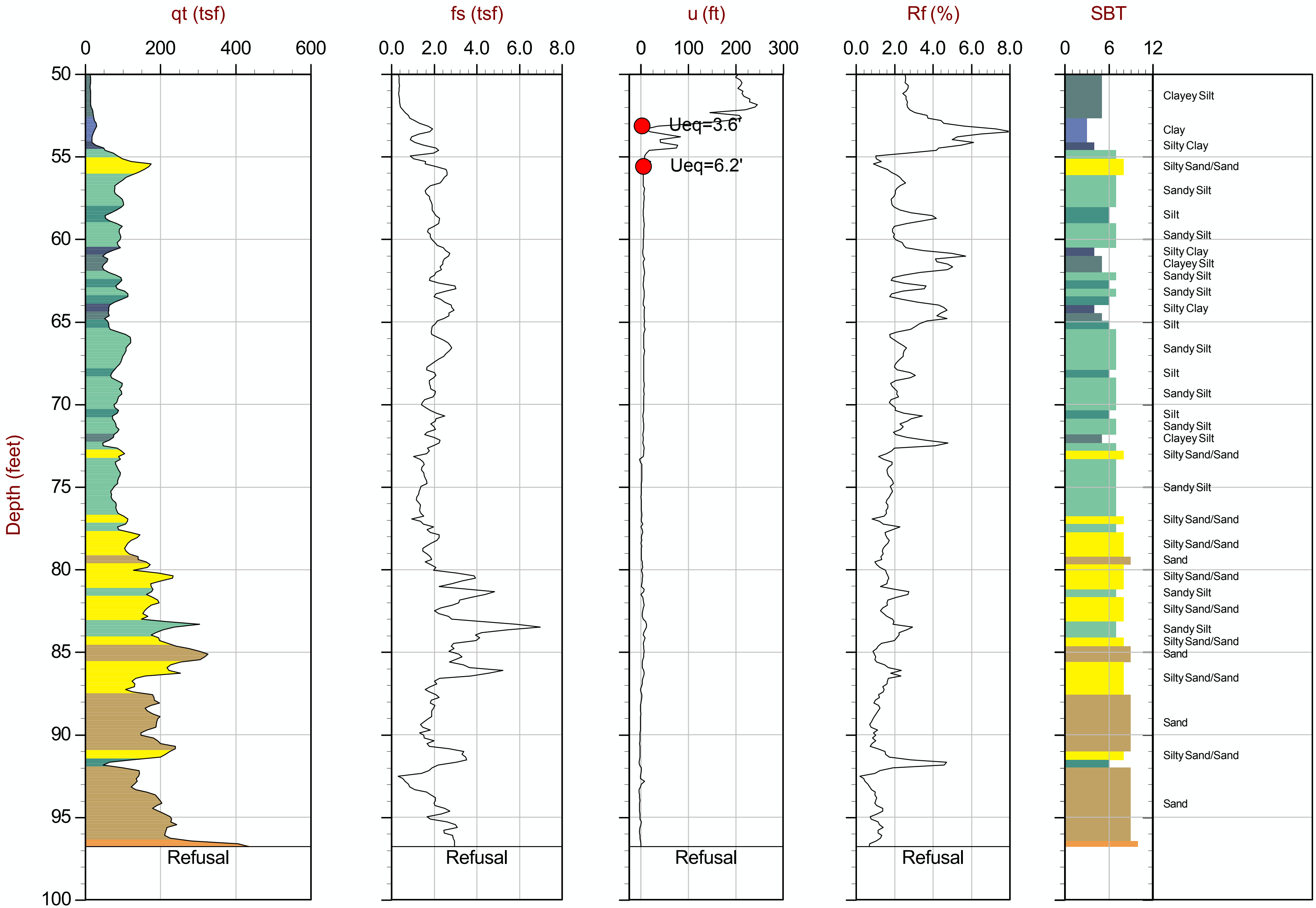
SBT: Lunne, Robertson and Powell, 1997
Coords: Lat: 35.647650 Long: -108.495850
Equilibrium Pore Pressure from Dissipation

CONETEC

MWH Americas

Job No: 13-52118
Date: 11:07:13 12:13
Site: CHURCH ROCK MILL SITE TSF

Sounding: RCPT-11
Cone: 155:T1500F15U500



Max Depth: 29.500 m / 96.78 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.150 m

File: 13-52118_RP11.COR
Unit Wt: SBT Chart Soil Zones

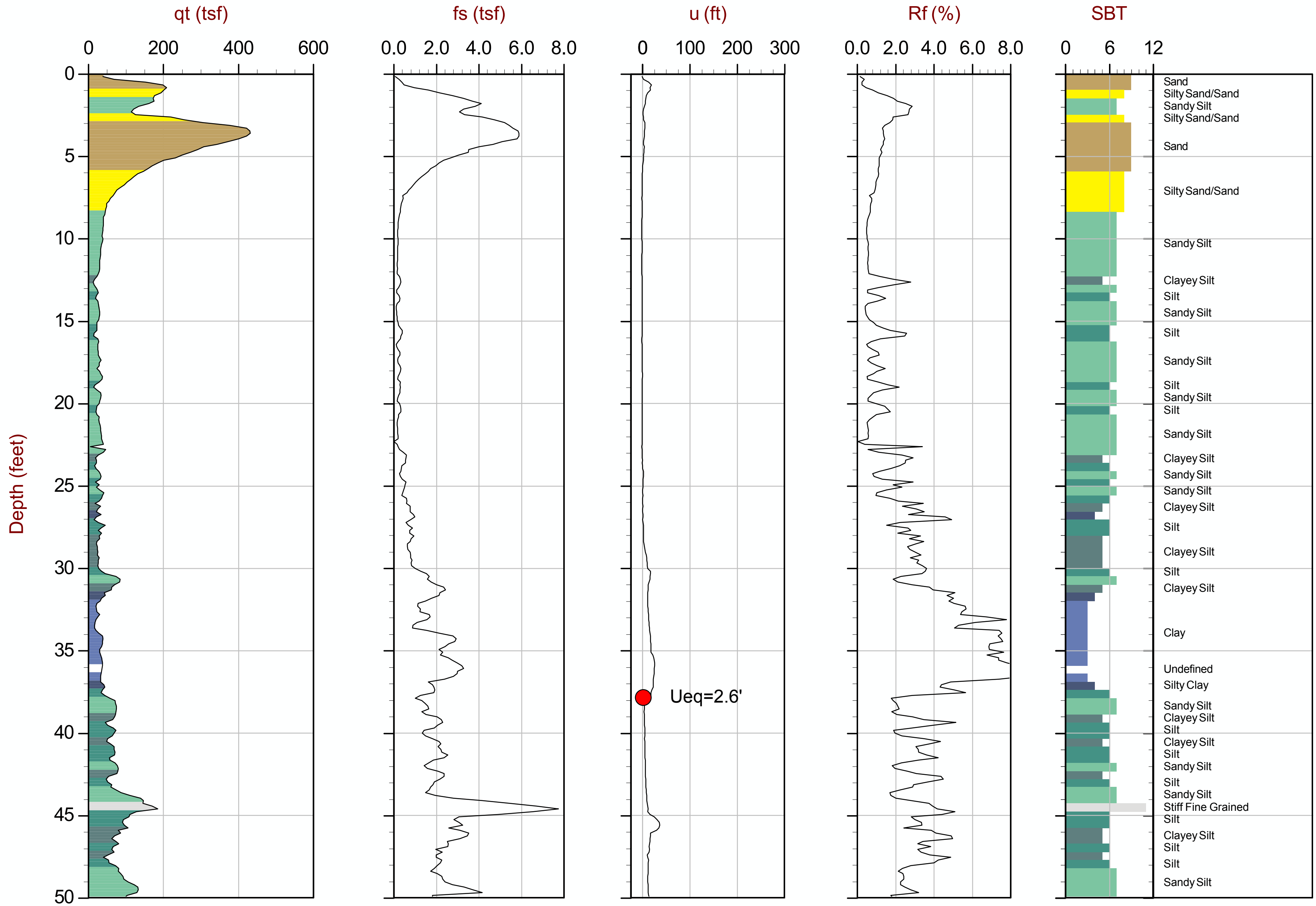
SBT: Lunne, Robertson and Powell, 1997
Coords: Lat: 35.647650 Long: -108.495850
Equilibrium Pore Pressure from Dissipation

CONETEC

MWH Americas

Job No: 13-52118
Date: 11:06:13 16:32
Site: CHURCH ROCK MILL SITE TSF

Sounding: RCPT-15
Cone: 155:T1500F15U500



Max Depth: 16.800 m / 55.12 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.150 m

File: 13-52118_RP15.COR
Unit Wt: SBT Chart Soil Zones

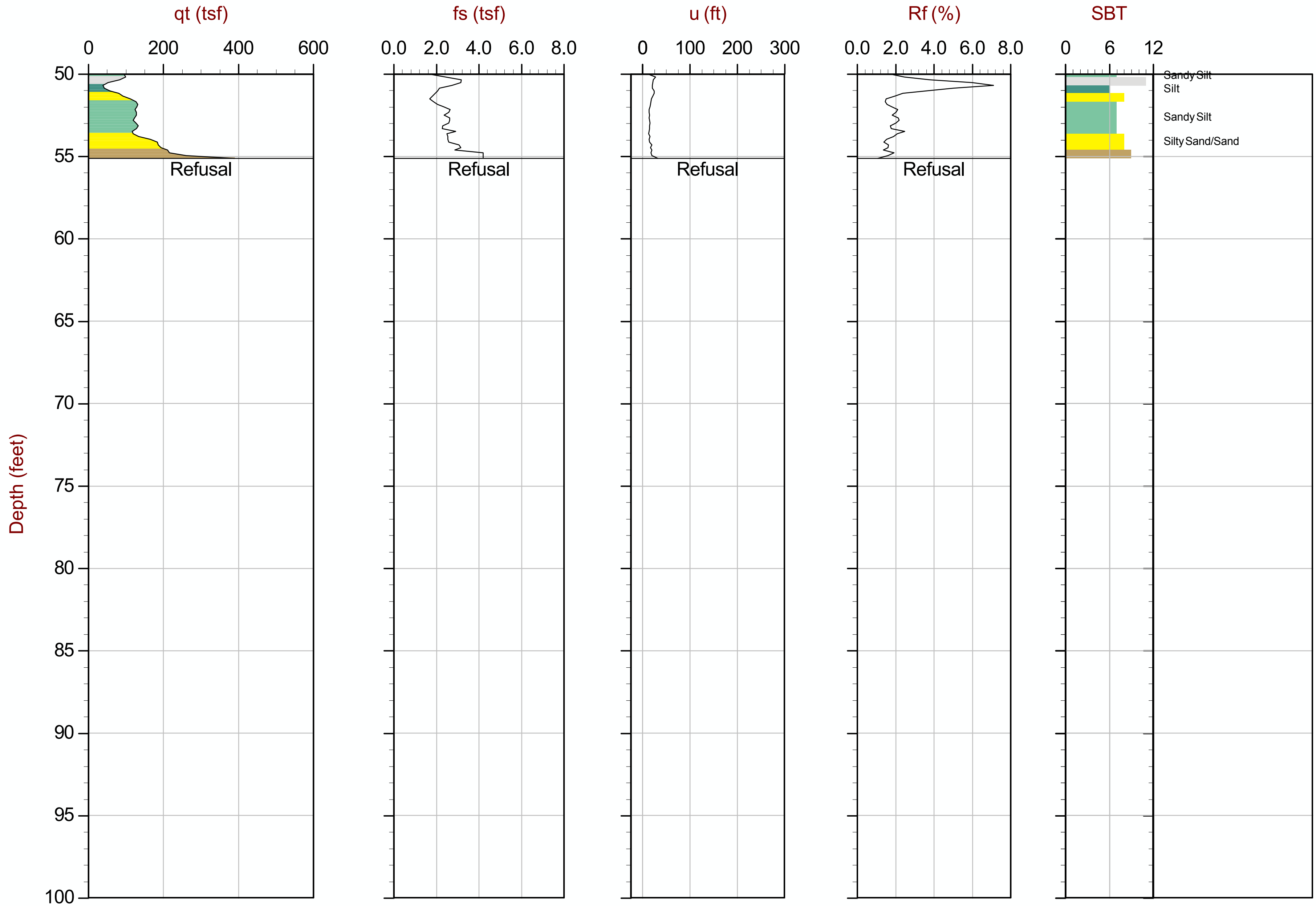
SBT: Lunne, Robertson and Powell, 1997
Coords: Lat: 35.647583 Long: -108.499800
● Equilibrium Pore Pressure from Dissipation

CONETEC

MWH Americas

Job No: 13-52118
Date: 11:06:13 16:32
Site: CHURCH ROCK MILL SITE TSF

Sounding: RCPT-15
Cone: 155:T1500F15U500



Max Depth: 16.800 m / 55.12 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.150 m

File: 13-52118_RP15.COR
Unit Wt: SBT Chart Soil Zones

SBT: Lunne, Robertson and Powell, 1997
Coords: Lat: 35.647583 Long: -108.499800
Equilibrium Pore Pressure from Dissipation

ATTACHMENT E

RECORDED WATER LEVELS AT THE CHURCH ROCK SITE

Well ID	Measurement Date	Measurement Time	Historical Reference Elev	Water Level Depth	Water Level Elev
0509 D	1/4/2016	8:37	6949.44	82.89	6866.55
EPA 23	1/4/2016	9:30	6926.31	59.52	6866.79
GW 1	1/4/2016	14:20	6916.46	65.01	6851.45
GW 2	7/6/2015	14:25	6912.88	58.96	6853.92
GW 3	7/7/2015	10:50	6910.04	56	6854.04
632	1/4/2016	12:35	6903.49	48.05	6855.44
EPA 25	1/5/2016	10:35	6903.38	56.62	6846.76
EPA 27	1/12/1999		6910.95	55.45	6855.5
EPA 28	1/4/2016	15:20	6917.86	65.83	6852.03
624	1/4/2016	16:35	6898.57	53.61	6844.96

Note: Water levels provided by email from Chester Engineers, on April 20, 2016.

ATTACHMENT F

SEISMIC SETTLEMENT ANALYSIS CALCULATIONS

UNC-NECR WASTE REPOSITORY SEISMIC SETTLEMENT ANALYSIS - CPT-01

Data File: 13-52118_RP01-BSC-CPT
Location: UNC-NECR 2013 Mill Site PDS

Cells Requiring User Input/Manipulation

http://projects.mwhglobal.com/.../13-52118_RP02-BSC-CPT.XLS

Erosion Protection	Coarse Tailings
Cover Soil	Coarse/Fine Tailings
Mine Spoils	Fine Tailings
Radon Barrier	Coarse Alluvium
General Fill	Fine Alluvium

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.3
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69
Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.3
Earthquake Moment Magnitude, M:	6.3
Magnitude Scaling Factor, MSF:	1.59

0.00	Water surface elevation during CPT investigation (ft amsl)
0.00	Water surface elevation at t_0 (ft amsl)
0.00	Water surface elevation at t_1 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Earthquake
8.26	Equiv. Number of Uniform Strain Cycles, N

2013 CPT Data from ConeTec								Material Type	CPT Data Interpretations										Conditions at t_1		
Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (per drilling log from coupled borehole)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	Normalized Cone Penetration Resistance	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1, u_1 (tsf)	Effective Stress at t_1 (tsf)
0.164	6969.80	16.2	0.010	16.1	5.1	2.20	0.06%	Radon Barrier	0.061	122.3	0.01	0.000	0.01	0	1610	0.06%	0.3	59%	0.14	0.000	0.14
0.328	6969.63	42.1	0.084	42.1	3.5	1.53	0.20%	Radon Barrier	0.061	122.3	0.02	0.000	0.02	0	2097	0.20%	0.5	59%	0.15	0.000	0.15
0.492	6969.47	69.1	0.265	69.0	4.0	1.75	0.38%	Radon Barrier	0.061	122.3	0.03	0.000	0.03	0	2294	0.38%	0.8	59%	0.16	0.000	0.16
0.656	6969.30	112.7	0.532	112.8	-1.5	-0.65	0.47%	Radon Barrier	0.061	122.3	0.04	0.000	0.04	0	2809	0.47%	0.9	59%	0.17	0.000	0.17
0.820	6969.14	156.8	0.733	156.4	63.7	27.59	0.47%	Radon Barrier	0.061	122.3	0.05	0.000	0.05	0	3126	0.47%	0.9	59%	0.18	0.000	0.18
0.984	6968.98	167.1	1.370	166.9	30.9	13.40	0.82%	Radon Barrier	0.061	122.3	0.06	0.000	0.06	0	2776	0.82%	1.1	59%	0.19	0.000	0.19
1.148	6968.81	191.0	2.019	190.8	35.7	15.47	1.06%	Radon Barrier	0.061	122.3	0.07	0.000	0.07	0	2720	1.06%	1.2	59%	0.20	0.000	0.20
1.312	6968.65	190.2	2.339	190.1	15.5	6.73	1.23%	Radon Barrier	0.061	122.3	0.08	0.000	0.08	0	2369	1.23%	1.3	59%	0.21	0.000	0.21
1.476	6968.48	212.1	3.122	212.1	9.7	4.19	1.47%	Radon Barrier	0.061	122.3	0.09	0.000	0.09	0	2349	1.47%	1.4	59%	0.22	0.000	0.22
1.640	6968.32	221.1	3.843	221.0	13.9	6.02	1.74%	Radon Barrier	0.061	122.3	0.10	0.000	0.10	0	2204	1.74%	1.5	59%	0.23	0.000	0.23
1.804	6968.16	224.7	4.838	224.7	4.7	2.03	2.15%	Radon Barrier	0.061	122.3	0.11	0.000	0.11	0	2036	2.15%	1.6	59%	0.24	0.000	0.24
1.968	6967.99	217.7	5.537	217.7	2.0	0.88	2.54%	Radon Barrier	0.061	122.3	0.12	0.000	0.12	0	1808	2.55%	1.6	59%	0.25	0.000	0.25
2.133	6967.83	201.2	5.163	201.2	2.1	0.89	2.57%	General Fill	0.057	113.8	0.13	0.000	0.13	0	1550	2.57%	1.7	48%	0.26	0.000	0.26
2.297	6967.66	234.6	4.924	234.6	2.7	1.16	2.10%	General Fill	0.057	113.8	0.14	0.000	0.14	0	1686	2.10%	1.6	48%	0.27	0.000	0.27
2.461	6967.50	272.0	4.716	272.0	5.6	2.44	1.73%	General Fill	0.057	113.8	0.15	0.000	0.15	0	1832	1.73%	1.5	48%	0.27	0.000	0.27
2.625	6967.34	314.3	4.833	314.2	6.3	2.75	1.54%	General Fill	0.057	113.8	0.16	0.000	0.16	0	1991	1.54%	1.4	48%	0.28	0.000	0.28
2.789	6967.17	380.9	4.667	380.8	3.6	1.55	1.23%	General Fill	0.057	113.8	0.17	0.000	0.17	0	2279	1.23%	1.3	48%	0.29	0.000	0.29
2.953	6967.01	430.6	4.848	430.6	3.9	1.67	1.13%	General Fill	0.057	113.8	0.18	0.000	0.18	0	2440	1.13%	1.3	48%	0.30	0.000	0.30
3.117	6966.84	443.0	5.051	443.0	3.7	1.59	1.14%	General Fill	0.057	113.8	0.19	0.000	0.19	0	2384	1.14%	1.3	48%	0.31	0.000	0.31
3.281	6966.68	446.4	5.599	446.4	9.0	3.90	1.25%	General Fill	0.057	113.8	0.20	0.000	0.20	0	2288	1.25%	1.3	48%	0.32	0.000	0.32
3.445	6966.52	445.2	6.173	445.2	4.8	2.09	1.39%	General Fill	0.057	113.8	0.20	0.000	0.20	0	2177	1.39%	1.4	48%	0.33	0.000	0.33
3.609	6966.35	418.4	6.499	418.4	5.9	2.56	1.55%	General Fill	0.057	113.8	0.21	0.000	0.21	0	1957	1.55%	1.4	48%	0.34	0.000	0.34
3.773	6966.19	384.7	6.314	384.7	3.9	1.69	1.64%	General Fill	0.057	113.8	0.22	0.000	0.22	0	1724	1.64%	1.5	48%	0.35	0.000	0.35
3.937	6966.02	383.8	6.364	383.8	4.0	1.75	1.66%	General Fill	0.057	113.8	0.23	0.000	0.23	0	1651	1.66%	1.5	48%	0.36	0.000	0.36
4.101	6965.86	382.3	5.669	382.3	6.3	2.73	1.48%	General Fill	0.057	113.8	0.24	0.000	0.24	0	1581	1.48%	1.4	48%	0.37	0.000	0.37
4.265	6965.70	359.7	5.575	359.7	6.8	2.93	1.55%	General Fill	0.057	113.8	0.25	0.000	0.25	0	1432	1.55%	1.4	48%	0.38	0.000	0.38
4.429	6965.53	337.4	5.041	337.4	7.1	3.09	1.49%	General Fill	0.057	113.8	0.26	0.000	0.26	0	1295	1.50%	1.4	48%	0.39	0.000	0.39
4.593	6965.37	317.8	4.730	317.7	4.5	1.95	1.49%	General Fill	0.057	113.8	0.27	0.000	0.27	0	1177	1.49%	1.4	48%	0.40	0.000	0.40
4.757	6965.20	284.3	4.604	284.3	2.4	1.02	1.62%	General Fill	0.057	113.8	0.28	0.000	0.28	0	1018	1.62%	1.5	48%	0.41	0.000	0.41
4.921	6965.04	230.5	4.034	230.5	0.8	0.36	1.75%	General Fill	0.057	113.8	0.29	0.000	0.29	0	798	1.75%	1.6	48%	0.41	0.000	0.41
5.085	6964.88	179.6	3.217	179.6	-0.2	-0.10	1.79%	General Fill	0.057	113.8	0.30	0.000	0.30	0	602	1.79%	1.6	48%	0.42	0.000	0.42
5.249	6964.71	129.2	2.502	129.2	0.9	0.39	1.94%	General Fill	0.057	113.8	0.31	0.000	0.31	0	420	1.94%	1.7	48%	0.43	0.000	0.43
5.413	6964.55	81.8	1.983	81.8	-1.4	-0.61	2.43%	General Fill	0.057	113.8	0.32	0.000	0.32	0	257	2.43%	1.9	48%	0.44	0.000	0.44
5.577	6964.38	56.9	1.757	56.9	-1.3	-0.57	3.09%	General Fill	0.057	113.8	0.33	0.000	0.33	0	174	3.10%	2.1	48%	0.45	0.000	0.45
5.741	6964.22	46.0	1.697	46.0	-0.7	-0.30	3.69%	General Fill	0.057	113.8	0.34	0.000	0.34	0	136	3.71%	2.2	48%	0.46	0.000	0.46
5.905	6964.06	39.7	1.645	39.7	0.1	0.02	4.14%	General Fill	0.057	113.8	0.34	0.000	0.34	0	114	4.18%	2.3	48%	0.47	0.000	0.47
6.069	6963.89	36.1	1.690	36.1	-0.2	-0.08	4.68%	General Fill	0.057	113.8	0.35	0.000	0.35	0	101	4.73%	2.4	48%	0.48	0.000	0.48
6.234	6963.73	40.7	1.753	40.7	0.4	0.18	4.30%	General Fill	0.057	113.8	0.36	0.000	0.36	0	111	4.34%	2.3	48%	0.49	0.000	0.49
6.398	6963.56	40.1	1.814	40.1	0.6	0.26	4.52%	General Fill	0.057	113.8	0.37	0.000	0.37	0	107	4.57%	2.4	48%	0.50	0.000	0.50
6.562	6963.40	38.3	1.996	38.3	0.2	0.10	5.21%	General Fill	0.057	113.8	0.38	0.000	0.38	0	99	5.26%	2.4	48%	0.51	0.000	0.51
6.726	6963.23	42.1	2.110	42.1	-0.1	-0.06	5.02%	General Fill	0.057	113.8	0.39	0.000	0.39	0	107	5.06%	2.4	48%	0.52	0.000	0.52
6.890	6963.07	48.4	2.317	48.4	2.3	0.98	4.79%	General Fill	0.057	113.8	0.40	0.000	0.40	0	120	4.83%	2.4	48%	0.53	0.000	0.53
7.054	6962.91	53.7	2.416	53.7	2.4	1.06	4.50%	General Fill	0.057	113.8	0.41	0.000	0.41	0	130	4.53%	2.3	48%	0.54	0.000	0.54
7.218	6962.74	63.1	2.420	63.1	4.3	1.85	3.83%	General Fill	0.057	113.8	0.42	0.000	0.42	0	150	3.86%	2.2	48%	0.55	0.000	0.55
7.382	6962.58	74.5	2.677	74.5	3.5	1.53	3.59%	General Fill	0.057	113.8	0.43	0.000	0.43	0	173	3.62%	2.2	48%	0.55	0.000	0.55
7.546	6962.41	76.0	3.010	76.0	0.5	0.20	3.96%	General Fill	0.057	113.8	0.44	0.000	0.44	0	173	3.98%	2.2	48%	0.56	0.000	0.56
7.710	6962.25	67.3	3.053	67.2	1.9	0.83	4.54%	General Fill	0.057	113.8	0.45	0.000	0.45	0	149	4.57%	2.3	48%	0.57	0.000	0.57
7.874	6962.09	69.1	3.249	69.1	-0.9	-0.41	4.70%	General Fill	0.057	113.8	0.46	0.000	0.46	0	150	4.73%	2.3	48%	0.58	0.000	0.58
8.038	6961.92	76.9	3.433	76.9	-0.5	-0.20	4.46%	General Fill	0.057	113.8	0.47	0.000	0.47	0	164	4.49%	2.3	48%	0.59	0.000	0.59
8.202	6961.76	76.9	3.662	76.9	-0.2	-0.08	4.76%	General Fill	0.057	113.8	0.48	0.000	0.48	0	161	4.79%	2.3	48%	0.60	0.000	0.60
8.366	6961.59	75.6	3.700	75.6	0.4	0.18	4.89%	General Fill	0.057	113.8	0.48	0.000	0.48	0	155	4.93%	2.3	48%	0.61	0.000	0.61
8.530	6961.43	91.7	3.940	91.7	0.8	0.33	4.30%	General Fill	0.057	113.8	0.49	0.000	0.49	0	185	4.32%	2.2	48%	0.62	0.000	0.62
8.694	6961.27	93.1	4.178	93.1	1.6	0.71	4.49%	General Fill	0.057	113.8	0.50	0.000	0.50	0	184	4.51%	2.2	48%	0.63	0.000	0.63
8.858	6961.10	89.5	4.338	89.5	0.2	0.08	4.85%	General Fill	0.057	113.8	0.51	0.000	0.51	0	174	4.88%	2.3	48%	0.64	0.000	0.64
9.022	6960.94	78.4	4.367	78.4	-1.2	-0.53	5.57%	General Fill	0.057	113.8	0.52	0.000	0.52	0	149	5.61%	2.4	48%	0.65	0.000	0.65
9.186	6960.77	79.0	4.004	79.0	-1.8	-0.79	5.07%	General Fill	0.057	113.8	0.53	0.000	0.53	0	148	5.11%	2.3	48%	0.66	0.000	0.66
9.350	6960.61	72.1	3.530	72.1	-2.6	-1.14	4.90%	General Fill	0.057	113.8	0.54	0.000	0.54	0	132	4.93%	2.3	48%	0.67	0.000	0.67
9.514	6960.45	68.0	3.272	68.0	-3.1	-1.36	4.81%	General Fill	0.057	113.8	0.55	0.000	0.55	0	123	4.85%	2.4	48%	0.68	0.000	0.68
9.678	6960.28	70.6	3.353	70.6	-2.2	-0.96	4.75%	General Fill	0.057	113.8	0.56	0.000	0.56	0	125	4.79%	2.3	48%	0.69	0.000	0.69
9.842	6960.12	71.4	3.285	71.5	-2.2	-0.94	4.60%	General Fill	0.057	113.8	0.57	0.000	0.57	0	125	4.64%	2.3	48%	0.69	0.000	0.69
10.006	6959.95	62.4	3.418	62.4	-2.0	-0.85	5.48%	General Fill	0.057	113.8	0.58	0.000	0.58	0	107	5.53%	2.4	48%	0.70	0.000	0.70
10.170	6959.79	55.6	2.815	55.6	-0.7	-0.30	5.06%	General Fill	0.057	113.8	0.59	0.000	0.59	0	94	5.11%	2.4	48%	0.71	0.000	0.71
10.335	6959.63	49.2	2.360	49.2	-1.9	-0.83	4.80%	General Fill	0.057	113.8	0.60	0.000	0.60	0	81	4.86%	2.5	48%	0.72	0.000	0.72
10.499	6959.46	45.0	2.147	45.0	-0.8	-0.36	4.77%	General Fill	0.057	113.8	0.61	0.000	0.61	0	73	4.84%	2.5	48%	0.73	0.000	0.73
10.663	6959.30	42.4	1.673	42.4	-0.2	-0.08	3.95%	General Fill	0.057	113.8	0.62	0.000	0.62	0	68	4.00%	2.5	48%	0.74	0.000	0.74
10.827	6959.13	37.6	1.695	37.6	-0.8	-0.36	4.51%	General Fill	0.057	113.8	0.62	0.000	0.62	0	59	4.58%	2.5	48%	0.75	0.000	0.75
10.991	6958.97	35.2	1.694	35.3	-0.1	-0.04	4.81%	General Fill	0.057	113.8	0.63	0.000	0.63	0	55	4.89%	2.6	48%	0.76	0.000	0.76
11.155	6958.81	35.4	1.677	35.4	-0.9	-0.41	4.74%	General Fill	0.057	113.8	0.64	0.000	0.64	0	54	4.83%	2.6	48%	0.77	0.000	0.77
11.319	6958.64	36.7	1.729	36.7	-0.7	-0.29	4.71%	General Fill	0.057	113.8	0.65	0.000	0.65	0	55	4.80%	2.6	48%	0.78	0.000	0.78
11.483	6958.48	37.0	1.894	37.0	-0.7	-0.29	5.12%	General Fill	0.057	113.8	0.66	0.000	0.66	0	55	5.21%	2.6	48%	0.79	0.000	0.79
11.647	6958.31	34.0	1.595	34.0	-0.8	-0.36	4.69%	General Fill	0.057	113.8	0.67	0.000	0.67	0	50	4.78%	2.6	48%	0.80	0.000	0.80
11.811	6958.15	33.6	1.739	33.7	-4.6	-1.97	5.17%	General Fill	0.057	113.8	0.68	0.000	0.68	0	48	5.28%	2.6	48%	0.81	0.000	0.81
11.975	6957.99	74.4	1.842	74.4	-3.9	-1.71	2.48%	General Fill	0.057	113.8	0.69	0.000	0.69	0	107	2.50%	2.2	48%	0.82	0.000	0.82
12.139	6957.82	114.3	2.031	114.3	0.4	0.18	1.78%	General Fill	0.057	113.8	0.70	0.000	0.70	0	162	1.79%	1.9	48%	0.83	0.000	0.83
12.303	6957.66	152.5	1.987	152.5	0.4	0.18	1.30%	General Fill	0.057	113.8	0.71	0.000	0.71	0	214	1.31%	1.8	48%	0.83	0.000	0.83
12.467	6957.49	174.4	1.981	174.4	0.1	0.04	1.14%	General Fill	0.057	113.8	0.72	0.000	0.72	0	242	1.14%	1.7	48%	0.84	0.000	0.84
12.631	6957.33	188.8	2.144	188.8	0.0	0.00	1.14%	General Fill	0.057	113.8	0.73	0.000	0.73	0	259	1.14%	1.7	48%	0.85	0.000	0.85
12.795	6957.17	190.8	2.281	190.8	0.0	0.00	1.20%	General Fill	0.057	113.8	0.74	0.000	0.74	0	258	1.20%	1.7	48%	0.86	0.000	0.86

Midpoint Depth at t_1, z_1 (m)	Shear Wave Velocity, V_s (ft/sec)	Soil Density, ρ (tcf)	Max Shear Strain Modulus, G_{max} (tsf)	Coefficient a_2 for Stress Reduction Factor	Stress Reduction Factor, r_d	P = γ_{eff}*(G_{eff}/G_{max}) (tsf)	Plasticity Index, PI	g_1 for PI = 0	g_1 for PI = 15	g_1 for PI = 30	g_1	g_2 for PI = 0	g_2 for PI = 15	g_2 for PI = 30	g_2	Shear Strain, γ (%)	a	b	Threshhold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{c-15} (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
0.23	866	1.9E-03	1.4E+03	1249	0.9990	6.3E-06	12	0.102	0.091	4	0.093	35267	24912	1400	26983	0.001%	2.00	0.65	0.03%	0.000000	0.34	0.079	0.797	0.00%	0.0000
0.55	866	1.8E-03	1.3E+03	1121	0.9974	1.6E-05	12	0.125	0.114	4	0.116	24744	17358	1400	18835	0.002%	2.00	0.65	0.03%	0.000000	0.34	0.079	0.797	0.00%	0.0000
0.64	866	1.8E-03	1.4E+03	1087	0.9969	1.8E-05	12	0.129	0.118	4	0.121	23305	16330	1400	17725	0.002%	1.18	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000

Seismic Settlement Analysis - Stewart et al (2004)

TOTAL SEISMIC SETTLEMENT (FT): 0.0742

Midpoint Depth at t_1, z_1 (m)	Shear Wave Velocity, V_s (ft/sec)	Soil Density, ρ (tcf)	Max Shear Strain Modulus, G_{max} (tsf)	Coefficient a_2 for Stress Reduction Factor	Stress Reduction Factor, r_d	P = γ_{eff}*(G_{eff}/G_{max}) (tsf)	Plasticity Index, PI	g_1 for PI = 0	g_1 for PI = 15	g_1 for PI = 30	g_1	g_2 for PI = 0	g_2 for PI = 15	g_2 for PI = 30	g_2	Shear Strain, γ (%)	a	b	Threshhold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{c-15} (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
								0	15	30		0	15	30											
0.69	754	1.9E-03	1.1E+03	1069	0.9966	2.5E-05	16	0.132	0.121	4	0.379	22588	15817	1400	14856	0.003%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
0.74	754	1.9E-03	1.1E+03	1051	0.9964	2.6E-05	16	0.134	0.123	4	0.382	21941	15356	1400	14425	0.003%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
0.79	754	1.9E-03	1.1E+03	1034	0.9961	2.8E-05	16	0.136	0.125	4	0.384	21353	14937	1400	14034	0.003%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
0.84	754	1.9E-03	1.1E+03	1017	0.9958	3.0E-05	16	0.138	0.127	4	0.385	20817	14554	1400	13677	0.003%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
0.89	754	1.9E-03	1.1E+03	1000	0.9955	3.2E-05	16	0.140	0.129	4	0.387	20324	14203	1400	13350	0.004%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
0.94	754	1.9E-03	1.1E+03	983	0.9952	3.4E-05	16	0.142	0.131	4	0.389	19869	13879	1400	13047	0.004%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
0.99	754	1.9E-03	1.1E+03	967	0.9949	3.5E-05	16	0.143	0.133	4	0.391	19448	13579	1400	12767	0.004%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
1.04	754	1.9E-03	1.1E+03	951	0.9946	3.7E-05	16	0.145	0.135	4	0.392	19055	13300	1400	12506	0.004%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
1.09	754	1.9E-03	1.1E+03	935	0.9943	3.9E-05	16	0.146	0.137	4	0.394	18689	13039	1400	12263	0.005%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
1.14	754	1.9E-03	1.1E+03	919	0.9940	4.1E-05	16	0.148	0.138	4	0.396	18345	12795	1400	12035	0.005%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
1.19	754	1.9E-03	1.1E+03	904	0.9937	4.3E-05	16	0.150	0.140	4	0.397	18023	12565	1400	11821	0.005%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
1.24	754	1.9E-03	1.1E+03	889	0.9933	4.4E-05	16	0.151	0.141	4	0.399	17719	12349	1400	11619	0.005%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
1.29	754	1.8E-03	1.0E+03	874	0.9930	4.9E-05	19	0.152	0.143	4	1.171	17450	12158	1400	9289	0.006%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
1.34	754	1.8E-03	1.0E+03	860	0.9927	5.1E-05	19	0.154	0.144	4	1.172	17196	11978	1400	9157	0.007%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
1.39	754	1.8E-03	1.0E+03	846	0.9923	5.3E-05	19	0.155	0.145	4	1.173	16954	11806	1400	9031	0.007%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
1.44	754	1.8E-03	1.0E+03	832	0.9920	5.5E-05	19	0.156	0.147	4	1.174	16724	11643	1400	8911	0.007%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
1.49	754	1.8E-03	1.0E+03	818	0.9916	5.7E-05	19	0.157	0.148	4	1.175	16504	11487	1400	8797	0.008%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
1.54	754	1.8E-03	1.0E+03	804	0.9913	5.8E-05	19	0.158	0.149	4	1.176	16293	11337	1400	8687	0.008%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
1.59	754	1.8E-03	1.0E+03	791	0.9909	6.0E-05	19	0.159	0.150	4	1.177	16092	11194	1400	8583	0.008%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
1.64	754	1.8E-03	1.0E+03	778	0.9905	6.2E-05	19	0.160	0.152	4	1.178	15899	11058	1400	8482	0.008%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
1.69	754	1.8E-03	1.0E+03	765	0.9902	6.4E-05	19	0.162	0.153	4	1.179	15714	10926	1400	8386	0.009%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
1.74	754	1.8E-03	1.0E+03	752	0.9898	6.5E-05	19	0.163	0.154	4	1.179	15535	10800	1400	8293	0.009%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
1.79	754	1.8E-03	1.0E+03	740	0.9894	6.7E-05	19	0.164	0.155	4	1.180	15364	10678	1400	8204	0.009%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
1.84	754	1.8E-03	1.0E+03	728	0.9890	6.9E-05	19	0.165	0.156	4	1.181	15199	10561	1400	8118	0.010%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
1.89	754	1.8E-03	1.0E+03	716	0.9886	7.1E-05	19	0.166	0.157	4	1.182	15040	10449	1400	8036	0.010%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
1.94	754	1.8E-03	1.0E+03	704	0.9882	7.2E-05	19	0.167	0.158	4	1.183	14886	10340	1400	7956	0.010%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
1.99	754	1.8E-03	1.0E+03	692	0.9878	7.4E-05	19	0.167	0.159	4	1.183	14738	10235	1400	7879	0.011%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.04	754	1.8E-03	1.0E+03	681	0.9873	7.6E-05	19	0.168	0.160	4	1.184	14595	10134	1400	7805	0.011%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.09	754	1.8E-03	1.0E+03	669	0.9869	7.8E-05	19	0.169	0.161	4	1.185	14456	10036	1400	7733	0.011%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.14	754	1.8E-03	1.0E+03	658	0.9865	7.9E-05	19	0.170	0.162	4	1.186	14322	9941	1400	7663	0.012%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.19	754	1.8E-03	1.0E+03	648	0.9860	8.1E-05	19	0.171	0.163	4	1.186	14192	9849	1400	7596	0.012%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.24	754	1.8E-03	1.0E+03	637	0.9856	8.3E-05	19	0.172	0.164	4	1.187	14066	9759	1400	7530	0.012%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.29	754	1.8E-03	1.0E+03	626	0.9851	8.5E-05	19	0.173	0.165	4	1.188	13944	9673	1400	7467	0.013%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.34	754	1.8E-03	1.0E+03	616	0.9847	8.6E-05	19	0.174	0.166	4	1.188	13825	9589	1400	7405	0.013%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.39	754	1.8E-03	1.0E+03	606	0.9842	8.8E-05	19	0.174	0.167	4	1.189	13710	9508	1400	7346	0.013%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.44	754	1.8E-03	1.0E+03	596	0.9837	9.0E-05	19	0.175	0.168	4	1.190	13598	9428	1400	7287	0.014%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.49	754	1.8E-03	1.0E+03	586	0.9832	9.2E-05	19	0.176	0.169	4	1.190	13489	9351	1400	7231	0.014%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.54	754	1.8E-03	1.0E+03	577	0.9827	9.3E-05	19	0.177	0.169	4	1.191	13382	9276	1400	7176	0.014%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.59	754	1.8E-03	1.0E+03	567	0.9822	9.5E-05	19	0.178	0.170	4	1.192	13279	9203	1400	7122	0.015%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.64	754	1.8E-03	1.0E+03	558	0.9817	9.7E-05	19	0.178	0.171	4	1.192	13179	9132	1400	7070	0.015%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.69	754	1.8E-03	1.0E+03	549	0.9812	9.9E-05	19	0.179	0.172	4	1.193	13081	9063	1400	7019	0.015%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.74	754	1.8E-03	1.0E+03	540	0.9807	1.0E-04	19	0.180	0.173	4	1.193	12985	8995	1400	6970	0.016%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.79	754	1.8E-03	1.0E+03	531	0.9801	1.0E-04	19	0.181	0.174	4	1.194	12892	8930	1400	6922	0.016%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.84	754	1.8E-03	1.0E+03	522	0.9796	1.0E-04	19	0.181	0.174	4	1.195	12801	8865	1400	6875	0.016%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.89	754	1.8E-03	1.0E+03	514	0.9790	1.1E-04	19	0.182	0.175	4	1.195	12712	8803	1400	6829	0.017%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.94	754	1.8E-03	1.0E+03	505	0.9785	1.1E-04	19	0.183	0.176	4	1.196	12626	8742	1400	6784	0.017%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.99	754	1.8E-03	1.0E+03	497	0.9779	1.1E-04	19	0.183	0.177	4	1.196	12541	8682	1400	6740	0.017%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
3.04	754	1.8E-03	1.0E+03	489	0.9773	1.1E-04	19	0.184	0.177	4	1.197	12459	8624	1400	6697	0.018%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
3.09	754	1.8E-03	1.0E+03	481	0.9767	1.1E-04	19	0.185	0.178	4	1.197	12378	8567	1400	6655	0.018%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
3.14	754	1.8E-03	1.0E+03	473	0.9761	1.1E-04	19	0.185	0.179	4	1.198	12299	8511	1400	6615	0.018%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
3.19	754	1.8E-03	1.0E+03	465	0.9755	1.2E-04	19	0.186	0.180	4	1.198	12221	8456	1400	6575	0.019%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
3.24	754	1.8E-03	1.0E+03	458	0.9749	1.2E-04	19	0.187	0.180	4	1.199	12146	8403	1400	6535	0.019%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
3.29	754	1.8E-03	1.0E+03	450	0.9743	1.2E-04	19	0.187	0.181	4	1.199	12071	8351	1400	6497	0.019%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
3.34	754	1.8E-03	1.0E+03	443	0.9736	1.2E-04	19	0.188	0.182	4	1.200	11999	8299	1400	6459	0.020%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
3.39	754	1.8E-03	1.0E+03	436	0.9730	1.2E-04	19	0.189	0.182	4	1.200	11928	8249	1400	6423	0.020%	1.70	0.75	0.02%	0.000100	0.34	0.079	0.797	0.02%	0.0000
3.44	754	1.8E-03	1.0E+03	429	0.9723	1.2E-04	19	0.189	0.183	4	1.201	11858	8200	1400	6387	0.021%	1.70	0.75	0.02%	0.000206	0.34	0.079	0.797	0.03%	0.0001
3.49	754	1.8E-03	1.0E+03	422	0.9716	1.3E-04	19	0.190	0.184	4	1.201	11790	8152	1400	6351	0.021%	1.70	0.75	0.02%	0.000297	0.34	0.079	0.797	0.05%	0.0001
3.54	824	1.8E-03	1.2E+03	415	0.9710	1.1E-04	19	0.191	0.185	4	1.202	11723	8105	1400	6317	0.016%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
3.59	824	1.8E-03	1.2E+03	408	0.9703	1.1E-04	19	0.191	0.185	4	1.202	11657	8058	1400	6283	0.017%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
3.64	824	1.8E-03	1.2E+03	401	0.9696	1.1E-04	19	0.192	0.186	4	1.203	11593	8013	1400	6250	0.017%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
3.69	824	1.8E-03	1.2E+03	395	0.9688	1.1E-04	19	0.192	0.187	4	1.203	11529	7968	1400	6217	0.017%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
3.74	824	1.8E-03	1.2E+03	388	0.9681	1.1E-04	19	0.193	0.187	4	1.204	11467	7925	1400	6185	0.017%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
3.79	824	1.8E-03	1.2E+03	382	0.9674	1.1E-04	19	0.193	0.188	4	1.204	11406	7882	1400	6153	0.018%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
3.84	824	1.8E-03	1.2E+03	376	0.9666	1.2E-04	19	0.194	0.188	4	1.205	11346	7839	1400	6122	0.018%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
3.89	824	1.8E-03	1.2E+03	370	0.9659	1.2E-04	19	0.195	0.189	4	1.205	11287	7798	1400	6092	0.018%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
3.94	824	1.8E-03	1.2E+03	364	0.9651	1.2E-04	19	0.195	0.190	4	1.206	11230	7757	1400	6062	0.018%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
3.99	824	1.8E-03	1.2E+03	358	0.9643	1.2E-04	19	0.196	0.190	4	1.206	11173	7717	1400	6033	0.019%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
4.04	824	1.8E-03	1.2E+03	352	0.9635	1.2E-04	19	0.196	0.191	4	1.207	11117	7678	1400	6004	0.019%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
4.09	824	1.8E-03	1.2E+03	347	0.9627	1.2E-04	19	0.197	0.192	4	1.207	11062	7640	1400	5976	0.019%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
4.14	824	1.8E-03	1.2E+03	341	0.9619	1.2E-04	19	0.197	0.192	4	1.208	11009	7602	1400	5948	0.020%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
4.19	824	1.8E-03	1.2E+03	335	0.9610	1.2E-04	19	0.198	0.193	4	1.208	10956	7564	1400	5921	0.020%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
4.24	824	1.8E-03	1.2E+03	330	0.9602	1.3E-04	19	0.198	0.193	4	1.208	10904	7528	1400	5894	0.020%	1.70	0.75	0.02%	0.000083	0.34	0.079	0.797	0.01%	0.0000
4.29	824	1.8E-03	1.2E+03	325	0.9593	1.3E-04	19	0.199	0.194	4	1.209	10852	7492	1400	5867	0.020%	1.70	0.75	0.02%	0.000169	0.34	0.079	0.797	0.03%	0.0000
4.34	824	1.8E-03	1.2E+03	320	0.9585	1.3E-04	19	0.200	0.195	4	1.209	10802	7456	1400	5841	0.021%	1.70	0.75	0.02%	0.000242	0.34	0.079	0.797	0.04%	0.0001
4.39	824	1.8E-03	1.2E+03	314	0.9576	1.3E-04	19	0.200	0.195	4	1.210	10752	7421	1400	5815	0.021%	1.70	0.75	0.02%	0.000309	0.34	0.079	0.797	0.05%	0.0001
4.44	824	1.8E-03	1.2E+03	309	0.9567	1.3E-04	19	0.201	0.196	4	1.210	10703	7387	1400	5790	0.021%	1.70	0.75	0.02%	0.000371	0.34	0.079	0.797	0.06%	0.0001
4.49	824	1.8E-03	1.2E+03	304	0.9558	1.3E-04	19	0.201	0.196	4	1.211	10655	7353	1400	5765	0.022%	1.70	0.75	0.02%	0.000429	0.34	0.079	0.797	0.07%	0.0001
4.54	824	1.8E-03	1.2E+03	300	0.9548	1.3E-04	19	0.202	0.197	4	1.211	10608	7320	1400	5741	0.022%	1.70	0.75	0.02%	0.000485	0.34	0.079	0.797	0.08%	0.0001

12.959	6957.00	185.8	2.421	185.8	0.0	0.00	1.30%	General Fill	0.057	113.8	0.75	0.000	0.75	0	248	1.31%	1.7	48%	0.87	0.000	0.87
13.123	6956.84	173.6	2.319	173.6	-0.2	-0.08	1.34%	Coarse Tailings	0.054	108.1	0.75	0.000	0.75	0	229	1.34%	1.7	21%	0.88	0.000	0.88
13.287	6956.67	141.9	2.166	141.9	-0.6	-0.26	1.53%	Coarse Tailings	0.054	108.1	0.76	0.000	0.76	0	185	1.53%	1.9	21%	0.89	0.000	0.89
13.451	6956.51	104.4	2.194	104.4	-1.4	-0.61	2.10%	Coarse Tailings	0.054	108.1	0.77	0.000	0.77	0	134	2.12%	2.0	21%	0.90	0.000	0.90
13.615	6956.35	74.1	2.570	74.1	-0.1	-0.06	3.47%	Coarse Tailings	0.054	108.1	0.78	0.000	0.78	0	94	3.50%	2.3	21%	0.91	0.000	0.91
13.779	6956.18	56.9	2.954	56.9	0.8	0.36	5.20%	Coarse Tailings	0.054	108.1	0.79	0.000	0.79	0	71	5.27%	2.5	21%	0.92	0.000	0.92
13.943	6956.02	48.2	2.863	48.2	1.1	0.47	5.94%	Coarse Tailings	0.054	108.1	0.80	0.000	0.80	0	59	6.04%	2.6	21%	0.93	0.000	0.93
	6955.85					0.39	5.76%		0.057	113.8	0.81		0.81	0	49	5.87%	2.7	48%	0.93	0.000	0.93
	6955.69					0.81	5.38%		0.057	113.8	0.82		0.82	0	43	5.50%	2.7	48%	0.94	0.000	0.94
	6955.52					-0.08	5.18%		0.057	113.8	0.83		0.83	0	34	5.33%	2.7	48%	0.95	0.000	0.95
	6955.36					-0.08	4.66%		0.057	113.8	0.84		0.84	0	32	4.81%	2.7	48%	0.96	0.000	0.96
	6955.20					0.16	4.48%		0.057	113.8	0.85		0.85	0	31	4.62%	2.7	48%	0.97	0.000	0.97
	6955.03					0.16	4.19%		0.057	113.8	0.85		0.85	0	29	4.34%	2.7	48%	0.98	0.000	0.98
	6954.87					0.14	4.34%		0.057	113.8	0.86		0.86	0	27	4.49%	2.8	48%	0.99	0.000	0.99
	6954.70					0.75	4.51%		0.057	113.8	0.87		0.87	0	26	4.68%	2.8	48%	1.00	0.000	1.00
	6954.54					0.18	4.82%		0.057	113.8	0.88		0.88	0	23	5.02%	2.8	48%	1.01	0.000	1.01
	6954.38					0.06	4.47%		0.057	113.8	0.89		0.89	0	24	4.66%	2.8	48%	1.02	0.000	1.02
	6954.21					0.00	4.37%		0.057	113.8	0.90		0.90	0	23	4.57%	2.8	48%	1.03	0.000	1.03
	6954.05					-0.02	4.52%		0.057	113.8	0.91		0.91	0	22	4.73%	2.9	48%	1.04	0.000	1.04
	6953.88					-0.12	5.07%		0.057	113.8	0.92		0.92	0	19	5.33%	2.9	48%	1.05	0.000	1.05
	6953.72					0.30	4.74%		0.057	113.8	0.93		0.93	0	20	4.98%	2.9	48%	1.06	0.000	1.06
	6953.56					1.63	4.18%		0.057	113.8	0.94		0.94	0	23	4.36%	2.8	48%	1.07	0.000	1.07
	6953.39					1.75	4.37%		0.057	113.8	0.95		0.95	0	23	4.56%	2.8	48%	1.07	0.000	1.07
	6953.23					1.42	4.73%		0.057	113.8	0.96		0.96	0	21	4.96%	2.9	48%	1.08	0.000	1.08
	6953.06					1.12	4.23%		0.057	113.8	0.97		0.97	0	21	4.43%	2.9	48%	1.09	0.000	1.09
	6952.90					1.71	3.01%		0.057	113.8	0.98		0.98	0	28	3.12%	2.7	48%	1.10	0.000	1.10
17.224	6952.74	27.8	0.830	27.7	4.2	1.83	2.99%	General Fill	0.057	113.8	0.99	0.000	0.99	0	27	3.10%	2.7	48%	1.11	0.000	1.11
17.388	6952.57	26.6	0.901	26.6	4.3	1.87	3.39%	General Fill	0.057	113.8	0.99	0.000	0.99	0	26	3.52%	2.7	48%	1.12	0.000	1.12
17.552	6952.41	31.5	1.032	31.4	8.3	3.60	3.28%	General Fill	0.057	113.8	1.00	0.000	1.00	0	30	3.39%	2.6	48%	1.13	0.000	1.13
17.716	6952.24	33.0	1.144	33.0	12.4	5.37	3.46%	General Fill	0.057	113.8	1.01	0.000	1.01	0	32	3.57%	2.7	48%	1.14	0.000	1.14
17.880	6952.08	34.0	1.245	33.9	12.0	5.19	3.66%	General Fill	0.057	113.8	1.02	0.000	1.02	0	32	3.78%	2.7	48%	1.15	0.000	1.15
18.044	6951.92	34.1	1.228	34.0	11.0	4.78	3.60%	General Fill	0.057	113.8	1.03	0.000	1.03	0	32	3.71%	2.7	48%	1.16	0.000	1.16
18.208	6951.75	33.1	1.298	33.1	9.7	4.19	3.92%	General Fill	0.057	113.8	1.04	0.000	1.04	0	31	4.04%	2.7	48%	1.17	0.000	1.17
18.372	6951.59	37.5	1.786	37.5	-1.7	-0.73	4.76%	General Fill	0.057	113.8	1.05	0.000	1.05	0	35	4.90%	2.7	48%	1.18	0.000	1.18
18.537	6951.42	202.7	2.310	202.4	37.0	16.02	1.14%	Coarse Tailings	0.054	108.1	1.06	0.000	1.06	0	190	1.15%	1.7	21%	1.19	0.000	1.19
18.701	6951.26	378.5	3.479	378.3	20.7	8.97	0.92%	Coarse Tailings	0.054	108.1	1.07	0.000	1.07	0	353	0.92%	1.5	21%	1.20	0.000	1.20
18.865	6951.10	441.9	4.569	441.8	14.7	6.39	1.03%	Coarse Tailings	0.054	108.1	1.08	0.000	1.08	0	409	1.04%	1.5	21%	1.20	0.000	1.20
19.029	6950.93	455.6	5.386	455.5	13.0	5.63	1.18%	Coarse Tailings	0.054	108.1	1.09	0.000	1.09	0	418	1.19%	1.5	21%	1.21	0.000	1.21
19.193	6950.77	444.3	5.970	444.2	12.2	5.29	1.34%	Coarse Tailings	0.054	108.1	1.10	0.000	1.10	0	405	1.35%	1.6	21%	1.22	0.000	1.22
19.357	6950.60	447.3	6.547	447.2	11.4	4.94	1.46%	Coarse Tailings	0.054	108.1	1.10	0.000	1.10	0	404	1.47%	1.6	21%	1.23	0.000	1.23
19.521	6950.44	453.3	6.951	453.2	14.3	6.20	1.53%	Coarse Tailings	0.054	108.1	1.11	0.000	1.11	0	406	1.54%	1.6	21%	1.24	0.000	1.24
19.685	6950.28	436.4	7.310	436.3	14.0	6.06	1.68%	Coarse Tailings	0.054	108.1	1.12	0.000	1.12	0	388	1.68%	1.7	21%	1.25	0.000	1.25
19.849	6950.11	422.3	6.337	422.2	13.0	5.63	1.50%	Coarse Tailings	0.054	108.1	1.13	0.000	1.13	0	372	1.50%	1.7	21%	1.26	0.000	1.26
20.013	6949.95	398.5	6.234	398.4	11.5	4.96	1.56%	Coarse Tailings	0.054	108.1	1.14	0.000	1.14	0	349	1.57%	1.7	21%	1.27	0.000	1.27
20.177	6949.78	371.7	5.676	371.7	6.4	2.79	1.53%	Coarse Tailings	0.054	108.1	1.15	0.000	1.15	0	323	1.53%	1.7	21%	1.28	0.000	1.28
20.341	6949.62	347.5	5.235	347.4	5.6	2.42	1.51%	Coarse Tailings	0.054	108.1	1.16	0.000	1.16	0	299	1.51%	1.7	21%	1.28	0.000	1.28
20.505	6949.46	327.3	4.619	327.2	5.1	2.22	1.41%	Coarse Tailings	0.054	108.1	1.17	0.000	1.17	0	280	1.42%	1.7	21%	1.29	0.000	1.29
20.669	6949.29	307.4	4.488	307.4	4.5	1.95	1.46%	Coarse Tailings	0.054	108.1	1.18	0.000	1.18	0	261	1.47%	1.7	21%	1.30	0.000	1.30
20.833	6949.13	276.6	4.116	276.6	4.5	1.95	1.49%	Coarse Tailings	0.054	108.1	1.18	0.000	1.18	0	233	1.49%	1.8	21%	1.31	0.000	1.31
20.997	6948.96	250.8	3.769	250.8	3.9	1.69	1.50%	Coarse Tailings	0.054	108.1	1.19	0.000	1.19	0	209	1.51%	1.8	21%	1.32	0.000	1.32
21.161	6948.80	220.8	3.195	220.8	3.1	1.32	1.45%	Coarse Tailings	0.054	108.1	1.20	0.000	1.20	0	183	1.45%	1.8	21%	1.33	0.000	1.33
21.325	6948.64	194.2	2.742	194.1	2.7	1.18	1.41%	Coarse Tailings	0.054	108.1	1.21	0.000	1.21	0	159	1.42%	1.9	21%	1.34	0.000	1.34
21.489	6948.47	165.8	2.280	165.8	1.8	0.77	1.38%	Coarse Tailings	0.054	108.1	1.22	0.000	1.22	0	135	1.39%	1.9	21%	1.35	0.000	1.35
21.653	6948.31	144.1	1.934	144.1	0.9	0.39	1.34%	Coarse Tailings	0.054	108.1	1.23	0.000	1.23	0	116	1.35%	1.9	21%	1.35	0.000	1.35
21.817	6948.14	126.1	1.695	126.1	0.5	0.23	1.34%	Coarse Tailings	0.054	108.1	1.24	0.000	1.24	0	101	1.36%	2.0	21%	1.36	0.000	1.36
21.981	6947.98	113.3	1.453	113.3	-0.4	-0.16	1.28%	Coarse Tailings	0.054	108.1	1.25	0.000	1.25	0	90	1.30%	2.0	21%	1.37	0.000	1.37
22.145	6947.82	102.3	1.353	102.3	-0.4	-0.18	1.32%	Coarse Tailings	0.054	108.1	1.25	0.000	1.25	0	81	1.34%	2.1	21%	1.38	0.000	1.38
22.309	6947.65	95.2	1.213	95.2	-0.3	-0.12	1.27%	Coarse Tailings	0.054	108.1	1.26	0.000	1.26	0	74	1.29%	2.1	21%	1.39	0.000	1.39
22.473	6947.49	78.6	1.079	78.6	-1.5	-0.63	1.37%	Coarse Tailings	0.054	108.1	1.27	0.000	1.27	0	61	1.40%	2.2	21%	1.40	0.000	1.40
22.638	6947.32	70.0	0.980	70.0	-1.0	-0.45	1.40%	Coarse Tailings	0.054	108.1	1.28	0.000	1.28	0	54	1.43%	2.2	21%	1.41	0.000	1.41
22.802	6947.16	65.0	0.861	65.0	-0.9	-0.39	1.32%	Coarse Tailings	0.054	108.1	1.29	0.000	1.29	0	49	1.35%	2.2	21%	1.42	0.000	1.42
22.966	6946.99	56.3	0.793	56.3	-0.8	-0.36	1.41%	Coarse Tailings	0.054	108.1	1.30	0.000	1.30	0	42	1.44%	2.3	21%	1.43	0.000	1.43
23.130	6946.83	51.3	0.713	51.3	-0.5	-0.23	1.39%	Coarse Tailings	0.054	108.1	1.31	0.000	1.31	0	38	1.43%	2.3	21%	1.43	0.000	1.43
23.294	6946.67	47.5	0.618	47.5	-0.6	-0.26	1.30%	Coarse Tailings	0.054	108.1	1.32	0.000	1.32	0	35	1.34%	2.3	21%	1.44	0.000	1.44
23.458	6946.50	44.5	0.554	44.5	-0.5	-0.23	1.25%	Coarse Tailings	0.054	108.1	1.33	0.000	1.33	0	33	1.28%	2.4	21%	1.45	0.000	1.45
23.622	6946.34	43.1	0.488	43.1	-0.3	-0.14	1.13%	Coarse Tailings	0.054	108.1	1.33	0.000	1.33	0	31	1.17%	2.4	21%	1.46	0.000	1.46
23.786	6946.17	41.2	0.375	41.2	-0.1	-0.04	0.91%	Coarse Tailings	0.054	108.1	1.34	0.000	1.34	0	30	0.94%	2.3	21%	1.47	0.000	1.47
23.950	6946.01	42.3	0.401	42.3	-0.5	-0.20	0.95%	Coarse Tailings	0.054	108.1	1.35	0.000	1.35	0	30	0.98%	2.3	21%	1.48	0.000	1.48
24.114	6945.85	39.3	0.439	39.3	-0.1	-0.02	1.12%	Coarse Tailings	0.054	108.1	1.36	0.000	1.36	0	28	1.16%	2.4	21%	1.49	0.000	1.49
24.278	6945.68	43.9	0.477	43.9	-0.2	-0.10	1.09%	Coarse Tailings	0.054	108.1	1.37	0.000	1.37	0	31	1.12%	2.4	21%	1.50	0.000	1.50
24.442	6945.52	45.2	0.519	45.2	-0.4	-0.18	1.15%	Coarse Tailings	0.054	108.1	1.38	0.000	1.38	0	32	1.18%	2.4	21%	1.51	0.000	1.51
24.606	6945.35	45.9	0.556	46.0	-0.5	-0.23	1.21%	Coarse Tailings	0.054	108.1	1.39	0.000	1.39	0	32	1.25%	2.4	21%	1.51	0.000	1.51
24.770	6945.19	50.0	0.600	50.0	-0.1	-0.02	1.20%	Coarse Tailings	0.054	108.1	1.40	0.000	1.40	0	35	1.23%	2.3	21%	1.52	0.000	1.52
24.934	6945.03	54.6	0.540	54.6	0.4	0.18	0.99%	Coarse Tailings	0.054	108.1	1.41	0.000	1.41	0	38	1.02%	2.3	21%	1.53	0.000	1.53
25.098	6944.86	61.3	0.648	61.3	-0.1	-0.04	1.06%	Coarse Tailings	0.054	108.1	1.41	0.000	1.41	0	42	1.08%	2.2	21%	1.54	0.000	1.54
25.262	6944.70	74.3	0.758	74.3	0.1	0.04	1.02%	Coarse Tailings	0.054	108.1	1.42	0.000	1.42	0	51	1.04%	2.2	21%	1.55	0.000	1.55
25.426	6944.53	86.5	0.916	86.5	0.2	0.08	1.06%	Coarse Tailings	0.054	108.1	1.43	0.000	1.43	0	59	1.08%	2.1	21%	1.56	0.000	1.56
25.590	6944.37	103.5	1.055	103.5	0.1	0.02	1.02%	Coarse Tailings	0.054	108.1	1.44	0.000	1.44	0	71	1.03%	2.0	21%	1.57	0.000	1.57
25.754	6944.21	107.1	1.159	107.1	0.1	0.06	1.08%	Coarse Tailings	0.054	108.1	1.45	0.000	1.45	0	73	1.10%	2.0	21%	1.58	0.000	1.58
25.918	6944.04	104.7	1.177	104.7	-0.3	-0.14	1.12%	Coarse Tailings	0.054	108.1	1.46	0.000	1.46	0	71	1.14%	2.1	21%	1.59	0.000	1.59
26.082	6943.88	101.2	1.179	101.2	-0.2	-0.08	1.16%	Coarse Tailings	0.054	108.1	1.47	0.000	1.47	0	68	1.18%	2.1	21%	1.59	0.000	1.59
26.246	6943.71	98.4	1.211	98.4	-0.1	-0.06	1.23%	Coarse Tailings	0.054	108.1	1.48	0.000	1.48	0	66	1.25%	2.1	21%	1.60	0.000	1.60
26.410	6943.55	96.0	1.245	96.0	-0.3	-0.12	1.30%	Coarse Tailings	0.054	108.1	1.49	0.000	1.49	0	64	1.32%	2.1	21%	1.61	0.000	1.61
26.574	6943.39	90.8	1.350	90.8	-0.3	-0.14	1.49%	Coarse Tailings	0.054	108.1	1.49	0.000	1.49	0	60	1.51%	2.2	21%	1.62	0.000	1.62
26.739	6943.22	83.7	1.366	83.7	-0.4	-0.16	1.63%	Coarse Tailings	0.054	108.1	1.50	0.000	1.50	0	55	1.66%	2.3	21%	1.63	0.000	1.63
26.903	6943.06	71.4	1.393	71.4	-0.2	-0.08	1.95%	Coarse Tailings	0.054	108.1	1.51	0.000	1.51	0	46	1.99%	2.4	21%	1.64	0.000	1.64
27.067	6942.89	63.3	1.043	63.3	-0.3	-0.12	1.65%	Coarse Tailings	0.054	108.1	1.52	0.000	1.52	0	41	1.69%	2.4	21%	1.65	0.000	1.65
27.231	6942.73	67.0	1.061	67.0	0.1	0.04	1.58%	Coarse Tailings	0.054	108.1	1.53	0.000	1.53	0	43	1.62%	2.3	21%	1.66	0.000	1.66
27.395	6942.57	49.0	1.302	49.0	0.1	0.02	2.66%	Coarse Tailings	0.054	108.1	1.54	0.000	1.54	0	31	2.74%	2.6	21%	1.67	0.000	1.67
27.559	6942.40	37.0	1.179	37.0	-0.2	-0.10	3.19%	Coarse Tailings	0.054	108.1	1.55	0.000	1.55	0	23	3.33%	2.7	21%	1.67	0.000	1.67
27.723	6942.24	34.6	1.181	34.6	0.0	0.00	3.41%	Coarse Tailings	0.054	108.1	1.56	0.000	1.56	0	21	3.57%	2.8	21%	1.68	0.000	1.68
27.887	6942.07	64.8	1.158	64.8	0.8	0.36	1.79%	Coarse Tailings	0.054	108.1	1.57	0.000	1.57	0	40	1.83%	2.4	21%	1.69	0.000	1.69
28.051	6941.91	63.2	1.272	63.2	0.2	0.08	2.01%	Coarse Tailings	0.054	108.1	1.57	0.000	1.57	0	39	2.07%	2.4	21%	1.70	0.000	1.70
28.215	6941.75	49.8	1.258	49.8	-0.4	-0.16	2.52%	Coarse Tailings	0.054	108.1	1.58	0.000	1.58	0	30	2.61%	2.6	21%	1.71	0.000	1.71

4.59	824	1.8E-03	1.2E+03	295	0.9539	1.4E-04	19	0.202	0.197	4	1.211	10561	7287	1400	5717	0.022%	1.70	0.75	0.02%	0.000540	0.34	0.079	0.797	0.09%	0.0001
4.64	824	1.7E-03	1.1E+03	290	0.9529	1.4E-04	0	0.203	0.198	4	0.203	10517	7256	1400	10517	0.023%	1.79	1.00	0.01%	0.000231	0.36	0.025	0.785	0.04%	0.0001
4.69	824	1.7E-03	1.1E+03	285	0.9520	1.4E-04	0	0.203	0.198	4	0.203	10474	7226	1400	10474	0.023%	1.79	1.00	0.01%	0.000236	0.36	0.025	0.785	0.04%	0.0001
4.74	824	1.7E-03	1.1E+03	281	0.9510	1.5E-04	0	0.203	0.199	4	0.203	10432	7196	1400	10432	0.024%	1.79	1.00	0.01%	0.000242	0.36	0.025	0.785	0.04%	0.0001
4.79	824	1.7E-03	1.1E+03	276	0.9500	1.5E-04	0	0.204	0.200	4	0.204	10390	7166	1400	10390	0.024%	1.79	1.00	0.01%	0.000247	0.36	0.025	0.785	0.04%	0.0001
4.84	824	1.7E-03	1.1E+03	272	0.9490	1.5E-04	0	0.204	0.200	4	0.204	10349	7137	1400	10349	0.024%	1.79	1.00	0.01%	0.000253	0.36	0.025	0.785	0.04%	0.0001
4.89	824	1.7E-03	1.1E+03	268	0.9479	1.5E-04	0	0.205	0.201	4	0.205	10308	7109	1400	10308	0.024%	1.79	1.00	0.01%	0.000258	0.36	0.025	0.785	0.04%	0.0001
4.94	824	1.8E-03	1.2E+03	263	0.9469	1.4E-04	19	0.205	0.201	4	1.214	10265	7079	1400	5564	0.024%	1.70	0.75	0.02%	0.000865	0.34	0.079	0.797	0.14%	0.0002
4.99	824	1.8E-03	1.2E+03	259	0.9458	1.5E-04	19	0.206	0.202	4	1.215	10224	7049	1400	5543	0.024%	1.70	0.75	0.02%	0.000910	0.34	0.079	0.797	0.15%	0.0002
5.04	824	1.8E-03	1.2E+03	255	0.9447	1.5E-04	19	0.206	0.202	4	1.215	10182	7020	1400	5522	0.025%	1.70	0.75	0.02%	0.000955	0.34	0.079	0.797	0.15%	0.0003
5.09	720	1.8E-03	9.2E+02	251	0.9436	1.9E-04	19	0.207	0.203	4	1.215	10142	6992	1400	5501	0.039%	1.70	0.75	0.02%	0.002803	0.34	0.079	0.797	0.45%	0.0007
5.14	720	1.8E-03	9.2E+02	247	0.9425	2.0E-04	19	0.207	0.203	4	1.216	10102	6964	1400	5480	0.040%	1.70	0.75	0.02%	0.002856	0.34	0.079	0.797	0.46%	0.0007
5.19	720	1.8E-03	9.2E+02	243	0.9414	2.0E-04	19	0.208	0.204	4	1.216	10062	6936	1400	5460	0.040%	1.70	0.75	0.02%	0.002909	0.34	0.079	0.797	0.46%	0.0008
5.24	720	1.8E-03	9.2E+02	239	0.9402	2.0E-04	19	0.208	0.204	4	1.216	10023	6909	1400	5440	0.041%	1.70	0.75	0.02%	0.002961	0.34	0.079	0.797	0.47%	0.0008
5.29	720	1.8E-03	9.2E+02	236	0.9391	2.0E-04	19	0.209	0.205	4	1.217	9985	6882	1400	5420	0.041%	1.70	0.75	0.02%	0.003014	0.34	0.079	0.797	0.48%	0.0008
5.34	720	1.8E-03	9.2E+02	232	0.9379	2.0E-04	19	0.209	0.205	4	1.217	9947	6855	1400	5400	0.042%	1.70	0.75	0.02%	0.003066	0.34	0.079	0.797	0.49%	0.0008
5.39	720	1.8E-03	9.2E+02	228	0.9367	2.0E-04	19	0.209	0.206	4	1.218	9909	6829	1400	5381	0.042%	1.70	0.75	0.02%	0.003117	0.34	0.079	0.797	0.50%	0.0008
5.44	720	1.8E-03	9.2E+02	225	0.9355	2.0E-04	19	0.210	0.206	4	1.218	9872	6803	1400	5362	0.043%	1.70	0.75	0.02%	0.003168	0.34	0.079	0.797	0.51%	0.0008
5.49	720	1.8E-03	9.2E+02	221	0.9343	2.1E-04	19	0.210	0.207	4	1.218	9836	6777	1400	5343	0.043%	1.70	0.75	0.02%	0.003219	0.34	0.079	0.797	0.51%	0.0008
5.54	720	1.8E-03	9.2E+02	218	0.9330	2.1E-04	19	0.211	0.207	4	1.219	9800	6752	1400	5325	0.044%	1.70	0.75	0.02%	0.003270	0.34	0.079	0.797	0.52%	0.0009
5.59	720	1.8E-03	9.2E+02	214	0.9317	2.1E-04	19	0.211	0.208	4	1.219	9764	6727	1400	5306	0.044%	1.70	0.75	0.02%	0.003320	0.34	0.079	0.797	0.53%	0.0009
5.64	720	1.8E-03	9.2E+02	211	0.9304	2.1E-04	19	0.212	0.208	4	1.219	9729	6702	1400	5288	0.045%	1.70	0.75	0.02%	0.003370	0.34	0.079	0.797	0.54%	0.0009
5.69	720	1.8E-03	9.2E+02	208	0.9291	2.1E-04	19	0.212	0.209	4	1.220	9694	6678	1400	5270	0.045%	1.70	0.75	0.02%	0.003420	0.34	0.079	0.797	0.55%	0.0009
5.74	720	1.8E-03	9.2E+02	204	0.9278	2.1E-04	19	0.212	0.209	4	1.220	9660	6654	1400	5253	0.046%	1.70	0.75	0.02%	0.003469	0.34	0.079	0.797	0.55%	0.0009
5.79	720	1.8E-03	9.2E+02	201	0.9265	2.2E-04	19	0.213	0.210	4	1.220	9626	6630	1400	5235	0.046%	1.70	0.75	0.02%	0.003518	0.34	0.079	0.797	0.56%	0.0009
5.84	720	1.8E-03	9.2E+02	198	0.9251	2.2E-04	19	0.213	0.210	4	1.221	9593	6606	1400	5218	0.047%	1.70	0.75	0.02%	0.003566	0.34	0.079	0.797	0.57%	0.0009
5.89	720	1.8E-03	9.2E+02	195	0.9237	2.2E-04	19	0.214	0.211	4	1.221	9560	6583	1400	5201	0.047%	1.70	0.75	0.02%	0.003615	0.34	0.079	0.797	0.58%	0.0009
5.94	720	1.8E-03	9.2E+02	192	0.9223	2.2E-04	19	0.214	0.211	4	1.221	9527	6560	1400	5184	0.048%	1.70	0.75	0.02%	0.003662	0.34	0.079	0.797	0.58%	0.0010
5.99	720	1.8E-03	9.2E+02	189	0.9209	2.2E-04	19	0.215	0.211	4	1.222	9495	6537	1400	5167	0.048%	1.70	0.75	0.02%	0.003710	0.34	0.079	0.797	0.59%	0.0010
6.04	720	1.8E-03	9.2E+02	186	0.9194	2.2E-04	19	0.215	0.212	4	1.222	9463	6515	1400	5151	0.049%	1.70	0.75	0.02%	0.003757	0.34	0.079	0.797	0.60%	0.0010
6.09	720	1.8E-03	9.2E+02	183	0.9180	2.2E-04	19	0.215	0.212	4	1.222	9431	6493	1400	5135	0.049%	1.70	0.75	0.02%	0.003803	0.34	0.079	0.797	0.61%	0.0010
6.14	720	1.8E-03	9.2E+02	180	0.9165	2.3E-04	19	0.216	0.213	4	1.223	9400	6471	1400	5119	0.050%	1.70	0.75	0.02%	0.003850	0.34	0.079	0.797	0.61%	0.0010
6.19	720	1.8E-03	9.2E+02	178	0.9150	2.3E-04	19	0.216	0.213	4	1.223	9369	6449	1400	5103	0.050%	1.70	0.75	0.02%	0.003895	0.34	0.079	0.797	0.62%	0.0010
6.24	720	1.8E-03	9.2E+02	175	0.9135	2.3E-04	19	0.217	0.214	4	1.223	9339	6428	1400	5087	0.051%	1.70	0.75	0.02%	0.003941	0.34	0.079	0.797	0.63%	0.0010
6.29	720	1.7E-03	8.7E+02	172	0.9119	2.4E-04	0	0.217	0.214	4	0.217	9310	6408	1400	9310	0.061%	1.79	1.00	0.01%	0.000916	0.36	0.025	0.785	0.14%	0.0002
6.34	720	1.7E-03	8.7E+02	170	0.9103	2.4E-04	0	0.217	0.215	4	0.217	9281	6388	1400	9281	0.062%	1.79	1.00	0.01%	0.000928	0.36	0.025	0.785	0.15%	0.0002
6.39	720	1.7E-03	8.7E+02	167	0.9087	2.5E-04	0	0.218	0.215	4	0.218	9253	6368	1400	9253	0.062%	1.79	1.00	0.01%	0.000939	0.36	0.025	0.785	0.15%	0.0002
6.44	720	1.7E-03	8.7E+02	164	0.9071	2.5E-04	0	0.218	0.215	4	0.218	9226	6348	1400	9226	0.063%	1.79	1.00	0.01%	0.000951	0.36	0.025	0.785	0.15%	0.0002
6.49	720	1.7E-03	8.7E+02	162	0.9055	2.5E-04	0	0.218	0.216	4	0.218	9198	6329	1400	9198	0.064%	1.79	1.00	0.01%	0.000962	0.36	0.025	0.785	0.15%	0.0002
6.54	720	1.7E-03	8.7E+02	159	0.9038	2.5E-04	0	0.219	0.216	4	0.219	9171	6310	1400	9171	0.064%	1.79	1.00	0.01%	0.000974	0.36	0.025	0.785	0.15%	0.0003
6.59	705	1.7E-03	8.3E+02	157	0.9022	2.6E-04	0	0.219	0.217	4	0.219	9144	6291	1400	9144	0.073%	1.79	1.00	0.01%	0.001121	0.36	0.025	0.785	0.18%	0.0003
6.64	705	1.7E-03	8.3E+02	155	0.9005	2.6E-04	0	0.219	0.217	4	0.219	9117	6272	1400	9117	0.073%	1.79	1.00	0.01%	0.001135	0.36	0.025	0.785	0.18%	0.0003
6.69	705	1.7E-03	8.3E+02	152	0.8987	2.6E-04	0	0.220	0.218	4	0.220	9091	6254	1400	9091	0.074%	1.79	1.00	0.01%	0.001148	0.36	0.025	0.785	0.18%	0.0003
6.74	705	1.7E-03	8.3E+02	150	0.8970	2.7E-04	0	0.220	0.218	4	0.220	9065	6236	1400	9065	0.075%	1.79	1.00	0.01%	0.001160	0.36	0.025	0.785	0.18%	0.0003
6.79	705	1.7E-03	8.3E+02	148	0.8952	2.7E-04	0	0.221	0.218	4	0.221	9039	6217	1400	9039	0.076%	1.79	1.00	0.01%	0.001173	0.36	0.025	0.785	0.18%	0.0003
6.84	705	1.7E-03	8.3E+02	146	0.8934	2.7E-04	0	0.221	0.219	4	0.221	9013	6199	1400	9013	0.076%	1.79	1.00	0.01%	0.001186	0.36	0.025	0.785	0.19%	0.0003
6.89	705	1.7E-03	8.3E+02	143	0.8916	2.7E-04	0	0.221	0.219	4	0.221	8988	6182	1400	8988	0.077%	1.79	1.00	0.01%	0.001199	0.36	0.025	0.785	0.19%	0.0003
6.94	705	1.7E-03	8.3E+02	141	0.8897	2.7E-04	0	0.222	0.220	4	0.222	8962	6164	1400	8962	0.078%	1.79	1.00	0.01%	0.001211	0.36	0.025	0.785	0.19%	0.0003
6.99	705	1.7E-03	8.3E+02	139	0.8879	2.7E-04	0	0.222	0.220	4	0.222	8938	6147	1400	8938	0.078%	1.79	1.00	0.01%	0.001223	0.36	0.025	0.785	0.19%	0.0003
7.04	705	1.7E-03	8.3E+02	137	0.8860	2.7E-04	0	0.222	0.220	4	0.222	8913	6129	1400	8913	0.079%	1.79	1.00	0.01%	0.001235	0.36	0.025	0.785	0.19%	0.0003
7.09	705	1.7E-03	8.3E+02	135	0.8841	2.7E-04	0	0.223	0.221	4	0.223	8888	6112	1400	8888	0.080%	1.79	1.00	0.01%	0.001248	0.36	0.025	0.785	0.20%	0.0003
7.14	705	1.7E-03	8.3E+02	133	0.8821	2.8E-04	0	0.223	0.221	4	0.223	8864	6095	1400	8864	0.080%	1.79	1.00	0.01%	0.001259	0.36	0.025	0.785	0.20%	0.0003
7.19	705	1.7E-03	8.3E+02	131	0.8801	2.8E-04	0	0.223	0.221	4	0.223	8840	6078	1400	8840	0.081%	1.79	1.00	0.01%	0.001271	0.36	0.025	0.785	0.20%	0.0003
7.24	705	1.7E-03	8.3E+02	129	0.8782	2.8E-04	0	0.224	0.222	4	0.224	8816	6062	1400	8816	0.082%	1.79	1.00	0.01%	0.001283	0.36	0.025	0.785	0.20%	0.0003
7.29	705	1.7E-03	8.3E+02	127	0.8761	2.8E-04	0	0.224	0.222	4	0.224	8793	6045	1400	8793	0.082%	1.79	1.00	0.01%	0.001294	0.36	0.025	0.785	0.20%	0.0003
7.34	705	1.7E-03	8.3E+02	125	0.8741	2.8E-04	0	0.224	0.223	4	0.224	8770	6029	1400	8770	0.083%	1.79	1.00	0.01%	0.001305	0.36	0.025	0.785	0.20%	0.0003
7.39	705	1.7E-03	8.3E+02	123	0.8720	2.8E-04	0	0.225	0.223	4	0.225	8746	6013	1400	8746	0.084%	1.79	1.00	0.01%	0.001316	0.36	0.025	0.785	0.21%	0.0003
7.44	705	1.7E-03	8.3E+02	122	0.8699	2.8E-04	0	0.225	0.223	4	0.225	8724	5997	1400	8724	0.084%	1.79	1.00	0.01%	0.001327	0.36	0.025	0.785	0.21%	0.0003
7.49	705	1.7E-03	8.3E+02	120	0.8678	2.8E-04	0	0.225	0.224	4	0.225	8701	5981	1400	8701	0.085%	1.79	1.00	0.01%	0.001338	0.36	0.025	0.785	0.21%	0.0003
7.54	705	1.7E-03	8.3E+02	118	0.8656	2.8E-04	0	0.226	0.224	4	0.226	8678	5965	1400	8678	0.085%	1.79	1.00	0.01%	0.001348	0.36	0.025	0.785	0.21%	0.0003
7.59	705	1.7E-03	8.3E+02	116	0.8634	2.9E-04	0	0.226	0.225	4	0.226	8656	5949	1400	8656	0.086%	1.79	1.00	0.01%	0.001359	0.36	0.025	0.785	0.21%	0.0003
7.64	705	1.7E-03	8.3E+02	115	0.8612	2.9E-04	0	0.226	0.225	4	0.226	8634	5934	1400	8634	0.086%	1.79	1.00	0.01%	0.001369	0.36	0.025	0.785	0.21%	0.0004
7.69	705	1.7E-03	8.3E+02	113	0.8590	2.9E-04	0	0.227	0.225	4	0.227	8612	5918	1400	8612	0.087%	1.79	1.00	0.01%	0.001378	0.36	0.025	0.785	0.22%	0.0004
7.74	705	1.7E-03	8.3E+02	111	0.8568	2.9E-04	0	0.227	0.226	4	0.227	8590	5903	1400	8590	0.088%	1.79	1.00	0.01%	0.001388	0.36	0.025	0.785	0.22%	0.0004
7.79	705	1.7E-03	8.3E+02	110	0.8545	2.9E-04	0	0.227	0.226	4	0.227	8569	5888	1400	8569	0.088%	1.79	1.00	0.01%	0.001397	0.36	0.025	0.785	0.22%	0.0004
7.84	705	1.7E-03	8.3E+02	108	0.8521	2.9E-04	0	0.228	0.226	4	0.228	8547	5873	1400	8547	0.089%	1.79	1.00	0.01%	0.001406	0.36	0.025	0.785	0.22%	0.0004
7.89	705	1.7E-03	8.3E+02	107	0.8498	2.9E-04	0	0.228	0.227	4	0.228	8526	5858	1400	8526	0.089%	1.79	1.00	0.01%	0.001415	0.36	0.025	0.785	0.22%	0.0004
7.94	705	1.7E-03	8.3E+02	105	0.8474	2.9E-04	0	0.228	0.227	4	0.228	8505	5843	1400	8505	0.090%	1.79	1.00	0.01%	0.001424	0.36	0.025	0.785	0.22%	0.0004
7.99	705	1.7E-03	8.3E+02	104	0.8450	2.9E-04	0	0.229	0.227	4	0.229	8484	5829	1400	8484	0.090%	1.79	1.00	0.01%	0.001432	0.36	0.025	0.785	0.22%	0.0004
8.04	705	1.7E-03	8.3E+02	102	0.8426	2.9E-04	0	0.229	0.228	4	0.229	8464	5814	1400	8464	0.090%	1.79	1.00	0.01%	0.001440	0.36	0.025	0.785	0.23%	0.0004
8.09	705	1.7E-03	8.3E+02	101	0.8402	3.0E-04	0	0.229	0.228	4	0.229	8443	5800	1400	8443	0.091%	1.79	1.00	0.01%	0.001448	0.36	0.025	0.785	0.23%	0.0004
8.14	639	1.7E-03	6.9E+02	99	0.8377	3.6E-04	0	0.230	0.228	4	0.230	8423	5786	1400	8423	0.170%	1.79	1.00	0.01%	0.002865	0.36	0.025	0.785	0.45%	0.0007
8.19	639	1.7E-03	6.9E+02	98	0.8352	3.6E-04	0	0.230	0.229	4	0.230	8403	5772	1400	8403	0.171%	1.79	1.00	0.01%	0.002879	0.36	0.025	0.785	0.45%	0.0007
8.24	639	1.7E-03	6.9E+02	96	0.8326	3.6E-04	0	0.230	0.229	4	0.230	8383	5758	1400	8383	0.172%	1.79	1.00	0.01%	0.002893	0.36	0.025	0.785	0.45%	0.0007
8.29	639	1.7E-03	6.9E+02	95	0.8301	3.6E-04	0	0.230	0.230	4	0.230	8363	5744	1400	8363	0.172%	1.79	1.00	0.01%	0.002907	0.36	0.025	0.785	0.46%	0.0007
8.34	639	1.7E-03	6.9E+02	94	0.8275	3.6E-04	0	0.231	0.230	4	0.231	8343	5730	1400	8343	0.173%	1.79	1.00	0.01%	0.002919	0.36	0.025	0.785	0.46%	0.0008
8.39	639	1.7E-03	6.9E+02	92	0.8248	3.7E-04	0	0.231	0.230	4	0.231	8324	5716	1400	8324	0.174%	1.79	1.00	0.01%	0.002931	0.36	0.025	0.785	0.46%	0.0008
8.44	639	1.7E-03	6.9E+02	91	0.8222	3.7E-04	0	0.231	0.231	4	0.231	8304	5703	1400	8304	0.174%	1.79	1.00	0.01%	0.002943	0.36	0.025	0.785	0.46%	0.0008
8.49	639	1.7E-03	6.9E+02	90	0.8195	3.7E-04	0	0.232	0.231	4	0.232	8285	5690	1400	8285	0.175%	1.79	1.00	0.01%	0.002953	0.36	0.025	0.785	0.46%	0.0008
8.54	639	1.7E-03	6.9E+02	89	0.8168	3.7E-04	0	0.232	0.231	4	0.232	8266	5676	1400	8266	0.176%	1.79	1.00	0.01%	0.002963	0.36	0.025	0.785	0.47%	0.0008
8.59	639	1.7E-03	6.9E+02	87	0.8140	3.7E-04	0	0.232	0.232	4	0.232	8247	5663	1400	8247	0.176%	1.79	1.00	0.01%	0.002972	0.36	0.025	0.785	0.47%	0.0008
8.64	639	1.7E-03	6.9E+02	86	0.8112	3.7E-04	0	0.233	0.232	4	0.233	8229	5650	1400	8229	0.176%	1.79	1.00	0.01%	0.002980	0.36	0.025	0.785	0.47%	0.0008
8.69	639	1.7E-03	6.9E+02	85	0.8084	3.7E-04	0	0.233	0.232	4	0.233	8210	5637	1400	8210	0.177%	1.79	1.00	0.01%	0.002987	0.36	0.025	0.785	0.47%	0.0008
8.74	639	1.7E-03	6.9E+02	84	0.8056	3.7E-04	0	0.233	0.233	4	0.233	8192	5624	1400	8192	0.177%	1.79	1.00	0.01%	0.002994	0.36	0.025	0.785	0.47%	0.0008
8.79	639	1.7E-03	6.9E+02	83	0.8027	3.7E-04	0	0.233	0.233	4	0.233	8173	5611	1400	8173	0.178%	1.79	1.00	0.01%	0.003000	0.36	0.025	0.785	0.47%	0.0008
8.84	639	1.7E-03	6.9E+02	82	0.7998	3.7E-04	0	0.234	0.233	4	0.234	8155	5598	1400	8155	0.178%	1.79	1.00	0.01%	0.003005	0.36	0.025	0.785	0.47%	0.0008
8.89	639	1.7E-03	6.9E+02	81	0.7969	3.7E-04	0	0.234	0.234	4	0.234	8137	5586	1400	8137	0.178%	1.79	1.00	0.01%	0.003009	0.36	0.025	0.785	0.47%	0.0008
8.94	639	1.7E-03	6.9E+02	79	0.7940	3.7E-04	0	0.234	0.234	4	0.234	8119	5573	1400	8119	0.178%	1.79	1.00	0.01%	0.003012	0.36	0.025	0.785	0.47%	0.0008
8.99	639	1.7E-03	6.9E+02	78	0.7910	3.7E-04	0	0.235	0.234	4	0.235	8101	5561	1400	8101	0.178%	1.79	1.00	0.01%	0.003015	0.36	0.025	0.785	0.47%	0.0008
9.04	639	1.7E-03	6.9E+02	77	0.7880	3.8E-04	0	0.235	0.235	4	0.235	8084	5548	1400	8084	0.179%	1.79	1.00	0.01%	0.003017	0.36	0.025	0.785	0.47%	0.0008
9.09	639	1.7E-03	6.9E+02	76	0.7849	3.8E-04	0	0.235	0.235	4	0.235	8066	5536	1400	8066	0.179%	1.79	1.00	0.01%	0.003018	0.36	0.025	0.785	0.47%	0.0008
9.14	639	1.7E-03	6.9E+02	75	0.7818	3.8E-04	0	0.235	0.235	4	0.235	8049	5524	1400	8049	0.179%	1.79	1.00	0.01%	0.003018	0.36	0.025	0.785	0.47%	0.0008
9.19	639	1.7E-03	6.9E+02	74	0.7787	3.8E-04	0	0.236	0.236	4	0.236	8032	5512	1400	8032	0.179%	1.79	1.00	0.01%	0.003017	0.36	0.025	0.785	0.47%	0.0008
9.24	639	1.7E-03	6.9E+02	73	0.7756	3.8E-04	0	0.236	0.236	4	0.236	8015	5500	1400	8015	0.178%	1.79	1.00	0.01%	0.003016	0.36	0.025	0.785	0.47%	0.0008

28.379	6941.58	52.7	1.094	52.7	0.0	0.00	2.08%	Coarse Tailings	0.054	108.1	1.59	0.000	1.59	0	32	2.14%	2.5	21%	1.72	0.000	1.72
28.543	6941.42	68.3	0.939	68.3	0.7	0.30	1.38%	Coarse Tailings	0.054	108.1	1.60	0.000	1.60	0	42	1.41%	2.3	21%	1.73	0.000	1.73
28.707	6941.25	68.8	0.877	68.8	-0.5	-0.20	1.28%	Coarse Tailings	0.054	108.1	1.61	0.000	1.61	0	42	1.31%	2.3	21%	1.74	0.000	1.74
28.871	6941.09	66.0	0.760	66.0	-0.6	-0.24	1.15%	Coarse Tailings	0.054	108.1	1.62	0.000	1.62	0	40	1.18%	2.3	21%	1.75	0.000	1.75
29.035	6940.93	65.4	0.806	65.4	-0.4	-0.18	1.23%	Coarse Tailings	0.054	108.1	1.63	0.000	1.63	0	39	1.26%	2.3	21%	1.75	0.000	1.75
29.199	6940.76	58.3	0.903	58.3	-0.1	-0.02	1.55%	Coarse Tailings	0.054	108.1	1.64	0.000	1.64	0	35	1.59%	2.4	21%	1.76	0.000	1.76
29.363	6940.60	50.3	0.969	50.3	-0.2	-0.10	1.93%	Coarse Tailings	0.054	108.1	1.65	0.000	1.65	0	30	1.99%	2.5	21%	1.77	0.000	1.77
29.527	6940.43	62.7	0.917	62.7	0.3	0.12	1.46%	Coarse Tailings	0.054	108.1	1.65	0.000	1.65	0	37	1.50%	2.4	21%	1.78	0.000	1.78
29.691	6940.27	60.0	0.965	60.0	-0.3	-0.12	1.61%	Coarse Tailings	0.054	108.1	1.66	0.000	1.66	0	35	1.65%	2.4	21%	1.79	0.000	1.79
29.855	6940.11	48.8	0.798	48.8	0.1	0.04	1.63%	Coarse Tailings	0.054	108.1	1.67	0.000	1.67	0	28	1.69%	2.5	21%	1.80	0.000	1.80
30.019	6939.94	53.0	0.910	53.0	0.2	0.10	1.72%	Coarse Tailings	0.054	108.1	1.68	0.000	1.68	0	31	1.77%	2.5	21%	1.81	0.000	1.81
30.183	6939.78	57.5	1.186	57.6	-0.1	-0.06	2.06%	Coarse Tailings	0.054	108.1	1.69	0.000	1.69	0	33	2.12%	2.5	21%	1.82	0.000	1.82
30.347	6939.61	40.1	1.361	40.1	-0.3	-0.12	3.40%	Coarse Tailings	0.054	108.1	1.70	0.000	1.70	0	23	3.55%	2.8	21%	1.82	0.000	1.82
30.511	6939.45	33.4	1.365	33.4	0.2	0.08	4.09%	Coarse Tailings	0.054	108.1	1.71	0.000	1.71	0	19	4.31%	2.9	21%	1.83	0.000	1.83
30.675	6939.29	35.9	1.566	35.9	1.0	0.45	4.36%	Coarse Tailings	0.054	108.1	1.72	0.000	1.72	0	20	4.58%	2.9	21%	1.84	0.000	1.84
30.840	6939.12	22.7	1.245	22.7	0.1	0.06	5.49%	Coarse Tailings	0.054	108.1	1.72	0.000	1.72	0	12	5.94%	3.1	21%	1.85	0.000	1.85
31.004	6938.96	14.7	0.838	14.7	3.1	1.32	5.71%	Coarse Tailings	0.054	108.1	1.73	0.000	1.73	0	7	6.47%	3.3	21%	1.86	0.000	1.86
31.168	6938.79	13.2	0.590	13.1	6.0	2.60	4.48%	Coarse Tailings	0.054	108.1	1.74	0.000	1.74	0	7	5.16%	3.3	21%	1.87	0.000	1.87
31.332	6938.63	27.5	0.596	27.5	9.6	4.17	2.16%	Coarse Tailings	0.054	108.1	1.75	0.000	1.75	0	15	2.31%	2.8	21%	1.88	0.000	1.88
31.496	6938.46	32.9	0.804	32.9	5.4	2.32	2.44%	Coarse Tailings	0.054	108.1	1.76	0.000	1.76	0	18	2.58%	2.8	21%	1.89	0.000	1.89
31.660	6938.30	32.8	1.061	32.8	5.4	2.36	3.24%	Coarse Tailings	0.054	108.1	1.77	0.000	1.77	0	18	3.42%	2.8	21%	1.90	0.000	1.90
31.824	6938.14	28.3	1.290	28.2	5.1	2.20	4.56%	Coarse Tailings	0.054	108.1	1.78	0.000	1.78	0	15	4.87%	3.0	21%	1.90	0.000	1.90
31.988	6937.97	20.8	0.904	20.8	5.2	2.24	4.34%	Coarse Tailings	0.054	108.1	1.79	0.000	1.79	0	11	4.75%	3.1	21%	1.91	0.000	1.91
32.152	6937.81	22.0	0.794	21.9	13.0	5.61	3.61%	Coarse Tailings	0.054	108.1	1.80	0.000	1.80	0	11	3.93%	3.0	21%	1.92	0.000	1.92
32.316	6937.64	50.1	0.684	50.0	11.0	4.78	1.37%	Coarse Tailings	0.054	108.1	1.80	0.000	1.80	0	27	1.42%	2.5	21%	1.93	0.000	1.93
32.480	6937.48	59.0	0.805	59.0	7.6	3.28	1.36%	Coarse Tailings	0.054	108.1	1.81	0.000	1.81	0	32	1.41%	2.4	21%	1.94	0.000	1.94
32.644	6937.32	63.3	0.808	63.3	6.8	2.93	1.28%	Coarse Tailings	0.054	108.1	1.82	0.000	1.82	0	34	1.31%	2.4	21%	1.95	0.000	1.95
32.808	6937.15	63.0	1.132	63.0	6.3	2.75	1.80%	Coarse Tailings	0.054	108.1	1.83	0.000	1.83	0	33	1.85%	2.4	21%	1.96	0.000	1.96
32.972	6936.99	59.3	1.460	59.3	6.0	2.58	2.46%	Coarse Tailings	0.054	108.1	1.84	0.000	1.84	0	31	2.54%	2.6	21%	1.97	0.000	1.97
33.136	6936.82	54.3	1.805	54.3	6.3	2.75	3.32%	Coarse Tailings	0.054	108.1	1.85	0.000	1.85	0	28	3.44%	2.7	21%	1.98	0.000	1.98
33.300	6936.66	42.7	1.793	42.7	5.8	2.50	4.20%	Coarse Tailings	0.054	108.1	1.86	0.000	1.86	0	22	4.39%	2.8	21%	1.98	0.000	1.98
33.464	6936.50	32.7	1.516	32.6	5.8	2.52	4.64%	Coarse Tailings	0.054	108.1	1.87	0.000	1.87	0	16	4.92%	3.0	21%	1.99	0.000	1.99
33.628	6936.33	33.3	1.044	33.2	7.4	3.19	3.14%	Coarse Tailings	0.054	108.1	1.88	0.000	1.88	0	17	3.33%	2.8	21%	2.00	0.000	2.00
33.792	6936.17	36.9	1.171	36.8	6.5	2.83	3.18%	Coarse Tailings	0.054	108.1	1.88	0.000	1.88	0	19	3.35%	2.8	21%	2.01	0.000	2.01
33.956	6936.00	34.8	1.193	34.8	4.0	1.73	3.43%	Coarse Tailings	0.054	108.1	1.89	0.000	1.89	0	17	3.62%	2.9	21%	2.02	0.000	2.02
34.120	6935.84	33.1	1.240	33.1	4.3	1.85	3.75%	Coarse Tailings	0.054	108.1	1.90	0.000	1.90	0	16	3.97%	2.9	21%	2.03	0.000	2.03
34.284	6935.68	52.1	1.317	52.0	6.4	2.76	2.53%	Coarse Tailings	0.054	108.1	1.91	0.000	1.91	0	26	2.63%	2.6	21%	2.04	0.000	2.04
34.448	6935.51	44.6	1.402	44.6	4.7	2.03	3.14%	Coarse Alluvium	0.056	111.0	1.92	0.000	1.92	0	22	3.28%	2.7	36%	2.05	0.000	2.05
34.612	6935.35	29.7	1.175	29.7	5.8	2.50	3.95%	Coarse Alluvium	0.056	111.0	1.93	0.000	1.93	0	14	4.23%	3.0	36%	2.06	0.000	2.06
34.776	6935.18	44.7	1.089	44.7	7.5	3.23	2.43%	Coarse Alluvium	0.056	111.0	1.94	0.000	1.94	0	22	2.55%	2.7	36%	2.06	0.000	2.06
34.941	6935.02	71.4	1.222	71.3	6.3	2.75	1.71%	Coarse Alluvium	0.056	111.0	1.95	0.000	1.95	0	36	1.76%	2.4	36%	2.07	0.000	2.07
35.105	6934.86	104.1	1.507	104.1	6.1	2.62	1.45%	Coarse Alluvium	0.056	111.0	1.96	0.000	1.96	0	52	1.48%	2.2	36%	2.08	0.000	2.08
35.269	6934.69	202.3	2.997	202.2	8.8	3.82	1.48%	Coarse Alluvium	0.056	111.0	1.97	0.000	1.97	0	102	1.50%	2.0	36%	2.09	0.000	2.09
35.433	6934.53	273.6	5.524	273.6	8.1	3.50	2.02%	Coarse Alluvium	0.056	111.0	1.97	0.000	1.97	0	138	2.03%	2.0	36%	2.10	0.000	2.10
35.597	6934.36	262.5	7.086	262.5	6.9	2.97	2.70%	Coarse Alluvium	0.056	111.0	1.98	0.000	1.98	0	131	2.72%	2.1	36%	2.11	0.000	2.11
35.761	6934.20	155.8	7.241	155.8	5.1	2.20	4.65%	Coarse Alluvium	0.056	111.0	1.99	0.000	1.99	0	77	4.71%	2.5	36%	2.12	0.000	2.12
35.925	6934.04	133.2	4.810	133.2	6.4	2.76	3.61%	Coarse Alluvium	0.056	111.0	2.00	0.000	2.00	0	66	3.67%	2.4	36%	2.13	0.000	2.13
36.089	6933.87	70.0	3.734	70.0	5.4	2.32	5.33%	Coarse Alluvium	0.056	111.0	2.01	0.000	2.01	0	34	5.49%	2.8	36%	2.14	0.000	2.14
36.253	6933.71	40.6	1.978	40.5	4.4	1.91	4.88%	Coarse Alluvium	0.056	111.0	2.02	0.000	2.02	0	19	5.13%	2.9	36%	2.15	0.000	2.15
36.417	6933.54	31.4	1.901	31.4	4.3	1.85	6.05%	Coarse Alluvium	0.056	111.0	2.03	0.000	2.03	0	14	6.46%	3.1	36%	2.16	0.000	2.16
36.581	6933.38	25.8	1.845	25.8	4.4	1.89	7.14%	Coarse Alluvium	0.056	111.0	2.04	0.000	2.04	0	12	7.75%	3.2	36%	2.17	0.000	2.17
36.745	6933.22	25.0	1.678	25.0	5.1	2.22	6.71%	Coarse Alluvium	0.056	111.0	2.05	0.000	2.05	0	11	7.31%	3.2	36%	2.17	0.000	2.17
36.909	6933.05	26.5	1.469	26.5	5.5	2.38	5.53%	Coarse Alluvium	0.056	111.0	2.06	0.000	2.06	0	12	6.00%	3.1	36%	2.18	0.000	2.18
37.073	6932.89	27.8	1.554	27.8	5.7	2.46	5.58%	Coarse Alluvium	0.056	111.0	2.07	0.000	2.07	0	12	6.03%	3.1	36%	2.19	0.000	2.19
37.237	6932.72	29.5	1.787	29.5	6.8	2.95	6.06%	Coarse Alluvium	0.056	111.0	2.08	0.000	2.08	0	13	6.52%	3.1	36%	2.20	0.000	2.20
37.401	6932.56	34.2	1.855	34.2	7.1	3.09	5.42%	Coarse Alluvium	0.056	111.0	2.08	0.000	2.08	0	15	5.78%	3.0	36%	2.21	0.000	2.21
37.565	6932.40	54.5	2.149	54.4	7.8	3.40	3.94%	Coarse Alluvium	0.056	111.0	2.09	0.000	2.09	0	25	4.10%	2.8	36%	2.22	0.000	2.22
37.729	6932.23	86.0	2.718	86.0	9.0	3.88	3.16%	Coarse Alluvium	0.056	111.0	2.10	0.000	2.10	0	40	3.24%	2.5	36%	2.23	0.000	2.23
37.893	6932.07	83.0	2.883	82.9	8.3	3.58	3.47%	Coarse Alluvium	0.056	111.0	2.11	0.000	2.11	0	38	3.57%	2.6	36%	2.24	0.000	2.24
38.057	6931.90	59.6	2.894	59.5	9.2	3.99	4.86%	Coarse Alluvium	0.056	111.0	2.12	0.000	2.12	0	27	5.04%	2.8	36%	2.25	0.000	2.25
38.221	6931.74	50.5	2.527	50.4	10.8	4.68	5.01%	Coarse Alluvium	0.056	111.0	2.13	0.000	2.13	0	23	5.23%	2.9	36%	2.26	0.000	2.26
38.385	6931.58	30.0	1.994	29.9	10.5	4.55	6.66%	Coarse Alluvium	0.056	111.0	2.14	0.000	2.14	0	13	7.17%	3.1	36%	2.27	0.000	2.27
38.549	6931.41	20.8	0.913	20.7	10.1	4.39	4.40%	Coarse Alluvium	0.056	111.0	2.15	0.000	2.15	0	9	4.90%	3.2	36%	2.27	0.000	2.27
38.713	6931.25	16.1	0.467	16.1	10.6	4.58	2.90%	Coarse Alluvium	0.056	111.0	2.16	0.000	2.16	0	6	3.34%	3.2	36%	2.28	0.000	2.28
38.877	6931.08	17.2	0.909	17.2	11.5	4.96	5.28%	Coarse Alluvium	0.056	111.0	2.17	0.000	2.17	0	7	6.04%	3.3	36%	2.29	0.000	2.29
39.042	6930.92	25.8	0.860	25.8	10.0	4.31	3.33%	Coarse Alluvium	0.056	111.0	2.18	0.000	2.18	0	11	3.64%	3.0	36%	2.30	0.000	2.30
39.206	6930.75	28.7	1.144	28.7	10.8	4.66	3.98%	Coarse Alluvium	0.056	111.0	2.18	0.000	2.18	0	12	4.31%	3.0	36%	2.31	0.000	2.31
39.370	6930.59	28.0	0.889	28.0	9.1	3.93	3.17%	Coarse Alluvium	0.056	111.0	2.19	0.000	2.19	0	12	3.44%	3.0	36%	2.32	0.000	2.32
39.534	6930.43	17.1	0.734	17.0	9.1	3.94	4.30%	Coarse Alluvium	0.056	111.0	2.20	0.000	2.20	0	7	4.93%	3.3	36%	2.33	0.000	2.33
39.698	6930.26	13.8	0.491	13.8	9.9	4.29	3.55%	Coarse Alluvium	0.056	111.0	2.21	0.000	2.21	0	5	4.23%	3.3	36%	2.34	0.000	2.34
39.862	6930.10	13.8	0.419	13.8	10.0	4.35	3.03%	Coarse Alluvium	0.056	111.0	2.22	0.000	2.22	0	5	3.61%	3.3	36%	2.35	0.000	2.35
40.026	6929.93	14.7	0.519	14.6	10.3	4.47	3.54%	Coarse Alluvium	0.056	111.0	2.23	0.000	2.23	0	6	4.17%	3.3	36%	2.36	0.000	2.36
40.190	6929.77	17.1	0.478	17.0	12.7	5.51	2.80%	Coarse Alluvium	0.056	111.0	2.24	0.000	2.24	0	7	3.22%	3.2	36%	2.37	0.000	2.37
40.354	6929.61	14.2	0.422	14.2	12.9	5.59	2.97%	Coarse Alluvium	0.056	111.0	2.25	0.000	2.25	0	5	3.52%	3.3	36%	2.37	0.000	2.37
40.518	6929.44	13.0	0.410	12.9	12.9	5.57	3.17%	Coarse Alluvium	0.056	111.0	2.26	0.000	2.26	0	5	3.83%	3.3	36%	2.38	0.000	2.38
40.682	6929.28	23.9	0.504	23.8	14.0	6.06	2.11%	Coarse Alluvium	0.056	111.0	2.27	0.000	2.27	0	10	2.33%	3.0	36%	2.39	0.000	2.39
40.846	6929.11	25.6	0.512	25.5	13.5	5.86	2.00%	Coarse Alluvium	0.056	111.0	2.28	0.000	2.28	0	10	2.20%	2.9	36%	2.40	0.000	2.40
41.010	6928.95	15.1	0.406	15.0	11.3	4.88	2.70%	Fine Alluvium	0.060	120.7	2.29	0.000	2.29	0	6	3.18%	3.2	76%	2.41	0.000	2.41
41.174	6928.79	11.0	0.271	10.9	12.3	5.35	2.47%	Fine Alluvium	0.060	120.7	2.30	0.000	2.30	0	4	3.12%	3.4	76%	2.42	0.000	2.42
41.338	6928.62	11.6	0.279	11.5	13.2	5.72	2.40%	Fine Alluvium	0.060	120.7	2.31	0.000	2.31	0	4	2.99%	3.3	76%	2.43	0.000	2.43
41.502	6928.46	12.9	0.347	12.8	14.3	6.18	2.69%	Fine Alluvium	0.060	120.7	2.32	0.000	2.32	0	5	3.28%	3.3	76%	2.44	0.000	2.44
41.666	6928.29	13.9	0.451	13.8	15.0	6.49	3.25%	Fine Alluvium	0.060	120.7	2.32	0.000	2.32	0	5	3.91%	3.3	76%	2.45	0.000	2.45
41.830	6928.13	14.2	0.509	14.2	15.6	6.77	3.57%	Fine Alluvium	0.060	120.7	2.33	0.000	2.33	0	5	4.27%	3.3	76%	2.46	0.000	2.46
41.994	6927.97	14.6	0.644	14.5	16.5	7.16	4.42%	Fine Alluvium	0.060	120.7	2.34	0.000	2.34	0	5	5.27%	3.4	76%	2.47	0.000	2.47
42.158	6927.80	15.0	0.690	14.9	16.4	7.10	4.61%	Fine Alluvium	0.060	120.7	2.35	0.000	2.35	0	5	5.48%	3.4	76%	2.48	0.000	2.48
42.322	6927.64	13.0	0.710	12.9	15.2	6.59	5.48%	Fine Alluvium	0.060	120.7	2.36	0.000	2.36	0	4	6.70%	3.5	76%	2.49	0.000	2.49
42.486	6927.47	10.7	0.483	10.6	14.9	6.45	4.53%	Fine Alluvium	0.060	120.7	2.37	0.000	2.37	0	3	5.82%	3.5	76%	2.50	0.000	2.50
42.650	6927.31	9.8	0.207	9.8	15.4	6.67	2.10%	Fine Alluvium	0.060	120.7	2.38	0.000	2.38	0	3	2.77%	3.4	76%	2.51	0.000	2.51
42.814	6927.15	9.2	0.109	9.1	15.4	6.67	1.18%	Fine Alluvium	0.060	120.7	2.39	0.000	2.39	0	3	1.60%	3.3	76%	2.52	0.000	2.52
42.978	6926.98	8.4	0.087	8.4	15.4	6.69	1.03%	Fine Alluvium	0.060	120.7	2.40	0.000	2.40	0	3	1.44%	3.4	76%	2.53	0.000	2.53
43.143	6926.82	9.1	0.090	9.0	16.1	6.96	0.99%	Fine Alluvium	0.060	120.7	2.41	0.000	2.41	0	3	1.35%	3.3	76%	2.54	0.000	2.54
43.307	6926.65	8.8	0.107	8.7	16.2	7.04	1.21%	Fine Alluvium	0.060	120.7	2.42	0.000	2.42	0	3	1.67%	3.4	76%	2.55	0.000	2.55

9.29	639	1.7E-03	6.9E+02	72	0.7724	3.8E-04	0	0.236	0.236	4	0.236	7998	5488	1400	7998	0.178%	1.79	1.00	0.01%	0.003013	0.36	0.025	0.785	0.47%	0.0008
9.34	639	1.7E-03	6.9E+02	71	0.7693	3.8E-04	0	0.237	0.237	4	0.237	7981	5476	1400	7981	0.178%	1.79	1.00	0.01%	0.003010	0.36	0.025	0.785	0.47%	0.0008
9.39	639	1.7E-03	6.9E+02	70	0.7660	3.8E-04	0	0.237	0.237	4	0.237	7964	5465	1400	7964	0.178%	1.79	1.00	0.01%	0.003006	0.36	0.025	0.785	0.47%	0.0008
9.44	639	1.7E-03	6.9E+02	70	0.7628	3.8E-04	0	0.237	0.237	4	0.237	7947	5453	1400	7947	0.178%	1.79	1.00	0.01%	0.003001	0.36	0.025	0.785	0.47%	0.0008
9.49	639	1.7E-03	6.9E+02	69	0.7595	3.8E-04	0	0.237	0.238	4	0.237	7931	5442	1400	7931	0.177%	1.79	1.00	0.01%	0.002996	0.36	0.025	0.785	0.47%	0.0008
9.54	639	1.7E-03	6.9E+02	68	0.7562	3.8E-04	0	0.238	0.238	4	0.238	7915	5430	1400	7915	0.177%	1.79	1.00	0.01%	0.002989	0.36	0.025	0.785	0.47%	0.0008
9.59	639	1.7E-03	6.9E+02	67	0.7529	3.8E-04	0	0.238	0.238	4	0.238	7898	5419	1400	7898	0.177%	1.79	1.00	0.01%	0.002982	0.36	0.025	0.785	0.47%	0.0008
9.64	762	1.7E-03	9.7E+02	66	0.7495	2.7E-04	0	0.238	0.239	4	0.238	7882	5407	1400	7882	0.064%	1.79	1.00	0.01%	0.000960	0.36	0.025	0.785	0.15%	0.0002
9.69	762	1.7E-03	9.7E+02	65	0.7461	2.7E-04	0	0.239	0.239	4	0.239	7866	5396	1400	7866	0.064%	1.79	1.00	0.01%	0.000959	0.36	0.025	0.785	0.15%	0.0002
9.74	762	1.7E-03	9.7E+02	64	0.7427	2.7E-04	0	0.239	0.239	4	0.239	7850	5385	1400	7850	0.063%	1.79	1.00	0.01%	0.000957	0.36	0.025	0.785	0.15%	0.0002
9.79	762	1.7E-03	9.7E+02	64	0.7392	2.7E-04	0	0.239	0.239	4	0.239	7834	5374	1400	7834	0.063%	1.79	1.00	0.01%	0.000955	0.36	0.025	0.785	0.15%	0.0002
9.84	762	1.7E-03	9.7E+02	63	0.7357	2.7E-04	0	0.239	0.240	4	0.239	7819	5363	1400	7819	0.063%	1.79	1.00	0.01%	0.000953	0.36	0.025	0.785	0.15%	0.0002
9.89	762	1.7E-03	9.7E+02	62	0.7322	2.7E-04	0	0.240	0.240	4	0.240	7803	5352	1400	7803	0.063%	1.79	1.00	0.01%	0.000951	0.36	0.025	0.785	0.15%	0.0002
9.94	762	1.7E-03	9.7E+02	61	0.7287	2.7E-04	0	0.240	0.240	4	0.240	7788	5341	1400	7788	0.063%	1.79	1.00	0.01%	0.000948	0.36	0.025	0.785	0.15%	0.0002
9.99	762	1.7E-03	9.7E+02	60	0.7251	2.7E-04	0	0.240	0.241	4	0.240	7772	5330	1400	7772	0.063%	1.79	1.00	0.01%	0.000946	0.36	0.025	0.785	0.15%	0.0002
10.04	762	1.7E-03	9.7E+02	60	0.7215	2.7E-04	0	0.240	0.241	4	0.240	7757	5320	1400	7757	0.063%	1.79	1.00	0.01%	0.000943	0.36	0.025	0.785	0.15%	0.0002
10.09	762	1.7E-03	9.7E+02	59	0.7178	2.7E-04	0	0.241	0.241	4	0.241	7742	5309	1400	7742	0.063%	1.79	1.00	0.01%	0.000940	0.36	0.025	0.785	0.15%	0.0002
10.14	762	1.7E-03	9.7E+02	58	0.7142	2.7E-04	0	0.241	0.242	4	0.241	7727	5299	1400	7727	0.062%	1.79	1.00	0.01%	0.000936	0.36	0.025	0.785	0.15%	0.0002
10.19	762	1.7E-03	9.7E+02	58	0.7105	2.7E-04	0	0.241	0.242	4	0.241	7712	5288	1400	7712	0.062%	1.79	1.00	0.01%	0.000933	0.36	0.025	0.785	0.15%	0.0002
10.24	762	1.7E-03	9.7E+02	57	0.7068	2.7E-04	0	0.241	0.242	4	0.241	7697	5278	1400	7697	0.062%	1.79	1.00	0.01%	0.000929	0.36	0.025	0.785	0.15%	0.0002
10.29	762	1.7E-03	9.7E+02	56	0.7030	2.7E-04	0	0.242	0.243	4	0.242	7682	5267	1400	7682	0.062%	1.79	1.00	0.01%	0.000925	0.36	0.025	0.785	0.15%	0.0002
10.34	762	1.7E-03	9.7E+02	55	0.6993	2.7E-04	0	0.242	0.243	4	0.242	7667	5257	1400	7667	0.061%	1.79	1.00	0.01%	0.000921	0.36	0.025	0.785	0.14%	0.0002
10.39	762	1.7E-03	9.7E+02	55	0.6955	2.7E-04	0	0.242	0.243	4	0.242	7653	5247	1400	7653	0.061%	1.79	1.00	0.01%	0.000917	0.36	0.025	0.785	0.14%	0.0002
10.44	762	1.7E-03	9.7E+02	54	0.6917	2.7E-04	0	0.243	0.243	4	0.243	7638	5237	1400	7638	0.061%	1.79	1.00	0.01%	0.000913	0.36	0.025	0.785	0.14%	0.0002
10.49	762	1.7E-03	9.7E+02	54	0.6878	2.7E-04	0	0.243	0.244	4	0.243	7624	5227	1400	7624	0.061%	1.79	1.00	0.01%	0.000908	0.36	0.025	0.785	0.14%	0.0002
10.54	762	1.7E-03	9.7E+02	53	0.6839	2.7E-04	0	0.243	0.244	4	0.243	7609	5217	1400	7609	0.060%	1.79	1.00	0.01%	0.000903	0.36	0.025	0.785	0.14%	0.0002
10.59	762	1.7E-03	9.7E+02	52	0.6801	2.7E-04	0	0.243	0.244	4	0.243	7595	5207	1400	7595	0.060%	1.79	1.00	0.01%	0.000898	0.36	0.025	0.785	0.14%	0.0002
10.64	762	1.7E-03	9.7E+02	52	0.6761	2.6E-04	0	0.244	0.245	4	0.244	7581	5197	1400	7581	0.060%	1.79	1.00	0.01%	0.000893	0.36	0.025	0.785	0.14%	0.0002
10.69	762	1.7E-03	9.7E+02	51	0.6722	2.6E-04	0	0.244	0.245	4	0.244	7567	5187	1400	7567	0.060%	1.79	1.00	0.01%	0.000888	0.36	0.025	0.785	0.14%	0.0002
10.74	762	1.7E-03	9.7E+02	50	0.6682	2.6E-04	0	0.244	0.245	4	0.244	7553	5177	1400	7553	0.059%	1.79	1.00	0.01%	0.000882	0.36	0.025	0.785	0.14%	0.0002
10.79	762	1.7E-03	9.7E+02	50	0.6642	2.6E-04	0	0.244	0.245	4	0.244	7539	5168	1400	7539	0.059%	1.79	1.00	0.01%	0.000877	0.36	0.025	0.785	0.14%	0.0002
10.84	762	1.7E-03	9.7E+02	49	0.6602	2.6E-04	0	0.245	0.246	4	0.245	7526	5158	1400	7526	0.059%	1.79	1.00	0.01%	0.000871	0.36	0.025	0.785	0.14%	0.0002
10.89	762	1.7E-03	9.7E+02	49	0.6562	2.6E-04	0	0.245	0.246	4	0.245	7512	5149	1400	7512	0.058%	1.79	1.00	0.01%	0.000865	0.36	0.025	0.785	0.14%	0.0002
10.94	762	1.7E-03	9.7E+02	48	0.6521	2.6E-04	0	0.245	0.246	4	0.245	7498	5139	1400	7498	0.058%	1.79	1.00	0.01%	0.000859	0.36	0.025	0.785	0.13%	0.0002
10.99	762	1.7E-03	9.7E+02	48	0.6480	2.6E-04	0	0.245	0.247	4	0.245	7485	5130	1400	7485	0.058%	1.79	1.00	0.01%	0.000852	0.36	0.025	0.785	0.13%	0.0002
11.04	762	1.7E-03	9.7E+02	47	0.6439	2.6E-04	0	0.246	0.247	4	0.246	7471	5120	1400	7471	0.057%	1.79	1.00	0.01%	0.000846	0.36	0.025	0.785	0.13%	0.0002
11.09	762	1.7E-03	9.7E+02	47	0.6398	2.6E-04	0	0.246	0.247	4	0.246	7458	5111	1400	7458	0.057%	1.79	1.00	0.01%	0.000839	0.36	0.025	0.785	0.13%	0.0002
11.14	762	1.7E-03	1.0E+03	46	0.6356	2.5E-04	0	0.246	0.247	4	0.246	7444	5101	1400	7444	0.053%	2.00	1.00	0.01%	0.000866	0.36	0.025	0.785	0.14%	0.0002
11.19	762	1.7E-03	1.0E+03	46	0.6314	2.5E-04	0	0.246	0.248	4	0.246	7431	5092	1400	7431	0.053%	2.00	1.00	0.01%	0.000859	0.36	0.025	0.785	0.13%	0.0002
11.24	762	1.7E-03	1.0E+03	45	0.6272	2.5E-04	0	0.247	0.248	4	0.247	7417	5082	1400	7417	0.053%	2.00	1.00	0.01%	0.000852	0.36	0.025	0.785	0.13%	0.0002
11.29	762	1.7E-03	1.0E+03	45	0.6230	2.5E-04	0	0.247	0.248	4	0.247	7404	5073	1400	7404	0.052%	2.00	1.00	0.01%	0.000845	0.36	0.025	0.785	0.13%	0.0002
11.34	762	1.7E-03	1.0E+03	44	0.6188	2.5E-04	0	0.247	0.249	4	0.247	7391	5064	1400	7391	0.052%	2.00	1.00	0.01%	0.000838	0.36	0.025	0.785	0.13%	0.0002
11.39	762	1.7E-03	1.0E+03	44	0.6145	2.5E-04	0	0.247	0.249	4	0.247	7377	5055	1400	7377	0.052%	2.00	1.00	0.01%	0.000831	0.36	0.025	0.785	0.13%	0.0002
11.44	762	1.7E-03	1.0E+03	43	0.6103	2.5E-04	0	0.248	0.249	4	0.248	7364	5045	1400	7364	0.051%	2.00	1.00	0.01%	0.000823	0.36	0.025	0.785	0.13%	0.0002
11.49	762	1.7E-03	1.0E+03	43	0.6060	2.5E-04	0	0.248	0.250	4	0.248	7351	5036	1400	7351	0.051%	2.00	1.00	0.01%	0.000816	0.36	0.025	0.785	0.13%	0.0002
11.54	762	1.7E-03	1.0E+03	42	0.6017	2.5E-04	0	0.248	0.250	4	0.248	7338	5027	1400	7338	0.050%	2.00	1.00	0.01%	0.000808	0.36	0.025	0.785	0.13%	0.0002
11.59	762	1.7E-03	1.0E+03	42	0.5973	2.5E-04	0	0.248	0.250	4	0.248	7325	5018	1400	7325	0.050%	2.00	1.00	0.01%	0.000801	0.36	0.025	0.785	0.13%	0.0002
11.64	762	1.7E-03	1.0E+03	41	0.5930	2.5E-04	0	0.249	0.250	4	0.249	7313	5009	1400	7313	0.050%	2.00	1.00	0.01%	0.000793	0.36	0.025	0.785	0.12%	0.0002
11.69	762	1.7E-03	1.0E+03	41	0.5886	2.5E-04	0	0.249	0.251	4	0.249	7300	5000	1400	7300	0.049%	2.00	1.00	0.01%	0.000785	0.36	0.025	0.785	0.12%	0.0002
11.74	762	1.7E-03	1.0E+03	41	0.5843	2.5E-04	0	0.249	0.251	4	0.249	7287	4992	1400	7287	0.049%	2.00	1.00	0.01%	0.000777	0.36	0.025	0.785	0.12%	0.0002
11.79	762	1.7E-03	1.0E+03	40	0.5799	2.4E-04	0	0.249	0.251	4	0.249	7275	4983	1400	7275	0.048%	2.00	1.00	0.01%	0.000769	0.36	0.025	0.785	0.12%	0.0002
11.84	762	1.7E-03	1.0E+03	40	0.5755	2.4E-04	0	0.250	0.251	4	0.250	7262	4974	1400	7262	0.048%	2.00	1.00	0.01%	0.000761	0.36	0.025	0.785	0.12%	0.0002
11.89	762	1.7E-03	1.0E+03	39	0.5711	2.4E-04	0	0.250	0.252	4	0.250	7250	4965	1400	7250	0.048%	2.00	1.00	0.01%	0.000752	0.36	0.025	0.785	0.12%	0.0002
11.94	762	1.7E-03	1.0E+03	39	0.5666	2.4E-04	0	0.250	0.252	4	0.250	7237	4957	1400	7237	0.047%	2.00	1.00	0.01%	0.000744	0.36	0.025	0.785	0.12%	0.0002
11.99	762	1.7E-03	1.0E+03	39	0.5622	2.4E-04	0	0.250	0.252	4	0.250	7225	4948	1400	7225	0.047%	2.00	1.00	0.01%	0.000736	0.36	0.025	0.785	0.12%	0.0002
12.04	762	1.7E-03	1.0E+03	38	0.5577	2.4E-04	0	0.250	0.253	4	0.250	7213	4940	1400	7213	0.046%	2.00	1.00	0.01%	0.000727	0.36	0.025	0.785	0.11%	0.0002
12.09	762	1.7E-03	1.0E+03	38	0.5533	2.4E-04	0	0.251	0.253	4	0.251	7201	4931	1400	7201	0.046%	2.00	1.00	0.01%	0.000719	0.36	0.025	0.785	0.11%	0.0002
12.14	762	1.7E-03	1.0E+03	37	0.5488	2.4E-04	0	0.251	0.253	4	0.251	7189	4923	1400	7189	0.046%	2.00	1.00	0.01%	0.000710	0.36	0.025	0.785	0.11%	0.0002
12.19	762	1.7E-03	1.0E+03	37	0.5443	2.4E-04	0	0.251	0.253	4	0.251	7177	4914	1400	7177	0.045%	2.00	1.00	0.01%	0.000702	0.36	0.025	0.785	0.11%	0.0002
12.24	762	1.7E-03	1.0E+03	37	0.5398	2.4E-04	0	0.251	0.254	4	0.251	7165	4906	1400	7165	0.045%	2.00	1.00	0.01%	0.000693	0.36	0.025	0.785	0.11%	0.0002
12.29	762	1.7E-03	1.0E+03	36	0.5353	2.4E-04	0	0.252	0.254	4	0.252	7153	4898	1400	7153	0.044%	2.00	1.00	0.01%	0.000684	0.36	0.025	0.785	0.11%	0.0002
12.34	762	1.7E-03	1.0E+03	36	0.5308	2.3E-04	0	0.252	0.254	4	0.252	7141	4889	1400	7141	0.044%	2.00	1.00	0.01%	0.000675	0.36	0.025	0.785	0.11%	0.0002
12.39	762	1.7E-03	1.0E+03	36	0.5263	2.3E-04	0	0.252	0.254	4	0.252	7129	4881	1400	7129	0.043%	2.00	1.00	0.01%	0.000667	0.36	0.025	0.785	0.10%	0.0002
12.44	762	1.7E-03	1.0E+03	35	0.5218	2.3E-04	0	0.252	0.255	4	0.252	7118	4873	1400	7118	0.043%	2.00	1.00	0.01%	0.000658	0.36	0.025	0.785	0.10%	0.0002
12.49	762	1.7E-03	1.0E+03	35	0.5172	2.3E-04	0	0.253	0.255	4	0.253	7106	4865	1400	7106	0.042%	2.00	1.00	0.01%	0.000649	0.36	0.025	0.785	0.10%	0.0002
12.54	762	1.7E-03	1.0E+03	35	0.5127	2.3E-04	0	0.253	0.255	4	0.253	7094	4857	1400	7094	0.042%	2.00	1.00	0.01%	0.000640	0.36	0.025	0.785	0.10%	0.0002
12.59	762	1.7E-03	1.0E+03	34	0.5081	2.3E-04	0	0.253	0.256	4	0.253	7083	4849	1400	7083	0.042%	2.00	1.00	0.01%	0.000631	0.36	0.025	0.785	0.10%	0.0002
12.64	762	1.7E-03	1.0E+03	34	0.5036	2.3E-04	0	0.253	0.256	4	0.253	7071	4841	1400	7071	0.041%	2.00	1.00	0.01%	0.000622	0.36	0.025	0.785	0.10%	0.0002
12.69	772	1.7E-03	1.0E+03	34	0.4990	2.2E-04	0	0.254	0.256	4	0.254	7060	4833	1400	7060	0.039%	2.00	1.00	0.01%	0.000575	0.36	0.025	0.785	0.09%	0.0001
12.74	772	1.7E-03	1.0E+03	34	0.4945	2.2E-04	0	0.254	0.256	4	0.254	7049	4825	1400	7049	0.038%	2.00	1.00	0.01%	0.000566	0.36	0.025	0.785	0.09%	0.0001
12.79	772	1.7E-03	1.0E+03	33	0.4899	2.2E-04	0	0.254	0.257	4	0.254	7038	4817	1400	7038	0.038%	2.00	1.00	0.01%	0.000558	0.36	0.025	0.785	0.09%	0.0001
12.84	772	1.7E-03	1.0E+03	33	0.4854	2.2E-04	0	0.254	0.257	4	0.254	7026	4810	1400	7026	0.038%	2.00	1.00	0.01%	0.000550	0.36	0.025	0.785	0.09%	0.0001
12.89	772	1.7E-03	1.0E+03	33	0.4808	2.2E-04	0	0.254	0.257	4	0.254	7015	4802	1400	7015	0.037%	2.00	1.00	0.01%	0.000542	0.36	0.025	0.785	0.09%	0.0001
12.94	772	1.7E-03	1.0E+03	32	0.4763	2.1E-04	0	0.255	0.257	4	0.255	7004	4794	1400	7004	0.037%	2.00	1.00	0.01%	0.000533	0.36	0.025	0.785	0.08%	0.0001
12.99	772	1.7E-03	1.0E+03	32	0.4717	2.1E-04	0	0.255	0.258	4	0.255	6993	4786	1400	6993	0.036%	2.00	1.00	0.01%	0.000525	0.36	0.025	0.785	0.08%	0.0001
13.04	772	1.7E-03	1.0E+03	32	0.4671	2.1E-04	0	0.255	0.258	4	0.255	6982	4779	1400	6982	0.036%	2.00	1.00	0.01%	0.000517	0.36	0.025	0.785	0.08%	0.0001
13.09	772	1.7E-03	1.0E+03	32	0.4626	2.1E-04	0	0.255	0.258	4	0.255	6972	4771	1400	6972	0.035%	2.00	1.00	0.01%	0.000508	0.36	0.025	0.785	0.08%	0.0001
13.14	772	1.9E-03	1.1E+03	31	0.4580	1.9E-04	22	0.256	0.258	4	2.005	6960	4763	1400	3194	0.030%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
13.19	772	1.9E-03	1.1E+03	31	0.4535	1.9E-04	22	0.256	0.259	4	2.005	6948	4755	1400	3189	0.030%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
13.24	772	1.9E-03	1.1E+03	31	0.4489	1.9E-04	22	0.256	0.259	4	2.005	6937	4747	1400	3185	0.030%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
13.29	772	1.9E-03	1.1E+03	31	0.4444	1.9E-04	22	0.256	0.259	4	2.005	6925	4739	1400	3181	0.029%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
13.34	772	1.9E-03	1.1E+03	30	0.4398	1.9E-04	22	0.257	0.260	4	2.005	6913	4731	1400	3176	0.029%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
13.39	772	1.9E-03	1.1E+03	30	0.4353	1.9E-04	22	0.257	0.260	4	2.005	6902	4723	1400	3172	0.029%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
13.44	772	1.9E-03	1.1E+03	30	0.4308	1.9E-04	22	0.257	0.260	4	2.005	6891	4715	1400	3168	0.029%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
13.49	772	1.9E-03	1.1E+03	30	0.4263	1.8E-04	22	0.257	0.260	4	2.006	6879	4707	1400	3164	0.028%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
13.54	772	1.9E-03	1.1E+03	29	0.4218	1.8E-04	22	0.257	0.261	4	2.006	6868	4699	1400	3160	0.028%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
13.59	772	1.9E-03	1.1E+03	29	0.4172	1.8E-04	22	0.258	0.261	4	2.006	6857	4691	1400	3155	0.028%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
13.64	772	1.9E-03	1.1E+03	29	0.4128	1.8E-04	22	0.258	0.261	4	2.006	6846	4684	1400	3151	0.027%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
13.69	772	1.9E-03	1.1E+03	29	0.4083	1.8E-04	22	0.258	0.262	4	2.006	6835	4676	1400	3147	0.027%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
13.74	772	1.9E-03	1.1E+03	29	0.4038	1.8E-04	22	0.258	0.262	4	2.006	6824	4668	1400	3143	0.027%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
13.79	772	1.9E-03	1.1E+03	28	0.3993	1.8E-04	22	0.259	0.262	4	2.006	6813	4661	1400	3139	0.027%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
13.84	772	1.9E-03	1.1E+03	28	0.3948	1.8E-04	22	0.259	0.262	4	2.007	6802	4653	1400	3135	0.026%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000

43.471	6926.49	9.7	0.210	9.6	16.2	7.04	2.16%	Fine Alluvium	0.060	120.7	2.43	0.000	2.43	0	3	2.88%	3.4	76%	2.56	0.000	2.56
43.635	6926.33	11.7	0.290	11.6	16.9	7.32	2.48%	Fine Alluvium	0.060	120.7	2.44	0.000	2.44	0	4	3.13%	3.4	76%	2.57	0.000	2.57
43.799	6926.16	13.8	0.263	13.6	18.5	8.01	1.91%	Fine Alluvium	0.060	120.7	2.45	0.000	2.45	0	5	2.33%	3.2	76%	2.58	0.000	2.58
43.963	6926.00	12.9	0.317	12.8	19.0	8.24	2.46%	Fine Alluvium	0.060	120.7	2.46	0.000	2.46	0	4	3.05%	3.3	76%	2.59	0.000	2.59
44.127	6925.83	15.4	0.290	15.2	19.3	8.36	1.89%	Fine Alluvium	0.060	120.7	2.47	0.000	2.47	0	5	2.25%	3.2	76%	2.60	0.000	2.60
44.291	6925.67	16.2	0.444	16.1	18.7	8.09	2.73%	Fine Alluvium	0.060	120.7	2.48	0.000	2.48	0	6	3.23%	3.2	76%	2.61	0.000	2.61
44.455	6925.51	19.0	0.619	18.9	17.9	7.75	3.25%	Fine Alluvium	0.060	120.7	2.49	0.000	2.49	0	7	3.74%	3.2	76%	2.62	0.000	2.62
44.619	6925.34	16.5	0.622	16.4	18.4	7.95	3.77%	Fine Alluvium	0.060	120.7	2.50	0.000	2.50	0	6	4.45%	3.3	76%	2.63	0.000	2.63
44.783	6925.18	11.3	0.514	11.2	18.1	7.85	4.56%	Fine Alluvium	0.060	120.7	2.51	0.000	2.51	0	3	5.87%	3.5	76%	2.64	0.000	2.64
44.947	6925.01	15.2	0.482	15.0	19.7	8.52	3.18%	Fine Alluvium	0.060	120.7	2.52	0.000	2.52	0	5	3.81%	3.3	76%	2.65	0.000	2.65
45.111	6924.85	21.0	0.542	20.8	19.9	8.62	2.59%	Coarse Alluvium	0.056	111.0	2.53	0.000	2.53	0	7	2.94%	3.1	36%	2.66	0.000	2.66
45.275	6924.69	18.8	0.680	18.7	14.4	6.22	3.62%	Coarse Alluvium	0.056	111.0	2.54	0.000	2.54	0	6	4.19%	3.2	36%	2.67	0.000	2.67
45.439	6924.52	25.5	0.737	25.4	13.2	5.73	2.90%	Coarse Alluvium	0.056	111.0	2.55	0.000	2.55	0	9	3.22%	3.1	36%	2.68	0.000	2.68
45.603	6924.36	28.9	0.830	28.9	10.9	4.72	2.87%	Coarse Alluvium	0.056	111.0	2.56	0.000	2.56	0	10	3.15%	3.0	36%	2.69	0.000	2.69
45.767	6924.19	28.9	0.839	28.8	9.7	4.19	2.91%	Coarse Alluvium	0.056	111.0	2.57	0.000	2.57	0	10	3.19%	3.0	36%	2.69	0.000	2.69
45.931	6924.03	32.1	0.965	32.0	8.5	3.70	3.01%	Coarse Alluvium	0.056	111.0	2.58	0.000	2.58	0	11	3.27%	3.0	36%	2.70	0.000	2.70
46.095	6923.87	29.2	0.831	29.1	7.6	3.29	2.85%	Coarse Alluvium	0.056	111.0	2.59	0.000	2.59	0	10	3.13%	3.0	36%	2.71	0.000	2.71
46.259	6923.70	23.2	0.704	23.2	7.7	3.32	3.03%	Coarse Alluvium	0.056	111.0	2.60	0.000	2.60	0	8	3.41%	3.1	36%	2.72	0.000	2.72
46.423	6923.54	19.5	0.636	19.5	7.7	3.34	3.25%	Coarse Alluvium	0.056	111.0	2.60	0.000	2.60	0	7	3.75%	3.2	36%	2.73	0.000	2.73
46.587	6923.37	34.9	0.734	34.9	10.2	4.43	2.10%	Coarse Alluvium	0.056	111.0	2.61	0.000	2.61	0	12	2.27%	2.9	36%	2.74	0.000	2.74
46.751	6923.21	41.4	0.764	41.3	8.5	3.68	1.85%	Coarse Alluvium	0.056	111.0	2.62	0.000	2.62	0	15	1.97%	2.8	36%	2.75	0.000	2.75
46.915	6923.05	43.4	0.957	43.3	6.5	2.81	2.21%	Coarse Alluvium	0.056	111.0	2.63	0.000	2.63	0	15	2.35%	2.8	36%	2.76	0.000	2.76
47.079	6922.88	41.7	1.129	41.7	4.8	2.09	2.71%	Coarse Alluvium	0.056	111.0	2.64	0.000	2.64	0	15	2.89%	2.8	36%	2.77	0.000	2.77
47.244	6922.72	35.5	0.778	35.5	5.5	2.38	2.19%	Coarse Alluvium	0.056	111.0	2.65	0.000	2.65	0	12	2.37%	2.9	36%	2.78	0.000	2.78
47.408	6922.55	41.5	0.774	41.4	7.2	3.13	1.87%	Coarse Alluvium	0.056	111.0	2.66	0.000	2.66	0	15	1.99%	2.8	36%	2.79	0.000	2.79
47.572	6922.39	47.0	0.889	46.9	8.0	3.48	1.89%	Coarse Alluvium	0.056	111.0	2.67	0.000	2.67	0	17	2.01%	2.7	36%	2.80	0.000	2.80
47.736	6922.22	43.7	1.000	43.7	6.9	2.97	2.29%	Coarse Alluvium	0.056	111.0	2.68	0.000	2.68	0	15	2.44%	2.8	36%	2.80	0.000	2.80
47.900	6922.06	48.6	0.997	48.6	7.0	3.01	2.05%	Coarse Alluvium	0.056	111.0	2.69	0.000	2.69	0	17	2.17%	2.7	36%	2.81	0.000	2.81
48.064	6921.90	47.7	1.174	47.6	6.9	2.97	2.46%	Coarse Alluvium	0.056	111.0	2.70	0.000	2.70	0	17	2.61%	2.8	36%	2.82	0.000	2.82
48.228	6921.73	32.1	0.918	32.1	5.9	2.56	2.86%	Coarse Alluvium	0.056	111.0	2.71	0.000	2.71	0	11	3.12%	3.0	36%	2.83	0.000	2.83
48.392	6921.57	24.6	0.727	24.5	7.5	3.25	2.96%	Coarse Alluvium	0.056	111.0	2.71	0.000	2.71	0	8	3.32%	3.1	36%	2.84	0.000	2.84
48.556	6921.40	46.0	0.716	46.0	11.7	5.08	1.56%	Coarse Alluvium	0.056	111.0	2.72	0.000	2.72	0	16	1.65%	2.7	36%	2.85	0.000	2.85
48.720	6921.24	58.0	0.836	57.9	10.5	4.55	1.44%	Coarse Alluvium	0.056	111.0	2.73	0.000	2.73	0	20	1.51%	2.6	36%	2.86	0.000	2.86
48.884	6921.08	62.6	0.904	62.5	9.3	4.03	1.44%	Coarse Alluvium	0.056	111.0	2.74	0.000	2.74	0	22	1.51%	2.5	36%	2.87	0.000	2.87
49.048	6920.91	62.1	1.028	62.0	8.8	3.80	1.66%	Coarse Alluvium	0.056	111.0	2.75	0.000	2.75	0	22	1.73%	2.6	36%	2.88	0.000	2.88
49.212	6920.75	55.8	1.366	55.7	8.1	3.52	2.45%	Coarse Alluvium	0.056	111.0	2.76	0.000	2.76	0	19	2.58%	2.7	36%	2.89	0.000	2.89
49.376	6920.58	47.5	1.425	47.4	7.9	3.41	3.00%	Coarse Alluvium	0.056	111.0	2.77	0.000	2.77	0	16	3.19%	2.8	36%	2.90	0.000	2.90
49.540	6920.42	52.9	1.319	52.8	9.3	4.05	2.49%	Coarse Alluvium	0.056	111.0	2.78	0.000	2.78	0	18	2.63%	2.8	36%	2.90	0.000	2.90
49.704	6920.26	79.2	1.156	79.1	11.2	4.84	1.46%	Coarse Alluvium	0.056	111.0	2.79	0.000	2.79	0	27	1.51%	2.5	36%	2.91	0.000	2.91
49.868	6920.09	84.1	1.040	84.0	9.0	3.88	1.24%	Coarse Alluvium	0.056	111.0	2.80	0.000	2.80	0	29	1.28%	2.4	36%	2.92	0.000	2.92
50.032	6919.93	78.1	1.275	78.0	8.2	3.56	1.63%	Coarse Alluvium	0.056	111.0	2.81	0.000	2.81	0	27	1.69%	2.5	36%	2.93	0.000	2.93
50.196	6919.76	71.0	1.386	70.9	6.5	2.81	1.95%	Coarse Alluvium	0.056	111.0	2.81	0.000	2.81	0	24	2.03%	2.6	36%	2.94	0.000	2.94
50.360	6919.60	58.9	1.466	58.8	5.6	2.42	2.49%	Coarse Alluvium	0.056	111.0	2.82	0.000	2.82	0	20	2.62%	2.7	36%	2.95	0.000	2.95
50.524	6919.44	46.0	1.404	46.0	6.0	2.58	3.05%	Coarse Alluvium	0.056	111.0	2.83	0.000	2.83	0	15	3.25%	2.9	36%	2.96	0.000	2.96
50.688	6919.27	39.8	1.521	39.8	7.5	3.23	3.82%	Coarse Alluvium	0.056	111.0	2.84	0.000	2.84	0	13	4.11%	3.0	36%	2.97	0.000	2.97
50.852	6919.11	39.8	1.421	39.8	10.9	4.74	3.57%	Coarse Alluvium	0.056	111.0	2.85	0.000	2.85	0	13	3.84%	3.0	36%	2.98	0.000	2.98
51.016	6918.94	38.2	1.237	38.2	10.5	4.54	3.23%	Coarse Alluvium	0.056	111.0	2.86	0.000	2.86	0	12	3.50%	3.0	36%	2.99	0.000	2.99
51.180	6918.78	48.6	1.265	48.6	11.5	5.00	2.60%	Coarse Alluvium	0.056	111.0	2.87	0.000	2.87	0	16	2.76%	2.8	36%	3.00	0.000	3.00
51.345	6918.62	38.1	1.273	38.0	10.0	4.33	3.35%	Coarse Alluvium	0.056	111.0	2.88	0.000	2.88	0	12	3.62%	3.0	36%	3.00	0.000	3.00
51.509	6918.45	24.4	1.043	24.4	9.6	4.17	4.27%	Coarse Alluvium	0.056	111.0	2.89	0.000	2.89	0	7	4.85%	3.2	36%	3.01	0.000	3.01
51.673	6918.29	18.9	0.809	18.9	11.0	4.76	4.27%	Coarse Alluvium	0.056	111.0	2.90	0.000	2.90	0	6	5.04%	3.3	36%	3.02	0.000	3.02
51.837	6918.12	25.2	0.801	25.1	13.9	6.04	3.18%	Coarse Alluvium	0.056	111.0	2.91	0.000	2.91	0	8	3.59%	3.1	36%	3.03	0.000	3.03
52.001	6917.96	33.6	0.957	33.5	13.3	5.75	2.85%	Coarse Alluvium	0.056	111.0	2.91	0.000	2.91	0	11	3.12%	3.0	36%	3.04	0.000	3.04
52.165	6917.80	27.5	0.873	27.5	12.3	5.35	3.17%	Coarse Alluvium	0.056	111.0	2.92	0.000	2.92	0	8	3.55%	3.1	36%	3.05	0.000	3.05
52.329	6917.63	28.7	0.771	28.6	14.6	6.31	2.69%	Coarse Alluvium	0.056	111.0	2.93	0.000	2.93	0	9	2.99%	3.0	36%	3.06	0.000	3.06
52.493	6917.47	40.7	0.801	40.6	14.3	6.20	1.97%	Coarse Alluvium	0.056	111.0	2.94	0.000	2.94	0	13	2.12%	2.8	36%	3.07	0.000	3.07
52.657	6917.30	42.7	0.837	42.6	13.0	5.61	1.96%	Coarse Alluvium	0.056	111.0	2.95	0.000	2.95	0	13	2.11%	2.8	36%	3.08	0.000	3.08
52.821	6917.14	49.9	1.040	49.8	13.7	5.92	2.09%	Coarse Alluvium	0.056	111.0	2.96	0.000	2.96	0	16	2.22%	2.8	36%	3.09	0.000	3.09
52.985	6916.98	36.6	0.853	36.5	11.4	4.94	2.33%	Coarse Alluvium	0.056	111.0	2.97	0.000	2.97	0	11	2.54%	2.9	36%	3.10	0.000	3.10
53.149	6916.81	26.6	0.712	26.5	13.3	5.78	2.68%	Coarse Alluvium	0.056	111.0	2.98	0.000	2.98	0	8	3.02%	3.1	36%	3.10	0.000	3.10
53.313	6916.65	40.8	0.641	40.7	17.1	7.40	1.57%	Coarse Alluvium	0.056	111.0	2.99	0.000	2.99	0	13	1.69%	2.8	36%	3.11	0.000	3.11
53.477	6916.48	22.2	0.629	22.1	14.2	6.16	2.83%	Coarse Alluvium	0.056	111.0	3.00	0.000	3.00	0	6	3.27%	3.2	36%	3.12	0.000	3.12
53.641	6916.32	17.0	0.519	16.8	28.5	12.36	3.05%	Coarse Alluvium	0.056	111.0	3.01	0.000	3.01	0	5	3.71%	3.3	36%	3.13	0.000	3.13
53.805	6916.16	16.1	0.351	15.7	49.7	21.54	2.19%	Coarse Alluvium	0.056	111.0	3.01	0.000	3.01	0	4	2.69%	3.3	36%	3.14	0.000	3.14
53.969	6915.99	14.7	0.375	14.3	59.4	25.74	2.55%	Coarse Alluvium	0.056	111.0	3.02	0.000	3.02	0	4	3.21%	3.4	36%	3.15	0.000	3.15
54.133	6915.83	14.9	0.382	14.5	64.3	27.88	2.57%	Fine Alluvium	0.060	120.7	3.03	0.000	3.03	0	4	3.23%	3.4	76%	3.16	0.000	3.16
54.297	6915.66	13.7	0.398	13.3	68.7	29.75	2.89%	Fine Alluvium	0.060	120.7	3.04	0.000	3.04	0	4	3.72%	3.4	76%	3.17	0.000	3.17
54.461	6915.50	14.4	0.410	14.0	76.7	33.25	2.84%	Fine Alluvium	0.060	120.7	3.05	0.000	3.05	0	4	3.60%	3.4	76%	3.18	0.000	3.18
54.625	6915.34	15.7	0.436	15.2	81.0	35.10	2.77%	Fine Alluvium	0.060	120.7	3.06	0.000	3.06	0	4	3.44%	3.4	76%	3.19	0.000	3.19
54.789	6915.17	17.2	0.548	16.6	83.5	36.18	3.19%	Fine Alluvium	0.060	120.7	3.07	0.000	3.07	0	5	3.89%	3.3	76%	3.20	0.000	3.20
54.953	6915.01	16.3	0.656	15.9	76.6	33.19	4.01%	Fine Alluvium	0.060	120.7	3.08	0.000	3.08	0	4	4.95%	3.4	76%	3.21	0.000	3.21
55.117	6914.84	15.2	0.713	14.8	69.0	29.91	4.68%	Fine Alluvium	0.060	120.7	3.09	0.000	3.09	0	4	5.88%	3.5	76%	3.22	0.000	3.22
55.281	6914.68	15.5	0.701	15.0	80.6	34.92	4.53%	Fine Alluvium	0.060	120.7	3.10	0.000	3.10	0	4	5.66%	3.5	76%	3.23	0.000	3.23
55.446	6914.51	15.0	0.675	14.5	79.8	34.59	4.51%	Fine Alluvium	0.060	120.7	3.11	0.000	3.11	0	4	5.69%	3.5	76%	3.24	0.000	3.24
55.610	6914.35	15.3	0.663	14.9	68.4	29.65	4.32%	Fine Alluvium	0.060	120.7	3.12	0.000	3.12	0	4	5.43%	3.5	76%	3.25	0.000	3.25
55.774	6914.19	14.9	0.533	14.5	63.7	27.59	3.57%	Fine Alluvium	0.060	120.7	3.13	0.000	3.13	0	4	4.52%	3.4	76%	3.26	0.000	3.26
55.938	6914.02	13.6	0.493	13.2	65.5	28.37	3.63%	Fine Alluvium	0.060	120.7	3.14	0.000	3.14	0	3	4.71%	3.5	76%	3.27	0.000	3.27
56.102	6913.86	14.4	0.578	14.0	73.3	31.76	4.01%	Fine Alluvium	0.060	120.7	3.15	0.000	3.15	0	4	5.13%	3.5	76%	3.28	0.000	3.28
56.266	6913.69	14.5	0.590	14.1	71.2	30.85	4.06%	Fine Alluvium	0.060	120.7	3.16	0.000	3.16	0	4	5.19%	3.5	76%	3.29	0.000	3.29
56.430	6913.53	17.5	0.577	17.1	69.8	30.24	3.29%	Fine Alluvium	0.060	120.7	3.17	0.000	3.17	0	5	4.02%	3.4	76%	3.30	0.000	3.30
56.594	6913.37	15.9	0.466	15.5	57.7	25.01	2.94%	Fine Alluvium	0.060	120.7	3.18	0.000	3.18	0	4	3.68%	3.4	76%	3.31	0.000	3.31
56.758	6913.20	16.8	0.549	16.4	70.4	30.50	3.26%	Fine Alluvium	0.060	120.7	3.19	0.000	3.19	0	4	4.03%	3.4	76%	3.32	0.000	3.32
56.922	6913.04	14.0	0.604	13.6	59.7	25.85	4.31%	Fine Alluvium	0.060	120.7	3.20	0.000	3.20	0	3	5.59%	3.5	76%	3.33	0.000	3.33
57.086	6912.87	17.9	0.493	17.3	102.7	44.52	2.75%	Fine Alluvium	0.060	120.7	3.21	0.000	3.21	0	5	3.35%	3.3	76%	3.34	0.000	3.34
57.250	6912.71	15.9	0.489	15.4	92.2	39.96	3.07%	Fine Alluvium	0.060	120.7	3.22	0.000	3.22	0	4	3.85%	3.4	76%	3.35	0.000	3.35
57.414	6912.55	28.5	0.706	27.8	111.8	48.44	2.48%	Fine Alluvium	0.060	120.7	3.23	0.000	3.23	0	8	2.80%	3.1	76%	3.36	0.000	3.36
57.578	6912.38	22.3	0.699	22.1	36.5	15.80	3.13%	Fine Alluvium	0.060	120.7	3.24	0.000	3.24	0	6	3.66%	3.2	76%	3.37	0.000	3.37
57.742	6912.22	16.0	0.681	15.7	45.5	19.70	4.27%	Fine Alluvium	0.060	120.7	3.25	0.000	3.25	0	4	5.36%	3.5	76%	3.38	0.000	3.38
57.906	6912.05	15.3	0.630	14.9	65.0	28.15	4.13%	Fine Alluvium	0.060	120.7	3.26	0.000	3.26	0	4	5.25%	3.5	76%	3.39	0.000	3.39
58.070	6911.89	15.4	0.616	14.9	80.3	34.79	4.01%	Fine Alluvium	0.060	120.7	3.27	0.000	3.27	0	4	5.10%	3.5	76%	3.40	0.000	3.40
58.234	6911.73	16.6	0.775	16.1	81.9	35.49	4.66%	Fine Alluvium	0.060	120.7	3.28	0.000	3.28	0	4	5.80%	3.5	76%	3.41	0.000	3.41
58.398	6911.56	15.7	0.785	15.3	64.2	27.82	5.00%	Fine Alluvium	0.060	120.7	3.29	0.000	3.29	0	4	6.33%	3.5	76%	3.42	0.000	3.42
58.562	6911.40	15.1	0.734	14.7	65.1	28.21	4.87%	Fine Alluvium	0.060	120.7	3.30	0.000	3.30	0	4	6.24%	3.5	76%	3.43	0.000	3.43
58.726	6911.23	16.1	0.599	15.7	70.8	30.67	3.72%	Fine Alluvium	0.060	120.7	3.31	0.000	3.31	0	4	4.68%	3.4	76%	3.44	0.000	3.44
58.890	6911.07	15.8	0.601	15.4	70.5	30.55	3.80%	Fine Alluvium	0.060	120.7	3.32	0.000	3.32	0	4	4.82%	3.5	76%	3.45	0.000	3.45
59.054	6910.91	16.4	0.683	15.9	72.4	31.38	4.17%	Fine Alluvium	0.060	120.7	3.33	0.000	3.33	0	4	5.23%	3.5	76%	3.46	0.000	3.46

13.89	772	1.9E-03	1.1E+03	28	0.3904	1.7E-04	22	0.259	0.263	4	2.007	6791	4646	1400	3131	0.026%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
13.94	772	1.9E-03	1.1E+03	28	0.3860	1.7E-04	22	0.259	0.263	4	2.007	6781	4638	1400	3127	0.026%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
13.99	772	1.9E-03	1.1E+03	28	0.3815	1.7E-04	22	0.260	0.263	4	2.007	6770	4631	1400	3123	0.025%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
14.04	772	1.9E-03	1.1E+03	27	0.3771	1.7E-04	22	0.260	0.263	4	2.007	6759	4623	1400	3119	0.025%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
14.09	772	1.9E-03	1.1E+03	27	0.3728	1.7E-04	22	0.260	0.264	4	2.007	6749	4616	1400	3115	0.025%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
14.14	772	1.9E-03	1.1E+03	27	0.3684	1.7E-04	22	0.260	0.264	4	2.007	6738	4609	1400	3111	0.024%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
14.19	772	1.9E-03	1.1E+03	27	0.3640	1.7E-04	22	0.260	0.264	4	2.008	6728	4601	1400	3107	0.024%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
14.24	794	1.9E-03	1.2E+03	27	0.3597	1.6E-04	22	0.261	0.264	4	2.008	6717	4594	1400	3103	0.022%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
14.29	794	1.9E-03	1.2E+03	26	0.3553	1.5E-04	22	0.261	0.265	4	2.008	6707	4587	1400	3100	0.022%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
14.34	794	1.9E-03	1.2E+03	26	0.3510	1.5E-04	22	0.261	0.265	4	2.008	6697	4580	1400	3096	0.022%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
14.39	794	1.7E-03	1.1E+03	26	0.3467	1.7E-04	0	0.261	0.265	4	0.261	6687	4573	1400	6687	0.023%	2.00	1.00	0.01%	0.000269	0.36	0.025	0.785	0.04%	0.0001
14.44	794	1.7E-03	1.1E+03	26	0.3425	1.6E-04	0	0.262	0.265	4	0.262	6678	4567	1400	6678	0.023%	2.00	1.00	0.01%	0.000263	0.36	0.025	0.785	0.04%	0.0001
14.49	794	1.7E-03	1.1E+03	26	0.3382	1.6E-04	0	0.262	0.266	4	0.262	6669	4560	1400	6669	0.023%	2.00	1.00	0.01%	0.000256	0.36	0.025	0.785	0.04%	0.0001
14.54	794	1.7E-03	1.1E+03	26	0.3340	1.6E-04	0	0.262	0.266	4	0.262	6659	4554	1400	6659	0.023%	2.00	1.00	0.01%	0.000250	0.36	0.025	0.785	0.04%	0.0001
14.59	794	1.7E-03	1.1E+03	25	0.3297	1.6E-04	0	0.262	0.266	4	0.262	6650	4547	1400	6650	0.022%	2.00	1.00	0.01%	0.000244	0.36	0.025	0.785	0.04%	0.0001
14.64	794	1.7E-03	1.1E+03	25	0.3255	1.6E-04	0	0.262	0.266	4	0.262	6641	4541	1400	6641	0.022%	2.00	1.00	0.01%	0.000237	0.36	0.025	0.785	0.04%	0.0001
14.69	794	1.7E-03	1.1E+03	25	0.3214	1.6E-04	0	0.263	0.267	4	0.263	6632	4534	1400	6632	0.022%	2.00	1.00	0.01%	0.000231	0.36	0.025	0.785	0.04%	0.0001
14.74	794	1.7E-03	1.1E+03	25	0.3172	1.5E-04	0	0.263	0.267	4	0.263	6623	4528	1400	6623	0.021%	2.00	1.00	0.01%	0.000225	0.36	0.025	0.785	0.04%	0.0001
14.79	794	1.7E-03	1.1E+03	25	0.3131	1.5E-04	0	0.263	0.267	4	0.263	6614	4522	1400	6614	0.021%	2.00	1.00	0.01%	0.000219	0.36	0.025	0.785	0.03%	0.0001
14.84	794	1.7E-03	1.1E+03	25	0.3090	1.5E-04	0	0.263	0.267	4	0.263	6605	4515	1400	6605	0.021%	2.00	1.00	0.01%	0.000213	0.36	0.025	0.785	0.03%	0.0001
14.89	794	1.7E-03	1.1E+03	25	0.3049	1.5E-04	0	0.263	0.268	4	0.263	6596	4509	1400	6596	0.020%	2.00	1.00	0.01%	0.000207	0.36	0.025	0.785	0.03%	0.0001
14.94	794	1.7E-03	1.1E+03	24	0.3008	1.5E-04	0	0.264	0.268	4	0.264	6587	4503	1400	6587	0.020%	2.00	1.00	0.01%	0.000201	0.36	0.025	0.785	0.03%	0.0001
14.99	794	1.7E-03	1.1E+03	24	0.2967	1.5E-04	0	0.264	0.268	4	0.264	6578	4497	1400	6578	0.020%	2.00	1.00	0.01%	0.000195	0.36	0.025	0.785	0.03%	0.0001
15.04	794	1.7E-03	1.1E+03	24	0.2927	1.5E-04	0	0.264	0.268	4	0.264	6569	4491	1400	6569	0.019%	2.00	1.00	0.01%	0.000189	0.36	0.025	0.785	0.03%	0.0000
15.09	794	1.7E-03	1.1E+03	24	0.2887	1.4E-04	0	0.264	0.269	4	0.264	6560	4484	1400	6560	0.019%	2.00	1.00	0.01%	0.000184	0.36	0.025	0.785	0.03%	0.0000
15.14	794	1.7E-03	1.1E+03	24	0.2847	1.4E-04	0	0.264	0.269	4	0.264	6551	4478	1400	6551	0.019%	2.00	1.00	0.01%	0.000178	0.36	0.025	0.785	0.03%	0.0000
15.19	794	1.7E-03	1.1E+03	24	0.2808	1.4E-04	0	0.265	0.269	4	0.265	6543	4472	1400	6543	0.019%	2.00	1.00	0.01%	0.000172	0.36	0.025	0.785	0.03%	0.0000
15.24	794	1.7E-03	1.1E+03	24	0.2768	1.4E-04	0	0.265	0.269	4	0.265	6534	4466	1400	6534	0.018%	2.00	1.00	0.01%	0.000167	0.36	0.025	0.785	0.03%	0.0000
15.29	794	1.7E-03	1.1E+03	24	0.2729	1.4E-04	0	0.265	0.269	4	0.265	6525	4460	1400	6525	0.018%	2.00	1.00	0.01%	0.000161	0.36	0.025	0.785	0.03%	0.0000
15.34	794	1.7E-03	1.1E+03	23	0.2691	1.4E-04	0	0.265	0.270	4	0.265	6517	4454	1400	6517	0.018%	2.00	1.00	0.01%	0.000156	0.36	0.025	0.785	0.02%	0.0000
15.39	794	1.7E-03	1.1E+03	23	0.2652	1.4E-04	0	0.265	0.270	4	0.265	6508	4448	1400	6508	0.018%	2.00	1.00	0.01%	0.000150	0.36	0.025	0.785	0.02%	0.0000
15.44	794	1.7E-03	1.1E+03	23	0.2614	1.3E-04	0	0.266	0.270	4	0.266	6500	4442	1400	6500	0.017%	2.00	1.00	0.01%	0.000145	0.36	0.025	0.785	0.02%	0.0000
15.49	794	1.7E-03	1.1E+03	23	0.2576	1.3E-04	0	0.266	0.270	4	0.266	6491	4436	1400	6491	0.017%	2.00	1.00	0.01%	0.000139	0.36	0.025	0.785	0.02%	0.0000
15.54	794	1.7E-03	1.1E+03	23	0.2538	1.3E-04	0	0.266	0.271	4	0.266	6483	4430	1400	6483	0.017%	2.00	1.00	0.01%	0.000134	0.36	0.025	0.785	0.02%	0.0000
15.59	794	1.7E-03	1.1E+03	23	0.2501	1.3E-04	0	0.266	0.271	4	0.266	6474	4425	1400	6474	0.016%	2.00	1.00	0.01%	0.000129	0.36	0.025	0.785	0.02%	0.0000
15.64	794	1.7E-03	1.1E+03	23	0.2464	1.3E-04	0	0.266	0.271	4	0.266	6466	4419	1400	6466	0.016%	2.00	1.00	0.01%	0.000124	0.36	0.025	0.785	0.02%	0.0000
15.69	794	1.7E-03	1.1E+03	23	0.2427	1.3E-04	0	0.267	0.271	4	0.267	6458	4413	1400	6458	0.016%	2.00	1.00	0.01%	0.000119	0.36	0.025	0.785	0.02%	0.0000
15.74	757	1.7E-03	9.9E+02	22	0.2390	1.4E-04	0	0.267	0.272	4	0.267	6449	4407	1400	6449	0.018%	2.00	1.00	0.01%	0.000156	0.36	0.025	0.785	0.02%	0.0000
15.79	757	1.7E-03	9.9E+02	22	0.2354	1.4E-04	0	0.267	0.272	4	0.267	6441	4401	1400	6441	0.017%	2.00	1.00	0.01%	0.000150	0.36	0.025	0.785	0.02%	0.0000
15.84	757	1.7E-03	9.9E+02	22	0.2318	1.3E-04	0	0.267	0.272	4	0.267	6433	4396	1400	6433	0.017%	2.00	1.00	0.01%	0.000144	0.36	0.025	0.785	0.02%	0.0000
15.89	757	1.7E-03	9.9E+02	22	0.2282	1.3E-04	0	0.267	0.272	4	0.267	6425	4390	1400	6425	0.017%	2.00	1.00	0.01%	0.000138	0.36	0.025	0.785	0.02%	0.0000
15.94	757	1.7E-03	9.9E+02	22	0.2246	1.3E-04	0	0.268	0.272	4	0.268	6416	4384	1400	6416	0.017%	2.00	1.00	0.01%	0.000133	0.36	0.025	0.785	0.02%	0.0000
15.99	757	1.7E-03	9.9E+02	22	0.2211	1.3E-04	0	0.268	0.273	4	0.268	6408	4379	1400	6408	0.016%	2.00	1.00	0.01%	0.000127	0.36	0.025	0.785	0.02%	0.0000
16.04	757	1.7E-03	9.9E+02	22	0.2176	1.3E-04	0	0.268	0.273	4	0.268	6400	4373	1400	6400	0.016%	2.00	1.00	0.01%	0.000121	0.36	0.025	0.785	0.02%	0.0000
16.09	757	1.7E-03	9.9E+02	22	0.2141	1.3E-04	0	0.268	0.273	4	0.268	6392	4367	1400	6392	0.016%	2.00	1.00	0.01%	0.000116	0.36	0.025	0.785	0.02%	0.0000
16.14	757	1.7E-03	9.9E+02	22	0.2107	1.2E-04	0	0.268	0.273	4	0.268	6384	4362	1400	6384	0.016%	2.00	1.00	0.01%	0.000111	0.36	0.025	0.785	0.02%	0.0000
16.19	757	1.7E-03	9.9E+02	22	0.2073	1.2E-04	0	0.268	0.274	4	0.268	6376	4356	1400	6376	0.015%	2.00	1.00	0.01%	0.000105	0.36	0.025	0.785	0.02%	0.0000
16.24	757	1.7E-03	9.9E+02	22	0.2039	1.2E-04	0	0.269	0.274	4	0.269	6368	4351	1400	6368	0.015%	2.00	1.00	0.01%	0.000100	0.36	0.025	0.785	0.02%	0.0000
16.29	757	1.7E-03	9.9E+02	21	0.2006	1.2E-04	0	0.269	0.274	4	0.269	6360	4345	1400	6360	0.015%	2.00	1.00	0.01%	0.000095	0.36	0.025	0.785	0.01%	0.0000
16.34	757	1.7E-03	9.9E+02	21	0.1972	1.2E-04	0	0.269	0.274	4	0.269	6352	4340	1400	6352	0.014%	2.00	1.00	0.01%	0.000090	0.36	0.025	0.785	0.01%	0.0000
16.39	757	1.7E-03	9.9E+02	21	0.1939	1.2E-04	0	0.269	0.274	4	0.269	6344	4334	1400	6344	0.014%	2.00	1.00	0.01%	0.000085	0.36	0.025	0.785	0.01%	0.0000
16.44	757	1.7E-03	9.9E+02	21	0.1907	1.1E-04	0	0.269	0.275	4	0.269	6337	4329	1400	6337	0.014%	2.00	1.00	0.01%	0.000079	0.36	0.025	0.785	0.01%	0.0000
16.49	757	1.7E-03	9.9E+02	21	0.1875	1.1E-04	0	0.270	0.275	4	0.270	6329	4323	1400	6329	0.014%	2.00	1.00	0.01%	0.000075	0.36	0.025	0.785	0.01%	0.0000
16.54	757	1.7E-03	9.9E+02	21	0.1843	1.1E-04	0	0.270	0.275	4	0.270	6321	4318	1400	6321	0.013%	2.00	1.00	0.01%	0.000070	0.36	0.025	0.785	0.01%	0.0000
16.59	757	1.7E-03	9.9E+02	21	0.1811	1.1E-04	0	0.270	0.275	4	0.270	6313	4312	1400	6313	0.013%	2.00	1.00	0.01%	0.000065	0.36	0.025	0.785	0.01%	0.0000
16.64	757	1.7E-03	9.9E+02	21	0.1779	1.1E-04	0	0.270	0.276	4	0.270	6306	4307	1400	6306	0.013%	2.00	1.00	0.01%	0.000060	0.36	0.025	0.785	0.01%	0.0000
16.69	757	1.7E-03	9.9E+02	21	0.1748	1.1E-04	0	0.270	0.276	4	0.270	6298	4302	1400	6298	0.013%	2.00	1.00	0.01%	0.000055	0.36	0.025	0.785	0.01%	0.0000
16.74	757	1.7E-03	9.9E+02	21	0.1718	1.0E-04	0	0.271	0.276	4	0.271	6290	4296	1400	6290	0.013%	2.00	1.00	0.01%	0.000051	0.36	0.025	0.785	0.01%	0.0000
16.79	757	1.7E-03	9.9E+02	21	0.1687	1.0E-04	0	0.271	0.276	4	0.271	6283	4291	1400	6283	0.012%	2.00	1.00	0.01%	0.000046	0.36	0.025	0.785	0.01%	0.0000
16.84	757	1.7E-03	9.9E+02	21	0.1657	1.0E-04	0	0.271	0.276	4	0.271	6275	4286	1400	6275	0.012%	2.00	1.00	0.01%	0.000042	0.36	0.025	0.785	0.01%	0.0000
16.89	757	1.7E-03	9.9E+02	20	0.1627	1.0E-04	0	0.271	0.277	4	0.271	6268	4281	1400	6268	0.012%	2.00	1.00	0.01%	0.000037	0.36	0.025	0.785	0.01%	0.0000
16.94	757	1.7E-03	9.9E+02	20	0.1597	9.8E-05	0	0.271	0.277	4	0.271	6260	4275	1400	6260	0.012%	2.00	1.00	0.01%	0.000033	0.36	0.025	0.785	0.01%	0.0000
16.99	757	1.7E-03	9.9E+02	20	0.1568	9.7E-05	0	0.271	0.277	4	0.271	6253	4270	1400	6253	0.011%	2.00	1.00	0.01%	0.000028	0.36	0.025	0.785	0.00%	0.0000
17.04	757	1.7E-03	9.9E+02	20	0.1539	9.5E-05	0	0.272	0.277	4	0.272	6245	4265	1400	6245	0.011%	2.00	1.00	0.01%	0.000024	0.36	0.025	0.785	0.00%	0.0000
17.09	757	1.7E-03	9.9E+02	20	0.1510	9.4E-05	0	0.272	0.277	4	0.272	6238	4260	1400	6238	0.011%	2.00	1.00	0.01%	0.000020	0.36	0.025	0.785	0.00%	0.0000
17.14	757	1.9E-03	1.1E+03	20	0.1482	8.5E-05	22	0.272	0.278	4	2.015	6230	4254	1400	2922	0.010%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.19	757	1.9E-03	1.1E+03	20	0.1454	8.4E-05	22	0.272	0.278	4	2.015	6222	4249	1400	2919	0.010%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.24	757	1.9E-03	1.1E+03	20	0.1426	8.2E-05	22	0.272	0.278	4	2.015	6214	4243	1400	2916	0.010%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.29	663	1.9E-03	8.2E+02	20	0.1398	1.1E-04	22	0.273	0.278	4	2.015	6206	4238	1400	2913	0.013%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.34	663	1.9E-03	8.2E+02	20	0.1371	1.0E-04	22	0.273	0.279	4	2.015	6198	4232	1400	2911	0.013%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.39	663	1.9E-03	8.2E+02	20	0.1344	1.0E-04	22	0.273	0.279	4	2.015	6190	4227	1400	2908	0.013%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.44	663	1.9E-03	8.2E+02	20	0.1318	1.0E-04	22	0.273	0.279	4	2.015	6182	4221	1400	2905	0.012%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.49	663	1.9E-03	8.2E+02	20	0.1291	9.9E-05	22	0.273	0.279	4	2.016	6175	4216	1400	2902	0.012%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.54	663	1.9E-03	8.2E+02	20	0.1265	9.7E-05	22	0.274	0.280	4	2.016	6167	4210	1400	2899	0.012%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.59	663	1.9E-03	8.2E+02	20	0.1239	9.5E-05	22	0.274	0.280	4	2.016	6159	4205	1400	2896	0.012%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.64	663	1.9E-03	8.2E+02	20	0.1214	9.4E-05	22	0.274	0.280	4	2.016	6152	4200	1400	2893	0.011%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.69	663	1.9E-03	8.2E+02	19	0.1189	9.2E-05	22	0.274	0.280	4	2.016	6144	4194	1400	2890	0.011%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.74	663	1.9E-03	8.2E+02	19	0.1164	9.0E-05	22	0.274	0.280	4	2.016	6136	4189	1400	2888	0.011%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.79	663	1.9E-03	8.2E+02	19	0.1139	8.9E-05	22	0.275	0.281	4	2.016	6129	4184	1400	2885	0.011%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.84	663	1.9E-03	8.2E+02	19	0.1115	8.7E-05	22	0.275	0.281	4	2.016	6121	4179	1400	2882	0.010%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.89	663	1.9E-03	8.2E+02	19	0.1091	8.5E-05	22	0.275	0.281	4	2.017	6114	4173	1400	2879	0.010%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.94	663	1.9E-03	8.2E+02	19	0.1067	8.4E-05	22	0.275	0.281	4	2.017	6106	4168	1400	2876	0.010%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.99	663	1.9E-03	8.2E+02	19	0.1043	8.2E-05	22	0.275	0.282	4	2.017	6099	4163	1400	2874	0.010%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.04	663	1.9E-03	8.2E+02	19	0.1020	8.1E-05	22	0.275	0.282	4	2.017	6091	4158	1400	2871	0.009%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.09	663	1.9E-03	8.2E+02	19	0.0997	7.9E-05	22	0.276	0.282	4	2.017	6084	4153	1400	2868	0.009%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.14	663	1.9E-03	8.2E+02	19	0.0975	7.7E-05	22	0.276	0.282	4	2.017	6077	4148	1400	2865	0.009%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.19	663	1.9E-03	8.2E+02	19	0.0952	7.6E-05	22	0.276	0.282	4	2.017	6069	4143	1400	2863	0.009%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.24	663	1.9E-03	8.2E+02	19	0.0930	7.4E-05	22	0.276	0.283	4	2.017	6062	4137	1400	2860	0.009%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.29	663	1.9E-03	8.2E+02	19	0.0908	7.3E-05	22	0.276	0.283	4	2.018	6055	4132	1400	2857	0.008%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.34	663	1.9E-03	8.2E+02	19	0.0887	7.1E-05	22	0.277	0.283	4	2.018	6047	4127	1400	2855	0.008%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.39	663	1.9E-03	8.2E+02	19	0.0865	7.0E-05	22	0.277	0.283	4	2.018	6040	4122	1400	2852	0.008%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.44	663	1.9E-03	8.2E+02	19	0.0844	6.8E-05	22	0.277	0.283	4	2.018	6033	4117	1400	2849	0.008%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.49	663	1.9E-03	8.2E+02	19	0.0823	6.7E-05	22	0.277	0.284	4	2.018	6026	4112	1400	2847	0.008%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.54	663	1.9E-03	8.2E+02	19	0.0803	6.5E-05	22	0.277	0.284	4	2.018	6019	4107	1400	2844	0.007%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.59	663	1.9E-03	8.2E+02	19	0.0783	6.4E-05	22	0.278	0.284	4	2.018	6012	4102	1400	2841	0.007%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.64	663	1.9E-03	8.2E+02	19	0.0763	6.2E-05	22	0.278	0.284	4	2.018	6005	4098	1400	2839	0.007%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000

59.218	6910.74	16.6	0.710	16.2	71.7	31.05	4.27%	Fine Alluvium	0.060	120.7	3.34	0.000	3.34	0	4	5.34%	3.5	76%	3.47	0.000	3.47
59.382	6910.58	16.9	0.755	16.4	72.6	31.44	4.47%	Fine Alluvium	0.060	120.7	3.35	0.000	3.35	0	4	5.58%	3.5	76%	3.48	0.000	3.48
59.547	6910.41	17.2	0.736	16.8	70.0	30.32	4.28%	Fine Alluvium	0.060	120.7	3.36	0.000	3.36	0	4	5.32%	3.5	76%	3.49	0.000	3.49
59.711	6910.25	16.2	0.713	15.8	67.6	29.30	4.39%	Fine Alluvium	0.060	120.7	3.37	0.000	3.37	0	4	5.54%	3.5	76%	3.50	0.000	3.50
59.875	6910.09	16.1	0.530	15.6	70.7	30.65	3.30%	Fine Alluvium	0.060	120.7	3.38	0.000	3.38	0	4	4.18%	3.4	76%	3.51	0.000	3.51
60.039	6909.92	15.1	0.563	14.7	70.2	30.42	3.73%	Fine Alluvium	0.060	120.7	3.39	0.000	3.39	0	3	4.81%	3.5	76%	3.52	0.000	3.52
60.203	6909.76	17.0	0.683	16.3	120.8	52.33	4.02%	Fine Alluvium	0.060	120.7	3.40	0.000	3.40	0	4	5.02%	3.5	76%	3.53	0.000	3.53
60.367	6909.59	16.6	0.702	16.0	97.1	42.08	4.23%	Fine Alluvium	0.060	120.7	3.41	0.000	3.41	0	4	5.32%	3.5	76%	3.54	0.000	3.54
60.531	6909.43	16.9	0.765	16.3	100.8	43.66	4.53%	Fine Alluvium	0.060	120.7	3.42	0.000	3.42	0	4	5.68%	3.5	76%	3.55	0.000	3.55
60.695	6909.27	17.8	0.836	17.3	87.3	37.84	4.69%	Fine Alluvium	0.060	120.7	3.43	0.000	3.43	0	4	5.81%	3.5	76%	3.56	0.000	3.56
60.859	6909.10	17.1	0.886	16.7	67.4	29.20	5.17%	Fine Alluvium	0.060	120.7	3.44	0.000	3.44	0	4	6.48%	3.5	76%	3.57	0.000	3.57
61.023	6908.94	17.8	0.901	17.4	67.5	29.24	5.06%	Fine Alluvium	0.060	120.7	3.45	0.000	3.45	0	4	6.27%	3.5	76%	3.58	0.000	3.58
61.187	6908.77	20.0	0.996	19.5	79.2	34.31	4.98%	Fine Alluvium	0.060	120.7	3.46	0.000	3.46	0	5	6.02%	3.4	76%	3.59	0.000	3.59
61.351	6908.61	19.7	1.070	19.3	59.3	25.71	5.44%	Fine Alluvium	0.060	120.7	3.47	0.000	3.47	0	5	6.60%	3.5	76%	3.60	0.000	3.60
61.515	6908.45	20.9	1.228	20.6	57.4	24.89	5.86%	Fine Alluvium	0.060	120.7	3.48	0.000	3.48	0	5	7.03%	3.5	76%	3.61	0.000	3.61
61.679	6908.28	21.4	1.231	21.1	52.6	22.80	5.74%	Fine Alluvium	0.060	120.7	3.49	0.000	3.49	0	5	6.86%	3.4	76%	3.62	0.000	3.62
61.843	6908.12	20.1	1.115	19.8	42.1	18.22	5.55%	Fine Alluvium	0.060	120.7	3.50	0.000	3.50	0	5	6.72%	3.5	76%	3.63	0.000	3.63
62.007	6907.95	17.8	0.850	17.5	48.8	21.13	4.78%	Fine Alluvium	0.060	120.7	3.51	0.000	3.51	0	4	5.96%	3.5	76%	3.64	0.000	3.64
62.171	6907.79	16.3	0.630	16.0	52.5	22.74	3.86%	Fine Alluvium	0.060	120.7	3.52	0.000	3.52	0	4	4.92%	3.5	76%	3.65	0.000	3.65
62.335	6907.63	13.9	0.470	13.6	53.7	23.27	3.38%	Fine Alluvium	0.060	120.7	3.53	0.000	3.53	0	3	4.53%	3.5	76%	3.66	0.000	3.66
62.499	6907.46	14.0	0.488	13.6	60.4	26.15	3.50%	Fine Alluvium	0.060	120.7	3.54	0.000	3.54	0	3	4.68%	3.5	76%	3.67	0.000	3.67
62.663	6907.30	14.7	0.435	14.3	62.7	27.19	2.95%	Fine Alluvium	0.060	120.7	3.55	0.000	3.55	0	3	3.89%	3.5	76%	3.67	0.000	3.67
62.827	6907.13	15.5	0.494	15.1	65.6	28.43	3.18%	Fine Alluvium	0.060	120.7	3.56	0.000	3.56	0	3	4.13%	3.5	76%	3.68	0.000	3.68
62.991	6906.97	15.4	0.525	15.0	63.5	27.50	3.40%	Fine Alluvium	0.060	120.7	3.57	0.000	3.57	0	3	4.42%	3.5	76%	3.69	0.000	3.69
63.155	6906.81	15.9	0.619	15.4	69.0	29.89	3.91%	Fine Alluvium	0.060	120.7	3.58	0.000	3.58	0	3	5.04%	3.5	76%	3.70	0.000	3.70
63.319	6906.64	14.8	0.592	14.4	67.8	29.36	3.99%	Fine Alluvium	0.060	120.7	3.59	0.000	3.59	0	3	5.27%	3.6	76%	3.71	0.000	3.71
63.483	6906.48	15.7	0.596	15.2	80.7	34.98	3.80%	Fine Alluvium	0.060	120.7	3.60	0.000	3.60	0	3	4.94%	3.5	76%	3.72	0.000	3.72
63.648	6906.31	16.7	0.386	16.1	83.7	36.26	2.32%	Fine Alluvium	0.060	120.7	3.61	0.000	3.61	0	4	2.96%	3.4	76%	3.73	0.000	3.73
63.812	6906.15	16.6	0.447	16.1	86.2	37.34	2.69%	Fine Alluvium	0.060	120.7	3.62	0.000	3.62	0	4	3.44%	3.4	76%	3.74	0.000	3.74
63.976	6905.98	15.6	0.557	15.0	87.4	37.89	3.57%	Fine Alluvium	0.060	120.7	3.63	0.000	3.63	0	3	4.66%	3.5	76%	3.75	0.000	3.75
64.140	6905.82	15.2	0.546	14.7	83.5	36.18	3.58%	Fine Alluvium	0.060	120.7	3.64	0.000	3.64	0	3	4.71%	3.5	76%	3.76	0.000	3.76
64.304	6905.66	16.0	0.606	15.4	95.2	41.26	3.80%	Fine Alluvium	0.060	120.7	3.65	0.000	3.65	0	3	4.92%	3.5	76%	3.77	0.000	3.77
64.468	6905.49	15.3	0.515	14.8	88.8	38.50	3.36%	Fine Alluvium	0.060	120.7	3.66	0.000	3.66	0	3	4.41%	3.5	76%	3.78	0.000	3.78
64.632	6905.33	15.8	0.598	15.2	97.1	42.09	3.78%	Fine Alluvium	0.060	120.7	3.67	0.000	3.67	0	3	4.91%	3.5	76%	3.79	0.000	3.79
64.796	6905.16	17.5	0.637	16.9	96.8	41.95	3.64%	Fine Alluvium	0.060	120.7	3.68	0.000	3.68	0	4	4.61%	3.5	76%	3.80	0.000	3.80
64.960	6905.00	18.6	0.824	18.0	95.1	41.20	4.42%	Fine Alluvium	0.060	120.7	3.69	0.000	3.69	0	4	5.51%	3.5	76%	3.81	0.000	3.81
65.124	6904.84	18.8	0.855	18.3	89.3	38.68	4.54%	Fine Alluvium	0.060	120.7	3.70	0.000	3.70	0	4	5.64%	3.5	76%	3.82	0.000	3.82
65.288	6904.67	19.2	0.934	18.5	109.3	47.38	4.87%	Fine Alluvium	0.060	120.7	3.71	0.000	3.71	0	4	6.04%	3.5	76%	3.83	0.000	3.83
65.452	6904.51	18.2	0.883	17.7	90.4	39.16	4.85%	Fine Alluvium	0.060	120.7	3.72	0.000	3.72	0	4	6.09%	3.5	76%	3.84	0.000	3.84
65.616	6904.34	17.3	0.887	16.8	80.4	34.84	5.14%	Fine Alluvium	0.060	120.7	3.73	0.000	3.73	0	4	6.55%	3.6	76%	3.85	0.000	3.85
65.780	6904.18	17.6	0.780	17.1	83.5	36.20	4.43%	Fine Alluvium	0.060	120.7	3.74	0.000	3.74	0	4	5.63%	3.5	76%	3.86	0.000	3.86
65.944	6904.02	19.6	0.823	19.0	94.1	40.79	4.20%	Fine Alluvium	0.060	120.7	3.75	0.000	3.75	0	4	5.20%	3.4	76%	3.87	0.000	3.87
66.108	6903.85	21.3	0.943	20.7	90.9	39.37	4.43%	Fine Alluvium	0.060	120.7	3.76	0.000	3.76	0	5	5.38%	3.4	76%	3.88	0.000	3.88
66.272	6903.69	21.7	0.880	21.3	66.0	28.59	4.05%	Fine Alluvium	0.060	120.7	3.77	0.000	3.77	0	5	4.91%	3.4	76%	3.89	0.000	3.89
66.436	6903.52	21.3	1.246	21.0	50.9	22.07	5.84%	Fine Alluvium	0.060	120.7	3.78	0.000	3.78	0	5	7.09%	3.5	76%	3.90	0.000	3.90
66.600	6903.36	20.6	1.207	20.3	46.9	20.34	5.85%	Fine Alluvium	0.060	120.7	3.79	0.000	3.79	0	4	7.17%	3.5	76%	3.91	0.000	3.91
66.764	6903.20	20.8	1.003	20.5	52.3	22.68	4.83%	Fine Alluvium	0.060	120.7	3.80	0.000	3.80	0	4	5.90%	3.5	76%	3.92	0.000	3.92
66.928	6903.03	17.8	0.767	17.5	57.5	24.91	4.30%	Fine Alluvium	0.060	120.7	3.81	0.000	3.81	0	4	5.47%	3.5	76%	3.93	0.000	3.93
67.092	6902.87	17.0	0.693	16.6	63.1	27.35	4.07%	Fine Alluvium	0.060	120.7	3.82	0.000	3.82	0	3	5.24%	3.5	76%	3.94	0.000	3.94
67.256	6902.70	16.8	0.684	16.4	63.0	27.31	4.06%	Fine Alluvium	0.060	120.7	3.83	0.000	3.83	0	3	5.26%	3.5	76%	3.95	0.000	3.95
67.420	6902.54	17.7	0.747	17.3	63.5	27.50	4.21%	Fine Alluvium	0.060	120.7	3.84	0.000	3.84	0	4	5.37%	3.5	76%	3.96	0.000	3.96
67.584	6902.38	18.2	0.750	17.8	69.5	30.10	4.12%	Fine Alluvium	0.060	120.7	3.85	0.000	3.85	0	4	5.22%	3.5	76%	3.97	0.000	3.97
67.749	6902.21	18.0	0.744	17.6	65.0	28.18	4.13%	Fine Alluvium	0.060	120.7	3.86	0.000	3.86	0	4	5.26%	3.5	76%	3.98	0.000	3.98
67.913	6902.05	19.2	0.778	18.7	78.4	33.96	4.06%	Fine Alluvium	0.060	120.7	3.87	0.000	3.87	0	4	5.09%	3.5	76%	3.99	0.000	3.99
68.077	6901.88	20.0	0.848	19.5	76.5	33.17	4.24%	Fine Alluvium	0.060	120.7	3.88	0.000	3.88	0	4	5.27%	3.4	76%	4.00	0.000	4.00
68.241	6901.72	21.3	0.970	20.8	85.3	36.97	4.55%	Coarse Alluvium	0.056	111.0	3.88	0.000	3.88	0	4	5.57%	3.4	36%	4.01	0.000	4.01
68.405	6901.56	29.4	1.269	28.8	97.4	42.22	4.31%	Coarse Alluvium	0.056	111.0	3.89	0.000	3.89	0	7	4.97%	3.3	36%	4.02	0.000	4.02
68.569	6901.39	31.0	1.356	30.7	41.3	17.91	4.38%	Coarse Alluvium	0.056	111.0	3.90	0.000	3.90	0	7	5.01%	3.3	36%	4.03	0.000	4.03
68.733	6901.23	28.3	1.485	28.1	32.4	14.03	5.25%	Coarse Alluvium	0.056	111.0	3.91	0.000	3.91	0	6	6.09%	3.3	36%	4.04	0.000	4.04
68.897	6901.06	30.7	1.435	30.5	37.7	16.35	4.67%	Coarse Alluvium	0.056	111.0	3.92	0.000	3.92	0	7	5.36%	3.3	36%	4.05	0.000	4.05
69.061	6900.90	28.6	1.493	28.4	27.3	11.83	5.22%	Coarse Alluvium	0.056	111.0	3.93	0.000	3.93	0	6	6.05%	3.3	36%	4.06	0.000	4.06
69.225	6900.74	32.7	1.426	32.5	28.4	12.32	4.36%	Coarse Alluvium	0.056	111.0	3.94	0.000	3.94	0	7	4.96%	3.2	36%	4.07	0.000	4.07
69.389	6900.57	45.3	1.300	45.1	30.4	13.18	2.87%	Coarse Alluvium	0.056	111.0	3.95	0.000	3.95	0	10	3.15%	3.0	36%	4.07	0.000	4.07
69.553	6900.41	59.5	1.179	59.4	19.2	8.30	1.98%	Coarse Alluvium	0.056	111.0	3.96	0.000	3.96	0	14	2.12%	2.8	36%	4.08	0.000	4.08
69.717	6900.24	69.4	1.177	69.4	14.2	6.16	1.70%	Coarse Alluvium	0.056	111.0	3.97	0.000	3.97	0	17	1.80%	2.7	36%	4.09	0.000	4.09
69.881	6900.08	73.4	1.272	73.3	13.3	5.75	1.73%	Coarse Alluvium	0.056	111.0	3.98	0.000	3.98	0	17	1.83%	2.7	36%	4.10	0.000	4.10

18.69	663	1.9E-03	8.2E+02	19	0.0743	6.1E-05	22	0.278	0.285	4	2.018	5998	4093	1400	2836	0.007%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.74	663	1.9E-03	8.2E+02	18	0.0723	6.0E-05	22	0.278	0.285	4	2.019	5991	4088	1400	2833	0.007%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.79	666	1.9E-03	8.3E+02	18	0.0704	5.8E-05	22	0.278	0.285	4	2.019	5984	4083	1400	2831	0.006%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.84	666	1.9E-03	8.3E+02	18	0.0685	5.6E-05	22	0.278	0.285	4	2.019	5977	4078	1400	2828	0.006%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.89	666	1.9E-03	8.3E+02	18	0.0666	5.5E-05	22	0.279	0.285	4	2.019	5970	4073	1400	2826	0.006%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.94	666	1.9E-03	8.3E+02	18	0.0648	5.3E-05	22	0.279	0.286	4	2.019	5963	4068	1400	2823	0.006%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.99	666	1.9E-03	8.3E+02	18	0.0629	5.2E-05	22	0.279	0.286	4	2.019	5956	4064	1400	2821	0.006%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
19.04	666	1.9E-03	8.3E+02	18	0.0611	5.1E-05	22	0.279	0.286	4	2.019	5949	4059	1400	2818	0.006%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
19.09	666	1.9E-03	8.3E+02	18	0.0594	4.9E-05	22	0.279	0.286	4	2.019	5942	4054	1400	2816	0.005%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
19.14	666	1.9E-03	8.3E+02	18	0.0576	4.8E-05	22	0.280	0.286	4	2.019	5936	4049	1400	2813	0.005%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
19.19	666	1.9E-03	8.3E+02	18	0.0559	4.7E-05	22	0.280	0.287	4	2.020	5929	4045	1400	2811	0.005%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
19.24	666	1.9E-03	8.3E+02	18	0.0542	4.5E-05	22	0.280	0.287	4	2.020	5922	4040	1400	2808	0.005%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
19.29	666	1.9E-03	8.3E+02	18	0.0525	4.4E-05	22	0.280	0.287	4	2.020	5915	4035	1400	2806	0.005%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
19.34	666	1.9E-03	8.3E+02	18	0.0508	4.3E-05	22	0.280	0.287	4	2.020	5909	4031	1400	2803	0.005%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
19.39	666	1.9E-03	8.3E+02	18	0.0492	4.2E-05	22	0.280	0.288	4	2.020	5902	4026	1400	2801	0.005%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
19.44	666	1.9E-03	8.3E+02	18	0.0475	4.0E-05	22	0.281	0.288	4	2.020	5895	4022	1400	2798	0.004%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
19.49	666	1.9E-03	8.3E+02	18	0.0460	3.9E-05	22	0.281	0.288	4	2.020	5889	4017	1400	2796	0.004%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
19.54	666	1.9E-03	8.3E+02	18	0.0444	3.8E-05	22	0.281	0.288	4	2.020	5882	4012	1400	2793	0.004%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
19.59	666	1.9E-03	8.3E+02	18	0.0428	3.7E-05	22	0.281	0.288	4	2.020	5876	4008	1400	2791	0.004%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
19.64	666	1.9E-03	8.3E+02	18	0.0413	3.5E-05	22	0.281	0.289	4	2.021	5869	4003	1400	2788	0.004%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
19.69	666	1.9E-03	8.3E+02	18	0.0398	3.4E-05	22	0.281	0.289	4	2.021	5863	3999	1400	2786	0.004%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
19.74	666	1.9E-03	8.3E+02	18	0.0383	3.3E-05	22	0.282	0.289	4	2.021	5856	3994	1400	2784	0.004%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
19.79	666	1.9E-03	8.3E+02	18	0.0368	3.2E-05	22	0.282	0.289	4	2.021	5850	3990	1400	2781	0.003%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
19.84	666	1.9E-03	8.3E+02	18	0.0354	3.1E-05	22	0.282	0.289	4	2.021	5843	3985	1400	2779	0.003%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
19.89	666	1.9E-03	8.3E+02	18	0.0339	3.0E-05	22	0.282	0.290	4	2.021	5837	3981	1400	2776	0.003%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
19.94	666	1.9E-03	8.3E+02	18	0.0325	2.8E-05	22	0.282	0.290	4	2.021	5830	3976	1400	2774	0.003%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
19.99	666	1.9E-03	8.3E+02	18	0.0311	2.7E-05	22	0.283	0.290	4	2.021	5824	3972	1400	2772	0.003%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
20.04	666	1.9E-03	8.3E+02	18	0.0307	2.7E-05	22	0.283	0.290	4	2.021	5818	3968	1400	2769	0.003%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
20.09	666	1.9E-03	8.3E+02	18	0.0304	2.7E-05	22	0.283	0.290	4	2.022	5811	3963	1400	2767	0.003%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
20.14	666	1.9E-03	8.3E+02	18	0.0302	2.7E-05	22	0.283	0.291	4	2.022	5805	3959	1400	2765	0.003%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
20.19	666	1.9E-03	8.3E+02	18	0.0300	2.6E-05	22	0.283	0.291	4	2.022	5799	3954	1400	2762	0.003%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
20.24	666	1.9E-03	8.3E+02	18	0.0297	2.6E-05	22	0.283	0.291	4	2.022	5793	3950	1400	2760	0.003%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
20.29	666	1.9E-03	8.3E+02	18	0.0295	2.6E-05	22	0.284	0.291	4	2.022	5786	3946	1400	2758	0.003%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
20.34	740	1.9E-03	1.0E+03	18	0.0293	2.1E-05	22	0.284	0.291	4	2.022	5780	3942	1400	2755	0.002%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
20.39	740	1.9E-03	1.0E+03	18	0.0290	2.1E-05	22	0.284	0.292	4	2.022	5774	3937	1400	2753	0.002%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
20.44	740	1.9E-03	1.0E+03	18	0.0288	2.1E-05	22	0.284	0.292	4	2.022	5768	3933	1400	2751	0.002%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
20.49	740	1.9E-03	1.0E+03	17	0.0286	2.1E-05	22	0.284	0.292	4	2.022	5762	3929	1400	2749	0.002%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
20.54	740	1.9E-03	1.0E+03	17	0.0284	2.1E-05	22	0.284	0.292	4	2.023	5756	3924	1400	2746	0.002%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
20.59	740	1.9E-03	1.0E+03	17	0.0281	2.1E-05	22	0.285	0.292	4	2.023	5750	3920	1400	2744	0.002%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
20.64	740	1.9E-03	1.0E+03	17	0.0279	2.0E-05	22	0.285	0.293	4	2.023	5744	3916	1400	2742	0.002%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
20.69	740	1.9E-03	1.0E+03	17	0.0277	2.0E-05	22	0.285	0.293	4	2.023	5738	3912	1400	2740	0.002%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
20.74	740	1.9E-03	1.0E+03	17	0.0274	2.0E-05	22	0.285	0.293	4	2.023	5732	3908	1400	2737	0.002%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
20.79	740	1.9E-03	1.0E+03	17	0.0272	2.0E-05	22	0.285	0.293	4	2.023	5726	3903	1400	2735	0.002%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
20.84	740	1.9E-03	1.0E+03	17	0.0270	2.0E-05	22	0.285	0.293	4	2.023	5720	3899	1400	2733	0.002%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
20.89	740	1.9E-03	1.0E+03	17	0.0267	2.0E-05	22	0.286	0.294	4	2.023	5714	3895	1400	2731	0.002%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
20.94	740	1.9E-03	1.0E+03	17	0.0265	2.0E-05	22	0.286	0.294	4	2.023	5708	3891	1400	2729	0.002%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
20.99	740	1.9E-03	1.0E+03	17	0.0263	2.0E-05	22	0.286	0.294	4	2.023	5702	3887	1400	2726	0.002%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
21.04	740	1.9E-03	1.0E+03	17	0.0261	1.9E-05	22	0.286	0.294	4	2.024	5696	3883	1400	2724	0.002%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
21.09	740	1.9E-03	1.0E+03	17	0.0258	1.9E-05	22	0.286	0.294	4	2.024	5690	3879	1400	2722	0.002%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
21.14	740	1.9E-03	1.0E+03	17	0.0256	1.9E-05	22	0.286	0.295	4	2.024	5684	3875	1400	2720	0.002%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
21.19	740	1.9E-03	1.0E+03	17	0.0254	1.9E-05	22	0.287	0.295	4	2.024	5678	3871	1400	2718	0.002%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
21.24	740	1.9E-03	1.0E+03	17	0.0251	1.9E-05	22	0.287	0.295	4	2.024	5673	3867	1400	2716	0.002%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
21.29	740	1.9E-03	1.0E+03	17	0.0249	1.9E-05	22	0.287	0.295	4	2.024	5667	3863	1400	2713	0.002%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
21.34	740	1.9E-03	1.0E+03	17	0.0247	1.9E-05	22	0.287	0.295	4	2.024	5661	3859	1400	2711	0.002%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
21.39	740	1.9E-03	1.0E+03	17	0.0244	1.9E-05	22	0.287	0.296	4	2.024	5655	3855	1400	2709	0.002%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
21.44	740	1.7E-03	9.4E+02	17	0.0242	2.0E-05	0	0.287	0.296	4	0.287	5650	3851	1400	5650	0.002%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.49	740	1.7E-03	9.4E+02	17	0.0240	2.0E-05	0	0.288	0.296	4	0.288	5645	3847	1400	5645	0.002%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.54	740	1.7E-03	9.4E+02	17	0.0238	2.0E-05	0	0.288	0.296	4	0.288	5639	3844	1400	5639	0.002%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.59	740	1.7E-03	9.4E+02	17	0.0235	2.0E-05	0	0.288	0.296	4	0.288	5634	3840	1400	5634	0.002%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.64	740	1.7E-03	9.4E+02	17	0.0233	1.9E-05	0	0.288	0.296	4	0.288	5629	3836	1400	5629	0.002%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.69	740	1.7E-03	9.4E+02	17	0.0231	1.9E-05	0	0.288	0.297	4	0.288	5624	3833	1400	5624	0.002%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.74	740	1.7E-03	9.4E+02	17	0.0228	1.9E-05	0	0.288	0.297	4	0.288	5619	3829	1400	5619	0.002%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.79	740	1.7E-03	9.4E+02	17	0.0226	1.9E-05	0	0.288	0.297	4	0.288	5614	3826	1400	5614	0.002%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.84	959	1.7E-03	1.6E+03	17	0.0224	1.1E-05	0	0.289	0.297	4	0.289	5608	3822	1400	5608	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.89	959	1.7E-03	1.6E+03	17	0.0221	1.1E-05	0	0.289	0.297	4	0.289	5603	3819	1400	5603	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.94	959	1.7E-03	1.6E+03	17	0.0219	1.1E-05	0	0.289	0.298	4	0.289	5598	3815	1400	5598	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000

Proposed Repository	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Elev. At Bottom of Layer (ft)	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at Bottom of Layer (tsf)	Total Stress at Midpoint of Layer (tsf)	Equil Pore Pressure at Bottom of Layer (tsf)	Equil Pore Pressure at Midpoint of Layer (tsf)	Effective Stress at Bottom of Layer (tsf)	Effective Stress at Midpoint of Layer
Erosion Protection	6972.1	6971.3	6970.6	1.5	0.061	122.9	0.092	0.046	0.00	0.00	0.092	0.046
Cover Soil	6970.6	6970.3	6970.0	0.6	0.057	114.7	0.127	0.109	0.00	0.00	0.127	0.109
Mine Spoils	6970.0	6970.0	6970.0	0.0	0.058	116.4	0.127	0.127	0.00	0.00	0.127	0.127

6969.96	Ground Surface Elevation at time of CPT (ft amsl)
6972.06	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
1.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after placement (ft)
2.50	Thickness of Water Storage/Rooting Zone (Cover Soil; ft)

0.13	Additional Stress due to Proposed Repository Construction, $\Delta\sigma_{repos}$ (psf)
6954.95	Elevation of bottom of tailings (ft amsl)

UNC-NECR WASTE REPOSITORY SEISMIC SETTLEMENT ANALYSIS - CPT-02

Data File: 13-52118_RP02-BSC-CPT
Location: UNC-NECR 2013 Mill Site PDS
http://projects.mwhglobal.com/.../13-52118_RP02-BSC-CPT.XLS

Cells Requiring User Input/Manipulation

Legend	Legend
Erosion Protection	Coarse Tailings
Cover Soil	Coarse/Fine Tailings
Mine Spoils	Fine Tailings
Radon Barrier	Coarse Alluvium
General Fill	Fine Alluvium

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.3
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69
Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.3
Earthquake Moment Magnitude, M:	6.3
Magnitude Scaling Factor, MSF:	1.59

Value	Parameter
0.00	Water surface elevation during CPT investigation (ft amsl)
0.00	Water surface elevation at t_0 (ft amsl)
0.00	Water surface elevation at t_1 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Earthquake
8.26	Equiv. Number of Uniform Strain Cycles, N

2013 CPT Data from ConeTec									CPT Data Interpretations										Conditions at t_1		
Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (per drilling log from coupled borehole)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	Normalized Cone Penetration Resistance	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1, u_1 (tsf)	Effective Stress at t_1 (tsf)
0.164	6960.00	2.6	0.014	2.6	0.8	0.35	0.55%	Radon Barrier	0.061	122.3	0.01	0.000	0.01	0	254	0.55%	1.4	59%	0.84	0.000	0.84
0.328	6959.83	8.7	0.105	8.7	1.8	0.77	1.21%	Radon Barrier	0.061	122.3	0.02	0.000	0.02	0	432	1.21%	1.5	59%	0.85	0.000	0.85
0.492	6959.67	36.0	0.414	36.0	3.4	1.46	1.15%	Radon Barrier	0.061	122.3	0.03	0.000	0.03	0	1196	1.15%	1.3	59%	0.86	0.000	0.86
0.656	6959.50	66.4	0.539	66.4	4.5	1.95	0.81%	Radon Barrier	0.061	122.3	0.04	0.000	0.04	0	1655	0.81%	1.2	59%	0.87	0.000	0.87
0.820	6959.34	102.2	0.826	102.2	3.9	1.67	0.81%	Radon Barrier	0.061	122.3	0.05	0.000	0.05	0	2036	0.81%	1.1	59%	0.88	0.000	0.88
0.984	6959.18	135.1	0.687	135.1	7.5	3.25	0.51%	Radon Barrier	0.061	122.3	0.06	0.000	0.06	0	2244	0.51%	0.9	59%	0.89	0.000	0.89
1.148	6959.01	136.4	0.823	136.3	11.6	5.04	0.60%	Radon Barrier	0.061	122.3	0.07	0.000	0.07	0	1941	0.60%	1.0	59%	0.90	0.000	0.90
1.312	6958.85	130.0	0.996	130.0	7.5	3.23	0.77%	Radon Barrier	0.061	122.3	0.08	0.000	0.08	0	1619	0.77%	1.1	59%	0.91	0.000	0.91
1.476	6958.68	130.4	1.428	130.3	6.1	2.62	1.10%	Radon Barrier	0.061	122.3	0.09	0.000	0.09	0	1443	1.10%	1.3	59%	0.92	0.000	0.92
1.640	6958.52	131.0	1.889	130.9	5.7	2.48	1.44%	Radon Barrier	0.061	122.3	0.10	0.000	0.10	0	1304	1.44%	1.4	59%	0.93	0.000	0.93
1.804	6958.36	145.6	2.873	145.6	5.4	2.34	1.97%	Radon Barrier	0.061	122.3	0.11	0.000	0.11	0	1319	1.97%	1.6	59%	0.94	0.000	0.94
1.968	6958.19	219.5	3.426	219.5	6.1	2.62	1.56%	Radon Barrier	0.061	122.3	0.12	0.000	0.12	0	1822	1.56%	1.4	59%	0.95	0.000	0.95
2.133	6958.03	381.6	4.079	381.5	7.7	3.34	1.07%	General Fill	0.057	113.8	0.13	0.000	0.13	0	2941	1.07%	1.2	48%	0.96	0.000	0.96
2.297	6957.86	494.8	4.928	494.8	7.8	3.38	1.00%	General Fill	0.057	113.8	0.14	0.000	0.14	0	3558	1.00%	1.2	48%	0.97	0.000	0.97
2.461	6957.70	497.1	6.052	497.0	7.5	3.23	1.22%	General Fill	0.057	113.8	0.15	0.000	0.15	0	3349	1.22%	1.3	48%	0.98	0.000	0.98
2.625	6957.54	455.8	7.051	455.8	7.3	3.15	1.55%	General Fill	0.057	113.8	0.16	0.000	0.16	0	2889	1.55%	1.4	48%	0.99	0.000	0.99
2.789	6957.37	364.3	7.294	364.3	6.8	2.93	2.00%	General Fill	0.057	113.8	0.17	0.000	0.17	0	2180	2.00%	1.5	48%	1.00	0.000	1.00
2.953	6957.21	294.3	7.021	294.3	5.4	2.32	2.39%	General Fill	0.057	113.8	0.18	0.000	0.18	0	1668	2.39%	1.6	48%	1.01	0.000	1.01
3.117	6957.04	248.5	6.372	248.5	3.4	1.49	2.56%	General Fill	0.057	113.8	0.19	0.000	0.19	0	1337	2.57%	1.7	48%	1.02	0.000	1.02
3.281	6956.88	205.2	5.484	205.2	3.6	1.55	2.67%	General Fill	0.057	113.8	0.20	0.000	0.20	0	1051	2.68%	1.7	48%	1.03	0.000	1.03
3.445	6956.72	181.5	5.238	181.5	3.9	1.69	2.89%	General Fill	0.057	113.8	0.20	0.000	0.20	0	887	2.89%	1.8	48%	1.04	0.000	1.04
3.609	6956.55	171.3	4.579	171.3	3.8	1.65	2.67%	General Fill	0.057	113.8	0.21	0.000	0.21	0	800	2.68%	1.7	48%	1.05	0.000	1.05
3.773	6956.39	166.3	3.191	166.3	3.9	1.67	1.92%	General Fill	0.057	113.8	0.22	0.000	0.22	0	745	1.92%	1.6	48%	1.06	0.000	1.06
3.937	6956.22	170.8	3.177	170.8	4.2	1.81	1.86%	General Fill	0.057	113.8	0.23	0.000	0.23	0	734	1.86%	1.6	48%	1.07	0.000	1.07
4.101	6956.06	112.6	3.066	112.6	2.4	1.04	2.72%	General Fill	0.057	113.8	0.24	0.000	0.24	0	465	2.73%	1.8	48%	1.08	0.000	1.08
4.265	6955.89	188.5	2.546	188.5	2.9	1.26	1.35%	General Fill	0.057	113.8	0.25	0.000	0.25	0	750	1.35%	1.5	48%	1.08	0.000	1.08
4.429	6955.73	212.3	2.596	212.2	3.0	1.28	1.22%	General Fill	0.057	113.8	0.26	0.000	0.26	0	814	1.22%	1.4	48%	1.09	0.000	1.09
4.593	6955.57	287.2	4.504	287.2	1.4	0.59	1.57%	General Fill	0.057	113.8	0.27	0.000	0.27	0	1064	1.57%	1.5	48%	1.10	0.000	1.10
4.757	6955.40	441.5	6.718	441.4	3.4	1.49	1.52%	General Fill	0.057	113.8	0.28	0.000	0.28	0	1581	1.52%	1.4	48%	1.11	0.000	1.11
4.921	6955.24	436.9	6.855	436.9	7.7	3.32	1.57%	General Fill	0.057	113.8	0.29	0.000	0.29	0	1514	1.57%	1.4	48%	1.12	0.000	1.12
5.085	6955.07	442.6	7.358	442.5	5.8	2.50	1.66%	General Fill	0.057	113.8	0.30	0.000	0.30	0	1486	1.66%	1.5	48%	1.13	0.000	1.13
5.249	6954.91	463.0	5.871	463.0	6.7	2.89	1.27%	General Fill	0.057	113.8	0.31	0.000	0.31	0	1507	1.27%	1.4	48%	1.14	0.000	1.14
5.413	6954.75	426.1	6.056	426.0	6.5	2.81	1.42%	General Fill	0.057	113.8	0.32	0.000	0.32	0	1346	1.42%	1.4	48%	1.15	0.000	1.15
5.577	6954.58	334.4	7.047	334.4	8.1	3.52	2.11%	General Fill	0.057	113.8	0.33	0.000	0.33	0	1026	2.11%	1.6	48%	1.16	0.000	1.16
5.741	6954.42	237.6	5.766	237.6	6.2	2.68	2.43%	General Fill	0.057	113.8	0.34	0.000	0.34	0	708	2.43%	1.7	48%	1.17	0.000	1.17
5.905	6954.25	185.2	5.396	185.2	5.0	2.15	2.91%	General Fill	0.057	113.8	0.34	0.000	0.34	0	537	2.92%	1.8	48%	1.18	0.000	1.18
6.069	6954.09	154.1	4.847	154.1	4.4	1.91	3.15%	General Fill	0.057	113.8	0.35	0.000	0.35	0	435	3.15%	1.9	48%	1.19	0.000	1.19
6.234	6953.93	135.8	4.745	135.8	5.4	2.32	3.49%	General Fill	0.057	113.8	0.36	0.000	0.36	0	373	3.50%	2.0	48%	1.20	0.000	1.20
6.398	6953.76	116.2	4.702	116.1	6.3	2.75	4.05%	General Fill	0.057	113.8	0.37	0.000	0.37	0	311	4.06%	2.1	48%	1.21	0.000	1.21
6.562	6953.60	110.1	4.281	110.1	6.3	2.73	3.89%	General Fill	0.057	113.8	0.38	0.000	0.38	0	287	3.90%	2.1	48%	1.22	0.000	1.22
6.726	6953.43	102.3	3.917	102.2	5.8	2.50	3.83%	General Fill	0.057	113.8	0.39	0.000	0.39	0	261	3.84%	2.1	48%	1.22	0.000	1.22
6.890	6953.27	105.4	3.620	105.4	4.8	2.09	3.43%	General Fill	0.057	113.8	0.40	0.000	0.40	0	262	3.45%	2.0	48%	1.23	0.000	1.23
7.054	6953.11	103.2	3.330	103.2	4.7	2.05	3.23%	General Fill	0.057	113.8	0.41	0.000	0.41	0	251	3.24%	2.0	48%	1.24	0.000	1.24
7.218	6952.94	105.1	2.699	105.0	4.5	1.95	2.57%	General Fill	0.057	113.8	0.42	0.000	0.42	0	250	2.58%	2.0	48%	1.25	0.000	1.25
7.382	6952.78	112.8	2.702	112.8	4.4	1.89	2.40%	General Fill	0.057	113.8	0.43	0.000	0.43	0	262	2.41%	1.9	48%	1.26	0.000	1.26
7.546	6952.61	135.7	2.332	135.7	4.4	1.91	1.72%	General Fill	0.057	113.8	0.44	0.000	0.44	0	309	1.72%	1.8	48%	1.27	0.000	1.27
7.710	6952.45	133.8	2.944	133.8	4.6	1.97	2.20%	General Fill	0.057	113.8	0.45	0.000	0.45	0	298	2.21%	1.9	48%	1.28	0.000	1.28
7.874	6952.29	153.1	3.594	153.0	6.1	2.62	2.35%	General Fill	0.057	113.8	0.46	0.000	0.46	0	334	2.36%	1.9	48%	1.29	0.000	1.29
8.038	6952.12	181.7	3.731	181.7	6.4	2.79	2.05%	General Fill	0.057	113.8	0.47	0.000	0.47	0	389	2.06%	1.8	48%	1.30	0.000	1.30
8.202	6951.96	181.3	3.527	181.3	5.5	2.38	1.95%	General Fill	0.057	113.8	0.48	0.000	0.48	0	381	1.95%	1.8	48%	1.31	0.000	1.31
8.366	6951.79	168.3	3.251	168.3	5.1	2.20	1.93%	General Fill	0.057	113.8	0.48	0.000	0.48	0	346	1.94%	1.8	48%	1.32	0.000	1.32
8.530	6951.63	158.6	2.935	158.6	4.7	2.02	1.85%	General Fill	0.057	113.8	0.49	0.000	0.49	0	320	1.86%	1.8	48%	1.33	0.000	1.33
8.694	6951.47	138.6	2.606	138.6	4.3	1.85	1.88%	General Fill	0.057	113.8	0.50	0.000	0.50	0	274	1.89%	1.8	48%	1.34	0.000	1.34
8.858	6951.30	131.7	2.363	131.7	4.2	1.83	1.79%	General Fill	0.057	113.8	0.51	0.000	0.51	0	256	1.80%	1.8	48%	1.35	0.000	1.35
9.022	6951.14	121.8	2.239	121.7	4.0	1.73	1.84%	General Fill	0.057	113.8	0.52	0.000	0.52	0	232	1.85%	1.9	48%	1.36	0.000	1.36
9.186	6950.97	129.2	2.304	129.2	3.9	1.67	1.78%	General Fill	0.057	113.8	0.53	0.000	0.53	0	242	1.79%	1.8	48%	1.36	0.000	1.36
9.350	6950.81	136.6	2.274	136.6	4.0	1.73	1.66%	General Fill	0.057	113.8	0.54	0.000	0.54	0	252	1.67%	1.8	48%	1.37	0.000	1.37
9.514	6950.65	135.7	2.236	135.6	3.6	1.56	1.65%	General Fill	0.057	113.8	0.55	0.000	0.55	0	246	1.66%	1.8	48%	1.38	0.000	1.38
9.678	6950.48	127.5	2.186	127.5	3.9	1.67	1.71%	General Fill	0.057	113.8	0.56	0.000	0.56	0	227	1.72%	1.8	48%	1.39	0.000	1.39
9.842	6950.32	121.6	1.937	121.6	3.4	1.49	1.59%	General Fill	0.057	113.8	0.57	0.000	0.57	0	213	1.60%	1.8	48%	1.40	0.000	1.40
10.006	6950.15	97.7	1.808	97.7	3.3	1.44	1.85%	General Fill	0.057	113.8	0.58	0.000	0.58	0	168	1.86%	1.9	48%	1.41	0.000	1.41
10.170	6949.99	88.7	1.876	88.7	2.5	1.08	2.12%	General Fill	0.057	113.8	0.59	0.000	0.59	0	150	2.13%	2.0	48%	1.42	0.000	1.42
10.335	6949.83	87.7	1.791	87.7	3.3	1.44	2.04%	General Fill	0.057	113.8	0.60	0.000	0.60	0	146	2.06%	2.0	48%	1.43	0.000	1.43
10.499	6949.66	89.8	1.559	89.7	3.4	1.46	1.74%	General Fill	0.057	113.8	0.61	0.000	0.61	0	147	1.75%	2.0	48%	1.44	0.000	1.44
10.663	6949.50	74.8	0.915	74.8	2.5	1.10	1.22%	General Fill	0.057	113.8	0.62	0.000	0.62	0	121	1.23%	1.9	48%	1.45	0.000	1.45
10.827	6949.33	58.3	0.502	58.3	2.1	0.91	0.86%	General Fill	0.057	113.8	0.62	0.000	0.62	0	92	0.87%	1.9	48%	1.46	0.000	1.46
10.991	6949.17	43.9	0.468	43.9	2.1	0.89	1.07%	General Fill	0.057	113.8	0.63	0.000	0.63	0	68	1.08%	2.1	48%	1.47	0.000	1.47
11.155	6949.01	30.7	0.504	30.7	1.2	0.51	1.64%	General Fill	0.057	113.8	0.64	0.000	0.64	0	47	1.68%	2.3	48%	1.48	0.000	1.48
11.319	6948.84	22.6	0.588	22.6	1.1	0.47	2.61%	General Fill	0.057	113.8	0.65	0.000	0.65	0	34	2.68%	2.5	48%	1.49	0.000	1.49
11.483	6948.68	17.4	0.639	17.4	1.3	0.57	3.67%	General Fill	0.057	113.8	0.66	0.000	0.66	0	25	3.82%	2.7	48%	1.50	0.000	1.50
11.647	6948.51	19.0	0.599	19.0	1.4	0.59	3.15%	General Fill	0.057	113.8	0.67	0.000	0.67	0	27	3.27%	2.7	48%	1.50	0.000	1.50
11.811	6948.35	40.7	0.487	40.7	1.8	0.79	1.20%	General Fill	0.057	113.8	0.68	0.000	0.68	0	59	1.22%	2.1	48%	1.51	0.000	1.51
11.975	6948.19	49.0	0.546	49.0	2.3	0.98	1.11%	General Fill	0.057	113.8	0.69	0.000	0.69	0	70	1.13%	2.1	48%	1.52	0.000	1.52
12.139	6948.02	41.0	0.743	41.0	2.0	0.85	1.81%	General Fill	0.057	113.8	0.70	0.000	0.70	0	58	1.84%	2.3	48%	1.53	0.000	1.53
12.303	6947.86	20.4	0.871	20.4	1.8	0.77	4.27%	General Fill	0.057	113.8	0.71	0.000	0.71	0	28	4.42%	2.8	48%	1.54	0.000	1.54
12.467	6947.69	14.9	0.663	14.9	1.8	0.79	4.44%	General Fill	0.057	113.8	0.72	0.000	0.72	0	20	4.67%	2.9	48%	1.55	0.000	1.55
12.631	6947.53	12.1	0.383	12.1	1.9	0.81	3.16%	General Fill	0.057	113.8	0.73	0.000	0.73	0	16	3.36%	2.9	48%	1.56	0.000	1.56
12.795	6947.36	12.4	0.214	12.4	2.0	0.88	1.73%	General Fill	0.057	113.8	0.74	0.000	0.74	0	16	1.84%	2.7	48%	1.57	0.000	1.57
12.959	6947.20	12.5	0.185	12.5	1.9	0.83	1.48%	Fine Tailings	0.054	107.6	0.75	0.000	0.75	0	16	1.57%	2.7	83%	1.58	0.000	1.58
13.123	6947.04	12.6	0.173	12.6	2.3	0.98	1.38%	Fine Tailings	0.054	107.6	0.75	0.000	0.75	0	16	1.46%	2.7	83%	1.59	0.000	1.59
13.287	6946.87	12.3	0.189	12.3	2.3	0.98	1.53%	Fine Tailings	0.054	107.6	0.76	0.000	0.76	0	15	1.64%	2.7	83%	1.60	0.000	1.60

Midpoint Depth at t_1, z_1 (m)	Shear Wave Velocity, V_s (ft/sec)	Soil Density, ρ (tcf)	Max Shear Strain Modulus, G_{max} (tsf)	Coefficient a_2 for Stress Reduction Factor	Stress Reduction Factor, r_d	P = γ_{eff}*(G_{eff}/G_{max}) (tsf)	Plasticity Index, PI	g_1 for PI = 0	g_1 for PI = 15	g_1 for PI = 30	g_1	g_2 for PI = 0	g_2 for PI = 15	g_2 for PI = 30	g_2	Shear Strain, γ (%)	a	b	Threshhold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{c-15} (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
0.23	866	1.9E-03	1.4E+03	1249	0.9990	6.3E-06	12	0.102	0.091	4	0.093	35267	24912	1400	26983	0.001%	2.00	0.65	0.03%	0.000000	0.34	0.079	0.797	0.00%	0.0000
0.84	866	1.8E-03	1.3E+03	1017	0.9958	2.4E-05	12	0.137	0.127	4	0.129	20964	14659	1400	15920	0.003%	2.00	0.65	0.03%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.79	866	1.8E-03	1.4E+03	532	0.9802	7.5E-05	12	0.180	0.173	4	0.175	12909	8942	1400	9735	0.009%	1.18	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000

Seismic Settlement Analysis - Stewart et al (2004)

TOTAL SEISMIC SETTLEMENT (FT): 0.1222

Midpoint Depth at t_1, z_1 (m)	Shear Wave Velocity, V_s (ft/sec)	Soil Density, ρ (tcf)	Max Shear Strain Modulus, G_{max} (tsf)	Coefficient a_2 for Stress Reduction Factor	Stress Reduction Factor, r_d	P = γ_{eff}*(G_{eff}/G_{max}) (tsf)	Plasticity Index, PI	g_1 for PI = 0 (0)	g_1 for PI = 15 (15)	g_1 for PI = 30 (30)	g_1	g_2 for PI = 0 (0)	g_2 for PI = 15 (15)	g_2 for PI = 30 (30)	g_2	Shear Strain, γ (%)	a	b	Threshhold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{c-15} (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
4.40	936	1.9E-03	1.7E+03	313	0.9574	9.5E-05	16	0.201	0.196	4	0.449	10706	7389	1400	6990	0.012%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
4.45	936	1.9E-03	1.7E+03	308	0.9564	9.6E-05	16	0.201	0.196	5	0.517	10654	7352	1401	6956	0.013%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
4.50	936	1.9E-03	1.7E+03	303	0.9555	9.7E-05	16	0.202	0.197	6	0.584	10604	7317	1402	6922	0.013%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
4.55	936	1.9E-03	1.7E+03	298	0.9546	9.8E-05	16	0.202	0.198	7	0.651	10553	7281	1403	6889	0.013%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
4.60	936	1.9E-03	1.7E+03	294	0.9537	9.9E-05	16	0.203	0.198	8	0.718	10504	7247	1404	6857	0.014%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
4.65	936	1.9E-03	1.7E+03	289	0.9527	1.0E-04	16	0.203	0.199	9	0.785	10456	7213	1405	6825	0.014%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
4.70	936	1.9E-03	1.7E+03	284	0.9517	1.0E-04	16	0.204	0.199	10	0.853	10408	7179	1406	6794	0.015%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
4.75	936	1.9E-03	1.7E+03	280	0.9507	1.0E-04	16	0.204	0.200	11	0.920	10361	7146	1407	6763	0.015%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
4.80	936	1.9E-03	1.7E+03	275	0.9497	1.0E-04	16	0.205	0.200	12	0.987	10315	7113	1408	6733	0.015%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
4.85	936	1.9E-03	1.7E+03	271	0.9487	1.0E-04	16	0.205	0.201	13	1.054	10269	7081	1409	6703	0.016%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
4.90	936	1.9E-03	1.7E+03	267	0.9477	1.0E-04	16	0.206	0.202	14	1.121	10224	7050	1410	6674	0.016%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
4.95	936	1.9E-03	1.7E+03	262	0.9466	1.1E-04	16	0.206	0.202	15	1.189	10180	7019	1411	6645	0.016%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
5.00	936	1.8E-03	1.5E+03	258	0.9455	1.1E-04	19	0.207	0.203	16	4.415	10139	6990	1412	5503	0.020%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
5.05	936	1.8E-03	1.5E+03	254	0.9445	1.2E-04	19	0.207	0.203	17	4.682	10099	6962	1413	5482	0.020%	1.70	0.75	0.02%	0.000016	0.34	0.079	0.797	0.00%	0.0000
5.10	936	1.8E-03	1.5E+03	250	0.9434	1.2E-04	19	0.208	0.204	18	4.949	10060	6934	1414	5462	0.020%	1.70	0.75	0.02%	0.000130	0.34	0.079	0.797	0.02%	0.0000
5.15	936	1.8E-03	1.5E+03	246	0.9422	1.2E-04	19	0.208	0.204	19	5.216	10021	6907	1415	5442	0.021%	1.70	0.75	0.02%	0.000213	0.34	0.079	0.797	0.03%	0.0001
5.20	936	1.8E-03	1.5E+03	242	0.9411	1.2E-04	19	0.209	0.205	20	5.483	9983	6880	1416	5423	0.021%	1.70	0.75	0.02%	0.000284	0.34	0.079	0.797	0.05%	0.0001
5.25	936	1.8E-03	1.5E+03	238	0.9400	1.2E-04	19	0.209	0.205	21	5.751	9945	6853	1417	5404	0.021%	1.70	0.75	0.02%	0.000349	0.34	0.079	0.797	0.06%	0.0001
5.30	936	1.8E-03	1.5E+03	235	0.9388	1.2E-04	19	0.209	0.206	22	6.018	9907	6827	1418	5385	0.022%	1.70	0.75	0.02%	0.000410	0.34	0.079	0.797	0.07%	0.0001
5.35	936	1.8E-03	1.5E+03	231	0.9376	1.2E-04	19	0.210	0.206	23	6.285	9870	6801	1419	5366	0.022%	1.70	0.75	0.02%	0.000467	0.34	0.079	0.797	0.07%	0.0001
5.40	936	1.8E-03	1.5E+03	227	0.9364	1.2E-04	19	0.210	0.207	24	6.552	9834	6775	1420	5347	0.022%	1.70	0.75	0.02%	0.000521	0.34	0.079	0.797	0.08%	0.0001
5.45	936	1.8E-03	1.5E+03	224	0.9352	1.2E-04	19	0.211	0.207	25	6.819	9798	6750	1421	5329	0.022%	1.70	0.75	0.02%	0.000573	0.34	0.079	0.797	0.09%	0.0001
5.50	936	1.8E-03	1.5E+03	220	0.9339	1.2E-04	19	0.211	0.208	26	7.086	9762	6725	1422	5311	0.023%	1.70	0.75	0.02%	0.000623	0.34	0.079	0.797	0.10%	0.0002
5.55	936	1.8E-03	1.5E+03	217	0.9327	1.3E-04	19	0.212	0.208	27	7.353	9727	6701	1423	5293	0.023%	1.70	0.75	0.02%	0.000671	0.34	0.079	0.797	0.11%	0.0002
5.60	936	1.8E-03	1.5E+03	213	0.9314	1.3E-04	19	0.212	0.209	28	7.620	9692	6676	1424	5276	0.023%	1.70	0.75	0.02%	0.000717	0.34	0.079	0.797	0.11%	0.0002
5.65	936	1.8E-03	1.5E+03	210	0.9301	1.3E-04	19	0.212	0.209	29	7.887	9658	6652	1425	5258	0.023%	1.70	0.75	0.02%	0.000762	0.34	0.079	0.797	0.12%	0.0002
5.70	936	1.8E-03	1.5E+03	207	0.9288	1.3E-04	19	0.213	0.210	30	8.154	9624	6628	1426	5241	0.024%	1.70	0.75	0.02%	0.000806	0.34	0.079	0.797	0.13%	0.0002
5.75	936	1.8E-03	1.5E+03	204	0.9275	1.3E-04	19	0.213	0.210	31	8.421	9591	6605	1427	5224	0.024%	1.70	0.75	0.02%	0.000849	0.34	0.079	0.797	0.14%	0.0002
5.80	936	1.8E-03	1.5E+03	200	0.9261	1.3E-04	19	0.214	0.211	32	8.688	9558	6582	1428	5207	0.024%	1.70	0.75	0.02%	0.000891	0.34	0.079	0.797	0.14%	0.0002
5.85	936	1.8E-03	1.5E+03	197	0.9248	1.3E-04	19	0.214	0.211	33	8.955	9525	6559	1429	5191	0.024%	1.70	0.75	0.02%	0.000932	0.34	0.079	0.797	0.15%	0.0002
5.90	936	1.8E-03	1.5E+03	194	0.9234	1.3E-04	19	0.215	0.212	34	9.222	9493	6536	1430	5174	0.025%	1.70	0.75	0.02%	0.000971	0.34	0.079	0.797	0.15%	0.0003
5.95	936	1.8E-03	1.5E+03	191	0.9220	1.3E-04	19	0.215	0.212	35	9.489	9461	6514	1431	5158	0.025%	1.70	0.75	0.02%	0.001011	0.34	0.079	0.797	0.16%	0.0003
6.00	936	1.8E-03	1.5E+03	188	0.9205	1.3E-04	19	0.215	0.212	36	9.756	9429	6491	1432	5142	0.025%	1.70	0.75	0.02%	0.001049	0.34	0.079	0.797	0.17%	0.0003
6.05	936	1.8E-03	1.5E+03	185	0.9191	1.3E-04	19	0.216	0.213	37	10.023	9398	6470	1433	5126	0.026%	1.70	0.75	0.02%	0.001086	0.34	0.079	0.797	0.17%	0.0003
6.10	936	1.8E-03	1.5E+03	183	0.9176	1.4E-04	19	0.216	0.213	38	10.290	9367	6448	1434	5111	0.026%	1.70	0.75	0.02%	0.001123	0.34	0.079	0.797	0.18%	0.0003
6.15	936	1.8E-03	1.5E+03	180	0.9161	1.4E-04	19	0.217	0.214	39	10.557	9337	6426	1435	5095	0.026%	1.70	0.75	0.02%	0.001159	0.34	0.079	0.797	0.18%	0.0003
6.20	936	1.8E-03	1.5E+03	177	0.9146	1.4E-04	19	0.217	0.214	40	10.824	9307	6405	1436	5080	0.026%	1.70	0.75	0.02%	0.001195	0.34	0.079	0.797	0.19%	0.0003
6.25	936	1.8E-03	1.5E+03	174	0.9131	1.4E-04	19	0.217	0.215	41	11.091	9277	6384	1437	5065	0.026%	1.70	0.75	0.02%	0.001229	0.34	0.079	0.797	0.20%	0.0003
6.30	936	1.8E-03	1.5E+03	172	0.9115	1.4E-04	19	0.218	0.215	42	11.358	9247	6364	1438	5050	0.027%	1.70	0.75	0.02%	0.001264	0.34	0.079	0.797	0.20%	0.0003
6.35	936	1.8E-03	1.5E+03	169	0.9099	1.4E-04	19	0.218	0.216	43	11.625	9218	6343	1439	5035	0.027%	1.70	0.75	0.02%	0.001297	0.34	0.079	0.797	0.21%	0.0003
6.40	936	1.8E-03	1.5E+03	166	0.9084	1.4E-04	19	0.219	0.216	44	11.892	9189	6323	1440	5021	0.027%	1.70	0.75	0.02%	0.001330	0.34	0.079	0.797	0.21%	0.0003
6.45	936	1.8E-03	1.5E+03	164	0.9067	1.4E-04	19	0.219	0.216	45	12.159	9161	6303	1441	5006	0.027%	1.70	0.75	0.02%	0.001363	0.34	0.079	0.797	0.22%	0.0004
6.50	936	1.8E-03	1.5E+03	161	0.9051	1.4E-04	19	0.219	0.217	46	12.426	9132	6283	1442	4992	0.028%	1.70	0.75	0.02%	0.001395	0.34	0.079	0.797	0.22%	0.0004
6.55	936	1.8E-03	1.5E+03	159	0.9034	1.4E-04	19	0.220	0.217	47	12.693	9104	6263	1443	4978	0.028%	1.70	0.75	0.02%	0.001426	0.34	0.079	0.797	0.23%	0.0004
6.60	936	1.8E-03	1.5E+03	156	0.9017	1.4E-04	19	0.220	0.218	48	12.960	9077	6244	1444	4964	0.028%	1.70	0.75	0.02%	0.001457	0.34	0.079	0.797	0.23%	0.0004
6.65	936	1.8E-03	1.5E+03	154	0.9000	1.4E-04	19	0.220	0.218	49	13.227	9049	6225	1445	4950	0.028%	1.70	0.75	0.02%	0.001487	0.34	0.079	0.797	0.24%	0.0004
6.70	936	1.8E-03	1.5E+03	152	0.8983	1.4E-04	19	0.221	0.219	50	13.494	9022	6206	1446	4937	0.029%	1.70	0.75	0.02%	0.001517	0.34	0.079	0.797	0.24%	0.0004
6.75	936	1.8E-03	1.5E+03	149	0.8965	1.5E-04	19	0.221	0.219	51	13.761	8995	6187	1447	4923	0.029%	1.70	0.75	0.02%	0.001546	0.34	0.079	0.797	0.25%	0.0004
6.80	936	1.8E-03	1.5E+03	147	0.8948	1.5E-04	19	0.222	0.219	52	14.028	8969	6168	1448	4910	0.029%	1.70	0.75	0.02%	0.001575	0.34	0.079	0.797	0.25%	0.0004
6.85	936	1.8E-03	1.5E+03	145	0.8930	1.5E-04	19	0.222	0.220	53	14.295	8943	6150	1449	4896	0.029%	1.70	0.75	0.02%	0.001603	0.34	0.079	0.797	0.26%	0.0004
6.90	936	1.8E-03	1.5E+03	143	0.8911	1.5E-04	19	0.222	0.220	54	14.562	8917	6132	1450	4883	0.029%	1.70	0.75	0.02%	0.001631	0.34	0.079	0.797	0.26%	0.0004
6.95	936	1.8E-03	1.5E+03	141	0.8893	1.5E-04	19	0.223	0.221	55	14.828	8891	6114	1451	4870	0.030%	1.70	0.75	0.02%	0.001659	0.34	0.079	0.797	0.26%	0.0004
7.00	936	1.8E-03	1.5E+03	139	0.8874	1.5E-04	19	0.223	0.221	56	15.095	8865	6096	1452	4857	0.030%	1.70	0.75	0.02%	0.001685	0.34	0.079	0.797	0.27%	0.0004
7.05	936	1.8E-03	1.5E+03	137	0.8855	1.5E-04	19	0.223	0.221	57	15.362	8840	6078	1453	4845	0.030%	1.70	0.75	0.02%	0.001712	0.34	0.079	0.797	0.27%	0.0004
7.10	936	1.8E-03	1.5E+03	135	0.8836	1.5E-04	19	0.224	0.222	58	15.629	8815	6061	1454	4832	0.030%	1.70	0.75	0.02%	0.001738	0.34	0.079	0.797	0.28%	0.0005
7.15	936	1.8E-03	1.5E+03	133	0.8816	1.5E-04	19	0.224	0.222	59	15.896	8790	6043	1455	4820	0.030%	1.70	0.75	0.02%	0.001763	0.34	0.079	0.797	0.28%	0.0005
7.20	936	1.8E-03	1.5E+03	131	0.8796	1.5E-04	19	0.224	0.223	60	16.163	8766	6026	1456	4807	0.031%	1.70	0.75	0.02%	0.001788	0.34	0.079	0.797	0.29%	0.0005
7.25	936	1.8E-03	1.5E+03	129	0.8776	1.5E-04	19	0.225	0.223	61	16.430	8741	6009	1457	4795	0.031%	1.70	0.75	0.02%	0.001813	0.34	0.079	0.797	0.29%	0.0005
7.30	936	1.8E-03	1.5E+03	127	0.8756	1.5E-04	19	0.225	0.223	62	16.697	8717	5992	1458	4783	0.031%	1.70	0.75	0.02%	0.001837	0.34	0.079	0.797	0.29%	0.0005
7.35	936	1.8E-03	1.5E+03	125	0.8736	1.5E-04	19	0.225	0.224	63	16.964	8694	5975	1459	4771	0.031%	1.70	0.75	0.02%	0.001860	0.34	0.079	0.797	0.30%	0.0005
7.40	936	1.8E-03	1.5E+03	123	0.8715	1.5E-04	19	0.226	0.224	64	17.231	8670	5959	1460	4759	0.031%	1.70	0.75	0.02%	0.001883	0.34	0.079	0.797	0.30%	0.0005
7.45	936	1.8E-03	1.5E+03	121	0.8694	1.6E-04	19	0.226	0.225	65	17.498	8647	5943	1461	4747	0.032%	1.70	0.75	0.02%	0.001906	0.34	0.079	0.797	0.30%	0.0005
7.50	936	1.8E-03	1.5E+03	119	0.8672	1.6E-04	19	0.226	0.225	66	17.765	8623	5926	1462	4736	0.032%	1.70	0.75	0.02%	0.001928	0.34	0.079	0.797	0.31%	0.0005
7.55	557	1.8E-03	5.5E+02	118	0.8651	4.4E-04	19	0.227	0.225	67	18.032	8600	5910	1463	4724	0.342%	1.70	0.75	0.02%	0.023004	0.34	0.079	0.797	3.67%	0.0060
7.60	557	1.8E-03	5.5E+02	116	0.8629	4.4E-04	19	0.227	0.226	68	18.299	8578	5894	1464	4713	0.345%	1.70	0.75	0.02%	0.023146	0.34	0.079	0.797	3.69%	0.0061
7.65	557	1.8E-03	5.5E+02	114	0.8607	4.5E-04	19	0.228	0.226	69	18.566	8555	5878	1465	4702	0.348%	1.70	0.75	0.02%	0.023285	0.34	0.079	0.797	3.71%	0.0061
7.70	557	1.8E-03	5.5E+02	113	0.8585	4.5E-04	19	0.228	0.227	70	18.833	8533	5863	1466	4690	0.350%	1.70	0.75	0.02%	0.023421	0.34	0.079	0.797	3.73%	0.0061
7.75	557	1.8E-03	5.5E+02	111	0.8562	4.5E-04	19	0.228	0.227	71	19.100	8511	5847	1467	4679	0.353%	1.70	0.75	0.02%	0.023553	0.34	0.079	0.797	3.75%	0.0062
7.80	557	1.8E-03	5.5E+02	109	0.8539	4.5E-04	19	0.229	0.227	72	19.367	8489	5832	1468	4668	0.355%	1.70	0.75	0.02%	0.023682	0.34	0.079	0.797	3.77%	0.0062
7.85	557	1.8E-03	5.5E+02	108	0.8516	4.5E-04	19	0.229	0.228	73	19.634	8467	5817	1469	4657	0.358%	1.70	0.75	0.02%	0.023807	0.34	0.079	0.797	3.79%	0.0062
7.90	557	1.8E-03	5.5E+02	106	0.8492	4.5E-04	19	0.229	0.228	74	19.901	8445	5802	1470	4646	0.360%	1.70	0.75	0.02%	0.023928	0.34	0.079	0.797	3.81%	0.0063
7.95	557	1.8E-03	5.5E+02	105	0.8468	4.6E-04	19	0.229	0.228	75	20.168	8424	5787	1471	4636	0.362%	1.70	0.75	0.02%	0.024046	0.34	0.079	0.797	3.83%	0.0063
8.00	557	1.8E-03	5.5E+02	103	0.8444	4.6E-04	19	0.230	0.229	76	20.434	8403	5772	1472	4625	0.364%	1.70	0.75	0.02%	0.024160	0.34	0.079	0.797	3.85%	0.0063
8.05	557	1.8E-03	5.5E+02	102	0.8420	4.6E-04	19	0.230	0.229	77	20.701	8382	5757	1473	4615	0.366%	1.70	0.75	0.02%	0.024270	0.34	0.079	0.797	3.87%	0.0063
8.10	557	1.8E-03	5.5E+02	100	0.8395	4.6E-04	19	0.230	0.230	78	20.968	8361	5742	1474	4604	0.368%	1.70	0.75	0.02%	0.024376	0.34	0.079	0.797	3.89%	0.0064
8.15	557	1.8E-03	5.5E+02	99	0.8370	4.6E-04	19	0.231	0.230	79	21.235	8340	5728	1475	4594	0.370%	1.70	0.75	0.02%	0.024479	0.34	0.079	0.797	3.90%	0.0064
8.20	557	1.8E-03	5.5E+02	98	0.8345	4.6E-04	19	0.231	0.230	80	21.502	8320	5714	1476	4584	0.372%	1.70	0.75	0.02%	0.024577	0.34	0.079	0.797	3.92%	0.0064
8.25	557	1.8E-03	5.5E+02	96	0.8320	4.6E-04	19	0.231	0.231	81	21.769	8299	5699	1477	4573	0.374%	1.70	0.75	0.02%	0.024671	0.34	0.079	0.797	3.93%	0.0065
8.30	557	1.7E-03	5.2E+02	95	0.8294	4.9E-04	43	0.232	0.231	82	82.000	8280	5686	1478	1478	0.101%	0.90	0.75	0.06%	0.002610	0.25	0.323	0.851	0.44%	0.0007
8.35	557	1.7E-03	5.2E+02	93	0.8268	4.9E-04	43	0.232	0.231	83	83.000	8261	5673	1479	1479	0.102%	0.90	0.75	0.06%	0.002633	0.25	0.323	0.851	0.45%	0.0007
8.40	557	1.7E-03	5.2E+02	92	0.8242	4.9E-04	43	0.232	0.232	84	84.000	8243	5660	1480	1480	0.102%	0.90	0.75	0.06%	0.002655	0.25	0.323	0.851	0.45%	0.0007

13.451	6946.71	12.4	0.213	12.4	2.2	0.96	1.72%	Fine Tailings	0.054	107.6	0.77	0.000	0.77	0	15	1.83%	2.7	83%	1.61	0.000	1.61
13.615	6946.54	13.0	0.203	13.0	2.3	1.00	1.56%	Fine Tailings	0.054	107.6	0.78	0.000	0.78	0	16	1.66%	2.7	83%	1.61	0.000	1.61
13.779	6946.38	12.0	0.140	12.0	2.4	1.06	1.17%	Fine Tailings	0.054	107.6	0.79	0.000	0.79	0	14	1.25%	2.7	83%	1.62	0.000	1.62
13.943	6946.22	12.7	0.238	12.7	2.4	1.04	1.87%	Fine Tailings	0.054	107.6	0.80	0.000	0.80	0	15	2.00%	2.8	83%	1.63	0.000	1.63
14.107	6946.05	23.4	0.375	23.4	2.8	1.22	1.60%	Fine Tailings	0.054	107.6	0.81	0.000	0.81	0	28	1.66%	2.5	83%	1.64	0.000	1.64
14.271	6945.89	57.4	0.484	57.4	7.2	3.13	0.84%	Fine Tailings	0.054	107.6	0.82	0.000	0.82	0	69	0.86%	2.0	83%	1.65	0.000	1.65
14.436	6945.72	78.4	0.581	78.3	5.7	2.46	0.74%	Fine Tailings	0.054	107.6	0.82	0.000	0.82	0	94	0.75%	1.9	83%	1.66	0.000	1.66
14.600	6945.56	84.1	0.551	84.1	5.5	2.40	0.66%	Fine Tailings	0.054	107.6	0.83	0.000	0.83	0	100	0.66%	1.8	83%	1.67	0.000	1.67
14.764	6945.40	84.2	0.709	84.2	5.0	2.18	0.84%	Fine Tailings	0.054	107.6	0.84	0.000	0.84	0	99	0.85%	1.9	83%	1.68	0.000	1.68
14.928	6945.23	81.7	0.753	81.7	4.7	2.02	0.92%	Fine Tailings	0.054	107.6	0.85	0.000	0.85	0	95	0.93%	1.9	83%	1.68	0.000	1.68
15.092	6945.07	69.2	0.752	69.2	4.5	1.93	1.09%	Coarse Alluvium	0.056	111.0	0.86	0.000	0.86	0	79	1.10%	2.0	36%	1.69	0.000	1.69
15.256	6944.90	56.2	0.660	56.2	4.7	2.02	1.17%	Coarse Alluvium	0.056	111.0	0.87	0.000	0.87	0	64	1.19%	2.1	36%	1.70	0.000	1.70
15.420	6944.74	45.7	0.543	45.7	4.2	1.81	1.19%	Coarse Alluvium	0.056	111.0	0.88	0.000	0.88	0	51	1.21%	2.2	36%	1.71	0.000	1.71
15.584	6944.58	40.1	0.482	40.1	4.1	1.79	1.20%	Coarse Alluvium	0.056	111.0	0.89	0.000	0.89	0	44	1.23%	2.2	36%	1.72	0.000	1.72
15.748	6944.41	40.9	0.485	40.9	3.9	1.69	1.18%	Coarse Alluvium	0.056	111.0	0.90	0.000	0.90	0	45	1.21%	2.2	36%	1.73	0.000	1.73
15.912	6944.25	47.8	0.545	47.7	4.2	1.81	1.14%	Coarse Alluvium	0.056	111.0	0.91	0.000	0.91	0	52	1.16%	2.2	36%	1.74	0.000	1.74
16.076	6944.08	60.3	0.678	60.3	4.0	1.75	1.12%	Coarse Alluvium	0.056	111.0	0.91	0.000	0.91	0	65	1.14%	2.1	36%	1.75	0.000	1.75
16.240	6943.92	65.7	0.763	65.7	4.1	1.79	1.16%	Coarse Alluvium	0.056	111.0	0.92	0.000	0.92	0	70	1.18%	2.1	36%	1.76	0.000	1.76
16.404	6943.76	59.7	0.795	59.7	3.9	1.67	1.33%	Coarse Alluvium	0.056	111.0	0.93	0.000	0.93	0	63	1.35%	2.1	36%	1.77	0.000	1.77
16.568	6943.59	55.2	0.846	55.1	3.8	1.63	1.53%	Coarse Alluvium	0.056	111.0	0.94	0.000	0.94	0	58	1.56%	2.2	36%	1.78	0.000	1.78
16.732	6943.43	45.3	1.038	45.3	3.5	1.53	2.29%	Coarse Alluvium	0.056	111.0	0.95	0.000	0.95	0	47	2.34%	2.4	36%	1.78	0.000	1.78
16.896	6943.26	40.1	1.080	40.0	3.7	1.61	2.70%	Coarse Alluvium	0.056	111.0	0.96	0.000	0.96	0	41	2.76%	2.5	36%	1.79	0.000	1.79
17.060	6943.10	44.2	0.931	44.2	3.9	1.71	2.11%	Coarse Alluvium	0.056	111.0	0.97	0.000	0.97	0	45	2.15%	2.4	36%	1.80	0.000	1.80
17.224	6942.94	42.7	0.725	42.6	4.0	1.73	1.70%	Coarse Alluvium	0.056	111.0	0.98	0.000	0.98	0	43	1.74%	2.3	36%	1.81	0.000	1.81
17.388	6942.77	37.4	0.560	37.4	3.9	1.67	1.50%	Coarse Alluvium	0.056	111.0	0.99	0.000	0.99	0	37	1.54%	2.4	36%	1.82	0.000	1.82
17.552	6942.61	36.6	0.802	36.6	3.8	1.63	2.19%	Coarse Alluvium	0.056	111.0	1.00	0.000	1.00	0	36	2.25%	2.5	36%	1.83	0.000	1.83
17.716	6942.44	43.3	0.955	43.3	4.1	1.77	2.21%	Coarse Alluvium	0.056	111.0	1.01	0.000	1.01	0	42	2.26%	2.4	36%	1.84	0.000	1.84
17.880	6942.28	51.8	1.013	51.8	3.8	1.65	1.95%	Coarse Alluvium	0.056	111.0	1.02	0.000	1.02	0	50	1.99%	2.3	36%	1.85	0.000	1.85
18.044	6942.12	64.4	0.865	64.4	4.1	1.77	1.34%	Coarse Alluvium	0.056	111.0	1.02	0.000	1.02	0	62	1.36%	2.2	36%	1.86	0.000	1.86
18.208	6941.95	82.3	0.654	82.3	4.0	1.73	0.79%	Coarse Alluvium	0.056	111.0	1.03	0.000	1.03	0	79	0.80%	1.9	36%	1.87	0.000	1.87
18.372	6941.79	91.4	0.887	91.3	4.6	1.97	0.97%	Coarse Alluvium	0.056	111.0	1.04	0.000	1.04	0	87	0.98%	2.0	36%	1.88	0.000	1.88
18.537	6941.62	108.0	1.309	108.0	5.8	2.50	1.21%	Coarse Alluvium	0.056	111.0	1.05	0.000	1.05	0	102	1.22%	2.0	36%	1.89	0.000	1.89
18.701	6941.46	151.4	1.637	151.4	6.1	2.64	1.08%	Coarse Alluvium	0.056	111.0	1.06	0.000	1.06	0	142	1.09%	1.8	36%	1.89	0.000	1.89
18.865	6941.30	239.6	2.499	239.6	7.0	3.01	1.04%	Coarse Alluvium	0.056	111.0	1.07	0.000	1.07	0	223	1.05%	1.7	36%	1.90	0.000	1.90
19.029	6941.13	228.4	2.883	228.3	6.7	2.91	1.26%	Coarse Alluvium	0.056	111.0	1.08	0.000	1.08	0	211	1.27%	1.8	36%	1.91	0.000	1.91
19.193	6940.97	159.8	2.866	159.7	6.2	2.70	1.79%	Coarse Alluvium	0.056	111.0	1.09	0.000	1.09	0	146	1.81%	2.0	36%	1.92	0.000	1.92
19.357	6940.80	128.9	2.367	128.8	6.4	2.79	1.84%	Coarse Alluvium	0.056	111.0	1.10	0.000	1.10	0	116	1.85%	2.0	36%	1.93	0.000	1.93
19.521	6940.64	66.7	2.447	66.7	6.1	2.64	3.67%	Coarse Alluvium	0.056	111.0	1.11	0.000	1.11	0	59	3.73%	2.5	36%	1.94	0.000	1.94
19.685	6940.48	52.5	1.507	52.5	5.5	2.38	2.87%	Coarse Alluvium	0.056	111.0	1.12	0.000	1.12	0	46	2.93%	2.5	36%	1.95	0.000	1.95
19.849	6940.31	50.6	1.096	50.5	6.0	2.60	2.17%	Coarse Alluvium	0.056	111.0	1.12	0.000	1.12	0	44	2.22%	2.4	36%	1.96	0.000	1.96
20.013	6940.15	45.5	1.003	45.5	5.9	2.56	2.20%	Coarse Alluvium	0.056	111.0	1.13	0.000	1.13	0	39	2.26%	2.4	36%	1.97	0.000	1.97
20.177	6939.98	43.8	0.460	43.8	3.5	1.50	1.05%	Coarse Alluvium	0.056	111.0	1.14	0.000	1.14	0	37	1.08%	2.3	36%	1.98	0.000	1.98
20.341	6939.82	45.0	0.031	45.0	3.7	1.61	0.07%	Coarse Alluvium	0.056	111.0	1.15	0.000	1.15	0	38	0.07%	1.9	36%	1.99	0.000	1.99
20.505	6939.66	46.0	0.340	46.0	3.6	1.56	0.74%	Coarse Alluvium	0.056	111.0	1.16	0.000	1.16	0	39	0.76%	2.2	36%	1.99	0.000	1.99
20.669	6939.49	14.2	0.345	14.2	2.6	1.12	2.43%	Coarse Alluvium	0.056	111.0	1.17	0.000	1.17	0	11	2.64%	2.9	36%	2.00	0.000	2.00
20.833	6939.33	54.3	0.327	54.2	3.4	1.49	0.60%	Coarse Alluvium	0.056	111.0	1.18	0.000	1.18	0	45	0.62%	2.1	36%	2.01	0.000	2.01
20.997	6939.16	57.5	0.354	57.5	3.3	1.42	0.62%	Coarse Alluvium	0.056	111.0	1.19	0.000	1.19	0	47	0.63%	2.1	36%	2.02	0.000	2.02
21.161	6939.00	57.1	0.386	57.1	2.4	1.06	0.68%	Coarse Alluvium	0.056	111.0	1.20	0.000	1.20	0	47	0.69%	2.1	36%	2.03	0.000	2.03
21.325	6938.83	63.6	0.459	63.6	2.5	1.08	0.72%	Coarse Alluvium	0.056	111.0	1.21	0.000	1.21	0	52	0.74%	2.1	36%	2.04	0.000	2.04
21.489	6938.67	69.9	0.558	69.9	2.2	0.96	0.80%	Coarse Alluvium	0.056	111.0	1.22	0.000	1.22	0	56	0.81%	2.1	36%	2.05	0.000	2.05
21.653	6938.51	72.3	0.660	72.3	2.4	1.02	0.91%	Coarse Alluvium	0.056	111.0	1.22	0.000	1.22	0	58	0.93%	2.1	36%	2.06	0.000	2.06
21.817	6938.34	72.1	0.742	72.1	2.4	1.06	1.03%	Coarse Alluvium	0.056	111.0	1.23	0.000	1.23	0	57	1.05%	2.1	36%	2.07	0.000	2.07
21.981	6938.18	70.6	0.775	70.6	2.5	1.10	1.10%	Coarse Alluvium	0.056	111.0	1.24	0.000	1.24	0	56	1.12%	2.1	36%	2.08	0.000	2.08
22.145	6938.01	66.7	0.780	66.7	2.6	1.12	1.17%	Coarse Alluvium	0.056	111.0	1.25	0.000	1.25	0	52	1.19%	2.2	36%	2.09	0.000	2.09
22.309	6937.85	63.1	0.774	63.0	2.5	1.10	1.23%	Coarse Alluvium	0.056	111.0	1.26	0.000	1.26	0	49	1.25%	2.2	36%	2.09	0.000	2.09
22.473	6937.69	57.6	0.726	57.6	2.3	1.00	1.26%	Coarse Alluvium	0.056	111.0	1.27	0.000	1.27	0	44	1.29%	2.3	36%	2.10	0.000	2.10
22.638	6937.52	51.5	0.678	51.5	2.6	1.14	1.32%	Coarse Alluvium	0.056	111.0	1.28	0.000	1.28	0	39	1.35%	2.3	36%	2.11	0.000	2.11
22.802	6937.36	47.3	0.632	47.3	2.5	1.10	1.34%	Coarse Alluvium	0.056	111.0	1.29	0.000	1.29	0	36	1.37%	2.3	36%	2.12	0.000	2.12
22.966	6937.19	53.0	0.619	53.0	2.8	1.20	1.17%	Coarse Alluvium	0.056	111.0	1.30	0.000	1.30	0	40	1.20%	2.3	36%	2.13	0.000	2.13
23.130	6937.03	61.3	0.607	61.3	2.9	1.24	0.99%	Coarse Alluvium	0.056	111.0	1.31	0.000	1.31	0	46	1.01%	2.2	36%	2.14	0.000	2.14
23.294	6936.87	65.0	0.622	65.0	2.9	1.24	0.96%	Coarse Alluvium	0.056	111.0	1.32	0.000	1.32	0	48	0.98%	2.2	36%	2.15	0.000	2.15
23.458	6936.70	67.0	0.632	67.0	2.7	1.16	0.94%	Coarse Alluvium	0.056	111.0	1.32	0.000	1.32	0	50	0.96%	2.1	36%	2.16	0.000	2.16
23.622	6936.54	67.4	0.658	67.4	3.0	1.28	0.98%	Coarse Alluvium	0.056	111.0	1.33	0.000	1.33	0	50	1.00%	2.2	36%	2.17	0.000	2.17
23.786	6936.37	63.8	0.763	63.8	3.1	1.36	1.20%	Coarse Alluvium	0.056	111.0	1.34	0.000	1.34	0	47	1.22%	2.2	36%	2.18	0.000	2.18
23.950	6936.21	60.6	0.864	60.6	3.0	1.28	1.43%	Coarse Alluvium	0.056	111.0	1.35	0.000	1.35	0	44	1.46%	2.3	36%	2.19	0.000	2.19
24.114	6936.05	56.6	0.899	56.6	3.1	1.36	1.59%	Coarse Alluvium	0.056	111.0	1.36	0.000	1.36	0	41	1.63%	2.3	36%	2.19	0.000	2.19
24.278	6935.88	58.4	0.463	58.4	3.0	1.30	0.79%	Coarse Alluvium	0.056	111.0	1.37	0.000	1.37	0	42	0.81%	2.2	36%	2.20	0.000	2.20
24.442	6935.72	56.5	0.419	56.5	2.9	1.24	0.74%	Coarse Alluvium	0.056	111.0	1.38	0.000	1.38	0	40	0.76%	2.2	36%	2.21	0.000	2.21
24.606	6935.55	59.6	0.491	59.6	3.4	1.49	0.82%	Coarse Alluvium	0.056	111.0	1.39	0.000	1.39	0	42	0.84%	2.2	36%	2.22	0.000	2.22
24.770	6935.39	59.6	0.584	59.6	3.5	1.50	0.98%	Coarse Alluvium	0.056	111.0	1.40	0.000	1.40	0	42	1.00%	2.2	36%	2.23	0.000	2.23
24.934	6935.23	48.5	0.515	48.4	3.4	1.46	1.06%	Coarse Alluvium	0.056	111.0	1.41	0.000	1.41	0	33	1.09%	2.3	36%	2.24	0.000	2.24
25.098	6935.06	46.2	0.732	46.2	3.4	1.46	1.59%	Coarse Alluvium	0.056	111.0	1.42	0.000	1.42	0	32	1.64%	2.4	36%	2.25	0.000	2.25
25.262	6934.90	54.3	0.862	54.3	2.5	1.10	1.59%	Coarse Alluvium	0.056	111.0	1.42	0.000	1.42	0	37	1.63%	2.4	36%	2.26	0.000	2.26
25.426	6934.73	57.0	0.957	57.0	2.9	1.26	1.68%	Coarse Alluvium	0.056	111.0	1.43	0.000	1.43	0	39	1.72%	2.4	36%	2.27	0.000	2.27
25.590	6934.57	60.2	0.831	60.2	2.5	1.08	1.38%	Coarse Alluvium	0.056	111.0	1.44	0.000	1.44	0	41	1.41%	2.3	36%	2.28	0.000	2.28
25.754	6934.41	61.6	0.658	61.6	2.5	1.10	1.07%	Fine Alluvium	0.060	120.7	1.45	0.000	1.45	0	41	1.09%	2.2	76%	2.29	0.000	2.29
25.918	6934.24	52.0	0.903	52.0	2.6	1.14	1.74%	Fine Alluvium	0.060	120.7	1.46	0.000	1.46	0	35	1.79%	2.4	76%	2.30	0.000	2.30
26.082	6934.08	32.6	0.823	32.6	2.5	1.08	2.52%	Fine Alluvium	0.060	120.7	1.47	0.000	1.47	0	21	2.64%	2.7	76%	2.31	0.000	2.31
26.246	6933.91	24.2	0.702	24.2	2.7	1.18	2.90%	Fine Alluvium	0.060	120.7	1.48	0.000	1.48	0	15	3.09%	2.9	76%	2.32	0.000	2.32
26.410	6933.75	25.5	0.836	25.4	3.7	1.59	3.28%	Fine Alluvium	0.060	120.7	1.49	0.000	1.49	0	16	3.49%	2.9	76%	2.33	0.000	2.33
26.574	6933.59	16.9	0.905	16.9	2.4	1.02	5.35%	Fine Alluvium	0.060	120.7	1.50	0.000	1.50	0	10	5.88%	3.2	76%	2.34	0.000	2.34
26.739	6933.42	15.7	0.736	15.7	3.1	1.32	4.69%	Fine Alluvium	0.060	120.7	1.51	0.000	1.51	0	9	5.19%	3.2	76%	2.35	0.000	2.35
26.903	6933.26	15.0	0.577	15.0	3.9	1.71	3.85%	Fine Alluvium	0.060	120.7	1.52	0.000	1.52	0	9	4.28%	3.1	76%	2.36	0.000	2.36
27.067	6933.09	15.1	0.503	15.1	4.2	1.81	3.32%	Fine Alluvium	0.060	120.7	1.53	0.000	1.53	0	9	3.70%	3.1	76%	2.37	0.000	2.37
27.231	6932.93	18.4	0.498	18.4	4.4	1.91	2.70%	Fine Alluvium	0.060	120.7	1.54	0.000	1.54	0	11	2.95%	3.0	76%	2.38	0.000	2.38
27.395	6932.77	23.2	0.676	23.2	4.6	1.99	2.91%	Fine Alluvium	0.060	120.7	1.55	0.000	1.55	0	14	3.12%	2.9	76%	2.39	0.000	2.39
27.559	6932.60	27.1	0.811	27.0	5.3	2.30	3.00%	Fine Alluvium	0.060	120.7	1.56	0.000	1.56	0	16	3.18%	2.8	76%	2.40	0.000	2.40
27.723	6932.44	18.4	0.811	18.4	4.9	2.14	4.41%	Fine Alluvium	0.060	120.7	1.57	0.000	1.57	0	11	4.82%	3.1	76%	2.41	0.000	2.41
27.887	6932.27	13.3	0.646	13.3	4.7	2.03	4.86%	Fine Alluvium	0.060	120.7	1.58	0.000	1.58	0	7	5.52%	3.3	76%	2.42	0.000	2.42
28.051	6932.11	12.3	0.540	12.2	5.0	2.15	4.40%	Fine Alluvium	0.060	120.7	1.59	0.000	1.59	0	7	5.06%	3.3	76%	2.43	0.000	2.43
28.215	6931.95	12.7	0.537	12.6	5.4	2.34	4.24%	Fine Alluvium	0.060	120.7	1.60	0.000	1.60	0	7	4.86%	3.2	76%	2.44	0.000	2.44
28.379	6931.78	13.1	0.588	13.1	5.8	2.52	4.49%	Fine Alluvium	0.060	120.7	1.61	0.000	1.61	0	7	5.12%	3.3	76%	2.45	0.000	2.45
28.543	6931.62	13.2	0.612	13.2	6.2	2.67	4.63%	Fine Alluvium	0.060	120.7	1.62	0.000	1.62	0	7	5.27%	3.3	76%	2.45	0.000	2.45
28.707	6931.45	15.5	0.641	15.4	6.5	2.83	4.15%	Fine Alluvium	0.060	120.7	1.63	0.000	1.63	0	8	4.64%	3.2	76%	2.46	0.000	2.46
28.871	6931.29	15.3	0.550	15.3	6.7	2.91	3.58%	Fine Alluvium	0.060	120.7	1.64	0.000	1.64	0	8	4.01%	3.1	76%	2.47	0.000	2.47
29.035	6931.12	16.7	0.500	16.7	6.8	2.95	2.99%	Fine Alluvium	0.060	120.7	1.65	0.000	1.65	0	9	3.31%	3.1	76%	2.48	0.000	2.48
29.199	6930.96	18.1	0.478	18.1	7.1	3.07	2.63%	Fine Alluvium	0.060	120.7	1.66	0.000	1.66	0	10	2.90%	3.0	76%	2.49	0.000	2.49

8.45	557	1.7E-03	5.2E+02	91	0.8215	5.0E-04	43	0.233	0.232	85	85.000	8224	5647	1481	1481	0.103%	0.90	0.75	0.06%	0.002677	0.25	0.323	0.851	0.46%	0.0007
8.50	557	1.7E-03	5.2E+02	90	0.8188	5.0E-04	43	0.233	0.232	86	86.000	8206	5634	1482	1482	0.103%	0.90	0.75	0.06%	0.002698	0.25	0.323	0.851	0.46%	0.0008
8.55	557	1.7E-03	5.2E+02	88	0.8161	5.0E-04	43	0.233	0.233	87	87.000	8187	5621	1483	1483	0.104%	0.90	0.75	0.06%	0.002718	0.25	0.323	0.851	0.46%	0.0008
8.60	557	1.7E-03	5.2E+02	87	0.8133	5.0E-04	43	0.234	0.233	88	88.000	8169	5608	1484	1484	0.104%	0.90	0.75	0.06%	0.002738	0.25	0.323	0.851	0.47%	0.0008
8.65	557	1.7E-03	5.2E+02	86	0.8105	5.0E-04	43	0.234	0.233	89	89.000	8151	5596	1485	1485	0.104%	0.90	0.75	0.06%	0.002757	0.25	0.323	0.851	0.47%	0.0008
8.70	557	1.7E-03	5.2E+02	85	0.8077	5.0E-04	43	0.234	0.234	90	90.000	8133	5583	1486	1486	0.105%	0.90	0.75	0.06%	0.002776	0.25	0.323	0.851	0.47%	0.0008
8.75	557	1.7E-03	5.2E+02	84	0.8049	5.0E-04	43	0.234	0.234	91	91.000	8115	5571	1487	1487	0.105%	0.90	0.75	0.06%	0.002794	0.25	0.323	0.851	0.48%	0.0008
8.80	998	1.7E-03	1.7E+03	82	0.8020	1.6E-04	43	0.235	0.234	92	92.000	8098	5558	1488	1488	0.020%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
8.85	998	1.7E-03	1.7E+03	81	0.7991	1.6E-04	43	0.235	0.235	93	93.000	8080	5546	1489	1489	0.020%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
8.90	998	1.7E-03	1.7E+03	80	0.7962	1.6E-04	43	0.235	0.235	94	94.000	8063	5534	1490	1490	0.020%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
8.95	998	1.7E-03	1.7E+03	79	0.7932	1.5E-04	0	0.236	0.235	95	0.236	8045	5521	1491	8045	0.022%	2.00	1.00	0.01%	0.000245	0.36	0.025	0.785	0.04%	0.0001
9.00	998	1.7E-03	1.7E+03	78	0.7902	1.5E-04	0	0.236	0.236	96	0.236	8027	5509	1492	8027	0.022%	2.00	1.00	0.01%	0.000246	0.36	0.025	0.785	0.04%	0.0001
9.05	998	1.7E-03	1.7E+03	77	0.7872	1.5E-04	0	0.236	0.236	97	0.236	8010	5497	1493	8010	0.022%	2.00	1.00	0.01%	0.000247	0.36	0.025	0.785	0.04%	0.0001
9.10	998	1.7E-03	1.7E+03	76	0.7842	1.5E-04	0	0.236	0.236	98	0.236	7992	5485	1494	7992	0.022%	2.00	1.00	0.01%	0.000247	0.36	0.025	0.785	0.04%	0.0001
9.15	998	1.7E-03	1.7E+03	75	0.7811	1.5E-04	0	0.237	0.237	99	0.237	7975	5472	1495	7975	0.022%	2.00	1.00	0.01%	0.000248	0.36	0.025	0.785	0.04%	0.0001
9.20	998	1.7E-03	1.7E+03	74	0.7780	1.5E-04	0	0.237	0.237	100	0.237	7958	5460	1496	7958	0.022%	2.00	1.00	0.01%	0.000248	0.36	0.025	0.785	0.04%	0.0001
9.25	998	1.7E-03	1.7E+03	73	0.7748	1.5E-04	0	0.237	0.237	101	0.237	7941	5449	1497	7941	0.022%	2.00	1.00	0.01%	0.000249	0.36	0.025	0.785	0.04%	0.0001
9.30	998	1.7E-03	1.7E+03	72	0.7717	1.5E-04	0	0.238	0.238	102	0.238	7924	5437	1498	7924	0.022%	2.00	1.00	0.01%	0.000249	0.36	0.025	0.785	0.04%	0.0001
9.35	998	1.7E-03	1.7E+03	71	0.7685	1.5E-04	0	0.238	0.238	103	0.238	7907	5425	1499	7907	0.022%	2.00	1.00	0.01%	0.000249	0.36	0.025	0.785	0.04%	0.0001
9.40	998	1.7E-03	1.7E+03	70	0.7652	1.5E-04	0	0.238	0.238	104	0.238	7891	5413	1500	7891	0.022%	2.00	1.00	0.01%	0.000250	0.36	0.025	0.785	0.04%	0.0001
9.45	998	1.7E-03	1.7E+03	69	0.7620	1.5E-04	0	0.238	0.239	105	0.238	7874	5402	1501	7874	0.022%	2.00	1.00	0.01%	0.000250	0.36	0.025	0.785	0.04%	0.0001
9.50	998	1.7E-03	1.7E+03	68	0.7587	1.5E-04	0	0.239	0.239	106	0.239	7858	5390	1502	7858	0.023%	2.00	1.00	0.01%	0.000250	0.36	0.025	0.785	0.04%	0.0001
9.55	998	1.7E-03	1.7E+03	68	0.7554	1.5E-04	0	0.239	0.239	107	0.239	7841	5379	1503	7841	0.023%	2.00	1.00	0.01%	0.000250	0.36	0.025	0.785	0.04%	0.0001
9.60	998	1.7E-03	1.7E+03	67	0.7520	1.5E-04	0	0.239	0.240	108	0.239	7825	5368	1504	7825	0.023%	2.00	1.00	0.01%	0.000250	0.36	0.025	0.785	0.04%	0.0001
9.65	998	1.7E-03	1.7E+03	66	0.7486	1.5E-04	0	0.240	0.240	109	0.240	7809	5356	1505	7809	0.023%	2.00	1.00	0.01%	0.000250	0.36	0.025	0.785	0.04%	0.0001
9.70	998	1.7E-03	1.7E+03	65	0.7452	1.5E-04	0	0.240	0.240	110	0.240	7793	5345	1506	7793	0.023%	2.00	1.00	0.01%	0.000250	0.36	0.025	0.785	0.04%	0.0001
9.75	998	1.7E-03	1.7E+03	64	0.7418	1.5E-04	0	0.240	0.241	111	0.240	7777	5334	1507	7777	0.023%	2.00	1.00	0.01%	0.000250	0.36	0.025	0.785	0.04%	0.0001
9.80	998	1.7E-03	1.7E+03	63	0.7383	1.5E-04	0	0.240	0.241	112	0.240	7762	5323	1508	7762	0.022%	2.00	1.00	0.01%	0.000250	0.36	0.025	0.785	0.04%	0.0001
9.85	998	1.7E-03	1.7E+03	63	0.7348	1.6E-04	0	0.241	0.241	113	0.241	7746	5312	1509	7746	0.022%	2.00	1.00	0.01%	0.000249	0.36	0.025	0.785	0.04%	0.0001
9.90	998	1.7E-03	1.7E+03	62	0.7313	1.6E-04	0	0.241	0.242	114	0.241	7730	5301	1510	7730	0.022%	2.00	1.00	0.01%	0.000249	0.36	0.025	0.785	0.04%	0.0001
9.95	998	1.7E-03	1.7E+03	61	0.7278	1.6E-04	0	0.241	0.242	115	0.241	7715	5291	1511	7715	0.022%	2.00	1.00	0.01%	0.000249	0.36	0.025	0.785	0.04%	0.0001
10.00	998	1.7E-03	1.7E+03	60	0.7242	1.6E-04	0	0.241	0.242	116	0.241	7700	5280	1512	7700	0.022%	2.00	1.00	0.01%	0.000248	0.36	0.025	0.785	0.04%	0.0001
10.05	998	1.7E-03	1.7E+03	60	0.7206	1.5E-04	0	0.242	0.242	117	0.242	7685	5269	1513	7685	0.022%	2.00	1.00	0.01%	0.000248	0.36	0.025	0.785	0.04%	0.0001
10.10	998	1.7E-03	1.7E+03	59	0.7169	1.5E-04	0	0.242	0.243	118	0.242	7669	5259	1514	7669	0.022%	2.00	1.00	0.01%	0.000247	0.36	0.025	0.785	0.04%	0.0001
10.15	998	1.7E-03	1.7E+03	58	0.7133	1.5E-04	0	0.242	0.243	119	0.242	7654	5248	1515	7654	0.022%	2.00	1.00	0.01%	0.000247	0.36	0.025	0.785	0.04%	0.0001
10.20	998	1.7E-03	1.7E+03	57	0.7096	1.5E-04	0	0.242	0.243	120	0.242	7640	5238	1516	7640	0.022%	2.00	1.00	0.01%	0.000246	0.36	0.025	0.785	0.04%	0.0001
10.25	998	1.7E-03	1.7E+03	57	0.7059	1.5E-04	0	0.243	0.244	121	0.243	7625	5227	1517	7625	0.022%	2.00	1.00	0.01%	0.000245	0.36	0.025	0.785	0.04%	0.0001
10.30	894	1.7E-03	1.4E+03	56	0.7021	1.9E-04	0	0.243	0.244	122	0.243	7610	5217	1518	7610	0.032%	2.00	1.00	0.01%	0.000436	0.36	0.025	0.785	0.07%	0.0001
10.35	894	1.7E-03	1.4E+03	55	0.6983	1.9E-04	0	0.243	0.244	123	0.243	7595	5207	1519	7595	0.032%	2.00	1.00	0.01%	0.000435	0.36	0.025	0.785	0.07%	0.0001
10.40	894	1.7E-03	1.4E+03	55	0.6945	1.9E-04	0	0.244	0.245	124	0.244	7581	5197	1520	7581	0.032%	2.00	1.00	0.01%	0.000433	0.36	0.025	0.785	0.07%	0.0001
10.45	894	1.7E-03	1.4E+03	54	0.6907	1.9E-04	0	0.244	0.245	125	0.244	7567	5187	1521	7567	0.032%	2.00	1.00	0.01%	0.000432	0.36	0.025	0.785	0.07%	0.0001
10.50	894	1.7E-03	1.4E+03	53	0.6869	1.9E-04	0	0.244	0.245	126	0.244	7552	5177	1522	7552	0.032%	2.00	1.00	0.01%	0.000430	0.36	0.025	0.785	0.07%	0.0001
10.55	894	1.7E-03	1.4E+03	53	0.6830	1.9E-04	0	0.244	0.245	127	0.244	7538	5167	1523	7538	0.031%	2.00	1.00	0.01%	0.000428	0.36	0.025	0.785	0.07%	0.0001
10.60	894	1.7E-03	1.4E+03	52	0.6791	1.9E-04	0	0.245	0.246	128	0.245	7524	5157	1524	7524	0.031%	2.00	1.00	0.01%	0.000426	0.36	0.025	0.785	0.07%	0.0001
10.65	894	1.7E-03	1.4E+03	52	0.6751	1.9E-04	0	0.245	0.246	129	0.245	7510	5147	1525	7510	0.031%	2.00	1.00	0.01%	0.000424	0.36	0.025	0.785	0.07%	0.0001
10.70	894	1.7E-03	1.4E+03	51	0.6712	1.9E-04	0	0.245	0.246	130	0.245	7496	5137	1526	7496	0.031%	2.00	1.00	0.01%	0.000422	0.36	0.025	0.785	0.07%	0.0001
10.75	894	1.7E-03	1.4E+03	50	0.6672	1.9E-04	0	0.245	0.247	131	0.245	7482	5128	1527	7482	0.031%	2.00	1.00	0.01%	0.000420	0.36	0.025	0.785	0.07%	0.0001
10.80	894	1.7E-03	1.4E+03	50	0.6632	1.9E-04	0	0.246	0.247	132	0.246	7468	5118	1528	7468	0.031%	2.00	1.00	0.01%	0.000418	0.36	0.025	0.785	0.07%	0.0001
10.85	894	1.7E-03	1.4E+03	49	0.6592	1.9E-04	0	0.246	0.247	133	0.246	7455	5108	1529	7455	0.031%	2.00	1.00	0.01%	0.000415	0.36	0.025	0.785	0.07%	0.0001
10.90	894	1.7E-03	1.4E+03	49	0.6551	1.9E-04	0	0.246	0.248	134	0.246	7441	5099	1530	7441	0.031%	2.00	1.00	0.01%	0.000413	0.36	0.025	0.785	0.06%	0.0001
10.95	894	1.7E-03	1.4E+03	48	0.6511	1.9E-04	0	0.246	0.248	135	0.246	7427	5090	1531	7427	0.031%	2.00	1.00	0.01%	0.000410	0.36	0.025	0.785	0.06%	0.0001
11.00	894	1.7E-03	1.4E+03	48	0.6470	1.9E-04	0	0.247	0.248	136	0.247	7414	5080	1532	7414	0.030%	2.00	1.00	0.01%	0.000408	0.36	0.025	0.785	0.06%	0.0001
11.05	894	1.7E-03	1.4E+03	47	0.6429	1.9E-04	0	0.247	0.248	137	0.247	7401	5071	1533	7401	0.030%	2.00	1.00	0.01%	0.000405	0.36	0.025	0.785	0.06%	0.0001
11.10	894	1.7E-03	1.4E+03	46	0.6387	1.9E-04	0	0.247	0.249	138	0.247	7387	5062	1534	7387	0.030%	2.00	1.00	0.01%	0.000403	0.36	0.025	0.785	0.06%	0.0001
11.15	894	1.7E-03	1.4E+03	46	0.6346	1.9E-04	0	0.247	0.249	139	0.247	7374	5052	1535	7374	0.030%	2.00	1.00	0.01%	0.000400	0.36	0.025	0.785	0.06%	0.0001
11.20	894	1.7E-03	1.4E+03	45	0.6304	1.9E-04	0	0.248	0.249	140	0.248	7361	5043	1536	7361	0.030%	2.00	1.00	0.01%	0.000397	0.36	0.025	0.785	0.06%	0.0001
11.25	894	1.7E-03	1.4E+03	45	0.6262	1.9E-04	0	0.248	0.250	141	0.248	7348	5034	1537	7348	0.030%	2.00	1.00	0.01%	0.000394	0.36	0.025	0.785	0.06%	0.0001
11.30	894	1.7E-03	1.4E+03	44	0.6220	1.9E-04	0	0.248	0.250	142	0.248	7335	5025	1538	7335	0.030%	2.00	1.00	0.01%	0.000391	0.36	0.025	0.785	0.06%	0.0001
11.35	894	1.7E-03	1.4E+03	44	0.6177	1.9E-04	0	0.248	0.250	143	0.248	7322	5016	1539	7322	0.029%	2.00	1.00	0.01%	0.000388	0.36	0.025	0.785	0.06%	0.0001
11.40	894	1.7E-03	1.4E+03	44	0.6135	1.9E-04	0	0.249	0.250	144	0.249	7309	5007	1540	7309	0.029%	2.00	1.00	0.01%	0.000385	0.36	0.025	0.785	0.06%	0.0001
11.45	894	1.7E-03	1.4E+03	43	0.6092	1.9E-04	0	0.249	0.251	145	0.249	7297	4998	1541	7297	0.029%	2.00	1.00	0.01%	0.000382	0.36	0.025	0.785	0.06%	0.0001
11.50	894	1.7E-03	1.4E+03	43	0.6049	1.8E-04	0	0.249	0.251	146	0.249	7284	4989	1542	7284	0.029%	2.00	1.00	0.01%	0.000378	0.36	0.025	0.785	0.06%	0.0001
11.55	894	1.7E-03	1.4E+03	42	0.6006	1.8E-04	0	0.249	0.251	147	0.249	7271	4981	1543	7271	0.029%	2.00	1.00	0.01%	0.000375	0.36	0.025	0.785	0.06%	0.0001
11.60	894	1.7E-03	1.4E+03	42	0.5963	1.8E-04	0	0.250	0.252	148	0.250	7259	4972	1544	7259	0.029%	2.00	1.00	0.01%	0.000372	0.36	0.025	0.785	0.06%	0.0001
11.65	894	1.7E-03	1.4E+03	41	0.5919	1.8E-04	0	0.250	0.252	149	0.250	7247	4963	1545	7247	0.028%	2.00	1.00	0.01%	0.000368	0.36	0.025	0.785	0.06%	0.0001
11.70	894	1.7E-03	1.4E+03	41	0.5875	1.8E-04	0	0.250	0.252	150	0.250	7234	4955	1546	7234	0.028%	2.00	1.00	0.01%	0.000365	0.36	0.025	0.785	0.06%	0.0001
11.75	894	1.7E-03	1.4E+03	40	0.5832	1.8E-04	0	0.250	0.252	151	0.250	7222	4946	1547	7222	0.028%	2.00	1.00	0.01%	0.000361	0.36	0.025	0.785	0.06%	0.0001
11.80	894	1.7E-03	1.4E+03	40	0.5788	1.8E-04	0	0.251	0.253	152	0.251	7210	4938	1548	7210	0.028%	2.00	1.00	0.01%	0.000358	0.36	0.025	0.785	0.06%	0.0001
11.85	864	1.7E-03	1.3E+03	40	0.5744	1.9E-04	0	0.251	0.253	153	0.251	7198	4929	1549	7198	0.031%	2.00	1.00	0.01%	0.000421	0.36	0.025	0.785	0.07%	0.0001
11.90	864	1.7E-03	1.3E+03	39	0.5700	1.9E-04	0	0.251	0.253	154	0.251	7186	4921	1550	7186	0.031%	2.00	1.00	0.01%	0.000416	0.36	0.025	0.785	0.07%	0.0001
11.95	864	1.7E-03	1.3E+03	39	0.5655	1.9E-04	0	0.251	0.253	155	0.251	7174	4912	1551	7174	0.031%	2.00	1.00	0.01%	0.000412	0.36	0.025	0.785	0.06%	0.0001
12.00	864	1.7E-03	1.3E+03	38	0.5611	1.9E-04	0	0.251	0.254	156	0.251	7162	4904	1552	7162	0.030%	2.00	1.00	0.01%	0.000407	0.36	0.025	0.785	0.06%	0.0001
12.05	864	1.7E-03	1.3E+03	38	0.5566	1.9E-04	0	0.252	0.254	157	0.252	7150	4896	1553	7150	0.030%	2.00	1.00	0.01%	0.000403	0.36	0.025	0.785	0.06%	0.0001
12.10	864	1.7E-03	1.3E+03	38	0.5522	1.9E-04	0	0.252	0.254	158	0.252	7138	4887	1554	7138	0.030%	2.00	1.00	0.01%	0.000398	0.36	0.025	0.785	0.06%	0.0001
12.15	864	1.7E-03	1.3E+03	37	0.5477	1.9E-04	0	0.252	0.255	159	0.252	7126	4879	1555	7126	0.030%	2.00	1.00	0.01%	0.000394	0.36	0.025	0.785	0.06%	0.0001
12.20	864	1.9E-03	1.4E+03	37	0.5432	1.7E-04	22	0.252	0.255	160	74.803	7114	4870	1556	3324	0.031%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
12.25	864	1.9E-03	1.4E+03	37	0.5387	1.7E-04	22	0.253	0.255	161	75.269	7101	4862	1557	3319	0.030%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
12.30	864	1.9E-03	1.4E+03	36	0.5342	1.7E-04	22	0.253	0.255	162	75.736	7089	4853	1558	3315	0.030%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
12.35	864	1.9E-03	1.4E+03	36	0.5297	1.7E-04	22	0.253	0.256	163	76.203	7076	4844	1559	3311	0.030%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
12.40	864	1.9E-03	1.4E+03	36	0.5252	1.7E-04	22	0.253	0.256	164	76.670	7064	4836	1560	3307	0.030%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
12.45	864	1.9E-03	1.4E+03	35	0.5206	1.7E-04	22	0.254	0.256	165	77.137	7051	4827	1561	3303	0.030%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
12.50	864	1.9E-03	1.4E+03	35	0.5161	1.7E-04	22	0.254	0.257	166	77.604	7039	4818	1562	3299	0.029%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
12.55	864	1.9E-03	1.4E+03	35	0.5116	1.7E-04	22	0.254	0.257	167	78.070	7027	4810	1563	3295	0.029%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
12.60	864	1.9E-03	1.4E+03	34	0.5070	1.7E-04	22	0.254	0.257	168	78.537	7015	4802	1564	3291	0.029%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
12.65	864	1.9E-03	1.4E+03	34	0.5025	1.7E-04	22	0.255	0.257	169	79.004	7003	4793	1565	3287	0.029%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
12.70	864	1.9E-03	1.4E+03	34	0.4979	1.7E-04	22	0.255	0.258	170	79.471	6991	4785	1566	3283	0.028%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
12.75	864	1.9E-03	1.4E+03	33	0.4934	1.6E-04	22	0.255	0.258	171	79.938	6979	4777	1567	3279	0.028%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
12.80	864	1.9E-03	1.4E+03	33	0.4888	1.6E-04	22	0.255	0.258	172	80.404	6967	4768	1568	3275	0.028%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
12.85	864	1.9E-03	1.4E+03	33	0.4842	1.6E-04	22	0.256	0.259	173	80.871	6956	4760	1569	3271	0.028%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
12.90	864	1.9E-03	1.4E+03	33	0.4797	1.6E-04	22	0.256	0.259	174	81.338	6944	4752	1570	3267	0.027%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
12.95	864	1.9E-03	1.4E+03	32	0.4751	1.6E-04	22	0.256	0.259	175	81.805	6933	4744	1571	3263	0.027%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
13.00	864	1.9E-03	1.4E+03	32	0.4706	1.6E-04	22	0.256	0.259	176	82.272	6921	4736	1572	3259	0.027%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
13.05	864	1.9E-03	1.4E+03	32	0.4660	1.6E-04	22	0.257	0.260	177	82.739	6910	4728	1573	3256	0.027%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
13.10	864	1.9E-03	1.4E+03	32	0.4614	1.6E-04	22	0.257	0.260	178	83.205	6898	4720	1574	3252	0.026%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
13.15	864	1.9E-03	1.4E+03	31	0.4569	1.6E-04	22	0.257	0.260	179	83.672	6887	4712	1575	3248	0.026%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
13.20	864	1.9E-03	1.4E+03	31	0.4523	1.6E-04	22	0.257	0.261	180	84.139	6876	4704	1576	3244	0.026%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
13.25	864	1.9E-03	1.4E+03	31	0.4478	1.6E-04	22	0.258	0.261	181	84.606	6864	4696	1577	3241	0.026%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000

29.363	6930.80	16.2	0.371	16.1	7.3	3.17	2.29%	Fine Alluvium	0.060	120.7	1.67	0.000	1.67	0	9	2.56%	3.0	76%	2.50	0.000	2.50
29.527	6930.63	14.7	0.269	14.7	7.3	3.17	1.83%	Fine Alluvium	0.060	120.7	1.68	0.000	1.68	0	8	2.07%	3.0	76%	2.51	0.000	2.51
29.691	6930.47	16.1	0.245	16.1	7.7	3.32	1.52%	Fine Alluvium	0.060	120.7	1.69	0.000	1.69	0	9	1.70%	2.9	76%	2.52	0.000	2.52
29.855	6930.30	20.1	0.520	20.1	8.1	3.52	2.58%	Fine Alluvium	0.060	120.7	1.70	0.000	1.70	0	11	2.82%	3.0	76%	2.53	0.000	2.53
30.019	6930.14	23.8	0.935	23.7	9.2	3.97	3.93%	Fine Alluvium	0.060	120.7	1.71	0.000	1.71	0	13	4.24%	3.0	76%	2.54	0.000	2.54
30.183	6929.98	27.4	1.385	27.2	24.5	10.60	5.06%	Fine Alluvium	0.060	120.7	1.72	0.000	1.72	0	15	5.40%	3.0	76%	2.55	0.000	2.55
30.347	6929.81	26.9	1.592	26.8	23.7	10.27	5.91%	Fine Alluvium	0.060	120.7	1.73	0.000	1.73	0	15	6.32%	3.1	76%	2.56	0.000	2.56
30.511	6929.65	25.0	1.361	24.9	23.3	10.09	5.44%	Fine Alluvium	0.060	120.7	1.74	0.000	1.74	0	13	5.85%	3.1	76%	2.57	0.000	2.57
30.675	6929.48	24.7	1.184	24.6	23.0	9.95	4.79%	Fine Alluvium	0.060	120.7	1.75	0.000	1.75	0	13	5.15%	3.0	76%	2.58	0.000	2.58
30.840	6929.32	19.5	0.964	19.4	22.3	9.66	4.94%	Fine Alluvium	0.060	120.7	1.76	0.000	1.76	0	10	5.43%	3.1	76%	2.59	0.000	2.59
31.004	6929.16	17.6	0.759	17.5	22.0	9.52	4.31%	Fine Alluvium	0.060	120.7	1.77	0.000	1.77	0	9	4.80%	3.2	76%	2.60	0.000	2.60
31.168	6928.99	16.6	0.537	16.4	21.6	9.36	3.24%	Fine Alluvium	0.060	120.7	1.78	0.000	1.78	0	8	3.63%	3.1	76%	2.61	0.000	2.61
31.332	6928.83	17.7	0.547	17.6	21.9	9.50	3.09%	Fine Alluvium	0.060	120.7	1.79	0.000	1.79	0	9	3.43%	3.1	76%	2.62	0.000	2.62
31.496	6928.66	19.8	0.587	19.7	22.2	9.64	2.96%	Fine Alluvium	0.060	120.7	1.80	0.000	1.80	0	10	3.26%	3.0	76%	2.63	0.000	2.63
31.660	6928.50	24.8	0.838	24.7	21.1	9.13	3.38%	Fine Alluvium	0.060	120.7	1.81	0.000	1.81	0	13	3.64%	3.0	76%	2.64	0.000	2.64
31.824	6928.34	28.9	1.130	28.8	20.7	8.97	3.91%	Fine Alluvium	0.060	120.7	1.82	0.000	1.82	0	15	4.18%	2.9	76%	2.65	0.000	2.65
31.988	6928.17	30.9	1.378	30.8	19.2	8.34	4.46%	Fine Alluvium	0.060	120.7	1.83	0.000	1.83	0	16	4.74%	3.0	76%	2.66	0.000	2.66
32.152	6928.01	29.1	1.583	29.0	17.1	7.42	5.44%	Fine Alluvium	0.060	120.7	1.84	0.000	1.84	0	15	5.81%	3.0	76%	2.67	0.000	2.67
32.316	6927.84	26.4	1.602	26.3	15.2	6.57	6.06%	Fine Alluvium	0.060	120.7	1.85	0.000	1.85	0	13	6.52%	3.1	76%	2.68	0.000	2.68
32.480	6927.68	23.5	1.399	23.4	13.3	5.78	5.96%	Fine Alluvium	0.060	120.7	1.86	0.000	1.86	0	12	6.47%	3.1	76%	2.69	0.000	2.69
32.644	6927.52	19.8	1.138	19.7	12.5	5.41	5.76%	Fine Alluvium	0.060	120.7	1.87	0.000	1.87	0	10	6.36%	3.2	76%	2.70	0.000	2.70
32.808	6927.35	19.0	0.927	18.9	12.1	5.25	4.88%	Fine Alluvium	0.060	120.7	1.88	0.000	1.88	0	9	5.41%	3.2	76%	2.71	0.000	2.71
32.972	6927.19	17.2	0.805	17.1	11.9	5.14	4.69%	Fine Alluvium	0.060	120.7	1.89	0.000	1.89	0	8	5.27%	3.2	76%	2.72	0.000	2.72
33.136	6927.02	15.3	0.683	15.2	11.7	5.08	4.46%	Fine Alluvium	0.060	120.7	1.90	0.000	1.90	0	7	5.10%	3.3	76%	2.73	0.000	2.73
33.300	6926.86	15.2	0.540	15.2	11.8	5.10	3.54%	Fine Alluvium	0.060	120.7	1.91	0.000	1.91	0	7	4.05%	3.2	76%	2.74	0.000	2.74
33.464	6926.70	22.4	0.463	22.3	11.9	5.14	2.07%	Fine Alluvium	0.060	120.7	1.92	0.000	1.92	0	11	2.26%	2.9	76%	2.75	0.000	2.75
33.628	6926.53	166.5	2.761	166.4	16.2	7.04	1.66%	Weath. Sandstone	-	-	-	-	-	-	-	-	-	-	-	-	-
33.792	6926.37	319.0	2.761	318.9	18.4	7.97	0.87%	Weath. Sandstone	-	-	-	-	-	-	-	-	-	-	-	-	-
33.956	6926.20	581.2	2.761	581.1	14.3	6.20	0.48%	Weath. Sandstone	-	-	-	-	-	-	-	-	-	-	-	-	-

13.30	864	1.9E-03	1.4E+03	31	0.4432	1.5E-04	22	0.258	0.261	182	85.073	6853	4689	1578	3237	0.025%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
13.35	1275	1.9E-03	3.0E+03	30	0.4387	7.1E-05	22	0.258	0.261	183	85.539	6842	4681	1579	3233	0.009%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
13.40	1275	1.9E-03	3.0E+03	30	0.4342	7.0E-05	22	0.258	0.262	184	86.006	6831	4673	1580	3230	0.009%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
13.45	1275	1.9E-03	3.0E+03	30	0.4296	7.0E-05	22	0.258	0.262	185	86.473	6820	4666	1581	3226	0.009%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
13.50	1275	1.9E-03	3.0E+03	30	0.4251	6.9E-05	22	0.259	0.262	186	86.940	6809	4658	1582	3223	0.009%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
13.55	1275	1.9E-03	3.0E+03	29	0.4206	6.9E-05	22	0.259	0.262	187	87.407	6798	4651	1583	3219	0.009%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
13.60	1275	1.9E-03	3.0E+03	29	0.4161	6.8E-05	22	0.259	0.263	188	87.873	6788	4643	1584	3215	0.008%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
13.65	1275	1.9E-03	3.0E+03	29	0.4116	6.8E-05	22	0.259	0.263	189	88.340	6777	4636	1585	3212	0.008%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
13.70	1275	1.9E-03	3.0E+03	29	0.4071	6.7E-05	22	0.260	0.263	190	88.807	6766	4628	1586	3208	0.008%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
13.75	1275	1.9E-03	3.0E+03	29	0.4027	6.7E-05	22	0.260	0.264	191	89.274	6756	4621	1587	3205	0.008%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
13.80	1275	1.9E-03	3.0E+03	28	0.3982	6.6E-05	22	0.260	0.264	192	89.741	6745	4613	1588	3202	0.008%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
13.85	1275	1.9E-03	3.0E+03	28	0.3937	6.6E-05	22	0.260	0.264	193	90.207	6735	4606	1589	3198	0.008%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
13.90	1275	1.9E-03	3.0E+03	28	0.3893	6.5E-05	22	0.261	0.264	194	90.674	6724	4599	1590	3195	0.008%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
13.95	1275	1.9E-03	3.0E+03	28	0.3849	6.5E-05	22	0.261	0.265	195	91.141	6714	4592	1591	3191	0.008%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
14.00	1275	1.9E-03	3.0E+03	28	0.3805	6.4E-05	22	0.261	0.265	196	91.608	6704	4584	1592	3188	0.008%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
14.05	1275	1.9E-03	3.0E+03	27	0.3761	6.4E-05	22	0.261	0.265	197	92.075	6693	4577	1593	3185	0.008%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
14.10	1275	1.9E-03	3.0E+03	27	0.3717	6.3E-05	22	0.261	0.265	198	92.542	6683	4570	1594	3181	0.008%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
14.15	1275	1.9E-03	3.0E+03	27	0.3673	6.3E-05	22	0.262	0.266	199	93.008	6673	4563	1595	3178	0.008%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
14.20	1275	1.9E-03	3.0E+03	27	0.3629	6.2E-05	22	0.262	0.266	200	93.475	6663	4556	1596	3175	0.008%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
14.25	1275	1.9E-03	3.0E+03	27	0.3586	6.2E-05	22	0.262	0.266	201	93.942	6653	4549	1597	3171	0.008%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
14.30	1275	1.9E-03	3.0E+03	26	0.3543	6.1E-05	22	0.262	0.266	202	94.409	6643	4542	1598	3168	0.007%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
14.35	1275	1.9E-03	3.0E+03	26	0.3500	6.1E-05	22	0.263	0.267	203	94.876	6633	4535	1599	3165	0.007%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
14.40	1275	1.9E-03	3.0E+03	26	0.3457	6.0E-05	22	0.263	0.267	204	95.342	6623	4528	1600	3162	0.007%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
14.45	1275	1.9E-03	3.0E+03	26	0.3414	6.0E-05	22	0.263	0.267	205	95.809	6613	4521	1601	3158	0.007%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
14.50	1275	1.9E-03	3.0E+03	26	0.3371	5.9E-05	22	0.263	0.267	206	96.276	6603	4514	1602	3155	0.007%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
14.55	1275	1.9E-03	3.0E+03	26	0.3329	5.9E-05	22	0.263	0.268	207	96.743	6594	4508	1603	3152	0.007%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
14.60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14.65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14.70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Proposed Repository	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Elev. At Bottom of Layer (ft)	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at Bottom of Layer (tsf)	Total Stress at Midpoint of Layer (tsf)	Equil Pore Pressure at Bottom of Layer (tsf)	Equil Pore Pressure at Midpoint of Layer (tsf)	Effective Stress at Bottom of Layer (tsf)	Effective Stress at Midpoint of Layer (tsf)
Erosion Protection	6974.4	6973.7	6972.9	1.5	0.061	122.9	0.092	0.046	0.00	0.00	0.092	0.046
Cover Soil	6972.9	6971.7	6970.4	2.5	0.057	114.7	0.235	0.164	0.00	0.00	0.235	0.164
Mine Spoils	6970.4	6965.3	6960.2	10.3	0.058	116.4	0.834	0.535	0.00	0.00	0.834	0.535

6960.16	Ground Surface Elevation at time of CPT (ft amsl)
6974.44	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
1.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after placement (ft)
2.50	Thickness of Water Storage/Rooting Zone (Cover Soil; ft)

0.83	Additional Stress due to Proposed Repository Construction, $\Delta\sigma_{repos}$ (psf)
6945.15	Elevation of bottom of tailings (ft amsl)

UNC-NECR WASTE REPOSITORY SEISMIC SETTLEMENT ANALYSIS - CPT-08

Data File: 13-52118_RP08-BSC-CPT

Location: UNC-NECR 2013 Mill Site PDS

Cells Requiring User Input/Manipulation

http://projects.mwhglobal.com/.../13-52118_RP08-BSC-CPT.XLS

Erosion Protection	Coarse Tailings
Cover Soil	Coarse/Fine Tailings
Mine Spoils	Fine Tailings
Radon Barrier	Coarse Alluvium
General Fill	Fine Alluvium

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.3
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69
Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.3
Earthquake Moment Magnitude, M:	6.3
Magnitude Scaling Factor, MSF:	1.59

0.00	Water surface elevation during CPT investigation (ft amsl)
0.00	Water surface elevation at t_0 (ft amsl)
0.00	Water surface elevation at t_1 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Earthquake
8.26	Equiv. Number of Uniform Strain Cycles, N

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (per drilling log from coupled borehole)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	Normalized Cone Penetration Resistance	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1, u_1 (tsf)	Effective Stress at t_1 (tsf)
	2013 CPT Data from ConeTec								**CPT Data Interpretations**										**Conditions at t_1**		
0.164	6975.88	6.9	0.010	6.9	0.1	0.06	0.15%	Radon Barrier	0.061	122.3	0.01	0.000	0.01	0	685	0.15%	0.7	59%	0.84	0.000	0.84
0.328	6975.71	23.1	0.045	23.1	0.3	0.14	0.19%	Radon Barrier	0.061	122.3	0.02	0.000	0.02	0	1152	0.19%	0.7	59%	0.85	0.000	0.85
0.492	6975.55	48.4	0.210	48.4	1.8	0.79	0.43%	Radon Barrier	0.061	122.3	0.03	0.000	0.03	0	1607	0.43%	0.9	59%	0.86	0.000	0.86
0.656	6975.38	65.4	0.422	65.4	1.5	0.65	0.65%	Radon Barrier	0.061	122.3	0.04	0.000	0.04	0	1629	0.65%	1.1	59%	0.87	0.000	0.87
0.820	6975.22	84.7	0.445	84.7	2.4	1.06	0.53%	Radon Barrier	0.061	122.3	0.05	0.000	0.05	0	1688	0.53%	1.0	59%	0.88	0.000	0.88
0.984	6975.06	95.9	0.656	95.9	2.9	1.24	0.68%	Radon Barrier	0.061	122.3	0.06	0.000	0.06	0	1593	0.68%	1.1	59%	0.89	0.000	0.89
1.148	6974.89	91.0	0.730	91.0	3.5	1.53	0.80%	Radon Barrier	0.061	122.3	0.07	0.000	0.07	0	1296	0.80%	1.2	59%	0.90	0.000	0.90
1.312	6974.73	83.7	0.845	83.7	1.8	0.77	1.01%	Radon Barrier	0.061	122.3	0.08	0.000	0.08	0	1042	1.01%	1.3	59%	0.91	0.000	0.91
1.476	6974.56	88.8	1.305	88.8	0.9	0.39	1.47%	Radon Barrier	0.061	122.3	0.09	0.000	0.09	0	983	1.47%	1.5	59%	0.92	0.000	0.92
1.640	6974.40	111.4	1.803	111.4	1.2	0.51	1.62%	Radon Barrier	0.061	122.3	0.10	0.000	0.10	0	1109	1.62%	1.5	59%	0.93	0.000	0.93
1.804	6974.24	148.7	2.483	148.7	0.8	0.35	1.67%	Radon Barrier	0.061	122.3	0.11	0.000	0.11	0	1347	1.67%	1.5	59%	0.94	0.000	0.94
1.968	6974.07	180.4	2.837	180.4	0.4	0.16	1.57%	Radon Barrier	0.061	122.3	0.12	0.000	0.12	0	1497	1.57%	1.4	59%	0.95	0.000	0.95
2.133	6973.91	174.5	4.657	174.5	0.1	0.02	2.67%	General Fill	0.057	113.8	0.13	0.000	0.13	0	1344	2.67%	1.7	48%	0.96	0.000	0.96
2.297	6973.74	218.5	6.727	218.5	-0.2	-0.08	3.08%	General Fill	0.057	113.8	0.14	0.000	0.14	0	1570	3.08%	1.7	48%	0.97	0.000	0.97
2.461	6973.58	212.8	7.916	212.8	0.2	0.08	3.72%	General Fill	0.057	113.8	0.15	0.000	0.15	0	1433	3.72%	1.8	48%	0.98	0.000	0.98
2.625	6973.42	184.0	7.494	184.0	-1.9	-0.81	4.07%	General Fill	0.057	113.8	0.16	0.000	0.16	0	1166	4.08%	1.9	48%	0.99	0.000	0.99
2.789	6973.25	198.4	6.167	198.4	-1.0	-0.45	3.11%	General Fill	0.057	113.8	0.17	0.000	0.17	0	1187	3.11%	1.8	48%	1.00	0.000	1.00
2.953	6973.09	204.8	6.219	204.8	5.8	2.52	3.04%	General Fill	0.057	113.8	0.18	0.000	0.18	0	1160	3.04%	1.8	48%	1.01	0.000	1.01
3.117	6972.92	227.6	7.252	227.5	12.3	5.35	3.19%	General Fill	0.057	113.8	0.19	0.000	0.19	0	1224	3.19%	1.8	48%	1.02	0.000	1.02
3.281	6972.76	245.8	8.737	245.8	3.9	1.67	3.55%	General Fill	0.057	113.8	0.20	0.000	0.20	0	1259	3.56%	1.8	48%	1.03	0.000	1.03
3.445	6972.60	236.6	9.263	236.6	0.0	0.00	3.92%	General Fill	0.057	113.8	0.20	0.000	0.20	0	1157	3.92%	1.9	48%	1.03	0.000	1.03
3.609	6972.43	220.6	8.373	220.6	-4.4	-1.91	3.80%	General Fill	0.057	113.8	0.21	0.000	0.21	0	1031	3.80%	1.9	48%	1.04	0.000	1.04
3.773	6972.27	192.2	7.383	192.2	-6.0	-2.58	3.84%	General Fill	0.057	113.8	0.22	0.000	0.22	0	861	3.85%	1.9	48%	1.05	0.000	1.05
3.937	6972.10	183.7	7.063	183.7	-4.0	-1.75	3.85%	General Fill	0.057	113.8	0.23	0.000	0.23	0	789	3.85%	1.9	48%	1.06	0.000	1.06
4.101	6971.94	162.2	6.620	162.2	-2.6	-1.12	4.08%	General Fill	0.057	113.8	0.24	0.000	0.24	0	670	4.09%	1.9	48%	1.07	0.000	1.07
4.265	6971.77	127.4	4.743	127.4	-2.1	-0.91	3.72%	General Fill	0.057	113.8	0.25	0.000	0.25	0	506	3.73%	1.9	48%	1.08	0.000	1.08
4.429	6971.61	108.7	3.056	108.7	-0.6	-0.24	2.81%	General Fill	0.057	113.8	0.26	0.000	0.26	0	417	2.82%	1.9	48%	1.09	0.000	1.09
4.593	6971.45	99.5	2.493	99.5	0.1	0.02	2.51%	General Fill	0.057	113.8	0.27	0.000	0.27	0	368	2.51%	1.9	48%	1.10	0.000	1.10
4.757	6971.28	92.4	2.478	92.4	-0.1	-0.02	2.68%	General Fill	0.057	113.8	0.28	0.000	0.28	0	330	2.69%	1.9	48%	1.11	0.000	1.11
4.921	6971.12	90.1	2.219	90.1	0.1	0.04	2.46%	General Fill	0.057	113.8	0.29	0.000	0.29	0	311	2.47%	1.9	48%	1.12	0.000	1.12
5.085	6970.95	96.8	2.321	96.8	0.1	0.02	2.40%	General Fill	0.057	113.8	0.30	0.000	0.30	0	324	2.40%	1.9	48%	1.13	0.000	1.13
5.249	6970.79	118.6	3.164	118.6	0.9	0.39	2.67%	General Fill	0.057	113.8	0.31	0.000	0.31	0	385	2.67%	1.9	48%	1.14	0.000	1.14
5.413	6970.63	183.5	4.921	183.5	1.2	0.51	2.68%	General Fill	0.057	113.8	0.32	0.000	0.32	0	579	2.69%	1.8	48%	1.15	0.000	1.15
5.577	6970.46	294.0	6.122	294.0	1.6	0.71	2.08%	General Fill	0.057	113.8	0.33	0.000	0.33	0	902	2.08%	1.6	48%	1.16	0.000	1.16
5.741	6970.30	434.2	6.829	434.2	0.7	0.30	1.57%	General Fill	0.057	113.8	0.34	0.000	0.34	0	1295	1.57%	1.5	48%	1.17	0.000	1.17
5.905	6970.13	475.3	6.720	475.3	0.8	0.36	1.41%	General Fill	0.057	113.8	0.34	0.000	0.34	0	1379	1.41%	1.4	48%	1.17	0.000	1.17
6.069	6969.97	468.2	7.237	468.2	0.7	0.30	1.55%	General Fill	0.057	113.8	0.35	0.000	0.35	0	1323	1.55%	1.5	48%	1.18	0.000	1.18
6.234	6969.81	455.7	7.556	455.7	0.9	0.39	1.66%	General Fill	0.057	113.8	0.36	0.000	0.36	0	1254	1.66%	1.5	48%	1.19	0.000	1.19
6.398	6969.64	424.2	7.443	424.2	0.6	0.24	1.75%	General Fill	0.057	113.8	0.37	0.000	0.37	0	1138	1.76%	1.5	48%	1.20	0.000	1.20
6.562	6969.48	382.1	7.390	382.1	0.6	0.26	1.93%	General Fill	0.057	113.8	0.38	0.000	0.38	0	1000	1.94%	1.6	48%	1.21	0.000	1.21
6.726	6969.31	362.3	7.001	362.3	-0.4	-0.16	1.93%	General Fill	0.057	113.8	0.39	0.000	0.39	0	925	1.93%	1.6	48%	1.22	0.000	1.22
6.890	6969.15	310.0	6.544	310.0	-1.9	-0.83	2.11%	General Fill	0.057	113.8	0.40	0.000	0.40	0	773	2.11%	1.7	48%	1.23	0.000	1.23
7.054	6968.99	241.5	5.781	241.5	-1.4	-0.61	2.39%	Coarse Tailings	0.054	108.1	0.41	0.000	0.41	0	589	2.40%	1.7	21%	1.24	0.000	1.24
7.218	6968.82	226.4	4.982	226.4	0.1	0.06	2.20%	Coarse Tailings	0.054	108.1	0.42	0.000	0.42	0	540	2.20%	1.7	21%	1.25	0.000	1.25
7.382	6968.66	150.1	4.120	150.1	-0.1	-0.04	2.74%	Coarse Tailings	0.054	108.1	0.43	0.000	0.43	0	351	2.75%	1.9	21%	1.26	0.000	1.26
7.546	6968.49	104.5	3.636	104.5	0.8	0.33	3.48%	Coarse Tailings	0.054	108.1	0.44	0.000	0.44	0	239	3.49%	2.1	21%	1.27	0.000	1.27
7.710	6968.33	92.0	3.561	92.0	12.0	5.19	3.87%	Coarse Tailings	0.054	108.1	0.44	0.000	0.44	0	206	3.89%	2.1	21%	1.27	0.000	1.27
7.874	6968.17	125.7	3.834	125.6	11.7	5.07	3.05%	Coarse Tailings	0.054	108.1	0.45	0.000	0.45	0	276	3.06%	2.0	21%	1.28	0.000	1.28
8.038	6968.00	160.9	4.546	160.8	11.5	4.96	2.83%	Coarse Tailings	0.054	108.1	0.46	0.000	0.46	0	347	2.83%	1.9	21%	1.29	0.000	1.29
8.202	6967.84	171.0	4.787	170.9	15.0	6.49	2.80%	Coarse Tailings	0.054	108.1	0.47	0.000	0.47	0	362	2.81%	1.9	21%	1.30	0.000	1.30
8.366	6967.67	318.5	4.550	318.3	39.6	17.14	1.43%	Coarse Tailings	0.054	108.1	0.48	0.000	0.48	0	662	1.43%	1.5	21%	1.31	0.000	1.31
8.530	6967.51	305.5	3.463	305.4	22.2	9.62	1.13%	Coarse Tailings	0.054	108.1	0.49	0.000	0.49	0	624	1.14%	1.4	21%	1.32	0.000	1.32
8.694	6967.35	303.3	3.117	303.3	14.4	6.22	1.03%	Coarse Tailings	0.054	108.1	0.50	0.000	0.50	0	608	1.03%	1.4	21%	1.33	0.000	1.33
8.858	6967.18	344.4	3.532	344.3	13.9	6.04	1.03%	Coarse Tailings	0.054	108.1	0.51	0.000	0.51	0	679	1.03%	1.4	21%	1.34	0.000	1.34
9.022	6967.02	373.0	4.256	372.9	14.6	6.31	1.14%	Coarse Tailings	0.054	108.1	0.52	0.000	0.52	0	722	1.14%	1.4	21%	1.35	0.000	1.35
9.186	6966.85	418.1	4.463	418.0	10.2	4.41	1.07%	Coarse Tailings	0.054	108.1	0.52	0.000	0.52	0	796	1.07%	1.4	21%	1.35	0.000	1.35
9.350	6966.69	435.2	4.356	435.1	7.9	3.41	1.00%	Coarse Tailings	0.054	108.1	0.53	0.000	0.53	0	815	1.00%	1.3	21%	1.36	0.000	1.36
9.514	6966.53	425.0	4.519	425.0	6.5	2.81	1.06%	Coarse Tailings	0.054	108.1	0.54	0.000	0.54	0	783	1.06%	1.4	21%	1.37	0.000	1.37
9.678	6966.36	395.7	4.420	395.7	5.0	2.15	1.12%	Coarse Tailings	0.054	108.1	0.55	0.000	0.55	0	717	1.12%	1.4	21%	1.38	0.000	1.38
9.842	6966.20	358.2	4.302	358.1	4.7	2.05	1.20%	Coarse Tailings	0.054	108.1	0.56	0.000	0.56	0	639	1.20%	1.5	21%	1.39	0.000	1.39
10.006	6966.03	343.0	4.019	343.0	4.3	1.85	1.17%	Coarse Tailings	0.054	108.1	0.57	0.000	0.57	0	602	1.17%	1.5	21%	1.40	0.000	1.40
10.170	6965.87	321.1	3.920	321.1	4.7	2.05	1.22%	Coarse Tailings	0.054	108.1	0.58	0.000	0.58	0	555	1.22%	1.5	21%	1.41	0.000	1.41
10.335	6965.71	310.1	3.631	310.1	3.8	1.65	1.17%	Coarse Tailings	0.054	108.1	0.59	0.000	0.59	0	528	1.17%	1.5	21%	1.42	0.000	1.42
10.499	6965.54	284.3	3.480	284.3	3.1	1.32	1.22%	Coarse Tailings	0.054	108.1	0.60	0.000	0.60	0	476	1.23%	1.5	21%	1.43	0.000	1.43
10.663	6965.38	270.7	3.081	270.7	2.8	1.20	1.14%	Coarse Tailings	0.054	108.1	0.60	0.000	0.60	0	447	1.14%	1.5	21%	1.43	0.000	1.43
10.827	6965.21	257.8	3.174	257.8	2.4	1.04	1.23%	Coarse Tailings	0.054	108.1	0.61	0.000	0.61	0	419	1.23%	1.6	21%	1.44	0.000	1.44
10.991	6965.05	228.0	3.932	228.0	2.4	1.02	1.72%	Coarse Tailings	0.054	108.1	0.62	0.000	0.62	0	366	1.73%	1.7	21%	1.45	0.000	1.45
11.155	6964.89	196.5	4.039	196.4	2.8	1.22	2.06%	Coarse Tailings	0.054	108.1	0.63	0.000	0.63	0	310	2.06%	1.8	21%	1.46	0.000	1.46
11.319	6964.72	180.6	3.584	180.6	3.1	1.32	1.98%	Coarse Tailings	0.054	108.1	0.64	0.000	0.64	0	281	1.99%	1.8	21%	1.47	0.000	1.47
11.483	6964.56	171.0	2.616	170.9	2.3	0.98	1.53%	Coarse Tailings	0.054	108.1	0.65	0.000	0.65	0	263	1.54%	1.8	21%	1.48	0.000	1.48
11.647	6964.39	149.9	1.910	149.9	1.9	0.83	1.27%	Coarse Tailings	0.054	108.1	0.66	0.000	0.66	0	227	1.28%	1.7	21%	1.49	0.000	1.49
11.811	6964.23	141.0	2.061	141.0	2.0	0.88	1.46%	Coarse Tailings	0.054	108.1	0.67	0.000	0.67	0	211	1.47%	1.8	21%	1.50	0.000	1.50
11.975	6964.07	141.3	2.024	141.3	1.7	0.73	1.43%	Coarse Tailings	0.054	108.1	0.68	0.000	0.68	0	208	1.44%	1.8	21%	1.51	0.000	1.51
12.139	6963.90	137.2	1.911	137.2	1.6	0.69	1.39%	Coarse Tailings	0.054	108.1	0.68	0.000	0.68	0	200	1.40%	1.8	21%	1.51	0.000	1.51
12.303	6963.74	148.3	1.655	148.3	1.6	0.71	1.12%	Coarse Tailings	0.054	108.1	0.69	0.000	0.69	0	213	1.12%	1.7	21%	1.52	0.000	1.52

Midpoint Depth at t_1, z_1 (m)	Shear Wave Velocity, V_s (ft/sec)	Soil Density, ρ (tcf)	Max Shear Strain Modulus, G_{max} (tsf)	Coefficient a_2 for Stress Reduction Factor	Stress Reduction Factor, r_d	P = γ_{eff}*(G_{eff}/G_{max}) (tsf)	Plasticity Index, PI	g_1 for PI = 0	g_1 for PI = 15	g_1 for PI = 30	g_1	g_2 for PI = 0	g_2 for PI = 15	g_2 for PI = 30	g_2	Shear Strain, γ (%)	a	b	Threshhold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{c-15} (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
0.23	866	1.9E-03	1.4E+03	1249	0.9990	6.3E-06	12	0.102	0.091	4	0.093	35267	24912	1400	26983	0.001%	2.00	0.65	0.03%	0.000000	0.34	0.079	0.797	0.00%	0.0000
0.84	866	1.8E-03	1.3E+03	1017	0.9958	2.4E-05	12	0.137	0.127	4	0.129	20964	14659	1400	15920	0.003%	2.00	0.65	0.03%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.78	866	1.8E-03	1.4E+03	533	0.9803	7.5E-05	12	0.180	0.173	4	0.175	12926	8954	1400	9748	0.009%	1.18	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000

Seismic Settlement Analysis - Stewart et al (2004)

TOTAL SEISMIC SETTLEMENT (FT): 0.0765

Midpoint Depth at t_1, z_1 (m)	Shear Wave Velocity, V_s (ft/sec)	Soil Density, ρ (tcf)	Max Shear Strain Modulus, G_{max} (tsf)	Coefficient a_2 for Stress Reduction Factor	Stress Reduction Factor, r_d	P = γ_{eff}*(G_{eff}/G_{max}) (tsf)	Plasticity Index, PI	g_1 for PI = 0 (0)	g_1 for PI = 15 (15)	g_1 for PI = 30 (30)	g_1	g_2 for PI = 0 (0)	g_2 for PI = 15 (15)	g_2 for PI = 30 (30)	g_2	Shear Strain, γ (%)	a	b	Threshhold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{c-15} (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
4.38	1177	1.9E-03	2.6E+03	315	0.9577	6.0E-05	16	0.200	0.195	4	0.449	10724	7402	1400	7002	0.007%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
4.43	1177	1.9E-03	2.6E+03	310	0.9568	6.0E-05	16	0.201	0.196	5	0.516	10672	7365	1401	6967	0.007%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
4.48	1177	1.9E-03	2.6E+03	305	0.9559	6.1E-05	16	0.201	0.197	6	0.584	10621	7329	1402	6934	0.007%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
4.53	1177	1.9E-03	2.6E+03	300	0.9549	6.2E-05	16	0.202	0.197	7	0.651	10571	7294	1403	6901	0.007%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
4.58	1177	1.9E-03	2.6E+03	295	0.9540	6.2E-05	16	0.202	0.198	8	0.718	10521	7259	1404	6868	0.008%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
4.63	1177	1.9E-03	2.6E+03	291	0.9530	6.3E-05	16	0.203	0.198	9	0.785	10472	7224	1405	6836	0.008%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
4.68	1177	1.9E-03	2.6E+03	286	0.9521	6.4E-05	16	0.204	0.199	10	0.852	10424	7191	1406	6805	0.008%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
4.73	1177	1.9E-03	2.6E+03	281	0.9511	6.4E-05	16	0.204	0.200	11	0.920	10377	7157	1407	6774	0.008%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
4.78	1177	1.9E-03	2.6E+03	277	0.9501	6.5E-05	16	0.205	0.200	12	0.987	10331	7125	1408	6744	0.008%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
4.83	1177	1.9E-03	2.6E+03	273	0.9491	6.5E-05	16	0.205	0.201	13	1.054	10285	7092	1409	6714	0.008%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
4.88	1177	1.9E-03	2.6E+03	268	0.9480	6.6E-05	16	0.206	0.201	14	1.121	10240	7061	1410	6684	0.009%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
4.93	1177	1.9E-03	2.6E+03	264	0.9470	6.7E-05	16	0.206	0.202	15	1.188	10195	7030	1411	6655	0.009%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
4.98	1177	1.8E-03	2.4E+03	260	0.9459	7.2E-05	19	0.207	0.202	16	4.415	10155	7001	1412	5510	0.010%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
5.03	1177	1.8E-03	2.4E+03	256	0.9449	7.3E-05	19	0.207	0.203	17	4.682	10114	6973	1413	5490	0.010%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
5.08	1177	1.8E-03	2.4E+03	252	0.9438	7.4E-05	19	0.207	0.204	18	4.949	10075	6945	1414	5470	0.010%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
5.13	1177	1.8E-03	2.4E+03	248	0.9426	7.4E-05	19	0.208	0.204	19	5.216	10036	6917	1415	5450	0.011%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
5.18	1177	1.8E-03	2.4E+03	244	0.9415	7.5E-05	19	0.208	0.205	20	5.483	9997	6890	1416	5430	0.011%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
5.23	1177	1.8E-03	2.4E+03	240	0.9404	7.5E-05	19	0.209	0.205	21	5.750	9959	6863	1417	5411	0.011%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
5.28	1177	1.8E-03	2.4E+03	236	0.9392	7.6E-05	19	0.209	0.206	22	6.017	9921	6837	1418	5392	0.011%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
5.33	1177	1.8E-03	2.4E+03	232	0.9380	7.7E-05	19	0.210	0.206	23	6.284	9884	6811	1419	5373	0.011%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
5.38	1177	1.8E-03	2.4E+03	229	0.9368	7.7E-05	19	0.210	0.207	24	6.551	9847	6785	1420	5354	0.011%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
5.43	1177	1.8E-03	2.4E+03	225	0.9356	7.8E-05	19	0.211	0.207	25	6.818	9811	6760	1421	5336	0.011%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
5.48	1177	1.8E-03	2.4E+03	222	0.9344	7.8E-05	19	0.211	0.208	26	7.086	9775	6735	1422	5318	0.011%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
5.53	1177	1.8E-03	2.4E+03	218	0.9331	7.9E-05	19	0.211	0.208	27	7.353	9740	6710	1423	5300	0.012%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
5.58	1177	1.8E-03	2.4E+03	215	0.9319	8.0E-05	19	0.212	0.208	28	7.620	9705	6685	1424	5282	0.012%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
5.63	1177	1.8E-03	2.4E+03	211	0.9306	8.0E-05	19	0.212	0.209	29	7.887	9671	6661	1425	5265	0.012%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
5.68	1177	1.8E-03	2.4E+03	208	0.9293	8.1E-05	19	0.213	0.209	30	8.154	9637	6637	1426	5248	0.012%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
5.73	1177	1.8E-03	2.4E+03	205	0.9280	8.1E-05	19	0.213	0.210	31	8.421	9603	6614	1427	5230	0.012%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
5.78	1177	1.8E-03	2.4E+03	202	0.9266	8.2E-05	19	0.214	0.210	32	8.688	9570	6590	1428	5214	0.012%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
5.83	1177	1.8E-03	2.4E+03	198	0.9253	8.2E-05	19	0.214	0.211	33	8.955	9537	6567	1429	5197	0.012%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
5.88	1177	1.8E-03	2.4E+03	195	0.9239	8.3E-05	19	0.214	0.211	34	9.222	9505	6544	1430	5181	0.012%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
5.93	1177	1.8E-03	2.4E+03	192	0.9225	8.4E-05	19	0.215	0.212	35	9.489	9473	6522	1431	5164	0.012%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
5.98	1177	1.8E-03	2.4E+03	189	0.9211	8.4E-05	19	0.215	0.212	36	9.756	9441	6500	1432	5148	0.013%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
6.03	1177	1.8E-03	2.4E+03	186	0.9196	8.5E-05	19	0.216	0.213	37	10.023	9410	6478	1433	5132	0.013%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
6.08	1177	1.8E-03	2.4E+03	184	0.9182	8.5E-05	19	0.216	0.213	38	10.290	9379	6456	1434	5117	0.013%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
6.13	1177	1.8E-03	2.4E+03	181	0.9167	8.6E-05	19	0.216	0.214	39	10.557	9348	6434	1435	5101	0.013%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
6.18	1177	1.8E-03	2.4E+03	178	0.9152	8.6E-05	19	0.217	0.214	40	10.824	9318	6413	1436	5086	0.013%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
6.23	1177	1.8E-03	2.4E+03	175	0.9136	8.7E-05	19	0.217	0.215	41	11.091	9288	6392	1437	5071	0.013%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
6.28	1177	1.8E-03	2.4E+03	173	0.9121	8.7E-05	19	0.218	0.215	42	11.358	9258	6371	1438	5056	0.013%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
6.33	1177	1.8E-03	2.4E+03	170	0.9105	8.8E-05	19	0.218	0.215	43	11.625	9229	6351	1439	5041	0.013%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
6.38	1177	1.8E-03	2.4E+03	167	0.9089	8.8E-05	19	0.218	0.216	44	11.892	9200	6331	1440	5026	0.013%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
6.43	1177	1.8E-03	2.4E+03	165	0.9073	8.9E-05	19	0.219	0.216	45	12.159	9171	6310	1441	5012	0.014%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
6.48	1177	1.7E-03	2.3E+03	162	0.9057	9.4E-05	0	0.219	0.217	46	0.219	9144	6291	1442	9144	0.012%	1.79	1.00	0.01%	0.000031	0.36	0.025	0.785	0.00%	0.0000
6.53	1177	1.7E-03	2.3E+03	160	0.9040	9.5E-05	0	0.219	0.217	47	0.219	9118	6273	1443	9118	0.012%	1.79	1.00	0.01%	0.000032	0.36	0.025	0.785	0.01%	0.0000
6.58	1177	1.7E-03	2.3E+03	157	0.9024	9.5E-05	0	0.220	0.217	48	0.220	9091	6254	1444	9091	0.012%	1.79	1.00	0.01%	0.000033	0.36	0.025	0.785	0.01%	0.0000
6.63	1177	1.7E-03	2.3E+03	155	0.9007	9.6E-05	0	0.220	0.218	49	0.220	9065	6236	1445	9065	0.012%	1.79	1.00	0.01%	0.000035	0.36	0.025	0.785	0.01%	0.0000
6.68	1177	1.7E-03	2.3E+03	153	0.8989	9.6E-05	0	0.221	0.218	50	0.221	9039	6218	1446	9039	0.012%	1.79	1.00	0.01%	0.000036	0.36	0.025	0.785	0.01%	0.0000
6.73	1177	1.7E-03	2.3E+03	150	0.8972	9.7E-05	0	0.221	0.219	51	0.221	9013	6200	1447	9013	0.012%	1.79	1.00	0.01%	0.000037	0.36	0.025	0.785	0.01%	0.0000
6.78	1177	1.7E-03	2.3E+03	148	0.8954	9.7E-05	0	0.221	0.219	52	0.221	8988	6182	1448	8988	0.012%	1.79	1.00	0.01%	0.000038	0.36	0.025	0.785	0.01%	0.0000
6.83	1177	1.7E-03	2.3E+03	146	0.8936	9.8E-05	0	0.222	0.220	53	0.222	8963	6164	1449	8963	0.012%	1.79	1.00	0.01%	0.000040	0.36	0.025	0.785	0.01%	0.0000
6.88	1177	1.7E-03	2.3E+03	144	0.8918	9.8E-05	0	0.222	0.220	54	0.222	8938	6147	1450	8938	0.012%	1.79	1.00	0.01%	0.000041	0.36	0.025	0.785	0.01%	0.0000
6.93	1177	1.7E-03	2.3E+03	141	0.8900	9.8E-05	0	0.222	0.220	55	0.222	8913	6129	1451	8913	0.012%	1.79	1.00	0.01%	0.000042	0.36	0.025	0.785	0.01%	0.0000
6.98	1177	1.7E-03	2.3E+03	139	0.8881	9.9E-05	0	0.223	0.221	56	0.223	8889	6112	1452	8889	0.012%	1.79	1.00	0.01%	0.000043	0.36	0.025	0.785	0.01%	0.0000
7.03	1177	1.7E-03	2.3E+03	137	0.8862	9.9E-05	0	0.223	0.221	57	0.223	8865	6095	1453	8865	0.012%	1.79	1.00	0.01%	0.000045	0.36	0.025	0.785	0.01%	0.0000
7.08	1177	1.7E-03	2.3E+03	135	0.8843	1.0E-04	0	0.223	0.221	58	0.223	8841	6079	1454	8841	0.013%	1.79	1.00	0.01%	0.000046	0.36	0.025	0.785	0.01%	0.0000
7.13	1177	1.7E-03	2.3E+03	133	0.8823	1.0E-04	0	0.224	0.222	59	0.224	8817	6062	1455	8817	0.013%	1.79	1.00	0.01%	0.000047	0.36	0.025	0.785	0.01%	0.0000
7.18	1177	1.7E-03	2.3E+03	131	0.8804	1.0E-04	0	0.224	0.222	60	0.224	8793	6045	1456	8793	0.013%	1.79	1.00	0.01%	0.000048	0.36	0.025	0.785	0.01%	0.0000
7.23	853	1.7E-03	1.2E+03	129	0.8784	1.9E-04	0	0.224	0.223	61	0.224	8770	6029	1457	8770	0.035%	1.79	1.00	0.01%	0.000443	0.36	0.025	0.785	0.07%	0.0001
7.28	853	1.7E-03	1.2E+03	127	0.8764	1.9E-04	0	0.225	0.223	62	0.225	8747	6013	1458	8747	0.035%	1.79	1.00	0.01%	0.000447	0.36	0.025	0.785	0.07%	0.0001
7.33	853	1.7E-03	1.2E+03	126	0.8743	1.9E-04	0	0.225	0.223	63	0.225	8724	5997	1459	8724	0.035%	1.79	1.00	0.01%	0.000451	0.36	0.025	0.785	0.07%	0.0001
7.38	853	1.7E-03	1.2E+03	124	0.8722	1.9E-04	0	0.225	0.224	64	0.225	8701	5981	1460	8701	0.035%	1.79	1.00	0.01%	0.000455	0.36	0.025	0.785	0.07%	0.0001
7.43	853	1.7E-03	1.2E+03	122	0.8702	2.0E-04	0	0.226	0.224	65	0.226	8679	5965	1461	8679	0.036%	1.79	1.00	0.01%	0.000458	0.36	0.025	0.785	0.07%	0.0001
7.48	853	1.7E-03	1.2E+03	120	0.8680	2.0E-04	0	0.226	0.224	66	0.226	8656	5949	1462	8656	0.036%	1.79	1.00	0.01%	0.000462	0.36	0.025	0.785	0.07%	0.0001
7.53	853	1.7E-03	1.2E+03	118	0.8659	2.0E-04	0	0.226	0.225	67	0.226	8634	5934	1463	8634	0.036%	1.79	1.00	0.01%	0.000465	0.36	0.025	0.785	0.07%	0.0001
7.58	853	1.7E-03	1.2E+03	117	0.8637	2.0E-04	0	0.227	0.225	68	0.227	8612	5919	1464	8612	0.036%	1.79	1.00	0.01%	0.000469	0.36	0.025	0.785	0.07%	0.0001
7.63	853	1.7E-03	1.2E+03	115	0.8615	2.0E-04	0	0.227	0.226	69	0.227	8591	5903	1465	8591	0.036%	1.79	1.00	0.01%	0.000472	0.36	0.025	0.785	0.07%	0.0001
7.68	853	1.7E-03	1.2E+03	113	0.8593	2.0E-04	0	0.227	0.226	70	0.227	8569	5888	1466	8569	0.037%	1.79	1.00	0.01%	0.000475	0.36	0.025	0.785	0.07%	0.0001
7.73	853	1.7E-03	1.2E+03	112	0.8570	2.0E-04	0	0.228	0.226	71	0.228	8548	5873	1467	8548	0.037%	1.79	1.00	0.01%	0.000479	0.36	0.025	0.785	0.08%	0.0001
7.78	853	1.7E-03	1.2E+03	110	0.8547	2.0E-04	0	0.228	0.227	72	0.228	8526	5858	1468	8526	0.037%	1.79	1.00	0.01%	0.000482	0.36	0.025	0.785	0.08%	0.0001
7.83	853	1.7E-03	1.2E+03	108	0.8524	2.0E-04	0	0.228	0.227	73	0.228	8505	5844	1469	8505	0.037%	1.79	1.00	0.01%	0.000485	0.36	0.025	0.785	0.08%	0.0001
7.88	853	1.7E-03	1.2E+03	107	0.8501	2.0E-04	0	0.229	0.227	74	0.229	8485	5829	1470	8485	0.037%	1.79	1.00	0.01%	0.000488	0.36	0.025	0.785	0.08%	0.0001
7.93	853	1.7E-03	1.2E+03	105	0.8477	2.0E-04	0	0.229	0.228	75	0.229	8464	5815	1471	8464	0.037%	1.79	1.00	0.01%	0.000491	0.36	0.025	0.785	0.08%	0.0001
7.98	853	1.7E-03	1.2E+03	104	0.8453	2.0E-04	0	0.229	0.228	76	0.229	8444	5800	1472	8444	0.038%	1.79	1.00	0.01%	0.000494	0.36	0.025	0.785	0.08%	0.0001
8.03	853	1.7E-03	1.2E+03	102	0.8429	2.0E-04	0	0.230	0.228	77	0.230	8423	5786	1473	8423	0.038%	1.79	1.00	0.01%	0.000496	0.36	0.025	0.785	0.08%	0.0001
8.08	853	1.7E-03	1.2E+03	101	0.8404	2.0E-04	0	0.230	0.229	78	0.230	8403	5772	1474	8403	0.038%	1.79	1.00	0.01%	0.000499	0.36	0.025	0.785	0.08%	0.0001

12.467	6963.57	171.9	1.533	171.9	1.8	0.79	0.89%	Coarse Tailings	0.054	108.1	0.70	0.000	0.70	0	244	0.90%	1.6	21%	1.53	0.000	1.53
12.631	6963.41	177.1	1.749	177.1	1.9	0.81	0.99%	Coarse Tailings	0.054	108.1	0.71	0.000	0.71	0	248	0.99%	1.6	21%	1.54	0.000	1.54
12.795	6963.24	188.7	1.928	188.7	2.1	0.89	1.02%	Coarse Tailings	0.054	108.1	0.72	0.000	0.72	0	261	1.03%	1.6	21%	1.55	0.000	1.55
12.959	6963.08	214.1	2.066	214.1	1.9	0.81	0.96%	Coarse Tailings	0.054	108.1	0.73	0.000	0.73	0	293	0.97%	1.6	21%	1.56	0.000	1.56
13.123	6962.92	223.6	2.279	223.6	2.0	0.88	1.02%	Coarse Tailings	0.054	108.1	0.74	0.000	0.74	0	302	1.02%	1.6	21%	1.57	0.000	1.57
13.287	6962.75	247.1	2.375	247.1	1.8	0.79	0.96%	Coarse Tailings	0.054	108.1	0.75	0.000	0.75	0	330	0.96%	1.5	21%	1.58	0.000	1.58
13.451	6962.59	254.8	2.530	254.8	1.6	0.71	0.99%	Coarse Tailings	0.054	108.1	0.76	0.000	0.76	0	336	1.00%	1.5	21%	1.59	0.000	1.59
13.615	6962.42	246.9	2.534	246.9	1.8	0.77	1.03%	Coarse Tailings	0.054	108.1	0.76	0.000	0.76	0	322	1.03%	1.6	21%	1.59	0.000	1.59
13.779	6962.26	238.6	2.398	238.6	1.5	0.63	1.01%	Coarse Tailings	0.054	108.1	0.77	0.000	0.77	0	308	1.01%	1.6	21%	1.60	0.000	1.60
13.943	6962.10	226.5	2.107	226.5	1.5	0.63	0.93%	Coarse Tailings	0.054	108.1	0.78	0.000	0.78	0	289	0.93%	1.6	21%	1.61	0.000	1.61
14.107	6961.93	214.2	2.003	214.2	1.5	0.63	0.93%	Coarse Tailings	0.054	108.1	0.79	0.000	0.79	0	270	0.94%	1.6	21%	1.62	0.000	1.62
14.271	6961.77	200.1	1.891	200.1	2.1	0.89	0.95%	Coarse Tailings	0.054	108.1	0.80	0.000	0.80	0	249	0.95%	1.6	21%	1.63	0.000	1.63
14.436	6961.60	192.5	1.806	192.5	2.3	0.98	0.94%	Coarse Tailings	0.054	108.1	0.81	0.000	0.81	0	237	0.94%	1.6	21%	1.64	0.000	1.64
14.600	6961.44	184.8	1.764	184.8	1.6	0.67	0.95%	Coarse Tailings	0.054	108.1	0.82	0.000	0.82	0	225	0.96%	1.6	21%	1.65	0.000	1.65
14.764	6961.28	179.0	1.664	179.0	1.1	0.49	0.93%	Coarse Tailings	0.054	108.1	0.83	0.000	0.83	0	216	0.93%	1.6	21%	1.66	0.000	1.66
14.928	6961.11	176.7	1.460	176.7	1.3	0.55	0.83%	Coarse Tailings	0.054	108.1	0.83	0.000	0.83	0	211	0.83%	1.6	21%	1.67	0.000	1.67
15.092	6960.95	176.2	1.439	176.2	1.2	0.53	0.82%	Coarse Tailings	0.054	108.1	0.84	0.000	0.84	0	208	0.82%	1.6	21%	1.67	0.000	1.67
15.256	6960.78	172.2	1.406	172.2	1.1	0.49	0.82%	Coarse Tailings	0.054	108.1	0.85	0.000	0.85	0	201	0.82%	1.6	21%	1.68	0.000	1.68
15.420	6960.62	168.5	1.435	168.5	1.2	0.51	0.85%	Coarse Tailings	0.054	108.1	0.86	0.000	0.86	0	195	0.86%	1.6	21%	1.69	0.000	1.69
15.584	6960.46	163.4	1.381	163.4	1.1	0.47	0.85%	Coarse Tailings	0.054	108.1	0.87	0.000	0.87	0	187	0.85%	1.7	21%	1.70	0.000	1.70
15.748	6960.29	157.3	1.412	157.3	0.8	0.33	0.90%	Coarse Tailings	0.054	108.1	0.88	0.000	0.88	0	178	0.90%	1.7	21%	1.71	0.000	1.71
15.912	6960.13	157.8	1.527	157.8	0.8	0.36	0.97%	Coarse Tailings	0.054	108.1	0.89	0.000	0.89	0	177	0.97%	1.7	21%	1.72	0.000	1.72
16.076	6959.96	152.3	1.727	152.3	0.8	0.35	1.13%	Coarse Tailings	0.054	108.1	0.90	0.000	0.90	0	169	1.14%	1.8	21%	1.73	0.000	1.73
16.240	6959.80	132.3	1.869	132.3	0.6	0.26	1.41%	Coarse Tailings	0.054	108.1	0.91	0.000	0.91	0	145	1.42%	1.9	21%	1.74	0.000	1.74
16.404	6959.64	141.8	1.704	141.8	0.7	0.30	1.20%	Coarse Tailings	0.054	108.1	0.91	0.000	0.91	0	154	1.21%	1.8	21%	1.74	0.000	1.74
16.568	6959.47	155.5	1.609	155.5	0.8	0.35	1.03%	Coarse Tailings	0.054	108.1	0.92	0.000	0.92	0	167	1.04%	1.8	21%	1.75	0.000	1.75
16.732	6959.31	154.0	1.336	154.0	0.9	0.39	0.87%	Coarse Tailings	0.054	108.1	0.93	0.000	0.93	0	164	0.87%	1.7	21%	1.76	0.000	1.76
16.896	6959.14	148.4	1.184	148.4	0.8	0.36	0.80%	Coarse Tailings	0.054	108.1	0.94	0.000	0.94	0	157	0.80%	1.7	21%	1.77	0.000	1.77
17.060	6958.98	135.6	1.078	135.6	0.8	0.35	0.79%	Coarse Tailings	0.054	108.1	0.95	0.000	0.95	0	142	0.80%	1.7	21%	1.78	0.000	1.78
17.224	6958.82	126.4	0.950	126.4	0.8	0.33	0.75%	Coarse Tailings	0.054	108.1	0.96	0.000	0.96	0	131	0.76%	1.7	21%	1.79	0.000	1.79
17.388	6958.65	119.8	1.008	119.8	0.7	0.29	0.84%	Coarse Tailings	0.054	108.1	0.97	0.000	0.97	0	123	0.85%	1.8	21%	1.80	0.000	1.80
17.552	6958.49	110.9	1.285	110.9	1.6	0.69	1.16%	Coarse Tailings	0.054	108.1	0.98	0.000	0.98	0	113	1.17%	1.9	21%	1.81	0.000	1.81
17.716	6958.32	118.1	1.269	118.1	1.5	0.63	1.07%	Coarse Tailings	0.054	108.1	0.99	0.000	0.99	0	119	1.08%	1.9	21%	1.82	0.000	1.82
17.880	6958.16	121.2	1.323	121.2	1.5	0.65	1.09%	Coarse Tailings	0.054	108.1	0.99	0.000	0.99	0	121	1.10%	1.9	21%	1.82	0.000	1.82
18.044	6958.00	116.3	1.228	116.3	1.4	0.61	1.06%	General Fill	0.057	113.8	1.00	0.000	1.00	0	115	1.07%	1.9	48%	1.83	0.000	1.83
18.208	6957.83	107.6	1.104	107.6	1.2	0.53	1.03%	General Fill	0.057	113.8	1.01	0.000	1.01	0	105	1.04%	1.9	48%	1.84	0.000	1.84
18.372	6957.67	93.3	1.182	93.3	0.7	0.29	1.27%	General Fill	0.057	113.8	1.02	0.000	1.02	0	90	1.28%	2.0	48%	1.85	0.000	1.85
18.537	6957.50	67.8	1.399	67.8	0.8	0.35	2.06%	General Fill	0.057	113.8	1.03	0.000	1.03	0	65	2.09%	2.3	48%	1.86	0.000	1.86
18.701	6957.34	46.5	1.379	46.5	0.7	0.29	2.97%	General Fill	0.057	113.8	1.04	0.000	1.04	0	44	3.04%	2.5	48%	1.87	0.000	1.87
18.865	6957.18	58.5	1.191	58.5	0.8	0.36	2.04%	General Fill	0.057	113.8	1.05	0.000	1.05	0	55	2.07%	2.3	48%	1.88	0.000	1.88
19.029	6957.01	80.6	1.132	80.6	1.2	0.51	1.41%	General Fill	0.057	113.8	1.06	0.000	1.06	0	75	1.42%	2.1	48%	1.89	0.000	1.89
19.193	6956.85	90.3	0.855	90.3	0.6	0.26	0.95%	General Fill	0.057	113.8	1.07	0.000	1.07	0	83	0.96%	2.0	48%	1.90	0.000	1.90
19.357	6956.68	99.8	0.770	99.8	0.9	0.39	0.77%	General Fill	0.057	113.8	1.08	0.000	1.08	0	92	0.78%	1.9	48%	1.91	0.000	1.91
19.521	6956.52	113.2	0.883	113.2	0.7	0.30	0.78%	General Fill	0.057	113.8	1.09	0.000	1.09	0	103	0.79%	1.8	48%	1.92	0.000	1.92
19.685	6956.36	118.4	0.957	118.4	0.7	0.29	0.81%	General Fill	0.057	113.8	1.10	0.000	1.10	0	107	0.82%	1.8	48%	1.93	0.000	1.93
19.849	6956.19	119.3	0.860	119.3	1.0	0.43	0.72%	General Fill	0.057	113.8	1.11	0.000	1.11	0	107	0.73%	1.8	48%	1.94	0.000	1.94
20.013	6956.03	113.5	0.881	113.5	0.7	0.29	0.78%	General Fill	0.057	113.8	1.12	0.000	1.12	0	101	0.78%	1.8	48%	1.95	0.000	1.95
20.177	6955.86	99.2	0.867	99.2	0.8	0.35	0.87%	General Fill	0.057	113.8	1.13	0.000	1.13	0	87	0.88%	1.9	48%	1.96	0.000	1.96
20.341	6955.70	87.3	0.774	87.3	0.4	0.18	0.89%	General Fill	0.057	113.8	1.13	0.000	1.13	0	76	0.90%	2.0	48%	1.96	0.000	1.96
20.505	6955.54	80.4	0.637	80.4	0.4	0.18	0.79%	General Fill	0.057	113.8	1.14	0.000	1.14	0	69	0.80%	2.0	48%	1.97	0.000	1.97
20.669	6955.37	77.8	0.635	77.8	0.4	0.18	0.82%	General Fill	0.057	113.8	1.15	0.000	1.15	0	66	0.83%	2.0	48%	1.98	0.000	1.98
20.833	6955.21	78.7	0.644	78.7	0.9	0.39	0.82%	Coarse Tailings	0.054	108.1	1.16	0.000	1.16	0	67	0.83%	2.0	21%	1.99	0.000	1.99
20.997	6955.04	81.7	0.665	81.7	0.7	0.30	0.81%	Coarse Tailings	0.054	108.1	1.17	0.000	1.17	0	69	0.83%	2.0	21%	2.00	0.000	2.00
21.161	6954.88	84.4	0.673	84.4	0.9	0.39	0.80%	Coarse Tailings	0.054	108.1	1.18	0.000	1.18	0	71	0.81%	2.0	21%	2.01	0.000	2.01
21.325	6954.71	84.5	0.697	84.5	0.5	0.23	0.83%	Coarse Tailings	0.054	108.1	1.19	0.000	1.19	0	70	0.84%	2.0	21%	2.02	0.000	2.02
21.489	6954.55	79.7	0.727	79.7	0.3	0.12	0.91%	Coarse Tailings	0.054	108.1	1.20	0.000	1.20	0	66	0.93%	2.0	21%	2.03	0.000	2.03
21.653	6954.39	70.9	0.684	70.9	0.8	0.35	0.96%	Coarse Tailings	0.054	108.1	1.21	0.000	1.21	0	58	0.98%	2.1	21%	2.04	0.000	2.04
21.817	6954.22	65.1	0.587	65.1	0.4	0.16	0.90%	Coarse Tailings	0.054	108.1	1.22	0.000	1.22	0	53	0.92%	2.1	21%	2.05	0.000	2.05
21.981	6954.06	63.6	0.555	63.6	0.6	0.24	0.87%	Coarse Tailings	0.054	108.1	1.22	0.000	1.22	0	51	0.89%	2.1	21%	2.05	0.000	2.05
22.145	6953.89	62.2	0.623	62.2	0.4	0.16	1.00%	Coarse Tailings	0.054	108.1	1.23	0.000	1.23	0	49	1.02%	2.2	21%	2.06	0.000	2.06
22.309	6953.73	62.3	0.698	62.3	0.2	0.10	1.12%	Coarse Tailings	0.054	108.1	1.24	0.000	1.24	0	49	1.14%	2.2	21%	2.07	0.000	2.07
22.473	6953.57	65.2	0.684	65.2	0.2	0.10	1.05%	Coarse Tailings	0.054	108.1	1.25	0.000	1.25	0	51	1.07%	2.2	21%	2.08	0.000	2.08
22.638	6953.40	65.7	0.667	65.7	0.3	0.14	1.02%	Coarse Tailings	0.054	108.1	1.26	0.000	1.26	0	51	1.03%	2.2	21%	2.09	0.000	2.09
22.802	6953.24	62.8	0.665	62.8	0.1	0.06	1.06%	Coarse Tailings	0.054	108.1	1.27	0.000	1.27	0	49	1.08%	2.2	21%	2.10	0.000	2.10
22.966	6953.07	60.4	0.692	60.4	0.1	0.02	1.15%	Coarse Tailings	0.054	108.1	1.28	0.000	1.28	0	46	1.17%	2.2	21%	2.11	0.000	2.11
23.130	6952.91	64.0	0.653	64.0	0.1	0.04	1.02%	Coarse Tailings	0.054	108.1	1.29	0.000	1.29	0	49	1.04%	2.2	21%	2.12	0.000	2.12
23.294	6952.75	65.5	0.613	65.5	0.4	0.16	0.94%	Coarse Tailings	0.054	108.1	1.30	0.000	1.30	0	50	0.96%	2.1	21%	2.13	0.000	2.13
23.458	6952.58	67.5	0.578	67.5	0.5	0.20	0.86%	Coarse Tailings	0.054	108.1	1.30	0.000	1.30	0	51	0.87%	2.1	21%	2.13	0.000	2.13
23.622	6952.42	68.5	0.607	68.5	0.1	0.06	0.89%	Coarse Tailings	0.054	108.1	1.31	0.000	1.31	0	51	0.90%	2.1	21%	2.14	0.000	2.14
23.786	6952.25	68.5	0.554	68.5	0.2	0.08	0.81%	Coarse Tailings	0.054	108.1	1.32	0.000	1.32	0	51	0.83%	2.1	21%	2.15	0.000	2.15
23.950	6952.09	68.7	0.540	68.7	0.4	0.16	0.79%	Coarse Tailings	0.054	108.1	1.33	0.000	1.33	0	51	0.80%	2.1	21%	2.16	0.000	2.16
24.114	6951.93	66.6	0.509	66.6	1.0	0.45	0.76%	Coarse Tailings	0.054	108.1	1.34	0.000	1.34	0	49	0.78%	2.1	21%	2.17	0.000	2.17
24.278	6951.76	67.3	0.501	67.3	0.8	0.35	0.74%	Coarse Tailings	0.054	108.1	1.35	0.000	1.35	0	49	0.76%	2.1	21%	2.18	0.000	2.18
24.442	6951.60	67.6	0.479	67.6	0.9	0.39	0.71%	Coarse Tailings	0.054	108.1	1.36	0.000	1.36	0	49	0.72%	2.1	21%	2.19	0.000	2.19
24.606	6951.43	69.7	0.468	69.7	0.7	0.30	0.67%	Coarse Tailings	0.054	108.1	1.37	0.000	1.37	0	50	0.69%	2.1	21%	2.20	0.000	2.20
24.770	6951.27	73.4	0.534	73.4	0.8	0.35	0.73%	Coarse Tailings	0.054	108.1	1.37	0.000	1.37	0	52	0.74%	2.1	21%	2.21	0.000	2.21
24.934	6951.11	67.6	0.558	67.6	0.8	0.33	0.83%	Coarse Tailings	0.054	108.1	1.38	0.000	1.38	0	48	0.84%	2.1	21%	2.21	0.000	2.21
25.098	6950.94	51.9	0.730	51.9	0.8	0.33	1.41%	Coarse Tailings	0.054	108.1	1.39	0.000	1.39	0	36	1.45%	2.4	21%	2.22	0.000	2.22
25.262	6950.78	33.5	0.875	33.5	0.7	0.30	2.61%	Coarse Tailings	0.054	108.1	1.40	0.000	1.40	0	23	2.72%	2.7	21%	2.23	0.000	2.23
25.426	6950.61	21.0	0.814	21.0	0.3	0.12	3.87%	Coarse Tailings	0.054	108.1	1.41	0.000	1.41	0	14	4.15%	3.0	21%	2.24	0.000	2.24
25.590	6950.45	14.9	0.530	14.9	0.9	0.41	3.57%	Coarse Tailings	0.054	108.1	1.42	0.000	1.42	0	9	3.94%	3.1	21%	2.25	0.000	2.25
25.754	6950.29	13.7	0.284	13.7	1.5	0.65	2.07%	Coarse Tailings	0.054	108.1	1.43	0.000	1.43	0	9	2.31%	3.0	21%	2.26	0.000	2.26
25.918	6950.12	13.1	0.160	13.1	1.6	0.69	1.22%	Coarse Tailings	0.054	108.1	1.44	0.000	1.44	0	8	1.37%	2.9	21%	2.27	0.000	2.27
26.082	6949.96	12.9	0.169	12.9	1.7	0.73	1.31%	Coarse Tailings	0.054	108.1	1.45	0.000	1.45	0	8	1.48%	2.9	21%	2.28	0.000	2.28
26.246	6949.79	13.2	0.194	13.2	1.9	0.83	1.47%	Coarse Tailings	0.054	108.1	1.45	0.000	1.45	0	8	1.65%	2.9	21%	2.28	0.000	2.28
26.410	6949.63	13.5	0.250	13.5	2.5	1.08	1.86%	Fine Tailings	0.054	107.6	1.46	0.003	1.46	1	8	2.08%	3.0	83%	2.29	0.003	2.29
26.574	6949.47	15.1	0.321	15.0	6.5	2.83	2.13%	Fine Tailings	0.054	107.6	1.47	0.009	1.46	1	9	2.36%	3.0	83%	2.30	0.009	2.29
26.739	6949.30	15.7	0.328	15.6	8.2	3.56	2.09%	Fine Tailings	0.054	107.6	1.48	0.014	1.47	1	10	2.31%	2.9	83%	2.31	0.014	2.30

8.13	853	1.7E-03	1.2E+03	99	0.8380	2.0E-04	0	0.230	0.229	79	0.230	8383	5758	1475	8383	0.038%	1.79	1.00	0.01%	0.000502	0.36	0.025	0.785	0.08%	0.0001
8.18	853	1.7E-03	1.2E+03	98	0.8355	2.1E-04	0	0.230	0.230	80	0.230	8363	5744	1476	8363	0.038%	1.79	1.00	0.01%	0.000504	0.36	0.025	0.785	0.08%	0.0001
8.23	853	1.7E-03	1.2E+03	97	0.8329	2.1E-04	0	0.231	0.230	81	0.231	8344	5730	1477	8344	0.038%	1.79	1.00	0.01%	0.000506	0.36	0.025	0.785	0.08%	0.0001
8.28	853	1.7E-03	1.2E+03	95	0.8303	2.1E-04	0	0.231	0.230	82	0.231	8324	5717	1478	8324	0.038%	1.79	1.00	0.01%	0.000509	0.36	0.025	0.785	0.08%	0.0001
8.33	853	1.7E-03	1.2E+03	94	0.8278	2.1E-04	0	0.231	0.231	83	0.231	8305	5703	1479	8305	0.039%	1.79	1.00	0.01%	0.000511	0.36	0.025	0.785	0.08%	0.0001
8.38	853	1.7E-03	1.2E+03	93	0.8251	2.1E-04	0	0.232	0.231	84	0.232	8286	5690	1480	8286	0.039%	1.79	1.00	0.01%	0.000513	0.36	0.025	0.785	0.08%	0.0001
8.43	853	1.7E-03	1.2E+03	91	0.8225	2.1E-04	0	0.232	0.231	85	0.232	8267	5676	1481	8267	0.039%	1.79	1.00	0.01%	0.000515	0.36	0.025	0.785	0.08%	0.0001
8.48	853	1.7E-03	1.2E+03	90	0.8198	2.1E-04	0	0.232	0.232	86	0.232	8248	5663	1482	8248	0.039%	1.79	1.00	0.01%	0.000517	0.36	0.025	0.785	0.08%	0.0001
8.53	853	1.7E-03	1.2E+03	89	0.8171	2.1E-04	0	0.233	0.232	87	0.233	8229	5650	1483	8229	0.039%	1.79	1.00	0.01%	0.000519	0.36	0.025	0.785	0.08%	0.0001
8.58	853	1.7E-03	1.2E+03	88	0.8143	2.1E-04	0	0.233	0.232	88	0.233	8210	5637	1484	8210	0.039%	1.79	1.00	0.01%	0.000521	0.36	0.025	0.785	0.08%	0.0001
8.63	853	1.7E-03	1.2E+03	86	0.8116	2.1E-04	0	0.233	0.233	89	0.233	8192	5624	1485	8192	0.039%	1.79	1.00	0.01%	0.000522	0.36	0.025	0.785	0.08%	0.0001
8.68	853	1.7E-03	1.2E+03	85	0.8088	2.1E-04	0	0.233	0.233	90	0.233	8174	5611	1486	8174	0.039%	1.79	1.00	0.01%	0.000524	0.36	0.025	0.785	0.08%	0.0001
8.73	853	1.7E-03	1.2E+03	84	0.8059	2.1E-04	0	0.234	0.233	91	0.234	8155	5599	1487	8155	0.039%	1.79	1.00	0.01%	0.000526	0.36	0.025	0.785	0.08%	0.0001
8.78	809	1.7E-03	1.1E+03	83	0.8031	2.3E-04	0	0.234	0.234	92	0.234	8137	5586	1488	8137	0.049%	1.79	1.00	0.01%	0.000700	0.36	0.025	0.785	0.11%	0.0002
8.83	809	1.7E-03	1.1E+03	82	0.8002	2.4E-04	0	0.234	0.234	93	0.234	8119	5573	1489	8119	0.049%	1.79	1.00	0.01%	0.000701	0.36	0.025	0.785	0.11%	0.0002
8.88	809	1.7E-03	1.1E+03	81	0.7973	2.4E-04	0	0.235	0.234	94	0.235	8102	5561	1490	8102	0.049%	1.79	1.00	0.01%	0.000703	0.36	0.025	0.785	0.11%	0.0002
8.93	809	1.7E-03	1.1E+03	80	0.7943	2.4E-04	0	0.235	0.235	95	0.235	8084	5549	1491	8084	0.049%	1.79	1.00	0.01%	0.000704	0.36	0.025	0.785	0.11%	0.0002
8.98	809	1.7E-03	1.1E+03	79	0.7913	2.4E-04	0	0.235	0.235	96	0.235	8067	5536	1492	8067	0.049%	1.79	1.00	0.01%	0.000705	0.36	0.025	0.785	0.11%	0.0002
9.03	809	1.7E-03	1.1E+03	77	0.7883	2.4E-04	0	0.235	0.235	97	0.235	8049	5524	1493	8049	0.049%	1.79	1.00	0.01%	0.000706	0.36	0.025	0.785	0.11%	0.0002
9.08	809	1.7E-03	1.1E+03	76	0.7853	2.4E-04	0	0.236	0.236	98	0.236	8032	5512	1494	8032	0.050%	1.79	1.00	0.01%	0.000707	0.36	0.025	0.785	0.11%	0.0002
9.13	809	1.7E-03	1.1E+03	75	0.7822	2.4E-04	0	0.236	0.236	99	0.236	8015	5500	1495	8015	0.050%	1.79	1.00	0.01%	0.000708	0.36	0.025	0.785	0.11%	0.0002
9.18	809	1.7E-03	1.1E+03	74	0.7791	2.4E-04	0	0.236	0.236	100	0.236	7998	5488	1496	7998	0.050%	1.79	1.00	0.01%	0.000708	0.36	0.025	0.785	0.11%	0.0002
9.23	809	1.7E-03	1.1E+03	73	0.7760	2.4E-04	0	0.237	0.237	101	0.237	7981	5477	1497	7981	0.050%	1.79	1.00	0.01%	0.000709	0.36	0.025	0.785	0.11%	0.0002
9.28	809	1.7E-03	1.1E+03	72	0.7728	2.4E-04	0	0.237	0.237	102	0.237	7964	5465	1498	7964	0.050%	1.79	1.00	0.01%	0.000709	0.36	0.025	0.785	0.11%	0.0002
9.33	809	1.7E-03	1.1E+03	72	0.7696	2.4E-04	0	0.237	0.237	103	0.237	7948	5453	1499	7948	0.050%	1.79	1.00	0.01%	0.000709	0.36	0.025	0.785	0.11%	0.0002
9.38	809	1.7E-03	1.1E+03	71	0.7664	2.4E-04	0	0.237	0.238	104	0.237	7931	5442	1500	7931	0.050%	1.79	1.00	0.01%	0.000709	0.36	0.025	0.785	0.11%	0.0002
9.43	809	1.7E-03	1.1E+03	70	0.7632	2.4E-04	0	0.238	0.238	105	0.238	7915	5430	1501	7915	0.050%	1.79	1.00	0.01%	0.000709	0.36	0.025	0.785	0.11%	0.0002
9.48	809	1.7E-03	1.1E+03	69	0.7599	2.4E-04	0	0.238	0.238	106	0.238	7899	5419	1502	7899	0.050%	1.79	1.00	0.01%	0.000709	0.36	0.025	0.785	0.11%	0.0002
9.53	809	1.7E-03	1.1E+03	68	0.7566	2.4E-04	0	0.238	0.239	107	0.238	7882	5408	1503	7882	0.050%	1.79	1.00	0.01%	0.000708	0.36	0.025	0.785	0.11%	0.0002
9.58	809	1.7E-03	1.1E+03	67	0.7532	2.4E-04	0	0.239	0.239	108	0.239	7866	5396	1504	7866	0.050%	1.79	1.00	0.01%	0.000708	0.36	0.025	0.785	0.11%	0.0002
9.63	809	1.7E-03	1.1E+03	66	0.7499	2.4E-04	0	0.239	0.239	109	0.239	7850	5385	1505	7850	0.049%	1.79	1.00	0.01%	0.000707	0.36	0.025	0.785	0.11%	0.0002
9.68	809	1.7E-03	1.1E+03	65	0.7465	2.4E-04	0	0.239	0.239	110	0.239	7835	5374	1506	7835	0.049%	1.79	1.00	0.01%	0.000706	0.36	0.025	0.785	0.11%	0.0002
9.73	809	1.7E-03	1.1E+03	64	0.7430	2.4E-04	0	0.239	0.240	111	0.239	7819	5363	1507	7819	0.049%	1.79	1.00	0.01%	0.000705	0.36	0.025	0.785	0.11%	0.0002
9.78	809	1.7E-03	1.1E+03	64	0.7396	2.4E-04	0	0.240	0.240	112	0.240	7803	5352	1508	7803	0.049%	1.79	1.00	0.01%	0.000704	0.36	0.025	0.785	0.11%	0.0002
9.83	809	1.8E-03	1.2E+03	63	0.7361	2.3E-04	19	0.240	0.240	113	30.310	7787	5341	1509	4319	0.060%	1.70	0.75	0.02%	0.004775	0.34	0.079	0.797	0.76%	0.0012
9.88	809	1.8E-03	1.2E+03	62	0.7326	2.3E-04	19	0.240	0.241	114	30.577	7771	5329	1510	4311	0.060%	1.70	0.75	0.02%	0.004770	0.34	0.079	0.797	0.76%	0.0012
9.93	809	1.8E-03	1.2E+03	61	0.7291	2.3E-04	19	0.240	0.241	115	30.843	7755	5318	1511	4303	0.059%	1.70	0.75	0.02%	0.004763	0.34	0.079	0.797	0.76%	0.0012
9.98	809	1.8E-03	1.2E+03	61	0.7255	2.3E-04	19	0.241	0.241	116	31.110	7739	5307	1512	4295	0.059%	1.70	0.75	0.02%	0.004756	0.34	0.079	0.797	0.76%	0.0012
10.03	809	1.8E-03	1.2E+03	60	0.7219	2.3E-04	19	0.241	0.242	117	31.377	7723	5296	1513	4287	0.059%	1.70	0.75	0.02%	0.004747	0.34	0.079	0.797	0.76%	0.0012
10.08	809	1.8E-03	1.2E+03	59	0.7183	2.3E-04	19	0.241	0.242	118	31.644	7707	5285	1514	4279	0.059%	1.70	0.75	0.02%	0.004738	0.34	0.079	0.797	0.76%	0.0012
10.13	809	1.8E-03	1.2E+03	58	0.7146	2.3E-04	19	0.242	0.242	119	31.911	7692	5274	1515	4272	0.059%	1.70	0.75	0.02%	0.004728	0.34	0.079	0.797	0.75%	0.0012
10.18	809	1.8E-03	1.2E+03	58	0.7109	2.3E-04	19	0.242	0.243	120	32.178	7676	5263	1516	4264	0.059%	1.70	0.75	0.02%	0.004717	0.34	0.079	0.797	0.75%	0.0012
10.23	809	1.8E-03	1.2E+03	57	0.7072	2.3E-04	19	0.242	0.243	121	32.445	7661	5252	1517	4256	0.059%	1.70	0.75	0.02%	0.004705	0.34	0.079	0.797	0.75%	0.0012
10.28	761	1.8E-03	1.0E+03	56	0.7035	2.6E-04	19	0.242	0.243	122	32.712	7645	5242	1518	4249	0.075%	1.70	0.75	0.02%	0.006119	0.34	0.079	0.797	0.98%	0.0016
10.33	761	1.8E-03	1.0E+03	56	0.6997	2.6E-04	19	0.243	0.244	123	32.979	7630	5231	1519	4241	0.075%	1.70	0.75	0.02%	0.006101	0.34	0.079	0.797	0.97%	0.0016
10.38	761	1.8E-03	1.0E+03	55	0.6959	2.6E-04	19	0.243	0.244	124	33.246	7615	5221	1520	4234	0.075%	1.70	0.75	0.02%	0.006082	0.34	0.079	0.797	0.97%	0.0016
10.43	761	1.8E-03	1.0E+03	54	0.6921	2.6E-04	19	0.243	0.244	125	33.512	7600	5210	1521	4226	0.074%	1.70	0.75	0.02%	0.006063	0.34	0.079	0.797	0.97%	0.0016
10.48	761	1.8E-03	1.0E+03	54	0.6883	2.6E-04	19	0.243	0.245	126	33.779	7585	5200	1522	4219	0.074%	1.70	0.75	0.02%	0.006042	0.34	0.079	0.797	0.96%	0.0016
10.53	761	1.8E-03	1.0E+03	53	0.6844	2.6E-04	19	0.244	0.245	127	34.046	7570	5189	1523	4212	0.074%	1.70	0.75	0.02%	0.006020	0.34	0.079	0.797	0.96%	0.0016
10.58	761	1.8E-03	1.0E+03	52	0.6805	2.6E-04	19	0.244	0.245	128	34.313	7556	5179	1524	4204	0.074%	1.70	0.75	0.02%	0.005997	0.34	0.079	0.797	0.96%	0.0016
10.63	761	1.8E-03	1.0E+03	52	0.6766	2.6E-04	19	0.244	0.245	129	34.580	7541	5169	1525	4197	0.073%	1.70	0.75	0.02%	0.005973	0.34	0.079	0.797	0.95%	0.0016
10.68	761	1.7E-03	9.7E+02	51	0.6726	2.7E-04	0	0.245	0.246	130	0.245	7527	5159	1526	7527	0.062%	1.79	1.00	0.01%	0.000922	0.36	0.025	0.785	0.14%	0.0002
10.73	761	1.7E-03	9.7E+02	51	0.6687	2.7E-04	0	0.245	0.246	131	0.245	7514	5150	1527	7514	0.061%	1.79	1.00	0.01%	0.000916	0.36	0.025	0.785	0.14%	0.0002
10.78	761	1.7E-03	9.7E+02	50	0.6647	2.7E-04	0	0.245	0.246	132	0.245	7500	5140	1528	7500	0.061%	1.79	1.00	0.01%	0.000910	0.36	0.025	0.785	0.14%	0.0002
10.83	761	1.7E-03	9.7E+02	49	0.6607	2.7E-04	0	0.245	0.247	133	0.245	7486	5131	1529	7486	0.061%	1.79	1.00	0.01%	0.000904	0.36	0.025	0.785	0.14%	0.0002
10.88	761	1.7E-03	9.7E+02	49	0.6566	2.7E-04	0	0.246	0.247	134	0.246	7473	5121	1530	7473	0.060%	1.79	1.00	0.01%	0.000898	0.36	0.025	0.785	0.14%	0.0002
10.93	761	1.7E-03	9.7E+02	48	0.6526	2.7E-04	0	0.246	0.247	135	0.246	7460	5112	1531	7460	0.060%	1.79	1.00	0.01%	0.000891	0.36	0.025	0.785	0.14%	0.0002
10.98	761	1.7E-03	9.7E+02	48	0.6485	2.7E-04	0	0.246	0.247	136	0.246	7446	5103	1532	7446	0.059%	1.79	1.00	0.01%	0.000885	0.36	0.025	0.785	0.14%	0.0002
11.03	761	1.7E-03	9.7E+02	47	0.6444	2.7E-04	0	0.246	0.248	137	0.246	7433	5094	1533	7433	0.059%	1.79	1.00	0.01%	0.000878	0.36	0.025	0.785	0.14%	0.0002
11.08	761	1.7E-03	9.7E+02	47	0.6402	2.6E-04	0	0.247	0.248	138	0.247	7420	5084	1534	7420	0.059%	1.79	1.00	0.01%	0.000871	0.36	0.025	0.785	0.14%	0.0002
11.13	761	1.7E-03	9.7E+02	46	0.6361	2.6E-04	0	0.247	0.248	139	0.247	7407	5075	1535	7407	0.058%	1.79	1.00	0.01%	0.000864	0.36	0.025	0.785	0.14%	0.0002
11.18	761	1.7E-03	9.7E+02	46	0.6319	2.6E-04	0	0.247	0.249	140	0.247	7394	5066	1536	7394	0.058%	1.79	1.00	0.01%	0.000857	0.36	0.025	0.785	0.13%	0.0002
11.23	761	1.7E-03	9.7E+02	45	0.6277	2.6E-04	0	0.247	0.249	141	0.247	7381	5057	1537	7381	0.057%	1.79	1.00	0.01%	0.000849	0.36	0.025	0.785	0.13%	0.0002
11.28	761	1.7E-03	9.7E+02	45	0.6235	2.6E-04	0	0.247	0.249	142	0.247	7368	5048	1538	7368	0.057%	1.79	1.00	0.01%	0.000842	0.36	0.025	0.785	0.13%	0.0002
11.33	761	1.7E-03	9.7E+02	44	0.6193	2.6E-04	0	0.248	0.249	143	0.248	7356	5039	1539	7356	0.057%	1.79	1.00	0.01%	0.000834	0.36	0.025	0.785	0.13%	0.0002
11.38	761	1.7E-03	9.7E+02	44	0.6150	2.6E-04	0	0.248	0.250	144	0.248	7343	5031	1540	7343	0.056%	1.79	1.00	0.01%	0.000827	0.36	0.025	0.785	0.13%	0.0002
11.43	761	1.7E-03	9.7E+02	43	0.6108	2.6E-04	0	0.248	0.250	145	0.248	7330	5022	1541	7330	0.056%	1.79	1.00	0.01%	0.000819	0.36	0.025	0.785	0.13%	0.0002
11.48	761	1.7E-03	9.7E+02	43	0.6065	2.6E-04	0	0.248	0.250	146	0.248	7318	5013	1542	7318	0.055%	1.79	1.00	0.01%	0.000811	0.36	0.025	0.785	0.13%	0.0002
11.53	761	1.7E-03	9.7E+02	42	0.6022	2.6E-04	0	0.249	0.251	147	0.249	7305	5004	1543	7305	0.055%	1.79	1.00	0.01%	0.000803	0.36	0.025	0.785	0.13%	0.0002
11.58	761	1.7E-03	9.7E+02	42	0.5978	2.6E-04	0	0.249	0.251	148	0.249	7293	4996	1544	7293	0.054%	1.79	1.00	0.01%	0.000795	0.36	0.025	0.785	0.12%	0.0002
11.63	761	1.7E-03	9.7E+02	41	0.5935	2.6E-04	0	0.249	0.251	149	0.249	7281	4987	1545	7281	0.054%	1.79	1.00	0.01%	0.000787	0.36	0.025	0.785	0.12%	0.0002
11.68	761	1.7E-03	9.7E+02	41	0.5891	2.6E-04	0	0.249	0.251	150	0.249	7269	4979	1546	7269	0.053%	1.79	1.00	0.01%	0.000778	0.36	0.025	0.785	0.12%	0.0002
11.73	761	1.7E-03	9.7E+02	41	0.5848	2.6E-04	0	0.250	0.252	151	0.250	7256	4970	1547	7256	0.053%	1.79	1.00	0.01%	0.000770	0.36	0.025	0.785	0.12%	0.0002
11.78	761	1.7E-03	9.7E+02	40	0.5804	2.5E-04	0	0.250	0.252	152	0.250	7244	4962	1548	7244	0.053%	1.79	1.00	0.01%	0.000762	0.36	0.025	0.785	0.12%	0.0002
11.83	594	1.7E-03	5.9E+02	40	0.5760	4.2E-04	0	0.250	0.252	153	0.250	7232	4953	1549	7232	0.203%	1.79	1.00	0.01%	0.003446	0.36	0.025	0.785	0.54%	0.0009
11.88	594	1.7E-03	5.9E+02	39	0.5716	4.1E-04	0	0.250	0.252	154	0.250	7220	4945	1550	7220	0.199%	1.79	1.00	0.01%	0.003387	0.36	0.025	0.785	0.53%	0.0009
11.93	594	1.7E-03	5.9E+02	39	0.5671	4.1E-04	0	0.251	0.253	155	0.251	7209	4937	1551	7209	0.196%	1.79	1.00	0.01%	0.003329	0.36	0.025	0.785	0.52%	0.0009
11.98	594	1.7E-03	5.9E+02	39	0.5627	4.1E-04	0	0.251	0.253	156	0.251	7197	4928	1552	7197	0.193%	1.79	1.00	0.01%	0.003270	0.36	0.025	0.785	0.51%	0.0008
12.03	594	1.7E-03	5.9E+02	38	0.5583	4.1E-04	0	0.251	0.253	157	0.251	7185	4920	1553	7185	0.189%	1.79	1.00	0.01%	0.003212	0.36	0.025	0.785	0.50%	0.0008
12.08	594	1.7E-03	5.9E+02	38	0.5538	4.1E-04	0	0.251	0.253	158	0.251	7173	4912	1554	7173	0.186%	1.79	1.00	0.01%	0.003154	0.36	0.025	0.785	0.50%	0.0008
12.13	594	1.7E-03	5.9E+02	38	0.5493	4.1E-04	0	0.251	0.254	159	0.251	7162	4904	1555	7162	0.183%	1.79	1.00	0.01%	0.003096	0.36	0.025	0.785	0.49%	0.0008
12.18	594	1.7E-03	5.9E+02	37	0.5448	4.1E-04	0	0.252	0.254	160	0.252	7150	4896	1556	7150	0.180%	1.79	1.00	0.01%	0.003038	0.36	0.025	0.785	0.48%	0.0008
12.23	594	1.7E-03	5.9E+02	37	0.5403	4.0E-04	0	0.252	0.254	161	0.252	7139	4888	1557	7139	0.177%	1.79	1.00	0.01%	0.002981	0.36	0.025	0.785	0.47%	0.0008
12.28	594	1.7E-03	5.9E+02	36	0.5358	4.0E-04	0	0.252	0.255	162	0.252	7127	4880	1558	7127	0.173%	1.79	1.00	0.01%	0.002924	0.36	0.025	0.785	0.46%	0.0008
12.33	594	1.7E-03	5.9E+02	36	0.5313	4.0E-04	0	0.252	0.255	163	0.252	7116	4872	1559	7116	0.170%	1.79	1.00	0.01%	0.002868	0.36	0.025	0.785	0.45%	0.0007
12.38	594	1.7E-03	5.9E+02	36	0.5268	4.0E-04	43	0.253	0.255	164	164.000	7109	4867	1560	1560	0.074%	0.90	0.75	0.06%	0.001179	0.25	0.323	0.851	0.20%	0.0003
12.43	594	1.7E-03	5.9E+02	35	0.5223	4.0E-04	43	0.253	0.255	165	165.000	7104	4864	1561	1561	0.074%	0.90	0.75	0.06%	0.001145	0.25	0.323	0.851	0.19%	0.0003
12.48	594	1.7E-03	5.9E+02	35	0.5178	4.0E-04	43	0.253	0.255	166	166.000	7100	4861	1562	1562	0.073%	0.90	0.75	0.06%	0.001111	0.25	0.323	0.851	0.19%	0.0003

26.903	6949.14	13.4	0.287	13.3	14.4	6.24	2.14%	Fine Tailings	0.054	107.6	1.49	0.019	1.47	1	8	2.41%	3.0	83%	2.32	0.019	2.30
27.067	6948.97	12.1	0.242	12.0	14.3	6.20	2.01%	Fine Tailings	0.054	107.6	1.50	0.024	1.47	1	7	2.29%	3.1	83%	2.33	0.024	2.31
27.231	6948.81	12.3	0.235	12.2	15.7	6.79	1.92%	Fine Tailings	0.054	107.6	1.51	0.029	1.48	1	7	2.18%	3.0	83%	2.34	0.029	2.31
27.395	6948.65	12.9	0.282	12.8	18.8	8.13	2.18%	Fine Tailings	0.054	107.6	1.52	0.034	1.48	1	8	2.47%	3.0	83%	2.35	0.034	2.31
27.559	6948.48	13.0	0.314	12.9	19.3	8.36	2.42%	Fine Tailings	0.054	107.6	1.53	0.039	1.49	1	8	2.74%	3.1	83%	2.36	0.039	2.32
27.723	6948.32	11.5	0.282	11.4	19.8	8.58	2.46%	Fine Tailings	0.054	107.6	1.53	0.044	1.49	1	7	2.84%	3.1	83%	2.36	0.044	2.32
27.887	6948.15	11.4	0.219	11.3	20.6	8.93	1.92%	Fine Tailings	0.054	107.6	1.54	0.050	1.49	1	7	2.22%	3.1	83%	2.37	0.050	2.32
28.051	6947.99	10.9	0.198	10.8	21.4	9.25	1.82%	Fine Tailings	0.054	107.6	1.55	0.055	1.50	1	6	2.12%	3.1	83%	2.38	0.055	2.33
28.215	6947.83	10.5	0.189	10.3	22.1	9.56	1.81%	Fine Tailings	0.054	107.6	1.56	0.060	1.50	1	6	2.12%	3.1	83%	2.39	0.060	2.33
28.379	6947.66	10.0	0.193	9.9	22.6	9.78	1.93%	Fine Tailings	0.054	107.6	1.57	0.065	1.50	1	6	2.28%	3.1	83%	2.40	0.065	2.33
28.543	6947.50	10.3	0.200	10.1	23.1	10.01	1.95%	Fine Tailings	0.054	107.6	1.58	0.070	1.51	1	6	2.30%	3.1	83%	2.41	0.070	2.34
28.707	6947.33	10.5	0.214	10.3	24.2	10.50	2.04%	Fine Tailings	0.054	107.6	1.59	0.075	1.51	1	6	2.41%	3.1	83%	2.42	0.075	2.34
28.871	6947.17	11.2	0.187	11.0	24.5	10.62	1.67%	Fine Tailings	0.054	107.6	1.60	0.080	1.52	1	6	1.95%	3.1	83%	2.43	0.080	2.35
29.035	6947.00	10.7	0.180	10.6	26.0	11.25	1.68%	Fine Tailings	0.054	107.6	1.60	0.085	1.52	1	6	1.97%	3.1	83%	2.43	0.085	2.35
29.199	6946.84	10.1	0.196	9.9	26.4	11.45	1.94%	Fine Tailings	0.054	107.6	1.61	0.090	1.52	1	6	2.31%	3.2	83%	2.44	0.090	2.35
29.363	6946.68	10.6	0.258	10.5	27.5	11.90	2.43%	Fine Tailings	0.054	107.6	1.62	0.096	1.53	1	6	2.87%	3.2	83%	2.45	0.096	2.36
29.527	6946.51	14.1	0.293	13.9	27.8	12.06	2.08%	Fine Tailings	0.054	107.6	1.63	0.101	1.53	1	8	2.36%	3.0	83%	2.46	0.101	2.36
29.691	6946.35	10.8	0.347	10.6	27.8	12.04	3.23%	Fine Tailings	0.054	107.6	1.64	0.106	1.53	1	6	3.81%	3.2	83%	2.47	0.106	2.36
29.855	6946.18	14.4	0.429	14.2	30.4	13.18	2.98%	Fine Tailings	0.054	107.6	1.65	0.111	1.54	1	8	3.36%	3.1	83%	2.48	0.111	2.37
30.019	6946.02	15.7	0.393	15.6	31.8	13.77	2.50%	Fine Tailings	0.054	107.6	1.66	0.116	1.54	1	9	2.79%	3.0	83%	2.49	0.116	2.37
30.183	6945.86	11.7	0.400	11.5	31.3	13.54	3.43%	Fine Tailings	0.054	107.6	1.67	0.121	1.55	1	6	4.00%	3.2	83%	2.50	0.121	2.38
30.347	6945.69	10.7	0.406	10.5	38.2	16.55	3.80%	Fine Tailings	0.054	107.6	1.68	0.126	1.55	1	6	4.50%	3.3	83%	2.51	0.126	2.38
30.511	6945.53	10.1	0.309	9.8	41.9	18.16	3.06%	Fine Tailings	0.054	107.6	1.68	0.131	1.55	1	5	3.68%	3.3	83%	2.51	0.131	2.38
30.675	6945.36	9.8	0.235	9.6	42.4	18.36	2.39%	Fine Tailings	0.054	107.6	1.69	0.137	1.56	1	5	2.89%	3.2	83%	2.52	0.137	2.39
30.840	6945.20	9.7	0.240	9.4	45.6	19.76	2.47%	Fine Tailings	0.054	107.6	1.70	0.142	1.56	1	5	3.00%	3.2	83%	2.53	0.142	2.39
31.004	6945.04	9.4	0.231	9.1	47.8	20.70	2.46%	Fine Tailings	0.054	107.6	1.71	0.000	1.71	0	4	3.00%	3.3	83%	2.54	0.000	2.54
31.168	6944.87	10.6	0.274	10.3	51.4	22.27	2.59%	Coarse Tailings	0.054	108.1	1.72	0.000	1.72	0	5	3.09%	3.2	21%	2.55	0.000	2.55
31.332	6944.71	13.9	0.381	13.6	56.1	24.30	2.74%	Coarse Tailings	0.054	108.1	1.73	0.000	1.73	0	7	3.12%	3.1	21%	2.56	0.000	2.56
31.496	6944.54	37.6	0.447	37.3	57.6	24.97	1.19%	Coarse Tailings	0.054	108.1	1.74	0.000	1.74	0	21	1.24%	2.5	21%	2.57	0.000	2.57
31.660	6944.38	40.9	0.592	40.8	21.0	9.09	1.45%	Coarse Tailings	0.054	108.1	1.75	0.000	1.75	0	22	1.51%	2.5	21%	2.58	0.000	2.58
31.824	6944.22	51.5	0.738	51.4	15.0	6.49	1.43%	Coarse Tailings	0.054	108.1	1.76	0.000	1.76	0	28	1.48%	2.5	21%	2.59	0.000	2.59
31.988	6944.05	46.1	0.915	46.0	13.3	5.78	1.98%	Coarse Tailings	0.054	108.1	1.76	0.000	1.76	0	25	2.06%	2.6	21%	2.59	0.000	2.59
32.152	6943.89	46.6	1.079	46.5	12.5	5.41	2.32%	Coarse Tailings	0.054	108.1	1.77	0.000	1.77	0	25	2.41%	2.6	21%	2.60	0.000	2.60
32.316	6943.72	39.5	1.239	39.5	11.8	5.10	3.13%	Coarse Tailings	0.054	108.1	1.78	0.000	1.78	0	21	3.28%	2.8	21%	2.61	0.000	2.61
32.480	6943.56	25.6	1.078	25.6	11.2	4.84	4.21%	Coarse Tailings	0.054	108.1	1.79	0.000	1.79	0	13	4.52%	3.0	21%	2.62	0.000	2.62
32.644	6943.40	16.2	0.633	16.1	11.0	4.78	3.91%	Fine Tailings	0.054	107.6	1.80	0.004	1.79	1	8	4.40%	3.2	83%	2.63	0.004	2.63
32.808	6943.23	11.5	0.409	11.4	19.1	8.28	3.57%	Fine Tailings	0.054	107.6	1.81	0.010	1.80	1	5	4.23%	3.3	83%	2.64	0.010	2.63
32.972	6943.07	11.0	0.260	10.8	22.6	9.80	2.37%	Fine Tailings	0.054	107.6	1.82	0.015	1.80	1	5	2.84%	3.2	83%	2.65	0.015	2.63
33.136	6942.90	11.5	0.280	11.4	27.6	11.98	2.43%	Fine Tailings	0.054	107.6	1.83	0.020	1.81	1	5	2.89%	3.2	83%	2.66	0.020	2.64
33.300	6942.74	11.8	0.287	11.7	28.7	12.45	2.42%	Fine Tailings	0.054	107.6	1.83	0.025	1.81	1	6	2.87%	3.2	83%	2.66	0.025	2.64
33.464	6942.58	12.5	0.246	12.3	30.7	13.30	1.97%	Fine Tailings	0.054	107.6	1.84	0.030	1.81	1	6	2.31%	3.1	83%	2.67	0.030	2.64
33.628	6942.41	12.8	0.229	12.6	30.8	13.34	1.79%	Fine Tailings	0.054	107.6	1.85	0.035	1.82	1	6	2.09%	3.1	83%	2.68	0.035	2.65
33.792	6942.25	12.2	0.273	12.1	32.0	13.85	2.23%	Fine Tailings	0.054	107.6	1.86	0.040	1.82	1	6	2.63%	3.2	83%	2.69	0.040	2.65
33.956	6942.08	12.5	0.301	12.3	37.7	16.35	2.40%	Fine Tailings	0.054	107.6	1.87	0.045	1.82	1	6	2.82%	3.2	83%	2.70	0.045	2.65
34.120	6941.92	11.6	0.320	11.4	38.6	16.74	2.76%	Fine Tailings	0.054	107.6	1.88	0.051	1.83	1	5	3.29%	3.2	83%	2.71	0.051	2.66
34.284	6941.76	12.9	0.312	12.7	39.4	17.08	2.41%	Fine Tailings	0.054	107.6	1.89	0.056	1.83	1	6	2.83%	3.2	83%	2.72	0.056	2.66
34.448	6941.59	13.6	0.278	13.3	39.8	17.23	2.05%	Fine Tailings	0.054	107.6	1.90	0.061	1.84	1	6	2.38%	3.1	83%	2.73	0.061	2.67
34.612	6941.43	13.2	0.371	12.9	40.6	17.61	2.81%	Fine Tailings	0.054	107.6	1.91	0.066	1.84	1	6	3.29%	3.2	83%	2.74	0.066	2.67
34.776	6941.26	14.3	0.403	14.0	42.1	18.26	2.82%	Fine Tailings	0.054	107.6	1.91	0.071	1.84	1	7	3.26%	3.2	83%	2.74	0.071	2.67
34.941	6941.10	14.1	0.363	13.9	41.3	17.91	2.57%	Fine Tailings	0.054	107.6	1.92	0.076	1.85	1	7	2.97%	3.1	83%	2.75	0.076	2.68
35.105	6940.94	21.9	0.416	21.7	43.3	18.77	1.90%	Coarse/Fine Tailin	0.058	116.0	1.93	0.000	1.93	0	10	2.08%	2.9	52%	2.76	0.000	2.76
35.269	6940.77	32.9	0.772	32.8	21.2	9.17	2.35%	Coarse/Fine Tailin	0.058	116.0	1.94	0.000	1.94	0	16	2.49%	2.8	52%	2.77	0.000	2.77
35.433	6940.61	25.4	0.980	25.3	19.7	8.54	3.85%	Coarse/Fine Tailin	0.058	116.0	1.95	0.000	1.95	0	12	4.18%	3.0	52%	2.78	0.000	2.78
35.597	6940.44	17.2	0.791	17.1	18.4	7.99	4.60%	Coarse/Fine Tailin	0.058	116.0	1.96	0.000	1.96	0	8	5.19%	3.2	52%	2.79	0.000	2.79
35.761	6940.28	13.1	0.531	12.9	19.9	8.62	4.06%	Coarse/Fine Tailin	0.058	116.0	1.97	0.000	1.97	0	6	4.79%	3.3	52%	2.80	0.000	2.80
35.925	6940.12	12.3	0.358	12.2	22.7	9.84	2.91%	Coarse/Fine Tailin	0.058	116.0	1.98	0.000	1.98	0	5	3.47%	3.3	52%	2.81	0.000	2.81
36.089	6939.95	12.8	0.396	12.6	24.8	10.76	3.10%	Coarse/Fine Tailin	0.058	116.0	1.99	0.000	1.99	0	5	3.67%	3.3	52%	2.82	0.000	2.82
36.253	6939.79	14.1	0.352	13.9	27.8	12.04	2.50%	Coarse/Fine Tailin	0.058	116.0	2.00	0.000	2.00	0	6	2.92%	3.2	52%	2.83	0.000	2.83
36.417	6939.62	12.7	0.353	12.5	29.1	12.59	2.79%	Coarse/Fine Tailin	0.058	116.0	2.01	0.000	2.01	0	5	3.31%	3.2	52%	2.84	0.000	2.84
36.581	6939.46	12.6	0.400	12.4	32.0	13.87	3.17%	Coarse/Fine Tailin	0.058	116.0	2.02	0.000	2.02	0	5	3.77%	3.3	52%	2.85	0.000	2.85
36.745	6939.30	12.3	0.452	12.1	35.1	15.19	3.68%	Coarse/Fine Tailin	0.058	116.0	2.03	0.000	2.03	0	5	4.41%	3.3	52%	2.86	0.000	2.86
36.909	6939.13	19.1	0.504	18.9	31.6	13.71	2.63%	Coarse/Fine Tailin	0.058	116.0	2.04	0.000	2.04	0	8	2.95%	3.1	52%	2.87	0.000	2.87
37.073	6938.97	13.3	0.439	13.1	32.7	14.15	3.31%	Coarse/Fine Tailin	0.058	116.0	2.05	0.000	2.05	0	5	3.91%	3.3	52%	2.88	0.000	2.88
37.237	6938.80	11.7	0.354	11.5	38.2	16.53	3.02%	Coarse/Fine Tailin	0.058	116.0	2.06	0.000	2.06	0	5	3.67%	3.3	52%	2.89	0.000	2.89
37.401	6938.64	11.4	0.255	11.2	40.2	17.41	2.24%	Coarse/Fine Tailin	0.058	116.0	2.07	0.000	2.07	0	5	2.73%	3.3	52%	2.90	0.000	2.90
37.565	6938.47	12.1	0.256	11.9	41.8	18.10	2.11%	Coarse/Fine Tailin	0.058	116.0	2.08	0.000	2.08	0	5	2.55%	3.2	52%	2.91	0.000	2.91
37.729	6938.31	12.4	0.269	12.1	42.7	18.49	2.17%	Coarse/Fine Tailin	0.058	116.0	2.08	0.000	2.08	0	5	2.61%	3.2	52%	2.91	0.000	2.91
37.893	6938.15	12.7	0.266	12.4	44.0	19.08	2.09%	Coarse/Fine Tailin	0.058	116.0	2.09	0.000	2.09	0	5	2.51%	3.2	52%	2.92	0.000	2.92
38.057	6937.98	13.1	0.256	12.9	44.4	19.24	1.95%	Coarse/Fine Tailin	0.058	116.0	2.10	0.000	2.10	0	5	2.32%	3.2	52%	2.93	0.000	2.93
38.221	6937.82	13.4	0.205	13.1	45.1	19.54	1.54%	Coarse/Fine Tailin	0.058	116.0	2.11	0.000	2.11	0	5	1.82%	3.1	52%	2.94	0.000	2.94
38.385	6937.65	12.6	0.178	12.3	46.5	20.13	1.41%	Coarse/Fine Tailin	0.058	116.0	2.12	0.000	2.12	0	5	1.70%	3.1	52%	2.95	0.000	2.95
38.549	6937.49	12.0	0.236	11.7	52.9	22.92	1.97%	Coarse/Fine Tailin	0.058	116.0	2.13	0.000	2.13	0	5	2.39%	3.2	52%	2.96	0.000	2.96
38.713	6937.33	12.4	0.281	12.1	56.4	24.42	2.27%	Fine Tailings	0.054	107.6	2.14	0.004	2.14	1	5	2.74%	3.2	83%	2.97	0.004	2.97
38.877	6937.16	12.4	0.304	12.1	58.1	25.18	2.45%	Fine Tailings	0.054	107.6	2.15	0.009	2.14	1	5	2.96%	3.3	83%	2.98	0.009	2.97
39.042	6937.00	12.5	0.323	12.1	59.5	25.79	2.59%	Fine Tailings	0.054	107.6	2.16	0.014	2.14	1	5	3.13%	3.3	83%	2.99	0.014	2.98
39.206	6936.83	13.0	0.317	12.6	60.8	26.36	2.44%	Fine Tailings	0.054	107.6	2.17	0.019	2.15	1	5	2.93%	3.2	83%	3.00	0.019	2.98
39.370	6936.67	13.9	0.354	13.5	63.3	27.43	2.55%	Fine Tailings	0.054	107.6	2.18	0.024	2.15	1	5	3.02%	3.2	83%	3.01	0.024	2.98
39.534	6936.51	13.2	0.359	12.8	63.9	27.68	2.72%	Fine Tailings	0.054	107.6	2.19	0.029	2.16	1	5	3.26%	3.3	83%	3.02	0.029	2.99
39.698	6936.34	26.5	0.601	26.1	67.9	29.43	2.27%	Fine Tailings	0.054	107.6	2.19	0.034	2.16	1	11	2.47%	2.9	83%	3.02	0.034	2.99
39.862	6936.18	24.6	0.611	24.4	36.8	15.93	2.48%	Fine Tailings	0.054	107.6	2.20	0.039	2.16	1	10	2.72%	3.0	83%	3.03	0.039	2.99
40.026	6936.01	20.7	0.747	20.5	30.1	13.03	3.61%	Fine Tailings	0.054	107.6	2.21	0.044	2.17	1	9	4.04%	3.1	83%	3.04	0.044	3.00
40.190	6935.85	20.7	0.634	20.5	28.6	12.41	3.06%	Fine Tailings	0.054	107.6	2.22	0.050	2.17	1	9	3.43%	3.1	83%	3.05	0.050	3.00
40.354	6935.69	20.7	0.720	20.5	26.8	11.59	3.48%	Fine Tailings	0.054	107.6	2.23	0.055	2.17	1	8	3.90%	3.1	83%	3.06	0.055	3.00
40.518	6935.52	15.0	0.602	14.7	50.2	21.76	4.02%	Fine Tailings	0.054	107.6	2.24	0.060	2.18	1	6	4.73%	3.3	83%	3.07	0.060	3.01
40.682	6935.36	13.1	0.409	12.7	60.9	26.39	3.13%	Fine Tailings	0.054	107.6	2.25	0.065	2.18	1	5	3.78%	3.3	83%	3.08	0.065	3.01
40.846	6935.19	13.1	0.370	12.7	71.3	30.89	2.82%	Fine Tailings	0.054	107.6	2.26	0.070	2.19	1	5	3.40%	3.3	83%	3.09	0.070	3.02
41.010	6935.03	13.8	0.383	13.3	79.0	34.25	2.78%	Fine Tailings	0.054	107.6	2.26	0.075	2.19	1	5	3.33%	3.3	83%	3.09	0.075	3.02
41.174	6934.87	13.5	0.420	13.0	81.1	35.14	3.11%	Fine Tailings	0.054	107.6	2.27	0.080	2.19	1	5	3.74%	3.3	83%	3.10	0.080	3.02
41.338	6934.70	13.5	0.417	12.9	81.7	35.40	3.10%	Fine Tailings	0.054	107.6	2.28	0.085	2.20	1	5	3.73%	3.3	83%	3.11	0.085	3.03
41.502	6934.54	13.1	0.315	12.6	80.2	34.75	2.41%	Fine Tailings	0.054	107.6	2.29	0.091	2.20	1	5	2.92%	3.3	83%	3.12	0.091	3.03
41.666	6934.37	13.1	0.247	12.6	80.3	34.78	1.88%	Fine Tailings	0.054	107.6	2.30	0.096	2.20	1	5	2.28%	3.2	83%	3.13	0.096	3.03
41.830	6934.21	13.8	0.279	13.3	84.1	36.42	2.02%	Fine Tailings	0.054	107.6	2.31	0.101	2.21	1	5	2.42%	3.2	83%	3.14	0.101	3.04
41.994	6934.05	14.1	0.381	13.6	90.1	39.04	2.69%	Fine Tailings	0.054	107.6	2.32	0.106	2.21	1	5	3.22%	3.2	83%	3.15	0.106	3.04
42.158	6933.88	14.4	0.449	13.8	94.1	40.77	3.11%	Fine Tailings	0.054	107.6	2.33	0.111	2.22	1	5	3.71%	3.3	83%	3.16	0.111	3.05
42.322	6933.72	15.6	0.532	15.0	97.1	42.08	3.40%	Fine Tailings	0.054	107.6	2.34	0.116	2.22	1	6	4.00%	3.3	83%	3.17	0.116	3.05
42.486	6933.55	17.9	0.500	17.3	84.3	36.52	2.80%	Fine Tailings	0.054	107.6	2.34	0.121	2.22	1	7	3.22%	3.1	83%	3.17	0.121	3.05
42.650	6933.39	15.3	0.515	14.9	74.9	32.47	3.36%	Fine Tailings	0.054	107.6	2.35	0.126	2.23	1	6	3.97%	3.3	83%	3.18	0.126	3.06
42.814	6933.23	15.2	0.477	14.7	78.7	34.10	3.15%	Fine Tailings	0.054	107.6	2.36	0.131	2.23	1	6	3.73%	3.2	83%	3.19	0.131	3.06

12.53	594	1.7E-03	5.9E+02	35	0.5132	3.9E-04	43	0.253	0.255	167	167.000	7095	4857	1563	1563	0.073%	0.90	0.75	0.06%	0.001075	0.25	0.323	0.851	0.18%	0.0003
12.58	594	1.7E-03	5.9E+02	34	0.5087	3.9E-04	43	0.253	0.255	168	168.000	7090	4854	1564	1564	0.072%	0.90	0.75	0.06%	0.001039	0.25	0.323	0.851	0.18%	0.0003
12.63	594	1.7E-03	5.9E+02	34	0.5041	3.9E-04	43	0.253	0.256	169	169.000	7086	4851	1565	1565	0.072%	0.90	0.75	0.06%	0.001002	0.25	0.323	0.851	0.17%	0.0003
12.68	594	1.7E-03	5.9E+02	34	0.4996	3.9E-04	43	0.253	0.256	170	170.000	7081	4848	1566	1566	0.071%	0.90	0.75	0.06%	0.000964	0.25	0.323	0.851	0.16%	0.0003
12.73	594	1.7E-03	5.9E+02	34	0.4950	3.9E-04	43	0.253	0.256	171	171.000	7076	4844	1567	1567	0.070%	0.90	0.75	0.06%	0.000925	0.25	0.323	0.851	0.16%	0.0003
12.78	594	1.7E-03	5.9E+02	33	0.4905	3.8E-04	43	0.253	0.256	172	172.000	7072	4841	1568	1568	0.070%	0.90	0.75	0.06%	0.000886	0.25	0.323	0.851	0.15%	0.0002
12.83	594	1.7E-03	5.9E+02	33	0.4859	3.8E-04	43	0.253	0.256	173	173.000	7067	4838	1569	1569	0.069%	0.90	0.75	0.06%	0.000845	0.25	0.323	0.851	0.14%	0.0002
12.88	594	1.7E-03	5.9E+02	33	0.4813	3.8E-04	43	0.253	0.256	174	174.000	7062	4835	1570	1570	0.069%	0.90	0.75	0.06%	0.000803	0.25	0.323	0.851	0.14%	0.0002
12.93	594	1.7E-03	5.9E+02	32	0.4768	3.8E-04	43	0.254	0.256	175	175.000	7058	4831	1571	1571	0.068%	0.90	0.75	0.06%	0.000760	0.25	0.323	0.851	0.13%	0.0002
12.98	594	1.7E-03	5.9E+02	32	0.4722	3.7E-04	43	0.254	0.256	176	176.000	7053	4828	1572	1572	0.067%	0.90	0.75	0.06%	0.000716	0.25	0.323	0.851	0.12%	0.0002
13.03	594	1.7E-03	5.9E+02	32	0.4677	3.7E-04	43	0.254	0.256	177	177.000	7049	4825	1573	1573	0.067%	0.90	0.75	0.06%	0.000671	0.25	0.323	0.851	0.11%	0.0002
13.08	594	1.7E-03	5.9E+02	32	0.4631	3.7E-04	43	0.254	0.256	178	178.000	7044	4822	1574	1574	0.066%	0.90	0.75	0.06%	0.000624	0.25	0.323	0.851	0.11%	0.0002
13.13	594	1.7E-03	5.9E+02	31	0.4586	3.7E-04	43	0.254	0.257	179	179.000	7039	4819	1575	1575	0.066%	0.90	0.75	0.06%	0.000576	0.25	0.323	0.851	0.10%	0.0002
13.18	594	1.7E-03	5.9E+02	31	0.4540	3.7E-04	43	0.254	0.257	180	180.000	7035	4815	1576	1576	0.065%	0.90	0.75	0.06%	0.000526	0.25	0.323	0.851	0.09%	0.0001
13.23	594	1.7E-03	5.9E+02	31	0.4494	3.6E-04	43	0.254	0.257	181	181.000	7030	4812	1577	1577	0.064%	0.90	0.75	0.06%	0.000474	0.25	0.323	0.851	0.08%	0.0001
13.28	594	1.7E-03	5.9E+02	31	0.4449	3.6E-04	43	0.254	0.257	182	182.000	7026	4809	1578	1578	0.064%	0.90	0.75	0.06%	0.000420	0.25	0.323	0.851	0.07%	0.0001
13.33	587	1.7E-03	5.8E+02	30	0.4404	3.7E-04	43	0.254	0.257	183	183.000	7021	4806	1579	1579	0.065%	0.90	0.75	0.06%	0.000565	0.25	0.323	0.851	0.10%	0.0002
13.38	587	1.7E-03	5.8E+02	30	0.4358	3.6E-04	43	0.254	0.257	184	184.000	7017	4803	1580	1580	0.065%	0.90	0.75	0.06%	0.000511	0.25	0.323	0.851	0.09%	0.0001
13.43	587	1.7E-03	5.8E+02	30	0.4313	3.6E-04	43	0.254	0.257	185	185.000	7012	4800	1581	1581	0.064%	0.90	0.75	0.06%	0.000456	0.25	0.323	0.851	0.08%	0.0001
13.48	587	1.7E-03	5.8E+02	30	0.4268	3.6E-04	43	0.255	0.257	186	186.000	7008	4796	1582	1582	0.063%	0.90	0.75	0.06%	0.000397	0.25	0.323	0.851	0.07%	0.0001
13.53	587	1.7E-03	5.8E+02	29	0.4223	3.6E-04	43	0.255	0.257	187	187.000	7003	4793	1583	1583	0.063%	0.90	0.75	0.06%	0.000336	0.25	0.323	0.851	0.06%	0.0001
13.58	587	1.7E-03	5.8E+02	29	0.4178	3.5E-04	43	0.255	0.258	188	188.000	6999	4790	1584	1584	0.062%	0.90	0.75	0.06%	0.000270	0.25	0.323	0.851	0.05%	0.0001
13.63	587	1.7E-03	5.8E+02	29	0.4133	3.5E-04	43	0.255	0.258	189	189.000	6994	4787	1585	1585	0.061%	0.90	0.75	0.06%	0.000198	0.25	0.323	0.851	0.03%	0.0001
13.68	587	1.7E-03	5.8E+02	29	0.4088	3.5E-04	43	0.255	0.258	190	190.000	6990	4784	1586	1586	0.061%	0.90	0.75	0.06%	0.000115	0.25	0.323	0.851	0.02%	0.0000
13.73	587	1.7E-03	5.8E+02	29	0.4043	3.5E-04	43	0.255	0.258	191	191.000	6985	4781	1587	1587	0.060%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
13.78	587	1.7E-03	5.8E+02	28	0.3998	3.4E-04	43	0.259	0.262	192	192.000	6813	4660	1588	1588	0.059%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
13.83	587	1.7E-03	5.8E+02	28	0.3954	3.4E-04	0	0.259	0.262	193	0.259	6803	4654	1589	6803	0.097%	1.79	1.00	0.01%	0.001566	0.36	0.025	0.785	0.25%	0.0004
13.88	587	1.7E-03	5.8E+02	28	0.3909	3.4E-04	0	0.259	0.263	194	0.259	6793	4647	1590	6793	0.095%	1.79	1.00	0.01%	0.001527	0.36	0.025	0.785	0.24%	0.0004
13.93	587	1.7E-03	5.8E+02	28	0.3865	3.3E-04	0	0.259	0.263	195	0.259	6784	4640	1591	6784	0.093%	1.79	1.00	0.01%	0.001488	0.36	0.025	0.785	0.23%	0.0004
13.98	587	1.7E-03	5.8E+02	28	0.3821	3.3E-04	0	0.259	0.263	196	0.259	6774	4634	1592	6774	0.091%	1.79	1.00	0.01%	0.001450	0.36	0.025	0.785	0.23%	0.0004
14.03	587	1.7E-03	5.8E+02	27	0.3777	3.3E-04	0	0.260	0.263	197	0.260	6765	4627	1593	6765	0.089%	1.79	1.00	0.01%	0.001413	0.36	0.025	0.785	0.22%	0.0004
14.08	587	1.7E-03	5.8E+02	27	0.3733	3.3E-04	0	0.260	0.264	198	0.260	6755	4620	1594	6755	0.087%	1.79	1.00	0.01%	0.001377	0.36	0.025	0.785	0.22%	0.0004
14.13	587	1.7E-03	5.8E+02	27	0.3689	3.2E-04	0	0.260	0.264	199	0.260	6746	4614	1595	6746	0.085%	1.79	1.00	0.01%	0.001342	0.36	0.025	0.785	0.21%	0.0003
14.18	587	1.7E-03	5.8E+02	27	0.3645	3.2E-04	0	0.260	0.264	200	0.260	6736	4607	1596	6736	0.083%	1.79	1.00	0.01%	0.001307	0.36	0.025	0.785	0.21%	0.0003
14.23	587	1.7E-03	5.8E+02	27	0.3602	3.2E-04	0	0.261	0.264	201	0.261	6727	4601	1597	6727	0.081%	1.79	1.00	0.01%	0.001273	0.36	0.025	0.785	0.20%	0.0003
14.28	587	1.7E-03	5.8E+02	26	0.3558	3.2E-04	43	0.261	0.264	202	202.000	6722	4597	1598	1598	0.052%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
14.33	587	1.7E-03	5.8E+02	26	0.3515	3.1E-04	43	0.261	0.264	203	203.000	6718	4595	1599	1599	0.052%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
14.38	587	1.7E-03	5.8E+02	26	0.3472	3.1E-04	43	0.261	0.265	204	204.000	6715	4592	1600	1600	0.051%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
14.43	587	1.7E-03	5.8E+02	26	0.3430	3.1E-04	43	0.261	0.265	205	205.000	6711	4589	1601	1601	0.050%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
14.48	587	1.7E-03	5.8E+02	26	0.3387	3.1E-04	43	0.261	0.265	206	206.000	6707	4587	1602	1602	0.050%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
14.53	587	1.7E-03	5.8E+02	26	0.3345	3.0E-04	43	0.261	0.265	207	207.000	6703	4584	1603	1603	0.049%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
14.58	587	1.7E-03	5.8E+02	25	0.3302	3.0E-04	43	0.261	0.265	208	208.000	6699	4581	1604	1604	0.048%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
14.63	587	1.7E-03	5.8E+02	25	0.3260	3.0E-04	43	0.261	0.265	209	209.000	6695	4579	1605	1605	0.048%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
14.68	587	1.7E-03	5.8E+02	25	0.3218	2.9E-04	43	0.261	0.265	210	210.000	6691	4576	1606	1606	0.047%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
14.73	587	1.7E-03	5.8E+02	25	0.3177	2.9E-04	43	0.261	0.265	211	211.000	6688	4573	1607	1607	0.046%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
14.78	587	1.7E-03	5.8E+02	25	0.3135	2.9E-04	43	0.261	0.265	212	212.000	6684	4571	1608	1608	0.046%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
14.83	587	1.7E-03	5.8E+02	25	0.3094	2.9E-04	43	0.262	0.265	213	213.000	6680	4568	1609	1609	0.045%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
14.88	639	1.7E-03	6.8E+02	25	0.3053	2.4E-04	43	0.262	0.266	214	214.000	6676	4565	1610	1610	0.035%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
14.93	639	1.7E-03	6.8E+02	24	0.3013	2.4E-04	43	0.262	0.266	215	215.000	6672	4563	1611	1611	0.035%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
14.98	639	1.7E-03	6.8E+02	24	0.2972	2.3E-04	43	0.262	0.266	216	216.000	6669	4560	1612	1612	0.034%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
15.03	639	1.8E-03	7.4E+02	24	0.2932	2.1E-04	20	0.264	0.268	217	72.512	6583	4500	1613	3538	0.046%	2.00	0.65	0.03%	0.006707	0.34	0.079	0.797	1.07%	0.0018
15.08	639	1.8E-03	7.4E+02	24	0.2892	2.1E-04	20	0.264	0.268	218	72.845	6574	4494	1614	3534	0.045%	2.00	0.65	0.03%	0.006467	0.34	0.079	0.797	1.03%	0.0017
15.13	639	1.8E-03	7.4E+02	24	0.2852	2.1E-04	20	0.264	0.268	219	73.179	6564	4487	1615	3530	0.044%	2.00	0.65	0.03%	0.006225	0.34	0.079	0.797	0.99%	0.0016
15.18	639	1.8E-03	7.4E+02	24	0.2812	2.1E-04	20	0.264	0.269	220	73.512	6555	4481	1616	3526	0.043%	2.00	0.65	0.03%	0.005980	0.34	0.079	0.797	0.95%	0.0016
15.23	639	1.8E-03	7.4E+02	24	0.2773	2.1E-04	20	0.265	0.269	221	73.846	6546	4475	1617	3522	0.042%	2.00	0.65	0.03%	0.005734	0.34	0.079	0.797	0.91%	0.0015
15.28	639	1.8E-03	7.4E+02	24	0.2734	2.0E-04	20	0.265	0.269	222	74.179	6537	4468	1618	3518	0.041%	2.00	0.65	0.03%	0.005486	0.34	0.079	0.797	0.87%	0.0014
15.33	639	1.8E-03	7.4E+02	23	0.2695	2.0E-04	20	0.265	0.269	223	74.513	6528	4462	1619	3514	0.041%	2.00	0.65	0.03%	0.005235	0.34	0.079	0.797	0.83%	0.0014
15.38	639	1.8E-03	7.4E+02	23	0.2657	2.0E-04	20	0.265	0.270	224	74.846	6519	4456	1620	3510	0.040%	2.00	0.65	0.03%	0.004981	0.34	0.079	0.797	0.79%	0.0013
15.43	639	1.8E-03	7.4E+02	23	0.2618	2.0E-04	20	0.265	0.270	225	75.180	6510	4449	1621	3507	0.039%	2.00	0.65	0.03%	0.004723	0.34	0.079	0.797	0.75%	0.0012
15.48	639	1.8E-03	7.4E+02	23	0.2580	1.9E-04	20	0.266	0.270	226	75.513	6501	4443	1622	3503	0.038%	2.00	0.65	0.03%	0.004462	0.34	0.079	0.797	0.71%	0.0012
15.53	639	1.8E-03	7.4E+02	23	0.2543	1.9E-04	20	0.266	0.270	227	75.847	6492	4437	1623	3499	0.038%	2.00	0.65	0.03%	0.004196	0.34	0.079	0.797	0.67%	0.0011
15.58	639	1.8E-03	7.4E+02	23	0.2505	1.9E-04	20	0.266	0.271	228	76.180	6483	4431	1624	3495	0.037%	2.00	0.65	0.03%	0.003925	0.34	0.079	0.797	0.63%	0.0010
15.63	639	1.8E-03	7.4E+02	23	0.2468	1.9E-04	20	0.266	0.271	229	76.514	6475	4425	1625	3492	0.036%	2.00	0.65	0.03%	0.003647	0.34	0.079	0.797	0.58%	0.0010
15.68	639	1.8E-03	7.4E+02	23	0.2431	1.9E-04	20	0.266	0.271	230	76.847	6466	4419	1626	3488	0.035%	2.00	0.65	0.03%	0.003362	0.34	0.079	0.797	0.54%	0.0009
15.73	639	1.8E-03	7.4E+02	22	0.2394	1.8E-04	20	0.267	0.271	231	77.181	6457	4413	1627	3484	0.035%	2.00	0.65	0.03%	0.003069	0.34	0.079	0.797	0.49%	0.0008
15.78	639	1.8E-03	7.4E+02	22	0.2358	1.8E-04	20	0.267	0.272	232	77.514	6448	4407	1628	3480	0.034%	2.00	0.65	0.03%	0.002764	0.34	0.079	0.797	0.44%	0.0007
15.83	639	1.8E-03	7.4E+02	22	0.2322	1.8E-04	20	0.267	0.272	233	77.848	6440	4401	1629	3477	0.033%	2.00	0.65	0.03%	0.002444	0.34	0.079	0.797	0.39%	0.0006
15.88	639	1.8E-03	7.4E+02	22	0.2286	1.8E-04	20	0.267	0.272	234	78.181	6431	4395	1630	3473	0.033%	2.00	0.65	0.03%	0.002106	0.34	0.079	0.797	0.34%	0.0006
15.93	639	1.8E-03	7.4E+02	22	0.2250	1.8E-04	20	0.267	0.272	235	78.515	6423	4389	1631	3469	0.032%	2.00	0.65	0.03%	0.001742	0.34	0.079	0.797	0.28%	0.0005
15.98	639	1.8E-03	7.4E+02	22	0.2215	1.7E-04	20	0.268	0.272	236	78.848	6414	4383	1632	3466	0.031%	2.00	0.65	0.03%	0.001338	0.34	0.079	0.797	0.21%	0.0003
16.03	639	1.8E-03	7.4E+02	22	0.2180	1.7E-04	20	0.268	0.273	237	79.182	6406	4377	1633	3462	0.031%	2.00	0.65	0.03%	0.000860	0.34	0.079	0.797	0.14%	0.0002
16.08	639	1.8E-03	7.4E+02	22	0.2145	1.7E-04	20	0.268	0.273	238	79.515	6397	4371	1634	3459	0.030%	2.00	0.65	0.03%	0.000112	0.34	0.079	0.797	0.02%	0.0000
16.13	639	1.7E-03	6.8E+02	22	0.2111	1.8E-04	43	0.268	0.273	239	239.000	6393	4368	1635	1635	0.024%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.18	639	1.7E-03	6.8E+02	22	0.2077	1.8E-04	43	0.268	0.273	240	240.000	6389	4365	1636	1636	0.024%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.23	639	1.7E-03	6.8E+02	22	0.2043	1.7E-04	43	0.268	0.273	241	241.000	6386	4363	1637	1637	0.023%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.28	639	1.7E-03	6.8E+02	21	0.2009	1.7E-04	43	0.268	0.273	242	242.000	6383	4361	1638	1638	0.023%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.33	639	1.7E-03	6.8E+02	21	0.1976	1.7E-04	43	0.268	0.273	243	243.000	6380	4359	1639	1639	0.022%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.38	639	1.7E-03	6.8E+02	21	0.1943	1.7E-04	43	0.268	0.274	244	244.000	6376	4356	1640	1640	0.022%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.43	639	1.7E-03	6.8E+02	21	0.1911	1.7E-04	43	0.269	0.274	245	245.000	6373	4354	1641	1641	0.022%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.48	685	1.7E-03	7.8E+02	21	0.1878	1.4E-04	43	0.269	0.274	246	246.000	6370	4352	1642	1642	0.018%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.53	685	1.7E-03	7.8E+02	21	0.1846	1.4E-04	43	0.269	0.274	247	247.000	6367	4349	1643	1643	0.018%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.58	685	1.7E-03	7.8E+02	21	0.1815	1.4E-04	43	0.269	0.274	248	248.000	6363	4347	1644	1644	0.017%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.63	685	1.7E-03	7.8E+02	21	0.1783	1.4E-04	43	0.269	0.274	249	249.000	6360	4345	1645	1645	0.017%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.68	685	1.7E-03	7.8E+02	21	0.1752	1.3E-04	43	0.269	0.274	250	250.000	6357	4343	1646	1646	0.017%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.73	685	1.7E-03	7.8E+02	21	0.1721	1.3E-04	43	0.269	0.274	251	251.000	6354	4341	1647	1647	0.016%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.78	685	1.7E-03	7.8E+02	21	0.1691	1.3E-04	43	0.269	0.274	252	252.000	6350	4338	1648	1648	0.016%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.83	685	1.7E-03	7.8E+02	21	0.1660	1.3E-04	43	0.269	0.274	253	253.000	6347	4336	1649	1649	0.016%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.88	685	1.7E-03	7.8E+02	20	0.1630	1.3E-04	43	0.269	0.274	254	254.000	6344	4334	1650	1650	0.015%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.93	685	1.7E-03	7.8E+02	20	0.1601	1.2E-04	43	0.269	0.275	255	255.000	6341	4332	1651	1651	0.015%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.98	685	1.7E-03	7.8E+02	20	0.1571	1.2E-04	43	0.269	0.275	256	256.000	6338	4329	1652	1652	0.015%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.03	685	1.7E-03	7.8E+02	20	0.1542	1.2E-04	43	0.269	0.275	257	257.000	6335	4327	1653	1653	0.015%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.08	685	1.7E-03	7.8E+02	20	0.1514	1.2E-04	43	0.270	0.275	258	258.000	6331	4325	1654	1654	0.014%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.13	685	1.7E-03	7.8E+02	20	0.1485	1.2E-04	43	0.270	0.275	259	259.000	6328	4323	1655	1655	0.014%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.18	685	1.7E-03	7.8E+02	20	0.1457	1.1E-04	43	0.270	0.275	260	260.000	6325	4321	1656	1656	0.014%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.23	685	1.7E-03	7.8E+02	20	0.1429	1.1E-04	43	0.270	0.275	261	261.000	6322	4318	1657	1657	0.014%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.28	685	1.7E-03	7.8E+02	20	0.1402	1.1E-04	43	0.270	0.275	262	262.000	6319	4316	1658	1658	0.013%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.33	685	1.7E-03	7.8E+02	20	0.1374	1.1E-04	43	0.270	0.275	263	263.000	6316	4314	1659	1659	0.013%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.38	685	1.7E-03	7.8E+02	20	0.1347	1.1E-04	43	0.270	0.275	264	264.000	6312	4312	1660	1660	0.013%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000

42.978	6933.06	15.3	0.468	14.8	80.3	34.81	3.06%	Fine Tailings	0.054	107.6	2.37	0.137	2.23	1	6	3.62%	3.2	83%	3.20	0.137	3.06
43.143	6932.90	15.0	0.419	14.5	82.5	35.75	2.80%	Fine Tailings	0.054	107.6	2.38	0.142	2.24	1	6	3.32%	3.2	83%	3.21	0.142	3.07
43.307	6932.73	15.3	0.417	14.8	87.5	37.93	2.72%	Fine Tailings	0.054	107.6	2.39	0.147	2.24	1	6	3.22%	3.2	83%	3.22	0.147	3.07
43.471	6932.57	16.5	0.398	15.9	92.2	39.96	2.41%	Fine Tailings	0.054	107.6	2.40	0.152	2.25	1	6	2.82%	3.2	83%	3.23	0.152	3.08
43.635	6932.41	16.1	0.465	15.5	95.5	41.38	2.89%	Fine Tailings	0.054	107.6	2.41	0.157	2.25	1	6	3.40%	3.2	83%	3.24	0.157	3.08
43.799	6932.24	18.1	0.444	17.4	111.2	48.17	2.45%	Fine Tailings	0.054	107.6	2.41	0.162	2.25	1	7	2.83%	3.1	83%	3.24	0.162	3.08
43.963	6932.08	19.0	0.520	18.3	117.4	50.86	2.73%	Fine Tailings	0.054	107.6	2.42	0.167	2.26	1	7	3.13%	3.1	83%	3.25	0.167	3.09
44.127	6931.91	20.2	0.560	19.4	124.0	53.73	2.78%	Fine Tailings	0.054	107.6	2.43	0.172	2.26	1	8	3.16%	3.1	83%	3.26	0.172	3.09
44.291	6931.75	25.6	0.692	24.7	134.5	58.30	2.71%	Fine Tailings	0.054	107.6	2.44	0.178	2.26	1	10	2.99%	3.0	83%	3.27	0.178	3.09
44.455	6931.59	27.8	1.020	27.3	71.6	31.03	3.67%	Fine Tailings	0.054	107.6	2.45	0.183	2.27	1	11	4.03%	3.0	83%	3.28	0.183	3.10
44.619	6931.42	36.0	1.122	35.6	53.2	23.04	3.12%	Coarse Alluvium	0.056	111.0	2.46	0.000	2.46	0	14	3.35%	2.9	36%	3.29	0.000	3.29
44.783	6931.26	27.3	1.106	27.0	39.9	17.29	4.06%	Coarse Alluvium	0.056	111.0	2.47	0.000	2.47	0	10	4.46%	3.1	36%	3.30	0.000	3.30
44.947	6931.09	22.2	0.929	21.9	40.7	17.65	4.19%	Coarse Alluvium	0.056	111.0	2.48	0.000	2.48	0	8	4.71%	3.2	36%	3.31	0.000	3.31
45.111	6930.93	21.9	0.815	21.6	49.3	21.35	3.72%	Coarse Alluvium	0.056	111.0	2.49	0.000	2.49	0	8	4.19%	3.2	36%	3.32	0.000	3.32
45.275	6930.76	22.5	0.843	22.2	50.9	22.07	3.75%	Coarse Alluvium	0.056	111.0	2.50	0.000	2.50	0	8	4.21%	3.2	36%	3.33	0.000	3.33
45.439	6930.60	23.1	0.996	22.8	51.8	22.45	4.30%	Coarse Alluvium	0.056	111.0	2.50	0.000	2.50	0	8	4.83%	3.2	36%	3.33	0.000	3.33
45.603	6930.44	26.7	1.087	26.3	54.9	23.77	4.08%	Coarse Alluvium	0.056	111.0	2.51	0.000	2.51	0	10	4.50%	3.1	36%	3.34	0.000	3.34
45.767	6930.27	28.6	1.134	28.3	52.8	22.86	3.96%	Coarse Alluvium	0.056	111.0	2.52	0.000	2.52	0	10	4.34%	3.1	36%	3.35	0.000	3.35
45.931	6930.11	27.1	1.214	26.8	47.3	20.48	4.48%	Coarse Alluvium	0.056	111.0	2.53	0.000	2.53	0	10	4.94%	3.1	36%	3.36	0.000	3.36
46.095	6929.94	30.2	1.531	29.9	49.5	21.45	5.07%	Coarse Alluvium	0.056	111.0	2.54	0.000	2.54	0	11	5.54%	3.1	36%	3.37	0.000	3.37
46.259	6929.78	30.9	1.733	30.6	42.2	18.30	5.62%	Coarse Alluvium	0.056	111.0	2.55	0.000	2.55	0	11	6.12%	3.1	36%	3.38	0.000	3.38
46.423	6929.62	33.6	1.621	33.4	33.7	14.58	4.82%	Coarse Alluvium	0.056	111.0	2.56	0.000	2.56	0	12	5.22%	3.1	36%	3.39	0.000	3.39
46.587	6929.45	29.4	1.438	29.1	39.2	16.98	4.90%	Coarse Alluvium	0.056	111.0	2.57	0.000	2.57	0	10	5.36%	3.1	36%	3.40	0.000	3.40
46.751	6929.29	40.0	1.422	39.6	52.2	22.61	3.56%	Coarse Alluvium	0.056	111.0	2.58	0.000	2.58	0	15	3.80%	2.9	36%	3.41	0.000	3.41
46.915	6929.12	57.2	1.642	56.9	40.4	17.51	2.87%	Coarse Alluvium	0.056	111.0	2.59	0.000	2.59	0	21	3.01%	2.7	36%	3.42	0.000	3.42
47.079	6928.96	62.4	2.131	62.2	32.4	14.05	3.41%	Coarse Alluvium	0.056	111.0	2.60	0.000	2.60	0	23	3.56%	2.8	36%	3.43	0.000	3.43
47.244	6928.80	52.1	2.149	52.0	28.2	12.22	4.12%	Coarse Alluvium	0.056	111.0	2.60	0.000	2.60	0	19	4.34%	2.9	36%	3.43	0.000	3.43
47.408	6928.63	51.7	2.070	51.6	27.9	12.08	4.00%	Coarse Alluvium	0.056	111.0	2.61	0.000	2.61	0	19	4.21%	2.9	36%	3.44	0.000	3.44
47.572	6928.47	56.0	1.792	55.8	29.9	12.94	3.20%	Coarse Alluvium	0.056	111.0	2.62	0.000	2.62	0	20	3.36%	2.8	36%	3.45	0.000	3.45
47.736	6928.30	39.6	1.655	39.5	25.1	10.86	4.18%	Coarse Alluvium	0.056	111.0	2.63	0.000	2.63	0	14	4.48%	3.0	36%	3.46	0.000	3.46
47.900	6928.14	26.1	1.478	26.0	22.1	9.56	5.65%	Coarse Alluvium	0.056	111.0	2.64	0.000	2.64	0	9	6.29%	3.2	36%	3.47	0.000	3.47
48.064	6927.98	23.9	1.204	23.8	21.3	9.21	5.04%	Coarse Alluvium	0.056	111.0	2.65	0.000	2.65	0	8	5.67%	3.2	36%	3.48	0.000	3.48
48.228	6927.81	21.1	1.026	21.0	21.4	9.27	4.86%	Coarse Alluvium	0.056	111.0	2.66	0.000	2.66	0	7	5.56%	3.3	36%	3.49	0.000	3.49
48.392	6927.65	21.3	0.929	21.2	21.8	9.46	4.36%	Coarse Alluvium	0.056	111.0	2.67	0.000	2.67	0	7	4.99%	3.3	36%	3.50	0.000	3.50
48.556	6927.48	15.5	0.698	15.4	20.2	8.74	4.49%	Coarse Alluvium	0.056	111.0	2.68	0.000	2.68	0	5	5.42%	3.4	36%	3.51	0.000	3.51
48.720	6927.32	14.1	0.535	14.0	19.4	8.42	3.80%	Coarse Alluvium	0.056	111.0	2.69	0.000	2.69	0	4	4.70%	3.4	36%	3.52	0.000	3.52
48.884	6927.16	15.1	0.474	15.0	19.6	8.48	3.14%	Coarse Alluvium	0.056	111.0	2.70	0.000	2.70	0	5	3.82%	3.3	36%	3.53	0.000	3.53
49.048	6926.99	18.7	0.603	18.6	20.5	8.89	3.22%	Coarse Alluvium	0.056	111.0	2.71	0.000	2.71	0	6	3.76%	3.2	36%	3.54	0.000	3.54
49.212	6926.83	19.1	0.732	18.9	20.7	8.97	3.84%	Coarse Alluvium	0.056	111.0	2.71	0.000	2.71	0	6	4.48%	3.3	36%	3.54	0.000	3.54
49.376	6926.66	21.5	0.901	21.4	20.3	8.81	4.20%	Coarse Alluvium	0.056	111.0	2.72	0.000	2.72	0	7	4.80%	3.2	36%	3.55	0.000	3.55
49.540	6926.50	20.7	0.896	20.6	19.8	8.56	4.33%	Coarse Alluvium	0.056	111.0	2.73	0.000	2.73	0	7	4.98%	3.3	36%	3.56	0.000	3.56
49.704	6926.34	21.3	0.999	21.2	19.9	8.62	4.69%	Coarse Alluvium	0.056	111.0	2.74	0.000	2.74	0	7	5.39%	3.3	36%	3.57	0.000	3.57
49.868	6926.17	21.9	0.987	21.7	20.1	8.71	4.52%	Coarse Alluvium	0.056	111.0	2.75	0.000	2.75	0	7	5.17%	3.3	36%	3.58	0.000	3.58
50.032	6926.01	24.9	1.093	24.7	19.8	8.58	4.40%	Coarse Alluvium	0.056	111.0	2.76	0.000	2.76	0	8	4.95%	3.2	36%	3.59	0.000	3.59
50.196	6925.84	29.3	1.131	29.2	19.3	8.36	3.86%	Coarse Alluvium	0.056	111.0	2.77	0.000	2.77	0	10	4.26%	3.1	36%	3.60	0.000	3.60
50.360	6925.68	28.4	1.061	28.3	18.3	7.91	3.73%	Coarse Alluvium	0.056	111.0	2.78	0.000	2.78	0	9	4.14%	3.1	36%	3.61	0.000	3.61
50.524	6925.52	24.9	0.932	24.8	17.3	7.48	3.74%	Coarse Alluvium	0.056	111.0	2.79	0.000	2.79	0	8	4.22%	3.2	36%	3.62	0.000	3.62
50.688	6925.35	18.7	0.792	18.6	16.3	7.08	4.25%	Coarse Alluvium	0.056	111.0	2.80	0.000	2.80	0	6	5.00%	3.3	36%	3.63	0.000	3.63
50.852	6925.19	16.3	0.711	16.3	15.7	6.81	4.35%	Coarse Alluvium	0.056	111.0	2.81	0.000	2.81	0	5	5.25%	3.4	36%	3.64	0.000	3.64
51.016	6925.02	22.7	0.636	22.6	16.4	7.10	2.81%	Coarse Alluvium	0.056	111.0	2.81	0.000	2.81	0	7	3.20%	3.1	36%	3.64	0.000	3.64
51.180	6924.86	32.8	0.634	32.7	16.9	7.34	1.93%	Coarse Alluvium	0.056	111.0	2.82	0.000	2.82	0	11	2.11%	2.9	36%	3.65	0.000	3.65
51.345	6924.70	41.1	0.665	41.0	16.7	7.24	1.62%	Coarse Alluvium	0.056	111.0	2.83	0.000	2.83	0	14	1.74%	2.8	36%	3.66	0.000	3.66
51.509	6924.53	41.8	0.943	41.7	17.0	7.38	2.26%	Coarse Alluvium	0.056	111.0	2.84	0.000	2.84	0	14	2.42%	2.8	36%	3.67	0.000	3.67
51.673	6924.37	55.4	1.092	55.3	17.4	7.52	1.97%	Coarse Alluvium	0.056	111.0	2.85	0.000	2.85	0	18	2.08%	2.7	36%	3.68	0.000	3.68
51.837	6924.20	60.7	1.308	60.6	17.4	7.54	2.15%	Coarse Alluvium	0.056	111.0	2.86	0.000	2.86	0	20	2.26%	2.7	36%	3.69	0.000	3.69
52.001	6924.04	48.7	1.307	48.6	16.9	7.32	2.68%	Coarse Alluvium	0.056	111.0	2.87	0.000	2.87	0	16	2.85%	2.8	36%	3.70	0.000	3.70
52.165	6923.88	35.0	1.231	34.9	16.5	7.16	3.51%	Coarse Alluvium	0.056	111.0	2.88	0.000	2.88	0	11	3.83%	3.0	36%	3.71	0.000	3.71
52.329	6923.71	25.8	1.019	25.7	18.4	7.97	3.95%	Coarse Alluvium	0.056	111.0	2.89	0.000	2.89	0	8	4.45%	3.2	36%	3.72	0.000	3.72
52.493	6923.55	27.7	1.001	27.5	21.5	9.31	3.62%	Coarse Alluvium	0.056	111.0	2.90	0.000	2.90	0	9	4.04%	3.1	36%	3.73	0.000	3.73
52.657	6923.38	60.6	1.317	60.5	25.5	11.06	2.17%	Coarse Alluvium	0.056	111.0	2.91	0.000	2.91	0	20	2.28%	2.7	36%	3.74	0.000	3.74
52.821	6923.22	49.3	1.528	49.1	22.5	9.76	3.10%	Coarse Alluvium	0.056	111.0	2.91	0.000	2.91	0	16	3.30%	2.9	36%	3.74	0.000	3.74
52.985	6923.06	30.4	1.330	30.3	21.5	9.31	4.37%	Coarse Alluvium	0.056	111.0	2.92	0.000	2.92	0	9	4.84%	3.1	36%	3.75	0.000	3.75
53.149	6922.89	22.3	0.950	22.1	23.0	9.96	4.27%	Coarse Alluvium	0.056	111.0	2.93	0.000	2.93	0	7	4.91%	3.3	36%	3.76	0.000	3.76
53.313	6922.73	20.4	0.525	20.3	25.7	11.15	2.57%	Coarse Alluvium	0.056	111.0	2.94	0.000	2.94	0	6	3.00%	3.2	36%	3.77	0.000	3.77
53.477	6922.56	18.8	0.445	18.6	27.4	11.88	2.37%	Coarse Alluvium	0.056	111.0	2.95	0.000	2.95	0	5	2.81%	3.2	36%	3.78	0.000	3.78
53.641	6922.40	19.9	0.592	19.7	29.5	12.77	2.98%	Coarse Alluvium	0.056	111.0	2.96	0.000	2.96	0	6	3.50%	3.2	36%	3.79	0.000	3.79
53.805	6922.23	19.2	0.692	19.1	29.6	12.83	3.60%	Coarse Alluvium	0.056	111.0	2.97	0.000	2.97	0	5	4.25%	3.3	36%	3.80	0.000	3.80
53.969	6922.07	25.0	0.992	24.8	30.4	13.16	3.97%	Coarse Alluvium	0.056	111.0	2.98	0.000	2.98	0	7	4.51%	3.2	36%	3.81	0.000	3.81
54.133	6921.91	55.5	0.983	55.3	32.3	13.99	1.77%	Coarse Alluvium	0.056	111.0	2.99	0.000	2.99	0	18	1.87%	2.7	36%	3.82	0.000	3.82
54.297	6921.74	67.1	0.985	66.9	28.4	12.32	1.47%	Coarse Alluvium	0.056	111.0	3.00	0.000	3.00	0	21	1.54%	2.6	36%	3.83	0.000	3.83
54.461	6921.58	69.8	0.720	69.6	25.3	10.94	1.03%	Coarse Alluvium	0.056	111.0	3.01	0.000	3.01	0	22	1.08%	2.5	36%	3.84	0.000	3.84
54.625	6921.41	62.1	0.726	62.0	22.7	9.82	1.17%	Coarse Alluvium	0.056	111.0	3.01	0.000	3.01	0	20	1.23%	2.5	36%	3.84	0.000	3.84
54.789	6921.25	52.4	0.899	52.3	5.0	2.18	1.72%	Coarse Alluvium	0.056	111.0	3.02	0.000	3.02	0	16	1.82%	2.7	36%	3.85	0.000	3.85
54.953	6921.09	48.3	0.966	48.3	5.0	2.15	2.00%	Coarse Alluvium	0.056	111.0	3.03	0.000	3.03	0	15	2.13%	2.8	36%	3.86	0.000	3.86
55.117	6920.92	67.2	1.039	67.1	5.4	2.36	1.55%	Coarse Alluvium	0.056	111.0	3.04	0.000	3.04	0	21	1.62%	2.6	36%	3.87	0.000	3.87
55.281	6920.76	84.1	0.932	84.1	4.3	1.85	1.11%	Coarse Alluvium	0.056	111.0	3.05	0.000	3.05	0	27	1.15%	2.4	36%	3.88	0.000	3.88
55.446	6920.59	83.1	0.812	83.1	4.3	1.85	0.98%	Coarse Alluvium	0.056	111.0	3.06	0.000	3.06	0	26	1.01%	2.4	36%	3.89	0.000	3.89
55.610	6920.43	75.9	0.925	75.9	4.4	1.91	1.22%	Coarse Alluvium	0.056	111.0	3.07	0.000	3.07	0	24	1.27%	2.5	36%	3.90	0.000	3.90
55.774	6920.27	62.9	0.964	62.9	4.0	1.73	1.53%	Coarse Alluvium	0.056	111.0	3.08	0.000	3.08	0	19	1.61%	2.6	36%	3.91	0.000	3.91
55.938	6920.10	59.2	0.890	59.2	4.0	1.73	1.50%	Coarse Alluvium	0.056	111.0	3.09	0.000	3.09	0	18	1.59%	2.6	36%	3.92	0.000	3.92
56.102	6919.94	55.0	0.960	54.9	4.1	1.77	1.75%	Coarse Alluvium	0.056	111.0	3.10	0.000	3.10	0	17	1.85%	2.7	36%	3.93	0.000	3.93
56.266	6919.77	49.2	1.187	49.2	3.9	1.71	2.41%	Coarse Alluvium	0.056	111.0	3.11	0.000	3.11	0	15	2.57%	2.8	36%	3.94	0.000	3.94
56.430	6919.61	42.4	1.546	42.4	3.9	1.71	3.64%	Coarse Alluvium	0.056	111.0	3.11	0.000	3.11	0	13	3.93%	3.0	36%	3.95	0.000	3.95
56.594	6919.45	42.7	1.380	42.7	4.0	1.73	3.23%	Coarse Alluvium	0.056	111.0	3.12	0.000	3.12	0	13	3.48%	3.0	36%	3.95	0.000	3.95
56.758	6919.28	65.0	1.396	65.0	4.0	1.75	2.15%	Coarse Alluvium	0.056	111.0	3.13	0.000	3.13	0	20	2.26%	2.7	36%	3.96	0.000	3.96
56.922	6919.12	104.5	1.907	104.5	4.8	2.08	1.82%	Coarse Alluvium	0.056	111.0	3.14	0.000	3.14	0	32	1.88%	2.5	36%	3.97	0.000	3.97
57.086	6918.95	101.6	2.343	101.6	4.4	1.89	2.31%	Coarse Alluvium	0.056	111.0	3.15	0.000	3.15	0	31	2.38%	2.5	36%	3.98	0.000	3.98
57.250	6918.79	97.9	2.432	97.9	4.6	1.97	2.48%	Coarse Alluvium	0.056	111.0	3.16	0.000	3.16	0	30	2.57%	2.6	36%	3.99	0.000	3.99
57.414	6918.63	83.6	2.203	83.6	4.3	1.87	2.64%	Coarse Alluvium	0.056	111.0	3.17	0.000	3.17	0	25	2.74%	2.6	36%	4.00	0.000	4.00
57.578	6918.46	62.2	1.815	62.2	3.7	1.59	2.92%	Coarse Alluvium	0.056	111.0	3.18	0.000	3.18	0	19	3.07%	2.8	36%	4.01	0.000	4.01
57.742	6918.30	56.2	1.789	56.2	3.9	1.67	3.18%	Coarse Alluvium	0.056	111.0	3.19	0.000	3.19	0	17	3.38%	2.8	36%	4.02	0.000	4.02
57.906	6918.13	72.6	1.932	72.6	4.2	1.81	2.66%	Coarse Alluvium	0.056	111.0	3.20	0.000	3.20	0	22	2.78%	2.7	36%	4.03	0.000	4.03
58.070	6917.97	58.2	2.197	58.1	4.3	1.85	3.78%	Coarse Alluvium	0.056	111.0	3.21	0.000	3.21	0	17	4.00%	2.9	36%	4.04	0.000	4.04
58.234	6917.81	45.7	1.766	45.6	4.1	1.77	3.87%	Coarse Alluvium	0.056	111.0	3.22	0.000	3.22	0	13	4.16%	3.0	36%	4.05	0.000	4.05
58.398	6917.64	44.7	1.643	44.7	4.9	2.14	3.67%	Coarse Alluvium	0.056	111.0	3.22	0.000	3.22	0	13	3.96%	3.0	36%	4.05	0.000	4.05
58.562	6917.48	121.5	2.456	121.5	6.8	2.95	2.02%	Coarse Alluvium	0.056	111.0	3.23	0.000	3.23	0	37	2.08%	2.4	36%	4.06	0.000	4.06
58.726	6917.31	252.7	2.868	252.7	7.4	3.21	1.13%	Coarse Alluvium	0.056	111.0	3.24	0.000	3.24	0	77	1.15%	2.0	36%	4.07	0.000	4.07
58.890	6917.15	290.8	4.380	290.8	8.2	3.54	1.51%	Coarse Alluvium	0.056	111.0	3.25	0.000	3.25	0	88	1.52%	2.1	36%	4.08	0.000	4.08
59.054	6916.99	233.5	4.940	233.5	8.2	3.54	2.12%	Coarse Alluvium	0.056	111.0	3.26	0.000	3.26	0	71	2.15%	2.2	36%	4.09	0.000	4.09
59.218	6916.82	179.0	4.573	178.9	7.9	3.44	2.56%	Coarse Alluvium	0.056	111.0	3.27	0.000	3.27	0	54	2.60%	2.4	36%	4.10	0.000	4.10

17.43	685	1.7E-03	7.8E+02	20	0.1321	1.1E-04	43	0.270	0.275	265	265.000	6309	4310	1661	1661	0.013%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.48	685	1.7E-03	7.8E+02	20	0.1294	1.0E-04	43	0.270	0.275	266	266.000	6306	4307	1662	1662	0.012%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.53	685	1.7E-03	7.8E+02	20	0.1268	1.0E-04	43	0.270	0.276	267	267.000	6303	4305	1663	1663	0.012%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.58	685	1.7E-03	7.8E+02	20	0.1242	1.0E-04	43	0.270	0.276	268	268.000	6300	4303	1664	1664	0.012%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.63	685	1.7E-03	7.8E+02	20	0.1217	9.8E-05	43	0.270	0.276	269	269.000	6297	4301	1665	1665	0.012%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.68	685	1.7E-03	7.8E+02	19	0.1192	9.6E-05	43	0.270	0.276	270	270.000	6294	4299	1666	1666	0.011%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.73	685	1.7E-03	7.8E+02	19	0.1167	9.4E-05	43	0.271	0.276	271	271.000	6291	4297	1667	1667	0.011%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.78	685	1.7E-03	7.8E+02	19	0.1142	9.3E-05	43	0.271	0.276	272	272.000	6288	4294	1668	1668	0.011%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.83	685	1.7E-03	7.8E+02	19	0.1118	9.1E-05	43	0.271	0.276	273	273.000	6284	4292	1669	1669	0.011%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.88	685	1.7E-03	7.8E+02	19	0.1093	8.9E-05	43	0.271	0.276	274	274.000	6281	4290	1670	1670	0.010%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.93	685	1.7E-03	8.1E+02	19	0.1070	8.5E-05	0	0.275	0.281	275	0.275	6129	4184	1671	6129	0.010%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
17.98	685	1.7E-03	8.1E+02	19	0.1046	8.3E-05	0	0.275	0.281	276	0.275	6122	4179	1672	6122	0.010%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
18.03	685	1.7E-03	8.1E+02	19	0.1023	8.2E-05	0	0.275	0.281	277	0.275	6115	4174	1673	6115	0.009%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
18.08	685	1.7E-03	8.1E+02	19	0.1000	8.0E-05	0	0.275	0.281	278	0.275	6108	4169	1674	6108	0.009%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
18.13	685	1.7E-03	8.1E+02	19	0.0977	7.8E-05	0	0.275	0.281	279	0.275	6101	4165	1675	6101	0.009%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
18.18	685	1.7E-03	8.1E+02	19	0.0955	7.7E-05	0	0.275	0.282	280	0.275	6094	4160	1676	6094	0.009%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
18.23	685	1.7E-03	8.1E+02	19	0.0933	7.5E-05	0	0.276	0.282	281	0.276	6087	4155	1677	6087	0.008%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
18.28	1272	1.7E-03	2.8E+03	19	0.0911	2.1E-05	0	0.276	0.282	282	0.276	6080	4150	1678	6080	0.002%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
18.33	1272	1.7E-03	2.8E+03	19	0.0889	2.1E-05	0	0.276	0.282	283	0.276	6074	4146	1679	6074	0.002%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
18.38	1272	1.7E-03	2.8E+03	19	0.0868	2.0E-05	0	0.276	0.282	284	0.276	6067	4141	1680	6067	0.002%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
18.43	1272	1.7E-03	2.8E+03	19	0.0847	2.0E-05	0	0.276	0.283	285	0.276	6060	4136	1681	6060	0.002%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
18.48	1272	1.7E-03	2.8E+03	19	0.0826	2.0E-05	0	0.276	0.283	286	0.276	6054	4132	1682	6054	0.002%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
18.53	1272	1.7E-03	2.8E+03	19	0.0805	1.9E-05	0	0.277	0.283	287	0.277	6047	4127	1683	6047	0.002%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
18.58	1272	1.7E-03	2.8E+03	19	0.0785	1.9E-05	0	0.277	0.283	288	0.277	6040	4122	1684	6040	0.002%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
18.63	1272	1.7E-03	2.8E+03	19	0.0765	1.8E-05	0	0.277	0.283	289	0.277	6034	4118	1685	6034	0.002%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
18.68	1272	1.7E-03	2.8E+03	19	0.0745	1.8E-05	0	0.277	0.284	290	0.277	6027	4113	1686	6027	0.002%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
18.73	1272	1.7E-03	2.8E+03	18	0.0726	1.7E-05	0	0.277	0.284	291	0.277	6021	4109	1687	6021	0.002%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
18.78	1272	1.7E-03	2.8E+03	18	0.0706	1.7E-05	0	0.277	0.284	292	0.277	6014	4104	1688	6014	0.002%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
18.83	1272	1.7E-03	2.8E+03	18	0.0687	1.7E-05	0	0.278	0.284	293	0.278	6008	4100	1689	6008	0.002%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
18.88	1272	1.7E-03	2.8E+03	18	0.0668	1.6E-05	0	0.278	0.284	294	0.278	6001	4095	1690	6001	0.002%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
18.93	1272	1.7E-03	2.8E+03	18	0.0650	1.6E-05	0	0.278	0.285	295	0.278	5995	4091	1691	5995	0.002%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
18.98	1272	1.7E-03	2.8E+03	18	0.0632	1.5E-05	0	0.278	0.285	296	0.278	5988	4086	1692	5988	0.002%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
19.03	1272	1.7E-03	2.8E+03	18	0.0613	1.5E-05	0	0.278	0.285	297	0.278	5982	4082	1693	5982	0.002%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
19.08	1272	1.7E-03	2.8E+03	18	0.0596	1.5E-05	0	0.278	0.285	298	0.278	5975	4077	1694	5975	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
19.13	1272	1.7E-03	2.8E+03	18	0.0578	1.4E-05	0	0.279	0.285	299	0.279	5969	4073	1695	5969	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
19.18	1272	1.7E-03	2.8E+03	18	0.0561	1.4E-05	0	0.279	0.286	300	0.279	5963	4068	1696	5963	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
19.23	1272	1.7E-03	2.8E+03	18	0.0544	1.3E-05	0	0.279	0.286	301	0.279	5956	4064	1697	5956	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
19.28	1272	1.7E-03	2.8E+03	18	0.0527	1.3E-05	0	0.279	0.286	302	0.279	5950	4060	1698	5950	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
19.33	1272	1.7E-03	2.8E+03	18	0.0510	1.3E-05	0	0.279	0.286	303	0.279	5944	4055	1699	5944	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
19.38	1272	1.7E-03	2.8E+03	18	0.0494	1.2E-05	0	0.279	0.286	304	0.279	5937	4051	1700	5937	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
19.43	1220	1.7E-03	2.6E+03	18	0.0477	1.3E-05	0	0.280	0.287	305	0.280	5931	4047	1701	5931	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
19.48	1220	1.7E-03	2.6E+03	18	0.0461	1.3E-05	0	0.280	0.287	306	0.280	5925	4042	1702	5925	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
19.53	1220	1.7E-03	2.6E+03	18	0.0446	1.2E-05	0	0.280	0.287	307	0.280	5919	4038	1703	5919	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
19.58	1220	1.7E-03	2.6E+03	18	0.0430	1.2E-05	0	0.280	0.287	308	0.280	5913	4034	1704	5913	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
19.63	1220	1.7E-03	2.6E+03	18	0.0415	1.1E-05	0	0.280	0.287	309	0.280	5907	4029	1705	5907	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
19.68	1220	1.7E-03	2.6E+03	18	0.0400	1.1E-05	0	0.280	0.288	310	0.280	5900	4025	1706	5900	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
19.73	1220	1.7E-03	2.6E+03	18	0.0385	1.1E-05	0	0.281	0.288	311	0.281	5894	4021	1707	5894	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
19.78	1220	1.7E-03	2.6E+03	18	0.0370	1.0E-05	0	0.281	0.288	312	0.281	5888	4017	1708	5888	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
19.83	1220	1.7E-03	2.6E+03	18	0.0355	9.8E-06	0	0.281	0.288	313	0.281	5882	4012	1709	5882	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
19.88	1220	1.7E-03	2.6E+03	18	0.0341	9.4E-06	0	0.281	0.288	314	0.281	5876	4008	1710	5876	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
19.93	1220	1.7E-03	2.6E+03	18	0.0327	9.1E-06	0	0.281	0.289	315	0.281	5870	4004	1711	5870	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
19.98	1220	1.7E-03	2.6E+03	18	0.0313	8.7E-06	0	0.281	0.289	316	0.281	5864	4000	1712	5864	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.03	1220	1.7E-03	2.6E+03	18	0.0307	8.6E-06	0	0.282	0.289	317	0.282	5858	3996	1713	5858	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.08	1220	1.7E-03	2.6E+03	18	0.0305	8.5E-06	0	0.282	0.289	318	0.282	5852	3992	1714	5852	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.13	1220	1.7E-03	2.6E+03	18	0.0302	8.5E-06	0	0.282	0.289	319	0.282	5846	3987	1715	5846	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.18	1220	1.7E-03	2.6E+03	18	0.0300	8.4E-06	0	0.282	0.290	320	0.282	5840	3983	1716	5840	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.23	1220	1.7E-03	2.6E+03	18	0.0298	8.4E-06	0	0.282	0.290	321	0.282	5835	3979	1717	5835	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.28	1220	1.7E-03	2.6E+03	18	0.0295	8.3E-06	0	0.282	0.290	322	0.282	5829	3975	1718	5829	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.33	1220	1.7E-03	2.6E+03	18	0.0293	8.3E-06	0	0.283	0.290	323	0.283	5823	3971	1719	5823	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.38	1220	1.7E-03	2.6E+03	18	0.0291	8.3E-06	0	0.283	0.290	324	0.283	5817	3967	1720	5817	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.43	1220	1.7E-03	2.6E+03	18	0.0288	8.2E-06	0	0.283	0.290	325	0.283	5811	3963	1721	5811	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.48	1220	1.7E-03	2.6E+03	17	0.0286	8.2E-06	0	0.283	0.291	326	0.283	5805	3959	1722	5805	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.53	1220	1.7E-03	2.6E+03	17	0.0284	8.1E-06	0	0.283	0.291	327	0.283	5800	3955	1723	5800	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.58	1220	1.7E-03	2.6E+03	17	0.0282	8.1E-06	0	0.283	0.291	328	0.283	5794	3951	1724	5794	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.63	1220	1.7E-03	2.6E+03	17	0.0279	8.0E-06	0	0.284	0.291	329	0.284	5788	3947	1725	5788	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.68	1220	1.7E-03	2.6E+03	17	0.0277	8.0E-06	0	0.284	0.291	330	0.284	5782	3943	1726	5782	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.73	1220	1.7E-03	2.6E+03	17	0.0275	7.9E-06	0	0.284	0.292	331	0.284	5777	3939	1727	5777	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.78	1220	1.7E-03	2.6E+03	17	0.0272	7.9E-06	0	0.284	0.292	332	0.284	5771	3935	1728	5771	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.83	1220	1.7E-03	2.6E+03	17	0.0270	7.8E-06	0	0.284	0.292	333	0.284	5765	3931	1729	5765	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.88	1220	1.7E-03	2.6E+03	17	0.0268	7.8E-06	0	0.284	0.292	334	0.284	5760	3927	1730	5760	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.93	1220	1.7E-03	2.6E+03	17	0.0265	7.7E-06	0	0.284	0.292	335	0.284	5754	3923	1731	5754	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.98	1298	1.7E-03	2.9E+03	17	0.0263	6.8E-06	0	0.285	0.292	336	0.285	5749	3920	1732	5749	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.03	1298	1.7E-03	2.9E+03	17	0.0261	6.7E-06	0	0.285	0.293	337	0.285	5743	3916	1733	5743	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.08	1298	1.7E-03	2.9E+03	17	0.0259	6.7E-06	0	0.285	0.293	338	0.285	5738	3912	1734	5738	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.13	1298	1.7E-03	2.9E+03	17	0.0256	6.7E-06	0	0.285	0.293	339	0.285	5732	3908	1735	5732	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.18	1298	1.7E-03	2.9E+03	17	0.0254	6.6E-06	0	0.285	0.293	340	0.285	5726	3904	1736	5726	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.23	1298	1.7E-03	2.9E+03	17	0.0252	6.6E-06	0	0.285	0.293	341	0.285	5721	3900	1737	5721	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.28	1298	1.7E-03	2.9E+03	17	0.0249	6.5E-06	0	0.286	0.294	342	0.286	5715	3896	1738	5715	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.33	1298	1.7E-03	2.9E+03	17	0.0247	6.5E-06	0	0.286	0.294	343	0.286	5710	3893	1739	5710	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.38	1298	1.7E-03	2.9E+03	17	0.0245	6.4E-06	0	0.286	0.294	344	0.286	5705	3889	1740	5705	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.43	1298	1.7E-03	2.9E+03	17	0.0242	6.4E-06	0	0.286	0.294	345	0.286	5699	3885	1741	5699	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.48	1298	1.7E-03	2.9E+03	17	0.0240	6.3E-06	0	0.286	0.294	346	0.286	5694	3881	1742	5694	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.53	1298	1.7E-03	2.9E+03	17	0.0238	6.3E-06	0	0.286	0.294	347	0.286	5688	3878	1743	5688	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.58	1298	1.7E-03	2.9E+03	17	0.0236	6.3E-06	0	0.286	0.295	348	0.286	5683	3874	1744	5683	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.63	1298	1.7E-03	2.9E+03	17	0.0233	6.2E-06	0	0.287	0.295	349	0.287	5678	3870	1745	5678	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.68	1298	1.7E-03	2.9E+03	17	0.0231	6.2E-06	0	0.287	0.295	350	0.287	5672	3866	1746	5672	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.73	1298	1.7E-03	2.9E+03	17	0.0229	6.1E-06	0	0.287	0.295	351	0.287	5667	3863	1747	5667	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.78	1298	1.7E-03	2.9E+03	17	0.0226	6.1E-06	0	0.287	0.295	352	0.287	5662	3859	1748	5662	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.83	1298	1.7E-03	2.9E+03	17	0.0224	6.0E-06	0	0.287	0.296	353	0.287	5656	3855	1749	5656	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.88	1298	1.7E-03	2.9E+03	17	0.0222	6.0E-06	0	0.287	0.296	354	0.287	5651	3852	1750	5651	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.93	1298	1.7E-03	2.9E+03	17	0.0219	5.9E-06	0	0.288	0.296	355	0.288	5646	3848	1751	5646	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.98	1298	1.7E-03	2.9E+03	17	0.0217	5.9E-06	0	0.288	0.296	356	0.288	5641	3844	1752	5641	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.03	1298	1.7E-03	2.9E+03	17	0.0215	5.8E-06	0	0.288	0.296	357	0.288	5635	3841	1753	5635	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.08	1298	1.7E-03	2.9E+03	17	0.0213	5.8E-06	0	0.288	0.296	358	0.288	5630	3837	1754	5630	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.13	1298	1.7E-03	2.9E+03	17	0.0210	5.7E-06	0	0.288	0.297	359	0.288	5625	3834	1755	5625	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.18	1298	1.7E-03	2.9E+03	17	0.0208	5.7E-06	0	0.288	0.297	360	0.288	5620	3830	1756	5620	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.23	1298	1.7E-03	2.9E+03	17	0.0206	5.6E-06	0	0.288	0.297	361	0.288	5615	3826	1757	5615	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.28	1298	1.7E-03	2.9E+03	17	0.0203	5.6E-06	0	0.289	0.297	362	0.289	5609	3823	1758	5609	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.33	1298	1.7E-03	2.9E+03	17	0.0201	5.5E-06	0	0.289	0.297	363	0.289	5604	3819	1759	5604	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.38	1298	1.7E-03	2.9E+03	17	0.0199	5.5E-06	0	0.289	0.298	364	0.289	5599	3816	1760	5599	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000

59.382	6916.66	125.7	3.556	125.7	7.6	3.28	2.83%	Coarse Alluvium	0.056	111.0	3.28	0.000	3.28	0	37	2.90%	2.5	36%	4.11	0.000	4.11
59.547	6916.49	86.3	3.115	86.3	7.2	3.13	3.61%	Coarse Alluvium	0.056	111.0	3.29	0.000	3.29	0	25	3.75%	2.7	36%	4.12	0.000	4.12
59.711	6916.33	83.3	2.586	83.3	7.5	3.23	3.10%	Coarse Alluvium	0.056	111.0	3.30	0.000	3.30	0	24	3.23%	2.7	36%	4.13	0.000	4.13
59.875	6916.17	121.5	1.784	121.5	8.1	3.52	1.47%	Coarse Alluvium	0.056	111.0	3.31	0.000	3.31	0	36	1.51%	2.4	36%	4.14	0.000	4.14
60.039	6916.00	134.5	2.632	134.4	8.2	3.54	1.96%	Coarse Alluvium	0.056	111.0	3.32	0.000	3.32	0	40	2.01%	2.4	36%	4.15	0.000	4.15
60.203	6915.84	119.0	3.618	119.0	7.9	3.44	3.04%	Coarse Alluvium	0.056	111.0	3.32	0.000	3.32	0	35	3.13%	2.6	36%	4.15	0.000	4.15
60.367	6915.67	101.5	4.702	101.5	8.0	3.48	4.63%	Coarse Alluvium	0.056	111.0	3.33	0.000	3.33	0	29	4.79%	2.8	36%	4.16	0.000	4.16
60.531	6915.51	143.1	6.286	143.0	14.4	6.22	4.39%	Coal	-	-	-	-	-	-	-	-	-	-	-	-	-
60.695	6915.35	273.4	6.286	273.3	21.3	9.23	2.30%	Coal	-	-	-	-	-	-	-	-	-	-	-	-	-
60.859	6915.18	426.4	6.286	426.2	32.6	14.14	1.47%	Coal	-	-	-	-	-	-	-	-	-	-	-	-	-

22.43	1298	1.7E-03	2.9E+03	17	0.0196	5.4E-06	0	0.289	0.298	365	0.289	5594	3812	1761	5594	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22.53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22.58	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22.63	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22.68	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22.73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22.78	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22.83	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22.88	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Proposed Repositor	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Elev. At Bottom of Layer (ft)	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at Bottom of Layer (tsf)	Total Stress at Midpoint of Layer (tsf)	Equil Pore Pressure at Bottom of Layer (tsf)	Equil Pore Pressure at Midpoint of Layer	Effective Stress at Bottom of Layer (tsf)	Effective Stress at Midpoint of
Erosion Protection	6990.3	6989.5	6988.8	1.5	0.061	122.9	0.092	0.046	0.00	0.00	0.092	0.046
Cover Soil	6988.8	6987.5	6986.3	2.5	0.057	114.7	0.235	0.164	0.00	0.00	0.235	0.164
Mine Spoils	6986.3	6981.2	6976.0	10.2	0.058	116.4	0.830	0.533	0.00	0.00	0.830	0.533

6976.04	Ground Surface Elevation at time of CPT (ft amsl)
6990.26	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
1.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after placement (ft)
2.50	Thickness of Water Storage/Rooting Zone (Cover Soil; ft)

0.83	Additional Stress due to Proposed Repository Construction, $\Delta\sigma_{repos}$ (psf)
6931.50	Elevation of bottom of tailings (ft amsl)

UNC-NECR WASTE REPOSITORY SEISMIC SETTLEMENT ANALYSIS - CPT-10

Data File: 13-52118_RP10-BSC-CPT
Location: UNC-NECR 2013 Mill Site PDS

Cells Requiring User Input/Manipulation

http://projects.mwhglobal.com/.../13-52118_RP10-BSC-CPT.XLS

Legend	Legend
Erosion Protection	Coarse Tailings
Cover Soil	Coarse/Fine Tailings
Mine Spoils	Fine Tailings
Radon Barrier	Coarse Alluvium
General Fill	Fine Alluvium

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.3
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69

Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.3
Earthquake Moment Magnitude, M:	6.3
Magnitude Scaling Factor, MSF:	1.59

Value	Parameter
6883.40	Water surface elevation during CPT investigation (ft amsl)
6883.40	Water surface elevation at t_0 (ft amsl)
6883.40	Water surface elevation at t_1 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Earthquake
8.26	Equiv. Number of Uniform Strain Cycles, N

Midpoint Depth at t_1, z_1 (m)	Shear Wave Velocity, V_s (ft/sec)	Soil Density, ρ (tcf)	Max Shear Strain Modulus, G_{max} (tsf)	Coefficient a_2 for Stress Reduction Factor	Stress Reduction Factor, r_d	P = γ_{eff}*(G_{eff}/G_{max}) (tsf)	Plasticity Index, PI	g_1 for PI = 0	g_1 for PI = 15	g_1 for PI = 30	g_1	g_2 for PI = 0	g_2 for PI = 15	g_2 for PI = 30	g_2	Shear Strain, γ (%)	a	b	Threshhold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{c-15} (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
0.23	866	1.9E-03	1.4E+03	1249	0.9990	6.3E-06	12	0.102	0.091	4	0.093	35267	24912	1400	26983	0.001%	2.00	0.65	0.03%	0.000000	0.34	0.079	0.797	0.00%	0.0000
0.84	866	1.8E-03	1.3E+03	1017	0.9958	2.4E-05	12	0.137	0.127	4	0.129	20964	14659	1400	15920	0.003%	2.00	0.65	0.03%	0.000000	0.34	0.079	0.797	0.00%	0.0000
3.81	866	1.8E-03	1.4E+03	380	0.9671	1.0E-04	12	0.194	0.188	4	0.189	11360	7849	1400	8551	0.012%	1.18	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000

2013 CPT Data from ConeTec / CPT Data Interpretations / Conditions at t_1

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (per drilling log from coupled borehole)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	Normalized Cone Penetration Resistance	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1, u_1 (tsf)	Effective Stress at t_1 (tsf)
0.164	6973.44	3.5	0.010	3.3	35.8	15.52	0.29%	Radon Barrier	0.061	122.3	0.01	0.000	0.01	0	345	0.29%	1.2	59%	1.23	0.000	1.23
0.328	6973.27	4.6	0.108	4.5	8.5	3.66	2.36%	Radon Barrier	0.061	122.3	0.02	0.000	0.02	0	227	2.37%	1.9	59%	1.24	0.000	1.24
0.492	6973.11	11.3	0.106	11.3	5.3	2.28	0.94%	Radon Barrier	0.061	122.3	0.03	0.000	0.03	0	375	0.94%	1.5	59%	1.25	0.000	1.25
0.656	6972.94	30.1	0.223	30.0	9.0	3.90	0.74%	Radon Barrier	0.061	122.3	0.04	0.000	0.04	0	749	0.74%	1.2	59%	1.26	0.000	1.26
0.820	6972.78	48.2	0.257	48.2	1.7	0.73	0.53%	Radon Barrier	0.061	122.3	0.05	0.000	0.05	0	960	0.53%	1.1	59%	1.27	0.000	1.27
0.984	6972.62	75.1	0.280	75.0	8.6	3.74	0.37%	Radon Barrier	0.061	122.3	0.06	0.000	0.06	0	1246	0.37%	0.9	59%	1.28	0.000	1.28
1.148	6972.45	70.6	0.336	70.6	2.4	1.02	0.48%	Radon Barrier	0.061	122.3	0.07	0.000	0.07	0	1005	0.48%	1.0	59%	1.29	0.000	1.29
1.312	6972.29	66.8	0.393	66.8	3.9	1.69	0.59%	Radon Barrier	0.061	122.3	0.08	0.000	0.08	0	832	0.59%	1.1	59%	1.30	0.000	1.30
1.476	6972.12	68.0	0.456	68.0	1.7	0.75	0.67%	Radon Barrier	0.061	122.3	0.09	0.000	0.09	0	752	0.67%	1.2	59%	1.31	0.000	1.31
1.640	6971.96	68.8	0.760	68.8	0.9	0.41	1.11%	Radon Barrier	0.061	122.3	0.10	0.000	0.10	0	685	1.11%	1.4	59%	1.32	0.000	1.32
1.804	6971.80	75.0	1.185	75.0	2.1	0.89	1.58%	Radon Barrier	0.061	122.3	0.11	0.000	0.11	0	679	1.58%	1.6	59%	1.33	0.000	1.33
1.968	6971.63	105.1	1.817	105.1	7.3	3.17	1.73%	Radon Barrier	0.061	122.3	0.12	0.000	0.12	0	872	1.73%	1.6	59%	1.35	0.000	1.35
2.133	6971.47	132.3	3.007	132.2	11.7	5.08	2.27%	General Fill	0.057	113.8	0.13	0.000	0.13	0	1019	2.28%	1.6	48%	1.35	0.000	1.35
2.297	6971.30	159.7	4.044	159.6	17.5	7.57	2.53%	General Fill	0.057	113.8	0.14	0.000	0.14	0	1148	2.53%	1.7	48%	1.36	0.000	1.36
2.461	6971.14	171.5	5.127	171.4	23.0	9.95	2.99%	General Fill	0.057	113.8	0.15	0.000	0.15	0	1155	2.99%	1.7	48%	1.37	0.000	1.37
2.625	6970.98	168.1	5.694	168.1	11.6	5.02	3.39%	General Fill	0.057	113.8	0.16	0.000	0.16	0	1065	3.39%	1.8	48%	1.38	0.000	1.38
2.789	6970.81	152.4	5.098	152.3	5.4	2.36	3.35%	General Fill	0.057	113.8	0.17	0.000	0.17	0	911	3.35%	1.8	48%	1.39	0.000	1.39
2.953	6970.65	136.3	4.745	136.3	2.2	0.94	3.48%	General Fill	0.057	113.8	0.18	0.000	0.18	0	772	3.49%	1.9	48%	1.40	0.000	1.40
3.117	6970.48	116.0	4.208	115.9	1.7	0.73	3.63%	General Fill	0.057	113.8	0.19	0.000	0.19	0	623	3.63%	1.9	48%	1.41	0.000	1.41
3.281	6970.32	100.2	3.982	100.1	22.8	9.86	3.97%	General Fill	0.057	113.8	0.20	0.000	0.20	0	513	3.98%	2.0	48%	1.42	0.000	1.42
3.445	6970.16	91.8	3.420	91.7	5.0	2.15	3.73%	General Fill	0.057	113.8	0.20	0.000	0.20	0	448	3.74%	2.0	48%	1.43	0.000	1.43
3.609	6969.99	81.4	3.048	81.4	5.0	2.18	3.74%	General Fill	0.057	113.8	0.21	0.000	0.21	0	380	3.75%	2.0	48%	1.44	0.000	1.44
3.773	6969.83	82.5	2.961	82.4	20.8	9.01	3.59%	General Fill	0.057	113.8	0.22	0.000	0.22	0	369	3.60%	2.0	48%	1.45	0.000	1.45
3.937	6969.66	88.9	2.980	88.9	6.2	2.70	3.35%	General Fill	0.057	113.8	0.23	0.000	0.23	0	382	3.36%	2.0	48%	1.46	0.000	1.46
4.101	6969.50	94.1	3.569	94.1	6.1	2.64	3.79%	General Fill	0.057	113.8	0.24	0.000	0.24	0	388	3.80%	2.0	48%	1.47	0.000	1.47
4.265	6969.33	110.6	4.227	110.6	8.8	3.80	3.82%	General Fill	0.057	113.8	0.25	0.000	0.25	0	440	3.83%	2.0	48%	1.48	0.000	1.48
4.429	6969.17	119.7	4.319	119.6	5.1	2.22	3.61%	General Fill	0.057	113.8	0.26	0.000	0.26	0	459	3.62%	2.0	48%	1.49	0.000	1.49
4.593	6969.01	108.1	3.869	108.0	4.5	1.93	3.58%	General Fill	0.057	113.8	0.27	0.000	0.27	0	400	3.59%	2.0	48%	1.49	0.000	1.49
4.757	6968.84	88.7	3.214	88.7	1.7	0.75	3.62%	General Fill	0.057	113.8	0.28	0.000	0.28	0	317	3.64%	2.0	48%	1.50	0.000	1.50
4.921	6968.68	73.0	2.450	72.9	4.8	2.09	3.36%	General Fill	0.057	113.8	0.29	0.000	0.29	0	252	3.37%	2.0	48%	1.51	0.000	1.51
5.085	6968.51	67.2	2.274	67.2	1.4	0.61	3.38%	General Fill	0.057	113.8	0.30	0.000	0.30	0	225	3.40%	2.1	48%	1.52	0.000	1.52
5.249	6968.35	70.1	2.479	70.1	1.2	0.53	3.54%	General Fill	0.057	113.8	0.31	0.000	0.31	0	227	3.55%	2.1	48%	1.53	0.000	1.53
5.413	6968.19	79.2	2.592	79.2	2.5	1.10	3.27%	General Fill	0.057	113.8	0.32	0.000	0.32	0	249	3.28%	2.0	48%	1.54	0.000	1.54
5.577	6968.02	117.1	2.461	117.1	6.0	2.58	2.10%	General Fill	0.057	113.8	0.33	0.000	0.33	0	359	2.11%	1.8	48%	1.55	0.000	1.55
5.741	6967.86	136.7	2.097	136.7	4.2	1.83	1.53%	General Fill	0.057	113.8	0.34	0.000	0.34	0	407	1.54%	1.6	48%	1.56	0.000	1.56
5.905	6967.69	145.9	1.683	145.9	5.5	2.38	1.15%	General Fill	0.057	113.8	0.34	0.000	0.34	0	423	1.16%	1.5	48%	1.57	0.000	1.57
6.069	6967.53	149.2	1.876	149.2	5.4	2.34	1.26%	General Fill	0.057	113.8	0.35	0.000	0.35	0	421	1.26%	1.6	48%	1.58	0.000	1.58
6.234	6967.37	147.6	1.838	147.6	4.2	1.83	1.25%	General Fill	0.057	113.8	0.36	0.000	0.36	0	406	1.25%	1.6	48%	1.59	0.000	1.59
6.398	6967.20	145.8	2.024	145.8	3.0	1.30	1.39%	General Fill	0.057	113.8	0.37	0.000	0.37	0	391	1.39%	1.6	48%	1.60	0.000	1.60
6.562	6967.04	139.7	2.297	139.7	2.9	1.26	1.64%	General Fill	0.057	113.8	0.38	0.000	0.38	0	365	1.65%	1.7	48%	1.61	0.000	1.61
6.726	6966.87	120.4	3.073	120.4	2.8	1.22	2.55%	General Fill	0.057	113.8	0.39	0.000	0.39	0	307	2.56%	1.9	48%	1.62	0.000	1.62
6.890	6966.71	92.0	3.381	92.0	3.3	1.42	3.68%	Coarse Tailings	0.054	108.1	0.40	0.000	0.40	0	229	3.69%	2.1	21%	1.62	0.000	1.62
7.054	6966.55	74.6	2.934	74.6	7.3	3.15	3.93%	Coarse Tailings	0.054	108.1	0.41	0.000	0.41	0	182	3.95%	2.2	21%	1.63	0.000	1.63
7.218	6966.38	196.1	3.150	195.9	28.4	12.30	1.61%	Coarse Tailings	0.054	108.1	0.42	0.000	0.42	0	469	1.61%	1.6	21%	1.64	0.000	1.64
7.382	6966.22	197.9	3.377	197.8	12.8	5.53	1.71%	Coarse Tailings	0.054	108.1	0.43	0.000	0.43	0	463	1.71%	1.7	21%	1.65	0.000	1.65
7.546	6966.05	115.4	2.830	115.4	0.7	0.30	2.45%	Coarse Tailings	0.054	108.1	0.44	0.000	0.44	0	264	2.46%	1.9	21%	1.66	0.000	1.66
7.710	6965.89	74.5	3.389	74.5	0.1	0.06	4.55%	Coarse Tailings	0.054	108.1	0.44	0.000	0.44	0	167	4.58%	2.3	21%	1.67	0.000	1.67
7.874	6965.73	70.5	3.113	70.5	4.7	2.03	4.41%	Coarse Tailings	0.054	108.1	0.45	0.000	0.45	0	155	4.44%	2.3	21%	1.68	0.000	1.68
8.038	6965.56	78.3	3.495	78.0	46.7	20.25	4.46%	Coarse Tailings	0.054	108.1	0.46	0.000	0.46	0	168	4.49%	2.2	21%	1.69	0.000	1.69
8.202	6965.40	192.2	4.149	191.3	155.3	67.31	2.16%	Coarse Tailings	0.054	108.1	0.47	0.000	0.47	0	407	2.16%	1.8	21%	1.70	0.000	1.70
8.366	6965.23	278.0	3.670	277.8	25.1	10.88	1.32%	Coarse Tailings	0.054	108.1	0.48	0.000	0.48	0	578	1.32%	1.5	21%	1.70	0.000	1.70
8.530	6965.07	312.7	4.080	312.7	6.6	2.87	1.30%	Coarse Tailings	0.054	108.1	0.49	0.000	0.49	0	639	1.31%	1.5	21%	1.71	0.000	1.71
8.694	6964.91	305.6	3.655	305.5	16.0	6.93	1.20%	Coarse Tailings	0.054	108.1	0.50	0.000	0.50	0	613	1.20%	1.5	21%	1.72	0.000	1.72
8.858	6964.74	279.3	3.841	279.2	3.2	1.40	1.38%	Coarse Tailings	0.054	108.1	0.51	0.000	0.51	0	551	1.38%	1.5	21%	1.73	0.000	1.73
9.022	6964.58	219.5	3.165	219.5	0.0	0.00	1.44%	Coarse Tailings	0.054	108.1	0.52	0.000	0.52	0	425	1.45%	1.6	21%	1.74	0.000	1.74
9.186	6964.41	163.2	3.657	163.2	-0.9	-0.41	2.24%	Coarse Tailings	0.054	108.1	0.52	0.000	0.52	0	310	2.25%	1.9	21%	1.75	0.000	1.75
9.350	6964.25	138.1	3.792	138.1	7.2	3.13	2.75%	Coarse Tailings	0.054	108.1	0.53	0.000	0.53	0	258	2.76%	2.0	21%	1.76	0.000	1.76
9.514	6964.09	119.6	3.094	119.5	21.7	9.42	2.59%	Coarse Tailings	0.054	108.1	0.54	0.000	0.54	0	220	2.60%	2.0	21%	1.77	0.000	1.77
9.678	6963.92	93.6	1.788	93.6	2.6	1.12	1.91%	Coarse Tailings	0.054	108.1	0.55	0.000	0.55	0	169	1.92%	2.0	21%	1.78	0.000	1.78
9.842	6963.76	75.5	0.790	75.5	0.4	0.16	1.05%	Coarse Tailings	0.054	108.1	0.56	0.000	0.56	0	134	1.05%	1.8	21%	1.78	0.000	1.78
10.006	6963.59	64.4	0.843	64.4	1.4	0.59	1.31%	Coarse Tailings	0.054	108.1	0.57	0.000	0.57	0	112	1.32%	2.0	21%	1.79	0.000	1.79
10.170	6963.43	57.8	0.915	57.8	2.6	1.12	1.58%	Coarse Tailings	0.054	108.1	0.58	0.000	0.58	0	99	1.60%	2.0	21%	1.80	0.000	1.80

Seismic Settlement Analysis - Stewart et al (2004)

TOTAL SEISMIC SETTLEMENT (FT): 0.1151

Midpoint Depth at t_1, z_1 (m)	Shear Wave Velocity, V_s (ft/sec)	Soil Density, ρ (tcf)	Max Shear Strain Modulus, G_{max} (tsf)	Coefficient a_2 for Stress Reduction Factor	Stress Reduction Factor, r_d	P = γ_{eff}*(G_{eff}/G_{max}) (tsf)	Plasticity Index, PI	g_1 for PI = 0	g_1 for PI = 15	g_1 for PI = 30	g_1	g_2 for PI = 0	g_2 for PI = 15	g_2 for PI = 30	g_2	Shear Strain, γ (%)	a	b	Threshhold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{c-15} (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
								0	15	30		0	15	30											
6.45	926	1.9E-03	1.6E+03	164	0.9068	1.3E-04	16	0.219	0.216	4	0.469	9159	6302	1400	5975	0.019%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
6.50	926	1.9E-03	1.6E+03	161	0.9051	1.3E-04	16	0.219	0.217	5	0.536	9128	6280	1401	5955	0.019%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
6.55	926	1.9E-03	1.6E+03	159	0.9035	1.4E-04	16	0.220	0.217	6	0.603	9098	6259	1402	5935	0.020%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
6.60	926	1.9E-03	1.6E+03	157	0.9018	1.4E-04	16	0.220	0.218	7	0.670	9069	6238	1403	5916	0.020%	0.65	0.75	0.02%	0.000066	0.34	0.079	0.797	0.01%	0.0000
6.65	926	1.9E-03	1.6E+03	154	0.9001	1.4E-04	16	0.221	0.218	8	0.737	9039	6218	1404	5897	0.021%	0.65	0.75	0.02%	0.000117	0.34	0.079	0.797	0.02%	0.0000
6.70	926	1.9E-03	1.6E+03	152	0.8984	1.4E-04	16	0.221	0.219	9	0.804	9010	6197	1405	5878	0.022%	0.65	0.75	0.02%	0.000160	0.34	0.079	0.797	0.03%	0.0000
6.75	926	1.9E-03	1.6E+03	150	0.8966	1.4E-04	16	0.221	0.219	10	0.871	8982	6177	1406	5859	0.022%	0.65	0.75	0.02%	0.000198	0.34	0.079	0.797	0.03%	0.0001
6.80	926	1.9E-03	1.6E+03	147	0.8948	1.4E-04	16	0.222	0.220	11	0.938	8953	6157	1407	5841	0.023%	0.65	0.75	0.02%	0.000232	0.34	0.079	0.797	0.04%	0.0001
6.85	926	1.9E-03	1.6E+03	145	0.8930	1.4E-04	16	0.222	0.220	12	1.005	8925	6138	1408	5822	0.023%	0.65	0.75	0.02%	0.000263	0.34	0.079	0.797	0.04%	0.0001
6.90	926	1.9E-03	1.6E+03	143	0.8912	1.4E-04	16	0.223	0.221	13	1.073	8897	6118	1409	5804	0.023%	0.65	0.75	0.02%	0.000292	0.34	0.079	0.797	0.05%	0.0001
6.95	926	1.9E-03	1.6E+03	141	0.8893	1.4E-04	16	0.223	0.221	14	1.140	8870	6099	1410	5786	0.024%	0.65	0.75	0.02%	0.000320	0.34	0.079	0.797	0.05%	0.0001
7.00	926	1.9E-03	1.6E+03	139	0.8875	1.4E-04	16	0.223	0.221	15	1.207	8843	6080	1411	5769	0.024%	0.65	0.75	0.02%	0.000345	0.34	0.079	0.797	0.06%	0.0001
7.05	926	1.8E-03	1.5E+03	137	0.8856	1.5E-04	19	0.224	0.222	16	4.429	8818	6062	1412	4822	0.029%	1.70	0.75	0.02%	0.001617	0.34	0.079	0.797	0.26%	0.0004
7.10	926	1.8E-03	1.5E+03	135	0.8836	1.6E-04	19	0.224	0.222	17	4.696	8793	6045	1413	4810	0.030%	1.70	0.75	0.02%	0.001659	0.34	0.079	0.797	0.26%	0.0004
7.15	926	1.8E-03	1.5E+03	133	0.8817	1.6E-04	19	0.224	0.223	18	4.963	8768	6028	1414	4798	0.030%	1.70	0.75	0.02%	0.001700	0.34	0.079	0.797	0.27%	0.0004
7.20	926	1.8E-03	1.5E+03	131	0.8797	1.6E-04	19	0.225	0.223	19	5.230	8744	6011	1415	4785	0.030%	1.70	0.75	0.02%	0.001738	0.34	0.079	0.797	0.28%	0.0005
7.25	926	1.8E-03	1.5E+03	129	0.8777	1.6E-04	19	0.225	0.223	20	5.497	8720	5994	1416	4773	0.031%	1.70	0.75	0.02%	0.001775	0.34	0.079	0.797	0.28%	0.0005
7.30	926	1.8E-03	1.5E+03	127	0.8757	1.6E-04	19	0.225	0.224	21	5.764	8696	5977	1417	4761	0.031%	1.70	0.75	0.02%	0.001810	0.34	0.079	0.797	0.29%	0.0005
7.35	926	1.8E-03	1.5E+03	125	0.8736	1.6E-04	19	0.226	0.224	22	6.031	8672	5961	1418	4749	0.031%	1.70	0.75	0.02%	0.001844	0.34	0.079	0.797	0.29%	0.0005
7.40	926	1.8E-03	1.5E+03	123	0.8716	1.6E-04	19	0.226	0.225	23	6.298	8649	5944	1419	4738	0.031%	1.70	0.75	0.02%	0.001876	0.34	0.079	0.797	0.30%	0.0005
7.45	926	1.8E-03	1.5E+03	121	0.8695	1.6E-04	19	0.226	0.225	24	6.565	8626	5928	1420	4726	0.032%	1.70	0.75	0.02%	0.001908	0.34	0.079	0.797	0.30%	0.0005
7.50	926	1.8E-03	1.5E+03	119	0.8673	1.6E-04	19	0.227	0.225	25	6.832	8603	5912	1421	4714	0.032%	1.70	0.75	0.02%	0.001938	0.34	0.079	0.797	0.31%	0.0005
7.55	926	1.8E-03	1.5E+03	118	0.8652	1.6E-04	19	0.227	0.226	26	7.099	8580	5896	1422	4703	0.032%	1.70	0.75	0.02%	0.001967	0.34	0.079	0.797	0.31%	0.0005
7.60	926	1.8E-03	1.5E+03	116	0.8630	1.6E-04	19	0.227	0.226	27	7.366	8557	5880	1423	4692	0.032%	1.70	0.75	0.02%	0.001995	0.34	0.079	0.797	0.32%	0.0005
7.65	926	1.8E-03	1.5E+03	114	0.8608	1.6E-04	19	0.228	0.227	28	7.633	8535	5864	1424	4680	0.033%	1.70	0.75	0.02%	0.002022	0.34	0.079	0.797	0.32%	0.0005
7.70	926	1.8E-03	1.5E+03	113	0.8585	1.6E-04	19	0.228	0.227	29	7.900	8513	5849	1425	4669	0.033%	1.70	0.75	0.02%	0.002048	0.34	0.079	0.797	0.33%	0.0005
7.75	926	1.8E-03	1.5E+03	111	0.8563	1.6E-04	19	0.228	0.227	30	8.167	8491	5834	1426	4658	0.033%	1.70	0.75	0.02%	0.002074	0.34	0.079	0.797	0.33%	0.0005
7.80	926	1.8E-03	1.5E+03	109	0.8540	1.6E-04	19	0.229	0.228	31	8.434	8469	5818	1427	4647	0.033%	1.70	0.75	0.02%	0.002098	0.34	0.079	0.797	0.33%	0.0005
7.85	926	1.8E-03	1.5E+03	108	0.8516	1.6E-04	19	0.229	0.228	32	8.701	8448	5803	1428	4636	0.033%	1.70	0.75	0.02%	0.002122	0.34	0.079	0.797	0.34%	0.0006
7.90	926	1.8E-03	1.5E+03	106	0.8493	1.7E-04	19	0.229	0.228	33	8.968	8426	5788	1429	4626	0.034%	1.70	0.75	0.02%	0.002145	0.34	0.079	0.797	0.34%	0.0006
7.95	926	1.8E-03	1.5E+03	105	0.8469	1.7E-04	19	0.230	0.229	34	9.234	8405	5773	1430	4615	0.034%	1.70	0.75	0.02%	0.002167	0.34	0.079	0.797	0.35%	0.0006
8.00	926	1.8E-03	1.5E+03	103	0.8445	1.7E-04	19	0.230	0.229	35	9.501	8384	5759	1431	4605	0.034%	1.70	0.75	0.02%	0.002189	0.34	0.079	0.797	0.35%	0.0006
8.05	926	1.8E-03	1.5E+03	102	0.8421	1.7E-04	19	0.230	0.230	36	9.768	8363	5744	1432	4594	0.034%	1.70	0.75	0.02%	0.002209	0.34	0.079	0.797	0.35%	0.0006
8.10	926	1.8E-03	1.5E+03	100	0.8396	1.7E-04	19	0.231	0.230	37	10.035	8342	5729	1433	4584	0.034%	1.70	0.75	0.02%	0.002229	0.34	0.079	0.797	0.36%	0.0006
8.15	926	1.8E-03	1.5E+03	99	0.8371	1.7E-04	19	0.231	0.230	38	10.302	8322	5715	1434	4573	0.035%	1.70	0.75	0.02%	0.002249	0.34	0.079	0.797	0.36%	0.0006
8.20	926	1.8E-03	1.5E+03	98	0.8346	1.7E-04	19	0.231	0.231	39	10.569	8302	5701	1435	4563	0.035%	1.70	0.75	0.02%	0.002267	0.34	0.079	0.797	0.36%	0.0006
8.25	926	1.8E-03	1.5E+03	96	0.8321	1.7E-04	19	0.232	0.231	40	10.836	8281	5687	1436	4553	0.035%	1.70	0.75	0.02%	0.002285	0.34	0.079	0.797	0.36%	0.0006
8.30	926	1.8E-03	1.5E+03	95	0.8295	1.7E-04	19	0.232	0.231	41	11.103	8261	5673	1437	4543	0.035%	1.70	0.75	0.02%	0.002303	0.34	0.079	0.797	0.37%	0.0006
8.35	926	1.8E-03	1.5E+03	94	0.8269	1.7E-04	19	0.232	0.232	42	11.370	8242	5659	1438	4533	0.035%	1.70	0.75	0.02%	0.002319	0.34	0.079	0.797	0.37%	0.0006
8.40	926	1.8E-03	1.5E+03	92	0.8243	1.7E-04	19	0.233	0.232	43	11.637	8222	5645	1439	4523	0.035%	1.70	0.75	0.02%	0.002335	0.34	0.079	0.797	0.37%	0.0006
8.45	926	1.8E-03	1.5E+03	91	0.8216	1.7E-04	19	0.233	0.232	44	11.904	8202	5631	1440	4514	0.035%	1.70	0.75	0.02%	0.002350	0.34	0.079	0.797	0.37%	0.0006
8.50	926	1.7E-03	1.4E+03	90	0.8189	1.8E-04	0	0.233	0.233	45	0.233	8184	5619	1441	8184	0.030%	1.79	1.00	0.01%	0.000349	0.36	0.025	0.785	0.05%	0.0001
8.55	926	1.7E-03	1.4E+03	88	0.8162	1.8E-04	0	0.234	0.233	46	0.234	8166	5606	1442	8166	0.030%	1.79	1.00	0.01%	0.000350	0.36	0.025	0.785	0.06%	0.0001
8.60	926	1.7E-03	1.4E+03	87	0.8134	1.8E-04	0	0.234	0.233	47	0.234	8148	5593	1443	8148	0.030%	1.79	1.00	0.01%	0.000352	0.36	0.025	0.785	0.06%	0.0001
8.65	926	1.7E-03	1.4E+03	86	0.8106	1.8E-04	0	0.234	0.234	48	0.234	8130	5581	1444	8130	0.030%	1.79	1.00	0.01%	0.000353	0.36	0.025	0.785	0.06%	0.0001
8.70	926	1.7E-03	1.4E+03	85	0.8078	1.8E-04	0	0.234	0.234	49	0.234	8112	5568	1445	8112	0.030%	1.79	1.00	0.01%	0.000354	0.36	0.025	0.785	0.06%	0.0001
8.75	926	1.7E-03	1.4E+03	84	0.8050	1.8E-04	0	0.235	0.234	50	0.235	8094	5556	1446	8094	0.030%	1.79	1.00	0.01%	0.000355	0.36	0.025	0.785	0.06%	0.0001
8.80	926	1.7E-03	1.4E+03	83	0.8021	1.8E-04	0	0.235	0.235	51	0.235	8077	5543	1447	8077	0.030%	1.79	1.00	0.01%	0.000356	0.36	0.025	0.785	0.06%	0.0001
8.85	926	1.7E-03	1.4E+03	81	0.7992	1.8E-04	0	0.235	0.235	52	0.235	8059	5531	1448	8059	0.030%	1.79	1.00	0.01%	0.000357	0.36	0.025	0.785	0.06%	0.0001
8.90	926	1.7E-03	1.4E+03	80	0.7963	1.8E-04	0	0.236	0.235	53	0.236	8042	5519	1449	8042	0.030%	1.79	1.00	0.01%	0.000357	0.36	0.025	0.785	0.06%	0.0001
8.95	926	1.7E-03	1.4E+03	79	0.7933	1.8E-04	0	0.236	0.236	54	0.236	8025	5507	1450	8025	0.030%	1.79	1.00	0.01%	0.000358	0.36	0.025	0.785	0.06%	0.0001
9.00	926	1.7E-03	1.4E+03	78	0.7903	1.8E-04	0	0.236	0.236	55	0.236	8008	5495	1451	8008	0.030%	1.79	1.00	0.01%	0.000359	0.36	0.025	0.785	0.06%	0.0001
9.05	926	1.7E-03	1.4E+03	77	0.7873	1.8E-04	0	0.236	0.236	56	0.236	7991	5483	1452	7991	0.030%	1.79	1.00	0.01%	0.000359	0.36	0.025	0.785	0.06%	0.0001
9.10	926	1.7E-03	1.4E+03	76	0.7843	1.8E-04	0	0.237	0.237	57	0.237	7974	5472	1453	7974	0.030%	1.79	1.00	0.01%	0.000360	0.36	0.025	0.785	0.06%	0.0001
9.15	926	1.7E-03	1.4E+03	75	0.7812	1.8E-04	0	0.237	0.237	58	0.237	7957	5460	1454	7957	0.030%	1.79	1.00	0.01%	0.000360	0.36	0.025	0.785	0.06%	0.0001
9.20	926	1.7E-03	1.4E+03	74	0.7781	1.8E-04	0	0.237	0.237	59	0.237	7941	5448	1455	7941	0.030%	1.79	1.00	0.01%	0.000361	0.36	0.025	0.785	0.06%	0.0001
9.25	926	1.7E-03	1.4E+03	73	0.7749	1.8E-04	0	0.238	0.238	60	0.238	7924	5437	1456	7924	0.030%	1.79	1.00	0.01%	0.000361	0.36	0.025	0.785	0.06%	0.0001
9.30	727	1.7E-03	8.9E+02	72	0.7718	3.0E-04	0	0.238	0.238	61	0.238	7908	5425	1457	7908	0.086%	1.79	1.00	0.01%	0.001355	0.36	0.025	0.785	0.21%	0.0003
9.35	727	1.7E-03	8.9E+02	71	0.7686	3.0E-04	0	0.238	0.238	62	0.238	7892	5414	1458	7892	0.086%	1.79	1.00	0.01%	0.001354	0.36	0.025	0.785	0.21%	0.0003
9.40	727	1.7E-03	8.9E+02	70	0.7653	3.0E-04	0	0.238	0.239	63	0.238	7875	5403	1459	7875	0.086%	1.79	1.00	0.01%	0.001353	0.36	0.025	0.785	0.21%	0.0003
9.45	727	1.7E-03	8.9E+02	69	0.7621	3.0E-04	0	0.239	0.239	64	0.239	7859	5392	1460	7859	0.086%	1.79	1.00	0.01%	0.001351	0.36	0.025	0.785	0.21%	0.0003
9.50	727	1.7E-03	8.9E+02	68	0.7588	3.0E-04	0	0.239	0.239	65	0.239	7844	5380	1461	7844	0.085%	1.79	1.00	0.01%	0.001350	0.36	0.025	0.785	0.21%	0.0003

10.335	6963.27	55.1	0.973	55.1	0.5	0.23	1.76%	Coarse Tailings	0.054	108.1	0.59	0.000	0.59	0	93	1.78%	2.1	21%	1.81	0.000	1.81
10.499	6963.10	51.6	0.881	51.6	-0.1	-0.02	1.71%	Coarse Tailings	0.054	108.1	0.60	0.000	0.60	0	86	1.73%	2.1	21%	1.82	0.000	1.82
10.663	6962.94	49.0	0.661	49.0	0.4	0.18	1.35%	Coarse Tailings	0.054	108.1	0.60	0.000	0.60	0	80	1.37%	2.1	21%	1.83	0.000	1.83
10.827	6962.77	50.0	0.437	50.0	-1.6	-0.67	0.87%	Coarse Tailings	0.054	108.1	0.61	0.000	0.61	0	81	0.88%	2.0	21%	1.84	0.000	1.84
10.991	6962.61	52.0	0.400	52.0	0.8	0.33	0.77%	Coarse Tailings	0.054	108.1	0.62	0.000	0.62	0	83	0.78%	1.9	21%	1.85	0.000	1.85
11.155	6962.45	56.5	0.416	56.5	-1.3	-0.55	0.74%	Coarse Tailings	0.054	108.1	0.63	0.000	0.63	0	89	0.74%	1.9	21%	1.86	0.000	1.86
11.319	6962.28	66.0	0.471	66.0	-0.7	-0.29	0.71%	Coarse Tailings	0.054	108.1	0.64	0.000	0.64	0	102	0.72%	1.8	21%	1.86	0.000	1.86
11.483	6962.12	84.8	0.502	84.8	0.6	0.26	0.59%	Coarse Tailings	0.054	108.1	0.65	0.000	0.65	0	130	0.60%	1.7	21%	1.87	0.000	1.87
11.647	6961.95	91.2	0.499	91.2	1.4	0.59	0.55%	Coarse Tailings	0.054	108.1	0.66	0.000	0.66	0	138	0.55%	1.6	21%	1.88	0.000	1.88
11.811	6961.79	88.1	0.486	88.1	-0.3	-0.12	0.55%	Coarse Tailings	0.054	108.1	0.67	0.000	0.67	0	131	0.56%	1.7	21%	1.89	0.000	1.89
11.975	6961.63	77.7	0.504	77.7	-1.0	-0.43	0.65%	Coarse Tailings	0.054	108.1	0.67	0.000	0.67	0	114	0.65%	1.8	21%	1.90	0.000	1.90
12.139	6961.46	69.6	0.473	69.6	-0.9	-0.41	0.68%	Coarse Tailings	0.054	108.1	0.68	0.000	0.68	0	101	0.69%	1.8	21%	1.91	0.000	1.91
12.303	6961.30	60.0	0.435	60.0	-1.2	-0.51	0.72%	Coarse Tailings	0.054	108.1	0.69	0.000	0.69	0	86	0.73%	1.9	21%	1.92	0.000	1.92
12.467	6961.13	54.6	0.370	54.6	-0.8	-0.36	0.68%	Coarse Tailings	0.054	108.1	0.70	0.000	0.70	0	77	0.69%	1.9	21%	1.93	0.000	1.93
12.631	6960.97	50.6	0.332	50.6	-0.9	-0.39	0.66%	Coarse Tailings	0.054	108.1	0.71	0.000	0.71	0	70	0.67%	1.9	21%	1.93	0.000	1.93
12.795	6960.80	48.2	0.317	48.3	-0.9	-0.39	0.66%	Coarse Tailings	0.054	108.1	0.72	0.000	0.72	0	66	0.67%	2.0	21%	1.94	0.000	1.94
12.959	6960.64	47.5	0.298	47.5	-0.9	-0.41	0.63%	Coarse Tailings	0.054	108.1	0.73	0.000	0.73	0	64	0.64%	2.0	21%	1.95	0.000	1.95
13.123	6960.48	46.3	0.361	46.3	-1.0	-0.43	0.78%	Coarse Tailings	0.054	108.1	0.74	0.000	0.74	0	62	0.79%	2.0	21%	1.96	0.000	1.96
13.287	6960.31	45.1	0.318	45.1	-0.4	-0.16	0.70%	Coarse Tailings	0.054	108.1	0.75	0.000	0.75	0	60	0.72%	2.0	21%	1.97	0.000	1.97
13.451	6960.15	44.2	0.310	44.2	0.2	0.08	0.70%	Coarse Tailings	0.054	108.1	0.75	0.000	0.75	0	58	0.71%	2.0	21%	1.98	0.000	1.98
13.615	6959.98	42.6	0.299	42.6	-0.3	-0.12	0.70%	Coarse Tailings	0.054	108.1	0.76	0.000	0.76	0	55	0.71%	2.0	21%	1.99	0.000	1.99
13.779	6959.82	37.7	0.382	37.7	-1.1	-0.49	1.01%	Coarse Tailings	0.054	108.1	0.77	0.000	0.77	0	48	1.03%	2.2	21%	2.00	0.000	2.00
13.943	6959.66	34.4	0.553	34.4	0.5	0.23	1.61%	Coarse Tailings	0.054	108.1	0.78	0.000	0.78	0	43	1.64%	2.3	21%	2.01	0.000	2.01
14.107	6959.49	34.0	0.484	34.0	0.5	0.23	1.42%	Coarse Tailings	0.054	108.1	0.79	0.000	0.79	0	42	1.46%	2.3	21%	2.01	0.000	2.01
14.271	6959.33	34.0	0.409	34.0	-0.2	-0.10	1.20%	Coarse Tailings	0.054	108.1	0.80	0.000	0.80	0	42	1.23%	2.3	21%	2.02	0.000	2.02
14.436	6959.16	37.3	0.267	37.3	0.1	0.06	0.72%	Coarse Tailings	0.054	108.1	0.81	0.000	0.81	0	45	0.73%	2.1	21%	2.03	0.000	2.03
14.600	6959.00	40.5	0.207	40.5	0.4	0.16	0.51%	Coarse Tailings	0.054	108.1	0.82	0.000	0.82	0	49	0.52%	2.0	21%	2.04	0.000	2.04
14.764	6958.84	42.1	0.212	42.1	0.2	0.08	0.50%	Coarse Tailings	0.054	108.1	0.83	0.000	0.83	0	50	0.51%	2.0	21%	2.05	0.000	2.05
14.928	6958.67	44.0	0.175	44.0	-0.1	-0.04	0.40%	Coarse Tailings	0.054	108.1	0.83	0.000	0.83	0	52	0.41%	1.9	21%	2.06	0.000	2.06
15.092	6958.51	48.6	0.191	48.6	0.3	0.14	0.39%	Coarse Tailings	0.054	108.1	0.84	0.000	0.84	0	57	0.40%	1.9	21%	2.07	0.000	2.07
15.256	6958.34	53.3	0.228	53.3	0.7	0.30	0.43%	Coarse Tailings	0.054	108.1	0.85	0.000	0.85	0	62	0.43%	1.9	21%	2.08	0.000	2.08
15.420	6958.18	57.4	0.286	57.4	0.4	0.16	0.50%	Coarse Tailings	0.054	108.1	0.86	0.000	0.86	0	66	0.51%	1.9	21%	2.09	0.000	2.09
15.584	6958.02	58.2	0.349	58.2	0.1	0.06	0.60%	Coarse Tailings	0.054	108.1	0.87	0.000	0.87	0	66	0.61%	1.9	21%	2.09	0.000	2.09
15.748	6957.85	59.2	0.386	59.2	0.5	0.20	0.65%	Coarse Tailings	0.054	108.1	0.88	0.000	0.88	0	66	0.66%	1.9	21%	2.10	0.000	2.10
15.912	6957.69	59.6	0.376	59.6	0.0	0.00	0.63%	Coarse Tailings	0.054	108.1	0.89	0.000	0.89	0	66	0.64%	1.9	21%	2.11	0.000	2.11
16.076	6957.52	57.6	0.338	57.6	-0.2	-0.08	0.59%	Coarse Tailings	0.054	108.1	0.90	0.000	0.90	0	63	0.60%	1.9	21%	2.12	0.000	2.12
16.240	6957.36	55.6	0.319	55.6	-0.2	-0.10	0.57%	Coarse Tailings	0.054	108.1	0.91	0.000	0.91	0	60	0.58%	2.0	21%	2.13	0.000	2.13
16.404	6957.20	54.2	0.330	54.2	-0.3	-0.14	0.61%	Coarse Tailings	0.054	108.1	0.91	0.000	0.91	0	58	0.62%	2.0	21%	2.14	0.000	2.14
16.568	6957.03	54.3	0.324	54.3	-0.1	-0.02	0.60%	Coarse Tailings	0.054	108.1	0.92	0.000	0.92	0	58	0.61%	2.0	21%	2.15	0.000	2.15
16.732	6956.87	57.8	0.349	57.8	0.1	0.04	0.60%	Coarse Tailings	0.054	108.1	0.93	0.000	0.93	0	61	0.61%	2.0	21%	2.16	0.000	2.16
16.896	6956.70	58.1	0.381	58.1	0.1	0.06	0.66%	Coarse Tailings	0.054	108.1	0.94	0.000	0.94	0	61	0.67%	2.0	21%	2.17	0.000	2.17
17.060	6956.54	43.5	0.597	43.5	-1.2	-0.53	1.37%	Coarse Tailings	0.054	108.1	0.95	0.000	0.95	0	45	1.40%	2.3	21%	2.17	0.000	2.17
17.224	6956.38	20.6	0.532	20.7	-2.0	-0.85	2.58%	Coarse Tailings	0.054	108.1	0.96	0.000	0.96	0	21	2.70%	2.7	21%	2.18	0.000	2.18
17.388	6956.21	9.2	0.329	9.3	-16.9	-7.32	3.57%	Coarse Tailings	0.054	108.1	0.97	0.000	0.97	0	9	3.99%	3.1	21%	2.19	0.000	2.19
17.552	6956.05	8.0	0.192	8.0	-1.9	-0.83	2.41%	Coarse Tailings	0.054	108.1	0.98	0.000	0.98	0	7	2.75%	3.1	21%	2.20	0.000	2.20
17.716	6955.88	9.3	0.141	8.9	58.9	25.52	1.52%	Coarse Tailings	0.054	108.1	0.99	0.000	0.99	0	8	1.70%	2.9	21%	2.21	0.000	2.21
17.880	6955.72	13.1	0.175	12.9	43.8	18.99	1.33%	Coarse Tailings	0.054	108.1	0.99	0.000	0.99	0	12	1.44%	2.8	21%	2.22	0.000	2.22
18.044	6955.56	10.4	0.143	10.3	18.0	7.81	1.38%	Coarse Tailings	0.054	108.1	1.00	0.000	1.00	0	9	1.53%	2.9	21%	2.23	0.000	2.23
18.208	6955.39	7.6	0.129	7.5	18.8	8.16	1.70%	Coarse Tailings	0.054	108.1	1.01	0.000	1.01	0	6	1.96%	3.1	21%	2.24	0.000	2.24
18.372	6955.23	6.7	0.101	6.6	26.6	11.53	1.50%	Coarse Tailings	0.054	108.1	1.02	0.000	1.02	0	6	1.77%	3.1	21%	2.25	0.000	2.25
18.537	6955.06	6.8	0.080	6.6	34.8	15.07	1.18%	Coarse Tailings	0.054	108.1	1.03	0.000	1.03	0	6	1.39%	3.0	21%	2.25	0.000	2.25
18.701	6954.90	6.4	0.069	6.2	33.7	14.60	1.08%	Coarse Tailings	0.054	108.1	1.04	0.000	1.04	0	5	1.29%	3.1	21%	2.26	0.000	2.26
18.865	6954.74	7.3	0.110	7.1	40.7	17.65	1.50%	Coarse Tailings	0.054	108.1	1.05	0.000	1.05	0	6	1.75%	3.1	21%	2.27	0.000	2.27
19.029	6954.57	8.2	0.108	8.0	30.0	13.01	1.31%	Fine Tailings	0.054	107.6	1.06	0.004	1.05	1	7	1.51%	3.0	83%	2.28	0.004	2.28
19.193	6954.41	7.2	0.091	7.1	13.6	5.88	1.26%	Fine Tailings	0.054	107.6	1.06	0.009	1.06	1	6	1.48%	3.0	83%	2.29	0.009	2.28
19.357	6954.24	7.2	0.094	7.1	15.2	6.59	1.31%	Fine Tailings	0.054	107.6	1.07	0.014	1.06	1	6	1.54%	3.1	83%	2.30	0.014	2.28
19.521	6954.08	7.7	0.091	7.6	22.9	9.90	1.18%	Fine Tailings	0.054	107.6	1.08	0.019	1.06	1	6	1.37%	3.0	83%	2.31	0.019	2.29
19.685	6953.92	8.6	0.102	8.5	14.6	6.32	1.19%	Fine Tailings	0.054	107.6	1.09	0.024	1.07	1	7	1.36%	3.0	83%	2.32	0.024	2.29
19.849	6953.75	9.0	0.122	8.9	16.9	7.30	1.35%	Fine Tailings	0.054	107.6	1.10	0.030	1.07	1	7	1.54%	3.0	83%	2.32	0.030	2.30
20.013	6953.59	8.5	0.126	8.3	32.8	14.21	1.48%	Fine Tailings	0.054	107.6	1.11	0.035	1.07	1	7	1.71%	3.0	83%	2.33	0.035	2.30
20.177	6953.42	7.8	0.103	7.7	20.8	9.03	1.32%	Fine Tailings	0.054	107.6	1.12	0.040	1.08	1	6	1.55%	3.0	83%	2.34	0.040	2.30
20.341	6953.26	6.9	0.100	6.8	26.5	11.47	1.44%	Fine Tailings	0.054	107.6	1.13	0.045	1.08	1	5	1.72%	3.1	83%	2.35	0.045	2.31
20.505	6953.10	6.5	0.098	6.3	30.6	13.24	1.51%	Fine Tailings	0.054	107.6	1.14	0.050	1.09	1	5	1.83%	3.1	83%	2.36	0.050	2.31
20.669	6952.93	6.3	0.091	6.1	31.2	13.52	1.44%	Fine Tailings	0.054	107.6	1.14	0.055	1.09	1	5	1.76%	3.2	83%	2.37	0.055	2.31
20.833	6952.77	6.3	0.137	6.1	35.9	15.56	2.18%	Fine Tailings	0.054	107.6	1.15	0.060	1.09	1	5	2.67%	3.2	83%	2.38	0.060	2.32
20.997	6952.60	7.8	0.124	7.5	39.0	16.88	1.60%	Fine Tailings	0.054	107.6	1.16	0.065	1.10	1	6	1.88%	3.1	83%	2.39	0.065	2.32
21.161	6952.44	7.3	0.071	7.1	27.6	11.98	0.97%	Fine Tailings	0.054	107.6	1.17	0.071	1.10	1	6	1.16%	3.0	83%	2.40	0.071	2.32
21.325	6952.27	7.6	0.135	7.4	33.1	14.36	1.78%	Fine Tailings	0.054	107.6	1.18	0.076	1.10	1	6	2.10%	3.1	83%	2.40	0.076	2.33
21.489	6952.11	11.5	0.156	11.3	33.2	14.38	1.36%	Fine Tailings	0.054	107.6	1.19	0.081	1.11	1	9	1.51%	2.9	83%	2.41	0.081	2.33
21.653	6951.95	9.0	0.134	8.9	18.5	8.03	1.48%	Fine Tailings	0.054	107.6	1.20	0.086	1.11	1	7	1.71%	3.0	83%	2.42	0.086	2.34
21.817	6951.78	7.3	0.253	7.1	32.2	13.97	3.48%	Fine Tailings	0.054	107.6	1.21	0.091	1.12	1	5	4.17%	3.3	83%	2.43	0.091	2.34
21.981	6951.62	6.9	0.209	6.7	40.8	17.69	3.01%	Fine Tailings	0.054	107.6	1.22	0.096	1.12	1	5	3.65%	3.3	83%	2.44	0.096	2.34
22.145	6951.45	8.7	0.210	8.7	6.2	2.67	2.41%	Fine Tailings	0.054	107.6	1.22	0.101	1.12	1	7	2.81%	3.1	83%	2.45	0.101	2.35
22.309	6951.29	9.4	0.231	9.4	10.4	4.52	2.45%	Fine Tailings	0.054	107.6	1.23	0.106	1.13	1	7	2.82%	3.1	83%	2.46	0.106	2.35
22.473	6951.13	11.6	0.199	11.5	14.6	6.34	1.71%	Fine Tailings	0.054	107.6	1.24	0.111	1.13	1	9	1.92%	2.9	83%	2.47	0.111	2.35
22.638	6950.96	9.2	0.173	9.1	19.2	8.34	1.87%	Fine Tailings	0.054	107.6	1.25	0.117	1.13	1	7	2.17%	3.0	83%	2.47	0.117	2.36
22.802	6950.80	9.0	0.171	8.7	47.4	20.52	1.89%	Fine Tailings	0.054	107.6	1.26	0.122	1.14	1	7	2.20%	3.1	83%	2.48	0.122	2.36
22.966	6950.63	8.5	0.164	8.2	54.3	23.55	1.93%	Fine Tailings	0.054	107.6	1.27	0.127	1.14	1	6	2.27%	3.1	83%	2.49	0.127	2.37
23.130	6950.47	10.1	0.170	9.9	42.1	18.22	1.68%	Fine Tailings	0.054	107.6	1.28	0.132	1.14	1	8	1.92%	3.0	83%	2.50	0.132	2.37
23.294	6950.31	11.0	0.208	10.8	25.2	10.90	1.89%	Fine Tailings	0.054	107.6	1.29	0.137	1.15	1	8	2.14%	3.0	83%	2.51	0.137	2.37
23.458	6950.14	18.7	0.228	18.2	91.8	39.80	1.22%	Fine Tailings	0.054	107.6	1.29	0.142	1.15	1	15	1.31%	2.7	83%	2.52	0.142	2.38

9.55	727	1.7E-03	8.9E+02	68	0.7555	3.0E-04	0	0.239	0.240	66	0.239	7828	5369	1462	7828	0.085%	1.79	1.00	0.01%	0.001348	0.36	0.025	0.785	0.21%	0.0003
9.60	727	1.7E-03	8.9E+02	67	0.7521	3.0E-04	0	0.239	0.240	67	0.239	7812	5358	1463	7812	0.085%	1.79	1.00	0.01%	0.001345	0.36	0.025	0.785	0.21%	0.0003
9.65	727	1.7E-03	8.9E+02	66	0.7487	3.0E-04	0	0.240	0.240	68	0.240	7797	5348	1464	7797	0.085%	1.79	1.00	0.01%	0.001342	0.36	0.025	0.785	0.21%	0.0003
9.70	727	1.7E-03	8.9E+02	65	0.7453	3.0E-04	0	0.240	0.241	69	0.240	7781	5337	1465	7781	0.085%	1.79	1.00	0.01%	0.001339	0.36	0.025	0.785	0.21%	0.0003
9.75	727	1.7E-03	8.9E+02	64	0.7419	3.0E-04	0	0.240	0.241	70	0.240	7766	5326	1466	7766	0.085%	1.79	1.00	0.01%	0.001336	0.36	0.025	0.785	0.21%	0.0003
9.80	727	1.7E-03	8.9E+02	63	0.7384	3.0E-04	0	0.241	0.241	71	0.241	7751	5315	1467	7751	0.084%	1.79	1.00	0.01%	0.001332	0.36	0.025	0.785	0.21%	0.0003
9.85	727	1.7E-03	8.9E+02	63	0.7349	3.0E-04	0	0.241	0.241	72	0.241	7735	5305	1468	7735	0.084%	1.79	1.00	0.01%	0.001328	0.36	0.025	0.785	0.21%	0.0003
9.90	727	1.7E-03	8.9E+02	62	0.7314	3.0E-04	0	0.241	0.242	73	0.241	7720	5294	1469	7720	0.084%	1.79	1.00	0.01%	0.001324	0.36	0.025	0.785	0.21%	0.0003
9.95	727	1.7E-03	8.9E+02	61	0.7279	3.0E-04	0	0.241	0.242	74	0.241	7705	5284	1470	7705	0.084%	1.79	1.00	0.01%	0.001320	0.36	0.025	0.785	0.21%	0.0003
10.00	727	1.7E-03	8.9E+02	60	0.7243	3.0E-04	0	0.242	0.242	75	0.242	7691	5273	1471	7691	0.083%	1.79	1.00	0.01%	0.001315	0.36	0.025	0.785	0.21%	0.0003
10.05	727	1.7E-03	8.9E+02	60	0.7207	3.0E-04	0	0.242	0.243	76	0.242	7676	5263	1472	7676	0.083%	1.79	1.00	0.01%	0.001310	0.36	0.025	0.785	0.21%	0.0003
10.10	727	1.7E-03	8.9E+02	59	0.7171	3.0E-04	0	0.242	0.243	77	0.242	7661	5253	1473	7661	0.083%	1.79	1.00	0.01%	0.001304	0.36	0.025	0.785	0.20%	0.0003
10.15	727	1.7E-03	8.9E+02	58	0.7134	3.0E-04	0	0.242	0.243	78	0.242	7647	5243	1474	7647	0.083%	1.79	1.00	0.01%	0.001299	0.36	0.025	0.785	0.20%	0.0003
10.20	727	1.7E-03	8.9E+02	57	0.7097	3.0E-04	0	0.243	0.244	79	0.243	7632	5233	1475	7632	0.082%	1.79	1.00	0.01%	0.001293	0.36	0.025	0.785	0.20%	0.0003
10.25	727	1.7E-03	8.9E+02	57	0.7060	3.0E-04	0	0.243	0.244	80	0.243	7618	5223	1476	7618	0.082%	1.79	1.00	0.01%	0.001287	0.36	0.025	0.785	0.20%	0.0003
10.30	727	1.7E-03	8.9E+02	56	0.7022	3.0E-04	0	0.243	0.244	81	0.243	7604	5213	1477	7604	0.082%	1.79	1.00	0.01%	0.001280	0.36	0.025	0.785	0.20%	0.0003
10.35	727	1.7E-03	8.9E+02	55	0.6985	3.0E-04	0	0.243	0.244	82	0.243	7589	5203	1478	7589	0.081%	1.79	1.00	0.01%	0.001273	0.36	0.025	0.785	0.20%	0.0003
10.40	727	1.7E-03	8.9E+02	55	0.6947	3.0E-04	0	0.244	0.245	83	0.244	7575	5193	1479	7575	0.081%	1.79	1.00	0.01%	0.001266	0.36	0.025	0.785	0.20%	0.0003
10.45	727	1.7E-03	8.9E+02	54	0.6908	3.0E-04	0	0.244	0.245	84	0.244	7561	5183	1480	7561	0.080%	1.79	1.00	0.01%	0.001259	0.36	0.025	0.785	0.20%	0.0003
10.50	727	1.7E-03	8.9E+02	53	0.6870	3.0E-04	0	0.244	0.245	85	0.244	7547	5173	1481	7547	0.080%	1.79	1.00	0.01%	0.001252	0.36	0.025	0.785	0.20%	0.0003
10.55	727	1.7E-03	8.9E+02	53	0.6831	3.0E-04	0	0.244	0.246	86	0.244	7534	5164	1482	7534	0.080%	1.79	1.00	0.01%	0.001244	0.36	0.025	0.785	0.20%	0.0003
10.60	727	1.7E-03	8.9E+02	52	0.6792	3.0E-04	0	0.245	0.246	87	0.245	7520	5154	1483	7520	0.079%	1.79	1.00	0.01%	0.001236	0.36	0.025	0.785	0.19%	0.0003
10.65	727	1.7E-03	8.9E+02	52	0.6753	3.0E-04	0	0.245	0.246	88	0.245	7506	5145	1484	7506	0.079%	1.79	1.00	0.01%	0.001228	0.36	0.025	0.785	0.19%	0.0003
10.70	727	1.7E-03	8.9E+02	51	0.6713	3.0E-04	0	0.245	0.246	89	0.245	7493	5135	1485	7493	0.078%	1.79	1.00	0.01%	0.001219	0.36	0.025	0.785	0.19%	0.0003
10.75	727	1.7E-03	8.9E+02	50	0.6674	3.0E-04	0	0.245	0.247	90	0.245	7479	5126	1486	7479	0.078%	1.79	1.00	0.01%	0.001211	0.36	0.025	0.785	0.19%	0.0003
10.80	727	1.7E-03	8.9E+02	50	0.6634	3.0E-04	0	0.246	0.247	91	0.246	7466	5116	1487	7466	0.077%	1.79	1.00	0.01%	0.001202	0.36	0.025	0.785	0.19%	0.0003
10.85	589	1.7E-03	5.8E+02	49	0.6593	4.5E-04	0	0.246	0.247	92	0.246	7452	5107	1488	7452	0.292%	1.79	1.00	0.01%	0.005041	0.36	0.025	0.785	0.79%	0.0013
10.90	589	1.7E-03	5.8E+02	49	0.6553	4.5E-04	0	0.246	0.248	93	0.246	7439	5098	1489	7439	0.288%	1.79	1.00	0.01%	0.004981	0.36	0.025	0.785	0.78%	0.0013
10.95	589	1.7E-03	5.8E+02	48	0.6512	4.5E-04	0	0.246	0.248	94	0.246	7426	5089	1490	7426	0.285%	1.79	1.00	0.01%	0.004919	0.36	0.025	0.785	0.77%	0.0013
11.00	589	1.7E-03	5.8E+02	48	0.6471	4.5E-04	0	0.247	0.248	95	0.247	7413	5079	1491	7413	0.281%	1.79	1.00	0.01%	0.004857	0.36	0.025	0.785	0.76%	0.0013
11.05	589	1.7E-03	5.8E+02	47	0.6430	4.5E-04	0	0.247	0.248	96	0.247	7400	5070	1492	7400	0.278%	1.79	1.00	0.01%	0.004794	0.36	0.025	0.785	0.75%	0.0012
11.10	589	1.7E-03	5.8E+02	47	0.6389	4.5E-04	0	0.247	0.249	97	0.247	7387	5061	1493	7387	0.274%	1.79	1.00	0.01%	0.004730	0.36	0.025	0.785	0.74%	0.0012
11.15	589	1.7E-03	5.8E+02	46	0.6347	4.5E-04	0	0.247	0.249	98	0.247	7374	5052	1494	7374	0.271%	1.79	1.00	0.01%	0.004666	0.36	0.025	0.785	0.73%	0.0012
11.20	589	1.7E-03	5.8E+02	45	0.6305	4.4E-04	0	0.248	0.249	99	0.248	7361	5043	1495	7361	0.267%	1.79	1.00	0.01%	0.004602	0.36	0.025	0.785	0.72%	0.0012
11.25	589	1.7E-03	5.8E+02	45	0.6263	4.4E-04	0	0.248	0.250	100	0.248	7349	5035	1496	7349	0.263%	1.79	1.00	0.01%	0.004537	0.36	0.025	0.785	0.71%	0.0012
11.30	589	1.7E-03	5.8E+02	45	0.6221	4.4E-04	0	0.248	0.250	101	0.248	7336	5026	1497	7336	0.260%	1.79	1.00	0.01%	0.004471	0.36	0.025	0.785	0.70%	0.0012
11.35	589	1.7E-03	5.8E+02	44	0.6179	4.4E-04	0	0.248	0.250	102	0.248	7324	5017	1498	7324	0.256%	1.79	1.00	0.01%	0.004406	0.36	0.025	0.785	0.69%	0.0011
11.40	589	1.7E-03	5.8E+02	44	0.6136	4.4E-04	0	0.249	0.250	103	0.249	7311	5008	1499	7311	0.252%	1.79	1.00	0.01%	0.004340	0.36	0.025	0.785	0.68%	0.0011
11.45	589	1.7E-03	5.8E+02	43	0.6093	4.4E-04	0	0.249	0.251	104	0.249	7299	5000	1500	7299	0.249%	1.79	1.00	0.01%	0.004273	0.36	0.025	0.785	0.67%	0.0011
11.50	589	1.7E-03	5.8E+02	43	0.6050	4.4E-04	0	0.249	0.251	105	0.249	7286	4991	1501	7286	0.245%	1.79	1.00	0.01%	0.004207	0.36	0.025	0.785	0.66%	0.0011
11.55	589	1.7E-03	5.8E+02	42	0.6007	4.4E-04	0	0.249	0.251	106	0.249	7274	4982	1502	7274	0.241%	1.79	1.00	0.01%	0.004140	0.36	0.025	0.785	0.65%	0.0011
11.60	589	1.7E-03	5.8E+02	42	0.5964	4.3E-04	0	0.250	0.251	107	0.250	7262	4974	1503	7262	0.238%	1.79	1.00	0.01%	0.004074	0.36	0.025	0.785	0.64%	0.0010
11.65	589	1.7E-03	5.8E+02	41	0.5921	4.3E-04	0	0.250	0.252	108	0.250	7250	4966	1504	7250	0.234%	1.79	1.00	0.01%	0.004007	0.36	0.025	0.785	0.63%	0.0010
11.70	589	1.7E-03	5.8E+02	41	0.5877	4.3E-04	0	0.250	0.252	109	0.250	7238	4957	1505	7238	0.230%	1.79	1.00	0.01%	0.003941	0.36	0.025	0.785	0.62%	0.0010
11.75	589	1.7E-03	5.8E+02	40	0.5833	4.3E-04	0	0.250	0.252	110	0.250	7226	4949	1506	7226	0.226%	1.79	1.00	0.01%	0.003874	0.36	0.025	0.785	0.61%	0.0010
11.80	589	1.7E-03	5.8E+02	40	0.5789	4.3E-04	0	0.250	0.253	111	0.250	7214	4940	1507	7214	0.223%	1.79	1.00	0.01%	0.003808	0.36	0.025	0.785	0.60%	0.0010
11.85	589	1.7E-03	5.8E+02	40	0.5745	4.3E-04	0	0.251	0.253	112	0.251	7202	4932	1508	7202	0.219%	1.79	1.00	0.01%	0.003741	0.36	0.025	0.785	0.59%	0.0010
11.90	589	1.7E-03	5.8E+02	39	0.5701	4.3E-04	0	0.251	0.253	113	0.251	7190	4924	1509	7190	0.215%	1.79	1.00	0.01%	0.003675	0.36	0.025	0.785	0.58%	0.0009
11.95	589	1.7E-03	5.8E+02	39	0.5657	4.2E-04	0	0.251	0.253	114	0.251	7179	4916	1510	7179	0.212%	1.79	1.00	0.01%	0.003609	0.36	0.025	0.785	0.57%	0.0009
12.00	589	1.7E-03	5.8E+02	39	0.5612	4.2E-04	0	0.251	0.254	115	0.251	7167	4908	1511	7167	0.208%	1.79	1.00	0.01%	0.003544	0.36	0.025	0.785	0.56%	0.0009
12.05	589	1.7E-03	5.8E+02	38	0.5568	4.2E-04	0	0.252	0.254	116	0.252	7155	4900	1512	7155	0.204%	1.79	1.00	0.01%	0.003478	0.36	0.025	0.785	0.55%	0.0009
12.10	589	1.7E-03	5.8E+02	38	0.5523	4.2E-04	0	0.252	0.254	117	0.252	7144	4892	1513	7144	0.201%	1.79	1.00	0.01%	0.003413	0.36	0.025	0.785	0.54%	0.0009
12.15	589	1.7E-03	5.8E+02	37	0.5478	4.2E-04	0	0.252	0.254	118	0.252	7132	4884	1514	7132	0.197%	1.79	1.00	0.01%	0.003349	0.36	0.025	0.785	0.53%	0.0009
12.20	589	1.7E-03	5.8E+02	37	0.5433	4.2E-04	43	0.252	0.255	119	119.000	7126	4879	1515	1515	0.078%	0.90	0.75	0.06%	0.001403	0.25	0.323	0.851	0.24%	0.0004
12.25	589	1.7E-03	5.8E+02	37	0.5389	4.1E-04	43	0.252	0.255	120	120.000	7122	4876	1516	1516	0.078%	0.90	0.75	0.06%	0.001372	0.25	0.323	0.851	0.23%	0.0004
12.30	589	1.7E-03	5.8E+02	36	0.5343	4.1E-04	43	0.252	0.255	121	121.000	7117	4873	1517	1517	0.077%	0.90	0.75	0.06%	0.001340	0.25	0.323	0.851	0.23%	0.0004
12.35	469	1.7E-03	3.7E+02	36	0.5298	6.5E-04	43	0.252	0.255	122	122.000	7112	4869	1518	1518	0.173%	0.90	0.75	0.06%	0.005535	0.25	0.323	0.851	0.94%	0.0015
12.40	469	1.7E-03	3.7E+02	36	0.5253	6.5E-04	43	0.253	0.255	123	123.000	7107	4866	1519	1519	0.171%	0.90	0.75	0.06%	0.005480	0.25	0.323	0.851	0.93%	0.0015
12.45	469	1.7E-03	3.7E+02	35	0.5208	6.4E-04	43	0.253	0.255	124	124.000	7103	4863	1520	1520	0.170%	0.90	0.75	0.06%	0.005423	0.25	0.323	0.851	0.92%	0.0015
12.50	469	1.7E-03	3.7E+02	35	0.5162	6.4E-04	43	0.253	0.255	125	125.000	7098	4859	1521	1521	0.168%	0.90	0.75	0.06%	0.005366	0.25	0.323	0.851	0.91%	0.0015
12.55	469	1.7E-03	3.7E+02	35	0.5117	6.4E-04	43	0.253	0.255	126	126.000	7093	4856	1522	1522	0.167%	0.90	0.75	0.06%	0.005308	0.25	0.323	0.851	0.90%	0.0015
12.60	469	1.7E-03	3.7E+02	34	0.5072	6.3E-04	43	0.253	0.255	127	127.000	7089	4853	1523	1523	0.165%	0.90	0.75	0.06%	0.005250	0.25	0.323	0.851	0.89%	0.0015
12.65	469	1.7E-03	3.7E+02	34	0.5026	6.3E-04	43	0.253	0.256	128	128.000	7084	4850	1524	1524	0.163%	0.90	0.75	0.06%	0.005190	0.25	0.323	0.851	0.88%	0.0014
12.70	469	1.7E-03	3.7E+02	34	0.4981	6.3E-04	43	0.253	0.256	129	129.000	7079	4846	1525	1525	0.162%	0.90	0.75	0.06%	0.005130	0.25	0.323	0.851	0.87%	0.0014
12.75	469	1.7E-03	3.7E+02	33	0.4935	6.2E-04	43	0.253	0.256	130	130.000	7075	4843	1526	1526	0.160%	0.90	0.75	0.06%	0.005069	0.25	0.323	0.851	0.86%	0.0014
12.80	469	1.7E-03	3.7E+02	33	0.4890	6.2E-04	43	0.253	0.256	131	131.000	7070	4840	1527	1527	0.159%	0.90	0.75	0.06%	0.005007	0.25	0.323	0.851	0.85%	0.0014
12.85	469	1.7E-03	3.7E+02	33	0.4844	6.2E-04	43	0.253	0.256	132	132.000	7065	4837	1528	1528	0.157%	0.90	0.75	0.06%	0.004945	0.25	0.323	0.851	0.84%	0.0014
12.90	469	1.7E-03	3.7E+02	33	0.4798	6.1E-04	43	0.253	0.256	133	133.000	7061	4833	1529	1529	0.155%	0.90	0.75	0.06%	0.004882	0.25	0.323	0.851	0.83%	0.0014
12.95	469	1.7E-03	3.7E+02	32	0.4753	6.1E-04	43	0.254	0.256	134	134.000	7056	4830	1530	1530	0.154%	0.90	0.75	0.06%	0.004818	0.25	0.323	0.851	0.82%	0.0013
13.00	469	1.7E-03	3.7E+02	32	0.4707	6.0E-04	43	0.254	0.256	135	135.000	7052	4827	1531	1531	0.152%	0.90	0.75	0.06%	0.004754	0.25	0.323	0.851	0.81%	0.0013
13.05	469	1.7E-03	3.7E+02	32	0.4662	6.0E-04	43	0.254	0.256	136	136.000	7047	4824	1532	1532	0.150%	0.90	0.75	0.06%	0.004689	0.25	0.323	0.851	0.80%	0.0013
13.10	469	1.7E-03	3.7E+02	32	0.4616	6.0E-04	43	0.254	0.257	137	137.000	7042	4821	1533	1533	0.149%	0.90	0.75	0.06%	0.004623	0.25	0.323	0.851	0.79%	0.0013
13.15	469	1.7E-03	3.7E+02	31	0.4570	5.9E-04	43	0.254	0.257	138	138.000	7038	4817	1534	1534	0.147%	0.90	0.75	0.06%	0.004557	0.25	0.323	0.851	0.78%	0.0013
13.20	469	1.7E-03	3.7E+02	31	0.4525	5.9E-04	43	0.254	0.257	139	139.000	7033	4814	1535	1535	0.145%	0.90	0.75	0.06%	0.004490	0.25	0.323	0.851	0.76%	0.0013
13.25	469	1.7E-03	3.7E+02	31	0.4479	5.9E-04	43	0.254	0.257	140	140.000	7029	4811	1536	1536	0.144%	0.90	0.75	0.06%	0.004423	0.25	0.323	0.851	0.75%	0.0012
13.30	469	1.7E-03	3.7E+02	31	0.4434	5.8E-04	43	0.254	0.257	141	141.000	7024	4808	1537	1537	0.142%	0.90	0.75	0.06%	0.004355	0.25	0.323	0.851	0.74%	0.0012
13.35	469	1.7E-03	3.7E+02	30	0.4389	5.8E-04	43	0.254	0.257	142	142.000	7020	4805	1538	1538	0.140%	0.90	0.75	0.06%	0.004287	0.25	0.323	0.851	0.73%	0.0012
13.40	469	1.7E-03	3.7E+02	30	0.4343	5.7E-04	43	0.254	0.257	143	143.000	7015	4802	1539	1539	0.138%	0.90	0.75	0.06%	0.004218	0.25	0.323	0.851	0.72%	0.0012
13.45	469	1.7E-03	3.7E+02	30	0.4298	5.7E-04	43	0.255	0.257	144	144.000	7011	4799	1540	1540	0.137%	0.90	0.75	0.06%	0.004149	0.25	0.323	0.851	0.71%	0.0012
13.50	469	1.7E-03	3.7E+02	30	0.4253	5.7E-04	43	0.255	0.257	145	145.000	7006	4795	1541	1541	0.135%	0.90	0.75	0.06%	0.004079	0.25	0.323	0.851	0.69%	0.0011
13.55	469	1.7E-03	3.7E+02	29	0.4208	5.6E-04	43	0.255	0.257	146	146.000	7002	4792	1542	1542	0.133%	0.90	0.75	0.06%	0.004009	0.25	0.323	0.851	0.68%	0.0011

23.622	6949.98	25.0	0.246	24.8	28.4	12.30	0.99%	Fine Tailings	0.054	107.6	1.30	0.147	1.16	1	20	1.04%	2.5	83%	2.53	0.147	2.38
23.786	6949.81	27.6	0.308	27.5	17.4	7.52	1.12%	Fine Tailings	0.054	107.6	1.31	0.152	1.16	1	23	1.17%	2.5	83%	2.54	0.152	2.38
23.950	6949.65	24.2	0.338	24.2	11.4	4.94	1.39%	Fine Tailings	0.054	107.6	1.32	0.158	1.16	1	20	1.48%	2.6	83%	2.55	0.158	2.39
24.114	6949.49	22.9	0.395	22.8	9.9	4.29	1.73%	Fine Tailings	0.054	107.6	1.33	0.163	1.17	1	18	1.83%	2.7	83%	2.55	0.163	2.39
24.278	6949.32	20.9	0.416	20.8	8.9	3.84	1.99%	Fine Tailings	0.054	107.6	1.34	0.168	1.17	1	17	2.13%	2.7	83%	2.56	0.168	2.40
24.442	6949.16	23.1	0.444	23.0	7.7	3.34	1.93%	Fine Tailings	0.054	107.6	1.35	0.000	1.35	0	16	2.05%	2.7	83%	2.57	0.000	2.57
24.606	6948.99	25.3	0.519	25.2	7.0	3.03	2.05%	Coarse Tailings	0.054	108.1	1.36	0.000	1.36	0	18	2.17%	2.7	21%	2.58	0.000	2.58
24.770	6948.83	16.2	0.500	16.2	5.7	2.48	3.08%	Coarse Tailings	0.054	108.1	1.37	0.000	1.37	0	11	3.36%	3.0	21%	2.59	0.000	2.59
24.934	6948.67	10.7	0.338	10.6	5.8	2.52	3.17%	Coarse Tailings	0.054	108.1	1.37	0.000	1.37	0	7	3.63%	3.2	21%	2.60	0.000	2.60
25.098	6948.50	8.6	0.263	8.5	8.3	3.58	3.06%	Coarse Tailings	0.054	108.1	1.38	0.000	1.38	0	5	3.65%	3.3	21%	2.61	0.000	2.61
25.262	6948.34	9.6	0.146	9.4	42.8	18.53	1.52%	Coarse Tailings	0.054	108.1	1.39	0.000	1.39	0	6	1.77%	3.1	21%	2.62	0.000	2.62
25.426	6948.17	9.6	0.131	9.3	46.3	20.07	1.36%	Coarse Tailings	0.054	108.1	1.40	0.000	1.40	0	6	1.60%	3.1	21%	2.63	0.000	2.63
25.590	6948.01	9.2	0.124	8.9	50.5	21.90	1.34%	Coarse Tailings	0.054	108.1	1.41	0.000	1.41	0	6	1.58%	3.1	21%	2.63	0.000	2.63
25.754	6947.85	9.4	0.116	9.1	60.6	26.25	1.23%	Coarse Tailings	0.054	108.1	1.42	0.002	1.42	1	6	1.45%	3.0	21%	2.64	0.002	2.64
25.918	6947.68	8.3	0.114	7.9	57.1	24.73	1.38%	Fine Tailings	0.054	107.6	1.43	0.007	1.42	1	5	1.67%	3.1	83%	2.65	0.007	2.65
26.082	6947.52	7.7	0.112	7.3	71.0	30.77	1.45%	Fine Tailings	0.054	107.6	1.44	0.012	1.42	1	4	1.78%	3.2	83%	2.66	0.012	2.65
26.246	6947.35	7.7	0.108	7.3	63.1	27.35	1.40%	Fine Tailings	0.054	107.6	1.44	0.017	1.43	1	4	1.72%	3.2	83%	2.67	0.017	2.65
26.410	6947.19	7.5	0.085	7.1	52.0	22.53	1.14%	Fine Tailings	0.054	107.6	1.45	0.022	1.43	1	4	1.41%	3.2	83%	2.68	0.022	2.66
26.574	6947.03	8.0	0.101	7.6	67.8	29.36	1.26%	Fine Tailings	0.054	107.6	1.46	0.027	1.44	1	5	1.54%	3.1	83%	2.69	0.027	2.66
26.739	6946.86	8.8	0.168	8.4	69.2	30.00	1.91%	Fine Tailings	0.054	107.6	1.47	0.032	1.44	1	5	2.30%	3.2	83%	2.70	0.032	2.66
26.903	6946.70	9.5	0.168	9.1	67.4	29.20	1.77%	Fine Tailings	0.054	107.6	1.48	0.038	1.44	1	6	2.10%	3.1	83%	2.70	0.038	2.67
27.067	6946.53	8.1	0.176	7.7	72.9	31.60	2.17%	Fine Tailings	0.054	107.6	1.49	0.043	1.45	1	5	2.66%	3.3	83%	2.71	0.043	2.67
27.231	6946.37	9.1	0.146	8.6	87.3	37.83	1.60%	Fine Tailings	0.054	107.6	1.50	0.048	1.45	1	5	1.91%	3.1	83%	2.72	0.048	2.67
27.395	6946.21	8.9	0.194	8.3	97.2	42.14	2.18%	Fine Tailings	0.054	107.6	1.51	0.053	1.45	1	5	2.63%	3.2	83%	2.73	0.053	2.68
27.559	6946.04	10.1	0.182	9.4	105.1	45.53	1.80%	Fine Tailings	0.054	107.6	1.52	0.058	1.46	1	6	2.12%	3.1	83%	2.74	0.058	2.68
27.723	6945.88	9.1	0.160	8.4	111.3	48.23	1.76%	Fine Tailings	0.054	107.6	1.52	0.063	1.46	1	5	2.11%	3.2	83%	2.75	0.063	2.69
27.887	6945.71	9.0	0.156	8.3	118.2	51.21	1.73%	Fine Tailings	0.054	107.6	1.53	0.068	1.46	1	5	2.08%	3.2	83%	2.76	0.068	2.69
28.051	6945.55	9.0	0.173	8.3	114.9	49.78	1.92%	Fine Tailings	0.054	107.6	1.54	0.073	1.47	1	5	2.32%	3.2	83%	2.77	0.073	2.69
28.215	6945.39	8.7	0.177	8.0	104.5	45.29	2.04%	Fine Tailings	0.054	107.6	1.55	0.078	1.47	1	5	2.48%	3.2	83%	2.78	0.078	2.70
28.379	6945.22	8.4	0.157	7.7	114.3	49.54	1.86%	Fine Tailings	0.054	107.6	1.56	0.084	1.48	1	5	2.29%	3.2	83%	2.78	0.084	2.70
28.543	6945.06	8.3	0.157	7.7	108.9	47.20	1.88%	Fine Tailings	0.054	107.6	1.57	0.089	1.48	1	5	2.32%	3.2	83%	2.79	0.089	2.70
28.707	6944.89	7.6	0.159	7.0	102.2	44.29	2.10%	Fine Tailings	0.054	107.6	1.58	0.094	1.48	1	4	2.65%	3.3	83%	2.80	0.094	2.71
28.871	6944.73	7.6	0.138	7.0	99.8	43.23	1.81%	Fine Tailings	0.054	107.6	1.59	0.099	1.49	1	4	2.28%	3.3	83%	2.81	0.099	2.71
29.035	6944.56	8.0	0.129	7.5	84.9	36.77	1.60%	Fine Tailings	0.054	107.6	1.59	0.104	1.49	1	4	2.00%	3.2	83%	2.82	0.104	2.72
29.199	6944.40	7.9	0.135	7.3	90.8	39.35	1.71%	Fine Tailings	0.054	107.6	1.60	0.109	1.49	1	4	2.15%	3.2	83%	2.83	0.109	2.72
29.363	6944.24	8.7	0.135	8.2	88.4	38.29	1.55%	Fine Tailings	0.054	107.6	1.61	0.114	1.50	1	5	1.90%	3.2	83%	2.84	0.114	2.72
29.527	6944.07	11.1	0.278	10.7	69.6	30.14	2.49%	Fine Tailings	0.054	107.6	1.62	0.119	1.50	1	6	2.92%	3.2	83%	2.85	0.119	2.73
29.691	6943.91	13.1	0.268	12.8	49.5	21.43	2.05%	Fine Tailings	0.054	107.6	1.63	0.125	1.51	1	8	2.35%	3.0	83%	2.85	0.125	2.73
29.855	6943.74	9.9	0.285	9.6	47.3	20.50	2.89%	Fine Tailings	0.054	107.6	1.64	0.130	1.51	1	5	3.47%	3.3	83%	2.86	0.130	2.73
30.019	6943.58	8.2	0.258	7.8	53.8	23.30	3.16%	Fine Tailings	0.054	107.6	1.65	0.135	1.51	1	4	3.95%	3.4	83%	2.87	0.135	2.74
30.183	6943.42	8.3	0.182	7.7	91.8	39.80	2.20%	Fine Tailings	0.054	107.6	1.66	0.140	1.52	1	4	2.75%	3.3	83%	2.88	0.140	2.74
30.347	6943.25	7.2	0.145	6.6	97.3	42.18	2.02%	Fine Tailings	0.054	107.6	1.67	0.145	1.52	1	4	2.64%	3.3	83%	2.89	0.145	2.75
30.511	6943.09	8.1	0.132	7.5	100.3	43.48	1.63%	Fine Tailings	0.054	107.6	1.67	0.150	1.52	1	4	2.06%	3.2	83%	2.90	0.150	2.75
30.675	6942.92	8.0	0.136	7.3	100.8	43.66	1.71%	Fine Tailings	0.054	107.6	1.68	0.155	1.53	1	4	2.17%	3.3	83%	2.91	0.155	2.75
30.840	6942.76	7.3	0.135	6.7	90.1	39.03	1.86%	Fine Tailings	0.054	107.6	1.69	0.160	1.53	1	4	2.43%	3.3	83%	2.92	0.160	2.76
31.004	6942.60	7.3	0.136	6.7	92.9	40.24	1.87%	Coarse Tailings	0.054	108.1	1.70	0.000	1.70	0	3	2.44%	3.4	21%	2.93	0.000	2.93
31.168	6942.43	7.9	0.125	7.3	95.4	41.34	1.59%	Coarse Tailings	0.054	108.1	1.71	0.000	1.71	0	4	2.03%	3.3	21%	2.93	0.000	2.93
31.332	6942.27	7.6	0.119	7.0	87.5	37.90	1.57%	Coarse Tailings	0.054	108.1	1.72	0.000	1.72	0	3	2.04%	3.3	21%	2.94	0.000	2.94
31.496	6942.10	6.4	0.096	5.9	81.3	35.22	1.49%	Coarse Tailings	0.054	108.1	1.73	0.000	1.73	0	3	2.04%	3.4	21%	2.95	0.000	2.95
31.660	6941.94	7.3	0.083	6.8	81.4	35.28	1.14%	Coarse Tailings	0.054	108.1	1.74	0.000	1.74	0	3	1.50%	3.3	21%	2.96	0.000	2.96
31.824	6941.78	7.3	0.082	6.8	88.6	38.39	1.12%	Coarse Tailings	0.054	108.1	1.75	0.000	1.75	0	3	1.47%	3.3	21%	2.97	0.000	2.97
31.988	6941.61	7.2	0.092	6.6	90.8	39.33	1.28%	Coarse Tailings	0.054	108.1	1.75	0.000	1.75	0	3	1.69%	3.3	21%	2.98	0.000	2.98
32.152	6941.45	6.8	0.110	6.3	93.8	40.65	1.61%	Coarse Tailings	0.054	108.1	1.76	0.000	1.76	0	3	2.17%	3.4	21%	2.99	0.000	2.99
32.316	6941.28	7.8	0.112	7.3	84.7	36.69	1.44%	Coarse Tailings	0.054	108.1	1.77	0.000	1.77	0	3	1.86%	3.3	21%	3.00	0.000	3.00
32.480	6941.12	8.0	0.130	7.5	81.4	35.26	1.63%	Coarse Tailings	0.054	108.1	1.78	0.000	1.78	0	3	2.10%	3.3	21%	3.01	0.000	3.01
32.644	6940.96	7.2	0.134	6.6	87.1	37.74	1.87%	Coarse Tailings	0.054	108.1	1.79	0.000	1.79	0	3	2.49%	3.4	21%	3.01	0.000	3.01
32.808	6940.79	8.1	0.101	7.7	70.0	30.32	1.25%	Coarse Tailings	0.054	108.1	1.80	0.000	1.80	0	3	1.61%	3.3	21%	3.02	0.000	3.02
32.972	6940.63	7.9	0.083	7.5	65.6	28.43	1.05%	Coarse Tailings	0.054	108.1	1.81	0.000	1.81	0	3	1.37%	3.2	21%	3.03	0.000	3.03
33.136	6940.46	9.0	0.122	8.5	77.4	33.54	1.36%	Coarse Tailings	0.054	108.1	1.82	0.000	1.82	0	4	1.71%	3.2	21%	3.04	0.000	3.04
33.300	6940.30	9.9	0.152	9.3	95.5	41.38	1.53%	Fine Tailings	0.054	107.6	1.83	0.003	1.82	1	4	1.88%	3.2	83%	3.05	0.003	3.05
33.464	6940.14	20.0	0.225	19.4	86.7	37.58	1.13%	Fine Tailings	0.054	107.6	1.83	0.008	1.83	1	10	1.24%	2.8	83%	3.06	0.008	3.05
33.628	6939.97	24.7	0.393	24.5	18.9	8.18	1.59%	Fine Tailings	0.054	107.6	1.84	0.013	1.83	1	12	1.72%	2.8	83%	3.07	0.013	3.05
33.792	6939.81	21.2	0.550	21.1	9.4	4.09	2.60%	Fine Tailings	0.054	107.6	1.85	0.018	1.83	1	11	2.85%	3.0	83%	3.08	0.018	3.06
33.956	6939.64	17.4	0.630	17.3	14.0	6.06	3.62%	Fine Tailings	0.054	107.6	1.86	0.024	1.84	1	8	4.05%	3.1	83%	3.08	0.024	3.06
34.120	6939.48	16.1	0.498	15.9	20.3	8.81	3.10%	Fine Tailings	0.054	107.6	1.87	0.029	1.84	1	8	3.51%	3.1	83%	3.09	0.029	3.07
34.284	6939.32	10.1	0.240	9.9	25.5	11.04	2.38%	Fine Tailings	0.054	107.6	1.88	0.034	1.84	1	4	2.92%	3.3	83%	3.10	0.034	3.07
34.448	6939.15	7.8	0.180	7.5	52.2	22.61	2.29%	Fine Tailings	0.054	107.6	1.89	0.039	1.85	1	3	3.02%	3.4	83%	3.11	0.039	3.07
34.612	6938.99	6.6	0.135	6.3	61.8	26.78	2.03%	Fine Tailings	0.054	107.6	1.90	0.044	1.85	1	3	2.85%	3.5	83%	3.12	0.044	3.08
34.776	6938.82	7.3	0.122	6.9	65.9	28.57	1.67%	Fine Tailings	0.054	107.6	1.90	0.049	1.86	1	3	2.26%	3.4	83%	3.13	0.049	3.08
34.941	6938.66	7.5	0.130	7.1	70.1	30.38	1.73%	Fine Tailings	0.054	107.6	1.91	0.054	1.86	1	3	2.32%	3.4	83%	3.14	0.054	3.08
35.105	6938.50	6.9	0.137	6.4	74.0	32.05	1.99%	Fine Tailings	0.054	107.6	1.92	0.059	1.86	1	3	2.75%	3.5	83%	3.15	0.059	3.09
35.269	6938.33	7.4	0.147	7.0	78.1	33.84	1.98%	Fine Tailings	0.054	107.6	1.93	0.065	1.87	1	3	2.67%	3.4	83%	3.16	0.065	3.09
35.433	6938.17	7.6	0.150	7.0	94.5	40.94	1.97%	Fine Tailings	0.054	107.6	1.94	0.070	1.87	1	3	2.65%	3.4	83%	3.16	0.070	3.09
35.597	6938.00	8.4	0.150	7.8	100.9	43.72	1.78%	Fine Tailings	0.054	107.6	1.95	0.075	1.87	1	3	2.32%	3.3	83%	3.17	0.075	3.10
35.761	6937.84	8.3	0.143	7.7	97.6	42.30	1.72%	Fine Tailings	0.054	107.6	1.96	0.080	1.88	1	3	2.25%	3.3	83%	3.18	0.080	3.10
35.925	6937.68	8.6	0.122	8.0	97.4	42.22	1.41%	Fine Tailings	0.054	107.6	1.97	0.085	1.88	1	4	1.83%	3.3	83%	3.19	0.085	3.11
36.089	6937.51	7.6	0.134	7.0	104.9	45.45	1.76%	Fine Tailings	0.054	107.6	1.98	0.090	1.88	1	3	2.38%	3.4	83%	3.20	0.090	3.11
36.253	6937.35	8.3	0.161	7.7	106.2	46.00	1.94%	Fine Tailings	0.054	107.6	1.98	0.095	1.89	1	3	2.54%	3.4	83%	3.21	0.095	3.11
36.417	6937.18	9.5	0.161	8.9	96.9	41.99	1.69%	Fine Tailings	0.054	107.6	1.99	0.100	1.89	1	4	2.14%	3.3	83%	3.22	0.100	3.12
36.581	6937.02	11.0	0.514	10.4	91.6	39.69	4.69%	Fine Tailings	0.054	107.6	2.00	0.105	1.90	1	5	5.74%	3.4	83%	3.23	0.105	3.12
36.745	6936.86	12.2	0.543	11.6	95.0	41.18	4.45%	Fine Tailings	0.054	107.6	2.01	0.111	1.90	1	5	5.33%	3.4	83%	3.24	0.111	3.12
36.909	6936.69	11.1	0.408	10.8	49.7	21.52	3.68%	Fine Tailings	0.054	107.6	2.02	0.116	1.90	1	5	4.50%	3.4	83%	3.24	0.116	3.13

13.60	469	1.7E-03	3.7E+02	29	0.4163	5.6E-04	43	0.255	0.258	147	147.000	6997	4789	1543	1543	0.132%	0.90	0.75	0.06%	0.003939	0.25	0.323	0.851	0.67%	0.0011
13.65	469	1.7E-03	3.7E+02	29	0.4118	5.5E-04	43	0.255	0.258	148	148.000	6993	4786	1544	1544	0.130%	0.90	0.75	0.06%	0.003868	0.25	0.323	0.851	0.66%	0.0011
13.70	469	1.7E-03	3.7E+02	29	0.4073	5.5E-04	43	0.255	0.258	149	149.000	6988	4783	1545	1545	0.128%	0.90	0.75	0.06%	0.003796	0.25	0.323	0.851	0.65%	0.0011
13.75	469	1.7E-03	3.7E+02	29	0.4028	5.5E-04	43	0.255	0.258	150	150.000	6984	4780	1546	1546	0.126%	0.90	0.75	0.06%	0.003725	0.25	0.323	0.851	0.63%	0.0010
13.80	469	1.7E-03	3.7E+02	28	0.3983	5.4E-04	43	0.255	0.258	151	151.000	6979	4777	1547	1547	0.125%	0.90	0.75	0.06%	0.003653	0.25	0.323	0.851	0.62%	0.0010
13.85	469	1.7E-03	3.7E+02	28	0.3939	5.4E-04	43	0.259	0.263	152	152.000	6779	4637	1548	1548	0.123%	0.90	0.75	0.06%	0.003581	0.25	0.323	0.851	0.61%	0.0010
13.90	508	1.7E-03	4.3E+02	28	0.3894	4.5E-04	0	0.260	0.263	153	0.260	6769	4630	1549	6769	0.235%	1.79	1.00	0.01%	0.004030	0.36	0.025	0.785	0.63%	0.0010
13.95	508	1.7E-03	4.3E+02	28	0.3850	4.5E-04	0	0.260	0.263	154	0.260	6760	4623	1550	6760	0.228%	1.79	1.00	0.01%	0.003899	0.36	0.025	0.785	0.61%	0.0010
14.00	508	1.7E-03	4.3E+02	28	0.3806	4.5E-04	0	0.260	0.264	155	0.260	6750	4617	1551	6750	0.221%	1.79	1.00	0.01%	0.003771	0.36	0.025	0.785	0.59%	0.0010
14.05	508	1.7E-03	4.3E+02	27	0.3762	4.4E-04	0	0.260	0.264	156	0.260	6741	4610	1552	6741	0.214%	1.79	1.00	0.01%	0.003647	0.36	0.025	0.785	0.57%	0.0009
14.10	508	1.7E-03	4.3E+02	27	0.3718	4.4E-04	0	0.260	0.264	157	0.260	6731	4604	1553	6731	0.207%	1.79	1.00	0.01%	0.003527	0.36	0.025	0.785	0.55%	0.0009
14.15	508	1.7E-03	4.3E+02	27	0.3674	4.3E-04	0	0.261	0.264	158	0.261	6722	4597	1554	6722	0.201%	1.79	1.00	0.01%	0.003411	0.36	0.025	0.785	0.54%	0.0009
14.20	508	1.7E-03	4.3E+02	27	0.3631	4.3E-04	0	0.261	0.265	159	0.261	6713	4591	1555	6713	0.194%	1.79	1.00	0.01%	0.003298	0.36	0.025	0.785	0.52%	0.0008
14.25	508	1.7E-03	4.3E+02	27	0.3587	4.3E-04	0	0.261	0.265	160	0.261	6705	4586	1556	6705	0.188%	1.79	1.00	0.01%	0.003190	0.36	0.025	0.785	0.50%	0.0008
14.30	508	1.7E-03	4.3E+02	26	0.3544	4.2E-04	43	0.261	0.265	161	161.000	6701	4583	1557	1557	0.082%	0.90	0.75	0.06%	0.001632	0.25	0.323	0.851	0.28%	0.0005
14.35	508	1.7E-03	4.3E+02	26	0.3501	4.2E-04	43	0.261	0.265	162	162.000	6698	4580	1558	1558	0.081%	0.90	0.75	0.06%	0.001567	0.25	0.323	0.851	0.27%	0.0004
14.40	508	1.7E-03	4.3E+02	26	0.3458	4.2E-04	43	0.261	0.265	163	163.000	6694	4577	1559	1559	0.080%	0.90	0.75	0.06%	0.001501	0.25	0.323	0.851	0.26%	0.0004
14.45	508	1.7E-03	4.3E+02	26	0.3415	4.1E-04	43	0.261	0.265	164	164.000	6690	4575	1560	1560	0.079%	0.90	0.75	0.06%	0.001435	0.25	0.323	0.851	0.24%	0.0004
14.50	508	1.7E-03	4.3E+02	26	0.3373	4.1E-04	43	0.261	0.265	165	165.000	6686	4572	1561	1561	0.077%	0.90	0.75	0.06%	0.001368	0.25	0.323	0.851	0.23%	0.0004
14.55	508	1.7E-03	4.3E+02	26	0.3331	4.1E-04	43	0.261	0.265	166	166.000	6682	4569	1562	1562	0.076%	0.90	0.75	0.06%	0.001300	0.25	0.323	0.851	0.22%	0.0004
14.60	508	1.7E-03	4.3E+02	25	0.3288	4.0E-04	43	0.262	0.265	167	167.000	6678	4567	1563	1563	0.075%	0.90	0.75	0.06%	0.001232	0.25	0.323	0.851	0.21%	0.0003
14.65	508	1.7E-03	4.3E+02	25	0.3246	4.0E-04	43	0.262	0.266	168	168.000	6675	4564	1564	1564	0.074%	0.90	0.75	0.06%	0.001162	0.25	0.323	0.851	0.20%	0.0003
14.70	508	1.7E-03	4.3E+02	25	0.3205	3.9E-04	43	0.262	0.266	169	169.000	6671	4562	1565	1565	0.073%	0.90	0.75	0.06%	0.001092	0.25	0.323	0.851	0.19%	0.0003
14.75	508	1.7E-03	4.3E+02	25	0.3163	3.9E-04	43	0.262	0.266	170	170.000	6667	4559	1566	1566	0.072%	0.90	0.75	0.06%	0.001021	0.25	0.323	0.851	0.17%	0.0003
14.80	508	1.7E-03	4.3E+02	25	0.3122	3.9E-04	43	0.262	0.266	171	171.000	6663	4556	1567	1567	0.071%	0.90	0.75	0.06%	0.000948	0.25	0.323	0.851	0.16%	0.0003
14.85	508	1.7E-03	4.3E+02	25	0.3081	3.8E-04	43	0.262	0.266	172	172.000	6660	4554	1568	1568	0.070%	0.90	0.75	0.06%	0.000874	0.25	0.323	0.851	0.15%	0.0002
14.90	508	1.7E-03	4.3E+02	25	0.3040	3.8E-04	43	0.262	0.266	173	173.000	6656	4551	1569	1569	0.069%	0.90	0.75	0.06%	0.000799	0.25	0.323	0.851	0.14%	0.0002
14.95	508	1.7E-03	4.3E+02	24	0.2999	3.8E-04	43	0.262	0.266	174	174.000	6652	4548	1570	1570	0.067%	0.90	0.75	0.06%	0.000721	0.25	0.323	0.851	0.12%	0.0002
15.00	508	1.7E-03	4.3E+02	24	0.2959	3.7E-04	43	0.262	0.266	175	175.000	6648	4546	1571	1571	0.066%	0.90	0.75	0.06%	0.000642	0.25	0.323	0.851	0.11%	0.0002
15.05	508	1.7E-03	4.3E+02	24	0.2918	3.7E-04	43	0.262	0.266	176	176.000	6644	4543	1572	1572	0.065%	0.90	0.75	0.06%	0.000559	0.25	0.323	0.851	0.10%	0.0002
15.10	508	1.7E-03	4.3E+02	24	0.2878	3.6E-04	43	0.262	0.266	177	177.000	6641	4541	1573	1573	0.064%	0.90	0.75	0.06%	0.000473	0.25	0.323	0.851	0.08%	0.0001
15.15	508	1.7E-03	4.3E+02	24	0.2839	3.6E-04	43	0.262	0.267	178	178.000	6637	4538	1574	1574	0.063%	0.90	0.75	0.06%	0.000382	0.25	0.323	0.851	0.07%	0.0001
15.20	508	1.7E-03	4.3E+02	24	0.2799	3.6E-04	43	0.263	0.267	179	179.000	6633	4535	1575	1575	0.062%	0.90	0.75	0.06%	0.000285	0.25	0.323	0.851	0.05%	0.0001
15.25	508	1.7E-03	4.3E+02	24	0.2760	3.5E-04	43	0.263	0.267	180	180.000	6630	4533	1576	1576	0.061%	0.90	0.75	0.06%	0.000175	0.25	0.323	0.851	0.03%	0.0000
15.30	508	1.7E-03	4.3E+02	23	0.2721	3.5E-04	43	0.263	0.267	181	181.000	6626	4530	1577	1577	0.060%	0.90	0.75	0.06%	0.000029	0.25	0.323	0.851	0.00%	0.0000
15.35	508	1.7E-03	4.3E+02	23	0.2682	3.4E-04	43	0.263	0.267	182	182.000	6622	4528	1578	1578	0.059%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
15.40	489	1.7E-03	4.0E+02	23	0.2644	3.7E-04	43	0.263	0.267	183	183.000	6618	4525	1579	1579	0.065%	0.90	0.75	0.06%	0.000568	0.25	0.323	0.851	0.10%	0.0002
15.45	489	1.7E-03	4.0E+02	23	0.2606	3.6E-04	43	0.263	0.267	184	184.000	6615	4522	1580	1580	0.064%	0.90	0.75	0.06%	0.000475	0.25	0.323	0.851	0.08%	0.0001
15.50	489	1.7E-03	4.0E+02	23	0.2568	3.6E-04	43	0.263	0.267	185	185.000	6611	4520	1581	1581	0.063%	0.90	0.75	0.06%	0.000377	0.25	0.323	0.851	0.06%	0.0001
15.55	489	1.7E-03	4.0E+02	23	0.2530	3.5E-04	43	0.263	0.267	186	186.000	6607	4517	1582	1582	0.062%	0.90	0.75	0.06%	0.000270	0.25	0.323	0.851	0.05%	0.0001
15.60	489	1.7E-03	4.0E+02	23	0.2493	3.5E-04	43	0.263	0.267	187	187.000	6604	4515	1583	1583	0.061%	0.90	0.75	0.06%	0.000148	0.25	0.323	0.851	0.03%	0.0000
15.65	489	1.7E-03	4.0E+02	23	0.2456	3.5E-04	43	0.263	0.268	188	188.000	6600	4512	1584	1584	0.060%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
15.70	489	1.7E-03	4.0E+02	23	0.2419	3.4E-04	43	0.263	0.268	189	189.000	6596	4510	1585	1585	0.059%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
15.75	489	1.7E-03	4.0E+02	22	0.2382	3.4E-04	43	0.263	0.268	190	190.000	6593	4507	1586	1586	0.058%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
15.80	489	1.7E-03	4.0E+02	22	0.2346	3.3E-04	43	0.264	0.268	191	191.000	6589	4505	1587	1587	0.057%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
15.85	489	1.7E-03	4.0E+02	22	0.2310	3.3E-04	0	0.267	0.272	192	0.267	6430	4394	1588	6430	0.083%	1.79	1.00	0.01%	0.001307	0.36	0.025	0.785	0.21%	0.0003
15.90	489	1.7E-03	4.0E+02	22	0.2274	3.2E-04	0	0.267	0.272	193	0.267	6422	4388	1589	6422	0.080%	1.79	1.00	0.01%	0.001260	0.36	0.025	0.785	0.20%	0.0003
15.95	489	1.7E-03	4.0E+02	22	0.2239	3.2E-04	0	0.268	0.272	194	0.268	6414	4383	1590	6414	0.078%	1.79	1.00	0.01%	0.001215	0.36	0.025	0.785	0.19%	0.0003
16.00	489	1.7E-03	4.0E+02	22	0.2203	3.2E-04	0	0.268	0.273	195	0.268	6406	4377	1591	6406	0.075%	1.79	1.00	0.01%	0.001171	0.36	0.025	0.785	0.18%	0.0003
16.05	489	1.7E-03	4.0E+02	22	0.2169	3.1E-04	0	0.268	0.273	196	0.268	6398	4372	1592	6398	0.073%	1.79	1.00	0.01%	0.001129	0.36	0.025	0.785	0.18%	0.0003
16.10	489	1.7E-03	4.0E+02	22	0.2134	3.1E-04	0	0.268	0.273	197	0.268	6391	4366	1593	6391	0.071%	1.79	1.00	0.01%	0.001088	0.36	0.025	0.785	0.17%	0.0003
16.15	489	1.7E-03	4.0E+02	22	0.2100	3.0E-04	0	0.268	0.273	198	0.268	6383	4361	1594	6383	0.069%	1.79	1.00	0.01%	0.001049	0.36	0.025	0.785	0.16%	0.0003
16.20	489	1.7E-03	4.0E+02	22	0.2066	3.0E-04	0	0.269	0.274	199	0.269	6375	4355	1595	6375	0.067%	1.79	1.00	0.01%	0.001011	0.36	0.025	0.785	0.16%	0.0003
16.25	489	1.7E-03	4.0E+02	21	0.2032	3.0E-04	0	0.269	0.274	200	0.269	6367	4350	1596	6367	0.064%	1.79	1.00	0.01%	0.000975	0.36	0.025	0.785	0.15%	0.0003
16.30	489	1.7E-03	4.0E+02	21	0.1998	2.9E-04	0	0.269	0.274	201	0.269	6360	4345	1597	6360	0.063%	1.79	1.00	0.01%	0.000940	0.36	0.025	0.785	0.15%	0.0002
16.35	489	1.7E-03	4.0E+02	21	0.1965	2.9E-04	0	0.269	0.274	202	0.269	6352	4339	1598	6352	0.061%	1.79	1.00	0.01%	0.000906	0.36	0.025	0.785	0.14%	0.0002
16.40	489	1.7E-03	4.0E+02	21	0.1932	2.8E-04	0	0.269	0.274	203	0.269	6344	4334	1599	6344	0.059%	1.79	1.00	0.01%	0.000873	0.36	0.025	0.785	0.14%	0.0002
16.45	489	1.7E-03	4.0E+02	21	0.1900	2.8E-04	0	0.269	0.275	204	0.269	6337	4329	1600	6337	0.057%	1.79	1.00	0.01%	0.000841	0.36	0.025	0.785	0.13%	0.0002
16.50	489	1.7E-03	4.0E+02	21	0.1868	2.8E-04	0	0.270	0.275	205	0.270	6329	4323	1601	6329	0.055%	1.79	1.00	0.01%	0.000811	0.36	0.025	0.785	0.13%	0.0002
16.55	489	1.7E-03	4.0E+02	21	0.1836	2.7E-04	43	0.270	0.275	206	206.000	6324	4320	1602	1602	0.042%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.60	489	1.7E-03	4.0E+02	21	0.1804	2.7E-04	43	0.270	0.275	207	207.000	6321	4318	1603	1603	0.041%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.65	489	1.7E-03	4.0E+02	21	0.1773	2.7E-04	43	0.270	0.275	208	208.000	6318	4316	1604	1604	0.041%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.70	489	1.7E-03	4.0E+02	21	0.1742	2.6E-04	43	0.270	0.275	209	209.000	6315	4313	1605	1605	0.040%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.75	489	1.7E-03	4.0E+02	21	0.1711	2.6E-04	43	0.270	0.275	210	210.000	6312	4311	1606	1606	0.039%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.80	489	1.7E-03	4.0E+02	21	0.1681	2.5E-04	43	0.270	0.275	211	211.000	6308	4309	1607	1607	0.038%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.85	489	1.7E-03	4.0E+02	21	0.1650	2.5E-04	43	0.270	0.276	212	212.000	6305	4307	1608	1608	0.037%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.90	489	1.7E-03	4.0E+02	20	0.1621	2.5E-04	43	0.270	0.276	213	213.000	6302	4305	1609	1609	0.036%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.95	489	1.7E-03	4.0E+02	20	0.1591	2.4E-04	43	0.270	0.276	214	214.000	6299	4303	1610	1610	0.036%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.00	503	1.7E-03	4.2E+02	20	0.1562	2.3E-04	43	0.270	0.276	215	215.000	6296	4300	1611	1611	0.032%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.05	503	1.7E-03	4.2E+02	20	0.1533	2.2E-04	43	0.270	0.276	216	216.000	6293	4298	1612	1612	0.032%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.10	503	1.7E-03	4.2E+02	20	0.1504	2.2E-04	43	0.271	0.276	217	217.000	6290	4296	1613	1613	0.031%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.15	503	1.7E-03	4.2E+02	20	0.1476	2.1E-04	43	0.271	0.276	218	218.000	6287	4294	1614	1614	0.030%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.20	503	1.7E-03	4.2E+02	20	0.1448	2.1E-04	43	0.271	0.276	219	219.000	6284	4292	1615	1615	0.030%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.25	503	1.7E-03	4.2E+02	20	0.1420	2.1E-04	43	0.271	0.276	220	220.000	6281	4290	1616	1616	0.029%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.30	503	1.7E-03	4.2E+02	20	0.1392	2.0E-04	43	0.271	0.276	221	221.000	6277	4287	1617	1617	0.028%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.35	503	1.7E-03	4.2E+02	20	0.1365	2.0E-04	43	0.271	0.276	222	222.000	6274	4285	1618	1618	0.028%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.40	503	1.7E-03	4.2E+02	20	0.1338	2.0E-04	43	0.271	0.276	223	223.000	6271	4283	1619	1619	0.027%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.45	503	1.7E-03	4.2E+02	20	0.1312	1.9E-04	43	0.271	0.277	224	224.000	6268	4281	1620	1620	0.027%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.50	503	1.7E-03	4.2E+02	20	0.1285	1.9E-04	43	0.271	0.277	225	225.000	6265	4279	1621	1621	0.026%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.55	503	1.7E-03	4.2E+02	20	0.1259	1.9E-04	43	0.271	0.277	226	226.000	6262	4277	1622	1622	0.025%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.60	503	1.7E-03	4.2E+02	20	0.1234	1.8E-04	43	0.271	0.277	227	227.000	6259	4275	1623	1623	0.025%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.65	503	1.7E-03	4.2E+02	19	0.1208	1.8E-04	43	0.271	0.277	228	228.000	6256	4273	1624	1624	0.024%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000

37.073	6936.53	9.1	0.257	8.6	87.9	38.11	2.81%	Fine Tailings	0.054	107.6	2.03	0.121	1.91	1	4	3.61%	3.4	83%	3.25	0.121	3.13
37.237	6936.36	9.5	0.185	8.9	90.0	39.00	1.95%	Fine Tailings	0.054	107.6	2.04	0.126	1.91	1	4	2.48%	3.3	83%	3.26	0.126	3.14
37.401	6936.20	9.2	0.138	8.6	91.6	39.68	1.50%	Fine Tailings	0.054	107.6	2.05	0.131	1.91	1	4	1.94%	3.3	83%	3.27	0.131	3.14
37.565	6936.03	9.9	0.149	9.4	92.3	39.98	1.50%	Fine Tailings	0.054	107.6	2.05	0.136	1.92	1	4	1.89%	3.2	83%	3.28	0.136	3.14
37.729	6935.87	10.3	0.186	9.7	98.0	42.48	1.81%	Fine Tailings	0.054	107.6	2.06	0.141	1.92	1	4	2.26%	3.2	83%	3.29	0.141	3.15
37.893	6935.71	10.4	0.235	9.8	99.4	43.09	2.25%	Fine Tailings	0.054	107.6	2.07	0.146	1.93	1	4	2.81%	3.3	83%	3.30	0.146	3.15
38.057	6935.54	9.9	0.261	9.4	90.1	39.04	2.63%	Fine Tailings	0.054	107.6	2.08	0.152	1.93	1	4	3.32%	3.3	83%	3.31	0.152	3.15
38.221	6935.38	10.1	0.207	9.5	92.4	40.02	2.05%	Fine Tailings	0.054	107.6	2.09	0.157	1.93	1	4	2.59%	3.3	83%	3.31	0.157	3.16
38.385	6935.21	9.3	0.187	8.7	83.9	36.34	2.02%	Fine Tailings	0.054	107.6	2.10	0.162	1.94	1	4	2.61%	3.3	83%	3.32	0.162	3.16
38.549	6935.05	10.0	0.192	9.4	96.0	41.59	1.93%	Fine Tailings	0.054	107.6	2.11	0.167	1.94	1	4	2.44%	3.3	83%	3.33	0.167	3.17
38.713	6934.89	10.1	0.189	9.5	99.9	43.29	1.87%	Fine Tailings	0.054	107.6	2.12	0.172	1.94	1	4	2.36%	3.3	83%	3.34	0.172	3.17
38.877	6934.72	10.1	0.174	9.5	100.2	43.44	1.72%	Fine Tailings	0.054	107.6	2.13	0.177	1.95	1	4	2.17%	3.3	83%	3.35	0.177	3.17
39.042	6934.56	10.2	0.185	9.5	104.2	45.14	1.82%	Fine Tailings	0.054	107.6	2.13	0.182	1.95	1	4	2.31%	3.3	83%	3.36	0.182	3.18
39.206	6934.39	10.0	0.172	9.3	103.9	45.02	1.73%	Fine Tailings	0.054	107.6	2.14	0.187	1.96	1	4	2.20%	3.3	83%	3.37	0.187	3.18
39.370	6934.23	9.6	0.179	8.9	103.1	44.66	1.87%	Fine Tailings	0.054	107.6	2.15	0.192	1.96	1	4	2.42%	3.3	83%	3.38	0.192	3.18
39.534	6934.07	10.1	0.186	9.4	105.8	45.86	1.84%	Fine Tailings	0.054	107.6	2.16	0.198	1.96	1	4	2.35%	3.3	83%	3.39	0.198	3.19
39.698	6933.90	11.1	0.218	10.5	111.9	48.48	1.96%	Fine Tailings	0.054	107.6	2.17	0.203	1.97	1	5	2.43%	3.2	83%	3.39	0.203	3.19
39.862	6933.74	10.9	0.250	10.2	112.4	48.69	2.29%	Fine Tailings	0.054	107.6	2.18	0.208	1.97	1	4	2.87%	3.3	83%	3.40	0.208	3.19
40.026	6933.57	11.2	0.266	10.5	111.8	48.46	2.37%	Fine Tailings	0.054	107.6	2.19	0.213	1.97	1	5	2.95%	3.3	83%	3.41	0.213	3.20
40.190	6933.41	11.4	0.259	10.6	114.6	49.64	2.28%	Fine Tailings	0.054	107.6	2.20	0.218	1.98	1	5	2.83%	3.3	83%	3.42	0.218	3.20
40.354	6933.25	11.1	0.254	10.4	115.1	49.89	2.29%	Fine Tailings	0.054	107.6	2.20	0.223	1.98	1	4	2.85%	3.3	83%	3.43	0.223	3.21
40.518	6933.08	11.2	0.254	10.5	117.1	50.74	2.27%	Fine Tailings	0.054	107.6	2.21	0.228	1.99	1	5	2.83%	3.3	83%	3.44	0.228	3.21
40.682	6932.92	11.0	0.256	10.3	117.2	50.80	2.33%	Fine Tailings	0.054	107.6	2.22	0.233	1.99	1	4	2.92%	3.3	83%	3.45	0.233	3.21
40.846	6932.75	10.5	0.259	9.8	118.3	51.25	2.47%	Fine Tailings	0.054	107.6	2.23	0.239	1.99	1	4	3.14%	3.3	83%	3.46	0.239	3.22
41.010	6932.59	11.1	0.263	10.4	119.3	51.69	2.36%	Fine Tailings	0.054	107.6	2.24	0.244	2.00	1	4	2.96%	3.3	83%	3.46	0.244	3.22
41.174	6932.43	11.1	0.273	10.3	119.3	51.69	2.47%	Fine Tailings	0.054	107.6	2.25	0.249	2.00	1	4	3.09%	3.3	83%	3.47	0.249	3.22
41.338	6932.26	11.1	0.294	10.3	120.1	52.04	2.65%	Fine Tailings	0.054	107.6	2.26	0.254	2.00	1	4	3.33%	3.3	83%	3.48	0.254	3.23
41.502	6932.10	11.8	0.323	11.0	119.6	51.81	2.74%	Fine Tailings	0.054	107.6	2.27	0.259	2.01	1	5	3.40%	3.3	83%	3.49	0.259	3.23
41.666	6931.93	12.6	0.398	11.9	113.1	49.01	3.17%	Fine Tailings	0.054	107.6	2.28	0.264	2.01	1	5	3.87%	3.3	83%	3.50	0.264	3.24
41.830	6931.77	16.4	0.408	15.9	76.9	33.33	2.49%	Fine Tailings	0.054	107.6	2.28	0.269	2.01	1	7	2.89%	3.1	83%	3.51	0.269	3.24
41.994	6931.61	15.4	0.291	15.1	54.3	23.55	1.88%	Fine Tailings	0.054	107.6	2.29	0.274	2.02	1	7	2.21%	3.1	83%	3.52	0.274	3.24
42.158	6931.44	13.6	0.304	13.1	70.5	30.56	2.24%	Fine Tailings	0.054	107.6	2.30	0.279	2.02	1	6	2.70%	3.2	83%	3.53	0.279	3.25
42.322	6931.28	12.3	0.310	11.7	90.1	39.03	2.52%	Fine Tailings	0.054	107.6	2.31	0.285	2.03	1	5	3.11%	3.3	83%	3.54	0.285	3.25
42.486	6931.11	12.2	0.307	11.6	95.9	41.57	2.52%	Fine Tailings	0.054	107.6	2.32	0.290	2.03	1	5	3.11%	3.3	83%	3.54	0.290	3.25
42.650	6930.95	12.5	0.307	11.9	100.1	43.38	2.45%	Fine Tailings	0.054	107.6	2.33	0.295	2.03	1	5	3.00%	3.2	83%	3.55	0.295	3.26
42.814	6930.79	13.9	0.349	13.3	110.2	47.75	2.50%	Fine Tailings	0.054	107.6	2.34	0.300	2.04	1	6	3.01%	3.2	83%	3.56	0.300	3.26
42.978	6930.62	13.8	0.399	13.1	115.0	49.84	2.88%	Fine Tailings	0.054	107.6	2.35	0.305	2.04	1	6	3.47%	3.2	83%	3.57	0.305	3.27
43.143	6930.46	15.0	0.333	14.3	117.8	51.04	2.22%	Fine Tailings	0.054	107.6	2.35	0.310	2.04	1	6	2.63%	3.1	83%	3.58	0.310	3.27
43.307	6930.29	21.0	0.524	20.1	144.2	62.47	2.50%	Fine Tailings	0.054	107.6	2.36	0.315	2.05	1	9	2.81%	3.0	83%	3.59	0.315	3.27
43.471	6930.13	38.1	0.656	37.7	75.7	32.82	1.72%	Fine Tailings	0.054	107.6	2.37	0.320	2.05	1	17	1.83%	2.7	83%	3.60	0.320	3.28
43.635	6929.97	63.5	0.655	63.4	29.0	12.55	1.03%	Fine Tailings	0.054	107.6	2.38	0.326	2.06	1	30	1.07%	2.4	83%	3.61	0.326	3.28
43.799	6929.80	97.7	0.867	97.6	14.8	6.40	0.89%	Fine Tailings	0.054	107.6	2.39	0.331	2.06	1	46	0.91%	2.2	83%	3.61	0.331	3.28
43.963	6929.64	98.3	1.272	98.2	14.9	6.45	1.29%	Fine Tailings	0.054	107.6	2.40	0.336	2.06	1	46	1.33%	2.2	83%	3.62	0.336	3.29
44.127	6929.47	112.0	2.010	111.9	12.3	5.31	1.79%	Fine Tailings	0.054	107.6	2.41	0.341	2.07	1	53	1.83%	2.3	83%	3.63	0.341	3.29
44.291	6929.31	109.6	2.524	109.5	15.0	6.49	2.30%	Fine Tailings	0.054	107.6	2.42	0.346	2.07	1	52	2.35%	2.4	83%	3.64	0.346	3.30
44.455	6929.15	113.0	2.656	112.9	16.0	6.93	2.35%	Fine Tailings	0.054	107.6	2.43	0.351	2.07	1	53	2.40%	2.4	83%	3.65	0.351	3.30
44.619	6928.98	111.7	2.084	111.6	14.1	6.12	1.87%	Coarse Alluvium	0.056	111.0	2.43	0.000	2.43	0	45	1.91%	2.4	36%	3.66	0.000	3.66
44.783	6928.82	105.8	1.834	105.7	12.0	5.20	1.73%	Coarse Alluvium	0.056	111.0	2.44	0.000	2.44	0	42	1.77%	2.4	36%	3.67	0.000	3.67
44.947	6928.65	95.7	1.621	95.6	11.1	4.82	1.69%	Coarse Alluvium	0.056	111.0	2.45	0.000	2.45	0	38	1.74%	2.4	36%	3.68	0.000	3.68
45.111	6928.49	89.1	1.414	89.0	12.7	5.49	1.59%	Coarse Alluvium	0.056	111.0	2.46	0.000	2.46	0	35	1.63%	2.4	36%	3.69	0.000	3.69
45.275	6928.32	88.3	1.068	88.2	11.6	5.04	1.21%	Coarse Alluvium	0.056	111.0	2.47	0.000	2.47	0	35	1.24%	2.3	36%	3.70	0.000	3.70
45.439	6928.16	85.7	0.869	85.6	10.8	4.68	1.01%	Coarse Alluvium	0.056	111.0	2.48	0.000	2.48	0	34	1.04%	2.3	36%	3.70	0.000	3.70
45.603	6928.00	80.0	0.831	79.9	10.2	4.41	1.04%	Coarse Alluvium	0.056	111.0	2.49	0.000	2.49	0	31	1.07%	2.3	36%	3.71	0.000	3.71
45.767	6927.83	76.4	0.827	76.3	10.8	4.66	1.08%	Coarse Alluvium	0.056	111.0	2.50	0.000	2.50	0	30	1.12%	2.4	36%	3.72	0.000	3.72
45.931	6927.67	70.7	0.768	70.7	9.6	4.17	1.09%	Coarse Alluvium	0.056	111.0	2.51	0.000	2.51	0	27	1.13%	2.4	36%	3.73	0.000	3.73
46.095	6927.50	66.2	0.658	66.1	9.2	3.97	0.99%	Coarse Alluvium	0.056	111.0	2.52	0.000	2.52	0	25	1.03%	2.4	36%	3.74	0.000	3.74
46.259	6927.34	64.2	0.624	64.2	9.3	4.05	0.97%	Coarse Alluvium	0.056	111.0	2.53	0.000	2.53	0	24	1.01%	2.4	36%	3.75	0.000	3.75
46.423	6927.18	63.2	0.598	63.1	12.7	5.51	0.95%	Coarse Alluvium	0.056	111.0	2.53	0.000	2.53	0	24	0.99%	2.4	36%	3.76	0.000	3.76
46.587	6927.01	63.7	0.522	63.7	11.5	4.98	0.82%	Coarse Alluvium	0.056	111.0	2.54	0.000	2.54	0	24	0.85%	2.4	36%	3.77	0.000	3.77
46.751	6926.85	60.0	0.517	60.0	10.0	4.33	0.86%	Coarse Alluvium	0.056	111.0	2.55	0.000	2.55	0	23	0.90%	2.4	36%	3.78	0.000	3.78
46.915	6926.68	58.4	0.517	58.3	8.8	3.80	0.89%	Coarse Alluvium	0.056	111.0	2.56	0.000	2.56	0	22	0.93%	2.4	36%	3.79	0.000	3.79
47.079	6926.52	57.5	0.506	57.5	8.5	3.68	0.88%	Coarse Alluvium	0.056	111.0	2.57	0.000	2.57	0	21	0.92%	2.4	36%	3.80	0.000	3.80
47.244	6926.36	58.1	0.513	58.0	8.4	3.64	0.88%	Coarse Alluvium	0.056	111.0	2.58	0.000	2.58	0	22	0.92%	2.4	36%	3.80	0.000	3.80
47.408	6926.19	58.5	0.511	58.5	8.0	3.48	0.87%	Coarse Alluvium	0.056	111.0	2.59	0.000	2.59	0	22	0.91%	2.4	36%	3.81	0.000	3.81
47.572	6926.03	59.3	0.543	59.2	8.1	3.52	0.92%	Coarse Alluvium	0.056	111.0	2.60	0.000	2.60	0	22	0.96%	2.4	36%	3.82	0.000	3.82
47.736	6925.86	63.7	0.567	63.7	8.1	3.50	0.89%	Coarse Alluvium	0.056	111.0	2.61	0.000	2.61	0	23	0.93%	2.4	36%	3.83	0.000	3.83
47.900	6925.70	67.9	0.588	67.8	7.7	3.34	0.87%	Coarse Alluvium	0.056	111.0	2.62	0.000	2.62	0	25	0.90%	2.4	36%	3.84	0.000	3.84
48.064	6925.54	72.3	0.652	72.3	7.6	3.29	0.90%	Coarse Alluvium	0.056	111.0	2.63	0.000	2.63	0	27	0.94%	2.4	36%	3.85	0.000	3.85
48.228	6925.37	73.8	0.711	73.7	7.2	3.13	0.96%	Coarse Alluvium	0.056	111.0	2.63	0.000	2.63	0	27	1.00%	2.4	36%	3.86	0.000	3.86
48.392	6925.21	72.5	0.758	72.4	6.7	2.91	1.05%	Coarse Alluvium	0.056	111.0	2.64	0.000	2.64	0	26	1.09%	2.4	36%	3.87	0.000	3.87
48.556	6925.04	74.7	0.785	74.6	7.2	3.11	1.05%	Coarse Alluvium	0.056	111.0	2.65	0.000	2.65	0	27	1.09%	2.4	36%	3.88	0.000	3.88
48.720	6924.88	83.5	0.818	83.4	6.8	2.93	0.98%	Coarse Alluvium	0.056	111.0	2.66	0.000	2.66	0	30	1.01%	2.3	36%	3.89	0.000	3.89
48.884	6924.72	82.2	0.779	82.2	6.3	2.73	0.95%	Coarse Alluvium	0.056	111.0	2.67	0.000	2.67	0	30	0.98%	2.3	36%	3.90	0.000	3.90
49.048	6924.55	82.3	0.757	82.3	6.2	2.70	0.92%	Coarse Alluvium	0.056	111.0	2.68	0.000	2.68	0	30	0.95%	2.3	36%	3.90	0.000	3.90
49.212	6924.39	85.3	0.769	85.3	6.0	2.60	0.90%	Coarse Alluvium	0.056	111.0	2.69	0.000	2.69	0	31	0.93%	2.3	36%	3.91	0.000	3.91
49.376	6924.22	84.0	0.824	83.9	6.0	2.58	0.98%	Coarse Alluvium	0.056	111.0	2.70	0.000	2.70	0	30	1.01%	2.3	36%	3.92	0.000	3.92
49.540	6924.06	84.5	0.859	84.5	6.2	2.67	1.02%	Coarse Alluvium	0.056	111.0	2.71	0.000	2.71	0	30	1.05%	2.3	36%	3.93	0.000	3.93
49.704	6923.90	82.6	0.825	82.6	6.1	2.64	1.00%	Coarse Alluvium	0.056	111.0	2.72	0.000	2.72	0	29	1.03%	2.4	36%	3.94	0.000	3.94
49.868	6923.73	80.2	0.595	80.1	5.7	2.46	0.74%	Coarse Alluvium	0.056	111.0	2.73	0.000	2.73	0	28	0.77%	2.3	36%	3.95	0.000	3.95

17.70	503	1.7E-03	4.2E+02	19	0.1183	1.8E-04	43	0.271	0.277	229	229.000	6253	4270	1625	1625	0.024%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.75	503	1.7E-03	4.2E+02	19	0.1158	1.7E-04	43	0.272	0.277	230	230.000	6250	4268	1626	1626	0.023%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.80	503	1.7E-03	4.2E+02	19	0.1134	1.7E-04	43	0.272	0.277	231	231.000	6247	4266	1627	1627	0.023%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.85	503	1.7E-03	4.2E+02	19	0.1110	1.7E-04	43	0.272	0.277	232	232.000	6244	4264	1628	1628	0.022%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.90	503	1.7E-03	4.2E+02	19	0.1086	1.6E-04	43	0.272	0.277	233	233.000	6241	4262	1629	1629	0.022%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.95	503	1.7E-03	4.2E+02	19	0.1062	1.6E-04	43	0.272	0.277	234	234.000	6238	4260	1630	1630	0.021%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.00	503	1.7E-03	4.2E+02	19	0.1038	1.6E-04	43	0.272	0.278	235	235.000	6235	4258	1631	1631	0.020%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.05	503	1.7E-03	4.2E+02	19	0.1015	1.6E-04	43	0.272	0.278	236	236.000	6232	4256	1632	1632	0.020%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.10	503	1.7E-03	4.2E+02	19	0.0992	1.5E-04	43	0.272	0.278	237	237.000	6229	4254	1633	1633	0.019%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.15	503	1.7E-03	4.2E+02	19	0.0970	1.5E-04	43	0.272	0.278	238	238.000	6226	4252	1634	1634	0.019%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.20	503	1.7E-03	4.2E+02	19	0.0947	1.5E-04	43	0.272	0.278	239	239.000	6223	4249	1635	1635	0.019%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.25	503	1.7E-03	4.2E+02	19	0.0925	1.4E-04	43	0.272	0.278	240	240.000	6220	4247	1636	1636	0.018%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.30	503	1.7E-03	4.2E+02	19	0.0903	1.4E-04	43	0.272	0.278	241	241.000	6217	4245	1637	1637	0.018%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.35	503	1.7E-03	4.2E+02	19	0.0882	1.4E-04	43	0.272	0.278	242	242.000	6214	4243	1638	1638	0.017%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.40	503	1.7E-03	4.2E+02	19	0.0861	1.3E-04	43	0.272	0.278	243	243.000	6211	4241	1639	1639	0.017%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.45	674	1.7E-03	7.6E+02	19	0.0840	7.3E-05	43	0.273	0.278	244	244.000	6208	4239	1640	1640	0.008%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.50	674	1.7E-03	7.6E+02	19	0.0819	7.1E-05	43	0.273	0.278	245	245.000	6205	4237	1641	1641	0.008%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.55	674	1.7E-03	7.6E+02	19	0.0798	7.0E-05	43	0.273	0.278	246	246.000	6202	4235	1642	1642	0.008%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.60	674	1.7E-03	7.6E+02	19	0.0778	6.8E-05	43	0.273	0.279	247	247.000	6199	4233	1643	1643	0.008%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.65	674	1.7E-03	7.6E+02	19	0.0758	6.7E-05	43	0.273	0.279	248	248.000	6196	4231	1644	1644	0.007%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.70	674	1.7E-03	7.6E+02	19	0.0739	6.5E-05	43	0.273	0.279	249	249.000	6193	4229	1645	1645	0.007%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.75	674	1.7E-03	7.6E+02	18	0.0719	6.4E-05	43	0.273	0.279	250	250.000	6190	4227	1646	1646	0.007%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.80	674	1.7E-03	7.6E+02	18	0.0700	6.2E-05	43	0.273	0.279	251	251.000	6187	4225	1647	1647	0.007%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.85	674	1.7E-03	7.6E+02	18	0.0681	6.0E-05	43	0.273	0.279	252	252.000	6184	4223	1648	1648	0.007%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.90	674	1.7E-03	7.6E+02	18	0.0662	5.9E-05	43	0.273	0.279	253	253.000	6182	4221	1649	1649	0.006%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.95	674	1.7E-03	7.6E+02	18	0.0644	5.7E-05	43	0.273	0.279	254	254.000	6179	4219	1650	1650	0.006%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
19.00	674	1.7E-03	7.6E+02	18	0.0626	5.6E-05	43	0.273	0.279	255	255.000	6176	4217	1651	1651	0.006%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
19.05	674	1.7E-03	7.6E+02	18	0.0608	5.4E-05	43	0.273	0.279	256	256.000	6173	4215	1652	1652	0.006%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
19.10	674	1.7E-03	7.6E+02	18	0.0590	5.3E-05	43	0.274	0.279	257	257.000	6170	4213	1653	1653	0.006%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
19.15	674	1.7E-03	7.6E+02	18	0.0572	5.2E-05	43	0.274	0.280	258	258.000	6167	4211	1654	1654	0.006%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
19.20	674	1.7E-03	7.6E+02	18	0.0555	5.0E-05	43	0.274	0.280	259	259.000	6164	4209	1655	1655	0.005%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
19.25	674	1.7E-03	7.6E+02	18	0.0538	4.9E-05	43	0.274	0.280	260	260.000	6161	4207	1656	1656	0.005%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
19.30	674	1.7E-03	7.6E+02	18	0.0521	4.7E-05	43	0.274	0.280	261	261.000	6158	4205	1657	1657	0.005%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
19.35	674	1.7E-03	7.6E+02	18	0.0505	4.6E-05	43	0.274	0.280	262	262.000	6155	4203	1658	1658	0.005%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
19.40	674	1.7E-03	7.6E+02	18	0.0488	4.5E-05	43	0.274	0.280	263	263.000	6153	4201	1659	1659	0.005%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
19.45	674	1.7E-03	7.6E+02	18	0.0472	4.3E-05	43	0.274	0.280	264	264.000	6150	4199	1660	1660	0.005%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
19.50	674	1.7E-03	7.6E+02	18	0.0456	4.2E-05	43	0.274	0.280	265	265.000	6147	4197	1661	1661	0.004%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
19.55	674	1.7E-03	7.6E+02	18	0.0440	4.0E-05	43	0.274	0.280	266	266.000	6144	4195	1662	1662	0.004%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
19.60	674	1.7E-03	7.6E+02	18	0.0425	3.9E-05	43	0.274	0.280	267	267.000	6141	4193	1663	1663	0.004%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
19.65	674	1.7E-03	7.6E+02	18	0.0410	3.8E-05	43	0.274	0.280	268	268.000	6138	4191	1664	1664	0.004%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
19.70	674	1.7E-03	7.6E+02	18	0.0395	3.7E-05	43	0.274	0.280	269	269.000	6135	4189	1665	1665	0.004%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
19.75	674	1.7E-03	7.6E+02	18	0.0380	3.5E-05	43	0.274	0.281	270	270.000	6133	4187	1666	1666	0.004%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
19.80	674	1.7E-03	7.6E+02	18	0.0365	3.4E-05	43	0.275	0.281	271	271.000	6130	4185	1667	1667	0.004%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
19.85	674	1.7E-03	7.6E+02	18	0.0351	3.3E-05	43	0.275	0.281	272	272.000	6127	4183	1668	1668	0.003%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
19.90	674	1.7E-03	7.6E+02	18	0.0336	3.1E-05	43	0.275	0.281	273	273.000	6124	4181	1669	1669	0.003%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
19.95	674	1.7E-03	7.6E+02	18	0.0322	3.0E-05	43	0.275	0.281	274	274.000	6121	4179	1670	1670	0.003%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
20.00	674	1.7E-03	7.8E+02	18	0.0308	2.8E-05	0	0.281	0.289	275	0.281	5867	4002	1671	5867	0.003%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.05	674	1.7E-03	7.8E+02	18	0.0306	2.8E-05	0	0.282	0.289	276	0.282	5861	3997	1672	5861	0.003%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.10	674	1.7E-03	7.8E+02	18	0.0304	2.8E-05	0	0.282	0.289	277	0.282	5855	3993	1673	5855	0.003%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.15	674	1.7E-03	7.8E+02	18	0.0301	2.8E-05	0	0.282	0.289	278	0.282	5849	3989	1674	5849	0.003%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.20	674	1.7E-03	7.8E+02	18	0.0299	2.8E-05	0	0.282	0.289	279	0.282	5843	3985	1675	5843	0.003%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.25	674	1.7E-03	7.8E+02	18	0.0297	2.7E-05	0	0.282	0.290	280	0.282	5837	3981	1676	5837	0.003%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.30	674	1.7E-03	7.8E+02	18	0.0295	2.7E-05	0	0.282	0.290	281	0.282	5831	3977	1677	5831	0.003%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.35	1194	1.7E-03	2.5E+03	18	0.0292	8.6E-06	0	0.283	0.290	282	0.283	5825	3973	1678	5825	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.40	1194	1.7E-03	2.5E+03	18	0.0290	8.6E-06	0	0.283	0.290	283	0.283	5819	3969	1679	5819	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.45	1194	1.7E-03	2.5E+03	18	0.0288	8.5E-06	0	0.283	0.290	284	0.283	5814	3965	1680	5814	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.50	1194	1.7E-03	2.5E+03	17	0.0285	8.5E-06	0	0.283	0.291	285	0.283	5808	3961	1681	5808	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.55	1194	1.7E-03	2.5E+03	17	0.0283	8.4E-06	0	0.283	0.291	286	0.283	5802	3957	1682	5802	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.60	1194	1.7E-03	2.5E+03	17	0.0281	8.4E-06	0	0.283	0.291	287	0.283	5796	3953	1683	5796	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.65	1194	1.7E-03	2.5E+03	17	0.0278	8.3E-06	0	0.283	0.291	288	0.283	5790	3949	1684	5790	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.70	1194	1.7E-03	2.5E+03	17	0.0276	8.3E-06	0	0.284	0.291	289	0.284	5785	3945	1685	5785	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.75	1194	1.7E-03	2.5E+03	17	0.0274	8.2E-06	0	0.284	0.291	290	0.284	5779	3941	1686	5779	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.80	1194	1.7E-03	2.5E+03	17	0.0272	8.2E-06	0	0.284	0.292	291	0.284	5773	3937	1687	5773	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.85	1194	1.7E-03	2.5E+03	17	0.0269	8.1E-06	0	0.284	0.292	292	0.284	5768	3933	1688	5768	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.90	1194	1.7E-03	2.5E+03	17	0.0267	8.1E-06	0	0.284	0.292	293	0.284	5762	3929	1689	5762	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.95	1194	1.7E-03	2.5E+03	17	0.0265	8.0E-06	0	0.284	0.292	294	0.284	5756	3925	1690	5756	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.00	1194	1.7E-03	2.5E+03	17	0.0262	8.0E-06	0	0.285	0.292	295	0.285	5751	3921	1691	5751	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.05	1194	1.7E-03	2.5E+03	17	0.0260	7.9E-06	0	0.285	0.293	296	0.285	5745	3917	1692	5745	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.10	1194	1.7E-03	2.5E+03	17	0.0258	7.9E-06	0	0.285	0.293	297	0.285	5740	3913	1693	5740	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.15	1194	1.7E-03	2.5E+03	17	0.0255	7.8E-06	0	0.285	0.293	298	0.285	5734	3909	1694	5734	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.20	1194	1.7E-03	2.5E+03	17	0.0253	7.8E-06	0	0.285	0.293	299	0.285	5729	3906	1695	5729	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.25	1194	1.7E-03	2.5E+03	17	0.0251	7.7E-06	0	0.285	0.293	300	0.285	5723	3902	1696	5723	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.30	1194	1.7E-03	2.5E+03	17	0.0249	7.7E-06	0	0.285	0.294	301	0.285	5718	3898	1697	5718	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.35	1194	1.7E-03	2.5E+03	17	0.0246	7.6E-06	0	0.286	0.294	302	0.286	5712	3894	1698	5712	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.40	1194	1.7E-03	2.5E+03	17	0.0244	7.6E-06	0	0.286	0.294	303	0.286	5707	3890	1699	5707	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.45	1194	1.7E-03	2.5E+03	17	0.0242	7.5E-06	0	0.286	0.294	304	0.286	5701	3887	1700	5701	0.001%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.50	1507	1.7E-03	3.9E+03	17	0.0239	4.7E-06	0	0.286	0.294	305	0.286	5696	3883	1701	5696	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.55	1507	1.7E-03	3.9E+03	17	0.0237	4.7E-06	0	0.286	0.294	306	0.286	5690	3879	1702	5690	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.60	1507	1.7E-03	3.9E+03	17	0.0235	4.6E-06	0	0.286	0.295	307	0.286	5685	3875	1703	5685	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000

50.032	6923.57	76.8	0.605	76.8	5.5	2.40	0.79%	Coarse Alluvium	0.056	111.0	2.73	0.000	2.73	0	27	0.82%	2.3	36%	3.96	0.000	3.96
50.196	6923.40	76.5	0.611	76.4	5.6	2.44	0.80%	Coarse Alluvium	0.056	111.0	2.74	0.000	2.74	0	27	0.83%	2.3	36%	3.97	0.000	3.97
50.360	6923.24	73.7	0.656	73.7	4.8	2.09	0.89%	Coarse Alluvium	0.056	111.0	2.75	0.000	2.75	0	26	0.92%	2.4	36%	3.98	0.000	3.98
50.524	6923.08	76.5	0.669	76.5	4.9	2.11	0.87%	Coarse Alluvium	0.056	111.0	2.76	0.000	2.76	0	27	0.91%	2.4	36%	3.99	0.000	3.99
50.688	6922.91	79.2	0.663	79.2	5.6	2.42	0.84%	Coarse Alluvium	0.056	111.0	2.77	0.000	2.77	0	28	0.87%	2.3	36%	4.00	0.000	4.00
50.852	6922.75	81.9	0.668	81.9	4.7	2.05	0.82%	Coarse Alluvium	0.056	111.0	2.78	0.000	2.78	0	28	0.84%	2.3	36%	4.01	0.000	4.01
51.016	6922.58	81.3	0.656	81.3	3.8	1.63	0.81%	Coarse Alluvium	0.056	111.0	2.79	0.000	2.79	0	28	0.84%	2.3	36%	4.01	0.000	4.01
51.180	6922.42	81.3	0.639	81.3	0.3	0.14	0.79%	Coarse Alluvium	0.056	111.0	2.80	0.000	2.80	0	28	0.81%	2.3	36%	4.02	0.000	4.02
51.345	6922.26	80.6	0.649	80.6	3.3	1.42	0.81%	Coarse Alluvium	0.056	111.0	2.81	0.000	2.81	0	28	0.83%	2.3	36%	4.03	0.000	4.03
51.509	6922.09	81.0	0.644	81.0	3.5	1.50	0.79%	Coarse Alluvium	0.056	111.0	2.82	0.000	2.82	0	28	0.82%	2.3	36%	4.04	0.000	4.04
51.673	6921.93	80.1	0.626	80.1	3.6	1.55	0.78%	Coarse Alluvium	0.056	111.0	2.83	0.000	2.83	0	27	0.81%	2.3	36%	4.05	0.000	4.05
51.837	6921.76	81.9	0.764	81.9	3.7	1.61	0.93%	Coarse Alluvium	0.056	111.0	2.84	0.000	2.84	0	28	0.97%	2.4	36%	4.06	0.000	4.06
52.001	6921.60	77.2	0.870	77.2	3.5	1.53	1.13%	Coarse Alluvium	0.056	111.0	2.84	0.000	2.84	0	26	1.17%	2.4	36%	4.07	0.000	4.07
52.165	6921.44	74.2	0.943	74.1	4.1	1.77	1.27%	Coarse Alluvium	0.056	111.0	2.85	0.000	2.85	0	25	1.32%	2.5	36%	4.08	0.000	4.08
52.329	6921.27	77.0	0.912	76.9	3.9	1.67	1.19%	Coarse Alluvium	0.056	111.0	2.86	0.000	2.86	0	26	1.23%	2.4	36%	4.09	0.000	4.09
52.493	6921.11	71.8	0.996	71.8	3.0	1.30	1.39%	Coarse Alluvium	0.056	111.0	2.87	0.000	2.87	0	24	1.44%	2.5	36%	4.10	0.000	4.10
52.657	6920.94	56.5	1.402	56.5	2.6	1.14	2.48%	Coarse Alluvium	0.056	111.0	2.88	0.000	2.88	0	19	2.61%	2.7	36%	4.11	0.000	4.11
52.821	6920.78	42.0	1.549	42.0	3.1	1.34	3.69%	Coarse Alluvium	0.056	111.0	2.89	0.000	2.89	0	14	3.96%	3.0	36%	4.11	0.000	4.11
52.985	6920.62	39.3	1.641	39.3	5.6	2.42	4.18%	Coarse Alluvium	0.056	111.0	2.90	0.000	2.90	0	13	4.51%	3.0	36%	4.12	0.000	4.12
53.149	6920.45	38.8	1.586	38.8	6.5	2.81	4.09%	Coarse Alluvium	0.056	111.0	2.91	0.000	2.91	0	12	4.42%	3.0	36%	4.13	0.000	4.13
53.313	6920.29	40.7	1.370	40.6	8.2	3.54	3.37%	Coarse Alluvium	0.056	111.0	2.92	0.000	2.92	0	13	3.63%	3.0	36%	4.14	0.000	4.14
53.477	6920.12	41.8	1.035	41.8	6.2	2.70	2.47%	Coarse Alluvium	0.056	111.0	2.93	0.000	2.93	0	13	2.66%	2.9	36%	4.15	0.000	4.15
53.641	6919.96	52.0	0.917	52.0	4.9	2.11	1.76%	Coarse Alluvium	0.056	111.0	2.94	0.000	2.94	0	17	1.87%	2.7	36%	4.16	0.000	4.16
53.805	6919.79	53.2	0.932	53.2	4.5	1.95	1.75%	Coarse Alluvium	0.056	111.0	2.94	0.000	2.94	0	17	1.85%	2.7	36%	4.17	0.000	4.17
53.969	6919.63	60.2	0.957	60.2	4.5	1.95	1.59%	Coarse Alluvium	0.056	111.0	2.95	0.000	2.95	0	19	1.67%	2.6	36%	4.18	0.000	4.18
54.133	6919.47	78.9	1.096	78.8	5.6	2.42	1.39%	Coarse Alluvium	0.056	111.0	2.96	0.000	2.96	0	26	1.44%	2.5	36%	4.19	0.000	4.19
54.297	6919.30	84.2	1.495	84.2	5.4	2.34	1.77%	Coarse Alluvium	0.056	111.0	2.97	0.000	2.97	0	27	1.84%	2.5	36%	4.20	0.000	4.20
54.461	6919.14	100.2	1.165	100.2	5.4	2.36	1.16%	Coarse Alluvium	0.056	111.0	2.98	0.000	2.98	0	33	1.20%	2.3	36%	4.21	0.000	4.21
54.625	6918.97	105.0	1.871	105.0	2.6	1.14	1.78%	Coarse Alluvium	0.056	111.0	2.99	0.000	2.99	0	34	1.83%	2.4	36%	4.21	0.000	4.21
54.789	6918.81	94.5	2.569	94.5	4.1	1.77	2.72%	Coarse Alluvium	0.056	111.0	3.00	0.000	3.00	0	31	2.81%	2.6	36%	4.22	0.000	4.22
54.953	6918.65	130.0	1.676	130.0	0.9	0.41	1.29%	Coarse Alluvium	0.056	111.0	3.01	0.000	3.01	0	42	1.32%	2.3	36%	4.23	0.000	4.23
55.117	6918.48	207.7	2.402	207.7	4.2	1.81	1.16%	Coarse Alluvium	0.056	111.0	3.02	0.000	3.02	0	68	1.17%	2.1	36%	4.24	0.000	4.24
55.281	6918.32	275.5	2.556	275.5	3.2	1.40	0.93%	Coarse Alluvium	0.056	111.0	3.03	0.000	3.03	0	90	0.94%	1.9	36%	4.25	0.000	4.25
55.446	6918.15	247.8	2.916	247.8	4.2	1.83	1.18%	Coarse Alluvium	0.056	111.0	3.04	0.000	3.04	0	81	1.19%	2.0	36%	4.26	0.000	4.26
55.610	6917.99	223.1	2.610	223.1	2.5	1.10	1.17%	Coarse Alluvium	0.056	111.0	3.04	0.000	3.04	0	72	1.19%	2.1	36%	4.27	0.000	4.27
55.774	6917.83	196.9	2.377	196.9	2.4	1.02	1.21%	Coarse Alluvium	0.056	111.0	3.05	0.000	3.05	0	63	1.23%	2.1	36%	4.28	0.000	4.28
55.938	6917.66	173.9	2.254	173.9	1.5	0.65	1.30%	Coarse Alluvium	0.056	111.0	3.06	0.000	3.06	0	56	1.32%	2.2	36%	4.29	0.000	4.29
56.102	6917.50	155.8	2.130	155.8	2.5	1.10	1.37%	Coarse Alluvium	0.056	111.0	3.07	0.000	3.07	0	50	1.39%	2.2	36%	4.30	0.000	4.30
56.266	6917.33	152.5	2.824	152.5	3.2	1.40	1.85%	Coarse Alluvium	0.056	111.0	3.08	0.000	3.08	0	48	1.89%	2.3	36%	4.31	0.000	4.31
56.430	6917.17	159.2	2.616	159.2	4.3	1.85	1.64%	Coarse Alluvium	0.056	111.0	3.09	0.000	3.09	0	51	1.68%	2.3	36%	4.31	0.000	4.31
56.594	6917.01	178.1	2.995	178.0	6.2	2.70	1.68%	Coarse Alluvium	0.056	111.0	3.10	0.000	3.10	0	56	1.71%	2.3	36%	4.32	0.000	4.32
56.758	6916.84	217.7	3.115	217.6	9.2	4.00	1.43%	Coarse Alluvium	0.056	111.0	3.11	0.000	3.11	0	69	1.45%	2.1	36%	4.33	0.000	4.33
56.922	6916.68	187.3	2.881	187.3	0.4	0.16	1.54%	Coarse Alluvium	0.056	111.0	3.12	0.000	3.12	0	59	1.56%	2.2	36%	4.34	0.000	4.34
57.086	6916.51	134.1	2.669	134.1	3.1	1.34	1.99%	Coarse Alluvium	0.056	111.0	3.13	0.000	3.13	0	42	2.04%	2.4	36%	4.35	0.000	4.35
57.250	6916.35	94.2	2.226	94.2	1.9	0.83	2.36%	Coarse Alluvium	0.056	111.0	3.14	0.000	3.14	0	29	2.44%	2.6	36%	4.36	0.000	4.36
57.414	6916.19	84.5	2.004	84.5	3.7	1.59	2.37%	Coarse Alluvium	0.056	111.0	3.14	0.000	3.14	0	26	2.46%	2.6	36%	4.37	0.000	4.37
57.578	6916.02	88.0	1.613	88.0	3.5	1.50	1.83%	Coarse Alluvium	0.056	111.0	3.15	0.000	3.15	0	27	1.90%	2.5	36%	4.38	0.000	4.38
57.742	6915.86	88.0	1.218	88.0	3.0	1.28	1.38%	Coarse Alluvium	0.056	111.0	3.16	0.000	3.16	0	27	1.44%	2.5	36%	4.39	0.000	4.39
57.906	6915.69	91.9	0.957	91.9	2.9	1.24	1.04%	Coarse Alluvium	0.056	111.0	3.17	0.000	3.17	0	28	1.08%	2.4	36%	4.40	0.000	4.40
58.070	6915.53	92.6	0.962	92.6	2.8	1.20	1.04%	Coarse Alluvium	0.056	111.0	3.18	0.000	3.18	0	28	1.08%	2.4	36%	4.41	0.000	4.41
58.234	6915.37	92.3	1.379	92.3	2.7	1.18	1.49%	Coarse Alluvium	0.056	111.0	3.19	0.000	3.19	0	28	1.55%	2.5	36%	4.41	0.000	4.41
58.398	6915.20	99.2	1.033	99.2	4.6	1.97	1.04%	Coarse Alluvium	0.056	111.0	3.20	0.000	3.20	0	30	1.08%	2.4	36%	4.42	0.000	4.42
58.562	6915.04	107.2	1.156	107.2	1.8	0.79	1.08%	Coarse Alluvium	0.056	111.0	3.21	0.000	3.21	0	32	1.11%	2.3	36%	4.43	0.000	4.43
58.726	6914.87	106.8	1.129	106.8	2.0	0.85	1.06%	Coarse Alluvium	0.056	111.0	3.22	0.000	3.22	0	32	1.09%	2.3	36%	4.44	0.000	4.44
58.890	6914.71	104.4	1.226	104.3	2.6	1.12	1.17%	Coarse Alluvium	0.056	111.0	3.23	0.000	3.23	0	31	1.21%	2.4	36%	4.45	0.000	4.45
59.054	6914.55	104.5	1.098	104.5	3.0	1.30	1.05%	Coarse Alluvium	0.056	111.0	3.24	0.000	3.24	0	31	1.08%	2.3	36%	4.46	0.000	4.46
59.218	6914.38	100.5	0.946	100.5	2.7	1.16	0.94%	Coarse Alluvium	0.056	111.0	3.24	0.000	3.24	0	30	0.97%	2.3	36%	4.47	0.000	4.47
59.382	6914.22	96.8	0.760	96.8	2.6	1.14	0.78%	Coarse Alluvium	0.056	111.0	3.25	0.000	3.25	0	29	0.81%	2.3	36%	4.48	0.000	4.48
59.547	6914.05	91.5	0.756	91.5	2.1	0.89	0.83%	Coarse Alluvium	0.056	111.0	3.26	0.000	3.26	0	27	0.86%	2.3	36%	4.49	0.000	4.49
59.711	6913.89	86.1	0.908	86.1	2.2	0.96	1.06%	Coarse Alluvium	0.056	111.0	3.27	0.000	3.27	0	25	1.10%	2.4	36%	4.50	0.000	4.50
59.875	6913.73	81.4	0.709	81.4	2.2	0.96	0.87%	Coarse Alluvium	0.056	111.0	3.28	0.000	3.28	0	24	0.91%	2.4	36%	4.51	0.000	4.51
60.039	6913.56	83.4	0.536	83.4	2.6	1.14	0.64%	Coarse Alluvium	0.056	111.0	3.29	0.000	3.29	0	24	0.67%	2.3	36%	4.52	0.000	4.52
60.203	6913.40	88.2	0.485	88.2	1.8	0.79	0.55%	Coarse Alluvium	0.056	111.0	3.30	0.000	3.30	0	26	0.57%	2.3	36%	4.52	0.000	4.52
60.367	6913.23	90.8	0.512	90.8	1.2	0.51	0.56%	Coarse Alluvium	0.056	111.0	3.31	0.000	3.31	0	26	0.58%	2.3	36%	4.53	0.000	4.53
60.531	6913.07	96.7	0.526	96.7	0.8	0.36	0.54%	Coarse Alluvium	0.056	111.0	3.32	0.000	3.32	0	28	0.56%	2.2	36%	4.54	0.000	4.54
60.695	6912.91	96.9	0.567	96.9	0.7	0.29	0.58%	Coarse Alluvium	0.056	111.0	3.33	0.000	3.33	0	28	0.61%	2.3	36%	4.55	0.000	4.55
60.859	6912.74	96.8	0.627	96.8	0.4	0.18	0.65%	Coarse Alluvium	0.056	111.0	3.34	0.000	3.34	0	28	0.67%	2.3	36%	4.56	0.000	4.56
61.023	6912.58	95.9	0.676	95.9	0.6	0.26	0.71%	Coarse Alluvium	0.056	111.0	3.35	0.000	3.35	0	28	0.73%	2.3	36%	4.57	0.000	4.57
61.187	6912.41	91.6	0.709	91.6	0.7	0.30	0.77%	Coarse Alluvium	0.056	111.0	3.35	0.000	3.35	0	26	0.80%	2.3	36%	4.58	0.000	4.58
61.351	6912.25	92.4	0.700	92.4	0.5	0.23	0.76%	Coarse Alluvium	0.056	111.0	3.36	0.000	3.36	0	26	0.79%	2.3	36%	4.59	0.000	4.59
61.515	6912.09	97.1	0.651	97.1	1.1	0.47	0.67%	Coarse Alluvium	0.056	111.0	3.37	0.000	3.37	0	28	0.69%	2.3	36%	4.60	0.000	4.60
61.679	6911.92	102.2	0.641	102.2	1.0	0.45	0.63%	Coarse Alluvium	0.056	111.0	3.38	0.000	3.38	0	29	0.65%	2.3	36%	4.61	0.000	4.61
61.843	6911.76	109.5	0.711	109.5	1.6	0.69	0.65%	Coarse Alluvium	0.056	111.0	3.39	0.000	3.39	0	31	0.67%	2.2	36%	4.62	0.000	4.62
62.007	6911.59	136.9	0.854	136.8	3.6	1.55	0.62%	Coarse Alluvium	0.056	111.0	3.40	0.000	3.40	0	39	0.64%	2.1	36%	4.62	0.000	4.62
62.171	6911.43	180.0	1.173	179.9	3.3	1.42	0.65%	Coarse Alluvium	0.056	111.0	3.41	0.000	3.41	0	52	0.66%	2.0	36%	4.63	0.000	4.63
62.335	6911.26	197.5	1.539	197.5	3.0	1.30	0.78%	Coarse Alluvium	0.056	111.0	3.42	0.000	3.42	0	57	0.79%	2.0	36%	4.64	0.000	4.64
62.499	6911.10	231.8	1.879	231.8	4.8	2.08	0.81%	Coarse Alluvium	0.056	111.0	3.43	0.000	3.43	0	67	0.82%	2.0	36%	4.65	0.000	4.65
62.663	6910.94	299.8	2.207	299.8	3.1	1.36	0.74%	Coarse Alluvium	0.056	111.0	3.44	0.000	3.44	0	86	0.74%	1.9	36%	4.66	0.000	4.66
62.827	6910.77	375.2	2.317	375.2	6.9	2.97	0.62%	Coarse Alluvium	0.056	111.0	3.45	0.000	3.45	0	108	0.62%	1.8	36%	4.67	0.000	4.67
62.991	6910.61	490.4	2.317	490.4	9.6	4.15	0.47%	Coarse Alluvium	0.056	111.0	3.45	0.000	3.45	0	141	0.48%	1.6	36%	4.68	0.000	4.68
63.155	6910.44	502.6	2.317	502.5	8.6	3.72	0.46%	Coarse Alluvium	0.056	111.0	3.46	0.000	3.46	0	144	0.46%	1.6	36%	4.69	0.000	4.69

21.65	1507	1.7E-03	3.9E+03	17	0.0232	4.6E-06	0	0.287	0.295	308	0.287	5680	3872	1704	5680	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.70	1507	1.7E-03	3.9E+03	17	0.0230	4.5E-06	0	0.287	0.295	309	0.287	5674	3868	1705	5674	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.75	1507	1.7E-03	3.9E+03	17	0.0228	4.5E-06	0	0.287	0.295	310	0.287	5669	3864	1706	5669	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.80	1507	1.7E-03	3.9E+03	17	0.0226	4.5E-06	0	0.287	0.295	311	0.287	5664	3861	1707	5664	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.85	1507	1.7E-03	3.9E+03	17	0.0223	4.4E-06	0	0.287	0.295	312	0.287	5658	3857	1708	5658	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.90	1507	1.7E-03	3.9E+03	17	0.0221	4.4E-06	0	0.287	0.296	313	0.287	5653	3853	1709	5653	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.95	1507	1.7E-03	3.9E+03	17	0.0219	4.4E-06	0	0.287	0.296	314	0.287	5648	3850	1710	5648	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.00	1507	1.7E-03	3.9E+03	17	0.0216	4.3E-06	0	0.288	0.296	315	0.288	5643	3846	1711	5643	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.05	1507	1.7E-03	3.9E+03	17	0.0214	4.3E-06	0	0.288	0.296	316	0.288	5637	3842	1712	5637	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.10	1507	1.7E-03	3.9E+03	17	0.0212	4.3E-06	0	0.288	0.296	317	0.288	5632	3839	1713	5632	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.15	1507	1.7E-03	3.9E+03	17	0.0209	4.2E-06	0	0.288	0.297	318	0.288	5627	3835	1714	5627	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.20	1507	1.7E-03	3.9E+03	17	0.0207	4.2E-06	0	0.288	0.297	319	0.288	5622	3831	1715	5622	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.25	1507	1.7E-03	3.9E+03	17	0.0205	4.2E-06	0	0.288	0.297	320	0.288	5617	3828	1716	5617	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.30	1507	1.7E-03	3.9E+03	17	0.0203	4.1E-06	0	0.289	0.297	321	0.289	5612	3824	1717	5612	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.35	1507	1.7E-03	3.9E+03	17	0.0200	4.1E-06	0	0.289	0.297	322	0.289	5606	3821	1718	5606	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.40	1507	1.7E-03	3.9E+03	17	0.0198	4.0E-06	0	0.289	0.297	323	0.289	5601	3817	1719	5601	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.45	1507	1.7E-03	3.9E+03	17	0.0196	4.0E-06	0	0.289	0.298	324	0.289	5596	3814	1720	5596	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.50	1507	1.7E-03	3.9E+03	17	0.0193	4.0E-06	0	0.289	0.298	325	0.289	5591	3810	1721	5591	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.55	1507	1.7E-03	3.9E+03	17	0.0191	3.9E-06	0	0.289	0.298	326	0.289	5586	3807	1722	5586	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.60	1507	1.7E-03	3.9E+03	17	0.0189	3.9E-06	0	0.289	0.298	327	0.289	5581	3803	1723	5581	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.65	1507	1.7E-03	3.9E+03	17	0.0186	3.8E-06	0	0.290	0.298	328	0.290	5576	3800	1724	5576	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.70	1507	1.7E-03	3.9E+03	17	0.0184	3.8E-06	0	0.290	0.298	329	0.290	5571	3796	1725	5571	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.75	1507	1.7E-03	3.9E+03	17	0.0182	3.8E-06	0	0.290	0.299	330	0.290	5566	3793	1726	5566	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.80	1507	1.7E-03	3.9E+03	17	0.0180	3.7E-06	0	0.290	0.299	331	0.290	5561	3789	1727	5561	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.85	1507	1.7E-03	3.9E+03	17	0.0177	3.7E-06	0	0.290	0.299	332	0.290	5556	3786	1728	5556	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.90	1507	1.7E-03	3.9E+03	17	0.0175	3.6E-06	0	0.290	0.299	333	0.290	5551	3782	1729	5551	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.95	1507	1.7E-03	3.9E+03	17	0.0173	3.6E-06	0	0.290	0.299	334	0.290	5546	3779	1730	5546	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
23.00	1507	1.7E-03	3.9E+03	17	0.0170	3.6E-06	0	0.291	0.300	335	0.291	5541	3775	1731	5541	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
23.05	1829	1.7E-03	5.8E+03	17	0.0168	2.4E-06	0	0.291	0.300	336	0.291	5536	3772	1732	5536	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
23.10	1829	1.7E-03	5.8E+03	17	0.0166	2.4E-06	0	0.291	0.300	337	0.291	5531	3769	1733	5531	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
23.15	1829	1.7E-03	5.8E+03	17	0.0163	2.3E-06	0	0.291	0.300	338	0.291	5526	3765	1734	5526	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
23.20	1829	1.7E-03	5.8E+03	17	0.0161	2.3E-06	0	0.291	0.300	339	0.291	5522	3762	1735	5522	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
23.25	1829	1.7E-03	5.8E+03	17	0.0159	2.3E-06	0	0.291	0.300	340	0.291	5517	3758	1736	5517	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
23.30	1829	1.7E-03	5.8E+03	17	0.0157	2.3E-06	0	0.291	0.301	341	0.291	5512	3755	1737	5512	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
23.35	1829	1.7E-03	5.8E+03	17	0.0154	2.2E-06	0	0.292	0.301	342	0.292	5507	3752	1738	5507	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
23.40	1829	1.7E-03	5.8E+03	17	0.0152	2.2E-06	0	0.292	0.301	343	0.292	5502	3748	1739	5502	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
23.45	1829	1.7E-03	5.8E+03	17	0.0150	2.2E-06	0	0.292	0.301	344	0.292	5497	3745	1740	5497	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
23.50	1829	1.7E-03	5.8E+03	17	0.0147	2.1E-06	0	0.292	0.301	345	0.292	5493	3742	1741	5493	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
23.55	1829	1.7E-03	5.8E+03	17	0.0145	2.1E-06	0	0.292	0.301	346	0.292	5488	3738	1742	5488	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
23.60	1829	1.7E-03	5.8E+03	17	0.0143	2.1E-06	0	0.292	0.302	347	0.292	5483	3735	1743	5483	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
23.65	1829	1.7E-03	5.8E+03	17	0.0140	2.1E-06	0	0.292	0.302	348	0.292	5478	3732	1744	5478	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
23.70	1829	1.7E-03	5.8E+03	17	0.0138	2.0E-06	0	0.293	0.302	349	0.293	5474	3729	1745	5474	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
23.75	1829	1.7E-03	5.8E+03	17	0.0136	2.0E-06	0	0.293	0.302	350	0.293	5469	3725	1746	5469	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
23.80	1829	1.7E-03	5.8E+03	17	0.0134	2.0E-06	0	0.293	0.302	351	0.293	5464	3722	1747	5464	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
23.85	1829	1.7E-03	5.8E+03	17	0.0131	1.9E-06	0	0.293	0.302	352	0.293	5460	3719	1748	5460	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
23.90	1829	1.7E-03	5.8E+03	17	0.0129	1.9E-06	0	0.293	0.303	353	0.293	5455	3715	1749	5455	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
23.95	1829	1.7E-03	5.8E+03	17	0.0127	1.9E-06	0	0.293	0.303	354	0.293	5450	3712	1750	5450	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
24.00	1829	1.7E-03	5.8E+03	17	0.0124	1.8E-06	0	0.293	0.303	355	0.293	5446	3709	1751	5446	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
24.05	1829	1.7E-03	5.8E+03	17	0.0122	1.8E-06	0	0.294	0.303	356	0.294	5441	3706	1752	5441	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
24.10	1829	1.7E-03	5.8E+03	17	0.0120	1.8E-06	0	0.294	0.303	357	0.294	5436	3703	1753	5436	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
24.15	1829	1.7E-03	5.8E+03	17	0.0117	1.8E-06	0	0.294	0.303	358	0.294	5432	3699	1754	5432	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
24.20	1829	1.7E-03	5.8E+03	17	0.0115	1.7E-06	0	0.294	0.304	359	0.294	5427	3696	1755	5427	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
24.25	1829	1.7E-03	5.8E+03	17	0.0113	1.7E-06	0	0.294	0.304	360	0.294	5423	3693	1756	5423	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
24.30	1829	1.7E-03	5.8E+03	17	0.0111	1.7E-06	0	0.294	0.304	361	0.294	5418	3690	1757	5418	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
24.35	1829	1.7E-03	5.8E+03	17	0.0108	1.6E-06	0	0.294	0.304	362	0.294	5414	3687	1758	5414	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
24.40	1829	1.7E-03	5.8E+03	17	0.0106	1.6E-06	0	0.295	0.304	363	0.295	5409	3684	1759	5409	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
24.45	1829	1.7E-03	5.8E+03	17	0.0104	1.6E-06	0	0.295	0.304	364	0.295	5404	3680	1760	5404	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
24.50	1829	1.7E-03	5.8E+03	17	0.0101	1.5E-06	0	0.295	0.305	365	0.295	5400	3677	1761	5400	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
24.55	1514	1.7E-03	4.0E+03	17	0.0099	2.2E-06	0	0.295	0.305	366	0.295	5395	3674	1762	5395	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
24.60	1514	1.7E-03	4.0E+03	17	0.0097	2.1E-06	0	0.295	0.305	367	0.295	5391	3671	1763	5391	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
24.65	1514	1.7E-03	4.0E+03	17	0.0094	2.1E-06	0	0.295	0.305	368	0.295	5387	3668	1764	5387	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
24.70	1514	1.7E-03	4.0E+03	17	0.0092	2.1E-06	0	0.295	0.305	369	0.295	5382	3665	1765	5382	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
24.75	1514	1.7E-03	4.0E+03	17	0.0090	2.0E-06	0	0.296	0.305	370	0.296	5378	3662	1766	5378	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
24.80	1514	1.7E-03	4.0E+03	17	0.0088	2.0E-06	0	0.296	0.306	371	0.296	5373	3659	1767	5373	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
24.85	1514	1.7E-03	4.0E+03	17	0.0085	1.9E-06	0	0.296	0.306	372	0.296	5369	3656	1768	5369	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
24.90	1514	1.7E-03	4.0E+03	17	0.0083	1.9E-06	0	0.296	0.306	373	0.296	5364	3653	1769	5364	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
24.95	1514	1.7E-03	4.0E+03	17	0.0081	1.8E-06	0	0.296	0.306	374	0.296	5360	3650	1770	5360	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
25.00	1514	1.7E-03	4.0E+03	17	0.0078	1.8E-06	0	0.296	0.306	375	0.296	5356	3646	1771	5356	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
25.05	1514	1.7E-03	4.0E+03	17	0.0076	1.7E-06	0	0.296	0.306	376	0.296	5351	3643	1772	5351	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
25.10	1514	1.7E-03	4.0E+03	17	0.0074	1.7E-06	0	0.296	0.307	377	0.296	5347	3640	1773	5347	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
25.15	1514	1.7E-03	4.0E+03	17	0.0071	1.6E-06	0	0.297	0.307	378	0.297	5343	3637	1774	5343	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
25.20	1514	1.7E-03	4.0E+03	17	0.0069	1.6E-06	0	0.297	0.307	379	0.297	5338	3634	1775	5338	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
25.25	1514	1.7E-03	4.0E+03	17	0.0067	1.5E-06	0	0.297	0.307	380	0.297	5334	3631	1776	5334	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
25.30	1514	1.7E-03	4.0E+03	16	0.0065	1.5E-06	0	0.297	0.307	381	0.297	5330	3628	1777	5330	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
25.35	1514	1.7E-03	4.0E+03	16	0.0062	1.4E-06	0	0.297	0.307	382	0.297	5325	3625	1778	5325	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
25.40	1514	1.7E-03	4.0E+03	16	0.0060	1.4E-06	0	0.297	0.307	383	0.297	5321	3622	1779	5321	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
25.45	1514	1.7E-03	4.0E+03	16	0.0058	1.3E-06	0	0.297	0.308	384	0.297	5317	3619	1780	5317	0.000%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
25.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25.60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25.65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Proposed Repository	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Elev. At Bottom of Layer (ft)	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at Bottom of Layer (tsf)	Total Stress at Midpoint of Layer (tsf)	Equil Pore Pressure at Bottom of Layer (tsf)	Equil Pore Pressure at Midpoint of Layer (tsf)	Effective Stress at Bottom of Layer (tsf)	Effective Stress at Midpoint of Layer (tsf)
Erosion Protection	6994.6	6993.9	6993.1	1.5	0.061	122.9	0.092	0.046	0.00	0.00	0.092	0.046
Cover Soil	6993.1	6991.9	6990.6	2.5	0.057	114.7	0.235	0.164	0.00	0.00	0.235	0.164
Mine Spoils	6990.6	6982.1	6973.6	17.0	0.058	116.4	1.225	0.730	0.00	0.00	1.225	0.730

6973.60	Ground Surface Elevation at time of CPT (ft amsl)
6994.60	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
1.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after placement (ft)
2.50	Thickness of Water Storage/Rooting Zone (Cover Soil; ft)

1.22	Additional Stress due to Proposed Repository Construction, $\Delta\sigma_{repos}$ (psf)
6929.06	Elevation of bottom of tailings (ft amsl)

UNC-NECR WASTE REPOSITORY SEISMIC SETTLEMENT ANALYSIS - CPT-11

Data File: 13-52118_RP11-BSC-CPT
Location: UNC-NECR 2013 Mill Site PDS
Cells Requiring User Input/Manipulation
http://projects.mwhglobal.com/.../13-52118_RP11-BSC-CPT.XLS

Erosion Protection | Coarse Tailings
Cover Soil | Coarse/Fine Tailings
Mine Spoils | Fine Tailings
Radon Barrier | Coarse Alluvium
General Fill | Fine Alluvium

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.3
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69
Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.3
Earthquake Moment Magnitude, M:	6.3
Magnitude Scaling Factor, MSF:	1.59

6887.43	Water surface elevation during CPT investigation (ft amsl)
6887.43	Water surface elevation at t_0 (ft amsl)
6887.43	Water surface elevation at t_1 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Earthquake
8.26	Equiv. Number of Uniform Strain Cycles, N

Midpoint Depth at t_1, z_1 (m)	Shear Wave Velocity, V_s (ft/sec)	Soil Density, ρ (tcf)	Max Shear Strain Modulus, G_{max} (tsf)	Coefficient a_2 for Stress Reduction Factor	Stress Reduction Factor, r_d	P = γ_{eff}*(G_{eff}/G_{max}) (tsf)	Plasticity Index, PI	g_1 for PI = 0	g_1 for PI = 15	g_1 for PI = 30	g_1	g_2 for PI = 0	g_2 for PI = 15	g_2 for PI = 30	g_2	Shear Strain, γ (%)	a	b	Threshhold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{c-15} (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
0.23	866	1.9E-03	1.4E+03	1249	0.9990	6.3E-06	12	0.102	0.091	4	0.093	35267	24912	1400	26983	0.00%	2.00	0.65	0.030%	0.000000	0.34	0.079	0.797	0.00%	0.0000
0.84	866	1.8E-03	1.3E+03	1017	0.9958	2.4E-05	12	0.137	0.127	4	0.129	20964	14659	1400	15920	0.00%	2.00	0.65	0.030%	0.000000	0.34	0.079	0.797	0.00%	0.0000
1.26	866	1.8E-03	1.4E+03	883	0.9932	3.5E-05	12	0.150	0.141	4	0.143	17816	12418	1400	13498	0.00%	1.18	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000

2013 CPT Data from ConeTec | **CPT Data Interpretations** | **Conditions at t_1**

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (per drilling log from coupled borehole)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	Normalized Cone Penetration Resistance	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1, u_1 (tsf)	Effective Stress at t_1 (tsf)
0.164	6977.27	6.5	0.212	6.4	2.1	0.91	3.29%	Radon Barrier	0.061	122.3	0.01	0.000	0.01	0	642	3.29%	1.9	59%	0.26	0.000	0.26
0.328	6977.10	29.7	0.150	29.7	3.2	1.40	0.50%	Radon Barrier	0.061	122.3	0.02	0.000	0.02	0	1480	0.51%	1.0	59%	0.27	0.000	0.27
0.492	6976.94	35.1	0.256	35.1	3.3	1.42	0.73%	Radon Barrier	0.061	122.3	0.03	0.000	0.03	0	1165	0.73%	1.2	59%	0.28	0.000	0.28
0.656	6976.77	33.5	0.409	33.5	3.6	1.55	1.22%	Radon Barrier	0.061	122.3	0.04	0.000	0.04	0	833	1.22%	1.4	59%	0.29	0.000	0.29
0.820	6976.61	25.8	0.463	25.8	5.9	2.56	1.80%	Radon Barrier	0.061	122.3	0.05	0.000	0.05	0	513	1.80%	1.7	59%	0.30	0.000	0.30
0.984	6976.45	26.6	0.869	26.6	5.8	2.50	3.26%	Radon Barrier	0.061	122.3	0.06	0.000	0.06	0	441	3.27%	1.9	59%	0.31	0.000	0.31
1.148	6976.28	30.7	1.085	30.7	6.5	2.83	3.53%	Radon Barrier	0.061	122.3	0.07	0.000	0.07	0	436	3.54%	2.0	59%	0.32	0.000	0.32
1.312	6976.12	41.4	1.070	41.4	4.0	1.75	2.58%	Radon Barrier	0.061	122.3	0.08	0.000	0.08	0	515	2.59%	1.8	59%	0.33	0.000	0.33
1.476	6975.95	56.7	1.208	56.7	2.3	0.98	2.13%	Radon Barrier	0.061	122.3	0.09	0.000	0.09	0	628	2.13%	1.7	59%	0.34	0.000	0.34
1.640	6975.79	84.8	1.832	84.8	2.7	1.16	2.16%	Radon Barrier	0.061	122.3	0.10	0.000	0.10	0	844	2.16%	1.6	59%	0.35	0.000	0.35
1.804	6975.63	103.7	2.230	103.6	3.7	1.59	2.15%	Radon Barrier	0.061	122.3	0.11	0.000	0.11	0	938	2.15%	1.6	59%	0.36	0.000	0.36
1.968	6975.46	128.1	3.024	128.1	4.4	1.89	2.36%	Radon Barrier	0.061	122.3	0.12	0.000	0.12	0	1063	2.36%	1.7	59%	0.37	0.000	0.37
2.133	6975.30	163.8	4.014	163.8	4.6	1.99	2.45%	General Fill	0.057	113.8	0.13	0.000	0.13	0	1262	2.45%	1.7	48%	0.38	0.000	0.38
2.297	6975.13	183.5	4.842	183.5	4.1	1.77	2.64%	General Fill	0.057	113.8	0.14	0.000	0.14	0	1319	2.64%	1.7	48%	0.39	0.000	0.39
2.461	6974.97	174.0	5.348	174.0	3.0	1.28	3.07%	General Fill	0.057	113.8	0.15	0.000	0.15	0	1172	3.08%	1.8	48%	0.40	0.000	0.40
2.625	6974.81	163.0	4.389	163.0	1.8	0.79	2.69%	General Fill	0.057	113.8	0.16	0.000	0.16	0	1032	2.70%	1.7	48%	0.41	0.000	0.41
2.789	6974.64	171.9	3.486	171.8	2.5	1.08	2.03%	General Fill	0.057	113.8	0.17	0.000	0.17	0	1028	2.03%	1.6	48%	0.42	0.000	0.42
2.953	6974.48	198.9	4.100	198.9	3.4	1.49	2.06%	General Fill	0.057	113.8	0.18	0.000	0.18	0	1127	2.06%	1.6	48%	0.43	0.000	0.43
3.117	6974.31	196.5	4.240	196.4	4.3	1.87	2.16%	General Fill	0.057	113.8	0.19	0.000	0.19	0	1057	2.16%	1.6	48%	0.44	0.000	0.44
3.281	6974.15	180.5	5.026	180.5	5.1	2.20	2.78%	General Fill	0.057	113.8	0.20	0.000	0.20	0	925	2.79%	1.7	48%	0.45	0.000	0.45
3.445	6973.99	187.8	5.784	187.7	7.9	3.44	3.08%	General Fill	0.057	113.8	0.20	0.000	0.20	0	918	3.08%	1.8	48%	0.46	0.000	0.46
3.609	6973.82	192.6	6.317	192.6	6.3	2.73	3.28%	General Fill	0.057	113.8	0.21	0.000	0.21	0	900	3.28%	1.8	48%	0.47	0.000	0.47
3.773	6973.66	175.9	6.887	175.9	6.1	2.64	3.91%	General Fill	0.057	113.8	0.22	0.000	0.22	0	788	3.92%	1.9	48%	0.47	0.000	0.47
3.937	6973.49	158.4	7.100	158.4	6.5	2.83	4.48%	General Fill	0.057	113.8	0.23	0.000	0.23	0	681	4.49%	2.0	48%	0.48	0.000	0.48
4.101	6973.33	136.0	5.102	136.0	3.7	1.59	3.75%	General Fill	0.057	113.8	0.24	0.000	0.24	0	562	3.76%	1.9	48%	0.49	0.000	0.49
4.265	6973.16	162.5	3.670	162.5	3.3	1.42	2.26%	General Fill	0.057	113.8	0.25	0.000	0.25	0	646	2.26%	1.7	48%	0.50	0.000	0.50
4.429	6973.00	197.6	3.387	197.6	5.2	2.26	1.71%	General Fill	0.057	113.8	0.26	0.000	0.26	0	758	1.72%	1.6	48%	0.51	0.000	0.51
4.593	6972.84	159.1	3.789	159.1	5.5	2.40	2.38%	General Fill	0.057	113.8	0.27	0.000	0.27	0	589	2.39%	1.7	48%	0.52	0.000	0.52
4.757	6972.67	157.2	4.277	157.2	5.2	2.24	2.72%	General Fill	0.057	113.8	0.28	0.000	0.28	0	562	2.73%	1.8	48%	0.53	0.000	0.53
4.921	6972.51	161.7	3.962	161.6	4.7	2.03	2.45%	General Fill	0.057	113.8	0.29	0.000	0.29	0	560	2.46%	1.8	48%	0.54	0.000	0.54
5.085	6972.34	146.0	4.376	146.0	3.5	1.50	3.00%	General Fill	0.057	113.8	0.30	0.000	0.30	0	490	3.00%	1.9	48%	0.55	0.000	0.55
5.249	6972.18	130.3	4.272	130.3	1.5	0.63	3.28%	General Fill	0.057	113.8	0.31	0.000	0.31	0	424	3.29%	1.9	48%	0.56	0.000	0.56
5.413	6972.02	113.9	3.835	113.9	1.1	0.49	3.37%	General Fill	0.057	113.8	0.32	0.000	0.32	0	359	3.38%	2.0	48%	0.57	0.000	0.57
5.577	6971.85	109.6	3.261	109.6	1.2	0.51	2.98%	General Fill	0.057	113.8	0.33	0.000	0.33	0	335	2.99%	1.9	48%	0.58	0.000	0.58
5.741	6971.69	102.2	2.794	102.2	0.2	0.10	2.73%	General Fill	0.057	113.8	0.34	0.000	0.34	0	304	2.74%	1.9	48%	0.59	0.000	0.59
5.905	6971.52	90.4	2.521	90.4	0.1	0.04	2.79%	General Fill	0.057	113.8	0.34	0.000	0.34	0	261	2.80%	2.0	48%	0.60	0.000	0.60
6.069	6971.36	84.6	3.166	84.6	0.2	0.08	3.74%	General Fill	0.057	113.8	0.35	0.000	0.35	0	238	3.76%	2.1	48%	0.61	0.000	0.61
6.234	6971.20	79.1	3.569	79.1	0.1	0.06	4.51%	General Fill	0.057	113.8	0.36	0.000	0.36	0	217	4.53%	2.2	48%	0.61	0.000	0.61
6.398	6971.03	84.5	3.568	84.5	0.3	0.12	4.22%	General Fill	0.057	113.8	0.37	0.000	0.37	0	226	4.24%	2.2	48%	0.62	0.000	0.62
6.562	6970.87	86.3	2.929	86.3	0.6	0.24	3.39%	General Fill	0.057	113.8	0.38	0.000	0.38	0	225	3.41%	2.1	48%	0.63	0.000	0.63
6.726	6970.70	85.5	2.271	85.5	0.2	0.08	2.65%	General Fill	0.057	113.8	0.39	0.000	0.39	0	218	2.67%	2.0	48%	0.64	0.000	0.64
6.890	6970.54	72.2	2.136	72.2	0.2	0.10	2.96%	General Fill	0.057	113.8	0.40	0.000	0.40	0	179	2.97%	2.1	48%	0.65	0.000	0.65
7.054	6970.38	61.6	1.956	61.6	-0.1	-0.06	3.18%	General Fill	0.057	113.8	0.41	0.000	0.41	0	149	3.20%	2.2	48%	0.66	0.000	0.66
7.218	6970.21	51.9	1.726	52.0	-0.4	-0.16	3.32%	General Fill	0.057	113.8	0.42	0.000	0.42	0	123	3.35%	2.2	48%	0.67	0.000	0.67
7.382	6970.05	52.9	1.618	52.9	-0.3	-0.14	3.06%	General Fill	0.057	113.8	0.43	0.000	0.43	0	122	3.08%	2.2	48%	0.68	0.000	0.68
7.546	6969.88	61.3	1.441	61.3	0.4	0.18	2.35%	General Fill	0.057	113.8	0.44	0.000	0.44	0	139	2.37%	2.1	48%	0.69	0.000	0.69
7.710	6969.72	73.4	1.832	73.4	0.1	0.04	2.50%	General Fill	0.057	113.8	0.45	0.000	0.45	0	163	2.51%	2.1	48%	0.70	0.000	0.70
7.874	6969.56	83.7	2.162	83.7	0.3	0.14	2.58%	General Fill	0.057	113.8	0.46	0.000	0.46	0	182	2.60%	2.0	48%	0.71	0.000	0.71
8.038	6969.39	69.9	2.409	69.9	0.0	0.00	3.45%	General Fill	0.057	113.8	0.47	0.000	0.47	0	149	3.47%	2.2	48%	0.72	0.000	0.72
8.202	6969.23	54.0	2.303	54.0	0.7	0.29	4.27%	General Fill	0.057	113.8	0.48	0.000	0.48	0	113	4.30%	2.3	48%	0.73	0.000	0.73
8.366	6969.06	45.6	2.005	45.6	0.5	0.23	4.39%	General Fill	0.057	113.8	0.48	0.000	0.48	0	93	4.44%	2.4	48%	0.74	0.000	0.74
8.530	6968.90	40.8	1.495	40.8	-0.2	-0.08	3.67%	General Fill	0.057	113.8	0.49	0.000	0.49	0	82	3.71%	2.4	48%	0.75	0.000	0.75
8.694	6968.74	37.5	1.102	37.5	-0.1	-0.04	2.94%	General Fill	0.057	113.8	0.50	0.000	0.50	0	74	2.98%	2.3	48%	0.75	0.000	0.75
8.858	6968.57	39.9	1.002	39.9	-0.1	-0.02	2.51%	General Fill	0.057	113.8	0.51	0.000	0.51	0	77	2.54%	2.3	48%	0.76	0.000	0.76
9.022	6968.41	39.5	0.994	39.5	-0.2	-0.08	2.52%	General Fill	0.057	113.8	0.52	0.000	0.52	0	75	2.55%	2.3	48%	0.77	0.000	0.77
9.186	6968.24	40.3	1.022	40.3	-0.2	-0.08	2.54%	General Fill	0.057	113.8	0.53	0.000	0.53	0	75	2.57%	2.3	48%	0.78	0.000	0.78
9.350	6968.08	44.3	1.319	44.3	-0.2	-0.08	2.98%	General Fill	0.057	113.8	0.54	0.000	0.54	0	81	3.01%	2.3	48%	0.79	0.000	0.79
9.514	6967.92	53.5	1.414	53.5	0.2	0.10	2.64%	General Fill	0.057	113.8	0.55	0.000	0.55	0	96	2.67%	2.2	48%	0.80	0.000	0.80
9.678	6967.75	54.8	1.346	54.8	0.2	0.08	2.46%	General Fill	0.057	113.8	0.56	0.000	0.56	0	97	2.48%	2.2	48%	0.81	0.000	0.81
9.842	6967.59	48.8	1.158	48.8	-0.5	-0.23	2.38%	General Fill	0.057	113.8	0.57	0.000	0.57	0	85	2.40%	2.2	48%	0.82	0.000	0.82
10.006	6967.42	44.9	1.071	44.9	-0.3	-0.14	2.39%	General Fill	0.057	113.8	0.58	0.000	0.58	0	77	2.42%	2.3	48%	0.83	0.000	0.83
10.170	6967.26	40.7	0.971	40.7	0.0	0.00	2.38%	General Fill	0.057	113.8	0.59	0.000	0.59	0	68	2.42%	2.3	48%	0.84	0.000	0.84
10.335	6967.10	38.7	0.941	38.8	-0.3	-0.14	2.43%	General Fill	0.057	113.8	0.60	0.000	0.60	0	64	2.47%	2.3	48%	0.85	0.000	0.85
10.499	6966.93	39.2	0.954	39.2	-0.4	-0.16	2.43%	General Fill	0.057	113.8	0.61	0.000	0.61	0	64	2.47%	2.3	48%	0.86	0.000	0.86
10.663	6966.77	44.1	0.988	44.1	-0.5	-0.20	2.24%	General Fill	0.057	113.8	0.62	0.000	0.62	0	71	2.27%	2.3	48%	0.87	0.000	0.87
10.827	6966.60	54.5	1.270	54.5	0.1	0.06	2.33%	General Fill	0.057	113.8	0.62	0.000	0.62	0	86	2.36%	2.2	48%	0.88	0.000	0.88
10.991	6966.44	62.1	1.974	62.1	0.3	0.12	3.18%	General Fill	0.057	113.8	0.63	0.000	0.63	0	97	3.21%	2.3	48%	0.89	0.000	0.89

Seismic Settlement Analysis - Stewart et al (2004)

TOTAL SEISMIC SETTLEMENT (FT): 0.1334

Midpoint Depth at t_1, z_1 (m)	Shear Wave Velocity, V_s (ft/sec)	Soil Density, ρ (tcf)	Max Shear Strain Modulus, G_{max} (tsf)	Coefficient a_2 for Stress Reduction Factor	Stress Reduction Factor, r_d	P = γ_{eff}*(G_{eff}/G_{max}) (tsf)	Plasticity Index, PI	g_1 for PI = 0 (0)	g_1 for PI = 15 (15)	g_1 for PI = 30 (30)	g_1	g_2 for PI = 0 (0)	g_2 for PI = 15 (15)	g_2 for PI = 30 (30)	g_2	Shear Strain, γ (%)	a	b	Threshhold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{c-15} (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
1.35	953	1.9E-03	1.7E+03	856	0.9926	2.9E-05	16	0.153	0.144	4	0.401	17298	12050	1400	11340	0.00%	0.65	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
1.40	953	1.9E-03	1.7E+03	841	0.9922	3.0E-05	16	0.154	0.145	4	0.402	17033	11862	1400	11165	0.00%	0.65	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
1.45	953	1.9E-03	1.7E+03	828	0.9919	3.2E-05	16	0.156	0.146	5	0.470	16782	11684	1401	10998	0.00%	0.65	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
1.50	953	1.9E-03	1.7E+03	814	0.9915	3.3E-05	16	0.157	0.148	6	0.538	16543	11514	1402	10840	0.00%	0.65	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
1.55	953	1.9E-03	1.7E+03	800	0.9912	3.4E-05	16	0.158	0.149	7	0.606	16316	11353	1403	10690	0.00%	0.65	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
1.60	953	1.9E-03	1.7E+03	787	0.9908	3.5E-05	16	0.159	0.150	8	0.674	16098	11199	1404	10546	0.00%	0.65	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
1.65	953	1.9E-03	1.7E+03	774	0.9904	3.6E-05	16	0.161	0.152	9	0.741	15891	11052	1405	10409	0.00%	0.65	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
1.70	953	1.9E-03	1.7E+03	761	0.9900	3.7E-05	16	0.162	0.153	10	0.809	15692	10911	1406	10277	0.00%	0.65	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
1.75	953	1.9E-03	1.7E+03	749	0.9897	3.8E-05	16	0.163	0.154	11	0.877	15502	10776	1407	10151	0.00%	0.65	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
1.80	953	1.9E-03	1.7E+03	736	0.9893	3.9E-05	16	0.164	0.155	12	0.945	15319	10647	1408	10031	0.00%	0.65	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
1.85	953	1.9E-03	1.7E+03	724	0.9889	4.0E-05	16	0.165	0.156	13	1.013	15144	10522	1409	9915	0.01%	0.65	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
1.90	953	1.9E-03	1.7E+03	712	0.9885	4.2E-05	16	0.166	0.158	14	1.080	14975	10403	1410	9803	0.01%	0.65	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
1.95	953	1.8E-03	1.6E+03	700	0.9881	4.6E-05	19	0.167	0.159	15	4.116	14824	10296	1411	7926	0.01%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.00	953	1.8E-03	1.6E+03	689	0.9876	4.7E-05	19	0.168	0.160	16	4.384	14678	10192	1412	7851	0.01%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.05	953	1.8E-03	1.6E+03	677	0.9872	4.8E-05	19	0.169	0.161	17	4.651	14536	10092	1413	7778	0.01%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.10	953	1.8E-03	1.6E+03	666	0.9868	4.9E-05	19	0.170	0.162	18	4.918	14399	9995	1414	7707	0.01%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.15	953	1.8E-03	1.6E+03	655	0.9864	5.0E-05	19	0.171	0.163	19	5.186	14267	9902	1415	7639	0.01%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.20	953	1.8E-03	1.6E+03	644	0.9859	5.1E-05	19	0.171	0.163	20	5.453	14139	9811	1416	7572	0.01%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.25	953	1.8E-03	1.6E+03	634	0.9855	5.2E-05	19	0.172	0.164	21	5.721	14014	9723	1417	7508	0.01%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.30	953	1.8E-03	1.6E+03	623	0.9850	5.3E-05	19	0.173	0.165	22	5.988	13893	9637	1418	7446	0.01%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.35	953	1.8E-03	1.6E+03	613	0.9845	5.5E-05	19	0.174	0.166	23	6.255	13776	9554	1419	7385	0.01%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.40	953	1.8E-03	1.6E+03	603	0.9841	5.6E-05	19	0.175	0.167	24	6.523	13662	9474	1420	7326	0.01%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.45	953	1.8E-03	1.6E+03	593	0.9836	5.7E-05	19	0.176	0.168	25	6.790	13552	9396	1421	7269	0.01%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.50	953	1.8E-03	1.6E+03	583	0.9831	5.8E-05	19	0.176	0.169	26	7.057	13444	9319	1422	7213	0.01%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.55	953	1.8E-03	1.6E+03	574	0.9826	5.9E-05	19	0.177	0.170	27	7.324	13339	9245	1423	7159	0.01%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.60	953	1.8E-03	1.6E+03	564	0.9821	6.0E-05	19	0.178	0.171	28	7.592	13237	9173	1424	7107	0.01%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.65	953	1.8E-03	1.6E+03	555	0.9816	6.1E-05	19	0.179	0.171	29	7.859	13137	9103	1425	7056	0.01%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.70	953	1.8E-03	1.6E+03	546	0.9810	6.2E-05	19	0.179	0.172	30	8.126	13041	9035	1426	7006	0.01%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.75	953	1.8E-03	1.6E+03	537	0.9805	6.3E-05	19	0.180	0.173	31	8.394	12946	8968	1427	6957	0.01%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.80	953	1.8E-03	1.6E+03	528	0.9800	6.4E-05	19	0.181	0.174	32	8.661	12854	8903	1428	6909	0.01%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.85	953	1.8E-03	1.6E+03	520	0.9794	6.5E-05	19	0.182	0.175	33	8.928	12764	8839	1429	6863	0.01%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.90	953	1.8E-03	1.6E+03	511	0.9789	6.6E-05	19	0.182	0.175	34	9.195	12676	8777	1430	6818	0.01%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.95	953	1.8E-03	1.6E+03	503	0.9783	6.8E-05	19	0.183	0.176	35	9.463	12590	8717	1431	6774	0.01%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
3.00	953	1.8E-03	1.6E+03	494	0.9777	6.9E-05	19	0.184	0.177	36	9.730	12506	8657	1432	6731	0.01%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
3.05	953	1.8E-03	1.6E+03	486	0.9771	7.0E-05	19	0.184	0.178	37	9.997	12424	8600	1433	6689	0.01%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
3.10	953	1.8E-03	1.6E+03	478	0.9765	7.1E-05	19	0.185	0.178	38	10.264	12344	8543	1434	6647	0.01%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
3.15	953	1.8E-03	1.6E+03	471	0.9759	7.2E-05	19	0.186	0.179	39	10.531	12266	8488	1435	6607	0.01%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
3.20	953	1.8E-03	1.6E+03	463	0.9753	7.3E-05	19	0.186	0.180	40	10.799	12189	8434	1436	6568	0.01%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
3.25	953	1.8E-03	1.6E+03	455	0.9747	7.4E-05	19	0.187	0.181	41	11.066	12114	8381	1437	6529	0.01%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
3.30	953	1.8E-03	1.6E+03	448	0.9741	7.5E-05	19	0.188	0.181	42	11.333	12041	8329	1438	6491	0.01%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
3.35	953	1.8E-03	1.6E+03	441	0.9734	7.6E-05	19	0.188	0.182	43	11.600	11969	8278	1439	6454	0.01%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
3.40	953	1.8E-03	1.6E+03	434	0.9728	7.7E-05	19	0.189	0.183	44	11.867	11898	8228	1440	6418	0.01%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
3.45	953	1.8E-03	1.6E+03	426	0.9721	7.8E-05	19	0.190	0.183	45	12.135	11829	8180	1441	6383	0.01%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
3.50	953	1.8E-03	1.6E+03	420	0.9714	7.9E-05	19	0.190	0.184	46	12.402	11761	8132	1442	6348	0.01%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
3.55	953	1.8E-03	1.6E+03	413	0.9708	8.0E-05	19	0.191	0.185	47	12.669	11695	8085	1443	6314	0.01%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
3.60	953	1.8E-03	1.6E+03	406	0.9701	8.1E-05	19	0.191	0.185	48	12.936	11630	8039	1444	6280	0.01%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
3.65	953	1.8E-03	1.6E+03	399	0.9693	8.2E-05	19	0.192	0.186	49	13.203	11566	7994	1445	6248	0.01%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
3.70	953	1.8E-03	1.6E+03	393	0.9686	8.3E-05	19	0.193	0.187	50	13.470	11503	7950	1446	6216	0.01%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
3.75	953	1.8E-03	1.6E+03	387	0.9679	8.4E-05	19	0.193	0.187	51	13.737	11441	7907	1447	6184	0.01%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
3.80	953	1.8E-03	1.6E+03	380	0.9672	8.5E-05	19	0.194	0.188	52	14.005	11381	7864	1448	6153	0.01%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
3.85	953	1.8E-03	1.6E+03	374	0.9664	8.6E-05	19	0.194	0.189	53	14.272	11322	7822	1449	6123	0.01%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
3.90	953	1.8E-03	1.6E+03	368	0.9656	8.7E-05	19	0.195	0.189	54	14.539	11263	7781	1450	6093	0.01%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
3.95	953	1.8E-03	1.6E+03	362	0.9649	8.8E-05	19	0.195	0.190	55	14.806	11206	7741	1451	6063	0.01%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
4.00	953	1.8E-03	1.6E+03	356	0.9641	9.0E-05	19	0.196	0.191	56	15.073	11150	7701	1452	6035	0.01%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
4.05	953	1.8E-03	1.6E+03	351	0.9633	9.1E-05	19	0.197	0.191	57	15.340	11094	7662	1453	6006	0.02%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
4.10	953	1.8E-03	1.6E+03	345	0.9625	9.2E-05	19	0.197	0.192	58	15.607	11040	7624	1454	5978	0.02%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
4.15	953	1.8E-03	1.6E+03	339	0.9616	9.3E-05	19	0.198	0.192	59	15.874	10986	7586	1455	5951	0.02%	1.70	0.75	0.020%	0.000000	0.34	0.079	0.797	0.00%	0.0000
4.20	821	1.8E-03	1.2E+03	334	0.9608	1.3E-04	19	0.198	0.193	60	16.142	10934	7549	1456	5924	0.03%	1.70	0.75	0.020%	0.001129	0.34	0.079	0.797	0.18%	0.0003
4.25	821	1.8E-03	1.2E+03	329	0.9600	1.3E-04	19	0.199	0.194	61	16.409	10882	7513	1457	5898	0.03%	1.70	0.75	0.020%	0.001188	0.34	0.079	0.797	0.19%	0.0003
4.30	821	1.8E-03	1.2E+03	323	0.9591	1.3E-04	19	0.199	0.194	62	16.676	10831	7477	1458	5872	0.03%	1.70	0.75	0.020%	0.001246	0.34	0.079	0.797	0.20%	0.0003
4.35	821	1.8E-03	1.2E+03	318	0.9582	1.3E-04	19	0.200	0.195	63	16.943	10781	7441	1459	5846	0.03%	1.70	0.75	0.020%	0.001304	0.34	0.079	0.797	0.21%	0.0003
4.40	821	1.8E-03	1.2E+03	313	0.9573	1.3E-04	19	0.200	0.195	64	17.210	10732	7407	1460	5821	0.03%	1.70	0.75	0.020%	0.001361	0.34	0.079	0.797	0.22%	0.0004
4.45	821	1.8E-03	1.2E+03	308	0.9564	1.3E-04	19	0.201	0.196	65	17.477	10683	7372	1461	5796	0.03%	1.70	0.75	0.020%	0.001417	0.34	0.079	0.797	0.23%	0.0004
4.50	821	1.8E-03	1.2E+03	303	0.9555	1.3E-04	19	0.201	0.197	66	17.744	10635	7339	1462	5772	0.03%	1.70	0.75	0.020%	0.001473	0.34	0.079	0.797	0.23%	0.0004
4.55	821	1.8E-03	1.2E+03	298	0.9546	1.4E-04	19	0.202	0.197	67	18.011	10588	7306	1463	5748	0.03%	1.70	0.75	0.020%	0.001528	0.34	0.079	0.797	0.24%	0.0004
4.60	821	1.8E-03	1.2E+03	293	0.9536	1.4E-04	19	0.202	0.198	68	18.278	10542	7273	1464	5724	0.03%	1.70	0.75	0.020%	0.001582	0.34	0.079	0.797	0.25%	0.0004
4.65	821	1.8E-03	1.2E+03	289	0.9527	1.4E-04	19	0.203	0.198	69	18.545	10496	7241	1465	5701	0.03%	1.70	0.75	0.020%	0.001636	0.34	0.079	0.797	0.26%	0.0004

11.155	6966.28	61.7	2.643	61.7	-0.1	-0.06	4.28%	General Fill	0.057	113.8	0.64	0.000	0.64	0	95	4.33%	2.4	48%	0.89	0.000	0.89
11.319	6966.11	58.6	2.825	58.6	0.3	0.12	4.82%	General Fill	0.057	113.8	0.65	0.000	0.65	0	89	4.87%	2.4	48%	0.90	0.000	0.90
11.483	6965.95	62.0	2.694	62.0	0.5	0.23	4.34%	General Fill	0.057	113.8	0.66	0.000	0.66	0	93	4.39%	2.4	48%	0.91	0.000	0.91
11.647	6965.78	72.6	2.346	72.6	0.2	0.08	3.23%	General Fill	0.057	113.8	0.67	0.000	0.67	0	107	3.26%	2.3	48%	0.92	0.000	0.92
11.811	6965.62	70.7	2.347	70.7	0.1	0.04	3.32%	General Fill	0.057	113.8	0.68	0.000	0.68	0	103	3.35%	2.3	48%	0.93	0.000	0.93
11.975	6965.46	57.0	2.344	57.0	-0.2	-0.10	4.11%	General Fill	0.057	113.8	0.69	0.000	0.69	0	82	4.16%	2.4	48%	0.94	0.000	0.94
12.139	6965.29	46.1	2.132	46.2	-0.4	-0.18	4.62%	General Fill	0.057	113.8	0.70	0.000	0.70	0	65	4.69%	2.5	48%	0.95	0.000	0.95
12.303	6965.13	38.0	1.770	38.0	-0.2	-0.10	4.66%	General Fill	0.057	113.8	0.71	0.000	0.71	0	53	4.75%	2.6	48%	0.96	0.000	0.96
12.467	6964.96	34.0	1.387	34.0	-0.6	-0.24	4.08%	General Fill	0.057	113.8	0.72	0.000	0.72	0	46	4.17%	2.6	48%	0.97	0.000	0.97
12.631	6964.80	33.8	0.990	33.8	-0.5	-0.20	2.93%	General Fill	0.057	113.8	0.73	0.000	0.73	0	45	3.00%	2.5	48%	0.98	0.000	0.98
12.795	6964.63	35.2	0.855	35.3	-0.5	-0.20	2.43%	General Fill	0.057	113.8	0.74	0.000	0.74	0	47	2.48%	2.4	48%	0.99	0.000	0.99
12.959	6964.47	38.4	0.748	38.4	-0.5	-0.23	1.95%	General Fill	0.057	113.8	0.75	0.000	0.75	0	50	1.99%	2.3	48%	1.00	0.000	1.00
13.123	6964.31	38.4	0.813	38.4	-0.4	-0.16	2.12%	General Fill	0.057	113.8	0.76	0.000	0.76	0	50	2.16%	2.4	48%	1.01	0.000	1.01
13.287	6964.14	40.0	0.924	40.0	-0.4	-0.18	2.31%	General Fill	0.057	113.8	0.76	0.000	0.76	0	51	2.36%	2.4	48%	1.02	0.000	1.02
13.451	6963.98	41.2	1.059	41.2	-0.2	-0.10	2.57%	General Fill	0.057	113.8	0.77	0.000	0.77	0	52	2.62%	2.4	48%	1.03	0.000	1.03
13.615	6963.81	42.6	1.130	42.6	-0.4	-0.16	2.65%	General Fill	0.057	113.8	0.78	0.000	0.78	0	53	2.70%	2.4	48%	1.03	0.000	1.03
13.779	6963.65	42.1	1.133	42.1	-0.3	-0.12	2.69%	General Fill	0.057	113.8	0.79	0.000	0.79	0	52	2.74%	2.4	48%	1.04	0.000	1.04
13.943	6963.49	42.6	0.951	42.6	-0.6	-0.26	2.23%	General Fill	0.057	113.8	0.80	0.000	0.80	0	52	2.28%	2.4	48%	1.05	0.000	1.05
14.107	6963.32	46.4	0.948	46.4	-0.1	-0.04	2.04%	General Fill	0.057	113.8	0.81	0.000	0.81	0	56	2.08%	2.3	48%	1.06	0.000	1.06
14.271	6963.16	43.4	0.939	43.4	-0.3	-0.12	2.16%	General Fill	0.057	113.8	0.82	0.000	0.82	0	52	2.20%	2.4	48%	1.07	0.000	1.07
14.436	6962.99	41.3	0.907	41.3	-0.1	-0.06	2.20%	General Fill	0.057	113.8	0.83	0.000	0.83	0	49	2.24%	2.4	48%	1.08	0.000	1.08
14.600	6962.83	46.0	1.104	46.0	0.1	0.02	2.40%	General Fill	0.057	113.8	0.84	0.000	0.84	0	54	2.44%	2.4	48%	1.09	0.000	1.09
14.764	6962.67	68.8	1.832	68.8	0.6	0.24	2.66%	General Fill	0.057	113.8	0.85	0.000	0.85	0	80	2.69%	2.3	48%	1.10	0.000	1.10
14.928	6962.50	139.9	2.813	139.9	2.2	0.96	2.01%	General Fill	0.057	113.8	0.86	0.000	0.86	0	162	2.02%	2.0	48%	1.11	0.000	1.11
15.092	6962.34	251.0	3.685	251.0	3.9	1.67	1.47%	General Fill	0.057	113.8	0.87	0.000	0.87	0	289	1.47%	1.7	48%	1.12	0.000	1.12
15.256	6962.17	335.8	5.525	335.8	4.4	1.89	1.65%	General Fill	0.057	113.8	0.88	0.000	0.88	0	382	1.65%	1.7	48%	1.13	0.000	1.13
15.420	6962.01	348.9	6.990	348.9	3.5	1.50	2.00%	General Fill	0.057	113.8	0.89	0.000	0.89	0	393	2.01%	1.8	48%	1.14	0.000	1.14
15.584	6961.85	335.1	8.254	335.1	2.8	1.20	2.46%	General Fill	0.057	113.8	0.90	0.000	0.90	0	373	2.47%	1.8	48%	1.15	0.000	1.15
15.748	6961.68	313.5	8.912	313.5	2.2	0.94	2.84%	General Fill	0.057	113.8	0.90	0.000	0.90	0	346	2.85%	1.9	48%	1.16	0.000	1.16
15.912	6961.52	283.3	7.971	283.3	1.7	0.73	2.81%	General Fill	0.057	113.8	0.91	0.000	0.91	0	309	2.82%	1.9	48%	1.17	0.000	1.17
16.076	6961.35	244.1	6.188	244.1	2.8	1.22	2.53%	General Fill	0.057	113.8	0.92	0.000	0.92	0	263	2.54%	1.9	48%	1.17	0.000	1.17
16.240	6961.19	239.4	5.322	239.3	3.9	1.69	2.22%	General Fill	0.057	113.8	0.93	0.000	0.93	0	256	2.23%	1.9	48%	1.18	0.000	1.18
16.404	6961.03	272.1	5.977	272.0	3.3	1.44	2.20%	General Fill	0.057	113.8	0.94	0.000	0.94	0	288	2.20%	1.9	48%	1.19	0.000	1.19
16.568	6960.86	206.3	5.625	206.3	3.8	1.63	2.73%	General Fill	0.057	113.8	0.95	0.000	0.95	0	216	2.74%	2.0	48%	1.20	0.000	1.20
16.732	6960.70	129.5	5.206	129.5	5.2	2.26	4.02%	General Fill	0.057	113.8	0.96	0.000	0.96	0	134	4.05%	2.3	48%	1.21	0.000	1.21
16.896	6960.53	109.6	1.599	109.6	7.1	3.07	1.46%	General Fill	0.057	113.8	0.97	0.000	0.97	0	112	1.47%	2.0	48%	1.22	0.000	1.22
17.060	6960.37	71.9	1.296	71.9	2.5	1.10	1.80%	General Fill	0.057	113.8	0.98	0.000	0.98	0	72	1.83%	2.2	48%	1.23	0.000	1.23
17.224	6960.21	59.0	1.102	59.0	1.8	0.77	1.87%	General Fill	0.057	113.8	0.99	0.000	0.99	0	59	1.90%	2.3	48%	1.24	0.000	1.24
17.388	6960.04	64.5	1.458	64.4	2.2	0.96	2.26%	General Fill	0.057	113.8	1.00	0.000	1.00	0	64	2.30%	2.3	48%	1.25	0.000	1.25
17.552	6959.88	88.0	1.984	88.0	4.2	1.81	2.25%	General Fill	0.057	113.8	1.01	0.000	1.01	0	86	2.28%	2.2	48%	1.26	0.000	1.26
17.716	6959.71	100.0	3.078	99.9	8.9	3.87	3.08%	General Fill	0.057	113.8	1.02	0.000	1.02	0	97	3.11%	2.3	48%	1.27	0.000	1.27
17.880	6959.55	106.9	3.615	106.9	7.7	3.35	3.38%	General Fill	0.057	113.8	1.03	0.000	1.03	0	103	3.41%	2.3	48%	1.28	0.000	1.28
18.044	6959.39	107.4	3.421	107.3	9.3	4.05	3.19%	General Fill	0.057	113.8	1.04	0.000	1.04	0	103	3.22%	2.3	48%	1.29	0.000	1.29
18.208	6959.22	109.7	3.159	109.6	11.3	4.90	2.88%	General Fill	0.057	113.8	1.04	0.000	1.04	0	104	2.91%	2.2	48%	1.30	0.000	1.30
18.372	6959.06	96.5	2.430	96.4	8.1	3.50	2.52%	General Fill	0.057	113.8	1.05	0.000	1.05	0	91	2.55%	2.2	48%	1.31	0.000	1.31
18.537	6958.89	72.3	1.823	72.3	4.6	1.97	2.52%	General Fill	0.057	113.8	1.06	0.000	1.06	0	67	2.56%	2.3	48%	1.31	0.000	1.31
18.701	6958.73	49.0	1.056	49.0	2.3	0.98	2.16%	General Fill	0.057	113.8	1.07	0.000	1.07	0	45	2.20%	2.4	48%	1.32	0.000	1.32
18.865	6958.57	40.9	0.614	40.9	1.2	0.51	1.50%	General Fill	0.057	113.8	1.08	0.000	1.08	0	37	1.54%	2.4	48%	1.33	0.000	1.33
19.029	6958.40	30.4	0.597	30.4	0.3	0.12	1.96%	General Fill	0.057	113.8	1.09	0.000	1.09	0	27	2.04%	2.6	48%	1.34	0.000	1.34
19.193	6958.24	27.7	0.626	27.7	-0.3	-0.12	2.26%	General Fill	0.057	113.8	1.10	0.000	1.10	0	24	2.36%	2.6	48%	1.35	0.000	1.35
19.357	6958.07	24.7	0.669	24.7	-0.7	-0.30	2.71%	General Fill	0.057	113.8	1.11	0.000	1.11	0	21	2.84%	2.7	48%	1.36	0.000	1.36
19.521	6957.91	26.7	0.645	26.7	-0.3	-0.12	2.41%	General Fill	0.057	113.8	1.12	0.000	1.12	0	23	2.52%	2.7	48%	1.37	0.000	1.37
19.685	6957.75	21.7	0.567	21.7	-0.5	-0.20	2.61%	General Fill	0.057	113.8	1.13	0.000	1.13	0	18	2.75%	2.8	48%	1.38	0.000	1.38
19.849	6957.58	21.7	0.601	21.7	-0.6	-0.26	2.77%	General Fill	0.057	113.8	1.14	0.000	1.14	0	18	2.92%	2.8	48%	1.39	0.000	1.39
20.013	6957.42	25.1	0.891	25.1	-1.0	-0.43	3.55%	General Fill	0.057	113.8	1.15	0.000	1.15	0	21	3.72%	2.8	48%	1.40	0.000	1.40
20.177	6957.25	38.9	1.167	38.9	-0.3	-0.14	3.00%	General Fill	0.057	113.8	1.16	0.000	1.16	0	33	3.09%	2.6	48%	1.41	0.000	1.41
20.341	6957.09	38.3	1.198	38.3	-0.6	-0.26	3.13%	General Fill	0.057	113.8	1.17	0.000	1.17	0	32	3.23%	2.6	48%	1.42	0.000	1.42
20.505	6956.93	31.6	0.945	31.6	-1.1	-0.49	2.99%	General Fill	0.057	113.8	1.18	0.000	1.18	0	26	3.11%	2.7	48%	1.43	0.000	1.43
20.669	6956.76	29.7	0.711	29.7	-0.7	-0.29	2.39%	General Fill	0.057	113.8	1.18	0.000	1.18	0	24	2.49%	2.6	48%	1.44	0.000	1.44
20.833	6956.60	28.2	0.539	28.2	-0.8	-0.33	1.91%	General Fill	0.057	113.8	1.19	0.000	1.19	0	23	2.00%	2.6	48%	1.45	0.000	1.45
20.997	6956.43	24.4	0.441	24.4	-0.9	-0.41	1.81%	General Fill	0.057	113.8	1.20	0.000	1.20	0	19	1.90%	2.6	48%	1.45	0.000	1.45
21.161	6956.27	23.3	0.371	23.3	-1.0	-0.43	1.60%	General Fill	0.057	113.8	1.21	0.000	1.21	0	18	1.68%	2.6	48%	1.46	0.000	1.46
21.325	6956.10	24.6	0.312	24.6	-1.3	-0.57	1.27%	General Fill	0.057	113.8	1.22	0.000	1.22	0	19	1.34%	2.6	48%	1.47	0.000	1.47
21.489	6955.94	20.9	0.348	20.9	-0.6	-0.26	1.66%	General Fill	0.057	113.8	1.23	0.000	1.23	0	16	1.77%	2.7	48%	1.48	0.000	1.48
21.653	6955.78	18.7	0.388	18.7	-0.2	-0.10	2.08%	General Fill	0.057	113.8	1.24	0.000	1.24	0	14	2.23%	2.8	48%	1.49	0.000	1.49
21.817	6955.61	20.5	0.564	20.5	-0.3	-0.12	2.75%	General Fill	0.057	113.8	1.25	0.000	1.25	0	15	2.93%	2.8	48%	1.50	0.000	1.50
21.981	6955.45	31.5	1.036	31.5	-0.2	-0.10	3.29%	General Fill	0.057	113.8	1.26	0.000	1.26	0	24	3.43%	2.7	48%	1.51	0.000	1.51
22.145	6955.28	59.7	1.551	59.7	0.1	0.02	2.60%	General Fill	0.057	113.8	1.27	0.000	1.27	0	46	2.66%	2.4	48%	1.52	0.000	1.52
22.309	6955.12	68.0	1.307	67.9	2.5	1.10	1.92%	General Fill	0.057	113.8	1.28	0.000	1.28	0	52	1.96%	2.3	48%	1.53	0.000	1.53
22.473	6954.96	74.8	1.320	74.8	1.9	0.81	1.76%	General Fill	0.057	113.8	1.29	0.000	1.29	0	57	1.79%	2.3	48%	1.54	0.000	1.54
22.638	6954.79	95.7	1.688	95.7	1.3	0.57	1.76%	General Fill	0.057	113.8	1.30	0.000	1.30	0	73	1.79%	2.2	48%	1.55	0.000	1.55
22.802	6954.63	101.9	2.104	101.9	1.8	0.77	2.07%	General Fill	0.057	113.8	1.31	0.000	1.31	0	77	2.09%	2.2	48%	1.56	0.000	1.56
22.966	6954.46	113.3	3.005	113.3	2.2	0.96	2.65%	General Fill	0.057	113.8	1.32	0.000	1.32	0	85	2.68%	2.3	48%	1.57	0.000	1.57
23.130	6954.30	137.6	3.634	137.6	3.5	1.50	2.64%	General Fill	0.057	113.8	1.32	0.000	1.32	0	103	2.67%	2.2	48%	1.58	0.000	1.58
23.294	6954.14	144.6	4.151	144.6	4.5	1.93	2.87%	General Fill	0.057	113.8	1.33	0.000	1.33	0	107	2.90%	2.2	48%	1.59	0.000	1.59
23.458	6953.97	138.7	4.271	138.7	5.4	2.32	3.08%	General Fill	0.057	113.8	1.34	0.000	1.34	0	102	3.11%	2.3	48%	1.59	0.000	1.59
23.622	6953.81	127.0	4.370	127.0	4.6	1.99	3.44%	General Fill	0.057	113.8	1.35	0.000	1.35	0	93	3.48%	2.3	48%	1.60	0.000	1.60
23.786	6953.64	105.8	3.484	105.7	3.6	1.55	3.29%	General Fill	0.057	113.8	1.36	0.000	1.36	0	77	3.34%	2.4	48%	1.61	0.000	1.61
23.950	6953.48	104.9	3.193	104.9	3.9	1.69	3.04%	General Fill	0.057	113.8	1.37	0.000	1.37	0	76	3.08%	2.3	48%	1.62	0.000	1.62
24.114	6953.32	100.0	2.838	99.9	3.3	1.44	2.84%	General Fill	0.057	113.8	1.38	0.000	1.38	0	71	2.88%	2.3	48%	1.63	0.000	1.63
24.278	6953.15	77.9	2.845	77.9	2.2	0.94	3.65%	General Fill	0.057	113.8	1.39	0.000	1.39	0	55	3.72%	2.5	48%	1.64	0.000	1.64
24.442	6952.99	67.3	2.777	67.3	1.8	0.77	4.13%	General Fill	0.057	113.8	1.40	0.000	1.40	0	47	4.21%	2.6	48%	1.65	0.000	1.65
24.606	6952.82	58.9	2.669	58.9	1.9	0.81	4.53%	General Fill	0.057	113.8	1.41	0.000	1.41	0	41	4.64%	2.6	48%	1.66	0.000	1.66
24.770	6952.66	49.3	2.288	49.3	1.7	0.75	4.64%	General Fill	0.057	113.8	1.42	0.000	1.42	0	34	4.78%	2.7	48%	1.67	0.000	1.67
24.934	6952.50	52.0	1.715	52.0	1.9	0.83	3.30%	General Fill	0.057	113.8	1.43	0.000	1.43	0	35	3.39%	2.6	48%	1.68	0.000	1.68
25.098	6952.33	45.4	1.412	45.4	1.6	0.71	3.11%	General Fill	0.057	113.8	1.44	0.000	1.44	0	31	3.21%	2.6	48%	1.69	0.000	1.69
25.262	6952.17	38.8	1.265	38.8	-0.5	-0.20	3.26%	General Fill	0.057	113.8	1.45	0.000	1.45	0	26	3.38%	2.7	48%	1.70	0.000	1.70
25.426	6952.00	37.9	1.312	37.9	-0.5	-0.23	3.47%	General Fill	0.057	113.8	1.46	0.000	1.46	0	25	3.60%	2.7	48%	1.71	0.000	1.71

4.70	821	1.8E-03	1.2E+03	284	0.9517	1.4E-04	19	0.203	0.199	70	18.812	10451	7209	1466	5678	0.03%	1.70	0.75	0.020%	0.001690	0.34	0.079	0.797	0.27%	0.0004
4.75	821	1.8E-03	1.2E+03	280	0.9507	1.4E-04	19	0.204	0.199	71	19.079	10407	7178	1467	5655	0.03%	1.70	0.75	0.020%	0.001743	0.34	0.079	0.797	0.28%	0.0005
4.80	821	1.8E-03	1.2E+03	275	0.9497	1.4E-04	19	0.204	0.200	72	19.347	10363	7147	1468	5633	0.03%	1.70	0.75	0.020%	0.001796	0.34	0.079	0.797	0.29%	0.0005
4.85	821	1.8E-03	1.2E+03	271	0.9487	1.4E-04	19	0.205	0.200	73	19.614	10320	7117	1469	5611	0.03%	1.70	0.75	0.020%	0.001848	0.34	0.079	0.797	0.29%	0.0005
4.90	821	1.8E-03	1.2E+03	266	0.9476	1.4E-04	19	0.205	0.201	74	19.881	10277	7087	1470	5589	0.03%	1.70	0.75	0.020%	0.001900	0.34	0.079	0.797	0.30%	0.0005
4.95	821	1.8E-03	1.2E+03	262	0.9466	1.5E-04	19	0.206	0.201	75	20.148	10235	7058	1471	5568	0.03%	1.70	0.75	0.020%	0.001951	0.34	0.079	0.797	0.31%	0.0005
5.00	821	1.8E-03	1.2E+03	258	0.9455	1.5E-04	19	0.206	0.202	76	20.415	10194	7029	1472	5547	0.03%	1.70	0.75	0.020%	0.002002	0.34	0.079	0.797	0.32%	0.0005
5.05	821	1.8E-03	1.2E+03	254	0.9444	1.5E-04	19	0.207	0.203	77	20.682	10153	7000	1473	5526	0.03%	1.70	0.75	0.020%	0.002052	0.34	0.079	0.797	0.33%	0.0005
5.10	821	1.8E-03	1.2E+03	250	0.9433	1.5E-04	19	0.207	0.203	78	20.949	10113	6972	1474	5506	0.03%	1.70	0.75	0.020%	0.002102	0.34	0.079	0.797	0.34%	0.0005
5.15	821	1.8E-03	1.2E+03	246	0.9422	1.5E-04	19	0.208	0.204	79	21.216	10073	6944	1475	5486	0.03%	1.70	0.75	0.020%	0.002152	0.34	0.079	0.797	0.34%	0.0006
5.20	821	1.8E-03	1.2E+03	242	0.9411	1.5E-04	19	0.208	0.204	80	21.483	10034	6916	1476	5466	0.03%	1.70	0.75	0.020%	0.002201	0.34	0.079	0.797	0.35%	0.0006
5.25	821	1.8E-03	1.2E+03	238	0.9399	1.5E-04	19	0.208	0.205	81	21.750	9996	6889	1477	5446	0.03%	1.70	0.75	0.020%	0.002250	0.34	0.079	0.797	0.36%	0.0006
5.30	821	1.8E-03	1.2E+03	235	0.9387	1.5E-04	19	0.209	0.205	82	22.017	9958	6862	1478	5427	0.03%	1.70	0.75	0.020%	0.002299	0.34	0.079	0.797	0.37%	0.0006
5.35	821	1.8E-03	1.2E+03	231	0.9376	1.6E-04	19	0.209	0.206	83	22.284	9920	6836	1479	5408	0.04%	1.70	0.75	0.020%	0.002347	0.34	0.079	0.797	0.37%	0.0006
5.40	821	1.8E-03	1.2E+03	227	0.9364	1.6E-04	19	0.210	0.206	84	22.551	9883	6810	1480	5389	0.04%	1.70	0.75	0.020%	0.002394	0.34	0.079	0.797	0.38%	0.0006
5.45	821	1.8E-03	1.2E+03	224	0.9351	1.6E-04	19	0.210	0.207	85	22.818	9846	6784	1481	5370	0.04%	1.70	0.75	0.020%	0.002442	0.34	0.079	0.797	0.39%	0.0006
5.50	821	1.8E-03	1.2E+03	220	0.9339	1.6E-04	19	0.211	0.207	86	23.085	9810	6759	1482	5352	0.04%	1.70	0.75	0.020%	0.002489	0.34	0.079	0.797	0.40%	0.0007
5.55	821	1.8E-03	1.2E+03	217	0.9326	1.6E-04	19	0.211	0.208	87	23.352	9774	6734	1483	5334	0.04%	1.70	0.75	0.020%	0.002536	0.34	0.079	0.797	0.40%	0.0007
5.60	821	1.8E-03	1.2E+03	213	0.9314	1.6E-04	19	0.211	0.208	88	23.619	9739	6709	1484	5316	0.04%	1.70	0.75	0.020%	0.002582	0.34	0.079	0.797	0.41%	0.0007
5.65	821	1.8E-03	1.2E+03	210	0.9301	1.6E-04	19	0.212	0.209	89	23.886	9704	6684	1485	5298	0.04%	1.70	0.75	0.020%	0.002628	0.34	0.079	0.797	0.42%	0.0007
5.70	821	1.8E-03	1.2E+03	207	0.9288	1.6E-04	19	0.212	0.209	90	24.153	9670	6660	1486	5280	0.04%	1.70	0.75	0.020%	0.002673	0.34	0.079	0.797	0.43%	0.0007
5.75	821	1.8E-03	1.2E+03	204	0.9274	1.7E-04	19	0.213	0.209	91	24.420	9636	6636	1487	5263	0.04%	1.70	0.75	0.020%	0.002718	0.34	0.079	0.797	0.43%	0.0007
5.80	838	1.8E-03	1.2E+03	200	0.9261	1.6E-04	19	0.213	0.210	92	24.687	9602	6613	1488	5246	0.04%	1.70	0.75	0.020%	0.002449	0.34	0.079	0.797	0.39%	0.0006
5.85	838	1.8E-03	1.2E+03	197	0.9247	1.6E-04	19	0.214	0.210	93	24.954	9569	6590	1489	5229	0.04%	1.70	0.75	0.020%	0.002491	0.34	0.079	0.797	0.40%	0.0007
5.90	838	1.8E-03	1.2E+03	194	0.9233	1.6E-04	19	0.214	0.211	94	25.221	9536	6566	1490	5213	0.04%	1.70	0.75	0.020%	0.002533	0.34	0.079	0.797	0.40%	0.0007
5.95	838	1.8E-03	1.2E+03	191	0.9219	1.6E-04	19	0.214	0.211	95	25.488	9504	6544	1491	5196	0.04%	1.70	0.75	0.020%	0.002574	0.34	0.079	0.797	0.41%	0.0007
6.00	838	1.8E-03	1.2E+03	188	0.9205	1.6E-04	19	0.215	0.212	96	25.755	9472	6521	1492	5180	0.04%	1.70	0.75	0.020%	0.002615	0.34	0.079	0.797	0.42%	0.0007
6.05	838	1.8E-03	1.2E+03	185	0.9190	1.7E-04	19	0.215	0.212	97	26.022	9440	6499	1493	5164	0.04%	1.70	0.75	0.020%	0.002656	0.34	0.079	0.797	0.42%	0.0007
6.10	838	1.8E-03	1.2E+03	182	0.9176	1.7E-04	19	0.216	0.213	98	26.289	9409	6477	1494	5148	0.04%	1.70	0.75	0.020%	0.002696	0.34	0.079	0.797	0.43%	0.0007
6.15	838	1.8E-03	1.2E+03	180	0.9161	1.7E-04	19	0.216	0.213	99	26.556	9378	6455	1495	5133	0.04%	1.70	0.75	0.020%	0.002736	0.34	0.079	0.797	0.44%	0.0007
6.20	838	1.8E-03	1.2E+03	177	0.9145	1.7E-04	19	0.216	0.214	100	26.823	9347	6434	1496	5117	0.04%	1.70	0.75	0.020%	0.002776	0.34	0.079	0.797	0.44%	0.0007
6.25	838	1.8E-03	1.2E+03	174	0.9130	1.7E-04	19	0.217	0.214	101	27.090	9317	6413	1497	5102	0.04%	1.70	0.75	0.020%	0.002815	0.34	0.079	0.797	0.45%	0.0007
6.30	838	1.8E-03	1.2E+03	171	0.9115	1.7E-04	19	0.217	0.215	102	27.357	9287	6392	1498	5087	0.04%	1.70	0.75	0.020%	0.002854	0.34	0.079	0.797	0.45%	0.0007
6.35	838	1.8E-03	1.2E+03	169	0.9099	1.7E-04	19	0.218	0.215	103	27.624	9257	6371	1499	5072	0.04%	1.70	0.75	0.020%	0.002892	0.34	0.079	0.797	0.46%	0.0008
6.40	838	1.8E-03	1.2E+03	166	0.9083	1.7E-04	19	0.218	0.215	104	27.891	9228	6350	1500	5057	0.04%	1.70	0.75	0.020%	0.002930	0.34	0.079	0.797	0.47%	0.0008
6.45	838	1.8E-03	1.2E+03	164	0.9067	1.7E-04	19	0.218	0.216	105	28.158	9199	6330	1501	5042	0.04%	1.70	0.75	0.020%	0.002968	0.34	0.079	0.797	0.47%	0.0008
6.50	838	1.8E-03	1.2E+03	161	0.9050	1.8E-04	19	0.219	0.216	106	28.425	9170	6310	1502	5028	0.04%	1.70	0.75	0.020%	0.003005	0.34	0.079	0.797	0.48%	0.0008
6.55	838	1.8E-03	1.2E+03	159	0.9034	1.8E-04	19	0.219	0.217	107	28.692	9142	6290	1503	5013	0.04%	1.70	0.75	0.020%	0.003041	0.34	0.079	0.797	0.48%	0.0008
6.60	838	1.8E-03	1.2E+03	156	0.9017	1.8E-04	19	0.220	0.217	108	28.959	9114	6270	1504	4999	0.04%	1.70	0.75	0.020%	0.003078	0.34	0.079	0.797	0.49%	0.0008
6.65	838	1.8E-03	1.2E+03	154	0.9000	1.8E-04	19	0.220	0.218	109	29.226	9086	6251	1505	4985	0.04%	1.70	0.75	0.020%	0.003113	0.34	0.079	0.797	0.50%	0.0008
6.70	838	1.8E-03	1.2E+03	152	0.8982	1.8E-04	19	0.220	0.218	110	29.493	9059	6231	1506	4971	0.04%	1.70	0.75	0.020%	0.003149	0.34	0.079	0.797	0.50%	0.0008
6.75	838	1.8E-03	1.2E+03	149	0.8965	1.8E-04	19	0.221	0.218	111	29.760	9032	6212	1507	4958	0.04%	1.70	0.75	0.020%	0.003183	0.34	0.079	0.797	0.51%	0.0008
6.80	838	1.8E-03	1.2E+03	147	0.8947	1.8E-04	19	0.221	0.219	112	30.027	9005	6194	1508	4944	0.04%	1.70	0.75	0.020%	0.003218	0.34	0.079	0.797	0.51%	0.0008
6.85	838	1.8E-03	1.2E+03	145	0.8929	1.8E-04	19	0.221	0.219	113	30.294	8978	6175	1509	4931	0.04%	1.70	0.75	0.020%	0.003252	0.34	0.079	0.797	0.52%	0.0009
6.90	838	1.8E-03	1.2E+03	143	0.8911	1.8E-04	19	0.222	0.220	114	30.561	8952	6156	1510	4917	0.04%	1.70	0.75	0.020%	0.003285	0.34	0.079	0.797	0.52%	0.0009
6.95	838	1.8E-03	1.2E+03	141	0.8892	1.8E-04	19	0.222	0.220	115	30.828	8925	6138	1511	4904	0.04%	1.70	0.75	0.020%	0.003318	0.34	0.079	0.797	0.53%	0.0009
7.00	838	1.8E-03	1.2E+03	139	0.8873	1.8E-04	19	0.223	0.221	116	31.095	8900	6120	1512	4891	0.04%	1.70	0.75	0.020%	0.003351	0.34	0.079	0.797	0.53%	0.0009
7.05	838	1.8E-03	1.2E+03	136	0.8854	1.9E-04	19	0.223	0.221	117	31.362	8874	6102	1513	4878	0.05%	1.70	0.75	0.020%	0.003383	0.34	0.079	0.797	0.54%	0.0009
7.10	838	1.8E-03	1.2E+03	134	0.8835	1.9E-04	19	0.223	0.221	118	31.629	8849	6084	1514	4865	0.05%	1.70	0.75	0.020%	0.003414	0.34	0.079	0.797	0.54%	0.0009
7.15	838	1.8E-03	1.2E+03	132	0.8815	1.9E-04	19	0.224	0.222	119	31.896	8824	6067	1515	4853	0.05%	1.70	0.75	0.020%	0.003445	0.34	0.079	0.797	0.55%	0.0009
7.20	838	1.8E-03	1.2E+03	130	0.8796	1.9E-04	19	0.224	0.222	120	32.163	8799	6049	1516	4840	0.05%	1.70	0.75	0.020%	0.003476	0.34	0.079	0.797	0.55%	0.0009
7.25	853	1.8E-03	1.3E+03	129	0.8776	1.8E-04	19	0.224	0.223	121	32.430	8774	6032	1517	4828	0.04%	1.70	0.75	0.020%	0.003202	0.34	0.079	0.797	0.51%	0.0008
7.30	853	1.8E-03	1.3E+03	127	0.8755	1.8E-04	19	0.225	0.223	122	32.697	8750	6015	1518	4816	0.04%	1.70	0.75	0.020%	0.003230	0.34	0.079	0.797	0.51%	0.0008
7.35	853	1.8E-03	1.3E+03	125	0.8735	1.8E-04	19	0.225	0.223	123	32.964	8726	5998	1519	4804	0.04%	1.70	0.75	0.020%	0.003258	0.34	0.079	0.797	0.52%	0.0009
7.40	853	1.8E-03	1.3E+03	123	0.8714	1.8E-04	19	0.225	0.224	124	33.231	8702	5981	1520	4792	0.04%	1.70	0.75	0.020%	0.003285	0.34	0.079	0.797	0.52%	0.0009
7.45	853	1.8E-03	1.3E+03	121	0.8693	1.9E-04	19	0.226	0.224	125	33.498	8678	5965	1521	4780	0.04%	1.70	0.75	0.020%	0.003311	0.34	0.079	0.797	0.53%	0.0009
7.50	853	1.8E-03	1.3E+03	119	0.8672	1.9E-04	19	0.226	0.225	126	33.765	8655	5948	1522	4768	0.04%	1.70	0.75	0.020%	0.003337	0.34	0.079	0.797	0.53%	0.0009
7.55	853	1.8E-03	1.3E+03	118	0.8650	1.9E-04	19	0.226	0.225	127	34.032	8631	5932	1523	4756	0.04%	1.70	0.75	0.020%	0.003363	0.34	0.079	0.797	0.54%	0.0009
7.60	853	1.8E-03	1.3E+03	116	0.8628	1.9E-04	19	0.227	0.225	128	34.299	8608	5916	1524	4745	0.05%	1.70	0.75	0.020%	0.003388	0.34	0.079	0.797	0.54%	0.0009
7.65	853	1.8E-03	1.3E+03	114	0.8606	1.9E-04	19	0.227	0.226	129	34.566	8585	5900	1525	4733	0.05%	1.70	0.75	0.020%	0.003412	0.34	0.079	0.797	0.54%	0.0009
7.70	853	1.8E-03	1.3E+03	113	0.8584	1.9E-04	19	0.227	0.226	130	34.832	8563	5884	1526	4722	0.05%	1.70	0.75	0.020%	0.003436	0.34	0.079	0.797	0.55%	0.0009
7.75	853	1.8E-03	1.3E+03	111	0.8561	1.9E-04	19	0.228	0.226	131	35.099	8540	5868	1527	4711	0.05%	1.70	0.75	0.020%	0.003460	0.34	0.079	0.797	0.55%	0.0009
7.80	853	1.8E-03	1.3E+03	109	0.8538	1.9E-04	19	0.228	0.227	132	35.366	8518	5853	1528	4699	0.05%	1.70	0.75	0.020%	0.003482	0.34	0.079	0.797	0.56%	0.0009
7.85	853	1.8E-03	1.3E+03	108	0.8515	1.9E-04	19	0.228	0.227	133	35.633	8496	5837	1529	4688	0.05%	1.70	0.75	0.020%	0.003505	0.34	0.079	0.797	0.56%	0.0009
7.90	853	1.8E-03	1.3E+03	106	0.8491	1.9E-04	19	0.229	0.228	134	35.900	8474	5822	1530	4677	0.05%	1.70	0.75	0.020%	0.003526	0.34	0.079	0.797	0.56%	0.0009
7.95	853	1.8E-03	1.3E+03	105	0.8467	1.9E-04	19	0.229	0.228	135	36.167	8453	5807	1531	4667	0.05%	1.70	0.75	0.020%	0.003547	0.34	0.079	0.797	0.57%	0.0009
8.00	853	1.8E-03	1.3E+03	103	0.8443	1.9E-04	19	0.229	0.228	136	36.434	8431	5792	1532	4656	0.05%	1.70	0.75	0.020%	0.003568	0.34	0.079	0.797	0.57%	0.0009
8.05	853	1.8E-03	1.3E+03	102	0.8419	1.9E-04	19	0.230	0.229	137	36.701	8410	5777	1533	4645	0.05%	1.70	0.75	0.020%	0.003588	0.34	0.079	0.797	0.57%	0.0009
8.10	853	1.8E-03	1.3E+03	100	0.8394	1.9E-04	19	0.230	0.229	138	36.968	8389	5762	1534	4635	0.05%	1.70	0.75	0.020%	0.003607	0.34	0.079	0.797	0.58%	0.0009
8.15	853	1.8E-03	1.3E+03	99	0.8369	2.0E-04	19	0.230	0.229	139	37.235	8368	5747	1535	4624	0.05%	1.70	0.75	0.020%	0.003626	0.34	0.079	0.797	0.58%	0.0009
8.20	853	1.8E-03	1.3E+03	97	0.8344	2.0E-04	19	0.231	0.230	140	37.502	8347	5733	1536	4614	0.05%	1.70	0.75	0.020%	0.003644	0.34	0.079	0.797	0.58%	0.0010
8.25	853	1.8E-03	1.3E+03	96	0.8319	2.0E-04	19	0.231	0.230	141	37.769	8327	5719	1537	4603	0.05%	1.70	0.75	0.020%	0.003661	0.34	0.079	0.797	0.58%	0.0010
8.30	853	1.8E-03	1.3E+03	95	0.8293	2.0E-04	19	0.231	0.231	142	38.036	8306	5704	1538	4593	0.05%	1.70	0.75	0.020%	0.003678	0.34	0.079	0.797	0.59%	0.0010
8.35	853	1.8E-03	1.3E+03	93	0.8267	2.0E-04	19	0.232	0.231	143	38.303	8286	5690	1539	4583	0.05%	1.70	0.75	0.020%	0.003694	0.34	0.079	0.797	0.59%	0.0010
8.40	853	1.8E-03	1.3E+03	92	0.8241	2.0E-04	19	0.232	0.231	144	38.570	8266	5676	1540	4573	0.05%	1.70	0.75	0.020%	0.003710	0.34	0.079	0.797	0.59%	0.0010
8.45	853	1.8E-03	1.3E+03	91	0.8214	2.0E-04	19	0.232	0.232	145	38.837	8246	5662	1541	4563	0.05%	1.70	0.75	0.020%	0.003725	0.34	0.079	0.797	0.59%	0.0010
8.50	853	1.8E-03	1.3E+03	90	0.8187	2.0E-04	19	0.233	0.232	146	39.103	8227	5648	1542	4553	0.05%	1.70	0.75	0.020%	0.003739	0.34	0.079	0.797	0.60%	0.0010
8.55	853	1.8E-03	1.3E+03	88	0.8160	2.0E-04	19	0.233	0.232	147	39.370	8207	5635	1543	4544	0.05%	1.70	0.75	0.020%	0.003753	0.34	0.079	0.797	0.60%	0.0010
8.60	853	1.8E-03	1.3E+03	87	0.8132	2.0E-04	19	0.233	0.233	148	39.637	8188	5621	1544	4534	0.05%	1.70	0.75	0.020%	0.003766	0.34	0.079	0.797	0.60%	0.0010
8.65	853	1.8E-03	1.3E+03	86	0.8104	2.0E-04	19	0.234	0.233	149	39.904	8168	5608	1545	4524	0.05%	1.70	0.75	0.020%	0.003778	0.34	0.079	0.797	0.60%	0.0010
8.70	853	1.8E-03	1.3E+03	85	0.8076	2.0E-04	19	0.234	0.233	150	40.171	8149	5594	1546	4515	0.05%	1.70	0.75	0.020%	0.003790	0.34	0.079	0.797	0.60%	0.0010
8.75	853	1.8E-03	1.3E+03	84	0.8048	2.0E-04	19	0.234	0.234	151	40.438	8130	5581	1547	4505	0.05%	1.70	0.75	0.020%	0.003801	0.34	0.079	0.797	0.61%	0.0010
8.80	897	1.8E-03	1.4E+03	82	0.8019	1.8E-04	19	0.234	0.234	152	40.705	8112	5568	1548	4496	0.04%	1.70	0.75	0.020%	0.002959	0.34	0.079	0.797	0.47%	0.0008
8.85	897	1.8E-03	1.4E+03	81	0.7990	1.8E-04	19	0.235	0.234	153	40.972	8093	5555	1549	4487	0.04%	1.70	0.75	0.020%	0.002968	0.34	0.079	0.797	0.47%	0.0008
8.90	897	1.8E-03	1.4E+03	80	0.7961	1.8E-04	19	0.235	0.235	154	41.239	8075	5542	1550	4477	0.04%	1.70	0.75	0.020%	0.002976	0.34	0.079	0.797	0.47%	0.0008
8.95	897	1.8E-03	1.4E+03	79	0.7931	1.8E-04	19	0.235	0.235	155	41.506	8056	5529	1551	4468	0.04%	1.70	0.75	0.020%	0.002983	0.34	0.079	0.797	0.48%	0.0008
9.00	897	1.8E-03	1.4E+03	78	0.7901	1.8E-04	19	0.236	0.236	156	41.773	8038	5516	1552	4459	0.04%	1.70	0.75	0.020%	0.002990	0.34	0.079	0.797	0.48%	0.0008
9.05	897	1.8E-03	1.4E+03	77	0.7871	1.8E-04	19	0.236	0.236	157	42.040	8020	5504	1553	4450	0.04%	1.70	0.75	0.020%	0.002997	0.34	0.079	0.797	0.48%	0.0008

25.590	6951.84	38.4	1.611	38.4	-0.6	-0.26	4.19%	General Fill	0.057	113.8	1.46	0.000	1.46	0	25	4.36%	2.8	48%	1.72	0.000	1.72
25.754	6951.68	47.0	1.787	47.0	-0.5	-0.23	3.80%	General Fill	0.057	113.8	1.47	0.000	1.47	0	31	3.92%	2.7	48%	1.73	0.000	1.73
25.918	6951.51	49.2	1.819	49.2	-0.6	-0.26	3.70%	General Fill	0.057	113.8	1.48	0.000	1.48	0	32	3.81%	2.7	48%	1.73	0.000	1.73
26.082	6951.35	50.7	1.690	50.7	-0.5	-0.23	3.33%	General Fill	0.057	113.8	1.49	0.000	1.49	0	33	3.43%	2.6	48%	1.74	0.000	1.74
26.246	6951.18	53.8	1.866	53.8	-0.5	-0.20	3.47%	General Fill	0.057	113.8	1.50	0.000	1.50	0	35	3.57%	2.6	48%	1.75	0.000	1.75
26.410	6951.02	59.2	2.031	59.2	-0.5	-0.23	3.43%	General Fill	0.057	113.8	1.51	0.000	1.51	0	38	3.52%	2.6	48%	1.76	0.000	1.76
26.574	6950.86	60.6	1.994	60.6	-0.1	-0.06	3.29%	General Fill	0.057	113.8	1.52	0.000	1.52	0	39	3.37%	2.6	48%	1.77	0.000	1.77
26.739	6950.69	64.6	2.277	64.6	-0.3	-0.12	3.53%	General Fill	0.057	113.8	1.53	0.000	1.53	0	41	3.61%	2.6	48%	1.78	0.000	1.78
26.903	6950.53	68.4	2.223	68.5	-0.4	-0.16	3.25%	General Fill	0.057	113.8	1.54	0.000	1.54	0	43	3.32%	2.5	48%	1.79	0.000	1.79
27.067	6950.36	64.6	2.093	64.6	0.1	0.04	3.24%	General Fill	0.057	113.8	1.55	0.000	1.55	0	41	3.32%	2.5	48%	1.80	0.000	1.80
27.231	6950.20	67.9	2.017	67.9	-0.1	-0.02	2.97%	General Fill	0.057	113.8	1.56	0.000	1.56	0	43	3.04%	2.5	48%	1.81	0.000	1.81
27.395	6950.04	71.5	1.948	71.5	0.1	0.04	2.72%	General Fill	0.057	113.8	1.57	0.000	1.57	0	45	2.79%	2.5	48%	1.82	0.000	1.82
27.559	6949.87	71.8	2.207	71.8	-0.2	-0.08	3.07%	General Fill	0.057	113.8	1.58	0.000	1.58	0	45	3.14%	2.5	48%	1.83	0.000	1.83
27.723	6949.71	81.8	2.242	81.8	0.3	0.14	2.74%	General Fill	0.057	113.8	1.59	0.000	1.59	0	51	2.79%	2.4	48%	1.84	0.000	1.84
27.887	6949.54	102.4	2.701	102.4	1.2	0.51	2.64%	General Fill	0.057	113.8	1.60	0.000	1.60	0	63	2.68%	2.3	48%	1.85	0.000	1.85
28.051	6949.38	105.0	3.171	105.0	0.8	0.35	3.02%	General Fill	0.057	113.8	1.60	0.000	1.60	0	64	3.07%	2.4	48%	1.86	0.000	1.86
28.215	6949.22	93.3	3.179	93.3	1.5	0.63	3.41%	General Fill	0.057	113.8	1.61	0.000	1.61	0	57	3.47%	2.5	48%	1.87	0.000	1.87
28.379	6949.05	93.5	3.284	93.4	3.7	1.59	3.51%	General Fill	0.057	113.8	1.62	0.000	1.62	0	57	3.58%	2.5	48%	1.87	0.000	1.87
28.543	6948.89	99.1	3.151	99.1	2.4	1.04	3.18%	General Fill	0.057	113.8	1.63	0.000	1.63	0	60	3.23%	2.4	48%	1.88	0.000	1.88
28.707	6948.72	90.4	2.720	90.4	2.6	1.12	3.01%	General Fill	0.057	113.8	1.64	0.000	1.64	0	54	3.06%	2.4	48%	1.89	0.000	1.89
28.871	6948.56	76.4	2.454	76.4	1.6	0.67	3.21%	General Fill	0.057	113.8	1.65	0.000	1.65	0	45	3.28%	2.5	48%	1.90	0.000	1.90
29.035	6948.39	71.0	2.498	70.9	2.7	1.18	3.52%	General Fill	0.057	113.8	1.66	0.000	1.66	0	42	3.60%	2.6	48%	1.91	0.000	1.91
29.199	6948.23	72.3	2.818	72.3	3.4	1.49	3.90%	General Fill	0.057	113.8	1.67	0.000	1.67	0	42	3.99%	2.6	48%	1.92	0.000	1.92
29.363	6948.07	70.5	3.251	70.5	3.1	1.34	4.61%	General Fill	0.057	113.8	1.68	0.000	1.68	0	41	4.72%	2.7	48%	1.93	0.000	1.93
29.527	6947.90	69.6	3.140	69.6	3.3	1.42	4.51%	General Fill	0.057	113.8	1.69	0.000	1.69	0	40	4.62%	2.7	48%	1.94	0.000	1.94
29.691	6947.74	63.5	2.815	63.5	3.0	1.30	4.43%	General Fill	0.057	113.8	1.70	0.000	1.70	0	36	4.55%	2.7	48%	1.95	0.000	1.95
29.855	6947.57	52.6	2.351	52.6	1.7	0.73	4.47%	General Fill	0.057	113.8	1.71	0.000	1.71	0	30	4.62%	2.7	48%	1.96	0.000	1.96
30.019	6947.41	47.7	2.008	47.7	1.2	0.53	4.21%	General Fill	0.057	113.8	1.72	0.000	1.72	0	27	4.37%	2.8	48%	1.97	0.000	1.97
30.183	6947.25	37.1	1.824	37.1	-0.3	-0.12	4.92%	General Fill	0.057	113.8	1.73	0.000	1.73	0	20	5.16%	2.9	48%	1.98	0.000	1.98
30.347	6947.08	42.0	1.881	42.0	-0.2	-0.08	4.48%	General Fill	0.057	113.8	1.74	0.000	1.74	0	23	4.67%	2.8	48%	1.99	0.000	1.99
30.511	6946.92	42.1	1.882	42.1	-0.2	-0.10	4.47%	General Fill	0.057	113.8	1.74	0.000	1.74	0	23	4.66%	2.8	48%	2.00	0.000	2.00
30.675	6946.75	42.4	2.072	42.4	0.1	0.06	4.89%	General Fill	0.057	113.8	1.75	0.000	1.75	0	23	5.10%	2.9	48%	2.01	0.000	2.01
30.840	6946.59	38.2	2.014	38.2	-0.1	-0.04	5.27%	General Fill	0.057	113.8	1.76	0.000	1.76	0	21	5.52%	2.9	48%	2.01	0.000	2.01
31.004	6946.43	31.1	1.839	31.1	-0.4	-0.16	5.91%	General Fill	0.057	113.8	1.77	0.000	1.77	0	17	6.27%	3.0	48%	2.02	0.000	2.02
31.168	6946.26	27.2	1.562	27.2	-0.7	-0.30	5.74%	General Fill	0.057	113.8	1.78	0.000	1.78	0	14	6.14%	3.1	48%	2.03	0.000	2.03
31.332	6946.10	23.8	1.225	23.8	-0.3	-0.14	5.14%	General Fill	0.057	113.8	1.79	0.000	1.79	0	12	5.56%	3.1	48%	2.04	0.000	2.04
31.496	6945.93	19.6	1.043	19.6	0.8	0.33	5.31%	General Fill	0.057	113.8	1.80	0.000	1.80	0	10	5.85%	3.2	48%	2.05	0.000	2.05
31.660	6945.77	20.9	0.989	20.9	1.0	0.43	4.73%	General Fill	0.057	113.8	1.81	0.000	1.81	0	11	5.18%	3.1	48%	2.06	0.000	2.06
31.824	6945.61	22.7	0.955	22.7	1.8	0.77	4.21%	General Fill	0.057	113.8	1.82	0.000	1.82	0	11	4.57%	3.1	48%	2.07	0.000	2.07
31.988	6945.44	34.2	1.725	34.2	2.8	1.20	5.04%	General Fill	0.057	113.8	1.83	0.000	1.83	0	18	5.32%	3.0	48%	2.08	0.000	2.08
32.152	6945.28	167.5	3.581	167.5	7.1	3.09	2.14%	General Fill	0.057	113.8	1.84	0.000	1.84	0	90	2.16%	2.2	48%	2.09	0.000	2.09
32.316	6945.11	321.8	6.023	321.8	6.2	2.70	1.87%	General Fill	0.057	113.8	1.85	0.000	1.85	0	173	1.88%	1.9	48%	2.10	0.000	2.10
32.480	6944.95	380.3	7.789	380.2	9.9	4.29	2.05%	General Fill	0.057	113.8	1.86	0.000	1.86	0	204	2.06%	1.9	48%	2.11	0.000	2.11
32.644	6944.79	371.5	7.460	371.5	11.0	4.78	2.01%	General Fill	0.057	113.8	1.87	0.000	1.87	0	198	2.02%	1.9	48%	2.12	0.000	2.12
32.808	6944.62	321.0	6.963	320.9	9.8	4.25	2.17%	General Fill	0.057	113.8	1.88	0.000	1.88	0	170	2.18%	2.0	48%	2.13	0.000	2.13
32.972	6944.46	254.9	5.341	254.9	7.6	3.28	2.10%	General Fill	0.057	113.8	1.88	0.000	1.88	0	134	2.11%	2.0	48%	2.14	0.000	2.14
33.136	6944.29	162.1	3.841	162.1	7.2	3.13	2.37%	General Fill	0.057	113.8	1.89	0.000	1.89	0	85	2.40%	2.2	48%	2.15	0.000	2.15
33.300	6944.13	118.1	2.119	118.1	5.1	2.22	1.79%	General Fill	0.057	113.8	1.90	0.000	1.90	0	61	1.82%	2.2	48%	2.15	0.000	2.15
33.464	6943.97	95.9	1.236	95.9	2.8	1.20	1.29%	General Fill	0.057	113.8	1.91	0.000	1.91	0	49	1.32%	2.2	48%	2.16	0.000	2.16
33.628	6943.80	88.4	0.623	88.4	2.4	1.04	0.70%	General Fill	0.057	113.8	1.92	0.000	1.92	0	45	0.72%	2.1	48%	2.17	0.000	2.17
33.792	6943.64	88.6	1.921	88.6	2.0	0.85	2.17%	General Fill	0.057	113.8	1.93	0.000	1.93	0	45	2.22%	2.4	48%	2.18	0.000	2.18
33.956	6943.47	51.6	2.126	51.6	0.2	0.08	4.12%	General Fill	0.057	113.8	1.94	0.000	1.94	0	26	4.28%	2.8	48%	2.19	0.000	2.19
34.120	6943.31	55.2	2.273	55.2	1.8	0.79	4.12%	General Fill	0.057	113.8	1.95	0.000	1.95	0	27	4.27%	2.7	48%	2.20	0.000	2.20
34.284	6943.15	65.5	1.245	65.5	2.5	1.10	1.90%	General Fill	0.057	113.8	1.96	0.000	1.96	0	32	1.96%	2.5	48%	2.21	0.000	2.21
34.448	6942.98	74.8	1.921	74.8	2.9	1.26	2.57%	General Fill	0.057	113.8	1.97	0.000	1.97	0	37	2.64%	2.5	48%	2.22	0.000	2.22
34.612	6942.82	71.5	2.842	71.5	3.4	1.46	3.97%	General Fill	0.057	113.8	1.98	0.000	1.98	0	35	4.09%	2.7	48%	2.23	0.000	2.23
34.776	6942.65	84.4	3.493	84.4	4.1	1.79	4.14%	General Fill	0.057	113.8	1.99	0.000	1.99	0	41	4.24%	2.6	48%	2.24	0.000	2.24
34.941	6942.49	101.3	3.063	101.3	4.3	1.85	3.02%	General Fill	0.057	113.8	2.00	0.000	2.00	0	50	3.08%	2.5	48%	2.25	0.000	2.25
35.105	6942.33	76.9	2.935	76.9	4.1	1.77	3.82%	General Fill	0.057	113.8	2.01	0.000	2.01	0	37	3.92%	2.6	48%	2.26	0.000	2.26
35.269	6942.16	70.8	2.707	70.8	2.0	0.85	3.83%	General Fill	0.057	113.8	2.02	0.000	2.02	0	34	3.94%	2.7	48%	2.27	0.000	2.27
35.433	6942.00	58.4	2.667	58.4	1.6	0.71	4.57%	General Fill	0.057	113.8	2.02	0.000	2.02	0	28	4.73%	2.8	48%	2.28	0.000	2.28
35.597	6941.83	59.7	2.886	59.7	1.7	0.75	4.84%	General Fill	0.057	113.8	2.03	0.000	2.03	0	28	5.01%	2.8	48%	2.29	0.000	2.29
35.761	6941.67	63.6	2.755	63.6	1.9	0.81	4.33%	General Fill	0.057	113.8	2.04	0.000	2.04	0	30	4.47%	2.7	48%	2.29	0.000	2.29
35.925	6941.51	70.6	2.388	70.6	2.1	0.91	3.38%	General Fill	0.057	113.8	2.05	0.000	2.05	0	33	3.48%	2.6	48%	2.30	0.000	2.30
36.089	6941.34	65.9	1.886	65.8	1.8	0.77	2.86%	General Fill	0.057	113.8	2.06	0.000	2.06	0	31	2.96%	2.6	48%	2.31	0.000	2.31
36.253	6941.18	62.3	1.502	62.3	1.3	0.57	2.41%	General Fill	0.057	113.8	2.07	0.000	2.07	0	29	2.49%	2.6	48%	2.32	0.000	2.32
36.417	6941.01	60.4	1.486	60.4	0.8	0.35	2.46%	General Fill	0.057	113.8	2.08	0.000	2.08	0	28	2.55%	2.6	48%	2.33	0.000	2.33
36.581	6940.85	59.2	1.748	59.2	0.8	0.36	2.95%	General Fill	0.057	113.8	2.09	0.000	2.09	0	27	3.06%	2.7	48%	2.34	0.000	2.34
36.745	6940.69	54.6	1.994	54.6	0.6	0.26	3.65%	General Fill	0.057	113.8	2.10	0.000	2.10	0	25	3.80%	2.7	48%	2.35	0.000	2.35
36.909	6940.52	48.6	1.774	48.6	0.6	0.26	3.65%	General Fill	0.057	113.8	2.11	0.000	2.11	0	22	3.82%	2.8	48%	2.36	0.000	2.36
37.073	6940.36	54.7	1.759	54.7	1.1	0.49	3.22%	General Fill	0.057	113.8	2.12	0.000	2.12	0	25	3.35%	2.7	48%	2.37	0.000	2.37
37.237	6940.19	50.4	1.722	50.4	0.5	0.23	3.42%	General Fill	0.057	113.8	2.13	0.000	2.13	0	23	3.57%	2.8	48%	2.38	0.000	2.38
37.401	6940.03	45.6	1.817	45.6	1.0	0.43	3.98%	General Fill	0.057	113.8	2.14	0.000	2.14	0	20	4.18%	2.8	48%	2.39	0.000	2.39
37.565	6939.86	38.9	1.931	38.9	0.5	0.23	4.97%	General Fill	0.057	113.8	2.15	0.000	2.15	0	17	5.26%	3.0	48%	2.40	0.000	2.40
37.729	6939.70	37.5	1.975	37.5	0.6	0.24	5.27%	General Fill	0.057	113.8	2.16	0.000	2.16	0	16	5.59%	3.0	48%	2.41	0.000	2.41
37.893	6939.54	41.1	1.391	41.1	0.8	0.35	3.38%	General Fill	0.057	113.8	2.16	0.000	2.16	0	18	3.57%	2.8	48%	2.42	0.000	2.42
38.057	6939.37	60.9	1.509	60.9	-0.6	-0.24	2.48%	General Fill	0.057	113.8	2.17	0.000	2.17	0	27	2.57%	2.6	48%	2.43	0.000	2.43
38.221	6939.21	82.0	1.841	82.0	0.8	0.33	2.25%	General Fill	0.057	113.8	2.18	0.000	2.18	0	37	2.31%	2.5	48%	2.43	0.000	2.43
38.385	6939.04	55.6	2.193	55.6	0.5	0.23	3.95%	General Fill	0.057	113.8	2.19	0.000	2.19	0	24	4.11%	2.8	48%	2.44	0.000	2.44
38.549	6938.88	56.7	2.214	56.7	2.8	1.20	3.91%	General Fill	0.057	113.8	2.20	0.000	2.20	0	25	4.06%	2.8	48%	2.45	0.000	2.45
38.713	6938.72	47.8	1.786	47.7	2.8	1.22	3.74%	General Fill	0.057	113.8	2.21	0.000	2.21	0	21	3.92%	2.8	48%	2.46	0.000	2.46
38.877	6938.55	39.5	1.625	39.5	4.2	1.81	4.12%	General Fill	0.057	113.8	2.22	0.000	2.22	0	17	4.36%	2.9	48%	2.47	0.000	2.47

9.10	897	1.8E-03	1.4E+03	76	0.7840	1.8E-04	19	0.236	0.236	158	42.307	8002	5491	1554	4441	0.04%	1.70	0.75	0.020%	0.003002	0.34	0.079	0.797	0.48%	0.0008
9.15	897	1.8E-03	1.4E+03	75	0.7810	1.8E-04	19	0.237	0.237	159	42.573	7984	5479	1555	4432	0.04%	1.70	0.75	0.020%	0.003007	0.34	0.079	0.797	0.48%	0.0008
9.20	897	1.8E-03	1.4E+03	74	0.7778	1.9E-04	19	0.237	0.237	160	42.840	7967	5466	1556	4424	0.04%	1.70	0.75	0.020%	0.003012	0.34	0.079	0.797	0.48%	0.0008
9.25	897	1.8E-03	1.4E+03	73	0.7747	1.9E-04	19	0.237	0.237	161	43.107	7949	5454	1557	4415	0.04%	1.70	0.75	0.020%	0.003015	0.34	0.079	0.797	0.48%	0.0008
9.30	897	1.8E-03	1.4E+03	72	0.7715	1.9E-04	19	0.237	0.238	162	43.374	7932	5442	1558	4406	0.04%	1.70	0.75	0.020%	0.003019	0.34	0.079	0.797	0.48%	0.0008
9.35	897	1.8E-03	1.4E+03	71	0.7683	1.9E-04	19	0.238	0.238	163	43.641	7914	5430	1559	4398	0.04%	1.70	0.75	0.020%	0.003021	0.34	0.079	0.797	0.48%	0.0008
9.40	897	1.8E-03	1.4E+03	70	0.7651	1.9E-04	19	0.238	0.238	164	43.908	7897	5418	1560	4389	0.04%	1.70	0.75	0.020%	0.003023	0.34	0.079	0.797	0.48%	0.0008
9.45	897	1.8E-03	1.4E+03	69	0.7618	1.9E-04	19	0.238	0.239	165	44.175	7880	5406	1561	4381	0.04%	1.70	0.75	0.020%	0.003024	0.34	0.079	0.797	0.48%	0.0008
9.50	897	1.8E-03	1.4E+03	68	0.7585	1.9E-04	19	0.239	0.239	166	44.442	7864	5394	1562	4372	0.04%	1.70	0.75	0.020%	0.003025	0.34	0.079	0.797	0.48%	0.0008
9.55	897	1.8E-03	1.4E+03	68	0.7552	1.9E-04	19	0.239	0.239	167	44.709	7847	5383	1563	4364	0.04%	1.70	0.75	0.020%	0.003025	0.34	0.079	0.797	0.48%	0.0008
9.60	897	1.8E-03	1.4E+03	67	0.7519	1.9E-04	19	0.239	0.240	168	44.976	7830	5371	1564	4356	0.04%	1.70	0.75	0.020%	0.003024	0.34	0.079	0.797	0.48%	0.0008
9.65	897	1.8E-03	1.4E+03	66	0.7485	1.9E-04	19	0.239	0.240	169	45.243	7814	5359	1565	4348	0.04%	1.70	0.75	0.020%	0.003023	0.34	0.079	0.797	0.48%	0.0008
9.70	897	1.8E-03	1.4E+03	65	0.7451	1.9E-04	19	0.240	0.240	170	45.509	7797	5348	1566	4339	0.04%	1.70	0.75	0.020%	0.003021	0.34	0.079	0.797	0.48%	0.0008
9.75	897	1.8E-03	1.4E+03	64	0.7416	1.9E-04	19	0.240	0.241	171	45.776	7781	5337	1567	4331	0.04%	1.70	0.75	0.020%	0.003019	0.34	0.079	0.797	0.48%	0.0008
9.80	897	1.8E-03	1.4E+03	63	0.7382	1.9E-04	19	0.240	0.241	172	46.043	7765	5325	1568	4323	0.04%	1.70	0.75	0.020%	0.003015	0.34	0.079	0.797	0.48%	0.0008
9.85	897	1.8E-03	1.4E+03	63	0.7347	1.9E-04	19	0.241	0.241	173	46.310	7749	5314	1569	4315	0.04%	1.70	0.75	0.020%	0.003012	0.34	0.079	0.797	0.48%	0.0008
9.90	897	1.8E-03	1.4E+03	62	0.7312	1.9E-04	19	0.241	0.241	174	46.577	7733	5303	1570	4308	0.04%	1.70	0.75	0.020%	0.003007	0.34	0.079	0.797	0.48%	0.0008
9.95	897	1.8E-03	1.4E+03	61	0.7276	1.9E-04	19	0.241	0.242	175	46.844	7717	5292	1571	4300	0.04%	1.70	0.75	0.020%	0.003002	0.34	0.079	0.797	0.48%	0.0008
10.00	897	1.8E-03	1.4E+03	60	0.7240	1.9E-04	19	0.241	0.242	176	47.111	7701	5281	1572	4292	0.04%	1.70	0.75	0.020%	0.002996	0.34	0.079	0.797	0.48%	0.0008
10.05	897	1.8E-03	1.4E+03	59	0.7204	1.9E-04	19	0.242	0.242	177	47.378	7686	5270	1573	4284	0.04%	1.70	0.75	0.020%	0.002990	0.34	0.079	0.797	0.48%	0.0008
10.10	897	1.8E-03	1.4E+03	59	0.7168	1.9E-04	19	0.242	0.243	178	47.645	7670	5259	1574	4277	0.04%	1.70	0.75	0.020%	0.002983	0.34	0.079	0.797	0.48%	0.0008
10.15	897	1.8E-03	1.4E+03	58	0.7131	1.9E-04	19	0.242	0.243	179	47.912	7655	5249	1575	4269	0.04%	1.70	0.75	0.020%	0.002975	0.34	0.079	0.797	0.47%	0.0008
10.20	897	1.8E-03	1.4E+03	57	0.7094	1.9E-04	19	0.242	0.243	180	48.178	7640	5238	1576	4261	0.04%	1.70	0.75	0.020%	0.002967	0.34	0.079	0.797	0.47%	0.0008
10.25	897	1.8E-03	1.4E+03	57	0.7057	1.9E-04	19	0.243	0.244	181	48.445	7625	5227	1577	4254	0.04%	1.70	0.75	0.020%	0.002958	0.34	0.079	0.797	0.47%	0.0008
10.30	987	1.8E-03	1.7E+03	56	0.7020	1.5E-04	19	0.243	0.244	182	48.712	7609	5217	1578	4246	0.03%	1.70	0.75	0.020%	0.001625	0.34	0.079	0.797	0.26%	0.0004
10.35	987	1.8E-03	1.7E+03	55	0.6982	1.5E-04	19	0.243	0.244	183	48.979	7595	5206	1579	4239	0.03%	1.70	0.75	0.020%	0.001618	0.34	0.079	0.797	0.26%	0.0004
10.40	987	1.8E-03	1.7E+03	55	0.6944	1.5E-04	19	0.244	0.245	184	49.246	7580	5196	1580	4232	0.03%	1.70	0.75	0.020%	0.001609	0.34	0.079	0.797	0.26%	0.0004
10.45	987	1.8E-03	1.7E+03	54	0.6906	1.5E-04	19	0.244	0.245	185	49.513	7565	5186	1581	4224	0.03%	1.70	0.75	0.020%	0.001600	0.34	0.079	0.797	0.26%	0.0004
10.50	987	1.8E-03	1.7E+03	53	0.6867	1.5E-04	19	0.244	0.245	186	49.780	7550	5175	1582	4217	0.03%	1.70	0.75	0.020%	0.001591	0.34	0.079	0.797	0.25%	0.0004
10.55	987	1.8E-03	1.7E+03	53	0.6828	1.5E-04	19	0.244	0.246	187	50.047	7536	5165	1583	4210	0.03%	1.70	0.75	0.020%	0.001581	0.34	0.079	0.797	0.25%	0.0004
10.60	987	1.8E-03	1.7E+03	52	0.6789	1.5E-04	19	0.245	0.246	188	50.314	7521	5155	1584	4203	0.03%	1.70	0.75	0.020%	0.001571	0.34	0.079	0.797	0.25%	0.0004
10.65	987	1.8E-03	1.7E+03	51	0.6750	1.5E-04	19	0.245	0.246	189	50.581	7507	5145	1585	4196	0.03%	1.70	0.75	0.020%	0.001560	0.34	0.079	0.797	0.25%	0.0004
10.70	987	1.8E-03	1.7E+03	51	0.6710	1.5E-04	19	0.245	0.246	190	50.847	7493	5135	1586	4189	0.03%	1.70	0.75	0.020%	0.001548	0.34	0.079	0.797	0.25%	0.0004
10.75	987	1.8E-03	1.7E+03	50	0.6671	1.5E-04	19	0.245	0.247	191	51.114	7478	5125	1587	4182	0.03%	1.70	0.75	0.020%	0.001536	0.34	0.079	0.797	0.24%	0.0004
10.80	987	1.8E-03	1.7E+03	50	0.6631	1.5E-04	19	0.246	0.247	192	51.381	7464	5115	1588	4175	0.03%	1.70	0.75	0.020%	0.001523	0.34	0.079	0.797	0.24%	0.0004
10.85	987	1.8E-03	1.7E+03	49	0.6590	1.5E-04	19	0.246	0.247	193	51.648	7450	5106	1589	4168	0.03%	1.70	0.75	0.020%	0.001510	0.34	0.079	0.797	0.24%	0.0004
10.90	987	1.8E-03	1.7E+03	49	0.6550	1.5E-04	19	0.246	0.248	194	51.915	7436	5096	1590	4161	0.03%	1.70	0.75	0.020%	0.001497	0.34	0.079	0.797	0.24%	0.0004
10.95	987	1.8E-03	1.7E+03	48	0.6509	1.5E-04	19	0.246	0.248	195	52.182	7423	5086	1591	4154	0.03%	1.70	0.75	0.020%	0.001483	0.34	0.079	0.797	0.24%	0.0004
11.00	987	1.8E-03	1.7E+03	48	0.6468	1.5E-04	19	0.247	0.248	196	52.449	7409	5077	1592	4147	0.03%	1.70	0.75	0.020%	0.001468	0.34	0.079	0.797	0.23%	0.0004
11.05	987	1.8E-03	1.7E+03	47	0.6427	1.5E-04	19	0.247	0.249	197	52.716	7395	5067	1593	4141	0.03%	1.70	0.75	0.020%	0.001453	0.34	0.079	0.797	0.23%	0.0004
11.10	987	1.8E-03	1.7E+03	46	0.6386	1.5E-04	19	0.247	0.249	198	52.982	7382	5058	1594	4134	0.03%	1.70	0.75	0.020%	0.001437	0.34	0.079	0.797	0.23%	0.0004
11.15	987	1.8E-03	1.7E+03	46	0.6344	1.5E-04	19	0.247	0.249	199	53.249	7368	5048	1595	4127	0.03%	1.70	0.75	0.020%	0.001421	0.34	0.079	0.797	0.23%	0.0004
11.20	987	1.8E-03	1.7E+03	45	0.6302	1.5E-04	19	0.248	0.249	200	53.516	7355	5039	1596	4121	0.03%	1.70	0.75	0.020%	0.001404	0.34	0.079	0.797	0.22%	0.0004
11.25	987	1.8E-03	1.7E+03	45	0.6260	1.5E-04	19	0.248	0.250	201	53.783	7341	5029	1597	4114	0.03%	1.70	0.75	0.020%	0.001387	0.34	0.079	0.797	0.22%	0.0004
11.30	987	1.8E-03	1.7E+03	44	0.6218	1.5E-04	19	0.248	0.250	202	54.050	7328	5020	1598	4108	0.03%	1.70	0.75	0.020%	0.001369	0.34	0.079	0.797	0.22%	0.0004
11.35	987	1.8E-03	1.7E+03	44	0.6176	1.5E-04	19	0.248	0.250	203	54.317	7315	5011	1599	4101	0.03%	1.70	0.75	0.020%	0.001350	0.34	0.079	0.797	0.22%	0.0004
11.40	987	1.8E-03	1.7E+03	44	0.6133	1.5E-04	19	0.249	0.251	204	54.584	7302	5002	1600	4095	0.03%	1.70	0.75	0.020%	0.001331	0.34	0.079	0.797	0.21%	0.0003
11.45	987	1.8E-03	1.7E+03	43	0.6090	1.5E-04	19	0.249	0.251	205	54.851	7289	4993	1601	4088	0.03%	1.70	0.75	0.020%	0.001312	0.34	0.079	0.797	0.21%	0.0003
11.50	987	1.8E-03	1.7E+03	43	0.6047	1.5E-04	19	0.249	0.251	206	55.118	7276	4984	1602	4082	0.03%	1.70	0.75	0.020%	0.001292	0.34	0.079	0.797	0.21%	0.0003
11.55	987	1.8E-03	1.7E+03	42	0.6004	1.5E-04	19	0.249	0.251	207	55.384	7263	4975	1603	4076	0.03%	1.70	0.75	0.020%	0.001271	0.34	0.079	0.797	0.20%	0.0003
11.60	987	1.8E-03	1.7E+03	42	0.5961	1.5E-04	19	0.250	0.252	208	55.651	7251	4966	1604	4069	0.03%	1.70	0.75	0.020%	0.001250	0.34	0.079	0.797	0.20%	0.0003
11.65	987	1.8E-03	1.7E+03	41	0.5917	1.5E-04	19	0.250	0.252	209	55.918	7238	4957	1605	4063	0.03%	1.70	0.75	0.020%	0.001229	0.34	0.079	0.797	0.20%	0.0003
11.70	987	1.8E-03	1.7E+03	41	0.5874	1.5E-04	19	0.250	0.252	210	56.185	7225	4948	1606	4057	0.03%	1.70	0.75	0.020%	0.001207	0.34	0.079	0.797	0.19%	0.0003
11.75	987	1.8E-03	1.7E+03	40	0.5830	1.5E-04	19	0.250	0.253	211	56.452	7213	4940	1607	4051	0.03%	1.70	0.75	0.020%	0.001184	0.34	0.079	0.797	0.19%	0.0003
11.80	987	1.8E-03	1.7E+03	40	0.5786	1.5E-04	19	0.251	0.253	212	56.719	7200	4931	1608	4045	0.03%	1.70	0.75	0.020%	0.001161	0.34	0.079	0.797	0.19%	0.0003
11.85	918	1.8E-03	1.5E+03	40	0.5742	1.7E-04	19	0.251	0.253	213	56.986	7188	4922	1609	4039	0.03%	1.70	0.75	0.020%	0.002036	0.34	0.079	0.797	0.32%	0.0005
11.90	918	1.8E-03	1.5E+03	39	0.5698	1.7E-04	19	0.251	0.253	214	57.253	7176	4914	1610	4033	0.03%	1.70	0.75	0.020%	0.002009	0.34	0.079	0.797	0.32%	0.0005
11.95	918	1.8E-03	1.5E+03	39	0.5654	1.7E-04	19	0.251	0.254	215	57.519	7163	4905	1611	4027	0.03%	1.70	0.75	0.020%	0.001981	0.34	0.079	0.797	0.32%	0.0005
12.00	918	1.8E-03	1.5E+03	38	0.5609	1.7E-04	19	0.252	0.254	216	57.786	7151	4897	1612	4021	0.03%	1.70	0.75	0.020%	0.001953	0.34	0.079	0.797	0.31%	0.0005
12.05	918	1.8E-03	1.5E+03	38	0.5565	1.7E-04	19	0.252	0.254	217	58.053	7139	4888	1613	4015	0.03%	1.70	0.75	0.020%	0.001924	0.34	0.079	0.797	0.31%	0.0005
12.10	918	1.8E-03	1.5E+03	38	0.5520	1.6E-04	19	0.252	0.255	218	58.320	7127	4880	1614	4009	0.03%	1.70	0.75	0.020%	0.001895	0.34	0.079	0.797	0.30%	0.0005
12.15	918	1.8E-03	1.5E+03	37	0.5475	1.6E-04	19	0.252	0.255	219	58.587	7115	4872	1615	4003	0.03%	1.70	0.75	0.020%	0.001866	0.34	0.079	0.797	0.30%	0.0005
12.20	918	1.8E-03	1.5E+03	37	0.5430	1.6E-04	19	0.253	0.255	220	58.854	7103	4863	1616	3997	0.03%	1.70	0.75	0.020%	0.001836	0.34	0.079	0.797	0.29%	0.0005
12.25	918	1.8E-03	1.5E+03	37	0.5385	1.6E-04	19	0.253	0.255	221	59.121	7092	4855	1617	3992	0.03%	1.70	0.75	0.020%	0.001805	0.34	0.079	0.797	0.29%	0.0005
12.30	918	1.8E-03	1.5E+03	36	0.5340	1.6E-04	19	0.253	0.256	222	59.387	7080	4847	1618	3986	0.03%	1.70	0.75	0.020%	0.001774	0.34	0.079	0.797	0.28%	0.0005
12.35	918	1.8E-03	1.5E+03	36	0.5295	1.6E-04	19	0.253	0.256	223	59.654	7068	4839	1619	3980	0.03%	1.70	0.75	0.020%	0.001743	0.34	0.079	0.797	0.28%	0.0005
12.40	918	1.8E-03	1.5E+03	36	0.5250	1.6E-04	19	0.254	0.256	224	59.921	7056	4831	1620	3974	0.03%	1.70	0.75	0.020%	0.001711	0.34	0.079	0.797	0.27%	0.0004
12.45	918	1.8E-03	1.5E+03	35	0.5204	1.6E-04	19	0.254	0.256	225	60.188	7045	4822	1621	3969	0.03%	1.70	0.75	0.020%	0.001679	0.34	0.079	0.797	0.27%	0.0004
12.50	918	1.8E-03	1.5E+03	35	0.5159	1.6E-04	19	0.254	0.257	226	60.455	7033	4814	1622	3963	0.03%	1.70	0.75	0.020%	0.001646	0.34	0.079	0.797	0.26%	0.0004
12.55	918	1.8E-03	1.5E+03	35	0.5114	1.6E-04	19	0.254	0.257	227	60.722	7022	4806	1623	3958	0.03%	1.70	0.75	0.020%	0.001613	0.34	0.079	0.797	0.26%	0.0004
12.60	918	1.8E-03	1.5E+03	34	0.5068	1.6E-04	19	0.255	0.257	228	60.989	7011	4799	1624	3952	0.03%	1.70	0.75	0.020%	0.001579	0.34	0.079	0.797	0.25%	0.0004
12.65	918	1.8E-03	1.5E+03	34	0.5023	1.6E-04	19	0.255	0.258	229	61.256	6999	4791	1625	3947	0.03%	1.70	0.75	0.020%	0.001544	0.34	0.079	0.797	0.25%	0.0004
12.70	918	1.8E-03	1.5E+03	34	0.4977	1.6E-04	19	0.255	0.258	230	61.522	6988	4783	1626	3941	0.03%	1.70	0.75	0.020%	0.001510	0.34	0.079	0.797	0.24%	0.0004
12.75	918	1.8E-03	1.5E+03	33	0.4932	1.5E-04	19	0.255	0.258	231	61.789	6977	4775	1627	3936	0.03%	1.70	0.75	0.020%	0.001475	0.34	0.079	0.797	0.24%	0.0004
12.80	918	1.8E-03	1.5E+03	33	0.4886	1.5E-04	19	0.255	0.258	232	62.056	6966	4767	1628	3930	0.03%	1.70	0.75	0.020%	0.001439	0.34	0.079	0.797	0.23%	0.0004
12.85	918	1.8E-03	1.5E+03	33	0.4841	1.5E-04	19	0.256	0.259	233	62.323	6955	4760	1629	3925	0.03%	1.70	0.75	0.020%	0.001403	0.34	0.079	0.797	0.22%	0.0004
12.90	918	1.8E-03	1.5E+03	33	0.4795	1.5E-04	19	0.256	0.259	234	62.590	6944	4752	1630	3919	0.03%	1.70	0.75	0.020%	0.001366	0.34	0.079	0.797	0.22%	0.0004
12.95	918	1.8E-03	1.5E+03	32	0.4749	1.5E-04	19	0.256	0.259	235	62.857	6933	4744	1631	3914	0.03%	1.70	0.75	0.020%	0.001329	0.34	0.079	0.797	0.21%	0.0003
13.00	918	1.8E-03	1.5E+03	32	0.4704	1.5E-04	19	0.256	0.259	236	63.124	6922	4737	1632	3909	0.03%	1.70	0.75	0.020%	0.001291	0.34	0.079	0.797	0.21%	0.0003
13.05	918	1.8E-03	1.5E+03	32	0.4658	1.5E-04	19	0.257	0.260	237	63.390	6911	4729	1633	3904	0.03%	1.70	0.75	0.020%	0.001253	0.34	0.079	0.797	0.20%	0.0003
13.10	918	1.8E-03	1.5E+03	32	0.4613	1.5E-04	19	0.257	0.260	238	63.657	6901	4722	1634	3898	0.03%	1.70	0.75	0.020%	0.001215	0.34	0.079	0.797	0.19%	0.0003
13.15	918	1.8E-03	1.5E+03	31	0.4567	1.5E-04	19	0.257	0.260	239	63.924	6890	4714	1635	3893	0.03%	1.70	0.75	0.020%	0.001175	0.34	0.079	0.797	0.19%	0.0003

39.042	6938.39	36.7	1.507	36.7	3.3	1.44	4.10%	General Fill	0.057	113.8	2.23	0.000	2.23	0	15	4.37%	2.9	48%	2.48	0.000	2.48
39.206	6938.22	37.9	1.421	37.9	3.3	1.42	3.75%	General Fill	0.057	113.8	2.24	0.000	2.24	0	16	3.98%	2.9	48%	2.49	0.000	2.49
39.370	6938.06	36.3	1.375	36.3	2.2	0.96	3.79%	General Fill	0.057	113.8	2.25	0.000	2.25	0	15	4.04%	2.9	48%	2.50	0.000	2.50
39.534	6937.90	38.1	1.361	38.1	2.7	1.16	3.58%	General Fill	0.057	113.8	2.26	0.000	2.26	0	16	3.80%	2.9	48%	2.51	0.000	2.51
39.698	6937.73	45.3	1.490	45.3	2.4	1.02	3.29%	General Fill	0.057	113.8	2.27	0.000	2.27	0	19	3.47%	2.8	48%	2.52	0.000	2.52
39.862	6937.57	46.0	1.458	46.0	2.4	1.04	3.17%	General Fill	0.057	113.8	2.28	0.000	2.28	0	19	3.34%	2.8	48%	2.53	0.000	2.53
40.026	6937.40	37.9	1.662	37.9	2.2	0.96	4.39%	General Fill	0.057	113.8	2.29	0.000	2.29	0	16	4.67%	3.0	48%	2.54	0.000	2.54
40.190	6937.24	34.3	1.625	34.3	2.5	1.08	4.74%	General Fill	0.057	113.8	2.30	0.000	2.30	0	14	5.08%	3.0	48%	2.55	0.000	2.55
40.354	6937.08	36.5	1.530	36.5	2.4	1.04	4.19%	General Fill	0.057	113.8	2.30	0.000	2.30	0	15	4.47%	3.0	48%	2.56	0.000	2.56
40.518	6936.91	38.6	1.514	38.6	3.1	1.36	3.92%	General Fill	0.057	113.8	2.31	0.000	2.31	0	16	4.17%	2.9	48%	2.57	0.000	2.57
40.682	6936.75	40.1	1.406	40.1	2.7	1.16	3.51%	General Fill	0.057	113.8	2.32	0.000	2.32	0	16	3.72%	2.9	48%	2.57	0.000	2.57
40.846	6936.58	45.4	1.394	45.4	2.8	1.22	3.07%	General Fill	0.057	113.8	2.33	0.000	2.33	0	18	3.24%	2.8	48%	2.58	0.000	2.58
41.010	6936.42	43.1	1.454	43.1	2.6	1.12	3.37%	General Fill	0.057	113.8	2.34	0.000	2.34	0	17	3.57%	2.8	48%	2.59	0.000	2.59
41.174	6936.26	36.9	1.481	36.8	2.2	0.94	4.02%	General Fill	0.057	113.8	2.35	0.000	2.35	0	15	4.29%	3.0	48%	2.60	0.000	2.60
41.338	6936.09	30.0	1.456	30.0	2.7	1.16	4.85%	General Fill	0.057	113.8	2.36	0.000	2.36	0	12	5.26%	3.1	48%	2.61	0.000	2.61
41.502	6935.93	24.0	1.284	24.0	3.0	1.28	5.35%	General Fill	0.057	113.8	2.37	0.000	2.37	0	9	5.94%	3.2	48%	2.62	0.000	2.62
41.666	6935.76	24.9	1.103	24.9	3.9	1.71	4.43%	General Fill	0.057	113.8	2.38	0.000	2.38	0	9	4.90%	3.1	48%	2.63	0.000	2.63
41.830	6935.60	30.8	1.070	30.7	5.1	2.20	3.48%	General Fill	0.057	113.8	2.39	0.000	2.39	0	12	3.77%	3.0	48%	2.64	0.000	2.64
41.994	6935.44	40.2	1.115	40.2	4.7	2.03	2.78%	General Fill	0.057	113.8	2.40	0.000	2.40	0	16	2.95%	2.8	48%	2.65	0.000	2.65
42.158	6935.27	27.8	1.095	27.8	3.4	1.46	3.94%	General Fill	0.057	113.8	2.41	0.000	2.41	0	11	4.31%	3.1	48%	2.66	0.000	2.66
42.322	6935.11	23.4	1.016	23.4	3.4	1.46	4.34%	General Fill	0.057	113.8	2.42	0.000	2.42	0	9	4.84%	3.2	48%	2.67	0.000	2.67
42.486	6934.94	17.1	0.778	17.1	2.8	1.22	4.55%	General Fill	0.057	113.8	2.43	0.000	2.43	0	6	5.30%	3.3	48%	2.68	0.000	2.68
42.650	6934.78	7.8	0.469	7.8	2.4	1.02	6.02%	General Fill	0.057	113.8	2.43	0.000	2.43	0	2	8.75%	3.8	48%	2.69	0.000	2.69
42.814	6934.62	7.0	0.165	7.0	3.4	1.49	2.35%	General Fill	0.057	113.8	2.44	0.000	2.44	0	2	3.60%	3.7	48%	2.70	0.000	2.70
42.978	6934.45	6.1	0.088	6.1	4.9	2.14	1.44%	General Fill	0.057	113.8	2.45	0.000	2.45	0	1	2.42%	3.7	48%	2.71	0.000	2.71
43.143	6934.29	6.4	0.064	6.3	6.6	2.87	1.01%	General Fill	0.057	113.8	2.46	0.000	2.46	0	2	1.65%	3.6	48%	2.71	0.000	2.71
43.307	6934.12	6.1	0.056	6.1	9.3	4.05	0.92%	General Fill	0.057	113.8	2.47	0.000	2.47	0	1	1.54%	3.6	48%	2.72	0.000	2.72
43.471	6933.96	6.6	0.054	6.5	12.4	5.37	0.82%	General Fill	0.057	113.8	2.48	0.000	2.48	0	2	1.32%	3.5	48%	2.73	0.000	2.73
43.635	6933.80	6.8	0.062	6.7	15.7	6.79	0.91%	General Fill	0.057	113.8	2.49	0.000	2.49	0	2	1.44%	3.5	48%	2.74	0.000	2.74
43.799	6933.63	7.7	0.068	7.3	52.7	22.82	0.89%	General Fill	0.057	113.8	2.50	0.000	2.50	0	2	1.32%	3.4	48%	2.75	0.000	2.75
43.963	6933.47	8.3	0.087	7.9	59.1	25.60	1.05%	General Fill	0.057	113.8	2.51	0.000	2.51	0	2	1.51%	3.4	48%	2.76	0.000	2.76
44.127	6933.30	9.0	0.095	8.5	68.2	29.55	1.06%	General Fill	0.057	113.8	2.52	0.000	2.52	0	3	1.47%	3.4	48%	2.77	0.000	2.77
44.291	6933.14	8.7	0.099	8.2	81.6	35.34	1.13%	General Fill	0.057	113.8	2.53	0.000	2.53	0	2	1.60%	3.4	48%	2.78	0.000	2.78
44.455	6932.98	8.5	0.095	7.9	92.9	40.27	1.12%	General Fill	0.057	113.8	2.54	0.000	2.54	0	2	1.60%	3.4	48%	2.79	0.000	2.79
44.619	6932.81	9.1	0.098	8.5	103.8	44.96	1.07%	General Fill	0.057	113.8	2.55	0.004	2.54	1	3	1.49%	3.4	48%	2.80	0.004	2.80
44.783	6932.65	9.6	0.106	8.9	115.0	49.82	1.11%	General Fill	0.057	113.8	2.56	0.009	2.55	1	3	1.51%	3.3	48%	2.81	0.009	2.80
44.947	6932.48	10.3	0.140	9.5	125.6	54.44	1.36%	General Fill	0.057	113.8	2.57	0.014	2.55	1	3	1.81%	3.3	48%	2.82	0.014	2.80
45.111	6932.32	10.6	0.141	9.7	140.1	60.72	1.33%	General Fill	0.057	113.8	2.57	0.019	2.56	1	3	1.76%	3.3	48%	2.83	0.019	2.81
45.275	6932.15	11.5	0.162	10.5	161.3	69.89	1.41%	General Fill	0.057	113.8	2.58	0.024	2.56	1	3	1.83%	3.3	48%	2.84	0.024	2.81
45.439	6931.99	11.6	0.215	10.5	179.2	77.64	1.85%	General Fill	0.057	113.8	2.59	0.029	2.56	1	4	2.38%	3.3	48%	2.85	0.029	2.82
45.603	6931.83	11.6	0.223	10.5	165.2	71.58	1.93%	Fine Tailings	0.054	107.6	2.60	0.034	2.57	1	3	2.49%	3.3	83%	2.85	0.034	2.82
45.767	6931.66	11.5	0.211	10.5	170.6	73.94	1.83%	Fine Tailings	0.054	107.6	2.61	0.040	2.57	1	3	2.37%	3.3	83%	2.86	0.040	2.82
45.931	6931.50	11.6	0.226	10.4	186.7	80.92	1.96%	Fine Tailings	0.054	107.6	2.62	0.045	2.58	1	3	2.53%	3.3	83%	2.87	0.045	2.83
46.095	6931.33	11.2	0.204	9.9	195.9	84.90	1.83%	Fine Tailings	0.054	107.6	2.63	0.050	2.58	1	3	2.39%	3.4	83%	2.88	0.050	2.83
46.259	6931.17	11.4	0.160	10.2	189.8	82.26	1.41%	Fine Tailings	0.054	107.6	2.64	0.055	2.58	1	3	1.83%	3.3	83%	2.89	0.055	2.83
46.423	6931.01	12.4	0.164	11.2	207.6	89.96	1.32%	Fine Tailings	0.054	107.6	2.65	0.060	2.59	1	4	1.67%	3.2	83%	2.90	0.060	2.84
46.587	6930.84	13.8	0.292	12.4	222.1	96.25	2.11%	Fine Tailings	0.054	107.6	2.66	0.065	2.59	1	4	2.62%	3.3	83%	2.91	0.065	2.84
46.751	6930.68	18.8	0.393	18.0	122.6	53.14	2.09%	Fine Tailings	0.054	107.6	2.66	0.070	2.59	1	6	2.43%	3.1	83%	2.92	0.070	2.85
46.915	6930.51	15.5	0.317	14.4	183.4	79.49	2.04%	Fine Tailings	0.054	107.6	2.67	0.075	2.60	1	5	2.46%	3.2	83%	2.92	0.075	2.85
47.079	6930.35	15.2	0.169	13.6	259.6	#####	1.11%	Fine Tailings	0.054	107.6	2.68	0.080	2.60	1	5	1.35%	3.1	83%	2.93	0.080	2.85
47.244	6930.19	15.8	0.164	14.2	270.2	#####	1.04%	Fine Tailings	0.054	107.6	2.69	0.086	2.61	1	5	1.25%	3.1	83%	2.94	0.086	2.86
47.408	6930.02	16.8	0.209	15.0	292.3	#####	1.24%	Fine Tailings	0.054	107.6	2.70	0.091	2.61	1	5	1.48%	3.1	83%	2.95	0.091	2.86
47.572	6929.86	18.1	0.233	16.1	312.3	#####	1.29%	Fine Tailings	0.054	107.6	2.71	0.096	2.61	1	6	1.52%	3.0	83%	2.96	0.096	2.86
47.736	6929.69	18.7	0.236	16.6	325.0	#####	1.26%	Fine Tailings	0.054	107.6	2.72	0.101	2.62	1	6	1.48%	3.0	83%	2.97	0.101	2.87
47.900	6929.53	19.5	0.247	17.5	320.4	#####	1.27%	Fine Tailings	0.054	107.6	2.73	0.106	2.62	1	6	1.48%	3.0	83%	2.98	0.106	2.87
48.064	6929.37	18.5	0.268	16.5	316.4	#####	1.45%	Fine Tailings	0.054	107.6	2.73	0.111	2.62	1	6	1.70%	3.1	83%	2.99	0.111	2.88
48.228	6929.20	20.1	0.311	17.9	356.7	#####	1.55%	Fine Tailings	0.054	107.6	2.74	0.116	2.63	1	7	1.79%	3.0	83%	3.00	0.116	2.88
48.392	6929.04	16.8	0.391	15.0	275.0	#####	2.33%	Fine Tailings	0.054	107.6	2.75	0.121	2.63	1	5	2.79%	3.2	83%	3.00	0.121	2.88
48.556	6928.87	15.0	0.412	13.5	249.3	#####	2.75%	Fine Tailings	0.054	107.6	2.76	0.127	2.63	1	5	3.36%	3.3	83%	3.01	0.127	2.89
48.720	6928.71	16.1	0.364	14.4	269.7	#####	2.26%	Fine Tailings	0.054	107.6	2.77	0.132	2.64	1	5	2.73%	3.2	83%	3.02	0.132	2.89
48.884	6928.55	15.5	0.340	14.0	245.2	#####	2.19%	Fine Tailings	0.054	107.6	2.78	0.137	2.64	1	5	2.67%	3.2	83%	3.03	0.137	2.89
49.048	6928.38	14.5	0.364	13.1	235.4	#####	2.50%	Fine Tailings	0.054	107.6	2.79	0.142	2.65	1	4	3.10%	3.3	83%	3.04	0.142	2.90
49.212	6928.22	13.9	0.345	12.6	209.7	90.88	2.49%	Fine Tailings	0.054	107.6	2.80	0.147	2.65	1	4	3.12%	3.3	83%	3.05	0.147	2.90
49.376	6928.05	13.5	0.324	12.2	202.6	87.81	2.40%	Fine Tailings	0.054	107.6	2.81	0.152	2.65	1	4	3.03%	3.3	83%	3.06	0.152	2.91
49.540	6927.89	12.2	0.315	10.9	202.2	87.62	2.59%	Fine Tailings	0.054	107.6	2.81	0.157	2.66	1	4	3.37%	3.4	83%	3.07	0.157	2.91
49.704	6927.73	12.5	0.319	11.2	202.5	87.77	2.56%	Fine Tailings	0.054	107.6	2.82	0.162	2.66	1	4	3.30%	3.4	83%	3.07	0.162	2.91
49.868	6927.56	12.6	0.307	11.3	206.1	89.31	2.44%	Fine Tailings	0.054	107.6	2.83	0.167	2.66	1	4	3.15%	3.4	83%	3.08	0.167	2.92
50.032	6927.40	13.1	0.334	11.8	204.5	88.62	2.56%	Fine Tailings	0.054	107.6	2.84	0.173	2.67	1	4	3.27%	3.4	83%	3.09	0.173	2.92
50.196	6927.23	13.9	0.358	12.7	200.5	86.87	2.57%	Fine Tailings	0.054	107.6	2.85	0.178	2.67	1	4	3.23%	3.3	83%	3.10	0.178	2.92
50.360	6927.07	14.2	0.369	12.9	209.8	90.90	2.59%	Fine Tailings	0.054	107.6	2.86	0.183	2.68	1	4	3.24%	3.3	83%	3.11	0.183	2.93
50.524	6926.91	14.3	0.368	13.0	213.5	92.51	2.57%	Fine Tailings	0.054	107.6	2.87	0.188	2.68	1	4	3.21%	3.3	83%	3.12	0.188	2.93
50.688	6926.74	13.6	0.372	12.3	210.7	91.31	2.73%	Fine Tailings	0.054	107.6	2.88	0.193	2.68	1	4	3.46%	3.4	83%	3.13	0.193	2.93
50.852	6926.58	13.5	0.365	12.2	205.0	88.85	2.70%	Fine Tailings	0.054	107.6	2.88	0.198	2.69	1	4	3.43%	3.4	83%	3.14	0.198	2.94
51.016	6926.41	13.8	0.358	12.4	215.9	93.54	2.60%	Fine Tailings	0.054	107.6	2.89	0.203	2.69	1	4	3.29%	3.3	83%	3.15	0.203	2.94
51.180	6926.25	14.1	0.345	12.8	213.5	92.51	2.44%	Fine Tailings	0.054	107.6	2.90	0.208	2.69	1	4	3.07%	3.3	83%	3.15	0.208	2.95
51.345	6926.09	14.1	0.366	12.8	217.8	94.36	2.59%	Fine Tailings	0.054	107.6	2.91	0.214	2.70	1	4	3.27%	3.3	83%	3.16	0.214	2.95
51.509	6925.92	14.3	0.372	12.9	231.0	#####	2.60%	Fine Tailings	0.054	107.6	2.92	0.219	2.70	1	4	3.27%	3.3	83%	3.17	0.219	2.95
51.673	6925.76	14.4	0.384	12.9	229.7	99.52	2.67%	Fine Tailings	0.054	107.6	2.93	0.224	2.71	1	4	3.36%	3.3	83%	3.18	0.224	2.96
51.837	6925.59	14.9	0.395	13.3	246.7	#####	2.66%	Fine Tailings	0.054	107.6	2.94	0.229	2.71	1	4	3.31%	3.3	83%	3.19	0.229	2.96
52.001	6925.43	16.1	0.433	14.6	241.5	#####	2.69%	Fine Tailings	0.054	107.6	2.95	0.234	2.71	1	5	3.29%	3.3	83%	3.20	0.234	2.96
52.165	6925.27	19.4	0.543	18.0	220.4	95.52	2.80%	Fine Tailings	0.054	107.6	2.96	0.239	2.72	1	6	3.30%	3.2	83%	3.21	0.239	2.97
52.329	6925.10	20.7	0.636	19.8	146.1	63.31	3.08%	Fine Tailings	0.054	107.6	2.96	0.244	2.72	1	7	3.59%	3.2	83%	3.22	0.244	2.97
52.493	6924.94	21.4	0.788	20.1	208.1	90.17	3.69%	Fine Tailings	0.054	107.6	2.97	0.249	2.72	1	7	4.28%	3.2	83%	3.23	0.249	2.98
52.657	6924.77	23.1	0.866	21.7	213.1	92.33	3.76%	Fine Tailings	0.054	107.6	2.98	0.254	2.73	1	7	4.31%	3.2	83%	3.23	0.254	2.98

13.20	918	1.8E-03	1.5E+03	31	0.4522	1.5E-04	19	0.257	0.260	240	64.191	6879	4707	1636	3888	0.03%	1.70	0.75	0.020%	0.001136	0.34	0.079	0.797	0.18%	0.0003
13.25	918	1.8E-03	1.5E+03	31	0.4476	1.5E-04	19	0.257	0.261	241	64.458	6869	4699	1637	3883	0.03%	1.70	0.75	0.020%	0.001096	0.34	0.079	0.797	0.17%	0.0003
13.30	918	1.8E-03	1.5E+03	31	0.4431	1.5E-04	19	0.258	0.261	242	64.725	6858	4692	1638	3878	0.03%	1.70	0.75	0.020%	0.001055	0.34	0.079	0.797	0.17%	0.0003
13.35	829	1.8E-03	1.2E+03	30	0.4385	1.8E-04	19	0.258	0.261	243	64.992	6848	4685	1639	3873	0.03%	1.70	0.75	0.020%	0.002278	0.34	0.079	0.797	0.36%	0.0006
13.40	829	1.8E-03	1.2E+03	30	0.4340	1.8E-04	19	0.258	0.261	244	65.258	6837	4678	1640	3868	0.03%	1.70	0.75	0.020%	0.002229	0.34	0.079	0.797	0.36%	0.0006
13.45	829	1.8E-03	1.2E+03	30	0.4295	1.7E-04	19	0.258	0.262	245	65.525	6827	4670	1641	3862	0.03%	1.70	0.75	0.020%	0.002181	0.34	0.079	0.797	0.35%	0.0006
13.50	829	1.8E-03	1.2E+03	30	0.4249	1.7E-04	19	0.259	0.262	246	65.792	6817	4663	1642	3857	0.03%	1.70	0.75	0.020%	0.002132	0.34	0.079	0.797	0.34%	0.0006
13.55	829	1.8E-03	1.2E+03	29	0.4204	1.7E-04	19	0.259	0.262	247	66.059	6806	4656	1643	3853	0.03%	1.70	0.75	0.020%	0.002083	0.34	0.079	0.797	0.33%	0.0005
13.60	829	1.8E-03	1.2E+03	29	0.4159	1.7E-04	19	0.259	0.262	248	66.326	6796	4649	1644	3848	0.03%	1.70	0.75	0.020%	0.002033	0.34	0.079	0.797	0.32%	0.0005
13.65	829	1.8E-03	1.2E+03	29	0.4114	1.7E-04	19	0.259	0.263	249	66.593	6786	4642	1645	3843	0.03%	1.70	0.75	0.020%	0.001983	0.34	0.079	0.797	0.32%	0.0005
13.70	829	1.8E-03	1.2E+03	29	0.4070	1.7E-04	19	0.259	0.263	250	66.860	6776	4635	1646	3838	0.03%	1.70	0.75	0.020%	0.001933	0.34	0.079	0.797	0.31%	0.0005
13.75	829	1.8E-03	1.2E+03	28	0.4025	1.7E-04	19	0.260	0.263	251	67.126	6766	4628	1647	3833	0.03%	1.70	0.75	0.020%	0.001883	0.34	0.079	0.797	0.30%	0.0005
13.80	829	1.8E-03	1.2E+03	28	0.3980	1.7E-04	19	0.260	0.264	252	67.393	6756	4621	1648	3828	0.03%	1.70	0.75	0.020%	0.001832	0.34	0.079	0.797	0.29%	0.0005
13.85	829	1.8E-03	1.2E+03	28	0.3936	1.6E-04	19	0.260	0.264	253	67.660	6746	4614	1649	3823	0.03%	1.70	0.75	0.020%	0.001781	0.34	0.079	0.797	0.28%	0.0005
13.90	829	1.8E-03	1.2E+03	28	0.3891	1.6E-04	19	0.260	0.264	254	67.927	6736	4607	1650	3818	0.03%	1.70	0.75	0.020%	0.001730	0.34	0.079	0.797	0.28%	0.0005
13.95	829	1.8E-03	1.2E+03	28	0.3847	1.6E-04	19	0.261	0.264	255	68.194	6726	4600	1651	3814	0.03%	1.70	0.75	0.020%	0.001678	0.34	0.079	0.797	0.27%	0.0004
14.00	829	1.8E-03	1.2E+03	27	0.3803	1.6E-04	19	0.261	0.265	256	68.461	6716	4593	1652	3809	0.03%	1.70	0.75	0.020%	0.001627	0.34	0.079	0.797	0.26%	0.0004
14.05	829	1.8E-03	1.2E+03	27	0.3759	1.6E-04	19	0.261	0.265	257	68.727	6707	4586	1653	3804	0.03%	1.70	0.75	0.020%	0.001574	0.34	0.079	0.797	0.25%	0.0004
14.10	829	1.8E-03	1.2E+03	27	0.3715	1.6E-04	19	0.261	0.265	258	68.994	6697	4580	1654	3799	0.03%	1.70	0.75	0.020%	0.001522	0.34	0.079	0.797	0.24%	0.0004
14.15	829	1.8E-03	1.2E+03	27	0.3671	1.6E-04	19	0.261	0.265	259	69.261	6687	4573	1655	3795	0.03%	1.70	0.75	0.020%	0.001469	0.34	0.079	0.797	0.23%	0.0004
14.20	829	1.8E-03	1.2E+03	27	0.3628	1.6E-04	19	0.262	0.265	260	69.528	6678	4566	1656	3790	0.03%	1.70	0.75	0.020%	0.001416	0.34	0.079	0.797	0.23%	0.0004
14.25	829	1.8E-03	1.2E+03	27	0.3584	1.5E-04	19	0.262	0.266	261	69.795	6668	4560	1657	3786	0.03%	1.70	0.75	0.020%	0.001362	0.34	0.079	0.797	0.22%	0.0004
14.30	829	1.8E-03	1.2E+03	26	0.3541	1.5E-04	19	0.262	0.266	262	70.062	6659	4553	1658	3781	0.03%	1.70	0.75	0.020%	0.001309	0.34	0.079	0.797	0.21%	0.0003
14.35	829	1.8E-03	1.2E+03	26	0.3498	1.5E-04	19	0.262	0.266	263	70.329	6649	4546	1659	3776	0.03%	1.70	0.75	0.020%	0.001254	0.34	0.079	0.797	0.20%	0.0003
14.40	829	1.8E-03	1.2E+03	26	0.3455	1.5E-04	19	0.262	0.266	264	70.595	6640	4540	1660	3772	0.03%	1.70	0.75	0.020%	0.001199	0.34	0.079	0.797	0.19%	0.0003
14.45	829	1.8E-03	1.2E+03	26	0.3412	1.5E-04	19	0.263	0.267	265	70.862	6630	4533	1661	3767	0.03%	1.70	0.75	0.020%	0.001144	0.34	0.079	0.797	0.18%	0.0003
14.50	829	1.8E-03	1.2E+03	26	0.3370	1.5E-04	19	0.263	0.267	266	71.129	6621	4527	1662	3763	0.03%	1.70	0.75	0.020%	0.001088	0.34	0.079	0.797	0.17%	0.0003
14.55	829	1.8E-03	1.2E+03	26	0.3327	1.5E-04	19	0.263	0.267	267	71.396	6612	4520	1663	3758	0.03%	1.70	0.75	0.020%	0.001032	0.34	0.079	0.797	0.16%	0.0003
14.60	829	1.8E-03	1.2E+03	25	0.3285	1.4E-04	19	0.263	0.267	268	71.663	6602	4514	1664	3754	0.02%	1.70	0.75	0.020%	0.000975	0.34	0.079	0.797	0.16%	0.0003
14.65	829	1.8E-03	1.2E+03	25	0.3243	1.4E-04	19	0.263	0.268	269	71.930	6593	4507	1665	3749	0.02%	1.70	0.75	0.020%	0.000917	0.34	0.079	0.797	0.15%	0.0002
14.70	829	1.8E-03	1.2E+03	25	0.3202	1.4E-04	19	0.264	0.268	270	72.196	6584	4501	1666	3745	0.02%	1.70	0.75	0.020%	0.000859	0.34	0.079	0.797	0.14%	0.0002
14.75	829	1.8E-03	1.2E+03	25	0.3160	1.4E-04	19	0.264	0.268	271	72.463	6575	4495	1667	3741	0.02%	1.70	0.75	0.020%	0.000800	0.34	0.079	0.797	0.13%	0.0002
14.80	829	1.8E-03	1.2E+03	25	0.3119	1.4E-04	19	0.264	0.268	272	72.730	6566	4488	1668	3736	0.02%	1.70	0.75	0.020%	0.000739	0.34	0.079	0.797	0.12%	0.0002
14.85	829	1.8E-03	1.2E+03	25	0.3078	1.4E-04	19	0.264	0.269	273	72.997	6557	4482	1669	3732	0.02%	1.70	0.75	0.020%	0.000678	0.34	0.079	0.797	0.11%	0.0002
14.90	648	1.8E-03	7.4E+02	25	0.3037	2.2E-04	19	0.264	0.269	274	73.264	6552	4478	1670	3729	0.05%	1.70	0.75	0.020%	0.003971	0.34	0.079	0.797	0.63%	0.0010
14.95	648	1.8E-03	7.4E+02	24	0.2996	2.2E-04	19	0.265	0.269	275	73.531	6548	4476	1671	3728	0.05%	1.70	0.75	0.020%	0.003879	0.34	0.079	0.797	0.62%	0.0010
15.00	648	1.8E-03	7.4E+02	24	0.2956	2.2E-04	19	0.265	0.269	276	73.797	6543	4473	1672	3726	0.05%	1.70	0.75	0.020%	0.003788	0.34	0.079	0.797	0.60%	0.0010
15.05	648	1.8E-03	7.4E+02	24	0.2916	2.2E-04	19	0.265	0.269	277	74.064	6539	4470	1673	3724	0.05%	1.70	0.75	0.020%	0.003697	0.34	0.079	0.797	0.59%	0.0010
15.10	648	1.8E-03	7.4E+02	24	0.2876	2.1E-04	19	0.265	0.269	278	74.331	6535	4467	1674	3722	0.05%	1.70	0.75	0.020%	0.003606	0.34	0.079	0.797	0.57%	0.0009
15.15	648	1.8E-03	7.4E+02	24	0.2836	2.1E-04	19	0.265	0.269	279	74.598	6531	4464	1675	3721	0.05%	1.70	0.75	0.020%	0.003516	0.34	0.079	0.797	0.56%	0.0009
15.20	648	1.7E-03	7.0E+02	24	0.2796	2.2E-04	43	0.265	0.269	280	280.000	6528	4462	1676	1676	0.03%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
15.25	648	1.7E-03	7.0E+02	24	0.2757	2.2E-04	43	0.265	0.270	281	281.000	6524	4459	1677	1677	0.03%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
15.30	648	1.7E-03	7.0E+02	23	0.2718	2.2E-04	43	0.265	0.270	282	282.000	6521	4457	1678	1678	0.03%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
15.35	648	1.7E-03	7.0E+02	23	0.2680	2.1E-04	43	0.265	0.270	283	283.000	6517	4455	1679	1679	0.03%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
15.40	648	1.7E-03	7.0E+02	23	0.2641	2.1E-04	43	0.265	0.270	284	284.000	6514	4452	1680	1680	0.03%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
15.45	648	1.7E-03	7.0E+02	23	0.2603	2.1E-04	43	0.265	0.270	285	285.000	6510	4450	1681	1681	0.03%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
15.50	648	1.7E-03	7.0E+02	23	0.2565	2.1E-04	43	0.265	0.270	286	286.000	6507	4447	1682	1682	0.03%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
15.55	648	1.7E-03	7.0E+02	23	0.2527	2.0E-04	43	0.266	0.270	287	287.000	6503	4445	1683	1683	0.03%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
15.60	648	1.7E-03	7.0E+02	23	0.2490	2.0E-04	43	0.266	0.270	288	288.000	6500	4442	1684	1684	0.03%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
15.65	648	1.7E-03	7.0E+02	23	0.2453	2.0E-04	43	0.266	0.270	289	289.000	6496	4440	1685	1685	0.03%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
15.70	648	1.7E-03	7.0E+02	23	0.2416	2.0E-04	43	0.266	0.270	290	290.000	6493	4438	1686	1686	0.03%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
15.75	648	1.7E-03	7.0E+02	22	0.2379	2.0E-04	43	0.266	0.270	291	291.000	6490	4435	1687	1687	0.03%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
15.80	648	1.7E-03	7.0E+02	22	0.2343	1.9E-04	43	0.266	0.271	292	292.000	6486	4433	1688	1688	0.03%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
15.85	648	1.7E-03	7.0E+02	22	0.2307	1.9E-04	43	0.266	0.271	293	293.000	6483	4430	1689	1689	0.03%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
15.90	648	1.7E-03	7.0E+02	22	0.2271	1.9E-04	43	0.266	0.271	294	294.000	6479	4428	1690	1690	0.03%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
15.95	648	1.7E-03	7.0E+02	22	0.2236	1.9E-04	43	0.266	0.271	295	295.000	6476	4426	1691	1691	0.03%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.00	648	1.7E-03	7.0E+02	22	0.2201	1.8E-04	43	0.266	0.271	296	296.000	6472	4423	1692	1692	0.02%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.05	648	1.7E-03	7.0E+02	22	0.2166	1.8E-04	43	0.266	0.271	297	297.000	6469	4421	1693	1693	0.02%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.10	648	1.7E-03	7.0E+02	22	0.2131	1.8E-04	43	0.266	0.271	298	298.000	6466	4418	1694	1694	0.02%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.15	648	1.7E-03	7.0E+02	22	0.2097	1.8E-04	43	0.266	0.271	299	299.000	6462	4416	1695	1695	0.02%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.20	648	1.7E-03	7.0E+02	22	0.2063	1.7E-04	43	0.267	0.271	300	300.000	6459	4414	1696	1696	0.02%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.25	648	1.7E-03	7.0E+02	21	0.2029	1.7E-04	43	0.267	0.271	301	301.000	6455	4411	1697	1697	0.02%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.30	648	1.7E-03	7.0E+02	21	0.1996	1.7E-04	43	0.267	0.271	302	302.000	6452	4409	1698	1698	0.02%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.35	648	1.7E-03	7.0E+02	21	0.1963	1.7E-04	43	0.267	0.272	303	303.000	6449	4407	1699	1699	0.02%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.40	640	1.7E-03	6.8E+02	21	0.1930	1.7E-04	43	0.267	0.272	304	304.000	6445	4404	1700	1700	0.02%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.45	640	1.7E-03	6.8E+02	21	0.1898	1.7E-04	43	0.267	0.272	305	305.000	6442	4402	1701	1701	0.02%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.50	640	1.7E-03	6.8E+02	21	0.1865	1.6E-04	43	0.267	0.272	306	306.000	6439	4400	1702	1702	0.02%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.55	640	1.7E-03	6.8E+02	21	0.1833	1.6E-04	43	0.267	0.272	307	307.000	6435	4397	1703	1703	0.02%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.60	640	1.7E-03	6.8E+02	21	0.1802	1.6E-04	43	0.267	0.272	308	308.000	6432	4395	1704	1704	0.02%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.65	640	1.7E-03	6.8E+02	21	0.1770	1.6E-04	43	0.267	0.272	309	309.000	6428	4393	1705	1705	0.02%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.70	640	1.7E-03	6.8E+02	21	0.1739	1.5E-04	43	0.267	0.272	310	310.000	6425	4390	1706	1706	0.02%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.75	640	1.7E-03	6.8E+02	21	0.1709	1.5E-04	43	0.267	0.272	311	311.000	6422	4388	1707	1707	0.02%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.80	640	1.7E-03	6.8E+02	21	0.1678	1.5E-04	43	0.267	0.272	312	312.000	6418	4386	1708	1708	0.02%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.85	640	1.7E-03	6.8E+02	21	0.1648	1.5E-04	43	0.268	0.272	313	313.000	6415	4383	1709	1709	0.02%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.90	640	1.7E-03	6.8E+02	20	0.1618	1.5E-04	43	0.268	0.273	314	314.000	6412	4381	1710	1710	0.02%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.95	640	1.7E-03	6.8E+02	20	0.1589	1.4E-04	43	0.268	0.273	315	315.000	6409	4379	1711	1711	0.02%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.00	640	1.7E-03	6.8E+02	20	0.1560	1.4E-04	43	0.268	0.273	316	316.000	6405	4376	1712	1712	0.02%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.05	640	1.7E-03	6.8E+02	20	0.1531	1.4E-04	43	0.268	0.273	317	317.000	6402	4374	1713	1713	0.02%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.10	640	1.7E-03	6.8E+02	20	0.1502	1.4E-04	43	0.268	0.273	318	318.000	6399	4372	1714	1714	0.02%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.15	640	1.7E-03	6.8E+02	20	0.1474	1.3E-04	43	0.268	0.273	319	319.000	6395	4370	1715	1715	0.02%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.20	640	1.7E-03	6.8E+02	20	0.1446	1.3E-04	43	0.268	0.273	320	320.000	6392	4367	1716	1716	0.02%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.25	640	1.7E-03	6.8E+02	20	0.1418	1.3E-04	43	0.268	0.273	321	321.000	6389	4365	1717	1717	0.02%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.30	640	1.7E-03	6.8E+02	20	0.1390	1.3E-04	43	0.268	0.273	322	322.000	6386	4363	1718	1718	0.02%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.35	640	1.7E-03	6.8E+02	20	0.1363	1.3E-04	43	0.268	0.273	323	323.000	6382	4360	1719	1719	0.02%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000

52.821	6924.61	24.4	1.078	23.3	183.3	79.43	4.42%	Fine Tailings	0.054	107.6	2.99	0.260	2.73	1	8	5.03%	3.2	83%	3.24	0.260	2.98
52.985	6924.45	28.8	1.315	28.0	126.1	54.62	4.56%	Fine Tailings	0.054	107.6	3.00	0.265	2.73	1	9	5.09%	3.2	83%	3.25	0.265	2.99
53.149	6924.28	30.6	1.722	30.3	36.8	15.96	5.63%	Fine Tailings	0.054	107.6	3.01	0.270	2.74	1	10	6.25%	3.2	83%	3.26	0.270	2.99
53.313	6924.12	26.6	1.938	26.5	11.0	4.78	7.29%	Fine Tailings	0.054	107.6	3.02	0.275	2.74	1	9	8.23%	3.3	83%	3.27	0.275	2.99
53.477	6923.95	22.4	1.813	22.3	18.9	8.19	8.08%	Fine Tailings	0.054	107.6	3.03	0.280	2.75	1	7	9.34%	3.4	83%	3.28	0.280	3.00
53.641	6923.79	20.1	1.307	19.8	48.4	20.96	6.50%	Fine Tailings	0.054	107.6	3.04	0.285	2.75	1	6	7.65%	3.4	83%	3.29	0.285	3.00
53.805	6923.62	18.1	0.954	17.5	84.0	36.40	5.28%	Fine Tailings	0.054	107.6	3.04	0.290	2.75	1	5	6.36%	3.4	83%	3.30	0.290	3.01
53.969	6923.46	17.7	0.885	17.4	40.9	17.71	5.01%	Fine Alluvium	0.060	120.7	3.05	0.000	3.05	0	5	6.06%	3.4	76%	3.31	0.000	3.31
54.133	6923.30	18.0	1.099	17.7	42.0	18.18	6.11%	Fine Alluvium	0.060	120.7	3.06	0.000	3.06	0	5	7.37%	3.5	76%	3.32	0.000	3.32
54.297	6923.13	27.8	1.519	27.3	77.6	33.61	5.46%	Fine Alluvium	0.060	120.7	3.07	0.000	3.07	0	8	6.14%	3.3	76%	3.33	0.000	3.33
54.461	6922.97	48.6	2.094	48.1	74.9	32.46	4.31%	Fine Alluvium	0.060	120.7	3.08	0.000	3.08	0	15	4.60%	3.0	76%	3.34	0.000	3.34
54.625	6922.80	52.8	2.211	52.7	17.4	7.52	4.19%	Fine Alluvium	0.060	120.7	3.09	0.000	3.09	0	16	4.45%	2.9	76%	3.35	0.000	3.35
54.789	6922.64	74.5	1.977	74.4	12.3	5.33	2.66%	Fine Alluvium	0.060	120.7	3.10	0.000	3.10	0	23	2.77%	2.7	76%	3.36	0.000	3.36
54.953	6922.48	86.2	0.896	86.1	7.7	3.35	1.04%	Fine Alluvium	0.060	120.7	3.11	0.000	3.11	0	27	1.08%	2.4	76%	3.36	0.000	3.36
55.117	6922.31	98.4	1.047	98.4	8.0	3.46	1.06%	Coarse Alluvium	0.056	111.0	3.12	0.000	3.12	0	31	1.10%	2.4	36%	3.37	0.000	3.37
55.281	6922.15	122.4	1.603	122.3	20.7	8.95	1.31%	Coarse Alluvium	0.056	111.0	3.13	0.000	3.13	0	38	1.34%	2.3	36%	3.38	0.000	3.38
55.446	6921.98	175.1	1.595	175.0	16.6	7.18	0.91%	Coarse Alluvium	0.056	111.0	3.14	0.000	3.14	0	55	0.93%	2.1	36%	3.39	0.000	3.39
55.610	6921.82	169.2	2.120	169.1	13.5	5.84	1.25%	Coarse Alluvium	0.056	111.0	3.15	0.000	3.15	0	53	1.28%	2.2	36%	3.40	0.000	3.40
55.774	6921.66	157.0	2.567	156.9	8.2	3.54	1.64%	Coarse Alluvium	0.056	111.0	3.16	0.000	3.16	0	49	1.67%	2.3	36%	3.41	0.000	3.41
55.938	6921.49	142.0	2.604	141.9	6.2	2.70	1.83%	Coarse Alluvium	0.056	111.0	3.17	0.000	3.17	0	44	1.88%	2.4	36%	3.42	0.000	3.42
56.102	6921.33	122.9	2.604	122.8	5.1	2.22	2.12%	Coarse Alluvium	0.056	111.0	3.18	0.000	3.18	0	38	2.18%	2.5	36%	3.43	0.000	3.43
56.266	6921.16	108.3	2.477	108.3	4.7	2.03	2.29%	Coarse Alluvium	0.056	111.0	3.19	0.000	3.19	0	33	2.36%	2.5	36%	3.44	0.000	3.44
56.430	6921.00	99.3	2.397	99.2	5.1	2.20	2.41%	Coarse Alluvium	0.056	111.0	3.20	0.000	3.20	0	30	2.49%	2.6	36%	3.45	0.000	3.45
56.594	6920.84	88.6	2.278	88.5	5.0	2.18	2.57%	Coarse Alluvium	0.056	111.0	3.20	0.000	3.20	0	27	2.67%	2.6	36%	3.46	0.000	3.46
56.758	6920.67	79.2	1.818	79.2	5.0	2.15	2.30%	Coarse Alluvium	0.056	111.0	3.21	0.000	3.21	0	24	2.39%	2.6	36%	3.47	0.000	3.47
56.922	6920.51	78.3	1.667	78.3	7.6	3.29	2.13%	Coarse Alluvium	0.056	111.0	3.22	0.000	3.22	0	23	2.22%	2.6	36%	3.47	0.000	3.47
57.086	6920.34	78.1	1.590	78.0	7.1	3.07	2.04%	Coarse Alluvium	0.056	111.0	3.23	0.000	3.23	0	23	2.13%	2.6	36%	3.48	0.000	3.48
57.250	6920.18	79.5	1.632	79.4	6.5	2.81	2.05%	Coarse Alluvium	0.056	111.0	3.24	0.000	3.24	0	24	2.14%	2.6	36%	3.49	0.000	3.49
57.414	6920.02	90.2	1.782	90.2	6.8	2.93	1.97%	Coarse Alluvium	0.056	111.0	3.25	0.000	3.25	0	27	2.05%	2.6	36%	3.50	0.000	3.50
57.578	6919.85	98.3	1.799	98.3	6.8	2.93	1.83%	Coarse Alluvium	0.056	111.0	3.26	0.000	3.26	0	29	1.89%	2.5	36%	3.51	0.000	3.51
57.742	6919.69	100.9	1.873	100.8	6.4	2.76	1.86%	Coarse Alluvium	0.056	111.0	3.27	0.000	3.27	0	30	1.92%	2.5	36%	3.52	0.000	3.52
57.906	6919.52	102.1	1.920	102.1	6.4	2.76	1.88%	Coarse Alluvium	0.056	111.0	3.28	0.000	3.28	0	30	1.94%	2.5	36%	3.53	0.000	3.53
58.070	6919.36	96.5	1.922	96.5	5.8	2.50	1.99%	Coarse Alluvium	0.056	111.0	3.29	0.000	3.29	0	28	2.06%	2.5	36%	3.54	0.000	3.54
58.234	6919.20	83.6	1.922	83.6	5.1	2.20	2.30%	Coarse Alluvium	0.056	111.0	3.30	0.000	3.30	0	24	2.39%	2.6	36%	3.55	0.000	3.55
58.398	6919.03	69.4	1.998	69.4	4.8	2.09	2.88%	Coarse Alluvium	0.056	111.0	3.30	0.000	3.30	0	20	3.02%	2.8	36%	3.56	0.000	3.56
58.562	6918.87	52.8	2.089	52.8	5.0	2.18	3.96%	Coarse Alluvium	0.056	111.0	3.31	0.000	3.31	0	15	4.22%	2.9	36%	3.57	0.000	3.57
58.726	6918.70	54.1	2.266	54.1	6.2	2.68	4.19%	Coarse Alluvium	0.056	111.0	3.32	0.000	3.32	0	15	4.46%	3.0	36%	3.57	0.000	3.57
58.890	6918.54	64.3	2.249	64.3	6.0	2.58	3.50%	Coarse Alluvium	0.056	111.0	3.33	0.000	3.33	0	18	3.69%	2.8	36%	3.58	0.000	3.58
59.054	6918.38	83.2	2.213	83.2	6.8	2.95	2.66%	Coarse Alluvium	0.056	111.0	3.34	0.000	3.34	0	24	2.77%	2.7	36%	3.59	0.000	3.59
59.218	6918.21	99.1	1.992	99.1	6.7	2.91	2.01%	Coarse Alluvium	0.056	111.0	3.35	0.000	3.35	0	29	2.08%	2.5	36%	3.60	0.000	3.60
59.382	6918.05	91.2	1.743	91.2	5.6	2.44	1.91%	Coarse Alluvium	0.056	111.0	3.36	0.000	3.36	0	26	1.98%	2.6	36%	3.61	0.000	3.61
59.547	6917.88	89.9	1.702	89.9	5.6	2.44	1.89%	Coarse Alluvium	0.056	111.0	3.37	0.000	3.37	0	26	1.97%	2.6	36%	3.62	0.000	3.62
59.711	6917.72	91.8	1.836	91.8	6.1	2.62	2.00%	Coarse Alluvium	0.056	111.0	3.38	0.000	3.38	0	26	2.08%	2.6	36%	3.63	0.000	3.63
59.875	6917.56	94.4	1.834	94.3	5.8	2.52	1.94%	Coarse Alluvium	0.056	111.0	3.39	0.000	3.39	0	27	2.02%	2.5	36%	3.64	0.000	3.64
60.039	6917.39	92.1	1.915	92.1	5.4	2.32	2.08%	Coarse Alluvium	0.056	111.0	3.40	0.000	3.40	0	26	2.16%	2.6	36%	3.65	0.000	3.65
60.203	6917.23	84.6	2.042	84.5	5.2	2.26	2.42%	Coarse Alluvium	0.056	111.0	3.40	0.000	3.40	0	24	2.52%	2.6	36%	3.66	0.000	3.66
60.367	6917.06	86.8	2.158	86.8	5.4	2.34	2.48%	Coarse Alluvium	0.056	111.0	3.41	0.000	3.41	0	24	2.59%	2.6	36%	3.67	0.000	3.67
60.531	6916.90	93.5	2.428	93.5	5.4	2.36	2.60%	Coarse Alluvium	0.056	111.0	3.42	0.000	3.42	0	26	2.69%	2.6	36%	3.67	0.000	3.67
60.695	6916.74	73.1	2.546	73.1	3.8	1.65	3.48%	Coarse Alluvium	0.056	111.0	3.43	0.000	3.43	0	20	3.65%	2.8	36%	3.68	0.000	3.68
60.859	6916.57	54.9	2.741	54.9	3.9	1.67	4.99%	Coarse Alluvium	0.056	111.0	3.44	0.000	3.44	0	15	5.33%	3.0	36%	3.69	0.000	3.69
61.023	6916.41	47.0	2.681	47.0	4.7	2.02	5.70%	Coarse Alluvium	0.056	111.0	3.45	0.000	3.45	0	13	6.16%	3.1	36%	3.70	0.000	3.70
61.187	6916.24	59.9	2.474	59.9	7.6	3.28	4.13%	Coarse Alluvium	0.056	111.0	3.46	0.000	3.46	0	16	4.38%	2.9	36%	3.71	0.000	3.71
61.351	6916.08	57.7	2.418	57.6	5.5	2.38	4.19%	Coarse Alluvium	0.056	111.0	3.47	0.000	3.47	0	16	4.46%	2.9	36%	3.72	0.000	3.72
61.515	6915.92	50.8	2.422	50.7	4.9	2.11	4.77%	Coarse Alluvium	0.056	111.0	3.48	0.000	3.48	0	14	5.12%	3.0	36%	3.73	0.000	3.73
61.679	6915.75	45.5	2.292	45.5	5.8	2.52	5.03%	Coarse Alluvium	0.056	111.0	3.49	0.000	3.49	0	12	5.45%	3.1	36%	3.74	0.000	3.74
61.843	6915.59	49.3	2.345	49.2	7.1	3.07	4.76%	Coarse Alluvium	0.056	111.0	3.50	0.000	3.50	0	13	5.12%	3.0	36%	3.75	0.000	3.75
62.007	6915.42	62.8	2.091	62.8	8.0	3.48	3.33%	Coarse Alluvium	0.056	111.0	3.50	0.000	3.50	0	17	3.52%	2.9	36%	3.76	0.000	3.76
62.171	6915.26	81.9	2.022	81.9	7.3	3.17	2.47%	Coarse Alluvium	0.056	111.0	3.51	0.000	3.51	0	22	2.58%	2.7	36%	3.77	0.000	3.77
62.335	6915.09	94.4	1.820	94.4	6.3	2.75	1.93%	Coarse Alluvium	0.056	111.0	3.52	0.000	3.52	0	26	2.00%	2.6	36%	3.77	0.000	3.77
62.499	6914.93	97.3	1.785	97.3	6.1	2.62	1.83%	Coarse Alluvium	0.056	111.0	3.53	0.000	3.53	0	27	1.90%	2.5	36%	3.78	0.000	3.78
62.663	6914.77	90.0	2.240	90.0	5.3	2.30	2.49%	Coarse Alluvium	0.056	111.0	3.54	0.000	3.54	0	24	2.59%	2.6	36%	3.79	0.000	3.79
62.827	6914.60	81.6	2.978	81.6	5.1	2.20	3.65%	Coarse Alluvium	0.056	111.0	3.55	0.000	3.55	0	22	3.81%	2.8	36%	3.80	0.000	3.80
62.991	6914.44	85.3	3.029	85.2	6.2	2.67	3.55%	Coarse Alluvium	0.056	111.0	3.56	0.000	3.56	0	23	3.71%	2.8	36%	3.81	0.000	3.81
63.155	6914.27	104.6	2.560	104.5	7.0	3.01	2.45%	Coarse Alluvium	0.056	111.0	3.57	0.000	3.57	0	28	2.53%	2.6	36%	3.82	0.000	3.82
63.319	6914.11	113.6	2.098	113.5	6.5	2.83	1.85%	Coarse Alluvium	0.056	111.0	3.58	0.000	3.58	0	31	1.91%	2.5	36%	3.83	0.000	3.83
63.483	6913.95	113.9	2.009	113.8	6.7	2.89	1.76%	Coarse Alluvium	0.056	111.0	3.59	0.000	3.59	0	31	1.82%	2.5	36%	3.84	0.000	3.84
63.648	6913.78	95.7	2.337	95.7	5.5	2.40	2.44%	Coarse Alluvium	0.056	111.0	3.60	0.000	3.60	0	26	2.54%	2.6	36%	3.85	0.000	3.85
63.812	6913.62	77.3	2.500	77.3	5.3	2.28	3.23%	Coarse Alluvium	0.056	111.0	3.60	0.000	3.60	0	20	3.39%	2.8	36%	3.86	0.000	3.86
63.976	6913.45	65.3	2.806	65.3	5.2	2.24	4.30%	Coarse Alluvium	0.056	111.0	3.61	0.000	3.61	0	17	4.55%	2.9	36%	3.87	0.000	3.87
64.140	6913.29	62.1	2.838	62.1	7.6	3.28	4.57%	Coarse Alluvium	0.056	111.0	3.62	0.000	3.62	0	16	4.85%	3.0	36%	3.87	0.000	3.87
64.304	6913.13	62.1	2.935	62.0	7.3	3.17	4.73%	Coarse Alluvium	0.056	111.0	3.63	0.000	3.63	0	16	5.02%	3.0	36%	3.88	0.000	3.88
64.468	6912.96	60.8	2.689	60.7	6.7	2.91	4.42%	Coarse Alluvium	0.056	111.0	3.64	0.000	3.64	0	16	4.71%	3.0	36%	3.89	0.000	3.89
64.632	6912.80	64.0	2.694	63.9	7.3	3.15	4.21%	Coarse Alluvium	0.056	111.0	3.65	0.000	3.65	0	17	4.47%	2.9	36%	3.90	0.000	3.90
64.796	6912.63	51.7	2.453	51.6	6.5	2.83	4.75%	Coarse Alluvium	0.056	111.0	3.66	0.000	3.66	0	13	5.11%	3.0	36%	3.91	0.000	3.91
64.960	6912.47	58.3	2.154	58.3	7.8	3.40	3.69%	Coarse Alluvium	0.056	111.0	3.67	0.000	3.67	0	15	3.94%	2.9	36%	3.92	0.000	3.92
65.124	6912.31	62.3	2.066	62.2	6.8	2.95	3.32%	Coarse Alluvium	0.056	111.0	3.68	0.000	3.68	0	16	3.53%	2.9	36%	3.93	0.000	3.93
65.288	6912.14	62.0	1.918	62.0	7.0	3.05	3.09%	Coarse Alluvium	0.056	111.0	3.69	0.000	3.69	0	16	3.29%	2.9	36%	3.94	0.000	3.94
65.452	6911.98	66.9	1.901	66.9	8.6	3.72	2.84%	Coarse Alluvium	0.056	111.0	3.70	0.000	3.70	0	17	3.01%	2.8	36%	3.95	0.000	3.95
65.616	6911.81	88.3	1.871	88.3	7.1	3.09	2.12%	Coarse Alluvium	0.056	111.0	3.71	0.000	3.71	0	23	2.21%	2.6	36%	3.96	0.000	3.96
65.780	6911.65	107.8	1.886	107.8	6.5	2.81	1.75%	Coarse Alluvium	0.056	111.0	3.71	0.000	3.71	0	28	1.81%	2.5	36%	3.97	0.000	3.97
65.944	6911.49	120.1	2.143	120.0	6.2	2.70	1.78%	Coarse Alluvium	0.056	111.0	3.72	0.000	3.72	0	31	1.84%	2.5	36%	3.98	0.000	3.98
66.108	6911.32	120.9	2.433	120.9	6.2	2.70	2.01%	Coarse Alluvium	0.056	111.0	3.73	0.000	3.73	0	31	2.08%	2.5	36%	3.98	0.000	3.98
66.272	6911.16	120.6	2.662	120.6	6.1	2.64	2.21%	Coarse Alluvium	0.056	111.0	3.74	0.000	3.74	0	31	2.28%	2.5	36%	3.99	0.000	3.99

17.40	640	1.7E-03	6.8E+02	20	0.1336	1.2E-04	43	0.268	0.273	324	324.000	6379	4358	1720	1720	0.02%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.45	640	1.7E-03	6.8E+02	20	0.1310	1.2E-04	43	0.268	0.274	325	325.000	6376	4356	1721	1721	0.01%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.50	640	1.7E-03	6.8E+02	20	0.1284	1.2E-04	43	0.269	0.274	326	326.000	6373	4354	1722	1722	0.01%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.55	640	1.7E-03	6.8E+02	20	0.1258	1.2E-04	43	0.269	0.274	327	327.000	6369	4351	1723	1723	0.01%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.60	640	1.7E-03	6.8E+02	20	0.1232	1.2E-04	43	0.269	0.274	328	328.000	6366	4349	1724	1724	0.01%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.65	640	1.7E-03	6.8E+02	19	0.1206	1.1E-04	43	0.269	0.274	329	329.000	6363	4347	1725	1725	0.01%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.70	640	1.7E-03	6.8E+02	19	0.1181	1.1E-04	43	0.269	0.274	330	330.000	6360	4345	1726	1726	0.01%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.75	640	1.9E-03	7.7E+02	19	0.1157	9.7E-05	22	0.275	0.281	331	154.617	6116	4175	1727	3033	0.01%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.80	640	1.9E-03	7.7E+02	19	0.1132	9.5E-05	22	0.275	0.281	332	155.083	6109	4170	1728	3030	0.01%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.85	640	1.9E-03	7.7E+02	19	0.1108	9.4E-05	22	0.275	0.281	333	155.550	6101	4165	1729	3028	0.01%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.90	640	1.9E-03	7.7E+02	19	0.1084	9.2E-05	22	0.275	0.282	334	156.017	6094	4160	1730	3026	0.01%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.95	1229	1.9E-03	2.8E+03	19	0.1060	2.4E-05	22	0.276	0.282	335	156.484	6086	4154	1731	3023	0.00%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.00	1229	1.9E-03	2.8E+03	19	0.1037	2.4E-05	22	0.276	0.282	336	156.950	6079	4149	1732	3021	0.00%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.05	1229	1.9E-03	2.8E+03	19	0.1013	2.3E-05	22	0.276	0.282	337	157.417	6072	4144	1733	3019	0.00%	0.90	0.75	0.060%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.10	1229	1.7E-03	2.6E+03	19	0.0991	2.5E-05	0	0.276	0.283	338	0.276	6065	4140	1734	6065	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
18.15	1229	1.7E-03	2.6E+03	19	0.0968	2.5E-05	0	0.276	0.283	339	0.276	6058	4135	1735	6058	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
18.20	1229	1.7E-03	2.6E+03	19	0.0946	2.4E-05	0	0.277	0.283	340	0.277	6052	4130	1736	6052	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
18.25	1229	1.7E-03	2.6E+03	19	0.0924	2.4E-05	0	0.277	0.283	341	0.277	6045	4126	1737	6045	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
18.30	1229	1.7E-03	2.6E+03	19	0.0902	2.3E-05	0	0.277	0.283	342	0.277	6038	4121	1738	6038	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
18.35	1229	1.7E-03	2.6E+03	19	0.0880	2.3E-05	0	0.277	0.284	343	0.277	6032	4116	1739	6032	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
18.40	1229	1.7E-03	2.6E+03	19	0.0859	2.2E-05	0	0.277	0.284	344	0.277	6025	4112	1740	6025	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
18.45	1229	1.7E-03	2.6E+03	19	0.0838	2.2E-05	0	0.277	0.284	345	0.277	6019	4107	1741	6019	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
18.50	1229	1.7E-03	2.6E+03	19	0.0817	2.1E-05	0	0.278	0.284	346	0.278	6012	4103	1742	6012	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
18.55	1229	1.7E-03	2.6E+03	19	0.0797	2.1E-05	0	0.278	0.284	347	0.278	6006	4098	1743	6006	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
18.60	1229	1.7E-03	2.6E+03	19	0.0777	2.0E-05	0	0.278	0.285	348	0.278	5999	4094	1744	5999	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
18.65	1229	1.7E-03	2.6E+03	19	0.0757	2.0E-05	0	0.278	0.285	349	0.278	5993	4089	1745	5993	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
18.70	1229	1.7E-03	2.6E+03	19	0.0737	1.9E-05	0	0.278	0.285	350	0.278	5986	4085	1746	5986	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
18.75	1229	1.7E-03	2.6E+03	18	0.0718	1.9E-05	0	0.278	0.285	351	0.278	5980	4080	1747	5980	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
18.80	1229	1.7E-03	2.6E+03	18	0.0699	1.8E-05	0	0.279	0.285	352	0.279	5973	4076	1748	5973	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
18.85	1229	1.7E-03	2.6E+03	18	0.0680	1.8E-05	0	0.279	0.286	353	0.279	5967	4071	1749	5967	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
18.90	1229	1.7E-03	2.6E+03	18	0.0661	1.7E-05	0	0.279	0.286	354	0.279	5961	4067	1750	5961	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
18.95	1229	1.7E-03	2.6E+03	18	0.0642	1.7E-05	0	0.279	0.286	355	0.279	5954	4063	1751	5954	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
19.00	1229	1.7E-03	2.6E+03	18	0.0624	1.7E-05	0	0.279	0.286	356	0.279	5948	4058	1752	5948	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
19.05	1229	1.7E-03	2.6E+03	18	0.0606	1.6E-05	0	0.279	0.286	357	0.279	5942	4054	1753	5942	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
19.10	1229	1.7E-03	2.6E+03	18	0.0589	1.6E-05	0	0.280	0.286	358	0.280	5936	4050	1754	5936	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
19.15	1229	1.7E-03	2.6E+03	18	0.0571	1.5E-05	0	0.280	0.287	359	0.280	5929	4045	1755	5929	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
19.20	1229	1.7E-03	2.6E+03	18	0.0554	1.5E-05	0	0.280	0.287	360	0.280	5923	4041	1756	5923	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
19.25	1229	1.7E-03	2.6E+03	18	0.0537	1.4E-05	0	0.280	0.287	361	0.280	5917	4037	1757	5917	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
19.30	1229	1.7E-03	2.6E+03	18	0.0520	1.4E-05	0	0.280	0.287	362	0.280	5911	4032	1758	5911	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
19.35	1229	1.7E-03	2.6E+03	18	0.0503	1.4E-05	0	0.280	0.287	363	0.280	5905	4028	1759	5905	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
19.40	1229	1.7E-03	2.6E+03	18	0.0487	1.3E-05	0	0.281	0.288	364	0.281	5899	4024	1760	5899	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
19.45	1091	1.7E-03	2.1E+03	18	0.0471	1.6E-05	0	0.281	0.288	365	0.281	5892	4020	1761	5892	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
19.50	1091	1.7E-03	2.1E+03	18	0.0455	1.6E-05	0	0.281	0.288	366	0.281	5886	4015	1762	5886	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
19.55	1091	1.7E-03	2.1E+03	18	0.0439	1.5E-05	0	0.281	0.288	367	0.281	5880	4011	1763	5880	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
19.60	1091	1.7E-03	2.1E+03	18	0.0424	1.5E-05	0	0.281	0.288	368	0.281	5874	4007	1764	5874	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
19.65	1091	1.7E-03	2.1E+03	18	0.0408	1.4E-05	0	0.281	0.289	369	0.281	5868	4003	1765	5868	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
19.70	1091	1.7E-03	2.1E+03	18	0.0393	1.4E-05	0	0.282	0.289	370	0.282	5862	3999	1766	5862	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
19.75	1091	1.7E-03	2.1E+03	18	0.0379	1.3E-05	0	0.282	0.289	371	0.282	5856	3994	1767	5856	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
19.80	1091	1.7E-03	2.1E+03	18	0.0364	1.3E-05	0	0.282	0.289	372	0.282	5850	3990	1768	5850	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
19.85	1091	1.7E-03	2.1E+03	18	0.0350	1.2E-05	0	0.282	0.289	373	0.282	5845	3986	1769	5845	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
19.90	1091	1.7E-03	2.1E+03	18	0.0335	1.2E-05	0	0.282	0.290	374	0.282	5839	3982	1770	5839	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
19.95	1091	1.7E-03	2.1E+03	18	0.0321	1.1E-05	0	0.282	0.290	375	0.282	5833	3978	1771	5833	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.00	1091	1.7E-03	2.1E+03	18	0.0308	1.1E-05	0	0.282	0.290	376	0.282	5827	3974	1772	5827	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.05	1091	1.7E-03	2.1E+03	18	0.0306	1.1E-05	0	0.283	0.290	377	0.283	5821	3970	1773	5821	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.10	1091	1.7E-03	2.1E+03	18	0.0304	1.1E-05	0	0.283	0.290	378	0.283	5815	3966	1774	5815	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.15	1091	1.7E-03	2.1E+03	18	0.0301	1.1E-05	0	0.283	0.291	379	0.283	5809	3962	1775	5809	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.20	1091	1.7E-03	2.1E+03	18	0.0299	1.1E-05	0	0.283	0.291	380	0.283	5804	3958	1776	5804	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.25	1091	1.7E-03	2.1E+03	18	0.0297	1.1E-05	0	0.283	0.291	381	0.283	5798	3954	1777	5798	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.30	1091	1.7E-03	2.1E+03	18	0.0294	1.1E-05	0	0.283	0.291	382	0.283	5792	3950	1778	5792	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.35	1091	1.7E-03	2.1E+03	18	0.0292	1.1E-05	0	0.284	0.291	383	0.284	5786	3946	1779	5786	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.40	1091	1.7E-03	2.1E+03	18	0.0290	1.0E-05	0	0.284	0.291	384	0.284	5781	3942	1780	5781	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.45	1091	1.7E-03	2.1E+03	18	0.0287	1.0E-05	0	0.284	0.292	385	0.284	5775	3938	1781	5775	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.50	1091	1.7E-03	2.1E+03	17	0.0285	1.0E-05	0	0.284	0.292	386	0.284	5769	3934	1782	5769	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.55	1091	1.7E-03	2.1E+03	17	0.0283	1.0E-05	0	0.284	0.292	387	0.284	5764	3930	1783	5764	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.60	1091	1.7E-03	2.1E+03	17	0.0281	1.0E-05	0	0.284	0.292	388	0.284	5758	3926	1784	5758	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.65	1091	1.7E-03	2.1E+03	17	0.0278	1.0E-05	0	0.285	0.292	389	0.285	5753	3922	1785	5753	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.70	1091	1.7E-03	2.1E+03	17	0.0276	1.0E-05	0	0.285	0.293	390	0.285	5747	3918	1786	5747	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.75	1091	1.7E-03	2.1E+03	17	0.0274	1.0E-05	0	0.285	0.293	391	0.285	5741	3914	1787	5741	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.80	1091	1.7E-03	2.1E+03	17	0.0271	1.0E-05	0	0.285	0.293	392	0.285	5736	3911	1788	5736	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.85	1091	1.7E-03	2.1E+03	17	0.0269	9.9E-06	0	0.285	0.293	393	0.285	5730	3907	1789	5730	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.90	1091	1.7E-03	2.1E+03	17	0.0267	9.8E-06	0	0.285	0.293	394	0.285	5725	3903	1790	5725	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
20.95	1091	1.7E-03	2.1E+03	17	0.0264	9.8E-06	0	0.285	0.293	395	0.285	5719	3899	1791	5719	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.00	1091	1.7E-03	2.1E+03	17	0.0262	9.7E-06	0	0.286	0.294	396	0.286	5714	3895	1792	5714	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.05	1060	1.7E-03	1.9E+03	17	0.0260	1.0E-05	0	0.286	0.294	397	0.286	5708	3892	1793	5708	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.10	1060	1.7E-03	1.9E+03	17	0.0258	1.0E-05	0	0.286	0.294	398	0.286	5703	3888	1794	5703	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.15	1060	1.7E-03	1.9E+03	17	0.0255	1.0E-05	0	0.286	0.294	399	0.286	5697	3884	1795	5697	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.20	1060	1.7E-03	1.9E+03	17	0.0253	1.0E-05	0	0.286	0.294	400	0.286	5692	3880	1796	5692	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.25	1060	1.7E-03	1.9E+03	17	0.0251	1.0E-05	0	0.286	0.295	401	0.286	5687	3876	1797	5687	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.30	1060	1.7E-03	1.9E+03	17	0.0248	9.9E-06	0	0.287	0.295	402	0.287	5681	3873	1798	5681	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.35	1060	1.7E-03	1.9E+03	17	0.0246	9.8E-06	0	0.287	0.295	403	0.287	5676	3869	1799	5676	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.40	1060	1.7E-03	1.9E+03	17	0.0244	9.8E-06	0	0.287	0.295	404	0.287	5671	3865	1800	5671	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.45	1060	1.7E-03	1.9E+03	17	0.0241	9.7E-06	0	0.287	0.295	405	0.287	5665	3862	1801	5665	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.50	1060	1.7E-03	1.9E+03	17	0.0239	9.6E-06	0	0.287	0.295	406	0.287	5660	3858	1802	5660	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000

66.436	6910.99	113.0	2.772	113.0	6.0	2.58	2.45%	Coarse Alluvium	0.056	111.0	3.75	0.000	3.75	0	29	2.54%	2.6	36%	4.00	0.000	4.00
66.600	6910.83	108.1	2.836	108.0	6.0	2.58	2.62%	Coarse Alluvium	0.056	111.0	3.76	0.000	3.76	0	28	2.72%	2.6	36%	4.01	0.000	4.01
66.764	6910.67	108.1	2.718	108.0	7.9	3.41	2.51%	Coarse Alluvium	0.056	111.0	3.77	0.000	3.77	0	28	2.61%	2.6	36%	4.02	0.000	4.02
66.928	6910.50	104.4	2.567	104.4	6.6	2.87	2.46%	Coarse Alluvium	0.056	111.0	3.78	0.000	3.78	0	27	2.55%	2.6	36%	4.03	0.000	4.03
67.092	6910.34	99.3	2.456	99.3	6.2	2.70	2.47%	Coarse Alluvium	0.056	111.0	3.79	0.000	3.79	0	25	2.57%	2.6	36%	4.04	0.000	4.04
67.256	6910.17	97.1	2.223	97.1	6.3	2.75	2.29%	Coarse Alluvium	0.056	111.0	3.80	0.000	3.80	0	25	2.38%	2.6	36%	4.05	0.000	4.05
67.420	6910.01	94.4	2.017	94.3	6.2	2.67	2.14%	Coarse Alluvium	0.056	111.0	3.81	0.000	3.81	0	24	2.23%	2.6	36%	4.06	0.000	4.06
67.584	6909.85	91.1	1.874	91.1	6.2	2.67	2.06%	Coarse Alluvium	0.056	111.0	3.81	0.000	3.81	0	23	2.15%	2.6	36%	4.07	0.000	4.07
67.749	6909.68	84.0	1.676	83.9	6.0	2.60	2.00%	Coarse Alluvium	0.056	111.0	3.82	0.000	3.82	0	21	2.09%	2.6	36%	4.08	0.000	4.08
67.913	6909.52	77.2	1.655	77.2	5.8	2.50	2.14%	Coarse Alluvium	0.056	111.0	3.83	0.000	3.83	0	19	2.25%	2.7	36%	4.08	0.000	4.08
68.077	6909.35	71.7	2.027	71.6	5.8	2.50	2.83%	Coarse Alluvium	0.056	111.0	3.84	0.000	3.84	0	18	2.99%	2.8	36%	4.09	0.000	4.09
68.241	6909.19	67.3	2.078	67.2	6.3	2.73	3.09%	Coarse Alluvium	0.056	111.0	3.85	0.000	3.85	0	16	3.28%	2.8	36%	4.10	0.000	4.10
68.405	6909.03	69.6	1.971	69.6	6.1	2.62	2.83%	Coarse Alluvium	0.056	111.0	3.86	0.000	3.86	0	17	3.00%	2.8	36%	4.11	0.000	4.11
68.569	6908.86	85.5	1.780	85.4	6.4	2.79	2.08%	Coarse Alluvium	0.056	111.0	3.87	0.000	3.87	0	21	2.18%	2.7	36%	4.12	0.000	4.12
68.733	6908.70	98.8	1.776	98.7	7.2	3.11	1.80%	Coarse Alluvium	0.056	111.0	3.88	0.000	3.88	0	24	1.87%	2.6	36%	4.13	0.000	4.13
68.897	6908.53	97.2	1.825	97.1	6.7	2.89	1.88%	Coarse Alluvium	0.056	111.0	3.89	0.000	3.89	0	24	1.96%	2.6	36%	4.14	0.000	4.14
69.061	6908.37	91.4	1.844	91.4	6.4	2.76	2.02%	Coarse Alluvium	0.056	111.0	3.90	0.000	3.90	0	22	2.11%	2.6	36%	4.15	0.000	4.15
69.225	6908.21	95.7	2.058	95.7	6.2	2.67	2.15%	Coarse Alluvium	0.056	111.0	3.91	0.000	3.91	0	24	2.24%	2.6	36%	4.16	0.000	4.16
69.389	6908.04	97.0	2.048	96.9	6.9	2.99	2.11%	Coarse Alluvium	0.056	111.0	3.91	0.000	3.91	0	24	2.20%	2.6	36%	4.17	0.000	4.17
69.553	6907.88	88.5	1.961	88.5	6.1	2.64	2.22%	Coarse Alluvium	0.056	111.0	3.92	0.000	3.92	0	22	2.32%	2.7	36%	4.18	0.000	4.18
69.717	6907.71	86.1	1.567	86.1	6.0	2.60	1.82%	Coarse Alluvium	0.056	111.0	3.93	0.000	3.93	0	21	1.91%	2.6	36%	4.18	0.000	4.18
69.881	6907.55	83.7	1.456	83.7	6.0	2.60	1.74%	Coarse Alluvium	0.056	111.0	3.94	0.000	3.94	0	20	1.82%	2.6	36%	4.19	0.000	4.19
70.045	6907.38	75.7	1.403	75.7	6.4	2.76	1.85%	Coarse Alluvium	0.056	111.0	3.95	0.000	3.95	0	18	1.96%	2.7	36%	4.20	0.000	4.20
70.209	6907.22	78.4	1.601	78.4	5.7	2.46	2.04%	Coarse Alluvium	0.056	111.0	3.96	0.000	3.96	0	19	2.15%	2.7	36%	4.21	0.000	4.21
70.373	6907.06	89.0	1.829	89.0	5.6	2.44	2.05%	Coarse Alluvium	0.056	111.0	3.97	0.000	3.97	0	21	2.15%	2.6	36%	4.22	0.000	4.22
70.537	6906.89	85.0	2.108	85.0	4.8	2.09	2.48%	Coarse Alluvium	0.056	111.0	3.98	0.000	3.98	0	20	2.60%	2.7	36%	4.23	0.000	4.23
70.701	6906.73	72.9	2.513	72.9	4.0	1.75	3.45%	Coarse Alluvium	0.056	111.0	3.99	0.000	3.99	0	17	3.64%	2.9	36%	4.24	0.000	4.24
70.865	6906.56	72.8	2.090	72.7	5.2	2.26	2.87%	Coarse Alluvium	0.056	111.0	4.00	0.000	4.00	0	17	3.04%	2.8	36%	4.25	0.000	4.25
71.029	6906.40	77.2	2.061	77.1	5.0	2.18	2.67%	Coarse Alluvium	0.056	111.0	4.01	0.000	4.01	0	18	2.82%	2.8	36%	4.26	0.000	4.26
71.193	6906.24	80.6	1.837	80.6	5.7	2.46	2.28%	Coarse Alluvium	0.056	111.0	4.01	0.000	4.01	0	19	2.40%	2.7	36%	4.27	0.000	4.27
71.357	6906.07	81.9	2.006	81.8	5.8	2.50	2.45%	Coarse Alluvium	0.056	111.0	4.02	0.000	4.02	0	19	2.58%	2.7	36%	4.28	0.000	4.28
71.521	6905.91	89.4	2.071	89.4	5.8	2.50	2.32%	Coarse Alluvium	0.056	111.0	4.03	0.000	4.03	0	21	2.43%	2.7	36%	4.28	0.000	4.28
71.685	6905.74	85.4	1.670	85.4	4.7	2.02	1.95%	Coarse Alluvium	0.056	111.0	4.04	0.000	4.04	0	20	2.05%	2.7	36%	4.29	0.000	4.29
71.850	6905.58	75.7	1.569	75.7	4.4	1.89	2.07%	Coarse Alluvium	0.056	111.0	4.05	0.000	4.05	0	18	2.19%	2.7	36%	4.30	0.000	4.30
72.014	6905.42	75.3	1.992	75.3	5.4	2.34	2.65%	Coarse Alluvium	0.056	111.0	4.06	0.000	4.06	0	18	2.80%	2.8	36%	4.31	0.000	4.31
72.178	6905.25	63.4	2.295	63.4	4.6	1.97	3.62%	Coarse Alluvium	0.056	111.0	4.07	0.000	4.07	0	15	3.87%	2.9	36%	4.32	0.000	4.32
72.342	6905.09	46.8	2.246	46.8	4.3	1.87	4.80%	Coarse Alluvium	0.056	111.0	4.08	0.000	4.08	0	10	5.26%	3.1	36%	4.33	0.000	4.33
72.506	6904.92	47.8	1.964	47.8	5.7	2.46	4.11%	Coarse Alluvium	0.056	111.0	4.09	0.000	4.09	0	11	4.49%	3.1	36%	4.34	0.000	4.34
72.670	6904.76	84.5	1.695	84.5	7.4	3.19	2.01%	Coarse Alluvium	0.056	111.0	4.10	0.000	4.10	0	20	2.11%	2.7	36%	4.35	0.000	4.35
72.834	6904.60	95.9	1.774	95.9	5.9	2.56	1.85%	Coarse Alluvium	0.056	111.0	4.11	0.000	4.11	0	22	1.93%	2.6	36%	4.36	0.000	4.36
72.998	6904.43	104.6	1.651	104.5	5.7	2.48	1.58%	Coarse Alluvium	0.056	111.0	4.12	0.000	4.12	0	24	1.64%	2.5	36%	4.37	0.000	4.37
73.162	6904.27	88.9	1.047	88.9	4.8	2.09	1.18%	Coarse Alluvium	0.056	111.0	4.12	0.000	4.12	0	21	1.23%	2.5	36%	4.38	0.000	4.38
73.326	6904.10	93.6	1.342	93.6	-2.6	-1.14	1.43%	Coarse Alluvium	0.056	111.0	4.13	0.000	4.13	0	22	1.50%	2.6	36%	4.39	0.000	4.39
73.490	6903.94	80.1	1.507	80.1	-0.7	-0.30	1.88%	Coarse Alluvium	0.056	111.0	4.14	0.000	4.14	0	18	1.98%	2.7	36%	4.39	0.000	4.39
73.654	6903.78	81.8	1.537	81.8	2.4	1.06	1.88%	Coarse Alluvium	0.056	111.0	4.15	0.000	4.15	0	19	1.98%	2.7	36%	4.40	0.000	4.40
73.818	6903.61	85.0	1.434	85.0	2.4	1.06	1.69%	Coarse Alluvium	0.056	111.0	4.16	0.000	4.16	0	19	1.77%	2.6	36%	4.41	0.000	4.41
73.982	6903.45	88.0	1.420	88.0	2.0	0.85	1.61%	Coarse Alluvium	0.056	111.0	4.17	0.000	4.17	0	20	1.69%	2.6	36%	4.42	0.000	4.42
74.146	6903.28	93.1	1.520	93.1	2.2	0.94	1.63%	Coarse Alluvium	0.056	111.0	4.18	0.000	4.18	0	21	1.71%	2.6	36%	4.43	0.000	4.43
74.310	6903.12	92.1	1.544	92.1	2.1	0.89	1.68%	Coarse Alluvium	0.056	111.0	4.19	0.000	4.19	0	21	1.76%	2.6	36%	4.44	0.000	4.44
74.474	6902.96	88.4	1.592	88.4	1.7	0.73	1.80%	Coarse Alluvium	0.056	111.0	4.20	0.000	4.20	0	20	1.89%	2.6	36%	4.45	0.000	4.45
74.638	6902.79	86.2	1.643	86.2	1.9	0.81	1.91%	Coarse Alluvium	0.056	111.0	4.21	0.000	4.21	0	19	2.00%	2.7	36%	4.46	0.000	4.46
74.802	6902.63	86.5	1.678	86.5	1.2	0.53	1.94%	Coarse Alluvium	0.056	111.0	4.22	0.000	4.22	0	20	2.04%	2.7	36%	4.47	0.000	4.47
74.966	6902.46	77.0	1.381	77.0	0.9	0.39	1.79%	Coarse Alluvium	0.056	111.0	4.22	0.000	4.22	0	17	1.90%	2.7	36%	4.48	0.000	4.48
75.130	6902.30	72.0	1.337	72.0	1.0	0.45	1.86%	Coarse Alluvium	0.056	111.0	4.23	0.000	4.23	0	16	1.97%	2.7	36%	4.49	0.000	4.49
75.294	6902.14	68.0	1.301	68.0	1.0	0.45	1.91%	Coarse Alluvium	0.056	111.0	4.24	0.000	4.24	0	15	2.04%	2.8	36%	4.49	0.000	4.49
75.458	6901.97	70.1	1.272	70.1	0.8	0.36	1.81%	Coarse Alluvium	0.056	111.0	4.25	0.000	4.25	0	15	1.93%	2.7	36%	4.50	0.000	4.50
75.622	6901.81	69.4	1.196	69.4	0.6	0.24	1.72%	Coarse Alluvium	0.056	111.0	4.26	0.000	4.26	0	15	1.84%	2.7	36%	4.51	0.000	4.51
75.786	6901.64	72.3	1.167	72.3	0.7	0.29	1.61%	Coarse Alluvium	0.056	111.0	4.27	0.000	4.27	0	16	1.71%	2.7	36%	4.52	0.000	4.52
75.951	6901.48	81.3	1.280	81.3	1.2	0.51	1.58%	Coarse Alluvium	0.056	111.0	4.28	0.000	4.28	0	18	1.66%	2.6	36%	4.53	0.000	4.53
76.115	6901.32	82.5	1.372	82.5	1.1	0.49	1.66%	Coarse Alluvium	0.056	111.0	4.29	0.000	4.29	0	18	1.75%	2.6	36%	4.54	0.000	4.54
76.279	6901.15	81.5	1.347	81.5	0.8	0.35	1.65%	Coarse Alluvium	0.056	111.0	4.30	0.000	4.30	0	18	1.74%	2.7	36%	4.55	0.000	4.55
76.443	6900.99	83.7	1.312	83.7	1.1	0.49	1.57%	Coarse Alluvium	0.056	111.0	4.31	0.000	4.31	0	18	1.65%	2.6	36%	4.56	0.000	4.56
76.607	6900.82	86.8	1.384	86.8	2.2	0.96	1.59%	Coarse Alluvium	0.056	111.0	4.32	0.000	4.32	0	19	1.68%	2.6	36%	4.57	0.000	4.57
76.771	6900.66	102.4	1.512	102.4	2.0	0.85	1.48%	Coarse Alluvium	0.056	111.0	4.32	0.000	4.32	0	23	1.54%	2.5	36%	4.58	0.000	4.58
76.935	6900.50	113.5	0.957	113.5	1.5	0.63	0.84%	Coarse Alluvium	0.056	111.0	4.33	0.000	4.33	0	25	0.88%	2.4	36%	4.59	0.000	4.59
77.099	6900.33	111.7	1.361	111.7	1.2	0.53	1.22%	Coarse Alluvium	0.056	111.0	4.34	0.000	4.34	0	25	1.27%	2.5	36%	4.59	0.000	4.59
77.263	6900.17	106.8	1.506	106.8	4.4	1.91	1.41%	Coarse Alluvium	0.056	111.0	4.35	0.000	4.35	0	24	1.47%	2.5	36%	4.60	0.000	4.60
77.427	6900.00	86.2	1.982	86.2	0.4	0.16	2.30%	Coarse Alluvium	0.056	111.0	4.36	0.000	4.36	0	19	2.42%	2.7	36%	4.61	0.000	4.61
77.591	6899.84	88.7	1.678	88.7	2.9	1.26	1.89%	Coarse Alluvium	0.056	111.0	4.37	0.000	4.37	0	19	1.99%	2.7	36%	4.62	0.000	4.62
77.755	6899.68	120.4	1.831	120.3	4.2	1.83	1.52%	Coarse Alluvium	0.056	111.0	4.38	0.000	4.38	0	26	1.58%	2.5	36%	4.63	0.000	4.63
77.919	6899.51	145.7	2.244	145.6	2.1	0.89	1.54%	Coarse Alluvium	0.056	111.0	4.39	0.000	4.39	0	32	1.59%	2.4	36%	4.64	0.000	4.64
78.083	6899.35	137.9	2.233	137.9	1.0	0.43	1.62%	Coarse Alluvium	0.056	111.0	4.40	0.000	4.40	0	30	1.67%	2.5	36%	4.65	0.000	4.65
78.247	6899.18	122.6	2.131	122.6	2.5	1.08	1.74%	Coarse Alluvium	0.056	111.0	4.41	0.000	4.41	0	27	1.80%	2.5	36%	4.66	0.000	4.66
78.411	6899.02	112.8	1.876	112.8	0.5	0.23	1.66%	Coarse Alluvium	0.056	111.0	4.42	0.000	4.42	0	25	1.73%	2.5	36%	4.67	0.000	4.67
78.575	6898.85	108.9	1.646	108.9	1.6	0.71	1.51%	Coarse Alluvium	0.056	111.0	4.42	0.000	4.42	0	24	1.58%	2.5	36%	4.68	0.000	4.68
78.739	6898.69	104.2	1.479	104.2	1.6	0.67	1.42%	Coarse Alluvium	0.056	111.0	4.43	0.000	4.43	0	23	1.48%	2.5	36%	4.69	0.000	4.69
78.903	6898.53	107.9	1.467	107.9	1.1	0.49	1.36%	Coarse Alluvium	0.056	111.0	4.44	0.000	4.44	0	23	1.42%	2.5	36%	4.69	0.000	4.69
79.067	6898.36	116.8	1.667	116.8	1.4	0.59	1.43%	Coarse Alluvium	0.056	111.0	4.45	0.000	4.45	0	25	1.48%	2.5	36%	4.70	0.000	4.70
79.231	6898.20	140.5	1.836	140.5	1.2	0.51	1.31%	Coarse Alluvium	0.056	111.0	4.46	0.000	4.46	0	30	1.35%	2.4	36%	4.71	0.000	4.71
79.395	6898.03	140.6	1.890	140.6	1.4	0.59	1.34%	Coarse Alluvium	0.056	111.0	4.47	0.000	4.47	0	30	1.39%	2.4	36%	4.72	0.000	4.72
79.559	6897.87	161.2	1.585	161.2	3.3	1.44	0.98%	Coarse Alluvium	0.056	111.0	4.48	0.000	4.48	0	35	1.01%	2.3	36%	4.73	0.000	4.73
79.723	6897.71	172.6	1.841	172.5	2.7	1.18	1.07%	Coarse Alluvium	0.056	111.0	4.49	0.000	4.49	0	37	1.10%	2.3	36%	4.74	0.000	4.74
79.887	6897.54	164.9	2.077	164.9	4.3	1.85	1.26%	Coarse Alluvium	0.056	111.0	4.50	0.000	4.50	0	36	1.29%	2.3	36%	4.75	0.000	4.75
80.052	6897.38	128.8	1.981	128.8	1.4	0.59	1.54%	Coarse Alluvium	0.056	111.0	4.51	0.000	4.51	0	28	1.59%	2.5	36%	4.76	0.000	4.76
80.216	6897.21	193.6	3.060	193.6	2.7	1.16	1.58%	Coarse Alluvium	0.056	111.0	4.52	0.000	4.52	0	42	1.62%	2.3	36%	4.77	0.000	4.77
80.380	6897.05	234.3	3.869	234.2	3.9	1.71	1.65%	Coarse Alluvium	0.056	111.0	4.52	0.000	4.52	0	51	1.68%	2.3	36%	4.78	0.000	4.78
80.544	6896.89	232.5	3.947	232.5	3.4	1.46	1.70%	Coarse Alluvium	0.056	111.0	4.53	0.000	4.53	0	50	1.73%	2.3	36%	4.79	0.000	4.79

21.55	1060	1.7E-03	1.9E+03	17	0.0237	9.5E-06	0	0.287	0.296	407	0.287	5655	3854	1803	5655	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.60	1060	1.7E-03	1.9E+03	17	0.0235	9.5E-06	0	0.287	0.296	408	0.287	5649	3851	1804	5649	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.65	1060	1.7E-03	1.9E+03	17	0.0232	9.4E-06	0	0.288	0.296	409	0.288	5644	3847	1805	5644	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.70	1060	1.7E-03	1.9E+03	17	0.0230	9.3E-06	0	0.288	0.296	410	0.288	5639	3843	1806	5639	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.75	1060	1.7E-03	1.9E+03	17	0.0228	9.3E-06	0	0.288	0.296	411	0.288	5634	3840	1807	5634	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.80	1060	1.7E-03	1.9E+03	17	0.0225	9.2E-06	0	0.288	0.297	412	0.288	5629	3836	1808	5629	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.85	1060	1.7E-03	1.9E+03	17	0.0223	9.1E-06	0	0.288	0.297	413	0.288	5623	3832	1809	5623	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.90	1060	1.7E-03	1.9E+03	17	0.0221	9.0E-06	0	0.288	0.297	414	0.288	5618	3829	1810	5618	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
21.95	1060	1.7E-03	1.9E+03	17	0.0218	9.0E-06	0	0.288	0.297	415	0.288	5613	3825	1811	5613	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.00	1060	1.7E-03	1.9E+03	17	0.0216	8.9E-06	0	0.289	0.297	416	0.289	5608	3822	1812	5608	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.05	1060	1.7E-03	1.9E+03	17	0.0214	8.8E-06	0	0.289	0.297	417	0.289	5603	3818	1813	5603	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.10	1060	1.7E-03	1.9E+03	17	0.0212	8.7E-06	0	0.289	0.298	418	0.289	5598	3815	1814	5598	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.15	1060	1.7E-03	1.9E+03	17	0.0209	8.7E-06	0	0.289	0.298	419	0.289	5593	3811	1815	5593	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.20	1060	1.7E-03	1.9E+03	17	0.0207	8.6E-06	0	0.289	0.298	420	0.289	5588	3808	1816	5588	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.25	1060	1.7E-03	1.9E+03	17	0.0205	8.5E-06	0	0.289	0.298	421	0.289	5582	3804	1817	5582	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.30	1060	1.7E-03	1.9E+03	17	0.0202	8.4E-06	0	0.290	0.298	422	0.290	5577	3801	1818	5577	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.35	1060	1.7E-03	1.9E+03	17	0.0200	8.4E-06	0	0.290	0.298	423	0.290	5572	3797	1819	5572	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.40	1060	1.7E-03	1.9E+03	17	0.0198	8.3E-06	0	0.290	0.299	424	0.290	5567	3794	1820	5567	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.45	1060	1.7E-03	1.9E+03	17	0.0195	8.2E-06	0	0.290	0.299	425	0.290	5562	3790	1821	5562	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.50	1060	1.7E-03	1.9E+03	17	0.0193	8.1E-06	0	0.290	0.299	426	0.290	5557	3787	1822	5557	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.55	1003	1.7E-03	1.7E+03	17	0.0191	9.0E-06	0	0.290	0.299	427	0.290	5552	3783	1823	5552	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.60	1003	1.7E-03	1.7E+03	17	0.0189	8.9E-06	0	0.290	0.299	428	0.290	5548	3780	1824	5548	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.65	1003	1.7E-03	1.7E+03	17	0.0186	8.8E-06	0	0.291	0.299	429	0.291	5543	3776	1825	5543	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.70	1003	1.7E-03	1.7E+03	17	0.0184	8.7E-06	0	0.291	0.300	430	0.291	5538	3773	1826	5538	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.75	1003	1.7E-03	1.7E+03	17	0.0182	8.6E-06	0	0.291	0.300	431	0.291	5533	3770	1827	5533	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.80	1003	1.7E-03	1.7E+03	17	0.0179	8.5E-06	0	0.291	0.300	432	0.291	5528	3766	1828	5528	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.85	1003	1.7E-03	1.7E+03	17	0.0177	8.4E-06	0	0.291	0.300	433	0.291	5523	3763	1829	5523	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.90	1003	1.7E-03	1.7E+03	17	0.0175	8.3E-06	0	0.291	0.300	434	0.291	5518	3759	1830	5518	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
22.95	1003	1.7E-03	1.7E+03	17	0.0172	8.3E-06	0	0.291	0.300	435	0.291	5513	3756	1831	5513	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
23.00	1003	1.7E-03	1.7E+03	17	0.0170	8.2E-06	0	0.292	0.301	436	0.292	5508	3753	1832	5508	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
23.05	1003	1.7E-03	1.7E+03	17	0.0168	8.1E-06	0	0.292	0.301	437	0.292	5504	3749	1833	5504	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
23.10	1003	1.7E-03	1.7E+03	17	0.0166	8.0E-06	0	0.292	0.301	438	0.292	5499	3746	1834	5499	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
23.15	1003	1.7E-03	1.7E+03	17	0.0163	7.9E-06	0	0.292	0.301	439	0.292	5494	3743	1835	5494	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
23.20	1003	1.7E-03	1.7E+03	17	0.0161	7.8E-06	0	0.292	0.301	440	0.292	5489	3739	1836	5489	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
23.25	1003	1.7E-03	1.7E+03	17	0.0159	7.7E-06	0	0.292	0.302	441	0.292	5485	3736	1837	5485	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
23.30	1003	1.7E-03	1.7E+03	17	0.0156	7.6E-06	0	0.292	0.302	442	0.292	5480	3733	1838	5480	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
23.35	1003	1.7E-03	1.7E+03	17	0.0154	7.5E-06	0	0.293	0.302	443	0.293	5475	3729	1839	5475	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
23.40	1003	1.7E-03	1.7E+03	17	0.0152	7.4E-06	0	0.293	0.302	444	0.293	5470	3726	1840	5470	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
23.45	1003	1.7E-03	1.7E+03	17	0.0149	7.3E-06	0	0.293	0.302	445	0.293	5466	3723	1841	5466	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
23.50	1003	1.7E-03	1.7E+03	17	0.0147	7.2E-06	0	0.293	0.302	446	0.293	5461	3720	1842	5461	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
23.55	1003	1.7E-03	1.7E+03	17	0.0145	7.1E-06	0	0.293	0.303	447	0.293	5456	3716	1843	5456	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
23.60	1003	1.7E-03	1.7E+03	17	0.0143	7.0E-06	0	0.293	0.303	448	0.293	5452	3713	1844	5452	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
23.65	1003	1.7E-03	1.7E+03	17	0.0140	6.9E-06	0	0.293	0.303	449	0.293	5447	3710	1845	5447	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
23.70	1003	1.7E-03	1.7E+03	17	0.0138	6.8E-06	0	0.294	0.303	450	0.294	5442	3707	1846	5442	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
23.75	1003	1.7E-03	1.7E+03	17	0.0136	6.7E-06	0	0.294	0.303	451	0.294	5438	3704	1847	5438	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
23.80	1003	1.7E-03	1.7E+03	17	0.0133	6.6E-06	0	0.294	0.303	452	0.294	5433	3700	1848	5433	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
23.85	1003	1.7E-03	1.7E+03	17	0.0131	6.5E-06	0	0.294	0.304	453	0.294	5429	3697	1849	5429	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
23.90	1003	1.7E-03	1.7E+03	17	0.0129	6.4E-06	0	0.294	0.304	454	0.294	5424	3694	1850	5424	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
23.95	1003	1.7E-03	1.7E+03	17	0.0126	6.3E-06	0	0.294	0.304	455	0.294	5419	3691	1851	5419	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
24.00	1003	1.7E-03	1.7E+03	17	0.0124	6.2E-06	0	0.294	0.304	456	0.294	5415	3688	1852	5415	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
24.05	1005	1.7E-03	1.7E+03	17	0.0122	6.1E-06	0	0.295	0.304	457	0.295	5410	3684	1853	5410	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
24.10	1005	1.7E-03	1.7E+03	17	0.0120	6.0E-06	0	0.295	0.304	458	0.295	5406	3681	1854	5406	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
24.15	1005	1.7E-03	1.7E+03	17	0.0117	5.9E-06	0	0.295	0.305	459	0.295	5401	3678	1855	5401	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
24.20	1005	1.7E-03	1.7E+03	17	0.0115	5.8E-06	0	0.295	0.305	460	0.295	5397	3675	1856	5397	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
24.25	1005	1.7E-03	1.7E+03	17	0.0113	5.7E-06	0	0.295	0.305	461	0.295	5392	3672	1857	5392	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
24.30	1005	1.7E-03	1.7E+03	17	0.0110	5.6E-06	0	0.295	0.305	462	0.295	5388	3669	1858	5388	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
24.35	1005	1.7E-03	1.7E+03	17	0.0108	5.5E-06	0	0.295	0.305	463	0.295	5383	3666	1859	5383	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
24.40	1005	1.7E-03	1.7E+03	17	0.0106	5.4E-06	0	0.295	0.305	464	0.295	5379	3663	1860	5379	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
24.45	1005	1.7E-03	1.7E+03	17	0.0103	5.3E-06	0	0.296	0.305	465	0.296	5374	3660	1861	5374	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
24.50	1005	1.7E-03	1.7E+03	17	0.0101	5.1E-06	0	0.296	0.306	466	0.296	5370	3657	1862	5370	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
24.55	1005	1.7E-03	1.7E+03	17	0.0099	5.0E-06	0	0.296	0.306	467	0.296	5366	3653	1863	5366	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
24.60	1005	1.7E-03	1.7E+03	17	0.0097	4.9E-06	0	0.296	0.306	468	0.296	5361	3650	1864	5361	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
24.65	1005	1.7E-03	1.7E+03	17	0.0094	4.8E-06	0	0.296	0.306	469	0.296	5357	3647	1865	5357	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
24.70	1005	1.7E-03	1.7E+03	17	0.0092	4.7E-06	0	0.296	0.306	470	0.296	5352	3644	1866	5352	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
24.75	1005	1.7E-03	1.7E+03	17	0.0090	4.6E-06	0	0.296	0.306	471	0.296	5348	3641	1867	5348	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
24.80	1005	1.7E-03	1.7E+03	17	0.0087	4.5E-06	0	0.297	0.307	472	0.297	5344	3638	1868	5344	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
24.85	1005	1.7E-03	1.7E+03	17	0.0085	4.4E-06	0	0.297	0.307	473	0.297	5339	3635	1869	5339	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
24.90	1005	1.7E-03	1.7E+03	17	0.0083	4.3E-06	0	0.297	0.307	474	0.297	5335	3632	1870	5335	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
24.95	1005	1.7E-03	1.7E+03	17	0.0080	4.2E-06	0	0.297	0.307	475	0.297	5331	3629	1871	5331	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
25.00	1005	1.7E-03	1.7E+03	17	0.0078	4.1E-06	0	0.297	0.307	476	0.297	5326	3626	1872	5326	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
25.05	1005	1.7E-03	1.7E+03	17	0.0076	3.9E-06	0	0.297	0.307	477	0.297	5322	3623	1873	5322	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
25.10	1005	1.7E-03	1.7E+03	17	0.0074	3.8E-06	0	0.297	0.308	478	0.297	5318	3620	1874	5318	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
25.15	1005	1.7E-03	1.7E+03	17	0.0071	3.7E-06	0	0.298	0.308	479	0.298	5314	3617	1875	5314	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
25.20	1005	1.7E-03	1.7E+03	17	0.0069	3.6E-06	0	0.298	0.308	480	0.298	5309	3614	1876	5309	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
25.25	1005	1.7E-03	1.7E+03	17	0.0067	3.5E-06	0	0.298	0.308	481	0.298	5305	3612	1877	5305	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
25.30	1005	1.7E-03	1.7E+03	16	0.0064	3.4E-06	0	0.298	0.308	482	0.298	5301	3609	1878	5301	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
25.35	1005	1.7E-03	1.7E+03	16	0.0062	3.3E-06	0	0.298	0.308	483	0.298	5297	3606	1879	5297	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
25.40	1005	1.7E-03	1.7E+03	16	0.0060	3.1E-06	0	0.298	0.309	484	0.298	5293	3603	1880	5293	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
25.45	1005	1.7E-03	1.7E+03	16	0.0057	3.0E-06	0	0.298	0.309	485	0.298	5288	3600	1881	5288	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
25.50	1005	1.7E-03	1.7E+03	16	0.0055	2.9E-06	0	0.298	0.309	486	0.298	5284	3597	1882	5284	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
25.55	1235	1.7E-03	2.6E+03	16	0.0053	1.9E-06	0	0.299	0.309	487	0.299	5280	3594	1883	5280	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
25.60	1235	1.7E-03	2.6E+03	16	0.0051	1.8E-06	0	0.299	0.309	488	0.299	5276	3591	1884	5276	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
25.65	1235	1.7E-03	2.6E+03	16	0.0048	1.7E-06	0	0.299	0.309	489	0.299	5272	3588	1885	5272	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
25.70	1235	1.7E-03	2.6E+03	16	0.0046	1.6E-06	0	0.299	0.309	490	0.299	5267	3585	1886	5267	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
25.75	1235	1.7E-03	2.6E+03	16	0.0044	1.5E-06	0	0.299	0.310	491	0.299	5263	3582	1887	5263	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
25.80	1235	1.7E-03	2.6E+03	16	0.0041	1.5E-06	0	0.299	0.310	492	0.299	5259	3580	1888	5259	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
25.85	1235	1.7E-03	2.6E+03	16	0.0039	1.4E-06	0	0.299	0.310	493	0.299	5255	3577	1889	5255	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000

80.708	6896.72	201.0	3.303	201.0	2.8	1.20	1.64%	Coarse Alluvium	0.056	111.0	4.54	0.000	4.54	0	43	1.68%	2.3	36%	4.79	0.000	4.79
80.872	6896.56	174.7	2.828	174.6	1.9	0.83	1.62%	Coarse Alluvium	0.056	111.0	4.55	0.000	4.55	0	37	1.66%	2.4	36%	4.80	0.000	4.80
81.036	6896.39	175.9	2.247	175.9	1.4	0.59	1.28%	Coarse Alluvium	0.056	111.0	4.56	0.000	4.56	0	38	1.31%	2.3	36%	4.81	0.000	4.81
81.200	6896.23	180.5	3.641	180.5	6.9	2.97	2.02%	Coarse Alluvium	0.056	111.0	4.57	0.000	4.57	0	39	2.07%	2.4	36%	4.82	0.000	4.82
81.364	6896.07	176.2	4.838	176.2	5.7	2.46	2.75%	Coarse Alluvium	0.056	111.0	4.58	0.000	4.58	0	37	2.82%	2.5	36%	4.83	0.000	4.83
81.528	6895.90	162.7	4.408	162.7	0.2	0.10	2.71%	Coarse Alluvium	0.056	111.0	4.59	0.000	4.59	0	34	2.79%	2.6	36%	4.84	0.000	4.84
81.692	6895.74	178.8	3.777	178.8	4.5	1.93	2.11%	Coarse Alluvium	0.056	111.0	4.60	0.000	4.60	0	38	2.17%	2.4	36%	4.85	0.000	4.85
81.856	6895.57	192.8	3.206	192.7	4.9	2.14	1.66%	Coarse Alluvium	0.056	111.0	4.61	0.000	4.61	0	41	1.70%	2.4	36%	4.86	0.000	4.86
82.020	6895.41	196.4	3.155	196.4	5.6	2.42	1.61%	Coarse Alluvium	0.056	111.0	4.62	0.000	4.62	0	42	1.65%	2.3	36%	4.87	0.000	4.87
82.184	6895.25	175.8	2.856	175.8	6.8	2.93	1.62%	Coarse Alluvium	0.056	111.0	4.63	0.000	4.63	0	37	1.67%	2.4	36%	4.88	0.000	4.88
82.348	6895.08	165.6	2.303	165.6	4.7	2.05	1.39%	Coarse Alluvium	0.056	111.0	4.63	0.000	4.63	0	35	1.43%	2.4	36%	4.89	0.000	4.89
82.512	6894.92	158.2	2.014	158.1	3.9	1.69	1.27%	Coarse Alluvium	0.056	111.0	4.64	0.000	4.64	0	33	1.31%	2.4	36%	4.90	0.000	4.90
82.676	6894.75	153.2	2.228	153.2	3.2	1.38	1.45%	Coarse Alluvium	0.056	111.0	4.65	0.000	4.65	0	32	1.50%	2.4	36%	4.90	0.000	4.90
82.840	6894.59	166.2	2.685	166.2	3.4	1.46	1.62%	Coarse Alluvium	0.056	111.0	4.66	0.000	4.66	0	35	1.66%	2.4	36%	4.91	0.000	4.91
83.004	6894.43	149.4	2.829	149.4	5.3	2.28	1.89%	Coarse Alluvium	0.056	111.0	4.67	0.000	4.67	0	31	1.95%	2.5	36%	4.92	0.000	4.92
83.168	6894.26	213.0	4.207	213.0	10.1	4.37	1.97%	Coarse Alluvium	0.056	111.0	4.68	0.000	4.68	0	45	2.02%	2.4	36%	4.93	0.000	4.93
83.332	6894.10	304.4	5.876	304.3	12.0	5.20	1.93%	Coarse Alluvium	0.056	111.0	4.69	0.000	4.69	0	64	1.96%	2.2	36%	4.94	0.000	4.94
83.496	6893.93	237.4	6.993	237.3	12.3	5.35	2.95%	Coarse Alluvium	0.056	111.0	4.70	0.000	4.70	0	50	3.01%	2.5	36%	4.95	0.000	4.95
83.660	6893.77	206.9	5.430	206.8	9.3	4.03	2.62%	Coarse Alluvium	0.056	111.0	4.71	0.000	4.71	0	43	2.69%	2.5	36%	4.96	0.000	4.96
83.824	6893.61	187.5	4.225	187.5	5.7	2.46	2.25%	Coarse Alluvium	0.056	111.0	4.72	0.000	4.72	0	39	2.31%	2.5	36%	4.97	0.000	4.97
83.988	6893.44	174.8	3.938	174.8	5.4	2.32	2.25%	Coarse Alluvium	0.056	111.0	4.73	0.000	4.73	0	36	2.32%	2.5	36%	4.98	0.000	4.98
84.153	6893.28	194.7	4.146	194.7	9.0	3.90	2.13%	Coarse Alluvium	0.056	111.0	4.73	0.000	4.73	0	40	2.18%	2.4	36%	4.99	0.000	4.99
84.317	6893.11	198.1	3.974	198.0	7.0	3.01	2.01%	Coarse Alluvium	0.056	111.0	4.74	0.000	4.74	0	41	2.06%	2.4	36%	5.00	0.000	5.00
84.481	6892.95	219.7	2.921	219.7	5.0	2.15	1.33%	Coarse Alluvium	0.056	111.0	4.75	0.000	4.75	0	45	1.36%	2.3	36%	5.00	0.000	5.00
84.645	6892.79	241.9	2.807	241.8	5.9	2.54	1.16%	Coarse Alluvium	0.056	111.0	4.76	0.000	4.76	0	50	1.18%	2.2	36%	5.01	0.000	5.01
84.809	6892.62	275.3	2.947	275.2	5.8	2.52	1.07%	Coarse Alluvium	0.056	111.0	4.77	0.000	4.77	0	57	1.09%	2.1	36%	5.02	0.000	5.02
84.973	6892.46	304.3	2.706	304.2	7.2	3.11	0.89%	Coarse Alluvium	0.056	111.0	4.78	0.000	4.78	0	63	0.90%	2.0	36%	5.03	0.000	5.03
85.137	6892.29	326.3	3.161	326.3	6.3	2.75	0.97%	Coarse Alluvium	0.056	111.0	4.79	0.000	4.79	0	67	0.98%	2.0	36%	5.04	0.000	5.04
85.301	6892.13	317.5	3.308	317.5	6.2	2.68	1.04%	Coarse Alluvium	0.056	111.0	4.80	0.000	4.80	0	65	1.06%	2.1	36%	5.05	0.000	5.05
85.465	6891.97	305.3	2.983	305.2	4.4	1.91	0.98%	Coarse Alluvium	0.056	111.0	4.81	0.000	4.81	0	63	0.99%	2.1	36%	5.06	0.000	5.06
85.629	6891.80	253.4	2.720	253.4	3.1	1.34	1.07%	Coarse Alluvium	0.056	111.0	4.82	0.000	4.82	0	52	1.09%	2.2	36%	5.07	0.000	5.07
85.793	6891.64	227.0	3.377	227.0	3.0	1.30	1.49%	Coarse Alluvium	0.056	111.0	4.83	0.000	4.83	0	46	1.52%	2.3	36%	5.08	0.000	5.08
85.957	6891.47	217.9	3.663	217.9	2.9	1.26	1.68%	Coarse Alluvium	0.056	111.0	4.83	0.000	4.83	0	44	1.72%	2.3	36%	5.09	0.000	5.09
86.121	6891.31	222.3	5.234	222.3	5.5	2.40	2.35%	Coarse Alluvium	0.056	111.0	4.84	0.000	4.84	0	45	2.41%	2.4	36%	5.10	0.000	5.10
86.285	6891.14	253.5	4.559	253.5	6.5	2.83	1.80%	Coarse Alluvium	0.056	111.0	4.85	0.000	4.85	0	51	1.83%	2.3	36%	5.10	0.000	5.10
86.449	6890.98	158.9	3.725	158.9	6.2	2.67	2.34%	Coarse Alluvium	0.056	111.0	4.86	0.000	4.86	0	32	2.42%	2.5	36%	5.11	0.000	5.11
86.613	6890.82	134.2	2.265	134.2	3.8	1.65	1.69%	Coarse Alluvium	0.056	111.0	4.87	0.000	4.87	0	27	1.75%	2.5	36%	5.12	0.000	5.12
86.777	6890.65	124.3	2.022	124.3	3.0	1.30	1.63%	Coarse Alluvium	0.056	111.0	4.88	0.000	4.88	0	24	1.69%	2.5	36%	5.13	0.000	5.13
86.941	6890.49	131.8	2.125	131.7	3.0	1.28	1.61%	Coarse Alluvium	0.056	111.0	4.89	0.000	4.89	0	26	1.67%	2.5	36%	5.14	0.000	5.14
87.105	6890.32	130.9	1.817	130.9	1.0	0.45	1.39%	Coarse Alluvium	0.056	111.0	4.90	0.000	4.90	0	26	1.44%	2.5	36%	5.15	0.000	5.15
87.269	6890.16	107.8	1.588	107.8	-0.4	-0.18	1.47%	Coarse Alluvium	0.056	111.0	4.91	0.000	4.91	0	21	1.54%	2.6	36%	5.16	0.000	5.16
87.433	6890.00	125.8	1.786	125.8	0.3	0.14	1.42%	Coarse Alluvium	0.056	111.0	4.92	0.000	4.92	0	25	1.48%	2.5	36%	5.17	0.000	5.17
87.597	6889.83	178.9	2.091	178.9	2.0	0.85	1.17%	Coarse Alluvium	0.056	111.0	4.93	0.000	4.93	0	35	1.20%	2.3	36%	5.18	0.000	5.18
87.761	6889.67	182.9	2.239	182.9	1.6	0.69	1.22%	Coarse Alluvium	0.056	111.0	4.93	0.000	4.93	0	36	1.26%	2.3	36%	5.19	0.000	5.19
87.925	6889.50	184.0	1.863	184.0	1.0	0.45	1.01%	Coarse Alluvium	0.056	111.0	4.94	0.000	4.94	0	36	1.04%	2.3	36%	5.20	0.000	5.20
88.089	6889.34	198.0	1.832	198.0	0.5	0.20	0.93%	Coarse Alluvium	0.056	111.0	4.95	0.000	4.95	0	39	0.95%	2.2	36%	5.20	0.000	5.20
88.254	6889.18	175.0	2.037	175.0	-0.5	-0.20	1.16%	Coarse Alluvium	0.056	111.0	4.96	0.000	4.96	0	34	1.20%	2.3	36%	5.21	0.000	5.21
88.418	6889.01	159.1	1.975	159.2	-0.6	-0.24	1.24%	Coarse Alluvium	0.056	111.0	4.97	0.000	4.97	0	31	1.28%	2.4	36%	5.22	0.000	5.22
88.582	6888.85	165.7	1.897	165.7	-0.4	-0.18	1.14%	Coarse Alluvium	0.056	111.0	4.98	0.000	4.98	0	32	1.18%	2.3	36%	5.23	0.000	5.23
88.746	6888.68	178.8	1.899	178.8	-0.2	-0.08	1.06%	Coarse Alluvium	0.056	111.0	4.99	0.000	4.99	0	35	1.09%	2.3	36%	5.24	0.000	5.24
88.910	6888.52	198.4	1.887	198.4	-0.6	-0.24	0.95%	Coarse Alluvium	0.056	111.0	5.00	0.000	5.00	0	39	0.98%	2.2	36%	5.25	0.000	5.25
89.074	6888.36	193.1	1.716	193.1	-0.8	-0.36	0.89%	Coarse Alluvium	0.056	111.0	5.01	0.000	5.01	0	38	0.91%	2.2	36%	5.26	0.000	5.26
89.238	6888.19	190.0	1.544	190.0	-1.3	-0.57	0.81%	Coarse Alluvium	0.056	111.0	5.02	0.000	5.02	0	37	0.83%	2.2	36%	5.27	0.000	5.27
89.402	6888.03	188.9	1.368	188.9	-1.1	-0.47	0.72%	Coarse Alluvium	0.056	111.0	5.03	0.000	5.03	0	37	0.74%	2.2	36%	5.28	0.000	5.28
89.566	6887.86	188.1	1.479	188.1	-1.3	-0.55	0.79%	Coarse Alluvium	0.056	111.0	5.03	0.000	5.03	0	36	0.81%	2.2	36%	5.29	0.000	5.29
89.730	6887.70	164.1	1.834	164.1	-0.8	-0.36	1.12%	Coarse Alluvium	0.056	111.0	5.04	0.000	5.04	0	32	1.15%	2.4	36%	5.30	0.000	5.30
89.894	6887.54	147.7	1.329	147.7	-1.5	-0.65	0.90%	Coarse Alluvium	0.056	111.0	5.05	0.000	5.05	0	28	0.93%	2.3	36%	5.30	0.000	5.30
90.058	6887.37	148.4	1.521	148.4	-1.6	-0.71	1.02%	Coarse Alluvium	0.056	111.0	5.06	0.000	5.06	0	28	1.06%	2.4	36%	5.31	0.000	5.31
90.222	6887.21	181.2	1.550	181.2	-1.7	-0.75	0.86%	Coarse Alluvium	0.056	111.0	5.07	0.000	5.07	0	35	0.88%	2.3	36%	5.32	0.000	5.32
90.386	6887.04	193.4	1.996	193.4	-1.6	-0.69	1.03%	Coarse Alluvium	0.056	111.0	5.08	0.000	5.08	0	37	1.06%	2.3	36%	5.33	0.000	5.33
90.550	6886.88	200.4	1.665	200.4	-2.5	-1.08	0.83%	Coarse Alluvium	0.056	111.0	5.09	0.000	5.09	0	38	0.85%	2.2	36%	5.34	0.000	5.34
90.714	6886.72	240.4	1.781	240.4	-1.7	-0.75	0.74%	Coarse Alluvium	0.056	111.0	5.10	0.000	5.10	0	46	0.76%	2.1	36%	5.35	0.000	5.35
90.878	6886.55	240.0	2.697	240.0	-1.7	-0.73	1.12%	Coarse Alluvium	0.056	111.0	5.11	0.000	5.11	0	46	1.15%	2.2	36%	5.36	0.000	5.36
91.042	6886.39	225.2	3.396	225.2	-1.9	-0.81	1.51%	Coarse Alluvium	0.056	111.0	5.12	0.000	5.12	0	43	1.54%	2.3	36%	5.37	0.000	5.37
91.206	6886.22	213.7	3.313	213.7	-1.5	-0.65	1.55%	Coarse Alluvium	0.056	111.0	5.13	0.000	5.13	0	41	1.59%	2.3	36%	5.38	0.000	5.38
91.370	6886.06	200.7	3.490	200.7	-1.6	-0.71	1.74%	Coarse Alluvium	0.056	111.0	5.14	0.000	5.14	0	38	1.78%	2.4	36%	5.39	0.000	5.39
91.534	6885.90	123.1	3.538	123.1	-2.7	-1.16	2.87%	Coarse Alluvium	0.056	111.0	5.14	0.000	5.14	0	23	3.00%	2.7	36%	5.40	0.000	5.40
91.698	6885.73	64.5	3.045	64.5	-3.7	-1.59	4.72%	Coarse Alluvium	0.056	111.0	5.15	0.000	5.15	0	12	5.13%	3.1	36%	5.41	0.000	5.41
91.862	6885.57	47.7	2.189	47.7	-3.3	-1.44	4.59%	Coarse Alluvium	0.056	111.0	5.16	0.000	5.16	0	8	5.14%	3.2	36%	5.41	0.000	5.41
92.026	6885.40	99.9	1.913	99.9	1.2	0.51	1.92%	Coarse Alluvium	0.056	111.0	5.17	0.000	5.17	0	18	2.02%	2.7	36%	5.42	0.000	5.42
92.190	6885.24	142.8	1.768	142.8	1.3	0.55	1.24%	Coarse Alluvium	0.056	111.0	5.18	0.000	5.18	0	27	1.28%	2.4	36%	5.43	0.000	5.43
92.355	6885.08	144.2	1.412	144.2	0.1	0.02	0.98%	Coarse Alluvium	0.056	111.0	5.19	0.000	5.19	0	27	1.02%	2.4	36%	5.44	0.000	5.44
92.519	6884.91	142.1	0.308	142.1	-0.7	-0.30	0.22%	Coarse Alluvium	0.056	111.0	5.20	0.000	5.20	0	26	0.23%	2.1	36%	5.45	0.000	5.45
92.683	6884.75	135.4	0.530	135.4	-0.8	-0.35	0.39%	Coarse Alluvium	0.056	111.0	5.21	0.000	5.21	0	25	0.41%	2.2	36%	5.46	0.000	5.46
92.847	6884.58	138.6	0.653	138.5	8.5	3.66	0.47%	Coarse Alluvium	0.056	111.0	5.22	0.000	5.22	0	26	0.49%	2.3	36%	5.47	0.000	5.47
93.011	6884.42	131.0	0.808	131.0	0.9	0.39	0.62%	Coarse Alluvium	0.056	111.0	5.23	0.000	5.23	0	24	0.64%	2.3	36%	5.48	0.000	5.48
93.175	6884.26	122.0	0.867	122.0	-0.6	-0.26	0.71%	Coarse Alluvium	0.056	111.0	5.24	0.000	5.24	0	22	0.74%	2.4	36%	5.49	0.000	5.49
93.339	6884.09	134.9	1.098	134.9	-4.0	-1.75	0.81%	Coarse Alluvium	0.056	111.0	5.24	0.000	5.24	0	25	0.85%	2.4	36%	5.50	0.000	5.50
93.503	6883.93	163.2	1.641	163.2	-3.4	-1.46	1.01%	Coarse Alluvium	0.056	111.0	5.25	0.000	5.25	0	30	1.04%	2.3	36%	5.51	0.000	5.51
93.667	6883.76	186.9	1.857	186.9	-2.7	-1.18	0.99%	Coarse Alluvium	0.056	111.0	5.26	0.000	5.26	0	35	1.02%	2.3	36%	5.51	0.000	5.51
93.831	6883.60	193.0	2.073	193.0	-2.5	-1.08	1.07%	Coarse Alluvium	0.056	111.0	5.27	0.000	5.27	0	36	1.10%	2.3	36%	5.52	0.000	5.52
93.995	6883.44	199.4	2.059	199.4	-2.3	-0.98	1.03%	Coarse Alluvium	0.056	111.0	5.28	0.000	5.28	0	37	1.06%	2.3	36%	5.53	0.000	5.53
94.159	6883.27	204.2	2.008	204.2	-2.5	-1.08	0.98%	Coarse Alluvium	0.056	111.0	5.29	0.000	5.29	0	38	1.01%	2.3	36%	5.54	0.000	5.54
94.323	6883.11	190.8	2.045	190.8	-2.7	-1.16	1.07%	Coarse Alluvium	0.056	111.0	5.30	0.000	5.30	0	35	1.10%	2.3	36%	5.55	0.000	5.55
94.487	6882.94	178.7	2.495	178.7	-2.6	-1.14	1.40%	Coarse Alluvium	0.056	111.0	5.31	0.000	5.31	0	33	1.44%	2.4	36%	5.56	0.000	5.56
94.651	6882.78	195.5	2.741	195.5	-2.4	-1.02	1.40%	Coarse Alluvium	0.056	111.0	5.32	0.000	5.32	0	36	1.44%	2.4	36%	5.57	0.000	5.57

25.90	1235	1.7E-03	2.6E+03	16	0.0037	1.3E-06	0	0.300	0.310	494	0.300	5251	3574	1890	5251	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
25.95	1235	1.7E-03	2.6E+03	16	0.0034	1.2E-06	0	0.300	0.310	495	0.300	5247	3571	1891	5247	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
26.00	1235	1.7E-03	2.6E+03	16	0.0032	1.1E-06	0	0.300	0.310	496	0.300	5243	3568	1892	5243	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
26.05	1235	1.7E-03	2.6E+03	16	0.0030	1.1E-06	0	0.300	0.311	497	0.300	5239	3565	1893	5239	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
26.10	1235	1.7E-03	2.6E+03	16	0.0028	9.9E-07	0	0.300	0.311	498	0.300	5235	3563	1894	5235	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
26.15	1235	1.7E-03	2.6E+03	16	0.0025	9.1E-07	0	0.300	0.311	499	0.300	5231	3560	1895	5231	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
26.20	1235	1.7E-03	2.6E+03	16	0.0023	8.3E-07	0	0.300	0.311	500	0.300	5227	3557	1896	5227	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
26.25	1235	1.7E-03	2.6E+03	16	0.0021	7.5E-07	0	0.300	0.311	501	0.300	5223	3554	1897	5223	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
26.30	1235	1.7E-03	2.6E+03	16	0.0018	6.6E-07	0	0.301	0.311	502	0.301	5219	3551	1898	5219	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
26.35	1235	1.7E-03	2.6E+03	16	0.0016	5.8E-07	0	0.301	0.312	503	0.301	5215	3549	1899	5215	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
26.40	1235	1.7E-03	2.6E+03	16	0.0014	5.0E-07	0	0.301	0.312	504	0.301	5211	3546	1900	5211	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
26.45	1235	1.7E-03	2.6E+03	16	0.0012	4.2E-07	0	0.301	0.312	505	0.301	5207	3543	1901	5207	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
26.50	1235	1.7E-03	2.6E+03	16	0.0009	3.3E-07	0	0.301	0.312	506	0.301	5203	3540	1902	5203	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
26.55	1235	1.7E-03	2.6E+03	16	0.0007	2.5E-07	0	0.301	0.312	507	0.301	5199	3538	1903	5199	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
26.60	1235	1.7E-03	2.6E+03	16	0.0005	1.7E-07	0	0.301	0.312	508	0.301	5195	3535	1904	5195	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
26.65	1235	1.7E-03	2.6E+03	16	0.0002	8.4E-08	0	0.301	0.312	509	0.301	5191	3532	1905	5191	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
26.70	1235	1.7E-03	2.6E+03	16	0.0000	4.7E-11	0	0.302	0.313	510	0.302	5187	3530	1906	5187	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
26.75	1235	1.7E-03	2.6E+03	16	-0.0002	######	0	0.302	0.313	511	0.302	5183	3527	1907	5183	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
26.80	1235	1.7E-03	2.6E+03	16	-0.0005	######	0	0.302	0.313	512	0.302	5179	3524	1908	5179	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
26.85	1235	1.7E-03	2.6E+03	16	-0.0007	######	0	0.302	0.313	513	0.302	5175	3521	1909	5175	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
26.90	1235	1.7E-03	2.6E+03	16	-0.0009	######	0	0.302	0.313	514	0.302	5171	3519	1910	5171	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
26.95	1235	1.7E-03	2.6E+03	16	-0.0011	######	0	0.302	0.313	515	0.302	5168	3516	1911	5168	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
27.00	1235	1.7E-03	2.6E+03	16	-0.0014	######	0	0.302	0.313	516	0.302	5164	3513	1912	5164	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
27.05	1235	1.7E-03	2.6E+03	16	-0.0016	######	0	0.302	0.314	517	0.302	5160	3511	1913	5160	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
27.10	1016	1.7E-03	1.8E+03	16	-0.0018	######	0	0.303	0.314	518	0.303	5156	3508	1914	5156	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
27.15	1016	1.7E-03	1.8E+03	16	-0.0021	######	0	0.303	0.314	519	0.303	5152	3505	1915	5152	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
27.20	1016	1.7E-03	1.8E+03	16	-0.0023	######	0	0.303	0.314	520	0.303	5148	3503	1916	5148	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
27.25	1016	1.7E-03	1.8E+03	16	-0.0025	######	0	0.303	0.314	521	0.303	5144	3500	1917	5144	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
27.30	1016	1.7E-03	1.8E+03	16	-0.0028	######	0	0.303	0.314	522	0.303	5141	3497	1918	5141	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
27.35	1016	1.7E-03	1.8E+03	16	-0.0030	######	0	0.303	0.315	523	0.303	5137	3495	1919	5137	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
27.40	1016	1.7E-03	1.8E+03	16	-0.0032	######	0	0.303	0.315	524	0.303	5133	3492	1920	5133	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
27.45	1016	1.7E-03	1.8E+03	16	-0.0034	######	0	0.304	0.315	525	0.304	5129	3489	1921	5129	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
27.50	1016	1.7E-03	1.8E+03	16	-0.0037	######	0	0.304	0.315	526	0.304	5126	3487	1922	5126	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
27.55	1016	1.7E-03	1.8E+03	16	-0.0039	######	0	0.304	0.315	527	0.304	5122	3484	1923	5122	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
27.60	1016	1.7E-03	1.8E+03	16	-0.0041	######	0	0.304	0.315	528	0.304	5118	3482	1924	5118	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
27.65	1016	1.7E-03	1.8E+03	16	-0.0044	######	0	0.304	0.315	529	0.304	5114	3479	1925	5114	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
27.70	1016	1.7E-03	1.8E+03	16	-0.0046	######	0	0.304	0.316	530	0.304	5111	3476	1926	5111	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
27.75	1016	1.7E-03	1.8E+03	16	-0.0048	######	0	0.304	0.316	531	0.304	5107	3474	1927	5107	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
27.80	1016	1.7E-03	1.8E+03	16	-0.0051	######	0	0.304	0.316	532	0.304	5103	3471	1928	5103	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
27.85	1016	1.7E-03	1.8E+03	16	-0.0053	######	0	0.305	0.316	533	0.305	5099	3469	1929	5099	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
27.90	1016	1.7E-03	1.8E+03	16	-0.0055	######	0	0.305	0.316	534	0.305	5096	3466	1930	5096	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
27.95	1016	1.7E-03	1.8E+03	16	-0.0057	######	0	0.305	0.316	535	0.305	5092	3464	1931	5092	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
28.00	1016	1.7E-03	1.8E+03	16	-0.0060	######	0	0.305	0.316	536	0.305	5088	3461	1932	5088	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
28.05	1016	1.7E-03	1.8E+03	16	-0.0062	######	0	0.305	0.317	537	0.305	5085	3459	1933	5085	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
28.10	1016	1.7E-03	1.8E+03	16	-0.0064	######	0	0.305	0.317	538	0.305	5081	3456	1934	5081	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
28.15	1016	1.7E-03	1.8E+03	16	-0.0067	######	0	0.305	0.317	539	0.305	5077	3453	1935	5077	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
28.20	1016	1.7E-03	1.8E+03	16	-0.0069	######	0	0.305	0.317	540	0.305	5074	3451	1936	5074	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
28.25	1016	1.7E-03	1.8E+03	16	-0.0071	######	0	0.305	0.317	541	0.305	5070	3448	1937	5070	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
28.30	1016	1.7E-03	1.8E+03	16	-0.0074	######	0	0.306	0.317	542	0.306	5067	3446	1938	5067	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
28.35	1016	1.7E-03	1.8E+03	16	-0.0076	######	0	0.306	0.318	543	0.306	5063	3443	1939	5063	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
28.40	1016	1.7E-03	1.8E+03	16	-0.0078	######	0	0.306	0.318	544	0.306	5059	3441	1940	5059	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
28.45	1016	1.7E-03	1.8E+03	16	-0.0080	######	0	0.306	0.318	545	0.306	5056	3438	1941	5056	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
28.50	1016	1.7E-03	1.8E+03	16	-0.0083	######	0	0.306	0.318	546	0.306	5052	3436	1942	5052	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
28.55	1016	1.7E-03	1.8E+03	16	-0.0085	######	0	0.306	0.318	547	0.306	5049	3433	1943	5049	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
28.60	1637	1.7E-03	4.6E+03	16	-0.0087	######	0	0.306	0.318	548	0.306	5045	3431	1944	5045	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
28.65	1637	1.7E-03	4.6E+03	16	-0.0090	######	0	0.306	0.318	549	0.306	5041	3429	1945	5041	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
28.70	1637	1.7E-03	4.6E+03	16	-0.0092	######	0	0.307	0.319	550	0.307	5038	3426	1946	5038	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
28.75	1637	1.7E-03	4.6E+03	16	-0.0094	######	0	0.307	0.319	551	0.307	5034	3424	1947	5034	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
28.80	1637	1.7E-03	4.6E+03	16	-0.0097	######	0	0.307	0.319	552	0.307	5031	3421	1948	5031	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
28.85	1637	1.7E-03	4.6E+03	16	-0.0099	######	0	0.307	0.319	553	0.307	5027	3419	1949	5027	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
28.90	1637	1.7E-03	4.6E+03	16	-0.0101	######	0	0.307	0.319	554	0.307	5024	3416	1950	5024	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
28.95	1637	1.7E-03	4.6E+03	16	-0.0103	######	0	0.307	0.319	555	0.307	5020	3414	1951	5020	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
29.00	1637	1.7E-03	4.6E+03	16	-0.0106	######	0	0.307	0.319	556	0.307	5017	3411	1952	5017	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
29.05	1637	1.7E-03	4.6E+03	16	-0.0108	######	0	0.307	0.320	557	0.307	5013	3409	1953	5013	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
29.10	1637	1.7E-03	4.6E+03	16	-0.0110	######	0	0.308	0.320	558	0.308	5010	3407	1954	5010	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
29.15	1637	1.7E-03	4.6E+03	16	-0.0113	######	0	0.308	0.320	559	0.308	5006	3404	1955	5006	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
29.20	1637	1.7E-03	4.6E+03	16	-0.0115	######	0	0.308	0.320	560	0.308	5003	3402	1956	5003	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
29.25	1637	1.7E-03	4.6E+03	16	-0.0117	######	0	0.308	0.320	561	0.308	4999	3399	1957	4999	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
29.30	1637	1.7E-03	4.6E+03	16	-0.0120	######	0	0.308	0.320	562	0.308	4996	3397	1958	4996	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
29.35	1637	1.7E-03	4.6E+03	16	-0.0122	######	0	0.308	0.320	563	0.308	4992	3395	1959	4992	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
29.40	1637	1.7E-03	4.6E+03	16	-0.0124	######	0	0.308	0.321	564	0.308	4989	3392	1960	4989	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
29.45	1637	1.7E-03	4.6E+03	16	-0.0126	######	0	0.308	0.321	565	0.308	4986	3390	1961	4986	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
29.50	1637	1.7E-03	4.6E+03	16	-0.0129	######	0	0.309	0.321	566	0.309	4982	3387	1962	4982	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
29.55	1637	1.7E-03	4.6E+03	16	-0.0131	######	0	0.309	0.321	567	0.309	4979	3385	1963	4979	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
29.60	1637	1.7E-03	4.6E+03	16	-0.0133	######	0	0.309	0.321	568	0.309	4975	3383	1964	4975	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
29.65	1637	1.7E-03	4.6E+03	16	-0.0136	######	0	0.309	0.321	569	0.309	4972	3380	1965	4972	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
29.70	1637	1.7E-03	4.6E+03	16	-0.0138	######	0	0.309	0.321	570	0.309	4969	3378	1966	4969	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
29.75	1637	1.7E-03	4.6E+03	16	-0.0140	######	0	0.309	0.322	571	0.309	4965	3376	1967	4965	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
29.80	1637	1.7E-03	4.6E+03	16	-0.0143	######	0	0.309	0.322	572	0.309	4962	3373	1968	4962	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
29.85	1637	1.7E-03	4.6E+03	16	-0.0145	######	0	0.309	0.322	573	0.309	4958	3371	1969	4958	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
29.90	1637	1.7E-03	4.6E+03	16	-0.0147	######	0	0.309	0.322	574	0.309	4955	3369	1970	4955	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
29.95	1637	1.7E-03	4.6E+03	16	-0.0149	######	0	0.310	0.322	575	0.310	4952	3366	1971	4952	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
30.00	1637	1.7E-03	4.6E+03	16	-0.0152	######	0	0.310	0.322	576	0.310	4948	3364	1972	4948	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
30.05	1637	1.7E-03	4.6E+03	16	-0.0154	######	0	0.310	0.322	577	0.310	4945	3362	1973	4945	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
30.10	1637	1.7E-03	4.6E+03	16	-0.0156	######	0	0.310	0.323	578	0.310	4942	3359	1974	4942	0.00%	2.00	1.00	0.010%	0.000000	0.36	0.025	0.785	0.00%	0.0000
30.15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Proposed Repository	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Elev. At Bottom of Layer (ft)	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at Bottom of Layer (tsf)	Total Stress at Midpoint of Layer (tsf)	Equil Pore Pressure at Bottom of Layer (tsf)	Equil Pore Pressure at Midpoint of Layer (tsf)	Effective Stress at Bottom of Layer (tsf)	Effective Stress at Midpoint of Layer (tsf)
Erosion Protection	6981.7	6981.0	6980.2	1.5	0.061	122.9	0.092	0.046	0.00	0.00	0.092	0.046
Cover Soil	6980.2	6979.0	6977.7	2.5	0.057	114.7	0.235	0.164	0.00	0.00	0.235	0.164
Mine Spoils	6977.7	6977.6	6977.4	0.3	0.058	116.4	0.252	0.244	0.00	0.00	0.252	0.244

6977.43	Ground Surface Elevation at time of CPT (ft amsl)
6981.71	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
1.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after placement (ft)
2.50	Thickness of Water Storage/Rooting Zone (Cover Soil; ft)

0.25	Additional Stress due to Proposed Repository Construction, $\Delta\sigma_{repos}$ (psf)
6923.54	Elevation of bottom of tailings (ft amsl)

UNC-NECR WASTE REPOSITORY SEISMIC SETTLEMENT ANALYSIS - CPT-15

Data File: 13-52118_RP11-BSC-CPT
Location: UNC-NECR 2013 Mill Site PDS
http://projects.mwhglobal.com/.../13-52118_RP15-BSC-CPT.XLS

Cells Requiring User Input/Manipulation

Legend	Legend
Erosion Protection	Coarse Tailings
Cover Soil	Coarse/Fine Tailings
Mine Spoils	Fine Tailings
Radon Barrier	Coarse Alluvium
General Fill	Fine Alluvium

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.3
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69
Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.3
Earthquake Moment Magnitude, M:	6.3
Magnitude Scaling Factor, MSF:	1.59

Value	Parameter
0.00	Water surface elevation during CPT investigation (ft amsl)
0.00	Water surface elevation at t_0 (ft amsl)
0.00	Water surface elevation at t_1 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Earthquake
8.26	Equiv. Number of Uniform Strain Cycles, N

Midpoint Depth at t_1, z_1 (m)	Shear Wave Velocity, V_s (ft/sec)	Soil Density, ρ (tcf)	Max Shear Strain Modulus, G_{max} (tsf)	Coefficient a_2 for Stress Reduction Factor	Stress Reduction Factor, r_d	P = γ_{eff}*(G_{eff}/G_{max}) (tsf)	Plasticity Index, PI	g_1 for PI = 0	g_1 for PI = 15	g_1 for PI = 30	g_1	g_2 for PI = 0	g_2 for PI = 15	g_2 for PI = 30	g_2	Shear Strain, γ (%)	a	b	Threshhold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{c-15} (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
0.23	866	1.9E-03	1.4E+03	1249	0.9990	6.3E-06	12	0.102	0.091	4	0.093	35267	24912	1400	26983	0.001%	2.00	0.65	0.03%	0.000000	0.34	0.079	0.797	0.00%	0.0000
0.84	866	1.8E-03	1.3E+03	1017	0.9958	2.4E-05	12	0.137	0.127	4	0.129	20964	14659	1400	15920	0.003%	2.00	0.65	0.03%	0.000000	0.34	0.079	0.797	0.00%	0.0000
1.38	866	1.8E-03	1.4E+03	848	0.9924	3.8E-05	12	0.154	0.144	4	0.146	17169	11959	1400	13001	0.004%	1.18	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000

2013 CPT Data from ConeTec								CPT Data Interpretations											Conditions at t_1		
Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (per drilling log from coupled borehole)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	Normalized Cone Penetration Resistance	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1, u_1 (tsf)	Effective Stress at t_1 (tsf)
0.164	6976.48	38.9	0.066	38.9	-1.2	-0.51	0.17%	Radon Barrier	0.061	122.3	0.01	0.000	0.01	0	3880	0.17%	0.5	59%	0.31	0.000	0.31
0.328	6976.31	68.5	0.255	68.5	2.0	0.88	0.37%	Radon Barrier	0.061	122.3	0.02	0.000	0.02	0	3411	0.37%	0.8	59%	0.32	0.000	0.32
0.492	6976.15	153.5	0.385	153.4	13.3	5.78	0.25%	Radon Barrier	0.061	122.3	0.03	0.000	0.03	0	5100	0.25%	0.7	59%	0.33	0.000	0.33
0.656	6975.98	198.9	0.493	198.8	18.4	7.95	0.25%	Radon Barrier	0.061	122.3	0.04	0.000	0.04	0	4956	0.25%	0.7	59%	0.34	0.000	0.34
0.820	6975.82	209.2	0.964	209.1	15.8	6.85	0.46%	Radon Barrier	0.061	122.3	0.05	0.000	0.05	0	4170	0.46%	0.9	59%	0.35	0.000	0.35
0.984	6975.66	202.0	1.632	201.9	16.8	7.26	0.81%	Radon Barrier	0.061	122.3	0.06	0.000	0.06	0	3354	0.81%	1.1	59%	0.36	0.000	0.36
1.148	6975.49	194.1	2.159	194.0	11.1	4.82	1.11%	Radon Barrier	0.061	122.3	0.07	0.000	0.07	0	2763	1.11%	1.3	59%	0.37	0.000	0.37
1.312	6975.33	176.4	2.758	176.4	8.4	3.64	1.56%	Radon Barrier	0.061	122.3	0.08	0.000	0.08	0	2197	1.56%	1.4	59%	0.38	0.000	0.38
1.476	6975.16	172.4	3.280	172.4	6.6	2.87	1.90%	Radon Barrier	0.061	122.3	0.09	0.000	0.09	0	1908	1.90%	1.5	59%	0.39	0.000	0.39
1.640	6975.00	175.7	3.694	175.7	5.8	2.52	2.10%	Radon Barrier	0.061	122.3	0.10	0.000	0.10	0	1750	2.10%	1.6	59%	0.40	0.000	0.40
1.804	6974.84	161.9	4.117	161.8	5.5	2.40	2.54%	Radon Barrier	0.061	122.3	0.11	0.000	0.11	0	1466	2.55%	1.7	59%	0.41	0.000	0.41
1.968	6974.67	134.1	3.840	134.0	4.1	1.77	2.86%	Radon Barrier	0.061	122.3	0.12	0.000	0.12	0	1113	2.87%	1.7	59%	0.42	0.000	0.42
2.133	6974.51	120.5	3.293	120.5	2.1	0.91	2.73%	General Fill	0.057	113.8	0.13	0.000	0.13	0	928	2.73%	1.7	48%	0.43	0.000	0.43
2.297	6974.34	114.6	3.096	114.6	0.9	0.41	2.70%	General Fill	0.057	113.8	0.14	0.000	0.14	0	823	2.70%	1.7	48%	0.44	0.000	0.44
2.461	6974.18	125.5	3.340	125.5	0.8	0.33	2.66%	General Fill	0.057	113.8	0.15	0.000	0.15	0	845	2.66%	1.7	48%	0.45	0.000	0.45
2.625	6974.02	220.2	4.154	220.2	2.4	1.06	1.89%	General Fill	0.057	113.8	0.16	0.000	0.16	0	1395	1.89%	1.5	48%	0.46	0.000	0.46
2.789	6973.85	256.4	4.727	256.4	2.5	1.10	1.84%	General Fill	0.057	113.8	0.17	0.000	0.17	0	1534	1.84%	1.5	48%	0.46	0.000	0.46
2.953	6973.69	305.1	5.216	305.1	4.8	2.09	1.71%	General Fill	0.057	113.8	0.18	0.000	0.18	0	1729	1.71%	1.5	48%	0.47	0.000	0.47
3.117	6973.52	377.3	5.421	377.3	5.4	2.36	1.44%	Coarse Tailings	0.054	108.1	0.19	0.000	0.19	0	2036	1.44%	1.4	21%	0.48	0.000	0.48
3.281	6973.36	421.6	5.598	421.6	5.3	2.30	1.33%	Coarse Tailings	0.054	108.1	0.19	0.000	0.19	0	2171	1.33%	1.3	21%	0.49	0.000	0.49
3.445	6973.20	430.2	5.857	430.2	4.4	1.89	1.36%	Coarse Tailings	0.054	108.1	0.20	0.000	0.20	0	2118	1.36%	1.4	21%	0.50	0.000	0.50
3.609	6973.03	431.5	5.893	431.4	4.1	1.77	1.37%	Coarse Tailings	0.054	108.1	0.21	0.000	0.21	0	2036	1.37%	1.4	21%	0.51	0.000	0.51
3.773	6972.87	421.6	5.896	421.6	3.6	1.56	1.40%	Coarse Tailings	0.054	108.1	0.22	0.000	0.22	0	1909	1.40%	1.4	21%	0.52	0.000	0.52
3.937	6972.70	400.9	5.806	400.9	3.2	1.40	1.45%	Coarse Tailings	0.054	108.1	0.23	0.000	0.23	0	1745	1.45%	1.4	21%	0.53	0.000	0.53
4.101	6972.54	372.4	5.108	372.4	2.5	1.08	1.37%	Coarse Tailings	0.054	108.1	0.24	0.000	0.24	0	1561	1.37%	1.4	21%	0.54	0.000	0.54
4.265	6972.37	342.8	4.671	342.8	2.4	1.04	1.36%	Coarse Tailings	0.054	108.1	0.25	0.000	0.25	0	1385	1.36%	1.4	21%	0.55	0.000	0.55
4.429	6972.21	307.9	4.013	307.9	3.9	1.71	1.30%	Coarse Tailings	0.054	108.1	0.26	0.000	0.26	0	1201	1.30%	1.4	21%	0.55	0.000	0.55
4.593	6972.05	291.4	3.536	291.3	3.1	1.32	1.21%	Coarse Tailings	0.054	108.1	0.27	0.000	0.27	0	1098	1.21%	1.4	21%	0.56	0.000	0.56
4.757	6971.88	272.4	3.513	272.4	2.9	1.24	1.29%	Coarse Tailings	0.054	108.1	0.27	0.000	0.27	0	994	1.29%	1.4	21%	0.57	0.000	0.57
4.921	6971.72	249.3	3.044	249.3	2.1	0.91	1.22%	Coarse Tailings	0.054	108.1	0.28	0.000	0.28	0	881	1.22%	1.4	21%	0.58	0.000	0.58
5.085	6971.55	231.8	2.683	231.8	1.9	0.81	1.16%	Coarse Tailings	0.054	108.1	0.29	0.000	0.29	0	794	1.16%	1.4	21%	0.59	0.000	0.59
5.249	6971.39	201.6	2.341	201.6	1.6	0.71	1.16%	Coarse Tailings	0.054	108.1	0.30	0.000	0.30	0	670	1.16%	1.4	21%	0.60	0.000	0.60
5.413	6971.23	185.0	2.137	185.0	1.0	0.45	1.15%	Coarse Tailings	0.054	108.1	0.31	0.000	0.31	0	597	1.16%	1.5	21%	0.61	0.000	0.61
5.577	6971.06	170.7	1.978	170.7	0.3	0.12	1.16%	Coarse Tailings	0.054	108.1	0.32	0.000	0.32	0	535	1.16%	1.5	21%	0.62	0.000	0.62
5.741	6970.90	159.5	1.744	159.5	0.2	0.10	1.09%	Coarse Tailings	0.054	108.1	0.33	0.000	0.33	0	486	1.10%	1.5	21%	0.62	0.000	0.62
5.905	6970.73	146.7	1.630	146.7	-0.2	-0.10	1.11%	Coarse Tailings	0.054	108.1	0.34	0.000	0.34	0	436	1.11%	1.5	21%	0.63	0.000	0.63
6.069	6970.57	132.1	1.490	132.1	-0.7	-0.29	1.13%	Coarse Tailings	0.054	108.1	0.34	0.000	0.34	0	382	1.13%	1.6	21%	0.64	0.000	0.64
6.234	6970.41	121.9	1.332	121.9	-0.8	-0.33	1.09%	Coarse Tailings	0.054	108.1	0.35	0.000	0.35	0	344	1.10%	1.6	21%	0.65	0.000	0.65
6.398	6970.24	113.3	1.179	113.3	-0.7	-0.30	1.04%	Coarse Tailings	0.054	108.1	0.36	0.000	0.36	0	311	1.04%	1.6	21%	0.66	0.000	0.66
6.562	6970.08	104.0	1.031	104.0	-0.9	-0.41	0.99%	Coarse Tailings	0.054	108.1	0.37	0.000	0.37	0	279	1.00%	1.6	21%	0.67	0.000	0.67
6.726	6969.91	96.0	0.935	96.0	-0.7	-0.30	0.97%	Coarse Tailings	0.054	108.1	0.38	0.000	0.38	0	251	0.98%	1.6	21%	0.68	0.000	0.68
6.890	6969.75	85.1	0.824	85.2	-1.0	-0.45	0.97%	Coarse Tailings	0.054	108.1	0.39	0.000	0.39	0	218	0.97%	1.7	21%	0.69	0.000	0.69
7.054	6969.59	76.4	0.714	76.4	-1.0	-0.45	0.93%	Coarse Tailings	0.054	108.1	0.40	0.000	0.40	0	191	0.94%	1.7	21%	0.70	0.000	0.70
7.218	6969.42	71.0	0.633	71.0	-1.0	-0.45	0.89%	Coarse Tailings	0.054	108.1	0.41	0.000	0.41	0	173	0.90%	1.7	21%	0.70	0.000	0.70
7.382	6969.26	66.5	0.428	66.5	-1.3	-0.55	0.64%	Coarse Tailings	0.054	108.1	0.42	0.000	0.42	0	159	0.65%	1.6	21%	0.71	0.000	0.71
7.546	6969.09	59.5	0.458	59.5	-1.4	-0.61	0.77%	Coarse Tailings	0.054	108.1	0.42	0.000	0.42	0	139	0.78%	1.7	21%	0.72	0.000	0.72
7.710	6968.93	54.6	0.414	54.6	-0.8	-0.35	0.76%	Coarse Tailings	0.054	108.1	0.43	0.000	0.43	0	125	0.76%	1.8	21%	0.73	0.000	0.73
7.874	6968.77	49.6	0.356	49.6	-0.9	-0.39	0.72%	Coarse Tailings	0.054	108.1	0.44	0.000	0.44	0	111	0.72%	1.8	21%	0.74	0.000	0.74
8.038	6968.60	48.4	0.337	48.4	-1.1	-0.49	0.70%	Coarse Tailings	0.054	108.1	0.45	0.000	0.45	0	106	0.70%	1.8	21%	0.75	0.000	0.75
8.202	6968.44	46.7	0.323	46.7	-1.2	-0.51	0.69%	Coarse Tailings	0.054	108.1	0.46	0.000	0.46	0	100	0.70%	1.8	21%	0.76	0.000	0.76
8.366	6968.27	45.0	0.310	45.0	-1.3	-0.55	0.69%	Coarse Tailings	0.054	108.1	0.47	0.000	0.47	0	95	0.70%	1.8	21%	0.77	0.000	0.77
8.530	6968.11	43.4	0.279	43.4	-1.3	-0.57	0.64%	Coarse Tailings	0.054	108.1	0.48	0.000	0.48	0	90	0.65%	1.8	21%	0.78	0.000	0.78
8.694	6967.95	40.9	0.242	40.9	-1.2	-0.53	0.59%	Coarse Tailings	0.054	108.1	0.49	0.000	0.49	0	83	0.60%	1.8	21%	0.78	0.000	0.78
8.858	6967.78	40.2	0.221	40.2	-1.6	-0.67	0.55%	Coarse Tailings	0.054	108.1	0.50	0.000	0.50	0	80	0.56%	1.8	21%	0.79	0.000	0.79
9.022	6967.62	40.3	0.211	40.4	-1.7	-0.73	0.52%	Coarse Tailings	0.054	108.1	0.50	0.000	0.50	0	79	0.53%	1.8	21%	0.80	0.000	0.80
9.186	6967.45	39.9	0.208	39.9	-1.4	-0.61	0.52%	Coarse Tailings	0.054	108.1	0.51	0.000	0.51	0	77	0.53%	1.8	21%	0.81	0.000	0.81
9.350	6967.29	39.4	0.199	39.5	-1.4	-0.61	0.50%	Coarse Tailings	0.054	108.1	0.52	0.000	0.52	0	75	0.51%	1.8	21%	0.82	0.000	0.82
9.514	6967.13	39.1	0.194	39.1	-1.8	-0.77	0.50%	Coarse Tailings	0.054	108.1	0.53	0.000	0.53	0	73	0.50%	1.9	21%	0.83	0.000	0.83
9.678	6966.96	37.3	0.190	37.4	-1.8	-0.79	0.51%	Coarse Tailings	0.054	108.1	0.54	0.000	0.54	0	68	0.52%	1.9	21%	0.84	0.000	0.84
9.842	6966.80	37.0	0.193	37.0	-1.9	-0.83	0.52%	Coarse Tailings	0.054	108.1	0.55	0.000	0.55	0	66	0.53%	1.9	21%	0.85	0.000	0.85
10.006	6966.63	39.4	0.210	39.5	-1.8	-0.79	0.53%	Coarse Tailings	0.054	108.1	0.56	0.000	0.56	0	70	0.54%	1.9	21%	0.86	0.000	0.86
10.170	6966.47	37.7	0.215	37.7	-0.6	-0.24	0.57%	Coarse Tailings	0.054	108.1	0.57	0.000	0.57	0	66	0.58%	1.9	21%	0.86	0.000	0.86
10.335	6966.31	35.4	0.207	35.4	-0.8	-0.35	0.59%	Coarse Tailings	0.054	108.1	0.58	0.000	0.58	0	60	0.60%	2.0	21%	0.87	0.000	0.87
10.499	6966.14	33.6	0.194	33.7	-0.9	-0.39	0.58%	Coarse Tailings	0.054	108.1	0.58	0.000	0.58	0	57	0.59%	2.0	21%	0.88	0.000	0.88
10.663	6965.98	33.1	0.190	33.1	-1.3	-0.57	0.57%	Coarse Tailings	0.054	108.1	0.59	0.000	0.59	0	55	0.59%	2.0	21%	0.89	0.000	0.89
10.827	6965.81	32.8	0.193	32.8	-1.3	-0.57	0.59%	Coarse Tailings	0.054	108.1	0.60	0.000	0.60	0	53	0.60%	2.0	21%	0.90	0.000	0.90
10.991	6965.65	32.4	0.189	32.4	-1.5	-0.63	0.58%	Coarse Tailings	0.054	108.1	0.61	0.000	0.61	0	52	0.59%	2.0	21%	0.91	0.000	0.91
11.155	6965.49	31.7	0.178	31.7	-1.9	-0.83	0.56%	Coarse Tailings	0.054	108.1	0.62	0.000	0.62	0	50	0.57%	2.0	21%	0.92	0.000	0.92
11.319	6965.32	31.0	0.176	31.0	-1.6	-0.71	0.57%	Coarse Tailings	0.054	108.1	0.63	0.000	0.63	0	48	0.58%	2.0	21%	0.93	0.000	0.93
11.483	6965.16	30.8	0.169	30.8	-1.8	-0.77	0.55%	Coarse Tailings	0.054	108.1	0.64	0.000	0.64	0	47	0.56%	2.0	21%	0.94	0.000	0.94

Seismic Settlement Analysis - Stewart et al (2004)

TOTAL SEISMIC SETTLEMENT (FT): 0.0944

Midpoint Depth at t_1, z_1 (m)	Shear Wave Velocity, V_s (ft/sec)	Soil Density, ρ (tcf)	Max Shear Strain Modulus, G_{max} (tsf)	Coefficient a_2 for Stress Reduction Factor	Stress Reduction Factor, r_d	P = γ_{eff}*(G_{eff}/G_{max}) (tsf)	Plasticity Index, PI	g_1 for PI = 0	g_1 for PI = 15	g_1 for PI = 30	g_1	g_2 for PI = 0	g_2 for PI = 15	g_2 for PI = 30	g_2	Shear Strain, γ (%)	a	b	Threshhold Shear Strain, γ_{tv} (%)	Volumetric Strain at 15 Cycles, ε_{c-15} (%)	R	c	C_N	Volumetric Strain for Design Event, ε_v (%)	Incremental Consolidation (ft)
								0	15	30		0	15	30											
1.60	680	1.9E-03	8.8E+02	790	0.9909	6.8E-05	16	0.159	0.150	4	0.406	16188	11262	1400	10605	0.009%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
1.65	680	1.9E-03	8.8E+02	776	0.9905	7.0E-05	16	0.160	0.151	4	0.408	15976	11112	1400	10465	0.009%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
1.70	680	1.9E-03	8.8E+02	764	0.9901	7.2E-05	16	0.161	0.152	5	0.476	15774	10969	1401	10331	0.010%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
1.75	680	1.9E-03	8.8E+02	751	0.9897	7.4E-05	16	0.162	0.154	6	0.543	15580	10832	1402	10203	0.010%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
1.80	680	1.9E-03	8.8E+02	739	0.9893	7.6E-05	16	0.163	0.155	7	0.611	15395	10700	1403	10080	0.011%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
1.85	680	1.9E-03	8.8E+02	726	0.9890	7.9E-05	16	0.164	0.156	8	0.679	15216	10574	1404	9962	0.012%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
1.90	680	1.9E-03	8.8E+02	714	0.9885	8.1E-05	16	0.166	0.157	9	0.747	15045	10452	1405	9849	0.012%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
1.95	680	1.9E-03	8.8E+02	703	0.9881	8.3E-05	16	0.167	0.158	10	0.814	14880	10335	1406	9740	0.013%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.00	680	1.9E-03	8.8E+02	691	0.9877	8.5E-05	16	0.168	0.159	11	0.882	14721	10223	1407	9635	0.014%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.05	680	1.9E-03	8.8E+02	680	0.9873	8.7E-05	16	0.169	0.160	12	0.950	14568	10114	1408	9534	0.014%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.10	680	1.9E-03	8.8E+02	668	0.9869	8.9E-05	16	0.170	0.161	13	1.017	14420	10010	1409	9436	0.015%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.15	680	1.9E-03	8.8E+02	657	0.9864	9.2E-05	16	0.170	0.162	14	1.085	14277	9909	1410	9342	0.016%	0.65	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.20	680	1.8E-03	8.2E+02	646	0.9860	1.0E-04	19	0.171	0.163	15	4.120	14148	9817	1411	7576	0.019%	1.70	0.75	0.02%	0.000000	0.34	0.079	0.797	0.00%	0.0000
2.25	680	1.8E-03	8.2E+02	636	0.9855	1.0E-04	19	0.172	0.164	16	4.387	14023	9729	1412	7511	0.020%	1.70	0.75	0.02%	0.000009	0.34	0.079	0.797	0.00%	0.0000
2.30	680	1.8E-03	8.2E+02	625	0.9851	1.0E-04	19	0.173	0.165	17	4.655	13902	9644	1413	7449	0.021%	1.70	0.75	0.02%	0.000235	0.34	0.079	0.797	0.04%	0.0001
2.35	680	1.8E-03	8.2E+02	615	0.9846	1.1E-04	19	0.174	0.166	18	4.922	13785	9561	1414	7388	0.021%	1.70	0.75	0.02%	0.000394	0.34	0.079	0.797	0.06%	0.0001
2.40	680	1.8E-03	8.2E+02	605	0.9841	1.1E-04	19	0.175	0.167	19	5.189	13671	9480	1415	7329	0.022%	1.70	0.75	0.02%	0.000534	0.34	0.079	0.797	0.09%	0.0001
2.45	680	1.8E-03	8.2E+02	595	0.9837	1.1E-04	19	0.176	0.168	20	5.457	13560	9401	1416	7272	0.023%	1.70	0.75	0.02%	0.000664	0.34	0.079	0.797	0.11%	0.0002
2.50	680	1.7E-03	7.8E+02	585	0.9832	1.2E-04	0	0.176	0.169	21	0.176	13457	9329	1417	13457	0.019%	1.79	1.00	0.01%	0.000162	0.36	0.025	0.785	0.03%	0.0000
2.55	680	1.7E-03	7.8E+02	576	0.9827	1.2E-04	0	0.177	0.170	22	0.177	13357	9258	1418	13357	0.020%	1.79	1.00	0.01%	0.000171	0.36	0.025	0.785	0.03%	0.0000
2.60	680	1.7E-03	7.8E+02	566	0.9822	1.2E-04	0	0.178	0.170	23	0.178	13260	9189	1419	13260	0.020%	1.79	1.00	0.01%	0.000180	0.36	0.025	0.785	0.03%	0.0000
2.65	680	1.7E-03	7.8E+02	557	0.9817	1.3E-04	0	0.178	0.171	24	0.178	13164	9122	1420	13164	0.021%	1.79	1.00	0.01%	0.000190	0.36	0.025	0.785	0.03%	0.0000
2.70	680	1.7E-03	7.8E+02	548	0.9811	1.3E-04	0	0.179	0.172	25	0.179	13072	9057	1421	13072	0.021%	1.79	1.00	0.01%	0.000200	0.36	0.025	0.785	0.03%	0.0001
2.75	680	1.7E-03	7.8E+02	539	0.9806	1.3E-04	0	0.180	0.173	26	0.180	12981	8993	1422	12981	0.022%	1.79	1.00	0.01%	0.000209	0.36	0.025	0.785	0.03%	0.0001
2.80	680	1.7E-03	7.8E+02	530	0.9801	1.3E-04	0	0.181	0.174	27	0.181	12893	8930	1423	12893	0.022%	1.79	1.00	0.01%	0.000219	0.36	0.025	0.785	0.03%	0.0001
2.85	680	1.7E-03	7.8E+02	521	0.9795	1.3E-04	0	0.181	0.174	28	0.181	12806	8869	1424	12806	0.023%	1.79	1.00	0.01%	0.000229	0.36	0.025	0.785	0.04%	0.0001
2.90	680	1.7E-03	7.8E+02	513	0.9790	1.4E-04	0	0.182	0.175	29	0.182	12722	8809	1425	12722	0.023%	1.79	1.00	0.01%	0.000240	0.36	0.025	0.785	0.04%	0.0001
2.95	680	1.7E-03	7.8E+02	504	0.9784	1.4E-04	0	0.183	0.176	30	0.183	12639	8751	1426	12639	0.024%	1.79	1.00	0.01%	0.000250	0.36	0.025	0.785	0.04%	0.0001
3.00	680	1.7E-03	7.8E+02	496	0.9778	1.4E-04	0	0.183	0.177	31	0.183	12558	8694	1427	12558	0.025%	1.79	1.00	0.01%	0.000260	0.36	0.025	0.785	0.04%	0.0001
3.05	680	1.7E-03	7.8E+02	488	0.9772	1.4E-04	0	0.184	0.177	32	0.184	12479	8638	1428	12479	0.025%	1.79	1.00	0.01%	0.000271	0.36	0.025	0.785	0.04%	0.0001
3.10	680	1.7E-03	7.8E+02	480	0.9767	1.4E-04	0	0.185	0.178	33	0.185	12402	8584	1429	12402	0.026%	1.79	1.00	0.01%	0.000282	0.36	0.025	0.785	0.04%	0.0001
3.15	680	1.7E-03	7.8E+02	472	0.9761	1.5E-04	0	0.185	0.179	34	0.185	12326	8530	1430	12326	0.026%	1.79	1.00	0.01%	0.000293	0.36	0.025	0.785	0.05%	0.0001
3.20	680	1.7E-03	7.8E+02	464	0.9754	1.5E-04	0	0.186	0.179	35	0.186	12252	8478	1431	12252	0.027%	1.79	1.00	0.01%	0.000304	0.36	0.025	0.785	0.05%	0.0001
3.25	680	1.7E-03	7.8E+02	457	0.9748	1.5E-04	0	0.186	0.180	36	0.186	12180	8427	1432	12180	0.028%	1.79	1.00	0.01%	0.000315	0.36	0.025	0.785	0.05%	0.0001
3.30	680	1.7E-03	7.8E+02	449	0.9742	1.5E-04	0	0.187	0.181	37	0.187	12108	8377	1433	12108	0.028%	1.79	1.00	0.01%	0.000326	0.36	0.025	0.785	0.05%	0.0001
3.35	680	1.7E-03	7.8E+02	442	0.9735	1.5E-04	0	0.188	0.181	38	0.188	12039	8327	1434	12039	0.029%	1.79	1.00	0.01%	0.000338	0.36	0.025	0.785	0.05%	0.0001
3.40	680	1.7E-03	7.8E+02	435	0.9729	1.6E-04	0	0.188	0.182	39	0.188	11970	8279	1435	11970	0.030%	1.79	1.00	0.01%	0.000349	0.36	0.025	0.785	0.05%	0.0001
3.45	680	1.7E-03	7.8E+02	428	0.9722	1.6E-04	0	0.189	0.183	40	0.189	11903	8232	1436	11903	0.030%	1.79	1.00	0.01%	0.000361	0.36	0.025	0.785	0.06%	0.0001
3.50	680	1.7E-03	7.8E+02	421	0.9716	1.6E-04	0	0.189	0.183	41	0.189	11837	8185	1437	11837	0.031%	1.79	1.00	0.01%	0.000373	0.36	0.025	0.785	0.06%	0.0001
3.55	680	1.7E-03	7.8E+02	414	0.9709	1.6E-04	0	0.190	0.184	42	0.190	11773	8140	1438	11773	0.032%	1.79	1.00	0.01%	0.000385	0.36	0.025	0.785	0.06%	0.0001
3.60	680	1.7E-03	7.8E+02	407	0.9702	1.7E-04	0	0.191	0.185	43	0.191	11709	8095	1439	11709	0.032%	1.79	1.00	0.01%	0.000397	0.36	0.025	0.785	0.06%	0.0001
3.65	680	1.7E-03	7.8E+02	401	0.9695	1.7E-04	0	0.191	0.185	44	0.191	11647	8051	1440	11647	0.033%	1.79	1.00	0.01%	0.000410	0.36	0.025	0.785	0.06%	0.0001
3.70	680	1.7E-03	7.8E+02	394	0.9688	1.7E-04	0	0.192	0.186	45	0.192	11586	8008	1441	11586	0.034%	1.79	1.00	0.01%	0.000422	0.36	0.025	0.785	0.07%	0.0001
3.75	680	1.7E-03	7.8E+02	388	0.9680	1.7E-04	0	0.192	0.187	46	0.192	11526	7966	1442	11526	0.034%	1.79	1.00	0.01%	0.000435	0.36	0.025	0.785	0.07%	0.0001
3.80	680	1.7E-03	7.8E+02	381	0.9673	1.7E-04	0	0.193	0.187	47	0.193	11467	7925	1443	11467	0.035%	1.79	1.00	0.01%	0.000447	0.36	0.025	0.785	0.07%	0.0001
3.85	680	1.7E-03	7.8E+02	375	0.9665	1.8E-04	0	0.193	0.188	48	0.193	11409	7884	1444	11409	0.036%	1.79	1.00	0.01%	0.000460	0.36	0.025	0.785	0.07%	0.0001
3.90	680	1.7E-03	7.8E+02	369	0.9658	1.8E-04	0	0.194	0.188	49	0.194	11352	7844	1445	11352	0.036%	1.79	1.00	0.01%	0.000473	0.36	0.025	0.785	0.07%	0.0001
3.95	680	1.7E-03	7.8E+02	363	0.9650	1.8E-04	0	0.195	0.189	50	0.195	11296	7804	1446	11296	0.037%	1.79	1.00	0.01%	0.000487	0.36	0.025	0.785	0.08%	0.0001
4.00	680	1.7E-03	7.8E+02	357	0.9642	1.8E-04	0	0.195	0.190	51	0.195	11241	7765	1447	11241	0.038%	1.79	1.00	0.01%	0.000500	0.36	0.025	0.785	0.08%	0.0001
4.05	680	1.7E-03	7.8E+02	352	0.9634	1.8E-04	0	0.196	0.190	52	0.196	11187	7727	1448	11187	0.039%	1.79	1.00	0.01%	0.000513	0.36	0.025	0.785	0.08%	0.0001
4.10	680	1.7E-03	7.8E+02	346	0.9626	1.9E-04	0	0.196	0.191	53	0.196	11134	7690	1449	11134	0.039%	1.79	1.00	0.01%	0.000527	0.36	0.025	0.785	0.08%	0.0001
4.15	680	1.7E-03	7.8E+02	340	0.9618	1.9E-04	0	0.197	0.191	54	0.197	11082	7653	1450	11082	0.040%	1.79	1.00	0.01%	0.000541	0.36	0.025	0.785	0.08%	0.0001
4.20	680	1.7E-03	7.8E+02	335	0.9610	1.9E-04	0	0.197	0.192	55	0.197	11030	7617	1451	11030	0.041%	1.79	1.00	0.01%	0.000555	0.36	0.025	0.785	0.09%	0.0001
4.25	680	1.7E-03	7.8E+02	330	0.9601	1.9E-04	0	0.198	0.193	56	0.198	10979	7581	1452	10979	0.042%	1.79	1.00	0.01%	0.000569	0.36	0.025	0.785	0.09%	0.0001
4.30	680	1.7E-03	7.8E+02	324	0.9592	1.9E-04	0	0.198	0.193	57	0.198	10929	7546	1453	10929	0.043%	1.79	1.00	0.01%	0.000583	0.36	0.025	0.785	0.09%	0.0002
4.35	680	1.7E-03	7.8E+02	319	0.9584	2.0E-04	0	0.199	0.194	58	0.199	10880	7511	1454	10880	0.043%	1.79	1.00	0.01%	0.000597	0.36	0.025	0.785	0.09%	0.0002
4.40	680	1.7E-03	7.8E+02	314	0.9575	2.0E-04	0	0.199	0.194	59	0.199	10832	7477	1455	10832	0.044%	1.79	1.00	0.01%	0.000612	0.36	0.025	0.785	0.10%	0.0002
4.45	607	1.7E-03	6.2E+02	309	0.9566	2.5E-04	0	0.200	0.195	60	0.200	10784	7444	1456	10784	0.082%	1.79	1.00	0.01%	0.001297	0.36	0.025	0.785	0.20%	0.0003
4.50	607	1.7E-03	6.2E+02	304	0.9557	2.5E-04	0	0.200	0.195	61	0.200	10737	7411	1457	10737	0.084%	1.79	1.00	0.01%	0.001329	0.36	0.025	0.785	0.21%	0.0003
4.55	607	1.7E-03	6.2E+02	299	0.9547	2.5E-04	0	0.201	0.196	62	0.201	10691	7378	1458	10691	0.086%	1.79	1.00	0.01%	0.001362	0.36	0.025	0.785	0.21%	0.0004
4.60	607	1.7E-03	6.2E+02	294	0.9538	2.6E-04	0	0.201	0.196	63	0.201	10645	7346	1459	10645	0.088%	1.79	1.00	0.01%	0.001396	0.36	0.025	0.785	0.22%	0.0004
4.65	607	1.7E-03	6.2E+02	290	0.9528	2.6E-04	0	0.202	0.197	64	0.202	10600	7314	1460	10600	0.090%	1.79	1.00	0.01%	0.001430	0.36	0.025	0.785	0.22%	0.0004
4.70	607	1.7E-03	6.2E+02	285	0.9519	2.6E-04	0	0.202	0.197	65	0.202	10556	7283	1461	10556	0.092%	1.79	1.00	0.01%	0.001464	0.36	0.025	0.785	0.23%	0.0004
4.75	607	1.7E-03	6.2E+02	280	0.9509	2.6E-04	0	0.203	0.198	66	0.203	10513	7253	1462	10513	0.094%	1.79	1.00	0.01%	0.001498	0.36	0.025	0.785	0.24%	0.0004
4.80	607	1.7E-03	6.2E+02	276	0.9499	2.7E-04	0	0.203	0.199	67	0.203	10469	7222	1463	10469	0.096%	1.79	1.00	0.01%	0.001534	0.36	0.025	0.785	0.24%	0.0004
4.85	607	1.7E-03	6.2E+02	272	0.9488	2.7E-04	0	0.204	0.199	68	0.204	10427	7192	1464	10427	0.098%	1.79	1.00	0.01%	0.001569	0.36	0.025	0.785	0.25%	0.0004
4.90	607	1.7E-03	6.2E+02	267	0.9478	2.7E-04	0	0.204	0.200	69	0.204	10385	7163	1465	10385	0.100%	1.79	1.00	0.01%	0.001605	0.36	0.025	0.785	0.25%	0.0004
4.95	607	1.7E-03	6.2E+02	263	0.9468	2.7E-04	0	0.204	0.200	70	0.204	10344	7134	1466	10344	0.102%	1.79	1.00	0.01%	0.001641	0.36	0.025	0.785	0.26%	0.0004
5.00	607	1.7E-03	6.2E+02	259	0.9457	2.8E-04	0	0.205	0.201	71	0.205	10303	7105	1467	10303	0.104%	1.79	1.00	0.01%	0.001678	0.36	0.025	0.785	0.26%	0.0004
5.05	607	1.7E-03	6.2E+02	255	0.9446	2.8E-04	0	0.205	0.201	72	0.205	10263	7077	1468	10263	0.106%	1.79	1.00	0.01%	0.001714	0.36	0.025	0.785	0.27%	0.0004

11.647	6964.99	30.2	0.170	30.2	-1.6	-0.67	0.56%	Coarse Tailings	0.054	108.1	0.65	0.000	0.65	0	46	0.58%	2.1	21%	0.94	0.000	0.94
11.811	6964.83	30.5	0.175	30.5	-1.4	-0.61	0.57%	Coarse Tailings	0.054	108.1	0.66	0.000	0.66	0	45	0.59%	2.1	21%	0.95	0.000	0.95
11.975	6964.67	29.2	0.173	29.2	-1.8	-0.79	0.59%	Coarse Tailings	0.054	108.1	0.66	0.000	0.66	0	43	0.61%	2.1	21%	0.96	0.000	0.96
12.139	6964.50	26.9	0.168	27.0	-2.0	-0.88	0.62%	Coarse Tailings	0.054	108.1	0.67	0.000	0.67	0	39	0.64%	2.1	21%	0.97	0.000	0.97
12.303	6964.34	23.4	0.280	23.4	-1.2	-0.51	1.20%	Coarse Tailings	0.054	108.1	0.68	0.000	0.68	0	33	1.23%	2.3	21%	0.98	0.000	0.98
12.467	6964.17	16.2	0.310	16.3	-0.7	-0.30	1.91%	Coarse Tailings	0.054	108.1	0.69	0.000	0.69	0	23	1.99%	2.6	21%	0.99	0.000	0.99
12.631	6964.01	12.4	0.349	12.4	-0.7	-0.29	2.81%	Coarse Tailings	0.054	108.1	0.70	0.000	0.70	0	17	2.98%	2.8	21%	1.00	0.000	1.00
12.795	6963.84	15.2	0.291	15.2	-1.0	-0.45	1.91%	Coarse Tailings	0.054	108.1	0.71	0.000	0.71	0	20	2.00%	2.6	21%	1.01	0.000	1.01
12.959	6963.68	20.6	0.228	20.6	-0.9	-0.39	1.11%	Coarse Tailings	0.054	108.1	0.72	0.000	0.72	0	28	1.15%	2.4	21%	1.02	0.000	1.02
13.123	6963.52	24.8	0.134	24.8	-0.8	-0.35	0.54%	Coarse Tailings	0.054	108.1	0.73	0.000	0.73	0	33	0.56%	2.2	21%	1.02	0.000	1.02
13.287	6963.35	26.3	0.145	26.3	-1.2	-0.51	0.55%	Coarse Tailings	0.054	108.1	0.74	0.000	0.74	0	35	0.57%	2.2	21%	1.03	0.000	1.03
13.451	6963.19	22.3	0.254	22.3	-1.2	-0.53	1.14%	Coarse Tailings	0.054	108.1	0.74	0.000	0.74	0	29	1.18%	2.4	21%	1.04	0.000	1.04
13.615	6963.02	19.6	0.294	19.6	-0.5	-0.23	1.50%	Coarse Tailings	0.054	108.1	0.75	0.000	0.75	0	25	1.56%	2.5	21%	1.05	0.000	1.05
13.779	6962.86	25.8	0.270	25.8	-0.7	-0.29	1.05%	Coarse Tailings	0.054	108.1	0.76	0.000	0.76	0	33	1.08%	2.3	21%	1.06	0.000	1.06
13.943	6962.70	27.2	0.156	27.2	-0.6	-0.26	0.57%	Coarse Tailings	0.054	108.1	0.77	0.000	0.77	0	34	0.59%	2.2	21%	1.07	0.000	1.07
14.107	6962.53	28.2	0.119	28.2	-1.2	-0.51	0.42%	Coarse Tailings	0.054	108.1	0.78	0.000	0.78	0	35	0.43%	2.1	21%	1.08	0.000	1.08
14.271	6962.37	28.9	0.121	28.9	-0.5	-0.23	0.42%	Coarse Tailings	0.054	108.1	0.79	0.000	0.79	0	36	0.43%	2.1	21%	1.09	0.000	1.09
14.436	6962.20	30.1	0.133	30.1	-0.7	-0.29	0.44%	Coarse Tailings	0.054	108.1	0.80	0.000	0.80	0	37	0.45%	2.1	21%	1.09	0.000	1.09
14.600	6962.04	30.0	0.143	30.0	-0.6	-0.26	0.48%	Coarse Tailings	0.054	108.1	0.81	0.000	0.81	0	36	0.49%	2.1	21%	1.10	0.000	1.10
14.764	6961.88	29.6	0.161	29.6	-0.9	-0.41	0.54%	Coarse Tailings	0.054	108.1	0.81	0.000	0.81	0	35	0.56%	2.2	21%	1.11	0.000	1.11
14.928	6961.71	27.3	0.174	27.3	-1.1	-0.47	0.64%	Coarse Tailings	0.054	108.1	0.82	0.000	0.82	0	32	0.66%	2.2	21%	1.12	0.000	1.12
15.092	6961.55	22.9	0.199	22.9	-1.4	-0.59	0.87%	Coarse Tailings	0.054	108.1	0.83	0.000	0.83	0	26	0.90%	2.4	21%	1.13	0.000	1.13
15.256	6961.38	23.2	0.232	23.2	-0.6	-0.26	1.00%	Coarse Tailings	0.054	108.1	0.84	0.000	0.84	0	27	1.04%	2.4	21%	1.14	0.000	1.14
15.420	6961.22	22.4	0.309	22.4	-0.5	-0.20	1.38%	Coarse Tailings	0.054	108.1	0.85	0.000	0.85	0	25	1.43%	2.5	21%	1.15	0.000	1.15
15.584	6961.06	23.3	0.405	23.3	-0.7	-0.29	1.74%	Coarse Tailings	0.054	108.1	0.86	0.000	0.86	0	26	1.80%	2.5	21%	1.16	0.000	1.16
15.748	6960.89	15.4	0.397	15.4	-0.6	-0.24	2.59%	Coarse Tailings	0.054	108.1	0.87	0.000	0.87	0	17	2.74%	2.8	21%	1.17	0.000	1.17
15.912	6960.73	13.8	0.342	13.8	-0.9	-0.39	2.48%	Coarse Tailings	0.054	108.1	0.88	0.000	0.88	0	15	2.65%	2.8	21%	1.17	0.000	1.17
16.076	6960.56	24.9	0.307	24.9	-2.3	-0.98	1.23%	Coarse Tailings	0.054	108.1	0.89	0.000	0.89	0	27	1.28%	2.4	21%	1.18	0.000	1.18
16.240	6960.40	27.6	0.207	27.6	-1.5	-0.63	0.75%	Coarse Tailings	0.054	108.1	0.89	0.000	0.89	0	30	0.78%	2.3	21%	1.19	0.000	1.19
16.404	6960.24	25.9	0.126	25.9	-0.6	-0.24	0.49%	Coarse Tailings	0.054	108.1	0.90	0.000	0.90	0	28	0.50%	2.2	21%	1.20	0.000	1.20
16.568	6960.07	25.7	0.147	25.8	-0.7	-0.29	0.57%	Coarse Tailings	0.054	108.1	0.91	0.000	0.91	0	27	0.59%	2.3	21%	1.21	0.000	1.21
16.732	6959.91	25.9	0.208	25.9	-0.8	-0.35	0.80%	Coarse Tailings	0.054	108.1	0.92	0.000	0.92	0	27	0.83%	2.3	21%	1.22	0.000	1.22
16.896	6959.74	26.6	0.292	26.6	-0.7	-0.30	1.10%	Coarse Tailings	0.054	108.1	0.93	0.000	0.93	0	28	1.14%	2.4	21%	1.23	0.000	1.23
17.060	6959.58	26.6	0.305	26.6	-0.9	-0.39	1.15%	Coarse Tailings	0.054	108.1	0.94	0.000	0.94	0	27	1.19%	2.4	21%	1.24	0.000	1.24
17.224	6959.42	30.6	0.205	30.6	-1.0	-0.45	0.67%	Coarse Tailings	0.054	108.1	0.95	0.000	0.95	0	31	0.69%	2.2	21%	1.25	0.000	1.25
17.388	6959.25	34.6	0.189	34.6	-1.1	-0.49	0.55%	Coarse Tailings	0.054	108.1	0.96	0.000	0.96	0	35	0.56%	2.2	21%	1.25	0.000	1.25
17.552	6959.09	29.3	0.215	29.3	-0.8	-0.35	0.73%	Coarse Tailings	0.054	108.1	0.97	0.000	0.97	0	29	0.76%	2.3	21%	1.26	0.000	1.26
17.716	6958.92	28.8	0.301	28.8	-0.4	-0.16	1.04%	Coarse Tailings	0.054	108.1	0.97	0.000	0.97	0	29	1.08%	2.4	21%	1.27	0.000	1.27
17.880	6958.76	23.4	0.344	23.4	-0.9	-0.41	1.47%	Coarse Tailings	0.054	108.1	0.98	0.000	0.98	0	23	1.54%	2.5	21%	1.28	0.000	1.28
18.044	6958.60	30.1	0.314	30.2	-0.6	-0.26	1.04%	Coarse Tailings	0.054	108.1	0.99	0.000	0.99	0	29	1.08%	2.4	21%	1.29	0.000	1.29
18.208	6958.43	32.4	0.276	32.4	-0.3	-0.14	0.85%	Coarse Tailings	0.054	108.1	1.00	0.000	1.00	0	31	0.88%	2.3	21%	1.30	0.000	1.30
18.372	6958.27	38.3	0.198	38.3	0.0	0.00	0.52%	Coarse Tailings	0.054	108.1	1.01	0.000	1.01	0	37	0.53%	2.1	21%	1.31	0.000	1.31
18.537	6958.10	36.6	0.196	36.6	-1.0	-0.43	0.54%	Coarse Tailings	0.054	108.1	1.02	0.000	1.02	0	35	0.55%	2.2	21%	1.32	0.000	1.32
18.701	6957.94	28.5	0.312	28.6	-1.0	-0.43	1.09%	Coarse Tailings	0.054	108.1	1.03	0.000	1.03	0	27	1.13%	2.4	21%	1.33	0.000	1.33
18.865	6957.78	18.4	0.298	18.4	-0.8	-0.36	1.62%	Coarse Tailings	0.054	108.1	1.04	0.000	1.04	0	17	1.71%	2.7	21%	1.33	0.000	1.33
19.029	6957.61	14.8	0.326	14.9	-1.2	-0.53	2.20%	Coarse Tailings	0.054	108.1	1.05	0.000	1.05	0	13	2.36%	2.8	21%	1.34	0.000	1.34
19.193	6957.45	22.6	0.299	22.6	-1.1	-0.47	1.32%	Coarse Tailings	0.054	108.1	1.05	0.000	1.05	0	20	1.39%	2.6	21%	1.35	0.000	1.35
19.357	6957.28	33.4	0.289	33.4	-1.1	-0.47	0.87%	Coarse Tailings	0.054	108.1	1.06	0.000	1.06	0	30	0.89%	2.3	21%	1.36	0.000	1.36
19.521	6957.12	33.8	0.240	33.8	-1.3	-0.55	0.71%	Coarse Tailings	0.054	108.1	1.07	0.000	1.07	0	31	0.73%	2.3	21%	1.37	0.000	1.37
19.685	6956.96	32.5	0.185	32.5	-1.1	-0.47	0.57%	Coarse Tailings	0.054	108.1	1.08	0.000	1.08	0	29	0.59%	2.2	21%	1.38	0.000	1.38
19.849	6956.79	30.8	0.173	30.9	-0.9	-0.41	0.56%	Coarse Tailings	0.054	108.1	1.09	0.000	1.09	0	27	0.58%	2.3	21%	1.39	0.000	1.39
20.013	6956.63	28.7	0.272	28.7	-1.4	-0.59	0.95%	Coarse Tailings	0.054	108.1	1.10	0.000	1.10	0	25	0.99%	2.4	21%	1.40	0.000	1.40
20.177	6956.46	22.4	0.323	22.4	-0.8	-0.36	1.44%	Coarse Tailings	0.054	108.1	1.11	0.000	1.11	0	19	1.52%	2.6	21%	1.41	0.000	1.41
20.341	6956.30	22.0	0.349	22.1	-0.7	-0.30	1.58%	Coarse Tailings	0.054	108.1	1.12	0.000	1.12	0	19	1.67%	2.6	21%	1.41	0.000	1.41
20.505	6956.14	20.1	0.349	20.1	-0.9	-0.41	1.74%	Coarse Tailings	0.054	108.1	1.13	0.000	1.13	0	17	1.84%	2.7	21%	1.42	0.000	1.42
20.669	6955.97	22.7	0.229	22.8	-0.8	-0.33	1.01%	Coarse Tailings	0.054	108.1	1.13	0.000	1.13	0	19	1.06%	2.5	21%	1.43	0.000	1.43
20.833	6955.81	28.8	0.238	28.8	-0.5	-0.20	0.83%	Coarse Tailings	0.054	108.1	1.14	0.000	1.14	0	24	0.86%	2.4	21%	1.44	0.000	1.44
20.997	6955.64	27.8	0.178	27.9	-0.6	-0.26	0.64%	Coarse Tailings	0.054	108.1	1.15	0.000	1.15	0	23	0.67%	2.3	21%	1.45	0.000	1.45
21.161	6955.48	29.6	0.154	29.6	-0.8	-0.35	0.52%	Coarse Tailings	0.054	108.1	1.16	0.000	1.16	0	24	0.54%	2.3	21%	1.46	0.000	1.46
21.325	6955.31	31.3	0.170	31.3	-0.8	-0.35	0.54%	Coarse Tailings	0.054	108.1	1.17	0.000	1.17	0	26	0.56%	2.3	21%	1.47	0.000	1.47
21.489	6955.15	32.4	0.181	32.4	-0.7	-0.29	0.56%	Coarse Tailings	0.054	108.1	1.18	0.000	1.18	0	26	0.58%	2.3	21%	1.48	0.000	1.48
21.653	6954.99	32.8	0.193	32.8	-0.5	-0.20	0.59%	Coarse Tailings	0.054	108.1	1.19	0.000	1.19	0	27	0.61%	2.3	21%	1.49	0.000	1.49
21.817	6954.82	34.4	0.196	34.4	-0.6	-0.24	0.57%	Coarse Tailings	0.054	108.1	1.20	0.000	1.20	0	28	0.59%	2.3	21%	1.49	0.000	1.49
21.981	6954.66	34.7	0.203	34.7	-0.5	-0.23	0.58%	Coarse Tailings	0.054	108.1	1.21	0.000	1.21	0	28	0.61%	2.3	21%	1.50	0.000	1.50
22.145	6954.49	35.6	0.204	35.6	-0.7	-0.29	0.57%	Coarse Tailings	0.054	108.1	1.21	0.000	1.21	0	28	0.59%	2.2	21%	1.51	0.000	1.51
22.309	6954.33	37.2	0.010	37.2	-0.9	-0.39	0.03%	Coarse Tailings	0.054	108.1	1.22	0.000	1.22	0	29	0.03%	2.0	21%	1.52	0.000	1.52
22.473	6954.17	40.2	0.156	40.2	-0.7	-0.30	0.39%	Coarse Tailings	0.054	108.1	1.23	0.000	1.23	0	32	0.40%	2.1	21%	1.53	0.000	1.53
22.638	6954.00	6.0	0.203	6.0	-1.9	-0.81	3.40%	Coarse Tailings	0.054	108.1	1.24	0.000	1.24	0	4	4.28%	3.4	21%	1.54	0.000	1.54
22.802	6953.84	46.1	0.268	46.2	-0.5	-0.23	0.58%	Coarse Tailings	0.054	108.1	1.25	0.000	1.25	0	36	0.60%	2.2	21%	1.55	0.000	1.55
22.966	6953.67	40.5	0.458	40.5	-0.6	-0.26	1.13%	Coarse Tailings	0.054	108.1	1.26	0.000	1.26	0	31	1.17%	2.4	21%	1.56	0.000	1.56
23.130	6953.51	26.1	0.611	26.1	-1.1	-0.49	2.34%	Coarse Tailings	0.054	108.1	1.27	0.000	1.27	0	20	2.46%	2.7	21%	1.56	0.000	1.56
23.294	6953.35	19.6	0.570	19.6	-0.6	-0.24	2.91%	Coarse Tailings	0.054	108.1	1.28	0.000	1.28	0	14	3.12%	2.9	21%	1.57	0.000	1.57
23.458	6953.18	22.0	0.558	22.0	-0.3	-0.14	2.54%	Coarse Tailings	0.054	108.1	1.28	0.000	1.28	0	16	2.70%	2.8	21%	1.58	0.000	1.58
23.622	6953.02	21.9	0.547	21.9	-0.6	-0.26	2.50%	Coarse Tailings	0.054	108.1	1.29	0.000	1.29	0	16	2.66%	2.8	21%	1.59	0.000	1.59
23.786	6952.85	17.1	0.379	17.2	-0.2	-0.08	2.21%	Coarse Tailings	0.054	108.1	1.30	0.000	1.30	0	12	2.39%	2.9	21%	1.60	0.000	1.60
23.950	6952.69	20.5	0.361	20.5	0.4	0.18	1.76%	Coarse Tailings	0.054	108.1	1.31	0.000	1.31	0	15	1.88%	2.7	21%	1.61	0.000	1.61
24.114	6952.53	28.3	0.331	28.2	2.4	1.02	1.17%	Coarse Tailings	0.054	108.1	1.32	0.000	1.32	0	20	1.23%	2.5	21%	1.62	0.000	1.62
24.278	6952.36	32.1	0.263	32.1	2.1	0.91	0.82%	Coarse Tailings	0.054	108.1	1.33	0.000	1.33	0	23	0.85%	2.4	21%	1.63	0.000	1.63
24.442	6952.20	34.6	0.308	34.6	1.8	0.79	0.89%	Coarse Tailings	0.054	108.1	1.34	0.000	1.34	0	25	0.93%	2.4	21%	1.64	0.000	1.64
24.606	6952.03	31.4	0.412	31.4	1.3	0.57	1.31%	Coarse Tailings	0.054	108.1	1.35	0.000	1.35	0	22	1.37%	2.5	21%	1.64	0.000	1.64
24.770	6951.87	19.6	0.574	19.6	1.3	0.57	2.92%	Coarse Tailings	0.054	108.1	1.36	0.000	1.36	0	13	3.14%	2.9	21%	1.65	0.000	1.65
24.934	6951.71	28.9	0.546	28.9	1.2	0.51	1.89%	Coarse Tailings	0.054	108.1	1.36	0.000	1.36	0	20	1.98%	2.6	21%	1.66	0.000	1.66
25.098	6951.54	21.7	0.511	21.7	0.8	0.36	2.35%	Coarse Tailings	0.054	108.1	1.37	0.000	1.37	0	15	2.51%	2.8	21%	1.67	0.000	1.67
25.262	6951.38	29.9	0.463	29.9	0.1	0.04	1.55%	Coarse Tailings	0.054	108.1	1.38	0.000	1.38	0	21	1.62%	2.6	21%	1.68	0.000	1.68
25.426	6951.21	41.6	0.432	41.6	0.2	0.10	1.04%	Coarse Tailings	0.054	108.1	1.39	0.000	1.39	0	29	1.08%	2.4	21%	1.69	0.000	1.69
25.590	6951.05	37.9	0.373	37.9	0.7	0.30	0.98%	Coarse Tailings	0.054	108.1	1.40	0.000	1.40	0	26	1.02%	2.4	21%	1.70	0.000	1.70
25.754	6950.89	35.0	0.602	35.0	0.0	0.00	1.72%	Coarse Tailings	0.054	108.1	1.41	0.000	1.41	0	24	1.79%	2.6	21%	1.71	0.000	1.71
25.918	6950.72	28.9	0.617	28.9	0.5	0.23	2.14%	Coarse Tailings	0.054	108.1	1.42	0.000	1.42	0	19	2.25%	2.7	21%	1.72	0.000	1.72

5.10	607	1.7E-03	6.2E+02	251	0.9435	2.8E-04	0	0.206	0.202	73	0.206	10223	7049	1469	10223	0.108%	1.79	1.00	0.01%	0.001752	0.36	0.025	0.785	0.28%	0.0005
5.15	607	1.7E-03	6.2E+02	247	0.9424	2.8E-04	0	0.206	0.202	74	0.206	10184	7022	1470	10184	0.110%	1.79	1.00	0.01%	0.001789	0.36	0.025	0.785	0.28%	0.0005
5.20	607	1.7E-03	6.2E+02	243	0.9413	2.9E-04	0	0.207	0.203	75	0.207	10146	6995	1471	10146	0.112%	1.79	1.00	0.01%	0.001827	0.36	0.025	0.785	0.29%	0.0005
5.25	607	1.7E-03	6.2E+02	239	0.9401	2.9E-04	0	0.207	0.203	76	0.207	10108	6968	1472	10108	0.114%	1.79	1.00	0.01%	0.001866	0.36	0.025	0.785	0.29%	0.0005
5.30	607	1.7E-03	6.2E+02	235	0.9390	2.9E-04	0	0.208	0.204	77	0.208	10070	6941	1473	10070	0.116%	1.79	1.00	0.01%	0.001904	0.36	0.025	0.785	0.30%	0.0005
5.35	607	1.7E-03	6.2E+02	232	0.9378	2.9E-04	0	0.208	0.204	78	0.208	10033	6915	1474	10033	0.119%	1.79	1.00	0.01%	0.001943	0.36	0.025	0.785	0.31%	0.0005
5.40	607	1.7E-03	6.2E+02	228	0.9366	2.9E-04	0	0.208	0.205	79	0.208	9996	6890	1475	9996	0.121%	1.79	1.00	0.01%	0.001982	0.36	0.025	0.785	0.31%	0.0005
5.45	607	1.7E-03	6.2E+02	224	0.9354	3.0E-04	0	0.209	0.205	80	0.209	9960	6864	1476	9960	0.123%	1.79	1.00	0.01%	0.002022	0.36	0.025	0.785	0.32%	0.0005
5.50	607	1.7E-03	6.2E+02	221	0.9341	3.0E-04	0	0.209	0.206	81	0.209	9924	6839	1477	9924	0.125%	1.79	1.00	0.01%	0.002061	0.36	0.025	0.785	0.32%	0.0005
5.55	607	1.7E-03	6.2E+02	217	0.9329	3.0E-04	0	0.210	0.206	82	0.210	9889	6814	1478	9889	0.127%	1.79	1.00	0.01%	0.002101	0.36	0.025	0.785	0.33%	0.0005
5.60	607	1.7E-03	6.2E+02	214	0.9316	3.0E-04	0	0.210	0.206	83	0.210	9854	6790	1479	9854	0.130%	1.79	1.00	0.01%	0.002141	0.36	0.025	0.785	0.34%	0.0006
5.65	607	1.7E-03	6.2E+02	211	0.9303	3.1E-04	0	0.211	0.207	84	0.211	9819	6765	1480	9819	0.132%	1.79	1.00	0.01%	0.002182	0.36	0.025	0.785	0.34%	0.0006
5.70	607	1.7E-03	6.2E+02	207	0.9290	3.1E-04	0	0.211	0.207	85	0.211	9785	6741	1481	9785	0.134%	1.79	1.00	0.01%	0.002222	0.36	0.025	0.785	0.35%	0.0006
5.75	607	1.7E-03	6.2E+02	204	0.9277	3.1E-04	0	0.211	0.208	86	0.211	9752	6718	1482	9752	0.136%	1.79	1.00	0.01%	0.002263	0.36	0.025	0.785	0.36%	0.0006
5.80	607	1.7E-03	6.2E+02	201	0.9263	3.1E-04	0	0.212	0.208	87	0.212	9718	6694	1483	9718	0.139%	1.79	1.00	0.01%	0.002304	0.36	0.025	0.785	0.36%	0.0006
5.84	607	1.7E-03	6.2E+02	198	0.9250	3.1E-04	0	0.212	0.209	88	0.212	9686	6671	1484	9686	0.141%	1.79	1.00	0.01%	0.002345	0.36	0.025	0.785	0.37%	0.0006
5.89	607	1.7E-03	6.2E+02	195	0.9236	3.2E-04	0	0.213	0.209	89	0.213	9653	6649	1485	9653	0.143%	1.79	1.00	0.01%	0.002387	0.36	0.025	0.785	0.37%	0.0006
5.94	607	1.7E-03	6.2E+02	192	0.9222	3.2E-04	0	0.213	0.210	90	0.213	9621	6626	1486	9621	0.146%	1.79	1.00	0.01%	0.002428	0.36	0.025	0.785	0.38%	0.0006
5.99	607	1.7E-03	6.2E+02	189	0.9207	3.2E-04	0	0.213	0.210	91	0.213	9589	6604	1487	9589	0.148%	1.79	1.00	0.01%	0.002470	0.36	0.025	0.785	0.39%	0.0006
6.04	607	1.7E-03	6.2E+02	186	0.9193	3.2E-04	0	0.214	0.211	92	0.214	9558	6582	1488	9558	0.150%	1.79	1.00	0.01%	0.002511	0.36	0.025	0.785	0.39%	0.0006
6.09	607	1.7E-03	6.2E+02	183	0.9178	3.2E-04	0	0.214	0.211	93	0.214	9527	6560	1489	9527	0.153%	1.79	1.00	0.01%	0.002553	0.36	0.025	0.785	0.40%	0.0007
6.14	607	1.7E-03	6.2E+02	180	0.9163	3.3E-04	0	0.215	0.211	94	0.215	9496	6538	1490	9496	0.155%	1.79	1.00	0.01%	0.002595	0.36	0.025	0.785	0.41%	0.0007
6.19	607	1.7E-03	6.2E+02	177	0.9148	3.3E-04	0	0.215	0.212	95	0.215	9466	6517	1491	9466	0.157%	1.79	1.00	0.01%	0.002636	0.36	0.025	0.785	0.41%	0.0007
6.24	607	1.7E-03	6.2E+02	175	0.9133	3.3E-04	0	0.215	0.212	96	0.215	9436	6496	1492	9436	0.160%	1.79	1.00	0.01%	0.002678	0.36	0.025	0.785	0.42%	0.0007
6.29	607	1.7E-03	6.2E+02	172	0.9117	3.3E-04	0	0.216	0.213	97	0.216	9406	6475	1493	9406	0.162%	1.79	1.00	0.01%	0.002720	0.36	0.025	0.785	0.43%	0.0007
6.34	607	1.7E-03	6.2E+02	169	0.9102	3.3E-04	0	0.216	0.213	98	0.216	9376	6454	1494	9376	0.164%	1.79	1.00	0.01%	0.002762	0.36	0.025	0.785	0.43%	0.0007
6.39	607	1.7E-03	6.2E+02	167	0.9086	3.4E-04	0	0.216	0.214	99	0.216	9347	6434	1495	9347	0.167%	1.79	1.00	0.01%	0.002804	0.36	0.025	0.785	0.44%	0.0007
6.44	607	1.7E-03	6.2E+02	164	0.9070	3.4E-04	0	0.217	0.214	100	0.217	9319	6414	1496	9319	0.169%	1.79	1.00	0.01%	0.002845	0.36	0.025	0.785	0.45%	0.0007
6.49	607	1.7E-03	6.2E+02	162	0.9053	3.4E-04	0	0.217	0.214	101	0.217	9290	6394	1497	9290	0.171%	1.79	1.00	0.01%	0.002887	0.36	0.025	0.785	0.45%	0.0007
6.54	607	1.7E-03	6.2E+02	159	0.9037	3.4E-04	0	0.218	0.215	102	0.218	9262	6374	1498	9262	0.174%	1.79	1.00	0.01%	0.002928	0.36	0.025	0.785	0.46%	0.0008
6.59	607	1.7E-03	6.2E+02	157	0.9020	3.4E-04	0	0.218	0.215	103	0.218	9234	6354	1499	9234	0.176%	1.79	1.00	0.01%	0.002969	0.36	0.025	0.785	0.47%	0.0008
6.64	607	1.7E-03	6.2E+02	154	0.9003	3.5E-04	0	0.218	0.216	104	0.218	9206	6335	1500	9206	0.178%	1.79	1.00	0.01%	0.003011	0.36	0.025	0.785	0.47%	0.0008
6.69	607	1.7E-03	6.2E+02	152	0.8985	3.5E-04	0	0.219	0.216	105	0.219	9179	6316	1501	9179	0.180%	1.79	1.00	0.01%	0.003051	0.36	0.025	0.785	0.48%	0.0008
6.74	607	1.7E-03	6.2E+02	150	0.8968	3.5E-04	0	0.219	0.217	106	0.219	9152	6297	1502	9152	0.183%	1.79	1.00	0.01%	0.003092	0.36	0.025	0.785	0.49%	0.0008
6.79	607	1.7E-03	6.2E+02	148	0.8950	3.5E-04	0	0.219	0.217	107	0.219	9125	6278	1503	9125	0.185%	1.79	1.00	0.01%	0.003133	0.36	0.025	0.785	0.49%	0.0008
6.84	607	1.7E-03	6.2E+02	145	0.8932	3.5E-04	0	0.220	0.217	108	0.220	9099	6260	1504	9099	0.187%	1.79	1.00	0.01%	0.003173	0.36	0.025	0.785	0.50%	0.0008
6.89	607	1.7E-03	6.2E+02	143	0.8914	3.5E-04	0	0.220	0.218	109	0.220	9073	6241	1505	9073	0.189%	1.79	1.00	0.01%	0.003213	0.36	0.025	0.785	0.50%	0.0008
6.94	607	1.7E-03	6.2E+02	141	0.8895	3.6E-04	0	0.220	0.218	110	0.220	9047	6223	1506	9047	0.192%	1.79	1.00	0.01%	0.003252	0.36	0.025	0.785	0.51%	0.0008
6.99	607	1.7E-03	6.2E+02	139	0.8877	3.6E-04	0	0.221	0.219	111	0.221	9021	6205	1507	9021	0.194%	1.79	1.00	0.01%	0.003291	0.36	0.025	0.785	0.52%	0.0008
7.04	607	1.7E-03	6.2E+02	137	0.8858	3.6E-04	0	0.221	0.219	112	0.221	8995	6187	1508	8995	0.196%	1.79	1.00	0.01%	0.003330	0.36	0.025	0.785	0.52%	0.0009
7.09	607	1.7E-03	6.2E+02	135	0.8839	3.6E-04	0	0.222	0.219	113	0.222	8970	6169	1509	8970	0.198%	1.79	1.00	0.01%	0.003369	0.36	0.025	0.785	0.53%	0.0009
7.14	607	1.7E-03	6.2E+02	133	0.8819	3.6E-04	0	0.222	0.220	114	0.222	8945	6152	1510	8945	0.200%	1.79	1.00	0.01%	0.003407	0.36	0.025	0.785	0.53%	0.0009
7.19	607	1.7E-03	6.2E+02	131	0.8799	3.7E-04	0	0.222	0.220	115	0.222	8920	6134	1511	8920	0.202%	1.79	1.00	0.01%	0.003444	0.36	0.025	0.785	0.54%	0.0009
7.24	607	1.7E-03	6.2E+02	129	0.8779	3.7E-04	0	0.223	0.221	116	0.223	8896	6117	1512	8896	0.205%	1.79	1.00	0.01%	0.003481	0.36	0.025	0.785	0.55%	0.0009
7.29	607	1.7E-03	6.2E+02	127	0.8759	3.7E-04	0	0.223	0.221	117	0.223	8872	6100	1513	8872	0.207%	1.79	1.00	0.01%	0.003518	0.36	0.025	0.785	0.55%	0.0009
7.34	607	1.7E-03	6.2E+02	125	0.8739	3.7E-04	0	0.223	0.221	118	0.223	8848	6083	1514	8848	0.209%	1.79	1.00	0.01%	0.003554	0.36	0.025	0.785	0.56%	0.0009
7.39	607	1.7E-03	6.2E+02	123	0.8718	3.7E-04	0	0.224	0.222	119	0.224	8824	6067	1515	8824	0.211%	1.79	1.00	0.01%	0.003589	0.36	0.025	0.785	0.56%	0.0009
7.44	607	1.7E-03	6.2E+02	121	0.8697	3.7E-04	0	0.224	0.222	120	0.224	8800	6050	1516	8800	0.212%	1.79	1.00	0.01%	0.003624	0.36	0.025	0.785	0.57%	0.0009
7.49	616	1.7E-03	6.4E+02	120	0.8676	3.6E-04	0	0.224	0.223	121	0.224	8777	6034	1517	8777	0.192%	1.79	1.00	0.01%	0.003256	0.36	0.025	0.785	0.51%	0.0008
7.54	616	1.7E-03	6.4E+02	118	0.8654	3.7E-04	0	0.225	0.223	122	0.225	8753	6017	1518	8753	0.194%	1.79	1.00	0.01%	0.003286	0.36	0.025	0.785	0.52%	0.0008
7.59	616	1.7E-03	6.4E+02	116	0.8632	3.7E-04	0	0.225	0.223	123	0.225	8730	6001	1519	8730	0.195%	1.79	1.00	0.01%	0.003315	0.36	0.025	0.785	0.52%	0.0009
7.64	616	1.7E-03	6.4E+02	115	0.8610	3.7E-04	0	0.225	0.224	124	0.225	8708	5985	1520	8708	0.197%	1.79	1.00	0.01%	0.003343	0.36	0.025	0.785	0.52%	0.0009
7.69	616	1.7E-03	6.4E+02	113	0.8588	3.7E-04	0	0.226	0.224	125	0.226	8685	5970	1521	8685	0.198%	1.79	1.00	0.01%	0.003370	0.36	0.025	0.785	0.53%	0.0009
7.74	616	1.7E-03	6.4E+02	111	0.8565	3.7E-04	0	0.226	0.224	126	0.226	8663	5954	1522	8663	0.200%	1.79	1.00	0.01%	0.003397	0.36	0.025	0.785	0.53%	0.0009
7.79	616	1.7E-03	6.4E+02	110	0.8542	3.7E-04	0	0.226	0.225	127	0.226	8641	5938	1523	8641	0.201%	1.79	1.00	0.01%	0.003423	0.36	0.025	0.785	0.54%	0.0009
7.84	616	1.7E-03	6.4E+02	108	0.8519	3.7E-04	0	0.227	0.225	128	0.227	8619	5923	1524	8619	0.203%	1.79	1.00	0.01%	0.003449	0.36	0.025	0.785	0.54%	0.0009
7.89	616	1.7E-03	6.4E+02	106	0.8496	3.7E-04	0	0.227	0.225	129	0.227	8597	5908	1525	8597	0.204%	1.79	1.00	0.01%	0.003473	0.36	0.025	0.785	0.55%	0.0009
7.94	616	1.7E-03	6.4E+02	105	0.8472	3.8E-04	0	0.227	0.226	130	0.227	8575	5893	1526	8575	0.205%	1.79	1.00	0.01%	0.003497	0.36	0.025	0.785	0.55%	0.0009
7.99	616	1.7E-03	6.4E+02	103	0.8448	3.8E-04	0	0.228	0.226	131	0.228	8554	5878	1527	8554	0.207%	1.79	1.00	0.01%	0.003521	0.36	0.025	0.785	0.55%	0.0009
8.04	616	1.7E-03	6.4E+02	102	0.8424	3.8E-04	0	0.228	0.227	132	0.228	8533	5863	1528	8533	0.208%	1.79	1.00	0.01%	0.003543	0.36	0.025	0.785	0.56%	0.0009
8.09	616	1.7E-03	6.4E+02	101	0.8399	3.8E-04	0	0.228	0.227	133	0.228	8512	5848	1529	8512	0.209%	1.79	1.00	0.01%	0.003565	0.36	0.025	0.785	0.56%	0.0009
8.14	616	1.7E-03	6.4E+02	99	0.8374	3.8E-04	0	0.228	0.227	134	0.228	8491	5833	1530	8491	0.210%	1.79	1.00	0.01%	0.003585	0.36	0.025	0.785	0.56%	0.0009
8.19	616	1.7E-03	6.4E+02	98	0.8349	3.8E-04	0	0.229	0.228	135	0.229	8470	5819	1531	8470	0.211%	1.79	1.00	0.01%	0.003605	0.36	0.025	0.785	0.57%	0.0009
8.24	616	1.7E-03	6.4E+02	96	0.8324	3.8E-04	0	0.229	0.228	136	0.229	8449	5804	1532	8449	0.212%	1.79	1.00	0.01%	0.003624	0.36	0.025	0.785	0.57%	0.0009
8.29	616	1.7E-03	6.4E+02	95	0.8298	3.8E-04	0	0.229	0.228	137	0.229	8429	5790	1533	8429	0.213%	1.79	1.00	0.01%	0.003642	0.36	0.025	0.785	0.57%	0.0009
8.34	616	1.7E-03	6.4E+02	94	0.8272	3.8E-04	0	0.230	0.229	138	0.230	8409	5776	1534	8409	0.214%	1.79	1.00	0.01%	0.003659	0.36	0.025	0.785	0.57%	0.0009
8.39	616	1.7E-03	6.4E+02	92	0.8245	3.9E-04	0	0.230	0.229	139	0.230	8389	5762	1535	8389	0.215%	1.79	1.00	0.01%	0.003675	0.36	0.025	0.785	0.58%	0.0009
8.44	616	1.7E-03	6.4E+02	91	0.8219	3.9E-04	0	0.230	0.229	140	0.230	8369	5748	1536	8369	0.216%	1.79	1.00	0.01%	0.003690	0.36	0.025	0.785	0.58%	0.0010
8.49	616	1.7E-03	6.4E+02	90	0.8192	3.9E-04	0	0.231	0.230	141	0.231	8349	5734	1537	8349	0.217%	1.79	1.00	0.01%	0.003705	0.36	0.025	0.785	0.58%	0.0010
8.54	616	1.7E-03	6.4E+02	89	0.8165	3.9E-04	0	0.231	0.230	142	0.231	8330	5721	1538	8330	0.218%	1.79	1.00	0.01%	0.003718	0.36	0.025	0.785	0.58%	0.0010
8.59	616	1.7E-03	6.4E+02	87	0.8137	3.9E-04	0	0.231	0.230	143	0.231	8310	5707	1539	8310	0.218%	1.79	1.00	0.01%	0.003730	0.36	0.025	0.785	0.59%	0.0010
8.64	616	1.7E-03	6.4E+02	86	0.8109	3.9E-04	0	0.232	0.231	144	0.232	8291	5694	1540	8291	0.219%	1.79	1.00	0.01%	0.003741	0.36	0.025	0.785	0.59%	0.0010
8.69	616	1.7E-03	6.4E+02	85	0.8081	3.9E-04	0	0.232	0.231	145	0.232	8272	5680	1541	8272	0.220%	1.79	1.00	0.01%	0.003752	0.36	0.025	0.785	0.59%	0.0010
8.74	616	1.7E-03	6.4E+02	84	0.8053	3.9E-04	0	0.232	0.232	146	0.232	8253	5667	1542	8253	0.220%	1.79	1.00	0.01%	0.003761	0.36	0.025	0.785	0.59%	0.0010
8.79	616	1.7E-03	6.4E+02	83	0.8024	3.9E-04	0	0.232	0.232	147	0.232	8234	5654	1543	8234	0.221%	1.79	1.00	0.01%	0.003769	0.36	0.025	0.785	0.59%	0.0010
8.84	616	1.7E-03	6.4E+02	82	0.7995	3.9E-04	0	0.233	0.232	148	0.233	8216	5641	1544	8216	0.221%	1.79	1.00	0.01%	0.003776	0.36	0.025	0.785	0.59%	0.0010
8.89	616	1.7E-03	6.4E+02	80	0.7966	3.9E-04	0	0.233	0.233	149	0.233	8197	5628	1545	8197	0.221%	1.79	1.00	0.01%	0.003782	0.36	0.025	0.785	0.59%	0.0010
8.94	616	1.7E-03	6.4E+02	79	0.7937	4.0E-04	0	0.233	0.233	150	0.233	8179	5615	1546	8179	0.222%	1.79	1.00	0.01%	0.003787	0.36	0.025	0.785	0.59%	0.0010
8.99	616	1.7E-03	6.4E+02	78	0.7907	4.0E-04	0	0.234	0.233	151	0.234	8161	5602	1547	8161	0.222%	1.79	1.00	0.01%	0.003790	0.36	0.025	0.785	0.60%	0.0010
9.04	636	1.7E-03	6.8E+02	77	0.7876	3.7E-04	0	0.234	0.234	152	0.234	8143	5590	1548	8143	0.176%	1.79	1.00	0.01%	0.002970	0.36	0.025	0.785	0.47%	0.0008
9.09	636	1.7E-03	6.8E+02	76	0.7846	3.7E-04	0	0.234	0.234	153	0.234	8125	5577	1549	8125	0.176%	1.79	1.00	0.01%	0.002971	0.36	0.025	0.785	0.47%	0.0008
9.14	636	1.7E-03	6.8E+02	75	0.7815	3.7E-04	0	0.235	0.234	154	0.235	8107	5565	1550	8107	0.176%	1.79	1.00	0.01%	0.002972	0.36	0.025	0.785	0.47%	0.0008
9.19	636	1.7E-03	6.8E+02	74	0.7784	3.7E-04	0	0.235	0.235	155	0.235	8089	5552	1551	8089	0.176%	1.79	1.00	0.01%	0.002972	0.36	0.025	0.785	0.47%	0.0008
9.24	636	1.7E-03	6.8E+02	73	0.7753	3.7E-04	0	0.235	0.235	156	0.235	8072	5540	1552	8072	0.176%	1.79	1.00	0.01%	0.002972	0.36	0.025	0.785	0.47%	0.0008
9.29	636	1.7E-03	6.8E+02	72	0.7721	3.7E-04	0	0.235	0.235	157	0.235	8054	5528	1553	8054	0.176%	1.79	1.00	0.01%	0.002970	0.36	0.025	0.785	0.47%	0.0008
9.34	636	1.7E-03	6.8E+02	71	0.7689	3.7E-04	0	0.236	0.236	158	0.236	8037	5516	1554	8037	0.176%	1.79	1.00	0.01%	0.002967	0.36	0.025	0.785	0.47%	0.0008
9.39	636	1.7E-03	6.8E+02	70	0.7657	3.8E-04	0	0.236	0.236	159	0.236	8020	5504	1555	8020	0.176%	1.79	1.00	0.01%	0.002964	0.36	0.025	0.785	0.47%	0.0008
9.44	636	1.7E-03	6.8E+02	69	0.7624	3.8E-04	0	0.236	0.236	160	0.236	8003	5492	1556	8003	0.175%	1.79	1.00	0.01%	0.002960	0.36	0.025	0.785	0.46%	0.0008

26.082	6950.56	17.6	0.606	17.6	0.4	0.18	3.44%	Coarse Tailings	0.054	108.1	1.43	0.000	1.43	0	11	3.75%	3.0	21%	1.72	0.000	1.72
26.246	6950.39	32.7	0.775	32.7	0.8	0.35	2.37%	Coarse Tailings	0.054	108.1	1.44	0.000	1.44	0	22	2.48%	2.7	21%	1.73	0.000	1.73
26.410	6950.23	24.9	0.769	24.9	0.6	0.24	3.09%	Coarse Tailings	0.054	108.1	1.44	0.000	1.44	0	16	3.28%	2.8	21%	1.74	0.000	1.74
26.574	6950.07	22.2	0.776	22.2	0.4	0.16	3.50%	Coarse Tailings	0.054	108.1	1.45	0.000	1.45	0	14	3.74%	2.9	21%	1.75	0.000	1.75
26.739	6949.90	34.4	0.919	34.4	0.8	0.33	2.68%	Coarse Tailings	0.054	108.1	1.46	0.000	1.46	0	22	2.79%	2.7	21%	1.76	0.000	1.76
26.903	6949.74	21.7	0.997	21.7	0.8	0.35	4.59%	Coarse Tailings	0.054	108.1	1.47	0.000	1.47	0	14	4.92%	3.0	21%	1.77	0.000	1.77
27.067	6949.57	16.1	0.792	16.1	0.4	0.16	4.93%	Coarse Tailings	0.054	108.1	1.48	0.000	1.48	0	10	5.43%	3.2	21%	1.78	0.000	1.78
27.231	6949.41	26.1	0.589	26.1	0.8	0.35	2.25%	Coarse Tailings	0.054	108.1	1.49	0.000	1.49	0	17	2.39%	2.8	21%	1.79	0.000	1.79
27.395	6949.25	45.0	0.692	45.0	1.9	0.81	1.54%	Coarse Tailings	0.054	108.1	1.50	0.000	1.50	0	29	1.59%	2.5	21%	1.80	0.000	1.80
27.559	6949.08	33.5	0.889	33.5	1.9	0.81	2.65%	Coarse Tailings	0.054	108.1	1.51	0.000	1.51	0	21	2.78%	2.7	21%	1.80	0.000	1.80
27.723	6948.92	26.5	0.744	26.5	1.9	0.81	2.81%	Coarse Tailings	0.054	108.1	1.52	0.000	1.52	0	16	2.98%	2.8	21%	1.81	0.000	1.81
27.887	6948.75	35.5	0.749	35.4	2.1	0.89	2.11%	Coarse Tailings	0.054	108.1	1.52	0.000	1.52	0	22	2.21%	2.6	21%	1.82	0.000	1.82
28.051	6948.59	28.6	0.945	28.6	1.8	0.77	3.30%	Coarse Tailings	0.054	108.1	1.53	0.000	1.53	0	18	3.49%	2.8	21%	1.83	0.000	1.83
28.215	6948.43	30.2	0.826	30.2	1.8	0.77	2.74%	Coarse Tailings	0.054	108.1	1.54	0.000	1.54	0	19	2.89%	2.8	21%	1.84	0.000	1.84
28.379	6948.26	22.5	0.783	22.5	2.3	0.98	3.48%	Coarse Tailings	0.054	108.1	1.55	0.000	1.55	0	14	3.74%	2.9	21%	1.85	0.000	1.85
28.543	6948.10	21.3	0.651	21.3	3.1	1.34	3.05%	Coarse Tailings	0.054	108.1	1.56	0.000	1.56	0	13	3.30%	2.9	21%	1.86	0.000	1.86
28.707	6947.93	24.7	0.647	24.7	4.2	1.81	2.62%	Coarse Tailings	0.054	108.1	1.57	0.000	1.57	0	15	2.80%	2.8	21%	1.87	0.000	1.87
28.871	6947.77	24.5	0.677	24.5	5.4	2.32	2.76%	Coarse Tailings	0.054	108.1	1.58	0.000	1.58	0	15	2.95%	2.9	21%	1.88	0.000	1.88
29.035	6947.60	25.4	0.771	25.4	6.2	2.70	3.03%	Coarse Tailings	0.054	108.1	1.59	0.000	1.59	0	15	3.24%	2.9	21%	1.88	0.000	1.88
29.199	6947.44	23.8	0.792	23.8	7.8	3.40	3.33%	Coarse Tailings	0.054	108.1	1.60	0.000	1.60	0	14	3.56%	2.9	21%	1.89	0.000	1.89
29.363	6947.28	28.9	0.798	28.8	9.2	3.99	2.76%	Coarse Tailings	0.054	108.1	1.60	0.000	1.60	0	17	2.93%	2.8	21%	1.90	0.000	1.90
29.527	6947.11	27.0	0.867	26.9	9.3	4.05	3.22%	Coarse Tailings	0.054	108.1	1.61	0.000	1.61	0	16	3.42%	2.9	21%	1.91	0.000	1.91
29.691	6946.95	26.4	0.820	26.3	9.8	4.23	3.11%	Coarse Tailings	0.054	108.1	1.62	0.000	1.62	0	15	3.31%	2.9	21%	1.92	0.000	1.92
29.855	6946.78	24.9	0.848	24.8	10.0	4.35	3.41%	Coarse Tailings	0.054	108.1	1.63	0.000	1.63	0	14	3.65%	2.9	21%	1.93	0.000	1.93
30.019	6946.62	27.9	1.013	27.9	10.8	4.66	3.63%	Coarse Tailings	0.054	108.1	1.64	0.000	1.64	0	16	3.86%	2.9	21%	1.94	0.000	1.94
30.183	6946.46	35.8	1.269	35.7	16.7	7.24	3.55%	Fine Alluvium	0.060	120.7	1.65	0.000	1.65	0	21	3.72%	2.8	76%	1.95	0.000	1.95
30.347	6946.29	45.7	1.550	45.6	16.4	7.12	3.39%	Fine Alluvium	0.060	120.7	1.66	0.000	1.66	0	27	3.52%	2.7	76%	1.96	0.000	1.96
30.511	6946.13	73.1	1.680	73.0	16.2	7.04	2.30%	Fine Alluvium	0.060	120.7	1.67	0.000	1.67	0	43	2.35%	2.4	76%	1.97	0.000	1.97
30.675	6945.96	84.5	1.591	84.4	15.5	6.71	1.88%	Fine Alluvium	0.060	120.7	1.68	0.000	1.68	0	49	1.92%	2.3	76%	1.98	0.000	1.98
30.840	6945.80	83.2	1.767	83.1	13.7	5.94	2.12%	Fine Alluvium	0.060	120.7	1.69	0.000	1.69	0	48	2.17%	2.4	76%	1.99	0.000	1.99
31.004	6945.64	70.2	2.017	70.2	12.4	5.37	2.87%	Fine Alluvium	0.060	120.7	1.70	0.000	1.70	0	40	2.94%	2.5	76%	2.00	0.000	2.00
31.168	6945.47	62.2	2.343	62.1	12.1	5.23	3.77%	Fine Alluvium	0.060	120.7	1.71	0.000	1.71	0	35	3.87%	2.6	76%	2.01	0.000	2.01
31.332	6945.31	61.1	2.427	61.0	12.1	5.23	3.97%	Fine Alluvium	0.060	120.7	1.72	0.000	1.72	0	35	4.09%	2.7	76%	2.02	0.000	2.02
31.496	6945.14	42.6	2.177	42.5	11.3	4.88	5.11%	Fine Alluvium	0.060	120.7	1.73	0.000	1.73	0	24	5.33%	2.9	76%	2.03	0.000	2.03
31.660	6944.98	45.4	2.130	45.3	11.3	4.90	4.69%	Fine Alluvium	0.060	120.7	1.74	0.000	1.74	0	25	4.88%	2.8	76%	2.04	0.000	2.04
31.824	6944.82	35.2	1.773	35.2	10.9	4.72	5.03%	Fine Alluvium	0.060	120.7	1.75	0.000	1.75	0	19	5.29%	2.9	76%	2.05	0.000	2.05
31.988	6944.65	31.1	1.490	31.0	11.1	4.82	4.79%	Fine Alluvium	0.060	120.7	1.76	0.000	1.76	0	17	5.08%	3.0	76%	2.06	0.000	2.06
32.152	6944.49	22.7	1.147	22.6	10.5	4.55	5.05%	Fine Alluvium	0.060	120.7	1.77	0.000	1.77	0	12	5.48%	3.1	76%	2.07	0.000	2.07
32.316	6944.32	20.0	1.124	19.9	10.7	4.62	5.63%	Fine Alluvium	0.060	120.7	1.78	0.000	1.78	0	10	6.18%	3.2	76%	2.08	0.000	2.08
32.480	6944.16	21.9	1.247	21.9	12.0	5.20	5.68%	Fine Alluvium	0.060	120.7	1.79	0.000	1.79	0	11	6.19%	3.1	76%	2.09	0.000	2.09
32.644	6944.00	22.4	1.225	22.4	11.7	5.08	5.46%	Fine Alluvium	0.060	120.7	1.80	0.000	1.80	0	11	5.93%	3.1	76%	2.10	0.000	2.10
32.808	6943.83	30.9	1.665	30.8	13.0	5.63	5.39%	Fine Alluvium	0.060	120.7	1.81	0.000	1.81	0	16	5.73%	3.0	76%	2.11	0.000	2.11
32.972	6943.67	25.6	1.719	25.5	13.3	5.78	6.72%	Fine Alluvium	0.060	120.7	1.82	0.000	1.82	0	13	7.24%	3.1	76%	2.12	0.000	2.12
33.136	6943.50	20.0	1.559	20.0	13.1	5.66	7.78%	Fine Alluvium	0.060	120.7	1.83	0.000	1.83	0	10	8.56%	3.3	76%	2.13	0.000	2.13
33.300	6943.34	17.7	1.093	17.7	14.0	6.08	6.16%	Fine Alluvium	0.060	120.7	1.84	0.000	1.84	0	9	6.87%	3.3	76%	2.14	0.000	2.14
33.464	6943.18	17.0	0.903	17.0	14.2	6.16	5.30%	Fine Alluvium	0.060	120.7	1.85	0.000	1.85	0	8	5.94%	3.2	76%	2.15	0.000	2.15
33.628	6943.01	17.2	0.875	17.2	14.6	6.32	5.08%	Fine Alluvium	0.060	120.7	1.86	0.000	1.86	0	8	5.69%	3.2	76%	2.16	0.000	2.16
33.792	6942.85	20.8	1.542	20.7	15.1	6.55	7.41%	Fine Alluvium	0.060	120.7	1.87	0.000	1.87	0	10	8.14%	3.3	76%	2.17	0.000	2.17
33.956	6942.68	28.3	2.137	28.2	15.4	6.67	7.56%	Fine Alluvium	0.060	120.7	1.88	0.000	1.88	0	14	8.10%	3.1	76%	2.17	0.000	2.17
34.120	6942.52	37.8	2.783	37.7	16.5	7.16	7.36%	Fine Alluvium	0.060	120.7	1.89	0.000	1.89	0	19	7.74%	3.0	76%	2.18	0.000	2.18
34.284	6942.36	39.2	2.940	39.1	16.9	7.30	7.50%	Fine Alluvium	0.060	120.7	1.90	0.000	1.90	0	20	7.89%	3.0	76%	2.19	0.000	2.19
34.448	6942.19	37.7	2.870	37.6	16.9	7.34	7.61%	Fine Alluvium	0.060	120.7	1.91	0.000	1.91	0	19	8.02%	3.1	76%	2.20	0.000	2.20
34.612	6942.03	37.3	2.586	37.2	17.5	7.58	6.93%	Fine Alluvium	0.060	120.7	1.92	0.000	1.92	0	18	7.30%	3.0	76%	2.21	0.000	2.21
34.776	6941.86	35.2	2.418	35.1	18.0	7.81	6.87%	Fine Alluvium	0.060	120.7	1.93	0.000	1.93	0	17	7.27%	3.1	76%	2.22	0.000	2.22
34.941	6941.70	30.8	2.126	30.7	17.7	7.65	6.90%	Fine Alluvium	0.060	120.7	1.94	0.000	1.94	0	15	7.36%	3.1	76%	2.23	0.000	2.23
35.105	6941.54	30.1	2.298	30.0	17.7	7.69	7.64%	Fine Alluvium	0.060	120.7	1.95	0.000	1.95	0	14	8.17%	3.1	76%	2.24	0.000	2.24
35.269	6941.37	32.5	2.207	32.4	22.2	9.64	6.79%	Fine Alluvium	0.060	120.7	1.96	0.000	1.96	0	16	7.22%	3.1	76%	2.25	0.000	2.25
35.433	6941.21	34.8	2.574	34.7	23.9	10.35	7.39%	Fine Alluvium	0.060	120.7	1.97	0.000	1.97	0	17	7.83%	3.1	76%	2.26	0.000	2.26
35.597	6941.04	37.2	2.744	37.0	24.7	10.72	7.38%	Fine Alluvium	0.060	120.7	1.98	0.000	1.98	0	18	7.79%	3.1	76%	2.27	0.000	2.27
35.761	6940.88	38.0	2.976	37.9	25.3	10.98	7.83%	Fine Alluvium	0.060	120.7	1.99	0.000	1.99	0	18	8.26%	3.1	76%	2.28	0.000	2.28
35.925	6940.72	38.0	3.196	37.8	25.6	11.10	8.42%	Fine Alluvium	0.060	120.7	2.00	0.000	2.00	0	18	8.89%	3.1	76%	2.29	0.000	2.29
36.089	6940.55	37.0	3.283	36.8	25.1	10.86	8.87%	Fine Alluvium	0.060	120.7	2.01	0.000	2.01	0	17	9.38%	3.1	76%	2.30	0.000	2.30
36.253	6940.39	35.5	2.998	35.4	24.9	10.80	8.44%	Fine Alluvium	0.060	120.7	2.02	0.000	2.02	0	17	8.95%	3.1	76%	2.31	0.000	2.31
36.417	6940.22	33.9	2.974	33.8	25.0	10.84	8.76%	Fine Alluvium	0.060	120.7	2.03	0.000	2.03	0	16	9.32%	3.2	76%	2.32	0.000	2.32
36.581	6940.06	32.3	2.817	32.1	23.8	10.29	8.73%	Fine Alluvium	0.060	120.7	2.04	0.000	2.04	0	15	9.32%	3.2	76%	2.33	0.000	2.33
36.745	6939.90	32.3	2.386	32.1	23.0	9.98	7.40%	Fine Alluvium	0.060	120.7	2.05	0.000	2.05	0	15	7.90%	3.1	76%	2.34	0.000	2.34
36.909	6939.73	33.3	1.627	33.1	23.0	9.95	4.89%	Fine Alluvium	0.060	120.7	2.06	0.000	2.06	0	15	5.21%	3.0	76%	2.35	0.000	2.35
37.073	6939.57	41.6	1.831	41.4	23.0	9.95	4.40%	Fine Alluvium	0.060	120.7	2.07	0.000	2.07	0	19	4.63%	2.9	76%	2.36	0.000	2.36
37.237	6939.40	43.7	1.892	43.6	23.2	10.04	4.33%	Fine Alluvium	0.060	120.7	2.08	0.000	2.08	0	20	4.54%	2.9	76%	2.37	0.000	2.37
37.401	6939.24	38.4	1.935	38.2	19.9	8.64	5.04%	Fine Alluvium	0.060	120.7	2.09	0.000	2.09	0	17	5.33%	3.0	76%	2.38	0.000	2.38
37.565	6939.07	33.6	1.901	33.5	17.9	7.75	5.66%	Fine Alluvium	0.060	120.7	2.09	0.000	2.09	0	15	6.04%	3.0	76%	2.39	0.000	2.39
37.729	6938.91	43.8	1.261	43.7	18.1	7.83	2.88%	Fine Alluvium	0.060	120.7	2.10	0.000	2.10	0	20	3.02%	2.8	76%	2.40	0.000	2.40
37.893	6938.75	57.0	1.013	56.9	17.3	7.51	1.78%	Fine Alluvium	0.060	120.7	2.11	0.000	2.11	0	26	1.84%	2.5	76%	2.41	0.000	2.41
38.057	6938.58	70.7	1.333	70.7	3.4	1.46	1.89%	Coarse Alluvium	0.056	111.0	2.12	0.000	2.12	0	32	1.94%	2.5	36%	2.42	0.000	2.42
38.221	6938.42	72.4	1.485	72.3	3.7	1.59	2.05%	Coarse Alluvium	0.056	111.0	2.13	0.000	2.13	0	33	2.11%	2.5	36%	2.43	0.000	2.43
38.385	6938.25	75.2	1.598	75.2	4.0	1.73	2.13%	Coarse Alluvium	0.056	111.0	2.14	0.000	2.14	0	34	2.19%	2.5	36%	2.44	0.000	2.44
38.549	6938.09	74.8	1.648	74.8	3.7	1.59	2.20%	Coarse Alluvium	0.056	111.0	2.15	0.000	2.15	0	34	2.27%	2.5	36%	2.45	0.000	2.45
38.713	6937.93	73.4	1.333	73.4	3.5	1.53	1.82%	Coarse Alluvium	0.056	111.0	2.16	0.000	2.16	0	33	1.87%	2.5	36%	2.46	0.000	2.46
38.877	6937.76	72.7	1.512	72.7	3.9	1.67	2.08%	Coarse Alluvium	0.056	111.0	2.17	0.000	2.17	0	33	2.14%	2.5	36%	2.47	0.000	2.47
39.042	6937.60	70.3	2.033	70.2	3.7	1.61	2.89%	Coarse Alluvium	0.056	111.0	2.18	0.000	2.18	0	31	2.99%	2.6	36%	2.48	0.000	2.48
39.206	6937.43	64.6	2.247	64.6	4.1	1.79	3.48%	Coarse Alluvium	0.056	111.0	2.19	0.000	2.19	0	29	3.60%	2.7	36%	2.49	0.000	2.49
39.370	6937.27	44.7	2.304	44.7	3.8	1.63	5.15%	Coarse Alluvium	0.056	111.0	2.20	0.000	2.20	0	19	5.42%	2.9	36%	2.49	0.000	2.49
39.534	6937.11	51.7	2.063	51.7	4.4	1.89	3.99%	Coarse Alluvium	0.056	111.0	2.21	0.000	2.21	0	22	4.17%	2.8	36%	2.50	0.000	2.50
39.698	6936.94	66.3	1.912	66.3	5.1	2.22	2.88%	Coarse Alluvium	0.056	111.0	2.21	0.000	2.21	0	29	2.98%	2.6	36%	2.51	0.000	2.51
39.862	6936.78	74.4	1.421	74.3	5.0	2.15	1.91%	Coarse Alluvium	0.056	111.0	2.22	0.000	2.22	0	32	1.97%	2.5	36%	2.52	0.000	2.52
40.026	6936.61	68.4	1.350	68.3	4.9	2.11	1.97%	Coarse Alluvium	0.056	111.0	2.23	0.000	2.23	0	30	2.04%	2.5	36%	2.53	0.000	2.53

9.49	636	1.7E-03	6.8E+02	69	0.7592	3.8E-04	0	0.237	0.237	161	0.237	7986	5480	1557	7986	0.175%	1.79	1.00	0.01%	0.002955	0.36	0.025	0.785	0.46%	0.0008
9.54	636	1.7E-03	6.8E+02	68	0.7558	3.8E-04	0	0.237	0.237	162	0.237	7969	5468	1558	7969	0.175%	1.79	1.00	0.01%	0.002949	0.36	0.025	0.785	0.46%	0.0008
9.59	636	1.7E-03	6.8E+02	67	0.7525	3.8E-04	0	0.237	0.237	163	0.237	7952	5457	1559	7952	0.174%	1.79	1.00	0.01%	0.002943	0.36	0.025	0.785	0.46%	0.0008
9.64	636	1.7E-03	6.8E+02	66	0.7491	3.8E-04	0	0.237	0.237	164	0.237	7936	5445	1560	7936	0.174%	1.79	1.00	0.01%	0.002935	0.36	0.025	0.785	0.46%	0.0008
9.69	636	1.7E-03	6.8E+02	65	0.7457	3.8E-04	0	0.238	0.238	165	0.238	7919	5434	1561	7919	0.174%	1.79	1.00	0.01%	0.002927	0.36	0.025	0.785	0.46%	0.0008
9.74	636	1.7E-03	6.8E+02	64	0.7423	3.8E-04	0	0.238	0.238	166	0.238	7903	5422	1562	7903	0.173%	1.79	1.00	0.01%	0.002918	0.36	0.025	0.785	0.46%	0.0008
9.79	636	1.7E-03	6.8E+02	63	0.7388	3.8E-04	0	0.238	0.238	167	0.238	7887	5411	1563	7887	0.172%	1.79	1.00	0.01%	0.002908	0.36	0.025	0.785	0.46%	0.0007
9.84	636	1.7E-03	6.8E+02	63	0.7353	3.8E-04	0	0.238	0.239	168	0.238	7871	5400	1564	7871	0.172%	1.79	1.00	0.01%	0.002898	0.36	0.025	0.785	0.46%	0.0007
9.89	636	1.7E-03	6.8E+02	62	0.7318	3.8E-04	0	0.239	0.239	169	0.239	7855	5388	1565	7855	0.171%	1.79	1.00	0.01%	0.002886	0.36	0.025	0.785	0.45%	0.0007
9.94	636	1.7E-03	6.8E+02	61	0.7283	3.8E-04	0	0.239	0.239	170	0.239	7839	5377	1566	7839	0.171%	1.79	1.00	0.01%	0.002874	0.36	0.025	0.785	0.45%	0.0007
9.99	636	1.7E-03	6.8E+02	60	0.7247	3.8E-04	0	0.239	0.240	171	0.239	7823	5366	1567	7823	0.170%	1.79	1.00	0.01%	0.002861	0.36	0.025	0.785	0.45%	0.0007
10.04	636	1.7E-03	6.8E+02	60	0.7211	3.8E-04	0	0.240	0.240	172	0.240	7808	5355	1568	7808	0.169%	1.79	1.00	0.01%	0.002848	0.36	0.025	0.785	0.45%	0.0007
10.09	636	1.7E-03	6.8E+02	59	0.7175	3.8E-04	0	0.240	0.240	173	0.240	7792	5345	1569	7792	0.168%	1.79	1.00	0.01%	0.002833	0.36	0.025	0.785	0.44%	0.0007
10.14	636	1.7E-03	6.8E+02	58	0.7138	3.8E-04	0	0.240	0.241	174	0.240	7777	5334	1570	7777	0.167%	1.79	1.00	0.01%	0.002818	0.36	0.025	0.785	0.44%	0.0007
10.19	636	1.7E-03	6.8E+02	57	0.7101	3.8E-04	0	0.240	0.241	175	0.240	7761	5323	1571	7761	0.167%	1.79	1.00	0.01%	0.002802	0.36	0.025	0.785	0.44%	0.0007
10.24	636	1.7E-03	6.8E+02	57	0.7064	3.8E-04	0	0.241	0.241	176	0.241	7746	5312	1572	7746	0.166%	1.79	1.00	0.01%	0.002786	0.36	0.025	0.785	0.44%	0.0007
10.29	636	1.7E-03	6.8E+02	56	0.7027	3.8E-04	0	0.241	0.242	177	0.241	7731	5302	1573	7731	0.165%	1.79	1.00	0.01%	0.002769	0.36	0.025	0.785	0.43%	0.0007
10.34	636	1.7E-03	6.8E+02	55	0.6989	3.8E-04	0	0.241	0.242	178	0.241	7716	5291	1574	7716	0.164%	1.79	1.00	0.01%	0.002751	0.36	0.025	0.785	0.43%	0.0007
10.39	636	1.7E-03	6.8E+02	55	0.6951	3.8E-04	0	0.241	0.242	179	0.241	7701	5281	1575	7701	0.163%	1.79	1.00	0.01%	0.002732	0.36	0.025	0.785	0.43%	0.0007
10.44	636	1.7E-03	6.8E+02	54	0.6913	3.8E-04	0	0.242	0.242	180	0.242	7686	5271	1576	7686	0.162%	1.79	1.00	0.01%	0.002713	0.36	0.025	0.785	0.43%	0.0007
10.49	636	1.7E-03	6.8E+02	53	0.6874	3.8E-04	0	0.242	0.243	181	0.242	7672	5260	1577	7672	0.160%	1.79	1.00	0.01%	0.002693	0.36	0.025	0.785	0.42%	0.0007
10.54	801	1.7E-03	1.1E+03	53	0.6835	2.4E-04	0	0.242	0.243	182	0.242	7657	5250	1578	7657	0.047%	1.79	1.00	0.01%	0.000666	0.36	0.025	0.785	0.10%	0.0002
10.59	801	1.7E-03	1.1E+03	52	0.6796	2.4E-04	0	0.242	0.243	183	0.242	7643	5240	1579	7643	0.047%	1.79	1.00	0.01%	0.000663	0.36	0.025	0.785	0.10%	0.0002
10.64	801	1.7E-03	1.1E+03	52	0.6757	2.4E-04	0	0.243	0.244	184	0.243	7628	5230	1580	7628	0.047%	1.79	1.00	0.01%	0.000659	0.36	0.025	0.785	0.10%	0.0002
10.69	801	1.7E-03	1.1E+03	51	0.6718	2.4E-04	0	0.243	0.244	185	0.243	7614	5220	1581	7614	0.047%	1.79	1.00	0.01%	0.000656	0.36	0.025	0.785	0.10%	0.0002
10.74	801	1.9E-03	1.2E+03	50	0.6678	2.1E-04	22	0.243	0.244	186	86.930	7598	5209	1582	3516	0.044%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
10.79	801	1.9E-03	1.2E+03	50	0.6638	2.1E-04	22	0.244	0.245	187	87.397	7582	5198	1583	3511	0.044%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
10.84	801	1.9E-03	1.2E+03	49	0.6598	2.1E-04	22	0.244	0.245	188	87.864	7566	5187	1584	3505	0.044%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
10.89	801	1.9E-03	1.2E+03	49	0.6557	2.1E-04	22	0.244	0.245	189	88.331	7551	5176	1585	3500	0.044%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
10.94	801	1.9E-03	1.2E+03	48	0.6517	2.1E-04	22	0.244	0.246	190	88.798	7535	5165	1586	3495	0.044%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
10.99	801	1.9E-03	1.2E+03	48	0.6476	2.1E-04	22	0.245	0.246	191	89.264	7520	5154	1587	3490	0.043%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
11.04	801	1.9E-03	1.2E+03	47	0.6435	2.1E-04	22	0.245	0.246	192	89.731	7505	5144	1588	3484	0.043%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
11.09	801	1.9E-03	1.2E+03	47	0.6393	2.1E-04	22	0.245	0.247	193	90.198	7490	5133	1589	3479	0.043%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
11.14	801	1.9E-03	1.2E+03	46	0.6352	2.1E-04	22	0.245	0.247	194	90.665	7475	5123	1590	3474	0.043%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
11.19	801	1.9E-03	1.2E+03	46	0.6310	2.1E-04	22	0.246	0.247	195	91.132	7460	5112	1591	3469	0.043%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
11.24	801	1.9E-03	1.2E+03	45	0.6268	2.1E-04	22	0.246	0.247	196	91.599	7445	5102	1592	3464	0.043%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
11.29	801	1.9E-03	1.2E+03	45	0.6226	2.1E-04	22	0.246	0.248	197	92.065	7430	5092	1593	3459	0.042%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
11.34	801	1.9E-03	1.2E+03	44	0.6183	2.1E-04	22	0.247	0.248	198	92.532	7416	5081	1594	3454	0.042%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
11.39	801	1.9E-03	1.2E+03	44	0.6141	2.1E-04	22	0.247	0.248	199	92.999	7401	5071	1595	3449	0.042%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
11.44	801	1.9E-03	1.2E+03	43	0.6098	2.1E-04	22	0.247	0.249	200	93.466	7387	5061	1596	3444	0.042%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
11.49	801	1.9E-03	1.2E+03	43	0.6055	2.1E-04	22	0.247	0.249	201	93.933	7372	5051	1597	3439	0.042%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
11.54	801	1.9E-03	1.2E+03	42	0.6012	2.1E-04	22	0.248	0.249	202	94.400	7358	5041	1598	3434	0.041%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
11.59	801	1.9E-03	1.2E+03	42	0.5969	2.0E-04	22	0.248	0.250	203	94.866	7344	5031	1599	3430	0.041%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
11.64	801	1.9E-03	1.2E+03	41	0.5925	2.0E-04	22	0.248	0.250	204	95.333	7330	5022	1600	3425	0.041%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
11.69	801	1.9E-03	1.2E+03	41	0.5882	2.0E-04	22	0.248	0.250	205	95.800	7316	5012	1601	3420	0.041%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
11.74	801	1.9E-03	1.2E+03	41	0.5838	2.0E-04	22	0.249	0.251	206	96.267	7302	5002	1602	3415	0.040%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
11.79	801	1.9E-03	1.2E+03	40	0.5794	2.0E-04	22	0.249	0.251	207	96.734	7288	4992	1603	3411	0.040%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
11.84	801	1.9E-03	1.2E+03	40	0.5750	2.0E-04	22	0.249	0.251	208	97.201	7275	4983	1604	3406	0.040%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
11.89	801	1.9E-03	1.2E+03	39	0.5706	2.0E-04	22	0.250	0.251	209	97.667	7261	4973	1605	3402	0.040%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
11.94	801	1.9E-03	1.2E+03	39	0.5662	2.0E-04	22	0.250	0.252	210	98.134	7248	4964	1606	3397	0.039%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
11.99	801	1.9E-03	1.2E+03	39	0.5617	2.0E-04	22	0.250	0.252	211	98.601	7234	4955	1607	3392	0.039%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
12.04	801	1.9E-03	1.2E+03	38	0.5573	2.0E-04	22	0.250	0.252	212	99.068	7221	4945	1608	3388	0.039%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
12.09	1095	1.9E-03	2.2E+03	38	0.5528	1.1E-04	22	0.251	0.253	213	99.535	7208	4936	1609	3383	0.015%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
12.14	1095	1.9E-03	2.2E+03	37	0.5483	1.1E-04	22	0.251	0.253	214	100.002	7195	4927	1610	3379	0.015%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
12.19	1095	1.9E-03	2.2E+03	37	0.5438	1.1E-04	22	0.251	0.253	215	100.468	7181	4918	1611	3375	0.015%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
12.24	1095	1.9E-03	2.2E+03	37	0.5393	1.1E-04	22	0.251	0.254	216	100.935	7168	4909	1612	3370	0.015%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
12.29	1095	1.9E-03	2.2E+03	36	0.5348	1.0E-04	22	0.252	0.254	217	101.402	7156	4900	1613	3366	0.015%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
12.34	1095	1.9E-03	2.2E+03	36	0.5303	1.0E-04	22	0.252	0.254	218	101.869	7143	4891	1614	3362	0.015%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
12.39	1095	1.9E-03	2.2E+03	36	0.5258	1.0E-04	22	0.252	0.254	219	102.336	7130	4882	1615	3357	0.015%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
12.44	1095	1.9E-03	2.2E+03	35	0.5213	1.0E-04	22	0.252	0.255	220	102.803	7117	4873	1616	3353	0.015%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
12.49	1095	1.9E-03	2.2E+03	35	0.5168	1.0E-04	22	0.253	0.255	221	103.269	7105	4864	1617	3349	0.014%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
12.54	1095	1.9E-03	2.2E+03	35	0.5122	1.0E-04	22	0.253	0.255	222	103.736	7092	4855	1618	3345	0.014%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
12.59	1095	1.9E-03	2.2E+03	34	0.5077	1.0E-04	22	0.253	0.256	223	104.203	7080	4847	1619	3340	0.014%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
12.64	1095	1.9E-03	2.2E+03	34	0.5031	1.0E-04	22	0.253	0.256	224	104.670	7067	4838	1620	3336	0.014%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
12.69	1095	1.9E-03	2.2E+03	34	0.4986	1.0E-04	22	0.254	0.256	225	105.137	7055	4829	1621	3332	0.014%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
12.74	1095	1.9E-03	2.2E+03	34	0.4940	1.0E-04	22	0.254	0.257	226	105.603	7043	4821	1622	3328	0.014%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
12.79	1095	1.9E-03	2.2E+03	33	0.4895	1.0E-04	22	0.254	0.257	227	106.070	7031	4812	1623	3324	0.014%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
12.84	1095	1.9E-03	2.2E+03	33	0.4849	9.9E-05	22	0.254	0.257	228	106.537	7018	4804	1624	3320	0.014%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
12.89	1095	1.9E-03	2.2E+03	33	0.4803	9.9E-05	22	0.255	0.257	229	107.004	7006	4796	1625	3316	0.014%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
12.94	1095	1.9E-03	2.2E+03	32	0.4758	9.8E-05	22	0.255	0.258	230	107.471	6995	4787	1626	3312	0.014%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
12.99	1095	1.9E-03	2.2E+03	32	0.4712	9.8E-05	22	0.255	0.258	231	107.938	6983	4779	1627	3308	0.013%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
13.04	1095	1.9E-03	2.2E+03	32	0.4667	9.7E-05	22	0.255	0.258	232	108.404	6971	4771	1628	3304	0.013%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
13.09	1095	1.9E-03	2.2E+03	32	0.4621	9.7E-05	22	0.256	0.259	233	108.871	6959	4763	1629	3300	0.013%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
13.14	1095	1.7E-03	2.1E+03	31	0.4575	1.0E-04	0	0.256	0.259	234	0.256	6948	4755	1630	6948	0.013%	2.00	1.00	0.01%	0.000054	0.36	0.025	0.785	0.01%	0.0000
13.19	1095	1.7E-03	2.1E+03	31	0.4530	1.0E-04	0	0.256	0.259	235	0.256	6938	4748	1631	6938	0.013%	2.00	1.00	0.01%	0.000052	0.36	0.025	0.785	0.01%	0.0000
13.24	1095	1.7E-03	2.1E+03	31	0.4484	1.0E-04	0	0.256	0.259	236	0.256	6927	4740	1632	6927	0.013%	2.00	1.00	0.01%	0.000050	0.36	0.025	0.785	0.01%	0.0000
13.29	1095	1.7E-03	2.1E+03	31	0.4439	1.0E-04	0	0.256	0.260	237	0.256	6916	4733	1633	6916	0.012%	2.00	1.00	0.01%	0.000048	0.36	0.025	0.785	0.01%	0.0000
13.34	1095	1.7E-03	2.1E+03	30	0.4394	1.0E-04	0	0.257	0.260	238	0.257	6906	4725	1634	6906	0.012%	2.00	1.00	0.01%	0.000046	0.36	0.025	0.785	0.01%	0.0000
13.39	1095	1.7E-03	2.1E+03	30	0.4348	1.0E-04	0	0.257	0.260	239	0.257	6895	4718	1635	6895	0.012%	2.00	1.00	0.01%	0.000044	0.36	0.025	0.785	0.01%	0.0000
13.44	1095	1.7E-03	2.1E+03	30	0.4303	1.0E-04	0	0.257	0.260	240	0.257	6885	4711	1636	6885	0.012%	2.00	1.00	0.01%	0.000042	0.36	0.025	0.785	0.01%	0.0000
13.49	1095	1.7E-03	2.1E+03	30	0.4258	1.0E-04	0	0.257	0.261	241	0.257	6875	4704	1637	6875	0.012%	2.00	1.00	0.01%	0.000040	0.36	0.025	0.785	0.01%	0.0000
13.54	1095	1.7E-03	2.1E+03	29	0.4213	9.9E-05	0	0.258	0.261	242	0.258	6864	4697	1638	6864	0.012%	2.00	1.00	0.01%	0.000038	0.36	0.025	0.785	0.01%	0.0000
13.59	1092	1.7E-03	2.1E+03	29	0.4168	9.9E-05	0	0.258	0.261	243	0.258	6854	4689	1639	6854	0.012%	2.00	1.00	0.01%	0.000037	0.36	0.025	0.785	0.01%	0.0000
13.64	1092	1.7E-03	2.1E+03	29	0.4123	9.8E-05	0	0.258	0.261	244	0.258	6844	4682	1640	6844	0.012%	2.00	1.00	0.01%	0.000035	0.36	0.025	0.785	0.01%	0.0000
13.69	1092	1.7E-03	2.1E+03	29	0.4078	9.8E-05	0	0.258	0.262	245	0.258	6834	4675	1641	6834	0.012%	2.00	1.00	0.01%	0.000033	0.36	0.025	0.785	0.01%	0.0000
13.74	1092	1.7E-03	2.1E+03	29	0.4033	9.7E-05	0	0.258	0.262	246	0.258	6824	4668	1642	6824	0.012%	2.00	1.00	0.01%	0.000031	0.36	0.025	0.785	0.00%	0.0000

40.190	6936.45	64.4	1.507	64.4	5.0	2.15	2.34%	Coarse Alluvium	0.056	111.0	2.24	0.000	2.24	0	28	2.42%	2.6	36%	2.54	0.000	2.54
40.354	6936.29	51.8	1.815	51.8	4.5	1.95	3.50%	Coarse Alluvium	0.056	111.0	2.25	0.000	2.25	0	22	3.66%	2.8	36%	2.55	0.000	2.55
40.518	6936.12	49.2	2.141	49.2	4.8	2.08	4.35%	Coarse Alluvium	0.056	111.0	2.26	0.000	2.26	0	21	4.56%	2.9	36%	2.56	0.000	2.56
40.682	6935.96	58.5	2.216	58.5	5.3	2.28	3.79%	Coarse Alluvium	0.056	111.0	2.27	0.000	2.27	0	25	3.94%	2.8	36%	2.57	0.000	2.57
40.846	6935.79	68.3	2.094	68.3	5.3	2.30	3.07%	Coarse Alluvium	0.056	111.0	2.28	0.000	2.28	0	29	3.17%	2.6	36%	2.58	0.000	2.58
41.010	6935.63	69.3	2.215	69.2	5.2	2.24	3.20%	Coarse Alluvium	0.056	111.0	2.29	0.000	2.29	0	29	3.31%	2.7	36%	2.59	0.000	2.59
41.174	6935.47	70.8	2.270	70.8	4.8	2.08	3.21%	Coarse Alluvium	0.056	111.0	2.30	0.000	2.30	0	30	3.31%	2.6	36%	2.59	0.000	2.59
41.338	6935.30	70.3	2.546	70.3	5.4	2.34	3.62%	Coarse Alluvium	0.056	111.0	2.31	0.000	2.31	0	29	3.74%	2.7	36%	2.60	0.000	2.60
41.502	6935.14	56.4	2.378	56.3	4.7	2.03	4.22%	Coarse Alluvium	0.056	111.0	2.32	0.000	2.32	0	23	4.40%	2.8	36%	2.61	0.000	2.61
41.666	6934.97	57.9	1.860	57.9	5.6	2.44	3.21%	Coarse Alluvium	0.056	111.0	2.32	0.000	2.32	0	24	3.35%	2.7	36%	2.62	0.000	2.62
41.830	6934.81	71.4	1.653	71.3	6.2	2.70	2.32%	Coarse Alluvium	0.056	111.0	2.33	0.000	2.33	0	30	2.39%	2.6	36%	2.63	0.000	2.63
41.994	6934.65	77.4	1.425	77.4	5.8	2.50	1.84%	Coarse Alluvium	0.056	111.0	2.34	0.000	2.34	0	32	1.90%	2.5	36%	2.64	0.000	2.64
42.158	6934.48	79.8	1.586	79.8	5.9	2.54	1.99%	Coarse Alluvium	0.056	111.0	2.35	0.000	2.35	0	33	2.05%	2.5	36%	2.65	0.000	2.65
42.322	6934.32	79.1	2.082	79.1	6.2	2.67	2.63%	Coarse Alluvium	0.056	111.0	2.36	0.000	2.36	0	33	2.71%	2.6	36%	2.66	0.000	2.66
42.486	6934.15	76.5	2.369	76.5	6.3	2.73	3.10%	Coarse Alluvium	0.056	111.0	2.37	0.000	2.37	0	31	3.19%	2.6	36%	2.67	0.000	2.67
42.650	6933.99	54.1	2.369	54.1	6.3	2.73	4.37%	Coarse Alluvium	0.056	111.0	2.38	0.000	2.38	0	22	4.58%	2.8	36%	2.68	0.000	2.68
42.814	6933.83	48.2	2.165	48.1	7.0	3.03	4.50%	Coarse Alluvium	0.056	111.0	2.39	0.000	2.39	0	19	4.73%	2.9	36%	2.69	0.000	2.69
42.978	6933.66	51.6	1.904	51.6	7.3	3.17	3.69%	Coarse Alluvium	0.056	111.0	2.40	0.000	2.40	0	21	3.87%	2.8	36%	2.69	0.000	2.69
43.143	6933.50	62.5	1.837	62.5	7.4	3.19	2.94%	Coarse Alluvium	0.056	111.0	2.41	0.000	2.41	0	25	3.06%	2.7	36%	2.70	0.000	2.70
43.307	6933.33	60.0	1.735	59.9	7.3	3.15	2.89%	Coarse Alluvium	0.056	111.0	2.42	0.000	2.42	0	24	3.02%	2.7	36%	2.71	0.000	2.71
43.471	6933.17	74.2	1.678	74.1	7.8	3.40	2.26%	Coarse Alluvium	0.056	111.0	2.42	0.000	2.42	0	30	2.34%	2.6	36%	2.72	0.000	2.72
43.635	6933.01	88.0	1.497	88.0	8.1	3.50	1.70%	Coarse Alluvium	0.056	111.0	2.43	0.000	2.43	0	35	1.75%	2.4	36%	2.73	0.000	2.73
43.799	6932.84	111.2	1.955	111.2	8.6	3.74	1.76%	Coarse Alluvium	0.056	111.0	2.44	0.000	2.44	0	45	1.80%	2.3	36%	2.74	0.000	2.74
43.963	6932.68	139.3	2.806	139.2	9.0	3.90	2.01%	Coarse Alluvium	0.056	111.0	2.45	0.000	2.45	0	56	2.05%	2.3	36%	2.75	0.000	2.75
44.127	6932.51	147.4	4.138	147.3	9.2	3.99	2.81%	Coarse Alluvium	0.056	111.0	2.46	0.000	2.46	0	59	2.86%	2.4	36%	2.76	0.000	2.76
44.291	6932.35	146.3	5.462	146.2	10.1	4.37	3.73%	Coarse Alluvium	0.056	111.0	2.47	0.000	2.47	0	58	3.80%	2.5	36%	2.77	0.000	2.77
44.455	6932.19	170.7	6.731	170.6	10.6	4.60	3.94%	Coarse Alluvium	0.056	111.0	2.48	0.000	2.48	0	68	4.00%	2.5	36%	2.78	0.000	2.78
44.619	6932.02	185.1	7.743	185.0	11.6	5.02	4.18%	Coarse Alluvium	0.056	111.0	2.49	0.000	2.49	0	73	4.24%	2.4	36%	2.79	0.000	2.79
44.783	6931.86	128.4	6.546	128.3	11.4	4.92	5.10%	Coarse Alluvium	0.056	111.0	2.50	0.000	2.50	0	50	5.20%	2.6	36%	2.80	0.000	2.80
44.947	6931.69	110.8	4.906	110.7	16.0	6.93	4.43%	Coarse Alluvium	0.056	111.0	2.51	0.000	2.51	0	43	4.53%	2.6	36%	2.80	0.000	2.80
45.111	6931.53	108.9	3.071	108.7	24.4	10.57	2.82%	Fine Alluvium	0.060	120.7	2.52	0.000	2.52	0	42	2.89%	2.5	76%	2.81	0.000	2.81
45.275	6931.36	94.2	2.838	94.0	30.4	13.18	3.01%	Fine Alluvium	0.060	120.7	2.53	0.000	2.53	0	36	3.10%	2.6	76%	2.82	0.000	2.82
45.439	6931.20	91.1	3.068	90.9	35.8	15.50	3.37%	Fine Alluvium	0.060	120.7	2.54	0.000	2.54	0	35	3.46%	2.6	76%	2.83	0.000	2.83
45.603	6931.04	95.8	3.249	95.6	36.1	15.66	3.39%	Fine Alluvium	0.060	120.7	2.55	0.000	2.55	0	37	3.48%	2.6	76%	2.84	0.000	2.84
45.767	6930.87	105.6	2.581	105.4	34.7	15.03	2.44%	Fine Alluvium	0.060	120.7	2.56	0.000	2.56	0	40	2.51%	2.5	76%	2.85	0.000	2.85
45.931	6930.71	80.3	3.109	80.1	29.6	12.83	3.87%	Fine Alluvium	0.060	120.7	2.57	0.000	2.57	0	30	4.00%	2.7	76%	2.86	0.000	2.86
46.095	6930.54	85.8	3.520	85.7	17.0	7.38	4.10%	Fine Alluvium	0.060	120.7	2.58	0.000	2.58	0	32	4.23%	2.7	76%	2.87	0.000	2.87
46.259	6930.38	70.5	3.470	70.4	16.4	7.12	4.92%	Fine Alluvium	0.060	120.7	2.59	0.000	2.59	0	26	5.11%	2.8	76%	2.88	0.000	2.88
46.423	6930.22	62.6	3.118	62.5	15.9	6.89	4.98%	Fine Alluvium	0.060	120.7	2.60	0.000	2.60	0	23	5.19%	2.9	76%	2.89	0.000	2.89
46.587	6930.05	73.8	2.530	73.7	15.8	6.83	3.43%	Fine Alluvium	0.060	120.7	2.61	0.000	2.61	0	27	3.55%	2.7	76%	2.90	0.000	2.90
46.751	6929.89	80.7	2.560	80.6	15.3	6.63	3.17%	Fine Alluvium	0.060	120.7	2.62	0.000	2.62	0	30	3.28%	2.6	76%	2.91	0.000	2.91
46.915	6929.72	66.3	2.542	66.2	13.6	5.90	3.83%	Fine Alluvium	0.060	120.7	2.63	0.000	2.63	0	24	3.99%	2.8	76%	2.92	0.000	2.92
47.079	6929.56	62.6	1.985	62.5	14.6	6.34	3.17%	Fine Alluvium	0.060	120.7	2.64	0.000	2.64	0	23	3.31%	2.7	76%	2.93	0.000	2.93
47.244	6929.40	68.5	2.287	68.5	14.0	6.06	3.34%	Fine Alluvium	0.060	120.7	2.64	0.000	2.64	0	25	3.47%	2.7	76%	2.94	0.000	2.94
47.408	6929.23	52.7	1.998	52.7	9.9	4.27	3.79%	Fine Alluvium	0.060	120.7	2.65	0.000	2.65	0	19	3.99%	2.9	76%	2.95	0.000	2.95
47.572	6929.07	40.8	1.994	40.7	11.2	4.86	4.89%	Fine Alluvium	0.060	120.7	2.66	0.000	2.66	0	14	5.23%	3.0	76%	2.96	0.000	2.96
47.736	6928.90	53.4	2.256	53.3	12.9	5.59	4.23%	Fine Alluvium	0.060	120.7	2.67	0.000	2.67	0	19	4.45%	2.9	76%	2.97	0.000	2.97
47.900	6928.74	54.6	2.196	54.6	12.0	5.19	4.02%	Fine Alluvium	0.060	120.7	2.68	0.000	2.68	0	19	4.23%	2.9	76%	2.98	0.000	2.98
48.064	6928.58	72.9	2.046	72.8	12.3	5.31	2.81%	Fine Alluvium	0.060	120.7	2.69	0.000	2.69	0	26	2.92%	2.7	76%	2.99	0.000	2.99
48.228	6928.41	81.0	1.908	81.0	11.9	5.14	2.35%	Fine Alluvium	0.060	120.7	2.70	0.000	2.70	0	29	2.44%	2.6	76%	3.00	0.000	3.00
48.392	6928.25	80.2	1.730	80.1	11.7	5.07	2.16%	Fine Alluvium	0.060	120.7	2.71	0.000	2.71	0	29	2.23%	2.6	76%	3.01	0.000	3.01
48.556	6928.08	85.9	2.045	85.8	11.6	5.02	2.38%	Fine Alluvium	0.060	120.7	2.72	0.000	2.72	0	31	2.46%	2.6	76%	3.02	0.000	3.02
48.720	6927.92	92.2	2.256	92.1	11.2	4.84	2.45%	Fine Alluvium	0.060	120.7	2.73	0.000	2.73	0	33	2.52%	2.5	76%	3.03	0.000	3.03
48.884	6927.76	94.8	2.312	94.8	11.0	4.76	2.44%	Fine Alluvium	0.060	120.7	2.74	0.000	2.74	0	34	2.51%	2.5	76%	3.04	0.000	3.04
49.048	6927.59	105.8	2.407	105.7	11.2	4.86	2.28%	Fine Alluvium	0.060	120.7	2.75	0.000	2.75	0	37	2.34%	2.5	76%	3.05	0.000	3.05
49.212	6927.43	122.2	2.757	122.1	11.7	5.07	2.26%	Fine Alluvium	0.060	120.7	2.76	0.000	2.76	0	43	2.31%	2.4	76%	3.06	0.000	3.06
49.376	6927.26	132.4	3.301	132.3	12.2	5.27	2.49%	Fine Alluvium	0.060	120.7	2.77	0.000	2.77	0	47	2.55%	2.4	76%	3.07	0.000	3.07
49.540	6927.10	133.7	3.732	133.7	12.3	5.35	2.79%	Fine Alluvium	0.060	120.7	2.78	0.000	2.78	0	47	2.85%	2.5	76%	3.08	0.000	3.08
49.704	6926.94	129.6	4.167	129.5	12.3	5.33	3.22%	Fine Alluvium	0.060	120.7	2.79	0.000	2.79	0	45	3.29%	2.5	76%	3.09	0.000	3.09
49.868	6926.77	103.9	1.821	103.8	12.4	5.39	1.75%	Fine Alluvium	0.060	120.7	2.80	0.000	2.80	0	36	1.80%	2.4	76%	3.10	0.000	3.10
50.032	6926.61	96.1	1.817	96.1	15.0	6.49	1.89%	Fine Alluvium	0.060	120.7	2.81	0.000	2.81	0	33	1.95%	2.5	76%	3.11	0.000	3.11
50.196	6926.44	99.3	2.434	99.1	27.7	12.00	2.45%	Coarse Alluvium	0.056	111.0	2.82	0.000	2.82	0	34	2.52%	2.5	36%	3.12	0.000	3.12
50.360	6926.28	84.0	3.182	83.8	22.8	9.86	3.79%	Coarse Alluvium	0.056	111.0	2.83	0.000	2.83	0	29	3.92%	2.7	36%	3.13	0.000	3.13
50.524	6926.12	52.6	3.156	52.5	21.9	9.48	6.00%	Coarse Alluvium	0.056	111.0	2.84	0.000	2.84	0	18	6.34%	3.0	36%	3.14	0.000	3.14
50.688	6925.95	38.6	2.742	38.4	20.4	8.83	7.11%	Coarse Alluvium	0.056	111.0	2.85	0.000	2.85	0	13	7.68%	3.2	36%	3.15	0.000	3.15
50.852	6925.79	43.0	2.157	42.8	21.0	9.09	5.02%	Coarse Alluvium	0.056	111.0	2.86	0.000	2.86	0	14	5.38%	3.0	36%	3.16	0.000	3.16
51.016	6925.62	57.6	2.068	57.5	24.7	10.69	3.59%	Coarse Alluvium	0.056	111.0	2.87	0.000	2.87	0	19	3.78%	2.8	36%	3.17	0.000	3.17
51.180	6925.46	81.2	1.947	81.0	25.0	10.82	2.40%	Coarse Alluvium	0.056	111.0	2.88	0.000	2.88	0	27	2.49%	2.6	36%	3.17	0.000	3.17
51.345	6925.30	92.8	1.829	92.7	21.4	9.27	1.97%	Coarse Alluvium	0.056	111.0	2.89	0.000	2.89	0	31	2.03%	2.5	36%	3.18	0.000	3.18
51.509	6925.13	111.8	1.691	111.7	18.6	8.05	1.51%	Coarse Alluvium	0.056	111.0	2.90	0.000	2.90	0	38	1.55%	2.4	36%	3.19	0.000	3.19
51.673	6924.97	127.5	1.862	127.4	17.4	7.52	1.46%	Coarse Alluvium	0.056	111.0	2.90	0.000	2.90	0	43	1.49%	2.3	36%	3.20	0.000	3.20
51.837	6924.80	131.5	2.071	131.4	16.6	7.20	1.57%	Coarse Alluvium	0.056	111.0	2.91	0.000	2.91	0	44	1.61%	2.3	36%	3.21	0.000	3.21
52.001	6924.64	130.1	2.340	130.0	15.8	6.85	1.80%	Fine Alluvium	0.060	120.7	2.92	0.000	2.92	0	43	1.84%	2.4	76%	3.22	0.000	3.22
52.165	6924.48	124.5	2.653	124.4	14.4	6.22	2.13%	Fine Alluvium	0.060	120.7	2.93	0.000	2.93	0	41	2.18%	2.4	76%	3.23	0.000	3.23
52.329	6924.31	128.5	2.597	128.4	14.4	6.22	2.02%	Fine Alluvium	0.060	120.7	2.94	0.000	2.94	0	43	2.07%	2.4	76%	3.24	0.000	3.24
52.493	6924.15	128.9	2.368	128.8	14.9	6.47	1.84%	Fine Alluvium	0.060	120.7	2.95	0.000	2.95	0	43	1.88%	2.4	76%	3.25	0.000	3.25
52.657	6923.98	123.4	2.644	123.3	14.1	6.12	2.14%	Fine Alluvium	0.060	120.7	2.96	0.000	2.96	0	41	2.20%	2.4	76%	3.26	0.000	3.26
52.821	6923.82	120.1	2.625	120.0	15.1	6.53	2.19%	Fine Alluvium	0.060	120.7	2.97	0.000	2.97	0	39	2.24%	2.4	76%	3.27	0.000	3.27
52.985	6923.66	127.6	2.583	127.5	15.8	6.83	2.02%	Fine Alluvium	0.060	120.7	2.98	0.000	2.98	0	42	2.07%	2.4	76%	3.28	0.000	3.28
53.149	6923.49	133.7	2.313	133.6	14.8	6.43	1.73%	Fine Alluvium	0.060	120.7	2.99	0.000	2.99	0	44	1.77%	2.3	76%	3.29	0.000	3.29
53.313	6923.33	128.5	2.286	128.4	14.5	6.26	1.78%	Fine Alluvium	0.060	120.7	3.00	0.000	3.00	0	42	1.82%	2.4	76%	3.30	0.000	3.30
53.477	6923.16	117.4	2.912	117.3	13.5	5.86	2.48%	Fine Alluvium	0.060	120.7	3.01	0.000	3.01	0	38	2.55%	2.5	76%	3.31	0.000	3.31
53.641	6923.00	119.7	2.512	119.6	13.1	5.69	2.10%	Fine Alluvium	0.060	120.7	3.02	0.000	3.02	0	39	2.15%	2.4	76%	3.32	0.000	3.32
53.805	6922.83	134.1	2.551	134.0	15.6	6.77	1.90%	Fine Alluvium	0.060	120.7	3.03	0.000	3.03	0	43	1.95%	2.4	76%	3.33	0.000	3.33
53.969	6922.67	165.3	2.556	165.2	14.0	6.08	1.55%	Fine Alluvium	0.060	120.7	3.04	0.000	3.04	0	53	1.58%	2.2	76%	3.34	0.000	3.34
54.133	6922.51	184.4	2.581	184.3	14.6	6.32	1.40%	Fine Alluvium	0.060	120.7	3.05	0.000	3.05	0	59	1.42%	2.2	76%	3.35	0.000	3.35
54.297	6922.34	187.0	3.073	186.9	19.9	8.64	1.64%	Fine Alluvium	0.060	120.7	3.06	0.000	3.06	0	60	1.67%	2.2	76%	3.36	0.000	3.36
54.461	6922.18	194.5	3.149	194.4	17.1	7.42	1.62%	Fine Alluvium	0.060	120.7	3.07	0.000	3.07	0	62	1.64%	2.2	76%	3.37	0.000	3.37
54.625	6922.01	211.5	2.885	211.4	19.8	8.58	1.36%	Fine Alluvium	0.060	120.7	3.08	0.000	3.08	0	68	1.38%	2.1	76%	3.38	0.000	3.38
54.789	6921.85	216.9	4.198	216.8	18.3	7.93	1.94%	Fine Alluvium	0.060	120.7	3.09	0.000	3.09	0	69	1.96%	2.2	76%	3.39	0.000	3.39
54.953	6921.69	260.9	4.198	260.8	19.8	8.58	1.61%	Fine Alluvium	0.060	120.7	3.10	0.000	3.10	0	83	1.63%	2.1	76%	3.40	0.000	3.40
55.117	6921.52	390.0	4.198	389.8	32.8	14.21	1.08%	Fine Alluvium	0.060	120.7	3.11	0.000	3.11	0	124	1.08%	1.9	76%	3.41	0.000	3.41

13.79	1092	1.7E-03	2.1E+03	28	0.3988	9.6E-05	0	0.259	0.262	247	0.259	6814	4661	1643	6814	0.011%	2.00	1.00	0.01%	0.000029	0.36	0.025	0.785	0.00%	0.0000
13.84	1092	1.7E-03	2.1E+03	28	0.3944	9.5E-05	0	0.259	0.262	248	0.259	6804	4654	1644	6804	0.011%	2.00	1.00	0.01%	0.000026	0.36	0.025	0.785	0.00%	0.0000
13.89	1092	1.7E-03	2.1E+03	28	0.3899	9.5E-05	0	0.259	0.263	249	0.259	6794	4647	1645	6794	0.011%	2.00	1.00	0.01%	0.000024	0.36	0.025	0.785	0.00%	0.0000
13.94	1092	1.7E-03	2.1E+03	28	0.3855	9.4E-05	0	0.259	0.263	250	0.259	6784	4640	1646	6784	0.011%	2.00	1.00	0.01%	0.000022	0.36	0.025	0.785	0.00%	0.0000
13.99	1092	1.7E-03	2.1E+03	28	0.3811	9.3E-05	0	0.259	0.263	251	0.259	6774	4633	1647	6774	0.011%	2.00	1.00	0.01%	0.000020	0.36	0.025	0.785	0.00%	0.0000
14.04	1092	1.7E-03	2.1E+03	27	0.3767	9.2E-05	0	0.260	0.263	252	0.260	6764	4627	1648	6764	0.011%	2.00	1.00	0.01%	0.000018	0.36	0.025	0.785	0.00%	0.0000
14.09	1092	1.7E-03	2.1E+03	27	0.3723	9.2E-05	0	0.260	0.264	253	0.260	6754	4620	1649	6754	0.011%	2.00	1.00	0.01%	0.000016	0.36	0.025	0.785	0.00%	0.0000
14.14	1092	1.7E-03	2.1E+03	27	0.3679	9.1E-05	0	0.260	0.264	254	0.260	6745	4613	1650	6745	0.011%	2.00	1.00	0.01%	0.000013	0.36	0.025	0.785	0.00%	0.0000
14.19	1092	1.7E-03	2.1E+03	27	0.3636	9.0E-05	0	0.260	0.264	255	0.260	6735	4606	1651	6735	0.011%	2.00	1.00	0.01%	0.000011	0.36	0.025	0.785	0.00%	0.0000
14.24	1092	1.7E-03	2.1E+03	27	0.3592	8.9E-05	0	0.261	0.264	256	0.261	6726	4600	1652	6726	0.010%	2.00	1.00	0.01%	0.000009	0.36	0.025	0.785	0.00%	0.0000
14.29	1092	1.7E-03	2.1E+03	26	0.3549	8.9E-05	0	0.261	0.265	257	0.261	6716	4593	1653	6716	0.010%	2.00	1.00	0.01%	0.000007	0.36	0.025	0.785	0.00%	0.0000
14.34	1092	1.7E-03	2.1E+03	26	0.3506	8.8E-05	0	0.261	0.265	258	0.261	6706	4586	1654	6706	0.010%	2.00	1.00	0.01%	0.000005	0.36	0.025	0.785	0.00%	0.0000
14.39	1092	1.7E-03	2.1E+03	26	0.3463	8.7E-05	0	0.261	0.265	259	0.261	6697	4580	1655	6697	0.010%	2.00	1.00	0.01%	0.000003	0.36	0.025	0.785	0.00%	0.0000
14.44	1092	1.7E-03	2.1E+03	26	0.3420	8.6E-05	0	0.261	0.265	260	0.261	6688	4573	1656	6688	0.010%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
14.49	1092	1.7E-03	2.1E+03	26	0.3378	8.5E-05	0	0.262	0.265	261	0.262	6678	4567	1657	6678	0.010%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
14.54	1092	1.7E-03	2.1E+03	26	0.3335	8.5E-05	0	0.262	0.266	262	0.262	6669	4560	1658	6669	0.010%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
14.59	1092	1.7E-03	2.1E+03	25	0.3293	8.4E-05	0	0.262	0.266	263	0.262	6660	4554	1659	6660	0.010%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
14.64	1092	1.7E-03	2.1E+03	25	0.3251	8.3E-05	0	0.262	0.266	264	0.262	6650	4547	1660	6650	0.010%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
14.69	1092	1.7E-03	2.1E+03	25	0.3209	8.2E-05	0	0.262	0.266	265	0.262	6641	4541	1661	6641	0.009%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
14.74	1092	1.7E-03	2.1E+03	25	0.3168	8.2E-05	0	0.263	0.267	266	0.263	6632	4534	1662	6632	0.009%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
14.79	1092	1.7E-03	2.1E+03	25	0.3126	8.1E-05	0	0.263	0.267	267	0.263	6623	4528	1663	6623	0.009%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
14.84	1092	1.7E-03	2.1E+03	25	0.3085	8.0E-05	0	0.263	0.267	268	0.263	6614	4522	1664	6614	0.009%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
14.89	1092	1.7E-03	2.1E+03	25	0.3044	7.9E-05	0	0.263	0.267	269	0.263	6605	4516	1665	6605	0.009%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
14.94	1092	1.7E-03	2.1E+03	24	0.3004	7.8E-05	0	0.263	0.268	270	0.263	6596	4509	1666	6596	0.009%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
14.99	1092	1.7E-03	2.1E+03	24	0.2963	7.8E-05	0	0.264	0.268	271	0.264	6587	4503	1667	6587	0.009%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
15.04	1092	1.7E-03	2.1E+03	24	0.2923	7.7E-05	0	0.264	0.268	272	0.264	6578	4497	1668	6578	0.009%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
15.09	1092	1.7E-03	2.1E+03	24	0.2883	7.6E-05	0	0.264	0.268	273	0.264	6569	4491	1669	6569	0.009%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
15.14	1092	1.7E-03	2.1E+03	24	0.2843	7.5E-05	0	0.264	0.269	274	0.264	6560	4485	1670	6560	0.009%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
15.19	1092	1.7E-03	2.1E+03	24	0.2804	7.4E-05	0	0.264	0.269	275	0.264	6552	4478	1671	6552	0.008%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
15.24	1092	1.7E-03	2.1E+03	24	0.2764	7.4E-05	0	0.265	0.269	276	0.265	6543	4472	1672	6543	0.008%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
15.29	1092	1.9E-03	2.2E+03	23	0.2725	6.7E-05	22	0.265	0.269	277	129.410	6533	4466	1673	3162	0.008%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
15.34	1092	1.9E-03	2.2E+03	23	0.2687	6.6E-05	22	0.265	0.270	278	129.877	6524	4459	1674	3159	0.008%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
15.39	1206	1.9E-03	2.7E+03	23	0.2648	5.4E-05	22	0.265	0.270	279	130.344	6515	4453	1675	3156	0.006%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
15.44	1206	1.9E-03	2.7E+03	23	0.2610	5.3E-05	22	0.265	0.270	280	130.811	6505	4446	1676	3153	0.006%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
15.49	1206	1.9E-03	2.7E+03	23	0.2572	5.3E-05	22	0.266	0.270	281	131.277	6496	4440	1677	3150	0.006%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
15.54	1206	1.9E-03	2.7E+03	23	0.2534	5.2E-05	22	0.266	0.271	282	131.744	6487	4433	1678	3147	0.006%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
15.59	1206	1.9E-03	2.7E+03	23	0.2497	5.1E-05	22	0.266	0.271	283	132.211	6478	4427	1679	3145	0.006%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
15.64	1206	1.9E-03	2.7E+03	23	0.2460	5.1E-05	22	0.266	0.271	284	132.678	6469	4421	1680	3142	0.006%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
15.69	1206	1.9E-03	2.7E+03	23	0.2423	5.0E-05	22	0.267	0.271	285	133.145	6459	4414	1681	3139	0.006%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
15.74	1206	1.9E-03	2.7E+03	22	0.2386	5.0E-05	22	0.267	0.272	286	133.611	6450	4408	1682	3136	0.006%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
15.79	1206	1.9E-03	2.7E+03	22	0.2350	4.9E-05	22	0.267	0.272	287	134.078	6441	4402	1683	3133	0.006%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
15.84	1206	1.9E-03	2.7E+03	22	0.2314	4.8E-05	22	0.267	0.272	288	134.545	6432	4395	1684	3130	0.006%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
15.89	1206	1.9E-03	2.7E+03	22	0.2278	4.8E-05	22	0.267	0.272	289	135.012	6424	4389	1685	3127	0.006%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
15.94	1206	1.9E-03	2.7E+03	22	0.2242	4.7E-05	22	0.268	0.272	290	135.479	6415	4383	1686	3124	0.005%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
15.99	1206	1.9E-03	2.7E+03	22	0.2207	4.7E-05	22	0.268	0.273	291	135.945	6406	4377	1687	3122	0.005%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.04	1206	1.9E-03	2.7E+03	22	0.2172	4.6E-05	22	0.268	0.273	292	136.412	6397	4371	1688	3119	0.005%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.09	1206	1.9E-03	2.7E+03	22	0.2138	4.5E-05	22	0.268	0.273	293	136.879	6388	4365	1689	3116	0.005%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.14	1206	1.9E-03	2.7E+03	22	0.2103	4.5E-05	22	0.268	0.273	294	137.346	6380	4359	1690	3113	0.005%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.19	1206	1.9E-03	2.7E+03	22	0.2069	4.4E-05	22	0.269	0.274	295	137.813	6371	4353	1691	3111	0.005%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.24	1206	1.9E-03	2.7E+03	21	0.2036	4.4E-05	22	0.269	0.274	296	138.279	6362	4347	1692	3108	0.005%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.29	1206	1.9E-03	2.7E+03	21	0.2002	4.3E-05	22	0.269	0.274	297	138.746	6354	4341	1693	3105	0.005%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.34	1206	1.9E-03	2.7E+03	21	0.1969	4.3E-05	22	0.269	0.274	298	139.213	6345	4335	1694	3102	0.005%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.39	1206	1.9E-03	2.7E+03	21	0.1936	4.2E-05	22	0.269	0.275	299	139.680	6337	4329	1695	3100	0.005%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.44	1206	1.9E-03	2.7E+03	21	0.1904	4.1E-05	22	0.270	0.275	300	140.147	6328	4323	1696	3097	0.005%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.49	1206	1.9E-03	2.7E+03	21	0.1871	4.1E-05	22	0.270	0.275	301	140.613	6320	4317	1697	3094	0.005%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.54	1206	1.9E-03	2.7E+03	21	0.1839	4.0E-05	22	0.270	0.275	302	141.080	6311	4311	1698	3092	0.005%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.59	1206	1.9E-03	2.7E+03	21	0.1808	4.0E-05	22	0.270	0.276	303	141.547	6303	4305	1699	3089	0.004%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.64	1142	1.9E-03	2.4E+03	21	0.1776	4.4E-05	22	0.270	0.276	304	142.014	6295	4300	1700	3086	0.005%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.69	1142	1.9E-03	2.4E+03	21	0.1745	4.3E-05	22	0.271	0.276	305	142.481	6287	4294	1701	3084	0.005%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.74	1142	1.9E-03	2.4E+03	21	0.1714	4.2E-05	22	0.271	0.276	306	142.947	6278	4288	1702	3081	0.005%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.79	1142	1.9E-03	2.4E+03	21	0.1684	4.2E-05	22	0.271	0.277	307	143.414	6270	4282	1703	3079	0.005%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
16.84	1142	1.7E-03	2.2E+03	21	0.1654	4.5E-05	0	0.271	0.277	308	0.271	6263	4277	1704	6263	0.005%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
16.89	1142	1.7E-03	2.2E+03	20	0.1624	4.4E-05	0	0.271	0.277	309	0.271	6255	4272	1705	6255	0.005%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
16.94	1142	1.7E-03	2.2E+03	20	0.1594	4.3E-05	0	0.272	0.277	310	0.272	6248	4267	1706	6248	0.005%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
16.99	1142	1.7E-03	2.2E+03	20	0.1565	4.3E-05	0	0.272	0.277	311	0.272	6240	4262	1707	6240	0.005%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
17.04	1142	1.7E-03	2.2E+03	20	0.1536	4.2E-05	0	0.272	0.278	312	0.272	6233	4256	1708	6233	0.004%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
17.09	1142	1.7E-03	2.2E+03	20	0.1507	4.1E-05	0	0.272	0.278	313	0.272	6226	4251	1709	6226	0.004%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
17.14	1142	1.7E-03	2.2E+03	20	0.1479	4.1E-05	0	0.272	0.278	314	0.272	6218	4246	1710	6218	0.004%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
17.19	1142	1.7E-03	2.2E+03	20	0.1451	4.0E-05	0	0.272	0.278	315	0.272	6211	4241	1711	6211	0.004%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
17.24	1142	1.7E-03	2.2E+03	20	0.1423	3.9E-05	0	0.273	0.278	316	0.273	6204	4236	1712	6204	0.004%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
17.29	1142	1.7E-03	2.2E+03	20	0.1395	3.9E-05	0	0.273	0.279	317	0.273	6196	4231	1713	6196	0.004%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
17.34	1142	1.7E-03	2.2E+03	20	0.1368	3.8E-05	0	0.273	0.279	318	0.273	6189	4226	1714	6189	0.004%	2.00	1.00	0.01%	0.000000	0.36	0.025	0.785	0.00%	0.0000
17.39	1142	1.9E-03	2.4E+03	20	0.1341	3.4E-05	22	0.273	0.279	319	149.016	6181	4221	1715	3051	0.004%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.44	1142	1.9E-03	2.4E+03	20	0.1315	3.4E-05	22	0.273	0.279	320	149.482	6174	4215	1716	3049	0.004%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.49	1142	1.9E-03	2.4E+03	20	0.1288	3.3E-05	22	0.274	0.280	321	149.949	6166	4210	1717	3046	0.004%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.54	1142	1.9E-03	2.4E+03	20	0.1262	3.3E-05	22	0.274	0.280	322	150.416	6158	4204	1718	3044	0.004%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.59	1142	1.9E-03	2.4E+03	20	0.1237	3.2E-05	22	0.274	0.280	323	150.883	6150	4199	1719	3042	0.004%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.64	1142	1.9E-03	2.4E+03	20	0.1211	3.2E-05	22	0.274	0.280	324	151.349	6143	4194	1720	3039	0.003%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.69	1142	1.9E-03	2.4E+03	19	0.1186	3.1E-05	22	0.274	0.280	325	151.816	6135	4188	1721	3037	0.003%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.74	1142	1.9E-03	2.4E+03	19	0.1161	3.0E-05	22	0.275	0.281	326	152.283	6128	4183	1722	3035	0.003%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.79	1142	1.9E-03	2.4E+03	19	0.1136	3.0E-05	22	0.275	0.281	327	152.750	6120	4178	1723	3032	0.003%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.84	1142	1.9E-03	2.4E+03	19	0.1112	2.9E-05	22	0.275	0.281	328	153.217	6113	4173	1724	3030	0.003%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.89	1142	1.9E-03	2.4E+03	19	0.1088	2.9E-05	22	0.275	0.281	329	153.683	6105	4167	1725	3028	0.003%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.94	1142	1.9E-03	2.4E+03	19	0.1064	2.8E-05	22	0.275	0.282	330	154.150	6098	4162	1726	3025	0.003%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
17.99	1142	1.9E-03	2.4E+03	19	0.1041	2.8E-05	22	0.276	0.282	331	154.617	6090	4157	1727	3023	0.003%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.04	1142	1.9E-03	2.4E+03	19	0.1018	2.7E-05	22	0.276	0.282	332	155.084	6083	4152	1728	3021	0.003%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.09	1142	1.9E-03	2.4E+03	19	0.0995	2.7E-05	22	0.276	0.282	333	155.551	6076	4147	1729	3019	0.003%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.14	1142	1.9E-03	2.4E+03	19	0.0972	2.6E-05	22	0.276	0.282	334	156.017	6068	4142	1730	3016	0.003%	0.90	0.75	0.06%	0.000000	0.25	0.323	0.851	0.00%	0.0000
18.19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18.24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18.29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18.34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Proposed Repository	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Elev. At Bottom of Layer (ft)	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at Bottom of Layer (tsf)	Total Stress at Midpoint of Layer (tsf)	Equil Pore Pressure at Bottom of Layer (tsf)	Equil Pore Pressure at Midpoint of Layer (tsf)	Effective Stress at Bottom of Layer (tsf)	Effective Stress at Midpoint of Layer (tsf)
Erosion Protection	6981.7	6981.0	6980.2	1.5	0.061	122.9	0.092	0.046	0.00	0.00	0.092	0.046
Cover Soil	6980.2	6979.0	6977.7	2.5	0.057	114.7	0.235	0.164	0.00	0.00	0.235	0.164
Mine Spoils	6977.7	6977.2	6976.6	1.1	0.058	116.4	0.298	0.267	0.00	0.00	0.298	0.267

6976.64	Ground Surface Elevation at time of CPT (ft amsl)
6981.71	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
1.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after placement (ft)
2.50	Thickness of Water Storage/Rooting Zone (Cover Soil; ft)

0.30	Additional Stress due to Proposed Repository Construction, $\Delta\sigma_{repos}$ (psf)
6946.54	Elevation of bottom of tailings (ft amsl)

ATTACHMENT G.5
Repository (Existing Radon Barrier) Cover Cracking Analysis

MWH now part of Stantec

CALCULATIONS

Client: GE/UNC **Sheet:** 1 of 6
Project: Northeast Church Rock Mine Site Removal Action
Description: Cover Cracking of the Existing Radon Barrier **Job No:** 10508639

ATTACHMENT G.5: REPOSITORY (EXISTING RADON BARRIER) COVER CRACKING ANALYSIS

Revisioning

Rev.	Date	Description	By	Checked	Date
0	06/02/2016	Preliminary (30%) Design	S. Moore	J. Cumbers	6/23/16
1	July 2017	95% Design	S. Downey	M. Davis	10/17/17

Location and Format

Electronic copies of these calculations are located on the Stantec internal project teamsite.

The following calculations were generated using the following software:

Microsoft Excel 2013

Table of Contents

Objective

The objective of this calculation brief is to analyze the potential for cover cracking of the existing radon barrier, where the new repository cover transitions directly to the existing radon barrier.

Background

This analysis was performed as part of the design of the Removal Action (RA) at the Northeast Church Rock Mine Site (Mine Site) and the related Remedial Action (RA) at the Church Rock Mill Site (Mill Site). The Mine Site and Mill Site are located in close proximity to one another, approximately 16 miles northeast of Gallup, in McKinley County, New Mexico. They are located on adjacent Sections approximately one-half mile apart. The sites are temporarily being treated as one facility for purposes of the RA. The combined site is referred to as the “Settlement Agreement Site” (SA Site).

Site History

The NECR mine is a historical uranium mine operated by United Nuclear Corporation (UNC). Mining development began in 1967 and ended in 1982. While the mine operated, it served as the principal mineral source for the UNC uranium mill. The uranium mill and its adjacent disposal cells make up the UNC Superfund Site (the “UNC Mill Site”). Remedial activities addressing source control and on-site surface reclamation are being implemented by General Electric/United Nuclear Corporation (GE/UNC) under the direction of the U.S. Nuclear Regulatory Commission (NRC), pursuant to the UNC facility's NRC license, and integrated with the US Environmental Protection Agency’s (USEPA’s) selected remedy for the groundwater.

The tailings disposal area (TDA) is an unlined facility bounded by an embankment and subdivided by cross-dikes into three cells, which are identified as the South Cell, Central Cell, and North Cell. An estimated 3.5 million tons of tailings were pumped in slurry from the mill to the TDA.

Proposed Remedial Action

The proposed repository will be constructed on top of the existing TDA and will incorporate controlled placement of mine spoils on top of the existing TDA cover/radon barrier and a final evapotranspirative (ET) cover placed over the mine spoils. Improvements to the existing TDA cover/radon barrier within the footprint of the proposed repository will be completed prior to placement of mine spoils.

The design for the selected repository alternative will be evaluated as part of a NRC license amendment request for the existing licensed facility. The repository features that affect the licensed facility will meet the performance standards outlined in NRC regulations and areas of the existing facility affected by the repository construction will be evaluated for compliance. However, existing conditions of the facility not affected by the proposed repository were not evaluated as part of this analysis, as they are managed by the existing NRC license.

Site Description

The natural stratigraphy at the Mill Site is divided into two main components: the surficial unconsolidated deposits (alluvium) and the underlying consolidated bedrock units. The alluvium consists of a mixture of sand, silt, and clay with minor portions of gravel. Alluvial thicknesses at the site are usually around 50 feet, but exceed 120 feet in some locations. Generally, the uppermost bedrock unit at the site is the Upper Gallup Sandstone, though in some locations it is overlain by coal or the Mancos shale.

The TDA was constructed on top of the native alluvium and deposition of tailings via slurry within the TDA has resulted in an interbedded accumulation of tailings. TDA closure construction began in 1989 and was completed in 1995. Closure construction included placement of an interim cover (general fill) from 1989 through 1991 followed by placement of the final cover (radon barrier and erosion protection layer) from 1993 through 1995.

Site Investigation

In 2013, MWH performed pre-design studies (PDS) at the Mill Site and Mine Site to supplement previous site investigations and collect pre-design data necessary to perform the Removal Design (RD). Activities performed as part of the Mill Site PDS included: surveying, cone penetration tests (CPTs), drilling, standard penetration tests (SPTs), excavation and soil sampling, and subsequent laboratory testing. Geotechnical data collected during the PDS are presented in the PDS reports (MWH, 2014a and MWH, 2014b).

Results of the settlement analyses and seismic settlement analysis (Attachments G.3 and G.4 of Appendix G) were used for the cover cracking analysis. The potential for cover cracking was analyzed at three critical locations, CPT-01, CPT-15, and CPT-26, shown on **Figure 1**, located where the repository cover transitions directly to the TDA cover.

Applicable Codes and Standards

NUREG 1620 (NRC, 2003)

Methods

Results of the immediate, primary, and secondary consolidation, as well as the seismic settlement, were used to evaluate the potential for differential settlement and cover cracking. Differential settlement was determined by the difference between the estimated total potential future settlement at each of three locations and the settlement at the nearest point on the edge of the repository fill (assumed to be zero). The slope reduction at each location was calculated from the maximum differential settlement divided by the shortest distance between the point and edge of cover. The addition of minor amounts of grading fill (up to 3 feet) on the west and southwest sides of the cover may affect these selected locations, however the differential settlement results will not change significantly.

The evaluation of potential for cover cracking used the critical location determined in the differential settlement analysis. The method presented in Morrison-Knudsen Environmental Corporation (1993) was used to determine the tensile strain required to cause cracking of the radon barrier as a function of the plasticity index (PI) of the soil. The PI was estimated as the average of the measured PIs of radon barrier samples collected during the PDS (MWH, 2014a). The horizontal movement at the top of the radon barrier was calculated based on the method presented in Lee and Shen (1969). The peak horizontal movement is assumed to be twice the average horizontal movement based on relationships presented in Gourc et al. (2010) and Rajesh and Viswanadham (2010). The horizontal strain was calculated using the horizontal distance between the point and edge of cover. The calculated strain was compared to the maximum allowable strain to determine the potential for cover cracking.

Assumptions

Three critical locations were selected for the cover cracking analysis, CPT-01, CPT-15, and CPT-26. The greatest potential for detrimental cracking of the radon barrier is in the area where the radon barrier remains in its current configuration (i.e., at the edge of fill to be placed) and the fill differential adjacent to it is the highest. These locations were selected as critical because they are nearest to the repository slope where the final cover will transition directly to the existing radon barrier, and has the potential to cause cover cracking in the existing radon barrier. In the remaining area of the repository, differential settlements will be less since the fill will completely cover the existing radon barrier. The radon barrier will be recompacted and, therefore, this analysis only considers how the radon barrier performs after recompaction then loading. The critical locations used in the cover cracking analysis are shown on **Figure 1**.

Differential Settlement

The critical time period where differential settlement is a concern for the cover grading is after active placement of waste and the final cover is complete. Potential maximum future settlement after active placement of waste and the final cover includes immediate, primary and secondary consolidation as well as seismic settlement and is estimated to be 0.26 to 1.17 feet at the three locations evaluated (CPT-01, CPT-15, and CPT-26) (**Attachment A**). The horizontal distances range from 80 to 210 feet from each of these three points to the edge of the cover.

Calculations

Differential Settlement

The total potential differential settlement for the three locations were approximated using the estimated total settlement on the cover and assuming zero settlement at the edge of the repository. The maximum differential settlement in feet (equal to the estimated total settlement at each location) was divided by the distance in feet between the respective location and edge of the cover to obtain the slope reduction in percent.

Cover Cracking

Morrison-Knudsen Environmental Corporation (1993) presents a method for determining the tensile strain required to cause cracking of the radon barrier as a function of the PI of the soil. The tensile strain at cracking is calculated by the equation below:

$$\varepsilon_f(\%) = 0.05 + 0.003 * (PI)$$

where:

$\varepsilon_f(\%)$ = tensile strain to cause cracking of the radon barrier
PI = plasticity index of radon barrier

The PI value for the compacted radon attenuation layer was estimated as 16 percent, calculated as the average of the measured PIs of 10 radon barrier samples collected during the PDS (MWH, 2014a). The PI values ranged from 14 to 20, with a median value of 15.5. The average value was used as it is representative of the radon barrier material. Using this value for PI, the minimum tensile strain that will induce cracking is 0.10 percent. The maximum settlement-induced horizontal tensile strain on the radon attenuation layer must be less than 0.10 percent to prevent cover cracking.

The horizontal movement at the top of the radon barrier can be calculated based on the following equation (Lee and Shen, 1969), which is referenced in NUREG 1620 (NRC, 2003) for cover cracking analysis:

$$m = \frac{2}{3} H\alpha$$

where:

m = horizontal movement in feet
H = thickness of relatively incompressible material (in this analysis H is the thickness of the radon barrier)
α = local slope of the settlement profile (expressed as decimal fraction)

Horizontal movement at the maximum tailing thickness is calculated using a maximum thickness of relatively incompressible material of 1.8 feet (21 inches), and the total differential settlement. The thickness of relatively incompressible material was estimated assuming a maximum of 21 inches for the radon barrier, based on the As-Built Reports (Canonie, 1994, 1995). The as-built reports by Canonie do not include details on specific depths of the radon barrier at specific locations. The cover test pits conducted during the PDS were intentionally terminated prior to reaching the bottom of the radon barrier and were therefore not used to estimate the radon barrier thickness. By assuming the greatest thickness of radon barrier documented by Canonie (21 inches), the cover cracking results are conservative. The peak horizontal movement is assumed to be twice the average horizontal movement based on relationships presented in Gourc et al. (2010) and Rajesh and Viswanadham (2010).

The horizontal strain between any two settlement locations is the maximum horizontal movement divided by the horizontal distance. This value is then compared with the maximum allowable strain of 0.10 percent.

Results

The estimated reduction in slope for the three locations ranges from approximately 0.29 to 0.61 percent. The estimated differential settlement is sufficiently low such that ponding and slope reversal is not expected to occur.

The maximum horizontal strains calculated for the three locations are less than 0.01 percent. The values are lower than the calculated maximum allowable strain of 0.10 percent and indicate that cracking of the radon attenuation layer due to settlement is not likely. The results are summarized in **Table 1** and the spreadsheet calculations and results are presented in **Attachment A** to this brief.

Conclusions

The results indicate that cracking of the radon attenuation layer due to total differential settlement is not expected.

Attachments

- Figure 1 – Differential Settlement and Cover Cracking
- Attachment A – Spreadsheet Calculations

References

Canonie Environmental, 1994. As-built Report North Cell Final Reclamation, Church Rock Site, Gallup, New Mexico. November.

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Lee, K.L., and C.K. Shen, 1969. “Horizontal Movements Related to Subsidence.” Journal of Soil Mechanics and Foundation Division, ASCE Volume 95. January.

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U.S. Nuclear Regulatory Commission (NRC), 2003. "Standard Review Plan for the Review of a Reclamation Plan for Mill Tailings Sites Under Title II of Uranium Mill Tailings Radiation Control Act of 1978, Final Report." NUREG-1620. June.

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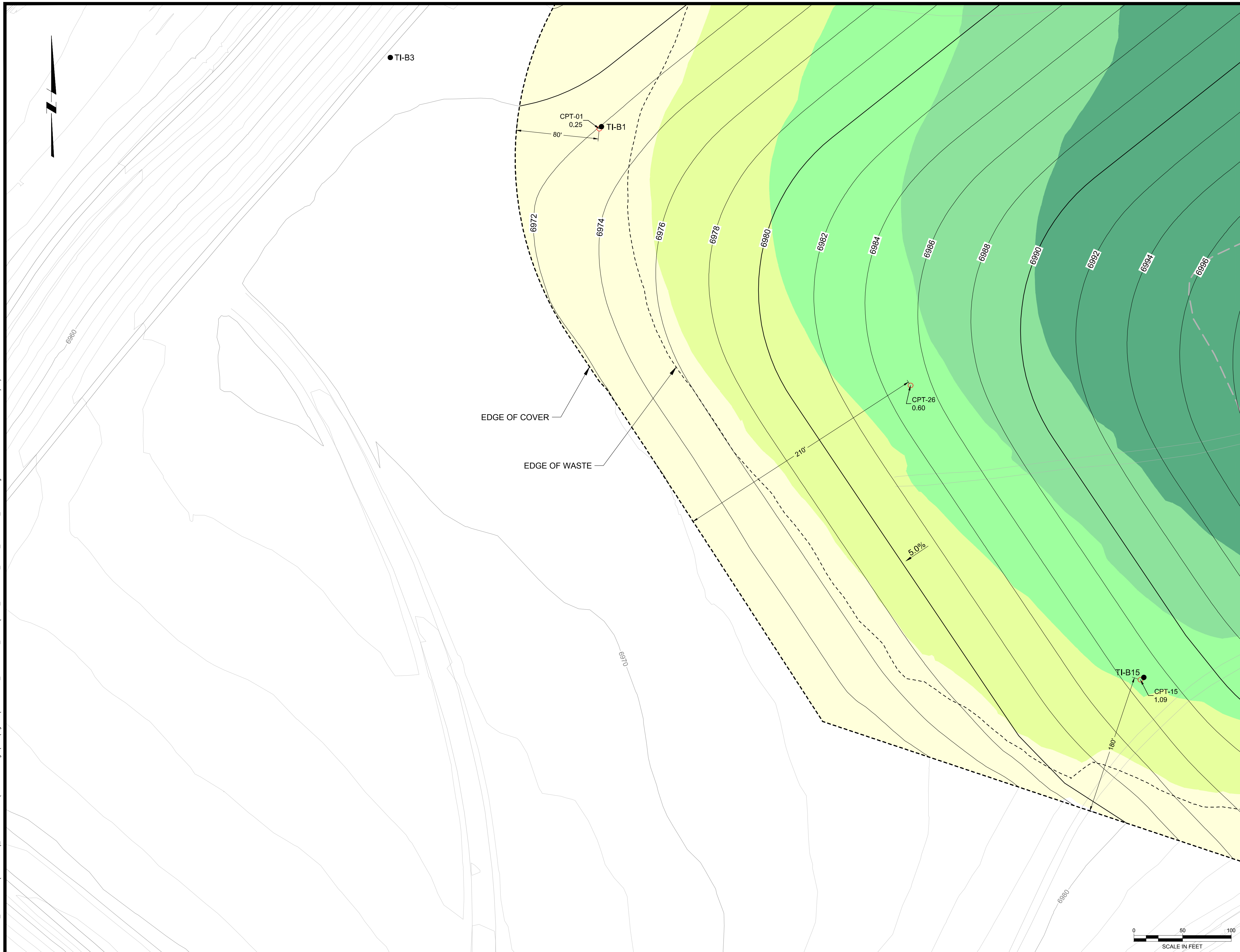
TABLE

Table 1: Estimated Differential Settlement and Cover Cracking Potential near the Edge of the Repository

Location/Borehole ID	Estimated Total Differential Settlement (ft)	Horizontal Distance to Edge of Cover (ft)	Resulting Slope Reduction (%)	Horizontal Strain (%)
TI-B1/CPT-01	0.25	80	0.32	0.009
TI-B15/CPT-15	1.09	180	0.61	0.008
CPT-26	0.60	210	0.29	0.003

FIGURE



LEGEND:

- 7200 — EXISTING GROUND SURFACE CONTOUR & ELEVATION, FEET
- 7200 — PROPOSED SURFACE CONTOUR & ELEVATION, FEET
- EXISTING ROAD
- EXISTING DRAINAGE
- FENCE
- BOUNDARY OF REPOSITORY
- FORMER BORROW PIT BOUNDARY
- CPT-17 — CPT LOCATION
- TI-B15 — BORING LOCATION
- 0.26 — ESTIMATED TOTAL SETTLEMENT (FEET)

NOTE:

1. THE ESTIMATED TOTAL SETTLEMENT FOR THE COVER CRACKING ANALYSIS INCLUDES IMMEDIATE, PRIMARY, SECONDARY, AND SEISMIC SETTLEMENT.

REPOSITORY FILL THICKNESS			
NUMBER	MIN (FT)	MAX (FT)	COLOR
1	0.0	5.0	
2	5.0	10.0	
3	10.0	15.0	
4	15.0	20.0	
5	20.0	30.0	
6	30.0	42.0	

DESIGNED S MOORE
CHECKED M DAVIS
APPROVED J CUMBERS

MWH now part of Stantec

UNITED NUCLEAR CORPORATION AND NORTHEAST CHURCH ROCK MINE
McKINLEY COUNTY, NEW MEXICO

DIFFERENTIAL SETTLEMENT AND COVER CRACKING

FIGURE
1
10508639
JULY, 2016

ATTACHMENT A

SPREADSHEET CALCULATIONS

Differential Settlement and Cover Cracking Evaluation

Date:	30-Jun-17
Calculated By:	S. Downey
Review:	J. Cumbers

During Placement of Waste and Final Cover

Location	Immediate Settlement (ft)
CPT-01	0.10
CPT-15	1.00
CPT-26	0.60

After Placement of Waste and Final Cover

Location	Total Primary, Secondary, and Seismic Settlement (ft)
CPT-01	0.15
CPT-15	0.09
CPT-26	0.00

During and After Placement of Waste and Final Cover

Total Potential Future Settlement (ft)
0.25
1.09
0.60

<u>Differential Settlement After Active Maintenance</u>

Location:	CPT-01	CPT-15	CPT-26
Maximum Differential Settlement (ft) =	0.25	1.09	0.60
Distance between point and edge of cover (ft) =	80	180	210
Slope reduction =	**0.32%**	**0.61%**	**0.29%**

<u>Evaluation of Potential for Cover Cracking</u>

Maximum Allowable Strain

Plasticity Index (PI) =	16
Maximum Allowable Strain (%) =	**0.10**

Average of 10 samples from the PDS (MWH, 2014)

<u>Peak Horizontal Movement</u>

Location:	CPT-01	CPT-15	CPT-26
Maximum Differential Settlement (ft) =	0.25	1.09	0.60
Distance between points (ft) =	80	180	210
Local slope of settlement profile, α =	0.003	0.006	0.003
Thickness of relatively incompressible material, H (ft) =	1.8	1.8	1.8
Horizontal movement, m (ft) =	0.004	0.007	0.003
Peak Horizontal Movement (ft) =	0.01	0.01	0.01

Horizontal Strain

Horizontal Strain (%) =	**0.009**	**0.008**	**0.003**

Horizontal Strain is **<** **Maximum Allowable Strain**

Cover Cracking is Not Likely

ATTACHMENT G.6

Repository Liquefaction Triggering Analysis

Client:	GE/UNC	**Sheet:**	1 of 24
Project:	Northeast Church Rock Mine Site Removal Action		
Description:	Liquefaction Triggering Analysis for the Mill Site Repository	**Job No:**	10508639

ATTACHMENT G.6: REPOSITORY LIQUEFACTION TRIGGERING ANALYSIS

Revisioning

Rev.	Date	Description	By	Checked	Date
0	June 2016	Preliminary (30%) Design	S. McManus	J. Barber	06/01/2016
1	June 2017	95% Design	T. Borden	M. Garton	06/26/2017

Location and Format

Electronic copies of these calculations are located on the Stantec internal project teamsite.

The calculations were generated using the following software:

Microsoft Excel

Table of Contents

Objective

The purpose of this calculation is to evaluate the potential for liquefaction of the materials beneath the repository. This calculation brief documents evaluation of the potential for liquefaction of saturated layers of tailings and alluvium beneath the proposed repository during the design seismic event. The analysis was performed for the proposed conditions (after completion of repository construction). A liquefaction screening analysis (Bray et al., 2009) was performed to identify potential zones of susceptible to liquefaction. Potential zones of susceptibility, as identified by the screening analysis, were evaluated by a liquefaction triggering analysis using two simplified liquefaction triggering analysis methods (Idriss and Boulanger, 2008; Youd et al., 2001). Liquefaction-induced settlement was estimated using the results of the liquefaction analysis and field data.

Background

This analysis was performed as part of the design of the Removal Action (RA) at the Northeast Church Rock Mine Site (Mine Site) and the related Remedial Action (RA) at the Church Rock Mill Site (Mill Site). The Mine Site and Mill Site are located in close proximity to one another, approximately 16 miles northeast of Gallup, in McKinley County, New Mexico. They are located on adjacent Sections approximately one-half mile apart. The sites are temporarily being treated as one facility for purposes of the RA. The combined site is referred to as the "Settlement Agreement Site" (SA Site).

Site History

The NECR mine is a historical uranium mine operated by United Nuclear Corporation (UNC). Mining development began in 1967 and ended in 1982. While the mine operated, it served as the principal mineral source for the UNC uranium mill. The uranium mill and its adjacent disposal cells make up the UNC Superfund Site (the "UNC Mill Site"). Remedial activities addressing source control and on-site surface reclamation are being implemented by General Electric/United Nuclear Corporation (GE/UNC) under the direction of the U.S. Nuclear Regulatory Commission (NRC), pursuant to the UNC facility's NRC license, and integrated with the US Environmental Protection Agency's (USEPA's) selected remedy for the groundwater.

The tailings disposal area (TDA) is an unlined facility bounded by an embankment and subdivided by cross-dikes into three cells, which are identified as the South Cell, Central Cell, and North Cell. An estimated 3.5 million tons of tailings were pumped in slurry from the mill to the TDA.

Proposed Remedial Action

The proposed repository will be constructed on top of the existing TDA and will incorporate controlled placement of mine waste on top of the existing TDA cover/radon barrier and a final evapotranspirative (ET) cover placed over the mine waste. Improvements to the existing TDA cover/radon barrier within the footprint of the proposed repository will be completed prior to placement of mine waste. **Figure 1** shows the location and grading of the proposed repository.

The design for the selected repository alternative will be evaluated as part of a NRC license amendment request for the existing licensed facility. The repository features that affect the licensed facility will meet the performance standards outlined in NRC regulations and areas of the existing facility affected by the repository construction will be evaluated for compliance. However, existing conditions of the facility not affected by the proposed repository were not evaluated as part of this analysis, as they are managed by the existing NRC license.

Site Description

The natural stratigraphy at the Mill Site is divided into two main components: the surficial unconsolidated deposits (alluvium) and the underlying consolidated bedrock units. The alluvium consists of a mixture of sand, silt, and clay with minor portions of gravel. Alluvial thicknesses at the site are usually around 50 feet, but exceed 120 feet in some locations. Generally, the uppermost bedrock unit at the site is the Upper Gallup Sandstone, though in some locations it is overlain by coal or the Mancos shale.

The TDA was constructed on top of the native alluvium and deposition of tailings via slurry within the TDA resulted in an interbedded accumulation of tailings. TDA closure construction began in 1989 and was completed in 1995. Closure construction included placement of an interim cover (general fill) from 1989 through 1991 followed by placement of the final cover (radon barrier and erosion protection layer) from 1993 through 1995.

Measurements taken in alluvial monitoring wells show an alluvial groundwater table in the vicinity of the TDA at approximately 6,867 feet above mean sea level (amsl), which indicates that the alluvium is unsaturated above this

elevation. Additionally, subsurface investigations of the TDA indicate that there is not a consistent static water level within the tailings or the alluvium above approximately 6,867 feet amsl. However, localized perched zones of saturation exist within the low-permeability, fine-grained tailings. These zones of saturation do not appear to extend beyond the fine-grained tailings into the higher-permeability coarse-grained tailings.

Site Investigation

In 2013, MWH performed pre-design studies (PDS) at the Mill Site and Mine Site to supplement previous site investigations and collect pre-design data necessary to perform the Remedial Design (RD). Activities performed as part of the Mill Site PDS included: surveying, cone penetration tests (CPTs), drilling, standard penetration tests (SPTs), excavation and soil sampling, and subsequent laboratory testing. Geotechnical data collected during the PDS are presented in the PDS reports (MWH, 2014a and MWH, 2014b) and summarized in **Attachment A**. A list of the materials encountered within the TDA during the PDS is presented in the Assumptions section below. Geotechnical properties for these materials and discussion of one-dimensional stratigraphic profiles developed for the liquefaction triggering analysis are also presented in the Assumptions section.

Applicable Codes and Standards

Applicable regulatory guidance documents include the following:

- NUREG 1620, Section 2.4 (NRC, 2003)
- NRC Regulatory Guide 3.11, Section C (NRC, 2008)

Methods

General

The liquefaction triggering analysis evaluated the potential for liquefaction of saturated soil layers beneath the proposed repository to damage the existing TDA radon barrier or compromise the effectiveness of the proposed repository. A liquefaction screening evaluation was performed to identify soil layers that may be susceptible to liquefaction.

One-dimensional soil profiles were developed for analysis, based on conditions observed during the Mill Site PDS field investigation and modified to reflect proposed conditions (after completion of repository construction) (see **Figure 2**). Identified zones of potentially susceptible soils within these profiles, as identified by the screening analysis, were evaluated for liquefaction potential using simplified liquefaction triggering analysis methods (Idriss and Boulanger, 2008; Youd et al., 2001). The “simplified procedure” was first developed by Seed and Idriss (1971). “That procedure has been modified and improved periodically since that time…” (Youd et al., 2001). Detailed earthquake measurements in recent decades have allowed researchers to adjust the simplified procedure for empirical accuracy. It is therefore appropriate to use these updated simplified procedures. Regulatory Guide 3.11 (2008) lists five criteria that any liquefaction analysis shall meet: (1) development of a detailed understanding of site conditions (see Attachment A)], (2) development of simplified cross-section amenable to analysis (see Figure 1), (3) calculation of the force required to liquefy the critical zone based on the characteristics of the critical zone (this is the Cyclic Resistance Ratio [CRR] as calculated below) (4) calculation of the design earthquake effect (this is the Cyclic Stress Ratio (CSR) as calculated below), and (5) computation of the factor of safety against liquefaction (see Table 2). Therefore, the liquefaction analysis presented herein meets the NRC Regulatory Guide 3.11 criteria.

The liquefaction triggering analysis used data collected during CPTs, Hollow Stem Auger (HSA) drilling, SPTs, and laboratory testing to calculate the factor of safety (FS) against liquefaction for potentially susceptible soil layers below the proposed repository. Primary analysis of the soil layers was performed using the results of CPTs. Results of SPTs, where available, were analyzed to provide a secondary data point against which the results of the CPT-based analysis were checked. The liquefaction triggering analyses incorporated supplemental data from laboratory testing and were

performed according to the methods outlined in Idriss and Boulanger (2008) and Youd et al. (2001). The FS was calculated as the average of the FS values calculated by each of the analysis methods. Both analysis methods were based in part on the CPT data, which was collected approximately every two inches within the subsurface profile. Due to the heterogeneity of the subsurface materials, anomalies occurred in the CPT data. By averaging the two calculation methods, the effects of anomalies on the calculated results was reduced for the evaluated profiles. The percent difference between the FS for the two methods was calculated for critical depths (location of minimum FS) and was observed to be at most 7 percent for CPT methods and 13 percent for SPT methods. Therefore, each method independently yields an answer close to the reported average.

Subsurface materials considered in the liquefaction triggering analysis are identified in the Assumptions section. Subsurface material properties relevant to the liquefaction triggering analysis and one-dimensional stratigraphic profiles evaluated in this analysis are also presented in the Assumptions section.

Liquefaction Screening Evaluation

A liquefaction screening evaluation was performed to identify soil layers that are potentially susceptible to liquefaction, considering tailings and alluvial soils at the TDA with perched layers of saturation, high fines content, and high plasticity. Saturated, or nearly-saturated, soils identified as “susceptible” or “moderately susceptible” to liquefaction (Bray et al., 2009) were further evaluated using the liquefaction triggering analysis, as described below. Unsaturated soils with a high degree of saturation (85 percent or higher) may behave like saturated soils and experience strength reduction due to excess pore pressure generation during a seismic event (NRC, 2008). Soils at or near saturation are composed mostly of the fine-grained tailings and fine-grained alluvium that exhibit a low hydraulic conductivity. For the purpose of this analysis, the term “nearly saturated” refers to soils between 85 percent and 99 percent saturation. Discussion of saturated and nearly saturated soil layers are presented in the Assumptions section. Every borehole was evaluated for the entire depth, which was generally in excess of 50 ft. The one borehole evaluated to a bottom depth of 34 ft. experienced refusal at that depth and liquefaction is therefore not a concern.

Soils were identified as “susceptible” or “moderately susceptible” to liquefaction according to the guidelines outlined in Bray et al. (2009), which state that a soil deposit is considered to be susceptible to liquefaction if the ratio of the water content (w_c) to liquid limit (LL) is greater than or equal to 0.85 ($w_c/LL \geq 0.85$), and the soil plasticity index (PI) is less than or equal to 12 ($PI \leq 12$). Soils with $12 < PI \leq 20$ and $w_c/LL \geq 0.8$ may be moderately susceptible to liquefaction. Soils with $PI > 20$ are considered too clayey to liquefy.

NRC Regulatory Guide 3.11 (2008) states that if three or more of the following indicate liquefaction is likely, then “… a more rigorous analysis of the liquefaction potential at a facility is required”: (1) geologic age and origin, (2) fines content and plasticity index, (3) saturation, (4) depth below ground surface, and (5) soil penetration and resistance. As discussed above, materials considered to be susceptible to liquefaction included materials with 85 percent saturation or greater (meets NUREG 3.11), water content to liquid limit ratio of 0.85 or greater (exceeds NUREG 3.11, which limits at a ratio of 0.9), and material depths from the ground surface to depths greater than 50 feet (meets NUREG 3.11). In addition, penetration resistances were used to evaluate liquefaction potential (meets NUREG 3.11). In cases where three or more of the NRC criteria were met, the materials were further evaluated using the Bray et al. (2009) criteria which states a soils plasticity index (PI) is a better indicator of susceptibility than weight of clay-size particles. PI values used in this evaluation come from laboratory testing of samples taken along the length of each borehole.

Analysis of Cone Penetration Testing Results

Two procedures were used to evaluate the potential for liquefaction of the soils beneath the proposed repository based on the results of the CPT soundings and the drilling logs associated with the “paired” hollow-stem auger boreholes. These methods (Idriss and Boulanger, 2008; Youd et al., 2001) are described below. The average FS calculated from the two methods was used to evaluate the liquefaction potential of these soils.

Idriss and Boulanger (2008)

The Idriss and Boulanger (2008) liquefaction triggering method estimates the cyclic stress ratio (CSR) based on the seismic design criteria and estimates the cyclic resistance ratio (CRR) based on the CPT readings and site conditions. CSR is calculated using a simplified procedure to estimate earthquake induced stresses normalized for a magnitude 7.5 earthquake and confining pressure equal to 1 atm, calculated using the following relationship:

$$CSR_{M=7.5,\sigma'_{vc}=1} = 0.65\frac{a_{max}}{g}\frac{\sigma_{vc}}{\sigma'_{vc}}r_d\frac{1}{MSF}\frac{1}{K_\sigma}\frac{1}{K_\alpha}$$

where:

a_{max}: maximum horizontal ground surface acceleration
σ_{vc}': effective vertical confining stress
σ_{vc}: total vertical confining stress
r_d: shear stress reduction coefficient
MSF: earthquake magnitude scaling factor
K_σ: overburden correction factor
K_α: static shear stress correction factor
g: acceleration due to gravity

The equations for the correction factors applied to the CSR for this evaluation are the following:

$$r_d = \exp(\alpha(z) + \beta(z)M)$$

$$\alpha(z) = -1.012 - 1.126\sin\left(\frac{z}{11.73} + 5.133\right)$$

$$\beta(z) = 0.106 + 0.118\sin\left(\frac{z}{11.28} + 5.142\right)$$

$$\mathrm{MSF} = 6.9\exp\left(\frac{-M}{4}\right) - 0.058 \quad \le 1.8$$

$$K_\sigma = 1 - C_\sigma \ln\left(\frac{\sigma'_{vc}}{P_a}\right) \le 1.1$$

$$C_\sigma = \frac{1}{37.3 - 8.27(q_{c1N})^{0.264}} \le 0.3$$

where:

r_d: shear stress reduction coefficient
q_{c1N}: tip resistance normalized to atmospheric pressure and overburden pressure
z: depth below ground surface
P_a: atmospheric pressure (calculated for an average elevation of 7,000 feet for the site)
M: design earthquake magnitude

The liquefaction triggering analysis was performed assuming essentially flat ground and ignored the effects of the sloping final surface of the repository. Thus, a static shear stress correction factor of $K_\alpha=1$ was used for all calculations.

The cone tip resistance (q_c) as measured in the field is dependent on the confining stress. To express the material strength independent of the in situ stress condition, the field readings are normalized for a confining stress of 1 atm (q_{c1}) according to:

$$q_{c1} = C_N * q_c$$

$$q_{c1N} = \frac{q_{c1}}{P_a}$$

For $21 \leq q_{c1N} \leq 254$: $C_N = \left(\frac{P_a}{\sigma'_{vc}}\right)^{1.338-0.249*(q_{c1N})^{0.264}} \leq 1.7$

where:

q_{c1}: cone tip resistance corrected to an effective overburden stress of 1 atm
C_N: CPT overburden correction factor
q_c: cone tip resistance recorded by cone penetrometer

Solving for C_N and q_{c1N} using the above expressions requires iteration, because q_{c1N} is dependent on C_N and C_N is dependent on q_{c1N}. This iteration was accomplished using circular references in a spreadsheet.

The relationship for CRR is based on liquefaction case histories and is expressed as:

$$\mathrm{CRR}_{M=7.5,\sigma'_{vc}=1} = \exp\left(\frac{q_{c1Ncs}}{540} + \left(\frac{q_{c1Ncs}}{67}\right)^2 - \left(\frac{q_{c1Ncs}}{80}\right)^3 + \left(\frac{q_{c1Ncs}}{114}\right)^4 - 3\right)$$

where:

q_{c1Ncs}: equivalent clean-sand corrected normalized tip resistance

The cone tip resistance corrected for overburden (q_{c1}) must be further corrected for the fines content (*q_{c1Ncs}*). A clayey material with the same strength as a clean sand will measure lower cone tip resistances, and this correction accounts for that phenomenon. The correction for clean sand is calculated as follows:

$$q_{c1Ncs} = q_{c1N} + \Delta q_{c1N}$$

$$\Delta q_{c1N} = \left(5.4 + \frac{q_{c1N}}{16}\right) \cdot \exp\left(1.63 + \frac{9.7}{\mathrm{FC}+0.01} - \left(\frac{15.7}{\mathrm{FC}+0.01}\right)^2\right)$$

where:

FC = Fines Content in %

The FS against liquefaction was computed as:

$$FS_{liq} = \frac{\mathrm{CRR}_{M=7.5,\sigma'_{vc}=1}}{\mathrm{CSR}_{M=7.5,\sigma'_{vc}=1}}$$

The correlation between CSR, CRR, and *q_{c1N}* is shown in Figure 67 of Idriss and Boulanger (2008).

Youd et al. (2001)

The Youd et al. (2001) liquefaction triggering analysis method estimates the CSR based on the seismic design criteria and estimates the CRR based on the CPT readings and site conditions. CSR is calculated using a simplified procedure to estimate earthquake induced stresses normalized for a magnitude of 7.5 and a confining pressure equal to 1 atm, calculated using the following relationship:

$$CSR_{M=7.5,\sigma'_{vc}=1} = 0.65\frac{a_{max}}{g}\frac{\sigma_{vc}}{\sigma'_{vc}}r_d\frac{1}{MSF}\frac{1}{K_\sigma}\frac{1}{K_\alpha}$$

where:

a_{max}: maximum horizontal ground surface acceleration
σ'_{vc}: effective vertical confining stress
σ_{vc}: total vertical confining stress
r_d: shear stress reduction coefficient
MSF: earthquake magnitude scaling factor
K_σ: overburden correction factor
K_α: static shear stress correction factor
g: acceleration due to gravity

The equations for the correction factors applied to the CSR for this evaluation are the following:

$$r_d = 1.0 - 0.00765 \times z \quad \text{for } z \le 9.15m$$

$$r_d = 1.174 - 0.0267 \times z \quad \text{for } 9.15m < z \le 23m$$

Revised Idriss Scaling Factor: $$MSF = \frac{10^{2.24}}{M_w^{2.56}}$$

$$K_\sigma = \left(\frac{\sigma'_{vc}}{P_a}\right)^{(f-1)}$$

where:

r_d: shear stress reduction coefficient
z: depth below ground surface
M_w: design earthquake magnitude
P_a: atmospheric pressure (calculated for an average elevation of 7,000 feet for the site)
σ'_{vc}: effective vertical overburden pressure
f = 0.7 to 0.8 for 40% ≤ relative density, D_r ≤ 60%
f = 0.6 to 0.7 for 60% < relative density, D_r ≤ 80%

$$D_r = \sqrt{\frac{q_{c1n}}{300}}$$

where:

q_{c1N}: tip resistance normalized to atmospheric pressure and overburden pressure (calculated using the same method as outlined in Idriss and Boulanger, 2008 [see above]).

The liquefaction triggering analysis was performed assuming essentially flat ground and ignored the effects of the sloping final surface of the repository. Thus, a static shear stress correction factor of $K_{\alpha}=1$ was used for all calculations.

The relationship for CRR is based on liquefaction case histories and is expressed as:

If $(q_{c1N})_{cs} < 50$ then $CRR_{7.5} = 0.833\left[\frac{(q_{c1N})_{cs}}{1000}\right] + 0.05$

If $50 \le (q_{c1N})_{cs} < 160$ then $CRR_{7.5} = 93\left[\frac{(q_{c1N})_{cs}}{1000}\right]^3 + 0.08$

If $(q_{c1N})_{cs} \ge 160$ then $CRR_{7.5} = 1.0$

where $(q_{c1N})_{cs}$ is the normalized cone penetration resistance adjusted to the clean sand value and is defined by:

$$(q_{c1N})_{cs} = K_c \times q_{c1N}$$

where:

q_{c1N}: tip resistance normalized to atmospheric pressure and overburden pressure
K_c: correction factor for grain characteristics

For $I_c \le 1.64$ $K_c = 1.0$

For $I_c > 1.64$ $K_c = -0.403 I_c^4 + 5.581 I_c^3 - 21.63 I_c^2 + 33.75 I_c - 17.88$

where:

I_c: soil behavior type index

I_c is defined by the following equations (per Robertson and Cabal, 2012, page 29):

$$I_c = \left[(3.47 - \log Q)^2 + (1.22 + \log F)^2\right]^{0.5}$$

$$Q = \frac{(q_t - \sigma_{vo})}{\sigma'_{vo}}$$

$$F = \left[\frac{f_s}{(q_c - \sigma_{vo})}\right] \times 100\%$$

where:

Q: normalized and dimensionless cone penetration resistance
F: normalized friction ratio
q_c: cone tip resistance recorded by cone penetrometer
f_s: sleeve friction measured by cone penetrometer

The FS against liquefaction was computed as:

$$FS_{liq} = \frac{\mathrm{CRR}_{M=7.5,\sigma'_{vc}=1}}{\mathrm{CSR}_{M=7.5,\sigma'_{vc}=1}}$$

The correlation between CSR, CRR, and q_{c1N} is shown in Figure 4 of Youd et al. (2001).

Analysis of Standard Penetration Test Results

Results of SPTs performed during the PDS were analyzed using two procedures to evaluate the potential for liquefaction of the soils beneath the proposed repository. These methods are described below (Idriss and Boulanger, 2008; Youd et al., 2001). The average FS calculated from the two methods was used to evaluate the liquefaction potential of these soils. Analyses using SPT blow counts were performed for the discreet locations for which SPT data was available (e.g. blow counts were not extrapolated to other areas). Analysis of SPT results were used only as a secondary data point against which the results of the CPT-based analysis were checked.

SPTs performed during the Mill Site PDS used an oversized split spoon sampler (2.5-inch outer diameter). To correct the recorded blow counts for this non-standard sampler, the LaCroix and Horn corrective method was applied (Rogers, 2006 after LaCroix and Horn, 1973):

$$N = N_1\left(\frac{2in}{D_1}\right)^2 \times \frac{12in}{L_1} \times \frac{W_1}{140lbs} \times \frac{H_1}{30in} = \frac{2N_1W_1H_1}{175D^2L_1}$$

For D = 2.5 in.: $N = N_1 \times 0.64$

where:

N: standard penetration resistance (blow count)
N_1: nonstandard penetration resistance (blow count)
L: sampler drive distance (12 in.)
D: outside diameter of the nonstandard sampler (2.5 in.)
W: weight of the hammer (140 lb.)
H: height of the hammer drop (30 in.)

Using this relationship, a correction factor of 0.64 was applied to the blow counts recorded during the Mill Site PDS.

After correcting the recorded blow counts for the non-standard sampler, the blow counts were further corrected for an energy ratio of 60 percent (Idriss and Boulanger, 2008), rod length, borehole diameter, and sampler type, using the following equations and correction factors:

$$N_{60} = C_E C_B C_R C_S N_m$$

Rod Length Correction Factor

Rod Length (m)	C_R
< 3	0.75
3 to 4	0.80
4 to 6	0.85
6 to 10	0.95
10 to 30	1.00

$$C_E = \frac{ER_m}{60}$$

where:

N_{60}: blow count for an energy ratio of 60%
C_E: energy ratio correction factor
C_B: correction factor for borehole diameter (equal to 1.15 for boreholes with D ≥ 8 in.)
C_R: correction factor for rod length
C_S: correction factor for samplers without liners (equal to 1.0 for a split spoon sampler with liners)
N_m: measured blow count
ER_m: delivered energy ratio

Idriss and Boulanger (2008)

The Idriss and Boulanger (2008) method of liquefaction triggering analysis using SPT blow counts is similar to the method presented in the same paper for analysis using CPT results (see above). The CSR is estimated using the same method as was used for the CPT-based analysis. However, the CRR is estimated using SPT blow counts. Using this method, the CRR can only be estimated at discrete locations within the soil profile where SPT blow counts are available.

The relationship for CRR is based on liquefaction case histories and is expressed as:

$$CRR_{M=7.5,\sigma'_{vc}=1} = \exp\left(\frac{(N_1)_{60cs}}{14.1} + \left(\frac{(N_1)_{60cs}}{126}\right)^2 - \left(\frac{(N_1)_{60cs}}{23.6}\right)^3 + \left(\frac{(N_1)_{60cs}}{25.4}\right)^4 - 2.8\right)$$

where:

$(N_1)_{60cs}$: *equivalent clean sand corrected $(N_1)_{60}$*

$$(N_1)_{60cs} = (N_1)_{60} + \Delta(N_1)_{60}$$

$$\Delta(N_1)_{60} = \exp\left(1.63 + \frac{9.7}{FC+0.01} - \left(\frac{15.7}{FC+0.01}\right)^2\right)$$

where:

FC: fines content (expressed in percent)
$\Delta(N_1)_{60}$: fines content correction factor for $(N_1)_{60}$
$(N_1)_{60}$: SPT blow count corrected to a 60% energy ratio and an overburden stress of 1 atm

$(N_1)_{60}$ is estimated using the following equations:

$$(N_1)_{60} = C_N \cdot N_{60}$$

$$C_N = \left(\frac{P_a}{\sigma'_{vc}}\right)^m$$

$$m = 0.784 - 0.521 \cdot D_R$$

$$D_R = \sqrt{\frac{(N_1)_{60}}{C_d}}$$

C_d = 40 for fine sands in recent fills (per Skempton, 1986)

where:

- *C_N: SPT overburden correction factor*
- *P_a: atmospheric pressure (calculated for an average elevation of 7,000 feet for the site)*
- *m: parameter dependent on sand properties and relative density*
- *σ'_{vc}: vertical effective stress*
- *D_R: relative density*

Solving for $(N_1)_{60}$ and C_N using the above expressions requires iteration, because $(N_1)_{60}$ is dependent on C_N and C_N is dependent on $(N_1)_{60}$. This iteration was accomplished using circular references in a spreadsheet.

As before, the FS against liquefaction was computed as:

$$FS_{liq} = \frac{\mathrm{CRR}_{M=7.5,\sigma'_{vc}=1}}{\mathrm{CSR}_{M=7.5,\sigma'_{vc}=1}}$$

Youd et al. (2001)

The Youd et al. (2001) liquefaction triggering analysis using SPT blow counts is similar to the method presented in the same paper for analysis using CPT results (see above). The CSR is estimated using the same method as was used for the CPT-based analysis. However, the CRR is estimated using SPT blow counts. Using this method, the CRR can only be estimated at discrete locations within the soil profile where SPT blow counts are available.

The relationship for CRR is based on liquefaction case histories and is expressed as:

$$CRR_{7.5} = \frac{1}{34 - (N_1)_{60cs}} + \frac{(N_1)_{60cs}}{135} + \frac{50}{\left[10 \cdot (N_1)_{60cs} + 45\right]^2} - \frac{1}{200}$$

where:

- $(N_1)_{60cs}$: *equivalent clean sand corrected $(N_1)_{60}$*

$(N_1)_{60cs}$ is estimated using the following equations:

$$(N_1)_{60cs} = \alpha + \beta \cdot (N_1)_{60}$$

For FC ≤ 5% α = 0

For 5% < FC < 35% $\alpha = \exp\left[1.76 - \left(\frac{190}{FC^2}\right)\right]$

For FC ≥ 35% α = 5.0

For FC ≤ 5% β = 1.0

For 5% < FC < 35% $\beta = \left[0.99 + \left(\frac{FC^{1.5}}{1{,}000}\right)\right]$

For FC ≥ 35% β = 1.2

where:

FC: fines content (expressed in percent)

$(N_1)_{60}$: SPT blow count corrected to a 60% energy ratio and an overburden stress of 1 atm calculated using the same method as outlined in Idriss and Boulanger, 2008 (see above).

As before, the FS against liquefaction was computed as:

$$FS_{liq} = \frac{\mathrm{CRR}_{M=7.5,\sigma'_{vc}=1}}{\mathrm{CSR}_{M=7.5,\sigma'_{vc}=1}}$$

Post-Liquefaction Reconsolidation Settlement

Following a seismic event during which liquefaction occurs, the soil may experience a volume change as the excess pore water dissipates and the soil particles rearrange themselves. One method for estimating this volume change is outlined in Idriss and Boulanger (2008), Section 4.4 “Post-liquefaction Reconsolidation Settlement”. Assuming that displacement occurs only in the vertical direction, the settlement can be calculated from the volumetric strain according to:

$$S_{v-1D} = \int_0^{z_{max}} \varepsilon_v * dz$$

where:

S_{v-1D} *: magnitude of vertical settlement with 1D assumptions*

ε_v *: volumetric strain*

z : depth below surface

The volumetric strain can be calculated using either SPT or CPT data. Both methods were implemented for the available data using the following equations:

Estimated volumetric strain using SPT data:

$$\varepsilon_v = 1.5 * e^{\left(-0.369*\sqrt{(N1_{60cs})}\right)} * \min(0.08, \gamma_{max})$$

where:

$N1_{60cs}$: *equivalent clean sand corrected $(N_1)_{60}$*

γ_{max} *: maximum shear strain developed during liquefaction*

Estimated volumetric strain using CPT data:

$$\varepsilon_v = 1.5 * e^{\left(2.551-1.147*{q_{c1Ncs}}^{0.264}\right)} * \min(0.08, \gamma_{max})$$

where:

γ_{max} : *maximum shear strain developed during liquefaction*
$q_{c1N_{cs}}$: *normalized cone penetration resistance adjusted to the clean sand value*

Note that the CPT correlation for volumetric strain is limited to q_{c1Ncs} values of greater or equal to 21. Values less than 21 are calculated as being on the asymptote defined by the value calculated at 21. To estimate the maximum shear strain, one must first identify which of three ranges the factor of safety falls in.

$$FS_{liq} \geq 2 \qquad \gamma_{max} = 0$$

$$2 > FS_{liq} > F_\alpha \qquad \gamma_{max} = \min\left[\gamma_{lim,} 0.035 * (2 - FS_{liq}) * \left(\frac{1 - F_\alpha}{FS_{liq} - F_\alpha}\right)\right]$$

$$F_\alpha \geq FS_{liq} \qquad \gamma_{max} = \gamma_{lim}$$

where:

γ_{lim} : *limiting shear strain*
F_α : *cut-off for above ranges defined below for both CPT and SPT data*

$$F_\alpha = 0.032 + 0.69 * \sqrt{N_{1,60cs}} - 0.13 * N_{1,60cs}$$

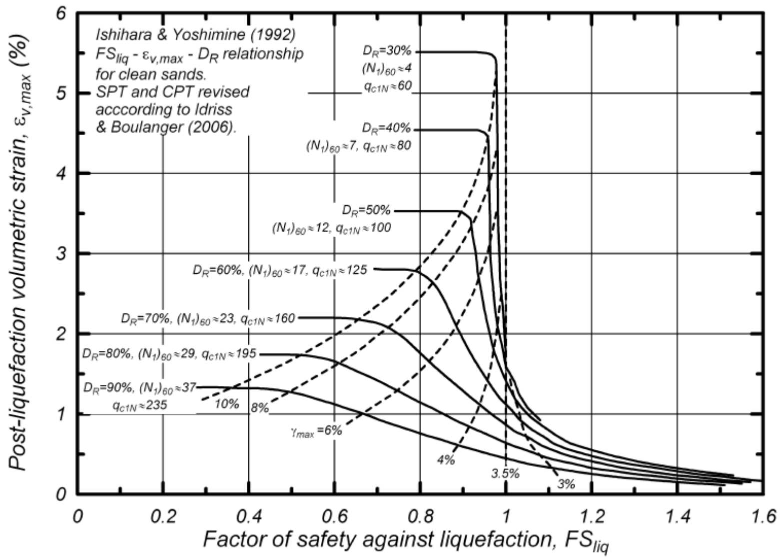
$$F_\alpha = -11.74 + 8.34 * q_{c1Ncs}{}^{0.264} - 1.371 * q_{c1Ncs}{}^{0.528}$$

Note that the SPT correlation for F_α is limited to $N_{1,60cs}$ values of greater or equal to 7 and the CPT correlation for F_α is limited to q_{c1Ncs} values of greater or equal to 69. Once the appropriate expression for the maximum shear strain has been estimated, the final term may be calculated according to (as before, equations for both CPT and SPT data):

$$\gamma_{lim} = 1.859 * \left(1.1 - \sqrt{\frac{N1_{60cs}}{46}}\right)^3 \geq 0$$

$$\gamma_{lim} = 1.859 * (2.163 - 0.478 * q_{c1Ncs}{}^{0.264})^3 \geq 0$$

There are a few important implications about this series of equations. Firstly, if the FS_{liq} is greater than or equal to 2, there will be zero settlement (as the volumetric strain term is multiplied by zero). The two primary inputs are relative density (alternatively expressed as $N_{1,60cs}$ or q_{c1Ncs}) and FS_{liq}(which is a function of CRR and CSR). Volumetric strain can therefore be plotted showing a series of solutions on the figure below.



(From Idriss and Boulanger 2008)

From the above plot, it can be seen that the settlement calculation is sensitive to an FS breakpoint of 1. Typical volumetric strains for an FS greater than 1 are in the range of 0.5 percent -1.5 percent. The top curve represents strains up to 5.5 percent. The maximum strain is approximately 12 percent, which is for the softest possible soil within the equation constraints (CPT values of less than 21).

Material Properties and General Assumptions

Subsurface Materials

The PDS investigation encountered the following materials within the TDA: general fill, erosion protection admixture, radon barrier (clay), tailings, alluvium, and various bedrock units (including coal, shale, and sandstone). For the purposes of the liquefaction triggering analysis, some of these units were further subdivided according to notation in the borehole logs, results of CPT logs, and results of laboratory analysis.

The material identifications used in this analysis are discussed below and are as follows: erosion protection, cover soil, mine waste, radon barrier, general fill, coarse tailings, fine tailings, coarse/fine tailings, coarse alluvium, and fine alluvium. A comprehensive discussion of material properties is contained in Appendix G: Mine Waste Repository Design. Table 1 presents the material properties associated with each of these materials used in this analysis.

Other General Assumptions

- The ground surface elevations for paired CPT and HSA boreholes have been estimated from the topographic survey using AutoCAD Civil3D.
- The design seismic event is the 10,000-year return period earthquake, which has a maximum peak ground acceleration (PGA) of 0.30 g and a magnitude of 5.5, as identified in the Seismic Hazard Analysis (SHA; see Appendix G, Attachment G.1).
- The minimum acceptable average factor of safety against liquefaction is 1.0 (NRC, 2008). If the FS is less than 1.0 over a minimum depth of 1 foot, the material is considered liquefiable.
- Soils that are have a degree of saturation less than 85 percent are assumed to be non-liquefiable (NRC, 2008).

- Soils at a depth in excess of 50 feet are less susceptible to liquefaction than those within the first 50 feet (NRC, 2008). Nonetheless, liquefaction triggering and susceptibility analysis was conducted for the available CPT/SPT data, which in some places went up to a depth of 80 feet. Two of the liquefiable layers are at depths of greater than 50 feet, and this should be considered a mitigating factor when analyzing the risk they pose.
- The liquefaction triggering analysis was performed assuming essentially flat ground, and ignored the effects of the sloping final surface of the repository. Thus, a static shear stress correction factor of K_{α}=1.0 was used for all calculations (Idriss and Boulanger, 2008).
- The in-field energy ratio (ER_m) for the SPTs performed during the PDS field investigation of the tailings impoundment is 0.75. This is based on published data for CME Automatic SPT hammers (USBR, 1999).

Stratigraphic Profiles

During the Mill Site PDS, eight CPTs were paired with boreholes to correlate CPT results with direct observation of the materials encountered. The borehole logs are presented in **Attachment B** and plots of the CPT measurements are presented in **Attachment C**. Seven of these “paired” CPT locations are within the footprint of the proposed repository. The CPT data combined with the profiles from the borehole logs were used to define the thickness and texture of the soil layers, as well as the location of the contact between the tailings and underlying alluvium. The relationships used to define the tailings-alluvium contact are described in the Mill Site PDS (MWH, 2014a).These subsurface profiles were modified using the proposed repository design to reflect proposed conditions after repository construction. The final one-dimensional profiles (**Figure 2**) and associated CPT results (**Attachment C**) were used in the liquefaction triggering analysis.

Groundwater

Groundwater was encountered during drilling in two of the boreholes (TI-B10 and TI-B11) within the footprint of the proposed repository. In both boreholes, the groundwater elevation was approximately 6,885 feet amsl. Groundwater was also encountered at about 6,903 feet amsl while drilling in boring B3 (drilled through the dam). In addition, alluvial wells 509D and EPA 23 (measured on 1/4/2016) show an alluvial ground water elevation of approximately 6,867 feet amsl. These elevations are below the bottom of the tailings and exceed the depth at which liquefaction is likely to occur. Therefore, the liquefaction triggering analysis did not assume the presence of a consistent static water level within the TDA. Water level measurements taken in the vicinity of the TDA are presented in **Attachment D**.

For the purpose of this analysis, it is assumed that localized perched zones of saturated or nearly saturated soils are present above the water levels in the alluvial wells and encountered while drilling. Unsaturated soils with a high degree of saturation (85 percent or higher) may behave like saturated soils and experience strength reduction due to excess pore pressure generation during a seismic event (NRC, 2008). Soils at or near saturation consist mostly of the fine-grained tailings and fine-grained alluvium that exhibit a low hydraulic conductivity. For the purpose of this analysis, the term “nearly saturated” refers to soils between 85 percent and 99 percent saturation.

For the purposes of this analysis, it has been assumed that hydrostatic conditions are present in tailings at or above 85 percent saturation considering the long term loading of the site. A layer of clay alluvium exists beneath much of the tailings impoundment. The clay layer appears to have localized zones of saturated or nearly saturated soils that may experience strength reduction due to excess pore pressure generation during a seismic event. For the purpose of this analysis, it is assumed that these soils are nearly saturated and should be included in the liquefaction screening and triggering analysis. It is also assumed that hydrostatic conditions do not exist in the alluvium, above the static water levels observed while drilling the HSA boreholes or the nearby alluvial monitoring wells.

It is also assumed that pore pressure dissipation tests performed in the tailings were unable to reach equilibrium due to the low hydraulic conductivity of the tailings deposited in the TDA. Therefore, the results of the pore pressure dissipation tests are likely to be artificially elevated and are not indicators of saturation. Assumptions regarding perched zones of saturated and nearly saturated soils at each of the paired CPT/boreholes are based on the results of CPTs,

observations during HSA drilling and sampling, and subsequent laboratory testing. These assumptions are presented below.

<u>*CPT-01 and TI-B1*</u>

Tailings

- It is assumed that saturated or nearly saturated tailings do not exist at this location.
- Dynamic pore pressures recorded by the CPT in the tailings at CPT-01 were not elevated, indicating that these tailings are unsaturated.
- Eight tailings samples from TI-B1 were analyzed for water contents. All but one of these samples had degrees of saturation below 85 percent (1 percent to 63 percent saturation).
- One tailings sample (from approximately 31.25 ft to 31.5 ft below ground surface [bgs]) was nearly saturated (94 percent saturation). However, it is assumed that this sample is not indicative of the soils in this area and was collected from a discontinuous layer of interbedded fine tailings for the following reasons:
    - o Three samples from the approximately 1.25 ft of immediately overlying soil (30 ft to 31.25 ft bgs) did not exhibit this level of saturation (1 percent to 47 percent saturation).
    - o Analysis of a soil sample from approximately one foot below this sample (32 ft to 33 ft bgs) did not exhibit this level of saturation (63 percent saturation).
    - o The boring log for TI-B1 indicated that the soils from 18.5 ft to 34.3 ft bgs are coarse tailings, an observation that is supported by laboratory analysis (other samples in this layer had fines contents of 7 percent, 9 percent and 53 percent). However, the sample in question had a fines content of 69 percent and was identified as fine tailings.

Alluvium

- At this location, it has been assumed that there are two layers of clay alluvium with increased degrees of saturation that may be susceptible to strength reduction during a seismic event. For the purposes of the analysis, these layers are assumed to behave as saturated soils, but hydrostatic conditions (e.g. perched ground water) are not present:
    - o 41.0 ft to 45.0 ft bgs
    - o 54.0 ft to 68.2 ft bgs
- These zones correspond to layers of fine alluvium observed during HSA drilling of TI-B1 and are separated by a layer of coarse alluvium that is unsaturated.
- It is assumed that hydrostatic conditions do not exist within the alluvium at this site above approximately elevation 6,867 ft amsl (approximately 103 ft bgs). This is supported by observations in alluvial monitoring wells (509D, EPA23) and boreholes and free water encountered at TI-B10 and TI-B11.
- The uppermost zone of soils assumed to be nearly saturated (41.0 ft to 45.0 ft bgs) corresponds to a layer of fine alluvium observed during HSA drilling at TI-B1. This assumption is based on the:
    - o Elevated dynamic pore pressures, one potential indicator of higher degrees of saturation, were measured in this layer during the CPT.
    - o Two samples from this layer that were submitted for laboratory analysis. One sample was 98 percent saturated and one sample was 100 percent saturated.
- It is assumed that the wetter fine-grained zones are separated by a layer of coarse alluvium (45.0 ft to 54.0 ft bgs) identified during HSA drilling. This assumption is based on the following:
    - o A sample of this layer was submitted for laboratory analysis, the results of which indicate that the material is 74 percent saturated.
    - o Dynamic pore pressures (one potential indicator of higher degrees of saturation) measured in this layer were not elevated, as they were in the overlying and underlying layers of fine alluvium.
- The lowermost zone of soils assumed to be nearly saturated (54.0 ft to 68.2 ft bgs) corresponds to a layer of fine alluvium observed during HSA drilling at TI-B1. This assumption is conservative and is based on the following:
    - o Elevated dynamic pore pressures, one potential indicator of higher degrees of saturation, were measured at in this layer during the CPT.

- No samples from this layer were submitted for laboratory analysis.
- Elevated dynamic pore pressure measurements (one potential indicator of higher degrees of saturation) were not observed below 68.2 ft bgs. Therefore, it is assumed that saturated soils do not exist from 68.2 ft to 103 ft bgs at this location.

CPT-02 and TI-B2

Tailings

- It has been assumed that saturated or nearly saturated tailings do not exist at this location.
- Dynamic pore pressures recorded by the CPT in this zone were not elevated, indicating that this zone is unsaturated.
- This assumption is supported by the degree of saturation calculated from laboratory testing results (77 percent saturation).

Alluvium

- It is assumed that the alluvium at this location is moist to wet, but is not saturated or nearly saturated above the weathered sandstone encountered at 33.5 ft bgs (approximate elevation: 6,926.5 ft amsl).
- Despite some elevated dynamic pore pressure measurements during the CPT at this location (one potential indicator of higher degrees of saturation), this assumption is based on the following:
  - No free water was encountered during HSA drilling at this location.
  - Laboratory analysis of samples from the alluvium at TI-B2 indicated that these soils are not at or near saturation (22 percent to 78 percent saturation).
  - The nearest alluvial well indicates that the static water level within the alluvium is approximately 6,867 ft amsl (approximately 93 ft bgs).

CPT-08 and TI-B8

Tailings

- It has been assumed for this analysis that there are three localized perched zones of saturation (hydrostatic conditions) within the tailings at this location.
- These zones of saturation correspond to the layers of fine tailings observed during HSA drilling:
  - 26.3 ft to 31.0 ft bgs
  - 32.5 ft to 35.0 ft bgs
  - 38.6 ft to 44.5 ft bgs
- The uppermost zone that is assumed to be saturated (26.3 ft to 31.0 ft bgs) corresponds to a layer of fine tailings observed during HSA drilling at TI-B8. This assumption is based on the following:
  - Elevated dynamic pore pressures, one potential indicator of higher degrees of saturation, were measured from approximately 26.9 ft to 31.5 ft bgs during the CPT.
  - A sample from this layer that was submitted for laboratory analysis, the results of which indicate that the material is fully saturated (100 percent saturation).
- The middle zone of assumed saturation (32.5 ft to 35.0 ft bgs) corresponds to a layer of fine tailings observed during HSA drilling at TI-B8. This assumption is based on the following:
  - Elevated dynamic pore pressures, one potential indicator of higher degrees of saturation, were measured from approximately 32.8 ft to 35.1 ft bgs during the CPT.
- The lowermost zone that is assumed to be saturated (38.6 ft to 44.5 ft bgs) corresponds to a layer of fine tailings observed during HSA drilling at TI-B8. This assumption is based on the following:
  - Elevated dynamic pore pressures, one potential indicator of higher degrees of saturation, were measured in this layer during the CPT.
  - Samples from this layer that were submitted for laboratory analysis, the results of which indicate that the material is 93 percent to 99 percent saturated.
- Laboratory analysis of samples of the coarse tailings and coarse/fine tailings between the layers of fine tailings at TI-B8 indicated that these soils are unsaturated (44 percent to 67 percent saturation).

- The dynamic pore pressure measurements taken during CPT-08 also support this pattern of nearly-saturated layers of fine tailings, interbedded with layers of coarser unsaturated tailings.
- The pore pressure dissipation test performed at 31.7 ft bgs did not reach zero, which may indicate saturated conditions; however, the material is classified as a CH (USCS) and has a fines content of 91 percent. It is likely that dynamic pore pressures generated by the CPT probe shearing the soils were very slow to dissipate, resulting in misleading measurements during the pore pressure dissipation test.

Alluvium

- It is assumed that the alluvium at this location is unsaturated. This assumption is based on the following:
  - Dynamic pore pressure measurements taken during the CPT were not elevated in the alluvium.
  - No free water was encountered during HSA drilling at this location.
  - The nearest alluvial well indicates that the static water level within the alluvium is approximately 6,867 ft amsl (approximately 109 ft bgs). Bedrock at TI-B8 was encountered at 61 ft bgs. Free water was encountered in the alluvium at B10 and B11 at about 90 ft bgs while drilling.

<u>CPT-10 and TI-B10</u>

Tailings

- At this location, it has been assumed for this analysis that free-draining layers of coarse tailings separate three perched zones of saturated tailings:
  - 18.9 ft to 24.4 ft bgs
  - 25.7 ft to 31.0 ft bgs
  - 33.2 ft to 44.6 ft bgs
- The uppermost zone that is assumed to be saturated (18.9 ft to 24.4 ft bgs) corresponds to a layer of fine tailings observed during HSA drilling at TI-B10. This assumption is based on the following:
  - Elevated dynamic pore pressures, one potential indicator of higher degrees of saturation, were measured from approximately 17.7 ft to 24.3 ft bgs during the CPT.
  - A sample from this layer was submitted for laboratory analysis, the results of which indicate that the material is 89 percent saturated.
- The uppermost and middle zones of assumed saturation are separated by a layer of unsaturated coarse tailings (24.4 ft to 25.7 ft bgs) identified during HSA drilling.
- The middle zone of assumed saturation (25.7 ft to 31.0 ft bgs) corresponds to a layer of fine tailings observed during HSA drilling at TI-B10. This assumption is based on the following:
  - Elevated dynamic pore pressures, one potential indicator of higher degrees of saturation, were measured in this layer during the CPT.
  - Samples from this layer that were submitted for laboratory analysis, the results of which indicate that the material is 95 percent to 96 percent saturated.
- The middle and lowermost zones of assumed saturation are separated by a layer of unsaturated coarse tailings (31.0 ft to 33.2 ft bgs) identified during HSA drilling. A sample of this layer was submitted for laboratory analysis, the results of which indicate that the material is unsaturated (62 percent saturation).
- The lowermost zone of assumed saturation (33.2 ft to 44.6 ft bgs) spans two layers of fine tailings (33.2 ft to 36.3 ft bgs and 37.8 ft to 44.6 ft bgs) and the layer of coarse/fine tailings by which they are separated. This assumption is based on the following:
  - Elevated dynamic pore pressures, one potential indicator of higher degrees of saturation, were measured during the CPT at this location to a depth of 43.8 ft bgs.
  - Laboratory analysis of samples of these tailings indicated that these soils are 95 percent to 100 percent saturated.

Alluvium

- It is assumed that the alluvium at this location is unsaturated above 90.2 ft bgs. This assumption is based on the following:

- Dynamic pore pressure measurements taken during the CPT at this location were not elevated in the alluvium.
- A static water level was measured in TI-B10 at 90.2 ft bgs (approximately 6,883 ft amsl), while drilling and the groundwater measurements in the nearest alluvial well (509D) indicate that the static water level near the tailings impoundment is approximately 6,867 ft amsl.

CPT-11 and TI-B11

Tailings

- It has been assumed that there is a localized perched zone of saturation (hydrostatic conditions) within the tailings at this location (44.5 ft to 53.9 ft bgs).
- This assumption corresponds to a layer of fine tailings observed during HSA drilling at TI-B11 and is based on the following:
  - Elevated dynamic pore pressures, one potential indicator of higher degrees of saturation, were measured from approximately 43.5 ft to 54.8 ft bgs during the CPT.
  - Laboratory analysis of samples of the fine tailings at TI-B11 indicated that these soils are 95 percent to 100 percent saturated.

Alluvium

- It is assumed that the alluvium at this location is unsaturated. This assumption is based on the following:
  - Dynamic pore pressure measurements taken during the CPT were not elevated in the alluvium.
  - Free water was not encountered in the alluvial soils (53.9 ft to 77.5 ft bgs). Free water (wet sampler bit) was encountered at approximately 90 ft bgs (approximately 6,887 ft amsl) in the weathered sandstone.
  - Laboratory analysis of alluvium samples at TI-B11 indicated that these soils are unsaturated (38 percent to 56 percent saturation).

CPT-15 and TI-B15

Tailings

- It has been assumed that there are no saturated tailings at this location. This assumption is based on the following:
  - The tailings at this location are of a coarse nature and therefore have a higher hydraulic conductivity than fine-grained tailings.
  - Results of multiple samples of tailings from this location that were submitted for laboratory analysis. Laboratory analysis indicated that the samples were unsaturated (22 percent to 58 percent saturation).

Alluvium

- At this location, it has been assumed that there are two layers of clay alluvium with increased degrees of saturation that may be susceptible to strength reduction during a seismic event. For the purposes of the analysis, these layers are assumed to behave as saturated soils, but hydrostatic conditions (e.g. perched groundwater) are not present:
  - 30.0 ft to 38.0 ft bgs
  - 45.0 ft to 50.0 ft bgs
- These zones correspond to layers of fine alluvium observed during HSA drilling of TI-B15 and are separated by a layer of coarse alluvium that is unsaturated
- It is assumed that hydrostatic conditions do not exist within the alluvium at this site above elevation approximately 6,867 ft amsl (approximately 110 ft bgs). This is supported by observations in alluvial monitoring wells and boreholes and free water encountered at TI-B10 and TI-B11.
- The uppermost zone of soils assumed to be nearly saturated (30.0 ft to 38.0 ft bgs) corresponds to a layer of fine alluvium observed during HSA drilling at TI-B15. This assumption is based on the following:
  - Elevated dynamic pore pressures, one potential indicator of higher degrees of saturation, were measured from approximately 30 ft to 38 ft bgs during the CPT.

  - Results of two samples from this layer that were submitted for laboratory analysis. One sample was 92 percent saturated and one sample was 70 percent saturated.
- It is assumed that the wetter fine-grained zones are separated by a layer of coarse alluvium (38.0 ft to 45.0 ft bgs) identified during HSA drilling. This assumption is based on the following:
  - A sample of this layer was submitted for laboratory analysis, the results of which indicate that the material is 33 percent saturated.
  - Dynamic pore pressures (one potential indicator of higher degrees of saturation) measured in this layer were not elevated, as they were in the overlying and underlying layers of fine alluvium.
- The lowermost zone of soils assumed to be nearly saturated (45.0 ft to 50.0 ft bgs) corresponds to a layer of fine alluvium observed during HSA drilling at TI-B15. This assumption is conservative and is based on the following:
  - Elevated dynamic pore pressures, one potential indicator of higher degrees of saturation, were measured at depths greater than 45 ft bgs during the CPT.
  - Results from two samples from this layer that were submitted for laboratory analysis. One sample was 93 percent saturated and one sample was 67 percent saturated.
- Despite some elevated dynamic pore pressure measurements (one potential indicator of higher degrees of saturation) below 50 ft bgs, it is assumed that nearly saturated soils do not exist between 50 ft and 110 ft bgs at this location. This assumption is based on the following:
  - A layer of coarse alluvium was observed at 50 ft to 52 ft bgs. Due to the coarse nature of this material and the water levels encountered while drilling at nearby locations during the PDS, at or below elevation 6,867 ft amsl (approximately 110 ft bgs) it is assumed that this layer is unsaturated and that the recorded dynamic pore pressures are the result of shearing induced by the penetrometer during CPT.
  - Laboratory analysis of alluvium samples from depths of 56 ft and 66 ft bgs at TI-B15 indicated that these soils were unsaturated (51 percent saturation for both samples).

<u>CPT-23 and TI-B23</u>

Tailings

- It has been assumed that saturated conditions do not exist within the tailings at this location. This assumption is based on the following:
  - Dynamic pore pressures recorded by the CPT in this zone were not elevated, indicating that this zone is unsaturated.
  - Laboratory analysis of a tailings sample collected from TI-B23 indicated these tailings are unsaturated (57 percent saturation).
  - The layer of fine tailings (the material most likely to have a high degree of saturation) did not exhibit positive dynamic pore pressures during the CPT.

Alluvium

- It is assumed that the moist to wet layers of fine alluvium at this location are nearly, but not completely, saturated and hydrostatic conditions are not present:
  - 16.0 ft to 20.3 ft bgs
  - 23.0 ft to 38.6 ft bgs
  - 40.0 ft to 43.0 ft bgs
- This assumption is based on the following:
  - Laboratory analysis of alluvium samples collected at this location indicated that the samples were nearly, but not completely, saturated (87 percent and 91 percent saturation).
  - Elevated dynamic pore pressure measurements, one potential indicator of higher degrees of saturation, were recorded below approximately 25 ft bgs but not in the uppermost layer of fine alluvium (16.0 ft to 20.3 ft bgs) or in the top approximately 2 feet of the middle layer of fine alluvium (23 ft bgs to 38.6 ft bgs).
  - The nearest alluvial well indicates that the static water level within the alluvium is approximately 6,867 feet amsl (approximately 92 ft bgs). Bedrock at TI-B8 was encountered at 65.5 ft bgs.

Also, the uppermost layer of fine alluvium (16.0 ft to 20.3 ft bgs) did not exhibit positive pore pressures, despite the laboratory results indicating 91 percent saturation.

Other Stratigraphic Assumptions

- The 4-foot-thick ET cover will consist of two layers: (1) an erosion protection layer (14-27 inches thick) on top of (2) a layer of cover soil (21-34 inches thick). The final cover thicknesses, changed during the Pre-final design and were updated in the analysis for the Pre-final design.
- The top of the ET cover will be the same as the finished grade of the proposed repository grading plan (as shown in **Figure 1**).
- Improvement and reconditioning of the existing TDA cover and radon barrier within the footprint of the proposed repository will result in a minimum 18-inch-thick radon barrier over the general fill. The existing erosion protection material will be removed from within the proposed repository footprint during this process. The finished grade of the improved radon barrier will be equal to existing grade.
- Mine waste will be placed from the top of the radon barrier (existing grade) to the bottom of the ET cover (4 ft below finished grade).

Calculations

Figure 3 presents the liquefaction screening evaluation. Results of laboratory analysis on soil samples have been plotted to identify the soils as susceptible, moderately susceptible, or unsusceptible to liquefaction (Bray, et al., 2009). **Attachment E** presents the liquefaction triggering analysis calculations.

Results

The liquefaction triggering analysis evaluated the potential for liquefaction of saturated soil layers during the design seismic event, which could cause settlement of the proposed repository cover, result in damage to the existing TDA radon barrier or compromise the effectiveness of the proposed repository. A liquefaction screening evaluation was performed to identify soil layers that may be susceptible to liquefaction. Results of the liquefaction screening evaluation are presented in **Figure 3**.

Soil layers meeting both of the following criteria were evaluated by a liquefaction triggering analysis:

- A sample taken from the soil layer was identified by the liquefaction screening evaluation as susceptible or moderately susceptible to liquefaction.
- The soil layer is fully saturated, nearly saturated (greater than or equal to 85 percent saturation per NRC, 2008), or has the potential to become saturated in the future.

Results of the liquefaction triggering analysis and liquefaction induced settlement are presented in **Table 2**. The FS values were calculated as the average of the FS values calculated using each of the liquefaction triggering analysis methods. Averaging the results of two methods mitigates the effects of anomalous results and draws upon the data and analyses used to develop both methods. Of the three locations identified as susceptible to liquefaction in the liquefaction screening evaluation, only one location was found to be potentially liquefiable (FS < 1): TI-B10 from 33.2 ft to 44.6 ft bgs. Although only one location was found to be potentially liquefiable, two locations were evaluated for post-liquefaction consolidation settlement: TI-B8 (liquefaction analysis at location TI-B8 resulted in a FS of 1.0) and TI-B10. These post-liquefaction settlements were estimated to be approximately 0.06 ft at TI-B8 (considering CPT data – SPT data resulted in zero settlement) and approximately 0.5 ft at TI-B10, considering CPT and SPT data. These settlements fall within the range of possible vertical strains described in the methods section, and therefore seem reasonable.

A sensitivity analysis was performed to explore how varying material properties would influence the results. Whereas the primary analysis presented herein uses the average (50th percentile) material properties (from multiple tests performed on a certain material), this sensitivity analysis uses the material property of the 30th percentile (see **Table 3**). Using the 30th percentile material properties, the results of the liquefaction analysis and post-liquefaction settlement showed little variation from the base case (50th percentile material properties) values. This is reasonable because the controlling parameters of this analysis are seismic hazard inputs, CPT/SPT values, and the liquefiable criteria outlined above.

Conclusions

Liquefaction Screening Evaluation

The liquefaction screening evaluation identified eight soil samples from four depths/locations as moderately susceptible to liquefaction (see **Figure 3**). None of the soil types encountered within or below the TDA had a significant portion of the profile identified as susceptible or moderately susceptible to liquefaction.

Liquefaction Analysis

Three of the four depths/locations identified as moderately susceptible to liquefaction were also fully saturated or nearly saturated. The minimum calculated average FS for one of these soil layers is 0.79 (calculated for a minimum thickness of 1 foot). This indicates that the layer of fine tailings from 33.2 ft to 44.6 ft bgs at TI-B10 does not meet the minimum acceptable FS criteria for liquefaction (per NRC, 2008 C.2.f). Note that the final depth of this layer will be about 54.2 ft to 65.6 ft. The soil layer at this depth and within this borehole location is susceptible to liquefaction under the design seismic event. However, the layer is at significant depth below the cover and is limited to a localized area within one of the former borrow pits. This layer is also below the pseudo-static failure surfaces identified in the slope stability analyses and is not likely to present a post-seismic slope stability concern, if it were to liquefy following the design seismic event.

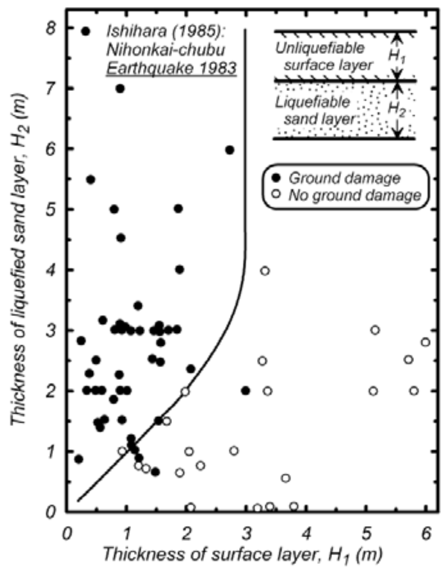
Per NUREG 1620 2.4.3(8) (NRC, 2003), liquefiable material may not require mitigation “if minor liquefaction potential is identified and is evaluated to have only a localized effect that may not directly alter the stability of embankments, the effect of liquefaction is adequately accounted for in analyses of both differential and total settlement and is shown not to compromise the intended performance of the radon barrier.” Based on the results of the liquefaction analysis for the 30% Design, mitigation measures are not considered necessary with respect to the post-seismic slope stability. Adding the mine waste and cover material to the site will increase vertical stresses and depths of existing material. From a calculation perspective, this additional material would increase vertical stress and result in higher FS values. The identified liquefaction potential at the Mill Site falls into this category of minor liquefaction. Neither slope stability nor the radon barrier would be compromised due to liquefaction given the location of the potentially liquefiable material, thickness of the layer, and the number of layer.

Liquefaction Induced Settlement

There are two mechanisms by which liquefied soil may experience settlement. The first is displacement caused by lateral spreading. Certain criteria are necessary for this type of displacement to occur, and these criteria are not present at this site. Specifically, this phenomenon may occur if a liquefied layer of soil extends to a free face. Not only have the liquefiable deposits been identified as pockets of material in a localized area, they are either at a depth greater than any free surface and/or hundreds of feet away. Therefore, this type of settlement was not accounted for in this analysis.

Of the three locations identified as liquefiable in the liquefaction analysis, two locations indicated the potential for post-liquefaction consolidation settlement. Note that the liquefaction analysis at location TI-B8 resulted in a FS of 1.0, at a depth of about 52 to 59 ft. While this does not meet the criteria for liquefaction (it meets the minimum required FS against liquefaction), it was evaluated for potential settlement due to the liquefaction. These post-liquefaction settlements were estimated to be about 0.06 ft at TI-B8 (considering CPT data – SPT data resulted in zero settlement)

and approximately 0.5 ft at TI-B10 (considering both CPT and SPT data sets). It is unlikely that settlements of this magnitude would be observed at the ground surface, due to depth at which they occur. Per Idriss and Boulanger (2008): "The consequences of one-dimensional settlement may, however, be largely mitigated by the presence of a thick nonliquefied layer above the liquefied soils (e.g., Ishihara 1985, Naesgaard et al. 1998, Bouckovalas and Dakoulas 2007)." At depths of 52 to 59 ft and 54 to 66 ft for TI-B8 and TI-B10, respectively, there is a substantial amount of nonliquefied material above the liquefiable pockets and surficial expressions of the liquefied pockets may not be realized as shown in the figure below from Idriss and Boulanger (2008) based on historic earthquake data.



Example of unliquefiable surface layer protecting against surface damage from case histories
(From Idriss and Boulanger 2008)

Based on the field data and the results of the calculations presented herein, the potential for liquefaction induced settlement at the site is contained in a localized area and occurs at a depth where surficial expression and damage to the radon barrier or ET cover is considered unlikely. Therefore, remedial action is not required.

Attachments

Figures

- Figure 1 – Borehole and CPT Locations for Liquefaction Triggering Analysis
- Figure 2 – One-Dimensional Stratigraphic Profiles
- Figure 3 – Liquefaction Screening Evaluation Results

Attachments

- Attachment A – Laboratory Results from Pre-Design Studies (MWH, 2014a and MWH, 2014b)
- Attachment B – Tailings Disposal Area Borehole Logs (MWH, 2014a)
- Attachment C – Tailings Disposal Area Cone Penetration Test Results (MWH, 2014a)
- Attachment D – Recorded Water Levels at the Mill Site (Chester Engineers, 2016)
- Attachment E – Liquefaction Triggering Analysis Calculations

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TABLES

Table 1: Material Properties Used in Liquefaction Triggering Analysis

Material Identification	Maximum Dry Unit Weight, γ_d (pcf)	Relative Compaction, C_r (% of Standard Proctor)	Specific Gravity, G_s	Void Ratio, e	Water Content, w (%)	Moist Unit Weight, γ_m (pcf)	Fines Content, FC (%)	Plasticity Index, PI
Erosion Protection	130.0	90	2.71	0.45	5.0	122.9	N/A	N/A
Cover Soil	115.0	90	2.69	0.62	10.8	114.7	53	12
Mine Spoils	118.3	90	2.66	0.56	9.3	116.4	53	12
Radon Barrier	116.3	95	2.68	0.51	9.4	122.3	59	16
Existing Fill	N/A	N/A	2.69	0.67	13.0	113.8	48	19
Coarse Tailings	N/A	N/A	2.67	0.71	10.9	108.1	21	0
Coarse/Fine Tailings	N/A	N/A	2.72	0.90	30.0	116.0	52	20
Fine Tailings	N/A	N/A	2.70	1.35	50.1	107.6	83	43
Coarse Alluvium	N/A	N/A	2.71	0.73	14.6	111.0	36	N/A
Fine Alluvium	N/A	N/A	2.74	0.72	21.4	120.7	76	N/A

Notes:

All values are the results of laboratory testing, unless otherwise noted.

Table 2: Minimum Average Factors of Safety Against Liquefaction and Predicted Settlement

Borehole	Soil Type	Depth Range of Soil Layer[1] (ft.)	Min. Average FS from Analysis of CPT Data	Min Average FS from Analysis of SPT Data	Post-Liq Consol. Settlement from CPT Data (ft.)	Post-Liq Consol. Settlement from SPT Data (ft.)
TI-B1	Fine Alluvium	43.2 – 47.1	44.9	45.1	0	0
TI-B8	Fine Tailings	52.8 – 58.7	1.01	N/A[2]	0.06	N/A[2]
TI-B10	Fine Tailings	54.2 – 65.6	0.88	0.79	0.47	0.51

Notes:

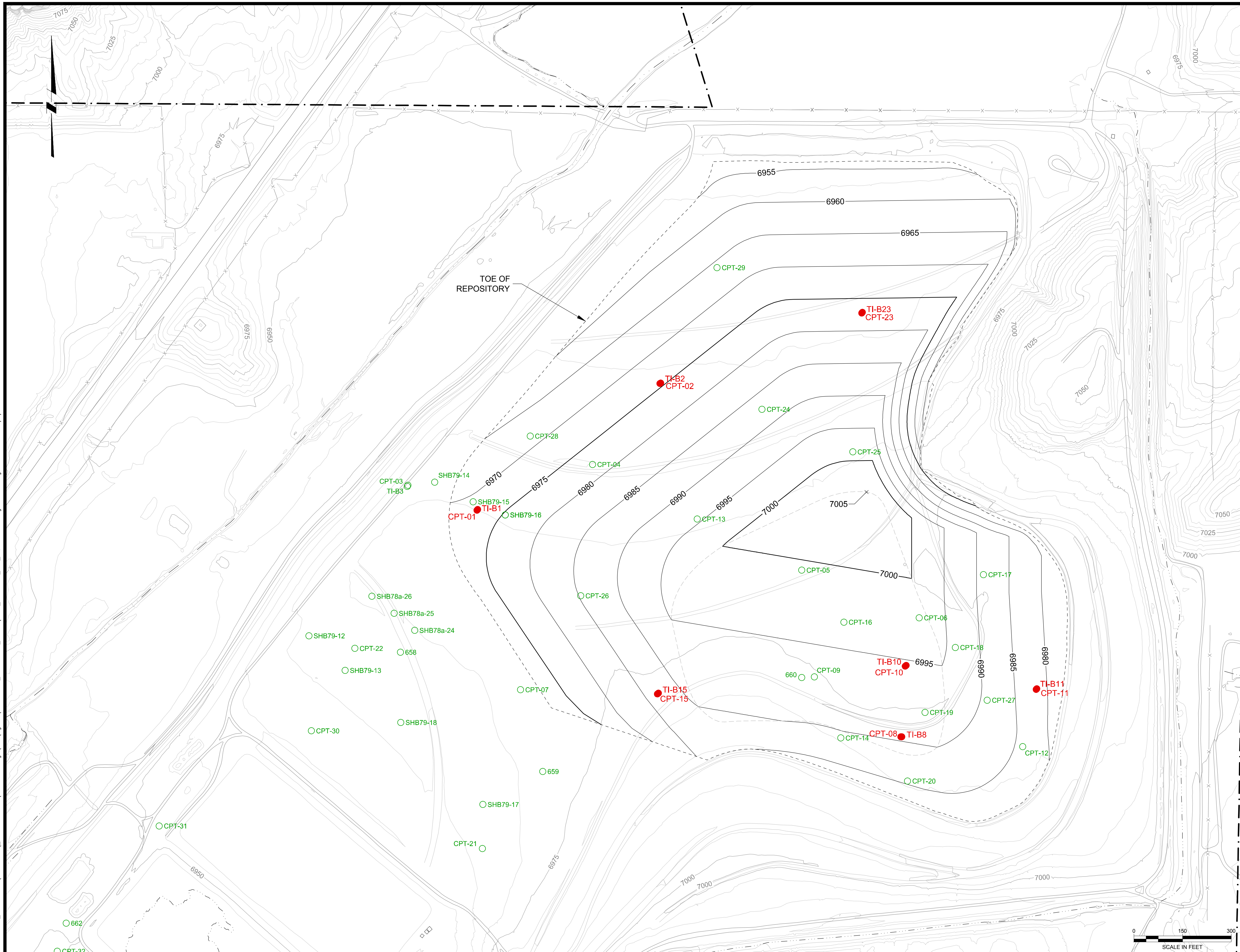
[1]Depth indicated is the depth considering the final proposed repository configuration

[2]An SPT (N = value) was not performed within this layer at TI-B8

Table 3: 30th Percentile Material Properties Used in Sensitivity Demonstration

Material Identification	Specific Gravity, G_s	Water Content, w (%)	Moist Unit Weight, γ_m (pcf)	Fines Content, FC (%)	Plasticity Index, PI
Existing Fill	2.67	8.4	104.4	38	19
Coarse Tailings	2.66	6.8	97.9	14	0
Coarse/Fine Tailings	2.72	27.6	109.4	49	18
Fine Tailings	2.61	41.6	94.6	77	36
Coarse Alluvium	2.68	11.9	105.8	30	0
Fine Alluvium	2.72	19.9	115.5	69	16

FIGURES



LEGEND:

7200	EXISTING GROUND SURFACE CONTOUR & ELEVATION, FEET
7200	PROPOSED SURFACE CONTOUR & ELEVATION, FEET
	EXISTING ROAD
	EXISTING DRAINAGE
	FENCE
	BOUNDARY OF REPOSITORY
●	PAIRED BOREHOLES AND CPT LOCATIONS USED FOR LI□UEFACTION ANALYSIS
○	OTHER BOREHOLES, WELLS, OR CPT LOCATIONS

DESIGNED S McMANUS
DRAWN K REED
CHECKED C WEBER

MWH

UNITED NUCLEAR CORPORATION AND NORTHEAST CHURCH ROCK MINE
McKINLEY COUNTY, NEW MEXICO

BOREHOLE AND CPT LOCATIONS
FOR LI□UEFACTION TRIGGERING ANALYSIS

FIGURE
1
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MAY, 2016

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TI-B1/CPT-01		
Depth below Existing Ground Surface at Time of CPT (ft)	Depth below Finished Ground Surface (ft)	Soil Type
-	0 - 1.5	Erosion Protection
-	1.5 - 2.1	Cover Soil
0.0 - 2.0	2.1 - 4.1	Radon Barrier
2.0 - 13.0	4.1 - 15.1	General Fill
13.0 - 15.0	15.1 - 16.1	Coarse Tailings
15.0 - 18.5	16.1 - 20.6	General Fill
18.5 - 34.3	20.6 - 36.4	Coarse Tailings
34.3 - 41.1	36.4 - 43.2	Coarse Alluvium
41.1 - 45.0	43.2 - 47.1	Fine Alluvium
45.0 - 54.0	47.1 - 56.1	Coarse Alluvium
54.0 - 68.2	56.1 - 70.3	Fine Alluvium
68.2 - 70.0	70.3 - 72.1	Coarse Alluvium

TI-B2/CPT-02		
Depth below Existing Ground Surface at Time of CPT (ft)	Depth below Finished Ground Surface (ft)	Soil Type
-	0 - 1.5	Erosion Protection
-	1.5 - 3.5	Cover Soil
-	3.5 - 14.3	Mine Spoils
0.0 - 2.0	14.3 - 16.3	Radon Barrier
2.0 - 12.8	16.3 - 27.1	General Fill
12.8 - 15.0	27.1 - 29.3	Fine Tailings
15.0 - 25.7	29.3 - 40.0	Coarse Alluvium
25.7 - 33.5	40.0 - 47.8	Fine Alluvium

TI-B8/CPT-08		
Depth below Existing Ground Surface at Time of CPT (ft)	Depth below Finished Ground Surface (ft)	Soil Type
-	0 - 1.5	Erosion Protection
-	1.5 - 3.5	Cover Soil
-	3.5 - 14.2	Mine Spoils
0.0 - 2.0	14.2 - 16.2	Radon Barrier
2.0 - 7.0	16.2 - 21.2	General Fill
7.0 - 18.0	21.2 - 32.2	Coarse Tailings
18.0 - 20.7	32.2 - 34.9	General Fill
20.7 - 26.3	34.9 - 40.5	Coarse Tailings
26.3 - 31.1	40.5 - 45.3	Fine Tailings
31.1 - 32.5	45.3 - 46.7	Coarse Tailings
32.5 - 35.0	46.7 - 49.2	Fine Tailings
35.0 - 38.6	49.2 - 52.8	Coarse/Fine Tailings
38.6 - 44.5	52.8 - 58.7	Fine Tailings
44.5+	58.7+	Coarse Alluvium

TI-B10/CPT-10		
Depth below Existing Ground Surface at Time of CPT (ft)	Depth below Finished Ground Surface (ft)	Soil Type
-	0 - 1.5	Erosion Protection
-	1.5 - 3.5	Cover Soil
-	3.5 - 21.0	Mine Spoils
0.0 - 2.0	21.0 - 23.0	Radon Barrier
2.0 - 6.8	23.0 - 27.8	General Fill
6.8 - 18.9	27.8 - 39.9	Coarse Tailings
18.9 - 24.4	39.9 - 45.4	Fine Tailings
24.4 - 25.7	45.4 - 46.7	Coarse Tailings
25.7 - 31.0	46.7 - 52.0	Fine Tailings
31.0 - 33.2	52.0 - 54.2	Coarse Tailings
33.2 - 44.6	54.2 - 65.6	Fine Tailings
44.6+	65.6+	Coarse Alluvium

TI-B11/CPT-11		
Depth below Existing Ground Surface at Time of CPT (ft)	Depth below Finished Ground Surface (ft)	Soil Type
-	0 - 1.5	Erosion Protection
-	1.5 - 3.5	Cover Soil
-	3.5 - 4.3	Mine Spoils
0.0 - 2.0	4.3 - 6.3	Radon Barrier
2.0 - 44.5	6.3 - 48.8	General Fill
44.5 - 53.9	48.8 - 58.2	Fine Tailings
53.9 - 55.0	58.2 - 59.3	Fine Alluvium
55.0 - 77.5	59.3 -81.8	Coarse Alluvium

TI-B15/CPT-15		
Depth below Existing Ground Surface at Time of CPT (ft)	Depth below Finished Ground Surface (ft)	Soil Type
-	0 - 1.5	Erosion Protection
-	1.5 - 3.5	Cover Soil
-	3.5 - 5.1	Mine Spoils
0.0 - 2.0	5.1 - 7.1	Radon Barrier
2.0 - 3.0	7.1 - 8.1	General Fill
3.0 - 30.0	8.1 - 35.1	Coarse Tailings
30.0 - 38.0	35.1 - 43.1	Fine Alluvium
38.0 - 45.0	43.1 - 50.1	Coarse Alluvium
45.0 - 50.0	50.1 - 55.1	Fine Alluvium
50.0 - 52.0	55.1 - 57.1	Coarse Alluvium
52.0 - 65.0	57.1 - 70.1	Fine Alluvium

TI-B23/CPT-23		
Depth below Existing Ground Surface at Time of CPT (ft)	Depth below Finished Ground Surface (ft)	Soil Type
-	0 - 1.5	Erosion Protection
-	1.5 - 3.5	Cover Soil
-	3.5 - 22.2	Mine Spoils
0.0 - 2.0	22.2 - 24.2	Radon Barrier
2.0 - 13.4	24.2 - 35.6	General Fill
13.4 - 14.2	35.6 - 36.4	Fine Tailings
14.2 - 16.0	36.4 - 38.2	Coarse Tailings
16.0 - 20.3	38.2 - 42.5	Fine Alluvium
20.3 - 23.0	42.5 - 45.2	Coarse Alluvium
23.0 - 38.6	45.2 - 60.8	Fine Alluvium
38.6 - 40.3	60.8 - 62.5	Coarse Alluvium
40.3 - 43.0	62.5 - 65.2	Fine Alluvium

PROJECT UNITED NULEAR CORPERATION AND NORTHEAST CHURCH ROCK MINE

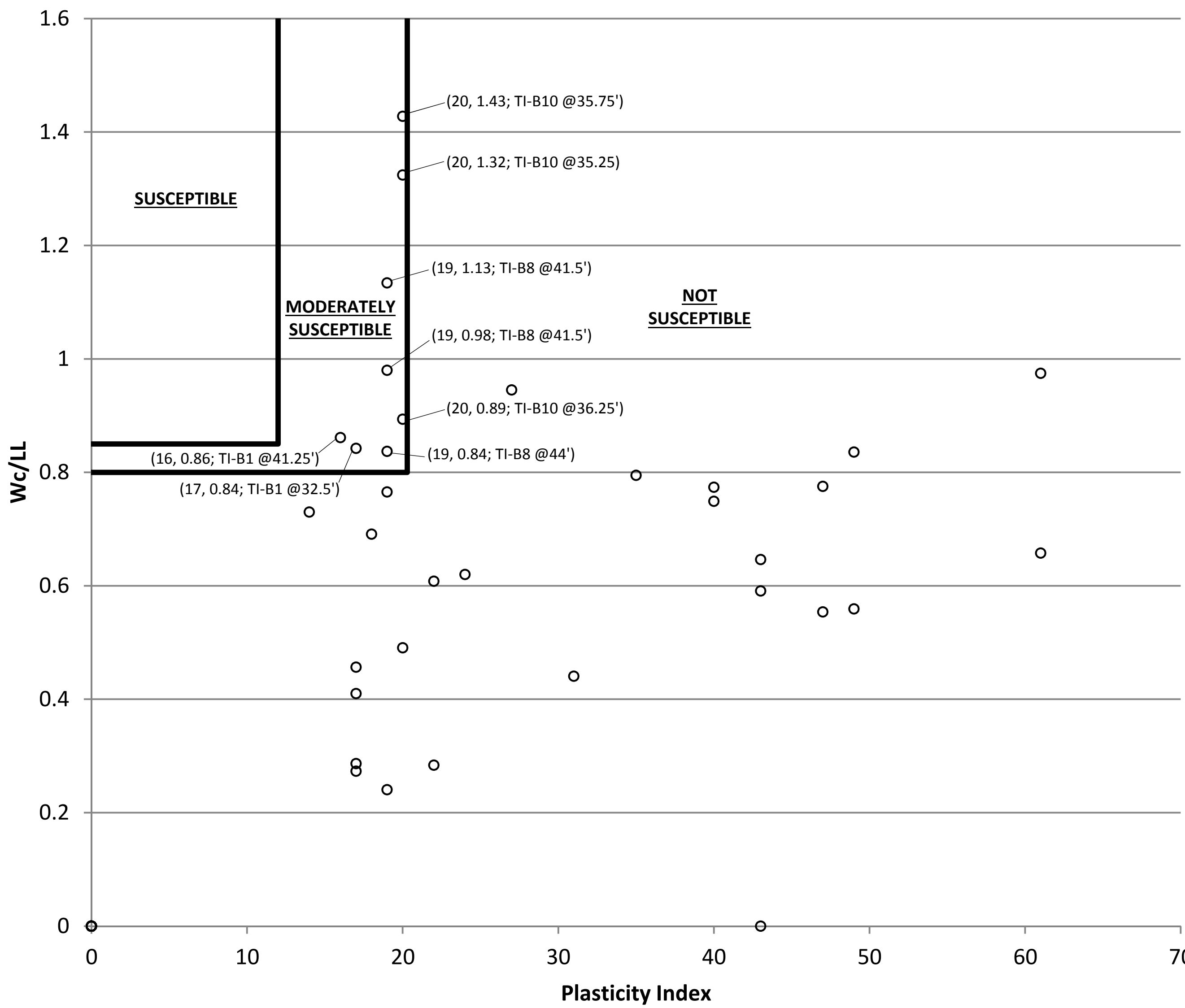
TITLE ONE-DIMENSIONAL STRATIGRAPHIC PROFILES

MWH

DATE May 2016

FIGURE 2

FILENAME FIG_2



PROJECT	UNITED NULEAR CORPERATION AND NORTHEAST CHURCH ROCK MINE
TITLE	LIQUEFACTION SCREENING EVALUATION RESULTS
DATE	May 2016
	FIGURE 3
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MWH

ATTACHMENT A

LABORATORY RESULTS FROM PRE-DESIGN STUDIES (MWH, 2014A AND MWH, 2014B)

Table 3-1 Summary of Geotechnical Laboratory Data - Cover Samples

Cover Layer	Sample	Sample Type [(1)]	Sample Depth Interval (in)		Material Description [(2)]	USCS [(2)]	USDA Classification [(3)]	Water Content (by mass) (%)	Specific Gravity	Standard Proctor (max. dd@opt. w.c.) (pcf @ %)	Atterberg Limits (%) [(5)] LL	PL	PI	USCS % Gravel	USCS % Sand	% Passing No. 200 Sieve (fines)	% Silt	USDA % Clay (<0.002 mm)	L.A. Abrasion [(6)] (% loss)	Sodium Soundness [(7)] (% loss)	Absorption [(8)] (%)	Pinhole Dispersion [(9)]	Remolded Saturated Hydraulic Conductivity [(10)] (cm/sec) 90%	95%	100%	Confining Stress (psi)	SWCC: -5 bar Water Content (by mass) (%) [(10)]	SWCC: Saturated Water Content (by mass) (%) [(11)]
Admix. (Gravel/ Soil Mixture)	TI - CS01 - 02A	Bulk	0	11	Clayey Gravel with Sand		Loam							33.3	23.4	43.3	28.0	15.3										
	TI - CS02 - 02A	Bulk	0	10	Clayey Gravel with Sand		Clay Loam		2.81 [(4)]					36.9	17.0	46.1	28.8	17.3	3.8	0.37	1.06							
	TI - CS03 - 02A	Bulk	0	6	Clayey Gravel with Sand		Loam							53.6	18.7	27.7	18.1	9.6										
	TI - CS04 - 02A	Bulk	0	10	Clayey Gravel with Sand		Loam							53.6	18.2	28.2	18.0	10.2										
	TI - CS05 - 02A	Bulk	0	9	Sandy Lean Clay		Loam							13.9	34.4	51.7	31.2	20.5										
	TI - CS06 - 02A	Bulk	0	7	Clayey Gravel with Sand		Loam		2.77 [(4)]					48.4	18.5	33.1	23.4	9.7	5.7	0.14	1.91							
	TI - CS07 - 02A	Bulk	0	20	Sandy Lean Clay	CL	Loam	7.8			28	13	15	1.1	41.0	60.9	42.4	18.5										
	TI - CS08 - 02A	Bulk	0	8	Clayey Gravel with Sand		Loam							56.7	18.5	24.8	17.2	7.6										
	TI - CS09 - 02A	Bulk	0	9	Clayey Gravel		Loam		2.78 [(4)]					53.6	14.2	32.2	21.2	11.0	5.1	1.17	1.55							
	TI - CS10 - 02A	Bulk	0	7	Clayey Gravel with Sand		Loam							41.4	19.7	38.9	26.1	12.8										
	TI - CS11 - 02A	Bulk	0	9	Clayey Gravel with Sand		Sandy Loam							30.7	30.1	39.2	26.1	13.1										
	TI - CS12 - 02A	Bulk	0	14	Sandy Lean Clay	CL	Loam	9.1			33	13	20	1.3	28.8	69.9	43.5	26.4										
Radon barrier (clay layer)	TI - CS03 - 04A	Bulk	6	24	Sandy Lean Clay	CL	Loam	6.0			28	14	14	6.3	38.7	55.0	36.1	18.9										
	TI - CS06 - 04A	Bulk	7	24	Sandy Lean Clay	CL	Loam	11.0			30	13	17	6.7	34.2	59.1	40.2	18.9										
	TI - CS10 - 04A	Bulk	7	25	Sandy Lean Clay	CL	Loam	7.7			29	14	15	2.3	39.5	58.2	36.9	21.3										
	TI - CS08 - 04A	Bulk	8	28	Sandy Lean Clay	CL	Loam	8.1	2.67	119.4 @ 11.9	27	12	15	11.3	35.0	53.7	36.7	17.0					9.1E-06	1.1E-05	1.5E-06	24		
	TI - CS05 - 04A	Bulk	9	24	Sandy Lean Clay	CL	Loam	9.6			29	12	17	1.3	37.3	61.4	42.0	19.4										
	TI - CS09 - 04A	Bulk	9	26	Sandy Lean Clay	CL	Loam	7.7			28	13	15	4.0	38.1	57.9	40.0	17.9										
	TI - CS11 - 04A	Bulk	9	24	Sandy Lean Clay	CL	Clay Loam	8.6	2.68	115.0 @ 14.9	32	13	19	5.1	28.4	66.5	40.7	25.8					7.6E-08	1.4E-07	1.0E-07	24		
	TI - CS02 - 04A	Bulk	10	24	Sandy Lean Clay	CL	Sandy Clay Loam	11.4			28	12	16	3.6	44.7	51.7	30.4	21.3										
	TI - CS04 - 04A	Bulk	10	24	Sandy Lean Clay	CL	Clay Loam	15.0	2.68	113.5 @ 15.0	35	15	20	0.9	35.0	68.2	37.2	26.9					4.6E-06	6.2E-06	2.3E-07	8		
	TI - CS01 - 04A	Bulk	11	24	Sandy Lean Clay	CL	Loam	9.2	2.68	117.3 @ 13.0	29	15	14	2.0	39.8	58.2	39.0	19.2				ND3	3.0E-04	4.6E-05	7.8E-07	8	8.6 / 9.6	21.7 / 19.0

Notes: 1. Sample Types: Bulk = bucket/grab sample

2. USCS = Unified Soil Classification Sysytem, material descriptions are based on field observations, and refined with laboratory data, if available. USCS classifications are provided only where sufficient laboratory data are available. CL = low plasticity clay

3. USDA = United States Department of Agriculture, USDA classifications are based on the sand/silt/clay fraction of the sample and on USDA grain-size designations.

4. Bulk saturated surface dry (SSD) specific gravity of the gravel fraction, average of three results (ASTM C127).

5. LL = liquid limit, PL = plastic limit, PI = plasticity index

6. L.A. abrasion results are percent loss, by mass, for 100 revolutions.

7. Weighted percent loss for the 3/4-inch to 3/8-inch size range

8. Average of three results for the gravel fraction of the cover gravel/soil mixture samples

9. Pinhole dispersion test (ASTM method A) conducted on a specimen remolded to approximately 95% of the maximum standard Proctor density at optimum water content. ND3 = slightly to moderately dispersive clays that erode slowly under 2-inch or 7-inch head.

10. Flexible wall permeameter tests conducted on specimens remolded to approximately 90, 95 and 100% of the maximum standard Proctor density and tested at the confining stresses shown in the table.

11. SWCC test conducted on material passing the No. 10 sieve, remolded to approximately 95% of the maximum standard Proctor density and optimum water content. SWCC tests performed with pairs of specimens for each test.

Table 3-4 Summary of Geotechnical Laboratory Data - Mill Site Impoundment

Area	Boring	Sample Type [9]	Sample Depth Interval (ft.)		Material Description [1]	USCS [1]	Water content (by mass, %) 110C	Water content (by mass, %) 60C	SWCC - Saturated water content (by mass, %)[2]	SWCC - Specimen dry density (pcf)[2]	Dry density (pcf), 110C	Dry density (pcf), 60C	Specific gravity, 110C	Specific gravity, 60C	Atterberg limits (%) LL	PL	PI	USCS % gravel (size)	USCS % sand (size)	% Passing No. 200 sieve	% Silt (size)	USDA % clay (size <0.002 mm)	Saturated Hydraulic conductivity (cm/sec)[3]	Hydraulic conductivity confining stress (psi)	Consolidation (Cc)[7]	Collapse potential (%) (inundation load (psf))	Triaxial[12] (peak friction angle (ϕ) (degrees), cohesion (psf), where applicable)
CENTRAL CELL	TI-B1	CA	16	16.5	Lean Clay with Sand (Fill)	CL	16.2				104.7				33	13	20	0.3	27.2	72.5	42.9	29.6					
	TI-B1	CA	20.5	21	Coarse Tailings		6.1	5.7																			
	TI-B1	CA	21	21.5	Coarse Tailings		7.5		21.9 / 19.8	96.5 / 99.6	105.5							0.0	90.7	9.3	5.5	3.8	3.7E-04	18	0.024		
	TI-B1	ST	27	27.5	Coarse Tailings	SP	4.0				97.6		2.67			NP		0.0	92.7	7.3	5.2	2.1	2.9E-03	14			34.9
	TI-B1	CA	30	30.5	Coarse Tailings		13.9	13.5																			
	TI-B1	CA	30.5	31	Coarse Tailings		14.6		29.6 / 33.8	84.2 / 83.6	91.6												3.0E-07	25	0.092		
	TI-B1	CA (top)	31	31.5	Coarse Tailings		0.8	0.4																			
	TI-B1	CA (bottom)	31	31.5	Fine Tailings	CL		41.6				76.5	2.68	*2.69*	44	17	27	0.0	30.9	69.1	54.6	14.5					33.3
	TI-B1	CC-AC	32	33	Coarse/Fine Tailings	CL	29.3	*27.8*							33	16	17	0.0	46.7	53.3	37.4	15.9					
	TI-B1	CA	36	36.5	Clayey Sand		21.0	19.9	36.3 / 33.2	85.2 / 88.0	97.3		2.73					0.0	62.5	37.5	32.8	4.7	1.7E-06	32	0.059		
	TI-B1	CA	41	41.5	Lean Clay with Sand	CL	26.7				98.6				31	15	16	0.0	18.2	81.8	54.7	27.1	1.2E-07	35			
	TI-B1	ST	45	46	Clayey Sand		22	21.2			106.0														0.058		34.4
CENTRAL CELL - BORROW PIT 1	TI-B10	ST (top)	10	11	Coarse Tailings		9.7	9.1			110	110.5	2.63	2.65													
	TI-B10	ST (bottom)	10	11	Coarse Tailings		9.0		20.7 / 21.5	102.6 / 101.2	96.8							0.2	71.9	27.9	16.6	11.3	4.3E-04	34	0.094		
	TI-B10	CC-AC [4] (top)	12.5	14	Coarse Tailings		6.7	6.3					2.61	2.64													
	TI-B10	CC-AC [4] (bot)	12.5	14	Coarse Tailings		7.5		31.3 / 31.4	85.0 / 85.0	99.1							0.7	71.5	27.8	18.9	8.9	6.7E-05	36			
	TI-B10	CA	15	15.5	Coarse Tailings		9.3				103.0																
	TI-B10	CA	16	16.5	Coarse Tailings	SM	6.5				100.0		2.65			NP		2.4	82.3	15.3	10.2	5.1					
	TI-B10	ST	21.5	22.5	Coarse/Fine Tailings	CL	28.1	*26.7*			91.9	*92.9*			43	19	24	0.0	43.0	57.0	51.4	5.6			0.111		
	TI-B10	CA	25.75	26	Fine Tailings		43.7	41.0																			
	TI-B10	CA	26	26.5	Fine Tailings	CH	60.4	*57.4*			63.1	*64.3*	2.71	*2.80*	74	27	47	0.0	10.0	90.0	82.6	7.4					
	TI-B10	ST	30.3	30.7	Fine Tailings	CH	47.7	*45.3*			72.2	*73.4*	2.71	*2.78*	57	22	35	0.0	24.3	75.7	68.4	7.3					
	TI-B10	ST	32	32.5	Coarse Tailings	SM	15.4				100.1		2.67			NP		0.0	83.1	16.9	12.6	4.3					
	TI-B10	CA	35	35.5	Fine Tailings		50.2	*47.7*			71.3	*72.5*															
	TI-B10	CA	35.5	36	Fine Tailings		54.2	51.4																			
	TI-B10	CA	36	36.5	Coarse/Fine Tailings	SC/CL	33.9	*32.2*			86.7	*87.8*	2.68	*2.72*	36	16	20	0.0	50.6	49.4	31.1	18.3					
	TI-B10	ST (top)	40	41	Fine Tailings		47.3	45.7			70.5	73.7	2.54	2.56													
	TI-B10	ST (bottom)	40	41	Fine Tailings	CH	49.7	*47.2*	47.7 / 55.7	75.3 / 67.9	73.3	*74.5*			61	21	40	0.0	20.7	79.3	46.5	32.9	2.9E-08	58	0.315		
	TI-B10	CA	46	46.5	Silty Sand		9.9				95.4		2.74					0.0	65.8	34.2	23.4	10.8					
	TI-B10	ST	55	56	Silty Sand		14.1		25.7 / 24.8	98.0 / 99.9	100.8												2.4E-05	72	0.139		
	TI-B10	CA	66	66.5	Silty Sand / Sandy Silt	SM/ML	13.8				94.5					NP		0.0	50.1	49.9	33.4	16.5					
	TI-B10	CA	71	71.5	Silty Sand		18.1				100.8																
	TI-B10	CA	91	91.5	Clayey Sand		18.6				105.6		2.66														
	TI-B10	CC	106.9	107.3	Sandstone		14.2				109.1												1.4E-07	115			
CENTRAL CELL - BORROW PIT 2	TI-B11	CA	6	6.5	Sandy Clay (Fill)		8.6				93.5																
	TI-B11	ST	15	16	Clayey Sand (Fill)		8.2		16.0 / 16.3	117.7 / 116.6	110.4		2.67					3.9	57.6	38.5	24.6	13.9	2.5E-05	38	0.085		
	TI-B11	CA	21	21.5	Sandy Clay (Fill)		12.3				107.6																
	TI-B11	ST	30.5	31.5	Sandy Clay (Fill)	CL	13.7				112.4				30	13	17	7.1	41.3	51.6	33.9	17.7	9.0E-07	51	0.059		
	TI-B11	CA	45.5	46	Fine Tailings		117.2	88.7																			
	TI-B11	ST	51.5	52.5	Fine Tailings	CH	63.0	*59.9*			62.5	*63.7*	2.75	*2.84*	91	30	61	0.0	2.7	97.3	90	7.3	3.1E-08	67	0.482		
	TI-B11	ST	56	57	Silty Sand	SM	16.2		31.0 / 30.8	90.6 / 92.8	77.9		2.64			NP		0.0	60.4	39.6	31.9	7.7	5.6E-04	72	0.129		
	TI-B11	CA	61	61.5	Sandy Clay		16.0				95.4							0.0	38.7	61.3	44.1	17.2					
	TI-B11	CA	66	66.5	Silty Sand		14.2				96.2																
	TI-B11	CA	81	81.5	Clayey Sand with Gravel		11.0				107.6		2.76					12.9	65.6	21.5	9.9	11.6					
	TI-B11	CA	100	100.2	Sandstone		21.1				103.9												1.3E-05	112			
CENTRAL CELL - BORROW PIT 1	TI-B8	CA	25	25.5	Coarse Tailings		9.0	8.4			103.7	104.2	2.72	2.72													
	TI-B8	CA [5]	25.5	26	Coarse Tailings		6.2		25.7	94.6	99.6							0.0	87.9	12.7	7.9	4.8	3.6E-04	46			
	TI-B8	CA [5]	26	26.5	Coarse Tailings	SM	16.8		27.0	94.8	91.7					NP		0.0	76.0	24.0	19.0	5.0					
	TI-B8	ST	30	31	Fine Tailings	CH	65.1	*61.8*			61.5	*62.7*			74	25	49	0.0	9.2	90.8	81.2	9.6			0.426		
	TI-B8	ST	31	31.5	Fine Tailings		44.3	41.4																			
	TI-B8	ST (top)	35	36	Coarse Tailings		14.3	13.6			90.9	91.4	2.66	2.67													
	TI-B8	ST (bottom)	35	36	Coarse Tailings		16.5		31.2 / 39.3	89.3 / 82.3	89.6		2.67										1.6E-05	43			
	TI-B8	ST (top)	41	42	Fine Tailings		41.8	*39.7*			79.2	*80.4*	2.60	2.63													
	TI-B8	ST (bottom)	41	42	Coarse/Fine Tailings	SC/CL	35.6	34.3	33.1 / 31.6	88.7 / 90.7	82.8	83.6			35	16	19	0.0	51.2	48.8	40.7	8.1	1.3E-07	53	0.262		
	TI-B8	CC-AC (top)	43.5	44.5	Coarse/Fine Tailings		31.2	29.3			91.0	92.3															
	TI-B8	CC-AC [6] (bot)	43.5	44.5	Fine Tailings		45.6	*43.3*	47.9 / 49.0	74.4 / 73.6	73.6	*74.8*						0.0	14.5	85.5	74.7	10.8	3.0E-08	61			

Table 3-4 Summary of Geotechnical Laboratory Data - Mill Site Impoundment (continued)

Area	Boring	Sample Type [9]	Sample Depth Interval (ft.)		Material Description [1]	USCS [1]	Water content (by mass, %) 110C	Water content (by mass, %) 60C	SWCC - Saturated water content (by mass, %) [2]	SWCC - Specimen dry density (pcf) [2]	Dry density (pcf), 110C	Dry density (pcf), 60C	Specific gravity, 110C	Specific gravity, 60C	Atterberg limits (%) LL	PL	PI	USCS % gravel (size)	USCS % sand (size)	% Passing No. 200 sieve	% Silt (size)	USDA % clay (size <0.002 mm)	Saturated Hydraulic conductivity (cm/sec) [3]	Hydraulic conductivity confining stress (psi)	Consolidation (Cc) [7]	Collapse potential (%) (inundation load (psf))	Triaxial [12] (peak friction angle (ϕ) (degrees), cohesion (psf), where applicable)
	TI-B8	CC-AC	44.5	45	Fine Tailings								2.59	2.60													
BORROW	TI-B8	CA	46	46.5	Lean Clay with Sand	CL	21.9				95.2		2.72		30	16	14	0.0	27.9	72.1	55.6	16.5					
PIT 1 (cont.)	TI-B8	CA	56	56.5	Silty Sand	SM	12.6				97.6		2.70			NP		0.0	57.0	43.0	30.9	12.1					
	TI-B8	BULK	63.5	64	Shale		X				X												X	X			
	TI-B15	CA	6	6.5	Coarse Tailings		5.4				101.1							0.0	87.5	12.5	9.8	2.7					
	TI-B15	CA	11	11.5	Coarse Tailings		6.8				93.8																
	TI-B15	CC-AC	13.5	14	Coarse Tailings	SM	19.0	18.4					2.68			NP		0.0	69.6	30.4	22.6	7.8					
	TI-B15	ST	15.5	16	Coarse Tailings	SM	14.2				90.4		2.66			NP		0.0	54.9	15.1	10.1	5.0	8.3E-04	38	0.126		
	TI-B15	CA	21	21.5	Coarse Tailings	SM	12.7				99.8		2.68			NP		0.0	80.6	19.4	13.3	6.1					
CENTRAL	TI-B15	CC-AC	28.5	29.5	Coarse Tailings	SM	19.3						2.66			NP		0.0	65.4	34.6	24.4	10.2					
CELL	TI-B15	CA (top)	31	31.5	Silty Sand		22.3	21.3																			
	TI-B15	CA (bottom)	31	31.5	Silty Sand	SM	17.1				101.8		2.71			NP		6.2	51.9	41.9	25.9	16.0					
	TI-B15	CA	41	41.5	Clayey Sand		11.4	10.1			87.1	88.1															
	TI-B15	CA (top)	46	46.5	Sandy Silt		25.8	24.0																			
	TI-B15	CA (bottom)	46	46.5	Sandy Silt	ML	17.3				99.3		2.81			NP		0.0	37.0	63.0	55.7	7.3					
	TI-B15	CA	56	56.5	Silty Clay		11.7	10.5			104.2	105.3															
	TI-B15	CA	66	66.5	Clayey Sand		12.7	11.8			100.7	101.5															
	TI-B23	ST	15.5	15.75	Coarse Tailings		20.7	19.6			87.7		2.77					0.0	62.8	37.2	34.1	3.1					
	TI-B23	ST	17.25	17.5	Sandy Clay		22.5				101.9		2.73					0.0	31.1	68.9	46.5	22.5					
	TI-B23	ST	26	27	Lean Clay	CL	21.6				101.7		2.73		49	18	31	0.0	8.8	91.2	43.8	47.5			0.046		
	TI-B23	CA	45.2	45.7	Sandstone		13.8				108.7												2.4E-07	43			
	TI-B23	CA [8]	65.5	66	Shale		10.2				103.0												9.7E-08	62			
NORTH	TI-B2	CA	6	6.5	Silty Sand with Gravel (Fill)		7.7				100.4		2.68					26.9	29.9	43.2	30.7	12.5					
CELL	TI-B2	CA	11	11.5	Clayey Sand (fill)		24.5				75.9		2.73					0.0	65.4	34.6	30.3	4.3					
	TI-B2	CC-AC	13.5	14.5	Fine Tailings		41.7	*39.6*										0.0	23.1	76.9	49.2	27.7					
	TI-B2	CA	15	15.5	Silty Sand		6.9				90.4		2.68														
	TI-B2	CA	21	21.5	Silty Sand		7.0				91.4		2.74					0.0	82.9	17.1	11.5	5.6					
	TI-B2	CA	26	26.5	Lean Clay with Sand	CL	23.5				93.2				34	16	18	0.0	20.9	79.1	51.5	27.6					
	TI-B2	BULK	38.4	38.7	Sandstone		13.5				X																
	TI-B3	CA	11	11.5	Silty Sand (dam)		5.1				108.4		2.64					5.4	74.7	19.9	13.5	6.4					
	TI-B3	CA	16	16.5	Silty Sand (dam)		4.7				105.3															-2.8 (2,236)	
	TI-B3	ST	21	22	Sandy Clay (dam)	CL	16.0				111.1				30	12	18	0.0	32.8	67.2	41.7	25.5				-0.03 (2,709)	32.2, 195
	TI-B3	CA	26	26.5	Sandy Clay (dam)		12.0				106.8				25	13	12										
	TI-B3	CA	31	31.5	Sandy Clay (dam)		16.1				108.4																
	TI-B3	ST (top)	35	36	Clayey Sand (dam)		10.5	10.2																			
DAM	TI-B3	ST (bottom)	35	36	Clayey Sand (dam)	SC	14.7				102.2		2.67		23	14	9	2.1	50.2	47.7	30.9	16.8			nc	-0.7 (4,608)	33.7, 135
	TI-B3	CA	41	41.5	Sandy Clay (dam)		21.5				90.6							0.0	33.8	66.2	41.7	24.5					
	TI-B3	CA	45.5	46	Sandy Clay (dam)		17.0	17.7			110.1	109.4															29.3, 293
	TI-B3	CA	46	46.5	Sandy Clay (dam)		18.0				104.8				28	13	15										
	TI-B3	ST	56	57	Lean Clay	CL	22.1	21.1			105.3	106.2	2.72		43	14	29	0.0	11.7	88.3	48.4	39.9				-1.5 (7,204)	22.2, 494
	TI-B3	CA	61	61.5	Silty Clay		25.8				99.0							0.0	22.0	78.0	54.9	23.1					

Notes: 1. Material descriptions are based on field observations, and refined with laboratory data, if available. USCS classifications are provided only where sufficient laboratory data are available.
2. SWCC tests conducted with pairs of specimens for each test.
3. Flexible wall permeameter tests conducted at confining pressures representing confining stresses for the proposed design fill. Confining stresses were estimated as the existing overburden stress on the specimens (depth times total unit weight of material above) plus the maximum anticipated fill height for the location times the estimated unit weight of fill.
4. Specimen remolded to the in-situ water content and density of the Shelby tube sample from 10-12.5 for the SWCC.
5. Remolded SWCC and permeability tests conducted on a 50-50 mixture of the materials from these two specimens, remolded to the average measured density of the two CA samples.
6. SWCC specimen remolded to the in-situ water content and density of the Shelby tube sample from 41-42 feet.
7. Compression indices estimated using the maximum anticipated loading during fill placement and the range of loading during testing. Initial void ratios are calculated using the average specific gravity for all samples of 2.70.
8. Shale sample had multiple horizontal fractures and was likely disturbed during sampling.
9. Sample Types: CC = continuous core, CC-AC = continuous core in acrylic liner, top/bottom indicates the specimen was taken from the top or bottom of the sample interval
10. Values in italics were calculated based on the relationship (WC60=0.951(WC110)-.0611) between the water content results measured for 15 tailings samples at the two oven temperatures.*
11. Shaded cells are alluvium.
12. Consolidated undrained (CU) triaxial shear, staged loading of one specimen with pore pressure measurements

ST = 3" diam. Shelby tube, CA = California sample
R = remolded, nc = Cc not calculated, because fill will not be placed in this location
X = testing not possible due to sample disturbance
LL = liquid limit, PL = plastic limit, PI = plasticity index

Table 3-5 Summary of Geotechnical Laboratory Data - Borrow Areas

Area	Sample	Sample Type [1]	Sample Depth Interval (ft)		Material Description [2]	USCS [2]	USDA Classification [3]	Water Content (by mass, %)	Dry Density (pcf)	Porosity	Specific Gravity	Standard Proctor (max. dd@opt. w.c.), (pcf @ %)	Atterberg Limits (%) [4] LL	PL	PI	USCS % Gravel	USCS % Sand	% Passing No. 200 Sieve (fines)	% Silt	USDA % Clay (<0.002 mm)	Pinhole Dispersion [5,6]	Remolded Saturated Hydraulic Conductivity (cm/sec) [7] 80%	85%	90%	SWCC: -5 bar Water Content (by mass, %) [8]	SWCC: Saturated Water Content (by mass, %) [8]
West Borrow	WB-B1-01A	CA	3.0	3.5	Clayey Sand			3.8	88.8	46.7	2.67															
	WB-B1-03A	CA	11.0	11.5	Clayey Sand	SC	Sandy Loam	6.4	111.0	33.3	2.67		28	18	10	2.8	48.6	48.6	32.8	15.8						
	WB-B1-06	Bulk	5.0	10.0	Silty, Clayey Sand	SC-SM	Sandy Loam				2.64	112.5 @ 13.7	26	20	6	0.8	52.3	46.9	31.0	15.9	ND3	7.2E-04	5.8E-04	2.1E-04	6.6 / 6.2	31.7 / 32.4
	WB-B2-02A	CA	5.5	6.0	Clayey Sand	SC	Sandy Loam	5.6	87.1	47.8	2.67					8.6	53.5	37.9	23.8	14.1						
	WB-B2-05	Bulk	10.0	20.0	Clayey Sand	SC	Sandy Loam						26	17	9	9.9	46.3	43.8	27.7	16.1	ND3	8.5E-05	1.2E-04	6.4E-05	6.4 / 6.7	30.9 / 33.7
	WB-B5-001B	CA	3.0	3.5	Clayey Sand			3.7	92.5	44.3	2.66															
	WB-B5-002A	CA	6.0	6.5	Silty, Clayey Sand	SC-SM	Sandy Loam	5.1	86.9	47.7	2.66		24	17	7	0.0	56.3	43.7	27.8	15.9						
	WB-B5-005	Bulk	0.0	10.0	Silty, Clayey Sand	SC-SM	Sandy Loam					117.3 @ 12.7				0.0	61.6	38.4	22.8	15.6						
East Borrow	EB-B2-001A	CA	3.0	3.5	Weath. Sandstone			5.8	107.1	35.8	2.67															
	EB-B3-003B	CA	10.5	11.0	Sandy Lean Clay	CL	Sandy Loam	6.0	83.1	50.7	2.70		26	15	11	0.0	46.3	53.7	34.9	18.8						
	EB-B4-02A	CA	6.0	6.5	Sandy Lean Clay	CL	Sandy Loam	5.4	80.7	51.2	2.65					0.0	48.5	51.5	33.9	17.6						
	EB-B4-06	Bulk	10.0	20.0	Silty, Clayey Sand	SC-SM	Sandy Loam				2.67	117.1 @ 12.9	23	17	6	0.0	50.5	49.5	32.0	17.5	ND3	8.7E-04	9.0E-04	4.4E-04	4.6 / 4.2	30.8 / 29.8
	EB-B5-02B	CA	5.5	6.0	Clayey Sand	SC	Sandy Loam	6.7	93.8	44.4	2.71		27	15	12	8.8	45.7	45.5	28.8	16.7						
	EB-B6-01B	CA	3.0	3.5	Sandy Clay			7.6	91.2	46.1	2.71															
	EB-B6-03	Bulk	0.0	10.0	Lean Clay with Sand	CL	Clay Loam					114.8 @ 14.1				0.0	26.6	73.4	44.3	29.1	ND3	2.3E-04	3.6E-05	2.9E-05	9.4 / 9.3	32.8 / 32.2
	EB-B6-04A	CA	11.0	11.5	Sandy Lean Clay	CL	Sandy Clay Loam	8.6	95.2	43.3	2.69		31	13	18	0.0	31.1	68.9	43.8	25.1						
South Borrow	SB-B1-01A	CA	3.5	4.0	Sandy Lean Clay	CL	Sandy Loam	7.1	91.4	49.3	2.89					0.0	43.1	56.9	39.2	17.7						
	SB-B1-03A	CA	11.0	11.5	Sandy Lean Clay	CL	Sandy Clay Loam	6.6	82.6	50.7	2.69		31	15	16	0.0	46.7	53.3	32.9	20.4						
	SB-B1-04	Bulk	0.0	25.0	Sandy Lean Clay	CL	Sandy Clay Loam				2.70	115.5 @ 14.2	33	14	19	0.0	42.6	57.4	30.7	26.7	ND1	2.3E-04	5.7E-05	1.4E-04	6.4 / 5.9	31.9 / 30.3
	SB-B2-02B	CA	5.5	6.0	Sandy Lean Clay	CL	Loam	7.7	80.1	52.6	2.70		36	15	21	0.0	29.8	70.2	45.4	24.8						
	SB-B3-02A	CA	6.0	6.5	Lean Clay with Sand	CL	Clay Loam	10.2	84.3	49.7	2.69		40	17	23	0.0	21.6	78.4	46.2	32.2						
	SB-B4-01	Bulk	0.0	15.0	Sandy Lean Clay	CL	Sandy Clay Loam	7.1			2.67	114.1 @ 14.4	33	15	18	0.8	39.6	59.6	35.7	23.9	ND3	3.4E-04	2.0E-04	7.4E-05	9.1 / 8.6	29.6 / 33.5
North Borrow	NB-B1-03B	CA	10.5	11.0	Silty Sand	SM	Sandy Loam	5.4	84.4	49.5	2.68		25	22	3	0.0	55.6	44.4	30.3	14.1						
	NB-B2-01B	CA	3.0	3.5	Silty Sand	SM	Sandy Loam	4.9	81.9	50.3	2.64		27	23	4	0.0	51.2	48.8	33.9	15.0						
	NB-B2-04	Bulk	0.0	10.0	Sandy, Silty Clay	CL-ML	Sandy Loam					113.9 @ 14.5	26	19	7	0.0	49.0	51.0	32.5	18.5	ND3	4.0E-04	2.7E-04	7.5E-05	4.9 / 4.7	29.5 / 29.9
Dilco Hill	DH-B1-01B	CA	3.0	3.5	Silty Sand			3.5	88.8	46.6	2.66															
	DH-B1-03	Bulk	0.0	10.0	Sandy, Silty Clay	CL-ML	Sandy Loam	5.4			2.67	117.5 @ 13.8	25	19	6	2.0	47.4	50.6	35.0	15.6	ND4	6.3E-04	7.1E-04	2.5E-04	4.2 / 4.1	39.6 / 35.0
	DH-B1-10	Bulk	35.0	45.0	Lean Clay with Sand	CL	Loam	10.3			2.38					1.5	20.9	77.6	60.9	16.7	ND3	1.6E-04	2.5E-05	3.2E-06	5.8 / 6.0	25.7 / 24.5
	DH-B2-03	CA	15.0	15.5	Silty Clay with Sand	CL-ML	Sandy Loam	10.5	96.7	39.2	2.55		29	24	5	0.0	27.7	72.3	66.9	5.4						
	DH-B3-05	Bulk	20.0	30.0	Sandy Lean Clay	CL	Loam	7.3			2.66	116.3 @ 13.0	29	18	11	2.5	34.6	62.9	45.5	17.4						

Notes: 1. Sample Types: CA = California sample, Bulk = bucket/grab sample

2. USCS = Unified Soil Classification Sysytem, material descriptions are based on field observations, and refined with laboratory data, if available. USCS classifications are provided only where sufficient laboratory data are available. CL = low plasticity clay

3. USDA = United States Department of Agriculture, USDA classifications are based on the sand/silt/clay fraction of the sample and on USDA grain-size designations.

4. LL = liquid limit, PL = plastic limit, PI = plasticity index

5. With the exception of DH-B1-03, which was tested at a density based on the natural in-situ density measured from the CA samples, specimens were remolded to approximately 85% of standard Proctor density and between the estimated natural and optimum water contents for the soil.

6. ND1 = nondispersive clay with very slight to no colloidal erosion under 15-inch or 40-inch head; ND4, ND3 = slightly to moderately dispersive clays that erode slowly under 2-inch or 7-inch head (ASTM test method A)

7. Specimens remolded to approximately 80%, 85%, and 90% of maximum standard Proctor dry density and between the estimated natural and optimum water contents for the soil.

8. Specimens remolded to approximately 85% of maximum standard Proctor dry density and between the estimated natural and optimum water contents for the soil. SWCC tests performed with pairs of speciments for each test.

Table 3-6 Summary of Geotechnical Laboratory Data - Site Stockpiles

Area	Sample	Sample Type [1]	Material Description	USCS [2]	Specific Gravity	Atterberg Limits (%) [4] LL	PL	PI	USCS % Gravel	USCS % Sand	% Passing No. 200 Sieve (fines)	L.A. Abrasion (% loss) [5]	Sodium Sulfate Soundness (% loss) [6]	Absorption (%) [7]	Unconfined Compressive Strength (psi) [8]	Splitting Tensile Strength (psi) [8]
Stockpiles	Topsoil-01	Bulk	Sandy Clay	CL	2.68	33	10	23	2.6	32.4	65.0					
	Topsoil-02	Bulk	Sandy Clay	CL	2.71	39	12	27	0.5	26.8	72.7					
	TI-SP1-01	Bulk	Crusher Fines						1.9	80.8	17.3					
	TI-SP2-01A	Bulk	Erosion Protection Gravel		2.78 [3]				93.0	6.3	0.7	5.7	8.26	1.868		
	TI-SP2-01C	Bulk	Erosion Protection Gravel						83.3	4.9	11.8					
	TI-SP3-01A	Bulk	Road Base (gravel with sand)						67.4	24.6	8.0					
	TI-SP4-01A	Bulk	Erosion Protection Gravel		2.75 [3]				98.0	1.2	0.8	6.1	10.47	2.091		
	TI-SP6 (56A)	Bulk	9-inch riprap												20,780 and 23,630	1,320 and 1,400
	TI-SP6 (56B)	Bulk	9-inch riprap												19,100 and 14,440	1,530 and 1,720

Notes: 1. Bulk = bucket/grab sample

2. USCS = Unified Soil Classification Sysytem, material descriptions are based on field observations, and refined with laboratory data, if available. USCS classifications are provided only where sufficient laboratory data are available. CL = low plasticity clay

3. Average of three bulk saturated surface dry (SSD) specific gravity results for the rock samples (ASTM C127)

4. LL = liquid limit, PL = plastic limit, PI = plasticity index

5. L.A. Abrasion results are percent loss, by mass, for 100 revolutions.

6. Weighted percentage loss for 0.75 to 1.5-inch size range

7. Average of three absorption results

8. Specimens were collected from the 9-inch stockpile and cored for strength testing.

Table 3-6 Geotechnical Test Results

Sample ID[1]	Sample Location	Sample Type	Sample Depth Interval		Gravimetric Water content	Dry Density	Specific gravity	Standard Proctor	
		Units:	top (ft bgs)	bottom (ft bgs)	(% by mass)	(pcf)	(g/cm^3)	max. dry density (pcf)[3]	optimum water content (%)
NECR1-CC01	NECR-1	Bulk	10	20			2.68	120.7	11.9
NECR1-CC17		CA[2]	5.5	6	4.9	92.3			
NECR1-CC17		CA	10.5	11	6.2	96.5			
NECR1-CC17		CA	15.5	16	2	106.7			
NECR1-CC17		CA	20.5	21	19.1	95.8			
NECR1-CC17		Bulk	0	10				120.3	11.3
NECR1-CC17		Bulk	10	20				125.1	10
NECR2-CC05	NECR-2	Bulk	0	10				118.8	11.9
NECR2-CC07		Bulk	0	10			2.71	117.8	11.6
NECR2-CC05		CA	2.5	3	8.1	93.7			
NECR2-CC05		CA	5	5.5	10	D[3]			
NECR2-CC06		CA	3.5	4	4.7	101.1			
NECR2-CC07		CA	6	6.5	2.7	101			
NECR2-CC07		CA	5.5	6	4.5	101.3			
NECR2-CC07		CA	10	10.5	4.1	97.1			
NECR2-CC01		CA	5.5	6	7.4	99.1			
NECR2-CC06		CA	3	3.5	5	103.4			
N2D-CC01	NECR-2 Drainage	Bulk	0	10				115.6	13.4
N2D-CC01		CA	3.5	4	8.6	91.2			
N2D-CC01		CA	6	6.5	4.7	87.2			
N2D-CC01		CA	11	11.5	4	91.8			
NMSA-CC02	NEMSA	CA	3	3.5	8.1	110.6			
NMSA-CC02		CA	6	6.5	20	97.5			
NMSA-CC02		CA	10.5	11	15	86.6			
NMSA-CC04		Bulk	0	15			2.66	125.2	9.8
P2-CC04	Pond 2	Bulk	0	3			2.66	102.0	20.6
P3-CC07	Pond 3	Bulk	0	5			2.63	109.7	13.7
SF2-CC01	Sandfill 2	Bulk	0	10			2.65	121.5	10.5
SF3-CC01	Sandfill 3	Bulk	0	10			2.68	121.7	11.1
SF3-CC01		CA	3.5	4	17	99.3			
SF3-CC01		CA	6	6.5	10.5	96.4			
SF3-CC01		CA	11	11.5	8.2	83.5			
SP-CC13	Sediment Pad	CA	5.5	6	10.2	101.4			
SP-CC13		CA	11	11.5	3.5	100.8			
SP-CC13		CA	15.5	16	6.9	97.5			
SP-CC13		Bulk	0	15			2.62	120.6	11.5

Notes:

pcf=pounds per cubic foot

1. Samples collected October-December 2013 during the Pre-Design Studies
2. CA = 2-inch diameter California sample, Bulk = 5-gallon bucket sample
3. Maximum dry density listed includes rock correction
4. D = Disturbed, moisture content only

ATTACHMENT B

TAILINGS DISPOSAL AREA BOREHOLE LOGS (MWH, 2014A)

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B1**

CONTRACTOR INFORMATION	DRILL RIG INFORMATION		BOREHOLE INFORMATION	
DRILLING COMPANY: NATIONAL	DRILLING RIG: CME 85 HD	BIT TYPE: N/A	CASING DEPTH: N/A	START: 11/21/2013
DRILLER: M. CAIN	DRILLING METHOD: HSA/CC	AUGER O.D.: 8.25"	SURFACE ELEV. (FT): 6969.7	FINISH: 11/21/2013
DRILLER'S HELPER: J. RAMIREZ	HAMMER TYPE: AUTO	HOLE DIAM.: 8.25"	DEPTH TO BEDROCK (FT): N/A	
LOGGED BY: R. SCHAUT	HAMMER WT: 140 lb	CORE DIAM.: 3.0"	TOTAL DEPTH (FT): 70.0	

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
0	14"				NA	(0' - 8") SILTY CLAY (FILL) - Light brown, soft, moist silty clay, trace to few very fine to fine sand.												
						(8" - 12") ROCK - 1/2" to 3" crushed basalt.												
1						(1' - 18.5') SILTY CLAY WITH SAND (FILL) - Dark brown, firm to hard, slightly moist silty clay, little to some very fine to fine sand, occasional coarse sand and gravel (upper ~5' may be compacted radon barrier).												
3						[0 - 5' Core not retained.]												
5	24"	CA 18"	1C	8														
			1B	9														
6			1A	11														
		AC	2															
10	30"	CA 18"	3C	10		[Below ~10', occasional elevated rad readings indicating possible sand tailings mixed with silty clay fill.]												
			3B	12														
11			3A	14		(~11' - ~11.5') 1/2" to 1" gravel observed.												
		AC	4															
13																		

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Rad levels measured with Ludlum Model 2 meter. Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B1**

	FIELD SAMPLE RECOVERY DATA								LABORATORY TEST DATA									
DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	30"	AC	4		NA													
14						(~13 - ~14') - Sand Tailings - see description below, slightly elevated rad readings.]												
15	32"	CA 18"	5C	5														
			5B	6														
16			5A	10			CL		16.2	104.7		33/13/20	0.3	27.2	72.5			
		AC	6															
17																		
18																		
						(18.5' - 34.3') SAND TAILINGS - Pale gray, dense, moist, fine to medium sand tailings, slightly elevated rad levels.												
19																		
20	36"	CA 18"	7C	19														
			7B	22					6.1									
21			7A	24					7.5	105.5			0.0	90.7	9.3	3.7E-4		
22		AC	8															
23																		
24																		
25	30"	ST 28"	9															
26																		
27									4.0	97.6	2.67	NP	0.0	92.7	7.3	2.9E-3		34.9
		AC	10															

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Rad levels measured with Ludlum Model 2 meter. Hole backfilled with cement/bentonite grout.

MWH

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B1**

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
28	30"	AC	10		NA												
29																	
						(29.6' - 34.3') Very fine grained sand tailings, abundant clayey zones.											
30	36"	CA 18"	11C	5				13.9									
			11B	5				14.6	91.6						3.0E-7	0.092	
31			11A	4													
							CL	41.6	76.5	2.69	44/17/27	0.0	30.9	69.1			33.3
32		AC	12				CL	27.8			33/16/17	0.0	46.7	53.3			
33																	
34																	
						(34.3' - ~41') CLAYEY SAND - Loose to medium dense, very moist to wet, very fine-grained clayey sand, increasing clay content with depth.											
35	40"	CA 18"	13C	7													
			13B	20													
36			13A	22		(35' - 36.5') High blow counts due to rock in CA shoe.		21.0	97.3	2.73		0.0	62.5	37.5	1.7E-6	0.059	
		AC	14B														
37																	
		AC	14A														
38																	
39																	
40	42"	CA 18"	15C	3													
			15B	5													
41			15A	5		(~41' - ~45') SANDY CLAY - Very moist to wet sandy clay, sand is very fine-grained.	CL	26.7	98.6		31/15/16	0.0	18.2	81.8	1.2E-7		
42																	

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Rad levels measured with Ludlum Model 2 meter. Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B1**

	FIELD SAMPLE RECOVERY DATA								LABORATORY TEST DATA										
DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	42"	AC	16		NA													
43																		
44																		
45	40"	ST 30"	17			(~45' - 54') CLAYEY SAND - Loose to medium dense, very moist to wet, very fine-grained clayey sand, decreasing clay content with depth.			22.0	106.0							.058	34.4
46																		
47																		
48																		
49																		
50	42"	CA 18"	18C	4														
			18B	5														
51			18A	7														
52																		
53																		
54						(54' - 68.2') SILTY CLAY - Dark brown, firm, very moist to wet silty clay, trace to few very fine sand.												
55	60"	CA 18"		6														
			19B	7														
56			19A	10														
57																		

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Rad levels measured with Ludlum Model 2 meter. Hole backfilled with cement/bentonite grout.

MWH

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B1**

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	60"				NA													
58																		
59																		
60	60"	CA 18"		5														
			20B	8														
61			20A	12														
62																		
63																		
64																		
65	60"	CA 18"		5														
			21B	7														
66			21A	11														
67																		
68						(68.2' - E.O.B.) SILTY SAND - Brown, silty, moist very fine to fine sand.												
69																		
70						E.O.B. at 70.0'												
71																		

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Rad levels measured with Ludlum Model 2 meter. Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B2**

CONTRACTOR INFORMATION	DRILL RIG INFORMATION		BOREHOLE INFORMATION	
DRILLING COMPANY: NATIONAL	DRILLING RIG: CME 85 HD	BIT TYPE: N/A	CASING DEPTH: N/A	START: 11/20/2013
DRILLER: M. CAIN	DRILLING METHOD: HSA/CC	AUGER O.D.: 8.25"	SURFACE ELEV. (FT): 6959.9	FINISH: 11/21/2013
DRILLER'S HELPER: J. RAMIREZ	HAMMER TYPE: AUTO	HOLE DIAM.: 8.25"	DEPTH TO BEDROCK (FT): 33.5	
LOGGED BY: R. SCHAUT	HAMMER WT: 140 lb	CORE DIAM.: 3.0"	TOTAL DEPTH (FT): 38.7	

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
0	8"					(0" - 3") SILTY CLAY - Brown, soft, silty clay, dry, trace few very fine to fine sand.												
				13		(3" - 6") ROCK - 1/2" to 3" crushed basalt.												
1		CA 17"	1B	11		(6" - ~2.5') SILTY CLAY - Dark brown, hard, slightly moist silty clay, few to little very fine sand, occasional coarse sand.												
			1A	18														
2						[0' - 5' Core not retained.]												
3						(~2.5' - 7.3') SILTY SAND WITH GRAVEL - Pale yellow, dense, dry to slightly moist silty very fine to medium sand with coarse sand and gravel.												
5	42"	CA 15"	2B	23														
				22														
6			2A	18					7.7	100.4	2.68		26.9	29.9	43.2			
		AC	3															
7						(7.3' - 12.8') CLAYEY SAND - Predominantly brown, medium dense, slightly moist to moist clayey fine to medium sand, abundant clay "pockets" throughout. May be sand tailings mixed with site soils.												
		AC	4															
10	40"	CA 18"	5C	6														
			5B	7														
11			5A	7					24.5	75.9	2.73		0.0	65.4	34.6			
		AC	6															
12		AC	7															
13						(12.8' - 15') SAND TAILINGS - Pale gray, moist sand												

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Rad levels measured with Ludlum Model 2 meter. Hole backfilled with cement/bentonite grout.
At 8:30 AM on 11/21/13, water was measured at 38.3' bgs (may be due to overnight precipitation as hole was left open overnight).

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	40"	AC	7			tailings, very fine silty sand from 12.8' to 13.2', fine to medium sand from 13.2' to 15'.			39.6				0.0	23.1	76.9			
14																		
15	42"	CA 18"	8C	5		(15' - 25.7') SILTY SAND - Brown, medium dense, moist silty very fine to fine sand, occasional roots. Appears to be natural "alluvium." Occasional dark brown clay lenses. Rad levels ~ background.			6.9	90.4	2.68							
			8B	5														
16			8A	7														
		AC	9															
17																		
		AC	10															
18																		
19																		
20	42"	CA 18"	11C	4														
			11B	4														
21			11A	6					7.0	91.4	2.74		0.0	82.9	17.1			
		AC	12															
22																		
		AC	13															
23																		
24																		
25	48"	CA 18"	14C	5														
			14B	6														
26			14A	6		(25.7' - 33.5') SILTY CLAY - Dark brown, moist, firm to hard, silty clay, trace to few very fine to fine sand, occasional coarse sand.	CL		23.5	93.2		34/16/18	0.0	20.9	79.1			
27																		

LEGEND:
CA = CALIFORNIA SAMPLE (2-INCH OD)
ST = SHELBY TUBE (3-INCH OD)
AC = ACRYLIC LINER
HSA = HOLLOW-STEM AUGER
CC = CONTINUOUS CORE
NR = NO RECOVERY

NOTES:
Rad levels measured with Ludlum Model 2 meter. Hole backfilled with cement/bentonite grout.
At 8:30 AM on 11/21/13, water was measured at 38.3' bgs (may be due to overnight precipitation as hole was left open overnight).

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B2**

	FIELD SAMPLE RECOVERY DATA								LABORATORY TEST DATA										
DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
28	48"																	
29																		
30	54"	CA 18"	15C	6														
			15B	11														
31			15A	12														
32						(32' - 33.5') Softer (soft to firm).												
33																		
						(33.5' - 38.7') WEATHERED SANDSTONE - Mottled pale yellow and reddish orange, moist, fissile, lightly cemented, very fine to fine sand.												
34																		
35	48"	NR		50/ 1"														
36																		
37																		
38					16	Bag sample of SS Core.			13.5	X								
39						E.O.B. = 38.7' (Practical Auger Refusal)												
40																		
41																		
42																		

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Rad levels measured with Ludlum Model 2 meter. Hole backfilled with cement/bentonite grout.
At 8:30 AM on 11/21/13, water was measured at 38.3' bgs (may be due to overnight precipitation as hole was left open overnight).

CLIENT:

PROJ. LOC.: GALLUP, NM

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B3**

CONTRACTOR INFORMATION	DRILL RIG INFORMATION		BOREHOLE INFORMATION	
DRILLING COMPANY: NATIONAL	DRILLING RIG: CME 85 HD	BIT TYPE: N/A	CASING DEPTH: N/A	START: 11/19/2013
DRILLER: M. CAIN	DRILLING METHOD: HSA/CC	AUGER O.D.: 8.25"	SURFACE ELEV. (FT): 6968.6	FINISH: 11/19/2013
DRILLER'S HELPER: J. RAMIREZ	HAMMER TYPE: AUTO	HOLE DIAM.: 8.25"	DEPTH TO BEDROCK (FT): N/A	
LOGGED BY: R. SCHAUT	HAMMER WT: 140 lb	CORE DIAM.: 3.0"	TOTAL DEPTH (FT): 70.0	

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
0	31"					(0' - 0.8') SANDY CLAY FILL - Brown, hard, slightly moist sandy clay, silty, sand is fine-grained.												
0.8						(0.8' - 10.8') GRAVELLY SAND FILL - Pale yellow, dense, slightly moist gravelly very fine to medium sand.												
5	33"	CA 7"		18		[Sample loose - not retained.]												
				50/ 6"														
10	50"	CA 18"	1C	30														
			1B	34														
10.8			1A	43		(10.8' - 16.8') SILTY SAND FILL - Yellow/orange, dense, moist very fine to fine sand, silty, occasional gravel.			5.1	108.4	2.64		5.4	74.7	19.9			

LEGEND:
CA = CALIFORNIA SAMPLE (2-INCH OD)
ST = SHELBY TUBE (3-INCH OD)
AC = ACRYLIC LINER
HSA = HOLLOW-STEM AUGER
CC = CONTINUOUS CORE
NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout. At 7:45 AM on 11/20/14, water was measured at 65.8' bgs.

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	50"																
14																	
15	38"	CA 18"	2C	18													
			2B	21													
16			2A	28				4.7	105.3								
17						(16.8' - 46.5') SANDY CLAY - Dark brown, firm to hard, moist sandy clay, very fine to fine sand.											
18																	
19																	
20	50"	ST 28.5"	3														
21							CL	16.0	111.1		30/12/18	0.0	32.8	67.2			32.2, 195
22																	
23						(22.6' - 26') More sand and gravel.											
24																	
25	52"	CA 18"	4C	10													
			4B	12													
26			4A	16			CL	12.0	106.8		25/13/12						
27																	

LEGEND:
CA = CALIFORNIA SAMPLE (2-INCH OD)
ST = SHELBY TUBE (3-INCH OD)
AC = ACRYLIC LINER
HSA = HOLLOW-STEM AUGER
CC = CONTINUOUS CORE
NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout. At 7:45 AM on 11/20/14, water was measured at 65.8' bgs.

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
28	52"																	
30	58"	CA 18"	5C	10														
			5B	10														
31			5A	19					16.1	108.4								
						(31.5' - 36') More sand: Sandy/Silty Clay.												
35	48"	ST 28"	6						10.5									
							SC		14.7	102.2	2.67	23/14/9	2.1	50.2	47.7			33.7, 135
40	57"	CA 18"	7C	3		(~40') Becomes very moist to wet.												
			7B	7														
41			7A	6					21.5	90.6			0.0	33.8	66.2			
42																		

LEGEND:
CA = CALIFORNIA SAMPLE (2-INCH OD)
ST = SHELBY TUBE (3-INCH OD)
AC = ACRYLIC LINER
HSA = HOLLOW-STEM AUGER
CC = CONTINUOUS CORE
NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout. At 7:45 AM on 11/20/14, water was measured at 65.8' bgs.

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B3**

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	57"																	
45	48"	CA 17"		6														
			8B	7					17.0	110.1								29.3, 293
46			8A	12					18.0	104.8		28/13/15						
						(46.5' - ~55') SILTY/CLAYEY SAND - Brown, loose, very moist to wet, silty/clayey very fine sand.												
50	27"	CA 17"	9C	2		["B" and "C" samples are best.]												
			9B	3														
51			9A	6														
55	30"	ST 24"	10			(~55' - 57.3') SILTY CLAY - Dark brown, firm to hard, wet silty clay, few to little very fine sand.												
							CL		22.1	105.3	2.72	43/14/29	0.0	11.7	88.3			22.2, 494

Depth scale: 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout. At 7:45 AM on 11/20/14, water was measured at 65.8' bgs.

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B3**

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	30"					(57.3' - 61.9') SILTY SAND - Brown, loose, wet, silty very fine to fine sand.												
58																		
59																		
60	33"	CA 18"	11C	3														
			11B	5														
61			11A	4					25.8	99.0			0.0	22.0	78.0			
62						(61.9' - E.O.B.) SILTY CLAY - Dark brown, firm to hard, wet silty clay, trace to few very fine to fine sand.												
63																		
64																		
65	32"	ST 28"	12															
66																		
67																		
68																		
69																		
70						E.O.B. at 70'												
71																		

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout. At 7:45 AM on 11/20/14, water was measured at 65.8' bgs.

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B8**

CONTRACTOR INFORMATION	DRILL RIG INFORMATION		BOREHOLE INFORMATION	
DRILLING COMPANY: NATIONAL	DRILLING RIG: CME 85 HD	BIT TYPE: N/A	CASING DEPTH: N/A	START: 12/3/2013
DRILLER: M. CAIN	DRILLING METHOD: HSA/CC	AUGER O.D.: 8.25"	SURFACE ELEV. (FT): 6976.1	FINISH: 12/4/2013
DRILLER'S HELPER: L. ALDAZ	HAMMER TYPE: AUTO	HOLE DIAM.: 8.25"	DEPTH TO BEDROCK (FT): 60.5	
LOGGED BY: R. SCHAUT	HAMMER WT: 140 lb	CORE DIAM.: 3.0"	TOTAL DEPTH (FT): 65.5	

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
0–7						(0' - ~7') SANDY CLAY - Dark brown, slightly moist sandy clay, silty, sand is very fine to fine-grained, occasional coarse sand and fine gravel. (0' - 20' No sampling. Material descriptions based on cuttings and should be considered approximate.)												
7–13						(~7' - ~18') SAND TAILINGS - Predominantly pale yellowish brown, fine to medium grained, slightly moist, some clayey material.												

LEGEND:
CA = CALIFORNIA SAMPLE (2-INCH OD)
ST = SHELBY TUBE (3-INCH OD)
AC = ACRYLIC LINER
HSA = HOLLOW-STEM AUGER
CC = CONTINUOUS CORE
NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM	CLIENT: NECR - PRE DESIGN STUDY INVESTIGATION	BORING LOG	BOREHOLE ID: TI-B8

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
14																		
15																		
16																		
17																		
18						(~18' - 20.7') SANDY CLAY - Dark brown, firm to hard, slighly moist sandy clay, very fine to fine sand, few to little coarse sand and fine gravel.												
19																		
20	36"					Begin sampling at 20'												
		AC	8															
21						(20.7' - 26.3') SAND TAILINGS - Pale yellow, medium dense, slightly moist to moist, fine to medium sand tailings, silty.												
22																		
23																		
24																		
25	54"	CA 18"	2C	7					9.0	103.7	2.72							
			2B	7					6.2	99.6			0.0	87.9	12.7	3.6E-4		
26			2A	10			SM		16.8	91.7		NP	0.0	76.0	24.0			
		AC	3B			(26.3' - ~31') FINE TAILINGS - Soft to firm, moist. (26.3' - 28.8') - Pale yellowish brown, few to little very fine sand.												
27																		
		AC	3A															

LEGEND:
CA = CALIFORNIA SAMPLE (2-INCH OD)
ST = SHELBY TUBE (3-INCH OD)
AC = ACRYLIC LINER
HSA = HOLLOW-STEM AUGER
CC = CONTINUOUS CORE
NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
28	54"	AC	3A														
29						(28.8' - 31') Pale gray, no sand.											
30	24"	ST 23"	4				CH	61.8	62.7		74/25/49	0.0	9.2	90.8		0.43	
31						(~31' - ~32.5') SAND TAILINGS - Pale yellowish brown, medium dense, moist, fine to medium sand, trace silt.		41.4									
32																	
33		AC	5			(~32.5' - 35') FINE TAILINGS WITH SAND - Pale gray, soft, moist, very fine to fine sand.											
34																	
35	30"	ST 28"	6			(35' - 38.6') CLAYEY/SILTY SAND TAILINGS - Pale yellowish gray, soft, moist, very fine to fine sand.		14.3	90.9	2.66							
								16.5	89.6	2.67					1.6E-5		
36																	
37																	
38		AC	7														
39						(38.6' - 44.5') FINE TAILINGS - Pale gray, firm, moist, trace to few very fine sand.											
40	37"	ST 27"	8														
41								39.7	80.4	2.63							
							SC / CL	34.3	83.6		35/16/19	0.0	51.2	48.8	1.3E-7	0.262	
42																	

LEGEND:
CA = CALIFORNIA SAMPLE (2-INCH OD)
ST = SHELBY TUBE (3-INCH OD)
AC = ACRYLIC LINER
HSA = HOLLOW-STEM AUGER
CC = CONTINUOUS CORE
NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

MWH

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B8**

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	37"	AC	9			(42.5' - 43.7') More sand (little to some).											
43																	
								29.3	92.3								
44								43.3	74.8			0.0	14.5	85.5	3.0E-8		
						(44.5' - 60.5') SILTY/CLAYEY SAND - Predominantly yellowish brown, medium dense, moist silty/clayey very fine to fine sand with abundant clay zones (as shown), occasional coarse sand throughout.				2.60							
45	48"	CA 18"	10C	6		(44.5' - 47.5') Silty clay with sand.											
			10B	9													
46			10A	10			CL	21.9	95.2	2.72	30/16/14	0.0	27.9	72.1			
47																	
48																	
49						(49' - 50') Reddish brown.											
50	40"	CA 18"		9													
			11B	10													
51			11A	12													
52																	
53																	
						(53.4' - 55') Silty clay with sand.											
54																	
55	42"	CA 18"	12C	8													
			12B	8													
56			12A	8			SM	12.6	97.6	2.70	NP	0.0	57.0	43.0			
57																	

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

MWH

PROJ. LOC.: GALLUP, NM

CLIENT: NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B8**

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
57	42"																	
58.7						(58.7' - 59.5') Silty clay with sand.												
59.5						(59.5' - 60') Reddish brown, fine to medium sand.												
60	48"	CA 18"	13C	16														
60.5			13B	22		(60.5' - 61') COAL - sandy.												
61			13A	50/ 4"		(61' - E.O.B.) SHALE - Dark grayish brown, hard to very hard, moist, silty, trace very fine sand.												
63.5					14	(bagged core)												
64	12"					At 64' - becomes fissile, very hard, brittle, more sand (few to little).												
65		CA 2"	15	50/ 2"		65.2' E.O.B. (Practical Auger Refusal at 65.0')												

Depth scale: 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM	CLIENT: NECR - PRE DESIGN STUDY INVESTIGATION	BORING LOG	BOREHOLE ID: TI-B10

CONTRACTOR INFORMATION	DRILL RIG INFORMATION		BOREHOLE INFORMATION	
DRILLING COMPANY: NATIONAL	DRILLING RIG: CME 85 HD	BIT TYPE: N/A	CASING DEPTH: N/A	START: 11/26/2013
DRILLER: M. CAIN	DRILLING METHOD: HSA/CC	AUGER O.D.: 8.25"	SURFACE ELEV. (FT): 6973.3	FINISH: 11/27/2013
DRILLER'S HELPER: J. RAMIREZ	HAMMER TYPE: AUTO	HOLE DIAM.: 8.25"	DEPTH TO BEDROCK (FT): 105.0	
LOGGED BY: R. SCHAUT	HAMMER WT: 140 lb	CORE DIAM.: 3.0"	TOTAL DEPTH (FT): 108.2	

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
0	21"					(0' - 0.6') SANDY CLAY - Light brown, soft, very moist sandy clay, very fine sand, some roots, silty.												
						(0.6' - 0.9') ROCK - 1/2" to 3" crushed basalt.												
1						(0.9' - 6.8') SANDY CLAY - Dark brown, hard, slighly moist to moist sandy clay, very fine to fine sand, occasional coarse sand to fine gravel, silty.												
2																		
3																		
4																		
5	45"	CA 17"		12														
			1B	13														
6			1A	19														
7						(6.8' - 18.9') SILTY SAND TAILINGS - Pale yellowish gray, loose to medium dense, moist, fine to medium, silty sand tailings, occasional more clayey/silty zones.												
8																		
9																		
10	33"	ST 27.5"	2						9.7	110.0	2.63							
									9.0	96.8			0.2	71.9	27.9	4.3E-4	0.094	
11																		
12																		
		AC	3						6.7		2.61							
13									7.5	99.1			0.7	71.5	27.8	6.7E-5		

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

MWH	CLIENT: GE / UNC	BORING LOG	BOREHOLE ID: TI-B10
PROJ. LOC.: GALLUP, NM	NECR - PRE DESIGN STUDY INVESTIGATION		

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	33"	AC	3														
14																	
15	42"	CA 18"	4C	5				9.3	103.0								
			4B	5													
16			4A	5			SM	6.5	100.0	2.65	NP	2.4	82.3	15.3			
		AC	5B														
17																	
		AC	5A														
18																	
19						(18.9' - 24.4') FINE TAILINGS - Pale gray, soft, moist, trace to few fine to medium sand.											
20	36"	ST 30"	6														
21																	
							CL	26.7	92.9		43/19/24	0.0	43.0	57.0		0.111	
22																	
		AC	7														
23																	
24																	
						(24.4' - 25.7') SAND TAILINGS - Pale yellowish gray, loose, moist to very moist, fine to medium sand.											
25	42"	CA 18"	8C	2													
			8B	2													
						(25.7' - ~31') FINE TAILINGS - Pale gray, soft, moist to very moist, trace to few fine to medium sand.		41.0									
26			8A	3			CH	57.4	64.3	2.80	74/27/47	0.0	10.0	90.0			
		AC	9B														
27																	
		AC	9A														

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B10**

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
28	42"	AC	9A														
30	42"	ST 27"	10				CH	45.3	73.4	2.78	57/22/35	0.0	24.3	75.7			
31						(~31' - 33.2') SAND TAILINGS - See description for 24.4' - 25.7'.											
32							SM	15.4	100.1	2.67	NP	0.0	83.1	16.9			
		AC	11														
33						(33.2' - 44.6') FINE TAILINGS - Pale gray, soft, moist to very moist.											
35	48"	CA 18"	12C	2				47.7	72.5								
			12B	2				51.4									
36			12A	2			SC / CL	32.2	87.8	2.72	36/16/20	0.0	50.6	49.4			
		AC	13B			(36.3' - 37.8') Some very fine to fine sand.											
37		AC	13A														
40	30"	ST 30"	14					45.7	73.7	2.56							
							CH	47.2	74.5		61/21/40	0.0	20.7	79.3	2.9E-8	0.315	
42																	

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM

CLIENT: NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B10**

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	30"	ST 30" AC	14 / 15															
43																		
44						(44.3' - 44.6') Appears finer grained (clayey), lighter gray, more moist.												
						(44.6' - 85.5') SILTY SAND - Light brown, medium dense, moist, silty very fine to fine sand, occasional coarse sand and fine gravel.												
45	42"	CA 17"		12														
			16B	12														
46			16A	14					9.9	95.4	2.74		0.0	65.8	34.2			
47																		
48																		
49																		
50	48"	CA 18"	17B	10														
			17A	11														
51				14														
52																		
53																		
54																		
55	42"	ST 17"	18						14.1	100.8						2.4E-5	0.139	
56						(~56' - 57.5') Gravelly.												
						(Shelby Tube refusal at 56.5')												
57																		

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	42"																	
58																		
59																		
60	39"	CA 18"		11														
			19B	11														
61			19A	14														
62																		
						(62.5' - 65.2') Weathered Sandstone (?) - Hard, moist, gravelly.												
63																		
64																		
65	48"	CA 18"		14														
			20B	14														
66			20A	15			SM / ML		13.8	94.5		NP	0.0	50.1	49.9			
67																		
68																		
69																		
70	30"	CA 18"		4														
			21B	6		(70.5' - 71.5') Moist to very moist, increased clay.												
71			21A	10					18.1	100.8								

LEGEND:
CA = CALIFORNIA SAMPLE (2-INCH OD)
ST = SHELBY TUBE (3-INCH OD)
AC = ACRYLIC LINER
HSA = HOLLOW-STEM AUGER
CC = CONTINUOUS CORE
NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
72	30"																	
73																		
74																		
75	42"	CA 18"		5														
			22B	7														
76			22A	11														
77																		
78																		
79																		
80	36"	CA 18"		9		(80' - 82') Gravelly (sandstone fragments)												
			23B	14														
81			23A	17														
82						(82' - 85.5') Weathered Sandstone - Mottled red/gray/brown, moist, fine to medium weathered sandstone.												
83																		
84	NA	3"	24	50/ 3"														
85	50"																	
86						(85.5' - 105') CLAYEY SAND - Dark brown, firm, very moist to wet, fine to medium clayey sand, occasional sandstone fragments.												

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM	CLIENT: NECR - PRE DESIGN STUDY INVESTIGATION	BORING LOG	BOREHOLE ID: TI-B10

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	50"																	
87																		
88																		
89																		
90	40"	CA 18"		7		[CA sampler wet 11/26/13.] [Water measured at approximately 90.2' bgs at 9:30 11/27/13.]												
			25B	12														
91			25A	10					18.6	105.6	2.66							
92																		
						[Core barrel wet 11/27/13.]												
93																		
94																		
95	52"	NR		1														
				5														
96				8														
97																		
						[Core barrel wet.]												
98																		
99																		
100	44"																	
101																		

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM

CLIENT: NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B10**

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	44"																	
102																		
						[Core barrel wet.]												
103																		
104																		
105	36"					(105' - E.O.B.) WEATHERED SANDSTONE - Pale yellowish brown, very dense, very moist, very fine to fine sandstone, some cemented zones.												
106																		
						[Core barrel wet.]												
107					26	(106.9' - 107.3') Bagged core sample.			14.2	109.1						1.4E-7		
108		1"		50/ 1.5"	27	(107.9' - 108') Bagged core sample. (108') CA sample not retained.												
						E.O.B. = 108.2 ft at 9:00 on 11/27/13 (practical auger refusal)												
109																		
110																		
111																		
112																		
113																		
114																		
115																		

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

MWH

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B11**

CONTRACTOR INFORMATION	DRILL RIG INFORMATION		BOREHOLE INFORMATION	
DRILLING COMPANY: NATIONAL	DRILLING RIG: CME 85 HD	BIT TYPE: N/A	CASING DEPTH: N/A	START: 12/2/2013
DRILLER: M. CAIN	DRILLING METHOD: HSA/CC	AUGER O.D.: 8.25"	SURFACE ELEV. (FT): 6977.3	FINISH: 12/3/2013
DRILLER'S HELPER: J. RAMIREZ	HAMMER TYPE: AUTO	HOLE DIAM.: 8.25"	DEPTH TO BEDROCK (FT): 96.9	
LOGGED BY: R. SCHAUT	HAMMER WT: 140 lb	CORE DIAM.: 3.0"	TOTAL DEPTH (FT): 103.0	

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
0	19"					(0' - 0.6') SANDY CLAY - Brown, soft, moist to very moist sandy clay, very fine to fine sand, roots, silty.												
0.6						(0.6' - 0.9') ROCK - 1/2" to 3" crushed basalt, silty clay in voids.												
0.9						(0.9' - 10.3') SANDY CLAY - Dark brown, hard, slightly moist sandy clay, very fine to fine sand, occasional coarse sand and gravel up to 1.5".												
5	30"	CA 17"	1C	12														
			1B	16														
6			1A	15					8.6	93.5								
10	42"	CA 18"	2C	7														
10.3						(10.3' - 12') SILTY SAND - Light brown, medium dense, slightly moist, silty very fine to fine sand.												
			2B	7														
			2A	8														
12						(12' - 15') SANDY CLAY - Dark brown, firm to hard, slightly moist sandy clay, very fine to fine sand, occasional gravel up to 3" size.												

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	42"																	
14																		
15	45"	ST 13"	3			(15' - 18') CLAYEY SAND - Light yellowish brown, medium dense, slightly moist, fine to medium clayey sand, occasional gravel up to 1".			8.2	110.4	2.67		3.9	57.6	38.5	2.5E-5	0.09	
16																		
17																		
18						(18' - 32.9') SANDY CLAY - Predominantly dark brown, hard, slighly moist sandy clay, silty, very fine to medium sand, few to little coarse sand and gravel up to ~1" size.												
19						(19.2' - 19.4') Sand, very fine to fine.												
20	48"	CA 18"	4C	4														
			4B	7														
21			4A	10					12.3	107.6								
22																		
23																		
24																		
25	56"	CA 18"	5C	7														
			5B	8														
26			5A	13														
27																		

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B11**

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
28	56"																	
29																		
30	47"	ST 21"	6				CL		13.7	112.4		30/13/17	7.1	41.3	51.6	9.0E-7	0.06	
31																		
32																		
33						(32.9' - 34') SAND (TAILINGS?) - Pale yellowish gray, slightly moist, fine to medium sand.												
34	NA					(34' - 45.5') SANDY CLAY WITH GRAVEL - Dark brown, firm to hard, moist sandy clay with very fine to coarse sand and gravel up to ~3", some metallic and fibrous debris.												
35						[34' - 38' Drilling through metallic debris (appers to be metal siding). Center bit required to penetrate debris. No core collected. CA sample attempted at 34' and 35' - no penetration or recovery.]												
36																		
37																		
38																		
39																		
40	51"	CA 3"		25 27 22		[Metallic debris in CA shoe - no sample.]												
41																		
42																		

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B11**

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	51"																	
45	60"	CA 18"	7C	7		(Photo 310 at 46'.)												
			7B	7		(45.5' - 53.9') FINE TAILINGS - Mottled orange and dark greenish gray (to 50'), pale yellowish gray (50' - 53.9'), firm, moist tailings.			88.7									
46			7A	8		[Photo 311 at 46.5'.]												
50	43"	ST 28"	8															
							CH		59.9	63.7	2.84	91/30/61	0.0	2.7	97.3	3.1E-8	0.48	
		AC	9			[Photo 312 at 52.5']												
54						(53.9' - 55') SILTY CLAY - Dark brown, hard, moist silty clay, trace very fine sand.												
55	48"	ST 25"	10			(55' - 77.5') SILTY SAND - Yellowish brown, medium dense, slighly moist to moist, silty, very fine to fine sand.												
56							SM		16.2	77.9	2.64	NP	0.0	60.4	39.6	5.6E-4	0.129	

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM	CLIENT: NECR - PRE DESIGN STUDY INVESTIGATION	BORING LOG	BOREHOLE ID: TI-B11

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	48"																	
		AC	11															
58																		
59																		
60	48"	CA 17"		9														
			12B	11														
61			12A	12		(61.1' - 62.1') Sandy clay.			16.0	95.4			0.0	38.7	61.3			
62																		
63						(63.1' - 64') Sandy clay.												
64																		
65	49"	CA 18"	13C	7														
			13B	7														
66			13A	12					14.2	96.2								
67																		
68																		
69																		
70	44"	CA 18"	14C	7														
			14B	9														
71			14A	10														

LEGEND:
CA = CALIFORNIA SAMPLE (2-INCH OD)
ST = SHELBY TUBE (3-INCH OD)
AC = ACRYLIC LINER
HSA = HOLLOW-STEM AUGER
CC = CONTINUOUS CORE
NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
72	44"																	
						(71.5' - 73.5') Abundant clayey sand zones.												
73																		
74																		
75	38"	CA 18"	15C	7														
			15B	8														
76			15A	11														
77																		
					16	(77.5' - 78') WEATHERED SANDSTONE - Rusty red, moist, fine to medium grained. (Sample #16 is bagged core.)												
78						(78' - 96.9') GRAVELLY SAND - Mottled rusty red/brown/yellow, dense, moist fine to medium sand, silty throughout, some clayey zones, abundant coarse material from coarse sand up to 3" gravel comprised of cemented sandstone.												
79																		
80	42"	CA 18"	17C	16														
			17B	21														
81			17A	21					11.0	107.6	2.76		12.9	65.6	21.5			
82																		
83																		
84																		
85	36"	CA 17"	18C	18														
			18B	21														
86			18A	19														

LEGEND:
CA = CALIFORNIA SAMPLE (2-INCH OD)
ST = SHELBY TUBE (3-INCH OD)
AC = ACRYLIC LINER
HSA = HOLLOW-STEM AUGER
CC = CONTINUOUS CORE
NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM

CLIENT: NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B11**

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	36"					(~86.7' - 87.2) Clayey.												
90	48"	NR		3, 5, 6		(~90' to 96.9') Becomes very moist to wet.												
92						(92' - 92.5') Clayey. [Core barrel is wet.]												
95	55"	CA 14"	19B, 19A	13, 20, 18														
96.9						(96.9' - E.O.B.) WEATHERED SANDSTONE - Pale yellowish brown, very dense, moist to very moist, fissile, fine-grained, weakly cemented.												
98					21	(98' - 98.3') Bagged core sample.												
100		CA 2"	20A	50/ 2"					21.1	103.9						1.3E-5		

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
102						(102.5' - 103') Reddish brown, strongly cemented sandstone.												
103						E.O.B. at 103.0' at 10:00 (practical auger refusal)												
104																		
105																		
106																		
107																		
108																		
109																		
110																		
111																		
112																		
113																		
114																		
115																		

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B15**

CONTRACTOR INFORMATION	DRILL RIG INFORMATION		BOREHOLE INFORMATION	
DRILLING COMPANY: NATIONAL	DRILLING RIG: CME 85 HD	BIT TYPE: N/A	CASING DEPTH: N/A	START: 12/5/2013
DRILLER: M. CAIN	DRILLING METHOD: HSA/CC	AUGER O.D.: 8.25"	SURFACE ELEV. (FT): 6976.8	FINISH: 12/5/2013
DRILLER'S HELPER: L. ALDAZ	HAMMER TYPE: AUTO	HOLE DIAM.: 8.25"	DEPTH TO BEDROCK (FT): N/A	
LOGGED BY: R. SCHAUT	HAMMER WT: 140 lb	CORE DIAM.: 3.0"	TOTAL DEPTH (FT): 71.5	

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
0	18"					(0' - 0.5') SANDY CLAY - Brown, soft, moist to very moist sandy clay, very find sand, roots.												
0.5						(0.5' - 0.8') ROCK - Crushed basalt, up to 3" size, sandy clay in voids.												
0.8						(0.8' - ~3') SANDY CLAY - Dark yellowish brown, hard, moist sandy clay, very fine to fine sand.												
3						(~3' - 30') SILTY SAND TAILINGS - Pale yellowish gray, loose to medium dense, moist, fine to medium sand.												
5	30"	CA 18"	1C	10														
5.5			1B	11														
6			1A	12					5.4	101.1			0.0	87.5	12.5			
6.5		AC	2															
10	30"	CA 18"		3														
10.5			3B	3														
11			3A	3					6.8	93.8								
11.5		AC	4															

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

MWH

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B15**

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	30"	AC	4			(13.5' - 13.8') Silty sand tailings.	SM		19.0		2.68	NP	0.0	69.6	30.4			
14																		
15	32"	ST 27"	5				SM		14.2	90.4	2.66	NP	0.0	54.9	15.1	8.3E-4	0.126	
16																		
17		AC	6															
18																		
19						(~19.5' to ~25') Becomes slightly finer grained (very fine to medium sand), slightly clayey.												
20	28"	CA 18"	7C	3														
			7B	2														
21			7A	4			SM		12.7	99.8	2.68	NP	0.0	80.6	19.4			
		AC	8															
22																		
23																		
24																		
25	27"	ST 23"	9															
26																		
27		AC	10			(~27' and below) Becomes clayey.												

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B15**

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
28	27"	AC	10			(~28.5' - 30') Very fine to fine sand	SM		19.3		2.66	NP	0.0	65.4	34.6			
30	36"	CA 18"	11C	6		(30' - ~32') SILTY SAND - Dark brown, medium dense, moist silty sand, very fine to fine sand.												
			11B	7														
31			11A	10			SM		22.3 17.1	101.8	2.71	NP	6.2	51.9	41.9			
32		AC	12			(~32' - 38') SILTY CLAY - Dark brown, firm to hard, moist silty clay, trace to few very fine to fine sand.												
35	40"	CA 18"	13C	8														
			13B	12														
36			13A	15														
38						(38' - 45') CLAYEY SAND - Yellowish brown, medium dense, moist clayey very fine to fine sand, silty, occasional 1-6" sandy clay zones.												
40	48"	CA 18"		10														
			14B	9														
41			14A	12					11.4	87.1								
42																		

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

MWH

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B15**

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	48"																	
43																		
44																		
45	26"	CA 18"	15C	13		(45' - 50') SANDY SILT - Dark yellowish brown, hard, moist, very fine to fine sand, occasional clayey sand zones.												
			15B	25														
46			15A	26					25.8									
									17.3	99.3	2.81	NP	0.0	37.0	63.0			
47																		
48																		
49																		
50	24"	CA 18"	16C	6		(50' - 52') CLAYEY SAND - Yellowish brown, medium dense, moist, very fine to fine sand, silty.												
			16B	8														
51			16A	11														
52						(52' - 65') SILTY CLAY - Dark yellowish brown, firm to hard, moist silty clay, trace to few very fine to fine sand, occasional thin (1-6") clayey sand zones.												
53						(~53' - 55') Very hard, very dense clay.												
54																		
55	18"	CA 18"	17C	10														
			17B	11														
56			17A	12					11.7	104.2								
57																		

LEGEND:
CA = CALIFORNIA SAMPLE (2-INCH OD)
ST = SHELBY TUBE (3-INCH OD)
AC = ACRYLIC LINER
HSA = HOLLOW-STEM AUGER
CC = CONTINUOUS CORE
NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM

CLIENT:

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B15**

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	18"																	
58																		
59																		
60	60"	CA 18"	18C	8														
			18B	11														
61			18A	15														
62																		
63																		
64																		
65	40"	CA 18"		6		(65' - E.O.B.) CLAYEY SAND - Yellowish brown, medium dense, moist, very fine to fine clayey sand, silty, occasional 1-3" zones of sandy clay.												
			19B	8														
66			19A	10					12.7	100.7								
67																		
68																		
69																		
70		CA 18"		7														
			20B	6														
71			20A	9														
						E.O.B. 71.5' at 14:30												

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

PROJ. LOC.: GALLUP, NM	CLIENT: NECR - PRE DESIGN STUDY INVESTIGATION	BORING LOG	BOREHOLE ID: TI-B23

CONTRACTOR INFORMATION	DRILL RIG INFORMATION		BOREHOLE INFORMATION	
DRILLING COMPANY: NATIONAL	DRILLING RIG: CME 85 HD	BIT TYPE: N/A	CASING DEPTH: N/A	START: 12/6/2013
DRILLER: M. CAIN	DRILLING METHOD: HSA/CC	AUGER O.D.: 8.25"	SURFACE ELEV. (FT): 6959.3	FINISH: 12/6/2013
DRILLER'S HELPER: L. ALDAZ	HAMMER TYPE: AUTO	HOLE DIAM.: 8.25"	DEPTH TO BEDROCK (FT): 43.0	
LOGGED BY: R. SCHAUT	HAMMER WT: 140 lb	CORE DIAM.: 3.0"	TOTAL DEPTH (FT): 70.5	

FIELD SAMPLE RECOVERY DATA / LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
0	39"					(0' - 0.6') SANDY CLAY - Light brown, soft, moist, very fine to fine sand, roots.												
0.6						(0.6' - 0.9') ROCK - Crushed basalt, 1/2" - 3", sandy clay in voids.												
0.9						(0.9' - 5') SANDY CLAY - Firm to hard, slighly moist to moist, sandy clay, very fine to fine sand, occasional coarse sand and very fine gravel.												
5	44"	CA 18"	1C	12		(5' - 7') SILTY SAND WITH GRAVEL - Light brown, medium dense, slightly moist to moist, silty very fine to fine sand with little to some gravel to 2".												
			1B	14														
			1A	10														
7						(7' - 13.4') SANDY CLAY - See 0.9' to 5' above.												
10	42"	CA 16"		5														
			2B	4														
			2A	6														

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

MWH PROJ. LOC.: GALLUP, NM	CLIENT: GE / UNC — NECR - PRE DESIGN STUDY INVESTIGATION	BORING LOG	BOREHOLE ID: TI-B23

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	42"					(13.4' - 14.2') FINE TAILINGS WITH SAND - Pale gray, soft to firm, moist with very fine to fine sand tailings.											
14						(14.2' - ~16') SILTY SAND TAILINGS - Pale yellowish gray, loose, moist, fine to medium sand.											
15	25"	ST 28"	3					20.7	87.7	2.77		0.0	62.8	37.2			
16						(~16' - 20.3') SANDY CLAY - Dark yellowish brown, firm, moist, very fine to fine sand.											
17								22.5	101.9	2.73		0.0	31.1	68.9			
		AC	4														
18																	
19																	
20	36"	CA 18"	5C	5													
			5B	6		(20.3' - 23') SILTY SAND - Yellowish brown, medium dense, moist, silty very fine to fine sand.											
21			5A	7													
22																	
23						(23' - 38.6') SILTY CLAY - Predominantly dark yellowish brown, firm to hard, moist silty clay with varying amount of sand as shown, occasional coarse sand to very fine gravel throughout.											
24						(23' - 27.5') Trace to few sand.											
25	39"	ST 30"	6														
26							CL	21.6	101.7	2.73	49/18/31	0.0	8.8	91.2		0.05	
27																	
						(27.5' - 30') Little to some sand.											

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

FIELD SAMPLE RECOVERY DATA | LABORATORY TEST DATA

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
28	39"																	
29																		
30	44"	CA 18"		5		(30' - 30.5') Gravelly.												
			7B	6		(30.5' - ~33.5') Little to some sand.												
31			7A	8														
32																		
33																		
						(~33.5' - ~34.3') Clayey sand, very fine to fine.												
34						(~34.3' - 38.6') Few to little sand.												
35	42"	ST 28"	8															
36																		
37																		
38																		
39						(38.6' - 40.3') CLAYEY SAND - Yellowish brown, medium dense, moist, very fine to fine sand, silty.												
40	25"	CA 18"		6														
			9B	9		(40.3' - 43') SILTY CLAY WITH SAND - Dark yellowish brown, firm to hard, moist, silty clay with little to some very fine to fine sand.												
41			9A	12														
42																		

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	25"																	
43						(43' - 65.5') SANDSTONE - Mostly very pale yellowish gray, moist, mostly non-or weakly cemented very fine to fine sand, some very hard, strongly cemented, fissile zones as shown, some clay zones as shown ("Zone 3"?).												
44						(43' - 43.6') Strongly cemented, fissile. (43.6' - 44') Clay - yellowish brown, firm to hard, moist, slightly silty.												
45	32"	CA 8"	10A	13 50/ 3"		(44' - 45.5') strongly cemented, fissile. (45.5' - 46.2') Clayey sand, yellowish brown.			13.8	108.7						2.4E-7		
46																		
47	16"					(~47' - ~48') Very hard, strongly cemented, fissile.												
48																		
49		CA NR		50/ 4"														
50	29"																	
51																		
52																		
53																		
54																		
55	33"	CA 3"	11A	50/ 5"		(~55' - 63') Coarser (fine to medium).												
56						(~56' - 56.8') Color is reddish yellow.												
57																		

LEGEND:
CA = CALIFORNIA SAMPLE (2-INCH OD)
ST = SHELBY TUBE (3-INCH OD)
AC = ACRYLIC LINER
HSA = HOLLOW-STEM AUGER
CC = CONTINUOUS CORE
NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

CLIENT: GE / UNC

PROJ. LOC.: GALLUP, NM

NECR - PRE DESIGN STUDY INVESTIGATION

BORING LOG

BOREHOLE ID: **TI-B23**

DEPTH (FT)	CORE RECOV. (IN)	SAMPLES & RECOV.	SAMPLE NO.	BLOW COUNT	BULK SAMPLE NO.	MATERIAL DESCRIPTION	USCS CLASS	GRAPHIC	WATER CONT. (%)	DRY DENSITY (PCF)	SPECIFIC GRAVITY	ATTERBERG LIMITS (LL/PL/PI)	% GRAVEL	% SAND	% FINES	SAT. HYD. COND. (cm/s)	CONSOLIDATION (Cc)	TRIAXIAL (PHI, C [PSF])
	33"																	
58																		
59																		
60	24"	CA 3"	12A	50/ 4"														
61																		
62																		
63						(~63 - 65.5') COAL - Black, hard, dry to slightly moist, fissile.												
64																		
65	30"	CA 13"	13B	24														
			13A	50/ 4.5"		(65.5' - E.O.B.) SHALE - Gray, very hard, slightly moist shale, trace silt, non- to weakly-cemented ("Zone 2"?).			10.2	103.0						9.7E-8		
66																		
67																		
68																		
69																		
70		CA 4"	14	50/ 5"														
						E.O.B. 70.5' @ 13:50												
71																		

LEGEND:
- CA = CALIFORNIA SAMPLE (2-INCH OD)
- ST = SHELBY TUBE (3-INCH OD)
- AC = ACRYLIC LINER
- HSA = HOLLOW-STEM AUGER
- CC = CONTINUOUS CORE
- NR = NO RECOVERY

NOTES:
Hole backfilled with cement/bentonite grout.

ATTACHMENT C

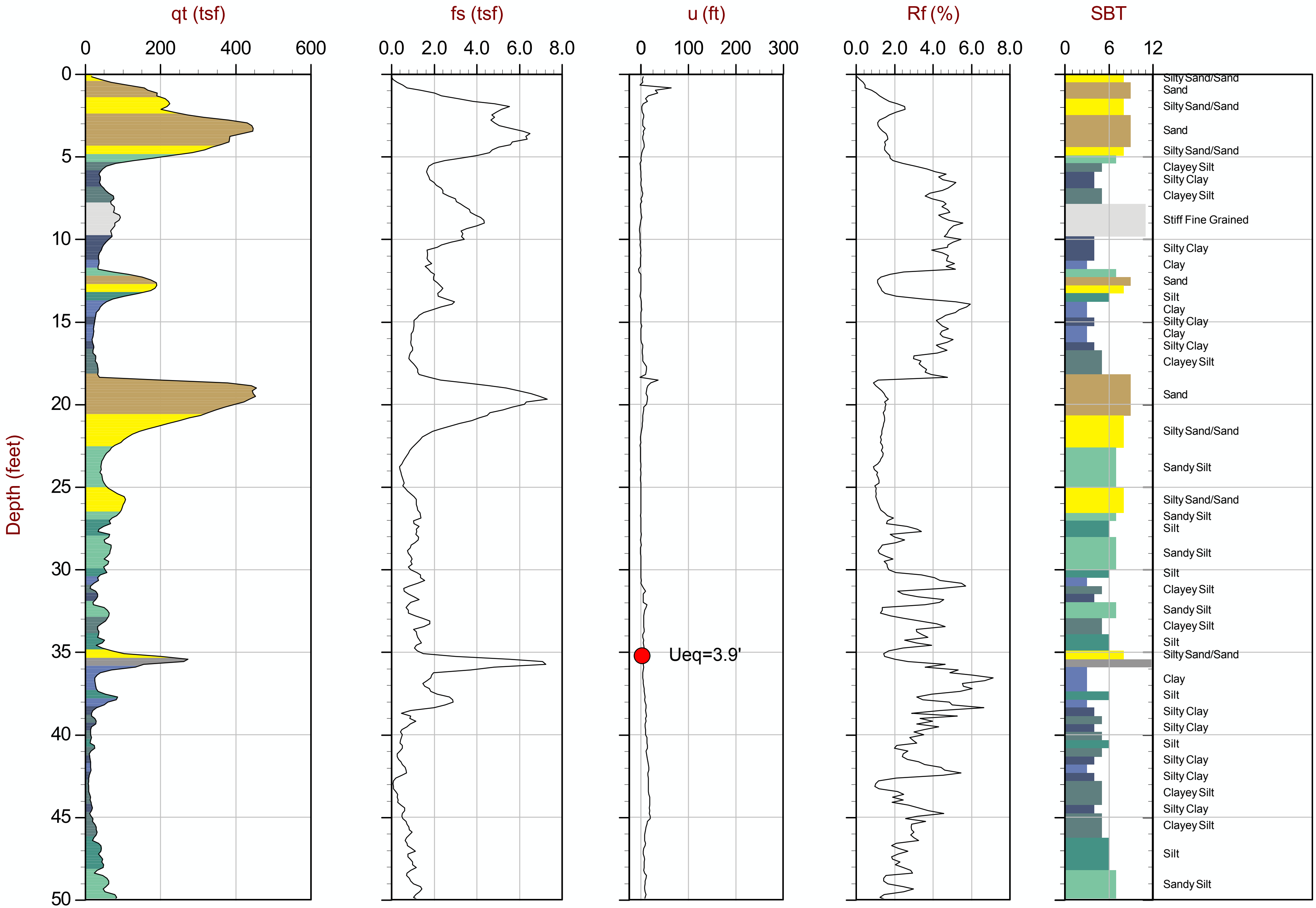
TAILINGS DISPOSAL AREA CONE PENETRATION TEST RESULTS (MWH, 2014A)

CONETEC

MWH Americas

Job No: 13-52118
Date: 11:07:13 15:36
Site: CHURCH ROCK MILL SITE TSF

Sounding: RCPT-01
Cone: 155:T1500F15U500



Max Depth: 26.950 m / 88.42 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.150 m

File: 13-52118_RP01.COR
Unit Wt: SBT Chart Soil Zones

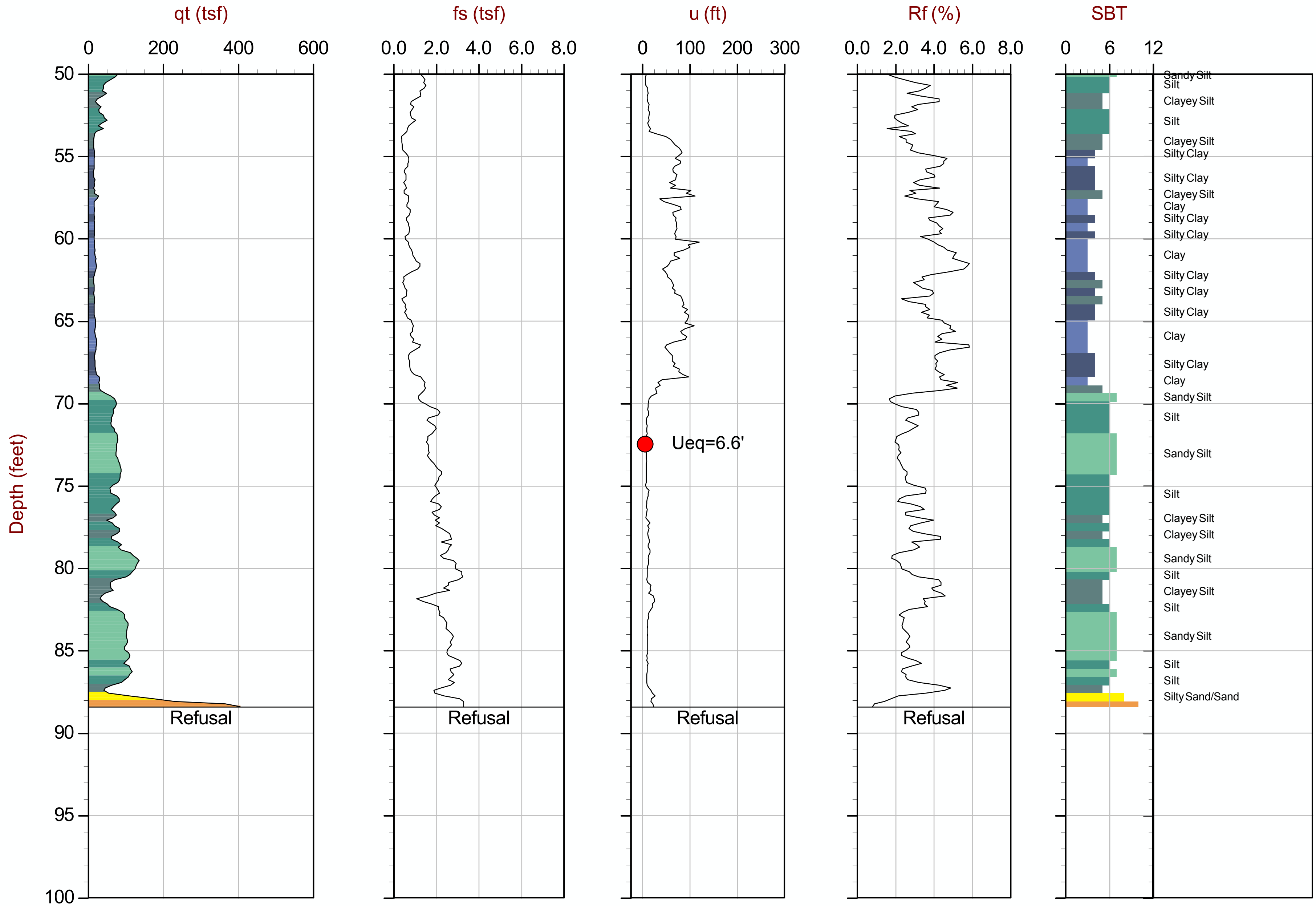
SBT: Lunne, Robertson and Powell, 1997
Coords: Lat: 35.649117 Long: -108.501667
Equilibrium Pore Pressure from Dissipation

CONETEC

MWH Americas

Job No: 13-52118
Date: 11:07:13 15:36
Site: CHURCH ROCK MILL SITE TSF

Sounding: RCPT-01
Cone: 155:T1500F15U500



Max Depth: 26.950 m / 88.42 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.150 m

File: 13-52118_RP01.COR
Unit Wt: SBT Chart Soil Zones

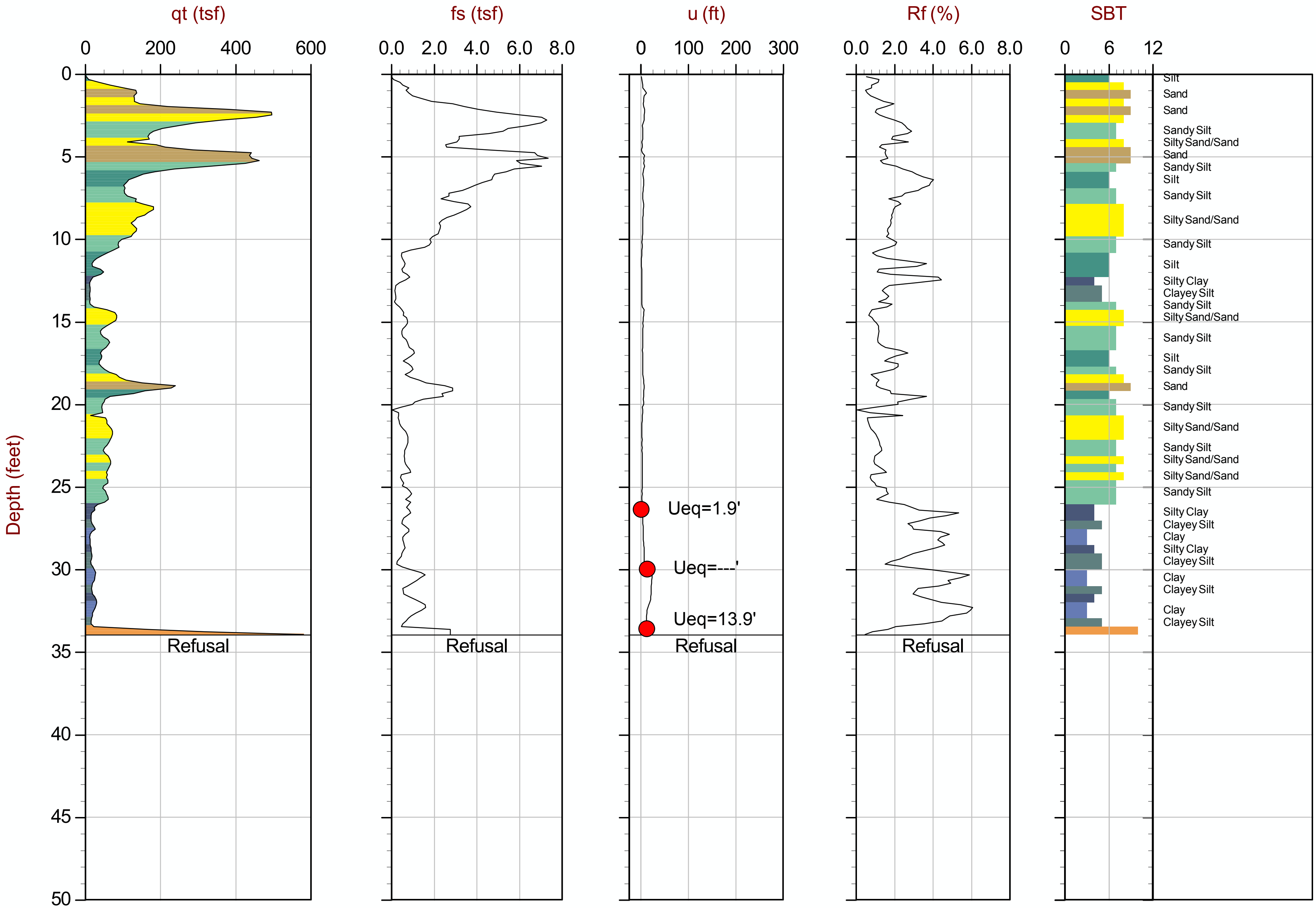
SBT: Lunne, Robertson and Powell, 1997
Coords: Lat: 35.649117 Long: -108.501667
● Equilibrium Pore Pressure from Dissipation

CONETEC

MWH Americas

Job No: 13-52118
Date: 11:05:13 13:37
Site: CHURCH ROCK MILL SITE TSF

Sounding: RCPT-02
Cone: 155:T1500F15U500



Max Depth: 10.350 m / 33.96 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.150 m

File: 13-52118_RP02.COR
Unit Wt: SBT Chart Soil Zones

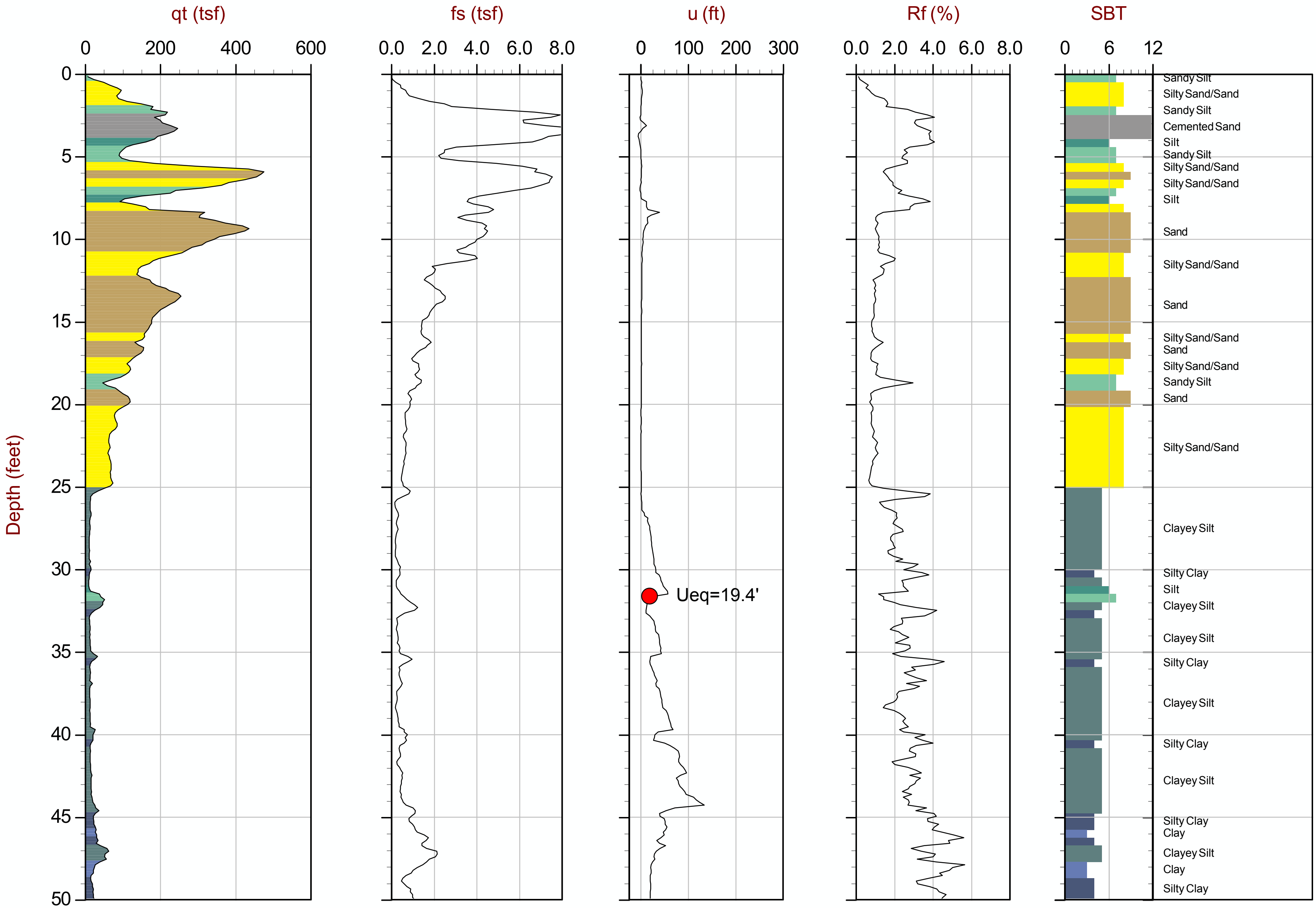
SBT: Lunne, Robertson and Powell, 1997
Coords: Lat: 35.650200 Long: -108.499750
Equilibrium Pore Pressure from Dissipation

CONETEC

MWH Americas

Job No: 13-52118
Date: 11:07:13 08:21
Site: CHURCH ROCK MILL SITE TSF

Sounding: RCPT-08
Cone: 155:T1500F15U500



Max Depth: 18.550 m / 60.86 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.150 m

File: 13-52118_RP08.COR
Unit Wt: SBT Chart Soil Zones

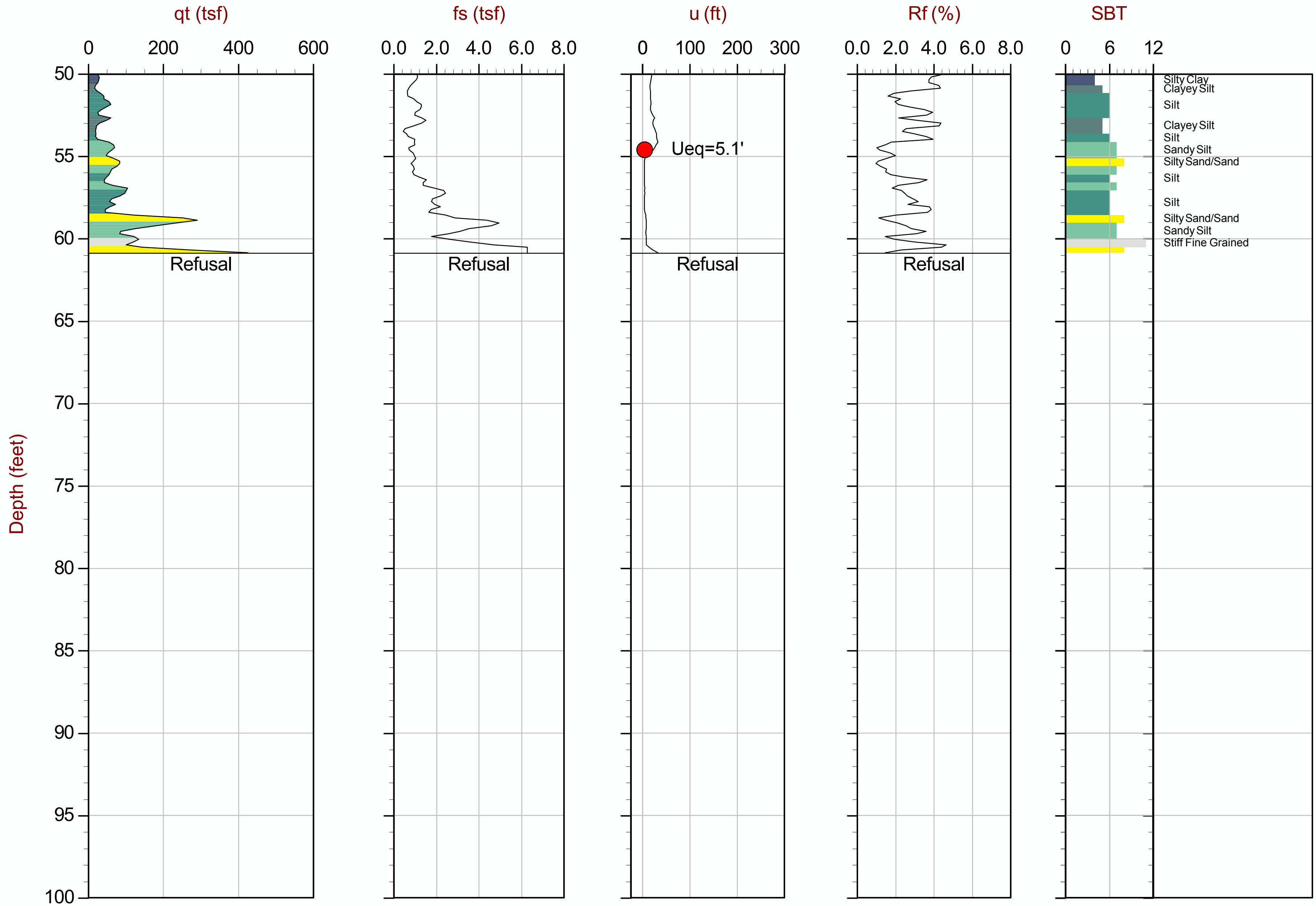
SBT: Lunne, Robertson and Powell, 1997
Coords: Lat: 35.647250 Long: -108.497250
Equilibrium Pore Pressure from Dissipation

CONETEC

MWH Americas

Job No: 13-52118
Date: 11:07:13 08:21
Site: CHURCH ROCK MILL SITE TSF

Sounding: RCPT-08
Cone: 155:T1500F15U500



Max Depth: 18.550 m / 60.86 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.150 m

File: 13-52118_RP08.COR
Unit Wt: SBT Chart Soil Zones

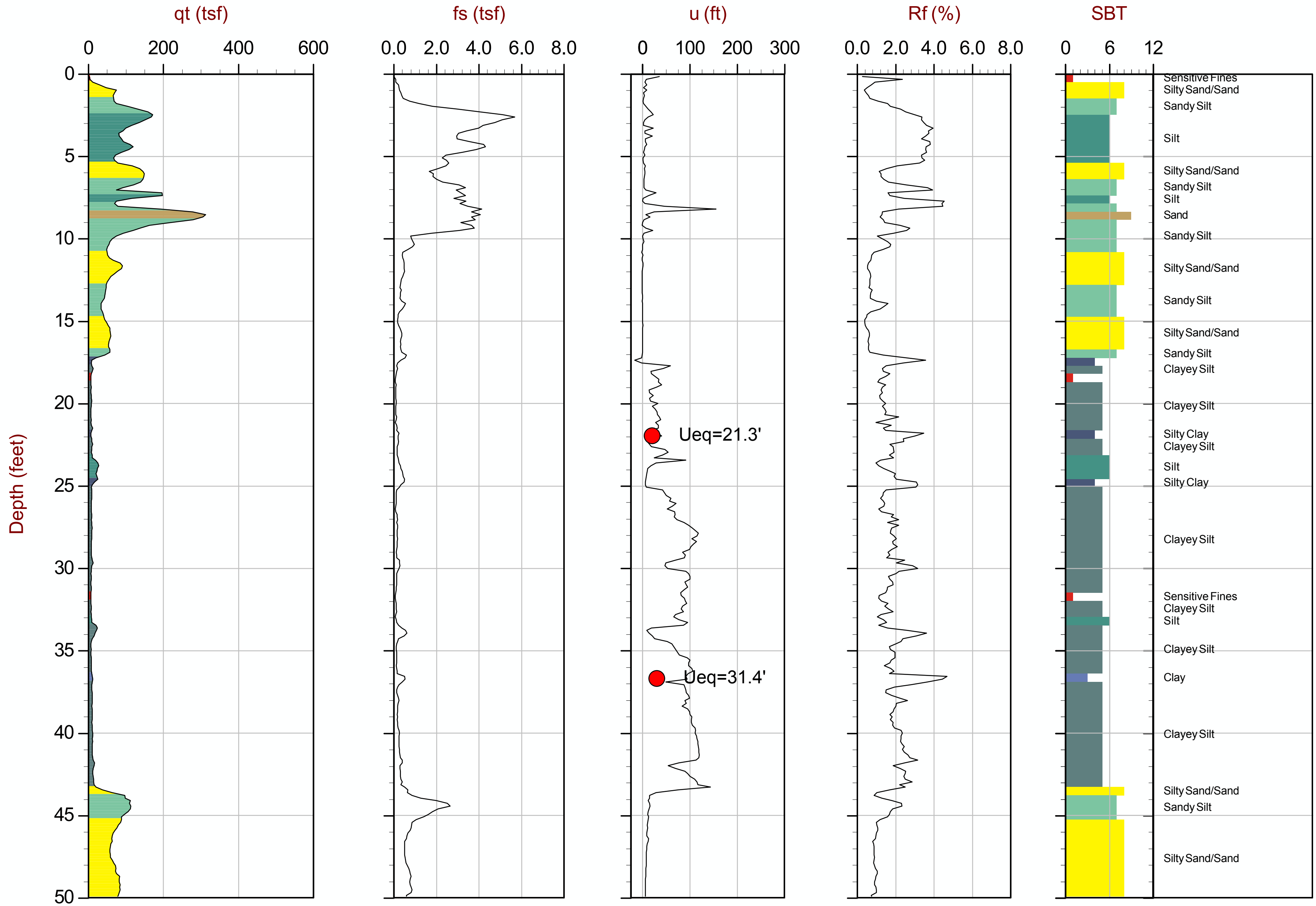
SBT: Lunne, Robertson and Powell, 1997
Coords: Lat: 35.647250 Long: -108.497250
● Equilibrium Pore Pressure from Dissipation

CONETEC

MWH Americas

Job No: 13-52118
Date: 11:06:13 10:23
Site: CHURCH ROCK MILL SITE TSF

Sounding: RCPT-10
Cone: 155:T1500F15U500



Max Depth: 19.250 m / 63.16 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.150 m

File: 13-52118_RP10.COR
Unit Wt: SBT Chart Soil Zones

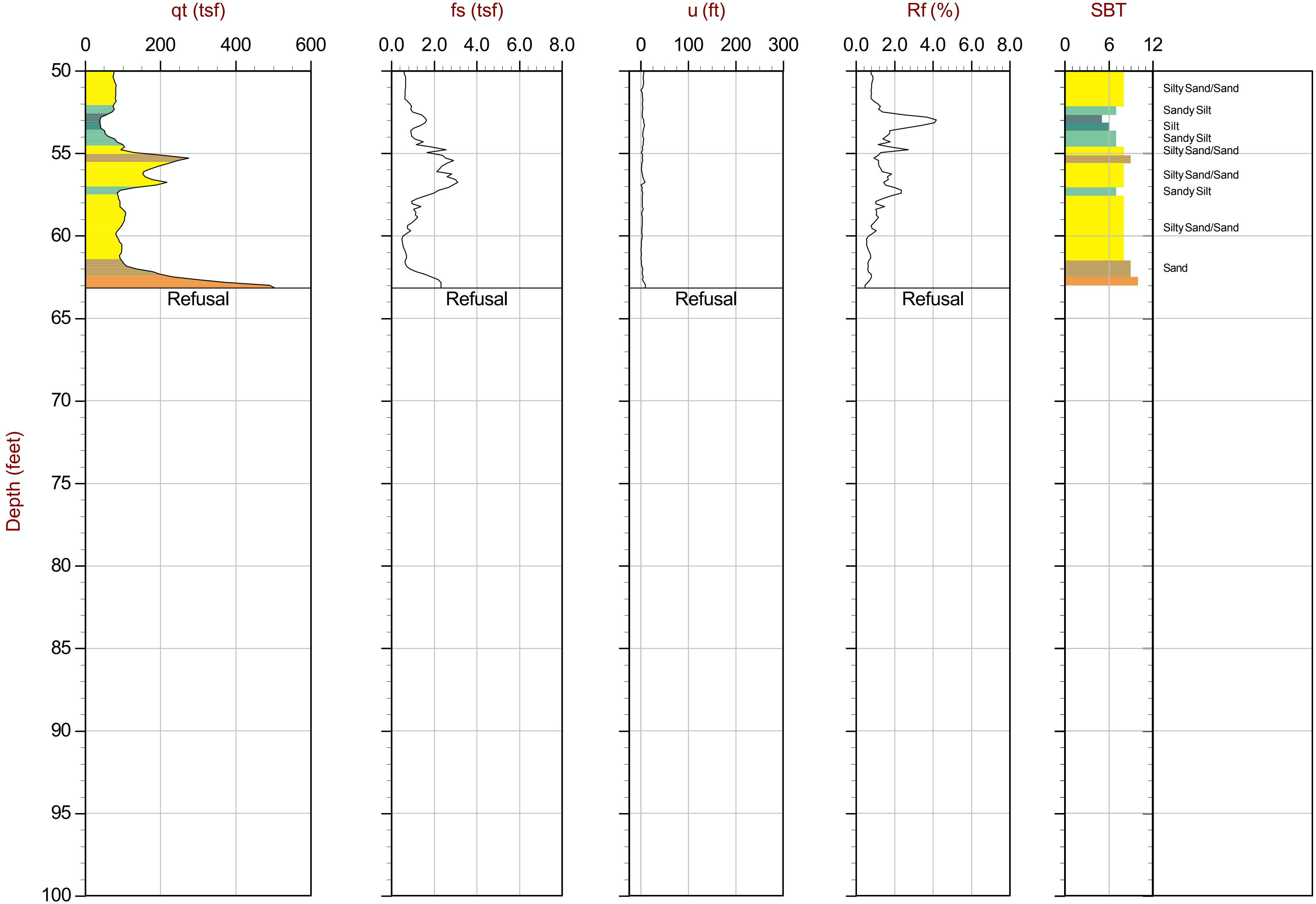
SBT: Lunne, Robertson and Powell, 1997
Coords: Lat: 35.647833 Long: -108.497217
Equilibrium Pore Pressure from Dissipation

CONETEC

MWH Americas

Job No: 13-52118
Date: 11:06:13 10:23
Site: CHURCH ROCK MILL SITE TSF

Sounding: RCPT-10
Cone: 155:T1500F15U500



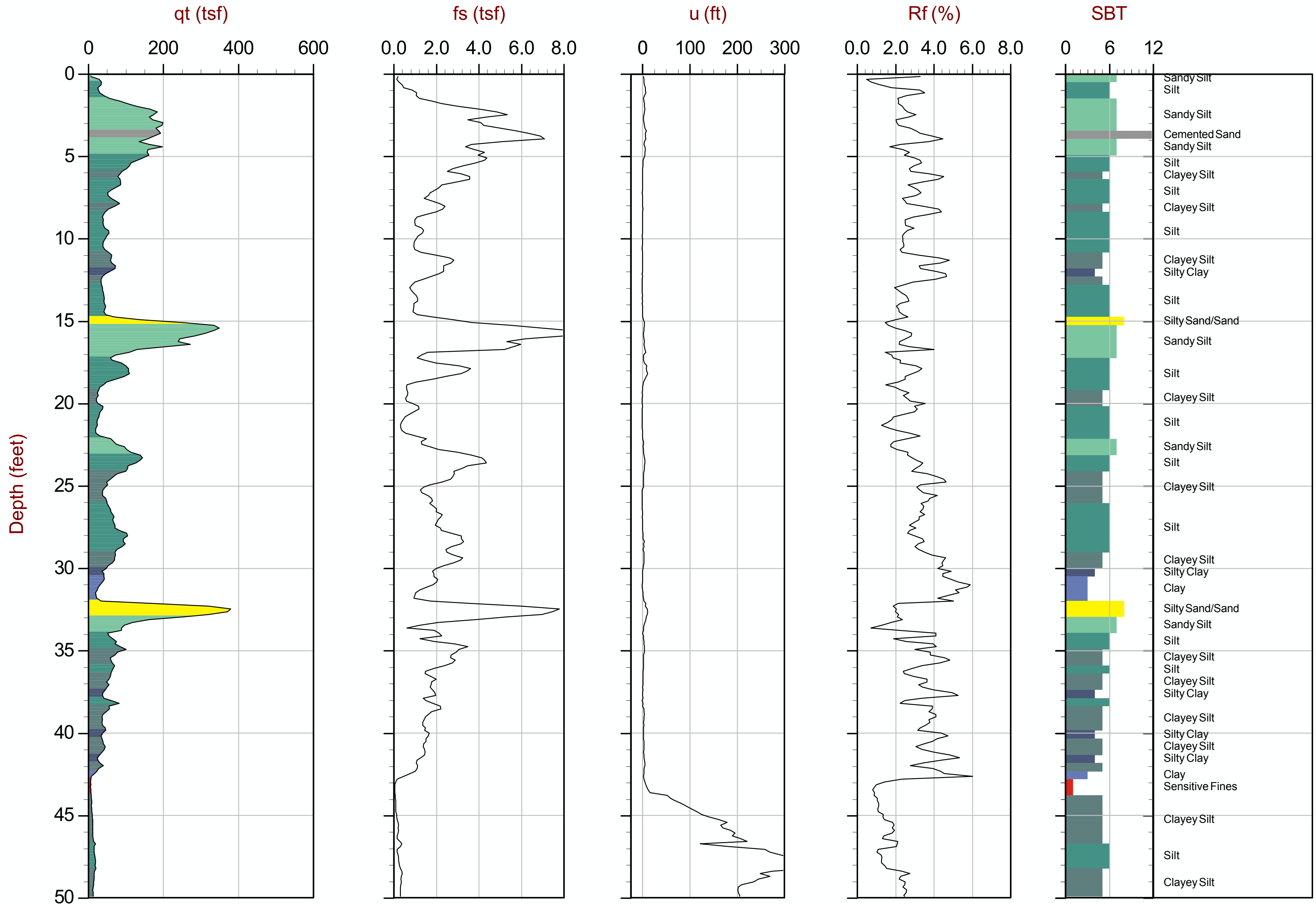
Max Depth: 19.250 m / 63.16 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.150 m

File: 13-52118_RP10.COR
Unit Wt: SBT Chart Soil Zones

SBT: Lunne, Robertson and Powell, 1997
Coords: Lat: 35.647833 Long: -108.497217
Equilibrium Pore Pressure from Dissipation

MWH Americas

Job No: 13-52118
Date: 11:07:13 12:13
Site: CHURCH ROCK MILL SITE TSF
Sounding: RCPT-11
Cone: 155:T1500F15U500



Max Depth: 29.500 m / 96.78 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.150 m

File: 13-52118_RP11.COR
Unit Wt: SBT Chart Soil Zones

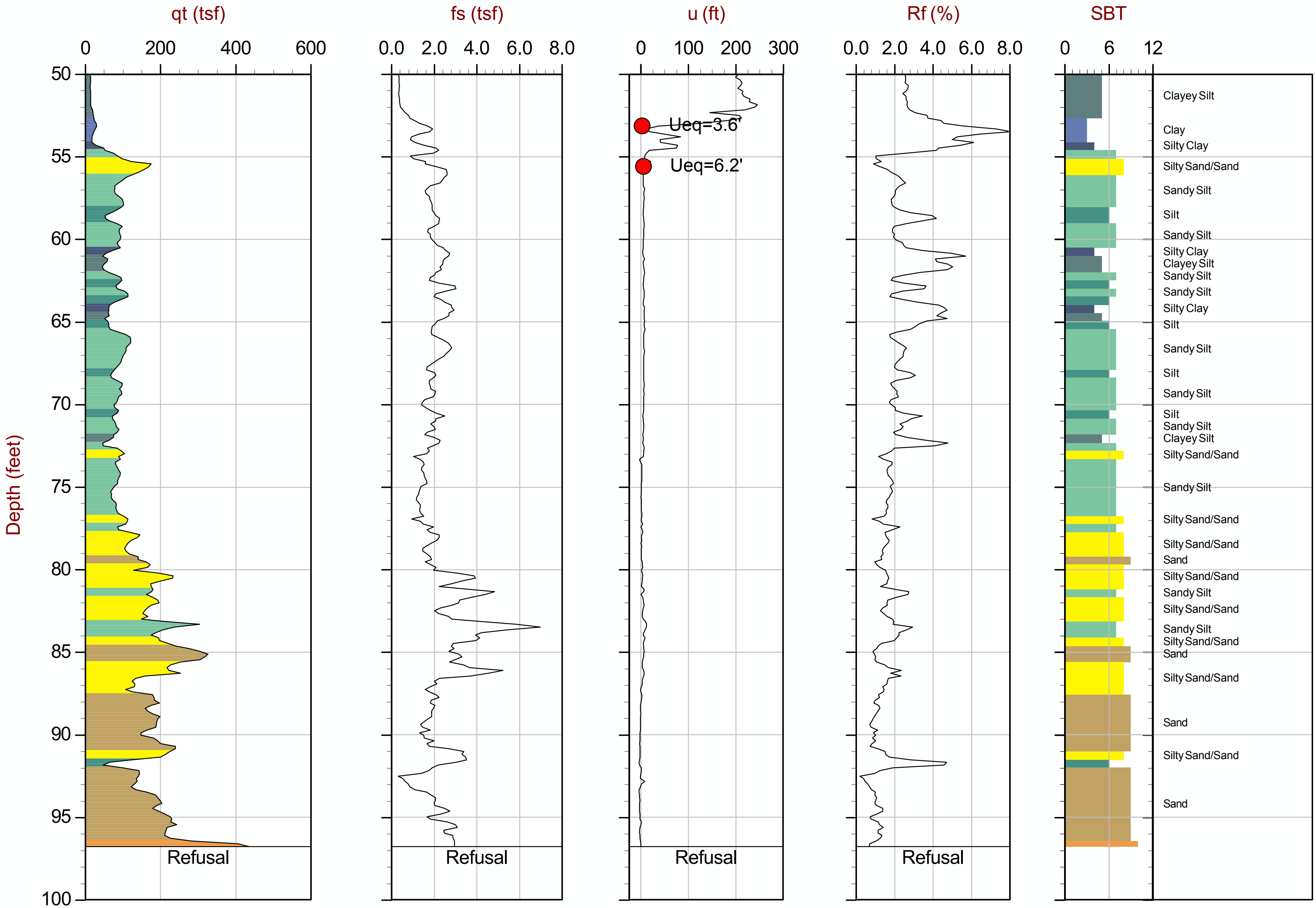
SBT: Lunne, Robertson and Powell, 1997
Coords: Lat: 35.647650 Long: -108.495850
Equilibrium Pore Pressure from Dissipation

ConeTec

MWH Americas

Job No: 13-52118
Date: 11:07:13 12:13
Site: CHURCH ROCK MILL SITE TSF

Sounding: RCPT-11
Cone: 155:T1500F15U500



Max Depth: 29.500 m / 96.78 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.150 m

File: 13-52118_RP11.COR
Unit Wt: SBT Chart Soil Zones

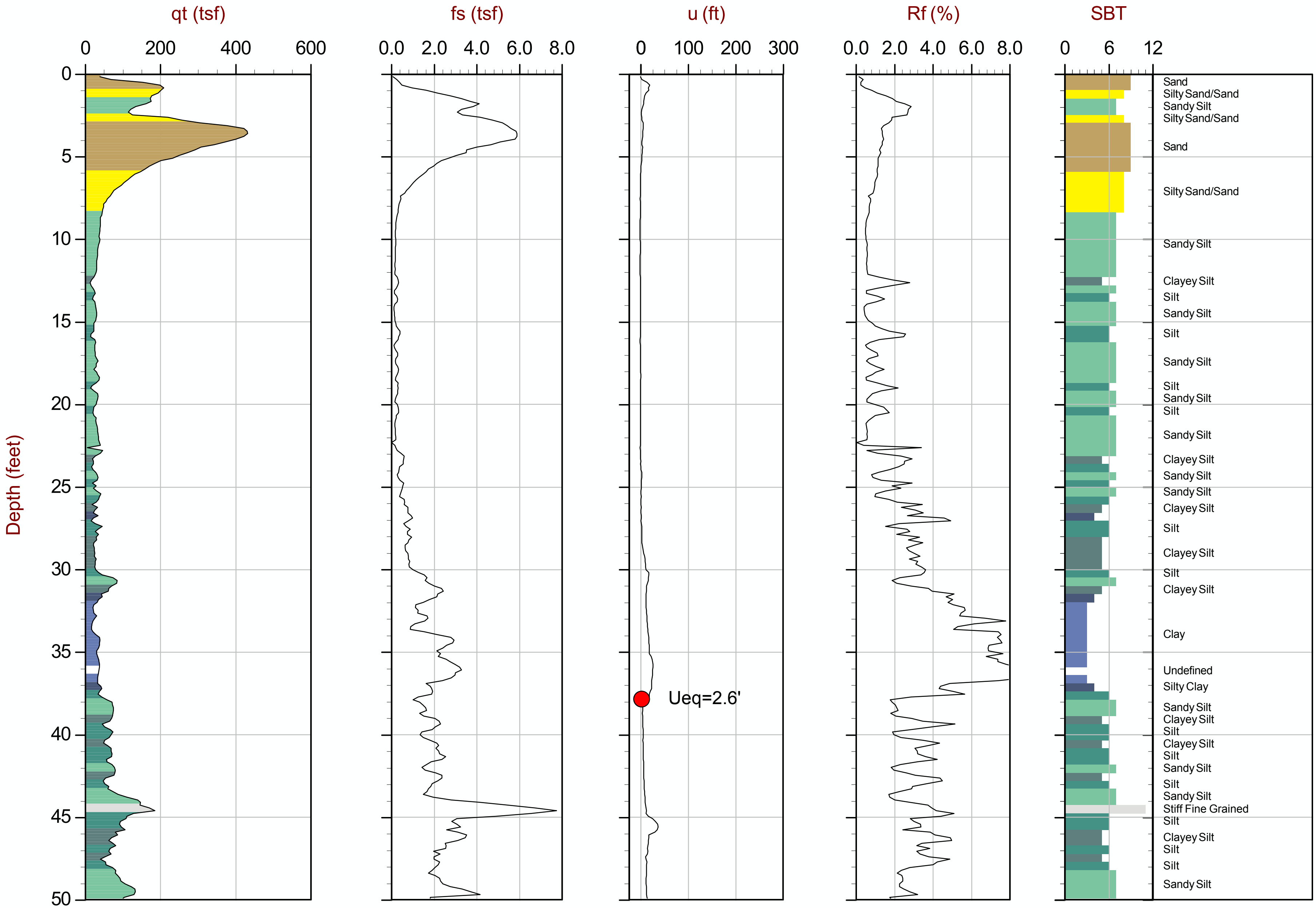
SBT: Lunne, Robertson and Powell, 1997
Coords: Lat: 35.647650 Long: -108.495850
Equilibrium Pore Pressure from Dissipation

CONETEC

MWH Americas

Job No: 13-52118
Date: 11:06:13 16:32
Site: CHURCH ROCK MILL SITE TSF

Sounding: RCPT-15
Cone: 155:T1500F15U500



Max Depth: 16.800 m / 55.12 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.150 m

File: 13-52118_RP15.COR
Unit Wt: SBT Chart Soil Zones

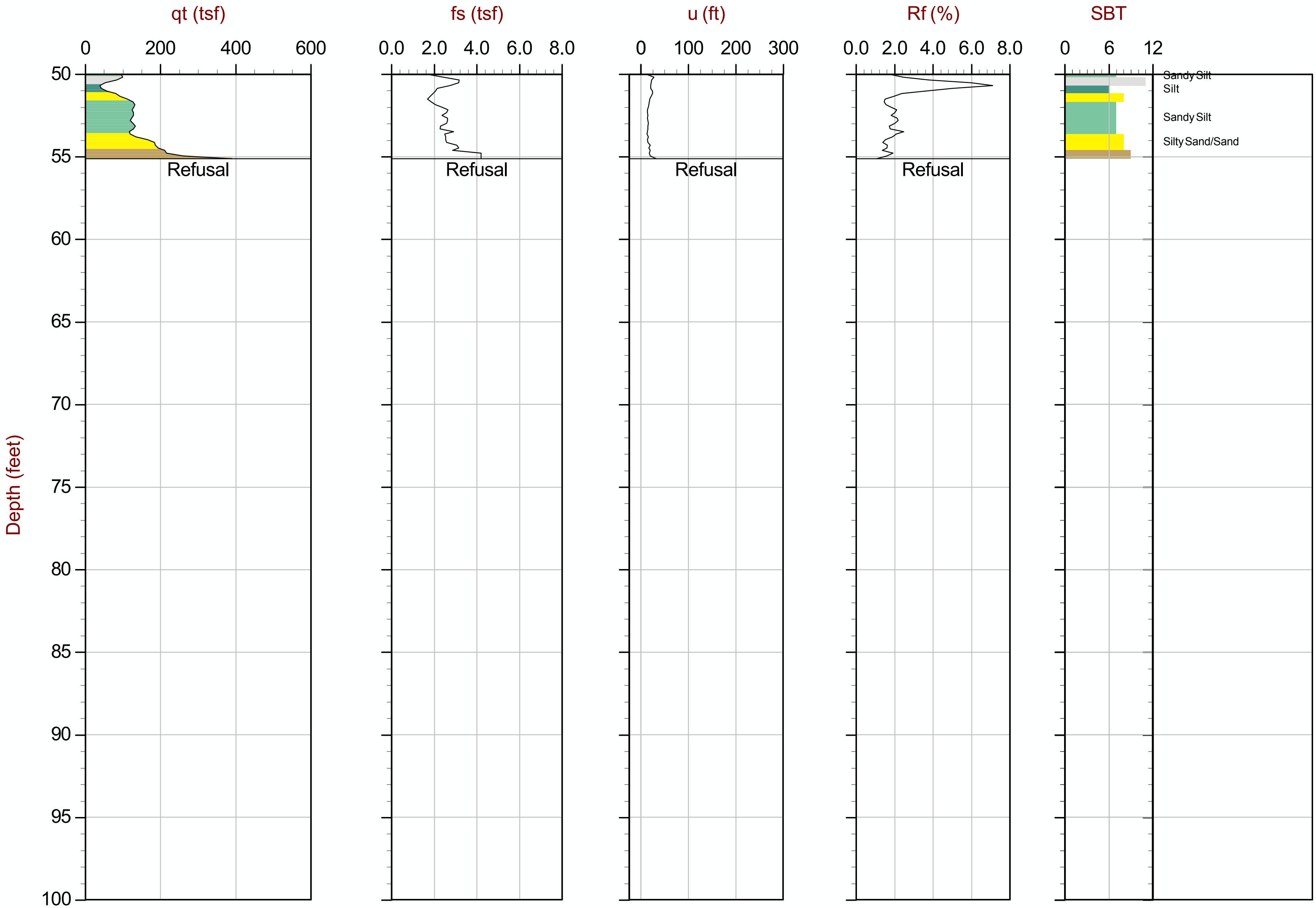
SBT: Lunne, Robertson and Powell, 1997
Coords: Lat: 35.647583 Long: -108.499800
Equilibrium Pore Pressure from Dissipation

CONETEC

MWH Americas

Job No: 13-52118
Date: 11:06:13 16:32
Site: CHURCH ROCK MILL SITE TSF

Sounding: RCPT-15
Cone: 155:T1500F15U500



Max Depth: 16.800 m / 55.12 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.150 m

File: 13-52118_RP15.COR
Unit Wt: SBT Chart Soil Zones

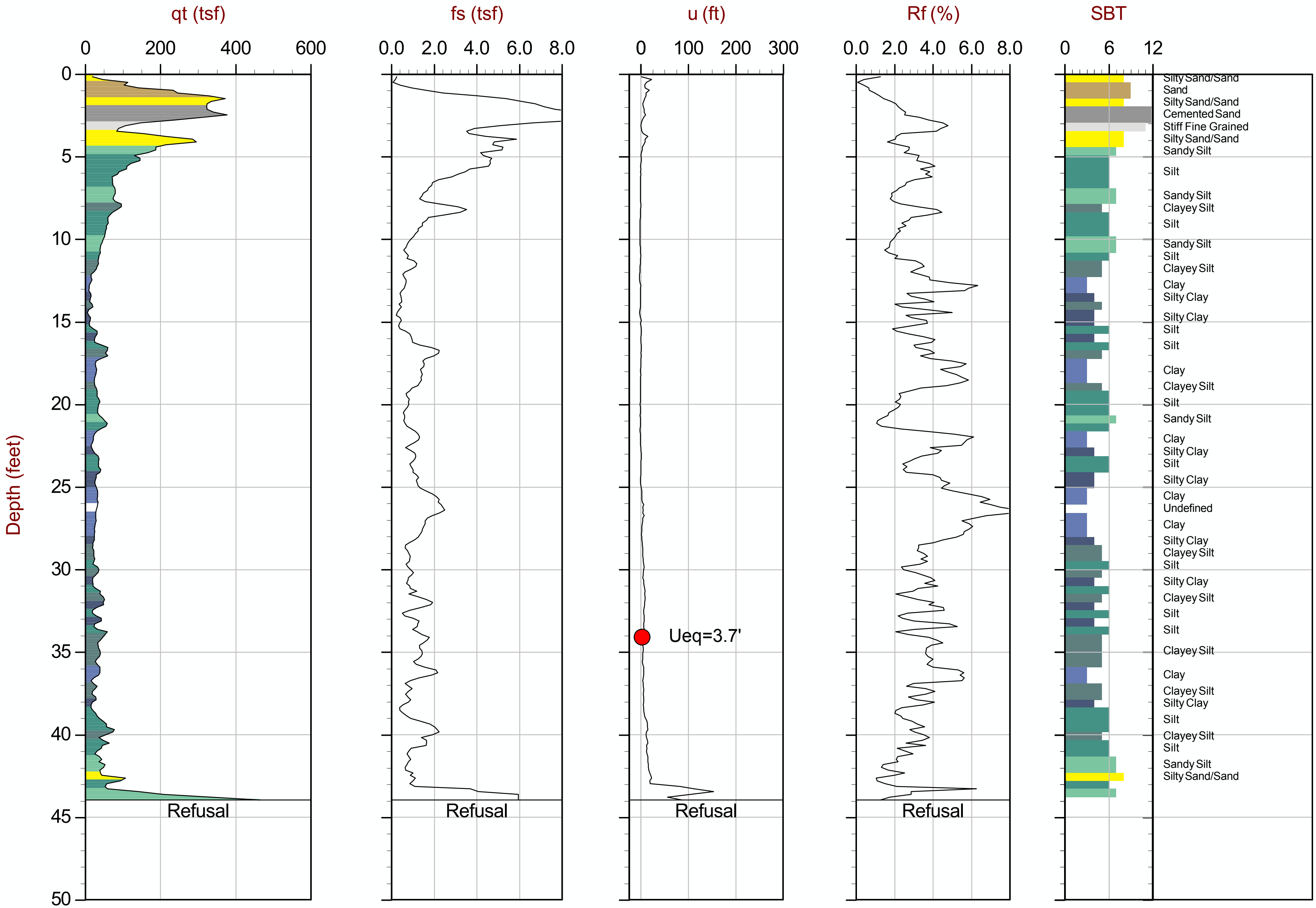
SBT: Lunne, Robertson and Powell, 1997
Coords: Lat: 35.647583 Long: -108.499800
Equilibrium Pore Pressure from Dissipation

ConeTec

MWH Americas

Job No: 13-52118
Date: 11:08:13 16:21
Site: CHURCH ROCK MILL SITE TSF

Sounding: RCPT-23
Cone: 155:T1500F15U500



Max Depth: 13.400 m / 43.96 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: 0.150 m

File: 13-52118_RP23.COR
Unit Wt: SBT Chart Soil Zones

SBT: Lunne, Robertson and Powell, 1997
Coords: Lat: 35.650833 Long: -108.497700
Equilibrium Pore Pressure from Dissipation

ATTACHMENT D

RECORDED WATER LEVELS AT THE MILL SITE (CHESTER ENGINEERS, 2016)

Well ID	Measurement Date	Measurement Time	Historical Reference Elev	Water Level Depth	Water Level Elev
0509 D	1/4/2016	8:37	6949.44	82.89	6866.55
EPA 23	1/4/2016	9:30	6926.31	59.52	6866.79
GW 1	1/4/2016	14:20	6916.46	65.01	6851.45
GW 2	7/6/2015	14:25	6912.88	58.96	6853.92
GW 3	7/7/2015	10:50	6910.04	56	6854.04
632	1/4/2016	12:35	6903.49	48.05	6855.44
EPA 25	1/5/2016	10:35	6903.38	56.62	6846.76
EPA 27	1/12/1999		6910.95	55.45	6855.5
EPA 28	1/4/2016	15:20	6917.86	65.83	6852.03
624	1/4/2016	16:35	6898.57	53.61	6844.96

Note: Water levels provided by email from Chester Engineers, on April 20, 2016.

ATTACHMENT E

LIQUEFACTION TRIGGERING ANALYSIS CALCULATIONS

UNC-NECR WASTE REPOSITORY LIQUEFACTION ANALYSIS - CPT-01

Data File: 13-52118_RP01-BSC-CPT
Location: UNC-NECR 2013 Mill Site PDS — Cells Requiring User Input/Manipulation
http://projects.mwhglobal.com/.../13-52118_RP02-BSC-CPT.XLS

Legend	Legend
Erosion Protection	Coarse Tailings
Cover Soil	Coarse/Fine Tailings
Mine Spoils	Fine Tailings
Radon Barrier	Coarse Alluvium
General Fill	Fine Alluvium

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.28
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69
Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.28
Earthquake Moment Magnitude, M:	6.3
Magnitude Scaling Factor, MSF:	1.59

Value	Parameter
0.00	Water surface elevation during CPT investigation (ft amsl)
0.00	Water surface elevation at t_0 (ft amsl)
0.00	Water surface elevation at t_1 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Earthquake
11.02	Equiv. Number of Uniform Strain Cycles, N
6969.96	Ground Surface Elevation at time of CPT (ft amsl)
6972.06	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
1.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after placement
2.00	Thickness of Water Storage/Rooting Zone (Cover Soil; ft)
0.11	Additional Stress due to Proposed Repository Construction, $\Delta\sigma_{repos}$ (psf)
6954.95	Elevation of bottom of tailings (ft amsl)

Proposed Repository	Elev. at Top of Layer (ft)	Elev. At Midpoint of Layer (ft)	Elev. At Bottom of Layer (ft)	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at Bottom of Layer	Total Stress at Midpoint of Layer	Equil Pore Pressure at Bottom of Layer	Equil Pore Pressure at	Effective Stress at Bottom of Layer (tsf)	Effective Stress at
Erosion Protection	6972.1	6971.3	6970.6	1.5	0.053	106.3	0.080	0.040	0.00	0.00	0.080	0.040
Cover Soil	6970.6	6970.3	6970.0	0.6	0.049	97.8	0.109	0.094	0.00	0.00	0.109	0.094
Mine Spoils	6970.0	6970.0	6970.0	0.0	0.058	115.1	0.109	0.109	0.00	0.00	0.109	0.109

2013 CPT Data from ConeTec / CPT Data Interpretations

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (per drilling log from coupled borehole)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %
0.164	6969.80	16.2	0.010	16.1	5.1	2.20	0.06%	Radon Barrier	0.060	120.9	0.01	0.000	0.01	0	1.70	27.421	2.63	33.64	1630	0.06%	0.3	59%
0.328	6969.63	42.1	0.084	42.1	3.5	1.53	0.20%	Radon Barrier	0.060	120.9	0.02	0.000	0.02	0	1.70	71.519	6.85	87.62	2122	0.20%	0.5	59%
0.492	6969.47	69.1	0.265	69.0	4.0	1.75	0.38%	Radon Barrier	0.060	120.9	0.03	0.000	0.03	0	1.70	117.351	11.24	143.75	2321	0.38%	0.8	59%
0.656	6969.30	112.7	0.532	112.8	-1.5	-0.65	0.47%	Radon Barrier	0.060	120.9	0.04	0.000	0.04	0	1.70	191.675	18.36	234.69	2843	0.47%	0.9	59%
0.820	6969.14	156.8	0.733	156.4	63.7	27.59	0.47%	Radon Barrier	0.060	120.9	0.05	0.000	0.05	0	1.70	265.897	25.47	326.42	3163	0.47%	0.9	59%
0.984	6968.98	167.1	1.370	166.9	30.9	13.40	0.82%	Radon Barrier	0.060	120.9	0.06	0.000	0.06	0	1.70	283.781	27.18	347.89	2809	0.82%	1.1	59%
1.148	6968.81	191.0	2.019	190.8	35.7	15.47	1.06%	Radon Barrier	0.060	120.9	0.07	0.000	0.07	0	1.70	324.309	31.06	397.58	2752	1.06%	1.2	59%
1.312	6968.65	190.2	2.339	190.1	15.5	6.73	1.23%	Radon Barrier	0.060	120.9	0.08	0.000	0.08	0	1.70	323.102	30.95	395.84	2397	1.23%	1.3	59%
1.476	6968.48	212.1	3.122	212.1	9.7	4.19	1.47%	Radon Barrier	0.060	120.9	0.09	0.000	0.09	0	1.70	360.485	34.53	441.54	2377	1.47%	1.4	59%
1.640	6968.32	221.1	3.843	221.0	13.9	6.02	1.74%	Radon Barrier	0.060	120.9	0.10	0.000	0.10	0	1.70	375.768	35.99	460.31	2230	1.74%	1.5	59%
1.804	6968.16	224.7	4.838	224.7	4.7	2.03	2.15%	Radon Barrier	0.060	120.9	0.11	0.000	0.11	0	1.70	381.939	36.58	467.75	2060	2.15%	1.6	59%
1.968	6967.99	217.7	5.537	217.7	2.0	0.88	2.54%	Radon Barrier	0.060	120.9	0.12	0.000	0.12	0	1.66	361.848	34.66	443.11	1829	2.55%	1.6	59%
2.133	6967.83	201.2	5.163	201.2	2.1	0.89	2.57%	General Fill	0.057	113.8	0.13	0.000	0.13	0	1.63	327.765	31.40	401.38	1567	2.57%	1.7	48%
2.297	6967.66	234.6	4.924	234.6	2.7	1.16	2.10%	General Fill	0.057	113.8	0.14	0.000	0.14	0	1.60	375.289	35.95	459.58	1704	2.10%	1.6	48%
2.461	6967.50	272.0	4.716	272.0	5.6	2.44	1.73%	General Fill	0.057	113.8	0.15	0.000	0.15	0	1.57	427.570	40.95	523.63	1850	1.73%	1.5	48%
2.625	6967.34	314.3	4.833	314.2	6.3	2.75	1.54%	General Fill	0.057	113.8	0.16	0.000	0.16	0	1.55	486.035	46.56	595.23	2009	1.54%	1.4	48%
2.789	6967.17	380.9	4.667	380.8	3.6	1.55	1.23%	General Fill	0.057	113.8	0.17	0.000	0.17	0	1.52	580.126	55.57	710.41	2298	1.23%	1.3	48%
2.953	6967.01	430.6	4.848	430.6	3.9	1.67	1.13%	General Fill	0.057	113.8	0.17	0.000	0.17	0	1.50	646.541	61.93	791.74	2460	1.13%	1.3	48%
3.117	6966.84	443.0	5.051	443.0	3.7	1.59	1.14%	General Fill	0.057	113.8	0.18	0.000	0.18	0	1.48	656.045	62.84	803.38	2403	1.14%	1.3	48%
3.281	6966.68	446.4	5.599	446.4	9.0	3.90	1.25%	General Fill	0.057	113.8	0.19	0.000	0.19	0	1.46	652.494	62.50	799.09	2304	1.25%	1.3	48%
3.445	6966.52	445.2	6.173	445.2	4.8	2.09	1.39%	General Fill	0.057	113.8	0.20	0.000	0.20	0	1.44	642.782	61.57	787.15	2193	1.39%	1.4	48%
3.609	6966.35	418.4	6.499	418.4	5.9	2.56	1.55%	General Fill	0.057	113.8	0.21	0.000	0.21	0	1.43	596.925	57.18	731.00	1970	1.55%	1.4	48%
3.773	6966.19	384.7	6.314	384.7	3.9	1.69	1.64%	General Fill	0.057	113.8	0.22	0.000	0.22	0	1.41	542.720	51.98	664.61	1735	1.64%	1.5	48%
3.937	6966.02	383.8	6.364	383.8	4.0	1.75	1.66%	General Fill	0.057	113.8	0.23	0.000	0.23	0	1.40	535.507	51.29	655.78	1661	1.66%	1.5	48%
4.101	6965.86	382.3	5.669	382.3	6.3	2.73	1.48%	General Fill	0.057	113.8	0.24	0.000	0.24	0	1.38	527.925	50.57	646.52	1590	1.48%	1.4	48%
4.265	6965.70	359.7	5.575	359.7	6.8	2.93	1.55%	General Fill	0.057	113.8	0.25	0.000	0.25	0	1.37	491.708	47.10	602.17	1440	1.55%	1.4	48%
4.429	6965.53	337.4	5.041	337.4	7.1	3.09	1.49%	General Fill	0.057	113.8	0.26	0.000	0.26	0	1.35	456.764	43.75	559.39	1302	1.50%	1.4	48%
4.593	6965.37	317.8	4.730	317.7	4.5	1.95	1.49%	General Fill	0.057	113.8	0.27	0.000	0.27	0	1.34	426.187	40.82	521.92	1183	1.49%	1.4	48%
4.757	6965.20	284.3	4.604	284.3	2.4	1.02	1.62%	General Fill	0.057	113.8	0.28	0.000	0.28	0	1.33	377.962	36.20	462.84	1023	1.62%	1.5	48%
4.921	6965.04	230.5	4.034	230.5	0.8	0.36	1.75%	General Fill	0.057	113.8	0.29	0.000	0.29	0	1.32	303.705	29.09	371.90	802	1.75%	1.6	48%
5.085	6964.88	179.6	3.217	179.6	-0.2	-0.10	1.79%	General Fill	0.057	113.8	0.30	0.000	0.30	0	1.31	234.694	22.48	287.38	605	1.79%	1.6	48%
5.249	6964.71	129.2	2.502	129.2	0.9	0.39	1.94%	General Fill	0.057	113.8	0.31	0.000	0.31	0	1.36	175.306	16.79	214.67	422	1.94%	1.7	48%
5.413	6964.55	81.8	1.983	81.8	-1.4	-0.61	2.43%	General Fill	0.057	113.8	0.31	0.000	0.31	0	1.47	120.538	11.55	147.58	259	2.43%	1.9	48%
5.577	6964.38	56.9	1.757	56.9	-1.3	-0.57	3.09%	General Fill	0.057	113.8	0.32	0.000	0.32	0	1.56	88.657	8.49	108.55	175	3.10%	2.1	48%
5.741	6964.22	46.0	1.697	46.0	-0.7	-0.30	3.69%	General Fill	0.057	113.8	0.33	0.000	0.33	0	1.60	73.402	7.03	89.87	137	3.71%	2.2	48%
5.905	6964.06	39.7	1.645	39.7	0.1	0.02	4.14%	General Fill	0.057	113.8	0.34	0.000	0.34	0	1.61	64.020	6.13	78.39	115	4.18%	2.3	48%
6.069	6963.89	36.1	1.690	36.1	-0.2	-0.08	4.68%	General Fill	0.057	113.8	0.35	0.000	0.35	0	1.61	58.256	5.58	71.33	101	4.73%	2.4	48%
6.234	6963.73	40.7	1.753	40.7	0.4	0.18	4.30%	General Fill	0.057	113.8	0.36	0.000	0.36	0	1.57	63.807	6.11	78.14	112	4.34%	2.3	48%
6.398	6963.56	40.1	1.814	40.1	0.6	0.26	4.52%	General Fill	0.057	113.8	0.37	0.000	0.37	0	1.55	62.189	5.96	76.16	107	4.57%	2.4	48%
6.562	6963.40	38.3	1.996	38.3	0.2	0.10	5.21%	General Fill	0.057	113.8	0.38	0.000	0.38	0	1.54	59.084	5.66	72.35	100	5.26%	2.4	48%
6.726	6963.23	42.1	2.110	42.1	-0.1	-0.06	5.02%	General Fill	0.057	113.8	0.39	0.000	0.39	0	1.51	63.327	6.07	77.54	107	5.06%	2.4	48%
6.890	6963.07	48.4	2.317	48.4	2.3	0.98	4.79%	General Fill	0.057	113.8	0.40	0.000	0.40	0	1.46	70.694	6.77	86.59	120	4.83%	2.4	48%
7.054	6962.91	53.7	2.416	53.7	2.4	1.06	4.50%	General Fill	0.057	113.8	0.41	0.000	0.41	0	1.43	76.553	7.33	93.77	130	4.53%	2.3	48%
7.218	6962.74	63.1	2.420	63.1	4.3	1.85	3.83%	General Fill	0.057	113.8	0.42	0.000	0.42	0	1.38	87.251	8.36	106.89	150	3.86%	2.2	48%
7.382	6962.58	74.5	2.677	74.5	3.5	1.53	3.59%	General Fill	0.057	113.8	0.43	0.000	0.43	0	1.34	99.831	9.56	122.28	173	3.62%	2.2	48%
7.546	6962.41	76.0	3.010	76.0	0.5	0.20	3.96%	General Fill	0.057	113.8	0.44	0.000	0.44	0	1.33	100.747	9.65	123.37	173	3.98%	2.2	48%
7.710	6962.25	67.3	3.053	67.2	1.9	0.83	4.54%	General Fill	0.057	113.8	0.45	0.000	0.45	0	1.33	89.760	8.60	109.93	150	4.57%	2.3	48%
7.874	6962.09	69.1	3.249	69.1	-0.9	-0.41	4.70%	General Fill	0.057	113.8	0.45	0.000	0.45	0	1.32	91.140	8.73	111.59	151	4.73%	2.3	48%
8.038	6961.92	76.9	3.433	76.9	-0.5	-0.20	4.46%	General Fill	0.057	113.8	0.46	0.000	0.46	0	1.29	99.383	9.52	121.69	165	4.49%	2.3	48%
8.202	6961.76	76.9	3.662	76.9	-0.2	-0.08	4.76%	General Fill	0.057	113.8	0.47	0.000	0.47	0	1.28	98.522	9.44	120.64	161	4.79%	2.3	48%
8.366	6961.59	75.6	3.700	75.6	0.4	0.18	4.89%	General Fill	0.057	113.8	0.48	0.000	0.48	0	1.27	96.292	9.22	117.92	156	4.93%	2.3	48%
8.530	6961.43	91.7	3.940	91.7	0.8	0.33	4.30%	General Fill	0.057	113.8	0.49	0.000	0.49	0	1.24	113.549	10.88	139.05	185	4.32%	2.2	48%
8.694	6961.27	93.1	4.178	93.1	1.6	0.71	4.49%	General Fill	0.057	113.8	0.50	0.000	0.50	0	1.23	114.285	10.95	139.96	185	4.51%	2.2	48%
8.858	6961.10	89.5	4.338	89.5	0.2	0.08	4.85%	General Fill	0.057	113.8	0.51	0.000	0.51	0	1.22	109.510	10.49	134.10	174	4.88%	2.3	48%
9.022	6960.94	78.4	4.367	78.4	-1.2	-0.53	5.57%	General Fill	0.057	113.8	0.52	0.000	0.52	0	1.23	96.485	9.24	118.13	150	5.61%	2.4	48%
9.186	6960.77	79.0	4.004	79.0	-1.8	-0.79	5.07%	General Fill	0.057	113.8	0.53	0.000	0.53	0	1.22	96.403	9.23	118.03	148	5.11%	2.3	48%
9.350	6960.61	72.1	3.530	72.1	-2.6	-1.14	4.90%	General Fill	0.057	113.8	0.54	0.000	0.54	0	1.22	88.055	8.43	107.80	133	4.93%	2.3	48%
9.514	6960.45	68.0	3.272	68.0	-3.1	-1.36	4.81%	General Fill	0.057	113.8	0.55	0.000	0.55	0	1.22	82.840	7.93	101.41	123	4.85%	2.4	48%
9.678	6960.28	70.6	3.353	70.6	-2.2	-0.96	4.75%	General Fill	0.057	113.8	0.56	0.000	0.56	0	1.21	85.106	8.15	104.19	126	4.79%	2.3	48%
9.842	6960.12	71.4	3.285	71.5	-2.2	-0.94	4.60%	General Fill	0.057	113.8	0.57	0.000	0.57	0	1.20	85.387	8.18	104.54	125	4.64%	2.3	48%
10.006	6959.95	62.4	3.418	62.4	-2.0	-0.85	5.48%	General Fill	0.057	113.8	0.58	0.000	0.58	0	1.20	74.741	7.16	91.50	107	5.53%	2.4	48%
10.170	6959.79	55.6	2.815	55.6	-0.7	-0.30	5.06%	General Fill	0.057	113.8	0.59	0.000	0.59	0	1.20	66.633	6.38	81.59	94	5.11%	2.4	48%
10.335	6959.63	49.2	2.360	49.2	-1.9	-0.83	4.80%	General Fill	0.057	113.8	0.59	0.000	0.59	0	1.20	58.901	5.64	72.11	82	4.86%	2.5	48%
10.499	6959.46	45.0	2.147	45.0	-0.8	-0.36	4.77%	General Fill	0.057	113.8	0.60	0.000	0.60	0	1.19	53.688	5.14	65.73	73	4.84%	2.5	48%
10.663	6959.30	42.4	1.673	42.4	-0.2	-0.08	3.95%	General Fill	0.057	113.8	0.61	0.000	0.61	0	1.19	50.305	4.82	61.60	68	4.00%	2.4	48%
10.827	6959.13	37.6	1.695	37.6	-0.8	-0.36	4.51%	General Fill	0.057	113.8	0.62	0.000	0.62	0	1.18	44.502	4.26	54.49	59	4.58%	2.5	48%
10.991	6958.97	35.2	1.694	35.3	-0.1	-0.04	4.81%	General Fill	0.057	113.8	0.63	0.000	0.63	0	1.18	41.476	3.97	50.79	55	4.89%	2.6	48%
11.155	6958.81	35.4	1.677	35.4	-0.9	-0.41	4.74%	General Fill	0.057	113.8	0.64	0.000	0.64	0	1.17	41.242	3.95	50.49	54	4.83%	2.6	48%
11.319	6958.64	36.7	1.729	36.7	-0.7	-0.29	4.71%	General Fill	0.057	113.8	0.65	0.000	0.65	0	1.15	42.364	4.06	51.87	55	4.80%	2.6	48%
11.483	6958.48	37.0	1.894	37.0	-0.7	-0.29	5.12%	General Fill	0.057	113.8	0.66	0.000	0.66	0	1.14	42.352	4.06	51.85	55	5.21%	2.6	48%
11.647	6958.31	34.0	1.595	34.0	-0.8	-0.36	4.69%	General Fill	0.057	113.8	0.67	0.000	0.67	0	1.14	38.715	3.71	47.40	50	4.78%	2.6	48%
11.811	6958.15	33.6	1.739	33.7	-4.6	-1.97	5.17%	General Fill	0.057	113.8	0.68	0.000	0.68	0	1.13	37.956	3.64	46.44	49	5.28%	2.6	48%
11.975	6957.99	74.4	1.842	74.4	-3.9	-1.71	2.48%	General Fill	0.057	113.8	0.69	0.000	0.69	0	1.09	81.019	7.76	99.18	107	2.50%	2.2	48%
12.139	6957.82	114.3	2.031	114.3	0.4	0.18	1.78%	General Fill	0.057	113.8	0.70	0.000	0.70	0	1.07	121.803	11.67	149.15	163	1.79%	1.9	48%
12.303	6957.66	152.5	1.987	152.5	0.4	0.18	1.30%	General Fill	0.057	113.8	0.71	0.000	0.71	0	1.05	160.008	15.33	195.93	215	1.31%	1.8	48%
12.467	6957.49	174.4	1.981	174.4	0.1	0.04	1.14%	General Fill	0.057	113.8	0.72	0.000	0.72	0	1.04	181.405	17.38	222.13	242	1.14%	1.7	48%
12.631	6957.33	188.8	2.144	188.8	0.0	0.00	1.14%	General Fill	0.057	113.8	0.73	0.000	0.73	0	1.03	195.165	18.69	238.98	259	1.14%	1.7	48%
12.795	6957.17	190.8	2.281	190.8	0.0	0.00	1.20%	General Fill	0.057	113.8	0.73	0.000	0.73	0	1.03	196.467	18.82	240.58	259	1.20%	1.7	48%
12.959	6957.00	185.8	2.421	185.8	0.0	0.00	1.30%	General Fill	0.057	113.8	0.74	0.000	0.74	0	1.03	190.809	18.28	233.65	249	1.31%	1.7	48%
13.123	6956.84	173.6	2.319	173.6	-0.2	-0.08	1.34%	Coarse Tailings	0.054	108.5	0.75	0.000	0.75	0	1.03	177.978	17.05	217.94	230	1.34%	1.7	21%
13.287	6956.67	141.9	2.166	141.9	-0.6	-0.26	1.53%	Coarse Tailings	0.054	108.5	0.76	0.000	0.76	0	1.03	145.457	13.93	178.11	185	1.53%	1.9	21%
13.451	6956.51	104.4	2.194	104.4	-1.4	-0.61	2.10%	Coarse Tailings	0.054	108.5	0.77	0.000	0.77	0	1.03	107.053	10.25	131.08	134	2.12%	2.0	21%
13.615	6956.35	74.1	2.570	74.1	-0.1	-0.06	3.47%	Coarse Tailings	0.054	108.5	0.78	0.000	0.78	0	1.02	75.908	7.27	92.95	94	3.50%	2.3	21%
13.779	6956.18	56.9	2.954	56.9	0.8	0.36	5.20%	Coarse Tailings	0.054	108.5	0.79	0.000	0.79	0	1.02	57.989	5.55	71.01	71	5.27%	2.5	21%
13.943	6956.02	48.2	2.863	48.2	1.1	0.47	5.94%	Coarse Tailings	0.054	108.5	0.80	0.000	0.80	0	1.01	48.881	4.68	59.86	59	6.04%	2.6	21%
14.107	6955.85	40.4	2.323	40.4	0.9	0.39	5.76%	General Fill	0.057	113.8	0.81	0.000	0.81	0	1.01	40.658	3.89	49.79	49	5.87%	2.7	48%
14.271	6955.69	36.0	1.938	36.0	1.9	0.81	5.38%	General Fill	0.057	113.8	0.82	0.000	0.82	0	1.00	36.020	3.45	44.12	43	5.50%	2.7	48%
14.436	6955.52	29.2	1.513	29.2	-0.2	-0.08	5.18%	General Fill	0.057	113.8	0.83	0.000	0.83	0	0.99	28.966	2.77	35.47	34	5.33%	2.7	48%
14.600	6955.36	27.8	1.299	27.9	-0.2	-0.08	4.66%	General Fill	0.057	113.8	0.84	0.000	0.84	0	0.98	27.414	2.63	33.57	32	4.81%	2.7	48%
14.764	6955.20	27.1	1.213	27.1	0.4	0.16	4.48%	General Fill	0.057	113.8	0.84	0.000	0.84	0	0.98	26.452	2.53	32.39	31	4.62%	2.7	48%
14.928	6955.03	25.5	1.069	25.5	0.4	0.16	4.19%	General Fill	0.057	113.8	0.85	0.000	0.85	0	0.97	24.683	2.36	30.23	29	4.34%	2.7	48%
15.092	6954.87	24.5	1.064	24.5	0.3	0.14	4.34%	General Fill	0.057	113.8	0.86	0.000	0.86	0	0.96	23.566	2.26	28.86	27	4.49%	2.8	48%
15.256	6954.70	23.5	1.058	23.5	1.7	0.75	4.51%	General Fill	0.057	113.8	0.87	0.000	0.87	0	0.95	22.340	2.14	27.37	26	4.68%	2.8	48%
15.420	6954.54	21.4	1.032	21.4	0.4	0.18	4.82%	General Fill	0.057	113.8	0.88	0.000	0.88	0	0.94	20.213	1.94	24.75	23	5.02%	2.8	48%
15.584	6954.38	22.6	1.012	22.6	0.1	0.06	4.47%	General Fill	0.057	113.8	0.89	0.000	0.89	0	0.94	21.199	2.03	25.96	24	4.66%	2.8	48%
15.748	6954.21	21.4	0.937	21.4	0.0	0.00	4.37%	General Fill	0.057	113.8	0.90	0.000	0.90	0	0.93	19.890	1.91	24.36	23	4.57%	2.8	48%
15.912	6954.05	20.8	0.939	20.8	-0.1	-0.02	4.52%	General Fill	0.057	113.8	0.91	0.000	0.91	0	0.92	19.133	1.83	23.43	22	4.73%	2.9	48%
16.076	6953.88	18.4	0.930	18.4	-0.3	-0.12	5.07%	General Fill	0.057	113.8	0.92	0.000	0.92	0	0.91	16.741	1.60	20.50	19	5.33%	2.9	48%
16.240	6953.72	19.2	0.909	19.2	0.7	0.30	4.74%	General Fill	0.057	113.8	0.93	0.000	0.93	0	0.90	17.355	1.66	21.26	20	4.98%	2.9	48%
16.404	6953.56	22.2	0.927	22.2	3.8	1.63	4.18%	General Fill	0.057	113.8	0.94	0.000	0.94	0	0.90	19.972	1.91	24.48	23	4.36%	2.8	48%
16.568	6953.39	22.7	0.989	22.6	4.0	1.75	4.37%	General Fill	0.057	113.8	0.95	0.000	0.95	0	0.89	20.231	1.94	24.80	23	4.56%	2.8	48%
16.732	6953.23	21.1	0.996	21.0	3.3	1.42	4.73%	General Fill	0.057	113.8	0.96	0.000	0.96	0	0.89	18.624	1.78	22.83	21	4.96%	2.9	48%
16.896	6953.06	20.9	0.885	20.9	2.6	1.12	4.23%	General Fill	0.057	113.8	0.97	0.000	0.97	0	0.88	18.374	1.76	22.52	21	4.43%	2.9	48%
17.060	6952.90	28.3	0.852	28.3	3.9	1.71	3.01%	General Fill	0.057	113.8	0.97	0.000	0.97	0	0.88	24.892	2.38	30.51	28	3.12%	2.7	48%
17.224	6952.74	27.8	0.830	27.7	4.2	1.83	2.99%	General Fill	0.057	113.8	0.98	0.000	0.98	0	0.87	24.202	2.32	29.66	27	3.10%	2.7	48%
17.388	6952.57	26.6	0.901	26.6	4.3	1.87	3.39%	General Fill	0.057	113.8	0.99	0.000	0.99	0	0.87	23.003	2.20	28.20	26	3.52%	2.7	48%
17.552	6952.41	31.5	1.032	31.4	8.3	3.60	3.28%	General Fill	0.057	113.8	1.00	0.000	1.00	0	0.86	27.155	2.60	33.31	30	3.39%	2.6	48%
17.716	6952.24	33.0	1.144	33.0	12.4	5.37	3.46%	General Fill	0.057	113.8	1.01	0.000	1.01	0	0.86	28.335	2.71	34.78	32	3.57%	2.7	48%
17.880	6952.08	34.0	1.245	33.9	12.0	5.19	3.66%	General Fill	0.057	113.8	1.02	0.000	1.02	0	0.86	28.998	2.78	35.59	32	3.78%	2.7	48%
18.044	6951.92	34.1	1.228	34.0	11.0	4.78	3.60%	General Fill	0.057	113.8	1.03	0.000	1.03	0	0.85	28.922	2.77	35.49	32	3.71%	2.7	48%
18.208	6951.75	33.1	1.298	33.1	9.7	4.19	3.92%	General Fill	0.057	113.8	1.04	0.000	1.04	0	0.84	27.888	2.67	34.21	31	4.04%	2.7	48%
18.372	6951.59	37.5	1.786	37.5	-1.7	-0.73	4.76%	General Fill	0.057	113.8	1.05	0.000	1.05	0	0.84	31.615	3.03	38.70	35	4.90%	2.7	48%
18.537	6951.42	202.7	2.310	202.4	37.0	16.02	1.14%	Coarse Tailings	0.054	108.5	1.06	0.000	1.06	0	0.93	187.683	17.98	230.08	190	1.15%	1.7	21%
18.701	6951.26	378.5	3.479	378.3	20.7	8.97	0.92%	Coarse Tailings	0.054	108.5	1.07	0.000	1.07	0	0.93	352.527	33.77	431.82	354	0.92%	1.5	21%

Conditions at t_1 / Liquefaction Triggering Analyses Using CPT Data

Depth at time of CPT (ft)	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1, u_1 (tsf)	Effective Stress at t_1 (tsf)	Will soil behave as saturated during 1=Yes 0=No	Is soil susceptible or mod susceptible to 1=Yes 0=No	I&B (2008) CSR: r_d	C_σ	K_σ	ξ_R	K_α	CSR M=7.5, s'v=1atm	CRR: Δqc_{1n}	qc_{1n-cs}	CRR M=7.5, s'v=1atm	FoS	Youd (2001) CSR: r_d	D_r	f	K_σ	K_α	CSR M=7.5, s'v=1atm	Kc	qc_{1n-cs}	(CRR) M=7.5, s'v=1atm	FoS	Average FoS	Liquefiable? 1=Yes 0=No	I&B (2008) CN	qc1 TSF	qc1 MPa	qc1N
0.164	0.12	0.000	0.12	0	0	1.00	0.06	1.10	-0.02	1.00	0.098	42.05	75.69	0.107	N/A	0.99	0.33	0.80	1.47	1.00	0.077	1.00	33.64	0.078	N/A	N/A	N/A	1.70	27.48	2.63	33.64
0.328	0.13	0.000	0.13	0	0	1.00	0.10	1.10	-0.36	1.00	0.098	60.96	148.58	0.265	N/A	0.99	0.54	0.73	1.65	1.00	0.069	1.00	87.62	0.143	N/A	N/A	N/A	1.70	71.56	6.85	87.62
0.492	0.14	0.000	0.14	0	0	1.00	0.15	1.10	-0.58	1.00	0.098	80.62	224.37	1.000	N/A	0.99	0.69	0.65	1.85	1.00	0.061	1.00	143.75	0.356	N/A	N/A	N/A	1.70	117.39	11.24	143.75
0.656	0.15	0.000	0.15	0	0	1.00	0.30	1.10	-0.60	1.00	0.098	112.47	347.16	1.000	N/A	0.99	0.88	0.60	1.98	1.00	0.057	1.00	234.69	1.000	N/A	N/A	N/A	1.70	191.66	18.35	234.69
0.820	0.16	0.000	0.16	0	0	0.99	0.30	1.10	-0.60	1.00	0.098	144.61	471.03	1.000	N/A	0.99	1.04	0.60	1.93	1.00	0.059	1.00	326.42	1.000	N/A	N/A	N/A	1.70	266.57	25.52	326.42
0.984	0.17	0.000	0.17	0	0	0.99	0.30	1.10	-0.60	1.00	0.097	152.13	500.02	1.000	N/A	0.99	1.08	0.60	1.88	1.00	0.060	1.00	347.89	1.000	N/A	N/A	N/A	1.70	284.11	27.20	347.89
1.148	0.18	0.000	0.18	0	0	0.99	0.30	1.10	-0.60	1.00	0.097	169.53	567.12	1.000	N/A	0.99	1.15	0.60	1.84	1.00	0.062	1.00	397.58	1.000	N/A	N/A	N/A	1.70	324.69	31.09	397.58
1.312	0.19	0.000	0.19	0	0	0.99	0.30	1.10	-0.60	1.00	0.097	168.92	564.77	1.000	N/A	0.99	1.15	0.60	1.80	1.00	0.063	1.00	395.84	1.000	N/A	N/A	N/A	1.70	323.27	30.95	395.84
1.476	0.20	0.000	0.20	0	0	0.99	0.30	1.10	-0.60	1.00	0.097	184.93	626.48	1.000	N/A	0.99	1.21	0.60	1.76	1.00	0.064	1.00	441.54	1.000	N/A	N/A	N/A	1.70	360.59	34.52	441.54
1.640	0.21	0.000	0.21	0	0	0.99	0.30	1.10	-0.60	1.00	0.097	191.51	651.82	1.000	N/A	0.99	1.24	0.60	1.73	1.00	0.066	1.00	460.31	1.000	N/A	N/A	N/A	1.70	375.92	35.99	460.31
1.804	0.22	0.000	0.22	0	0	0.99	0.30	1.10	-0.60	1.00	0.097	194.11	661.86	1.000	N/A	0.99	1.25	0.60	1.70	1.00	0.067	1.00	467.75	1.000	N/A	N/A	N/A	1.70	381.99	36.57	467.75
1.968	0.23	0.000	0.23	0	0	0.99	0.30	1.10	-0.60	1.00	0.097	185.48	628.60	1.000	N/A	0.99	1.22	0.60	1.67	1.00	0.068	1.00	443.11	1.000	N/A	N/A	N/A	1.66	361.87	34.65	443.11
2.133	0.24	0.000	0.24	0	0	0.99	0.30	1.10	-0.60	1.00	0.097	171.13	572.50	1.000	N/A	0.99	1.16	0.60	1.64	1.00	0.069	1.01	403.48	1.000	N/A	N/A	N/A	1.63	327.79	31.38	401.38
2.297	0.25	0.000	0.25	0	0	0.99	0.30	1.10	-0.60	1.00	0.097	191.54	651.12	1.000	N/A	0.99	1.24	0.60	1.61	1.00	0.070	1.00	459.58	1.000	N/A	N/A	N/A	1.60	375.32	35.93	459.58
2.461	0.26	0.000	0.26	0	0	0.99	0.30	1.10	-0.60	1.00	0.097	214.02	737.65	1.000	N/A	0.99	1.32	0.60	1.59	1.00	0.071	1.00	523.63	1.000	N/A	N/A	N/A	1.57	427.62	40.94	523.63
2.625	0.27	0.000	0.27	0	0	0.98	0.30	1.10	-0.60	1.00	0.097	239.13	834.37	1.000	N/A	0.99	1.41	0.60	1.57	1.00	0.072	1.00	595.23	1.000	N/A	N/A	N/A	1.55	486.10	46.54	595.23
2.789	0.27	0.000	0.27	0	0	0.98	0.30	1.10	-0.60	1.00	0.096	279.54	989.95	1.000	N/A	0.99	1.54	0.60	1.55	1.00	0.073	1.00	710.41	1.000	N/A	N/A	N/A	1.52	580.16	55.54	710.41
2.953	0.28	0.000	0.28	0	0	0.98	0.30	1.10	-0.60	1.00	0.096	308.08	######	1.000	N/A	0.99	1.62	0.60	1.53	1.00	0.074	1.00	791.74	1.000	N/A	N/A	N/A	1.50	646.58	61.90	791.74
3.117	0.29	0.000	0.29	0	0	0.98	0.30	1.10	-0.60	1.00	0.096	312.16	######	1.000	N/A	0.99	1.64	0.60	1.51	1.00	0.075	1.00	803.38	1.000	N/A	N/A	N/A	1.48	656.08	62.81	803.38
3.281	0.30	0.000	0.30	0	0	0.98	0.30	1.10	-0.60	1.00	0.096	310.65	######	1.000	N/A	0.99	1.63	0.60	1.49	1.00	0.076	1.00	799.09	1.000	N/A	N/A	N/A	1.46	652.58	62.48	799.09
3.445	0.31	0.000	0.31	0	0	0.98	0.30	1.10	-0.60	1.00	0.096	306.46	######	1.000	N/A	0.99	1.62	0.60	1.47	1.00	0.077	1.00	787.15	1.000	N/A	N/A	N/A	1.44	642.83	61.54	787.15
3.609	0.32	0.000	0.32	0	0	0.98	0.30	1.10	-0.60	1.00	0.096	286.77	######	1.000	N/A	0.99	1.56	0.60	1.45	1.00	0.078	1.00	731.00	1.000	N/A	N/A	N/A	1.43	596.98	57.15	731.00
3.773	0.33	0.000	0.33	0	0	0.98	0.30	1.10	-0.60	1.00	0.096	263.47	928.08	1.000	N/A	0.99	1.49	0.60	1.44	1.00	0.078	1.00	664.61	1.000	N/A	N/A	N/A	1.41	542.75	51.96	664.61
3.937	0.34	0.000	0.34	0	0	0.98	0.30	1.10	-0.60	1.00	0.096	260.38	916.15	1.000	N/A	0.99	1.48	0.60	1.42	1.00	0.079	1.00	655.78	1.000	N/A	N/A	N/A	1.40	535.54	51.27	655.78
4.101	0.35	0.000	0.35	0	0	0.98	0.30	1.10	-0.60	1.00	0.096	257.13	903.64	1.000	N/A	0.99	1.47	0.60	1.40	1.00	0.080	1.00	646.52	1.000	N/A	N/A	N/A	1.38	527.98	50.55	646.52
4.265	0.36	0.000	0.36	0	0	0.97	0.30	1.10	-0.60	1.00	0.096	241.57	843.74	1.000	N/A	0.99	1.42	0.60	1.39	1.00	0.081	1.00	602.17	1.000	N/A	N/A	N/A	1.37	491.77	47.08	602.17
4.429	0.37	0.000	0.37	0	0	0.97	0.30	1.10	-0.60	1.00	0.095	226.56	785.95	1.000	N/A	0.98	1.37	0.60	1.38	1.00	0.082	1.00	559.39	1.000	N/A	N/A	N/A	1.35	456.82	43.74	559.39
4.593	0.38	0.000	0.38	0	0	0.97	0.30	1.10	-0.60	1.00	0.095	213.41	735.33	1.000	N/A	0.98	1.32	0.60	1.36	1.00	0.083	1.00	521.92	1.000	N/A	N/A	N/A	1.34	426.22	40.81	521.92
4.757	0.39	0.000	0.39	0	0	0.97	0.30	1.10	-0.60	1.00	0.095	192.69	655.53	1.000	N/A	0.98	1.24	0.60	1.35	1.00	0.083	1.00	462.84	1.000	N/A	N/A	N/A	1.33	377.98	36.19	462.84
4.921	0.40	0.000	0.40	0	0	0.97	0.30	1.10	-0.60	1.00	0.095	160.78	532.68	1.000	N/A	0.98	1.11	0.60	1.34	1.00	0.084	1.00	371.90	1.000	N/A	N/A	N/A	1.32	303.71	29.08	371.90
5.085	0.41	0.000	0.41	0	0	0.97	0.30	1.10	-0.60	1.00	0.095	131.13	418.52	1.000	N/A	0.98	0.98	0.60	1.32	1.00	0.085	1.00	287.38	1.000	N/A	N/A	N/A	1.31	234.69	22.47	287.38
5.249	0.41	0.000	0.41	0	0	0.97	0.30	1.10	-0.60	1.00	0.095	105.63	320.30	1.000	N/A	0.98	0.85	0.60	1.31	1.00	0.086	1.06	226.94	1.000	N/A	N/A	N/A	1.36	175.31	16.78	214.67
5.413	0.42	0.000	0.42	0	0	0.97	0.16	1.10	-0.57	1.00	0.095	82.09	229.67	1.000	N/A	0.98	0.70	0.65	1.26	1.00	0.089	1.21	178.80	1.000	N/A	N/A	N/A	1.47	120.52	11.54	147.58
5.577	0.43	0.000	0.43	0	0	0.97	0.11	1.07	-0.43	1.00	0.097	68.39	176.94	0.490	N/A	0.98	0.60	0.70	1.21	1.00	0.093	1.47	159.31	0.456	N/A	N/A	N/A	1.56	88.64	8.49	108.55
5.741	0.44	0.000	0.44	0	0	0.97	0.10	1.06	-0.35	1.00	0.098	61.84	151.72	0.279	N/A	0.98	0.55	0.73	1.18	1.00	0.095	1.75	157.18	0.441	N/A	N/A	N/A	1.60	73.40	7.03	89.87
5.905	0.45	0.000	0.45	0	0	0.96	0.09	1.05	-0.29	1.00	0.099	57.81	136.21	0.220	N/A	0.98	0.51	0.74	1.16	1.00	0.096	2.01	157.66	0.444	N/A	N/A	N/A	1.61	64.02	6.13	78.39
6.069	0.46	0.000	0.46	0	0	0.96	0.08	1.05	-0.26	1.00	0.099	55.34	126.67	0.195	N/A	0.98	0.49	0.76	1.15	1.00	0.097	2.29	163.35	1.000	N/A	N/A	N/A	1.61	58.25	5.58	71.33
6.234	0.47	0.000	0.47	0	0	0.96	0.09	1.05	-0.29	1.00	0.099	57.72	135.86	0.219	N/A	0.98	0.51	0.74	1.15	1.00	0.097	2.08	162.71	1.000	N/A	N/A	N/A	1.57	63.81	6.11	78.14
6.398	0.48	0.000	0.48	0	0	0.96	0.09	1.05	-0.28	1.00	0.099	57.03	133.19	0.212	N/A	0.98	0.50	0.75	1.14	1.00	0.098	2.19	166.51	1.000	N/A	N/A	N/A	1.55	62.19	5.95	76.16
6.562	0.49	0.000	0.49	0	0	0.96	0.09	1.04	-0.26	1.00	0.099	55.69	128.05	0.198	N/A	0.98	0.49	0.75	1.13	1.00	0.099	2.46	178.26	1.000	N/A	N/A	N/A	1.54	59.09	5.66	72.35
6.726	0.50	0.000	0.50	0	0	0.96	0.09	1.04	-0.29	1.00	0.099	57.52	135.06	0.217	N/A	0.98	0.51	0.75	1.13	1.00	0.099	2.33	180.56	1.000	N/A	N/A	N/A	1.51	63.33	6.06	77.54
6.890	0.51	0.000	0.51	0	0	0.96	0.10	1.05	-0.33	1.00	0.099	60.69	147.28	0.260	N/A	0.98	0.54	0.73	1.14	1.00	0.098	2.15	185.77	1.000	N/A	N/A	N/A	1.46	70.71	6.77	86.59
7.054	0.52	0.000	0.52	0	0	0.96	0.10	1.05	-0.36	1.00	0.099	63.21	156.97	0.307	N/A	0.98	0.56	0.72	1.14	1.00	0.098	2.00	187.11	1.000	N/A	N/A	N/A	1.43	76.57	7.33	93.77
7.218	0.53	0.000	0.53	0	0	0.96	0.11	1.05	-0.42	1.00	0.098	67.81	174.70	0.460	N/A	0.98	0.60	0.70	1.14	1.00	0.098	1.72	184.05	1.000	N/A	N/A	N/A	1.38	87.29	8.36	106.89
7.382	0.54	0.000	0.54	0	0	0.95	0.13	1.05	-0.48	1.00	0.098	73.21	195.49	0.933	N/A	0.98	0.64	0.68	1.14	1.00	0.098	1.58	193.20	1.000	N/A	N/A	N/A	1.34	99.86	9.56	122.28
7.546	0.55	0.000	0.55	0	0	0.95	0.13	1.05	-0.48	1.00	0.098	73.59	196.96	0.994	N/A	0.98	0.64	0.68	1.14	1.00	0.098	1.66	205.00	1.000	N/A	N/A	N/A	1.33	100.75	9.65	123.37
7.710	0.55	0.000	0.55	0	0	0.95	0.11	1.04	-0.43	1.00	0.098	68.88	178.81	0.517	N/A	0.98	0.61	0.70	1.12	1.00	0.099	1.89	208.12	1.000	N/A	N/A	N/A	1.33	89.78	8.60	109.93
7.874	0.56	0.000	0.56	0	0	0.95	0.12	1.04	-0.44	1.00	0.098	69.46	181.05	0.553	N/A	0.98	0.61	0.70	1.12	1.00	0.100	1.93	215.13	1.000	N/A	N/A	N/A	1.32	91.13	8.72	111.59
8.038	0.57	0.000	0.57	0	0	0.95	0.13	1.04	-0.47	1.00	0.098	73.00	194.69	0.903	N/A	0.98	0.64	0.68	1.12	1.00	0.100	1.81	219.87	1.000	N/A	N/A	N/A	1.29	99.38	9.51	121.69
8.202	0.58	0.000	0.58	0	0	0.95	0.13	1.04	-0.47	1.00	0.098	72.63	193.27	0.852	N/A	0.98	0.63	0.68	1.11	1.00	0.100	1.89	228.16	1.000	N/A	N/A	N/A	1.28	98.52	9.43	120.64
8.366	0.59	0.000	0.59	0	0	0.95	0.12	1.04	-0.46	1.00	0.098	71.68	189.59	0.739	N/A	0.98	0.63	0.69	1.11	1.00	0.101	1.95	229.91	1.000	N/A	N/A	N/A	1.27	96.30	9.22	117.92
8.530	0.60	0.000	0.60	0	0	0.95	0.15	1.04	-0.53	1.00	0.098	79.09	218.14	1.000	N/A	0.98	0.68	0.66	1.11	1.00	0.100	1.69	235.47	1.000	N/A	N/A	N/A	1.24	113.55	10.87	139.05
8.694	0.61	0.000	0.61	0	0	0.95	0.15	1.04	-0.54	1.00	0.098	79.41	219.37	1.000	N/A	0.97	0.68	0.66	1.10	1.00	0.101	1.74	243.06	1.000	N/A	N/A	N/A	1.23	114.30	10.94	139.96
8.858	0.62	0.000	0.62	0	0	0.94	0.14	1.04	-0.52	1.00	0.098	77.36	211.45	1.000	N/A	0.97	0.67	0.67	1.10	1.00	0.101	1.85	248.74	1.000	N/A	N/A	N/A	1.22	109.51	10.48	134.10
9.022	0.63	0.000	0.63	0	0	0.94	0.12	1.03	-0.46	1.00	0.099	71.76	189.89	0.748	N/A	0.97	0.63	0.69	1.09	1.00	0.102	2.14	253.19	1.000	N/A	N/A	N/A	1.23	96.48	9.24	118.13
9.186	0.64	0.000	0.64	0	0	0.94	0.12	1.03	-0.46	1.00	0.099	71.72	189.75	0.744	N/A	0.97	0.63	0.69	1.08	1.00	0.103	2.03	239.81	1.000	N/A	N/A	N/A	1.22	96.39	9.23	118.03
9.350	0.65	0.000	0.65	0	0	0.94	0.11	1.03	-0.42	1.00	0.099	68.13	175.93	0.476	N/A	0.97	0.60	0.70	1.07	1.00	0.104	2.08	224.58	1.000	N/A	N/A	N/A	1.22	88.04	8.43	107.80
9.514	0.66	0.000	0.66	0	0	0.94	0.11	1.02	-0.39	1.00	0.099	65.89	167.30	0.382	N/A	0.97	0.58	0.71	1.07	1.00	0.104	2.13	216.09	1.000	N/A	N/A	N/A	1.22	82.82	7.93	101.41
9.678	0.67	0.000	0.67	0	0	0.94	0.11	1.02	-0.40	1.00	0.099	66.87	171.06	0.418	N/A	0.97	0.59	0.71	1.06	1.00	0.105	2.09	218.22	1.000	N/A	N/A	N/A	1.21	85.09	8.15	104.19
9.842	0.68	0.000	0.68	0	0	0.94	0.11	1.02	-0.40	1.00	0.099	66.99	171.53	0.423	N/A	0.97	0.59	0.70	1.06	1.00	0.105	2.06	215.24	1.000	N/A	N/A	N/A	1.20	85.37	8.17	104.54
10.006	0.69	0.000	0.69	0	0	0.94	0.10	1.02	-0.35	1.00	0.099	62.41	153.92	0.290	N/A	0.97	0.55	0.72	1.05	1.00	0.106	2.46	224.80	1.000	N/A	N/A	N/A	1.20	74.73	7.15	91.50
10.170	0.69	0.000	0.69	0	0	0.94	0.09	1.01	-0.30	1.00	0.099	58.93	140.52	0.234	N/A	0.97	0.52	0.74	1.04	1.00	0.106	2.49	203.10	1.000	N/A	N/A	N/A	1.20	66.63	6.38	81.59
10.335	0.70	0.000	0.70	0	0	0.93	0.09	1.01	-0.25	1.00	0.100	55.61	127.72	0.197	N/A	0.97	0.49	0.75	1.04	1.00	0.107	2.58	186.24	1.000	N/A	N/A	N/A	1.20	58.89	5.64	72.11
10.499	0.71	0.000	0.71	0	0	0.93	0.08	1.01	-0.21	1.00	0.100	53.37	119.11	0.178	N/A	0.97	0.47	0.77	1.03	1.00	0.107	2.72	178.68	1.000	N/A	N/A	N/A	1.19	53.68	5.14	65.73
10.663	0.72	0.000	0.72	0	0	0.93	0.08	1.01	-0.19	1.00	0.100	51.92	113.52	0.166	N/A	0.97	0.45	0.77	1.03	1.00	0.108	2.53	155.68	0.431	N/A	N/A	N/A	1.19	50.30	4.82	61.60
10.827	0.73	0.000	0.73	0	0	0.93	0.07	1.01	-0.14	1.00	0.100	49.43	103.91	0.149	N/A	0.97	0.43	0.79	1.02	1.00	0.108	2.94	160.33	1.000	N/A	N/A	N/A	1.18	44.50	4.26	54.49
10.991	0.74	0.000	0.74	0	0	0.93	0.07	1.01	-0.12	1.00	0.100	48.13	98.91	0.141	N/A	0.97	0.41	0.79	1.02	1.00	0.108	3.19	162.20	1.000	N/A	N/A	N/A	1.18	41.47	3.97	50.79
11.155	0.75	0.000	0.75	0	0	0.93	0.07	1.01	-0.11	1.00	0.100	48.03	98.52	0.140	N/A	0.97	0.41	0.79	1.02	1.00	0.109	3.19	161.01	1.000	N/A	N/A	N/A	1.17	41.23	3.95	50.49
11.319	0.76	0.000	0.76	0	0	0.93	0.07	1.01	-0.12	1.00	0.100	48.51	100.38	0.143	N/A	0.97	0.42	0.79	1.02	1.00	0.109	3.14	162.66	1.000	N/A	N/A	N/A	1.15	42.36	4.06	51.87
11.483	0.77	0.000	0.77	0	0	0.93	0.07	1.00	-0.12	1.00	0.099	48.50	100.36	0.143	N/A	0.97	0.42	0.79	1.01	1.00	0.109	3.30	171.31	1.000	N/A	N/A	N/A	1.14	42.35	4.05	51.85
11.647	0.78	0.000	0.78	0	0	0.92	0.07	1.00	-0.09	1.00	0.099	46.94	94.34	0.134	N/A	0.97	0.40	0.80	1.01	1.00	0.109	3.31	157.12	0.441	N/A	N/A	N/A	1.14	38.71	3.71	47.40
11.811	0.79	0.000	0.79	0	0	0.92	0.07	1.00	-0.08	1.00	0.099	46.60	93.04	0.132	N/A	0.97	0.39	0.80	1.01	1.00	0.110	3.56	165.52	1.000	N/A	N/A	N/A	1.13	37.92	3.63	46.44
11.975	0.80	0.000	0.80	0	0	0.92	0.11	1.00	-0.38	1.00	0.099	65.10	164.28	0.357	N/A	0.97	0.57	0.71	1.01	1.00	0.110	1.59	157.51	0.443	N/A	N/A	N/A	1.09	80.99	7.75	99.18
12.139	0.81	0.000	0.81	0	0	0.92	0.16	1.00	-0.56	1.00	0.099	82.64	231.79	1.000	N/A	0.97	0.71	0.65	1.00	1.00	0.110	1.23	182.80	1.000	N/A	N/A	N/A	1.07	121.81	11.66	149.15
12.303	0.82	0.000	0.82	0	0	0.92	0.25	1.00	-0.60	1.00	0.099	99.05	294.99	1.000	N/A	0.97	0.81	0.60	1.00	1.00	0.110	1.08	210.76	1.000	N/A	N/A	N/A	1.05	160.01	15.32	195.93
12.467	0.83	0.000	0.83	0	0	0.92	0.30	1.00	-0.60	1.00	0.099	108.24	330.38	1.000	N/A	0.97	0.86	0.60	1.00	1.00	0.111	1.02	226.92	1.000	N/A	N/A	N/A	1.04	181.41	17.37	222.13
12.631	0.83	0.000	0.83	0	0	0.92	0.30	0.99	-0.60	1.00	0.100	114.15	353.13	1.000	N/A	0.97	0.89	0.60	0.99	1.00	0.111	1.01	241.01	1.000	N/A	N/A	N/A	1.03	195.16	18.69	238.98
12.795	0.84	0.000	0.84	0	0	0.92	0.30	0.99	-0.60	1.00	0.100	114.71	355.29	1.000	N/A	0.97	0.90	0.60	0.99	1.00	0.112	1.02	245.62	1.000	N/A	N/A	N/A	1.03	196.47	18.81	240.58
12.959	0.85	0.000	0.85	0	0	0.91	0.30	0.99	-0.60	1.00	0.100	112.28	345.93	1.000	N/A	0.96	0.88	0.60	0.98	1.00	0.112	1.05	244.86	1.000	N/A	N/A	N/A	1.03	190.81	18.27	233.65
13.123	0.86	0.000	0.86	0	0	0.91	0.30	0.98	-0.60	1.00	0.100	87.29	305.22	1.000	N/A	0.96	0.85	0.60	0.98	1.00	0.113	1.07	232.85	1.000	N/A	N/A	N/A	1.03	177.98	17.04	217.94
13.287	0.87	0.000	0.87	0	0	0.91	0.21	0.99	-0.60	1.00	0.100	75.87	253.97	1.000	N/A	0.96	0.77	0.61	0.98	1.00	0.113	1.15	203.96	1.000	N/A	N/A	N/A	1.03	145.45	13.93	178.11
13.451	0.88	0.000	0.88	0	0	0.91	0.14	0.99	-0.50	1.00	0.099	62.38	193.45	0.858	N/A	0.96	0.66	0.67	0.98	1.00	0.113	1.37	179.07	1.000	N/A	N/A	N/A	1.03	107.04	10.25	131.08
13.615	0.89	0.000	0.89	0	0	0.91	0.10	0.99	-0.35	1.00	0.099	51.44	144.39	0.248	N/A	0.96	0.56	0.72	0.98	1.00	0.113	1.99	185.31	1.000	N/A	N/A	N/A	1.02	75.91	7.27	92.95
13.779	0.90	0.000	0.90	0	0	0.91	0.08	0.99	-0.24	1.00	0.099	45.15	116.16	0.172	N/A	0.96	0.49	0.76	0.98	1.00	0.112	2.91	206.80	1.000	N/A	N/A	N/A	1.02	57.99	5.55	71.01
13.943	0.91	0.000	0.91	0	0	0.91	0.08	0.99	-0.17	1.00	0.099	41.95	101.81	0.146	N/A	0.96	0.45	0.78	0.98	1.00	0.112	3.47	207.80	1.000	N/A	N/A	N/A	1.01	48.89	4.68	59.86
14.107	0.92	0.000	0.92	0	0	0.91	0.07	0.99	-0.10	1.00	0.099	47.78	97.57	0.139	N/A	0.96	0.41	0.80	0.98	1.00	0.112	3.78	188.01	1.000	N/A	N/A	N/A	1.01	40.66	3.89	49.79
14.271	0.93	0.000	0.93	0	0	0.90	0.07	0.99	-0.06	1.00	0.098	45.79	89.91	0.127	N/A	0.96	0.38	0.80	0.98	1.00	0.113	3.89	171.75	1.000	N/A	N/A	N/A	1.00	36.03	3.45	44.12
14.436	0.93	0.000	0.93	0	0	0.90	0.06	0.99	0.01	1.00	0.098	42.75	78.22	0.110	N/A	0.96	0.34	0.80	0.97	1.00	0.113	4.33	153.61	0.417	N/A	N/A	N/A	0.99	28.96	2.77	35.47
14.600	0.94	0.000	0.94	0	0	0.90	0.06	0.99	0.03	1.00	0.098	42.09	75.66	0.107	N/A	0.96	0.33	0.80	0.97	1.00	0.113	4.23	141.97	0.346	N/A	N/A	N/A	0.98	27.41	2.62	33.57
14.764	0.95	0.000	0.95	0	0	0.90	0.06	0.99	0.04	1.00	0.098	41.68	74.07	0.105	N/A	0.96	0.33	0.80	0.97	1.00	0.113	4.23	137.13	0.320	N/A	N/A	N/A	0.98	26.45	2.53	32.39
14.928	0.96	0.000	0.96	0	0	0.90	0.06	0.99	0.06	1.00	0.098	40.92	71.14	0.101	N/A	0.96	0.32	0.80	0.97	1.00	0.113	4.27	129.06	0.280	N/A	N/A	N/A	0.97	24.68	2.36	30.23
15.092	0.97	0.000	0.97	0	0	0.90	0.06	0.99	0.08	1.00	0.098	40.44	69.30	0.099	N/A	0.96	0.31	0.80	0.97	1.00	0.113	4.48	129.24	0.281	N/A	N/A	N/A	0.96	23.57	2.26	28.86
15.256	0.98	0.000	0.98	0	0	0.90	0.06	0.99	0.09	1.00	0.098	39.91	67.28	0.096	N/A	0.96	0.30	0.80	0.96	1.00	0.114	4.73	129.42	0.282	N/A	N/A	N/A	0.95	22.35	2.14	27.37
15.420	0.99	0.000	0.99	0	0	0.90	0.06	0.99	0.10	1.00	0.098	39.00	63.75	0.092	N/A	0.96	0.29	0.80	0.96	1.00	0.114	5.21	128.92	0.279	N/A	N/A	N/A	0.94	20.22	1.94	24.75
15.584	1.00	0.000	1.00	0	0	0.89	0.06	0.99	0.10	1.00	0.098	39.42	65.38	0.094	N/A	0.96	0.29	0.80	0.96	1.00	0.114	4.88	126.64	0.269	N/A	N/A	N/A	0.94	21.20	2.03	25.96
15.748	1.01	0.000	1.01	0	0	0.89	0.06	0.99	0.10	1.00	0.098	38.86	63.21	0.091	N/A	0.96	0.28	0.80	0.96	1.00	0.114	5.02	122.32	0.250	N/A	N/A	N/A	0.93	19.89	1.90	24.36
15.912	1.02	0.000	1.02	0	0	0.89	0.05	0.99	0.10	1.00	0.097	38.53	61.96	0.090	N/A	0.96	0.28	0.80	0.96	1.00	0.114	5.24	122.65	0.252	N/A	N/A	N/A	0.92	19.13	1.83	23.43
16.076	1.03	0.000	1.03	0	0	0.89	0.05	0.99	0.10	1.00	0.097	37.50	58.00	0.086	N/A	0.96	0.26	0.80	0.95	1.00	0.114	6.01	123.29	0.254	N/A	N/A	N/A	0.91	16.74	1.60	20.50
16.240	1.04	0.000	1.04	0	0	0.89	0.05	0.99	0.10	1.00	0.097	37.77	59.02	0.087	N/A	0.96	0.27	0.80	0.95	1.00	0.115	5.70	121.19	0.246	N/A	N/A	N/A	0.90	17.36	1.66	21.26
16.404	1.05	0.000	1.05	0	0	0.89	0.06	0.99	0.10	1.00	0.097	38.90	63.38	0.092	N/A	0.96	0.29	0.80	0.95	1.00	0.115	4.92	120.42	0.242	N/A	N/A	N/A	0.90	19.99	1.91	24.48
16.568	1.06	0.000	1.06	0	0	0.89	0.06	0.99	0.10	1.00	0.097	39.01	63.81	0.092	N/A	0.96	0.29	0.80	0.95	1.00	0.115	5.00	124.00	0.257	N/A	N/A	N/A	0.89	20.25	1.94	24.80
16.732	1.07	0.000	1.07	0	0	0.89	0.05	0.99	0.10	1.00	0.097	38.32	61.15	0.089	N/A	0.96	0.28	0.80	0.95	1.00	0.115	5.48	125.12	0.262	N/A	N/A	N/A	0.89	18.64	1.78	22.83
16.896	1.07	0.000	1.07	0	0	0.88	0.05	0.99	0.10	1.00	0.097	38.21	60.73	0.089	N/A	0.96	0.27	0.80	0.95	1.00	0.115	5.23	117.83	0.232	N/A	N/A	N/A	0.88	18.39	1.76	22.52
17.060	1.08	0.000	1.08	0	0	0.88	0.06	0.98	0.06	1.00	0.097	41.01	71.52	0.102	N/A	0.96	0.32	0.80	0.94	1.00	0.115	3.65	111.34	0.208	N/A	N/A	N/A	0.88	24.91	2.39	30.51
17.224	1.09	0.000	1.09	0	0	0.88	0.06	0.98	0.07	1.00	0.097	40.72	70.38	0.100	N/A	0.95	0.31	0.80	0.94	1.00	0.116	3.71	110.05	0.204	N/A	N/A	N/A	0.87	24.22	2.32	29.66
17.388	1.10	0.000	1.10	0	0	0.88	0.06	0.98	0.09	1.00	0.097	40.20	68.40	0.098	N/A	0.95	0.31	0.80	0.94	1.00	0.116	4.09	115.28	0.222	N/A	N/A	N/A	0.87	23.03	2.20	28.20
17.552	1.11	0.000	1.11	0	0	0.88	0.06	0.98	0.04	1.00	0.097	42.00	75.30	0.106	N/A	0.95	0.33	0.80	0.94	1.00	0.116	3.63	121.02	0.245	N/A	N/A	N/A	0.86	27.20	2.60	33.31
17.716	1.12	0.000	1.12	0	0	0.88	0.06	0.98	0.02	1.00	0.097	42.51	77.29	0.109	N/A	0.95	0.34	0.80	0.94	1.00	0.116	3.65	126.93	0.270	N/A	N/A	N/A	0.86	28.40	2.72	34.78
17.880	1.13	0.000	1.13	0	0	0.88	0.06	0.98	0.02	1.00	0.097	42.80	78.38	0.110	N/A	0.95	0.34	0.80	0.94	1.00	0.116	3.72	132.22	0.295	N/A	N/A	N/A	0.86	29.06	2.78	35.59
18.044	1.14	0.000	1.14	0	0	0.88	0.06	0.98	0.02	1.00	0.096	42.76	78.25	0.110	N/A	0.95	0.34	0.80	0.94	1.00	0.116	3.69	131.07	0.289	N/A	N/A	N/A	0.85	28.98	2.77	35.49
18.208	1.15	0.000	1.15	0	0	0.87	0.06	0.98	0.03	1.00	0.096	42.31	76.53	0.108	N/A	0.95	0.34	0.80	0.93	1.00	0.116	3.96	135.34	0.311	N/A	N/A	N/A	0.84	27.94	2.67	34.21
18.372	1.16	0.000	1.16	0	0	0.87	0.06	0.98	-0.01	1.00	0.096	43.89	82.59	0.116	N/A	0.95	0.36	0.80	0.93	1.00	0.117	4.10	158.79	0.452	N/A	N/A	N/A	0.84	31.61	3.03	38.70
18.537	1.17	0.000	1.17	0	0	0.87	0.30	0.89	-0.60	1.00	0.105	90.77	320.85	1.000	N/A	0.95	0.88	0.60	0.87	1.00	0.125	1.07	246.12	1.000	N/A	N/A	N/A	0.93	187.90	17.99	230.08
18.701	1.18	0.000	1.18	0	1	0.87	0.30	0.89	-0.60	1.00	0.105	148.63	580.45	1.000	N/A	0.95	1.20	0.60	0.86	1.00	0.126	1.00	431.82	1.000	N/A	N/A	N/A	0.93	352.65	33.76	431.82

Liquefaction Triggering Analyses Using SPT Data

Depth at time of SPT (ft)	Field Blow Count, N (from 2.5in	Rod Length Correction Factor	N_{60}	$(N_1)_{60}$ (blows/ft)	Relative Density D_R	m	SPT Correction Factor C_N	I&B (2008): $\Delta(N_1)_{60}$ (blows/ft)	$(N_1)_{60cs}$ (blows/ft)	(CRR) M=7.5, σ'vc=1atm	FoS	Youd (2001): α	β	$(N_1)_{60cs}$ (blows/ft)	(CRR) M=7.5, σ'vc=1atm	FoS	Average FoS
0.164		0.75	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.328		0.75	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.492		0.75	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.656		0.75	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.820		0.75	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.984		0.75	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
1.148		0.75	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
1.312		0.75	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
1.476		0.75	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
1.640		0.75	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
1.804		0.75	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
1.968		0.75	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
2.133		0.75	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
2.297		0.75	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
2.461		0.75	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
2.625		0.75	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
2.789		0.75	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
2.953		0.75	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
3.117		0.75	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
3.281		0.80	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
3.445		0.80	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
3.609		0.80	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
3.773		0.80	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
3.937		0.80	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
4.101		0.80	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
4.265		0.80	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
4.429		0.80	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
4.593		0.80	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
4.757		0.80	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
4.921		0.80	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
5.085		0.80	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
5.249		0.80	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
5.413		0.80	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
5.577		0.80	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
5.741		0.80	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
5.905	20	0.80	15	19	0.69	0.43	1.29	5.6	24.5	0.28	N/A	5.00	1.20	27.72	0.360	N/A	N/A
6.069		0.80	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
6.234		0.80	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
6.398		0.80	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
6.562		0.85	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
6.726		0.85	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
6.890		0.85	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
7.054		0.85	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
7.218		0.85	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
7.382		0.85	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
7.546		0.85	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
7.710		0.85	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
7.874		0.85	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
8.038		0.85	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
8.202		0.85	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
8.366		0.85	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
8.530		0.85	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
8.694		0.85	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
8.858		0.85	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
9.022		0.85	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
9.186		0.85	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
9.350		0.85	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
9.514		0.85	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
9.678		0.85	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
9.842		0.85	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
10.006		0.85	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
10.170		0.85	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
10.335		0.85	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
10.499		0.85	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
10.663		0.85	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
10.827		0.85	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
10.991	26	0.85	20	21	0.73	0.41	1.04	5.6	26.8	0.34	N/A	5.00	1.20	30.37	N/A	N/A	N/A
11.155		0.85	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
11.319		0.85	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
11.483		0.85	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
11.647		0.85	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
11.811		0.85	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
11.975		0.85	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
12.139		0.85	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
12.303		0.85	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
12.467		0.85	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
12.631		0.85	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
12.795		0.85	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
12.959		0.85	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
13.123		0.85	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
13.287		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
13.451		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
13.615		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
13.779		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
13.943		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
14.107		0.95	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
14.271		0.95	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
14.436		0.95	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
14.600		0.95	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
14.764		0.95	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
14.928		0.95	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
15.092		0.95	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
15.256		0.95	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
15.420		0.95	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
15.584		0.95	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
15.748		0.95	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
15.912	16	0.95	14	13	0.56	0.49	0.90	5.6	18.2	0.19	N/A	5.00	1.20	20.05	0.216	N/A	N/A
16.076		0.95	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
16.240		0.95	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
16.404		0.95	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
16.568		0.95	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
16.732		0.95	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
16.896		0.95	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
17.060		0.95	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
17.224		0.95	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
17.388		0.95	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
17.552		0.95	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
17.716		0.95	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
17.880		0.95	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
18.044		0.95	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
18.208		0.95	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
18.372		0.95	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
18.537		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
18.701		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-

18.865	6951.10	441.9	4.569	441.8	14.7	6.39	1.03%	Coarse Tailings	0.054	108.5	1.08	0.000	1.08	0
19.029	6950.93	455.6	5.386	455.5	13.0	5.63	1.18%	Coarse Tailings	0.054	108.5	1.09	0.000	1.09	0
19.193	6950.77	444.3	5.970	444.2	12.2	5.29	1.34%	Coarse Tailings	0.054	108.5	1.09	0.000	1.09	0
19.357	6950.60	447.3	6.547	447.2	11.4	4.94	1.46%	Coarse Tailings	0.054	108.5	1.10	0.000	1.10	0
19.521	6950.44	453.3	6.951	453.2	14.3	6.20	1.53%	Coarse Tailings	0.054	108.5	1.11	0.000	1.11	0
19.685	6950.28	436.4	7.310	436.3	14.0	6.06	1.68%	Coarse Tailings	0.054	108.5	1.12	0.000	1.12	0
19.849	6950.11	422.3	6.337	422.2	13.0	5.63	1.50%	Coarse Tailings	0.054	108.5	1.13	0.000	1.13	0
20.013	6949.95	398.5	6.234	398.4	11.5	4.96	1.56%	Coarse Tailings	0.054	108.5	1.14	0.000	1.14	0
20.177	6949.78	371.7	5.676	371.7	6.4	2.79	1.53%	Coarse Tailings	0.054	108.5	1.15	0.000	1.15	0
20.341	6949.62	347.5	5.235	347.4	5.6	2.42	1.51%	Coarse Tailings	0.054	108.5	1.16	0.000	1.16	0
20.505	6949.46	327.3	4.619	327.2	5.1	2.22	1.41%	Coarse Tailings	0.054	108.5	1.17	0.000	1.17	0
20.669	6949.29	307.4	4.488	307.4	4.5	1.95	1.46%	Coarse Tailings	0.054	108.5	1.17	0.000	1.17	0
20.833	6949.13	276.6	4.116	276.6	4.5	1.95	1.49%	Coarse Tailings	0.054	108.5	1.18	0.000	1.18	0
20.997	6948.96	250.8	3.769	250.8	3.9	1.69	1.50%	Coarse Tailings	0.054	108.5	1.19	0.000	1.19	0
21.161	6948.80	220.8	3.195	220.8	3.1	1.32	1.45%	Coarse Tailings	0.054	108.5	1.20	0.000	1.20	0
21.325	6948.64	194.2	2.742	194.1	2.7	1.18	1.41%	Coarse Tailings	0.054	108.5	1.21	0.000	1.21	0
21.489	6948.47	165.8	2.280	165.8	1.8	0.77	1.38%	Coarse Tailings	0.054	108.5	1.22	0.000	1.22	0
21.653	6948.31	144.1	1.934	144.1	0.9	0.39	1.34%	Coarse Tailings	0.054	108.5	1.23	0.000	1.23	0
21.817	6948.14	126.1	1.695	126.1	0.5	0.23	1.34%	Coarse Tailings	0.054	108.5	1.24	0.000	1.24	0
21.981	6947.98	113.3	1.453	113.3	-0.4	-0.16	1.28%	Coarse Tailings	0.054	108.5	1.25	0.000	1.25	0
22.145	6947.82	102.3	1.353	102.3	-0.4	-0.18	1.32%	Coarse Tailings	0.054	108.5	1.25	0.000	1.25	0
22.309	6947.65	95.2	1.213	95.2	-0.3	-0.12	1.27%	Coarse Tailings	0.054	108.5	1.26	0.000	1.26	0
22.473	6947.49	78.6	1.079	78.6	-1.5	-0.63	1.37%	Coarse Tailings	0.054	108.5	1.27	0.000	1.27	0
22.638	6947.32	70.0	0.980	70.0	-1.0	-0.45	1.40%	Coarse Tailings	0.054	108.5	1.28	0.000	1.28	0
22.802	6947.16	65.0	0.861	65.0	-0.9	-0.39	1.32%	Coarse Tailings	0.054	108.5	1.29	0.000	1.29	0
22.966	6946.99	56.3	0.793	56.3	-0.8	-0.36	1.41%	Coarse Tailings	0.054	108.5	1.30	0.000	1.30	0
23.130	6946.83	51.3	0.713	51.3	-0.5	-0.23	1.39%	Coarse Tailings	0.054	108.5	1.31	0.000	1.31	0
23.294	6946.67	47.5	0.618	47.5	-0.6	-0.26	1.30%	Coarse Tailings	0.054	108.5	1.32	0.000	1.32	0
23.458	6946.50	44.5	0.554	44.5	-0.5	-0.23	1.25%	Coarse Tailings	0.054	108.5	1.33	0.000	1.33	0
23.622	6946.34	43.1	0.488	43.1	-0.3	-0.14	1.13%	Coarse Tailings	0.054	108.5	1.33	0.000	1.33	0
23.786	6946.17	41.2	0.375	41.2	-0.1	-0.04	0.91%	Coarse Tailings	0.054	108.5	1.34	0.000	1.34	0
23.950	6946.01	42.3	0.401	42.3	-0.5	-0.20	0.95%	Coarse Tailings	0.054	108.5	1.35	0.000	1.35	0
24.114	6945.85	39.3	0.439	39.3	-0.1	-0.02	1.12%	Coarse Tailings	0.054	108.5	1.36	0.000	1.36	0
24.278	6945.68	43.9	0.477	43.9	-0.2	-0.10	1.09%	Coarse Tailings	0.054	108.5	1.37	0.000	1.37	0
24.442	6945.52	45.2	0.519	45.2	-0.4	-0.18	1.15%	Coarse Tailings	0.054	108.5	1.38	0.000	1.38	0
24.606	6945.35	45.9	0.556	46.0	-0.5	-0.23	1.21%	Coarse Tailings	0.054	108.5	1.39	0.000	1.39	0
24.770	6945.19	50.0	0.600	50.0	-0.1	-0.02	1.20%	Coarse Tailings	0.054	108.5	1.40	0.000	1.40	0
24.934	6945.03	54.6	0.540	54.6	0.4	0.18	0.99%	Coarse Tailings	0.054	108.5	1.41	0.000	1.41	0
25.098	6944.86	61.3	0.648	61.3	-0.1	-0.04	1.06%	Coarse Tailings	0.054	108.5	1.41	0.000	1.41	0
25.262	6944.70	74.3	0.758	74.3	0.1	0.04	1.02%	Coarse Tailings	0.054	108.5	1.42	0.000	1.42	0
25.426	6944.53	86.5	0.916	86.5	0.2	0.08	1.06%	Coarse Tailings	0.054	108.5	1.43	0.000	1.43	0
25.590	6944.37	103.5	1.055	103.5	0.1	0.02	1.02%	Coarse Tailings	0.054	108.5	1.44	0.000	1.44	0
25.754	6944.21	107.1	1.159	107.1	0.1	0.06	1.08%	Coarse Tailings	0.054	108.5	1.45	0.000	1.45	0
25.918	6944.04	104.7	1.177	104.7	-0.3	-0.14	1.12%	Coarse Tailings	0.054	108.5	1.46	0.000	1.46	0
26.082	6943.88	101.2	1.179	101.2	-0.2	-0.08	1.16%	Coarse Tailings	0.054	108.5	1.47	0.000	1.47	0
26.246	6943.71	98.4	1.211	98.4	-0.1	-0.06	1.23%	Coarse Tailings	0.054	108.5	1.48	0.000	1.48	0
26.410	6943.55	96.0	1.245	96.0	-0.3	-0.12	1.30%	Coarse Tailings	0.054	108.5	1.49	0.000	1.49	0
26.574	6943.39	90.8	1.350	90.8	-0.3	-0.14	1.49%	Coarse Tailings	0.054	108.5	1.49	0.000	1.49	0
26.739	6943.22	83.7	1.366	83.7	-0.4	-0.16	1.63%	Coarse Tailings	0.054	108.5	1.50	0.000	1.50	0
26.903	6943.06	71.4	1.393	71.4	-0.2	-0.08	1.95%	Coarse Tailings	0.054	108.5	1.51	0.000	1.51	0
27.067	6942.89	63.3	1.043	63.3	-0.3	-0.12	1.65%	Coarse Tailings	0.054	108.5	1.52	0.000	1.52	0
27.231	6942.73	67.0	1.061	67.0	0.1	0.04	1.58%	Coarse Tailings	0.054	108.5	1.53	0.000	1.53	0
27.395	6942.57	49.0	1.302	49.0	0.1	0.02	2.66%	Coarse Tailings	0.054	108.5	1.54	0.000	1.54	0
27.559	6942.40	37.0	1.179	37.0	-0.2	-0.10	3.19%	Coarse Tailings	0.054	108.5	1.55	0.000	1.55	0
27.723	6942.24	34.6	1.181	34.6	0.0	0.00	3.41%	Coarse Tailings	0.054	108.5	1.56	0.000	1.56	0
27.887	6942.07	64.8	1.158	64.8	0.8	0.36	1.79%	Coarse Tailings	0.054	108.5	1.57	0.000	1.57	0
28.051	6941.91	63.2	1.272	63.2	0.2	0.08	2.01%	Coarse Tailings	0.054	108.5	1.57	0.000	1.57	0
28.215	6941.75	49.8	1.258	49.8	-0.4	-0.16	2.52%	Coarse Tailings	0.054	108.5	1.58	0.000	1.58	0
28.379	6941.58	52.7	1.094	52.7	0.0	0.00	2.08%	Coarse Tailings	0.054	108.5	1.59	0.000	1.59	0
28.543	6941.42	68.3	0.939	68.3	0.7	0.30	1.38%	Coarse Tailings	0.054	108.5	1.60	0.000	1.60	0
28.707	6941.25	68.8	0.877	68.8	-0.5	-0.20	1.28%	Coarse Tailings	0.054	108.5	1.61	0.000	1.61	0
28.871	6941.09	66.0	0.760	66.0	-0.6	-0.24	1.15%	Coarse Tailings	0.054	108.5	1.62	0.000	1.62	0
29.035	6940.93	65.4	0.806	65.4	-0.4	-0.18	1.23%	Coarse Tailings	0.054	108.5	1.63	0.000	1.63	0
29.199	6940.76	58.3	0.903	58.3	-0.1	-0.02	1.55%	Coarse Tailings	0.054	108.5	1.64	0.000	1.64	0
29.363	6940.60	50.3	0.969	50.3	-0.2	-0.10	1.93%	Coarse Tailings	0.054	108.5	1.65	0.000	1.65	0
29.527	6940.43	62.7	0.917	62.7	0.3	0.12	1.46%	Coarse Tailings	0.054	108.5	1.65	0.000	1.65	0
29.691	6940.27	60.0	0.965	60.0	-0.3	-0.12	1.61%	Coarse Tailings	0.054	108.5	1.66	0.000	1.66	0
29.855	6940.11	48.8	0.798	48.8	0.1	0.04	1.63%	Coarse Tailings	0.054	108.5	1.67	0.000	1.67	0
30.019	6939.94	53.0	0.910	53.0	0.2	0.10	1.72%	Coarse Tailings	0.054	108.5	1.68	0.000	1.68	0
30.183	6939.78	57.5	1.186	57.6	-0.1	-0.06	2.06%	Coarse Tailings	0.054	108.5	1.69	0.000	1.69	0
30.347	6939.61	40.1	1.361	40.1	-0.3	-0.12	3.40%	Coarse Tailings	0.054	108.5	1.70	0.000	1.70	0
30.511	6939.45	33.4	1.365	33.4	0.2	0.08	4.09%	Coarse Tailings	0.054	108.5	1.71	0.000	1.71	0
30.675	6939.29	35.9	1.566	35.9	1.0	0.45	4.36%	Coarse Tailings	0.054	108.5	1.72	0.000	1.72	0
30.840	6939.12	22.7	1.245	22.7	0.1	0.06	5.49%	Coarse Tailings	0.054	108.5	1.73	0.000	1.73	0
31.004	6938.96	14.7	0.838	14.7	3.1	1.32	5.71%	Coarse Tailings	0.054	108.5	1.73	0.000	1.73	0
31.168	6938.79	13.2	0.590	13.1	6.0	2.60	4.48%	Coarse Tailings	0.054	108.5	1.74	0.000	1.74	0
31.332	6938.63	27.5	0.596	27.5	9.6	4.17	2.16%	Coarse Tailings	0.054	108.5	1.75	0.000	1.75	0
31.496	6938.46	32.9	0.804	32.9	5.4	2.32	2.44%	Coarse Tailings	0.054	108.5	1.76	0.000	1.76	0
31.660	6938.30	32.8	1.061	32.8	5.4	2.36	3.24%	Coarse Tailings	0.054	108.5	1.77	0.000	1.77	0
31.824	6938.14	28.3	1.290	28.2	5.1	2.20	4.56%	Coarse Tailings	0.054	108.5	1.78	0.000	1.78	0
31.988	6937.97	20.8	0.904	20.8	5.2	2.24	4.34%	Coarse Tailings	0.054	108.5	1.79	0.000	1.79	0
32.152	6937.81	22.0	0.794	21.9	13.0	5.61	3.61%	Coarse Tailings	0.054	108.5	1.80	0.000	1.80	0
32.316	6937.64	50.1	0.684	50.0	11.0	4.78	1.37%	Coarse Tailings	0.054	108.5	1.81	0.000	1.81	0
32.480	6937.48	59.0	0.805	59.0	7.6	3.28	1.36%	Coarse Tailings	0.054	108.5	1.81	0.000	1.81	0
32.644	6937.32	63.3	0.808	63.3	6.8	2.93	1.28%	Coarse Tailings	0.054	108.5	1.82	0.000	1.82	0
32.808	6937.15	63.0	1.132	63.0	6.3	2.75	1.80%	Coarse Tailings	0.054	108.5	1.83	0.000	1.83	0
32.972	6936.99	59.3	1.460	59.3	6.0	2.58	2.46%	Coarse Tailings	0.054	108.5	1.84	0.000	1.84	0
33.136	6936.82	54.3	1.805	54.3	6.3	2.75	3.32%	Coarse Tailings	0.054	108.5	1.85	0.000	1.85	0
33.300	6936.66	42.7	1.793	42.7	5.8	2.50	4.20%	Coarse Tailings	0.054	108.5	1.86	0.000	1.86	0
33.464	6936.50	32.7	1.516	32.6	5.8	2.52	4.64%	Coarse Tailings	0.054	108.5	1.87	0.000	1.87	0
33.628	6936.33	33.3	1.044	33.2	7.4	3.19	3.14%	Coarse Tailings	0.054	108.5	1.88	0.000	1.88	0
33.792	6936.17	36.9	1.171	36.8	6.5	2.83	3.18%	Coarse Tailings	0.054	108.5	1.89	0.000	1.89	0
33.956	6936.00	34.8	1.193	34.8	4.0	1.73	3.43%	Coarse Tailings	0.054	108.5	1.90	0.000	1.90	0
34.120	6935.84	33.1	1.240	33.1	4.3	1.85	3.75%	Coarse Tailings	0.054	108.5	1.90	0.000	1.90	0
34.284	6935.68	52.1	1.317	52.0	6.4	2.76	2.53%	Coarse Tailings	0.054	108.5	1.91	0.000	1.91	0
34.448	6935.51	44.6	1.402	44.6	4.7	2.03	3.14%	Coarse Alluvium	0.057	114.1	1.92	0.000	1.92	0
34.612	6935.35	29.7	1.175	29.7	5.8	2.50	3.95%	Coarse Alluvium	0.057	114.1	1.93	0.000	1.93	0
34.776	6935.18	44.7	1.089	44.7	7.5	3.23	2.43%	Coarse Alluvium	0.057	114.1	1.94	0.000	1.94	0
34.941	6935.02	71.4	1.222	71.3	6.3	2.75	1.71%	Coarse Alluvium	0.057	114.1	1.95	0.000	1.95	0
35.105	6934.86	104.1	1.507	104.1	6.1	2.62	1.45%	Coarse Alluvium	0.057	114.1	1.96	0.000	1.96	0
35.269	6934.69	202.3	2.997	202.2	8.8	3.82	1.48%	Coarse Alluvium	0.057	114.1	1.97	0.000	1.97	0
35.433	6934.53	273.6	5.524	273.6	8.1	3.50	2.02%	Coarse Alluvium	0.057	114.1	1.98	0.000	1.98	0
35.597	6934.36	262.5	7.086	262.5	6.9	2.97	2.70%	Coarse Alluvium	0.057	114.1	1.99	0.000	1.99	0
35.761	6934.20	155.8	7.241	155.8	5.1	2.20	4.65%	Coarse Alluvium	0.057	114.1	2.00	0.000	2.00	0
35.925	6934.04	133.2	4.810	133.2	6.4	2.76	3.61%	Coarse Alluvium	0.057	114.1	2.01	0.000	2.01	0
36.089	6933.87	70.0	3.734	70.0	5.4	2.32	5.33%	Coarse Alluvium	0.057	114.1	2.02	0.000	2.02	0
36.253	6933.71	40.6	1.978	40.5	4.4	1.91	4.88%	Coarse Alluvium	0.057	114.1	2.03	0.000	2.03	0
36.417	6933.54	31.4	1.901	31.4	4.3	1.85	6.05%	Coarse Alluvium	0.057	114.1	2.03	0.000	2.03	0
36.581	6933.38	25.8	1.845	25.8	4.4	1.89	7.14%	Coarse Alluvium	0.057	114.1	2.04	0.000	2.04	0
36.745	6933.22	25.0	1.678	25.0	5.1	2.22	6.71%	Coarse Alluvium	0.057	114.1	2.05	0.000	2.05	0
36.909	6933.05	26.5	1.469	26.5	5.5	2.38	5.53%	Coarse Alluvium	0.057	114.1	2.06	0.000	2.06	0
37.073	6932.89	27.8	1.554	27.8	5.7	2.46	5.58%	Coarse Alluvium	0.057	114.1	2.07	0.000	2.07	0
37.237	6932.72	29.5	1.787	29.5	6.8	2.95	6.06%	Coarse Alluvium	0.057	114.1	2.08	0.000	2.08	0
37.401	6932.56	34.2	1.855	34.2	7.1	3.09	5.42%	Coarse Alluvium	0.057	114.1	2.09	0.000	2.09	0
37.565	6932.40	54.5	2.149	54.4	7.8	3.40	3.94%	Coarse Alluvium	0.057	114.1	2.10	0.000	2.10	0
37.729	6932.23	86.0	2.718	86.0	9.0	3.88	3.16%	Coarse Alluvium	0.057	114.1	2.11	0.000	2.11	0
37.893	6932.07	83.0	2.883	82.9	8.3	3.58	3.47%	Coarse Alluvium	0.057	114.1	2.12	0.000	2.12	0
38.057	6931.90	59.6	2.894	59.5	9.2	3.99	4.86%	Coarse Alluvium	0.057	114.1	2.13	0.000	2.13	0
38.221	6931.74	50.5	2.527	50.4	10.8	4.68	5.01%	Coarse Alluvium	0.057	114.1	2.14	0.000	2.14	0
38.385	6931.58	30.0	1.994	29.9	10.5	4.55	6.66%	Coarse Alluvium	0.057	114.1	2.15	0.000	2.15	0
38.549	6931.41	20.8	0.913	20.7	10.1	4.39	4.40%	Coarse Alluvium	0.057	114.1	2.16	0.000	2.16	0
38.713	6931.25	16.1	0.467	16.1	10.6	4.58	2.90%	Coarse Alluvium	0.057	114.1	2.17	0.000	2.17	0
38.877	6931.08	17.2	0.909	17.2	11.5	4.96	5.28%	Coarse Alluvium	0.057	114.1	2.17	0.000	2.17	0
39.042	6930.92	25.8	0.860	25.8	10.0	4.31	3.33%	Coarse Alluvium	0.057	114.1	2.18	0.000	2.18	0
39.206	6930.75	28.7	1.144	28.7	10.8	4.66	3.98%	Coarse Alluvium	0.057	114.1	2.19	0.000	2.19	0
39.370	6930.59	28.0	0.889	28.0	9.1	3.93	3.17%	Coarse Alluvium	0.057	114.1	2.20	0.000	2.20	0
39.534	6930.43	17.1	0.734	17.0	9.1	3.94	4.30%	Coarse Alluvium	0.057	114.1	2.21	0.000	2.21	0
39.698	6930.26	13.8	0.491	13.8	9.9	4.29	3.55%	Coarse Alluvium	0.057	114.1	2.22	0.000	2.22	0
39.862	6930.10	13.8	0.419	13.8	10.0	4.35	3.03%	Coarse Alluvium	0.057	114.1	2.23	0.000	2.23	0

18.865	0.93	410.785	39.35	503.11	410	1.04%	1.5	21%	1.19	0.000	1.19	0	1	0.87	0.30	0.89	-0.60
19.029	0.93	422.547	40.47	517.51	419	1.19%	1.5	21%	1.19	0.000	1.19	0	1	0.87	0.30	0.89	-0.60
19.193	0.93	411.187	39.39	503.59	405	1.35%	1.6	21%	1.20	0.000	1.20	0	1	0.87	0.30	0.88	-0.60
19.357	0.92	413.081	39.57	505.90	404	1.47%	1.6	21%	1.21	0.000	1.21	0	1	0.86	0.30	0.88	-0.60
19.521	0.92	417.792	40.02	511.69	407	1.54%	1.6	21%	1.22	0.000	1.22	0	1	0.86	0.30	0.88	-0.60
19.685	0.92	401.314	38.44	491.51	388	1.68%	1.7	21%	1.23	0.000	1.23	0	1	0.86	0.30	0.88	-0.60
19.849	0.92	387.553	37.12	474.65	373	1.50%	1.7	21%	1.24	0.000	1.24	0	1	0.86	0.30	0.87	-0.60
20.013	0.92	364.969	34.96	446.99	349	1.57%	1.7	21%	1.25	0.000	1.25	0	1	0.86	0.30	0.87	-0.60
20.177	0.91	339.748	32.54	416.07	323	1.53%	1.7	21%	1.26	0.000	1.26	0	1	0.86	0.30	0.87	-0.60
20.341	0.91	316.960	30.36	388.16	299	1.51%	1.7	21%	1.27	0.000	1.27	0	1	0.86	0.30	0.87	-0.60
20.505	0.91	297.929	28.54	364.85	280	1.42%	1.7	21%	1.27	0.000	1.27	0	1	0.86	0.30	0.87	-0.60
20.669	0.91	279.314	26.75	342.05	261	1.47%	1.7	21%	1.28	0.000	1.28	0	1	0.85	0.30	0.86	-0.60
20.833	0.91	250.791	24.02	307.13	233	1.49%	1.8	21%	1.29	0.000	1.29	0	1	0.85	0.30	0.86	-0.60
20.997	0.91	226.992	21.74	277.98	209	1.51%	1.8	21%	1.30	0.000	1.30	0	1	0.85	0.30	0.86	-0.60
21.161	0.90	198.478	19.01	243.06	183	1.45%	1.8	21%	1.31	0.000	1.31	0	1	0.85	0.30	0.86	-0.60
21.325	0.88	171.430	16.42	209.94	159	1.42%	1.9	21%	1.32	0.000	1.32	0	1	0.85	0.30	0.86	-0.60
21.489	0.86	143.316	13.73	175.50	135	1.39%	1.9	21%	1.33	0.000	1.33	0	1	0.85	0.20	0.90	-0.60
21.653	0.85	122.183	11.70	149.62	116	1.35%	1.9	21%	1.34	0.000	1.34	0	1	0.85	0.16	0.92	-0.54
21.817	0.83	105.014	10.06	128.59	101	1.36%	2.0	21%	1.35	0.000	1.35	0	1	0.84	0.13	0.93	-0.47
21.981	0.82	92.920	8.90	113.78	90	1.30%	2.0	21%	1.35	0.000	1.35	0	1	0.84	0.12	0.94	-0.42
22.145	0.81	82.710	7.92	101.28	81	1.34%	2.1	21%	1.36	0.000	1.36	0	1	0.84	0.11	0.94	-0.37
22.309	0.80	76.053	7.28	93.13	74	1.29%	2.1	21%	1.37	0.000	1.37	0	1	0.84	0.10	0.95	-0.33
22.473	0.78	61.334	5.87	75.10	61	1.40%	2.2	21%	1.38	0.000	1.38	0	1	0.84	0.09	0.95	-0.24
22.638	0.77	53.752	5.15	65.81	54	1.43%	2.2	21%	1.39	0.000	1.39	0	1	0.84	0.08	0.96	-0.19
22.802	0.76	49.353	4.73	60.43	49	1.35%	2.2	21%	1.40	0.000	1.40	0	1	0.84	0.08	0.96	-0.16
22.966	0.75	41.992	4.02	51.41	42	1.44%	2.3	21%	1.41	0.000	1.41	0	1	0.83	0.07	0.96	-0.10
23.130	0.74	37.727	3.61	46.19	38	1.43%	2.3	21%	1.42	0.000	1.42	0	1	0.83	0.07	0.96	-0.06
23.294	0.73	34.492	3.30	42.23	35	1.34%	2.3	21%	1.43	0.000	1.43	0	1	0.83	0.07	0.96	-0.03
23.458	0.72	31.968	3.06	39.14	33	1.28%	2.4	21%	1.43	0.000	1.43	0	1	0.83	0.06	0.96	-0.01
23.622	0.71	30.717	2.94	37.61	31	1.17%	2.4	21%	1.44	0.000	1.44	0	1	0.83	0.06	0.96	0.01
23.786	0.71	29.080	2.79	35.61	30	0.94%	2.3	21%	1.45	0.000	1.45	0	1	0.83	0.06	0.96	0.03
23.950	0.70	29.772	2.85	36.45	30	0.98%	2.3	21%	1.46	0.000	1.46	0	1	0.83	0.06	0.96	0.02
24.114	0.70	27.385	2.62	33.53	28	1.16%	2.4	21%	1.47	0.000	1.47	0	1	0.83	0.06	0.96	0.04
24.278	0.70	30.742	2.94	37.64	31	1.12%	2.4	21%	1.48	0.000	1.48	0	1	0.82	0.06	0.96	0.01
24.442	0.70	31.572	3.02	38.66	32	1.18%	2.4	21%	1.49	0.000	1.49	0	1	0.82	0.06	0.96	0.00
24.606	0.70	32.002	3.07	39.18	32	1.25%	2.4	21%	1.50	0.000	1.50	0	1	0.82	0.06	0.96	-0.01
24.770	0.70	34.984	3.35	42.84	35	1.23%	2.3	21%	1.51	0.000	1.51	0	1	0.82	0.07	0.96	-0.04
24.934	0.70	38.330	3.67	46.94	38	1.02%	2.3	21%	1.51	0.000	1.51	0	1	0.82	0.07	0.96	-0.07
25.098	0.71	43.452	4.16	53.21	42	1.08%	2.2	21%	1.52	0.000	1.52	0	1	0.82	0.07	0.95	-0.11
25.262	0.72	53.658	5.14	65.71	51	1.04%	2.2	21%	1.53	0.000	1.53	0	1	0.82	0.08	0.95	-0.19
25.426	0.73	63.413	6.07	77.65	59	1.08%	2.1	21%	1.54	0.000	1.54	0	1	0.81	0.09	0.94	-0.25
25.590	0.75	77.438	7.42	94.82	71	1.03%	2.0	21%	1.55	0.000	1.55	0	1	0.81	0.10	0.93	-0.33
25.754	0.75	80.266	7.69	98.29	73	1.10%	2.0	21%	1.56	0.000	1.56	0	1	0.81	0.10	0.93	-0.35
25.918	0.74	77.916	7.46	95.41	71	1.14%	2.1	21%	1.57	0.000	1.57	0	1	0.81	0.10	0.93	-0.34
26.082	0.74	74.713	7.16	91.49	68	1.18%	2.1	21%	1.58	0.000	1.58	0	1	0.81	0.10	0.93	-0.32
26.246	0.73	72.089	6.91	88.27	66	1.25%	2.1	21%	1.59	0.000	1.59	0	1	0.81	0.10	0.94	-0.30
26.410	0.73	69.807	6.69	85.48	64	1.32%	2.1	21%	1.59	0.000	1.59	0	1	0.81	0.09	0.94	-0.29
26.574	0.72	65.286	6.25	79.94	60	1.51%	2.2	21%	1.60	0.000	1.60	0	1	0.80	0.09	0.94	-0.26
26.739	0.71	59.227	5.67	72.52	55	1.66%	2.3	21%	1.61	0.000	1.61	0	1	0.80	0.09	0.94	-0.22
26.903	0.69	49.226	4.72	60.28	46	1.99%	2.4	21%	1.62	0.000	1.62	0	1	0.80	0.08	0.95	-0.15
27.067	0.68	42.768	4.10	52.37	41	1.69%	2.4	21%	1.63	0.000	1.63	0	1	0.80	0.07	0.95	-0.10
27.231	0.68	45.425	4.35	55.62	43	1.62%	2.3	21%	1.64	0.000	1.64	0	1	0.80	0.07	0.95	-0.12
27.395	0.65	31.783	3.04	38.92	31	2.74%	2.6	21%	1.65	0.000	1.65	0	1	0.80	0.06	0.95	0.00
27.559	0.62	23.085	2.21	28.27	23	3.33%	2.7	21%	1.66	0.000	1.66	0	1	0.80	0.06	0.96	0.10
27.723	0.62	21.351	2.05	26.14	21	3.57%	2.8	21%	1.67	0.000	1.67	0	1	0.79	0.06	0.96	0.10
27.887	0.66	43.003	4.12	52.66	40	1.83%	2.4	21%	1.67	0.000	1.67	0	1	0.79	0.07	0.95	-0.10
28.051	0.66	41.625	3.99	50.97	39	2.07%	2.4	21%	1.68	0.000	1.68	0	1	0.79	0.07	0.95	-0.09
28.215	0.64	31.687	3.04	38.80	30	2.61%	2.6	21%	1.69	0.000	1.69	0	1	0.79	0.06	0.95	0.00
28.379	0.64	33.570	3.22	41.11	32	2.14%	2.5	21%	1.70	0.000	1.70	0	1	0.79	0.07	0.95	-0.02
28.543	0.66	44.941	4.30	55.03	42	1.41%	2.3	21%	1.71	0.000	1.71	0	1	0.79	0.07	0.95	-0.12
28.707	0.66	45.148	4.32	55.28	42	1.31%	2.3	21%	1.72	0.000	1.72	0	1	0.79	0.07	0.94	-0.12
28.871	0.65	42.875	4.11	52.50	40	1.18%	2.3	21%	1.73	0.000	1.73	0	1	0.78	0.07	0.95	-0.10
29.035	0.65	42.275	4.05	51.76	39	1.26%	2.3	21%	1.74	0.000	1.74	0	1	0.78	0.07	0.95	-0.10
29.199	0.63	36.934	3.54	45.23	35	1.59%	2.4	21%	1.75	0.000	1.75	0	1	0.78	0.07	0.95	-0.05
29.363	0.62	31.067	2.98	38.04	30	1.99%	2.5	21%	1.75	0.000	1.75	0	1	0.78	0.06	0.95	0.01
29.527	0.63	39.772	3.81	48.70	37	1.50%	2.4	21%	1.76	0.000	1.76	0	1	0.78	0.07	0.95	-0.07
29.691	0.63	37.724	3.61	46.19	35	1.65%	2.4	21%	1.77	0.000	1.77	0	1	0.78	0.07	0.95	-0.05
29.855	0.61	29.658	2.84	36.32	28	1.69%	2.5	21%	1.78	0.000	1.78	0	1	0.78	0.06	0.95	0.03
30.019	0.61	32.458	3.11	39.75	31	1.77%	2.5	21%	1.79	0.000	1.79	0	1	0.78	0.06	0.95	0.00
30.183	0.62	35.503	3.40	43.47	33	2.12%	2.5	21%	1.80	0.000	1.80	0	1	0.77	0.07	0.95	-0.03
30.347	0.58	23.411	2.24	28.67	23	3.55%	2.8	21%	1.81	0.000	1.81	0	1	0.77	0.06	0.95	0.10
30.511	0.57	18.967	1.82	23.23	19	4.31%	2.9	21%	1.82	0.000	1.82	0	1	0.77	0.05	0.96	0.10
30.675	0.57	20.471	1.96	25.07	20	4.58%	2.9	21%	1.83	0.000	1.83	0	1	0.77	0.06	0.96	0.10
30.840	0.56	12.640	1.21	15.48	12	5.94%	3.1	21%	1.84	0.000	1.84	0	1	0.77	0.05	0.96	0.10
31.004	0.55	8.134	0.78	9.97	7	6.47%	3.3	21%	1.84	0.000	1.84	0	1	0.77	0.05	0.96	0.10
31.168	0.55	7.256	0.70	8.91	7	5.16%	3.3	21%	1.85	0.000	1.85	0	1	0.77	0.04	0.96	0.10
31.332	0.55	15.121	1.45	18.56	15	2.31%	2.8	21%	1.86	0.000	1.86	0	1	0.76	0.05	0.96	0.10
31.496	0.55	18.151	1.74	22.25	18	2.58%	2.8	21%	1.87	0.000	1.87	0	1	0.76	0.05	0.96	0.10
31.660	0.55	17.991	1.72	22.05	18	3.42%	2.8	21%	1.88	0.000	1.88	0	1	0.76	0.05	0.96	0.10
31.824	0.54	15.362	1.47	18.83	15	4.87%	3.0	21%	1.89	0.000	1.89	0	1	0.76	0.05	0.96	0.10
31.988	0.54	11.260	1.08	13.81	11	4.75%	3.1	21%	1.90	0.000	1.90	0	1	0.76	0.05	0.96	0.10
32.152	0.54	11.837	1.13	14.55	11	3.93%	3.0	21%	1.91	0.000	1.91	0	1	0.76	0.05	0.96	0.10
32.316	0.57	28.690	2.75	35.18	27	1.42%	2.5	21%	1.92	0.000	1.92	0	1	0.76	0.06	0.95	0.04
32.480	0.59	34.569	3.31	42.36	32	1.41%	2.4	21%	1.92	0.000	1.92	0	1	0.75	0.07	0.94	-0.02
32.644	0.59	37.407	3.58	45.84	34	1.31%	2.4	21%	1.93	0.000	1.93	0	1	0.75	0.07	0.94	-0.05
32.808	0.59	37.047	3.55	45.39	33	1.85%	2.4	21%	1.94	0.000	1.94	0	1	0.75	0.07	0.94	-0.05
32.972	0.58	34.393	3.29	42.14	31	2.54%	2.6	21%	1.95	0.000	1.95	0	1	0.75	0.07	0.94	-0.02
33.136	0.57	30.932	2.96	37.90	28	3.44%	2.7	21%	1.96	0.000	1.96	0	1	0.75	0.06	0.94	0.02
33.300	0.55	23.331	2.23	28.59	22	4.39%	2.8	21%	1.97	0.000	1.97	0	1	0.75	0.06	0.95	0.10
33.464	0.52	17.086	1.64	20.94	16	4.92%	3.0	21%	1.98	0.000	1.98	0	1	0.75	0.05	0.95	0.10
33.628	0.52	17.353	1.66	21.28	17	3.33%	2.8	21%	1.99	0.000	1.99	0	1	0.74	0.05	0.95	0.10
33.792	0.53	19.455	1.86	23.85	19	3.35%	2.8	21%	2.00	0.000	2.00	0	1	0.74	0.05	0.95	0.10
33.956	0.52	18.150	1.74	22.24	17	3.62%	2.9	21%	2.00	0.000	2.00	0	1	0.74	0.05	0.95	0.10
34.120	0.52	17.068	1.63	20.92	16	3.97%	2.9	21%	2.01	0.000	2.01	0	1	0.74	0.05	0.95	0.10
34.284	0.55	28.640	2.74	35.10	26	2.63%	2.6	21%	2.02	0.000	2.02	0	0	0.74	0.06	0.94	0.04
34.448	0.53	23.867	2.29	29.24	22	3.28%	2.7	36%	2.03	0.000	2.03	0	0	0.74	0.06	0.95	0.10
34.612	0.51	15.152	1.45	18.58	14	4.23%	3.0	36%	2.04	0.000	2.04	0	0	0.74	0.05	0.95	0.10
34.776	0.53	23.710	2.27	29.06	22	2.55%	2.7	36%	2.05	0.000	2.05	0	0	0.74	0.06	0.95	0.10
34.941	0.57	40.923	3.92	50.14	36	1.76%	2.4	36%	2.06	0.000	2.06	0	0	0.73	0.07	0.93	-0.08
35.105	0.62	64.351	6.16	78.83	52	1.48%	2.2	36%	2.07	0.000	2.07	0	0	0.73	0.09	0.92	-0.25
35.269	0.73	147.906	14.17	181.16	102	1.50%	2.0	36%	2.08	0.000	2.08	0	0	0.73	0.21	0.80	-0.60
35.433	0.79	216.606	20.75	265.29	137	2.03%	2.0	36%	2.09	0.000	2.09	0	0	0.73	0.30	0.72	-0.60
35.597	0.79	207.567	19.88	254.21	131	2.72%	2.1	36%	2.10	0.000	2.10	0	0	0.73	0.30	0.72	-0.60
35.761	0.67	105.069	10.06	128.68	77	4.71%	2.5	36%	2.11	0.000	2.11	0	0	0.73	0.13	0.87	-0.46
35.925	0.65	85.975	8.24	105.31	65	3.67%	2.4	36%	2.12	0.000	2.12	0	0	0.73	0.11	0.89	-0.37
36.089	0.56	39.005	3.74	47.78	34	5.49%	2.8	36%	2.12	0.000	2.12	0	0	0.72	0.07	0.93	-0.06
36.253	0.50	20.413	1.96	25.01	19	5.13%	2.9	36%	2.13	0.000	2.13	0	0	0.72	0.06	0.95	0.10
36.417	0.49	15.392	1.47	18.86	14	6.46%	3.1	36%	2.14	0.000	2.14	0	0	0.72	0.05	0.95	0.10
36.581	0.49	12.599	1.21	15.44	12	7.75%	3.2	36%	2.15	0.000	2.15	0	0	0.72	0.05	0.95	0.10
36.745	0.49	12.150	1.16	14.90	11	7.31%	3.2	36%	2.16	0.000	2.16	0	0	0.72	0.05	0.95	0.10
36.909	0.48	12.848	1.23	15.75	12	6.00%	3.1	36%	2.17	0.000	2.17	0	0	0.72	0.05	0.95	0.10
37.073	0.48	13.421	1.29	16.46	12	6.03%	3.1	36%	2.18	0.000	2.18	0	0	0.72	0.05	0.95	0.10
37.237	0.48	14.173	1.36	17.38	13	6.52%	3.1	36%	2.19	0.000	2.19	0	0	0.71	0.05	0.95	0.10
37.401	0.48	16.382	1.57	20.09	15	5.78%	3.0	36%	2.20	0.000	2.20	0	0	0.71	0.05	0.95	0.10
37.565	0.51	27.970	2.68	34.28	25	4.10%	2.8	36%	2.21	0.000	2.21	0	0	0.71	0.06	0.94	0.05
37.729	0.56	48.354	4.63	59.25	40	3.24%	2.5	36%	2.22	0.000	2.22	0	0	0.71	0.08	0.92	-0.14
37.893	0.56	46.104	4.42	56.49	38	3.57%	2.6	36%	2.23	0.000	2.23	0	0	0.71	0.08	0.92	-0.12
38.057	0.52	30.780	2.95	37.73	27	5.04%	2.8	36%	2.24	0.000	2.24	0	0	0.71	0.06	0.94	0.02
38.221	0.50	25.165	2.41	30.86	23	5.23%	2.9	36%	2.25	0.000	2.25	0	0	0.71	0.06	0.94	0.09
38.385	0.47	14.041	1.34	17.23	13	7.17%	3.1	36%	2.26	0.000	2.26	0	0	0.71	0.05	0.95	0.10
38.549	0.47	9.695	0.93	11.91	9	4.90%	3.2	36%	2.27	0.000	2.27	0	0	0.70	0.05	0.95	0.10
38.713	0.47	7.493	0.72	9.21	6	3.35%	3.2	36%	2.27	0.000	2.27	0	0	0.70	0.04	0.95	0.10
38.877	0.46	7.975	0.76	9.81	7	6.04%	3.3	36%	2.28	0.000	2.28	0	0	0.70	0.05	0.95	0.10
39.042	0.46	11.933	1.14	14.65	11	3.64%	3.0	36%	2.29	0.000	2.29	0	0	0.70	0.05	0.95	0.10
39.206	0.46	13.247	1.27	16.26	12	4.31%	3.0	36%	2.30	0.000	2.30	0	0	0.70	0.05	0.95	0.10
39.370	0.46	12.881	1.23	15.80	12	3.44%	3.0	36%	2.31	0.000	2.31	0	0	0.70	0.05	0.95	0.10
39.534	0.46	7.809	0.75	9.59	7	4.94%	3.3	36%	2.32	0.000	2.32	0	0	0.70	0.04	0.95	0.10
39.698	0.46	6.297	0.60	7.75	5	4.23%	3.3	36%	2.33	0.000	2.33	0	0	0.69	0.04	0.95	0.10
39.862	0.46	6.277	0.60	7.72	5	3.61%	3.3	36%	2.34	0.000	2.34	0	0	0.69	0.04	0.95	0.10

18.865	1.00	0.106	169.08	672.20	1.000	N/A	0.95	1.30	0.60	0.86	1.00	0.126	1.00	503.11	1.000	N/A	N/A
19.029	1.00	0.106	173.21	690.72	1.000	N/A	0.95	1.31	0.60	0.86	1.00	0.126	1.00	517.51	1.000	N/A	N/A
19.193	1.00	0.106	169.22	672.81	1.000	N/A	0.95	1.30	0.60	0.86	1.00	0.127	1.00	503.59	1.000	N/A	N/A
19.357	1.00	0.106	169.88	675.78	1.000	N/A	0.95	1.30	0.60	0.85	1.00	0.127	1.00	505.90	1.000	N/A	N/A
19.521	1.00	0.106	171.54	683.23	1.000	N/A	0.95	1.31	0.60	0.85	1.00	0.127	1.00	513.09	1.000	N/A	N/A
19.685	1.00	0.106	165.75	657.27	1.000	N/A	0.95	1.28	0.60	0.85	1.00	0.128	1.03	507.61	1.000	N/A	N/A
19.849	1.00	0.106	160.92	635.57	1.000	N/A	0.95	1.26	0.60	0.85	1.00	0.128	1.01	480.06	1.000	N/A	N/A
20.013	1.00	0.106	152.98	599.97	1.000	N/A	0.95	1.22	0.60	0.84	1.00	0.128	1.03	461.56	1.000	N/A	N/A
20.177	1.00	0.106	144.12	560.19	1.000	N/A	0.95	1.18	0.60	0.84	1.00	0.129	1.04	432.48	1.000	N/A	N/A
20.341	1.00	0.106	136.11	524.27	1.000	N/A	0.95	1.14	0.60	0.84	1.00	0.129	1.05	407.13	1.000	N/A	N/A
20.505	1.00	0.106	129.43	494.28	1.000	N/A	0.95	1.10	0.60	0.84	1.00	0.129	1.05	381.33	1.000	N/A	N/A
20.669	1.00	0.107	122.89	464.94	1.000	N/A	0.95	1.07	0.60	0.83	1.00	0.130	1.07	364.46	1.000	N/A	N/A
20.833	1.00	0.107	112.87	420.00	1.000	N/A	0.95	1.01	0.60	0.83	1.00	0.130	1.09	335.06	1.000	N/A	N/A
20.997	1.00	0.107	104.51	382.49	1.000	N/A	0.95	0.96	0.60	0.83	1.00	0.130	1.11	309.73	1.000	N/A	N/A
21.161	1.00	0.107	94.49	337.55	1.000	N/A	0.95	0.90	0.60	0.83	1.00	0.130	1.13	275.61	1.000	N/A	N/A
21.325	1.00	0.107	84.99	294.93	1.000	N/A	0.95	0.84	0.60	0.83	1.00	0.131	1.16	243.59	1.000	N/A	N/A
21.489	1.00	0.101	75.12	250.62	1.000	N/A	0.94	0.76	0.62	0.83	1.00	0.130	1.20	210.33	1.000	N/A	N/A
21.653	1.00	0.099	67.69	217.32	1.000	N/A	0.94	0.71	0.65	0.84	1.00	0.128	1.24	185.36	1.000	N/A	N/A
21.817	1.00	0.098	61.66	190.26	0.758	N/A	0.94	0.65	0.67	0.85	1.00	0.127	1.29	166.29	1.000	N/A	N/A
21.981	1.00	0.097	57.41	171.19	0.420	N/A	0.94	0.62	0.69	0.86	1.00	0.126	1.33	150.79	0.399	N/A	N/A
22.145	1.00	0.096	53.83	155.10	0.297	N/A	0.94	0.58	0.71	0.86	1.00	0.125	1.39	141.07	0.341	N/A	N/A
22.309	1.00	0.096	51.49	144.62	0.249	N/A	0.94	0.56	0.72	0.87	1.00	0.124	1.42	132.28	0.295	N/A	N/A
22.473	1.00	0.095	46.32	121.42	0.183	N/A	0.94	0.50	0.75	0.88	1.00	0.123	1.60	119.78	0.240	N/A	N/A
22.638	1.00	0.094	43.66	109.47	0.159	N/A	0.94	0.47	0.77	0.88	1.00	0.122	1.71	112.64	0.213	N/A	N/A
22.802	1.00	0.094	42.11	102.54	0.147	N/A	0.94	0.45	0.78	0.89	1.00	0.121	1.75	105.61	0.190	N/A	N/A
22.966	1.00	0.094	39.53	90.94	0.128	N/A	0.94	0.41	0.79	0.89	1.00	0.120	1.95	100.44	0.174	N/A	N/A
23.130	1.00	0.093	38.03	84.23	0.119	N/A	0.94	0.39	0.80	0.90	1.00	0.120	2.07	95.41	0.161	N/A	N/A
23.294	1.00	0.093	36.89	79.13	0.111	N/A	0.94	0.38	0.80	0.89	1.00	0.120	2.12	89.44	0.147	N/A	N/A
23.458	1.00	0.093	36.01	75.15	0.106	N/A	0.94	0.36	0.80	0.89	1.00	0.120	2.18	85.22	0.138	N/A	N/A
23.622	1.00	0.093	35.57	73.18	0.104	N/A	0.94	0.35	0.80	0.89	1.00	0.120	2.15	80.74	0.129	N/A	N/A
23.786	1.00	0.093	34.99	70.60	0.100	N/A	0.94	0.34	0.80	0.89	1.00	0.120	2.04	72.65	0.116	N/A	N/A
23.950	1.00	0.093	35.24	71.69	0.102	N/A	0.94	0.35	0.80	0.89	1.00	0.120	2.05	74.57	0.119	N/A	N/A
24.114	1.00	0.092	34.40	67.93	0.097	N/A	0.94	0.33	0.80	0.89	1.00	0.121	2.30	77.11	0.123	N/A	N/A
24.278	1.00	0.092	35.58	73.22	0.104	N/A	0.94	0.35	0.80	0.89	1.00	0.121	2.12	79.85	0.127	N/A	N/A
24.442	1.00	0.092	35.87	74.53	0.105	N/A	0.94	0.36	0.80	0.89	1.00	0.121	2.14	82.66	0.133	N/A	N/A
24.606	1.00	0.092	36.02	75.20	0.106	N/A	0.94	0.36	0.80	0.89	1.00	0.121	2.17	85.04	0.137	N/A	N/A
24.770	1.00	0.092	37.07	79.91	0.113	N/A	0.94	0.38	0.80	0.88	1.00	0.121	2.05	88.03	0.143	N/A	N/A
24.934	1.00	0.092	38.24	85.18	0.120	N/A	0.94	0.40	0.80	0.88	1.00	0.121	1.81	85.10	0.137	N/A	N/A
25.098	1.00	0.092	40.04	93.25	0.132	N/A	0.94	0.42	0.79	0.88	1.00	0.122	1.74	92.67	0.154	N/A	N/A
25.262	1.00	0.093	43.63	109.33	0.159	N/A	0.94	0.47	0.77	0.86	1.00	0.124	1.56	102.27	0.179	N/A	N/A
25.426	1.00	0.093	47.05	124.70	0.190	N/A	0.94	0.51	0.75	0.85	1.00	0.126	1.47	114.16	0.218	N/A	N/A
25.590	1.00	0.094	51.98	146.80	0.258	N/A	0.94	0.56	0.72	0.84	1.00	0.128	1.35	128.13	0.276	N/A	N/A
25.754	1.00	0.094	52.97	151.26	0.277	N/A	0.94	0.57	0.71	0.83	1.00	0.128	1.36	133.67	0.302	N/A	N/A
25.918	1.00	0.094	52.15	147.55	0.261	N/A	0.93	0.56	0.72	0.83	1.00	0.128	1.39	132.79	0.298	N/A	N/A
26.082	1.00	0.093	51.02	142.51	0.241	N/A	0.93	0.55	0.72	0.83	1.00	0.128	1.43	130.90	0.289	N/A	N/A
26.246	1.00	0.093	50.10	138.37	0.227	N/A	0.93	0.54	0.73	0.84	1.00	0.128	1.48	130.57	0.287	N/A	N/A
26.410	1.00	0.093	49.30	134.78	0.216	N/A	0.93	0.53	0.73	0.84	1.00	0.127	1.53	130.64	0.287	N/A	N/A
26.574	1.00	0.092	47.71	127.65	0.197	N/A	0.93	0.52	0.74	0.84	1.00	0.127	1.66	132.63	0.297	N/A	N/A
26.739	1.00	0.092	45.58	118.10	0.176	N/A	0.93	0.49	0.75	0.85	1.00	0.126	1.81	131.05	0.289	N/A	N/A
26.903	1.00	0.091	42.07	102.35	0.146	N/A	0.93	0.45	0.78	0.86	1.00	0.124	2.16	129.93	0.284	N/A	N/A
27.067	1.00	0.091	39.80	92.17	0.130	N/A	0.93	0.42	0.79	0.87	1.00	0.123	2.15	112.55	0.213	N/A	N/A
27.231	1.00	0.091	40.73	96.36	0.137	N/A	0.93	0.43	0.78	0.86	1.00	0.124	2.05	113.81	0.217	N/A	N/A
27.395	1.00	0.090	35.94	74.86	0.106	N/A	0.93	0.36	0.80	0.87	1.00	0.122	3.23	125.55	0.264	N/A	N/A
27.559	1.00	0.090	32.89	61.16	0.089	N/A	0.93	0.31	0.80	0.87	1.00	0.122	4.27	120.74	0.244	N/A	N/A
27.723	1.00	0.089	32.28	58.42	0.086	N/A	0.93	0.30	0.80	0.87	1.00	0.123	4.63	121.01	0.245	N/A	N/A
27.887	1.00	0.090	39.89	92.55	0.131	N/A	0.93	0.42	0.79	0.86	1.00	0.123	2.24	117.98	0.233	N/A	N/A
28.051	1.00	0.090	39.40	90.37	0.127	N/A	0.93	0.41	0.79	0.86	1.00	0.123	2.42	123.28	0.254	N/A	N/A
28.215	1.00	0.089	35.91	74.71	0.106	N/A	0.93	0.36	0.80	0.86	1.00	0.122	3.17	122.87	0.253	N/A	N/A
28.379	1.00	0.089	36.57	77.68	0.109	N/A	0.93	0.37	0.80	0.86	1.00	0.122	2.78	114.34	0.219	N/A	N/A
28.543	1.00	0.090	40.57	95.60	0.135	N/A	0.92	0.43	0.79	0.85	1.00	0.124	1.95	107.57	0.196	N/A	N/A
28.707	1.00	0.090	40.64	95.92	0.136	N/A	0.92	0.43	0.79	0.85	1.00	0.124	1.89	104.57	0.186	N/A	N/A
28.871	1.00	0.090	39.84	92.34	0.130	N/A	0.92	0.42	0.79	0.85	1.00	0.123	1.87	98.02	0.168	N/A	N/A
29.035	1.00	0.089	39.63	91.39	0.129	N/A	0.92	0.42	0.79	0.85	1.00	0.123	1.94	100.18	0.174	N/A	N/A
29.199	1.00	0.089	37.75	82.98	0.117	N/A	0.92	0.39	0.80	0.86	1.00	0.122	2.30	104.20	0.185	N/A	N/A
29.363	1.00	0.089	35.69	73.73	0.104	N/A	0.92	0.36	0.80	0.86	1.00	0.122	2.83	107.48	0.195	N/A	N/A
29.527	1.00	0.089	38.75	87.45	0.123	N/A	0.92	0.40	0.80	0.86	1.00	0.122	2.16	105.22	0.188	N/A	N/A
29.691	1.00	0.089	38.03	84.22	0.119	N/A	0.92	0.39	0.80	0.86	1.00	0.122	2.32	107.36	0.195	N/A	N/A
29.855	1.00	0.088	35.20	71.51	0.101	N/A	0.91	0.35	0.80	0.86	1.00	0.122	2.70	97.94	0.167	N/A	N/A
30.019	1.00	0.088	36.18	75.93	0.107	N/A	0.91	0.36	0.80	0.85	1.00	0.122	2.62	104.05	0.185	N/A	N/A
30.183	1.00	0.088	37.25	80.72	0.114	N/A	0.91	0.38	0.80	0.85	1.00	0.122	2.72	118.14	0.233	N/A	N/A
30.347	1.00	0.087	33.00	61.67	0.090	N/A	0.91	0.31	0.80	0.85	1.00	0.122	4.44	127.34	0.272	N/A	N/A
30.511	1.00	0.087	31.44	54.67	0.082	N/A	0.91	0.28	0.80	0.85	1.00	0.122	5.49	127.50	0.273	N/A	N/A
30.675	1.00	0.087	31.97	57.04	0.085	N/A	0.91	0.29	0.80	0.85	1.00	0.122	5.44	136.30	0.315	N/A	N/A
30.840	1.00	0.086	29.22	44.70	0.073	N/A	0.91	0.23	0.80	0.85	1.00	0.122	8.04	124.44	0.259	N/A	N/A
31.004	1.00	0.086	27.64	37.61	0.067	N/A	0.90	0.18	0.80	0.85	1.00	0.122	10.67	106.44	0.192	N/A	N/A
31.168	1.00	0.086	27.34	36.25	0.066	N/A	0.90	0.17	0.80	0.85	1.00	0.121	10.46	93.19	0.155	N/A	N/A
31.332	1.00	0.086	30.10	48.66	0.076	N/A	0.90	0.25	0.80	0.85	1.00	0.121	4.74	87.95	0.143	N/A	N/A
31.496	1.00	0.086	31.16	53.41	0.081	N/A	0.90	0.27	0.80	0.85	1.00	0.121	4.43	98.56	0.169	N/A	N/A
31.660	1.00	0.086	31.11	53.16	0.081	N/A	0.90	0.27	0.80	0.85	1.00	0.121	5.08	112.11	0.211	N/A	N/A
31.824	1.00	0.086	30.18	49.01	0.077	N/A	0.90	0.25	0.80	0.85	1.00	0.121	6.59	124.06	0.258	N/A	N/A
31.988	1.00	0.085	28.74	42.55	0.071	N/A	0.90	0.21	0.80	0.84	1.00	0.121	7.84	108.26	0.198	N/A	N/A
32.152	1.00	0.085	28.95	43.50	0.072	N/A	0.90	0.22	0.80	0.84	1.00	0.121	7.01	102.00	0.179	N/A	N/A
32.316	1.00	0.086	34.87	70.05	0.100	N/A	0.89	0.34	0.80	0.84	1.00	0.121	2.58	90.62	0.149	N/A	N/A
32.480	1.00	0.086	36.93	79.29	0.112	N/A	0.89	0.38	0.80	0.84	1.00	0.121	2.31	97.95	0.167	N/A	N/A
32.644	1.00	0.086	37.93	83.76	0.118	N/A	0.89	0.39	0.80	0.84	1.00	0.121	2.15	98.61	0.169	N/A	N/A
32.808	1.00	0.086	37.80	83.19	0.117	N/A	0.89	0.39	0.80	0.84	1.00	0.121	2.53	114.70	0.220	N/A	N/A
32.972	1.00	0.086	36.87	79.01	0.111	N/A	0.89	0.37	0.80	0.84	1.00	0.121	3.08	129.78	0.283	N/A	N/A
33.136	1.00	0.086	35.65	73.56	0.104	N/A	0.89	0.36	0.80	0.84	1.00	0.121	3.82	144.64	0.361	N/A	N/A
33.300	1.00	0.085	32.98	61.58	0.090	N/A	0.89	0.31	0.80	0.84	1.00	0.121	5.02	143.65	0.356	N/A	N/A
33.464	1.00	0.084	30.79	51.73	0.079	N/A	0.88	0.26	0.80	0.84	1.00	0.121	6.26	131.05	0.289	N/A	N/A
33.628	2.00	0.042	30.88	52.16	0.080	N/A	0.88	0.27	0.80	0.84	2.00	0.060	5.16	109.85	0.203	N/A	N/A
33.792	3.00	0.028	31.62	55.47	0.083	N/A	0.88	0.28	0.80	0.84	3.00	0.040	4.86	115.93	0.225	N/A	N/A
33.956	4.00	0.021	31.16	53.40	0.081	N/A	0.88	0.27	0.80	0.84	4.00	0.030	5.25	116.77	0.228	N/A	N/A
34.120	5.00	0.017	30.78	51.70	0.079	N/A	0.88	0.26	0.80	0.83	5.00	0.024	5.68	118.72	0.236	N/A	N/A
34.284	6.00	0.014	34.85	69.94	0.100	N/A	0.88	0.34	0.80	0.83	6.00	0.020	3.49	122.50	0.251	N/A	N/A
34.448	7.00	0.012	39.88	69.13	0.099	N/A	0.88	0.31	0.80	0.83	7.00	0.017	4.32	126.22	0.267	N/A	N/A
34.612	8.00	0.010	36.20	54.78	0.082	N/A	0.88	0.25	0.80	0.83	8.00	0.015	6.29	116.89	0.229	N/A	N/A
34.776	9.00	0.009	39.82	68.88	0.098	N/A	0.87	0.31	0.80	0.83	9.00	0.013	3.83	111.35	0.208	N/A	N/A
34.941	10.00	0.008	47.09	97.23	0.138	N/A	0.87	0.41	0.80	0.83	10.00	0.012	2.37	118.94	0.236	N/A	N/A
35.105	11.00	0.008	56.98	135.81	0.219	N/A	0.87	0.51	0.74	0.79	11.00	0.011	1.76	138.79	0.329	N/A	N/A
35.269	12.00	0.008	92.28	273.44	1.000	N/A	0.87	0.78	0.61	0.70	12.00	0.012	1.33	240.68	1.000	N/A	N/A
35.433	13.00	0.008	121.29	386.57	1.000	N/A	0.87	0.94	0.60	0.69	13.00	0.011	1.34	354.85	1.000	N/A	N/A
35.597	14.00	0.008	117.47	371.68	1.000	N/A	0.87	0.92	0.60	0.69	14.00	0.010	1.53	387.89	1.000	N/A	N/A
35.761	15.00	0.006	74.18	202.86	1.000	N/A	0.87	0.65	0.67	0.73	15.00	0.009	2.61	335.98	1.000	N/A	N/A
35.925	16.00	0.005	66.12	171.42	0.422	N/A	0.86	0.59	0.70	0.75	16.00	0.008	2.45	258.39	1.000	N/A	N/A
36.089	17.00	0.005	46.28	94.06	0.133	N/A	0.86	0.40	0.80	0.83	17.00	0.007	4.45	212.42	1.000	N/A	N/A
36.253	18.00	0.005	38.42	63.44	0.092	N/A	0.86	0.29	0.80	0.83	18.00	0.007	5.89	147.41	0.378	N/A	N/A
36.417	19.00	0.004	36.30	55.17	0.083	N/A	0.86	0.25	0.80	0.82	19.00	0.006	7.62	143.81	0.357	N/A	N/A
36.581	20.00	0.004	35.12	50.57	0.078	N/A	0.86	0.23	0.80	0.82	20.00	0.006	9.23	142.48	0.349	N/A	N/A
36.745	21.00	0.004	34.93	49.83	0.077	N/A	0.86	0.22	0.80	0.82	21.00	0.006	9.18	136.69	0.317	N/A	N/A
36.909	22.00	0.004	35.23	50.98	0.078	N/A	0.86	0.23	0.80	0.82	22.00	0.005	8.17	128.76	0.279	N/A	N/A
37.073	23.00	0.004	35.47	51.93	0.079	N/A	0.86	0.23	0.80	0.82	23.00	0.005	8.00	131.62	0.292	N/A	N/A
37.237	24.00	0.003	35.79	53.17	0.081	N/A	0.85	0.24	0.80	0.82	24.00	0.005	8.03	139.60	0.333	N/A	N/A
37.401	25.00	0.003	36.72	56.81	0.084	N/A	0.85	0.26	0.80	0.82	25.00	0.005	7.01	140.80	0.340	N/A	N/A
37.565	26.00	0.003	41.62	75.90	0.107	N/A	0.85	0.34	0.80	0.82	26.00	0.005	4.51	154.70	0.424	N/A	N/A
37.729	27.00	0.003	50.23	109.48	0.159	N/A	0.85	0.44	0.78	0.80	27.00	0.004	3.02	179.09	1.000	N/A	N/A
37.893	28.00	0.003	49.28	105.77	0.152	N/A	0.85	0.43	0.78	0.80	28.00	0.004	3.26	184.39	1.000	N/A	N/A
38.057	29.00	0.003	42.81	80.53	0.113	N/A	0.85	0.35	0.80	0.82	29.00	0.004	4.80	181.10	1.000	N/A	N/A
38.221	30.00	0.003	40.44	71.29	0.101	N/A	0.85	0.32	0.80	0.82	30.00	0.004	5.40	166.70	1.000	N/A	N/A
38.385	31.00	0.003	35.74	52.97	0.080	N/A	0.84	0.24	0.80	0.82	31.00	0.004	8.45	145.64	0.367	N/A	N/A
38.549	32.00	0.002	33.90	45.81	0.074	N/A	0.84	0.20	0.80	0.82	32.00	0.004	8.88	105.78	0.190	N/A	N/A
38.713	33.00	0.002	32.97	42.19	0.070	N/A	0.84	0.18	0.80	0.81	33.00	0.004	8.99	82.86	0.133	N/A	N/A
38.877	34.00	0.002	33.18	42.98	0.071	N/A	0.84	0.18	0.80	0.81	34.00	0.003	10.79	105.80	0.190	N/A	N/A
39.042	35.00	0.002	34.85	49.50	0.077	N/A	0.84	0.22	0.80	0.81	35.00	0.003	6.94	101.68	0.178	N/A	N/A
39.206	36.00	0.002	35.40	51.66	0.079	N/A	0.84	0.23	0.80	0.81	36.00	0.003	7.00	113.81	0.217	N/A	N/A
39.370	37.00	0.002	35.25	51.05	0.079	N/A	0.84	0.23	0.80	0.81	37.00	0.003	6.47	102.23	0.179	N/A	N/A
39.534	38.00	0.002	33.11	42.70	0.071	N/A	0.84	0.18	0.80	0.81	38.00	0.003	10.15	97.41	0.166	N/A	N/A
39.698	39.00	0.002	32.47	40.21	0.069	N/A	0.83	0.16	0.80	0.81	39.00	0.003	10.93	84.66	0.136	N/A	N/A
39.862	40.00	0.002	32.46	40.18	0.069	N/A	0.83	0.16	0.80	0.81	40.00	0.003	10.38	80.14	0.128	N/A	N/A

18.865	N/A	0.93	410.87	39.34	503.11	18.865		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
19.029	N/A	0.93	422.62	40.46	517.51	19.029		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
19.193	N/A	0.93	411.26	39.37	503.59	19.193		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
19.357	N/A	0.92	413.15	39.55	505.90	19.357		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
19.521	N/A	0.92	417.87	40.01	511.69	19.521		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
19.685	N/A	0.92	401.39	38.43	491.51	19.685		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
19.849	N/A	0.92	387.63	37.11	474.65	19.849		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
20.013	N/A	0.92	365.03	34.95	446.99	20.013		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
20.177	N/A	0.91	339.78	32.53	416.07	20.177		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
20.341	N/A	0.91	316.99	30.35	388.16	20.341		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
20.505	N/A	0.91	297.96	28.53	364.85	20.505		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
20.669	N/A	0.91	279.34	26.74	342.05	20.669		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
20.833	N/A	0.91	250.82	24.01	307.13	20.833		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
20.997	N/A	0.91	227.01	21.73	277.98	20.997	46	0.95	40	35	0.94	0.30	0.87	4.6	39.6	3.64	N/A	3.73	1.08	41.70	N/A	N/A	N/A
21.161	N/A	0.90	198.50	19.00	243.06	21.161		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
21.325	N/A	0.88	171.45	16.41	209.94	21.325		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
21.489	N/A	0.86	143.33	13.72	175.50	21.489		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
21.653	N/A	0.85	122.19	11.70	149.62	21.653		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
21.817	N/A	0.83	105.02	10.05	128.59	21.817		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
21.981	N/A	0.82	92.92	8.90	113.78	21.981		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
22.145	N/A	0.81	82.71	7.92	101.28	22.145		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
22.309	N/A	0.80	76.05	7.28	93.13	22.309		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
22.473	N/A	0.78	61.33	5.87	75.10	22.473		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
22.638	N/A	0.77	53.75	5.15	65.81	22.638		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
22.802	N/A	0.76	49.35	4.72	60.43	22.802		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
22.966	N/A	0.75	41.99	4.02	51.41	22.966		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
23.130	N/A	0.74	37.73	3.61	46.19	23.130		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
23.294	N/A	0.73	34.49	3.30	42.23	23.294		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
23.458	N/A	0.72	31.97	3.06	39.14	23.458		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
23.622	N/A	0.71	30.72	2.94	37.61	23.622		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
23.786	N/A	0.71	29.08	2.78	35.61	23.786		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
23.950	N/A	0.70	29.77	2.85	36.45	23.950		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
24.114	N/A	0.70	27.38	2.62	33.53	24.114		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
24.278	N/A	0.70	30.74	2.94	37.64	24.278		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
24.442	N/A	0.70	31.57	3.02	38.66	24.442		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
24.606	N/A	0.70	32.00	3.06	39.18	24.606		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
24.770	N/A	0.70	34.98	3.35	42.84	24.770		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
24.934	N/A	0.70	38.33	3.67	46.94	24.934		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
25.098	N/A	0.71	43.45	4.16	53.21	25.098		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
25.262	N/A	0.72	53.66	5.14	65.71	25.262		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
25.426	N/A	0.73	63.41	6.07	77.65	25.426		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
25.590	N/A	0.75	77.44	7.41	94.82	25.590		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
25.754	N/A	0.75	80.27	7.68	98.29	25.754		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
25.918	N/A	0.74	77.91	7.46	95.41	25.918		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
26.082	N/A	0.74	74.71	7.15	91.49	26.082		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
26.246	N/A	0.73	72.09	6.90	88.27	26.246		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
26.410	N/A	0.73	69.81	6.68	85.48	26.410		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
26.574	N/A	0.72	65.28	6.25	79.94	26.574		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
26.739	N/A	0.71	59.23	5.67	72.52	26.739		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
26.903	N/A	0.69	49.22	4.71	60.28	26.903		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
27.067	N/A	0.68	42.77	4.09	52.37	27.067		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
27.231	N/A	0.68	45.43	4.35	55.62	27.231		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
27.395	N/A	0.65	31.78	3.04	38.92	27.395		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
27.559	N/A	0.62	23.08	2.21	28.27	27.559		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
27.723	N/A	0.62	21.35	2.04	26.14	27.723		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
27.887	N/A	0.66	43.01	4.12	52.66	27.887		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
28.051	N/A	0.66	41.63	3.99	50.97	28.051		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
28.215	N/A	0.64	31.69	3.03	38.80	28.215		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
28.379	N/A	0.64	33.57	3.21	41.11	28.379		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
28.543	N/A	0.66	44.94	4.30	55.03	28.543		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
28.707	N/A	0.66	45.15	4.32	55.28	28.707		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
28.871	N/A	0.65	42.87	4.10	52.50	28.871		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
29.035	N/A	0.65	42.27	4.05	51.76	29.035		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
29.199	N/A	0.63	36.93	3.54	45.23	29.199		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
29.363	N/A	0.62	31.07	2.97	38.04	29.363		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
29.527	N/A	0.63	39.77	3.81	48.70	29.527		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
29.691	N/A	0.63	37.72	3.61	46.19	29.691		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
29.855	N/A	0.61	29.66	2.84	36.32	29.855		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
30.019	N/A	0.61	32.46	3.11	39.75	30.019		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
30.183	N/A	0.62	35.50	3.40	43.47	30.183		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
30.347	N/A	0.58	23.41	2.24	28.67	30.347		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
30.511	N/A	0.57	18.97	1.82	23.23	30.511		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
30.675	N/A	0.57	20.47	1.96	25.07	30.675		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
30.840	N/A	0.56	12.64	1.21	15.48	30.840		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
31.004	N/A	0.55	8.14	0.78	9.97	31.004	9	1.00	8	5	0.36	0.60	0.61	4.6	9.7	0.12	N/A	3.73	1.08	9.25	0.107	N/A	N/A
31.168	N/A	0.55	7.28	0.70	8.91	31.168		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
31.332	N/A	0.55	15.15	1.45	18.56	31.332		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
31.496	N/A	0.55	18.17	1.74	22.25	31.496		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
31.660	N/A	0.55	18.01	1.72	22.05	31.660		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
31.824	N/A	0.54	15.38	1.47	18.83	31.824		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
31.988	N/A	0.54	11.28	1.08	13.81	31.988		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
32.152	N/A	0.54	11.88	1.14	14.55	32.152		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
32.316	N/A	0.57	28.73	2.75	35.18	32.316		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
32.480	N/A	0.59	34.60	3.31	42.36	32.480		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
32.644	N/A	0.59	37.43	3.58	45.84	32.644		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
32.808	N/A	0.59	37.07	3.55	45.39	32.808		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
32.972	N/A	0.58	34.41	3.29	42.14	32.972		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
33.136	N/A	0.57	30.95	2.96	37.90	33.136		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
33.300	N/A	0.55	23.35	2.24	28.59	33.300		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
33.464	N/A	0.52	17.10	1.64	20.94	33.464		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
33.628	N/A	0.52	17.38	1.66	21.28	33.628		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
33.792	N/A	0.53	19.48	1.86	23.85	33.792		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
33.956	N/A	0.52	18.16	1.74	22.24	33.956		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
34.120	N/A	0.52	17.08	1.64	20.92	34.120		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
34.284	N/A	0.55	28.66	2.74	35.10	34.284		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
34.448	N/A	0.53	23.88	2.29	29.24	34.448		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
34.612	N/A	0.51	15.17	1.45	18.58	34.612		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
34.776	N/A	0.53	23.73	2.27	29.06	34.776		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
34.941	N/A	0.57	40.95	3.92	50.14	34.941		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
35.105	N/A	0.62	64.37	6.16	78.83	35.105		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
35.269	N/A	0.73	147.95	14.16	181.16	35.269		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
35.433	N/A	0.79	216.65	20.74	265.29	35.433		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
35.597	N/A	0.79	207.60	19.88	254.21	35.597		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
35.761	N/A	0.67	105.09	10.06	128.68	35.761		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
35.925	N/A	0.65	86.00	8.23	105.31	35.925	42	1.00	39	28	0.83	0.35	0.72	5.5	33.2	0.78	N/A	5.00	1.20	38.21	N/A	N/A	N/A
36.089	N/A	0.56	39.02	3.74	47.78	36.089		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
36.253	N/A	0.50	20.43	1.96	25.01	36.253		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
36.417	N/A	0.49	15.41	1.47	18.86	36.417		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
36.581	N/A	0.49	12.61	1.21	15.44	36.581		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
36.745	N/A	0.49	12.17	1.16	14.90	36.745		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
36.909	N/A	0.48	12.86	1.23	15.75	36.909		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
37.073	N/A	0.48	13.44	1.29	16.46	37.073		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
37.237	N/A	0.48	14.19	1.36	17.38	37.237		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
37.401	N/A	0.48	16.40	1.57	20.09	37.401		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
37.565	N/A	0.51	27.99	2.68	34.28	37.565		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
37.729	N/A	0.56	48.39	4.63	59.25	37.729		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
37.893	N/A	0.56	46.13	4.42	56.49	37.893		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
38.057	N/A	0.52	30.81	2.95	37.73	38.057		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
38.221	N/A	0.50	25.20	2.41	30.86	38.221		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
38.385	N/A	0.47	14.07	1.35	17.23	38.385		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
38.549	N/A	0.47	9.72	0.93	11.91	38.549		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
38.713	N/A	0.47	7.52	0.72	9.21	38.713		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
38.877	N/A	0.46	8.01	0.77	9.81	38.877		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
39.042	N/A	0.46	11.96	1.15	14.65	39.042		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
39.206	N/A	0.46	13.28	1.27	16.26	39.206		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
39.370	N/A	0.46	12.91	1.24	15.80	39.370		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
39.534	N/A	0.46	7.84	0.75	9.59	39.534		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
39.698	N/A	0.46	6.33	0.61	7.75	39.698		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
39.862	N/A	0.46	6.31	0.60	7.72	39.862		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-

40.026	6929.93	14.7	0.519	14.6	10.3	4.47	3.54%	Coarse Alluvium	0.057	114.1	2.24	0.000	2.24	0	0.45	6.633	0.64	8.16	6	4.18%	3.3	36%	2.35	0.000	2.35	0	0
40.190	6929.77	17.1	0.478	17.0	12.7	5.51	2.80%	Coarse Alluvium	0.057	114.1	2.25	0.000	2.25	0	0.45	7.708	0.74	9.48	7	3.22%	3.2	36%	2.36	0.000	2.36	0	0
40.354	6929.61	14.2	0.422	14.2	12.9	5.59	2.97%	Coarse Alluvium	0.057	114.1	2.26	0.000	2.26	0	0.45	6.387	0.61	7.87	5	3.52%	3.3	36%	2.37	0.000	2.37	0	0
40.518	6929.44	13.0	0.410	12.9	12.9	5.57	3.17%	Coarse Alluvium	0.057	114.1	2.27	0.000	2.27	0	0.45	5.791	0.55	7.13	5	3.84%	3.3	36%	2.38	0.000	2.38	0	0
40.682	6929.28	23.9	0.504	23.8	14.0	6.06	2.11%	Coarse Alluvium	0.057	114.1	2.28	0.000	2.28	0	0.45	10.660	1.02	13.10	9	2.34%	3.0	36%	2.39	0.000	2.39	0	0
40.846	6929.11	25.6	0.512	25.5	13.5	5.86	2.00%	Coarse Alluvium	0.057	114.1	2.29	0.000	2.29	0	0.45	11.395	1.09	14.00	10	2.20%	2.9	36%	2.40	0.000	2.40	0	0
41.010	6928.95	15.1	0.406	15.0	11.3	4.88	2.70%	Fine Alluvium	0.060	120.6	2.30	0.000	2.30	0	0.45	6.674	0.64	8.21	6	3.18%	3.2	76%	2.41	0.000	2.41	1	1
41.174	6928.79	11.0	0.271	10.9	12.3	5.35	2.47%	Fine Alluvium	0.060	120.6	2.31	0.000	2.31	0	0.44	4.840	0.46	5.97	4	3.13%	3.4	76%	2.42	0.000	2.42	1	1
41.338	6928.62	11.6	0.279	11.5	13.2	5.72	2.40%	Fine Alluvium	0.060	120.6	2.32	0.000	2.32	0	0.44	5.107	0.49	6.30	4	3.00%	3.3	76%	2.43	0.000	2.43	1	1
41.502	6928.46	12.9	0.347	12.8	14.3	6.18	2.69%	Fine Alluvium	0.060	120.6	2.33	0.000	2.33	0	0.44	5.650	0.54	6.97	5	3.28%	3.3	76%	2.44	0.000	2.44	1	1
41.666	6928.29	13.9	0.451	13.8	15.0	6.49	3.25%	Fine Alluvium	0.060	120.6	2.34	0.000	2.34	0	0.44	6.054	0.58	7.46	5	3.91%	3.3	76%	2.45	0.000	2.45	1	1
41.830	6928.13	14.2	0.509	14.2	15.6	6.77	3.57%	Fine Alluvium	0.060	120.6	2.35	0.000	2.35	0	0.44	6.200	0.59	7.64	5	4.28%	3.3	76%	2.46	0.000	2.46	1	1
41.994	6927.97	14.6	0.644	14.5	16.5	7.16	4.42%	Fine Alluvium	0.060	120.6	2.36	0.000	2.36	0	0.44	6.320	0.61	7.79	5	5.27%	3.4	76%	2.47	0.000	2.47	1	1
42.158	6927.80	15.0	0.690	14.9	16.4	7.10	4.61%	Fine Alluvium	0.060	120.6	2.37	0.000	2.37	0	0.44	6.464	0.62	7.97	5	5.48%	3.4	76%	2.48	0.000	2.48	1	1
42.322	6927.64	13.0	0.710	12.9	15.2	6.59	5.48%	Fine Alluvium	0.060	120.6	2.38	0.000	2.38	0	0.43	5.584	0.53	6.89	4	6.71%	3.5	76%	2.49	0.000	2.49	1	1
42.486	6927.47	10.7	0.483	10.6	14.9	6.45	4.53%	Fine Alluvium	0.060	120.6	2.39	0.000	2.39	0	0.43	4.576	0.44	5.65	3	5.83%	3.5	76%	2.50	0.000	2.50	1	1
42.650	6927.31	9.8	0.207	9.8	15.4	6.67	2.10%	Fine Alluvium	0.060	120.6	2.40	0.000	2.40	0	0.43	4.203	0.40	5.20	3	2.78%	3.4	76%	2.51	0.000	2.51	1	1
42.814	6927.15	9.2	0.109	9.1	15.4	6.67	1.18%	Fine Alluvium	0.060	120.6	2.41	0.000	2.41	0	0.43	3.915	0.37	4.84	3	1.60%	3.3	76%	2.51	0.000	2.51	1	1
42.978	6926.98	8.4	0.087	8.4	15.4	6.69	1.03%	Fine Alluvium	0.060	120.6	2.42	0.000	2.42	0	0.43	3.577	0.34	4.43	2	1.44%	3.4	76%	2.52	0.000	2.52	1	1
43.143	6926.82	9.1	0.090	9.0	16.1	6.96	0.99%	Fine Alluvium	0.060	120.6	2.43	0.000	2.43	0	0.43	3.838	0.37	4.75	3	1.35%	3.3	76%	2.53	0.000	2.53	1	1
43.307	6926.65	8.8	0.107	8.7	16.2	7.04	1.21%	Fine Alluvium	0.060	120.6	2.44	0.000	2.44	0	0.43	3.716	0.36	4.60	3	1.67%	3.4	76%	2.54	0.000	2.54	1	1
43.471	6926.49	9.7	0.210	9.6	16.2	7.04	2.16%	Fine Alluvium	0.060	120.6	2.45	0.000	2.45	0	0.42	4.081	0.39	5.05	3	2.89%	3.4	76%	2.55	0.000	2.55	1	1
43.635	6926.33	11.7	0.290	11.6	16.9	7.32	2.48%	Fine Alluvium	0.060	120.6	2.46	0.000	2.46	0	0.42	4.906	0.47	6.06	4	3.14%	3.4	76%	2.56	0.000	2.56	1	1
43.799	6926.16	13.8	0.263	13.6	18.5	8.01	1.91%	Fine Alluvium	0.060	120.6	2.47	0.000	2.47	0	0.42	5.751	0.55	7.10	5	2.33%	3.2	76%	2.57	0.000	2.57	1	1
43.963	6926.00	12.9	0.317	12.8	19.0	8.24	2.46%	Fine Alluvium	0.060	120.6	2.48	0.000	2.48	0	0.42	5.359	0.51	6.62	4	3.05%	3.3	76%	2.58	0.000	2.58	1	1
44.127	6925.83	15.4	0.290	15.2	19.3	8.36	1.89%	Fine Alluvium	0.060	120.6	2.49	0.000	2.49	0	0.42	6.381	0.61	7.88	5	2.25%	3.2	76%	2.59	0.000	2.59	1	1
44.291	6925.67	16.2	0.444	16.1	18.7	8.09	2.73%	Fine Alluvium	0.060	120.6	2.49	0.000	2.49	0	0.42	6.737	0.65	8.31	6	3.23%	3.2	76%	2.60	0.000	2.60	1	1
44.455	6925.51	19.0	0.619	18.9	17.9	7.75	3.25%	Fine Alluvium	0.060	120.6	2.50	0.000	2.50	0	0.42	7.882	0.75	9.71	7	3.74%	3.2	76%	2.61	0.000	2.61	1	1
44.619	6925.34	16.5	0.622	16.4	18.4	7.95	3.77%	Fine Alluvium	0.060	120.6	2.51	0.000	2.51	0	0.42	6.799	0.65	8.38	6	4.45%	3.3	76%	2.62	0.000	2.62	1	1
44.783	6925.18	11.3	0.514	11.2	18.1	7.85	4.56%	Fine Alluvium	0.060	120.6	2.52	0.000	2.52	0	0.41	4.614	0.44	5.71	3	5.88%	3.5	76%	2.63	0.000	2.63	1	1
44.947	6925.01	15.2	0.482	15.0	19.7	8.52	3.18%	Fine Alluvium	0.060	120.6	2.53	0.000	2.53	0	0.41	6.205	0.59	7.66	5	3.82%	3.3	76%	2.64	0.000	2.64	1	1
45.111	6924.85	21.0	0.542	20.8	19.9	8.62	2.59%	Coarse Alluvium	0.057	114.1	2.54	0.000	2.54	0	0.41	8.573	0.82	10.56	7	2.94%	3.1	36%	2.65	0.000	2.65	0	0
45.275	6924.69	18.8	0.680	18.7	14.4	6.22	3.62%	Coarse Alluvium	0.057	114.1	2.55	0.000	2.55	0	0.41	7.658	0.73	9.42	6	4.20%	3.2	36%	2.66	0.000	2.66	0	0
45.439	6924.52	25.5	0.737	25.4	13.2	5.73	2.90%	Coarse Alluvium	0.057	114.1	2.56	0.000	2.56	0	0.41	10.377	0.99	12.75	9	3.22%	3.1	36%	2.67	0.000	2.67	0	0
45.603	6924.36	28.9	0.830	28.9	10.9	4.72	2.87%	Coarse Alluvium	0.057	114.1	2.57	0.000	2.57	0	0.41	11.775	1.13	14.45	10	3.15%	3.0	36%	2.68	0.000	2.68	0	0
45.767	6924.19	28.9	0.839	28.8	9.7	4.19	2.91%	Coarse Alluvium	0.057	114.1	2.58	0.000	2.58	0	0.41	11.717	1.12	14.38	10	3.19%	3.0	36%	2.69	0.000	2.69	0	0
45.931	6924.03	32.1	0.965	32.0	8.5	3.70	3.01%	Coarse Alluvium	0.057	114.1	2.59	0.000	2.59	0	0.41	12.978	1.24	15.92	11	3.28%	3.0	36%	2.70	0.000	2.70	0	0
46.095	6923.87	29.2	0.831	29.1	7.6	3.29	2.85%	Coarse Alluvium	0.057	114.1	2.60	0.000	2.60	0	0.40	11.781	1.13	14.45	10	3.13%	3.0	36%	2.71	0.000	2.71	0	0
46.259	6923.70	23.2	0.704	23.2	7.7	3.32	3.03%	Coarse Alluvium	0.057	114.1	2.61	0.000	2.61	0	0.40	9.356	0.90	11.48	8	3.41%	3.1	36%	2.72	0.000	2.72	0	0
46.423	6923.54	19.5	0.636	19.5	7.7	3.34	3.25%	Coarse Alluvium	0.057	114.1	2.62	0.000	2.62	0	0.40	7.842	0.75	9.63	6	3.76%	3.2	36%	2.73	0.000	2.73	0	0
46.587	6923.37	34.9	0.734	34.9	10.2	4.43	2.10%	Coarse Alluvium	0.057	114.1	2.63	0.000	2.63	0	0.40	13.980	1.34	17.15	12	2.27%	2.9	36%	2.74	0.000	2.74	0	0
46.751	6923.21	41.4	0.764	41.3	8.5	3.68	1.85%	Coarse Alluvium	0.057	114.1	2.64	0.000	2.64	0	0.40	16.517	1.58	20.25	15	1.97%	2.8	36%	2.75	0.000	2.75	0	0
46.915	6923.05	43.4	0.957	43.3	6.5	2.81	2.21%	Coarse Alluvium	0.057	114.1	2.65	0.000	2.65	0	0.40	17.317	1.66	21.22	15	2.35%	2.8	36%	2.76	0.000	2.76	0	0
47.079	6922.88	41.7	1.129	41.7	4.8	2.09	2.71%	Coarse Alluvium	0.057	114.1	2.66	0.000	2.66	0	0.40	16.577	1.59	20.31	15	2.89%	2.9	36%	2.77	0.000	2.77	0	0
47.244	6922.72	35.5	0.778	35.5	5.5	2.38	2.19%	Coarse Alluvium	0.057	114.1	2.67	0.000	2.67	0	0.40	14.080	1.35	17.26	12	2.37%	2.9	36%	2.77	0.000	2.77	0	0
47.408	6922.55	41.5	0.774	41.4	7.2	3.13	1.87%	Coarse Alluvium	0.057	114.1	2.67	0.000	2.67	0	0.40	16.387	1.57	20.09	15	1.99%	2.8	36%	2.78	0.000	2.78	0	0
47.572	6922.39	47.0	0.889	46.9	8.0	3.48	1.89%	Coarse Alluvium	0.057	114.1	2.68	0.000	2.68	0	0.40	18.813	1.80	23.06	16	2.01%	2.7	36%	2.79	0.000	2.79	0	0
47.736	6922.22	43.7	1.000	43.7	6.9	2.97	2.29%	Coarse Alluvium	0.057	114.1	2.69	0.000	2.69	0	0.39	17.185	1.65	21.06	15	2.44%	2.8	36%	2.80	0.000	2.80	0	0
47.900	6922.06	48.6	0.997	48.6	7.0	3.01	2.05%	Coarse Alluvium	0.057	114.1	2.70	0.000	2.70	0	0.40	19.501	1.87	23.90	17	2.17%	2.7	36%	2.81	0.000	2.81	0	0
48.064	6921.90	47.7	1.174	47.6	6.9	2.97	2.46%	Coarse Alluvium	0.057	114.1	2.71	0.000	2.71	0	0.40	18.970	1.82	23.25	17	2.61%	2.8	36%	2.82	0.000	2.82	0	0
48.228	6921.73	32.1	0.918	32.1	5.9	2.56	2.86%	Coarse Alluvium	0.057	114.1	2.72	0.000	2.72	0	0.39	12.510	1.20	15.34	11	3.13%	3.0	36%	2.83	0.000	2.83	0	0
48.392	6921.57	24.6	0.727	24.5	7.5	3.25	2.96%	Coarse Alluvium	0.057	114.1	2.73	0.000	2.73	0	0.39	9.550	0.91	11.72	8	3.33%	3.1	36%	2.84	0.000	2.84	0	0
48.556	6921.40	46.0	0.716	46.0	11.7	5.08	1.56%	Coarse Alluvium	0.057	114.1	2.74	0.000	2.74	0	0.39	17.994	1.72	22.07	16	1.65%	2.7	36%	2.85	0.000	2.85	0	0
48.720	6921.24	58.0	0.836	57.9	10.5	4.55	1.44%	Coarse Alluvium	0.057	114.1	2.75	0.000	2.75	0	0.41	23.856	2.29	29.25	20	1.51%	2.6	36%	2.86	0.000	2.86	0	0
48.884	6921.08	62.6	0.904	62.5	9.3	4.03	1.44%	Coarse Alluvium	0.057	114.1	2.76	0.000	2.76	0	0.42	26.151	2.50	32.05	22	1.51%	2.6	36%	2.87	0.000	2.87	0	0
49.048	6920.91	62.1	1.028	62.0	8.8	3.80	1.66%	Coarse Alluvium	0.057	114.1	2.77	0.000	2.77	0	0.42	25.806	2.47	31.63	21	1.73%	2.6	36%	2.88	0.000	2.88	0	0
49.212	6920.75	55.8	1.366	55.7	8.1	3.52	2.45%	Coarse Alluvium	0.057	114.1	2.78	0.000	2.78	0	0.40	22.512	2.16	27.59	19	2.58%	2.7	36%	2.89	0.000	2.89	0	0
49.376	6920.58	47.5	1.425	47.4	7.9	3.41	3.00%	Coarse Alluvium	0.057	114.1	2.79	0.000	2.79	0	0.39	18.401	1.76	22.56	16	3.19%	2.8	36%	2.90	0.000	2.90	0	0
49.540	6920.42	52.9	1.319	52.8	9.3	4.05	2.49%	Coarse Alluvium	0.057	114.1	2.80	0.000	2.80	0	0.40	20.956	2.01	25.69	18	2.63%	2.8	36%	2.91	0.000	2.91	0	0
49.704	6920.26	79.2	1.156	79.1	11.2	4.84	1.46%	Coarse Alluvium	0.057	114.1	2.81	0.000	2.81	0	0.44	34.686	3.32	42.51	27	1.51%	2.5	36%	2.91	0.000	2.91	0	0
49.868	6920.09	84.1	1.040	84.0	9.0	3.88	1.24%	Coarse Alluvium	0.057	114.1	2.82	0.000	2.82	0	0.44	37.365	3.58	45.78	29	1.28%	2.4	36%	2.92	0.000	2.92	0	0
50.032	6919.93	78.1	1.275	78.0	8.2	3.56	1.63%	Coarse Alluvium	0.057	114.1	2.82	0.000	2.82	0	0.43	33.880	3.25	41.51	27	1.69%	2.5	36%	2.93	0.000	2.93	0	0
50.196	6919.76	71.0	1.386	70.9	6.5	2.81	1.95%	Coarse Alluvium	0.057	114.1	2.83	0.000	2.83	0	0.42	29.932	2.87	36.67	24	2.03%	2.6	36%	2.94	0.000	2.94	0	0
50.360	6919.60	58.9	1.466	58.8	5.6	2.42	2.49%	Coarse Alluvium	0.057	114.1	2.84	0.000	2.84	0	0.40	23.580	2.26	28.89	20	2.62%	2.7	36%	2.95	0.000	2.95	0	0
50.524	6919.44	46.0	1.404	46.0	6.0	2.58	3.05%	Coarse Alluvium	0.057	114.1	2.85	0.000	2.85	0	0.38	17.317	1.66	21.22	15	3.25%	2.9	36%	2.96	0.000	2.96	0	0
50.688	6919.27	39.8	1.521	39.8	7.5	3.23	3.82%	Coarse Alluvium	0.057	114.1	2.86	0.000	2.86	0	0.38	14.921	1.43	18.29	13	4.12%	3.0	36%	2.97	0.000	2.97	0	0
50.852	6919.11	39.8	1.421	39.8	10.9	4.74	3.57%	Coarse Alluvium	0.057	114.1	2.87	0.000	2.87	0	0.37	14.883	1.43	18.26	13	3.84%	3.0	36%	2.98	0.000	2.98	0	0
51.016	6918.94	38.2	1.237	38.2	10.5	4.54	3.23%	Coarse Alluvium	0.057	114.1	2.88	0.000	2.88	0	0.37	14.252	1.37	17.48	12	3.50%	3.0	36%	2.99	0.000	2.99	0	0
51.180	6918.78	48.6	1.265	48.6	11.5	5.00	2.60%	Coarse Alluvium	0.057	114.1	2.89	0.000	2.89	0	0.38	18.313	1.75	22.46	16	2.76%	2.8	36%	3.00	0.000	3.00	0	0
51.345	6918.62	38.1	1.273	38.0	10.0	4.33	3.35%	Coarse Alluvium	0.057	114.1	2.90	0.000	2.90	0	0.37	14.109	1.35	17.30	12	3.62%	3.0	36%	3.01	0.000	3.01	0	0
51.509	6918.45	24.4	1.043	24.4	9.6	4.17	4.27%	Coarse Alluvium	0.057	114.1	2.91	0.000	2.91	0	0.37	9.020	0.86	11.07	7	4.85%	3.2	36%	3.02	0.000	3.02	0	0
51.673	6918.29	18.9	0.809	18.9	11.0	4.76	4.27%	Coarse Alluvium	0.057	114.1	2.92	0.000	2.92	0	0.37	6.973	0.67	8.57	5	5.05%	3.3	36%	3.03	0.000	3.03	0	0
51.837	6918.12	25.2	0.801	25.1	13.9	6.04	3.18%	Coarse Alluvium	0.057	114.1	2.93	0.000	2.93	0	0.37	9.256	0.89	11.37	8	3.60%	3.1	36%	3.04	0.000	3.04	0	0
52.001	6917.96	33.6	0.957	33.5	13.3	5.75	2.85%	Coarse Alluvium	0.057	114.1	2.94	0.000	2.94	0	0.37	12.328	1.18	15.13	10	3.12%	3.0	36%	3.05	0.000	3.05	0	0
52.165	6917.80	27.5	0.873	27.5	12.3	5.35	3.17%	Coarse Alluvium	0.057	114.1	2.95	0.000	2.95	0	0.37	10.075	0.97	12.37	8	3.55%	3.1	36%	3.06	0.000	3.06	0	0
52.329	6917.63	28.7	0.771	28.6	14.6	6.31	2.69%	Coarse Alluvium	0.057	114.1	2.96	0.000	2.96	0	0.37	10.471	1.00	12.86	9	2.99%	3.0	36%	3.06	0.000	3.06	0	0
52.493	6917.47	40.7	0.801	40.6	14.3	6.20	1.97%	Coarse Alluvium	0.057	114.1	2.96	0.000	2.96	0	0.36	14.817	1.42	18.18	13	2.12%	2.8	36%	3.07	0.000	3.07	0	0
52.657	6917.30	42.7	0.837	42.6	13.0	5.61	1.96%	Coarse Alluvium	0.057	114.1	2.97	0.000	2.97	0	0.36	15.502	1.48	19.02	13	2.11%	2.8	36%	3.08	0.000	3.08	0	0
52.821	6917.14	49.9	1.040	49.8	13.7	5.92	2.09%	Coarse Alluvium	0.057	114.1	2.98	0.000	2.98	0	0.37	18.314	1.75	22.46	16	2.22%	2.8	36%	3.09	0.000	3.09	0	0
52.985	6916.98	36.6	0.853	36.5	11.4	4.94	2.33%	Coarse Alluvium	0.057	114.1	2.99	0.000	2.99	0	0.36	13.230	1.27	16.23	11	2.54%	2.9	36%	3.10	0.000	3.10	0	0
53.149	6916.81	26.6	0.712	26.5	13.3	5.78	2.68%	Coarse Alluvium	0.057	114.1	3.00	0.000	3.00	0	0.36	9.581	0.92	11.77	8	3.02%	3.1	36%	3.11	0.000	3.11	0	0
53.313	6916.65	40.8	0.641	40.7	17.1	7.40	1.57%	Coarse Alluvium	0.057	114.1	3.01	0.000	3.01	0	0.36	14.684	1.41	18.03	13	1.69%	2.8	36%	3.12	0.000	3.12	0	0
53.477	6916.48	22.2	0.629	22.1	14.2	6.16	2.83%	Coarse Alluvium	0.057	114.1	3.02	0.000	3.02	0	0.36	7.955	0.76	9.78	6	3.28%	3.2	36%	3.13	0.000	3.13	0	0
53.641	6916.32	17.0	0.519	16.8	28.5	12.36	3.05%	Coarse Alluvium	0.057	114.1	3.03	0.000	3.03	0	0.36	6.038	0.58	7.47	5	3.71%	3.3	36%	3.14	0.000	3.14	0	0
53.805	6916.16	16.1	0.351	15.7	49.7	21.54	2.19%	Coarse Alluvium	0.057	114.1	3.04	0.000	3.04	0	0.36	5.634	0.54	7.03	4	2.70%	3.3	36%	3.15	0.000	3.15	0	0
53.969	6915.99	14.7	0.375	14.3	59.4	25.74	2.55%	Coarse Alluvium	0.057	114.1	3.05	0.000	3.05	0	0.36	5.120	0.49	6.43	4	3.22%	3.4	36%	3.16	0.000	3.16	0	0
54.133	6915.83	14.9	0.382	14.5	64.3	27.88	2.57%	Fine Alluvium	0.060	120.6	3.06	0.000	3.06	0	0.36	5.154	0.49	6.49	4	3.23%	3.4	76%	3.17	0.000	3.17	1	0
54.297	6915.66	13.7	0.398	13.3	68.7	29.75	2.89%	Fine Alluvium	0.060	120.6	3.07	0.000	3.07	0	0.36	4.732	0.45	5.98	3	3.73%	3.4	76%	3.18	0.000	3.18	1	0
54.461	6915.50	14.4	0.410	14.0	76.7	33.25	2.84%	Fine Alluvium	0.060	120.6	3.08	0.000	3.08	0	0.35	4.947	0.47	6.27	4	3.61%	3.4	76%	3.19	0.000	3.19	1	0
54.625	6915.34	15.7	0.436	15.2	81.0	35.10	2.77%	Fine Alluvium	0.060	120.6	3.09	0.000	3.09	0	0.35	5.383	0.52	6.81	4	3.45%	3.4	76%	3.20	0.000	3.20	1	0
54.789	6915.17	17.2	0.548	16.6	83.5	36.18	3.19%	Fine Alluvium	0.060	120.6	3.10	0.000	3.10	0	0.35	5.867	0.56	7.41	5	3.90%	3.3	76%	3.21	0.000	3.21	1	0
54.953	6915.01	16.3	0.656	15.9	76.6	33.19	4.01%	Fine Alluvium	0.060	120.6	3.11	0.000	3.11	0	0.35	5.582	0.53	7.04	4	4.95%	3.4	76%	3.22	0.000	3.22	1	0
55.117	6914.84	15.2	0.713	14.8	69.0	29.91	4.68%	Fine Alluvium	0.060	120.6	3.12	0.000	3.12	0	0.35	5.189	0.50	6.54	4	5.89%	3.5	76%	3.23	0.000	3.23	1	0
55.281	6914.68	15.5	0.701	15.0	80.6	34.92	4.53%	Fine Alluvium	0.060	120.6	3.13	0.000	3.13	0	0.35	5.243	0.50	6.64	4	5.67%	3.5	76%	3.24	0.000	3.24	1	0
55.446	6914.51	15.0	0.675	14.5	79.8	34.59	4.51%	Fine Alluvium	0.060	120.6	3.14	0.000	3.14	0	0.35	5.052	0.48	6.40	4	5.71%	3.5	76%	3.25	0.000	3.25	1	0
55.610	6914.35	15.3	0.663	14.9	68.4	29.65	4.32%	Fine Alluvium	0.060	120.6	3.15	0.000	3.15	0	0.35	5.192	0.50	6.54	4	5.44%	3.5	76%	3.26	0.000	3.26	1	0
55.774	6914.19	14.9	0.533	14.5	63.7	27.59	3.57%	Fine Alluvium	0.060	120.6	3.16	0.000	3.16	0	0.35	5.048	0.48	6.35	4	4.53%	3.5	76%	3.27	0.000	3.27	1	0
55.938	6914.02	13.6	0.493	13.2	65.5	28.37	3.63%	Fine Alluvium	0.060	120.6	3.17	0.000	3.17	0	0.35	4.571	0.44	5.77	3	4.73%	3.5	76%	3.28	0.000	3.28	1	0
56.102	6913.86	14.4	0.578	14.0	73.3	31.76	4.01%	Fine Alluvium	0.060	120.6	3.18	0.000	3.18	0	0.35	4.826	0.46	6.10	4	5.14%	3.5	76%	3.29	0.000	3.29	1	0
56.266	6913.69	14.5	0.590	14.1	71.2	30.85	4.06%	Fine Alluvium	0.060	120.6	3.19	0.000	3.19	0	0.34	4.859	0.47	6.14	4	5.20%	3.5	76%	3.30	0.000	3.30	1	0
56.430	6913.53	17.5	0.577	17.1	69.8	30.24	3.29%	Fine Alluvium	0.060	120.6	3.20	0.000	3.20	0	0.34	5.876	0.56	7.38	4	4.03%	3.4	76%	3.31	0.000	3.31	1	0
56.594	6913.37	15.9	0.466	15.5	57.7	25.01	2.94%	Fine Alluvium	0.060	120.6	3.21	0.000	3.21	0	0.34	5.316	0.51	6.66	4	3.69%	3.4	76%	3.32	0.000	3.32	1	0
56.758	6913.20	16.8	0.549	16.4	70.4	30.50	3.26%	Fine Alluvium	0.060	120.6	3.22	0.000	3.22	0	0.34	5.608	0.54	7.05	4	4.04%	3.4	76%	3.33	0.000	3.33	1	0
56.922	6913.04	14.0	0.604	13.6	59.7	25.85	4.31%	Fine Alluvium	0.060	120.6	3.23	0.000	3.23	0	0.34	4.659	0.45	5.86	3	5.60%	3.5	76%	3.34	0.000	3.34	1	0
57.086	6912.87	17.9	0.493	17.3	102.7	44.52	2.75%	Fine Alluvium	0.060	120.6	3.24	0.000	3.24	0	0.34	5.885	0.56	7.47	5	3.36%	3.3	76%	3.35	0.000	3.35	1	0
57.250	6912.71	15.9	0.489	15.4	92.2	39.96	3.07%	Fine Alluvium	0.060	120.6	3.25	0.000	3.25	0	0.34	5.221	0.50	6.63	4	3.85%	3.4	76%	3.36	0.000	3.36	1	0
57.414	6912.55	28.5	0.706	27.8	111.8	48.44	2.48%	Fine Alluvium	0.060	120.6	3.26	0.000	3.26	0	0.34	9.424	0.90	11.83	8	2.80%	3.1	76%	3.37	0.000	3.37	1	0
57.578	6912.38	22.3	0.699	22.1	36.5	15.80	3.13%	Fine Alluvium	0.060	120.6	3.27	0.000	3.27	0	0.34	7.484	0.72	9.26	6	3.66%	3.2	76%	3.38	0.000	3.38	1	0
57.742	6912.22	16.0	0.681	15.7	45.5	19.70	4.27%	Fine Alluvium	0.060	120.6	3.28	0.000	3.28	0	0.34	5.292	0.51	6.60	4	5.37%	3.5	76%	3.39	0.000	3.39	1	0
57.906	6912.05	15.3	0.630	14.9	65.0	28.15	4.13%	Fine Alluvium	0.060	120.6	3.29	0.000	3.29	0	0.34	5.000	0.48	6.29	4	5.26%	3.5	76%	3.40	0.000	3.40	1	0
58.070	6911.89	15.4	0.616	14.9	80.3	34.79	4.01%	Fine Alluvium	0.060	120.6	3.30	0.000	3.30	0	0.34	4.989	0.48	6.31	4	5.11%	3.5	76%	3.41	0.000	3.41	1	0
58.234	6911.73	16.6	0.775	16.1	81.9	35.49	4.66%	Fine Alluvium	0.060	120.6	3.31	0.000	3.31	0	0.34	5.406	0.52	6.83	4	5.81%	3.5	76%	3.42	0.000	3.42	1	0
58.398	6911.56	15.7	0.785	15.3	64.2	27.82	5.00%	Fine Alluvium	0.060	120.6	3.32	0.000	3.32	0	0.33	5.116	0.49	6.43	4	6.34%	3.5	76%	3.43	0.000	3.43	1	0
58.562	6911.40	15.1	0.734	14.7	65.1	28.21	4.87%	Fine Alluvium	0.060	120.6	3.33	0.000	3.33	0	0.33	4.890	0.47	6.15	4	6.25%	3.6	76%	3.44	0.000	3.44	1	0
58.726	6911.23	16.1	0.599	15.7	70.8	30.67	3.72%	Fine Alluvium	0.060	120.6	3.34	0.000	3.34	0	0.33	5.219	0.50	6.57	4	4.68%	3.5	76%	3.45	0.000	3.45	1	0
58.890	6911.07	15.8	0.601	15.4	70.5	30.55	3.80%	Fine Alluvium	0.060	120.6	3.35	0.000	3.35	0	0.33	5.100	0.49	6.42	4	4.83%	3.5	76%	3.45	0.000	3.45	1	0
59.054	6910.91	16.4	0.683	15.9	72.4	31.38	4.17%	Fine Alluvium	0.060	120.6	3.36	0.000	3.36	0	0.33	5.277	0.51	6.65	4	5.24%	3.5	76%	3.46	0.000	3.46	1	0
59.218	6910.74	16.6	0.710	16.2	71.7	31.05	4.27%	Fine Alluvium	0.060	120.6	3.37	0.000	3.37	0	0.33	5.351	0.51	6.73	4	5.35%	3.5	76%	3.47	0.000	3.47	1	0
59.382	6910.58	16.9	0.755	16.4	72.6	31.44	4.47%	Fine Alluvium	0.060	120.6	3.38	0.000	3.38	0	0.33	5.421	0.52	6.82	4	5.59%	3.5	76%	3.48	0.000	3.48	1	0
59.547	6910.41	17.2	0.736	16.8	70.0	30.32	4.28%	Fine Alluvium	0.060	120.6	3.39	0.000	3.39	0	0.33	5.514	0.53	6.93	4	5.33%	3.5	76%	3.49	0.000	3.49	1	0
59.711	6910.25	16.2	0.713	15.8	67.6	29.30	4.39%	Fine Alluvium	0.060	120.6	3.40	0.000	3.40	0	0.33	5.190	0.50	6.52	4	5.55%	3.5	76%	3.50	0.000	3.50	1	0
59.875	6910.09	16.1	0.530	15.6	70.7	30.65	3.30%	Fine Alluvium	0.060	120.6	3.41	0.000	3.41	0	0.33	5.116	0.49	6.44	4	4.19%	3.4	76%	3.51	0.000	3.51	1	0
60.039	6909.92	15.1	0.563	14.7	70.2	30.42	3.73%	Fine Alluvium	0.060	120.6	3.42	0.000	3.42	0	0.33	4.790	0.46	6.04	3	4.82%	3.5	76%	3.52	0.000	3.52	1	0
60.203	6909.76	17.0	0.683	16.3	120.8	52.33	4.02%	Fine Alluvium	0.060	120.6	3.43	0.000	3.43	0	0.33	5.298	0.51	6.79	4	5.03%	3.5	76%	3.53	0.000	3.53	1	0
60.367	6909.59	16.6	0.702	16.0	97.1	42.08	4.23%	Fine Alluvium	0.060	120.6	3.43	0.000	3.43	0	0.33	5.205	0.50	6.61	4	5.33%	3.5	76%	3.54	0.000	3.54	1	0
60.531	6909.43	16.9	0.765	16.3	100.8	43.66	4.53%	Fine Alluvium	0.060	120.6	3.44	0.000	3.44	0	0.32	5.274	0.51	6.71	4	5.69%	3.5	76%	3.55	0.000	3.55	1	0
60.695	6909.27	17.8	0.836	17.3	87.3	37.84	4.69%	Fine Alluvium	0.060	120.6	3.45	0.000	3.45	0	0.32	5.593	0.54	7.06	4	5.82%	3.5	76%	3.56	0.000	3.56	1	0
60.859	6909.10	17.1	0.886	16.7	67.4	29.20	5.17%	Fine Alluvium	0.060	120.6	3.46	0.000	3.46	0	0.32	5.396	0.52	6.77	4	6.49%	3.5	76%	3.57	0.000	3.57	1	0
61.023	6908.94	17.8	0.901	17.4	67.5	29.24	5.06%	Fine Alluvium	0.060	120.6	3.47	0.000	3.47	0	0.32	5.610	0.54	7.04	4	6.28%	3.5	76%	3.58	0.000	3.58	1	0
61.187	6908.77	20.0	0.996	19.5	79.2	34.31	4.98%	Fine Alluvium	0.060	120.6	3.48	0.000	3.48	0	0.32	6.273	0.60	7.88	5	6.03%	3.4	76%	3.59	0.000	3.59	1	0
61.351	6908.61	19.7	1.070	19.3	59.3	25.71	5.44%	Fine Alluvium	0.060	120.6	3.49	0.000	3.49	0	0.32	6.198	0.59	7.73	5	6.61%	3.5	76%	3.60	0.000	3.60	1	0

40.026	0.69	0.04	0.95	0.10	41.00	0.002	32.61	40.77	0.069	N/A	0.83	0.16	0.80	0.81	41.00	0.003	10.55	86.10	0.139	N/A	N/A	N/A
40.190	0.69	0.04	0.95	0.10	42.00	0.002	33.07	42.55	0.071	N/A	0.83	0.18	0.80	0.81	42.00	0.003	8.75	83.01	0.133	N/A	N/A	N/A
40.354	0.69	0.04	0.95	0.10	43.00	0.002	32.51	40.38	0.069	N/A	0.83	0.16	0.80	0.81	43.00	0.003	10.19	80.16	0.128	N/A	N/A	N/A
40.518	0.69	0.04	0.95	0.10	44.00	0.002	32.26	39.39	0.068	N/A	0.83	0.15	0.80	0.81	44.00	0.003	11.16	79.62	0.127	N/A	N/A	N/A
40.682	0.69	0.05	0.95	0.10	45.00	0.002	34.32	47.42	0.075	N/A	0.83	0.21	0.80	0.81	45.00	0.003	6.27	82.17	0.132	N/A	N/A	N/A
40.846	0.69	0.05	0.95	0.10	46.00	0.002	34.63	48.62	0.076	N/A	0.82	0.22	0.80	0.81	46.00	0.003	5.86	81.98	0.131	N/A	N/A	N/A
41.010	0.68	0.04	0.95	0.10	47.00	0.002	32.86	41.07	0.069	42.16	0.82	0.17	0.80	0.81	47.00	0.002	9.59	78.78	0.125	50.56	46.36	0
41.174	0.68	0.04	0.95	0.10	48.00	0.002	32.08	38.05	0.067	41.72	0.82	0.14	0.80	0.80	48.00	0.002	11.74	70.10	0.112	46.14	43.93	0
41.338	0.68	0.04	0.95	0.10	49.00	0.002	32.19	38.49	0.067	42.87	0.82	0.14	0.80	0.80	49.00	0.002	11.20	70.52	0.113	47.38	45.13	0
41.502	0.68	0.04	0.95	0.10	50.00	0.002	32.42	39.39	0.068	44.25	0.82	0.15	0.80	0.80	50.00	0.002	10.80	75.23	0.120	51.39	47.82	0
41.666	0.68	0.04	0.95	0.10	51.00	0.002	32.60	40.06	0.069	45.55	0.82	0.16	0.80	0.80	51.00	0.002	10.97	81.83	0.131	57.45	51.50	0
41.830	0.68	0.04	0.95	0.10	52.00	0.001	32.66	40.30	0.069	46.65	0.82	0.16	0.80	0.80	52.00	0.002	11.14	85.18	0.137	61.53	54.09	0
41.994	0.68	0.04	0.95	0.10	53.00	0.001	32.71	40.50	0.069	47.74	0.82	0.16	0.80	0.80	53.00	0.002	11.84	92.31	0.153	69.92	58.83	0
42.158	0.67	0.04	0.95	0.10	54.00	0.001	32.77	40.74	0.069	48.85	0.81	0.16	0.80	0.80	54.00	0.002	11.86	94.50	0.158	73.79	61.32	0
42.322	0.67	0.04	0.95	0.10	55.00	0.001	32.40	39.29	0.068	49.05	0.81	0.15	0.80	0.80	55.00	0.002	13.82	95.17	0.160	76.02	62.54	0
42.486	0.67	0.04	0.95	0.10	56.00	0.001	31.97	37.62	0.067	49.14	0.81	0.14	0.80	0.80	56.00	0.002	14.81	83.71	0.135	65.08	57.11	0
42.650	0.67	0.04	0.95	0.10	57.00	0.001	31.81	37.01	0.066	49.78	0.81	0.13	0.80	0.80	57.00	0.002	12.51	65.02	0.106	52.01	50.89	0
42.814	0.67	0.04	0.95	0.10	58.00	0.001	31.69	36.53	0.066	50.49	0.81	0.13	0.80	0.80	58.00	0.002	11.31	54.80	0.095	47.83	49.16	0
42.978	0.67	0.04	0.95	0.10	59.00	0.001	31.54	35.97	0.065	51.15	0.81	0.12	0.80	0.80	59.00	0.002	11.80	52.26	0.093	47.65	49.40	0
43.143	0.67	0.04	0.95	0.10	60.00	0.001	31.65	36.41	0.066	52.34	0.81	0.13	0.80	0.80	60.00	0.002	11.00	52.28	0.093	48.51	50.43	0
43.307	0.67	0.04	0.95	0.10	61.00	0.001	31.60	36.21	0.066	53.20	0.80	0.12	0.80	0.80	61.00	0.002	11.91	54.82	0.095	50.44	51.82	0
43.471	0.66	0.04	0.95	0.10	62.00	0.001	31.76	36.81	0.066	54.51	0.80	0.13	0.80	0.80	62.00	0.002	12.94	65.33	0.106	57.02	55.76	0
43.635	0.66	0.04	0.95	0.10	63.00	0.001	32.11	38.17	0.067	56.30	0.80	0.14	0.80	0.80	63.00	0.002	11.74	71.17	0.114	62.15	59.22	0
43.799	0.66	0.04	0.95	0.10	64.00	0.001	32.47	39.57	0.068	58.17	0.80	0.15	0.80	0.79	64.00	0.002	9.63	68.35	0.110	61.06	59.61	0
43.963	0.66	0.04	0.95	0.10	65.00	0.001	32.30	38.93	0.068	58.77	0.80	0.15	0.80	0.79	65.00	0.002	11.00	72.82	0.116	65.59	62.18	0
44.127	0.66	0.04	0.95	0.10	66.00	0.001	32.74	40.61	0.069	60.89	0.80	0.16	0.80	0.79	66.00	0.002	8.88	69.94	0.112	64.30	62.60	0
44.291	0.66	0.04	0.95	0.10	67.00	0.001	32.89	41.20	0.070	62.32	0.80	0.17	0.80	0.79	67.00	0.002	9.68	80.43	0.128	75.02	68.67	0
44.455	0.66	0.04	0.95	0.10	68.00	0.001	33.38	43.09	0.071	64.72	0.80	0.18	0.80	0.79	68.00	0.002	9.25	89.80	0.147	87.46	76.09	0
44.619	0.66	0.04	0.95	0.10	69.00	0.001	32.92	41.30	0.070	64.48	0.79	0.17	0.80	0.79	69.00	0.002	10.78	90.35	0.149	89.59	77.04	0
44.783	0.65	0.04	0.95	0.10	70.00	0.001	31.99	37.69	0.067	63.01	0.79	0.14	0.80	0.79	70.00	0.002	14.88	84.90	0.137	83.81	73.41	0
44.947	0.65	0.04	0.95	0.10	71.00	0.001	32.66	40.33	0.069	65.87	0.79	0.16	0.80	0.79	71.00	0.002	10.82	82.86	0.133	82.60	74.24	0
45.111	0.65	0.05	0.95	0.10	72.00	0.001	33.44	44.00	0.072	N/A	0.79	0.19	0.80	0.79	72.00	0.002	8.04	84.88	0.137	N/A	N/A	N/A
45.275	0.65	0.04	0.95	0.10	73.00	0.001	33.05	42.47	0.071	N/A	0.79	0.18	0.80	0.79	73.00	0.002	9.85	92.80	0.154	N/A	N/A	N/A
45.439	0.65	0.05	0.94	0.10	74.00	0.001	34.19	46.94	0.075	N/A	0.79	0.21	0.80	0.79	74.00	0.002	7.37	93.99	0.157	N/A	N/A	N/A
45.603	0.65	0.05	0.94	0.10	75.00	0.001	34.78	49.23	0.077	N/A	0.79	0.22	0.80	0.79	75.00	0.002	6.74	97.45	0.166	N/A	N/A	N/A
45.767	0.65	0.05	0.94	0.10	76.00	0.001	34.76	49.13	0.077	N/A	0.78	0.22	0.80	0.79	76.00	0.001	6.81	97.87	0.167	N/A	N/A	N/A
45.931	0.65	0.05	0.94	0.10	77.00	0.001	35.29	51.20	0.079	N/A	0.78	0.23	0.80	0.79	77.00	0.001	6.45	102.66	0.181	N/A	N/A	N/A
46.095	0.64	0.05	0.94	0.10	78.00	0.001	34.78	49.23	0.077	N/A	0.78	0.22	0.80	0.79	78.00	0.001	6.74	97.32	0.166	N/A	N/A	N/A
46.259	0.64	0.05	0.94	0.10	79.00	0.001	33.76	45.24	0.073	N/A	0.78	0.20	0.80	0.79	79.00	0.001	8.08	92.79	0.154	N/A	N/A	N/A
46.423	0.64	0.04	0.95	0.10	80.00	0.001	33.12	42.74	0.071	N/A	0.78	0.18	0.80	0.79	80.00	0.001	9.37	90.17	0.148	N/A	N/A	N/A
46.587	0.64	0.05	0.94	0.10	81.00	0.001	35.71	52.86	0.080	N/A	0.78	0.24	0.80	0.79	81.00	0.001	5.27	90.43	0.149	N/A	N/A	N/A
46.751	0.64	0.05	0.94	0.10	82.00	0.001	36.78	57.03	0.085	N/A	0.78	0.26	0.80	0.78	82.00	0.001	4.43	89.72	0.147	N/A	N/A	N/A
46.915	0.64	0.05	0.94	0.10	83.00	0.001	37.12	58.34	0.086	N/A	0.78	0.27	0.80	0.78	83.00	0.001	4.64	98.42	0.169	N/A	N/A	N/A
47.079	0.64	0.05	0.94	0.10	84.00	0.001	36.80	57.12	0.085	N/A	0.77	0.26	0.80	0.78	84.00	0.001	5.23	106.31	0.192	N/A	N/A	N/A
47.244	0.64	0.05	0.94	0.10	85.00	0.001	35.75	53.01	0.080	N/A	0.77	0.24	0.80	0.78	85.00	0.001	5.35	92.37	0.153	N/A	N/A	N/A
47.408	0.63	0.05	0.94	0.10	86.00	0.001	36.73	56.81	0.084	N/A	0.77	0.26	0.80	0.78	86.00	0.001	4.49	90.11	0.148	N/A	N/A	N/A
47.572	0.63	0.05	0.93	0.10	87.00	0.001	37.75	60.81	0.089	N/A	0.77	0.28	0.80	0.78	87.00	0.001	4.14	95.40	0.161	N/A	N/A	N/A
47.736	0.63	0.05	0.93	0.10	88.00	0.001	37.06	58.12	0.086	N/A	0.77	0.26	0.80	0.78	88.00	0.001	4.75	99.98	0.173	N/A	N/A	N/A
47.900	0.63	0.05	0.93	0.10	89.00	0.001	38.04	61.94	0.090	N/A	0.77	0.28	0.80	0.78	89.00	0.001	4.20	100.45	0.174	N/A	N/A	N/A
48.064	0.63	0.05	0.93	0.10	90.00	0.001	37.82	61.07	0.089	N/A	0.77	0.28	0.80	0.78	90.00	0.001	4.64	107.93	0.197	N/A	N/A	N/A
48.228	0.63	0.05	0.94	0.10	91.00	0.001	35.09	50.42	0.078	N/A	0.76	0.23	0.80	0.78	91.00	0.001	6.52	100.02	0.173	N/A	N/A	N/A
48.392	0.63	0.05	0.94	0.10	92.00	0.001	33.84	45.55	0.073	N/A	0.76	0.20	0.80	0.78	92.00	0.001	7.95	93.17	0.155	N/A	N/A	N/A
48.556	0.63	0.05	0.93	0.10	93.00	0.001	37.41	59.48	0.087	N/A	0.76	0.27	0.80	0.78	93.00	0.001	3.91	86.39	0.140	N/A	N/A	N/A
48.720	0.62	0.06	0.93	0.10	94.00	0.001	39.88	69.13	0.099	N/A	0.76	0.31	0.80	0.78	94.00	0.001	3.20	93.73	0.157	N/A	N/A	N/A
48.884	0.62	0.06	0.92	0.09	95.00	0.001	40.85	72.90	0.103	N/A	0.76	0.33	0.80	0.78	95.00	0.001	3.04	97.56	0.166	N/A	N/A	N/A
49.048	0.62	0.06	0.92	0.09	96.00	0.001	40.70	72.33	0.103	N/A	0.76	0.32	0.80	0.78	96.00	0.001	3.26	103.16	0.182	N/A	N/A	N/A
49.212	0.62	0.06	0.93	0.10	97.00	0.001	39.31	66.90	0.096	N/A	0.76	0.30	0.80	0.78	97.00	0.001	4.22	116.52	0.227	N/A	N/A	N/A
49.376	0.62	0.05	0.93	0.10	98.00	0.001	37.58	60.13	0.088	N/A	0.76	0.27	0.80	0.78	98.00	0.001	5.19	117.10	0.229	N/A	N/A	N/A
49.540	0.62	0.06	0.93	0.10	99.00	0.001	38.66	64.35	0.093	N/A	0.75	0.29	0.80	0.78	99.00	0.001	4.44	113.95	0.218	N/A	N/A	N/A
49.704	0.62	0.07	0.92	0.00	####	0.001	44.46	86.97	0.122	N/A	0.75	0.38	0.80	0.78	100.00	0.001	2.62	111.48	0.209	N/A	N/A	N/A
49.868	0.62	0.07	0.91	-0.03	####	0.001	45.59	91.37	0.129	N/A	0.75	0.39	0.80	0.77	101.00	0.001	2.35	107.45	0.195	N/A	N/A	N/A
50.032	0.62	0.07	0.92	0.00	####	0.001	44.11	85.63	0.121	N/A	0.75	0.37	0.80	0.77	102.00	0.001	2.80	116.19	0.226	N/A	N/A	N/A
50.196	0.61	0.06	0.92	0.04	####	0.001	42.44	79.12	0.111	N/A	0.75	0.35	0.80	0.77	103.00	0.001	3.26	119.41	0.238	N/A	N/A	N/A
50.360	0.61	0.06	0.93	0.10	####	0.001	39.76	68.65	0.098	N/A	0.75	0.31	0.80	0.77	104.00	0.001	4.17	120.38	0.242	N/A	N/A	N/A
50.524	0.61	0.05	0.93	0.10	####	0.001	37.12	58.34	0.086	N/A	0.75	0.27	0.80	0.77	105.00	0.001	5.43	115.20	0.222	N/A	N/A	N/A
50.688	0.61	0.05	0.93	0.10	####	0.001	36.11	54.40	0.082	N/A	0.74	0.25	0.80	0.77	106.00	0.001	6.61	121.00	0.245	N/A	N/A	N/A
50.852	0.61	0.05	0.93	0.10	####	0.001	36.09	54.35	0.082	N/A	0.74	0.25	0.80	0.77	107.00	0.001	6.43	117.37	0.230	N/A	N/A	N/A
51.016	0.61	0.05	0.93	0.10	####	0.001	35.83	53.31	0.081	N/A	0.74	0.24	0.80	0.77	108.00	0.001	6.34	110.87	0.207	N/A	N/A	N/A
51.180	0.61	0.05	0.93	0.10	####	0.001	37.54	60.00	0.088	N/A	0.74	0.27	0.80	0.77	109.00	0.001	4.90	110.06	0.204	N/A	N/A	N/A
51.345	0.61	0.05	0.93	0.10	####	0.001	35.77	53.07	0.081	N/A	0.74	0.24	0.80	0.77	110.00	0.001	6.49	112.22	0.211	N/A	N/A	N/A
51.509	0.60	0.05	0.94	0.10	####	0.001	33.62	44.69	0.073	N/A	0.74	0.19	0.80	0.77	111.00	0.001	9.60	106.28	0.192	N/A	N/A	N/A
51.673	0.60	0.04	0.94	0.10	####	0.001	32.75	41.32	0.070	N/A	0.74	0.17	0.80	0.77	112.00	0.001	11.34	97.18	0.165	N/A	N/A	N/A
51.837	0.60	0.05	0.94	0.10	####	0.001	33.72	45.09	0.073	N/A	0.74	0.19	0.80	0.77	113.00	0.001	8.43	95.88	0.162	N/A	N/A	N/A
52.001	0.60	0.05	0.94	0.10	####	0.001	35.02	50.15	0.078	N/A	0.73	0.22	0.80	0.77	114.00	0.001	6.64	100.55	0.175	N/A	N/A	N/A
52.165	0.60	0.05	0.94	0.10	####	0.001	34.06	46.44	0.074	N/A	0.73	0.20	0.80	0.77	115.00	0.001	7.96	98.49	0.169	N/A	N/A	N/A
52.329	0.60	0.05	0.94	0.10	####	0.001	34.23	47.10	0.075	N/A	0.73	0.21	0.80	0.77	116.00	0.001	7.27	93.48	0.156	N/A	N/A	N/A
52.493	0.60	0.05	0.93	0.10	####	0.001	36.07	54.25	0.082	N/A	0.73	0.25	0.80	0.77	117.00	0.001	5.01	91.15	0.150	N/A	N/A	N/A
52.657	0.60	0.05	0.93	0.10	####	0.001	36.36	55.37	0.083	N/A	0.73	0.25	0.80	0.77	118.00	0.001	4.85	92.20	0.153	N/A	N/A	N/A
52.821	0.60	0.05	0.93	0.10	####	0.001	37.54	60.01	0.088	N/A	0.73	0.27	0.80	0.77	119.00	0.001	4.46	100.21	0.174	N/A	N/A	N/A
52.985	0.59	0.05	0.93	0.10	####	0.001	35.40	51.63	0.079	N/A	0.73	0.23	0.80	0.77	120.00	0.001	5.84	94.84	0.159	N/A	N/A	N/A
53.149	0.59	0.05	0.94	0.10	####	0.001	33.86	45.62	0.073	N/A	0.72	0.20	0.80	0.77	121.00	0.001	7.74	91.11	0.150	N/A	N/A	N/A
53.313	0.59	0.05	0.93	0.10	####	0.001	36.01	54.04	0.082	N/A	0.72	0.25	0.80	0.76	122.00	0.001	4.61	83.05	0.133	N/A	N/A	N/A
53.477	0.59	0.05	0.94	0.10	####	0.001	33.17	42.95	0.071	N/A	0.72	0.18	0.80	0.76	123.00	0.001	9.00	88.05	0.143	N/A	N/A	N/A
53.641	0.59	0.04	0.94	0.10	####	0.001	32.37	39.85	0.068	N/A	0.72	0.16	0.80	0.76	124.00	0.001	11.16	83.36	0.134	N/A	N/A	N/A
53.805	0.59	0.04	0.94	0.10	####	0.001	32.22	39.26	0.068	N/A	0.72	0.15	0.80	0.76	125.00	0.001	10.47	73.64	0.117	N/A	N/A	N/A
53.969	0.59	0.04	0.94	0.10	####	0.001	32.02	38.45	0.067	N/A	0.72	0.15	0.80	0.76	126.00	0.001	11.74	75.52	0.120	N/A	N/A	N/A
54.133	0.59	0.04	0.94	0.10	####	0.001	32.26	38.74	0.068	N/A	0.72	0.15	0.80	0.76	127.00	0.001	11.70	75.90	0.121	N/A	N/A	N/A
54.297	0.59	0.04	0.94	0.10	####	0.001	32.08	38.06	0.067	N/A	0.72	0.14	0.80	0.76	128.00	0.001	12.89	77.09	0.123	N/A	N/A	N/A
54.461	0.58	0.04	0.94	0.10	####	0.001	32.18	38.45	0.067	N/A	0.71	0.14	0.80	0.76	129.00	0.001	12.39	77.65	0.124	N/A	N/A	N/A
54.625	0.58	0.04	0.94	0.10	####	0.001	32.37	39.18	0.068	N/A	0.71	0.15	0.80	0.76	130.00	0.001	11.58	78.90	0.126	N/A	N/A	N/A
54.789	0.58	0.04	0.94	0.10	####	0.001	32.58	39.99	0.069	N/A	0.71	0.16	0.80	0.76	131.00	0.001	11.43	84.70	0.137	N/A	N/A	N/A
54.953	0.58	0.04	0.94	0.10	####	0.001	32.45	39.49	0.068	N/A	0.71	0.15	0.80	0.76	132.00	0.001	12.77	89.91	0.148	N/A	N/A	N/A
55.117	0.58	0.04	0.94	0.10	####	0.000	32.28	38.81	0.068	N/A	0.71	0.15	0.80	0.76	133.00	0.001	14.12	92.31	0.153	N/A	N/A	N/A
55.281	0.58	0.04	0.94	0.10	####	0.000	32.31	38.94	0.068	N/A	0.71	0.15	0.80	0.76	134.00	0.001	13.83	91.79	0.152	N/A	N/A	N/A
55.446	0.58	0.04	0.94	0.10	####	0.000	32.23	38.63	0.068	N/A	0.71	0.15	0.80	0.76	135.00	0.001	14.16	90.63	0.149	N/A	N/A	N/A
55.610	0.58	0.04	0.94	0.10	####	0.000	32.28	38.82	0.068	N/A	0.70	0.15	0.80	0.76	136.00	0.001	13.78	90.10	0.148	N/A	N/A	N/A
55.774	0.58	0.04	0.94	0.10	####	0.000	32.21	38.56	0.067	N/A	0.70	0.15	0.80	0.76	137.00	0.001	13.24	84.06	0.135	N/A	N/A	N/A
55.938	0.57	0.04	0.94	0.10	####	0.000	32.01	37.78	0.067	N/A	0.70	0.14	0.80	0.76	138.00	0.001	14.23	82.14	0.132	N/A	N/A	N/A
56.102	0.57	0.04	0.94	0.10	####	0.000	32.12	38.23	0.067	N/A	0.70	0.14	0.80	0.76	139.00	0.001	14.12	86.20	0.140	N/A	N/A	N/A
56.266	0.57	0.04	0.94	0.10	####	0.000	32.14	38.27	0.067	N/A	0.70	0.14	0.80	0.76	140.00	0.001	14.13	86.73	0.141	N/A	N/A	N/A
56.430	0.57	0.04	0.94	0.10	####	0.000	32.57	39.95	0.069	N/A	0.70	0.16	0.80	0.76	141.00	0.001	11.64	85.87	0.139	N/A	N/A	N/A
56.594	0.57	0.04	0.94	0.10	####	0.000	32.32	38.98	0.068	N/A	0.70	0.15	0.80	0.76	142.00	0.001	12.07	80.37	0.128	N/A	N/A	N/A
56.758	0.57	0.04	0.94	0.10	####	0.000	32.45	39.50	0.068	N/A	0.70	0.15	0.80	0.76	143.00	0.001	11.99	84.53	0.136	N/A	N/A	N/A
56.922	0.57	0.04	0.94	0.10	####	0.000	32.04	37.90	0.067	N/A	0.69	0.14	0.80	0.75	144.00	0.001	14.89	87.26	0.142	N/A	N/A	N/A
57.086	0.57	0.04	0.94	0.10	####	0.000	32.60	40.07	0.069	N/A	0.69	0.16	0.80	0.75	145.00	0.001	10.89	81.41	0.130	N/A	N/A	N/A
57.250	0.57	0.04	0.94	0.10	####	0.000	32.31	38.94	0.068	N/A	0.69	0.15	0.80	0.75	146.00	0.001	12.29	81.52	0.130	N/A	N/A	N/A
57.414	0.56	0.05	0.93	0.10	####	0.000	34.11	45.94	0.074	N/A	0.69	0.20	0.80	0.75	147.00	0.001	7.59	89.73	0.147	N/A	N/A	N/A
57.578	0.56	0.04	0.94	0.10	####	0.000	33.22	42.48	0.071	N/A	0.69	0.18	0.80	0.75	148.00	0.001	9.80	90.77	0.150	N/A	N/A	N/A
57.742	0.56	0.04	0.94	0.10	####	0.000	32.30	38.89	0.068	N/A	0.69	0.15	0.80	0.75	149.00	0.001	13.72	90.51	0.149	N/A	N/A	N/A
57.906	0.56	0.04	0.94	0.10	####	0.000	32.19	38.48	0.067	N/A	0.69	0.14	0.80	0.75	150.00	0.001	14.03	88.27	0.144	N/A	N/A	N/A
58.070	0.56	0.04	0.94	0.10	####	0.000	32.20	38.51	0.067	N/A	0.68	0.15	0.80	0.75	151.00	0.001	13.88	87.62	0.143	N/A	N/A	N/A
58.234	0.56	0.04	0.94	0.10	####	0.000	32.38	39.21	0.068	N/A	0.68	0.15	0.80	0.75	152.00	0.001	13.81	94.29	0.158	N/A	N/A	N/A
58.398	0.56	0.04	0.94	0.10	####	0.000	32.24	38.67	0.068	N/A	0.68	0.15	0.80	0.75	153.00	0.001	14.71	94.56	0.159	N/A	N/A	N/A
58.562	0.56	0.04	0.94	0.10	####	0.000	32.14	38.30	0.067	N/A	0.68	0.14	0.80	0.75	154.00	0.001	15.03	92.48	0.154	N/A	N/A	N/A
58.726	0.56	0.04	0.94	0.10	####	0.000	32.29	38.86	0.068	N/A	0.68	0.15	0.80	0.75	155.00	0.001	13.20	86.73	0.141	N/A	N/A	N/A
58.890	0.56	0.04	0.94	0.10	####	0.000	32.24	38.66	0.068	N/A	0.68	0.15	0.80	0.75	156.00	0.001	13.51	86.81	0.141	N/A	N/A	N/A
59.054	0.55	0.04	0.94	0.10	####	0.000	32.31	38.96	0.068	N/A	0.68	0.15	0.80	0.75	157.00	0.001	13.60	90.37	0.149	N/A	N/A	N/A
59.218	0.55	0.04	0.94	0.10	####	0.000	32.34	39.08	0.068	N/A	0.68	0.15	0.80	0.75	158.00	0.001	13.59	91.48	0.151	N/A	N/A	N/A
59.382	0.55	0.04	0.94	0.10	####	0.000	32.37	39.19	0.068	N/A	0.67	0.15	0.80	0.75	159.00	0.001	13.68	93.28	0.155	N/A	N/A	N/A
59.547	0.55	0.04	0.94	0.10	####	0.000	32.41	39.34	0.068	N/A	0.67	0.15	0.80	0.75	160.00	0.001	13.35	92.49	0.154	N/A	N/A	N/A
59.711	0.55	0.04	0.94	0.10	####	0.000	32.27	38.79	0.068	N/A	0.67	0.15	0.80	0.75	161.00	0.001	14.02	91.50	0.151	N/A	N/A	N/A
59.875	0.55	0.04	0.94	0.10	####	0.000	32.24	38.68	0.068	N/A	0.67	0.15	0.80	0.75	162.00	0.001	12.93	83.31	0.134	N/A	N/A	N/A
60.039	0.55	0.04	0.94	0.10	####	0.000	32.10	38.14	0.067	N/A	0.67	0.14	0.80	0.75	163.00	0.001	14.06	84.96	0.137	N/A	N/A	N/A
60.203	0.55	0.04	0.94	0.10	####	0.000	32.36	39.15	0.068	N/A	0.67	0.15	0.80	0.75	164.00	0.001	13.28	90.18	0.148	N/A	N/A	N/A
60.367	0.55	0.04	0.94	0.10	####	0.000	32.30	38.92	0.068	N/A	0.67	0.15	0.80	0.75	165.00	0.001	13.75	90.95	0.150	N/A	N/A	N/A
60.531	0.55	0.04	0.94	0.10	####	0.000	32.33	39.04	0.068	N/A	0.66	0.15	0.80	0.75	166.00	0.001	13.93	93.47	0.156	N/A	N/A	N/A
60.695	0.54	0.04	0.94	0.10	####	0.000	32.46	39.52	0.068	N/A	0.66	0.15	0.80	0.74	167.00	0.001	13.62	96.21	0.163	N/A	N/A	N/A
60.859	0.54	0.04	0.94	0.10	####	0.000	32.36	39.13	0.068	N/A	0.66	0.15	0.80	0.74	168.00	0.001	14.46	97.95	0.167	N/A	N/A	N/A
61.023	0.54	0.04	0.94	0.10	####	0.000	32.45	39.48	0.068	N/A	0.66	0.15	0.80	0.74	169.00	0.001	14.00	98.53	0.169	N/A	N/A	N/A
61.187	0.54	0.04	0.94	0.10	####	0.000	32.74	40.62	0.069	N/A	0.66	0.16	0.80	0.74	170.00	0.001	12.96	102.04	0.179	N/A	N/A	N/A
61.351	0.54	0.04	0.94	0.10	####	0.000	32.69	40.43	0.069	N/A	0.66	0.16	0.80	0.74	171.00	0.001	13.51	104.47	0.186	N/A	N/A	N/A

0.45	6.66	0.64	8.16	40.026		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.45	7.74	0.74	9.48	40.190		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.45	6.42	0.62	7.87	40.354		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.45	5.83	0.56	7.13	40.518		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.45	10.70	1.02	13.10	40.682		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.45	11.43	1.09	14.00	40.846		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.45	6.71	0.64	8.21	41.010	10	1.00	9	5	0.35	0.60	0.52	5.6	10.3	0.12	48.55	5.00	1.20	10.75	0.120	48.27	48.41
0.44	4.87	0.47	5.97	41.174		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.44	5.14	0.49	6.30	41.338		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.44	5.69	0.54	6.97	41.502		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.44	6.09	0.58	7.46	41.666		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.44	6.24	0.60	7.64	41.830		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.44	6.36	0.61	7.79	41.994		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.44	6.51	0.62	7.97	42.158		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.43	5.63	0.54	6.89	42.322		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.43	4.62	0.44	5.65	42.486		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.43	4.24	0.41	5.20	42.650		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.43	3.96	0.38	4.84	42.814		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.43	3.62	0.35	4.43	42.978		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.43	3.88	0.37	4.75	43.143		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.43	3.76	0.36	4.60	43.307		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.42	4.12	0.39	5.05	43.471		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.42	4.95	0.47	6.06	43.635		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.42	5.80	0.56	7.10	43.799		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.42	5.41	0.52	6.62	43.963		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.42	6.43	0.62	7.88	44.127		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.42	6.79	0.65	8.31	44.291		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.42	7.93	0.76	9.71	44.455		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.42	6.85	0.66	8.38	44.619		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.41	4.66	0.45	5.71	44.783		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.41	6.26	0.60	7.66	44.947		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.41	8.62	0.83	10.56	45.111		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.41	7.70	0.74	9.42	45.275		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.41	10.41	1.00	12.75	45.439		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.41	11.80	1.13	14.45	45.603		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.41	11.74	1.12	14.38	45.767		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.41	13.00	1.24	15.92	45.931		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.40	11.80	1.13	14.45	46.095		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.40	9.38	0.90	11.48	46.259		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.40	7.86	0.75	9.63	46.423		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.40	14.01	1.34	17.15	46.587		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.40	16.54	1.58	20.25	46.751		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.40	17.33	1.66	21.22	46.915		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.40	16.59	1.59	20.31	47.079		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.40	14.09	1.35	17.26	47.244		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.40	16.41	1.57	20.09	47.408		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.40	18.83	1.80	23.06	47.572		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.39	17.20	1.65	21.06	47.736		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.40	19.52	1.87	23.90	47.900		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.40	18.99	1.82	23.25	48.064		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.39	12.52	1.20	15.34	48.228		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.39	9.57	0.92	11.72	48.392		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.39	18.02	1.73	22.07	48.556		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.41	23.88	2.29	29.25	48.720		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.42	26.18	2.51	32.05	48.884		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.42	25.83	2.47	31.63	49.048		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.40	22.53	2.16	27.59	49.212		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.39	18.42	1.76	22.56	49.376		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.40	20.98	2.01	25.69	49.540		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.44	34.72	3.32	42.51	49.704		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.44	37.39	3.58	45.78	49.868		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.43	33.90	3.25	41.51	50.032		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.42	29.95	2.87	36.67	50.196		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.40	23.59	2.26	28.89	50.360		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.38	17.33	1.66	21.22	50.524		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.38	14.94	1.43	18.29	50.688		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.37	14.91	1.43	18.26	50.852		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.37	14.28	1.37	17.48	51.016	12	1.00	11	5	0.36	0.60	0.46	5.5	10.6	0.12	N/A	5.00	1.20	11.09	0.123	N/A	N/A
0.38	18.34	1.76	22.46	51.180		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.37	14.13	1.35	17.30	51.345		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.37	9.04	0.87	11.07	51.509		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.37	7.00	0.67	8.57	51.673		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.37	9.29	0.89	11.37	51.837		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.37	12.36	1.18	15.13	52.001		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.37	10.10	0.97	12.37	52.165		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.37	10.50	1.01	12.86	52.329		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.36	14.85	1.42	18.18	52.493		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.36	15.53	1.49	19.02	52.657		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.37	18.35	1.76	22.46	52.821		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.36	13.26	1.27	16.23	52.985		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.36	9.61	0.92	11.77	53.149		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.36	14.72	1.41	18.03	53.313		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.36	7.99	0.76	9.78	53.477		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.36	6.10	0.58	7.47	53.641		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.36	5.74	0.55	7.03	53.805		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.36	5.25	0.50	6.43	53.969		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.36	5.30	0.51	6.49	54.133		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.36	4.88	0.47	5.98	54.297		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.35	5.12	0.49	6.27	54.461		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.35	5.56	0.53	6.81	54.625		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.35	6.05	0.58	7.41	54.789		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.35	5.75	0.55	7.04	54.953		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.35	5.34	0.51	6.54	55.117		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.35	5.42	0.52	6.64	55.281		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.35	5.23	0.50	6.40	55.446		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.35	5.34	0.51	6.54	55.610		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.35	5.19	0.50	6.35	55.774		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.35	4.71	0.45	5.77	55.938	17	1.00	16	7	0.42	0.56	0.46	5.6	12.7	0.14	N/A	5.00	1.20	13.57	0.146	N/A	N/A
0.35	4.98	0.48	6.10	56.102		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.34	5.01	0.48	6.14	56.266		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.34	6.03	0.58	7.38	56.430		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.34	5.44	0.52	6.66	56.594		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.34	5.76	0.55	7.05	56.758		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.34	4.79	0.46	5.86	56.922		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.34	6.10	0.58	7.47	57.086		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.34	5.42	0.52	6.63	57.250		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.34	9.66	0.92	11.83	57.414		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.34	7.56	0.72	9.26	57.578		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.34	5.39	0.52	6.60	57.742		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.34	5.14	0.49	6.29	57.906		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.34	5.16	0.49	6.31	58.070		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.34	5.58	0.53	6.83	58.234		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.33	5.25	0.50	6.43	58.398		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.33	5.03	0.48	6.15	58.562		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.33	5.37	0.51	6.57	58.726		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.33	5.25	0.50	6.42	58.890		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.33	5.43	0.52	6.65	59.054		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.33	5.50	0.53	6.73	59.218		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.33	5.57	0.53	6.82	59.382		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.33	5.66	0.54	6.93	59.547		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.33	5.33	0.51	6.52	59.711		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.33	5.26	0.50	6.44	59.875		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.33	4.93	0.47	6.04	60.039		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.33	5.54	0.53	6.79	60.203		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.33	5.40	0.52	6.61	60.367		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.32	5.48	0.52	6.71	60.531		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.32	5.77	0.55	7.06	60.695		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.32	5.53	0.53	6.77	60.859		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.32	5.75	0.55	7.04	61.023	20	1.00	18	8	0.45	0.55	0.44	5.6	13.7	0.15	N/A	5.00	1.20	14.81	0.158	N/A	N/A
0.32	6.43	0.62	7.88	61.187		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.32	6.32	0.60	7.73	61.351		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-

61.515	6908.45	20.9	1.228	20.6	57.4	24.89	5.86%	Fine Alluvium	0.060	120.6	3.50	0.000	3.50	0
61.679	6908.28	21.4	1.231	21.1	52.6	22.80	5.74%	Fine Alluvium	0.060	120.6	3.51	0.000	3.51	0
61.843	6908.12	20.1	1.115	19.8	42.1	18.22	5.55%	Fine Alluvium	0.060	120.6	3.52	0.000	3.52	0
62.007	6907.95	17.8	0.850	17.5	48.8	21.13	4.78%	Fine Alluvium	0.060	120.6	3.53	0.000	3.53	0
62.171	6907.79	16.3	0.630	16.0	52.5	22.74	3.86%	Fine Alluvium	0.060	120.6	3.54	0.000	3.54	0
62.335	6907.63	13.9	0.470	13.6	53.7	23.27	3.38%	Fine Alluvium	0.060	120.6	3.55	0.000	3.55	0
62.499	6907.46	14.0	0.488	13.6	60.4	26.15	3.50%	Fine Alluvium	0.060	120.6	3.56	0.000	3.56	0
62.663	6907.30	14.7	0.435	14.3	62.7	27.19	2.95%	Fine Alluvium	0.060	120.6	3.57	0.000	3.57	0
62.827	6907.13	15.5	0.494	15.1	65.6	28.43	3.18%	Fine Alluvium	0.060	120.6	3.58	0.000	3.58	0
62.991	6906.97	15.4	0.525	15.0	63.5	27.50	3.40%	Fine Alluvium	0.060	120.6	3.59	0.000	3.59	0
63.155	6906.81	15.9	0.619	15.4	69.0	29.89	3.91%	Fine Alluvium	0.060	120.6	3.60	0.000	3.60	0
63.319	6906.64	14.8	0.592	14.4	67.8	29.36	3.99%	Fine Alluvium	0.060	120.6	3.61	0.000	3.61	0
63.483	6906.48	15.7	0.596	15.2	80.7	34.98	3.80%	Fine Alluvium	0.060	120.6	3.62	0.000	3.62	0
63.648	6906.31	16.7	0.386	16.1	83.7	36.26	2.32%	Fine Alluvium	0.060	120.6	3.63	0.000	3.63	0
63.812	6906.15	16.6	0.447	16.1	86.2	37.34	2.69%	Fine Alluvium	0.060	120.6	3.64	0.000	3.64	0
63.976	6905.98	15.6	0.557	15.0	87.4	37.89	3.57%	Fine Alluvium	0.060	120.6	3.65	0.000	3.65	0
64.140	6905.82	15.2	0.546	14.7	83.5	36.18	3.58%	Fine Alluvium	0.060	120.6	3.66	0.000	3.66	0
64.304	6905.66	16.0	0.606	15.4	95.2	41.26	3.80%	Fine Alluvium	0.060	120.6	3.67	0.000	3.67	0
64.468	6905.49	15.3	0.515	14.8	88.8	38.50	3.36%	Fine Alluvium	0.060	120.6	3.68	0.000	3.68	0
64.632	6905.33	15.8	0.598	15.2	97.1	42.09	3.78%	Fine Alluvium	0.060	120.6	3.69	0.000	3.69	0
64.796	6905.16	17.5	0.637	16.9	96.8	41.95	3.64%	Fine Alluvium	0.060	120.6	3.70	0.000	3.70	0
64.960	6905.00	18.6	0.824	18.0	95.1	41.20	4.42%	Fine Alluvium	0.060	120.6	3.71	0.000	3.71	0
65.124	6904.84	18.8	0.855	18.3	89.3	38.68	4.54%	Fine Alluvium	0.060	120.6	3.72	0.000	3.72	0
65.288	6904.67	19.2	0.934	18.5	109.3	47.38	4.87%	Fine Alluvium	0.060	120.6	3.73	0.000	3.73	0
65.452	6904.51	18.2	0.883	17.7	90.4	39.16	4.85%	Fine Alluvium	0.060	120.6	3.74	0.000	3.74	0
65.616	6904.34	17.3	0.887	16.8	80.4	34.84	5.14%	Fine Alluvium	0.060	120.6	3.75	0.000	3.75	0
65.780	6904.18	17.6	0.780	17.1	83.5	36.20	4.43%	Fine Alluvium	0.060	120.6	3.76	0.000	3.76	0
65.944	6904.02	19.6	0.823	19.0	94.1	40.79	4.20%	Fine Alluvium	0.060	120.6	3.77	0.000	3.77	0
66.108	6903.85	21.3	0.943	20.7	90.9	39.37	4.43%	Fine Alluvium	0.060	120.6	3.78	0.000	3.78	0
66.272	6903.69	21.7	0.880	21.3	66.0	28.59	4.05%	Fine Alluvium	0.060	120.6	3.79	0.000	3.79	0
66.436	6903.52	21.3	1.246	21.0	50.9	22.07	5.84%	Fine Alluvium	0.060	120.6	3.80	0.000	3.80	0
66.600	6903.36	20.6	1.207	20.3	46.9	20.34	5.85%	Fine Alluvium	0.060	120.6	3.81	0.000	3.81	0
66.764	6903.20	20.8	1.003	20.5	52.3	22.68	4.83%	Fine Alluvium	0.060	120.6	3.82	0.000	3.82	0
66.928	6903.03	17.8	0.767	17.5	57.5	24.91	4.30%	Fine Alluvium	0.060	120.6	3.83	0.000	3.83	0
67.092	6902.87	17.0	0.693	16.6	63.1	27.35	4.07%	Fine Alluvium	0.060	120.6	3.84	0.000	3.84	0
67.256	6902.70	16.8	0.684	16.4	63.0	27.31	4.06%	Fine Alluvium	0.060	120.6	3.85	0.000	3.85	0
67.420	6902.54	17.7	0.747	17.3	63.5	27.50	4.21%	Fine Alluvium	0.060	120.6	3.86	0.000	3.86	0
67.584	6902.38	18.2	0.750	17.8	69.5	30.10	4.12%	Fine Alluvium	0.060	120.6	3.87	0.000	3.87	0
67.749	6902.21	18.0	0.744	17.6	65.0	28.18	4.13%	Fine Alluvium	0.060	120.6	3.88	0.000	3.88	0
67.913	6902.05	19.2	0.778	18.7	78.4	33.96	4.06%	Fine Alluvium	0.060	120.6	3.89	0.000	3.89	0
68.077	6901.88	20.0	0.848	19.5	76.5	33.17	4.24%	Fine Alluvium	0.060	120.6	3.90	0.000	3.90	0
68.241	6901.72	21.3	0.970	20.8	85.3	36.97	4.55%	Coarse Alluvium	0.057	114.1	3.91	0.000	3.91	0
68.405	6901.56	29.4	1.269	28.8	97.4	42.22	4.31%	Coarse Alluvium	0.057	114.1	3.92	0.000	3.92	0
68.569	6901.39	31.0	1.356	30.7	41.3	17.91	4.38%	Coarse Alluvium	0.057	114.1	3.93	0.000	3.93	0
68.733	6901.23	28.3	1.485	28.1	32.4	14.03	5.25%	Coarse Alluvium	0.057	114.1	3.94	0.000	3.94	0
68.897	6901.06	30.7	1.435	30.5	37.7	16.35	4.67%	Coarse Alluvium	0.057	114.1	3.95	0.000	3.95	0
69.061	6900.90	28.6	1.493	28.4	27.3	11.83	5.22%	Coarse Alluvium	0.057	114.1	3.96	0.000	3.96	0
69.225	6900.74	32.7	1.426	32.5	28.4	12.32	4.36%	Coarse Alluvium	0.057	114.1	3.97	0.000	3.97	0
69.389	6900.57	45.3	1.300	45.1	30.4	13.18	2.87%	Coarse Alluvium	0.057	114.1	3.97	0.000	3.97	0
69.553	6900.41	59.5	1.179	59.4	19.2	8.30	1.98%	Coarse Alluvium	0.057	114.1	3.98	0.000	3.98	0
69.717	6900.24	69.4	1.177	69.4	14.2	6.16	1.70%	Coarse Alluvium	0.057	114.1	3.99	0.000	3.99	0
69.881	6900.08	73.4	1.272	73.3	13.3	5.75	1.73%	Coarse Alluvium	0.057	114.1	4.00	0.000	4.00	0

61.515	0.32	6.594	0.63	8.22	5	7.04%	3.5	76%	3.61	0.000	3.61	1	0
61.679	0.32	6.743	0.65	8.38	5	6.87%	3.4	76%	3.62	0.000	3.62	1	0
61.843	0.32	6.320	0.61	7.84	5	6.73%	3.5	76%	3.63	0.000	3.63	1	0
62.007	0.32	5.555	0.53	6.92	4	5.97%	3.5	76%	3.64	0.000	3.64	1	0
62.171	0.32	5.079	0.49	6.35	4	4.93%	3.5	76%	3.65	0.000	3.65	1	0
62.335	0.32	4.302	0.41	5.40	3	4.54%	3.5	76%	3.66	0.000	3.66	1	0
62.499	0.32	4.292	0.41	5.40	3	4.70%	3.6	76%	3.67	0.000	3.67	1	0
62.663	0.32	4.523	0.43	5.69	3	3.90%	3.5	76%	3.68	0.000	3.68	1	0
62.827	0.31	4.755	0.46	5.98	3	4.14%	3.5	76%	3.69	0.000	3.69	1	0
62.991	0.31	4.723	0.45	5.94	3	4.43%	3.5	76%	3.70	0.000	3.70	1	0
63.155	0.31	4.832	0.46	6.08	3	5.05%	3.5	76%	3.71	0.000	3.71	1	0
63.319	0.31	4.503	0.43	5.68	3	5.28%	3.6	76%	3.72	0.000	3.72	1	0
63.483	0.31	4.733	0.45	5.99	3	4.95%	3.5	76%	3.73	0.000	3.73	1	0
63.648	0.31	5.022	0.48	6.35	4	2.96%	3.4	76%	3.74	0.000	3.74	1	0
63.812	0.31	4.990	0.48	6.31	4	3.45%	3.4	76%	3.75	0.000	3.75	1	0
63.976	0.31	4.663	0.45	5.92	3	4.67%	3.5	76%	3.76	0.000	3.76	1	0
64.140	0.31	4.554	0.44	5.77	3	4.72%	3.5	76%	3.77	0.000	3.77	1	0
64.304	0.31	4.742	0.45	6.03	3	4.93%	3.5	76%	3.78	0.000	3.78	1	0
64.468	0.31	4.557	0.44	5.79	3	4.42%	3.5	76%	3.79	0.000	3.79	1	0
64.632	0.31	4.682	0.45	5.96	3	4.92%	3.5	76%	3.80	0.000	3.80	1	0
64.796	0.31	5.182	0.50	6.57	4	4.62%	3.5	76%	3.81	0.000	3.81	1	0
64.960	0.31	5.523	0.53	6.99	4	5.52%	3.5	76%	3.82	0.000	3.82	1	0
65.124	0.31	5.588	0.54	7.05	4	5.65%	3.5	76%	3.83	0.000	3.83	1	0
65.288	0.30	5.634	0.54	7.15	4	6.05%	3.5	76%	3.84	0.000	3.84	1	0
65.452	0.30	5.373	0.51	6.79	4	6.10%	3.5	76%	3.85	0.000	3.85	1	0
65.616	0.30	5.089	0.49	6.42	4	6.57%	3.6	76%	3.86	0.000	3.86	1	0
65.780	0.30	5.175	0.50	6.53	4	5.64%	3.5	76%	3.87	0.000	3.87	1	0
65.944	0.30	5.742	0.55	7.25	4	5.21%	3.4	76%	3.88	0.000	3.88	1	0
66.108	0.30	6.250	0.60	7.86	5	5.39%	3.4	76%	3.89	0.000	3.89	1	0
66.272	0.30	6.412	0.61	8.00	5	4.91%	3.4	76%	3.90	0.000	3.90	1	0
66.436	0.30	6.320	0.61	7.86	5	7.10%	3.5	76%	3.91	0.000	3.91	1	0
66.600	0.30	6.098	0.58	7.57	4	7.18%	3.5	76%	3.92	0.000	3.92	1	0
66.764	0.30	6.124	0.59	7.62	4	5.91%	3.5	76%	3.93	0.000	3.93	1	0
66.928	0.30	5.216	0.50	6.52	4	5.48%	3.5	76%	3.94	0.000	3.94	1	0
67.092	0.30	4.961	0.48	6.22	3	5.25%	3.5	76%	3.95	0.000	3.95	1	0
67.256	0.30	4.891	0.47	6.13	3	5.27%	3.5	76%	3.96	0.000	3.96	1	0
67.420	0.30	5.149	0.49	6.45	4	5.38%	3.5	76%	3.97	0.000	3.97	1	0
67.584	0.30	5.269	0.50	6.61	4	5.23%	3.5	76%	3.98	0.000	3.98	1	0
67.749	0.30	5.202	0.50	6.52	4	5.27%	3.5	76%	3.99	0.000	3.99	1	0
67.913	0.30	5.510	0.53	6.92	4	5.10%	3.5	76%	4.00	0.000	4.00	1	0
68.077	0.29	5.744	0.55	7.21	4	5.27%	3.5	76%	4.01	0.000	4.01	1	0
68.241	0.29	6.110	0.59	7.67	4	5.57%	3.4	36%	4.02	0.000	4.02	0	0
68.405	0.29	8.455	0.81	10.57	7	4.98%	3.3	36%	4.03	0.000	4.03	0	0
68.569	0.29	8.998	0.86	11.11	7	5.01%	3.3	36%	4.04	0.000	4.04	0	0
68.733	0.29	8.219	0.79	10.14	6	6.09%	3.3	36%	4.05	0.000	4.05	0	0
68.897	0.29	8.892	0.85	10.97	7	5.36%	3.3	36%	4.06	0.000	4.06	0	0
69.061	0.29	8.281	0.79	10.20	6	6.06%	3.3	36%	4.07	0.000	4.07	0	0
69.225	0.29	9.452	0.91	11.64	7	4.96%	3.2	36%	4.07	0.000	4.07	0	0
69.389	0.29	13.077	1.25	16.08	10	3.15%	3.0	36%	4.08	0.000	4.08	0	0
69.553	0.29	17.235	1.65	21.15	14	2.12%	2.8	36%	4.09	0.000	4.09	0	0
69.717	0.30	21.074	2.02	25.84	16	1.80%	2.7	36%	4.10	0.000	4.10	0	0
69.881	0.31	22.633	2.17	27.75	17	1.83%	2.7	36%	4.11	0.000	4.11	0	0

61.515	0.54	0.04	0.94	0.10	####	0.000	32.86	41.07	0.069	N/A	0.66	0.17	0.80	0.74	172.00	0.001	13.35	109.64	0.203	N/A	N/A	N/A
61.679	0.54	0.04	0.93	0.10	####	0.000	32.92	41.30	0.070	N/A	0.65	0.17	0.80	0.74	173.00	0.001	13.09	109.76	0.203	N/A	N/A	N/A
61.843	0.54	0.04	0.94	0.10	####	0.000	32.73	40.57	0.069	N/A	0.65	0.16	0.80	0.74	174.00	0.001	13.50	105.86	0.190	N/A	N/A	N/A
62.007	0.54	0.04	0.94	0.10	####	0.000	32.41	39.33	0.068	N/A	0.65	0.15	0.80	0.74	175.00	0.001	13.94	96.47	0.163	N/A	N/A	N/A
62.171	0.54	0.04	0.94	0.10	####	0.000	32.21	38.56	0.067	N/A	0.65	0.15	0.80	0.74	176.00	0.001	13.81	87.64	0.143	N/A	N/A	N/A
62.335	0.53	0.04	0.94	0.10	####	0.000	31.88	37.28	0.066	N/A	0.65	0.13	0.80	0.74	177.00	0.001	14.89	80.37	0.128	N/A	N/A	N/A
62.499	0.53	0.04	0.94	0.10	####	0.000	31.88	37.28	0.066	N/A	0.65	0.13	0.80	0.74	178.00	0.001	15.04	81.25	0.130	N/A	N/A	N/A
62.663	0.53	0.04	0.94	0.10	####	0.000	31.98	37.67	0.067	N/A	0.65	0.14	0.80	0.74	179.00	0.001	13.78	78.41	0.125	N/A	N/A	N/A
62.827	0.53	0.04	0.94	0.10	####	0.000	32.08	38.06	0.067	N/A	0.65	0.14	0.80	0.74	180.00	0.001	13.60	81.32	0.130	N/A	N/A	N/A
62.991	0.53	0.04	0.94	0.10	####	0.000	32.07	38.00	0.067	N/A	0.64	0.14	0.80	0.74	181.00	0.001	13.95	82.83	0.133	N/A	N/A	N/A
63.155	0.53	0.04	0.94	0.10	####	0.000	32.12	38.20	0.067	N/A	0.64	0.14	0.80	0.74	182.00	0.001	14.31	87.06	0.141	N/A	N/A	N/A
63.319	0.53	0.04	0.94	0.10	####	0.000	31.98	37.65	0.067	N/A	0.64	0.14	0.80	0.74	183.00	0.001	15.13	85.90	0.139	N/A	N/A	N/A
63.483	0.53	0.04	0.94	0.10	####	0.000	32.08	38.07	0.067	N/A	0.64	0.14	0.80	0.74	184.00	0.001	14.36	86.02	0.139	N/A	N/A	N/A
63.648	0.53	0.04	0.94	0.10	####	0.000	32.21	38.56	0.067	N/A	0.64	0.15	0.80	0.74	185.00	0.001	11.85	75.21	0.120	N/A	N/A	N/A
63.812	0.53	0.04	0.94	0.10	####	0.000	32.20	38.51	0.067	N/A	0.64	0.15	0.80	0.74	186.00	0.001	12.45	78.64	0.125	N/A	N/A	N/A
63.976	0.53	0.04	0.94	0.10	####	0.000	32.06	37.98	0.067	N/A	0.64	0.14	0.80	0.74	187.00	0.001	14.23	84.22	0.136	N/A	N/A	N/A
64.140	0.52	0.04	0.94	0.10	####	0.000	32.01	37.78	0.067	N/A	0.63	0.14	0.80	0.74	188.00	0.001	14.50	83.73	0.135	N/A	N/A	N/A
64.304	0.52	0.04	0.94	0.10	####	0.000	32.10	38.13	0.067	N/A	0.63	0.14	0.80	0.74	189.00	0.001	14.32	86.35	0.140	N/A	N/A	N/A
64.468	0.52	0.04	0.94	0.10	####	0.000	32.01	37.80	0.067	N/A	0.63	0.14	0.80	0.74	190.00	0.001	14.21	82.24	0.132	N/A	N/A	N/A
64.632	0.52	0.04	0.94	0.10	####	0.000	32.07	38.04	0.067	N/A	0.63	0.14	0.80	0.74	191.00	0.001	14.42	85.97	0.139	N/A	N/A	N/A
64.796	0.52	0.04	0.94	0.10	####	0.000	32.29	38.86	0.068	N/A	0.63	0.15	0.80	0.73	192.00	0.001	13.32	87.56	0.142	N/A	N/A	N/A
64.960	0.52	0.04	0.93	0.10	####	0.000	32.43	39.42	0.068	N/A	0.63	0.15	0.80	0.73	193.00	0.001	13.60	95.01	0.160	N/A	N/A	N/A
65.124	0.52	0.04	0.93	0.10	####	0.000	32.45	39.50	0.068	N/A	0.63	0.15	0.80	0.73	194.00	0.001	13.63	96.13	0.163	N/A	N/A	N/A
65.288	0.52	0.04	0.93	0.10	####	0.000	32.49	39.64	0.068	N/A	0.63	0.15	0.80	0.73	195.00	0.000	13.83	98.93	0.170	N/A	N/A	N/A
65.452	0.52	0.04	0.93	0.10	####	0.000	32.36	39.15	0.068	N/A	0.62	0.15	0.80	0.73	196.00	0.000	14.29	97.04	0.165	N/A	N/A	N/A
65.616	0.52	0.04	0.93	0.10	####	0.000	32.23	38.65	0.068	N/A	0.62	0.15	0.80	0.73	197.00	0.000	15.12	97.05	0.165	N/A	N/A	N/A
65.780	0.52	0.04	0.93	0.10	####	0.000	32.27	38.80	0.068	N/A	0.62	0.15	0.80	0.73	198.00	0.000	14.27	93.19	0.155	N/A	N/A	N/A
65.944	0.51	0.04	0.93	0.10	####	0.000	32.52	39.77	0.068	N/A	0.62	0.16	0.80	0.73	199.00	0.000	13.08	94.82	0.159	N/A	N/A	N/A
66.108	0.51	0.04	0.93	0.10	####	0.000	32.73	40.60	0.069	N/A	0.62	0.16	0.80	0.73	200.00	0.000	12.61	99.18	0.171	N/A	N/A	N/A
66.272	0.51	0.04	0.93	0.10	####	0.000	32.78	40.79	0.069	N/A	0.62	0.16	0.80	0.73	201.00	0.000	12.10	96.86	0.165	N/A	N/A	N/A
66.436	0.51	0.04	0.93	0.10	####	0.000	32.73	40.59	0.069	N/A	0.62	0.16	0.80	0.73	202.00	0.000	13.86	108.88	0.200	N/A	N/A	N/A
66.600	0.51	0.04	0.93	0.10	####	0.000	32.63	40.21	0.069	N/A	0.61	0.16	0.80	0.73	203.00	0.000	14.20	107.56	0.196	N/A	N/A	N/A
66.764	0.51	0.04	0.93	0.10	####	0.000	32.65	40.27	0.069	N/A	0.61	0.16	0.80	0.73	204.00	0.000	13.27	101.10	0.176	N/A	N/A	N/A
66.928	0.51	0.04	0.93	0.10	####	0.000	32.27	38.79	0.068	N/A	0.61	0.15	0.80	0.73	205.00	0.000	14.20	92.53	0.154	N/A	N/A	N/A
67.092	0.51	0.04	0.93	0.10	####	0.000	32.16	38.38	0.067	N/A	0.61	0.14	0.80	0.73	206.00	0.000	14.41	89.62	0.147	N/A	N/A	N/A
67.256	0.51	0.04	0.93	0.10	####	0.000	32.13	38.27	0.067	N/A	0.61	0.14	0.80	0.73	207.00	0.000	14.55	89.24	0.146	N/A	N/A	N/A
67.420	0.51	0.04	0.93	0.10	####	0.000	32.24	38.69	0.068	N/A	0.61	0.15	0.80	0.73	208.00	0.000	14.22	91.69	0.152	N/A	N/A	N/A
67.584	0.51	0.04	0.93	0.10	####	0.000	32.30	38.91	0.068	N/A	0.61	0.15	0.80	0.73	209.00	0.000	13.89	91.79	0.152	N/A	N/A	N/A
67.749	0.51	0.04	0.93	0.10	####	0.000	32.27	38.78	0.068	N/A	0.61	0.15	0.80	0.73	210.00	0.000	14.05	91.53	0.151	N/A	N/A	N/A
67.913	0.50	0.04	0.93	0.10	####	0.000	32.41	39.33	0.068	N/A	0.60	0.15	0.80	0.73	211.00	0.000	13.40	92.81	0.154	N/A	N/A	N/A
68.077	0.50	0.04	0.93	0.10	####	0.000	32.51	39.71	0.068	N/A	0.60	0.15	0.80	0.73	212.00	0.000	13.24	95.40	0.161	N/A	N/A	N/A
68.241	0.50	0.04	0.93	0.10	####	0.000	32.44	40.12	0.069	N/A	0.60	0.16	0.80	0.73	213.00	0.000	13.00	99.72	0.172	N/A	N/A	N/A
68.405	0.50	0.05	0.93	0.10	####	0.000	33.44	44.01	0.072	N/A	0.60	0.19	0.80	0.73	214.00	0.000	10.35	109.42	0.202	N/A	N/A	N/A
68.569	0.50	0.05	0.93	0.10	####	0.000	33.63	44.74	0.073	N/A	0.60	0.19	0.80	0.73	215.00	0.000	10.08	112.02	0.211	N/A	N/A	N/A
68.733	0.50	0.05	0.93	0.10	####	0.000	33.29	43.43	0.071	N/A	0.60	0.18	0.80	0.73	216.00	0.000	11.43	115.87	0.225	N/A	N/A	N/A
68.897	0.50	0.05	0.93	0.10	####	0.000	33.58	44.55	0.072	N/A	0.60	0.19	0.80	0.73	217.00	0.000	10.42	114.36	0.219	N/A	N/A	N/A
69.061	0.50	0.05	0.93	0.10	####	0.000	33.32	43.52	0.072	N/A	0.59	0.18	0.80	0.73	218.00	0.000	11.37	116.02	0.225	N/A	N/A	N/A
69.225	0.50	0.05	0.93	0.10	####	0.000	33.81	45.45	0.073	N/A	0.59	0.20	0.80	0.73	219.00	0.000	9.79	113.89	0.217	N/A	N/A	N/A
69.389	0.50	0.05	0.92	0.10	####	0.000	35.34	51.42	0.079	N/A	0.59	0.23	0.80	0.72	220.00	0.000	6.69	107.63	0.196	N/A	N/A	N/A
69.553	0.50	0.05	0.91	0.10	####	0.000	37.09	58.24	0.086	N/A	0.59	0.27	0.80	0.72	221.00	0.000	4.73	99.97	0.173	N/A	N/A	N/A
69.717	0.50	0.06	0.91	0.10	####	0.000	38.71	64.55	0.093	N/A	0.59	0.29	0.80	0.72	222.00	0.000	3.96	102.30	0.180	N/A	N/A	N/A
69.881	0.49	0.06	0.91	0.10	####	0.000	39.37	67.11	0.096	N/A	0.59	0.30	0.80	0.72	223.00	0.000	3.85	106.74	0.193	N/A	N/A	N/A

0.32	6.71	0.64	8.22	61.515		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.32	6.85	0.66	8.38	61.679		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.32	6.40	0.61	7.84	61.843		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.32	5.65	0.54	6.92	62.007		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.32	5.18	0.50	6.35	62.171		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.32	4.41	0.42	5.40	62.335		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.32	4.41	0.42	5.40	62.499		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.32	4.65	0.44	5.69	62.663		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.31	4.88	0.47	5.98	62.827		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.31	4.85	0.46	5.94	62.991		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.31	4.97	0.48	6.08	63.155		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.31	4.64	0.44	5.68	63.319		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.31	4.89	0.47	5.99	63.483		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.31	5.18	0.50	6.35	63.648		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.31	5.16	0.49	6.31	63.812		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.31	4.83	0.46	5.92	63.976		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.31	4.72	0.45	5.77	64.140		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.31	4.93	0.47	6.03	64.304		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.31	4.73	0.45	5.79	64.468		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.31	4.87	0.47	5.96	64.632		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.31	5.37	0.51	6.57	64.796		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.31	5.71	0.55	6.99	64.960		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.31	5.76	0.55	7.05	65.124		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.30	5.84	0.56	7.15	65.288		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.30	5.54	0.53	6.79	65.452		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.30	5.24	0.50	6.42	65.616		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.30	5.33	0.51	6.53	65.780		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.30	5.92	0.57	7.25	65.944	18	1.00	17	7	0.41	0.57	0.41	5.6	12.4	0.14	N/A	5.00	1.20	13.19	0.142	N/A	N/A
0.30	6.42	0.61	7.86	66.108		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.30	6.54	0.63	8.00	66.272		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.30	6.42	0.61	7.86	66.436		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.30	6.19	0.59	7.57	66.600		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.30	6.22	0.60	7.62	66.764		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.30	5.32	0.51	6.52	66.928		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.30	5.08	0.49	6.22	67.092		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.30	5.01	0.48	6.13	67.256		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.30	5.27	0.50	6.45	67.420		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.30	5.40	0.52	6.61	67.584		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.30	5.32	0.51	6.52	67.749		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.30	5.65	0.54	6.92	67.913		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.29	5.88	0.56	7.21	68.077		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.29	6.27	0.60	7.67	68.241		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.29	8.63	0.83	10.57	68.405		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.29	9.07	0.87	11.11	68.569		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.29	8.28	0.79	10.14	68.733		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.29	8.96	0.86	10.97	68.897		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.29	8.33	0.80	10.20	69.061		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.29	9.50	0.91	11.64	69.225		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.29	13.13	1.26	16.08	69.389		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.29	17.27	1.65	21.15	69.553		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.30	21.10	2.02	25.84	69.717		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.31	22.66	2.17	27.75	69.881		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-

UNC-NECR WASTE REPOSITORY LIQUEFACTION ANALYSIS - CPT-08

Data File: 13-52118_RP08-BSC-CPT
Location: UNC-NECR 2013 Mill Site PDS — Cells Requiring User Input/Manipulation
http://projects.mwhglobal.com/.../13-52118_RP08-BSC-CPT.XLS

Legend: Erosion Protection; Cover Soil; Mine Spoils; Radon Barrier; General Fill; Coarse Tailings; Coarse/Fine Tailings; Fine Tailings; Coarse Alluvium; Fine Alluvium

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.28
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69

Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.28
Earthquake Moment Magnitude, M:	6.3
Magnitude Scaling Factor, MSF:	1.59

0.00	Water surface elevation during CPT investigation (ft amsl)
0.00	Water surface elevation at t_0 (ft amsl)
0.00	Water surface elevation at t_1 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Earthquake
11.02	Equiv. Number of Uniform Strain Cycles, N

6976.04	Ground Surface Elevation at time of CPT (ft amsl)
6990.26	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
1.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after placement (
2.00	Thickness of Water Storage/Rooting Zone (Cover Soil; ft)
0.79	Additional Stress due to Proposed Repository Construction, $\Delta\sigma_{repos}$ (psf)
6931.50	Elevation of bottom of tailings (ft amsl)

Proposed Repository	Elev. at Top of Layer (ft)		Elev. At Midpoint of Layer (ft)	Elev. At Bottom of Layer (ft)	Thickness of Layer (ft)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at Bottom of Layer	Total Stress at Midpoint of Layer	Equil Pore Pressure at Bottom of Layer	Equil Pore Pressure at	Effective Stress at Bottom of Layer (tsf)	Effective Stress at
Erosion Protection	6990.3		6989.5	6988.8	1.5	0.053	106.3	0.080	0.040	0.00	0.00	0.080	0.040
Cover Soil	6988.8		6987.8	6986.8	2.0	0.049	97.8	0.178	0.129	0.00	0.00	0.178	0.129
Mine Spoils	6986.8		6981.4	6976.0	10.7	0.058	115.1	0.794	0.486	0.00	0.00	0.794	0.486

2013 CPT Data from ConeTec

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (per drilling log from coupled borehole)	Unit Weight (tcf)
0.164	6975.88	6.9	0.010	6.9	0.1	0.06	0.15%	Radon Barrier	0.060
0.328	6975.71	23.1	0.045	23.1	0.3	0.14	0.19%	Radon Barrier	0.060
0.492	6975.55	48.4	0.210	48.4	1.8	0.79	0.43%	Radon Barrier	0.060
0.656	6975.38	65.4	0.422	65.4	1.5	0.65	0.65%	Radon Barrier	0.060
0.820	6975.22	84.7	0.445	84.7	2.4	1.06	0.53%	Radon Barrier	0.060
0.984	6975.06	95.9	0.656	95.9	2.9	1.24	0.68%	Radon Barrier	0.060
1.148	6974.89	91.0	0.730	91.0	3.5	1.53	0.80%	Radon Barrier	0.060
1.312	6974.73	83.7	0.845	83.7	1.8	0.77	1.01%	Radon Barrier	0.060
1.476	6974.56	88.8	1.305	88.8	0.9	0.39	1.47%	Radon Barrier	0.060
1.640	6974.40	111.4	1.803	111.4	1.2	0.51	1.62%	Radon Barrier	0.060
1.804	6974.24	148.7	2.483	148.7	0.8	0.35	1.67%	Radon Barrier	0.060
1.968	6974.07	180.4	2.837	180.4	0.4	0.16	1.57%	Radon Barrier	0.060
2.133	6973.91	174.5	4.657	174.5	0.1	0.02	2.67%	General Fill	0.057
2.297	6973.74	218.5	6.727	218.5	-0.2	-0.08	3.08%	General Fill	0.057
2.461	6973.58	212.8	7.916	212.8	0.2	0.08	3.72%	General Fill	0.057
2.625	6973.42	184.0	7.494	184.0	-1.9	-0.81	4.07%	General Fill	0.057
2.789	6973.25	198.4	6.167	198.4	-1.0	-0.45	3.11%	General Fill	0.057
2.953	6973.09	204.8	6.219	204.8	5.8	2.52	3.04%	General Fill	0.057
3.117	6972.92	227.6	7.252	227.5	12.3	5.35	3.19%	General Fill	0.057
3.281	6972.76	245.8	8.737	245.8	3.9	1.67	3.55%	General Fill	0.057
3.445	6972.60	236.6	9.263	236.6	0.0	0.00	3.92%	General Fill	0.057
3.609	6972.43	220.6	8.373	220.6	-4.4	-1.91	3.80%	General Fill	0.057
3.773	6972.27	192.2	7.383	192.2	-6.0	-2.58	3.84%	General Fill	0.057
3.937	6972.10	183.7	7.063	183.7	-4.0	-1.75	3.85%	General Fill	0.057
4.101	6971.94	162.2	6.620	162.2	-2.6	-1.12	4.08%	General Fill	0.057
4.265	6971.77	127.4	4.743	127.4	-2.1	-0.91	3.72%	General Fill	0.057
4.429	6971.61	108.7	3.056	108.7	-0.6	-0.24	2.81%	General Fill	0.057
4.593	6971.45	99.5	2.493	99.5	0.1	0.02	2.51%	General Fill	0.057
4.757	6971.28	92.4	2.478	92.4	-0.1	-0.02	2.68%	General Fill	0.057
4.921	6971.12	90.1	2.219	90.1	0.1	0.04	2.46%	General Fill	0.057
5.085	6970.95	96.8	2.321	96.8	0.1	0.02	2.40%	General Fill	0.057
5.249	6970.79	118.6	3.164	118.6	0.9	0.39	2.67%	General Fill	0.057
5.413	6970.63	183.5	4.921	183.5	1.2	0.51	2.68%	General Fill	0.057
5.577	6970.46	294.0	6.122	294.0	1.6	0.71	2.08%	General Fill	0.057
5.741	6970.30	434.2	6.829	434.2	0.7	0.30	1.57%	General Fill	0.057
5.905	6970.13	475.3	6.720	475.3	0.8	0.36	1.41%	General Fill	0.057
6.069	6969.97	468.2	7.237	468.2	0.7	0.30	1.55%	General Fill	0.057
6.234	6969.81	455.7	7.556	455.7	0.9	0.39	1.66%	General Fill	0.057
6.398	6969.64	424.2	7.443	424.2	0.6	0.24	1.75%	General Fill	0.057
6.562	6969.48	382.1	7.390	382.1	0.6	0.26	1.93%	General Fill	0.057
6.726	6969.31	362.3	7.001	362.3	-0.4	-0.16	1.93%	General Fill	0.057
6.890	6969.15	310.0	6.544	310.0	-1.9	-0.83	2.11%	General Fill	0.057
7.054	6968.99	241.5	5.781	241.5	-1.4	-0.61	2.39%	Coarse Tailings	0.054
7.218	6968.82	226.4	4.982	226.4	0.1	0.06	2.20%	Coarse Tailings	0.054
7.382	6968.66	150.1	4.120	150.1	-0.1	-0.04	2.74%	Coarse Tailings	0.054
7.546	6968.49	104.5	3.636	104.5	0.8	0.33	3.48%	Coarse Tailings	0.054
7.710	6968.33	92.0	3.561	92.0	12.0	5.19	3.87%	Coarse Tailings	0.054
7.874	6968.17	125.7	3.834	125.6	11.7	5.07	3.05%	Coarse Tailings	0.054
8.038	6968.00	160.9	4.546	160.8	11.5	4.96	2.83%	Coarse Tailings	0.054
8.202	6967.84	171.0	4.787	170.9	15.0	6.49	2.80%	Coarse Tailings	0.054
8.366	6967.67	318.5	4.550	318.3	39.6	17.14	1.43%	Coarse Tailings	0.054
8.530	6967.51	305.5	3.463	305.4	22.2	9.62	1.13%	Coarse Tailings	0.054
8.694	6967.35	303.3	3.117	303.3	14.4	6.22	1.03%	Coarse Tailings	0.054
8.858	6967.18	344.4	3.532	344.3	13.9	6.04	1.03%	Coarse Tailings	0.054
9.022	6967.02	373.0	4.256	372.9	14.6	6.31	1.14%	Coarse Tailings	0.054
9.186	6966.85	418.1	4.463	418.0	10.2	4.41	1.07%	Coarse Tailings	0.054
9.350	6966.69	435.2	4.356	435.1	7.9	3.41	1.00%	Coarse Tailings	0.054
9.514	6966.53	425.0	4.519	425.0	6.5	2.81	1.06%	Coarse Tailings	0.054
9.678	6966.36	395.7	4.420	395.7	5.0	2.15	1.12%	Coarse Tailings	0.054
9.842	6966.20	358.2	4.302	358.1	4.7	2.05	1.20%	Coarse Tailings	0.054
10.006	6966.03	343.0	4.019	343.0	4.3	1.85	1.17%	Coarse Tailings	0.054
10.170	6965.87	321.1	3.920	321.1	4.7	2.05	1.22%	Coarse Tailings	0.054
10.335	6965.71	310.1	3.631	310.1	3.8	1.65	1.17%	Coarse Tailings	0.054
10.499	6965.54	284.3	3.480	284.3	3.1	1.32	1.22%	Coarse Tailings	0.054
10.663	6965.38	270.7	3.081	270.7	2.8	1.20	1.14%	Coarse Tailings	0.054
10.827	6965.21	257.8	3.174	257.8	2.4	1.04	1.23%	Coarse Tailings	0.054
10.991	6965.05	228.0	3.932	228.0	2.4	1.02	1.72%	Coarse Tailings	0.054
11.155	6964.89	196.5	4.039	196.4	2.8	1.22	2.06%	Coarse Tailings	0.054
11.319	6964.72	180.6	3.584	180.6	3.1	1.32	1.98%	Coarse Tailings	0.054
11.483	6964.56	171.0	2.616	170.9	2.3	0.98	1.53%	Coarse Tailings	0.054
11.647	6964.39	149.9	1.910	149.9	1.9	0.83	1.27%	Coarse Tailings	0.054
11.811	6964.23	141.0	2.061	141.0	2.0	0.88	1.46%	Coarse Tailings	0.054
11.975	6964.07	141.3	2.024	141.3	1.7	0.73	1.43%	Coarse Tailings	0.054
12.139	6963.90	137.2	1.911	137.2	1.6	0.69	1.39%	Coarse Tailings	0.054
12.303	6963.74	148.3	1.655	148.3	1.6	0.71	1.12%	Coarse Tailings	0.054
12.467	6963.57	171.9	1.533	171.9	1.8	0.79	0.89%	Coarse Tailings	0.054
12.631	6963.41	177.1	1.749	177.1	1.9	0.81	0.99%	Coarse Tailings	0.054
12.795	6963.24	188.7	1.928	188.7	2.1	0.89	1.02%	Coarse Tailings	0.054
12.959	6963.08	214.1	2.066	214.1	1.9	0.81	0.96%	Coarse Tailings	0.054
13.123	6962.92	223.6	2.279	223.6	2.0	0.88	1.02%	Coarse Tailings	0.054
13.287	6962.75	247.1	2.375	247.1	1.8	0.79	0.96%	Coarse Tailings	0.054
13.451	6962.59	254.8	2.530	254.8	1.6	0.71	0.99%	Coarse Tailings	0.054
13.615	6962.42	246.9	2.534	246.9	1.8	0.77	1.03%	Coarse Tailings	0.054
13.779	6962.26	238.6	2.398	238.6	1.5	0.63	1.01%	Coarse Tailings	0.054
13.943	6962.10	226.5	2.107	226.5	1.5	0.63	0.93%	Coarse Tailings	0.054
14.107	6961.93	214.2	2.003	214.2	1.5	0.63	0.93%	Coarse Tailings	0.054
14.271	6961.77	200.1	1.891	200.1	2.1	0.89	0.95%	Coarse Tailings	0.054
14.436	6961.60	192.5	1.806	192.5	2.3	0.98	0.94%	Coarse Tailings	0.054
14.600	6961.44	184.8	1.764	184.8	1.6	0.67	0.95%	Coarse Tailings	0.054
14.764	6961.28	179.0	1.664	179.0	1.1	0.49	0.93%	Coarse Tailings	0.054
14.928	6961.11	176.7	1.460	176.7	1.3	0.55	0.83%	Coarse Tailings	0.054
15.092	6960.95	176.2	1.439	176.2	1.2	0.53	0.82%	Coarse Tailings	0.054
15.256	6960.78	172.2	1.406	172.2	1.1	0.49	0.82%	Coarse Tailings	0.054
15.420	6960.62	168.5	1.435	168.5	1.2	0.51	0.85%	Coarse Tailings	0.054
15.584	6960.46	163.4	1.381	163.4	1.1	0.47	0.85%	Coarse Tailings	0.054
15.748	6960.29	157.3	1.412	157.3	0.8	0.33	0.90%	Coarse Tailings	0.054
15.912	6960.13	157.8	1.527	157.8	0.8	0.36	0.97%	Coarse Tailings	0.054
16.076	6959.96	152.3	1.727	152.3	0.8	0.35	1.13%	Coarse Tailings	0.054
16.240	6959.80	132.3	1.869	132.3	0.6	0.26	1.41%	Coarse Tailings	0.054
16.404	6959.64	141.8	1.704	141.8	0.7	0.30	1.20%	Coarse Tailings	0.054
16.568	6959.47	155.5	1.609	155.5	0.8	0.35	1.03%	Coarse Tailings	0.054
16.732	6959.31	154.0	1.336	154.0	0.9	0.39	0.87%	Coarse Tailings	0.054
16.896	6959.14	148.4	1.184	148.4	0.8	0.36	0.80%	Coarse Tailings	0.054
17.060	6958.98	135.6	1.078	135.6	0.8	0.35	0.79%	Coarse Tailings	0.054
17.224	6958.82	126.4	0.950	126.4	0.8	0.33	0.75%	Coarse Tailings	0.054
17.388	6958.65	119.8	1.008	119.8	0.7	0.29	0.84%	Coarse Tailings	0.054
17.552	6958.49	110.9	1.285	110.9	1.6	0.69	1.16%	Coarse Tailings	0.054
17.716	6958.32	118.1	1.269	118.1	1.5	0.63	1.07%	Coarse Tailings	0.054
17.880	6958.16	121.2	1.323	121.2	1.5	0.65	1.09%	Coarse Tailings	0.054
18.044	6958.00	116.3	1.228	116.3	1.4	0.61	1.06%	General Fill	0.057
18.208	6957.83	107.6	1.104	107.6	1.2	0.53	1.03%	General Fill	0.057
18.372	6957.67	93.3	1.182	93.3	0.7	0.29	1.27%	General Fill	0.057
18.537	6957.50	67.8	1.399	67.8	0.8	0.35	2.06%	General Fill	0.057
18.701	6957.34	46.5	1.379	46.5	0.7	0.29	2.97%	General Fill	0.057

18.865	6957.18	58.5	1.191	58.5	0.8	0.36	2.04%	General Fill	0.057	113.8	1.05	0.000	1.05	0
19.029	6957.01	80.6	1.132	80.6	1.2	0.51	1.41%	General Fill	0.057	113.8	1.06	0.000	1.06	0
19.193	6956.85	90.3	0.855	90.3	0.6	0.26	0.95%	General Fill	0.057	113.8	1.07	0.000	1.07	0
19.357	6956.68	99.8	0.770	99.8	0.9	0.39	0.77%	General Fill	0.057	113.8	1.08	0.000	1.08	0
19.521	6956.52	113.2	0.883	113.2	0.7	0.30	0.78%	General Fill	0.057	113.8	1.09	0.000	1.09	0
19.685	6956.36	118.4	0.957	118.4	0.7	0.29	0.81%	General Fill	0.057	113.8	1.10	0.000	1.10	0
19.849	6956.19	119.3	0.860	119.3	1.0	0.43	0.72%	General Fill	0.057	113.8	1.11	0.000	1.11	0
20.013	6956.03	113.5	0.881	113.5	0.7	0.29	0.78%	General Fill	0.057	113.8	1.12	0.000	1.12	0
20.177	6955.86	99.2	0.867	99.2	0.8	0.35	0.87%	General Fill	0.057	113.8	1.13	0.000	1.13	0
20.341	6955.70	87.3	0.774	87.3	0.4	0.18	0.89%	General Fill	0.057	113.8	1.14	0.000	1.14	0
20.505	6955.54	80.4	0.637	80.4	0.4	0.18	0.79%	General Fill	0.057	113.8	1.14	0.000	1.14	0
20.669	6955.37	77.8	0.635	77.8	0.4	0.18	0.82%	General Fill	0.057	113.8	1.15	0.000	1.15	0
20.833	6955.21	78.7	0.644	78.7	0.9	0.39	0.82%	Coarse Tailings	0.054	108.5	1.16	0.000	1.16	0
20.997	6955.04	81.7	0.665	81.7	0.7	0.30	0.81%	Coarse Tailings	0.054	108.5	1.17	0.000	1.17	0
21.161	6954.88	84.4	0.673	84.4	0.9	0.39	0.80%	Coarse Tailings	0.054	108.5	1.18	0.000	1.18	0
21.325	6954.71	84.5	0.697	84.5	0.5	0.23	0.83%	Coarse Tailings	0.054	108.5	1.19	0.000	1.19	0
21.489	6954.55	79.7	0.727	79.7	0.3	0.12	0.91%	Coarse Tailings	0.054	108.5	1.20	0.000	1.20	0
21.653	6954.39	70.9	0.684	70.9	0.8	0.35	0.96%	Coarse Tailings	0.054	108.5	1.21	0.000	1.21	0
21.817	6954.22	65.1	0.587	65.1	0.4	0.16	0.90%	Coarse Tailings	0.054	108.5	1.22	0.000	1.22	0
21.981	6954.06	63.6	0.555	63.6	0.6	0.24	0.87%	Coarse Tailings	0.054	108.5	1.23	0.000	1.23	0
22.145	6953.89	62.2	0.623	62.2	0.4	0.16	1.00%	Coarse Tailings	0.054	108.5	1.23	0.000	1.23	0
22.309	6953.73	62.3	0.698	62.3	0.2	0.10	1.12%	Coarse Tailings	0.054	108.5	1.24	0.000	1.24	0
22.473	6953.57	65.2	0.684	65.2	0.2	0.10	1.05%	Coarse Tailings	0.054	108.5	1.25	0.000	1.25	0
22.638	6953.40	65.7	0.667	65.7	0.3	0.14	1.02%	Coarse Tailings	0.054	108.5	1.26	0.000	1.26	0
22.802	6953.24	62.8	0.665	62.8	0.1	0.06	1.06%	Coarse Tailings	0.054	108.5	1.27	0.000	1.27	0
22.966	6953.07	60.4	0.692	60.4	0.1	0.02	1.15%	Coarse Tailings	0.054	108.5	1.28	0.000	1.28	0
23.130	6952.91	64.0	0.653	64.0	0.1	0.04	1.02%	Coarse Tailings	0.054	108.5	1.29	0.000	1.29	0
23.294	6952.75	65.5	0.613	65.5	0.4	0.16	0.94%	Coarse Tailings	0.054	108.5	1.30	0.000	1.30	0
23.458	6952.58	67.5	0.578	67.5	0.5	0.20	0.86%	Coarse Tailings	0.054	108.5	1.31	0.000	1.31	0
23.622	6952.42	68.5	0.607	68.5	0.1	0.06	0.89%	Coarse Tailings	0.054	108.5	1.31	0.000	1.31	0
23.786	6952.25	68.5	0.554	68.5	0.2	0.08	0.81%	Coarse Tailings	0.054	108.5	1.32	0.000	1.32	0
23.950	6952.09	68.7	0.540	68.7	0.4	0.16	0.79%	Coarse Tailings	0.054	108.5	1.33	0.000	1.33	0
24.114	6951.93	66.6	0.509	66.6	1.0	0.45	0.76%	Coarse Tailings	0.054	108.5	1.34	0.000	1.34	0
24.278	6951.76	67.3	0.501	67.3	0.8	0.35	0.74%	Coarse Tailings	0.054	108.5	1.35	0.000	1.35	0
24.442	6951.60	67.6	0.479	67.6	0.9	0.39	0.71%	Coarse Tailings	0.054	108.5	1.36	0.000	1.36	0
24.606	6951.43	69.7	0.468	69.7	0.7	0.30	0.67%	Coarse Tailings	0.054	108.5	1.37	0.000	1.37	0
24.770	6951.27	73.4	0.534	73.4	0.8	0.35	0.73%	Coarse Tailings	0.054	108.5	1.38	0.000	1.38	0
24.934	6951.11	67.6	0.558	67.6	0.8	0.33	0.83%	Coarse Tailings	0.054	108.5	1.39	0.000	1.39	0
25.098	6950.94	51.9	0.730	51.9	0.8	0.33	1.41%	Coarse Tailings	0.054	108.5	1.39	0.000	1.39	0
25.262	6950.78	33.5	0.875	33.5	0.7	0.30	2.61%	Coarse Tailings	0.054	108.5	1.40	0.000	1.40	0
25.426	6950.61	21.0	0.814	21.0	0.3	0.12	3.87%	Coarse Tailings	0.054	108.5	1.41	0.000	1.41	0
25.590	6950.45	14.9	0.530	14.9	0.9	0.41	3.57%	Coarse Tailings	0.054	108.5	1.42	0.000	1.42	0
25.754	6950.29	13.7	0.284	13.7	1.5	0.65	2.07%	Coarse Tailings	0.054	108.5	1.43	0.000	1.43	0
25.918	6950.12	13.1	0.160	13.1	1.6	0.69	1.22%	Coarse Tailings	0.054	108.5	1.44	0.000	1.44	0
26.082	6949.96	12.9	0.169	12.9	1.7	0.73	1.31%	Coarse Tailings	0.054	108.5	1.45	0.000	1.45	0
26.246	6949.79	13.2	0.194	13.2	1.9	0.83	1.47%	Coarse Tailings	0.054	108.5	1.46	0.000	1.46	0
26.410	6949.63	13.5	0.250	13.5	2.5	1.08	1.86%	Fine Tailings	0.053	106.9	1.47	0.003	1.46	1
26.574	6949.47	15.1	0.321	15.0	6.5	2.83	2.13%	Fine Tailings	0.053	106.9	1.47	0.009	1.47	1
26.739	6949.30	15.7	0.328	15.6	8.2	3.56	2.09%	Fine Tailings	0.053	106.9	1.48	0.014	1.47	1
26.903	6949.14	13.4	0.287	13.3	14.4	6.24	2.14%	Fine Tailings	0.053	106.9	1.49	0.019	1.47	1
27.067	6948.97	12.1	0.242	12.0	14.3	6.20	2.01%	Fine Tailings	0.053	106.9	1.50	0.024	1.48	1
27.231	6948.81	12.3	0.235	12.2	15.7	6.79	1.92%	Fine Tailings	0.053	106.9	1.51	0.029	1.48	1
27.395	6948.65	12.9	0.282	12.8	18.8	8.13	2.18%	Fine Tailings	0.053	106.9	1.52	0.034	1.48	1
27.559	6948.48	13.0	0.314	12.9	19.3	8.36	2.42%	Fine Tailings	0.053	106.9	1.53	0.039	1.49	1
27.723	6948.32	11.5	0.282	11.4	19.8	8.58	2.46%	Fine Tailings	0.053	106.9	1.54	0.044	1.49	1
27.887	6948.15	11.4	0.219	11.3	20.6	8.93	1.92%	Fine Tailings	0.053	106.9	1.54	0.050	1.49	1
28.051	6947.99	10.9	0.198	10.8	21.4	9.25	1.82%	Fine Tailings	0.053	106.9	1.55	0.055	1.50	1
28.215	6947.83	10.5	0.189	10.3	22.1	9.56	1.81%	Fine Tailings	0.053	106.9	1.56	0.060	1.50	1
28.379	6947.66	10.0	0.193	9.9	22.6	9.78	1.93%	Fine Tailings	0.053	106.9	1.57	0.065	1.51	1
28.543	6947.50	10.3	0.200	10.1	23.1	10.01	1.95%	Fine Tailings	0.053	106.9	1.58	0.070	1.51	1
28.707	6947.33	10.5	0.214	10.3	24.2	10.50	2.04%	Fine Tailings	0.053	106.9	1.59	0.075	1.51	1
28.871	6947.17	11.2	0.187	11.0	24.5	10.62	1.67%	Fine Tailings	0.053	106.9	1.60	0.080	1.52	1
29.035	6947.00	10.7	0.180	10.6	26.0	11.25	1.68%	Fine Tailings	0.053	106.9	1.61	0.085	1.52	1
29.199	6946.84	10.1	0.196	9.9	26.4	11.45	1.94%	Fine Tailings	0.053	106.9	1.61	0.090	1.52	1
29.363	6946.68	10.6	0.258	10.5	27.5	11.90	2.43%	Fine Tailings	0.053	106.9	1.62	0.096	1.53	1
29.527	6946.51	14.1	0.293	13.9	27.8	12.06	2.08%	Fine Tailings	0.053	106.9	1.63	0.101	1.53	1
29.691	6946.35	10.8	0.347	10.6	27.8	12.04	3.23%	Fine Tailings	0.053	106.9	1.64	0.106	1.53	1
29.855	6946.18	14.4	0.429	14.2	30.4	13.18	2.98%	Fine Tailings	0.053	106.9	1.65	0.111	1.54	1
30.019	6946.02	15.7	0.393	15.6	31.8	13.77	2.50%	Fine Tailings	0.053	106.9	1.66	0.116	1.54	1
30.183	6945.86	11.7	0.400	11.5	31.3	13.54	3.43%	Fine Tailings	0.053	106.9	1.67	0.121	1.55	1
30.347	6945.69	10.7	0.406	10.5	38.2	16.55	3.80%	Fine Tailings	0.053	106.9	1.68	0.126	1.55	1
30.511	6945.53	10.1	0.309	9.8	41.9	18.16	3.06%	Fine Tailings	0.053	106.9	1.68	0.131	1.55	1
30.675	6945.36	9.8	0.235	9.6	42.4	18.36	2.39%	Fine Tailings	0.053	106.9	1.69	0.137	1.56	1
30.840	6945.20	9.7	0.240	9.4	45.6	19.76	2.47%	Fine Tailings	0.053	106.9	1.70	0.142	1.56	1
31.004	6945.04	9.4	0.231	9.1	47.8	20.70	2.46%	Fine Tailings	0.053	106.9	1.71	0.000	1.71	0
31.168	6944.87	10.6	0.274	10.3	51.4	22.27	2.59%	Coarse Tailings	0.054	108.5	1.72	0.000	1.72	0
31.332	6944.71	13.9	0.381	13.6	56.1	24.30	2.74%	Coarse Tailings	0.054	108.5	1.73	0.000	1.73	0
31.496	6944.54	37.6	0.447	37.3	57.6	24.97	1.19%	Coarse Tailings	0.054	108.5	1.74	0.000	1.74	0
31.660	6944.38	40.9	0.592	40.8	21.0	9.09	1.45%	Coarse Tailings	0.054	108.5	1.75	0.000	1.75	0
31.824	6944.22	51.5	0.738	51.4	15.0	6.49	1.43%	Coarse Tailings	0.054	108.5	1.76	0.000	1.76	0
31.988	6944.05	46.1	0.915	46.0	13.3	5.78	1.98%	Coarse Tailings	0.054	108.5	1.76	0.000	1.76	0
32.152	6943.89	46.6	1.079	46.5	12.5	5.41	2.32%	Coarse Tailings	0.054	108.5	1.77	0.000	1.77	0
32.316	6943.72	39.5	1.239	39.5	11.8	5.10	3.13%	Coarse Tailings	0.054	108.5	1.78	0.000	1.78	0
32.480	6943.56	25.6	1.078	25.6	11.2	4.84	4.21%	Coarse Tailings	0.054	108.5	1.79	0.000	1.79	0
32.644	6943.40	16.2	0.633	16.1	11.0	4.78	3.91%	Fine Tailings	0.053	106.9	1.80	0.004	1.80	1
32.808	6943.23	11.5	0.409	11.4	19.1	8.28	3.57%	Fine Tailings	0.053	106.9	1.81	0.010	1.80	1
32.972	6943.07	11.0	0.260	10.8	22.6	9.80	2.37%	Fine Tailings	0.053	106.9	1.82	0.015	1.80	1
33.136	6942.90	11.5	0.280	11.4	27.6	11.98	2.43%	Fine Tailings	0.053	106.9	1.83	0.020	1.81	1
33.300	6942.74	11.8	0.287	11.7	28.7	12.45	2.42%	Fine Tailings	0.053	106.9	1.83	0.025	1.81	1
33.464	6942.58	12.5	0.246	12.3	30.7	13.30	1.97%	Fine Tailings	0.053	106.9	1.84	0.030	1.81	1
33.628	6942.41	12.8	0.229	12.6	30.8	13.34	1.79%	Fine Tailings	0.053	106.9	1.85	0.035	1.82	1
33.792	6942.25	12.2	0.273	12.1	32.0	13.85	2.23%	Fine Tailings	0.053	106.9	1.86	0.040	1.82	1
33.956	6942.08	12.5	0.301	12.3	37.7	16.35	2.40%	Fine Tailings	0.053	106.9	1.87	0.045	1.82	1
34.120	6941.92	11.6	0.320	11.4	38.6	16.74	2.76%	Fine Tailings	0.053	106.9	1.88	0.051	1.83	1
34.284	6941.76	12.9	0.312	12.7	39.4	17.08	2.41%	Fine Tailings	0.053	106.9	1.89	0.056	1.83	1
34.448	6941.59	13.6	0.278	13.3	39.8	17.23	2.05%	Fine Tailings	0.053	106.9	1.90	0.061	1.84	1
34.612	6941.43	13.2	0.371	12.9	40.6	17.61	2.81%	Fine Tailings	0.053	106.9	1.90	0.066	1.84	1
34.776	6941.26	14.3	0.403	14.0	42.1	18.26	2.82%	Fine Tailings	0.053	106.9	1.91	0.071	1.84	1
34.941	6941.10	14.1	0.363	13.9	41.3	17.91	2.57%	Fine Tailings	0.053	106.9	1.92	0.076	1.85	1
35.105	6940.94	21.9	0.416	21.7	43.3	18.77	1.90%	Coarse/Fine Tailin	0.057	114.5	1.93	0.000	1.93	0
35.269	6940.77	32.9	0.772	32.8	21.2	9.17	2.35%	Coarse/Fine Tailin	0.057	114.5	1.94	0.000	1.94	0
35.433	6940.61	25.4	0.980	25.3	19.7	8.54	3.85%	Coarse/Fine Tailin	0.057	114.5	1.95	0.000	1.95	0
35.597	6940.44	17.2	0.791	17.1	18.4	7.99	4.60%	Coarse/Fine Tailin	0.057	114.5	1.96	0.000	1.96	0
35.761	6940.28	13.1	0.531	12.9	19.9	8.62	4.06%	Coarse/Fine Tailin	0.057	114.5	1.97	0.000	1.97	0
35.925	6940.12	12.3	0.358	12.2	22.7	9.84	2.91%	Coarse/Fine Tailin	0.057	114.5	1.98	0.000	1.98	0
36.089	6939.95	12.8	0.396	12.6	24.8	10.76	3.10%	Coarse/Fine Tailin	0.057	114.5	1.99	0.000	1.99	0
36.253	6939.79	14.1	0.352	13.9	27.8	12.04	2.50%	Coarse/Fine Tailin	0.057	114.5	2.00	0.000	2.00	0
36.417	6939.62	12.7	0.353	12.5	29.1	12.59	2.79%	Coarse/Fine Tailin	0.057	114.5	2.01	0.000	2.01	0
36.581	6939.46	12.6	0.400	12.4	32.0	13.87	3.17%	Coarse/Fine Tailin	0.057	114.5	2.02	0.000	2.02	0
36.745	6939.30	12.3	0.452	12.1	35.1	15.19	3.68%	Coarse/Fine Tailin	0.057	114.5	2.03	0.000	2.03	0
36.909	6939.13	19.1	0.504	18.9	31.6	13.71	2.63%	Coarse/Fine Tailin	0.057	114.5	2.04	0.000	2.04	0
37.073	6938.97	13.3	0.439	13.1	32.7	14.15	3.31%	Coarse/Fine Tailin	0.057	114.5	2.04	0.000	2.04	0
37.237	6938.80	11.7	0.354	11.5	38.2	16.53	3.02%	Coarse/Fine Tailin	0.057	114.5	2.05	0.000	2.05	0
37.401	6938.64	11.4	0.255	11.2	40.2	17.41	2.24%	Coarse/Fine Tailin	0.057	114.5	2.06	0.000	2.06	0
37.565	6938.47	12.1	0.256	11.9	41.8	18.10	2.11%	Coarse/Fine Tailin	0.057	114.5	2.07	0.000	2.07	0
37.729	6938.31	12.4	0.269	12.1	42.7	18.49	2.17%	Coarse/Fine Tailin	0.057	114.5	2.08	0.000	2.08	0
37.893	6938.15	12.7	0.266	12.4	44.0	19.08	2.09%	Coarse/Fine Tailin	0.057	114.5	2.09	0.000	2.09	0
38.057	6937.98	13.1	0.256	12.9	44.4	19.24	1.95%	Coarse/Fine Tailin	0.057	114.5	2.10	0.000	2.10	0
38.221	6937.82	13.4	0.205	13.1	45.1	19.54	1.54%	Coarse/Fine Tailin	0.057	114.5	2.11	0.000	2.11	0
38.385	6937.65	12.6	0.178	12.3	46.5	20.13	1.41%	Coarse/Fine Tailin	0.057	114.5	2.12	0.000	2.12	0
38.549	6937.49	12.0	0.236	11.7	52.9	22.92	1.97%	Coarse/Fine Tailin	0.057	114.5	2.13	0.000	2.13	0
38.713	6937.33	12.4	0.281	12.1	56.4	24.42	2.27%	Fine Tailings	0.053	106.9	2.14	0.004	2.13	1
38.877	6937.16	12.4	0.304	12.1	58.1	25.18	2.45%	Fine Tailings	0.053	106.9	2.15	0.009	2.14	1
39.042	6937.00	12.5	0.323	12.1	59.5	25.79	2.59%	Fine Tailings	0.053	106.9	2.16	0.014	2.14	1
39.206	6936.83	13.0	0.317	12.6	60.8	26.36	2.44%	Fine Tailings	0.053	106.9	2.16	0.019	2.15	1
39.370	6936.67	13.9	0.354	13.5	63.3	27.43	2.55%	Fine Tailings	0.053	106.9	2.17	0.024	2.15	1
39.534	6936.51	13.2	0.359	12.8	63.9	27.68	2.72%	Fine Tailings	0.053	106.9	2.18	0.029	2.15	1
39.698	6936.34	26.5	0.601	26.1	67.9	29.43	2.27%	Fine Tailings	0.053	106.9	2.19	0.034	2.16	1
39.862	6936.18	24.6	0.611	24.4	36.8	15.93	2.48%	Fine Tailings	0.053	106.9	2.20	0.039	2.16	1

18.865	0.86	50.244	4.81	61.53	55	2.07%	2.3	48%	1.85	0.000	1.85	0	0	0.77	0.08	0.94	-0.16	1.00
19.029	0.87	70.118	6.72	85.87	75	1.42%	2.1	48%	1.85	0.000	1.85	0	0	0.77	0.10	0.92	-0.29	1.00
19.193	0.87	78.717	7.54	96.39	83	0.96%	2.0	48%	1.86	0.000	1.86	0	0	0.76	0.10	0.91	-0.33	1.00
19.357	0.87	87.227	8.36	106.82	91	0.78%	1.9	48%	1.87	0.000	1.87	0	0	0.76	0.11	0.91	-0.38	1.00
19.521	0.88	99.369	9.52	121.68	103	0.79%	1.8	48%	1.88	0.000	1.88	0	0	0.76	0.13	0.89	-0.44	1.00
19.685	0.88	103.868	9.95	127.19	107	0.82%	1.8	48%	1.89	0.000	1.89	0	0	0.76	0.13	0.89	-0.46	1.00
19.849	0.87	104.297	9.99	127.72	107	0.73%	1.8	48%	1.90	0.000	1.90	0	0	0.76	0.13	0.89	-0.46	1.00
20.013	0.87	98.441	9.43	120.55	101	0.78%	1.8	48%	1.91	0.000	1.91	0	0	0.76	0.13	0.89	-0.43	1.00
20.177	0.85	84.744	8.12	103.78	87	0.88%	1.9	48%	1.92	0.000	1.92	0	0	0.76	0.11	0.91	-0.36	1.00
20.341	0.84	73.497	7.04	90.00	76	0.90%	2.0	48%	1.93	0.000	1.93	0	0	0.75	0.10	0.92	-0.30	1.00
20.505	0.83	66.955	6.41	81.99	69	0.80%	2.0	48%	1.94	0.000	1.94	0	0	0.75	0.09	0.92	-0.27	1.00
20.669	0.83	64.309	6.16	78.75	66	0.83%	2.0	48%	1.95	0.000	1.95	0	0	0.75	0.09	0.92	-0.25	1.00
20.833	0.82	64.870	6.21	79.44	67	0.83%	2.0	21%	1.96	0.000	1.96	0	0	0.75	0.09	0.92	-0.25	1.00
20.997	0.82	67.182	6.44	82.27	69	0.83%	2.0	21%	1.97	0.000	1.97	0	0	0.75	0.09	0.92	-0.27	1.00
21.161	0.82	69.322	6.64	84.89	70	0.81%	2.0	21%	1.97	0.000	1.97	0	0	0.75	0.09	0.92	-0.28	1.00
21.325	0.82	69.074	6.62	84.59	70	0.84%	2.0	21%	1.98	0.000	1.98	0	0	0.75	0.09	0.92	-0.28	1.00
21.489	0.81	64.552	6.18	79.05	65	0.93%	2.0	21%	1.99	0.000	1.99	0	0	0.74	0.09	0.92	-0.25	1.00
21.653	0.80	56.599	5.42	69.31	58	0.98%	2.1	21%	2.00	0.000	2.00	0	0	0.74	0.08	0.93	-0.20	1.00
21.817	0.79	51.402	4.92	62.94	53	0.92%	2.1	21%	2.01	0.000	2.01	0	0	0.74	0.08	0.93	-0.16	1.00
21.981	0.78	49.857	4.78	61.05	51	0.89%	2.1	21%	2.02	0.000	2.02	0	0	0.74	0.08	0.93	-0.15	1.00
22.145	0.78	48.436	4.64	59.31	49	1.02%	2.2	21%	2.03	0.000	2.03	0	0	0.74	0.08	0.93	-0.14	1.00
22.309	0.78	48.308	4.63	59.15	49	1.14%	2.2	21%	2.04	0.000	2.04	0	0	0.74	0.08	0.93	-0.14	1.00
22.473	0.77	50.499	4.84	61.84	51	1.07%	2.2	21%	2.05	0.000	2.05	0	0	0.74	0.08	0.93	-0.15	1.00
22.638	0.77	50.696	4.86	62.08	51	1.03%	2.2	21%	2.06	0.000	2.06	0	0	0.74	0.08	0.93	-0.16	1.00
22.802	0.76	48.058	4.60	58.85	48	1.08%	2.2	21%	2.06	0.000	2.06	0	0	0.73	0.08	0.93	-0.14	1.00
22.966	0.76	45.824	4.39	56.11	46	1.17%	2.2	21%	2.07	0.000	2.07	0	0	0.73	0.07	0.93	-0.12	1.00
23.130	0.76	48.570	4.65	59.48	49	1.04%	2.2	21%	2.08	0.000	2.08	0	0	0.73	0.08	0.93	-0.14	1.00
23.294	0.76	49.569	4.75	60.70	50	0.96%	2.1	21%	2.09	0.000	2.09	0	0	0.73	0.08	0.93	-0.15	1.00
23.458	0.76	51.041	4.89	62.50	51	0.87%	2.1	21%	2.10	0.000	2.10	0	0	0.73	0.08	0.93	-0.16	1.00
23.622	0.75	51.660	4.95	63.26	51	0.90%	2.1	21%	2.11	0.000	2.11	0	0	0.73	0.08	0.92	-0.16	1.00
23.786	0.75	51.374	4.92	62.91	51	0.83%	2.1	21%	2.12	0.000	2.12	0	0	0.73	0.08	0.92	-0.16	1.00
23.950	0.75	51.363	4.92	62.90	51	0.80%	2.1	21%	2.13	0.000	2.13	0	0	0.72	0.08	0.92	-0.16	1.00
24.114	0.74	49.411	4.73	60.51	49	0.78%	2.1	21%	2.14	0.000	2.14	0	0	0.72	0.08	0.93	-0.14	1.00
24.278	0.74	49.766	4.77	60.94	49	0.76%	2.1	21%	2.14	0.000	2.14	0	0	0.72	0.08	0.92	-0.15	1.00
24.442	0.74	49.753	4.77	60.93	49	0.72%	2.1	21%	2.15	0.000	2.15	0	0	0.72	0.08	0.92	-0.15	1.00
24.606	0.74	51.251	4.91	62.76	50	0.69%	2.1	21%	2.16	0.000	2.16	0	0	0.72	0.08	0.92	-0.16	1.00
24.770	0.74	54.120	5.18	66.27	52	0.74%	2.1	21%	2.17	0.000	2.17	0	0	0.72	0.08	0.92	-0.18	1.00
24.934	0.73	49.109	4.70	60.14	48	0.84%	2.1	21%	2.18	0.000	2.18	0	0	0.72	0.08	0.92	-0.14	1.00
25.098	0.70	36.467	3.49	44.66	36	1.45%	2.4	21%	2.19	0.000	2.19	0	0	0.71	0.07	0.93	-0.03	1.00
25.262	0.67	22.457	2.15	27.50	23	2.72%	2.7	21%	2.20	0.000	2.20	0	0	0.71	0.06	0.94	0.10	1.00
25.426	0.65	13.707	1.31	16.79	14	4.15%	3.0	21%	2.21	0.000	2.21	0	0	0.71	0.05	0.95	0.10	1.00
25.590	0.65	9.632	0.92	11.80	9	3.94%	3.1	21%	2.22	0.000	2.22	0	0	0.71	0.05	0.95	0.10	1.00
25.754	0.65	8.843	0.85	10.84	9	2.31%	3.0	21%	2.22	0.000	2.22	0	0	0.71	0.05	0.95	0.10	1.00
25.918	0.64	8.395	0.80	10.29	8	1.37%	2.9	21%	2.23	0.000	2.23	0	0	0.71	0.05	0.95	0.10	1.00
26.082	0.64	8.227	0.79	10.08	8	1.48%	2.9	21%	2.24	0.000	2.24	0	0	0.71	0.05	0.95	0.10	1.00
26.246	0.64	8.391	0.80	10.28	8	1.65%	2.9	21%	2.25	0.000	2.25	0	0	0.71	0.05	0.95	0.10	1.00
26.410	0.63	8.532	0.82	10.46	8	2.08%	3.0	83%	2.26	0.003	2.26	1	0	0.70	0.05	0.95	0.10	1.00
26.574	0.63	9.522	0.91	11.69	9	2.36%	3.0	83%	2.27	0.009	2.26	1	0	0.70	0.05	0.95	0.10	1.00
26.739	0.63	9.870	0.95	12.13	10	2.31%	2.9	83%	2.28	0.014	2.26	1	0	0.70	0.05	0.95	0.10	1.00
26.903	0.63	8.401	0.80	10.36	8	2.41%	3.0	83%	2.29	0.019	2.27	1	0	0.70	0.05	0.95	0.10	1.00
27.067	0.63	7.541	0.72	9.30	7	2.29%	3.1	83%	2.29	0.024	2.27	1	0	0.70	0.04	0.95	0.10	1.00
27.231	0.63	7.646	0.73	9.44	7	2.18%	3.0	83%	2.30	0.029	2.27	1	0	0.70	0.04	0.95	0.10	1.00
27.395	0.63	8.032	0.77	9.93	8	2.47%	3.0	83%	2.31	0.034	2.28	1	0	0.70	0.05	0.95	0.10	1.00
27.559	0.63	8.054	0.77	9.96	8	2.74%	3.1	83%	2.32	0.039	2.28	1	0	0.69	0.05	0.95	0.10	1.00
27.723	0.62	7.090	0.68	8.78	7	2.84%	3.1	83%	2.33	0.044	2.29	1	0	0.69	0.04	0.95	0.10	1.00
27.887	0.62	7.032	0.67	8.71	7	2.22%	3.1	83%	2.34	0.050	2.29	1	0	0.69	0.04	0.95	0.10	1.00
28.051	0.62	6.702	0.64	8.31	6	2.12%	3.1	83%	2.35	0.055	2.29	1	0	0.69	0.04	0.95	0.10	1.00
28.215	0.62	6.416	0.61	7.96	6	2.12%	3.1	83%	2.36	0.060	2.30	1	0	0.69	0.04	0.96	0.10	1.00
28.379	0.62	6.125	0.59	7.61	6	2.28%	3.1	83%	2.36	0.065	2.30	1	0	0.69	0.04	0.96	0.10	1.00
28.543	0.62	6.268	0.60	7.78	6	2.30%	3.1	83%	2.37	0.070	2.30	1	0	0.69	0.04	0.96	0.10	1.00
28.707	0.62	6.379	0.61	7.93	6	2.41%	3.1	83%	2.38	0.075	2.31	1	0	0.69	0.04	0.95	0.10	1.00
28.871	0.62	6.799	0.65	8.44	6	1.95%	3.1	83%	2.39	0.080	2.31	1	0	0.68	0.04	0.95	0.10	1.00
29.035	0.62	6.509	0.62	8.09	6	1.97%	3.1	83%	2.40	0.085	2.31	1	0	0.68	0.04	0.95	0.10	1.00
29.199	0.61	6.104	0.58	7.60	6	2.31%	3.2	83%	2.41	0.090	2.32	1	0	0.68	0.04	0.95	0.10	1.00
29.363	0.61	6.405	0.61	7.97	6	2.87%	3.2	83%	2.42	0.096	2.32	1	0	0.68	0.04	0.95	0.10	1.00
29.527	0.61	8.498	0.81	10.54	8	2.36%	3.0	83%	2.43	0.101	2.33	1	0	0.68	0.05	0.95	0.10	1.00
29.691	0.61	6.461	0.62	8.04	6	3.81%	3.2	83%	2.44	0.106	2.33	1	0	0.68	0.04	0.95	0.10	1.00
29.855	0.61	8.661	0.83	10.75	8	3.36%	3.1	83%	2.44	0.111	2.33	1	0	0.68	0.05	0.95	0.10	1.00
30.019	0.61	9.460	0.91	11.73	9	2.79%	3.0	83%	2.45	0.116	2.34	1	0	0.67	0.05	0.95	0.10	1.00
30.183	0.61	6.965	0.67	8.67	6	4.00%	3.2	83%	2.46	0.121	2.34	1	0	0.67	0.04	0.95	0.10	1.00
30.347	0.61	6.334	0.61	7.93	6	4.50%	3.3	83%	2.47	0.126	2.34	1	0	0.67	0.04	0.95	0.10	1.00
30.511	0.61	5.941	0.57	7.47	5	3.68%	3.3	83%	2.48	0.131	2.35	1	0	0.67	0.04	0.95	0.10	1.00
30.675	0.60	5.774	0.55	7.27	5	2.89%	3.2	83%	2.49	0.137	2.35	1	0	0.67	0.04	0.95	0.10	1.00
30.840	0.60	5.685	0.54	7.17	5	3.00%	3.2	83%	2.50	0.142	2.35	1	0	0.67	0.04	0.95	0.10	1.00
31.004	0.56	5.110	0.49	6.46	4	3.00%	3.3	83%	2.51	0.000	2.51	0	0	0.67	0.04	0.95	0.10	1.00
31.168	0.56	5.732	0.55	7.24	5	3.09%	3.2	21%	2.51	0.000	2.51	0	0	0.67	0.04	0.95	0.10	1.00
31.332	0.56	7.557	0.72	9.49	7	3.12%	3.1	21%	2.52	0.000	2.52	0	0	0.66	0.04	0.95	0.10	1.00
31.496	0.57	21.196	2.03	26.21	21	1.24%	2.5	21%	2.53	0.000	2.53	0	0	0.66	0.06	0.94	0.10	1.00
31.660	0.57	23.348	2.24	28.68	22	1.51%	2.5	21%	2.54	0.000	2.54	0	0	0.66	0.06	0.93	0.10	1.00
31.824	0.59	30.265	2.90	37.13	28	1.48%	2.5	21%	2.55	0.000	2.55	0	0	0.66	0.06	0.93	0.03	1.00
31.988	0.58	26.567	2.54	32.59	25	2.06%	2.6	21%	2.56	0.000	2.56	0	0	0.66	0.06	0.93	0.08	1.00
32.152	0.58	26.794	2.57	32.86	25	2.41%	2.6	21%	2.57	0.000	2.57	0	0	0.66	0.06	0.93	0.07	1.00
32.316	0.56	22.095	2.12	27.11	21	3.28%	2.8	21%	2.58	0.000	2.58	0	0	0.66	0.06	0.93	0.10	1.00
32.480	0.54	13.835	1.33	16.99	13	4.52%	3.0	21%	2.59	0.000	2.59	0	0	0.66	0.05	0.94	0.10	1.00
32.644	0.54	8.714	0.83	10.72	8	4.40%	3.2	83%	2.59	0.004	2.59	1	0	0.65	0.05	0.95	0.10	1.00
32.808	0.54	6.122	0.59	7.58	5	4.23%	3.3	83%	2.60	0.010	2.59	1	0	0.65	0.04	0.95	0.10	1.00
32.972	0.54	5.838	0.56	7.24	5	2.84%	3.2	83%	2.61	0.015	2.60	1	0	0.65	0.04	0.95	0.10	1.00
33.136	0.54	6.103	0.58	7.59	5	2.89%	3.2	83%	2.62	0.020	2.60	1	0	0.65	0.04	0.95	0.10	1.00
33.300	0.54	6.260	0.60	7.78	6	2.87%	3.2	83%	2.63	0.025	2.60	1	0	0.65	0.04	0.95	0.10	1.00
33.464	0.54	6.593	0.63	8.20	6	2.31%	3.1	83%	2.64	0.030	2.61	1	0	0.65	0.04	0.95	0.10	1.00
33.628	0.54	6.754	0.65	8.40	6	2.09%	3.1	83%	2.65	0.035	2.61	1	0	0.65	0.04	0.95	0.10	1.00
33.792	0.53	6.439	0.62	8.01	6	2.63%	3.2	83%	2.66	0.040	2.62	1	0	0.65	0.04	0.95	0.10	1.00
33.956	0.53	6.562	0.63	8.19	6	2.82%	3.2	83%	2.66	0.045	2.62	1	0	0.64	0.04	0.95	0.10	1.00
34.120	0.53	6.046	0.58	7.56	5	3.29%	3.2	83%	2.67	0.051	2.62	1	0	0.64	0.04	0.95	0.10	1.00
34.284	0.53	6.743	0.65	8.42	6	2.83%	3.2	83%	2.68	0.056	2.63	1	0	0.64	0.04	0.95	0.10	1.00
34.448	0.53	7.073	0.68	8.82	6	2.38%	3.1	83%	2.69	0.061	2.63	1	0	0.64	0.04	0.95	0.10	1.00
34.612	0.53	6.860	0.66	8.57	6	3.29%	3.2	83%	2.70	0.066	2.63	1	0	0.64	0.04	0.95	0.10	1.00
34.776	0.53	7.421	0.71	9.26	7	3.26%	3.2	83%	2.71	0.071	2.64	1	0	0.64	0.04	0.95	0.10	1.00
34.941	0.53	7.341	0.70	9.16	7	2.97%	3.1	83%	2.72	0.076	2.64	1	0	0.64	0.04	0.95	0.10	1.00
35.105	0.51	11.055	1.06	13.71	10	2.08%	2.9	52%	2.73	0.000	2.73	0	0	0.64	0.05	0.94	0.10	1.00
35.269	0.51	16.649	1.59	20.47	16	2.49%	2.8	52%	2.74	0.000	2.74	0	0	0.63	0.05	0.94	0.10	1.00
35.433	0.51	12.809	1.23	15.76	12	4.18%	3.0	52%	2.74	0.000	2.74	0	0	0.63	0.05	0.94	0.10	1.00
35.597	0.50	8.615	0.83	10.62	8	5.19%	3.2	52%	2.75	0.000	2.75	0	0	0.63	0.05	0.94	0.10	1.00
35.761	0.50	6.503	0.62	8.04	6	4.79%	3.3	52%	2.76	0.000	2.76	0	0	0.63	0.04	0.95	0.10	1.00
35.925	0.50	6.093	0.58	7.55	5	3.46%	3.3	52%	2.77	0.000	2.77	0	0	0.63	0.04	0.95	0.10	1.00
36.089	0.50	6.295	0.60	7.80	5	3.67%	3.3	52%	2.78	0.000	2.78	0	0	0.63	0.04	0.95	0.10	1.00
36.253	0.50	6.903	0.66	8.56	6	2.92%	3.2	52%	2.79	0.000	2.79	0	0	0.63	0.04	0.95	0.10	1.00
36.417	0.50	6.184	0.59	7.68	5	3.31%	3.2	52%	2.80	0.000	2.80	0	0	0.63	0.04	0.95	0.10	1.00
36.581	0.49	6.132	0.59	7.63	5	3.77%	3.3	52%	2.81	0.000	2.81	0	0	0.62	0.04	0.95	0.10	1.00
36.745	0.49	5.923	0.57	7.38	5	4.41%	3.3	52%	2.82	0.000	2.82	0	0	0.62	0.04	0.95	0.10	1.00
36.909	0.49	9.271	0.89	11.47	8	2.95%	3.1	52%	2.83	0.000	2.83	0	0	0.62	0.05	0.94	0.10	1.00
37.073	0.49	6.378	0.61	7.93	5	3.91%	3.3	52%	2.84	0.000	2.84	0	0	0.62	0.04	0.95	0.10	1.00
37.237	0.49	5.578	0.53	6.97	5	3.67%	3.3	52%	2.85	0.000	2.85	0	0	0.62	0.04	0.95	0.10	1.00
37.401	0.48	5.403	0.52	6.76	5	2.73%	3.3	52%	2.86	0.000	2.86	0	0	0.62	0.04	0.95	0.10	1.00
37.565	0.48	5.726	0.55	7.17	5	2.55%	3.2	52%	2.87	0.000	2.87	0	0	0.62	0.04	0.95	0.10	1.00
37.729	0.48	5.826	0.56	7.29	5	2.61%	3.2	52%	2.88	0.000	2.88	0	0	0.62	0.04	0.95	0.10	1.00
37.893	0.48	5.959	0.57	7.46	5	2.51%	3.2	52%	2.89	0.000	2.89	0	0	0.62	0.04	0.95	0.10	1.00
38.057	0.48	6.149	0.59	7.69	5	2.32%	3.2	52%	2.90	0.000	2.90	0	0	0.61	0.04	0.95	0.10	1.00
38.221	0.48	6.222	0.60	7.78	5	1.82%	3.1	52%	2.90	0.000	2.90	0	0	0.61	0.04	0.95	0.10	1.00
38.385	0.47	5.836	0.56	7.31	5	1.70%	3.1	52%	2.91	0.000	2.91	0	0	0.61	0.04	0.95	0.10	1.00
38.549	0.47	5.513	0.53	6.94	5	2.39%	3.2	52%	2.92	0.000	2.92	0	0	0.61	0.04	0.95	0.10	1.00
38.713	0.47	5.686	0.54	7.17	5	2.74%	3.2	83%	2.93	0.004	2.93	1	1	0.61	0.04	0.95	0.10	1.00
38.877	0.47	5.679	0.54	7.16	5	2.96%	3.3	83%	2.94	0.009	2.93	1	1	0.61	0.04	0.95	0.10	1.00
39.042	0.47	5.699	0.55	7.19	5	3.13%	3.3	83%	2.95	0.014	2.94	1	1	0.61	0.04	0.95	0.10	1.00
39.206	0.47	5.932	0.57	7.48	5	2.93%	3.2	83%	2.96	0.019	2.94	1	1	0.61	0.04	0.94	0.10	1.00
39.370	0.47	6.341	0.61	7.99	5	3.02%	3.2	83%	2.97	0.024	2.94	1	1	0.60	0.04	0.94	0.10	1.00
39.534	0.47	6.005	0.58	7.58	5	3.26%	3.3	83%	2.98	0.029	2.95	1	1	0.60	0.04	0.94	0.10	1.00
39.698	0.47	12.204	1.17	15.19	11	2.47%	2.9	83%	2.98	0.034	2.95	1	1	0.60	0.05	0.94	0.10	1.00
39.862	0.47	11.412	1.09	14.11	10	2.72%	3.0	83%	2.99	0.039	2.95	1	1	0.60	0.05	0.94	0.10	1.00

18.865	0.077	51.90	113.43	0.166	N/A	0.90	0.45	0.77	0.83	1.00	0.124	2.00	123.17	0.254	N/A	N/A	N/A
19.029	0.076	60.44	146.30	0.256	N/A	0.90	0.54	0.73	0.80	1.00	0.128	1.46	125.69	0.265	N/A	N/A	N/A
19.193	0.075	64.13	160.52	0.330	N/A	0.90	0.57	0.72	0.79	1.00	0.130	1.25	120.65	0.243	N/A	N/A	N/A
19.357	0.075	67.79	174.60	0.459	N/A	0.90	0.60	0.70	0.78	1.00	0.132	1.17	124.49	0.259	N/A	N/A	N/A
19.521	0.074	73.00	194.68	0.903	N/A	0.90	0.64	0.68	0.77	1.00	0.134	1.13	137.93	0.324	N/A	N/A	N/A
19.685	0.073	74.93	202.13	1.000	N/A	0.90	0.65	0.67	0.76	1.00	0.135	1.13	143.85	0.357	N/A	N/A	N/A
19.849	0.073	75.12	202.84	1.000	N/A	0.90	0.65	0.67	0.76	1.00	0.135	1.11	141.56	0.344	N/A	N/A	N/A
20.013	0.073	72.60	193.15	0.848	N/A	0.90	0.63	0.68	0.76	1.00	0.134	1.14	137.28	0.321	N/A	N/A	N/A
20.177	0.074	66.72	170.49	0.412	N/A	0.89	0.59	0.71	0.78	1.00	0.131	1.21	125.81	0.265	N/A	N/A	N/A
20.341	0.075	61.89	151.89	0.280	N/A	0.89	0.55	0.73	0.79	1.00	0.129	1.27	114.31	0.219	N/A	N/A	N/A
20.505	0.075	59.08	141.07	0.236	N/A	0.89	0.52	0.74	0.80	1.00	0.128	1.28	104.56	0.186	N/A	N/A	N/A
20.669	0.075	57.94	136.69	0.222	N/A	0.89	0.51	0.74	0.80	1.00	0.127	1.30	102.68	0.181	N/A	N/A	N/A
20.833	0.075	47.57	127.01	0.195	N/A	0.89	0.51	0.74	0.80	1.00	0.127	1.30	103.44	0.183	N/A	N/A	N/A
20.997	0.074	48.38	130.65	0.205	N/A	0.89	0.52	0.74	0.79	1.00	0.128	1.29	105.89	0.190	N/A	N/A	N/A
21.161	0.074	49.13	134.02	0.214	N/A	0.89	0.53	0.73	0.79	1.00	0.128	1.27	107.75	0.196	N/A	N/A	N/A
21.325	0.074	49.04	133.63	0.213	N/A	0.88	0.53	0.73	0.79	1.00	0.128	1.28	108.50	0.199	N/A	N/A	N/A
21.489	0.074	47.45	126.50	0.194	N/A	0.88	0.51	0.74	0.80	1.00	0.127	1.35	106.67	0.193	N/A	N/A	N/A
21.653	0.074	44.66	113.97	0.167	N/A	0.88	0.48	0.76	0.81	1.00	0.125	1.45	100.19	0.174	N/A	N/A	N/A
21.817	0.074	42.83	105.78	0.152	N/A	0.88	0.46	0.77	0.81	1.00	0.124	1.48	92.93	0.155	N/A	N/A	N/A
21.981	0.074	42.29	103.35	0.148	N/A	0.88	0.45	0.77	0.82	1.00	0.123	1.48	90.58	0.149	N/A	N/A	N/A
22.145	0.074	41.79	101.11	0.144	N/A	0.88	0.44	0.78	0.82	1.00	0.123	1.57	93.38	0.156	N/A	N/A	N/A
22.309	0.074	41.75	100.90	0.144	N/A	0.88	0.44	0.78	0.82	1.00	0.123	1.64	97.16	0.165	N/A	N/A	N/A
22.473	0.074	42.52	104.36	0.150	N/A	0.88	0.45	0.77	0.81	1.00	0.123	1.57	97.30	0.166	N/A	N/A	N/A
22.638	0.074	42.59	104.67	0.150	N/A	0.87	0.45	0.77	0.81	1.00	0.123	1.56	96.55	0.164	N/A	N/A	N/A
22.802	0.074	41.66	100.51	0.143	N/A	0.87	0.44	0.78	0.81	1.00	0.122	1.62	95.36	0.161	N/A	N/A	N/A
22.966	0.074	40.87	96.99	0.138	N/A	0.87	0.43	0.78	0.82	1.00	0.122	1.71	95.97	0.162	N/A	N/A	N/A
23.130	0.073	41.84	101.31	0.145	N/A	0.87	0.45	0.78	0.81	1.00	0.122	1.60	94.94	0.160	N/A	N/A	N/A
23.294	0.073	42.19	102.89	0.147	N/A	0.87	0.45	0.78	0.81	1.00	0.123	1.54	93.36	0.156	N/A	N/A	N/A
23.458	0.073	42.71	105.21	0.151	N/A	0.87	0.46	0.77	0.81	1.00	0.123	1.48	92.37	0.153	N/A	N/A	N/A
23.622	0.073	42.92	106.18	0.153	N/A	0.87	0.46	0.77	0.80	1.00	0.123	1.49	94.10	0.157	N/A	N/A	N/A
23.786	0.072	42.82	105.73	0.152	N/A	0.86	0.46	0.77	0.80	1.00	0.123	1.45	91.40	0.151	N/A	N/A	N/A
23.950	0.072	42.82	105.72	0.152	N/A	0.86	0.46	0.77	0.80	1.00	0.123	1.44	90.73	0.149	N/A	N/A	N/A
24.114	0.072	42.14	102.65	0.147	N/A	0.86	0.45	0.78	0.81	1.00	0.122	1.46	88.13	0.144	N/A	N/A	N/A
24.278	0.099	42.26	103.20	0.148	N/A	0.86	0.45	0.77	0.80	1.00	0.122	1.44	87.95	0.143	N/A	N/A	N/A
24.442	0.099	42.26	103.18	0.148	N/A	0.86	0.45	0.77	0.80	1.00	0.122	1.43	86.87	0.141	N/A	N/A	N/A
24.606	0.099	42.78	105.54	0.152	N/A	0.86	0.46	0.77	0.80	1.00	0.122	1.39	87.26	0.142	N/A	N/A	N/A
24.770	0.099	43.79	110.06	0.160	N/A	0.86	0.47	0.76	0.79	1.00	0.123	1.39	92.17	0.153	N/A	N/A	N/A
24.934	0.099	42.03	102.17	0.146	N/A	0.86	0.45	0.78	0.80	1.00	0.122	1.50	90.44	0.149	N/A	N/A	N/A
25.098	0.100	37.59	82.25	0.116	N/A	0.85	0.39	0.80	0.82	1.00	0.119	2.15	95.86	0.162	N/A	N/A	N/A
25.262	0.100	32.67	60.17	0.088	N/A	0.85	0.30	0.80	0.82	1.00	0.119	3.87	106.31	0.192	N/A	N/A	N/A
25.426	0.100	29.60	46.38	0.074	N/A	0.85	0.24	0.80	0.82	1.00	0.119	6.37	106.87	0.194	N/A	N/A	N/A
25.590	0.100	28.17	39.96	0.069	N/A	0.85	0.20	0.80	0.82	1.00	0.118	7.74	91.38	0.151	N/A	N/A	N/A
25.754	0.101	27.89	38.72	0.068	N/A	0.85	0.19	0.80	0.82	1.00	0.118	6.64	71.90	0.115	N/A	N/A	N/A
25.918	0.101	27.73	38.02	0.067	N/A	0.85	0.19	0.80	0.82	1.00	0.118	5.69	58.59	0.099	N/A	N/A	N/A
26.082	0.101	27.67	37.76	0.067	N/A	0.85	0.18	0.80	0.82	1.00	0.118	5.94	59.84	0.100	N/A	N/A	N/A
26.246	0.101	27.73	38.02	0.067	N/A	0.84	0.19	0.80	0.82	1.00	0.118	6.09	62.65	0.103	N/A	N/A	N/A
26.410	0.102	33.51	43.97	0.072	N/A	0.84	0.19	0.80	0.82	1.00	0.118	6.56	68.60	0.110	N/A	N/A	N/A
26.574	0.102	33.93	45.62	0.073	N/A	0.84	0.20	0.80	0.82	1.00	0.118	6.37	74.53	0.119	N/A	N/A	N/A
26.739	0.102	34.08	46.21	0.074	N/A	0.84	0.20	0.80	0.82	1.00	0.118	6.17	74.85	0.119	N/A	N/A	N/A
26.903	0.102	33.47	43.83	0.072	N/A	0.84	0.19	0.80	0.82	1.00	0.119	6.98	72.34	0.115	N/A	N/A	N/A
27.067	0.102	33.11	42.41	0.071	N/A	0.84	0.18	0.80	0.82	1.00	0.119	7.38	68.66	0.110	N/A	N/A	N/A
27.231	0.102	33.15	42.59	0.071	N/A	0.84	0.18	0.80	0.81	1.00	0.119	7.19	67.85	0.109	N/A	N/A	N/A
27.395	0.103	33.32	43.25	0.071	N/A	0.84	0.18	0.80	0.81	1.00	0.119	7.27	72.19	0.115	N/A	N/A	N/A
27.559	0.103	33.33	43.29	0.071	N/A	0.83	0.18	0.80	0.81	1.00	0.119	7.55	75.13	0.119	N/A	N/A	N/A
27.723	0.103	32.92	41.70	0.070	N/A	0.83	0.17	0.80	0.81	1.00	0.119	8.32	72.98	0.116	N/A	N/A	N/A
27.887	0.103	32.90	41.61	0.070	N/A	0.83	0.17	0.80	0.81	1.00	0.119	7.66	66.74	0.108	N/A	N/A	N/A
28.051	0.103	32.76	41.07	0.069	N/A	0.83	0.17	0.80	0.81	1.00	0.119	7.79	64.75	0.105	N/A	N/A	N/A
28.215	0.103	32.64	40.60	0.069	N/A	0.83	0.16	0.80	0.81	1.00	0.119	8.04	64.01	0.104	N/A	N/A	N/A
28.379	0.103	32.52	40.12	0.069	N/A	0.83	0.16	0.80	0.81	1.00	0.119	8.51	64.75	0.105	N/A	N/A	N/A
28.543	0.102	32.58	40.36	0.069	N/A	0.83	0.16	0.80	0.81	1.00	0.120	8.40	65.42	0.106	N/A	N/A	N/A
28.707	0.101	32.63	40.55	0.069	N/A	0.82	0.16	0.80	0.81	1.00	0.120	8.44	66.86	0.108	N/A	N/A	N/A
28.871	0.101	32.81	41.25	0.070	N/A	0.82	0.17	0.80	0.81	1.00	0.120	7.52	63.46	0.104	N/A	N/A	N/A
29.035	0.100	32.69	40.78	0.069	N/A	0.82	0.16	0.80	0.81	1.00	0.120	7.78	62.94	0.103	N/A	N/A	N/A
29.199	0.101	32.52	40.11	0.069	N/A	0.82	0.16	0.80	0.81	1.00	0.120	8.58	65.19	0.106	N/A	N/A	N/A
29.363	0.103	32.64	40.62	0.069	N/A	0.82	0.16	0.80	0.81	1.00	0.120	8.95	71.37	0.114	N/A	N/A	N/A
29.527	0.104	33.53	44.07	0.072	N/A	0.82	0.19	0.80	0.81	1.00	0.120	6.91	72.85	0.116	N/A	N/A	N/A
29.691	0.105	32.67	40.71	0.069	N/A	0.82	0.16	0.80	0.81	1.00	0.120	9.85	79.23	0.126	N/A	N/A	N/A
29.855	0.105	33.60	44.35	0.072	N/A	0.82	0.19	0.80	0.81	1.00	0.120	7.83	84.15	0.135	N/A	N/A	N/A
30.019	0.105	33.95	45.68	0.073	N/A	0.81	0.20	0.80	0.81	1.00	0.120	6.87	80.65	0.129	N/A	N/A	N/A
30.183	0.105	32.89	41.56	0.070	N/A	0.81	0.17	0.80	0.81	1.00	0.120	9.58	83.12	0.133	N/A	N/A	N/A
30.347	0.105	32.63	40.56	0.069	N/A	0.81	0.16	0.80	0.81	1.00	0.121	10.57	83.89	0.135	N/A	N/A	N/A
30.511	0.105	32.47	39.94	0.069	N/A	0.81	0.16	0.80	0.81	1.00	0.121	10.23	76.43	0.122	N/A	N/A	N/A
30.675	0.105	32.40	39.67	0.068	N/A	0.81	0.16	0.80	0.81	1.00	0.121	9.60	69.74	0.112	N/A	N/A	N/A
30.840	0.105	32.37	39.54	0.068	N/A	0.81	0.15	0.80	0.81	1.00	0.121	9.81	70.33	0.112	N/A	N/A	N/A
31.004	0.106	32.12	38.59	0.067	N/A	0.81	0.15	0.80	0.80	1.00	0.115	10.54	68.13	0.109	N/A	N/A	N/A
31.168	0.106	26.86	34.10	0.064	N/A	0.80	0.16	0.80	0.80	1.00	0.115	9.89	71.62	0.114	N/A	N/A	N/A
31.332	0.106	27.50	37.00	0.066	N/A	0.80	0.18	0.80	0.80	1.00	0.115	8.34	79.13	0.126	N/A	N/A	N/A
31.496	0.106	32.30	58.50	0.086	N/A	0.80	0.30	0.80	0.80	1.00	0.115	2.89	75.84	0.121	N/A	N/A	N/A
31.660	0.100	33.01	61.69	0.090	N/A	0.80	0.31	0.80	0.80	1.00	0.115	2.98	85.36	0.138	N/A	N/A	N/A
31.824	0.099	35.43	72.56	0.103	N/A	0.80	0.35	0.80	0.80	1.00	0.115	2.53	94.08	0.157	N/A	N/A	N/A
31.988	0.103	34.13	66.72	0.096	N/A	0.80	0.33	0.80	0.80	1.00	0.114	3.19	103.85	0.184	N/A	N/A	N/A
32.152	0.106	34.21	67.07	0.096	N/A	0.80	0.33	0.80	0.80	1.00	0.114	3.42	112.36	0.212	N/A	N/A	N/A
32.316	0.106	32.56	59.66	0.087	N/A	0.80	0.30	0.80	0.79	1.00	0.114	4.45	120.50	0.243	N/A	N/A	N/A
32.480	0.106	29.65	46.64	0.074	N/A	0.79	0.24	0.80	0.79	1.00	0.114	6.78	115.18	0.222	N/A	N/A	N/A
32.644	0.107	33.59	44.31	0.072	N/A	0.79	0.19	0.80	0.79	1.00	0.114	8.85	94.82	0.159	N/A	N/A	N/A
32.808	0.107	32.51	40.08	0.069	N/A	0.79	0.16	0.80	0.79	1.00	0.114	10.78	81.67	0.131	N/A	N/A	N/A
32.972	0.107	32.39	39.63	0.068	N/A	0.79	0.16	0.80	0.79	1.00	0.114	9.68	70.12	0.112	N/A	N/A	N/A
33.136	0.107	32.51	40.10	0.069	N/A	0.79	0.16	0.80	0.79	1.00	0.114	9.45	71.71	0.114	N/A	N/A	N/A
33.300	0.107	32.58	40.36	0.069	N/A	0.79	0.16	0.80	0.79	1.00	0.114	9.28	72.21	0.115	N/A	N/A	N/A
33.464	0.107	32.72	40.92	0.069	N/A	0.79	0.17	0.80	0.79	1.00	0.114	8.32	68.25	0.110	N/A	N/A	N/A
33.628	0.107	32.79	41.19	0.070	N/A	0.78	0.17	0.80	0.79	1.00	0.115	7.92	66.47	0.107	N/A	N/A	N/A
33.792	0.107	32.66	40.67	0.069	N/A	0.78	0.16	0.80	0.79	1.00	0.115	8.84	70.89	0.113	N/A	N/A	N/A
33.956	0.107	32.72	40.91	0.069	N/A	0.78	0.17	0.80	0.79	1.00	0.115	8.94	73.22	0.117	N/A	N/A	N/A
34.120	0.107	32.50	40.06	0.069	N/A	0.78	0.16	0.80	0.79	1.00	0.115	9.94	75.17	0.120	N/A	N/A	N/A
34.284	0.107	32.80	41.22	0.070	N/A	0.78	0.17	0.80	0.79	1.00	0.115	8.79	74.03	0.118	N/A	N/A	N/A
34.448	0.107	32.94	41.76	0.070	N/A	0.78	0.17	0.80	0.79	1.00	0.115	8.03	70.83	0.113	N/A	N/A	N/A
34.612	0.108	32.85	41.42	0.070	N/A	0.78	0.17	0.80	0.79	1.00	0.115	9.18	78.64	0.125	N/A	N/A	N/A
34.776	0.108	33.09	42.35	0.071	N/A	0.78	0.18	0.80	0.79	1.00	0.115	8.71	80.64	0.129	N/A	N/A	N/A
34.941	0.108	33.05	42.21	0.070	N/A	0.77	0.17	0.80	0.79	1.00	0.115	8.49	77.70	0.124	N/A	N/A	N/A
35.105	0.108	35.13	48.83	0.076	N/A	0.77	0.21	0.80	0.79	1.00	0.112	5.67	77.65	0.124	N/A	N/A	N/A
35.269	0.108	37.50	57.97	0.086	N/A	0.77	0.26	0.80	0.79	1.00	0.112	4.66	95.33	0.161	N/A	N/A	N/A
35.433	0.108	35.85	51.61	0.079	N/A	0.77	0.23	0.80	0.78	1.00	0.112	6.93	109.19	0.201	N/A	N/A	N/A
35.597	0.108	34.05	44.67	0.073	N/A	0.77	0.19	0.80	0.78	1.00	0.112	9.60	101.94	0.179	N/A	N/A	N/A
35.761	0.105	33.14	41.18	0.070	N/A	0.77	0.16	0.80	0.78	1.00	0.112	10.98	88.29	0.144	N/A	N/A	N/A
35.925	0.103	32.97	40.52	0.069	N/A	0.77	0.16	0.80	0.78	1.00	0.112	10.21	77.06	0.123	N/A	N/A	N/A
36.089	0.102	33.06	40.86	0.069	N/A	0.76	0.16	0.80	0.78	1.00	0.112	10.21	79.63	0.127	N/A	N/A	N/A
36.253	0.102	33.32	41.88	0.070	N/A	0.76	0.17	0.80	0.78	1.00	0.111	8.88	76.01	0.121	N/A	N/A	N/A
36.417	0.104	33.01	40.70	0.069	N/A	0.76	0.16	0.80	0.78	1.00	0.111	9.96	76.51	0.122	N/A	N/A	N/A
36.581	0.108	33.00	40.63	0.069	N/A	0.76	0.16	0.80	0.78	1.00	0.111	10.46	79.84	0.127	N/A	N/A	N/A
36.745	0.108	32.91	40.30	0.069	N/A	0.76	0.16	0.80	0.78	1.00	0.111	11.28	83.29	0.134	N/A	N/A	N/A
36.909	0.108	34.34	45.82	0.074	N/A	0.76	0.20	0.80	0.78	1.00	0.111	7.38	84.69	0.136	N/A	N/A	N/A
37.073	0.108	33.10	41.03	0.069	N/A	0.76	0.16	0.80	0.78	1.00	0.111	10.36	82.21	0.132	N/A	N/A	N/A
37.237	0.108	32.77	39.74	0.068	N/A	0.76	0.15	0.80	0.78	1.00	0.111	11.00	76.70	0.122	N/A	N/A	N/A
37.401	0.109	32.69	39.46	0.068	N/A	0.75	0.15	0.80	0.78	1.00	0.111	10.19	68.96	0.110	N/A	N/A	N/A
37.565	0.109	32.83	40.00	0.069	N/A	0.75	0.15	0.80	0.78	1.00	0.110	9.60	68.76	0.110	N/A	N/A	N/A
37.729	0.109	32.88	40.17	0.069	N/A	0.75	0.16	0.80	0.78	1.00	0.110	9.57	69.78	0.112	N/A	N/A	N/A
37.893	0.109	32.94	40.39	0.069	N/A	0.75	0.16	0.80	0.78	1.00	0.110	9.30	69.38	0.111	N/A	N/A	N/A
38.057	0.109	33.02	40.71	0.069	N/A	0.75	0.16	0.80	0.78	1.00	0.110	8.88	68.32	0.110	N/A	N/A	N/A
38.221	0.109	33.05	40.83	0.069	N/A	0.75	0.16	0.80	0.78	1.00	0.110	8.15	63.44	0.104	N/A	N/A	N/A
38.385	0.109	32.89	40.20	0.069	N/A	0.75	0.16	0.80	0.78	1.00	0.110	8.34	60.99	0.101	N/A	N/A	N/A
38.549	0.109	32.75	39.70	0.068	N/A	0.74	0.15	0.80	0.77	1.00	0.110	9.65	66.97	0.108	N/A	N/A	N/A
38.713	0.109	32.37	39.53	0.068	0.63	0.74	0.15	0.80	0.77	1.00	0.110	9.87	70.72	0.113	1.03	0.83	1
38.877	0.109	32.36	39.53	0.068	0.63	0.74	0.15	0.80	0.77	1.00	0.110	10.13	72.59	0.116	1.05	0.84	1
39.042	0.109	32.38	39.57	0.068	0.63	0.74	0.15	0.80	0.77	1.00	0.110	10.30	74.06	0.118	1.07	0.85	1
39.206	0.109	32.48	39.96	0.069	0.63	0.74	0.16	0.80	0.77	1.00	0.110	9.82	73.46	0.117	1.06	0.85	1
39.370	0.108	32.65	40.64	0.069	0.64	0.74	0.16	0.80	0.77	1.00	0.110	9.51	75.97	0.121	1.10	0.87	1
39.534	0.106	32.51	40.09	0.069	0.65	0.74	0.16	0.80	0.77	1.00	0.110	10.10	76.58	0.122	1.11	0.88	1
39.698	0.104	35.14	50.33	0.078	0.75	0.74	0.23	0.80	0.77	1.00	0.110	5.76	87.55	0.142	1.30	1.02	0
39.862	0.102	34.77	48.87	0.076	0.75	0.73	0.22	0.80	0.77	1.00	0.110	6.30	88.92	0.145	1.32	1.03	0

0.86	50.25	4.81	61.53	18.865		0.95	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.87	70.12	6.71	85.87	19.029		0.95	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.87	78.72	7.54	96.39	19.193		0.95	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.87	87.23	8.35	106.82	19.357		0.95	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.88	99.37	9.51	121.68	19.521		0.95	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.88	103.87	9.94	127.19	19.685		0.95	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.87	104.30	9.99	127.72	19.849		0.95	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.87	98.44	9.43	120.55	20.013		0.95	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.85	84.75	8.11	103.78	20.177		0.95	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.84	73.50	7.04	90.00	20.341		0.95	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.83	66.96	6.41	81.99	20.505		0.95	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.83	64.31	6.16	78.75	20.669		0.95	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.82	64.87	6.21	79.44	20.833		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
0.82	67.19	6.43	82.27	20.997		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
0.82	69.33	6.64	84.89	21.161		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
0.82	69.08	6.61	84.59	21.325		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
0.81	64.55	6.18	79.05	21.489		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
0.80	56.60	5.42	69.31	21.653		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
0.79	51.40	4.92	62.94	21.817		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
0.78	49.86	4.77	61.05	21.981		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
0.78	48.44	4.64	59.31	22.145		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
0.78	48.31	4.63	59.15	22.309		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
0.77	50.50	4.83	61.84	22.473		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
0.77	50.70	4.85	62.08	22.638		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
0.76	48.06	4.60	58.85	22.802		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
0.76	45.82	4.39	56.11	22.966		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
0.76	48.57	4.65	59.48	23.130		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
0.76	49.57	4.75	60.70	23.294		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
0.76	51.04	4.89	62.50	23.458		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
0.75	51.66	4.95	63.26	23.622		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
0.75	51.38	4.92	62.91	23.786		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
0.75	51.36	4.92	62.90	23.950		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
0.74	49.42	4.73	60.51	24.114		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
0.74	49.77	4.76	60.94	24.278		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
0.74	49.76	4.76	60.93	24.442		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
0.74	51.25	4.91	62.76	24.606		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
0.74	54.12	5.18	66.27	24.770		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
0.73	49.11	4.70	60.14	24.934		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
0.70	36.47	3.49	44.66	25.098		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
0.67	22.46	2.15	27.50	25.262		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
0.65	13.71	1.31	16.79	25.426		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
0.65	9.64	0.92	11.80	25.590		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
0.65	8.85	0.85	10.84	25.754		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
0.64	8.40	0.80	10.29	25.918		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
0.64	8.23	0.79	10.08	26.082	17	0.95	15	9	0.46	0.54	0.58	4.6	13.2	0.14	N/A	3.73	1.08	13.04	0.141	N/A	N/A
0.64	8.40	0.80	10.28	26.246		0.95	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
0.63	8.54	0.82	10.46	26.410		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.63	9.55	0.91	11.69	26.574		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.63	9.90	0.95	12.13	26.739		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.63	8.46	0.81	10.36	26.903		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.63	7.60	0.73	9.30	27.067		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.63	7.71	0.74	9.44	27.231		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.63	8.11	0.78	9.93	27.395		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.63	8.13	0.78	9.96	27.559		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.62	7.17	0.69	8.78	27.723		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.62	7.11	0.68	8.71	27.887		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.62	6.78	0.65	8.31	28.051		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.62	6.50	0.62	7.96	28.215		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.62	6.21	0.59	7.61	28.379		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.62	6.36	0.61	7.78	28.543		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.62	6.47	0.62	7.93	28.707		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.62	6.89	0.66	8.44	28.871		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.62	6.61	0.63	8.09	29.035		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.61	6.21	0.59	7.60	29.199		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.61	6.51	0.62	7.97	29.363		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.61	8.60	0.82	10.54	29.527		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.61	6.57	0.63	8.04	29.691		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.61	8.78	0.84	10.75	29.855		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.61	9.58	0.92	11.73	30.019		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.61	7.08	0.68	8.67	30.183		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.61	6.48	0.62	7.93	30.347		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.61	6.10	0.58	7.47	30.511		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.60	5.93	0.57	7.27	30.675		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.60	5.86	0.56	7.17	30.840		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.56	5.28	0.51	6.46	31.004		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.56	5.91	0.57	7.24	31.168		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
0.56	7.75	0.74	9.49	31.332		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
0.57	21.40	2.05	26.21	31.496		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
0.57	23.42	2.24	28.68	31.660		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
0.59	30.32	2.90	37.13	31.824		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
0.58	26.62	2.55	32.59	31.988		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
0.58	26.84	2.57	32.86	32.152		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
0.56	22.14	2.12	27.11	32.316		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
0.54	13.87	1.33	16.99	32.480		1.00	-	-	-	-	-	-	-	-	-	3.73	1.08	-	0.000	-	-
0.54	8.75	0.84	10.72	32.644		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.54	6.19	0.59	7.58	32.808		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.54	5.91	0.57	7.24	32.972		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.54	6.20	0.59	7.59	33.136		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.54	6.36	0.61	7.78	33.300		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.54	6.70	0.64	8.20	33.464		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.54	6.86	0.66	8.40	33.628		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.53	6.55	0.63	8.01	33.792		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.53	6.69	0.64	8.19	33.956		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.53	6.17	0.59	7.56	34.120		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.53	6.87	0.66	8.42	34.284		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.53	7.20	0.69	8.82	34.448		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.53	6.99	0.67	8.57	34.612		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.53	7.56	0.72	9.26	34.776		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.53	7.48	0.72	9.16	34.941		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.51	11.19	1.07	13.71	35.105		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.51	16.72	1.60	20.47	35.269		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.51	12.87	1.23	15.76	35.433		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.50	8.67	0.83	10.62	35.597		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.50	6.56	0.63	8.04	35.761		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.50	6.16	0.59	7.55	35.925		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.50	6.37	0.61	7.80	36.089		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.50	6.99	0.67	8.56	36.253		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.50	6.27	0.60	7.68	36.417		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.49	6.23	0.60	7.63	36.581		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.49	6.03	0.58	7.38	36.745		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.49	9.37	0.90	11.47	36.909		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.49	6.48	0.62	7.93	37.073		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.49	5.69	0.55	6.97	37.237		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.48	5.52	0.53	6.76	37.401		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.48	5.85	0.56	7.17	37.565		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.48	5.95	0.57	7.29	37.729		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.48	6.09	0.58	7.46	37.893		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.48	6.28	0.60	7.69	38.057		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.48	6.36	0.61	7.78	38.221		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.47	5.97	0.57	7.31	38.385		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.47	5.67	0.54	6.94	38.549		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.47	5.85	0.56	7.17	38.713		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.47	5.85	0.56	7.16	38.877		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.47	5.87	0.56	7.19	39.042		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.47	6.11	0.58	7.48	39.206		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.47	6.53	0.62	7.99	39.370		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.47	6.19	0.59	7.58	39.534		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.47	12.40	1.19	15.19	39.698		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
0.47	11.52	1.10	14.11	39.862		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-

40.026	6936.01	20.7	0.747	20.5	30.1	13.03	3.61%	Fine Tailings	0.053	106.9	2.21	0.044	2.16	1
40.190	6935.85	20.7	0.634	20.5	28.6	12.41	3.06%	Fine Tailings	0.053	106.9	2.22	0.050	2.17	1
40.354	6935.69	20.7	0.720	20.5	26.8	11.59	3.48%	Fine Tailings	0.053	106.9	2.23	0.055	2.17	1
40.518	6935.52	15.0	0.602	14.7	50.2	21.76	4.02%	Fine Tailings	0.053	106.9	2.23	0.060	2.17	1
40.682	6935.36	13.1	0.409	12.7	60.9	26.39	3.13%	Fine Tailings	0.053	106.9	2.24	0.065	2.18	1
40.846	6935.19	13.1	0.370	12.7	71.3	30.89	2.82%	Fine Tailings	0.053	106.9	2.25	0.070	2.18	1
41.010	6935.03	13.8	0.383	13.3	79.0	34.25	2.78%	Fine Tailings	0.053	106.9	2.26	0.075	2.19	1
41.174	6934.87	13.5	0.420	13.0	81.1	35.14	3.11%	Fine Tailings	0.053	106.9	2.27	0.080	2.19	1
41.338	6934.70	13.5	0.417	12.9	81.7	35.40	3.10%	Fine Tailings	0.053	106.9	2.28	0.085	2.19	1
41.502	6934.54	13.1	0.315	12.6	80.2	34.75	2.41%	Fine Tailings	0.053	106.9	2.29	0.091	2.20	1
41.666	6934.37	13.1	0.247	12.6	80.3	34.78	1.88%	Fine Tailings	0.053	106.9	2.30	0.096	2.20	1
41.830	6934.21	13.8	0.279	13.3	84.1	36.42	2.02%	Fine Tailings	0.053	106.9	2.30	0.101	2.20	1
41.994	6934.05	14.1	0.381	13.6	90.1	39.04	2.69%	Fine Tailings	0.053	106.9	2.31	0.106	2.21	1
42.158	6933.88	14.4	0.449	13.8	94.1	40.77	3.11%	Fine Tailings	0.053	106.9	2.32	0.111	2.21	1
42.322	6933.72	15.6	0.532	15.0	97.1	42.08	3.40%	Fine Tailings	0.053	106.9	2.33	0.116	2.21	1
42.486	6933.55	17.9	0.500	17.3	84.3	36.52	2.80%	Fine Tailings	0.053	106.9	2.34	0.121	2.22	1
42.650	6933.39	15.3	0.515	14.9	74.9	32.47	3.36%	Fine Tailings	0.053	106.9	2.35	0.126	2.22	1
42.814	6933.23	15.2	0.477	14.7	78.7	34.10	3.15%	Fine Tailings	0.053	106.9	2.36	0.131	2.23	1
42.978	6933.06	15.3	0.468	14.8	80.3	34.81	3.06%	Fine Tailings	0.053	106.9	2.37	0.137	2.23	1
43.143	6932.90	15.0	0.419	14.5	82.5	35.75	2.80%	Fine Tailings	0.053	106.9	2.37	0.142	2.23	1
43.307	6932.73	15.3	0.417	14.8	87.5	37.93	2.72%	Fine Tailings	0.053	106.9	2.38	0.147	2.24	1
43.471	6932.57	16.5	0.398	15.9	92.2	39.96	2.41%	Fine Tailings	0.053	106.9	2.39	0.152	2.24	1
43.635	6932.41	16.1	0.465	15.5	95.5	41.38	2.89%	Fine Tailings	0.053	106.9	2.40	0.157	2.24	1
43.799	6932.24	18.1	0.444	17.4	111.2	48.17	2.45%	Fine Tailings	0.053	106.9	2.41	0.162	2.25	1
43.963	6932.08	19.0	0.520	18.3	117.4	50.86	2.73%	Fine Tailings	0.053	106.9	2.42	0.167	2.25	1
44.127	6931.91	20.2	0.560	19.4	124.0	53.73	2.78%	Fine Tailings	0.053	106.9	2.43	0.172	2.25	1
44.291	6931.75	25.6	0.692	24.7	134.5	58.30	2.71%	Fine Tailings	0.053	106.9	2.44	0.178	2.26	1
44.455	6931.59	27.8	1.020	27.3	71.6	31.03	3.67%	Fine Tailings	0.053	106.9	2.44	0.183	2.26	1
44.619	6931.42	36.0	1.122	35.6	53.2	23.04	3.12%	Coarse Alluvium	0.057	114.1	2.45	0.000	2.45	0
44.783	6931.26	27.3	1.106	27.0	39.9	17.29	4.06%	Coarse Alluvium	0.057	114.1	2.46	0.000	2.46	0
44.947	6931.09	22.2	0.929	21.9	40.7	17.65	4.19%	Coarse Alluvium	0.057	114.1	2.47	0.000	2.47	0
45.111	6930.93	21.9	0.815	21.6	49.3	21.35	3.72%	Coarse Alluvium	0.057	114.1	2.48	0.000	2.48	0
45.275	6930.76	22.5	0.843	22.2	50.9	22.07	3.75%	Coarse Alluvium	0.057	114.1	2.49	0.000	2.49	0
45.439	6930.60	23.1	0.996	22.8	51.8	22.45	4.30%	Coarse Alluvium	0.057	114.1	2.50	0.000	2.50	0
45.603	6930.44	26.7	1.087	26.3	54.9	23.77	4.08%	Coarse Alluvium	0.057	114.1	2.51	0.000	2.51	0
45.767	6930.27	28.6	1.134	28.3	52.8	22.86	3.96%	Coarse Alluvium	0.057	114.1	2.52	0.000	2.52	0
45.931	6930.11	27.1	1.214	26.8	47.3	20.48	4.48%	Coarse Alluvium	0.057	114.1	2.53	0.000	2.53	0
46.095	6929.94	30.2	1.531	29.9	49.5	21.45	5.07%	Coarse Alluvium	0.057	114.1	2.54	0.000	2.54	0
46.259	6929.78	30.9	1.733	30.6	42.2	18.30	5.62%	Coarse Alluvium	0.057	114.1	2.55	0.000	2.55	0
46.423	6929.62	33.6	1.621	33.4	33.7	14.58	4.82%	Coarse Alluvium	0.057	114.1	2.56	0.000	2.56	0
46.587	6929.45	29.4	1.438	29.1	39.2	16.98	4.90%	Coarse Alluvium	0.057	114.1	2.57	0.000	2.57	0
46.751	6929.29	40.0	1.422	39.6	52.2	22.61	3.56%	Coarse Alluvium	0.057	114.1	2.58	0.000	2.58	0
46.915	6929.12	57.2	1.642	56.9	40.4	17.51	2.87%	Coarse Alluvium	0.057	114.1	2.59	0.000	2.59	0
47.079	6928.96	62.4	2.131	62.2	32.4	14.05	3.41%	Coarse Alluvium	0.057	114.1	2.59	0.000	2.59	0
47.244	6928.80	52.1	2.149	52.0	28.2	12.22	4.12%	Coarse Alluvium	0.057	114.1	2.60	0.000	2.60	0
47.408	6928.63	51.7	2.070	51.6	27.9	12.08	4.00%	Coarse Alluvium	0.057	114.1	2.61	0.000	2.61	0
47.572	6928.47	56.0	1.792	55.8	29.9	12.94	3.20%	Coarse Alluvium	0.057	114.1	2.62	0.000	2.62	0
47.736	6928.30	39.6	1.655	39.5	25.1	10.86	4.18%	Coarse Alluvium	0.057	114.1	2.63	0.000	2.63	0
47.900	6928.14	26.1	1.478	26.0	22.1	9.56	5.65%	Coarse Alluvium	0.057	114.1	2.64	0.000	2.64	0
48.064	6927.98	23.9	1.204	23.8	21.3	9.21	5.04%	Coarse Alluvium	0.057	114.1	2.65	0.000	2.65	0
48.228	6927.81	21.1	1.026	21.0	21.4	9.27	4.86%	Coarse Alluvium	0.057	114.1	2.66	0.000	2.66	0
48.392	6927.65	21.3	0.929	21.2	21.8	9.46	4.36%	Coarse Alluvium	0.057	114.1	2.67	0.000	2.67	0
48.556	6927.48	15.5	0.698	15.4	20.2	8.74	4.49%	Coarse Alluvium	0.057	114.1	2.68	0.000	2.68	0
48.720	6927.32	14.1	0.535	14.0	19.4	8.42	3.80%	Coarse Alluvium	0.057	114.1	2.69	0.000	2.69	0
48.884	6927.16	15.1	0.474	15.0	19.6	8.48	3.14%	Coarse Alluvium	0.057	114.1	2.70	0.000	2.70	0
49.048	6926.99	18.7	0.603	18.6	20.5	8.89	3.22%	Coarse Alluvium	0.057	114.1	2.71	0.000	2.71	0
49.212	6926.83	19.1	0.732	18.9	20.7	8.97	3.84%	Coarse Alluvium	0.057	114.1	2.72	0.000	2.72	0
49.376	6926.66	21.5	0.901	21.4	20.3	8.81	4.20%	Coarse Alluvium	0.057	114.1	2.73	0.000	2.73	0
49.540	6926.50	20.7	0.896	20.6	19.8	8.56	4.33%	Coarse Alluvium	0.057	114.1	2.73	0.000	2.73	0
49.704	6926.34	21.3	0.999	21.2	19.9	8.62	4.69%	Coarse Alluvium	0.057	114.1	2.74	0.000	2.74	0
49.868	6926.17	21.9	0.987	21.7	20.1	8.71	4.52%	Coarse Alluvium	0.057	114.1	2.75	0.000	2.75	0
50.032	6926.01	24.9	1.093	24.7	19.8	8.58	4.40%	Coarse Alluvium	0.057	114.1	2.76	0.000	2.76	0
50.196	6925.84	29.3	1.131	29.2	19.3	8.36	3.86%	Coarse Alluvium	0.057	114.1	2.77	0.000	2.77	0
50.360	6925.68	28.4	1.061	28.3	18.3	7.91	3.73%	Coarse Alluvium	0.057	114.1	2.78	0.000	2.78	0
50.524	6925.52	24.9	0.932	24.8	17.3	7.48	3.74%	Coarse Alluvium	0.057	114.1	2.79	0.000	2.79	0
50.688	6925.35	18.7	0.792	18.6	16.3	7.08	4.25%	Coarse Alluvium	0.057	114.1	2.80	0.000	2.80	0
50.852	6925.19	16.3	0.711	16.3	15.7	6.81	4.35%	Coarse Alluvium	0.057	114.1	2.81	0.000	2.81	0
51.016	6925.02	22.7	0.636	22.6	16.4	7.10	2.81%	Coarse Alluvium	0.057	114.1	2.82	0.000	2.82	0
51.180	6924.86	32.8	0.634	32.7	16.9	7.34	1.93%	Coarse Alluvium	0.057	114.1	2.83	0.000	2.83	0
51.345	6924.70	41.1	0.665	41.0	16.7	7.24	1.62%	Coarse Alluvium	0.057	114.1	2.84	0.000	2.84	0
51.509	6924.53	41.8	0.943	41.7	17.0	7.38	2.26%	Coarse Alluvium	0.057	114.1	2.85	0.000	2.85	0
51.673	6924.37	55.4	1.092	55.3	17.4	7.52	1.97%	Coarse Alluvium	0.057	114.1	2.86	0.000	2.86	0
51.837	6924.20	60.7	1.308	60.6	17.4	7.54	2.15%	Coarse Alluvium	0.057	114.1	2.87	0.000	2.87	0
52.001	6924.04	48.7	1.307	48.6	16.9	7.32	2.68%	Coarse Alluvium	0.057	114.1	2.88	0.000	2.88	0
52.165	6923.88	35.0	1.231	34.9	16.5	7.16	3.51%	Coarse Alluvium	0.057	114.1	2.88	0.000	2.88	0
52.329	6923.71	25.8	1.019	25.7	18.4	7.97	3.95%	Coarse Alluvium	0.057	114.1	2.89	0.000	2.89	0
52.493	6923.55	27.7	1.001	27.5	21.5	9.31	3.62%	Coarse Alluvium	0.057	114.1	2.90	0.000	2.90	0
52.657	6923.38	60.6	1.317	60.5	25.5	11.06	2.17%	Coarse Alluvium	0.057	114.1	2.91	0.000	2.91	0
52.821	6923.22	49.3	1.528	49.1	22.5	9.76	3.10%	Coarse Alluvium	0.057	114.1	2.92	0.000	2.92	0
52.985	6923.06	30.4	1.330	30.3	21.5	9.31	4.37%	Coarse Alluvium	0.057	114.1	2.93	0.000	2.93	0
53.149	6922.89	22.3	0.950	22.1	23.0	9.96	4.27%	Coarse Alluvium	0.057	114.1	2.94	0.000	2.94	0
53.313	6922.73	20.4	0.525	20.3	25.7	11.15	2.57%	Coarse Alluvium	0.057	114.1	2.95	0.000	2.95	0
53.477	6922.56	18.8	0.445	18.6	27.4	11.88	2.37%	Coarse Alluvium	0.057	114.1	2.96	0.000	2.96	0
53.641	6922.40	19.9	0.592	19.7	29.5	12.77	2.98%	Coarse Alluvium	0.057	114.1	2.97	0.000	2.97	0
53.805	6922.23	19.2	0.692	19.1	29.6	12.83	3.60%	Coarse Alluvium	0.057	114.1	2.98	0.000	2.98	0
53.969	6922.07	25.0	0.992	24.8	30.4	13.16	3.97%	Coarse Alluvium	0.057	114.1	2.99	0.000	2.99	0
54.133	6921.91	55.5	0.983	55.3	32.3	13.99	1.77%	Coarse Alluvium	0.057	114.1	3.00	0.000	3.00	0
54.297	6921.74	67.1	0.985	66.9	28.4	12.32	1.47%	Coarse Alluvium	0.057	114.1	3.01	0.000	3.01	0
54.461	6921.58	69.8	0.720	69.6	25.3	10.94	1.03%	Coarse Alluvium	0.057	114.1	3.02	0.000	3.02	0
54.625	6921.41	62.1	0.726	62.0	22.7	9.82	1.17%	Coarse Alluvium	0.057	114.1	3.02	0.000	3.02	0
54.789	6921.25	52.4	0.899	52.3	5.0	2.18	1.72%	Coarse Alluvium	0.057	114.1	3.03	0.000	3.03	0
54.953	6921.09	48.3	0.966	48.3	5.0	2.15	2.00%	Coarse Alluvium	0.057	114.1	3.04	0.000	3.04	0
55.117	6920.92	67.2	1.039	67.1	5.4	2.36	1.55%	Coarse Alluvium	0.057	114.1	3.05	0.000	3.05	0
55.281	6920.76	84.1	0.932	84.1	4.3	1.85	1.11%	Coarse Alluvium	0.057	114.1	3.06	0.000	3.06	0
55.446	6920.59	83.1	0.812	83.1	4.3	1.85	0.98%	Coarse Alluvium	0.057	114.1	3.07	0.000	3.07	0
55.610	6920.43	75.9	0.925	75.9	4.4	1.91	1.22%	Coarse Alluvium	0.057	114.1	3.08	0.000	3.08	0
55.774	6920.27	62.9	0.964	62.9	4.0	1.73	1.53%	Coarse Alluvium	0.057	114.1	3.09	0.000	3.09	0
55.938	6920.10	59.2	0.890	59.2	4.0	1.73	1.50%	Coarse Alluvium	0.057	114.1	3.10	0.000	3.10	0
56.102	6919.94	55.0	0.960	54.9	4.1	1.77	1.75%	Coarse Alluvium	0.057	114.1	3.11	0.000	3.11	0
56.266	6919.77	49.2	1.187	49.2	3.9	1.71	2.41%	Coarse Alluvium	0.057	114.1	3.12	0.000	3.12	0
56.430	6919.61	42.4	1.546	42.4	3.9	1.71	3.64%	Coarse Alluvium	0.057	114.1	3.13	0.000	3.13	0
56.594	6919.45	42.7	1.380	42.7	4.0	1.73	3.23%	Coarse Alluvium	0.057	114.1	3.14	0.000	3.14	0
56.758	6919.28	65.0	1.396	65.0	4.0	1.75	2.15%	Coarse Alluvium	0.057	114.1	3.15	0.000	3.15	0
56.922	6919.12	104.5	1.907	104.5	4.8	2.08	1.82%	Coarse Alluvium	0.057	114.1	3.16	0.000	3.16	0
57.086	6918.95	101.6	2.343	101.6	4.4	1.89	2.31%	Coarse Alluvium	0.057	114.1	3.17	0.000	3.17	0
57.250	6918.79	97.9	2.432	97.9	4.6	1.97	2.48%	Coarse Alluvium	0.057	114.1	3.17	0.000	3.17	0
57.414	6918.63	83.6	2.203	83.6	4.3	1.87	2.64%	Coarse Alluvium	0.057	114.1	3.18	0.000	3.18	0
57.578	6918.46	62.2	1.815	62.2	3.7	1.59	2.92%	Coarse Alluvium	0.057	114.1	3.19	0.000	3.19	0
57.742	6918.30	56.2	1.789	56.2	3.9	1.67	3.18%	Coarse Alluvium	0.057	114.1	3.20	0.000	3.20	0
57.906	6918.13	72.6	1.932	72.6	4.2	1.81	2.66%	Coarse Alluvium	0.057	114.1	3.21	0.000	3.21	0
58.070	6917.97	58.2	2.197	58.1	4.3	1.85	3.78%	Coarse Alluvium	0.057	114.1	3.22	0.000	3.22	0
58.234	6917.81	45.7	1.766	45.6	4.1	1.77	3.87%	Coarse Alluvium	0.057	114.1	3.23	0.000	3.23	0
58.398	6917.64	44.7	1.643	44.7	4.9	2.14	3.67%	Coarse Alluvium	0.057	114.1	3.24	0.000	3.24	0
58.562	6917.48	121.5	2.456	121.5	6.8	2.95	2.02%	Coarse Alluvium	0.057	114.1	3.25	0.000	3.25	0
58.726	6917.31	252.7	2.868	252.7	7.4	3.21	1.13%	Coarse Alluvium	0.057	114.1	3.26	0.000	3.26	0
58.890	6917.15	290.8	4.380	290.8	8.2	3.54	1.51%	Coarse Alluvium	0.057	114.1	3.27	0.000	3.27	0
59.054	6916.99	233.5	4.940	233.5	8.2	3.54	2.12%	Coarse Alluvium	0.057	114.1	3.28	0.000	3.28	0
59.218	6916.82	179.0	4.573	178.9	7.9	3.44	2.56%	Coarse Alluvium	0.057	114.1	3.29	0.000	3.29	0
59.382	6916.66	125.7	3.556	125.7	7.6	3.28	2.83%	Coarse Alluvium	0.057	114.1	3.30	0.000	3.30	0
59.547	6916.49	86.3	3.115	86.3	7.2	3.13	3.61%	Coarse Alluvium	0.057	114.1	3.31	0.000	3.31	0
59.711	6916.33	83.3	2.586	83.3	7.5	3.23	3.10%	Coarse Alluvium	0.057	114.1	3.31	0.000	3.31	0
59.875	6916.17	121.5	1.784	121.5	8.1	3.52	1.47%	Coarse Alluvium	0.057	114.1	3.32	0.000	3.32	0
60.039	6916.00	134.5	2.632	134.4	8.2	3.54	1.96%	Coarse Alluvium	0.057	114.1	3.33	0.000	3.33	0
60.203	6915.84	119.0	3.618	119.0	7.9	3.44	3.04%	Coarse Alluvium	0.057	114.1	3.34	0.000	3.34	0
60.367	6915.67	101.5	4.702	101.5	8.0	3.48	4.63%	Coarse Alluvium	0.057	114.1	3.35	0.000	3.35	0

UNC-NECR WASTE REPOSITORY LIQUEFACTION ANALYSIS - CPT-10

Data File: 13-52118_RP10-BSC-CPT
Location: UNC-NECR 2013 Mill Site PDS — Cells Requiring User Input/Manipulation
http://projects.mwhglobal.com/.../13-52118_RP10-BSC-CPT.XLS

Legend: Erosion Protection; Cover Soil; Mine Spoils; Radon Barrier; General Fill; Coarse Tailings; Coarse/Fine Tailings; Fine Tailings; Coarse Alluvium; Fine Alluvium

Idriss and Boulanger (2008)	
Max. Horiz. Acceleration, Amax/g:	0.28
Earthquake Moment Magnitude, M:	5.5
Magnitude Scaling Factor, MSF:	1.69
Youd, et al (2001)	
Max. Horiz. Acceleration, Amax/g:	0.28
Earthquake Moment Magnitude, M:	6.3
Magnitude Scaling Factor, MSF:	1.59

6883.40	Water surface elevation during CPT investigation (ft amsl)
6883.40	Water surface elevation at t_0 (ft amsl)
6883.40	Water surface elevation at t_1 (ft amsl)
1.44	Scaling Factor for stress ration, r_m
0.47	Volumetric Strain Ratio for Site-Specific Design Earthquake
11.02	Equiv. Number of Uniform Strain Cycles, N

6973.60	Ground Surface Elevation at time of CPT (ft amsl)
6994.60	Ground Surface Elevation Immediately after Placement of Final Cover (ft amsl)
1.50	Thickness of Erosion Protection Layer (rock mulch/topsoils) Immediately after Placement
2.00	Thickness of Water Storage/Rooting Zone (Cover Soil; ft)
1.18	Additional Stress due to Proposed Repository Construction, $\Delta\sigma_{repos}$ (psf)
6929.06	Elevation of bottom of tailings (ft amsl)

2013 CPT Data from ConeTec / CPT Data Interpretations / Conditions at t_1

Depth at time of CPT (ft)	Elevation (ft amsl)	qt TSF	fs TSF	qc TSF	Pw (u2) (ft)	Pw (u2) PSI	fs/qt (%)	Material Type (per drilling log from coupled borehole)	Unit Weight (tcf)	Unit Weight (pcf)	Total Stress at time of CPT (tsf)	Equil Pore Pressure at time of (tsf)	Effective Stress at time of CPT (tsf)	Saturated at time of CPT 1=Yes 0=No	CN	qc1 TSF	qc1 MPa	qc1N	Normalized Cone Penetration Resistance, Q_t	Normalized Friction Ratio, F_r (%)	Type Index, I_c	FC %	Total Stress at t_1 (tsf)	Equil Pore Pressure at t_1, u_1 (tsf)	Effective Stress at t_1 (tsf)	Will soil behave as saturated during 1=Yes 0=No	Is soil susceptible or mod susceptible to 1=Yes 0=No
0.164	6973.44	3.5	0.010	3.3	35.8	15.52	0.29%	Radon Barrier	0.060	120.9	0.01	0.000	0.01	0	1.70	5.525	0.53	7.23	349	0.29%	1.1	59%	1.19	0.000	1.19	0	0
0.328	6973.27	4.6	0.108	4.5	8.5	3.66	2.36%	Radon Barrier	0.060	120.9	0.02	0.000	0.02	0	1.70	7.701	0.74	9.54	230	2.37%	1.9	59%	1.20	0.000	1.20	0	0
0.492	6973.11	11.3	0.106	11.3	5.3	2.28	0.94%	Radon Barrier	0.060	120.9	0.03	0.000	0.03	0	1.70	19.176	1.84	23.55	379	0.94%	1.5	59%	1.21	0.000	1.21	0	0
0.656	6972.94	30.1	0.223	30.0	9.0	3.90	0.74%	Radon Barrier	0.060	120.9	0.04	0.000	0.04	0	1.70	51.034	4.89	62.61	757	0.74%	1.2	59%	1.22	0.000	1.22	0	0
0.820	6972.78	48.2	0.257	48.2	1.7	0.73	0.53%	Radon Barrier	0.060	120.9	0.05	0.000	0.05	0	1.70	81.923	7.85	100.34	971	0.53%	1.1	59%	1.23	0.000	1.23	0	0
0.984	6972.62	75.1	0.280	75.0	8.6	3.74	0.37%	Radon Barrier	0.060	120.9	0.06	0.000	0.06	0	1.70	127.534	12.22	156.28	1261	0.37%	0.9	59%	1.24	0.000	1.24	0	0
1.148	6972.45	70.6	0.336	70.6	2.4	1.02	0.48%	Radon Barrier	0.060	120.9	0.07	0.000	0.07	0	1.70	120.054	11.50	147.04	1017	0.48%	1.0	59%	1.25	0.000	1.25	0	0
1.312	6972.29	66.8	0.393	66.8	3.9	1.69	0.59%	Radon Barrier	0.060	120.9	0.08	0.000	0.08	0	1.70	113.560	10.88	139.11	842	0.59%	1.1	59%	1.26	0.000	1.26	0	0
1.476	6972.12	68.0	0.456	68.0	1.7	0.75	0.67%	Radon Barrier	0.060	120.9	0.09	0.000	0.09	0	1.70	115.617	11.07	141.60	761	0.67%	1.2	59%	1.27	0.000	1.27	0	0
1.640	6971.96	68.8	0.760	68.8	0.9	0.41	1.11%	Radon Barrier	0.060	120.9	0.10	0.000	0.10	0	1.70	116.909	11.20	143.17	693	1.11%	1.4	59%	1.28	0.000	1.28	0	0
1.804	6971.80	75.0	1.185	75.0	2.1	0.89	1.58%	Radon Barrier	0.060	120.9	0.11	0.000	0.11	0	1.70	127.534	12.22	156.19	687	1.58%	1.6	59%	1.29	0.000	1.29	0	0
1.968	6971.63	105.1	1.817	105.1	7.3	3.17	1.73%	Radon Barrier	0.060	120.9	0.12	0.000	0.12	0	1.70	178.670	17.11	218.88	883	1.73%	1.5	59%	1.30	0.000	1.30	0	0
2.133	6971.47	132.3	3.007	132.2	11.7	5.08	2.27%	General Fill	0.057	113.8	0.13	0.000	0.13	0	1.63	215.409	20.63	263.92	1030	2.28%	1.6	48%	1.31	0.000	1.31	0	0
2.297	6971.30	159.7	4.044	159.6	17.5	7.57	2.53%	General Fill	0.057	113.8	0.14	0.000	0.14	0	1.60	255.301	24.45	312.83	1159	2.53%	1.7	48%	1.32	0.000	1.32	0	0
2.461	6971.14	171.5	5.127	171.4	23.0	9.95	2.99%	General Fill	0.057	113.8	0.15	0.000	0.15	0	1.57	269.456	25.81	330.23	1166	2.99%	1.7	48%	1.33	0.000	1.33	0	0
2.625	6970.98	168.1	5.694	168.1	11.6	5.02	3.39%	General Fill	0.057	113.8	0.16	0.000	0.16	0	1.55	259.979	24.90	318.48	1075	3.39%	1.8	48%	1.34	0.000	1.34	0	0
2.789	6970.81	152.4	5.098	152.3	5.4	2.36	3.35%	General Fill	0.057	113.8	0.17	0.000	0.17	0	1.52	232.053	22.23	284.21	919	3.35%	1.8	48%	1.35	0.000	1.35	0	0
2.953	6970.65	136.3	4.745	136.3	2.2	0.94	3.48%	General Fill	0.057	113.8	0.17	0.000	0.17	0	1.51	205.455	19.68	251.61	778	3.49%	1.9	48%	1.36	0.000	1.36	0	0
3.117	6970.48	116.0	4.208	115.9	1.7	0.73	3.63%	General Fill	0.057	113.8	0.18	0.000	0.18	0	1.57	181.489	17.38	222.26	628	3.63%	1.9	48%	1.37	0.000	1.37	0	0
3.281	6970.32	100.2	3.982	100.1	22.8	9.86	3.97%	General Fill	0.057	113.8	0.19	0.000	0.19	0	1.61	161.428	15.46	197.95	517	3.98%	2.0	48%	1.38	0.000	1.38	0	0
3.445	6970.16	91.8	3.420	91.7	5.0	2.15	3.73%	General Fill	0.057	113.8	0.20	0.000	0.20	0	1.63	149.772	14.35	183.46	451	3.74%	2.0	48%	1.39	0.000	1.39	0	0
3.609	6969.99	81.4	3.048	81.4	5.0	2.18	3.74%	General Fill	0.057	113.8	0.21	0.000	0.21	0	1.66	135.445	12.97	165.92	383	3.75%	2.0	48%	1.40	0.000	1.40	0	0
3.773	6969.83	82.5	2.961	82.4	20.8	9.01	3.59%	General Fill	0.057	113.8	0.22	0.000	0.22	0	1.64	135.018	12.93	165.59	371	3.60%	2.0	48%	1.41	0.000	1.41	0	0
3.937	6969.66	88.9	2.980	88.9	6.2	2.70	3.35%	General Fill	0.057	113.8	0.23	0.000	0.23	0	1.59	141.287	13.53	173.08	384	3.36%	2.0	48%	1.42	0.000	1.42	0	0
4.101	6969.50	94.1	3.569	94.1	6.1	2.64	3.79%	General Fill	0.057	113.8	0.24	0.000	0.24	0	1.55	145.946	13.98	178.78	391	3.80%	2.0	48%	1.42	0.000	1.42	0	0
4.265	6969.33	110.6	4.227	110.6	8.8	3.80	3.82%	General Fill	0.057	113.8	0.25	0.000	0.25	0	1.48	163.375	15.65	200.15	442	3.83%	2.0	48%	1.43	0.000	1.43	0	0
4.429	6969.17	119.7	4.319	119.6	5.1	2.22	3.61%	General Fill	0.057	113.8	0.26	0.000	0.26	0	1.44	171.916	16.47	210.57	461	3.62%	2.0	48%	1.44	0.000	1.44	0	0
4.593	6969.01	108.1	3.869	108.0	4.5	1.93	3.58%	General Fill	0.057	113.8	0.27	0.000	0.27	0	1.46	157.551	15.09	192.97	402	3.59%	2.0	48%	1.45	0.000	1.45	0	0
4.757	6968.84	88.7	3.214	88.7	1.7	0.75	3.62%	General Fill	0.057	113.8	0.28	0.000	0.28	0	1.51	133.774	12.81	163.83	318	3.64%	2.0	48%	1.46	0.000	1.46	0	0
4.921	6968.68	73.0	2.450	72.9	4.8	2.09	3.36%	General Fill	0.057	113.8	0.29	0.000	0.29	0	1.55	113.383	10.86	138.90	253	3.37%	2.0	48%	1.47	0.000	1.47	0	0
5.085	6968.51	67.2	2.274	67.2	1.4	0.61	3.38%	General Fill	0.057	113.8	0.30	0.000	0.30	0	1.56	105.002	10.06	128.59	226	3.40%	2.1	48%	1.48	0.000	1.48	0	0
5.249	6968.35	70.1	2.479	70.1	1.2	0.53	3.54%	General Fill	0.057	113.8	0.31	0.000	0.31	0	1.53	107.503	10.30	131.65	228	3.55%	2.1	48%	1.49	0.000	1.49	0	0
5.413	6968.19	79.2	2.592	79.2	2.5	1.10	3.27%	General Fill	0.057	113.8	0.31	0.000	0.31	0	1.48	117.484	11.25	143.89	251	3.28%	2.0	48%	1.50	0.000	1.50	0	0
5.577	6968.02	117.1	2.461	117.1	6.0	2.58	2.10%	General Fill	0.057	113.8	0.32	0.000	0.32	0	1.36	159.623	15.29	195.52	360	2.11%	1.8	48%	1.51	0.000	1.51	0	0
5.741	6967.86	136.7	2.097	136.7	4.2	1.83	1.53%	General Fill	0.057	113.8	0.33	0.000	0.33	0	1.31	179.486	17.19	219.83	409	1.54%	1.6	48%	1.52	0.000	1.52	0	0
5.905	6967.69	145.9	1.683	145.9	5.5	2.38	1.15%	General Fill	0.057	113.8	0.34	0.000	0.34	0	1.29	187.869	18.00	230.10	424	1.16%	1.5	48%	1.53	0.000	1.53	0	0
6.069	6967.53	149.2	1.876	149.2	5.4	2.34	1.26%	General Fill	0.057	113.8	0.35	0.000	0.35	0	1.27	190.057	18.20	232.78	422	1.26%	1.6	48%	1.54	0.000	1.54	0	0
6.234	6967.37	147.6	1.838	147.6	4.2	1.83	1.25%	General Fill	0.057	113.8	0.36	0.000	0.36	0	1.27	187.238	17.93	229.32	407	1.25%	1.6	48%	1.55	0.000	1.55	0	0
6.398	6967.20	145.8	2.024	145.8	3.0	1.30	1.39%	General Fill	0.057	113.8	0.37	0.000	0.37	0	1.26	184.313	17.65	225.72	392	1.39%	1.6	48%	1.56	0.000	1.56	0	0
6.562	6967.04	139.7	2.297	139.7	2.9	1.26	1.64%	General Fill	0.057	113.8	0.38	0.000	0.38	0	1.27	176.746	16.93	216.46	366	1.65%	1.7	48%	1.56	0.000	1.56	0	0
6.726	6966.87	120.4	3.073	120.4	2.8	1.22	2.55%	General Fill	0.057	113.8	0.39	0.000	0.39	0	1.29	155.189	14.86	190.06	308	2.56%	1.9	48%	1.57	0.000	1.57	0	0
6.890	6966.71	92.0	3.381	92.0	3.3	1.42	3.68%	Coarse Tailings	0.054	108.5	0.40	0.000	0.40	0	1.33	122.774	11.76	150.37	230	3.69%	2.1	21%	1.58	0.000	1.58	0	0
7.054	6966.55	74.6	2.934	74.6	7.3	3.15	3.93%	Coarse Tailings	0.054	108.5	0.41	0.000	0.41	0	1.37	101.803	9.75	124.74	182	3.95%	2.2	21%	1.59	0.000	1.59	0	0
7.218	6966.38	196.1	3.150	195.9	28.4	12.30	1.61%	Coarse Tailings	0.054	108.5	0.42	0.000	0.42	0	1.19	234.044	22.42	286.85	470	1.61%	1.6	21%	1.60	0.000	1.60	0	0
7.382	6966.22	197.9	3.377	197.8	12.8	5.53	1.71%	Coarse Tailings	0.054	108.5	0.43	0.000	0.43	0	1.19	234.939	22.50	287.80	464	1.71%	1.7	21%	1.61	0.000	1.61	0	0
7.546	6966.05	115.4	2.830	115.4	0.7	0.30	2.45%	Coarse Tailings	0.054	108.5	0.43	0.000	0.43	0	1.26	144.982	13.89	177.54	265	2.46%	1.9	21%	1.62	0.000	1.62	0	0
7.710	6965.89	74.5	3.389	74.5	0.1	0.06	4.55%	Coarse Tailings	0.054	108.5	0.44	0.000	0.44	0	1.32	98.387	9.42	120.48	167	4.58%	2.3	21%	1.63	0.000	1.63	0	0
7.874	6965.73	70.5	3.113	70.5	4.7	2.03	4.41%	Coarse Tailings	0.054	108.5	0.45	0.000	0.45	0	1.32	93.019	8.91	113.95	155	4.44%	2.3	21%	1.64	0.000	1.64	0	0
8.038	6965.56	78.3	3.495	78.0	46.7	20.25	4.46%	Coarse Tailings	0.054	108.5	0.46	0.000	0.46	0	1.29	100.870	9.66	123.98	169	4.49%	2.2	21%	1.65	0.000	1.65	0	0
8.202	6965.40	192.2	4.149	191.3	155.3	67.31	2.16%	Coarse Tailings	0.054	108.5	0.47	0.000	0.47	0	1.16	221.330	21.20	272.39	408	2.16%	1.8	21%	1.65	0.000	1.65	0	0
8.366	6965.23	278.0	3.670	277.8	25.1	10.88	1.32%	Coarse Tailings	0.054	108.5	0.48	0.000	0.48	0	1.15	319.889	30.64	391.93	580	1.32%	1.5	21%	1.66	0.000	1.66	0	0
8.530	6965.07	312.7	4.080	312.7	6.6	2.87	1.30%	Coarse Tailings	0.054	108.5	0.49	0.000	0.49	0	1.15	358.281	34.32	438.78	640	1.31%	1.5	21%	1.67	0.000	1.67	0	0
8.694	6964.91	305.6	3.655	305.5	16.0	6.93	1.20%	Coarse Tailings	0.054	108.5	0.50	0.000	0.50	0	1.14	348.364	33.37	426.72	615	1.20%	1.5	21%	1.68	0.000	1.68	0	0
8.858	6964.74	279.3	3.841	279.2	3.2	1.40	1.38%	Coarse Tailings	0.054	108.5	0.51	0.000	0.51	0	1.14	316.930	30.36	388.11	552	1.38%	1.5	21%	1.69	0.000	1.69	0	0
9.022	6964.58	219.5	3.165	219.5	0.0	0.00	1.44%	Coarse Tailings	0.054	108.5	0.51	0.000	0.51	0	1.13	247.934	23.75	303.60	426	1.45%	1.6	21%	1.70	0.000	1.70	0	0
9.186	6964.41	163.2	3.657	163.2	-0.9	-0.41	2.24%	Coarse Tailings	0.054	108.5	0.52	0.000	0.52	0	1.14	186.023	17.82	227.78	311	2.25%	1.9	21%	1.71	0.000	1.71	0	0
9.350	6964.25	138.1	3.792	138.1	7.2	3.13	2.75%	Coarse Tailings	0.054	108.5	0.53	0.000	0.53	0	1.15	159.421	15.27	195.28	259	2.76%	2.0	21%	1.72	0.000	1.72	0	0
9.514	6964.09	119.6	3.094	119.5	21.7	9.42	2.59%	Coarse Tailings	0.054	108.5	0.54	0.000	0.54	0	1.17	139.236	13.34	170.69	220	2.60%	2.0	21%	1.73	0.000	1.73	0	0
9.678	6963.92	93.6	1.788	93.6	2.6	1.12	1.91%	Coarse Tailings	0.054	108.5	0.55	0.000	0.55	0	1.18	110.819	10.61	135.72	169	1.92%	2.0	21%	1.73	0.000	1.73	0	0
9.842	6963.76	75.5	0.790	75.5	0.4	0.16	1.05%	Coarse Tailings	0.054	108.5	0.56	0.000	0.56	0	1.20	90.459	8.66	110.77	134	1.05%	1.8	21%	1.74	0.000	1.74	0	0
10.006	6963.59	64.4	0.843	64.4	1.4	0.59	1.31%	Coarse Tailings	0.054	108.5	0.57	0.000	0.57	0	1.20	77.484	7.42	94.89	112	1.32%	2.0	21%	1.75	0.000	1.75	0	0
10.170	6963.43	57.8	0.915	57.8	2.6	1.12	1.58%	Coarse Tailings	0.054	108.5	0.58	0.000	0.58	0	1.20	69.528	6.66	85.16	99	1.60%	2.0	21%	1.76	0.000	1.76	0	0
10.335	6963.27	55.1	0.973	55.1	0.5	0.23	1.76%	Coarse Tailings	0.054	108.5	0.59	0.000	0.59	0	1.20	66.072	6.33	80.91	93	1.78%	2.1	21%	1.77	0.000	1.77	0	0
10.499	6963.10	51.6	0.881	51.6	-0.1	-0.02	1.71%	Coarse Tailings	0.054	108.5	0.59	0.000	0.59	0	1.19	61.653	5.91	75.49	86	1.73%	2.1	21%	1.78	0.000	1.78	0	0
10.663	6962.94	49.0	0.661	49.0	0.4	0.18	1.35%	Coarse Tailings	0.054	108.5	0.60	0.000	0.60	0	1.19	58.178	5.57	71.24	80	1.37%	2.1	21%	1.79	0.000	1.79	0	0
10.827	6962.77	50.0	0.437	50.0	-1.6	-0.67	0.87%	Coarse Tailings	0.054	108.5	0.61	0.000	0.61	0	1.18	58.924	5.64	72.14	81	0.88%	2.0	21%	1.80	0.000	1.80	0	0
10.991	6962.61	52.0	0.400	52.0	0.8	0.33	0.77%	Coarse Tailings	0.054	108.5	0.62	0.000	0.62	0	1.17	60.657	5.81	74.28	83	0.78%	1.9	21%	1.81	0.000	1.81	0	0
11.155	6962.45	56.5	0.416	56.5	-1.3	-0.55	0.74%	Coarse Tailings	0.054	108.5	0.63	0.000	0.63	0	1.15	65.154	6.24	79.77	89	0.74%	1.9	21%	1.81	0.000	1.81	0	0
11.319	6962.28	66.0	0.471	66.0	-0.7	-0.29	0.71%	Coarse Tailings	0.054	108.5	0.64	0.000	0.64	0	1.14	74.969	7.18	91.79	102	0.72%	1.8	21%	1.82	0.000	1.82	0	0
11.483	6962.12	84.8	0.502	84.8	0.6	0.26	0.59%	Coarse Tailings	0.054	108.5	0.65	0.000	0.65	0	1.11	94.424	9.04	115.63	130	0.60%	1.7	21%	1.83	0.000	1.83	0	0
11.647	6961.95	91.2	0.499	91.2	1.4	0.59	0.55%	Coarse Tailings	0.054	108.5	0.66	0.000	0.66	0	1.10	100.629	9.64	123.23	138	0.55%	1.6	21%	1.84	0.000	1.84	0	0
11.811	6961.79	88.1	0.486	88.1	-0.3	-0.12	0.55%	Coarse Tailings	0.054	108.5	0.67	0.000	0.67	0	1.10	96.770	9.27	118.49	131	0.56%	1.7	21%	1.85	0.000	1.85	0	0
11.975	6961.63	77.7	0.504	77.7	-1.0	-0.43	0.65%	Coarse Tailings	0.054	108.5	0.67	0.000	0.67	0	1.10	85.314	8.17	104.46	114	0.65%	1.8	21%	1.86	0.000	1.86	0	0
12.139	6961.46	69.6	0.473	69.6	-0.9	-0.41	0.68%	Coarse Tailings	0.054	108.5	0.68	0.000	0.68	0	1.10	76.269	7.31	93.38	101	0.69%	1.8	21%	1.87	0.000	1.87	0	0
12.303	6961.30	60.0	0.435	60.0	-1.2	-0.51	0.72%	Coarse Tailings	0.054	108.5	0.69	0.000	0.69	0	1.09	65.702	6.29	80.44	86	0.73%	1.9	21%	1.88	0.000	1.88	0	0
12.467	6961.13	54.6	0.370	54.6	-0.8	-0.36	0.68%	Coarse Tailings	0.054	108.5	0.70	0.000	0.70	0	1.09	59.541	5.70	72.90	77	0.69%	1.9	21%	1.89	0.000	1.89	0	0
12.631	6960.97	50.6	0.332	50.6	-0.9	-0.39	0.66%	Coarse Tailings	0.054	108.5	0.71	0.000	0.71	0	1.08	54.903	5.26	67.22	70	0.67%	1.9	21%	1.89	0.000	1.89	0	0
12.795	6960.80	48.2	0.317	48.3	-0.9	-0.39	0.66%	Coarse Tailings	0.054	108.5	0.72	0.000	0.72	0	1.08	52.036	4.98	63.71	66	0.67%	2.0	21%	1.90	0.000	1.90	0	0
12.959	6960.64	47.5	0.298	47.5	-0.9	-0.41	0.63%	Coarse Tailings	0.054	108.5	0.73	0.000	0.73	0	1.07	50.860	4.87	62.27	64	0.64%	2.0	21%	1.91	0.000	1.91	0	0
13.123	6960.48	46.3	0.361	46.3	-1.0	-0.43	0.78%	Coarse Tailings	0.054	108.5	0.74	0.000	0.74	0	1.06	49.310	4.72	60.37	62	0.79%	2.0	21%	1.92	0.000	1.92	0	0
13.287	6960.31	45.1	0.318	45.1	-0.4	-0.16	0.70%	Coarse Tailings	0.054	108.5	0.75	0.000	0.75	0	1.06	47.704	4.57	58.41	60	0.72%	2.0	21%	1.93	0.000	1.93	0	0
13.451	6960.15	44.2	0.310	44.2	0.2	0.08	0.70%	Coarse Tailings	0.054	108.5	0.75	0.000	0.75	0	1.05	46.435	4.45	56.86	58	0.71%	2.0	21%	1.94	0.000	1.94	0	0
13.615	6959.98	42.6	0.299	42.6	-0.3	-0.12	0.70%	Coarse Tailings	0.054	108.5	0.76	0.000	0.76	0	1.04	44.469	4.26	54.45	55	0.71%	2.0	21%	1.95	0.000	1.95	0	0
13.779	6959.82	37.7	0.382	37.7	-1.1	-0.49	1.01%	Coarse Tailings	0.054	108.5	0.77	0.000	0.77	0	1.04	39.117	3.75	47.89	48	1.03%	2.2	21%	1.96	0.000	1.96	0	0
13.943	6959.66	34.4	0.553	34.4	0.5	0.23	1.61%	Coarse Tailings	0.054	108.5	0.78	0.000	0.78	0	1.03	35.450	3.40	43.41	43	1.64%	2.3	21%	1.97	0.000	1.97	0	0
14.107	6959.49	34.0	0.484	34.0	0.5	0.23	1.42%	Coarse Tailings	0.054	108.5	0.79	0.000	0.79	0	1.02	34.729	3.33	42.53	42	1.46%	2.3	21%	1.97	0.000	1.97	0	0
14.271	6959.33	34.0	0.409	34.0	-0.2	-0.10	1.20%	Coarse Tailings	0.054	108.5	0.80	0.000	0.80	0	1.01	34.471	3.30	42.21	42	1.23%	2.3	21%	1.98	0.000	1.98	0	0
14.436	6959.16	37.3	0.267	37.3	0.1	0.06	0.72%	Coarse Tailings	0.054	108.5	0.81	0.000	0.81	0	1.01	37.554	3.60	45.99	45	0.73%	2.1	21%	1.99	0.000	1.99	0	0
14.600	6959.00	40.5	0.207	40.5	0.4	0.16	0.51%	Coarse Tailings	0.054	108.5	0.82	0.000	0.82	0	1.00	40.536	3.88	49.64	49	0.52%	2.0	21%	2.00	0.000	2.00	0	0
14.764	6958.84	42.1	0.212	42.1	0.2	0.08	0.50%	Coarse Tailings	0.054	108.5	0.83	0.000	0.83	0	0.99	41.778	4.00	51.16	50	0.51%	2.0	21%	2.01	0.000	2.01	0	0
14.928	6958.67	44.0	0.175	44.0	-0.1	-0.04	0.40%	Coarse Tailings	0.054	108.5	0.83	0.000	0.83	0	0.99	43.385	4.16	53.12	52	0.41%	1.9	21%	2.02	0.000	2.02	0	0
15.092	6958.51	48.6	0.191	48.6	0.3	0.14	0.39%	Coarse Tailings	0.054	108.5	0.84	0.000	0.84	0	0.98	47.622	4.56	58.32	57	0.40%	1.9	21%	2.03	0.000	2.03	0	0
15.256	6958.34	53.3	0.228	53.3	0.7	0.30	0.43%	Coarse Tailings	0.054	108.5	0.85	0.000	0.85	0	0.97	51.945	4.98	63.61	62	0.43%	1.9	21%	2.04	0.000	2.04	0	0
15.420	6958.18	57.4	0.286	57.4	0.4	0.16	0.50%	Coarse Tailings	0.054	108.5	0.86	0.000	0.86	0	0.97	55.688	5.33	68.19	66	0.51%	1.9	21%	2.05	0.000	2.05	0	0
15.584	6958.02	58.2	0.349	58.2	0.1	0.06	0.60%	Coarse Tailings	0.054	108.5	0.87	0.000	0.87	0	0.96	56.096	5.37	68.69	66	0.61%	1.9	21%	2.05	0.000	2.05	0	0
15.748	6957.85	59.2	0.386	59.2	0.5	0.20	0.65%	Coarse Tailings	0.054	108.5	0.88	0.000	0.88	0	0.96	56.754	5.44	69.50	66	0.66%	1.9	21%	2.06	0.000	2.06	0	0
15.912	6957.69	59.6	0.376	59.6	0.0	0.00	0.63%	Coarse Tailings	0.054	108.5	0.89	0.000	0.89	0	0.95	56.789	5.44	69.54	66	0.64%	1.9	21%	2.07	0.000	2.07	0	0
16.076	6957.52	57.6	0.338	57.6	-0.2	-0.08	0.59%	Coarse Tailings	0.054	108.5	0.90	0.000	0.90	0	0.95	54.557	5.23	66.80	63	0.60%	1.9	21%	2.08	0.000	2.08	0	0
16.240	6957.36	55.6	0.319	55.6	-0.2	-0.10	0.57%	Coarse Tailings	0.054	108.5	0.91	0.000	0.91	0	0.94	52.277	5.01	64.01	60	0.58%	2.0	21%	2.09	0.000	2.09	0	0
16.404	6957.20	54.2	0.330	54.2	-0.3	-0.14	0.61%	Coarse Tailings	0.054	108.5	0.91	0.000	0.91	0	0.93	50.631	4.85	62.00	58	0.62%	2.0	21%	2.10	0.000	2.10	0	0
16.568	6957.03	54.3	0.324	54.3	-0.1	-0.02	0.60%	Coarse Tailings	0.054	108.5	0.92	0.000	0.92	0	0.93	50.446	4.83	61.77	58	0.61%	2.0	21%	2.11	0.000	2.11	0	0
16.732	6956.87	57.8	0.349	57.8	0.1	0.04	0.60%	Coarse Tailings	0.054	108.5	0.93	0.000	0.93	0	0.93	53.481	5.12	65.49	61	0.61%	2.0	21%	2.12	0.000	2.12	0	0
16.896	6956.70	58.1	0.381	58.1	0.1	0.06	0.66%	Coarse Tailings	0.054	108.5	0.94	0.000	0.94	0	0.92	53.411	5.12	65.40	61	0.67%	2.0	21%	2.13	0.000	2.13	0	0
17.060	6956.54	43.5	0.597	43.5	-1.2	-0.53	1.37%	Coarse Tailings	0.054	108.5	0.95	0.000	0.95	0	0.91	39.478	3.78	48.33	45	1.40%	2.3	21%	2.13	0.000	2.13	0	0
17.224	6956.38	20.6	0.532	20.7	-2.0	-0.85	2.58%	Coarse Tailings	0.054	108.5	0.96	0.000	0.96	0	0.88	18.236	1.75	22.32	21	2.70%	2.7	21%	2.14	0.000	2.14	0	0
17.388	6956.21	9.2	0.329	9.3	-16.9	-7.32	3.57%	Coarse Tailings	0.054	108.5	0.97	0.000	0.97	0	0.88	8.151	0.78	9.87	9	3.99%	3.1	21%	2.15	0.000	2.15	0	0
17.552	6956.05	8.0	0.192	8.0	-1.9	-0.83	2.41%	Coarse Tailings	0.054	108.5	0.98	0.000	0.98	0	0.87	6.928	0.66	8.47	7	2.75%	3.1	21%	2.16	0.000	2.16	0	0
17.716	6955.88	9.3	0.141	8.9	58.9	25.52	1.52%	Coarse Tailings	0.054	108.5	0.99	0.000	0.99	0	0.86	7.699	0.74	9.82	8	1.70%	2.9	21%	2.17	0.000	2.17	0	0
17.880	6955.72	13.1	0.175	12.9	43.8	18.99	1.33%	Coarse Tailings	0.054	108.5	0.99	0.000	0.99	0	0.86	11.031	1.06	13.79	12	1.44%	2.8	21%	2.18	0.000	2.18	0	0
18.044	6955.56	10.4	0.143	10.3	18.0	7.81	1.38%	Coarse Tailings	0.054	108.5	1.00	0.000	1.00	0	0.85	8.733	0.84	10.81	9	1.53%	2.9	21%	2.19	0.000	2.19	0	0
18.208	6955.39	7.6	0.129	7.5	18.8	8.16	1.70%	Coarse Tailings	0.054	108.5	1.01	0.000	1.01	0	0.85	6.306	0.60	7.84	6	1.96%	3.1	21%	2.20	0.000	2.20	0	0
18.372	6955.23	6.7	0.101	6.6	26.6	11.53	1.50%	Coarse Tailings	0.054	108.5	1.02	0.000	1.02	0	0.84	5.507	0.53	6.91	6	1.77%	3.1	21%	2.21	0.000	2.21	0	0
18.537	6955.06	6.8	0.080	6.6	34.8	15.07	1.18%	Coarse Tailings	0.054	108.5	1.03	0.000	1.03	0	0.83	5.470	0.52	6.92	6	1.39%	3.0	21%	2.21	0.000	2.21	0	0
18.701	6954.90	6.4	0.069	6.2	33.7	14.60	1.08%	Coarse Tailings	0.054	108.5	1.04	0.000	1.04	0	0.83	5.119	0.49	6.48	5	1.29%	3.1	21%	2.22	0.000	2.22	0	0
18.865	6954.74	7.3	0.110	7.1	40.7	17.65	1.50%	Coarse Tailings	0.054	108.5	1.05	0.000	1.05	0	0.82	5.817	0.56	7.38	6	1.75%	3.1	21%	2.23	0.000	2.23	0	0

19.029	6954.57	8.2	0.108	8.0	30.0	13.01	1.31%	Fine Tailings	0.053	106.9	1.06	0.004	1.05	1	0.82	6.583	0.63	8.25	7	1.51%	3.0	83%	2.24	0.004	2.24	1	0	0.71	0.04	0.96	0.10	1.00	0.080	32.74	40.99	0.069	N/A	0.85	0.17	0.80	0.82	1.00	0.119	6.58	54.29	0.095	N/A	N/A	N/A
19.193	6954.41	7.2	0.091	7.1	13.6	5.88	1.26%	Fine Tailings	0.053	106.9	1.07	0.009	1.06	1	0.82	5.838	0.56	7.23	6	1.48%	3.0	83%	2.25	0.009	2.24	1	0	0.71	0.04	0.96	0.10	1.00	0.080	32.39	39.62	0.068	N/A	0.85	0.16	0.80	0.82	1.00	0.119	7.21	52.12	0.093	N/A	N/A	N/A
19.357	6954.24	7.2	0.094	7.1	15.2	6.59	1.31%	Fine Tailings	0.053	106.9	1.07	0.014	1.06	1	0.82	5.765	0.55	7.15	6	1.54%	3.1	83%	2.26	0.014	2.24	1	0	0.71	0.04	0.96	0.10	1.00	0.080	32.36	39.52	0.068	N/A	0.85	0.15	0.80	0.82	1.00	0.119	7.38	52.76	0.094	N/A	N/A	N/A
19.521	6954.08	7.7	0.091	7.6	22.9	9.90	1.18%	Fine Tailings	0.053	106.9	1.08	0.019	1.06	1	0.81	6.164	0.59	7.69	6	1.37%	3.0	83%	2.27	0.019	2.25	1	0	0.70	0.04	0.96	0.10	1.00	0.080	32.55	40.24	0.069	N/A	0.84	0.16	0.80	0.82	1.00	0.119	6.74	51.80	0.093	N/A	N/A	N/A
19.685	6953.92	8.6	0.102	8.5	14.6	6.32	1.19%	Fine Tailings	0.053	106.9	1.09	0.024	1.07	1	0.81	6.878	0.66	8.51	7	1.36%	3.0	83%	2.28	0.024	2.25	1	0	0.70	0.04	0.96	0.10	1.00	0.080	32.83	41.34	0.070	N/A	0.84	0.17	0.80	0.82	1.00	0.119	6.24	53.13	0.094	N/A	N/A	N/A
19.849	6953.75	9.0	0.122	8.9	16.9	7.30	1.35%	Fine Tailings	0.053	106.9	1.10	0.030	1.07	1	0.81	7.215	0.69	8.94	7	1.54%	3.0	83%	2.29	0.030	2.26	1	0	0.70	0.04	0.95	0.10	1.00	0.080	32.98	41.92	0.070	N/A	0.84	0.17	0.80	0.82	1.00	0.119	6.28	56.15	0.096	N/A	N/A	N/A
20.013	6953.59	8.5	0.126	8.3	32.8	14.21	1.48%	Fine Tailings	0.053	106.9	1.11	0.035	1.07	1	0.81	6.688	0.64	8.39	7	1.71%	3.0	83%	2.29	0.035	2.26	1	0	0.70	0.04	0.96	0.10	1.00	0.080	32.79	41.18	0.070	N/A	0.84	0.17	0.80	0.82	1.00	0.119	6.82	57.23	0.097	N/A	N/A	N/A
20.177	6953.42	7.8	0.103	7.7	20.8	9.03	1.32%	Fine Tailings	0.053	106.9	1.12	0.040	1.08	1	0.80	6.155	0.59	7.67	6	1.55%	3.0	83%	2.30	0.040	2.26	1	0	0.70	0.04	0.96	0.10	1.00	0.080	32.54	40.20	0.069	N/A	0.84	0.16	0.80	0.82	1.00	0.119	7.05	54.06	0.095	N/A	N/A	N/A
20.341	6953.26	6.9	0.100	6.8	26.5	11.47	1.44%	Fine Tailings	0.053	106.9	1.13	0.045	1.08	1	0.80	5.425	0.52	6.81	5	1.72%	3.1	83%	2.31	0.045	2.27	1	0	0.70	0.04	0.96	0.10	1.00	0.080	32.24	39.05	0.068	N/A	0.84	0.15	0.80	0.82	1.00	0.120	7.98	54.28	0.095	N/A	N/A	N/A
20.505	6953.10	6.5	0.098	6.3	30.6	13.24	1.51%	Fine Tailings	0.053	106.9	1.14	0.050	1.09	1	0.80	5.050	0.48	6.37	5	1.83%	3.1	83%	2.32	0.050	2.27	1	0	0.70	0.04	0.96	0.10	1.00	0.080	32.09	38.46	0.067	N/A	0.84	0.15	0.80	0.82	1.00	0.120	8.53	54.33	0.095	N/A	N/A	N/A
20.669	6952.93	6.3	0.091	6.1	31.2	13.52	1.44%	Fine Tailings	0.053	106.9	1.14	0.055	1.09	1	0.80	4.885	0.47	6.17	5	1.76%	3.2	83%	2.33	0.055	2.27	1	0	0.70	0.04	0.96	0.10	1.00	0.080	32.02	38.20	0.067	N/A	0.83	0.14	0.80	0.81	1.00	0.120	8.63	53.29	0.094	N/A	N/A	N/A
20.833	6952.77	6.3	0.137	6.1	35.9	15.56	2.18%	Fine Tailings	0.053	106.9	1.15	0.060	1.09	1	0.80	4.825	0.46	6.13	5	2.67%	3.2	83%	2.34	0.060	2.28	1	0	0.69	0.04	0.96	0.10	1.00	0.080	32.01	38.13	0.067	N/A	0.83	0.14	0.80	0.81	1.00	0.120	9.92	60.77	0.101	N/A	N/A	N/A
20.997	6952.60	7.8	0.124	7.5	39.0	16.88	1.60%	Fine Tailings	0.053	106.9	1.16	0.065	1.10	1	0.79	5.972	0.57	7.55	6	1.88%	3.1	83%	2.35	0.065	2.28	1	0	0.69	0.04	0.96	0.10	1.00	0.080	32.50	40.05	0.069	N/A	0.83	0.16	0.80	0.81	1.00	0.120	7.65	57.72	0.098	N/A	N/A	N/A
21.161	6952.44	7.3	0.071	7.1	27.6	11.98	0.97%	Fine Tailings	0.053	106.9	1.17	0.071	1.10	1	0.79	5.655	0.54	7.09	6	1.16%	3.0	83%	2.36	0.071	2.28	1	0	0.69	0.04	0.96	0.10	1.00	0.080	32.34	39.43	0.068	N/A	0.83	0.15	0.80	0.81	1.00	0.120	6.86	48.65	0.091	N/A	N/A	N/A
21.325	6952.27	7.6	0.135	7.4	33.1	14.36	1.78%	Fine Tailings	0.053	106.9	1.18	0.076	1.10	1	0.79	5.838	0.56	7.35	6	2.10%	3.1	83%	2.36	0.076	2.29	1	0	0.69	0.04	0.96	0.10	1.00	0.081	32.43	39.78	0.068	N/A	0.83	0.16	0.80	0.81	1.00	0.120	8.11	59.61	0.100	N/A	N/A	N/A
21.489	6952.11	11.5	0.156	11.3	33.2	14.38	1.36%	Fine Tailings	0.053	106.9	1.19	0.081	1.11	1	0.79	8.888	0.85	11.08	9	1.51%	2.9	83%	2.37	0.081	2.29	1	0	0.69	0.05	0.95	0.10	1.00	0.081	33.72	44.80	0.073	N/A	0.83	0.19	0.80	0.81	1.00	0.120	5.38	59.65	0.100	N/A	N/A	N/A
21.653	6951.95	9.0	0.134	8.9	18.5	8.03	1.48%	Fine Tailings	0.053	106.9	1.20	0.086	1.11	1	0.79	7.011	0.67	8.70	7	1.71%	3.0	83%	2.38	0.086	2.30	1	0	0.69	0.04	0.95	0.10	1.00	0.081	32.90	41.59	0.070	N/A	0.83	0.17	0.80	0.81	1.00	0.120	6.71	58.38	0.099	N/A	N/A	N/A
21.817	6951.78	7.3	0.253	7.1	32.2	13.97	3.48%	Fine Tailings	0.053	106.9	1.21	0.091	1.11	1	0.78	5.542	0.53	6.98	5	4.17%	3.3	83%	2.39	0.091	2.30	1	0	0.69	0.04	0.96	0.10	1.00	0.081	32.30	39.28	0.068	N/A	0.83	0.15	0.80	0.81	1.00	0.121	10.65	74.37	0.118	N/A	N/A	N/A
21.981	6951.62	6.9	0.209	6.7	40.8	17.69	3.01%	Fine Tailings	0.053	106.9	1.21	0.096	1.12	1	0.78	5.231	0.50	6.65	5	3.65%	3.3	83%	2.40	0.096	2.30	1	0	0.69	0.04	0.96	0.10	1.00	0.081	32.19	38.84	0.068	N/A	0.82	0.15	0.80	0.81	1.00	0.121	10.50	69.81	0.112	N/A	N/A	N/A
22.145	6951.45	8.7	0.210	8.7	6.2	2.67	2.41%	Fine Tailings	0.053	106.9	1.22	0.101	1.12	1	0.78	6.762	0.65	8.32	7	2.81%	3.1	83%	2.41	0.101	2.31	1	0	0.68	0.04	0.95	0.10	1.00	0.081	32.76	41.08	0.069	N/A	0.82	0.17	0.80	0.81	1.00	0.121	8.28	68.87	0.110	N/A	N/A	N/A
22.309	6951.29	9.4	0.231	9.4	10.4	4.52	2.45%	Fine Tailings	0.053	106.9	1.23	0.106	1.13	1	0.78	7.290	0.70	8.99	7	2.82%	3.1	83%	2.42	0.106	2.31	1	0	0.68	0.04	0.95	0.10	1.00	0.081	33.00	41.98	0.070	N/A	0.82	0.17	0.80	0.81	1.00	0.121	7.88	70.83	0.113	N/A	N/A	N/A
22.473	6951.13	11.6	0.199	11.5	14.6	6.34	1.71%	Fine Tailings	0.053	106.9	1.24	0.111	1.13	1	0.78	8.955	0.86	11.05	9	1.92%	2.9	83%	2.43	0.111	2.31	1	0	0.68	0.05	0.95	0.10	1.00	0.081	33.71	44.76	0.073	N/A	0.82	0.19	0.80	0.81	1.00	0.121	5.92	65.40	0.106	N/A	N/A	N/A
22.638	6950.96	9.2	0.173	9.1	19.2	8.34	1.87%	Fine Tailings	0.053	106.9	1.25	0.117	1.13	1	0.77	7.052	0.68	8.75	7	2.17%	3.0	83%	2.43	0.117	2.32	1	0	0.68	0.04	0.95	0.10	1.00	0.081	32.91	41.66	0.070	N/A	0.82	0.17	0.80	0.81	1.00	0.121	7.31	63.94	0.104	N/A	N/A	N/A
22.802	6950.80	9.0	0.171	8.7	47.4	20.52	1.89%	Fine Tailings	0.053	106.9	1.26	0.122	1.14	1	0.77	6.740	0.65	8.53	7	2.20%	3.1	83%	2.44	0.122	2.32	1	0	0.68	0.04	0.95	0.10	1.00	0.081	32.84	41.37	0.070	N/A	0.82	0.17	0.80	0.81	1.00	0.121	7.48	63.86	0.104	N/A	N/A	N/A
22.966	6950.63	8.5	0.164	8.2	54.3	23.55	1.93%	Fine Tailings	0.053	106.9	1.27	0.127	1.14	1	0.77	6.285	0.60	8.02	6	2.27%	3.1	83%	2.45	0.127	2.33	1	0	0.68	0.04	0.95	0.10	1.00	0.081	32.66	40.68	0.069	N/A	0.82	0.16	0.80	0.81	1.00	0.121	7.91	63.37	0.104	N/A	N/A	N/A
23.130	6950.47	10.1	0.170	9.9	42.1	18.22	1.68%	Fine Tailings	0.053	106.9	1.28	0.132	1.14	1	0.77	7.590	0.73	9.54	8	1.92%	3.0	83%	2.46	0.132	2.33	1	0	0.68	0.04	0.95	0.10	1.00	0.081	33.19	42.73	0.071	N/A	0.81	0.18	0.80	0.81	1.00	0.121	6.59	62.91	0.103	N/A	N/A	N/A
23.294	6950.31	11.0	0.208	10.8	25.2	10.90	1.89%	Fine Tailings	0.053	106.9	1.28	0.137	1.15	1	0.77	8.307	0.80	10.32	8	2.14%	3.0	83%	2.47	0.137	2.33	1	0	0.67	0.05	0.95	0.10	1.00	0.081	33.46	43.78	0.072	N/A	0.81	0.19	0.80	0.81	1.00	0.121	6.50	67.12	0.108	N/A	N/A	N/A
23.458	6950.14	18.7	0.228	18.2	91.8	39.80	1.22%	Fine Tailings	0.053	106.9	1.29	0.142	1.15	1	0.76	13.890	1.33	17.54	15	1.31%	2.7	83%	2.48	0.142	2.34	1	0	0.67	0.05	0.95	0.10	1.00	0.081	35.96	53.50	0.081	N/A	0.81	0.24	0.80	0.81	1.00	0.121	3.65	64.09	0.104	N/A	N/A	N/A
23.622	6949.98	25.0	0.246	24.8	28.4	12.30	0.99%	Fine Tailings	0.053	106.9	1.30	0.147	1.16	1	0.77	19.012	1.82	23.45	20	1.04%	2.5	83%	2.49	0.147	2.34	1	0	0.67	0.05	0.94	0.10	1.00	0.082	38.00	61.44	0.089	N/A	0.81	0.28	0.80	0.81	1.00	0.121	2.71	63.48	0.104	N/A	N/A	N/A

41.174	6932.43	11.1	0.273	10.3	119.3	51.69	2.47%	Fine Tailings	0.053	106.9	2.24	0.249	1.99	1	0.50	5.139	0.49	6.75	4	3.09%	3.3	83%	3.43	0.249	3.18	1	1	0.55	0.04	0.94	0.10	1.00	0.068	32.22	38.97	0.068	1.00	0.67	0.15	0.80	0.76	1.00	0.108	10.74	72.44	0.115	1.07	1.04	0	0.50	5.51	0.53	6.75	41.174		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
41.338	6932.26	11.1	0.294	10.3	120.1	52.04	2.65%	Fine Tailings	0.053	106.9	2.25	0.254	2.00	1	0.50	5.132	0.49	6.74	4	3.33%	3.3	83%	3.44	0.254	3.18	1	1	0.55	0.04	0.94	0.10	1.00	0.068	32.22	38.96	0.068	1.00	0.67	0.15	0.80	0.76	1.00	0.108	11.01	74.22	0.118	1.09	1.05	0	0.50	5.50	0.53	6.74	41.338		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
41.502	6932.10	11.8	0.323	11.0	119.6	51.81	2.74%	Fine Tailings	0.053	106.9	2.26	0.259	2.00	1	0.50	5.472	0.52	7.15	5	3.39%	3.3	83%	3.45	0.259	3.19	1	1	0.55	0.04	0.94	0.10	1.00	0.068	32.36	39.52	0.068	1.01	0.67	0.15	0.80	0.76	1.00	0.108	10.66	76.27	0.121	1.12	1.07	0	0.50	5.84	0.56	7.15	41.502		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
41.666	6931.93	12.6	0.398	11.9	113.1	49.01	3.17%	Fine Tailings	0.053	106.9	2.27	0.264	2.01	1	0.50	5.875	0.56	7.62	5	3.87%	3.3	83%	3.45	0.264	3.19	1	1	0.55	0.04	0.94	0.10	1.00	0.068	32.52	40.15	0.069	1.02	0.66	0.16	0.80	0.76	1.00	0.108	10.70	81.53	0.130	1.21	1.11	0	0.50	6.22	0.60	7.62	41.666		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
41.830	6931.77	16.4	0.408	15.9	76.9	33.33	2.49%	Fine Tailings	0.053	106.9	2.28	0.269	2.01	1	0.49	7.880	0.75	9.94	7	2.89%	3.1	83%	3.46	0.269	3.19	1	1	0.54	0.05	0.94	0.10	1.00	0.068	33.33	43.27	0.071	1.05	0.66	0.18	0.80	0.76	1.00	0.108	8.12	80.68	0.129	1.20	1.12	0	0.49	8.12	0.78	9.94	41.830		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
41.994	6931.61	15.4	0.291	15.1	54.3	23.55	1.88%	Fine Tailings	0.053	106.9	2.29	0.274	2.01	1	0.49	7.464	0.71	9.34	7	2.21%	3.1	83%	3.47	0.274	3.20	1	1	0.54	0.04	0.94	0.10	1.00	0.068	33.12	42.46	0.071	1.04	0.66	0.18	0.80	0.76	1.00	0.108	7.69	71.91	0.115	1.06	1.05	0	0.49	7.63	0.73	9.34	41.994		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
42.158	6931.44	13.6	0.304	13.1	70.5	30.56	2.24%	Fine Tailings	0.053	106.9	2.30	0.279	2.02	1	0.49	6.476	0.62	8.20	6	2.70%	3.2	83%	3.48	0.279	3.20	1	1	0.54	0.04	0.94	0.10	1.00	0.068	32.72	40.92	0.069	1.03	0.66	0.17	0.80	0.76	1.00	0.108	9.03	73.99	0.118	1.09	1.06	0	0.49	6.69	0.64	8.20	42.158		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
42.322	6931.28	12.3	0.310	11.7	90.1	39.03	2.52%	Fine Tailings	0.053	106.9	2.31	0.285	2.02	1	0.49	5.778	0.55	7.41	5	3.10%	3.3	83%	3.49	0.285	3.20	1	1	0.54	0.04	0.94	0.10	1.00	0.068	32.45	39.87	0.068	1.01	0.66	0.16	0.80	0.76	1.00	0.108	10.13	75.13	0.119	1.11	1.06	0	0.49	6.05	0.58	7.41	42.322		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
42.486	6931.11	12.2	0.307	11.6	95.9	41.57	2.52%	Fine Tailings	0.053	106.9	2.31	0.290	2.02	1	0.49	5.706	0.55	7.35	5	3.11%	3.3	83%	3.50	0.290	3.21	1	1	0.54	0.04	0.94	0.10	1.00	0.068	32.43	39.78	0.068	1.01	0.66	0.16	0.80	0.76	1.00	0.108	10.20	74.95	0.119	1.11	1.06	0	0.49	6.00	0.57	7.35	42.486		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
42.650	6930.95	12.5	0.307	11.9	100.1	43.38	2.45%	Fine Tailings	0.053	106.9	2.32	0.295	2.03	1	0.49	5.855	0.56	7.55	5	3.00%	3.2	83%	3.51	0.295	3.21	1	1	0.54	0.04	0.94	0.10	1.00	0.068	32.50	40.04	0.069	1.02	0.66	0.16	0.80	0.76	1.00	0.108	9.92	74.81	0.119	1.11	1.06	0	0.49	6.16	0.59	7.55	42.650		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
42.814	6930.79	13.9	0.349	13.3	110.2	47.75	2.50%	Fine Tailings	0.053	106.9	2.33	0.300	2.03	1	0.49	6.504	0.62	8.38	6	3.00%	3.2	83%	3.52	0.300	3.22	1	1	0.54	0.04	0.94	0.10	1.00	0.068	32.78	41.16	0.070	1.03	0.65	0.17	0.80	0.76	1.00	0.107	9.25	77.50	0.123	1.15	1.09	0	0.49	6.84	0.65	8.38	42.814		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
42.978	6930.62	13.8	0.399	13.1	115.0	49.84	2.88%	Fine Tailings	0.053	106.9	2.34	0.305	2.03	1	0.49	6.431	0.62	8.31	6	3.47%	3.2	83%	3.52	0.305	3.22	1	1	0.54	0.04	0.94	0.10	1.00	0.068	32.76	41.07	0.069	1.03	0.65	0.17	0.80	0.76	1.00	0.107	9.79	81.27	0.130	1.21	1.12	0	0.49	6.78	0.65	8.31	42.978		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
43.143	6930.46	15.0	0.333	14.3	117.8	51.04	2.22%	Fine Tailings	0.053	106.9	2.35	0.310	2.04	1	0.49	6.984	0.67	8.99	6	2.63%	3.1	83%	3.53	0.310	3.22	1	1	0.54	0.04	0.94	0.10	1.00	0.068	33.00	41.99	0.070	1.04	0.65	0.17	0.80	0.76	1.00	0.107	8.43	75.77	0.120	1.12	1.08	0	0.49	7.34	0.70	8.99	43.143		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
43.307	6930.29	21.0	0.524	20.1	144.2	62.47	2.50%	Fine Tailings	0.053	106.9	2.36	0.315	2.04	1	0.49	9.808	0.94	12.55	9	2.81%	3.0	83%	3.54	0.315	3.23	1	1	0.54	0.05	0.94	0.10	1.00	0.068	34.23	46.78	0.074	1.10	0.65	0.20	0.80	0.76	1.00	0.107	6.91	86.66	0.141	1.31	1.20	0	0.49	10.25	0.98	12.55	43.307		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
43.471	6930.13	38.1	0.656	37.7	75.7	32.82	1.72%	Fine Tailings	0.053	106.9	2.37	0.320	2.05	1	0.49	18.611	1.78	23.08	17	1.83%	2.7	83%	3.55	0.320	3.23	1	1	0.53	0.05	0.93	0.10	1.00	0.069	37.87	60.95	0.089	1.30	0.65	0.28	0.80	0.76	1.00	0.107	3.82	88.26	0.144	1.34	1.32	0	0.49	18.84	1.80	23.08	43.471		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
43.635	6929.97	63.5	0.655	63.4	29.0	12.55	1.03%	Fine Tailings	0.053	106.9	2.38	0.326	2.05	1	0.54	34.194	3.28	41.99	30	1.07%	2.4	83%	3.56	0.326	3.23	1	1	0.53	0.07	0.91	0.00	1.00	0.070	44.41	86.40	0.122	1.74	0.65	0.37	0.80	0.76	1.00	0.107	2.14	89.67	0.147	1.37	1.56	0	0.54	34.29	3.28	41.99	43.635		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
43.799	6929.80	97.7	0.867	97.6	14.8	6.40	0.89%	Fine Tailings	0.053	106.9	2.38	0.331	2.05	1	0.59	57.591	5.52	70.59	46	0.91%	2.2	83%	3.57	0.331	3.24	1	1	0.53	0.08	0.88	-0.18	1.00	0.072	54.30	124.89	0.190	2.66	0.65	0.49	0.76	0.72	1.00	0.114	1.56	110.30	0.205	1.80	2.23	0	0.59	57.65	5.52	70.59	43.799		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
43.963	6929.64	98.3	1.272	98.2	14.9	6.45	1.29%	Fine Tailings	0.053	106.9	2.39	0.336	2.06	1	0.59	57.983	5.55	71.07	47	1.33%	2.2	83%	3.58	0.336	3.24	1	1	0.53	0.08	0.88	-0.19	1.00	0.072	54.47	125.54	0.192	2.68	0.65	0.49	0.76	0.71	1.00	0.114	1.79	127.12	0.271	2.38	2.53	0	0.59	58.04	5.56	71.07	43.963		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
44.127	6929.47	112.0	2.010	111.9	12.3	5.31	1.79%	Fine Tailings	0.053	106.9	2.40	0.341	2.06	1	0.61	68.057	6.52	83.39	53	1.83%	2.3	83%	3.59	0.341	3.25	1	1	0.53	0.09	0.87	-0.25	1.00	0.073	58.73	142.13	0.240	3.30	0.64	0.53	0.74	0.70	1.00	0.117	1.92	159.79	0.459	3.93	3.62	0	0.61	68.10	6.52	83.39	44.127		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
44.291	6929.31	109.6	2.524	109.5	15.0	6.49	2.30%	Fine Tailings	0.053	106.9	2.41	0.346	2.06	1	0.60	66.158	6.34	81.08	52	2.35%	2.4	83%	3.59	0.346	3.25	1	1	0.53	0.09	0.87	-0.24	1.00	0.072	57.93	139.01	0.229	3.16	0.64	0.52	0.74	0.70	1.00	0.116	2.19	177.64	1.000	8.60	5.88	0	0.60	66.21	6.34	81.08	44.291		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
44.455	6929.15	113.0	2.656	112.9	16.0	6.93	2.35%	Fine Tailings	0.053	106.9	2.42	0.351	2.07	1	0.61	68.671	6.58	84.16	53	2.40%	2.4	83%	3.60	0.351	3.25	1	1	0.53	0.09	0.87	-0.25	1.00	0.073	59.00	143.16	0.243	3.35	0.64	0.53	0.74	0.69	1.00	0.117	2.18	183.16	1.000	8.55	5.95	0	0.61	68.73	6.58	84.16	44.455		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
44.619	6928.98	111.7	2.084	111.6	14.1	6.12	1.87%	Coarse Alluvium	0.057	114.1	2.43	0.000	2.43	0	0.54	60.492	5.79	74.13	45	1.91%	2.4	36%	3.61	0.000	3.61	0	0	0.53	0.09	0.87	-0.20	1.00	0.065	55.36	129.50	0.202	N/A	0.64	0.50	0.75	0.69	1.00	0.106	2.14	158.85	0.453	N/A	N/A	N/A	0.54	60.54	5.80	74.13	44.619		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
44.783	6928.82	105.8	1.834	105.7	12.0	5.20	1.73%	Coarse Alluvium	0.057	114.1	2.44	0.000	2.44	0	0.53	56.283	5.39	68.97	42	1.77%	2.4	36%	3.62	0.000	3.62	0	0	0.53	0.08	0.88	-0.17	1.00	0.065	53.58	122.55	0.185	N/A	0.64	0.48	0.76	0.70	1.00	0.104	2.14	147.82	0.380	N/A	N/A	N/A	0.53	56.32	5.39	68.97	44.783		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
44.947	6928.65	95.7	1.621	95.6	11.1	4.82	1.69%	Coarse Alluvium	0.057	114.1	2.45	0.000	2.45	0	0.52	49.353	4.73	60.48	38	1.74%	2.4	36%	3.63	0.000	3.63	0	0	0.53	0.08	0.88	-0.12	1.00	0.064	50.65	111.13	0.162	N/A	0.64	0.45	0.78	0.72	1.00	0.102	2.26	136.84	0.318	N/A	N/A	N/A	0.52	49.39	4.73	60.48	44.947		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
45.111	6928.49	89.1	1.414	89.0	12.7	5.49	1.59%	Coarse Alluvium	0.057	114.1	2.46	0.000	2.46	0	0.50	44.926	4.30	55.06	35	1.63%	2.4	36%	3.64	0.000	3.64	0	0	0.53	0.07	0.89	-0.08	1.00	0.064	48.79	103.85	0.149	N/A	0.64	0.43	0.79	0.73	1.00	0.100	2.30	126.87	0.270	N/A	N/A	N/A	0.50	44.97	4.31	55.06	45.111		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
45.275	6928.32	88.3	1.068	88.2	11.6	5.04	1.21%	Coarse Alluvium	0.057	114.1	2.47	0.000	2.47	0	0.50	44.302	4.24	54.29	35	1.24%	2.3	36%	3.65	0.000	3.65	0	0	0.52	0.07	0.89	-0.08	1.00	0.064	48.52	102.81	0.147	N/A	0.63	0.43	0.79	0.73	1.00	0.100	2.06	112.00	0.211	N/A	N/A	N/A	0.50	44.34	4.24	54.29	45.275		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
45.439	6928.16	85.7	0.869	85.6	10.8	4.68	1.01%	Coarse Alluvium	0.057	114.1	2.48	0.000	2.48	0	0.50	42.526	4.07	52.11	34	1.04%	2.3	36%	3.66	0.000	3.66	0	0	0.52	0.07	0.89	-0.06	1.00	0.063	47.77	99.88	0.142	N/A	0.63	0.42	0.79	0.73	1.00	0.099	1.96	102.37	0.180	N/A	N/A	N/A	0.50	42.56	4.07	52.11	45.439		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
45.603	6928.00	80.0	0.831	79.9	10.2	4.41	1.04%	Coarse Alluvium	0.057	114.1	2.48	0.000	2.48	0	0.49	38.896	3.73	47.67	31	1.07%	2.3	36%	3.67	0.000	3.67	0	0	0.52	0.07	0.90	-0.03	1.00	0.063	46.24	93.90	0.133	N/A	0.63	0.40	0.80	0.74	1.00	0.097	2.08	99.02	0.170	N/A	N/A	N/A	0.49	38.93	3.73	47.67	45.603		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
45.767	6927.83	76.4	0.827	76.3	10.8	4.66	1.08%	Coarse Alluvium	0.057	114.1	2.49	0.000	2.49	0	0.48	36.578	3.50	44.83	30	1.12%	2.4	36%	3.68	0.000	3.68	0	0	0.52	0.07	0.90	-0.01	1.00	0.063	45.26	90.09	0.127	N/A	0.63	0.39	0.80	0.74	1.00	0.097	2.18	97.91	0.167	N/A	N/A	N/A	0.48	36.61	3.51	44.83	45.767		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
45.931	6927.67	70.7	0.768	70.7	9.6	4.17	1.09%	Coarse Alluvium	0.057	114.1	2.50	0.000	2.50	0	0.47	33.152	3.18	40.63	27	1.13%	2.4	36%	3.69	0.000	3.69	0	0	0.52	0.07	0.90	0.02	1.00	0.062	43.81	84.44	0.119	N/A	0.63	0.37	0.80	0.74	1.00	0.097	2.31	93.79	0.157	N/A	N/A	N/A	0.47	33.18	3.18	40.63	45.931	26	1.00	24	11	0.53	0.51	0.46	5.5	16.6	0.17	N/A	5.00	1.20	18.31	0.195	N/A	N/A
46.095	6927.50	66.2	0.658	66.1	9.2	3.97	0.99%	Coarse Alluvium	0.057	114.1	2.51	0.000	2.51	0	0.46	30.412	2.91	37.27	25	1.03%	2.4	36%	3.70	0.000	3.70	0	0	0.52	0.06	0.90	0.05	1.00	0.062	42.65	79.92	0.113	N/A	0.63	0.35	0.80	0.74	1.00	0.097	2.34	87.26	0.142	N/A	N/A	N/A	0.46	30.44	2.91	37.27	46.095		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
46.259	6927.34	64.2	0.624	64.2	9.3	4.05	0.97%	Coarse Alluvium	0.057	114.1	2.52	0.000	2.52	0	0.46	29.230	2.80	35.82	24	1.01%	2.4	36%	3.71	0.000	3.71	0	0	0.52	0.06	0.91	0.06	1.00	0.062	42.15	77.98	0.110	N/A	0.63	0.35	0.80	0.74	1.00	0.097	2.37	85.07	0.137	N/A	N/A	N/A	0.46	29.26	2.80	35.82	46.259		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
46.423	6927.18	63.2	0.598	63.1	12.7	5.51	0.95%	Coarse Alluvium	0.057	114.1	2.53	0.000	2.53	0	0.45	28.534	2.73	34.98	24	0.99%	2.4	36%	3.72	0.000	3.72	0	0	0.52	0.06	0.91	0.07	1.00	0.062	41.86	76.85	0.108	N/A	0.63	0.34	0.80	0.74	1.00	0.097	2.38	83.43	0.134	N/A	N/A	N/A	0.45	28.57	2.74	34.98	46.423		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
46.587	6927.01	63.7	0.522	63.7	11.5	4.98	0.82%	Coarse Alluvium	0.057	114.1	2.54	0.000	2.54	0	0.45	28.760	2.75	35.26	24	0.85%	2.4	36%	3.73	0.000	3.73	0	0	0.52	0.06	0.91	0.07	1.00	0.062	41.96	77.21	0.109	N/A	0.62	0.34	0.80	0.74	1.00	0.096	2.25	79.31	0.126	N/A	N/A	N/A	0.45	28.79	2.76	35.26	46.587		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
46.751	6926.85	60.0	0.517	60.0	10.0	4.33	0.86%	Coarse Alluvium	0.057	114.1	2.55	0.000	2.55	0	0.44	26.632	2.55	32.65	23	0.90%	2.4	36%	3.73	0.000	3.73	0	0	0.52	0.06	0.91	0.09	1.00	0.061	41.06	73.70	0.104	N/A	0.62	0.33	0.80	0.74	1.00	0.096	2.40	78.30	0.125	N/A	N/A	N/A	0.44	26.66	2.55	32.65	46.751		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
46.915	6926.68	58.4	0.517	58.3	8.8	3.80	0.89%	Coarse Alluvium	0.057	114.1	2.56	0.000	2.56	0	0.44	25.645	2.46	31.43	22	0.93%	2.4	36%	3.74	0.000	3.74	0	0	0.52	0.06	0.91	0.10	1.00	0.061	40.64	72.07	0.102	N/A	0.62	0.32	0.80	0.74	1.00	0.096	2.48	77.98	0.124	N/A	N/A	N/A	0.44	25.67	2.46	31.43	46.915		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
47.079	6926.52	57.5	0.506	57.5	8.5	3.68	0.88%	Coarse Alluvium	0.057	114.1	2.57	0.000	2.57	0	0.44	25.115	2.41	30.78	21	0.92%	2.4	36%	3.75	0.000	3.75	0	0	0.51	0.06	0.91	0.10	1.00	0.061	40.41	71.20	0.101	N/A	0.62	0.32	0.80	0.74	1.00	0.096	2.51	77.17	0.123	N/A	N/A	N/A	0.44	25.14	2.41	30.78	47.079		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
47.244	6926.36	58.1	0.513	58.0	8.4	3.64	0.88%	Coarse Alluvium	0.057	114.1	2.58	0.000	2.58	0	0.44	25.308	2.42	31.02	22	0.92%	2.4	36%	3.76	0.000	3.76	0	0	0.51	0.06	0.91	0.10	1.00	0.061	40.49	71.51	0.101	N/A	0.62	0.32	0.80	0.74	1.00	0.096	2.50	77.61	0.123	N/A	N/A	N/A	0.44	25.33	2.43	31.02	47.244		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
47.408	6926.19	58.5	0.511	58.5	8.0	3.48	0.87%	Coarse Alluvium	0.057	114.1	2.59	0.000	2.59	0	0.44	25.467	2.44	31.21	22	0.91%	2.4	36%	3.77	0.000	3.77	0	0	0.51	0.06	0.91	0.10	1.00	0.061	40.56	71.77	0.102	N/A	0.62	0.32	0.80	0.74	1.00	0.096	2.48	77.52	0.123	N/A	N/A	N/A	0.44	25.49	2.44	31.21	47.408		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
47.572	6926.03	59.3	0.543	59.2	8.1	3.52	0.92%	Coarse Alluvium	0.057	114.1	2.60	0.000	2.60	0	0.44	25.793	2.47	31.61	22	0.96%	2.4	36%	3.78	0.000	3.78	0	0	0.51	0.06	0.91	0.10	1.00	0.061	40.70	72.31	0.103	N/A	0.62	0.32	0.80	0.74	1.00	0.096	2.51	79.42	0.127	N/A	N/A	N/A	0.44	25.82	2.47	31.61	47.572		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
47.736	6925.86	63.7	0.567	63.7	8.1	3.50	0.89%	Coarse Alluvium	0.057	114.1	2.61	0.000	2.61	0	0.44	28.128	2.69	34.47	23	0.93%	2.4	36%	3.79	0.000	3.79	0	0	0.51	0.06	0.91	0.08	1.00	0.061	41.69	76.16	0.107	N/A	0.61	0.34	0.80	0.74	1.00	0.095	2.36	81.47	0.130	N/A	N/A	N/A	0.44	28.15	2.70	34.47	47.736		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
47.900	6925.70	67.9	0.588	67.8	7.7	3.34	0.87%	Coarse Alluvium	0.057	114.1	2.62	0.000	2.62	0	0.45	30.333	2.91	37.17	25	0.90%	2.4	36%	3.80	0.000	3.80	0	0	0.51	0.06	0.90	0.05	1.00	0.061	42.62	79.79	0.112	N/A	0.61	0.35	0.80	0.74	1.00	0.095	2.24	83.38	0.134	N/A	N/A	N/A	0.45	30.35	2.91	37.17	47.900		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
48.064	6925.54	72.3	0.652	72.3	7.6	3.29	0.90%	Coarse Alluvium	0.057	114.1	2.62	0.000	2.62	0	0.45	32.749	3.14	40.13	27	0.94%	2.4	36%	3.81	0.000	3.81	0	0	0.51	0.07	0.90	0.03	1.00	0.061	43.64	83.76	0.118	N/A	0.61	0.37	0.80	0.73	1.00	0.095	2.18	87.63	0.143	N/A	N/A	N/A	0.45	32.77	3.14	40.13	48.064		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
48.228	6925.37	73.8	0.711	73.7	7.2	3.13	0.96%	Coarse Alluvium	0.057	114.1	2.63	0.000	2.63	0	0.45	33.481	3.21	41.02	27	1.00%	2.4	36%	3.82	0.000	3.82	0	0	0.51	0.07	0.90	0.02	1.00	0.061	43.94	84.97	0.120	N/A	0.61	0.37	0.80	0.73	1.00	0.095	2.22	90.87	0.150	N/A	N/A	N/A	0.45	33.50	3.21	41.02	48.228		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
48.392	6925.21	72.5	0.758	72.4	6.7	2.91	1.05%	Coarse Alluvium	0.057	114.1	2.64	0.000	2.64	0	0.45	32.624	3.12	39.97	26	1.09%	2.4	36%	3.83	0.000	3.83	0	0	0.51	0.06	0.90	0.03	1.00	0.061	43.58	83.55	0.118	N/A	0.61	0.37	0.80	0.73	1.00	0.095	2.32	92.85	0.154	N/A	N/A	N/A	0.45	32.64	3.13	39.97	48.392		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
48.556	6925.04	74.7	0.785	74.6	7.2	3.11	1.05%	Coarse Alluvium	0.057	114.1	2.65	0.000	2.65	0	0.45	33.793	3.24	41.40	27	1.09%	2.4	36%	3.84	0.000	3.84	0	0	0.51	0.07	0.90	0.02	1.00	0.061	44.08	85.48	0.120	N/A	0.61	0.37	0.80	0.73	1.00	0.095	2.28	94.59	0.159	N/A	N/A	N/A	0.45	33.81	3.24	41.40	48.556		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
48.720	6924.88	83.5	0.818	83.4	6.8	2.93	0.98%	Coarse Alluvium	0.057	114.1	2.66	0.000	2.66	0	0.47	38.799	3.72	47.53	30	1.01%	2.3	36%	3.85	0.000	3.85	0	0	0.51	0.07	0.89	-0.03	1.00	0.061	46.19	93.72	0.133	N/A	0.61	0.40	0.80	0.73	1.00	0.094	2.07	98.23	0.168	N/A	N/A	N/A	0.47	38.82	3.72	47.53	48.720		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
48.884	6924.72	82.2	0.779	82.2	6.3	2.73	0.95%	Coarse Alluvium	0.057	114.1	2.67	0.000	2.67	0	0.46	37.938	3.63	46.48	30	0.98%	2.3	36%	3.86	0.000	3.86	0	0	0.50	0.07	0.89	-0.02	1.00	0.061	45.83	92.30	0.130	N/A	0.61	0.39	0.80	0.73	1.00	0.094	2.07	96.01	0.162	N/A	N/A	N/A	0.46	37.96	3.63	46.48	48.884		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
49.048	6924.55	82.3	0.757	82.3	6.2	2.70	0.92%	Coarse Alluvium	0.057	114.1	2.68	0.000	2.68	0	0.46	37.898	3.63	46.43	30	0.95%	2.3	36%	3.87	0.000	3.87	0	0	0.50	0.07	0.89	-0.02	1.00	0.061	45.81	92.24	0.130	N/A	0.60	0.39	0.80	0.73	1.00	0.094	2.04	94.95	0.160	N/A	N/A	N/A	0.46	37.92	3.63	46.43	49.048		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
49.212	6924.39	85.3	0.769	85.3	6.0	2.60	0.90%	Coarse Alluvium	0.057	114.1	2.69	0.000	2.69	0	0.46	39.557	3.79	48.46	31	0.93%	2.3	36%	3.87	0.000	3.87	0	0	0.50	0.07	0.89	-0.04	1.00	0.061	46.51	94.97	0.134	N/A	0.60	0.40	0.80	0.73	1.00	0.094	1.99	96.29	0.163	N/A	N/A	N/A	0.46	39.57	3.79	48.46	49.212		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
49.376	6924.22	84.0	0.824	83.9	6.0	2.58	0.98%	Coarse Alluvium	0.057	114.1	2.70	0.000	2.70	0	0.46	38.653	3.70	47.35	30	1.01%	2.3	36%	3.88	0.000	3.88	0	0	0.50	0.07	0.89	-0.03	1.00	0.061	46.13	93.48	0.132	N/A	0.60	0.40	0.80	0.73	1.00	0.094	2.08	98.41	0.169	N/A	N/A	N/A	0.46	38.67	3.70	47.35	49.376		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
49.540	6924.06	84.5	0.859	84.5	6.2	2.67	1.02%	Coarse Alluvium	0.057	114.1	2.71	0.000	2.71	0	0.46	38.842	3.72	47.58	30	1.05%	2.3	36%	3.89	0.000	3.89	0	0	0.50	0.07	0.89	-0.03	1.00	0.061	46.21	93.79	0.133	N/A	0.60	0.40	0.80	0.73	1.00	0.094	2.10	100.10	0.173	N/A	N/A	N/A	0.46	38.86	3.72	47.58	49.540		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
49.704	6923.90	82.6	0.825	82.6	6.1	2.64	1.00%	Coarse Alluvium	0.057	114.1	2.72	0.000	2.72	0	0.46	37.649	3.61	46.12	29	1.03%	2.4	36%	3.90	0.000	3.90	0	0	0.50	0.07	0.89	-0.02	1.00	0.061	45.70	91.83	0.130	N/A	0.60	0.39	0.80	0.73	1.00	0.093	2.12	97.99	0.168	N/A	N/A	N/A	0.46	37.67	3.61	46.12	49.704		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
49.868	6923.73	80.2	0.595	80.1	5.7	2.46	0.74%	Coarse Alluvium	0.057	114.1	2.73	0.000	2.73	0	0.45	36.108	3.46	44.23	28	0.77%	2.3	36%	3.91	0.000	3.91	0	0	0.50	0.07	0.89	0.00	1.00	0.060	45.05	89.29	0.126	N/A	0.60	0.38	0.80	0.73	1.00	0.093	1.95	86.21	0.140	N/A	N/A	N/A	0.45	36.12	3.46	44.23	49.868		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
50.032	6923.57	76.8	0.605	76.8	5.5	2.40	0.79%	Coarse Alluvium	0.057	114.1	2.74	0.000	2.74	0	0.44	34.115	3.27	41.79	27	0.82%	2.3	36%	3.92	0.000	3.92	0	0	0.50	0.07	0.90	0.02	1.00	0.060	44.21	86.00	0.121	N/A	0.60	0.37	0.80	0.73	1.00	0.093	2.05	85.74	0.139	N/A	N/A	N/A	0.44	34.13	3.27	41.79	50.032		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
50.196	6923.40	76.5	0.611	76.4	5.6	2.44	0.80%	Coarse Alluvium	0.057	114.1	2.75	0.000	2.75	0	0.44	33.803	3.24	41.41	27	0.83%	2.3	36%	3.93	0.000	3.93	0	0	0.50	0.07	0.90	0.02	1.00	0.060	44.08	85.49	0.120	N/A	0.59	0.37	0.80	0.73	1.00	0.093	2.07	85.89	0.139	N/A	N/A	N/A	0.44	33.82	3.24	41.41	50.196		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
50.360	6923.24	73.7	0.656	73.7	4.8	2.09	0.89%	Coarse Alluvium	0.057	114.1	2.76	0.000	2.76	0	0.44	32.178	3.08	39.42	26	0.92%	2.4	36%	3.94	0.000	3.94	0	0	0.50	0.06	0.90	0.04	1.00	0.060	43.39	82.81	0.117	N/A	0.59	0.36	0.80	0.73	1.00	0.093	2.22	87.44	0.142	N/A	N/A	N/A	0.44	32.19	3.08	39.42	50.360		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
50.524	6923.08	76.5	0.669	76.5	4.9	2.11	0.87%	Coarse Alluvium	0.057	114.1	2.77	0.000	2.77	0	0.44	33.640	3.22	41.21	27	0.91%	2.4	36%	3.95	0.000	3.95	0	0	0.50	0.07	0.90	0.02	1.00	0.060	44.01	85.22	0.120	N/A	0.59	0.37	0.80	0.73	1.00	0.093	2.15	88.71	0.145	N/A	N/A	N/A	0.44	33.65	3.22	41.21	50.524		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
50.688	6922.91	79.2	0.663	79.2	5.6	2.42	0.84%	Coarse Alluvium	0.057	114.1	2.77	0.000	2.77	0	0.44	35.049	3.36	42.94	28	0.87%	2.3	36%	3.96	0.000	3.96	0	0	0.50	0.07	0.89	0.01	1.00	0.060	44.60	87.54	0.123	N/A	0.59	0.38	0.80	0.73	1.00	0.092	2.07	89.04	0.146	N/A	N/A	N/A	0.44	35.06	3.36	42.94	50.688		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
50.852	6922.75	81.9	0.668	81.9	4.7	2.05	0.82%	Coarse Alluvium	0.057	114.1	2.78	0.000	2.78	0	0.45	36.503	3.50	44.71	28	0.84%	2.3	36%	3.97	0.000	3.97	0	0	0.50	0.07	0.89	-0.01	1.00	0.060	45.22	89.93	0.127	N/A	0.59	0.39	0.80	0.73	1.00	0.092	2.01	89.98	0.148	N/A	N/A	N/A	0.45	36.52	3.50	44.71	50.852		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
51.016	6922.58	81.3	0.656	81.3	3.8	1.63	0.81%	Coarse Alluvium	0.057	114.1	2.79	0.000	2.79	0	0.44	36.035	3.45	44.14	28	0.84%	2.3	36%	3.98	0.000	3.98	0	0	0.49	0.07	0.89	0.00	1.00	0.060	45.02	89.16	0.126	N/A	0.59	0.38	0.80	0.73	1.00	0.092	2.02	89.16	0.146	N/A	N/A	N/A	0.44	36.05	3.45	44.14	51.016	25	1.00	23	10	0.50	0.52	0.44	5.5	15.6	0.16	N/A	5.00	1.20	17.06	0.181	N/A	N/A
51.180	6922.42	81.3	0.639	81.3	0.3	0.14	0.79%	Coarse Alluvium	0.057	114.1	2.80	0.000	2.80	0	0.44	35.930	3.44	44.00	28	0.81%	2.3	36%	3.99	0.000	3.99	0	0	0.49	0.07	0.89	0.00	1.00	0.060	44.97	88.97	0.125	N/A	0.59	0.38	0.80	0.73	1.00	0.092	2.01	88.27	0.144	N/A	N/A	N/A	0.44	35.93	3.44	44.00	51.180		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
51.345	6922.26	80.6	0.649	80.6	3.3	1.42	0.81%	Coarse Alluvium	0.057	114.1	2.81	0.000	2.81	0	0.44	35.435	3.39	43.40	28	0.83%	2.3	36%	4.00	0.000	4.00	0	0	0.49	0.07	0.89	0.00	1.00	0.059	44.77	88.17	0.124	N/A	0.59	0.38	0.80	0.73	1.00	0.092	2.04	88.52	0.145	N/A	N/A	N/A	0.44	35.44	3.39	43.40	51.345		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
51.509	6922.09	81.0	0.644	81.0	3.5	1.50	0.79%	Coarse Alluvium	0.057	114.1	2.82	0.000	2.82	0	0.44	35.589	3.41	43.59	28	0.82%	2.3	36%	4.01	0.000	4.01	0	0	0.49	0.07	0.89	0.00	1.00	0.059	44.83	88.42	0.125	N/A	0.58	0.38	0.80	0.73	1.00	0.092	2.03	88.35	0.144	N/A	N/A	N/A	0.44	35.60	3.41	43.59	51.509		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
51.673	6921.93	80.1	0.626	80.1	3.6	1.55	0.78%	Coarse Alluvium	0.057	114.1	2.83	0.000	2.83	0	0.44	34.950	3.35	42.81	27	0.81%	2.3	36%	4.02	0.000	4.02	0	0	0.49	0.07	0.89	0.01	1.00	0.059	44.56	87.37	0.123	N/A	0.58	0.38	0.80	0.73	1.00	0.091	2.04	87.15	0.142	N/A	N/A	N/A	0.44	34.96	3.35	42.81	51.673		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
51.837	6921.76	81.9	0.764	81.9	3.7	1.61	0.93%	Coarse Alluvium	0.057	114.1	2.84	0.000	2.84	0	0.44	35.890	3.44	43.96	28	0.97%	2.4	36%	4.02	0.000	4.02	0	0	0.49	0.07	0.89	0.00	1.00	0.059	44.96	88.92	0.125	N/A	0.58	0.38	0.80	0.73	1.00	0.091	2.14	94.24	0.158	N/A	N/A	N/A	0.44	35.90	3.44	43.96	51.837		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
52.001	6921.60	77.2	0.870	77.2	3.5	1.53	1.13%	Coarse Alluvium	0.057	114.1	2.85	0.000	2.85	0	0.43	33.170	3.18	40.63	26	1.17%	2.4	36%	4.03	0.000	4.03	0	0	0.49	0.07	0.90	0.03	1.00	0.059	43.81	84.44	0.119	N/A	0.58	0.37	0.80	0.73	1.00	0.091	2.41	98.04	0.168	N/A	N/A	N/A	0.43	33.18	3.18	40.63	52.001		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
52.165	6921.44	74.2	0.943	74.1	4.1	1.77	1.27%	Coarse Alluvium	0.057	114.1	2.86	0.000	2.86	0	0.42	31.411	3.01	38.48	25	1.32%	2.5	36%	4.04	0.000	4.04	0	0	0.49	0.06	0.90	0.05	1.00	0.059	43.07	81.54	0.115	N/A	0.58	0.36	0.80	0.73	1.00	0.091	2.62	100.72	0.175	N/A	N/A	N/A	0.42	31.42	3.01	38.48	52.165		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
52.329	6921.27	77.0	0.912	76.9	3.9	1.67	1.19%	Coarse Alluvium	0.057	114.1	2.87	0.000	2.87	0	0.43	32.841	3.15	40.23	26	1.23%	2.4	36%	4.05	0.000	4.05	0	0	0.49	0.07	0.90	0.03	1.00	0.059	43.67	83.90	0.118	N/A	0.58	0.37	0.80	0.73	1.00	0.091	2.48	99.81	0.172	N/A	N/A	N/A	0.43	32.85	3.15	40.23	52.329		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
52.493	6921.11	71.8	0.996	71.8	3.0	1.30	1.39%	Coarse Alluvium	0.057	114.1	2.88	0.000	2.88	0	0.42	30.001	2.87	36.75	24	1.44%	2.5	36%	4.06	0.000	4.06	0	0	0.49	0.06	0.90	0.06	1.00	0.058	42.47	79.22	0.112	N/A	0.58	0.35	0.80	0.73	1.00	0.091	2.79	102.58	0.180	N/A	N/A	N/A	0.42	30.01	2.87	36.75	52.493		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
52.657	6920.94	56.5	1.402	56.5	2.6	1.14	2.48%	Coarse Alluvium	0.057	114.1	2.89	0.000	2.89	0	0.39	22.121	2.12	27.10	19	2.61%	2.7	36%	4.07	0.000	4.07	0	0	0.49	0.06	0.91	0.10	1.00	0.058	39.14	66.24	0.095	N/A	0.57	0.30	0.80	0.73	1.00	0.090	4.32	117.03	0.229	N/A	N/A	N/A	0.39	22.13	2.12	27.10	52.657		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
52.821	6920.78	42.0	1.549	42.0	3.1	1.34	3.69%	Coarse Alluvium	0.057	114.1	2.90	0.000	2.90	0	0.37	15.612	1.50	19.13	14	3.96%	3.0	36%	4.08	0.000	4.08	0	0	0.49	0.05	0.92	0.10	1.00	0.057	36.39	55.52	0.083	N/A	0.57	0.25	0.80	0.72	1.00	0.090	6.34	121.18	0.246	N/A	N/A	N/A	0.37	15.62	1.50	19.13	52.821		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
52.985	6920.62	39.3	1.641	39.3	5.6	2.42	4.18%	Coarse Alluvium	0.057	114.1	2.91	0.000	2.91	0	0.37	14.556	1.39	17.84	13	4.51%	3.0	36%	4.09	0.000	4.09	0	0	0.48	0.05	0.92	0.10	1.00	0.057	35.95	53.79	0.081	N/A	0.57	0.24	0.80	0.72	1.00	0.090	7.01	125.00	0.262	N/A	N/A	N/A	0.37	14.57	1.39	17.84	52.985		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
53.149	6920.45	38.8	1.586	38.8	6.5	2.81	4.09%	Coarse Alluvium	0.057	114.1	2.91	0.000	2.91	0	0.37	14.331	1.37	17.57	12	4.42%	3.0	36%	4.10	0.000	4.10	0	0	0.48	0.05	0.92	0.10	1.00	0.057	35.86	53.42	0.081	N/A	0.57	0.24	0.80	0.72	1.00	0.090	7.01	123.21	0.254	N/A	N/A	N/A	0.37	14.35	1.37	17.57	53.149		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
53.313	6920.29	40.7	1.370	40.6	8.2	3.54	3.37%	Coarse Alluvium	0.057	114.1	2.92	0.000	2.92	0	0.37	14.978	1.43	18.36	13	3.63%	3.0	36%	4.11	0.000	4.11	0	0	0.48	0.05	0.92	0.10	1.00	0.057	36.13	54.49	0.082	N/A	0.57	0.25	0.80	0.72	1.00	0.090	6.26	115.00	0.221	N/A	N/A	N/A	0.37	15.00	1.44	18.36	53.313		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
53.477	6920.12	41.8	1.035	41.8	6.2	2.70	2.47%	Coarse Alluvium	0.057	114.1	2.93	0.000	2.93	0	0.37	15.386	1.47	18.86	13	2.66%	2.9	36%	4.12	0.000	4.12	0	0	0.48	0.05	0.92	0.10	1.00	0.057	36.30	55.16	0.083	N/A	0.57	0.25	0.80	0.72	1.00	0.090	5.37	101.36	0.177	N/A	N/A	N/A	0.37	15.40	1.47	18.86	53.477		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
53.641	6919.96	52.0	0.917	52.0	4.9	2.11	1.76%	Coarse Alluvium	0.057	114.1	2.94	0.000	2.94	0	0.38	19.586	1.88	24.00	17	1.87%	2.7	36%	4.13	0.000	4.13	0	0	0.48	0.06	0.91	0.10	1.00	0.057	38.07	62.07	0.090	N/A	0.57	0.28	0.80	0.72	1.00	0.089	3.98	95.45	0.161	N/A	N/A	N/A	0.38	19.60	1.88	24.00	53.641		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
53.805	6919.79	53.2	0.932	53.2	4.5	1.95	1.75%	Coarse Alluvium	0.057	114.1	2.95	0.000	2.95	0	0.38	20.094	1.92	24.62	17	1.85%	2.7	36%	4.14	0.000	4.14	0	0	0.48	0.06	0.91	0.10	1.00	0.057	38.29	62.91	0.091	N/A	0.57	0.29	0.80	0.72	1.00	0.089	3.91	96.24	0.163	N/A	N/A	N/A	0.38	20.10	1.92	24.62	53.805		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
53.969	6919.63	60.2	0.957	60.2	4.5	1.95	1.59%	Coarse Alluvium	0.057	114.1	2.96	0.000	2.96	0	0.39	23.361	2.24	28.62	19	1.67%	2.6	36%	4.15	0.000	4.15	0	0	0.48	0.06	0.91	0.10	1.00	0.057	39.67	68.29	0.097	N/A	0.56	0.31	0.80	0.72	1.00	0.089	3.44	98.35	0.168	N/A	N/A	N/A	0.39	23.37	2.24	28.62	53.969		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
54.133	6919.47	78.9	1.096	78.8	5.6	2.42	1.39%	Coarse Alluvium	0.057	114.1	2.97	0.000	2.97	0	0.42	32.869	3.15	40.27	26	1.44%	2.5	36%	4.16	0.000	4.16	0	0	0.48	0.07	0.89	0.03	1.00	0.058	43.68	83.95	0.118	N/A	0.56	0.37	0.80	0.72	1.00	0.089	2.68	107.77	0.196	N/A	N/A	N/A	0.42	32.88	3.15	40.27	54.133		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
54.297	6919.30	84.2	1.495	84.2	5.4	2.34	1.77%	Coarse Alluvium	0.057	114.1	2.98	0.000	2.98	0	0.42	35.694	3.42	43.72	27	1.84%	2.5	36%	4.16	0.000	4.16	0	0	0.48	0.07	0.89	0.00	1.00	0.058	44.88	88.60	0.125	N/A	0.56	0.38	0.80	0.72	1.00	0.089	2.86	125.25	0.263	N/A	N/A	N/A	0.42	35.71	3.42	43.72	54.297		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
54.461	6919.14	100.2	1.165	100.2	5.4	2.36	1.16%	Coarse Alluvium	0.057	114.1	2.99	0.000	2.99	0	0.45	44.723	4.28	54.78	33	1.20%	2.3	36%	4.17	0.000	4.17	0	0	0.48	0.07	0.88	-0.08	1.00	0.059	48.69	103.47	0.148	N/A	0.56	0.43	0.79	0.71	1.00	0.091	2.12	115.98	0.225	N/A	N/A	N/A	0.45	44.74	4.28	54.78	54.461		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
54.625	6918.97	105.0	1.871	105.0	2.6	1.14	1.78%	Coarse Alluvium	0.057	114.1	3.00	0.000	3.00	0	0.45	47.463	4.55	58.13	34	1.83%	2.4	36%	4.18	0.000	4.18	0	0	0.48	0.08	0.88	-0.10	1.00	0.059	49.84	107.97	0.156	N/A	0.48	0.44	0.78	0.70	1.00	0.078	2.49	144.58	0.361	N/A	N/A	N/A	0.45	47.47	4.54	58.13	54.625		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
54.789	6918.81	94.5	2.569	94.5	4.1	1.77	2.72%	Coarse Alluvium	0.057	114.1	3.01	0.000	3.01	0	0.44	41.194	3.95	50.46	30	2.81%	2.6	36%	4.19	0.000	4.19	0	0	0.48	0.07	0.88	-0.05	1.00	0.058	47.20	97.65	0.139	N/A	0.48	0.41	0.79	0.72	1.00	0.076	3.29	166.07	1.000	N/A	N/A	N/A	0.44	41.20	3.94	50.46	54.789		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
54.953	6918.65	130.0	1.676	130.0	0.9	0.41	1.29%	Coarse Alluvium	0.057	114.1	3.02	0.000	3.02	0	0.49	63.065	6.04	77.23	42	1.32%	2.3	36%	4.20	0.000	4.20	0	0	0.48	0.09	0.85	-0.21	1.00	0.060	56.43	133.66	0.213	N/A	0.48	0.51	0.75	0.66	1.00	0.082	1.89	145.95	0.369	N/A	N/A	N/A	0.49	63.07	6.04	77.23	54.953		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
55.117	6918.48	207.7	2.402	207.7	4.2	1.81	1.16%	Coarse Alluvium	0.057	114.1	3.03	0.000	3.03	0	0.59	122.460	11.73	149.97	68	1.17%	2.1	36%	4.21	0.000	4.21	0	0	0.48	0.16	0.74	-0.49	1.00	0.070	81.52	231.49	1.000	N/A	0.48	0.71	0.65	0.56	1.00	0.097	1.43	214.48	1.000	N/A	N/A	N/A	0.59	122.48	11.73	149.97	55.117		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
55.281	6918.32	275.5	2.556	275.5	3.2	1.40	0.93%	Coarse Alluvium	0.057	114.1	3.04	0.000	3.04	0	0.68	187.835	17.99	230.02	90	0.94%	1.9	36%	4.22	0.000	4.22	0	0	0.47	0.30	0.51	-0.60	1.00	0.101	109.13	339.15	1.000	N/A	0.47	0.88	0.60	0.52	1.00	0.105	1.22	280.16	1.000	N/A	N/A	N/A	0.68	187.85	17.98	230.02	55.281		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
55.446	6918.15	247.8	2.916	247.8	4.2	1.83	1.18%	Coarse Alluvium	0.057	114.1	3.05	0.000	3.05	0	0.64	159.162	15.25	194.92	80	1.19%	2.0	36%	4.23	0.000	4.23	0	0	0.47	0.25	0.59	-0.60	1.00	0.086	97.02	291.94	1.000	N/A	0.47	0.81	0.60	0.52	1.00	0.104	1.34	261.96	1.000	N/A	N/A	N/A	0.64	159.18	15.24	194.92	55.446		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
55.610	6917.99	223.1	2.610	223.1	2.5	1.10	1.17%	Coarse Alluvium	0.057	114.1	3.06	0.000	3.06	0	0.61	135.459	12.97	165.88	72	1.19%	2.1	36%	4.24	0.000	4.24	0	0	0.47	0.18	0.70	-0.54	1.00	0.073	87.01	252.89	1.000	N/A	0.47	0.74	0.63	0.54	1.00	0.100	1.40	232.07	1.000	N/A	N/A	N/A	0.61	135.47	12.97	165.88	55.610		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
55.774	6917.83	196.9	2.377	196.9	2.4	1.02	1.21%	Coarse Alluvium	0.057	114.1	3.06	0.000	3.06	0	0.57	112.316	10.76	137.54	63	1.23%	2.1	36%	4.25	0.000	4.25	0	0	0.47	0.14	0.76	-0.45	1.00	0.067	77.23	214.77	1.000	N/A	0.47	0.68	0.66	0.57	1.00	0.094	1.49	205.45	1.000	N/A	N/A	N/A	0.57	112.32	10.75	137.54	55.774		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
55.938	6917.66	173.9	2.254	173.9	1.5	0.65	1.30%	Coarse Alluvium	0.057	114.1	3.07	0.000	3.07	0	0.54	93.628	8.97	114.65	56	1.32%	2.2	36%	4.26	0.000	4.26	0	0	0.47	0.12	0.80	-0.37	1.00	0.063	69.34	183.99	0.608	N/A	0.47	0.62	0.69	0.60	1.00	0.090	1.63	186.84	1.000	N/A	N/A	N/A	0.54	93.63	8.96	114.65	55.938		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
56.102	6917.50	155.8	2.130	155.8	2.5	1.10	1.37%	Coarse Alluvium	0.057	114.1	3.08	0.000	3.08	0	0.51	79.832	7.65	97.76	50	1.39%	2.2	36%	4.27	0.000	4.27	0	0	0.47	0.10	0.83	-0.30	1.00	0.061	63.51	161.28	0.335	N/A	0.47	0.57	0.71	0.62	1.00	0.086	1.77	172.83	1.000	N/A	N/A	N/A	0.51	79.84	7.64	97.76	56.102		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
56.266	6917.33	152.5	2.824	152.5	3.2	1.40	1.85%	Coarse Alluvium	0.057	114.1	3.09	0.000	3.09	0	0.51	77.280	7.40	94.64	48	1.89%	2.3	36%	4.28	0.000	4.28	0	0	0.47	0.10	0.83	-0.29	1.00	0.061	62.44	157.08	0.308	N/A	0.47	0.56	0.72	0.63	1.00	0.086	2.05	193.94	1.000	N/A	N/A	N/A	0.51	77.29	7.40	94.64	56.266		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
56.430	6917.17	159.2	2.616	159.2	4.3	1.85	1.64%	Coarse Alluvium	0.057	114.1	3.10	0.000	3.10	0	0.52	81.999	7.85	100.43	50	1.68%	2.3	36%	4.29	0.000	4.29	0	0	0.47	0.11	0.82	-0.31	1.00	0.062	64.43	164.86	0.361	N/A	0.47	0.58	0.71	0.62	1.00	0.087	1.90	190.32	1.000	N/A	N/A	N/A	0.52	82.01	7.85	100.43	56.430		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
56.594	6917.01	178.1	2.995	178.0	6.2	2.70	1.68%	Coarse Alluvium	0.057	114.1	3.11	0.000	3.11	0	0.54	96.039	9.20	117.63	56	1.71%	2.3	36%	4.30	0.000	4.30	0	0	0.47	0.12	0.80	-0.38	1.00	0.064	70.36	187.99	0.697	N/A	0.47	0.63	0.69	0.59	1.00	0.090	1.80	212.16	1.000	N/A	N/A	N/A	0.54	96.06	9.20	117.63	56.594		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
56.758	6916.84	217.7	3.115	217.6	9.2	4.00	1.43%	Coarse Alluvium	0.057	114.1	3.12	0.000	3.12	0	0.59	128.910	12.35	157.89	69	1.45%	2.1	36%	4.31	0.000	4.31	0	0	0.47	0.17	0.71	-0.52	1.00	0.071	84.25	242.14	1.000	N/A	0.47	0.73	0.64	0.55	1.00	0.098	1.53	241.59	1.000	N/A	N/A	N/A	0.59	128.94	12.35	157.89	56.758		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
56.922	6916.68	187.3	2.881	187.3	0.4	0.16	1.54%	Coarse Alluvium	0.057	114.1	3.13	0.000	3.13	0	0.55	102.963	9.86	126.08	59	1.56%	2.2	36%	4.31	0.000	4.31	0	0	0.47	0.13	0.78	-0.41	1.00	0.065	73.28	199.36	1.000	N/A	0.47	0.65	0.68	0.58	1.00	0.092	1.70	213.85	1.000	N/A	N/A	N/A	0.55	102.96	9.86	126.08	56.922		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
57.086	6916.51	134.1	2.669	134.1	3.1	1.34	1.99%	Coarse Alluvium	0.057	114.1	3.14	0.000	3.14	0	0.48	63.865	6.12	78.21	42	2.04%	2.4	36%	4.32	0.000	4.32	0	0	0.47	0.09	0.85	-0.21	1.00	0.059	56.77	134.98	0.217	N/A	0.47	0.51	0.74	0.65	1.00	0.082	2.31	180.82	1.000	N/A	N/A	N/A	0.48	63.87	6.12	78.21	57.086		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
57.250	6916.35	94.2	2.226	94.2	1.9	0.83	2.36%	Coarse Alluvium	0.057	114.1	3.15	0.000	3.15	0	0.42	39.452	3.78	48.32	29	2.44%	2.6	36%	4.33	0.000	4.33	0	0	0.47	0.07	0.88	-0.03	1.00	0.057	46.46	94.78	0.134	N/A	0.47	0.40	0.80	0.72	1.00	0.074	3.17	153.01	0.413	N/A	N/A	N/A	0.42	39.46	3.78	48.32	57.250		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
57.414	6916.19	84.5	2.004	84.5	3.7	1.59	2.37%	Coarse Alluvium	0.057	114.1	3.16	0.000	3.16	0	0.40	34.067	3.26	41.73	26	2.46%	2.6	36%	4.34	0.000	4.34	0	0	0.47	0.07	0.89	0.02	1.00	0.056	44.19	85.91	0.121	N/A	0.47	0.37	0.80	0.72	1.00	0.074	3.42	142.70	0.350	N/A	N/A	N/A	0.40	34.08	3.26	41.73	57.414		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
57.578	6916.02	88.0	1.613	88.0	3.5	1.50	1.83%	Coarse Alluvium	0.057	114.1	3.17	0.000	3.17	0	0.41	35.849	3.43	43.91	27	1.90%	2.5	36%	4.35	0.000	4.35	0	0	0.47	0.07	0.89	0.00	1.00	0.057	44.94	88.85	0.125	N/A	0.47	0.38	0.80	0.72	1.00	0.074	2.94	129.23	0.281	N/A	N/A	N/A	0.41	35.86	3.43	43.91	57.578		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
57.742	6915.86	88.0	1.218	88.0	3.0	1.28	1.38%	Coarse Alluvium	0.057	114.1	3.18	0.000	3.18	0	0.41	35.788	3.43	43.83	27	1.44%	2.5	36%	4.36	0.000	4.36	0	0	0.46	0.07	0.89	0.01	1.00	0.056	44.91	88.75	0.125	N/A	0.46	0.38	0.80	0.72	1.00	0.074	2.59	113.64	0.216	N/A	N/A	N/A	0.41	35.80	3.43	43.83	57.742		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
57.906	6915.69	91.9	0.957	91.9	2.9	1.24	1.04%	Coarse Alluvium	0.057	114.1	3.19	0.000	3.19	0	0.41	37.766	3.62	46.25	28	1.08%	2.4	36%	4.37	0.000	4.37	0	0	0.46	0.07	0.88	-0.01	1.00	0.057	45.75	92.00	0.130	N/A	0.46	0.39	0.80	0.71	1.00	0.074	2.24	103.58	0.183	N/A	N/A	N/A	0.41	37.77	3.62	46.25	57.906		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
58.070	6915.53	92.6	0.962	92.6	2.8	1.20	1.04%	Coarse Alluvium	0.057	114.1	3.20	0.000	3.20	0	0.41	38.084	3.65	46.64	28	1.08%	2.4	36%	4.38	0.000	4.38	0	0	0.46	0.07	0.88	-0.02	1.00	0.057	45.88	92.53	0.131	N/A	0.46	0.39	0.80	0.71	1.00	0.074	2.23	103.95	0.184	N/A	N/A	N/A	0.41	38.09	3.65	46.64	58.070		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
58.234	6915.37	92.3	1.379	92.3	2.7	1.18	1.49%	Coarse Alluvium	0.057	114.1	3.20	0.000	3.20	0	0.41	37.814	3.62	46.31	28	1.55%	2.5	36%	4.39	0.000	4.39	0	0	0.46	0.07	0.88	-0.01	1.00	0.056	45.77	92.08	0.130	N/A	0.46	0.39	0.80	0.71	1.00	0.074	2.61	120.98	0.245	N/A	N/A	N/A	0.41	37.82	3.62	46.31	58.234		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
58.398	6915.20	99.2	1.033	99.2	4.6	1.97	1.04%	Coarse Alluvium	0.057	114.1	3.21	0.000	3.21	0	0.42	41.525	3.98	50.86	30	1.08%	2.4	36%	4.40	0.000	4.40	0	0	0.46	0.07	0.88	-0.05	1.00	0.057	47.34	98.20	0.140	N/A	0.46	0.41	0.79	0.71	1.00	0.075	2.14	108.76	0.200	N/A	N/A	N/A	0.42	41.54	3.98	50.86	58.398		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
58.562	6915.04	107.2	1.156	107.2	1.8	0.79	1.08%	Coarse Alluvium	0.057	114.1	3.22	0.000	3.22	0	0.43	46.002	4.41	56.34	32	1.11%	2.3	36%	4.41	0.000	4.41	0	0	0.46	0.08	0.87	-0.08	1.00	0.057	49.23	105.56	0.152	N/A	0.46	0.43	0.78	0.69	1.00	0.076	2.06	116.28	0.226	N/A	N/A	N/A	0.43	46.01	4.40	56.34	58.562		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
58.726	6914.87	106.8	1.129	106.8	2.0	0.85	1.06%	Coarse Alluvium	0.057	114.1	3.23	0.000	3.23	0	0.43	45.630	4.37	55.88	32	1.09%	2.3	36%	4.42	0.000	4.42	0	0	0.46	0.07	0.87	-0.08	1.00	0.057	49.07	104.95	0.151	N/A	0.46	0.43	0.78	0.69	1.00	0.076	2.06	114.98	0.221	N/A	N/A	N/A	0.43	45.64	4.37	55.88	58.726		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
58.890	6914.71	104.4	1.226	104.3	2.6	1.12	1.17%	Coarse Alluvium	0.057	114.1	3.24	0.000	3.24	0	0.42	44.130	4.23	54.05	31	1.21%	2.4	36%	4.43	0.000	4.43	0	0	0.46	0.07	0.88	-0.07	1.00	0.057	48.44	102.48	0.147	N/A	0.46	0.42	0.79	0.70	1.00	0.075	2.18	118.04	0.233	N/A	N/A	N/A	0.42	44.14	4.23	54.05	58.890		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
59.054	6914.55	104.5	1.098	104.5	3.0	1.30	1.05%	Coarse Alluvium	0.057	114.1	3.25	0.000	3.25	0	0.42	44.098	4.22	54.01	31	1.08%	2.3	36%	4.44	0.000	4.44	0	0	0.46	0.07	0.88	-0.07	1.00	0.057	48.42	102.43	0.147	N/A	0.46	0.42	0.79	0.70	1.00	0.075	2.09	112.86	0.214	N/A	N/A	N/A	0.42	44.11	4.22	54.01	59.054		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
59.218	6914.38	100.5	0.946	100.5	2.7	1.16	0.94%	Coarse Alluvium	0.057	114.1	3.26	0.000	3.26	0	0.42	41.755	4.00	51.14	30	0.97%	2.3	36%	4.45	0.000	4.45	0	0	0.46	0.07	0.88	-0.05	1.00	0.056	47.43	98.57	0.140	N/A	0.46	0.41	0.79	0.70	1.00	0.074	2.06	105.22	0.188	N/A	N/A	N/A	0.42	41.76	4.00	51.14	59.218		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
59.382	6914.22	96.8	0.760	96.8	2.6	1.14	0.78%	Coarse Alluvium	0.057	114.1	3.27	0.000	3.27	0	0.41	39.611	3.79	48.51	29	0.81%	2.3	36%	4.46	0.000	4.46	0	0	0.46	0.07	0.88	-0.03	1.00	0.056	46.53	95.04	0.135	N/A	0.46	0.40	0.80	0.71	1.00	0.074	1.98	95.92	0.162	N/A	N/A	N/A	0.41	39.62	3.79	48.51	59.382		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
59.547	6914.05	91.5	0.756	91.5	2.1	0.89	0.83%	Coarse Alluvium	0.057	114.1	3.28	0.000	3.28	0	0.40	36.617	3.51	44.84	27	0.86%	2.3	36%	4.46	0.000	4.46	0	0	0.46	0.07	0.88	0.00	1.00	0.056	45.26	90.11	0.127	N/A	0.46	0.39	0.80	0.71	1.00	0.073	2.10	94.03	0.157	N/A	N/A	N/A	0.40	36.62	3.51	44.84	59.547		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
59.711	6913.89	86.1	0.908	86.1	2.2	0.96	1.06%	Coarse Alluvium	0.057	114.1	3.29	0.000	3.29	0	0.39	33.684	3.23	41.25	25	1.10%	2.4	36%	4.47	0.000	4.47	0	0	0.46	0.07	0.89	0.03	1.00	0.056	44.02	85.28	0.120	N/A	0.46	0.37	0.80	0.71	1.00	0.073	2.41	99.32	0.171	N/A	N/A	N/A	0.39	33.69	3.23	41.25	59.711		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
59.875	6913.73	81.4	0.709	81.4	2.2	0.96	0.87%	Coarse Alluvium	0.057	114.1	3.30	0.000	3.30	0	0.38	31.218	2.99	38.23	24	0.91%	2.4	36%	4.48	0.000	4.48	0	0	0.46	0.06	0.89	0.05	1.00	0.055	42.98	81.22	0.114	N/A	0.46	0.36	0.80	0.71	1.00	0.073	2.33	89.04	0.146	N/A	N/A	N/A	0.38	31.22	2.99	38.23	59.875		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
60.039	6913.56	83.4	0.536	83.4	2.6	1.14	0.64%	Coarse Alluvium	0.057	114.1	3.31	0.000	3.31	0	0.39	32.171	3.08	39.40	24	0.67%	2.3	36%	4.49	0.000	4.49	0	0	0.46	0.06	0.89	0.04	1.00	0.055	43.39	82.79	0.116	N/A	0.46	0.36	0.80	0.71	1.00	0.073	2.06	81.13	0.130	N/A	N/A	N/A	0.39	32.18	3.08	39.40	60.039		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
60.203	6913.40	88.2	0.485	88.2	1.8	0.79	0.55%	Coarse Alluvium	0.057	114.1	3.32	0.000	3.32	0	0.39	34.547	3.31	42.31	26	0.57%	2.3	36%	4.50	0.000	4.50	0	0	0.46	0.07	0.89	0.02	1.00	0.055	44.39	86.70	0.122	N/A	0.46	0.38	0.80	0.71	1.00	0.073	1.89	80.00	0.128	N/A	N/A	N/A	0.39	34.55	3.31	42.31	60.203		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
60.367	6913.23	90.8	0.512	90.8	1.2	0.51	0.56%	Coarse Alluvium	0.057	114.1	3.33	0.000	3.33	0	0.39	35.830	3.43	43.88	26	0.59%	2.3	36%	4.51	0.000	4.51	0	0	0.45	0.07	0.88	0.01	1.00	0.055	44.93	88.81	0.125	N/A	0.45	0.38	0.80	0.71	1.00	0.073	1.87	82.13	0.132	N/A	N/A	N/A	0.39	35.83	3.43	43.88	60.367		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
60.531	6913.07	96.7	0.526	96.7	0.8	0.36	0.54%	Coarse Alluvium	0.057	114.1	3.34	0.000	3.34	0	0.40	38.864	3.72	47.59	28	0.56%	2.2	36%	4.52	0.000	4.52	0	0	0.45	0.07	0.88	-0.02	1.00	0.056	46.21	93.80	0.133	N/A	0.45	0.40	0.80	0.71	1.00	0.073	1.78	84.78	0.137	N/A	N/A	N/A	0.40	38.87	3.72	47.59	60.531		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
60.695	6912.91	96.9	0.567	96.9	0.7	0.29	0.58%	Coarse Alluvium	0.057	114.1	3.35	0.000	3.35	0	0.40	38.904	3.73	47.64	28	0.61%	2.3	36%	4.53	0.000	4.53	0	0	0.45	0.07	0.88	-0.02	1.00	0.056	46.23	93.87	0.133	N/A	0.45	0.40	0.80	0.71	1.00	0.073	1.82	86.73	0.141	N/A	N/A	N/A	0.40	38.91	3.72	47.64	60.695		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
60.859	6912.74	96.8	0.627	96.8	0.4	0.18	0.65%	Coarse Alluvium	0.057	114.1	3.35	0.000	3.35	0	0.40	38.745	3.71	47.44	28	0.67%	2.3	36%	4.54	0.000	4.54	0	0	0.45	0.07	0.88	-0.02	1.00	0.055	46.16	93.60	0.132	N/A	0.45	0.40	0.80	0.71	1.00	0.073	1.88	89.41	0.146	N/A	N/A	N/A	0.40	38.75	3.71	47.44	60.859		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
61.023	6912.58	95.9	0.676	95.9	0.6	0.26	0.71%	Coarse Alluvium	0.057	114.1	3.36	0.000	3.36	0	0.40	38.136	3.65	46.70	27	0.73%	2.3	36%	4.55	0.000	4.55	0	0	0.45	0.07	0.88	-0.01	1.00	0.055	45.90	92.60	0.131	N/A	0.45	0.39	0.80	0.71	1.00	0.073	1.95	91.28	0.151	N/A	N/A	N/A	0.40	38.14	3.65	46.70	61.023	25	1.00	23	9	0.48	0.53	0.40	5.5	14.7	0.15	N/A	5.00	1.20	16.03	0.171	N/A	N/A
61.187	6912.41	91.6	0.709	91.6	0.7	0.30	0.77%	Coarse Alluvium	0.057	114.1	3.37	0.000	3.37	0	0.39	35.786	3.43	43.82	26	0.80%	2.3	36%	4.56	0.000	4.56	0	0	0.45	0.07	0.88	0.01	1.00	0.055	44.91	88.73	0.125	N/A	0.45	0.38	0.80	0.71	1.00	0.073	2.09	91.41	0.151	N/A	N/A	N/A	0.39	35.79	3.43	43.82	61.187		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
61.351	6912.25	92.4	0.700	92.4	0.5	0.23	0.76%	Coarse Alluvium	0.057	114.1	3.38	0.000	3.38	0	0.39	36.132	3.46	44.25	26	0.79%	2.3	36%	4.57	0.000	4.57	0	0	0.45	0.07	0.88	0.01	1.00	0.055	45.06	89.30	0.126	N/A	0.45	0.38	0.80	0.71	1.00	0.073	2.06	91.20	0.151	N/A	N/A	N/A	0.39	36.13	3.46	44.25	61.351		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
61.515	6912.09	97.1	0.651	97.1	1.1	0.47	0.67%	Coarse Alluvium	0.057	114.1	3.39	0.000	3.39	0	0.40	38.542	3.69	47.20	28	0.69%	2.3	36%	4.58	0.000	4.58	0	0	0.45	0.07	0.88	-0.02	1.00	0.055	46.07	93.27	0.132	N/A	0.45	0.40	0.80	0.71	1.00	0.073	1.92	90.40	0.149	N/A	N/A	N/A	0.40	38.55	3.69	47.20	61.515		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
61.679	6911.92	102.2	0.641	102.2	1.0	0.45	0.63%	Coarse Alluvium	0.057	114.1	3.40	0.000	3.40	0	0.40	41.203	3.95	50.46	29	0.65%	2.3	36%	4.59	0.000	4.59	0	0	0.45	0.07	0.88	-0.04	1.00	0.055	47.20	97.66	0.139	N/A	0.45	0.41	0.79	0.70	1.00	0.073	1.82	91.67	0.152	N/A	N/A	N/A	0.40	41.21	3.95	50.46	61.679		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
61.843	6911.76	109.5	0.711	109.5	1.6	0.69	0.65%	Coarse Alluvium	0.057	114.1	3.41	0.000	3.41	0	0.41	45.149	4.32	55.29	31	0.67%	2.2	36%	4.60	0.000	4.60	0	0	0.45	0.07	0.87	-0.07	1.00	0.056	48.87	104.16	0.149	N/A	0.45	0.43	0.79	0.69	1.00	0.074	1.76	97.42	0.166	N/A	N/A	N/A	0.41	45.15	4.32	55.29	61.843		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
62.007	6911.59	136.9	0.854	136.8	3.6	1.55	0.62%	Coarse Alluvium	0.057	114.1	3.42	0.000	3.42	0	0.45	61.464	5.89	75.28	39	0.64%	2.1	36%	4.60	0.000	4.60	0	0	0.45	0.09	0.85	-0.19	1.00	0.057	55.76	131.03	0.206	N/A	0.45	0.50	0.75	0.65	1.00	0.079	1.53	115.43	0.223	N/A	N/A	N/A	0.45	61.47	5.89	75.28	62.007		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
62.171	6911.43	180.0	1.173	179.9	3.3	1.42	0.65%	Coarse Alluvium	0.057	114.1	3.43	0.000	3.43	0	0.51	91.250	8.74	111.75	51	0.66%	2.0	36%	4.61	0.000	4.61	0	0	0.45	0.12	0.80	-0.35	1.00	0.061	68.34	180.09	0.537	N/A	0.45	0.61	0.69	0.59	1.00	0.087	1.36	152.23	0.408	N/A	N/A	N/A	0.51	91.26	8.74	111.75	62.171		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
62.335	6911.26	197.5	1.539	197.5	3.0	1.30	0.78%	Coarse Alluvium	0.057	114.1	3.44	0.000	3.44	0	0.53	104.771	10.04	128.30	56	0.79%	2.1	36%	4.62	0.000	4.62	0	0	0.45	0.13	0.77	-0.42	1.00	0.063	74.05	202.35	1.000	N/A	0.45	0.65	0.67	0.57	1.00	0.090	1.37	176.06	1.000	N/A	N/A	N/A	0.53	104.78	10.03	128.30	62.335		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
62.499	6911.10	231.8	1.879	231.8	4.8	2.08	0.81%	Coarse Alluvium	0.057	114.1	3.45	0.000	3.45	0	0.58	133.903	12.83	163.99	66	0.82%	2.0	36%	4.63	0.000	4.63	0	0	0.45	0.18	0.69	-0.53	1.00	0.070	86.35	250.34	1.000	N/A	0.45	0.74	0.63	0.53	1.00	0.097	1.30	213.60	1.000	N/A	N/A	N/A	0.58	133.92	12.82	163.99	62.499		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
62.663	6910.94	299.8	2.207	299.8	3.1	1.36	0.74%	Coarse Alluvium	0.057	114.1	3.46	0.000	3.46	0	0.68	203.160	19.46	248.79	86	0.74%	1.9	36%	4.64	0.000	4.64	0	0	0.45	0.30	0.48	-0.60	1.00	0.101	115.60	364.39	1.000	N/A	0.45	0.91	0.60	0.50	1.00	0.102	1.18	292.41	1.000	N/A	N/A	N/A	0.68	203.17	19.45	248.79	62.663		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
62.827	6910.77	375.2	2.317	375.2	6.9	2.97	0.62%	Coarse Alluvium	0.057	114.1	3.47	0.000	3.47	0	0.68	256.189	24.54	313.74	107	0.62%	1.8	36%	4.65	0.000	4.65	0	0	0.45	0.30	0.48	-0.60	1.00	0.101	138.00	451.74	1.000	N/A	0.45	1.02	0.60	0.50	1.00	0.102	1.08	338.64	1.000	N/A	N/A	N/A	0.68	256.22	24.53	313.74	62.827		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
62.991	6910.61	490.4	2.317	490.4	9.6	4.15	0.47%	Coarse Alluvium	0.057	114.1	3.48	0.000	3.48	0	0.68	334.639	32.05	409.82	140	0.48%	1.6	36%	4.66	0.000	4.66	0	0	0.45	0.30	0.48	-0.60	1.00	0.101	171.13	580.95	1.000	N/A	0.45	1.17	0.60	0.50	1.00	0.102	1.00	409.82	1.000	N/A	N/A	N/A	0.68	334.68	32.04	409.82	62.991		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-
63.155	6910.44	502.6	2.317	502.5	8.6	3.72	0.46%	Coarse Alluvium	0.057	114.1	3.49	0.000	3.49	0	0.68	342.659	32.82	419.63	143	0.46%	1.6	36%	4.67	0.000	4.67	0	0	0.44	0.30	0.48	-0.60	1.00	0.101	174.52	594.15	1.000	N/A	0.44	1.18	0.60	0.50	1.00	0.102	1.00	419.63	1.000	N/A	N/A	N/A	0.68	342.70	32.81	419.63	63.155		1.00	-	-	-	-	-	-	-	-	-	5.00	1.20	-	0.000	-	-

ATTACHMENT G.7

Cover System Design Report – Dwyer Engineering, LLC

95% DRAFT

COVER SYSTEM DESIGN REPORT

July 2018

Northeast Church Rock Site Closure

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EXECUTIVE SUMMARY

The Removal Action (RA) referenced in the Administrative Settlement Agreement and Order on Consent for the United Nuclear Corporation Superfund Site and Northeast Church Rock (NECR) Mine Removal Site (AOC; USEPA, 2015) and described in the 2011 Action Memo (USEPA, 2011) and 2013 ROD (USEPA, 2013) calls for the excavation of approximately 1,000,000 cubic yards (cy) of mine waste from the Mine Site and placement at the Mill Site. Mine waste will be disposed of in a repository designed within the footprint of the existing tailings impoundment at the Mill Site. Disposal of waste at the Mill Site is contingent upon modification of the radioactive materials license issued by the U.S. Nuclear Regulatory Commission ("NRC") for the Mill Site.

The disposed of mine waste within the exiting tailings impoundment will be capped with a final cover system meeting applicable regulatory criteria and performance objectives. The final cover system referred to as an evapotranspiration (ET) cover is 4-ft thick (122 cm) composed of compacted cover soil overlain by a rock/soil admixture. The surface rock/soil admixture was designed to minimize erosion while providing a rooting medium for native vegetation as well as storage capacity for infiltrated precipitation. The overall profile provides adequate storage capacity to minimize flux through the cover and attenuate radon gas from the covered mine spoils below established performance criteria.

This report documents how the regulatory criteria and performance objectives have been satisfied with the cover design. The included documentation demonstrates the ability of the cover to provide adequate protection for a design life of 1000 years.

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FIGURES

TABLES

ACRONYMS AND ABBREVIATIONS

ACAP	Alternative Cover Assessment Program
ALCD	Alternative Landfill Cover Demonstration
AOC	Agreement and Order on Consent
ARAR	Applicable or Relevant and Appropriate Requirement
ASTM	American Society for Testing and Materials
BGS	below ground surface
CFR	Code of Federal Regulations
cm	centimeter
cy	cubic yards
DOE	Department of Energy
DWYER	Dwyer Engineering, LLC
EE/CA	Engineering Evaluation/Cost Analysis
ET	evapotranspiration
EWERU	Engineering and Wind Erosion Research Unit
GCL	Geosynthetic Clay Liner
MDD	maximum dry density
Mill Site	Church Rock Mill Site
Mine Site	Northeast Church Rock Mine Site
MWH	Montgomery Watson Harza
NECR	Northeast Church Rock
NOAA	National Oceanic and Atmospheric Administration
NRC	Nuclear Regulatory Commission
NRCS	Natural Resources Conservation Service
NTCRA	Non-Time Critical Removal Action
NWS	National Weather Service
PET	potential evapotranspiration
PMP	Probable Maximum Precipitation
PODR	Point of Diminishing Returns
PTW	principal threat waste
RA	Removal Action
RAO	Remedial Action Objective
ROD	Record of Decision
RAECOM	Radiation Attenuation Effectiveness and Cover Optimization with Moisture Effects
RUSLE	Revised Universal Soil Loss Equation
SA	Settlement Agreement Site
SOW	Statement of Work

ACRONYMS AND ABBREVIATIONS (CONTINUED)

USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USLE	Universal Soil Loss Equation
WEPS	Wind Erosion Prediction System
WEQ	Wind Erosion Equation

1.0 OVERVIEW OF DESIGN LOGIC

The Removal Action (RA) referenced in the Administrative Settlement Agreement and Order on Consent (AOC) and described in the 2011 Action Memo (USEPA, 2011) and 2013 Record of Decision (ROD; USEPA, 2013) calls for the excavation of approximately 1,000,000 cubic yards (cy) of mine waste from the Northeast Church Rock Mine Site (Mine Site) and placement at the Church Rock Mill Site (Mill Site). Mine waste will be disposed of in a repository designed within the footprint of the existing tailings impoundment at the Mill Site. These materials will then be capped with a final cover system, referred to as an evapotranspiration (ET) cover. The key regulatory performance criteria for the ET Cover system include:

- Maintain a design life of up to 1,000 years and at least 200 years.
- Minimize meteoric flux into the underlying mine waste (includes providing a rooting medium for native vegetation).
- Minimize erosion due to wind and runoff (up to the probably maximum precipitation event).
- Attenuate emanation of radon-222 from the mine waste to a rate of 20 pCi/m2s, average over the final cover surface.
- Design to accommodate minimum reliance on active maintenance.

This Design Report summarizes the design and analyses performed demonstrating that the recommended cover profile (1) meets the performance criteria and (2) will provide adequate protection for encapsulation of the mine spoils and underlying tailings materials for a design life of 1,000 years. The remainder of the report is structured as follows:

- Section 2 provides project background information.
- Section 3 provides the regulatory criteria and performance objectives for the cover design.
- Section 4 contains the erosion analysis and design incorporated into the final cover system.
- Section 5 summarizes the general cover profile development.
- Section 6, 7, and 8 contain the unsaturated modeling performed in support of the cover profile.
- Section 9 contains the cover's ability to mitigate radon flux through the cover.
- Section 10 summarizes the design logic and results.
- Appendices A and B include the specific input and output from the modeling simulations.

1.1 Erosion Protection

The Northeast Church Rock (NECR) site is located in an arid climate and exposed to erosion due to high-intensity precipitation events and significant wind. A key performance criterion for the cover system design is to provide for adequate erosion protection. The design event for evaluation of long-term erosional stability is the Probable Maximum Precipitation (PMP) based on Nuclear Regulatory Commission (NRC) guidelines in NUREG-1623 (NRC, 2002). The designed cover system is capable of withstanding the windy conditions at the site as well as a rainfall intensity

defined by the PMP event that is 6.5-inches for the 1-hour precipitation frequency [*Note: the PMP is significantly more conservative than the 2.96-inch value provided for the 1-hr precipitation frequency for a 1000 year period defined in the National Oceanic and Atmospheric Administration (NOAA) Atlas 14, Volume 1 (Bonnin, 2011)*].

The cover design is composed of two layers. The top layer is a uniform mixture of cover soil (67 percent by volume) with rock (33 percent by volume) referred to as a 'desert pavement'. This layer is designed to mitigate erosion by creating an armored surface with rock large enough to resist the erosive forces created during a PMP event. The bottom layer is composed of cover soil only. The overall cover thickness including both layers is a consistent 4 feet (122 cm).

Section 4 describes the design of the 'desert pavement' and analysis demonstrating the effectiveness of this layer. The admixture design is a function of the climate, soil, and cover surface geometry. The available cover soil borrow sources dictated the soil texture and thus fines content, while the geometry was optimized. The final geometry of the impoundment after placement of the mine spoils and cover system includes slopes generally less than 5 percent with slope lengths as long as 1,021 feet. In the design of the 'dessert pavement' layer, the smallest rock possible while still meeting the erosion requirements is preferred. Rock has no storage capacity, thus the overall thickness of cover is increased to overcome the loss of storage capacity from the addition of the rock. The rock to be used in the surface admixture layer or 'desert pavement' shall be durable to meet the 1,000-year design life requirement. This rock may not be readily available or may be expensive to acquire. Thus, the intent of this design is to maximize use of existing rock at the site meeting applicable durability requirements. Consequently, the thickness of the two layers varies (refer to Figure 13) depending on the location and respective slope length. The depth of rock/ soil admixture and rock size was varied: thinnest (14-inches thick with rock size of 1.5-inches) for top of slopes and gentle slopes; intermediate (18-inches thick with 2-inch rock) for middle of longer and/or steeper slope lengths; to thickest (27-inches thick with 3-inch rock) for bottom of longer and/or steeper slope lengths.

The resulting surface slopes meet guidance set forth in Dwyer et al. (1997) and NUREG-1623. The resulting surface was then analyzed utilizing the Revised Universal Soil Loss Equation (RUSLE) (USDA 1997) for surface water runoff induced soil loss and the Wind Erosion Prediction System or 'WEPS' (USDA 2010) for wind induced soil loss. The combined resulting estimated soil loss is significantly less than the USEPA (1991) recommended 2 tons/year/acre.

1.2 Applicable Data Supporting Effectiveness of ET Cover

Section 5 provides an overview of applicable field data and natural analogs that support the use of an ET Cover at the NECR site. The data includes applicable field data from a research project performed at Sandia National Laboratories (Dwyer 2003) that monitored test covers demonstrating the effectiveness of an ET Cover for the short-term. This data revealed that an ET Cover in a similar climate and elevation (foothills above Albuquerque, NM) with similar soil texture minimized flux through a 3.5-ft thick cover. Additional data included is a summary of applicable natural analogs that demonstrate the effectiveness of an ET Cover to minimize flux for the long-term. These natural analogs evaluated in a similar climate and elevation with similar soil texture, reveal that the typical long-term infiltration depth is about 2 feet. This is significantly less than the designed 4-ft thickness of the NECR cover.

1.3 Cover Depth Required to Minimize Flux

The final cover system contains two layers:

- A surface layer composed of a rock/soil admixture designed to mitigate erosion and enhance vegetation establishment.
- A bottom soil layer in conjunction with the surface layer contains adequate storage capacity to minimize flux due to meteoric water.

A series of computer simulations of the two-layered cover profile were performed to evaluate the myriad of variables to which the cover could be exposed during the 1,000-year performance period. The model geometry varied based on the respective rock/soil admixture design and depth described in Section 4. The computer sensitivity analyses evaluated possible climate change scenarios over this period of performance also considering information from the USEPA climate change website (https://www.epa.gov/climatechange). The full cover profile depth of 4 feet was shown to effectively minimize flux (in most cases reduce it to zero) for the multitude of scenarios modeled.

A key performance criterion of the cover system is effectiveness for up to 1,000 years, to the extent reasonably achievable, and, in any case, for at least 200 years (40 CFR 192). The applicable field data and natural analogs described in Section 5 provide confidence that an ET Cover will effectively perform for this criterion. UNSAT-H, a one-dimensional, finite-difference computer program developed at the Pacific Northwest National Laboratory by Fayer and Jones (1990) was used to simulate the water balance of the cover profile (Fayer 2000). UNSAT-H simulates water flow through soils by solving Richards' equation and simulates heat flow by solving Fourier's heat conduction equation.

Over the required performance period of the cover system, the climate can change from dry to average to wet - the worst case for flux minimization being more precipitation. The cover soil hydraulic properties can change as can the vegetation. Myriad computer simulations were performed to evaluate each consideration varying one parameter at a time and then evaluating multiple changes. These parameters and boundary conditions are discussed below.

The input parameters utilized in the modeling effort included the envelope of variables possible over the 1,000-year performance period. Climate is critical and thus both typical and extreme climates scenarios were modeled. The climate was varied during the modeling simulations to include both the typical and worst case possibilities. Historical weather data for the Gallup, NM area and surrounding weather stations were evaluated from available historical data from 1897 to 2016. The average precipitation at the Gallup airport is about 11 inches per year (28 cm) per the Western Regional Climate Center (http://www.wrcc.dri.edu/). The typical model climate used an annual precipitation volume of 11.71 inches (29.74 cm) distributed as shown in Figure 14. The precipitation is highest during July and August (Figure 14) while the climate's demand for water, referred to as potential evapotranspiration (PET), is also highest during those months.

The most extreme climate year occurred in 1906 when the area received 23.8 inches (60.5 cm) of precipitation. This climate year was utilized as the most extreme weather in the computer simulations. This was not only the highest annual precipitation received on record, but the majority of the moisture came in March and April with significant moisture also received in February, November and December (Figure 15). Much of this moisture came as snow or less intense rainstorms compared to the typical summer monsoons that produce high intensity storms and thus significant runoff. The worst case runoff event produced by the PMP was utilized for design of

the surface admixture layer per Section 4. These months with high precipitation volume also had reduced PET due to their cooler temperatures, so this period was also the worst case infiltration climate that the site has experienced during recorded history. To add conservatism, 1906 was modeled back-to-back in all computer simulations. This is a series of events that is beyond anything known to occur at this site. Furthermore, the precipitation was applied during the computer simulations at a rate less than the infiltration rate. That is, the precipitation was applied slowly enough to allow for close to 100 percent infiltration, thus minimizing runoff. This added conservatism in the modeling effort given that much of the precipitation at the site runs off before it can infiltrate into the cover system.

Other input parameters critical to successful cover system performance during the 1,000-yr period include the cover soil texture, resulting hydraulic properties, and the vegetation. A number of potential cover soil borrow sources were investigated at the NECR site. The sources deemed adequate for cover soil include the north drainage area, the south drainage area, the east borrow, and the west borrow (Figure 11). Each borrow soil was evaluated in the computer simulations to verify its effectiveness and the cover depth required to minimize flux. Samples taken from the borrow sources were tested to determine their respective hydraulic properties. The hydraulic properties utilized in the UNSAT-H simulations required remolded samples from soil obtained in the drilling exercise performed as part of the pre-design studies effort (MWH 2014). These hydraulic properties were utilized as input parameters in the computer sensitivity analyses. These remolded soil samples and their respective hydraulic properties are representative of the expected as-built condition of the cover system. Thus, these computer simulations utilizing these remolded values represent expected conditions for the short-term (less than 100 years).

A soil analog study of the potential borrow sources (Dwyer 2014) coincided with a vegetation analog study (Cedar Creek 2014) performed on the vegetation in various stages of maturation. Soil hydraulic properties change over time due to such things as soil pedogenesis, wet/dry cycles, and freeze/thaw cycles. In situ measurements of soil at multiple borrow sources were measured at multiple depths (surface, 1-ft, 2-ft, 3-ft and 4-ft). These soil data were utilized in computer simulations assumed to represent the long-term status of the soil.

Vegetation properties were also utilized in the computer simulations. The vegetation analogs studied represent a natural succession at the site (Cedar Creek 2014). The reclaimed community of vegetation represents vegetation in an area that has been disturbed and generally considered from a time period from seeding after construction completion up to about 50 years. The grassland community represents vegetation in an undisturbed setting and is assumed to represent the vegetation on the cover from a period of about 25 to 100 years after construction. The shrubland community represents vegetation in an undisturbed setting and is assumed to represent vegetation on the cover from a period of about 50 to 1,000 years. The effort to actually measure site parameters for soil and vegetation is not typically made for computer simulations of cover designs. Most cover design simply use generic values from the literature. However, extra effort was expended on this project to provide the best input parameters practical. Refer to Appendix A for details of these simulations.

Section 8 summarizes the sequenced long-term evaluation of the 4-ft cover overlying the mine spoils sequenced through time varying the vegetation and soil hydraulic properties (from constructed to long-term conditions) while evaluating possible typical and extreme climate conditions. Each admixture design was separately evaluated (Figure 19); thus there was three sets of simulations for each parameter sensitivity analysis. The output showed that once vegetation is

established, the net annual flux through the cover is zero. Refer to Appendix B for specifics of the simulations.

1.4 Radon Flux Evaluation

Section 9 provides an overview of the estimated radon release rate through the cover profile. The radon flux through the cover soil was calculated using the Radiation Attenuation Effectiveness and Cover Optimization with Moisture Effects (RAECOM) code, as described in (Rogers 1984a, 1984b). The model is used to perform one-dimensional, steady-state radon diffusion calculations for a multi-layer system. The computed radon flux for the cover profile is 11.37 pCi/m^{2}s (Table 19). This value is less than the maximum allowable value of 20 pCi/m^{2}s per 40 CFR 192.02.

2.0 BACKGROUND

The Mine and Mill Sites are located in close proximity to one another and approximately 16 miles northeast of Gallup, in McKinley County, New Mexico. The sites are temporarily being treated as one facility for purposes of the removal and remedial action, as described in the ROD (USEPA, 2013). The combined site is referred to as the "Settlement Agreement Site" (SA Site) in the AOC (USEPA, 2015). A summary of the site setting, history, and nature and extent of contamination is provided in the 2011 Action Memo (USEPA, 2011) and ROD (USEPA 2013).

An Engineering Evaluation/Cost Analysis (EE/CA) was prepared by the United States Environmental Protection Agency (USEPA), Region 9 to evaluate Non-Time- Critical Removal Action (NTCRA or "removal action") alternatives for soil and sediment (mine wastes) at the Mine Site. The site is a semi-arid climate at an elevation of about 7,000 feet above sea level. The vegetation is generally categorized as a pinyon-juniper landscape with shrubs and native grasses. The near surface soil is predominantly a clay loam.

The RA referenced in the AOC and described in the 2011 Action Memo (USEPA, 2011) and ROD (USEPA, 2013) is described in the first paragraph of Section 1. Disposal of waste at the Mill Site is contingent upon modification of the radioactive materials license issued by the NRC for the Mill Site.

The Selected Remedy addresses contaminated surface and subsurface soil from the Mine Site. Mine site waste with a radium 226 (Ra-226) concentration greater than 200 pCi/g and/or 500 mg/kg of total uranium is referred to as Principal Threat Waste (PTW) and will not be disposed of at the Mill Site.

The major components of the Selected Remedy are:

Excavation of Mine Waste. Waste from the Mine Site that contains concentrations of uranium and Ra-226 in excess of Action Levels established in the 2011 Action Memo (USEPA, 2011) will be excavated and transported offsite. Excavation at the Mine Site will continue until confirmation sample results from excavated areas are below the Action Levels established in 2011 Action Memo.

Repository Design. A repository to be designed at the Mill Site to contain mine waste from the Mine Site. The design will include an ET Cover over the repository to mitigate direct contact with the mine waste, limit infiltration of precipitation, and attenuate emanation of radon-222 from the mine waste.

Repository Construction. Construction of the repository is contingent on NRC approval of a license amendment to construct the repository for mine waste within the Mill Site Tailings Disposal Area. PTW will not be disposed of at the Mill Site, and will be transported from the Mine Site to an alternate disposal facility that will be selected during design.

3.0 PERFORMANCE OBJECTIVES & REGULATORY CRITERIA FOR COVER SYSTEM

The performance objectives and regulatory criteria for the cover system are summarized in Table 1. The cover system is an ET cover composed of natural earthen materials. The cover profile was designed to meet long-term performance objectives while visually blending into the natural aesthetics of the area.

The Performance Standards presented here are defined in the Action Memorandum: Request for a Non-Time-Critical Removal Action at the Northeast Church Rock Site (2011 Action Memo; USEPA, 2011), the ROD for the United Nuclear Corporation Site, (USEPA, 2013), and the AOC (USEPA, 2015) including the Statement of Work (SOW) attached as Appendix D to the AOC and were developed to define attainment of the Removal Action and Remedial Action Objectives (RAOs) for the Selected Remedy. The Performance Standards include both general and specific standards applicable to the Selected Remedy work elements and associated work components. Table 1 presents performance standards related to the repository design and construction and explains how the design accomplishes these standards. Refer to Appendix G, Table G.2-1 of the 95% Design Report for the full set of performance standards related to the closure design.

Table 1. Performance Objectives and Regulatory Criteria for Cover System

Performance Standard Requirement Citation/ Regulation	Performance Standard	Discussion
10 CFR 61.23(g)	10 CFR 61.23(e). Standards for Issuance of a License. Refer to www.ecfr.gov.	The cover system incorporates only natural materials with indefinite design lives. The input parameters utilized in the design process took into account the 1000-year performance of the final cover system. See also Appendix G, Table G.2-1 of the 95% Design Report.
10 CFR 61.51(a)(c)	10 CFR 61.42. Refer to www.ecfr.gov.	The design includes an ET Cover with soil and rock admixture surface layer over the waste materials, which will be located within the restricted area of the existing tailings impoundment. The cover is designed to minimize flux through the cover due to meteoric precipitation. Surface features direct surface water drainage away from disposal units at velocities and gradients which will not result in significant erosion that will require ongoing active maintenance in the future. The mine spoils and ET Cover material are intended to be placed in a manner whereby a positive slope shall be maintained throughout the construction process and final design to allow runoff and disallow ponding on the materials.

Performance Standard Requirement Citation/ Regulation	Performance Standard	Discussion
2011 Action Memo, V.A.1., Bullet 1 – Repository Design	Design a repository for the contaminated material excavated and removed from the NECR Mine Site. Design specifications will comply with CERCLA requirements, specifically all ARARs. The design, at a minimum, will include a low permeability layer (liner) and a cap structure that will mitigate direct contact, limit water infiltration, and perform as a radon barrier.	Refer to Sections 6 and 7, which demonstrate the cover effectively minimizes flux. The design of the final cover system minimizes flux based on the Dwyer et al. (2007) Point of Diminishing Returns methodology and USEPA (2012). The design of the cover system mitigates erosion by the inclusion of rock into the surface layer effectively forming a 'desert pavement'. In addition the slopes and slope lengths were optimized to mitigate surface erosion. Refer to Section 3 for the design and erosion analysis that addresses this specific issue. The cover system also provides a rooting medium for native vegetation that limits erosion and serves to assist remove infiltrated water via transpiration. The cover system limits the release of radon to the atmosphere. Refer to Section 8 for the calculations and analysis that demonstrate compliance with the computed radon flux value less than the maximum allowable of 20 pCi/m^2s per 40 CFR 192.02. The repository liner is generally assumed to be the existing radon barrier from the original final cover system. This soil shall be reworked to minimize its saturated hydraulic conductivity. A groundwater analysis (Dwyer 2017) effectively showed the hydraulic conductivity at this liner have deposition of the mine spoils and final cover system is less than 1 x 10-7 cm/sec. The radon barrier (low-permeability layer is described in Appendix G of the 95% Design Report.
2011 Action Memo, Table A-1; 2013 ROD Table 1 and Sections 2.9.2 and 2.9.5	40 CFR 192 02(a) and 02(b). Standards for the Control of Residual Radioactive Materials from Inactive Uranium Processing Sites. Refer to www.ecfr.gov. – (a) Be effective for up to one thousand years, to the extent reasonably achievable, and, in any case, for at least 200 years, and,(b) Provide reasonable assurance that releases of radon-222 from residual radioactive material to the atmosphere will not: (1) Exceed an average release rate of 20 picocuries per square meter per second.	The final cover system is composed of only natural materials (soil and rock) that have indefinite performance lives. The profile was designed utilizing input parameters that demonstrate the cover will meet the performance objectives for a minimum of 1,000 years. Refer to Section 6 and 7 the effectiveness of the cover profile for the full design life. The cover system also limits the release of radon to the atmosphere. Refer to Section 8 for calculations and analysis that demonstrate compliance with the computed radon flux

Performance Standard Requirement Citation/ Regulation	Performance Standard	Discussion
		value less than the maximum allowable of 20 pCi/m^{2}s per 40 CFR 192.02.
2013 ROD, Section 1.4 – Repository Design	Design a repository at the UNC Site for the contaminated material excavated and removed from the NECR Site. Design specifications will comply with CERCLA requirements including all applicable or relevant and appropriate requirements (ARARs). The design will include a cap structure that will mitigate direct contact, limit water infiltration, and perform as a radon barrier. Final design will determine actual configurations of cap and liner structure and will be submitted as part of a license amendment request to the Nuclear Regulatory Commission (NRC).	The repository is designed for long-term stability and the design criteria used eliminate, to the extent practicable, the need for on-going maintenance. The cover system incorporates only natural materials with indefinite design lives. The input parameters utilized in the design process took into account the 1,000-year performance of the final cover system. The design includes a soil and rock cover over the waste materials, which will be located within the restricted area of the existing tailings impoundment. Refer to Section 3. The cover is designed to minimize flux through the cover due to meteoric precipitation. Refer to Sections 6 and 7. Surface features direct surface water drainage away from disposal units at velocities and gradients which will not result in significant erosion that will require ongoing active maintenance in the future. Refer to Section 3. The design of the repository (including placement of mine spoils and cover material) shall minimize water contact with waste during storage, contact of standing water with waste during disposal and contact of percolating or standing water with wastes after disposal. The construction drawings and specifications were prepared to mitigate the potential for storm water to be in contact with mine spoils during placement and limit the ability of significant infiltration into underlying materials. The modeling (see Sections 6 and 7) demonstrates that once the final cover system is in place, this cover will mitigate flux and thus reduce potential for meteoric water to impact underlying materials. See also Appendix G, Table G.2-1 of the 95% Design Report.
2013 ROD, Section 2.9.1, Bullet 3	Remediation Action Objectives • Prevent the migration of concentrations of contaminants located in the soil, mine waste, and tailings contained within the Tailings Disposal Area to ground water where the migration of those contaminants would result in	A groundwater analysis was performed of the final impoundment configuration, including placement of the mine spoils and final cover system, and submitted in *Tailings Consolidation and Groundwater Evaluation - 95% Design Draft.* (Dwyer 2017). The flux through the entire impoundment profile was

Performance Standard Requirement Citation/ Regulation	Performance Standard	Discussion
	ground water concentrations that exceed remediation goals established in EPA's 1988 ROD for the Ground Water Operable Unit (including any amendment), and, through this action, prevent human and ecological receptors from being exposed to ground water with concentrations of contaminants that exceed remediation goals established in the 1988 ROD, including any amendment.	compared to the flux through the similar existing profile without inclusion of the mine spoils or final cover system. Analysis results showed no significant increase of moisture release that could affect the underlying groundwater.
2013 ROD, Section 2.9.2, Bullet 1	Radionuclides and their daughter products in soil, mine waste, and tailings contained within the Tailings Disposal Area will not release radon-222 emissions from residual radioactive material to the atmosphere in exceedance of an average release rate of 20 picocuries per square meter per second (pCi/m^2s) 16 [40 CFR §§ 192.02(b)(1) and 192.32(b)(1)(ii)].	The placement of mine spoils within the impoundment combined with the final cover system demonstrates that the release of radon to the atmosphere will be less than 20 picocuries per square meter per second. Analysis (described in Section 8) demonstrates the calculated radon release rate to be less than 20 pCi/m2s.
2013 ROD, Section 2.9.2, Bullet 2	Radionuclides and their daughter products in soil, mine waste, and tailings contained within the Tailings Disposal Area will not release radon-222 emissions from residual radioactive material to the atmosphere that will increase the annual average concentration of radon-222 in air at or above any location outside the disposal site by more than one-half picocurie per liter [40 CFR § 192.02(b)(2)].	The placement of mine spoils within the impoundment combined with the final cover system demonstrates that the release of radon to the atmosphere will be less than 20 pCi/m2s . Modeling (refer to Section 8) demonstrates the calculated radon release rate to be less than 20 pCi/m2s . Also refer to: RTCS Row 469, EPA Comment G.7-7 App. G, Att 7, Table 1 Comment: 2013 ROD, Section 2.9.2 Bullet 2. Where are the calculations presented to satisfy the criteria that radon-222 emissions at the edge of the repository will not increase by more than 0.5 pCi/l? [40DFR 192.02(b)(2)] Response: Dwyer completed radon calculations through cover and the results are summarized in Section 8. Requirements in 40 CFR 192.02 (b) are satisfied because the requirements are an 'or' requirement (as opposed to an 'and' requirement).
2013 ROD, Section 2.9.2, Bullet 3	Remediation Goals • Migration of contaminants from the Tailings Disposal Area shall not result in ground water concentrations that exceed remediation goals established in EPA's 1988 ROD for the Ground	A groundwater analysis (Dwyer 2017) of the flux through the entire impoundment profile was compared to the flux through the similar existing profile without inclusion of the mine spoils or final cover system. Analysis results show no significant increase of moisture

Performance Standard Requirement Citation/ Regulation	Performance Standard	Discussion
	Water Operable Unit, including any amendment.	release from the base of the alluvium beneath the existing fine tailings.
2013 ROD, Section 2.9.5 – Cap Design Criteria	Cap design and cost estimates for Alternative 2 are based on the following elements: 1) The design includes a soil and rock cover over the waste materials, which will be located within the restricted area of the existing tailings impoundment. 2) The cover is designed to minimize flux through the cover due to meteoric precipitation. 3) Surface features direct surface water drainage away from disposal units at velocities and gradients which will not result in significant erosion that will require ongoing active maintenance in the future. 4) The design of the repository including placement of mine spoils and cover material shall minimize contact of water with waste during storage, contact of standing water with waste during disposal and contact of percolating or standing water with wastes after disposal.	1) The final cover system is an ET Cover composed of soil and rock located within the existing tailings impoundment 2) This report demonstrates the ET Cover demonstrates that flux due to meteoric precipitation is minimized 3) The mine spoils shall be placed to ensure runoff from the repository at a slope not to exceed 5 percent 4) Modeling summarized in this report demonstrate that the ET Cover on the mine spoils placed within the impoundment shall effectively minimize water contact due to meteoric precipitation.
2013 ROD, Section 2.9.5 – Cap Design Criteria, Bullet 1	Cap longevity designed for a minimum of 200 years with minimal maintenance and for effectiveness up to one thousand years, to the extent reasonably achievable [40 CFR §§ 192.02(a),192.32(b)(1)(i), and 264.111(a)]	The cap was designed to minimize flux of meteoric water into underlying materials (see Sections 6 and 7). It is designed to resist erosion (see Section 3). It is also designed to limit radon to within regulatory acceptable levels (see Section 8).
2013 ROD, Section 2.9.5 – Cap Design Criteria, Bullet 2	A sufficient clean (uncontaminated) soil layer to provide assurance that releases in the form of Radon-220 and -222 will not exceed an average release rate of 20 picocuries per meter squared per second [40 CFR §§ 192.02(b)(1) and 192.32(b)(1)(ii)], and will not increase the annual average concentration of radon-220 and -222 in air at or above any location outside the disposal site by more than one-half picocurie per liter [40 CFR § 192.02(b)(2)]	The placement of mine spoils within the impoundment combined with the final cover system demonstrates that the release of radon to the atmosphere will be less than 20 pCi/m2s . Modeling (see Section 8) shows a computed radon release rate of less than 20 pCi/m2s .
2013 ROD, Section 2.9.5 –	Cap construction to protect the mine waste, reduce the potential for leachate development, and prevent contaminated	The cap was designed to minimize flux of meteoric water into underlying materials (refer to Sections 6 and 7). The lack of significant

Performance Standard Requirement Citation/ Regulation	Performance Standard	Discussion
Cap Design Criteria, Bullet 3	runoff by limiting infiltration of precipitation and by providing erosion protection and durability [40 CFR §§192.32(b)(1), 264.111(a), 264.111(b) 264.228(b)(1), 264.228(b)(3), and 264.228(b)(4)]	flux through the final cover system eliminates the potential for leachate development. Section 3 summarizes the surface layer design and analysis intended to minimize erosion and soil loss. Rock used in the rock/soil admixture will meet specified durability requirements intended to last for the 1,000-year design life of the cover system.
2013 ROD, Section 2.9.5 – Cap Design Criteria, Bullet 4	Cap slope, shape and drainage construction to ensure stability and minimize the effects of erosion, root intrusion, and animal destruction [40 CFR §§192.32(b)(1), 264.111(a), 264.111(b) 264.228(b)(1), 264.228(b)(3), and 264.228(b)(4)];	The repository is designed with top slopes of 2 to 5 percent to minimize the effects of soil loss due to runoff. The inclusion of a rock/soil admixture as the top layer of the cover system is intended to limit soil loss due to wind and water erosion. The admixture has also been shown to effectively maintain native vegetation.
2013 ROD, Section 2.9.5 – Cap Design Criteria, Bullet 6	the use of vegetation to emulate the structure, function, diversity, and dynamics of the native community to maximize resilience and sustainability	The cover system is designed to provide for a rooting medium for native vegetation. It is using locally available soil from engineer-approved borrow sources. The addition of a surface rock/soil admixture will also assist with the establishment and maturation of native vegetation. See also Appendix G, Table G.2-1 of the 95% Design Report.
2013 ROD, Section 2.9.5 – Cap Design Criteria, Bullet 7	Erosion modeling to determine effectiveness of cap design	The cap was designed to effectively minimize erosion. The slopes and slope lengths were designed to minimize erosion while enabling closure of a large volume of mine spoils. A rock/surface admixture is included in the cover profile that is intended to mitigate the formation of rill/gullies and limit soil loss due to both wind and water erosion. Section 3 summarizes the design and analysis performed related to erosion.
2013 ROD Table 1	10 CFR 40 Appendix A, Criterion 3. Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material From Ores Processed Primarily for Their Source Material Content. Refer to [www.ecfr.gov.](www.ecfr.gov)	The repository slopes have been optimized to limit the effects of erosion. Erosion protection design is included in Section 3.
2013 ROD Table 1	10 CFR 40 Appendix A, Criterion 5. Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material From	Criterion 5 is about a liner. This impoundment predated liner requirements. However, the repository includes a cover system designed to effectively minimize flux and limit the ability of meteoric water moving

Performance Standard Requirement Citation/ Regulation	Performance Standard	Discussion
	Ores Processed Primarily for Their Source Material Content. Refer to www.ecfr.gov.	into underlying materials (see Criterion 6 below). Thus the potential impact to groundwater is not increased. Refer to Dwyer (2017).
2013 ROD Table 1	10 CFR 40 Appendix A, Criterion 6. Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material From Ores Processed Primarily for Their Source Material Content. Refer to www.ecfr.gov.	The cover was designed to minimize flux of meteoric water into underlying materials (refer to Sections 6 and 7). Because there is no flux through the final vegetated cover system, there will be no increase in leachate (see Section 3). Rock used in the rock/soil admixture will meet specified durability requirements intended to last for the 1,000-yr design life of the cover system (95% Design Report, Appendix H). Section 8 summarizes the analysis performed that shows the radon release rate will not exceed an average release rate of 20 pCi/m^{2}s [40 CFR §§ 192.02(b)(1) and 192.32(b)(1)(ii)] and will not increase the annual average concentration of radon-220 and -222 in air at or above any location outside the disposal site by more than one-half picocurie per liter [40 CFR § 192.02(b)(2)]. See also Appendix G, Table G.2-1 of the 95% Design Report.
2013 ROD Table 1	10 CFR 61.44. Refer to www.ecfr.gov.	The final cover system was designed to meet a 1,000-yr design life without appreciable maintenance. It utilized only natural materials (soil and rock). The analysis and design demonstrated that the cover will effectively perform for the design life. See also Appendix G, Table G.2-1 of the 95% Design Report.
2013 ROD Table 1	10 CFR 61 51(a)(1), 51(a)(4), 51(a)(5) and 51(a)(6). Refer to www.ecfr.gov.	The repository volume has been designed for the anticipated volume of material to be removed from the Mine Site. The repository is designed for long-term stability and the design criteria used eliminate, to the extent practicable, the need for on-going maintenance. The cover system incorporates only natural materials with indefinite design lives. The input parameters utilized in the design process took the 1,000-year performance of the final cover system into account. The design includes a soil and rock cover over the waste materials, which will be located within the restricted area of the existing tailings impoundment (refer to Section 3).

Performance Standard Requirement Citation/ Regulation	Performance Standard	Discussion
		The cover is designed to minimize flux through the cover due to meteoric precipitation (see Sections 6 and 7). Surface features direct surface water drainage away from disposal units at velocities and gradients designed to prevent significant erosion that would require ongoing active maintenance (refer to Section 3). The design of the repository (including placement of mine spoils and cover material) shall minimize water contact with waste during storage, disposal and following disposal (95% Design Report, Appendix I). The construction drawings and specifications were prepared to mitigate the potential for storm water to be in contact with mine spoils during placement and limit the ability of significant infiltration into underlying materials. The modeling (see Sections 6 and 7) demonstrates that once the final cover system is in place, this cover will mitigate flux and thus reduce potential for meteoric water to impact underlying materials. See also Appendix G, Table G.2-1 of the 95% Design Report.
2013 ROD Table 1 and Section 2.9.5 Cap Design, Bullets 1, 3, and 4	40 CFR 264.111(a). Refer to www.ecfr.gov.	See 95% Design Submittal, Appendix I regarding maintenance of the storm water control features around the repository. The repository volume has been designed for the anticipated volume of material to be removed from the Mine Site. The repository is designed for long-term stability and the design criteria used eliminate, to the extent practicable, the need for on-going maintenance. The cover system incorporates only natural materials with indefinite design lives. The input parameters utilized in the design process took the 1,000-yr performance of the final cover system into account. The design includes a soil and rock cover over the waste materials, which will be located within the restricted area of the existing tailings impoundment (refer to Section 3). The cover is designed to minimize flux through the cover due to meteoric precipitation (refer to Sections 6 and 7).

Performance Standard Requirement Citation/ Regulation	Performance Standard	Discussion
		Surface features direct surface water drainage away from disposal units at velocities and gradients which will not result in significant erosion that will require ongoing active maintenance in the future. Refer to Section 3 of this report. The design of the repository (including placement of mine spoils and cover material) shall minimize water contact with waste during storage, during disposal and following disposal. The construction drawings and specifications were prepared to mitigate the potential for storm water to be in contact with mine spoils during placement and limit the ability of significant infiltration into underlying materials. The modeling (see Sections 6 and 7) demonstrates that once the final cover system is in place, this cover will mitigate flux and thus reduce potential for meteoric water to impact underlying materials. See also Appendix G, Table G.2-1 of the 95% Design Report
2013 ROD, Table 1 and Section 2.9.5, Cap Design Criteria, Bullets 3 and 4	40 CFR 264.228(b)(4). Refer to www.ecfr.gov.	The cover system incorporates a rock/soil admixture that minimizes erosion due to surface water runoff and wind. The armament also mitigates the potential for rills and gullies. Section 3 provides a design summary and analysis that demonstrate erosion is minimized for the final cover system. See also Appendix G, Table G.2-1 of the 95% Design Report
2013 ROD Table 1 and Sections 2.9.2 and 2.9.5	40 CFR 192.32(b) (1). Refer to www.ecfr.gov. (2) The requirements of § 192.32(b)(1) shall not apply to any portion of a licensed and/or disposal site which contains a concentration of radium-226 in land, averaged over areas of 100 square meters, which, as a result of uranium byproduct material, does not exceed the background level by more than: (i) 5 picocuries per gram (pCi/g), averaged over the first 15 centimeters (cm) below the surface, and (ii) 15 pCi/g, averaged over 15 cm thick layers more than 15 cm below the surface	Radon flux performance objectives were demonstrated to be satisfied with the 4-ft thick ET Cover (refer to Section 9).

Performance Standard Requirement Citation/ Regulation	Performance Standard	Discussion
2015 AOC SOW, Paragraph 26 – Acceptance Criteria	For the part of the Tailings Disposal Area that is to contain the mine waste from the NECR Site and for the part of the current tailings cell that may be disturbed during implementation of the remedy, Respondents shall include, in their Design, detailed plans and specifications to meet and demonstrate compliance with Acceptance Criteria consistent with Section 5.1 of NUREG 1620.	The repository volume has been designed for the anticipated volume of material to be removed from the Mine Site. The repository is designed for long-term stability and the design criteria used eliminate, to the extent practicable, the need for on-going maintenance. The cover system incorporates only natural materials with indefinite design lives. The input parameters utilized in the design process account for the 1,000-yr performance of the final cover system. The design includes a soil and rock cover over the waste materials, which will be located within the restricted area of the existing tailings impoundment (refer to Section 3). The cover is designed to minimize flux due to meteoric precipitation (refer to Sections 6 and 7). Surface features direct surface water drainage away from disposal units at velocities and gradients that will not result in significant erosion requiring ongoing active maintenance (see Section 3). The design of the repository (including placement of mine spoils and cover material) shall minimize water contact with waste during storage, during disposal and following disposal. The construction drawings and specifications were prepared to mitigate the potential for storm water to be in contact with mine spoils during placement and limit the ability of significant infiltration into underlying materials. The modeling (see Sections 6 and 7) demonstrates that once the final cover system is in place, this cover will mitigate flux and thus reduce potential for meteoric water to impact underlying materials. See also Appendix G, Table G.2-1 of the 95% Design Report

4.0 EROSION

The performance objectives related to the ET Cover's ability to resist erosion are to reduce soil loss due to erosion to less than 2 tons/acre/year (USEPA 1991) and demonstrate the long-term stability of the cover surface (NRC, 2002). The cover surface layer was designed to satisfy these performance objectives.

The cover surface layer is composed of a mixture of rock and cover soil designed to mitigate the potential for rill or gully formation as well as minimize soil loss. This admixture design varies (rock size and depth) depending on the specific slope and slope length (Figure 13). For example, the base of a long slope may have a large rock within the admixture and greater admixture thickness compared to the top of the slope. This erosion resistant admixture was designed consistent with guidance summarized in Dwyer et al. (2007) and USEPA (2012). The surface erosion admixture has been successfully deployed on multiple sites throughout the southwestern United States including an installation near San Mateo, NM on a uranium mine site closure. This site was closed in 2013 with an ET Cover similar to that proposed for the NECR site. Vegetation establishment on the cover exceeded performance requirements to have perennial plant coverage meet comparable undisturbed reference sites (Cedar Creek 2016). There has been no significant soil loss due to erosion nor any rill or gully formation on the cover system despite the site experiencing a beyond 100-year storm event (Cedar Creek 2016).

The following subsections summarize the design methods and calculations performed to develop a top layer. This top layer is composed of an admixture of rock and soil that is intended to form a 'desert pavement'. To ensure that the cover complies with NUREG-1623 and will behave as a desert pavement, two analyses were completed: the design of the rock/soil admixture per USEPA (2012) (Section 4.1) and an analysis of the long-term stability of the final slope as a rocky soil per NUREG-1623 (Section 4.2). The largest rock size as determined by the methodologies between that described in Section 4.1 and 4.2 governs and is summarized in Section 4.3, Tables 5 to 8. Finally, Section 4.4 summarizes the compliance of annual soil loss to less than 2 tons/acre/year as recommended by USEPA (1991).

4.1 DESIGN OF COVER SURFACE LAYER (ROCK/SOIL ADMIXTURE)

Rock/soil admixtures provide a proven means to minimize erosion while allowing for vegetation establishment without a significant reduction in evaporation (Waugh et al 1994, Dwyer 2003, Dwyer et al 2007). Erosion (Ligotke 1994) and water balance studies (Waugh 1994) suggest that moderate amounts of gravel mixed into the cover topsoil will control both water and wind erosion. As wind and water pass over the cover surface, some winnowing of fines from the admixture is expected, creating a vegetated erosion-resistant surface referred to as a “desert pavement”. The following rock/soil admixture design is for the final cover system's top surface where slopes are 5 percent or less.

4.1.1 Design Rainfall Event

The design event for evaluation of long-term erosional stability is the PMP based on NRC guidelines in NUREG-1623. This worst case storm event was used to design the surface admixture. The PMP, 1-hour precipitation value of 6.5-inches was utilized in the design and analysis. This PMP value was obtained from the most recent PMP study available (Applied Weather Associates, 2013). Results of this study supersede Hydrometeorological Report (HMR)

49 (Hansen et al. 1977). Definitions of PMP are found in most of the HMRs issued by the National Weather Service (NWS). The definition used in the most recently published HMR is "theoretically, the greatest depth of precipitation for a given duration that is physically possible over a given storm area at a particular geographical location at a certain time of the year" (HMR 59, p. 5).

The cover design life per 40 CFR 192(a) shall be effective for up to 1,000 years, to the extent reasonably achievable, and, in any case, for at least 200 years. To appreciate the size of the PMP design event and for comparison purposes, the 1,000 return period (1-hour precipitation frequency) is 2.96 inches (7.52 cm) as determined using data supplied by the National Oceanic and Atmospheric Administration (NOAA) National Weather Service (NWS) Hydrometerological Design Studies Center - NOAA Atlas 14, Volume 1 for Gallup, NM(Bonnin, 2011). The 1-hour time of concentration is generally considered conservative for any contributory area less than 50 acres (20 hectares) (Lindeburg 1989). It can be seen this 1,000 return period value is significantly less than the PMP value for the Church Rock, NM area that is 6.5-inches for the 1-hour precipitation frequency.

4.1.2 Runoff Prediction

The “rational method” was used to estimate runoff volumes. This method is commonly used in civil engineering applications and is a method recommended in DOE (1989) for design of cover systems for sites regulated by the Uranium Mill Tailings Radiation Control Act of 1978 (i.e., UMTRA sites) and NUREG-1623. The rational method is based on the assumption that rainfall occurs uniformly over the watershed at a constant intensity for duration equal to the time of concentration.

Using the rational method, the peak rate of runoff, (Q), in cubic feet per second (cfs) is given by the following expression [the runoff units are actually in acre-inches/hour but is commonly rounded to cfs]:

$$Q = C\ I\ A \qquad \textbf{Equation 1}$$

where:

C = Runoff coefficient (dimensionless) = 0.3 [Lindeburg 1989]

I = Rainfall intensity (in/hr) [Tables 3 and 4]

A = Surface area that contributes to runoff (acres) = $L^2/4$, [USEPA 2012, Dwyer et al 2007]

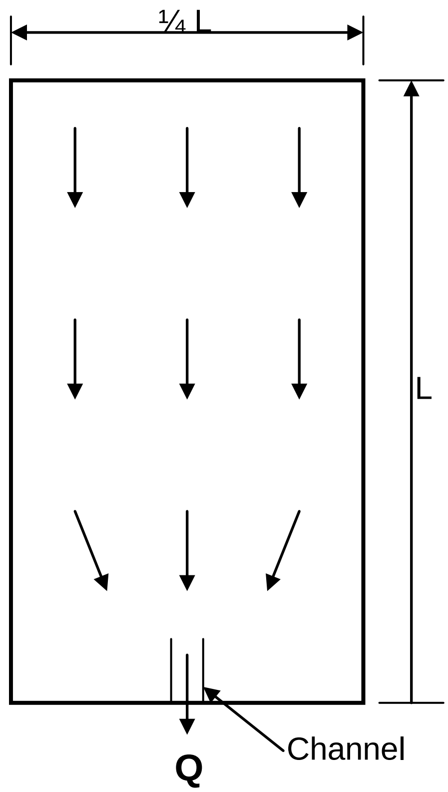


Figure 1. Contributory Area For Gully Formation

The time of concentration (t_c) was calculated based on the following equation (Brant & Oberman, 1975 per DOE 1989, p. 65):

$t_c = C*(L/S*i^2)^{1/3}$ **Equation 2**

where:

C = Coefficient = 1.0 bare area;

L = slope length (ft);

S = slope (ft/ft); and

i =rainfall intensity (in/hr) = 6.51 in/hr per PMP

Using the tabular values in Table 2 (DOE 1989), the percentage of rainfall intensity for a t_c of less than 1 hour can be determined.

Table 2. Incremental Rainfall Duration Percentage (DOE 1989, Table 4.1)

Rainfall Duration (RD) (min.)	Percentage of one-hour PMP (%)**
2.5	27.5
5	45
15	74
30	89
45	95
60	100

** % of one-hr PMP = RD/(0.089*RD + 0.0686)

The contributory surface area was calculated based on the assumed configuration shown in Figure 1 where L is the critical slope length [USEPA 2012, Dwyer et al. 2007]. Slopes and slope lengths were estimated from proposed contoured plans of the conceptual cover. Because most of the drainage areas from the cover were irregularly shaped, the slopes and slope lengths were estimated to match the area configuration described here.

The rainfall one-hour intensity corresponding to the computed time of concentration (tc) is then computed as follows (DOE 1989, p. 66):

$$I = PMP_{(t_c)} x \frac{60}{t_c}$$ **Equation 3**

Table 3 summarizes the computations for the slope length intervals for the 5 percent slope while Table 4 summarizes those for the 2 percent slope length.

Table 3. Calculation of Rainfall Intensity for Slope of 5% with Slope Length of 1021-ft

C	L (ft)	S (%)	PMP (in/hr)	Tc (min)	Extrapolation[1]	I (in/hr)
1	1021	5.00%	6.51	7.839672	56.7%	28.228
1	1000	5.00%	6.51	7.785551	56.5%	28.327
1	900	5.00%	6.51	7.516867	55.5%	28.827
1	800	5.00%	6.51	7.227465	54.4%	29.385
1	700	5.00%	6.51	6.912822	53.1%	30.017
1	600	5.00%	6.51	6.566588	51.7%	30.746
1	525	5.00%	6.51	6.28072	50.4%	31.374
1	500	5.00%	6.51	6.179396	50.0%	31.603
1	400	5.00%	6.51	5.736443	47.9%	32.644
1	350	5.00%	6.51	5.48671	46.7%	33.262
1	300	5.00%	6.51	5.211904	45.3%	33.969
1	200	5.00%	6.51	4.553018	41.7%	35.795

[1] Extrapolation is the % of one-hr PMP = RD/(0.089*RD + 0.0686) [refer to Table 2]

Table 4. Calculation of Rainfall Intensity of 2% with Slope Length of 1000-ft

C	L (ft)	S (%)	PMP (in/hr)	Tc (min)	extrapolation[1]	I (in/hr)
1	1000	2.0%	6.51	10.567	65.0%	24.0158
1	900	2.0%	6.51	10.202	64.0%	24.5048
1	800	2.0%	6.51	9.809	62.9%	25.0542
1	700	2.0%	6.51	9.382	61.7%	25.6803
1	600	2.0%	6.51	8.912	60.3%	26.4064
1	500	2.0%	6.51	8.387	58.5%	27.2686
1	400	2.0%	6.51	7.786	56.5%	28.3266
1	350	2.0%	6.51	7.074	53.8%	29.6909
1	300	2.0%	6.51	6.179	50.0%	31.6028
1	200	2.0%	6.51	4.905	43.7%	34.7971

[1] Extrapolation is the % of one-hr PMP = RD/(0.089*RD + 0.0686) [refer to Table 2]

4.1.3 Channel Geometry

The channel geometry shown in Figure 2 is that assumed for gully formation.

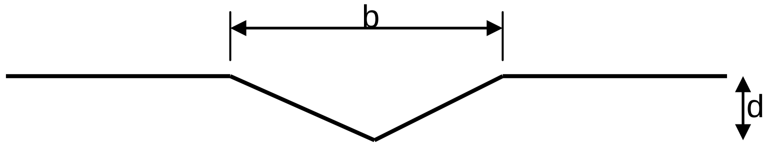


Figure 2. Channel Geometry

The geometry of the channel that forms is based on regression equations developed from analysis of a large number of channels (Simon, Li & Assoc. 1982). The channel width is given by:

$b = 37 (Q_m^{0.38} / M^{0.39})$ **Equation 4**

where:

b = width of flow (ft)

Q_m = mean annual flow (cfs)

M = percentage of silts and clays in soils (38 percent for applicable borrow soil)

The average percentage of fines (silt and clay) from the available cover soil borrow sources is about 57 percent. (MWH 2014) This value can be reduced by the volume percentage of rock added to the soil that is 33 percent. The resulting 'M' value is thus 38 percent. The mean annual flow (Q_m) is assumed to be between 10 percent and 20 percent of the peak rate of runoff (Q) (Dwyer et al. 2007). In this case 10 percent was used.

For the given discharge point of geometry, the hydraulic depth (d_h), defined as the flow cross-sectional area divided by the width of water surface, is half of the gully depth (d).

For flows at the critical slope:

$b = 0.5\, F^{0.6}\, F_r^{-0.4} Q^{0.4}$ **Equation 5**

where:

F = width to depth ratio = b/dh

F_r = Froude Number ≈ 1.0

4.1.4 Incipient Particle Size

The incipient particle size is the particle that is on the brink of movement at the assumed conditions. Any increase in the erosional forces acting on the particle, due to an increase in velocity or slope, for example, will cause its movement. For construction purposes, the incipient particle size is assumed to be the D_{50} (50 percent of rock passing the given sieve size). The rock are sorted in one-dimensional sieves, thus the rock passing a 1-inch sieve can actually be 1-inch wide by 2-inches long and/or 2-inches deep. Thus converting the incipient particle size to the rock specified D_{50} value is conservative given the D_{50} rock will likely have a larger mass than the inferred incipient particle size. This incipient particle size (D_c) was calculated using the Shield's Equation:

$D_c = \tau/F_s(\gamma_s - \gamma)$ **Equation 6**

where:

τ = total average shear stress (pcf)

F_s = Shield's dimensionless shear stress = 0.047

γ_s = specific weight of soil (pcf) [168.5 pcf]

γ = water density = 62.4 pcf

The total average shear stress is given by:

$\tau = \gamma \text{ dh } S$ **Equation 7**

where:

S = slope (ft/ft)

dh = hydraulic depth (ft) = A/b (Figure 2)

4.1.5 Depth of Scour and Armoring Required

The incipient particle size defines the maximum size of particle that will be eroded for a given set of conditions. Material larger than the incipient particle size will not be displaced or eroded, and can form an armoring that will protect the surface from erosion by similar or lesser storm events.

The depth of scour (Y_s) to establish an armor layer is given by (Pemberton and Lara 1984):

$Y_s = Y_a\ [(1/P_{c)}-1]$ **Equation 8**

where:

Y_s = scour depth

Y_a = armor layer thickness

P_c = decimal fraction of material coarser than the incipient particle size

4.2 LONG-TERM STABILITY OF ROCKY SOIL COVER

The ET Cover surface admixture layer is analyzed below to satisfy NUREG-1623 requirements for a stable slope of an unprotected soil cover. The long-term stability of the top deck cover surface with the addition of the rock/soil admixture can be determined by the following equation (NUREG-1623):

$S_s^{7/6} = [65*t^{5/3}]/[P*L*F*n]$ **Equation 9**

where:

S_s = maximum stable slope (%)

t = 0.4*D_{75} (75% of rock passing the given sieve size)

P = rainfall intensity

L = slope length

F= 3 (NUREG-1623)

n = 0.03

If the maximum stable slope (S_s) is greater than or equal to the actual slope, the cover is stable. The D_{75} used in Equation 9 is conservatively assumed to equate to the D_{50} and Dc in the preceding set of calculations to design the surface admixture layer.

4.3 Rock/Soil Calculations

An excel spreadsheet was used to simultaneously solve the multiple equations. Section 4.3.1 presents calculated results for the rock/soil admixture for the 5 percent slope with total slope length of 1,021 feet. Section 4.3.2 presents calculated results for the rock/soil admixture for the 2 percent slope with total slope length of 1,000 feet.

Because the cover system rock requirement is substantial and the slope lengths are varied, admixture requirements was computed in intervals along the slope length. That is, the top of the slope has less erosive forces because the slope length is shorter than the bottom of the slope. Tables 5 to 8 summarize the analysis performed.

4.3.1 Admixture Design for Single Slope Length of 1,021 ft at 5 Percent Slope

Table 5 summarizes the admixture calculations following the method outlined in Section 4.1 while utilizing the intensity values (I) in Table 3. The critical particle size (Dc) and admixture depth are computed based on the slope length location along the 5 percent slope. For slope lengths 525 feet and longer, a 3-inch rock is required with a corresponding admixture depth of 27 inches. For a slope length of 350 feet to 525 feet, a 2-inch rock is required with a corresponding admixture depth of 18 inches. From the top of the slope to a slope length of 350 feet, a 1.5-inch rock is required with a corresponding admixture depth of 14 inches. All mixtures will be 33 percent rock to 67 percent soil by volume for the full admixture depth.

The largest Dc in the admixture design (summarized in Section 4.1) or long-term stable slope (per NUREG-1623) is included in Table 5. For slope lengths greater than 400 feet, the admixture design governed the Dc size. For slope lengths less than 400 feet, the Dc determined was based on NUREG-1623 requirements for a long-term stable slope.

Table 5. Admixture Design Summary

I (in/hr)	S (%)	Slope Length (ft)	A (acres)	Q (cfs)	Qm (cfs)	b (ft)	dH (in)	τ (psf)	Rock Size Dc (in)	use Rock Size Dc (in)	% gravel	Ya (in)	Ys (in)	Admix Depth (in)	Comment
28.2	5	1021	5.98	50.66	5.07	16.6	5.02	1.305	3.1	3.00	33%	9.0	18	27.0	
28.3	5	1000	5.74	48.77	4.88	16.4	4.94	1.285	3.1	3.00	33%	9.0	18	27.0	
28.8	5	900	4.65	40.20	4.02	15.2	4.56	1.186	2.9	3.00	33%	9.0	18	27.0	
29.4	5	800	3.67	32.38	3.24	14.0	4.17	1.084	2.6	3.00	33%	9.0	18	27.0	
30.0	5	700	2.81	25.32	2.53	12.7	3.77	0.980	2.4	3.00	33%	9.0	18	27.0	
30.7	5	600	2.07	19.06	1.91	11.4	3.35	0.871	2.1	3.00	33%	9.0	18	27.0	
31.4	5	525	1.58	14.90	1.49	10.4	3.02	0.786	1.9	2.00	33%	6.0	12	18.0	
31.6	5	500	1.43	13.60	1.36	10.1	2.91	0.758	1.8	2.00	33%	6.0	12	18.0	
32.6	5	400	0.92	8.99	0.90	8.6	2.46	0.638	1.5	2.00	33%	6.0	12	18.0	increased rock size per Section 4.2 (NUREG-1623) [1]
33.3	5	350	0.70	7.02	0.70	7.8	2.22	0.576	1.4	2.00	33%	6.0	12	18.0	increased rock size per Section 4.2 (NUREG-1623) [1]
34.0	5	300	0.52	5.26	0.53	7.0	1.97	0.512	1.2	1.50	33%	4.5	9	14.0	increased rock size per Section 4.2 (NUREG-1623) [1]
35.8	5	200	0.23	2.47	0.25	5.3	1.44	0.374	0.9	1.50	33%	4.5	9	14.0	increased rock size per Section 4.2 (NUREG-1623) [1]
38.8	5	100	0.06	0.67	0.07	3.2	0.84	0.218	0.5	1.50	33%	4.5	9	14.0	increased rock size per Section 4.2 (NUREG-1623) [1]

1 Values highlighted (slope lengths 100 to 400-ft) required an increase in Dc to meet NUREG-1623 requirements (Section 4.2). Refer to Table 6.

Table 6 summarizes the calculations to verify compliance with the long-term stability of a rocky soil slope per NUREG-1623 (Section 4.2). The slope lengths utilized in the calculations correspond to those from Table 5. The slope is 5 percent, consequently any calculation that computed a stable slope of greater than 5 percent with the particle size determined in Table 5 was acceptable. However, for slope lengths less than 400 feet, the Dc was increased in the computations to satisfy the long-term stability of a rocky soil slope per NUREG-1623.

Table 6. Long-Term Stability of Rocky Soil 5% Slope (NUREG 1623)

Rock Size (D75)	t	P	L	Calculated Ss	Comments
3.0	1.2	28.228	1021	5.5%	The calculated stable slope is greater than 5% (the slope to be built), therefore the Dc for rock size developed in Section 4.1 is more conservative
3.0	1.2	28.3266	1000	5.6%	The calculated stable slope is greater than 5% (the slope to be built), therefore the Dc for rock size developed in Section 4.1 is more conservative
3.0	1.2	28.8265	900	6.0%	The calculated stable slope is greater than 5% (the slope to be built), therefore the Dc for rock size developed in Section 4.1 is more conservative
3.0	1.2	29.3851	800	6.6%	The calculated stable slope is greater than 5% (the slope to be built), therefore the Dc for rock size developed in Section 4.1 is more conservative
3.0	1.2	30.0175	700	7.2%	The calculated stable slope is greater than 5% (the slope to be built), therefore the Dc for rock size developed in Section 4.1 is more conservative
3.0	1.2	30.7456	600	8.1%	The calculated stable slope is greater than 5% (the slope to be built), therefore the Dc for rock size developed in Section 4.1 is more conservative
2.0	0.8	31.3739	525	5.0%	The calculated stable slope is greater than 5% (the slope to be built), therefore the Dc for rock size developed in Section 4.1 is more conservative
2.0	0.8	31.6028	500	5.2%	The calculated stable slope is greater than 5% (the slope to be built), therefore the Dc for rock size developed in Section 4.1 is more conservative
2.0	0.8	32.644	400	6.1%	As noted in Table 5, the rock size using this formula from NUREG-1623 governs for this slope length. The calculated stable slope is greater than 5% (the slope to be built), therefore the Dc for rock size developed in Section 4.1 is more conservative

Rock Size (D75)	t	P	L	Calculated Ss	Comments
2.0	0.8	33.2619	350	6.7%	As noted in Table 5, the rock size using this formula from NUREG-1623 governs for this slope length. The calculated stable slope is greater than 5% (the slope to be built), therefore the Dc for rock size developed in Section 4.1 is more conservative
1.5	0.6	33.9694	300	5.0%	As noted in Table 5, the rock size using this formula from NUREG-1623 governs for this slope length. The calculated stable slope is greater than 5% (the slope to be built), therefore the Dc for rock size developed in Section 4.1 is more conservative
1.5	0.6	35.7948	200	6.7%	As noted in Table 5, the rock size using this formula from NUREG-1623 governs for this slope length. The calculated stable slope is greater than 5% (the slope to be built), therefore the Dc for rock size developed in Section 4.1 is more conservative
1.5	0.6	38.7645	100	11.4%	As noted in Table 5, the rock size using this formula from NUREG-1623 governs for this slope length. The calculated stable slope is greater than 5% (the slope to be built), therefore the Dc for rock size developed in Section 4.1 is more conservative

[1] Values highlighted (slope lengths less than 400 feet) required an increase in D_{75} from the Dc value computed using the methods outlined in Section 4.1 to meet NUREG-1623 requirements. Refer to Table 5.

4.3.2 Admixture Design for Single Slope Length of 1,000 ft at 2 Percent Slope

Table 7 provides a summary of the admixture calculations following the method in Section 4.1 while utilizing the intensity values (I) in Table 4. The critical particle size (Dc) and admixture depth are computed based on the slope length along the 2 percent slope. For all slope lengths, the long-term stability of a rocky soil slope (per NUREG-1623) determined the critical rock size (Dc). All mixtures will be 33 percent rock to 67 percent soil by volume for the full admixture depth.

Table 7. Admixture Design Summary for Cover 2% Slope

I (in/hr)	S (%)	Slope Length (ft)	A (acres)	Q (cfs)	Qm (cfs)	b (ft)	dH (in)	τ (psf)	Dc (in)	use Dc (in)1,2	% Gravel	Ya (in)	Ys (in)	Admix Depth (in)	Comment
24.0	2	1000	5.739	41.35	4.13	15.36	4.61	0.480	1.2	1.5	33	4.5	9	14.0	increased rock size per Table 8. NUREG-1623
24.5	2	900	4.649	34.18	3.42	14.29	4.27	0.444	1.1	1.5	33	4.5	9	14.0	increased rock size per Table 8. NUREG-1623
25.1	2	800	3.673	27.61	2.76	13.17	3.90	0.406	1.0	1.5	33	4.5	9	14.0	increased rock size per Table 8. NUREG-1623
25.7	2	700	2.812	21.67	2.17	12.01	3.53	0.367	0.9	1.5	33	4.5	9	14.0	increased rock size per Table 8. NUREG-1623
26.4	2	600	2.066	16.37	1.64	10.80	3.15	0.327	0.8	1.5	33	4.5	9	14.0	increased rock size per Table 8. NUREG-1623
27.3	2	500	1.435	11.74	1.17	9.52	2.74	0.285	0.7	1.5	33	4.5	9	14.0	increased rock size per Table 8. NUREG-1623
28.3	2	400	0.918	7.80	0.78	8.15	2.32	0.241	0.6	1.5	33	4.5	9	14.0	increased rock size per Table 8. NUREG-1623
29.7	2	300	0.517	4.60	0.46	6.67	1.86	0.194	0.5	1.5	33	4.5	9	14.0	increased rock size per Table 8. NUREG-1623
31.6	2	200	0.230	2.18	0.22	5.02	1.37	0.142	0.3	1.5	33	4.5	9	14.0	increased rock size per Table 8. NUREG-1623
34.8	2	100	0.057	0.60	0.06	3.07	0.80	0.083	0.2	1.5[2]	33	4.5	9	14.0	

[1] Values highlighted (slope lengths 100 to 400 feet) required an increase in Dc to meet NUREG-1623 requirements. Refer to Table 6

[2] Adjusted the Dc to meet the available 1.5-inch rock on-site

Table 8 summarizes the calculations to verify compliance the long-term stability of a rocky soil slope per NUREG-1623. The slope lengths utilized in the calculations correspond to those from Table 7. For all slope lengths, the Dc was increased in the computations to satisfy the long-term stability of a rocky soil slope per NUREG-1623.

Table 8. Long-Term Stability of Rocky Soil 2% Slope (NUREG-1623)

D75[1]	t	P	L	Calculated Ss	Comments
1.5	0.6	24.0158	1000	2.4%	The calculated stable slope (Ss) is greater than the slope to be built of 2%, therefore OK
1.5	0.6	24.5048	900	2.6%	The calculated stable slope (Ss) is greater than the slope to be built of 2%, therefore OK
1.5	0.6	25.0542	800	2.8%	The calculated stable slope (Ss) is greater than the slope to be built of 2%, therefore OK
1.5	0.6	25.6803	700	3.1%	The calculated stable slope (Ss) is greater than the slope to be built of 2%, therefore OK
1.5	0.6	26.4064	600	3.4%	The calculated stable slope (Ss) is greater than the slope to be built of 2%, therefore OK
1.5	0.6	27.2686	500	3.9%	The calculated stable slope (Ss) is greater than the slope to be built of 2%, therefore OK
1.5	0.6	28.3266	400	4.6%	The calculated stable slope (Ss) is greater than the slope to be built of 2%, therefore OK
1.5	0.6	29.6909	300	5.6%	The calculated stable slope (Ss) is greater than the slope to be built of 2%, therefore OK
1.5	0.6	31.6028	200	7.5%	The calculated stable slope (Ss) is greater than the slope to be built of 2%, therefore OK
1.5	0.6	34.7971	100	12.5%	The calculated stable slope (Ss) is greater than the slope to be built of 2%, therefore OK

[1] Adjusted the Dc to meet the available 1.5-inch rock on-site

4.4 SOIL LOSS

The soil loss computed utilizing the Revised Universal Soil Loss Equation (RUSLE) and the Wind Erosion Prediction System or 'WEPS' (USDA 2010) is included to satisfy the USEPA (1991) guidance limiting soil loss to less than 2 tons/acre/year. It is recognized that these tools were developed by the USDA to provide an approximation of soil loss on farmlands with very fine grained soils (USDA 1997, USDA 2010). However, it is a common means utilized to satisfy the soil loss requirement per USEPA (1991). It does not infer that the computed soil loss is an estimate of expected soil loss given that the cover system includes a top layer composed of a mixture of

rock and gravel design to minimize soil loss. The rock size or incipient particle size defines the maximum size of particle that will be eroded for a given set of conditions. Material larger than the incipient particle size will not be displaced or eroded and will form an armoring to protect the surface from further erosion from similar or lesser storm events.

4.4.1 Soil Loss Due to Surface Water Runoff

RUSLE represents a revision of the Universal Soil Loss Equation (USLE) technology in how the factor values in the equation are determined. RUSLE is explained in USDA Handbook 703, "Predicting Soil Erosion by Water: A Guide to Conservation Planning with the Revised Universal Soil Loss Equation (RUSLE)" (USDA 1997). The RUSLE is expressed as:

$$A_s = R_e\ K\ (LS)\ C\ P_c$$ **Equation 10**

Where:

A_s = average annual soil loss by sheet and rill erosion in tons per acre

R_e = rainfall energy/erosivity factor (dimensionless) --- see Figure 4

K = soil erodibility factor (dimensionless) --- see Figure 3

LS = slope length and steepness factor (dimensionless) -- --- see Figure 5

C = vegetative cover and management factor (dimensionless)

P_c = conservation support practice factor (dimensionless)

The following figures are derived from Agriculture Handbook 703 (USDA 1997).

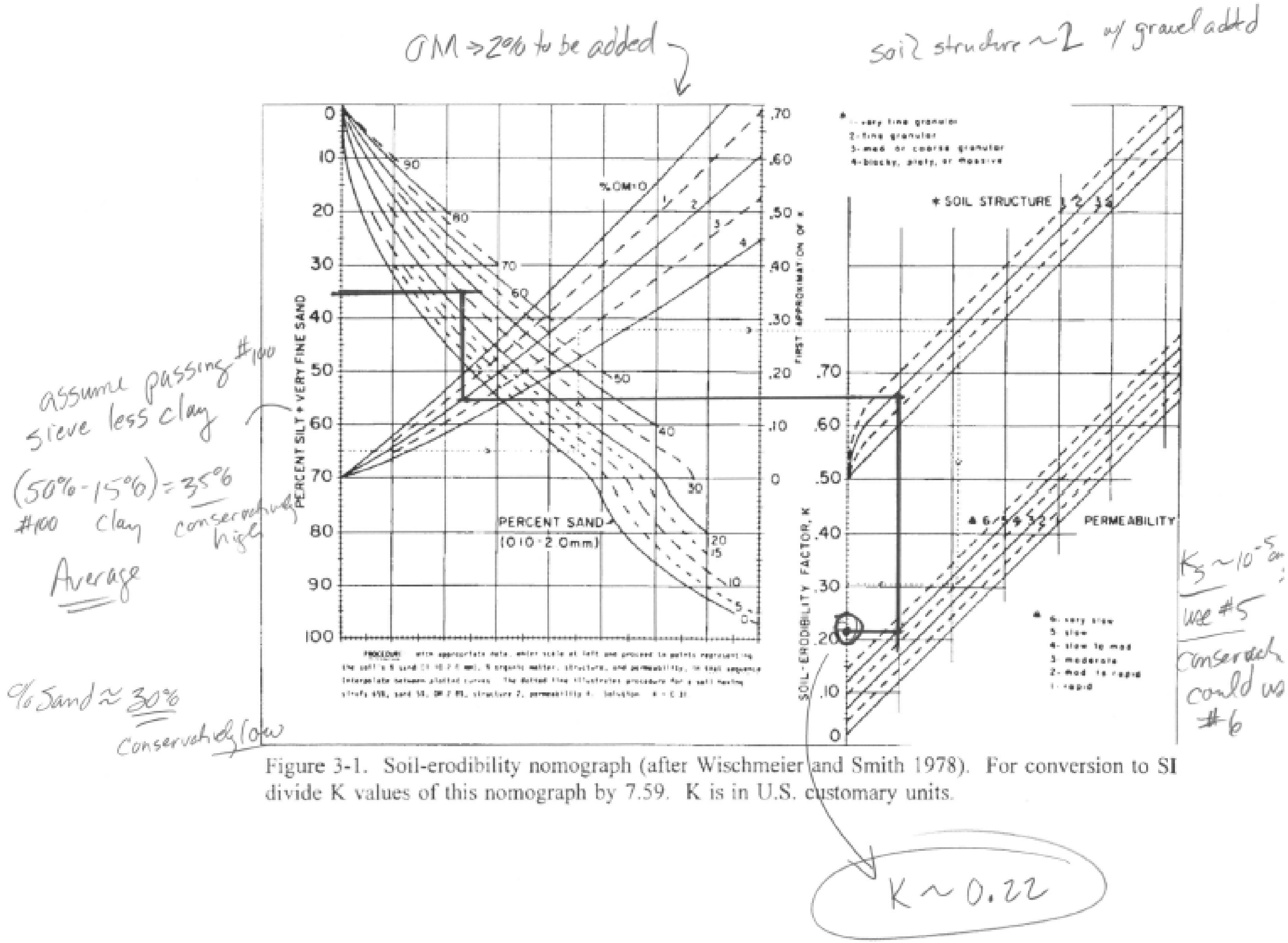


Figure 3-1. Soil-erodibility nomograph (after Wischmeier and Smith 1978). For conversion to SI divide K values of this nomograph by 7.59. K is in U.S. customary units.

Figure 3. RUSLE K Factor (USDA 1997)

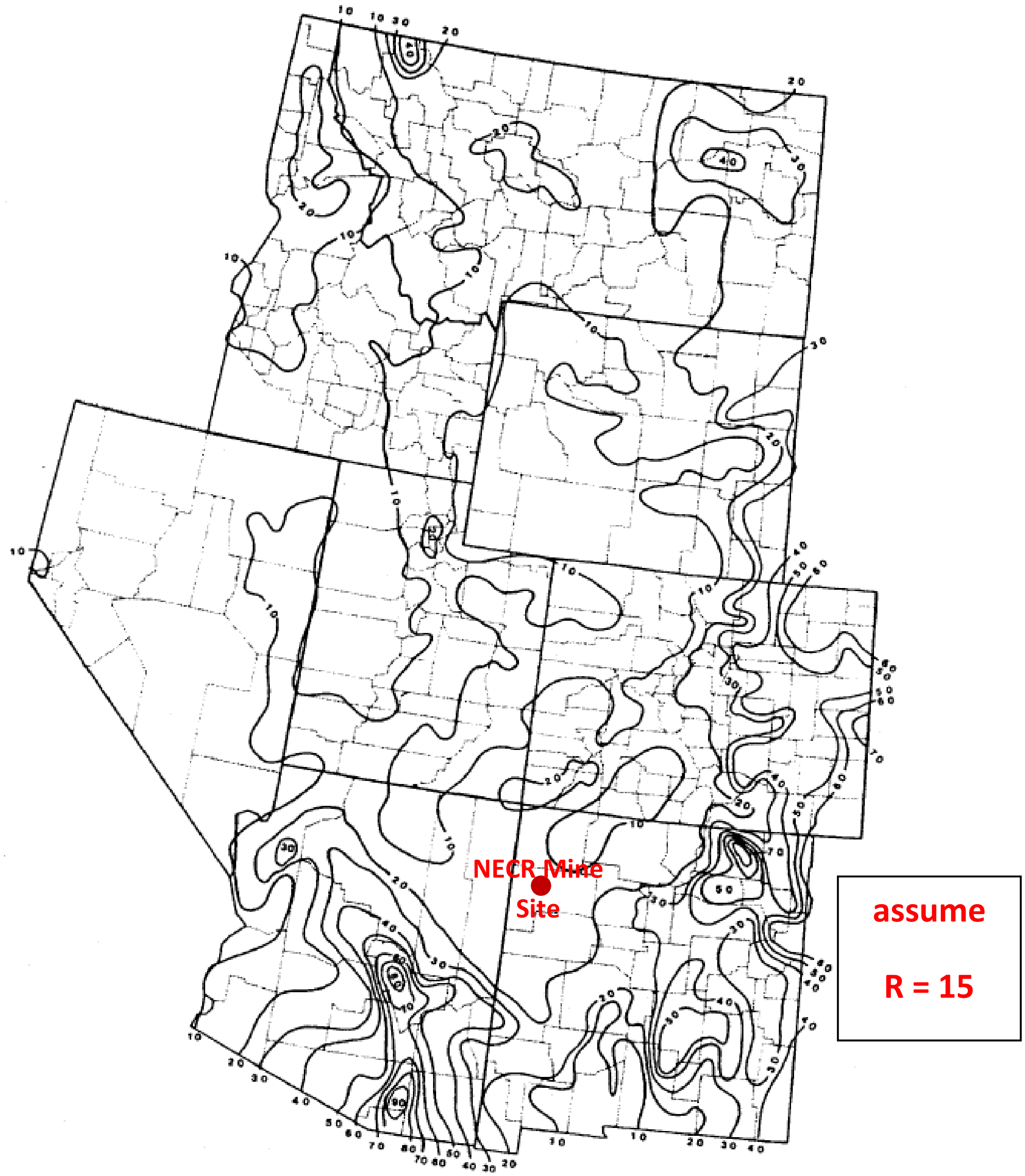


Figure 2-2. Isoerodent map of western United States. Units are hundreds ft·tonf·in(ac·h·yr)$^{-1}$.

Figure 4. RUSLE R Factor (USDA 1997)

assume = 1.10

Table 4-1.
Values for topographic factor, LS, for low ratio of rill to interrill erosion.[1]

Slope (%)	Horizontal slope length (ft)																
	<3	6	9	12	15	25	50	75	100	150	200	250	300	400	600	800	1000
0.2	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
0.5	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
1.0	0.12	0.12	0.12	0.12	0.12	0.13	0.13	0.14	0.14	0.15	0.15	0.15	0.15	0.16	0.16	0.17	0.17
2.0	0.20	0.20	0.20	0.20	0.20	0.21	0.23	0.25	0.26	0.27	0.28	0.29	0.30	0.31	0.33	0.34	0.35
3.0	0.26	0.26	0.26	0.26	0.26	0.29	0.33	0.36	0.38	0.40	0.43	0.44	0.46	0.48	0.52	0.55	0.57
4.0	0.33	0.33	0.33	0.33	0.33	0.36	0.43	0.46	0.50	0.54	0.58	0.61	0.63	0.67	0.74	0.78	0.82
5.0	0.38	0.38	0.38	0.38	0.38	0.44	0.52	0.57	0.62	0.68	0.73	0.78	0.81	0.87	0.97	1.04	1.10
6.0	0.44	0.44	0.44	0.44	0.44	0.50	0.61	0.68	0.74	0.83	0.90	0.95	1.00	1.08	1.21	1.31	1.40
8.0	0.54	0.54	0.54	0.54	0.54	0.64	0.79	0.90	0.99	1.12	1.23	1.32	1.40	1.53	1.74	1.91	2.05
10.0	0.60	0.63	0.65	0.66	0.68	0.81	1.03	1.19	1.31	1.51	1.67	1.80	1.92	2.13	2.45	2.71	2.93
12.0	0.61	0.70	0.75	0.80	0.83	1.01	1.31	1.52	1.69	1.97	2.20	2.39	2.56	2.85	3.32	3.70	4.02
14.0	0.63	0.76	0.85	0.92	0.98	1.20	1.58	1.85	2.08	2.44	2.73	2.99	3.21	3.60	4.23	4.74	5.18
16.0	0.65	0.82	0.94	1.04	1.12	1.38	1.85	2.18	2.46	2.91	3.28	3.60	3.88	4.37	5.17	5.82	6.39
20.0	0.68	0.93	1.11	1.26	1.39	1.74	2.37	2.84	3.22	3.85	4.38	4.83	5.24	5.95	7.13	8.10	8.94
25.0	0.73	1.05	1.30	1.51	1.70	2.17	3.00	3.63	4.16	5.03	5.76	6.39	6.96	7.97	9.65	11.04	12.26
30.0	0.77	1.16	1.48	1.75	2.00	2.57	3.60	4.40	5.08	6.18	7.11	7.94	8.68	9.99	12.19	14.04	15.66
40.0	0.85	1.36	1.79	2.17	2.53	3.30	4.73	5.84	6.78	8.37	9.71	10.91	11.99	13.92	17.19	19.96	22.41
50.0	0.91	1.52	2.06	2.54	3.00	3.95	5.74	7.14	8.33	10.37	12.11	13.65	15.06	17.59	21.88	25.55	28.82
60.0	0.97	1.67	2.29	2.85	3.41	4.52	6.63	8.29	9.72	12.16	14.26	16.13	17.84	20.92	26.17	30.58	34.71

[1]Such as for rangeland and other consolidated soil conditions with cover (applicable to thawing soil where both interrill and rill erosion are significant).

Figure 5. RUSLE LS Factor (USDA 1997)

The RUSLE C factor (C = 0.16) was derived using the RUSLE2 software available through the USDA. The RUSLE P factor is 1 since no conservation support practice is utilized.

Solving for As = 15*0.22*1.10*0.16*1 = 0.58 tons/acre/year.

4.4.2 Soil Loss Due to Wind Erosion

The Wind Erosion Prediction System or ‘WEPS’ (USDA 2010) is a process-based, daily time-step, wind erosion simulation model. It represents the latest in wind erosion prediction technology and is designed to provide wind erosion soil loss estimates from cultivated, agricultural fields. WEPS 1.0 consists of the computer implementation of the WEPS science model with a graphical user interface designed to provide easy-to-use methods of entering inputs to the model and obtaining output reports. WEPS was developed by the Engineering and Wind Erosion Research Unit (EWERU) of the United States Department of Agriculture, Agricultural Research Service. The WEPS model is now recommended by the USDA in lieu of the previously used Wind Erosion Equation (WEQ).

WEPS is a model developed primarily for use by the USDA, Natural Resources Conservation Service (NRCS). As such, many capabilities of WEPS reflect the needs of NRCS for use in cultivated agricultural systems. However, WEPS has capabilities used in many other situations where wind affected soil movement is a problem.

The WEPS model is set up to determine wind erosion for agriculture fields and not necessarily a final cover system such as that described in this report. However, the gravel/soil admixture design is intended to mitigate soil loss due to water runoff and wind erosion (Dwyer et al. 2007, USEPA 2012).

Input for the WEPS inherent to the model include the local wind data generated by the USDA. The user defined input included selection of the area (State: New Mexico, County: McKinley, Latitude: 35.58N, Longitude: 108.26W, and Elevation: 6749-ft). User designated physical data included shape of region (circle) and size of area shown on output (Figure 6). The soil chosen was sandy loam (specific soil properties included within the software library of data). Other user defined input parameters for the WEPS model includes the volume percent of rock fragments in the soil (0.33 ft^3/ft^3), any barriers included to disrupt the wind (none chosen), and any management techniques to assist the soil resist erosion (none chosen).

Figure 6 represents the output from the computer simulation representing the final cover system for the NECR closure whereby the initial estimated wind erosion is about <u>0.2 tons/acre/year</u>. This value is conservative given it was based on no lockage of wind by surrounding terrain or vegetation and no vegetation on the cover surface.

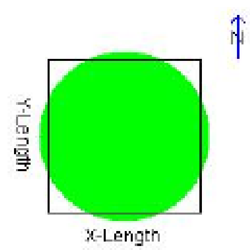
Run Summary

NRCS Natural Resources Conservation Service

NECR6

Run Date:	Wednesday, May 25, 2016, 08:54 PM		
Client Name:	UNC		
Farm No:	---	**Tract No:** ---	**Field No:** NECR - Imp
Run Location:	Runs		
Management:	NoCrop.man		
Soil:	Sandy_Loam_NA_100_SL.ifc		

Location Site Information



Field shape approximate

X-Length:	3190.3 ft	**Mode:**	NRCS
Y-Length:	3190.3 ft	**Soil Loss Tolerance (T):**	5.0 t/ac/yr
Radius:	1799.9 ft	**Site:**	UNITED STATES NEW MEXICO MCKINLEY
Area:	233.7 ac	**Location:**	35.58063° N, 108.26189° W
Elevation:	6748.7 ft	**Cligen:**	WINDOW ROCK
Orientation:	0.0 °	**Windgen:**	GALLUP MUNI/CLARKE

Erosion

		Gross Loss	Net Soil Loss From Field (t/ac)			
Period	**Crop/Residue**	t/ac	**Total**	**Creep/Salt.**	**Suspen.**	**PM10**
Rot. year: 1		0.2	0.2	0.1	0.2	Trace
Ave. Annual		0.2	0.2	0.1	0.2	Trace

SCI Summary

Soil Conditioning Index:	0.6	**SCI Subfactors**	
Energy Calculator:	0.0 gal diesel/ac	**OM:**	-0.03
Average Annual STIR:	0.0	**FO:**	1.00
Wind Erosion Soil Loss:	0.2 t/ac	**ER:**	0.91
Water Erosion Soil	0.0 t/ac		

Rotation Stir Energy

Date	**Operation**	**Fuel**	**Stir**	**Energy** Btu/ac	**Cost** USD/ac
Jan 01, 01	Add Non-Crop Mulch	Diesel	0.0	0	0.00
		Total / ac		0	0.00
		Total	0.0	0	0.00

Figure 6. Soil Loss due to Wind Erosion per WEPS (USDA 2010)

Since the annual soil loss of both wind and surface water is 0.78 tons/acre/year, which is less than 2 tons/acre/year, the performance criteria (USEPA 1991) is satisfied.

5.0 APPLICABILITY OF ET COVER AS FINAL COVER SYSTEM FOR NECR

This report describes an ET Cover System capable of meeting the stated performance objectives described in Section 3.0. The applicability of the ET cover for short and long-term at the site is based on the combination of the following:

1. Natural analog studies described in Section 5.1
2. Applicable field data described in Section 5.2

Natural analogs are a useful tool for evaluation of the long-term performance of a soil profile. Natural analog studies (Section 5.1) performed at the investigated potential borrow sources for cover material for the NECR project revealed that the effective maximum penetration depth of precipitation for typical climatic conditions is less than 2 feet (61 cm). These findings are consistent with other similar sites (Dwyer et al. 2007). Calcium carbonate and gypsum were identified in significant concentrations at a depth of about 18 inches (45 cm) revealing that these salts generally precipitated out at this maximum soil depth. A nearby site with similar elevation and climate revealed pronounced calcium carbonate horizons exist at a depth of about 2 feet (61 cm) reinforcing the typical infiltration depth (Figure 8). Furthermore, the majority of native vegetation roots were found to be limited to this upper 18 inches (45 cm) of soil reinforcing that this is the typical maximum depth of precipitation infiltration for the Mine Site conditions.

Applicable field data of cover systems are useful for evaluating the short-term effectiveness of a cover profile. A summary of applicable field data (Section 5.2) demonstrated an ET Cover is equivalent to a thicker prescriptive cover containing a clay barrier layer and geosynthetic membrane at this site (Dwyer 2003). The ET Cover will also provide more stability and longer-term performance than a cover depending on a product with a limited lifespan such as a geomembrane.

5.1 NATURAL ANALOGS EVALUATION

Analog studies involve the use of logical analogy to investigate natural and archaeological occurrences of materials, conditions, or processes similar to those known or predicted to occur in some part of the engineered cover system (Waugh 1994). Conventional engineering approaches for designing cover systems often fail to fully consider ecological processes. Natural ecosystems effective at capturing and or redistributing materials in the environment have evolved over millions of years. Consequently, when contaminants are introduced into the environment, ecosystem processes begin to influence the distribution and transport of these materials, just as they influence the distribution and transport of nutrients that occur naturally in ecosystems (Hakonson et al., 1992). As the ecological status of the cover changes, so will performance factors such as water infiltration, water retention, ET, soil erosion, gas diffusion, and biointrusion. The objective is to design the cover so that subsequent ecological change will enhance and preserve the encapsulating system. Consideration of natural analogs were included in the cover design by disclosing which properties are effective in a given environment and what processes may lead to possible failure.

An objective for designing a cover for the NECR site, given the longevity requirements for radionuclides, is to accommodate long-term environmental processes while requiring as little maintenance as possible. The performance of any cover will change as the environmental setting

inevitably evolves in response to natural processes. Understanding how environmental conditions may change is crucial to designing, constructing, and maintaining long-term cover systems. Effective modeling and performance assessment require scenarios based on both current and possible future environmental settings. Natural analog studies help identify and evaluate likely changes in environmental processes that may influence cover performance; processes that cannot be addressed with short-term field tests or existing numerical models (Waugh et al. 1994).

The natural analog study (Dwyer 1997, Waugh and Smith 1997) involved assessment of the effectiveness of undisturbed native soil profiles on or near the NECR site. This allowed for an evaluation of the typical maximum depth of infiltration. The depth of vegetation roots (Figure 7) from native grasses and shrubs were noted as well as the depth of calcium carbonate deposits or formation of a caliche layer. Soils in semiarid and arid regions commonly have carbonate-rich horizons at some depth below the surface. The origin of carbonate horizons involves carbonate-bicarbonate equilibria (Birkeland 1984), as shown by the following reactions:

$$CO_2 + H_2O$$

$$\uparrow\downarrow$$

$$CaCO_3 + H_2CO_3 \Leftrightarrow Ca^{2+} + 2HCO_3^-$$

Carbon dioxide partial pressures in soil air are 10 to more than 100 times that in the atmosphere; this decreases the pH, which, in turn, increases $CaCO_3$ solubility. The partial pressure of CO_2 is high as a result of CO_2 produced by root and microorganism respiration and organic matter decomposition. Thus, the highest CO_2 partial pressure are associated with the A horizon located near the surface, with values diminishing down to the base of the zone of roots. In arid and semi-arid regions, the quantity of water leaching through the soil is also generally greater near the surface than at depth. Thus, as the water moves vertically through the soil, the Ca^+ and HCO^{3-} content might increase to the point of saturation. Combining the effects of high CO_2 partial pressure and downward-percolating water, we might visualize the formation of a $CaCO_3$-rich horizon as follows: in the upper soil zone, Ca^{2+} is present by the leaching of calcium-bearing minerals. Due to plant growth and biological activity, CO_2 partial pressure is high and forms carbonic acid upon contact with calcium-bearing water. Percolating water carries Ca^{2+} and HCO_3^- ions downward in the profile. $CaCO_3$ precipitation as a caliche horizon takes place by some combination of decreasing CO_2 partial pressure (i.e. less carbonic acid production) below the zone of rooting and major biological activity and/or the progressive increase in Ca^{2+} and HCO_3^- concentrations with depth as the water is lost by ET. The position (depth) of the $CaCO_3^-$ bearing horizon is therefore related to the depth that precipitation infiltrates before it is removed by ET.

The concentrations of salts found dramatically increased in concentrations (Figure 8) at about 2 feet (61 cm) below ground surface (BGS) revealing that this is the typical maximum infiltration depth for precipitation. Extreme infiltration events could potentially move deeper than this, but as the area dried this moisture would likely move back up in the profile and be removed via ET. The moisture being drawn upward after an extreme infiltration event is a consequence of the energy gradients produced by the site-specific extreme climatic demand for water or PET as illustrated in Figures 14 and 15. This is another advantage of ET covers: they allow for moisture beneath a cover profile to move up and be removed from the profile via ET. A site in the foothills east of Albuquerque, NM (about 100 miles east of the NECR site) with similar vegetation, climate, and elevation shows a distinct interface between topsoil and calcium carbonate (Figure 8).

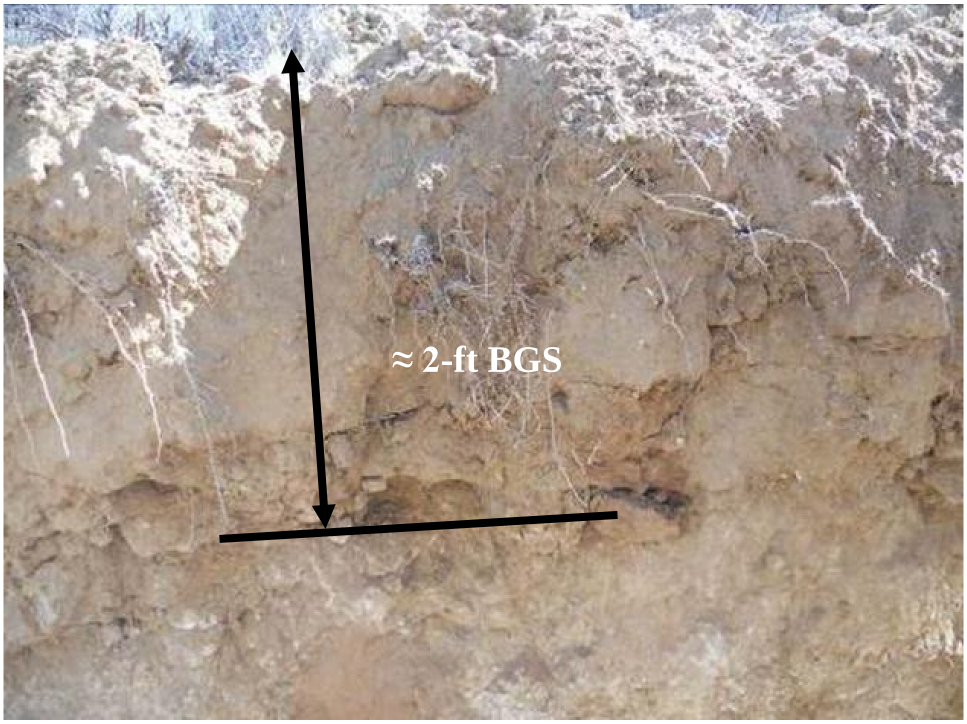


Figure 7. Root Depth @ 2-FT - NECR East Borrow Site

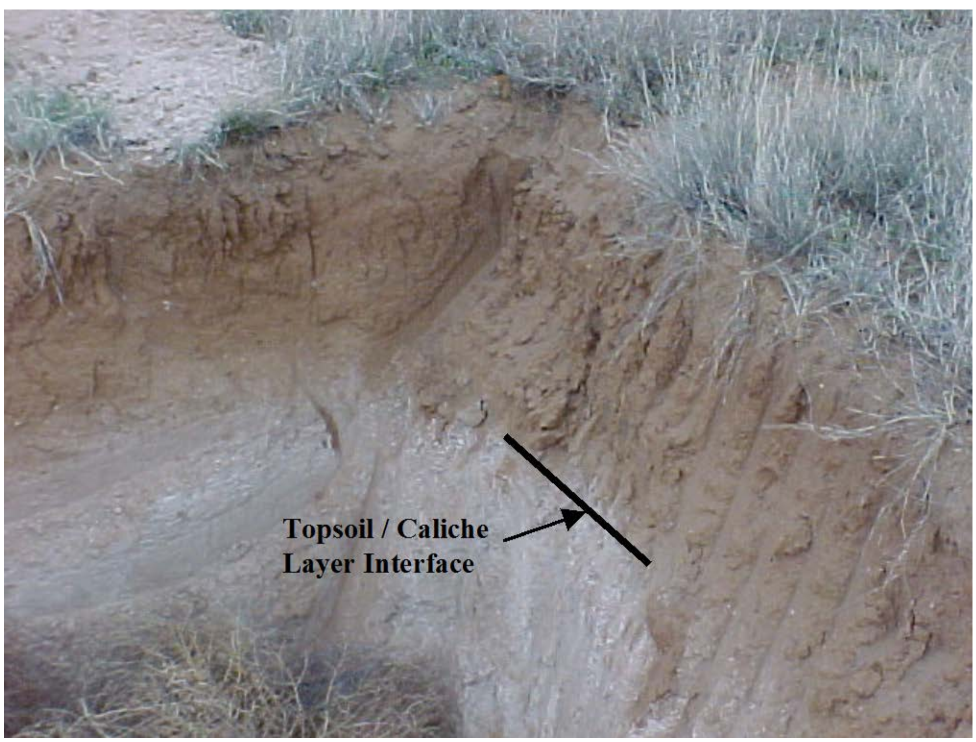


Figure 8. CaCO3/Soil Interface at Shallow Depth at site near Albuquerque, NM

5.2 RESEARCH AND FIELD DATA THAT SUPPORT THE USE OF AN ET COVER AT NECR

Myriad sites throughout the United States have been permitted for alternative cover systems based on applicable field data. Applicable field data is available on the USEPA web site (http://www.clu-in.org/download/remed/epa542f03015.pdf#search='evapotranspiration%20epa%20fact%20sheet); the USEPA's Alternative Cover Assessment Program (ACAP) web site (ftp://ftp.dri.edu/pub/ACAP/); and USEPA Technology Innovation web site (http://cluin.org/products/altcovers/).

One of the most widely used data sets is that from a large-scale demonstration performed at Sandia National Laboratory in Albuquerque, NM. This site has a similar climate, vegetation and soil textures as the NECR site. This project evaluated alternative covers side-by-side with prescriptive cover profiles (Dwyer 2003). This study was referred to as the Alternative Landfill Cover Demonstration (ALCD). There were six cover designs tested in this demonstration project: two baseline cover profiles (prescriptive RCRA Subtitle 'D' and Subtitle 'C' covers respectively) and four alternative cover designs (an ET Cover, two different Capillary Barrier System designs, and a cover featuring a Geosynthetic Clay Liner (GCL)). This study was endorsed by the Western Governors Association and was reviewed annually during its monitoring phase for its technical merit by a consortium of regulators and technical experts.

The demonstration allowed for testing of the cover profiles under both ambient and stressed conditions. During stress tests of the cover profiles, water was evenly applied to the plots to evaluate the subsequent water balance variables for each cover profile. Extreme summer events were simulated such as severe thunderstorms as well as winter and spring events such as large snow falls and expedited melting of snow during low transpiration periods.

The results showed that a well-designed ET Cover composed of 3.5 feet (107 cm) of native soil performed as well as or better than a prescriptive cover over 5-ft-thick (152 cm) containing a 2-ft-thick (61 cm) clay barrier layer and geomembrane (Figures 9 and 10). Because the RCRA Subtitle C soil barrier layer showed and increasing moisture buildup (Dwyer 2003) and the geomembrane has a limited design life. The ET Cover should significantly outperform this cover over the long-term. The moisture content continued to build within the Subtitle C clay barrier layer beneath the geomembrane due to leakage through the minimal flaws in the membrane (typical of a membrane installed with good quality control) while not allowing removal due to ET (this is not shown in the graphics below). The ET Cover profile produced zero flux after vegetation was well established.

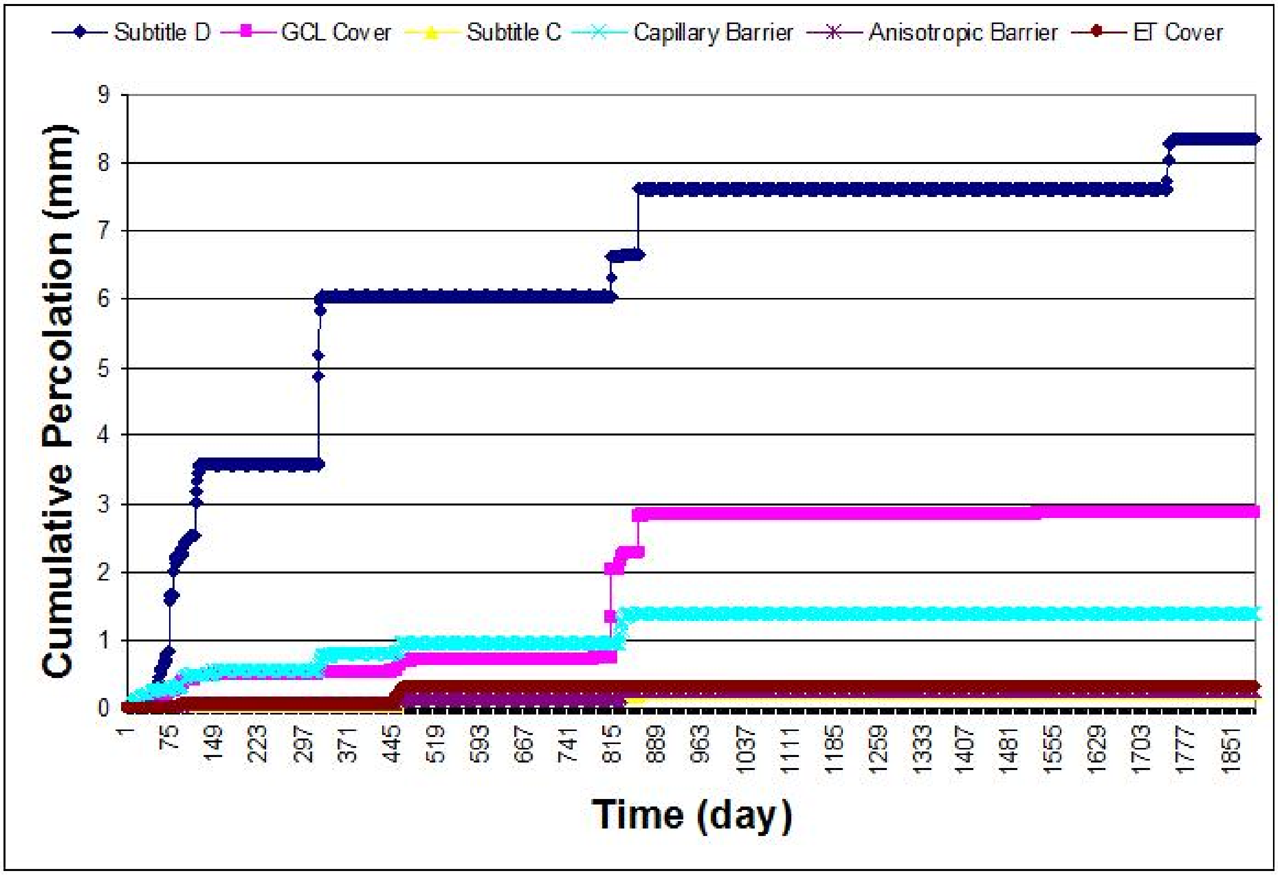
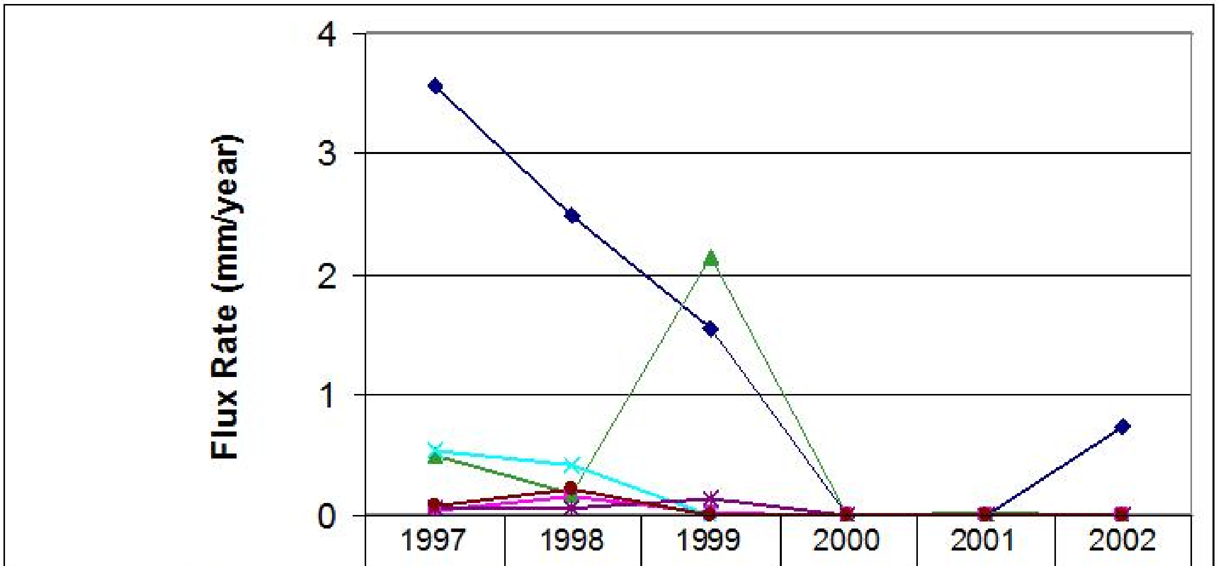


Figure 9. Sandia National Lab. Results: Cumulative Percolation for the Six Test Covers (Dwyer 2003)



	1997	1998	1999	2000	2001	2002
Subtitle D	3.56447	2.47911	1.56115	0.00000	0.00000	0.73966
Subtitle C	0.04131	0.15161	0.01756	0.00000	0.00000	0.00000
GCL Cover	0.50628	0.18831	2.15408	0.00018	0.02091	0.00000
Capillary Barrier	0.54412	0.40907	0.00000	0.00008	0.00002	0.00005
Anisotropic Barrier	0.05135	0.06888	0.13937	0.00035	0.00047	0.00021
ET Cover	0.07546	0.21837	0.00538	0.00002	0.00000	0.00000

Figure 10. Sandia National Lab. Results: Annual Flux for the Six Test Covers (Dwyer 2003)

6.0 UNSATURATED MODELING OF COVER SYSTEM

The previous section summarized data supporting the effectiveness of an ET Cover in both the short-term with the applicable field data and in the long-term with the natural analogs evaluation. This section provides an overview of modeling performed in support of the profile design for the final cover system.

Modeling was performed to determine an ET cover profile that minimizes flux given the myriad of input parameters (cover soil and vegetation data) and historical climate data for the site. Unsaturated flow modeling of a cover profile is useful to develop a minimum cover thickness and evaluate the cover profile subjected to a variety of conditions as well as input and boundary sensitivities (Dwyer et al. 2007, USEPA 2012).

6.1 OVERVIEW OF UNSAT-H

Historically, HELP (Schroeder et al., 1994) was utilized to predict water balance in landfill systems including the final cover. However, it is now recognized that this software has its limitations (ITRC 2003). Software more applicable for the analyses of water flow within an alternative earthen cover system is based on the Richard's Equation (ITRC 2003). One of the most common software (ITRC 2003) based on the Richard's equation is UNSAT-H (Fayer 2000). This unsaturated modeling software was designed specifically for earthen covers. It has been recommended for use on alternative earthen covers in the ITRC (2003) design guidance documents. Consequently, UNSAT-H was used on this project.

UNSAT-H has been used to design recent alternative earthen covers (Dwyer 2003). UNSAT-H is a one-dimensional, finite-difference computer program developed at the Pacific Northwest National Laboratory by Fayer and Jones (1990). UNSAT-H can be used to simulate the water balance of earthen covers as well as soil heat flow (Fayer 2000). UNSAT-H simulates water flow through soils by solving Richards' equation and simulates heat flow by solving Fourier's heat conduction equation.

A schematic illustration showing how UNSAT-H computes the water balance is shown in Figure 11. UNSAT-H separates precipitation falling on an earthen cover into infiltration and overland flow. The quantity of water that infiltrates depends on the infiltration capacity of the soil profile immediately prior to rainfall (e.g., total available porosity). Thus, the fraction of precipitation shed as overland flow depends on saturated and unsaturated hydraulic conductivities of the soils characteristic of the final cover. If the rate of precipitation exceeds the soil's infiltration capacity, the extra water is shed as surface runoff. UNSAT-H does not consider absorption and interception of water by the plant canopy, or the effect of slope and slope-length when computing surface runoff. This allows conservative infiltration and percolation estimates since cover systems are generally sloped to encourage runoff.

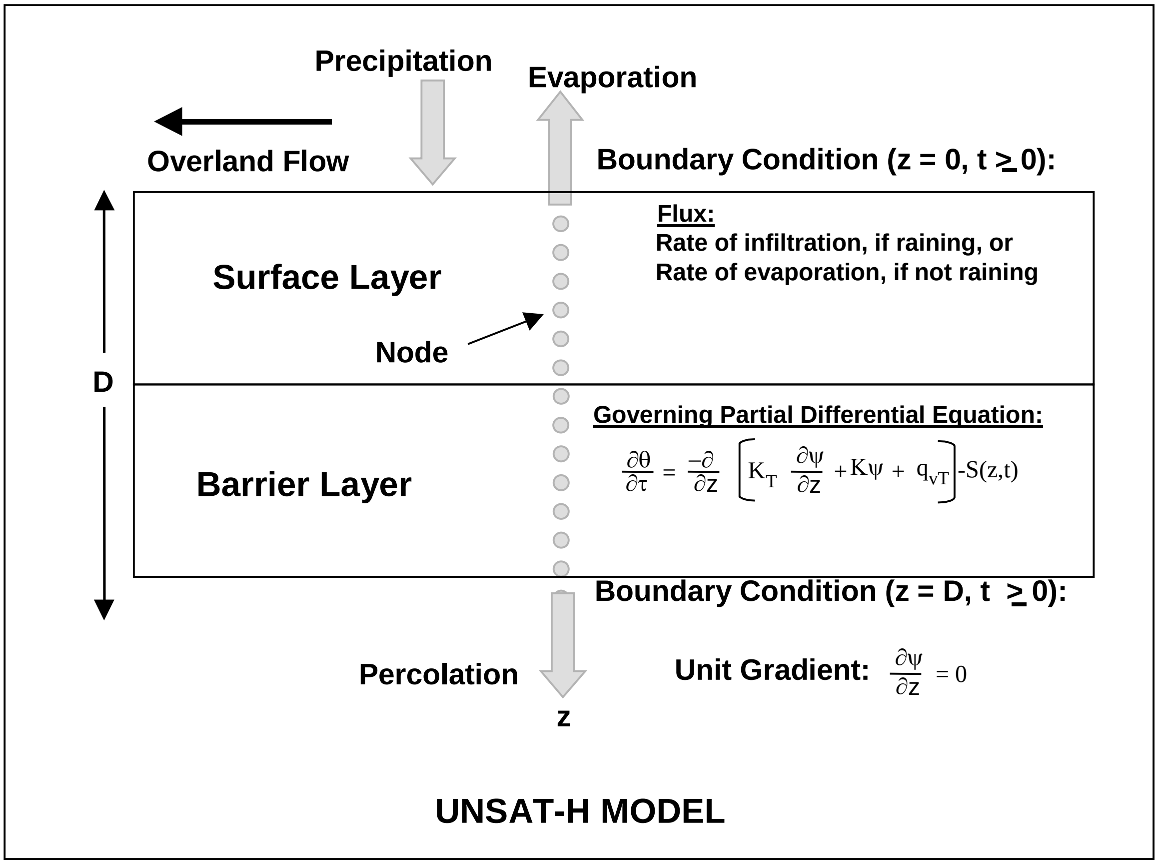


Figure 11. Schematic Representation of Water Balance Computation by UNSAT-H

Water infiltrating a soil profile during an UNSAT-H simulation moves upward or downward as a consequence of gravity and matric potential gradients. Evaporation from the cover surface is computed using Fick's law. Water removal by transpiration of plants is treated as a sink term in Richards' equation. Potential evapotranspiration (PET) is computed from the daily wind speed, relative humidity, net solar radiation, and daily minimum and maximum air temperatures using a modified form of Penman's equation given by Doorenbos and Pruitt (1977). Soil water storage is computed by integrating the water content profile. Flux from the lower boundary is via percolation. UNSAT-H, being a one-dimensional program, does not compute lateral drainage.

6.2 UNSAT-H INPUT PARAMETERS

Input parameters utilized in the computer simulations with UNSAT-H for the ET cover were developed based on field and laboratory measurements, values from the literature, and expert opinion. Parameter descriptions are in Sections 6.3 to 6.7.

The development of the final cover system utilizing unsaturated flow modeling was performed in a stepped approach. An extensive set of sensitivity analyses were performed to determine a minimum cover thickness. The sensitivity analyses evaluated potential input parameters and climate scenarios expected over the performance period of the cover system. The input parameters evaluated included the potential cover soil borrow sources, variability of the cover soil over time, variability in vegetation, and variability in cover profiles (surface erosion protection layer

composed of rock and soil). The upper boundary condition or climate was also evaluated from typical to extreme wet conditions.

There are three different rock/soil admixture designs depending on the slope and slope length. Refer to Figure 13 for geometry of the admixture designs and Section 4 for the analysis.

Multiple potential local borrow sources were evaluated for cover soil. As described in the Pre-Design Studies Report (MWH 2014), there were five borrow areas evaluated for cover soil: (1) the North Drainage Borrow Area; (2) the South Drainage Borrow Area; (3) Dilco Hill Borrow Area; (4) East Borrow Area; and (5) West Borrow Area (Figure 12).

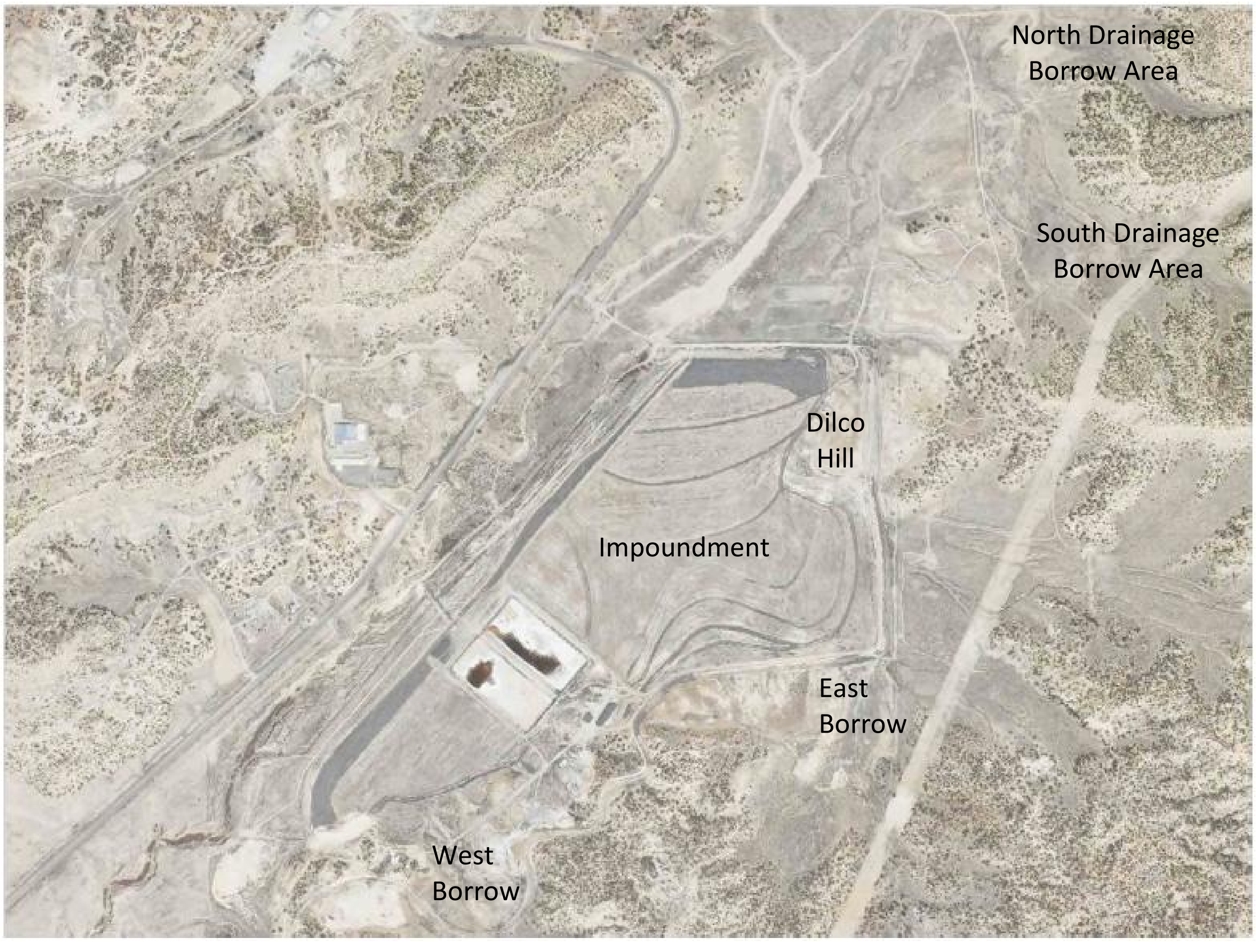


Figure 12. Cover Soil Borrow Areas

Soils were excavated from each borrow area and tested for geotechnical and hydraulic properties. The remolded laboratory measurements yielded soil results that would exist as the soil is installed; that is, the remolded samples represent the hydraulic status of the soils in the short- to intermediate-term.

Soil pedogenic processes can alter the soil hydraulic properties over a longer time period. Consequently, an analog study was performed whereby the cover soil borrow sources were measured in situ to measure the long-term hydraulic properties of potential soil borrow sources (Dwyer 2014). A tension infiltrometer was utilized to measure the moisture characteristic curve

and saturated hydraulic conductivity for the North Drainage Area, South Drainage area and East Borrow areas. The Dilco Hill area was not evaluated largely since it is not a likely borrow area and the East and West borrow areas have similar soil textures in a disturbed setting. Furthermore, the soil analog study was planned to coincide with the vegetation analog study performed at the site (Cedar Creek 2014).

6.3 MODEL GEOMETRY

The model geometry was based on the expected depth of the cover system. The nodal spacing was set at a range narrow enough to accurately represent the modeled cover profile. The erosion analysis and subsequent surface erosion protection layer was performed and optimized whereby there are three different cover profiles changing from the top of the slope toward the base of the slopes (refer to Section 4). In general, the top of the slope will have a top erosion protection layer composed of rock mixed with soil to a depth of 14 inches. The middle of the longer slope lengths will be composed of a top erosion protection layer composed of rock mixed with soil to a depth of 18 inches. While the base of the longer slopes will have a top surface layer composed of rock mixed with soil to a depth of 27 inches. The rock sizing varies from the top to bottom of the long 5 percent slope as follows: 1.5-inch diameter, 2-inch diameter, and 3-inches diameter, respectively. All admixture profiles contain 33 percent rock to 67 percent soil by volume. Cover profiles are 4-feet-thick. Cover soil beneath this erosion protection surface layer is from engineer-approved borrow sources. The mixed soil is from the same engineer-approved borrow sources. The rock is from engineer-approved on-site stockpiles or engineer-approved vendors meeting cover design durability requirements. Figure 13 shows a general summary of the profiles modeled.

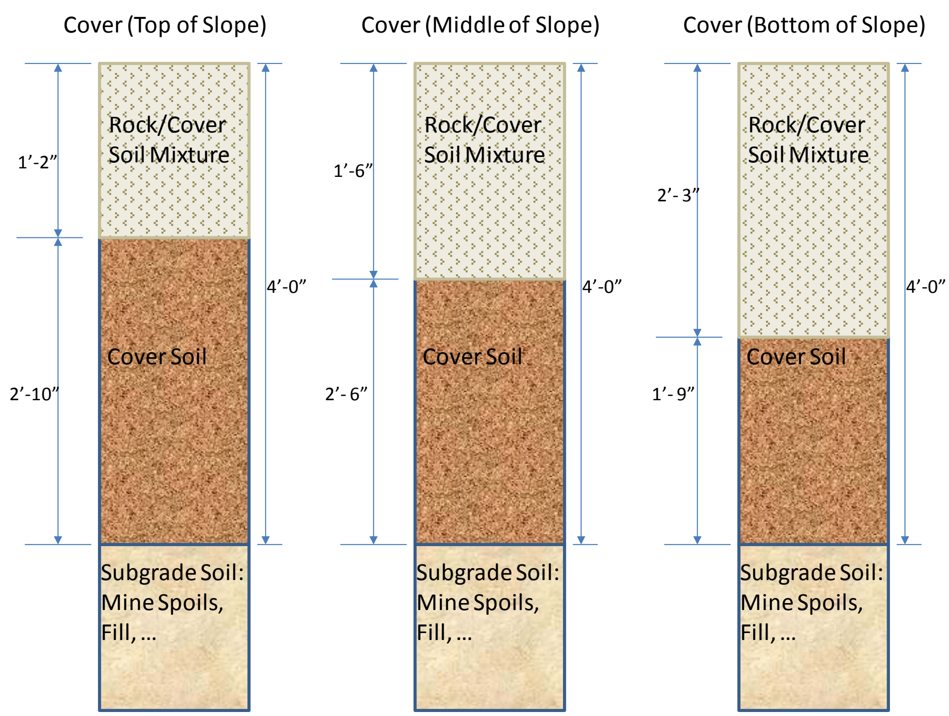


Figure 13. Cover Profiles

6.4 BOUNDARY CONDITIONS

Historical weather data for the Gallup, NM area and surrounding weather stations were evaluated from 1897 to 2016. Weather from Ft. Wingate, NM was utilized as the upper boundary condition due to its proximity and similar elevation to the Mill Site. Boundary conditions used to evaluate the modeled profiles included both typical climatic data and extreme conditions.

The average precipitation for the NECR area is about 11 inches per year (28 cm) (http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?nmgalf). Weather information from 1949 (Ft. Wingate, NM weather station) was utilized as the simulated "typical year" with an annual precipitation volume of 11.71-inches (29.74 cm). This typical climate year had just above the average annual precipitation volume (11.71-in compared to the average of 11-in/yr) and was distributed throughout the year as shown in Figure 14.

For every month of the year, the climate's demand for water (PET) far exceeds the actual supply of water (precipitation) (Figure 14). The climate's annual demand for water referred to as potential evapotranspiration (PET) is 83.4 inches (211.74 cm) or about 6.5 times more than the actual supply of water (precipitation). Consequently a "store and release" cover designed to take advantage of variances between the water demand and actual water supply (such as an ET cover) is well suited for the NECR site.

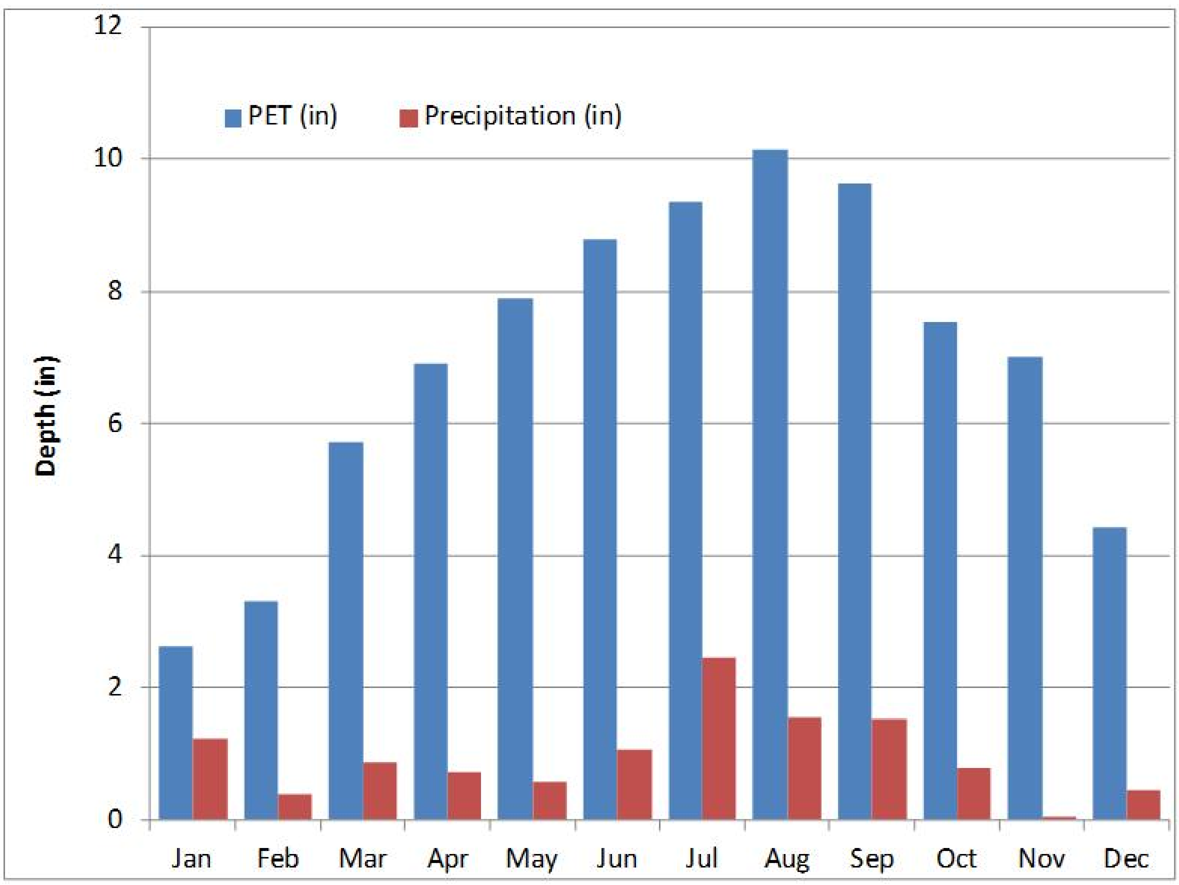


Figure 14. Typical Climate: Monthly Precip. Vs. Pet for Ft. Wingate, NM

Because the design requires long-term effectiveness, extreme climate conditions were also evaluated. The wettest year on record for the NECR area was 1906 (Ft. Wingate, NM weather station) and produced almost double the average annual precipitation volume (23.8 inches, or 60.5 cm). Furthermore, much of this moisture came as snow from January to April and October to December. This is a period in the modeling when PET is low and transpiration of moisture through vegetation is minimized or completely ceased. The monthly distribution of precipitation and PET are presented in Figure 15 for this wettest year on record. The wettest year was modeled two years in a row to add conservatism to the analyses. To add additional conservatism, the precipitation was applied at a rate slow enough to essentially force 100 percent infiltration (reduced runoff to zero or near zero), since much of the precipitation received at the NECR site runs off in high intensity storms. Erosion analysis (Section 4) utilized the PMP defined 1-hour event for calculation of surface runoff

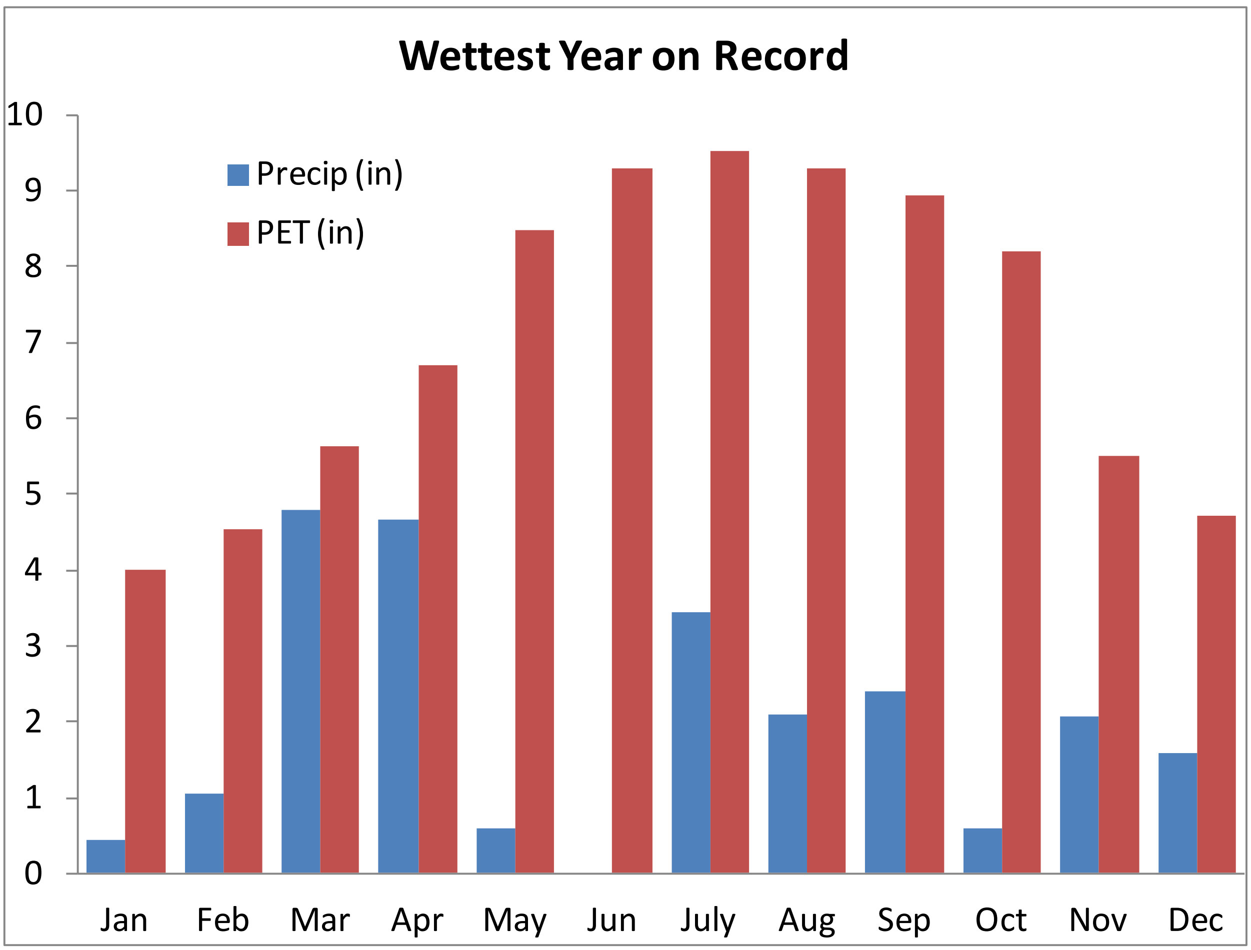


Figure 15. Wettest Year on Record Climate: Monthly Precip. Vs. Pet for Ft. Wingate, NM

Water flow across the surface and lower boundary of the cover profile of interest is determined by boundary condition specifications. For infiltration events, the upper boundary was conservatively set to a maximum hourly flux for these computer simulations of 0.4 inches (1 cm) per hour that

minimized runoff (zero in most cases) while maximizing infiltration. This is conservative because precipitation at the site generally comes from high-intensity storms where much of the precipitation will runoff without infiltrating into the cover profile.

The UNSAT-H program partitions PET into potential evaporation (E_p) and potential transpiration (T_p). Potential evaporation is estimated or derived from daily weather parameters (Fayer 2000). Potential transpiration is calculated using a function (Equation 11) based on the value of the assigned leaf area index (LAI) and an equation developed by Ritchie and Burnett (1971) as follows:

$$T_p = PET\ [a + b(LAI)^c] \quad \text{where } d \le LAI \le e \qquad \textbf{Equation 11}$$

where:

a,b,c,d, and e are fitting parameters

a = 0.0, b = 0.52, and c = 0.5, d = 0.1, and e = 2.7 (Fayer 2000)

The maximum and minimum daily temperatures, daily precipitation values and site latitude were input parameters used to calculate PET (Samani and Pessarkli, 1986). The Samani method used to calculate PET correlates well with the Penman method utilized within UNSAT-H (Samani and Pessarkli, 1986). The UNSAT-H program then partitioned the daily PET values into E_p and T_p. T_p was calculated using a function shown in Equation 11.

Two separate files were written for each year modeled: one file represented the daily PET values and the other file consisted of the daily precipitation values.

The lower boundary condition was a unit gradient. With the unit gradient, the calculated drainage flux depends on the hydraulic conductivity of the lower boundary node. The unit gradient corresponded to gravity-induced drainage and was most appropriate because drainage was not impeded. The base of the modeled profile was placed well below transient activity and in relative steady state conditions to ensure that the unit gradient bottom boundary condition used did not affect the output for the cover system.

6.5 VEGETATION DATA

Vegetation will generally increase ET from the cover because a plant's matric potential or suction can be orders of magnitude higher than that of the soil (Figure 16).

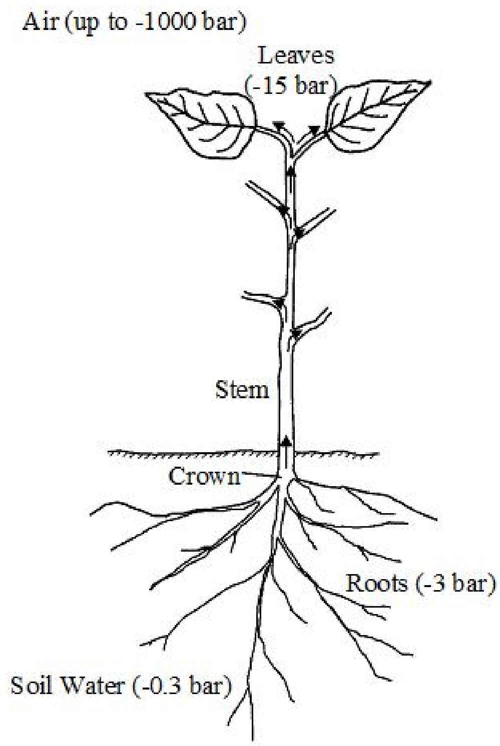


Figure 16. Typical Soil-Plant-Atmosphere Water Potential Variation (Hillel 1998)

The input parameters representing vegetation include the LAI, rooting depth and density, root growth rate, suction head values corresponding to the wilting point, head corresponding to the water content below which plant transpiration starts to decrease, and a head value corresponding to the water content above which plants do not transpire because of anaerobic conditions were defined. The onset and termination of the growing season for the site are defined in terms of Julian days. The maximum rooting depth is based on expected vegetation characteristics. The root length density (RLD) is assumed to follow an exponential function such as that defined in Equation 12:

$$RLD = a \exp(-bz) + c \qquad \textbf{Equation 12}$$

where:

a,b, and c are fitting parameters

z = depth below surface

The cover profiles (Figure 13) were modeled with vegetation on the surface. They were also modeled without any vegetation.

Cedar Creek performed an analog study of the native vegetation at the NECR site both in a disturbed setting and an undisturbed setting (Cedar Creek 2014). This study was utilized in the modeling to develop input parameters related to vegetation. The following rooting parameters (Table 9) were utilized when vegetation was included in the model (Cedar Creek 2014).

Table 9. Rooting Parameters (Cedar Creek 2014)

Parameter	Reclaimed Analog	Grass Analog	Shrub Analog
a	556.28	0.34	0.43
b	-0.0000054	-0.072	-0.034
c	-555.92	0.14	0.078

Other vegetation parameters including the LAI, percent bare area utilized, and maximum rooting depths for the respective vegetation used in a computer simulation are summarized in Table 10.

Table 10. Vegetation Parameters (Cedar Creek 2014)

Parameter	Reclaim Analog	Grass Analog	Shrub Analog
LAI	0.91	0.64	0.52
% Bare Area	52.3%	64.9%	75.2%
Root Length	147 cm	142 cm	155 cm

The vegetation analogs studied represent a natural succession at the site (Cedar Creek 2014). The reclaimed community of vegetation represents vegetation in a disturbed area and generally considered from seeding upon construction completion up to about 50 years. The grassland community represents undisturbed vegetation and is assumed to represent vegetation on the cover from about 25 to 100 years after construction. The shrubland community represents vegetation in an undisturbed setting and is assumed to represent vegetation on the cover from about 50 to 1,000 years.

In the modeling simulations that included vegetation, the onset and termination of the growing season for the site were Julian days 63 and 343, respectively. This is determined from the typical climate conditions for the NECR site and the respective growing degree days presented in Figure 17. The growing degree days were computed (Samani and Pessaraki 1986) for the typical year. The LAI was transitioned from 0 to the full LAI starting with Julian day 63 to 170. Day 171 through 266, the full LAI was utilized. The LAI was then transitioned down from the full LAI to 0 from Julian day 267 to 343. This was conservative since it is realistic that plants can transpire longer than indicated at this site.

The UNSAT-H model adjusts the full LAI based on the percent bare area of vegetation. For example, for a shrub vegetation with an LAI of 0.52 and a percent bare area of 75.2 percent, the LAI is reduced to 0.752 * 0.52 = 0.39.

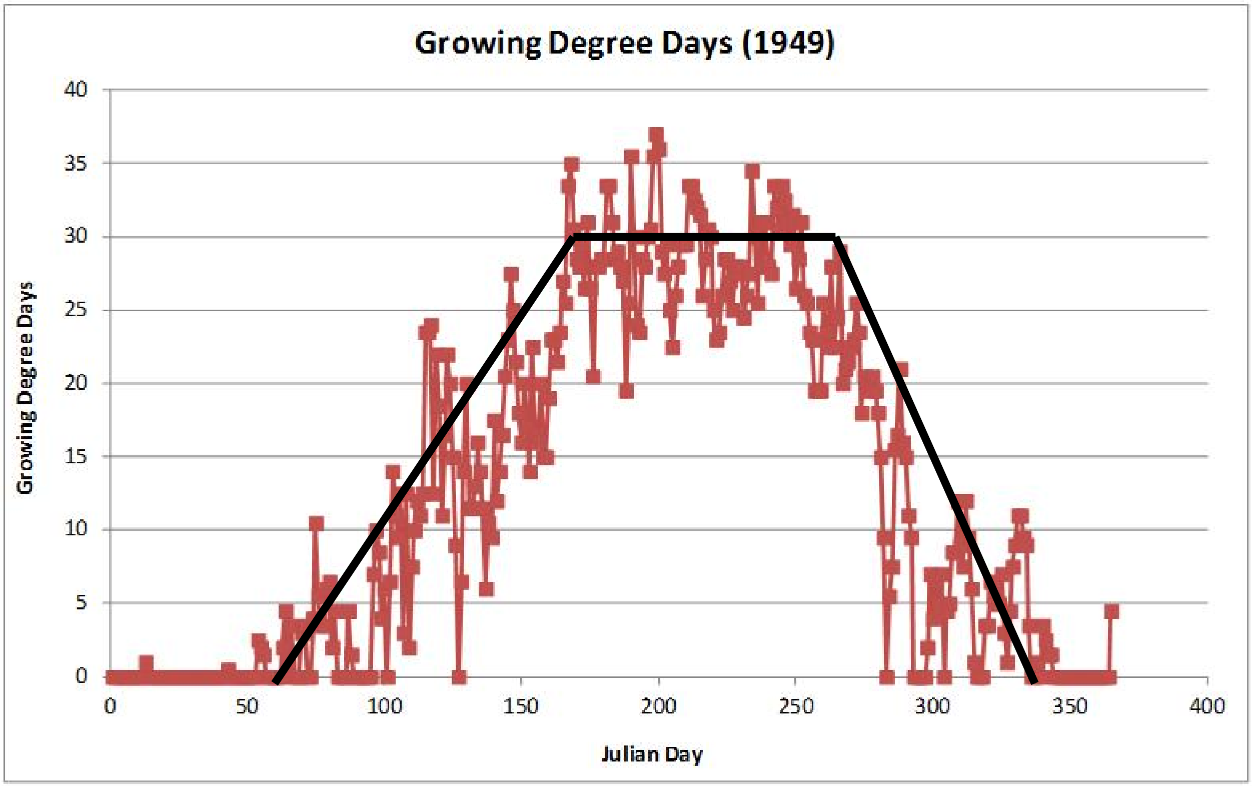


Figure 17. Leaf Area Index Transition during the Year

For computer simulations that do not include vegetation, the transpiration is set at zero. That is, all moisture removed from the profile upward is solely by evaporation.

6.6 SOIL PROPERTIES RELATED TO VEGETATION

Suction head values corresponding to the wilting point, head corresponding to the water content below which plant transpiration starts to decrease, and a head value corresponding to the water content above which plants do not transpire because of anaerobic conditions were defined. Matric potential or suction heads are generally written as positive numbers, but in reality are negative values. Consequently, the higher the value - the greater the soil suction.

Not all of the water stored in the soil can be removed via transpiration. Vegetation is generally assumed to reduce the soil moisture content to the permanent wilting point. The wilting point for these computer simulations was set at 40,000 cm for reclaimed vegetation and grassland and 70,000 for shrubland vegetation (Fayer and Walters 1995). This was conservatively used although some shrubs near the site could remove water from the soil to a suction of 100,000 cm (Hillel 1998). Evaporation from the soil surface can further reduce the soil moisture below the wilting point toward the residual saturation, which is the water content at an infinite matric potential. The head corresponding to the water content below which plant transpiration starts to decrease was defined as 32.2 feet (1000 cm) (Fayer and Walters 1995, Fayer 2000). The head value corresponding to the water content above which plants do not transpire because of anaerobic conditions was defined at 4 inches (30 cm) (Fayer and Walters 1995).

6.7 SOIL PROPERTIES

Soil mechanical and hydraulic properties were obtained from laboratory testing of multiple soil samples collected at various potential borrow sources (MWH 2014). There are multiple potential borrow sources for cover soil (Figure 12). Additionally, the top layer or rock/soil admixture of the cover profile has three different designs depending on where on the slope it is located. The upper admixture is composed of the mixture of rock and cover soil. In addition, the cover soil directly below the upper rock/soil admixture will be composed of soil from the same borrow source.

The hydraulic properties of the borrow soils modeled were obtained from laboratory testing of the various soil textures at a prescribed density of 90 percent of the maximum dry density (ASTM, 2012). This density approximately equates to the natural density of the borrow soils in their undisturbed setting. Because the density of the soil will migrate towards this natural density setting, it is warranted to install it as close to this density as possible. Therefore, the construction specifications for installation of the cover soil will require the installed density of the cover soil to be 90 percent of its maximum dry density (MDD) with a small tolerance allowance (+/- 5 pcf of MDD). The hydraulic properties of the remolded samples are assumed to represent the soil as it is installed in the field.

The top admixture layer have rock mixed into it at a volumetric ratio of 33 percent rock to 67 percent soil. The mixture of rock into the soil effectively alters its hydraulic properties. Consequently, the hydraulic properties were adjusted for the admixture layer (ASTM, 2007). Equation 13 was used to adjust the saturated hydraulic conductivity based on the addition of rock (Peck and Watson 1979).

$$K_b = [K_s * 2(1 - V_r)]/(2 + V_r) \qquad \textbf{Equation 13}$$

$$where: K_b = saturated\ hydraulic\ conductivty, bulk$$

$$K_s = saturated\ hydraulic\ conductivty, soil$$

$$V_r = volume\ of\ rock$$

For the computer simulations, the calculated bulk saturated hydraulic conductivity was then increased an order of magnitude in the top foot of the modeled cover system (14 inches for the admixture that is 14 inches deep) to account for dynamic processes such as freeze/thaw cycles, wet/dry cycles, and biointrusion. This added conservatism in the modeling results. This corresponds with findings from the soil analog studied at the site whereby soils in undisturbed settings have a saturated hydraulic conductivity of about one order of magnitude higher than the lower portions of the soil profile (Dwyer 2014).

The moisture retention data for the cover soil was also adjusted to reflect the addition of the rock in the surface admixture layer. The actual volumetric moisture content versus soil suction measurements made in the laboratory were utilized as the basis. Each respective measured volumetric moisture content was lowered per Equation 14 [ASTM 2007 and Bouwer & Rice 1984].

$$\theta_b = (1 - V_r)\theta_s \qquad \textbf{Equation 14}$$

$where{:}\ \theta_b = bulk\ volumetric\ moisture\ content$

$\theta_s = \text{saturated}\ volumetric\ moisture\ content$

$V_r = volume\ of\ rock$

The Mualem conductivity function was used to describe the unsaturated hydraulic conductivity of the soils (van Genuchten et al. 1991). The van Genuchten 'm' parameter for this function is assumed to be'1-1/n'; 'n' being one of the established van Genuchten parameters. The initial soil conditions were expressed in terms of suction head values that correspond to the average moisture content between each soil layer's field capacity and permanent wilting point determined from each respective soil layer's moisture characteristic curve.

A summary of the soil input parameters for the UNSAT-H simulations are summarized in Table 11. The respective borrow soil properties adjusted for the addition of 33 percent by volume rock for the top admixture layer is summarized in Table 12. The van Genuchten parameters were developed from the laboratory soil measurements (soil suction versus moisture content) using the RETC software (van Genuchten et al. 1991).

Table 11. Borrow Cover Soil Laboratory Measured Soil Properties

Borrow	Sample ID	Soil Type	Volume (cy)	K_s (cm/sec @ 90%)	Van Genuchten parameters			
					Θ_s (vol.)	Θ_r (vol.)	alpha	n
West Borrow	WB-B1-06	Sandy Loam	100000	2.10E-04	0.4951	0	0.0484	1.2943
East Borrow	EB-B6-03	Sandy Loam	50000	2.90E-05	0.5093	0	0.0140	1.2689
Dilco Hill	DH-B1-03	Sandy Loam	5000	2.50E-04	0.6281	0	0.0298	1.4159
South Drainage	SB-B4-01	Sandy Loam	170000	7.40E-05	0.5191	0	0.0373	1.2243
North Drainage	NB-B2-04	Sandy Loam	80000	7.50E-05	0.4563	0	0.0084	1.4721

Table 12. Adjusted Borrow Soil Laboratory Measured Soil Properties for 33% Rock by Volume

Borrow	K_s (cm/sec @ 90%)	Van Genuchten parameters			
		Θ_s (vol.)	Θ_r (vol.)	alpha	n
West Borrow	1.21E-04	0.3317	0	0.0484	1.2943
East Borrow	1.67E-05	0.3412	0	0.0140	1.2689
Dilco Hill	1.44E-04	0.4208	0	0.0298	1.4159
South Drainage	4.26E-05	0.3478	0	0.0373	1.2243
North Drainage	4.31E-05	0.3057	0	0.0084	1.4721

Soil hydraulic properties vary with time, as a result of soil pedogenic processes. As the ecological status of the cover matures and changes, so will performance factors such as water infiltration, water retention, ET, soil erosion, gas diffusion, and biointrusion (Dwyer 2003). Because changes in soil hydraulic properties are expected over time, and these changes will affect water movement within the cover, the cover profiles were also evaluated utilizing soil properties after dynamic ecosystem changes have altered the hydraulic properties of the soil profiles. Refer to the Natural Analog Study of cover soil borrow sources (Dwyer 2014).

A summary of the Natural Analog Study (Dwyer 2014) soil input parameters for the UNSAT-H simulation are summarized in Table 13. These soil properties are assumed to be the long-term values. The respective borrow soil properties adjusted for the addition of 33 percent by volume rock for the top admixture layer is summarized in Table 14.

Table 13. Soil Hydraulic Properties Measured In Situ with Tension Infiltrometer

Borrow	Depth	Van Genuchten parameters				Ks (cm/sec)
		Θ_s (vol.)	Θ_r (vol.)	α (1/cm)	n	
North Drainage Borrow	top foot	0.43057	0	0.00902	1.47081	3.70E-04
	rest	0.423809	0	0.008851	1.445759	6.96667E-05
South Drainage Borrow	top foot	0.458069	0	0.016946	1.30539	2.12E-04
	rest	0.478611	0	0.01685	1.316409	5.30E-05
East Borrow	top foot	0.48835	0	0.014612	1.256892	2.15E-04
	rest	0.492587	0	0.014538	1.289946	3.40E-05

Table 14. Tension Infiltrometer Measured Soil Hydraulic Properties Adjusted for Addition of 33% Gravel

Borrow	Depth	Van Genuchten parameters				K_s (cm/sec)
		Θ_s (vol.)	Θ_r (vol.)	α (1/cm)	n	
North Drainage Borrow	top foot	0.288482	0	0.00902	1.47081	2.13E-04
	rest	0.283952	0	0.008851	1.445759	4.01E-05
South Drainage Borrow	top foot	0.306906	0	0.016946	1.30539	1.22E-04
	rest	0.32067	0	0.01685	1.316409	3.05E-05
East Borrow	top foot	0.327195	0	0.014612	1.256892	1.24E-04
	rest	0.330033	0	0.014538	1.289946	1.96E-05

The subgrade soil used in the profile beneath the ET cover was that measured from the mine spoils using sample TT-205-GT1 remolded to 90 percent of the maximum dry density per ASTM (2012).

Table 15. Mine Spoils Measured Soil Hydraulic Properties

Sample	Depth	Van Genuchten parameters				K_s (cm/sec)
		Θ_s (vol.)	Θ_r (vol.)	α (1/cm)	n	
TT-205-GT1	all	0.3774	0	0.0525	1.2338	2.2E-04

7.0 UNSAT-H SENSITIVITY ANALYSES

Modeling was performed to evaluate ET cover profiles utilizing native soil and vegetation parameters described in Section 6 as well as variability in climate data for the site. The sensitivity analyses were performed to assess the range of potential input parameters and climatic scenarios expected over the long-term performance period of the final cover system and to demonstrate the cover system's ability to meet the performance objectives.

Soil hydraulic parameters were assessed for the potential borrow sources for cover soil (South Drainage Borrow Area, North Drainage Borrow Area, East Borrow, and West Borrow). The hydraulic soil parameters were evaluated based on the remolded values measured in the laboratory (MWH 2014) that are assumed to represent short-term conditions as well as the soil values measured in undisturbed area of the respective borrow sources in situ to assess the condition of the soils long-term (Dwyer 2014).

The various stages of vegetation were evaluated in the sensitivity analyses including no vegetation, reclaimed vegetation, grassland vegetation, and shrubland vegetation. These vegetation stages represent a natural succession at the site (Cedar Creek 2014) and are described in Section 6.5.

The cover profile variances were also evaluated based on the profiles depicted in Figure 13. The profiles include an admixture top surface consisting of 33 percent rock to 67 percent soil by volume with rock 1.5-inches in diameter mixed to a depth of 14 inches; with rock 2-inches in diameter mixed to a depth of 18 inches; and with rock 3-inches in diameter mixed to a depth of 27 inches. Directly underneath each admixture is the respective cover soil from the same borrow source without the mixture of rock.

Finally, sensitivity to climate variation was evaluated whereby both typical and extreme conditions were modeled. The typical climate year used to evaluate the cover performance was weather from 1949 with an annual precipitation volume of 11.71-inches (29.74 cm). The Ft. Wingate weather data set also had the most extreme weather with the wettest year on record in 1906 with an annual precipitation volume of 23.8-inches (60.5 cm). Much of that moisture came as snow from January to April and October to December. In this period of the modeling the PET is low and transpiration of moisture through vegetation is minimized or completely ceased (refer to Section 6.4).

Table 15 summarizes the simulations performed in the cover profile sensitivity analyses. Refer to Appendix A for details and specifics of the input and output for each simulation.

Table 16. Summary of Computer Simulations in the Cover Profile Sensitivity Analyses

Simulation Series	Cover Profile/Model Geometry	Input Parameters utilized in respective Sensitivity Analysis				
		Rock Size in Surface Admixture (D50)	Soil Borrow Source	Cover Soil Hydraulic Property Measurement	Vegetation Stage	Climate
Series A	14-in surface admixture over 34-in cover soil	1.5-inch	East Borrow	Remolded (EB-B6-03)	No vegetation	Typical & two consecutive years of wettest year on record

Simulation Series	Cover Profile/Model Geometry	Input Parameters utilized in respective Sensitivity Analysis				
		Rock Size in Surface Admixture (D50)	Soil Borrow Source	Cover Soil Hydraulic Property Measurement	Vegetation Stage	Climate
	14-in surface admixture over 34-in cover soil	1.5-inch	North Drainage Borrow	Remolded (NB-B2-04)	No vegetation	Typical & two consecutive years of wettest year on record
	14-in surface admixture over 34-in cover soil	1.5-inch	South Drainage Borrow	Remolded (SB-B4-01)	No vegetation	Typical & two consecutive years of wettest year on record
	14-in surface admixture over 34-in cover soil	1.5-inch	West Borrow	Remolded (WB-B1-06)	No vegetation	Typical & two consecutive years of wettest year on record
Series B	18-in surface admixture over 34-in cover soil	2-inch	East Borrow	Remolded (EB-B6-03)	No vegetation	Typical & two consecutive years of wettest year on record
	18-in surface admixture over 34-in cover soil	2-inch	North Drainage Borrow	Remolded (NB-B2-04)	No vegetation	Typical & two consecutive years of wettest year on record
	18-in surface admixture over 34-in cover soil	2-inch	South Drainage Borrow	Remolded (SB-B4-01)	No vegetation	Typical & two consecutive years of wettest year on record
	18-in surface admixture over 34-in cover soil	2-inch	West Borrow	Remolded (WB-B1-06)	No vegetation	Typical & two consecutive years of wettest year on record
Series C	27-in surface admixture over 34-in cover soil	3-inch	East Borrow	Remolded (EB-B6-03)	No vegetation	Typical & two consecutive years of wettest year on record
	27-in surface admixture over 34-in cover soil	3-inch	North Drainage Borrow	Remolded (NB-B2-04)	No vegetation	Typical & two consecutive years of wettest year on record
	27-in surface admixture over 34-in cover soil	3-inch	South Drainage Borrow	Remolded (SB-B4-01)	No vegetation	Typical & two consecutive years of wettest year on record
	27-in surface admixture over 34-in cover soil	3-inch	West Borrow	Remolded (WB-B1-06)	No vegetation	Typical & two consecutive years of wettest year on record

Simulation Series	Cover Profile/Model Geometry	Input Parameters utilized in respective Sensitivity Analysis				
		Rock Size in Surface Admixture (D50)	Soil Borrow Source	Cover Soil Hydraulic Property Measurement	Vegetation Stage	Climate
Series D	14-in surface admixture over 34-in cover soil	1.5-inch	East Borrow	Remolded (EB-B6-03)	Reclaimed Vegetation	Typical & two consecutive years of wettest year on record
	14-in surface admixture over 34-in cover soil	1.5-inch	North Drainage Borrow	Remolded (NB-B2-04)	Reclaimed Vegetation	Typical & two consecutive years of wettest year on record
	14-in surface admixture over 34-in cover soil	1.5-inch	South Drainage Borrow	Remolded (SB-B4-01)	Reclaimed Vegetation	Typical & two consecutive years of wettest year on record
	14-in surface admixture over 34-in cover soil	1.5-inch	West Borrow	Remolded (WB-B1-06)	Reclaimed Vegetation	Typical & two consecutive years of wettest year on record
Series E	18-in surface admixture over 34-in cover soil	2-inch	East Borrow	Remolded (EB-B6-03)	Reclaimed Vegetation	Typical & two consecutive years of wettest year on record
	18-in surface admixture over 34-in cover soil	2-inch	North Drainage Borrow	Remolded (NB-B2-04)	Reclaimed Vegetation	Typical & two consecutive years of wettest year on record
	18-in surface admixture over 34-in cover soil	2-inch	South Drainage Borrow	Remolded (SB-B4-01)	Reclaimed Vegetation	Typical & two consecutive years of wettest year on record
	18-in surface admixture over 34-in cover soil	2-inch	West Borrow	Remolded (WB-B1-06)	Reclaimed Vegetation	Typical & two consecutive years of wettest year on record
Series F	27-in surface admixture over 34-in cover soil	3-inch	East Borrow	Remolded (EB-B6-03)	Reclaimed Vegetation	Typical & two consecutive years of wettest year on record
	27-in surface admixture over 34-in cover soil	3-inch	North Drainage Borrow	Remolded (NB-B2-04)	Reclaimed Vegetation	Typical & two consecutive years of wettest year on record
	27-in surface admixture over 34-in cover soil	3-inch	South Drainage Borrow	Remolded (SB-B4-01)	Reclaimed Vegetation	Typical & two consecutive years of wettest year on record

Simulation Series	Cover Profile/Model Geometry	Input Parameters utilized in respective Sensitivity Analysis				
		Rock Size in Surface Admixture (D50)	Soil Borrow Source	Cover Soil Hydraulic Property Measurement	Vegetation Stage	Climate
	27-in surface admixture over 34-in cover soil	3-inch	West Borrow	Remolded (WB-B1-06)	Reclaimed Vegetation	Typical & two consecutive years of wettest year on record
Series G	14-in surface admixture over 34-in cover soil	1.5-inch	East Borrow	Remolded (EB-B6-03)	Grassland Vegetation	Typical & two consecutive years of wettest year on record
	14-in surface admixture over 34-in cover soil	1.5-inch	North Drainage Borrow	Remolded (NB-B2-04)	Grassland Vegetation	Typical & two consecutive years of wettest year on record
	14-in surface admixture over 34-in cover soil	1.5-inch	South Drainage Borrow	Remolded (SB-B4-01)	Grassland Vegetation	Typical & two consecutive years of wettest year on record
	14-in surface admixture over 34-in cover soil	1.5-inch	West Borrow	Remolded (WB-B1-06)	Grassland Vegetation	Typical & two consecutive years of wettest year on record
Series H	18-in surface admixture over 34-in cover soil	2-inch	East Borrow	Remolded (EB-B6-03)	Grassland Vegetation	Typical & two consecutive years of wettest year on record
	18-in surface admixture over 34-in cover soil	2-inch	North Drainage Borrow	Remolded (NB-B2-04)	Grassland Vegetation	Typical & two consecutive years of wettest year on record
	18-in surface admixture over 34-in cover soil	2-inch	South Drainage Borrow	Remolded (SB-B4-01)	Grassland Vegetation	Typical & two consecutive years of wettest year on record
	18-in surface admixture over 34-in cover soil	2-inch	West Borrow	Remolded (WB-B1-06)	Grassland Vegetation	Typical & two consecutive years of wettest year on record
Series I	27-in surface admixture over 34-in cover soil	3-inch	East Borrow	Remolded (EB-B6-03)	Grassland Vegetation	Typical & two consecutive years of wettest year on record
	27-in surface admixture over 34-in cover soil	3-inch	North Drainage Borrow	Remolded (NB-B2-04)	Grassland Vegetation	Typical & two consecutive years of wettest year on record

Simulation Series	Cover Profile/Model Geometry	Input Parameters utilized in respective Sensitivity Analysis				
		Rock Size in Surface Admixture (D50)	Soil Borrow Source	Cover Soil Hydraulic Property Measurement	Vegetation Stage	Climate
	27-in surface admixture over 34-in cover soil	3-inch	South Drainage Borrow	Remolded (SB-B4-01)	Grassland Vegetation	Typical & two consecutive years of wettest year on record
	27-in surface admixture over 34-in cover soil	3-inch	West Borrow	Remolded (WB-B1-06)	Reclaimed Vegetation	Typical & two consecutive years of wettest year on record
Series J	14-in surface admixture over 34-in cover soil	1.5-inch	East Borrow	Remolded (EB-B6-03)	Shrubland Vegetation	Typical & two consecutive years of wettest year on record
	14-in surface admixture over 34-in cover soil	1.5-inch	North Drainage Borrow	Remolded (NB-B2-04)	Shrubland Vegetation	Typical & two consecutive years of wettest year on record
	14-in surface admixture over 34-in cover soil	1.5-inch	South Drainage Borrow	Remolded (SB-B4-01)	Shrubland Vegetation	Typical & two consecutive years of wettest year on record
	14-in surface admixture over 34-in cover soil	1.5-inch	West Borrow	Remolded (WB-B1-06)	Shrubland Vegetation	Typical & two consecutive years of wettest year on record
Series K	18-in surface admixture over 34-in cover soil	2-inch	East Borrow	Remolded (EB-B6-03)	Shrubland Vegetation	Typical & two consecutive years of wettest year on record
	18-in surface admixture over 34-in cover soil	2-inch	North Drainage Borrow	Remolded (NB-B2-04)	Shrubland Vegetation	Typical & two consecutive years of wettest year on record
	18-in surface admixture over 34-in cover soil	2-inch	South Drainage Borrow	Remolded (SB-B4-01)	Shrubland Vegetation	Typical & two consecutive years of wettest year on record
	18-in surface admixture over 34-in cover soil	2-inch	West Borrow	Remolded (WB-B1-06)	Shrubland Vegetation	Typical & two consecutive years of wettest year on record
Series L	27-in surface admixture over 34-in cover soil	3-inch	East Borrow	Remolded (EB-B6-03)	Shrubland Vegetation	Typical & two consecutive years of wettest year on record

Simulation Series	Cover Profile/Model Geometry	Input Parameters utilized in respective Sensitivity Analysis				
		Rock Size in Surface Admixture (D50)	Soil Borrow Source	Cover Soil Hydraulic Property Measurement	Vegetation Stage	Climate
	27-in surface admixture over 34-in cover soil	3-inch	North Drainage Borrow	Remolded (NB-B2-04)	Shrubland Vegetation	Typical & two consecutive years of wettest year on record
	27-in surface admixture over 34-in cover soil	3-inch	South Drainage Borrow	Remolded (SB-B4-01)	Shrubland Vegetation	Typical & two consecutive years of wettest year on record
	27-in surface admixture over 34-in cover soil	3-inch	West Borrow	Remolded (WB-B1-06)	Shrubland Vegetation	Typical & two consecutive years of wettest year on record
Series M	14-in surface admixture over 34-in cover soil	1.5-inch	East Borrow	In Situ (Dwyer 2014)	No Vegetation	Typical & two consecutive years of wettest year on record
	14-in surface admixture over 34-in cover soil	1.5-inch	North Drainage Borrow	In Situ (Dwyer 2014)	No Vegetation	Typical & two consecutive years of wettest year on record
	14-in surface admixture over 34-in cover soil	1.5-inch	South Drainage Borrow	In Situ (Dwyer 2014)	No Vegetation	Typical & two consecutive years of wettest year on record
Series N	18-in surface admixture over 34-in cover soil	2-inch	East Borrow	In Situ (Dwyer 2014)	No Vegetation	Typical & two consecutive years of wettest year on record
	18-in surface admixture over 34-in cover soil	2-inch	North Drainage Borrow	In Situ (Dwyer 2014)	No Vegetation	Typical & two consecutive years of wettest year on record
	18-in surface admixture over 34-in cover soil	2-inch	South Drainage Borrow	In Situ (Dwyer 2014)	No Vegetation	Typical & two consecutive years of wettest year on record
Series O	27-in surface admixture over 34-in cover soil	3-inch	East Borrow	In Situ (Dwyer 2014)	No Vegetation	Typical & two consecutive years of wettest year on record
	27-in surface admixture over 34-in cover soil	3-inch	North Drainage Borrow	In Situ (Dwyer 2014)	No Vegetation	Typical & two consecutive years of wettest year on record

Simulation Series	Cover Profile/Model Geometry	Input Parameters utilized in respective Sensitivity Analysis				
		Rock Size in Surface Admixture (D50)	Soil Borrow Source	Cover Soil Hydraulic Property Measurement	Vegetation Stage	Climate
	27-in surface admixture over 34-in cover soil	3-inch	South Drainage Borrow	In Situ (Dwyer 2014)	No Vegetation	Typical & two consecutive years of wettest year on record
Series P	14-in surface admixture over 34-in cover soil	1.5-inch	East Borrow	In Situ (Dwyer 2014)	Reclaimed Vegetation	Typical & two consecutive years of wettest year on record
	14-in surface admixture over 34-in cover soil	1.5-inch	North Drainage Borrow	In Situ (Dwyer 2014)	Reclaimed Vegetation	Typical & two consecutive years of wettest year on record
	14-in surface admixture over 34-in cover soil	1.5-inch	South Drainage Borrow	In Situ (Dwyer 2014)	Reclaimed Vegetation	Typical & two consecutive years of wettest year on record
Series Q	18-in surface admixture over 34-in cover soil	2-inch	East Borrow	In Situ (Dwyer 2014)	Reclaimed Vegetation	Typical & two consecutive years of wettest year on record
	18-in surface admixture over 34-in cover soil	2-inch	North Drainage Borrow	In Situ (Dwyer 2014)	Reclaimed Vegetation	Typical & two consecutive years of wettest year on record
	18-in surface admixture over 34-in cover soil	2-inch	South Drainage Borrow	In Situ (Dwyer 2014)	Reclaimed Vegetation	Typical & two consecutive years of wettest year on record
Series R	27-in surface admixture over 34-in cover soil	3-inch	East Borrow	In Situ (Dwyer 2014)	Reclaimed Vegetation	Typical & two consecutive years of wettest year on record
	27-in surface admixture over 34-in cover soil	3-inch	North Drainage Borrow	In Situ (Dwyer 2014)	Reclaimed Vegetation	Typical & two consecutive years of wettest year on record
	27-in surface admixture over 34-in cover soil	3-inch	South Drainage Borrow	In Situ (Dwyer 2014)	Reclaimed Vegetation	Typical & two consecutive years of wettest year on record
Series S	14-in surface admixture over 34-in cover soil	1.5-inch	East Borrow	In Situ (Dwyer 2014)	Grassland Vegetation	Typical & two consecutive years of wettest year on record

Simulation Series	Cover Profile/Model Geometry	Input Parameters utilized in respective Sensitivity Analysis				
		Rock Size in Surface Admixture (D50)	Soil Borrow Source	Cover Soil Hydraulic Property Measurement	Vegetation Stage	Climate
	14-in surface admixture over 34-in cover soil	1.5-inch	North Drainage Borrow	In Situ (Dwyer 2014)	Grassland Vegetation	Typical & two consecutive years of wettest year on record
	14-in surface admixture over 34-in cover soil	1.5-inch	South Drainage Borrow	In Situ (Dwyer 2014)	Grassland Vegetation	Typical & two consecutive years of wettest year on record
Series T	18-in surface admixture over 34-in cover soil	2-inch	East Borrow	In Situ (Dwyer 2014)	Grassland Vegetation	Typical & two consecutive years of wettest year on record
	18-in surface admixture over 34-in cover soil	2-inch	North Drainage Borrow	In Situ (Dwyer 2014)	Grassland Vegetation	Typical & two consecutive years of wettest year on record
	18-in surface admixture over 34-in cover soil	2-inch	South Drainage Borrow	In Situ (Dwyer 2014)	Grassland Vegetation	Typical & two consecutive years of wettest year on record
Series U	27-in surface admixture over 34-in cover soil	3-inch	East Borrow	In Situ (Dwyer 2014)	Grassland Vegetation	Typical & two consecutive years of wettest year on record
	27-in surface admixture over 34-in cover soil	3-inch	North Drainage Borrow	In Situ (Dwyer 2014)	Grassland Vegetation	Typical & two consecutive years of wettest year on record
	27-in surface admixture over 34-in cover soil	3-inch	South Drainage Borrow	In Situ (Dwyer 2014)	Grassland Vegetation	Typical & two consecutive years of wettest year on record
Series V	14-in surface admixture over 34-in cover soil	1.5-inch	East Borrow	In Situ (Dwyer 2014)	Shrubland Vegetation	Typical & two consecutive years of wettest year on record
	14-in surface admixture over 34-in cover soil	1.5-inch	North Drainage Borrow	In Situ (Dwyer 2014)	Shrubland Vegetation	Typical & two consecutive years of wettest year on record
	14-in surface admixture over 34-in cover soil	1.5-inch	South Drainage Borrow	In Situ (Dwyer 2014)	Shrubland Vegetation	Typical & two consecutive years of wettest year on record

Simulation Series	Cover Profile/Model Geometry	Input Parameters utilized in respective Sensitivity Analysis				
		Rock Size in Surface Admixture (D50)	Soil Borrow Source	Cover Soil Hydraulic Property Measurement	Vegetation Stage	Climate
Series W	18-in surface admixture over 34-in cover soil	2-inch	East Borrow	In Situ (Dwyer 2014)	Shrubland Vegetation	Typical & two consecutive years of wettest year on record
	18-in surface admixture over 34-in cover soil	2-inch	North Drainage Borrow	In Situ (Dwyer 2014)	Shrubland Vegetation	Typical & two consecutive years of wettest year on record
	18-in surface admixture over 34-in cover soil	2-inch	South Drainage Borrow	In Situ (Dwyer 2014)	Shrubland Vegetation	Typical & two consecutive years of wettest year on record
Series X	27-in surface admixture over 34-in cover soil	3-inch	East Borrow	In Situ (Dwyer 2014)	Shrubland Vegetation	Typical & two consecutive years of wettest year on record
	27-in surface admixture over 34-in cover soil	3-inch	North Drainage Borrow	In Situ (Dwyer 2014)	Shrubland Vegetation	Typical & two consecutive years of wettest year on record
	27-in surface admixture over 34-in cover soil	3-inch	South Drainage Borrow	In Situ (Dwyer 2014)	Shrubland Vegetation	Typical & two consecutive years of wettest year on record

Although the varied input parameters such as soil, vegetation and cover profile geometry showed some sensitivity, the most sensitive item was the climatic variation. The Point of Diminishing Returns (PODR) method (Dwyer et al. 2007, USEPA 2011) utilizes modeling to calculate the cover thickness required to effectively minimize flux through the cover. That is, at the PODR, an additional inch of soil will no longer enhance the cover's performance. Based on the PODR method (Dwyer et al. 2007, EPA 2011), the outcome predicted a cover thickness of less than 2 feet for typical weather conditions for all soil, vegetation input parameters and cover profiles. For the wettest year on record, the PODR was produced at a depth of about 3 feet for all soil, vegetation input parameters and cover profiles. The PODR was less than 4 feet for a climate scenario that is beyond anything experienced in recorded history with the wettest year on record (much of the moisture is received in the winter months where PET is at its lowest) occurs in consecutive years. Refer to Figure 18 for the worst case graphic of the sensitivity analyses performed.

The input parameters were varied one at a time to evaluate their respective change on the calculated output. The recommended cover thickness is 4 feet based on analyses that demonstrated the cover has adequate storage capacity to withstand the worst-case scenarios expected over the 1,000-year performance period combined with some expected soil loss due to erosion (limited due to rock/soil

admixture). That is, no annual net percolation will pass through the vegetated cover system even in the worst case scenario.

The worst case graphic results from the series of simulations from the sensitivity analyses is shown in Figure 18. The PODR is achieved within the proposed cover profile. The results of simulations, including output graphics, are included in Appendix A.

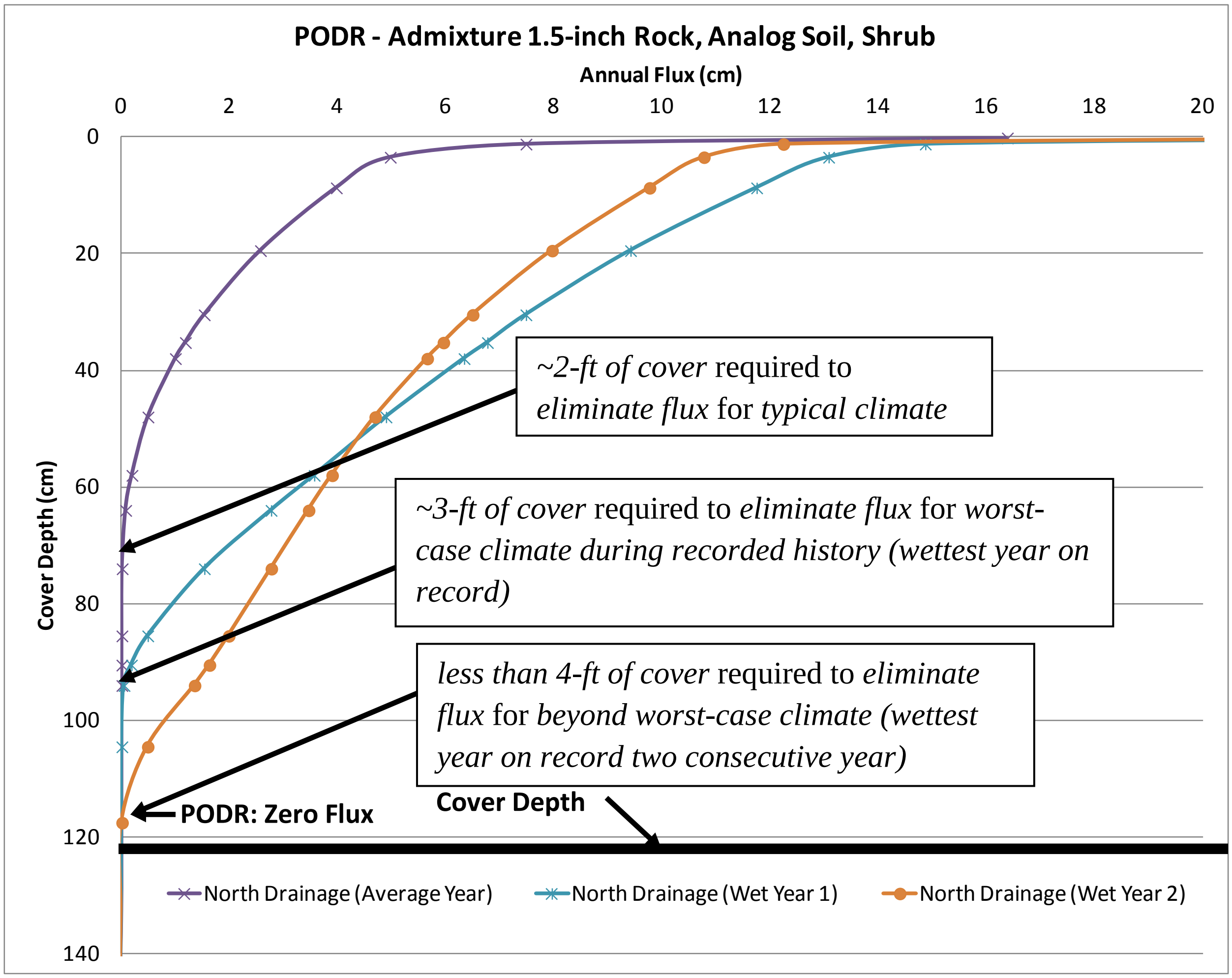


Figure 18. Worst Case Infiltration for Vegetated Cover System from Sensitivity Analyses

8.0 LONG-TERM SIMULATIONS

8.1 Long-Term Simulations Input Data

After the sensitivity analyses were performed as described in Section 7, the resulting cover profiles (Figure 13) were modeled to represent the long-term performance of the given profiles.

The long-term evaluation of the 4 foot cover profiles (Figure 13) overlying the mine spoils simulated the potential changes through the 1,000-year performance period, varying the vegetation and soil hydraulic properties as they evolve. Typical and extreme climate conditions are included. Each admixture (1.5-in diameter rock mixed with soil to 14-inch depth, 2-inch rock mixed with soil to 18-inch depth, and 3-inch diameter rock mixed with soil to a 27-inch depth - the remaining cover is soil from same borrow source) was separately evaluated (Figure 13), thus there were three sets of long-term simulations completed each in four stages.

The UNSAT-H software cannot alter input parameters after initiation of a given simulation. Consequently, the long-term evaluations were calculated in multiple stages, where the output from earlier time steps were used as input for subsequent time steps. That is, for each long-term evaluation, the initial simulation with an initial set of input parameters was performed for a specified period of time and set of climatic conditions. The last day of the last year of that initial simulation output, specifically the matric potential values for each node from the previous simulation, was then used as the initial soil conditions for the subsequent simulation with the altered input parameters (Figure 19). For example, the *final* soil suction values for each node in the model geometry for the 'initial' stage was used as the starting conditions for the next 'short-term' stage.

There was no vegetation included in the 'initial' stage, but vegetation was included in subsequent stages (Cedar Creek 2014). The long-term simulations were performed in four stages: the 'initial' stage, followed by the 'short-term' stage, followed by the 'intermediate' stage, and finally the 'long-term' stage (Figure 19). The initial stage consisted of 3 years of typical or average climate with no vegetation. The short-term stage, intermediate stage, and long-term stage all consisted of 20 years of average to extreme climatic data. Thus the whole long-term simulation is 63 years. The extreme climate data was the wettest year on record run consecutively sandwiched by typical climatic data. There were no dry climatic years included in any of the simulations. All precipitation in the weather files was conservatively set to allow for 100 percent or close to 100 percent infiltration, thus minimizing runoff.

Time	Initial	Short-Term	Intermediate	Long-Term
Vegetation	None	Disturbed (Reclaimed)	Grassland	Shrubland
Soil	Remolded (Lab Measured)	Remolded (Lab Measured)	Remolded (Lab Measured)	Undisturbed (In Situ Measured)
Climate	Typical	Typical and Extreme	Typical and Extreme	Typical and Extreme
No. of Years Modeled	3	20	20	20

Figure 19. Input based on Design Life for Computer Simulations

The first stage (initial time) of the long-term simulations, in the respective series for each admixture design assumed from the time of construction completion out three years with no vegetation. The soil from the south drainage borrow area was used since it is the largest borrow source. The soil hydraulic input parameters from different borrow sources showed minimal variation in the predicted PODR for the cover profiles from the sensitivity analyses described in Section 7. The remolded values for the soil hydraulic properties based on laboratory measurements (refer to Section 6) were used in the 'initial' stage. These soil properties were also the soil input parameters for the short- to intermediate- time periods. No vegetation is assumed for the 'initial' stage for a period of 3 years with average weather conditions. It is highly likely that vegetation will begin to emerge the first year and continue to expand into the second and third years, but to be conservative; absolutely no vegetation (and thus no transpiration) is included during the 'initial' model stage. Average weather conditions were assumed because dry conditions would obviously yield no flux and wet conditions would yield vegetation. The moisture condition (matric potential for each node in the model geometry) at the end of the third year, was used as the initial moisture conditions (matric potential for each node in the new model geometry) for the next 'short-term' stage.

The second stage (short-term time) of the long-term simulations in the respective series for each admixture included vegetation from the reclaimed vegetation analog (Cedar Creek 2014). The reclaimed community of vegetation represents vegetation in a disturbed area and generally considered from shortly after seeding upon construction completion up to about 50 years (Cedar Creek 2014). The soil input parameters and geometries from the first stage of simulations was consistent with this stage of simulations. Typical climate conditions were used for ten consecutive years followed by the wettest year on record two years in a row, followed by eight more years of typical climate conditions. This is conservative given the fact that the wettest year on record appears in two consecutive years every twenty years and that there are no dry years included in the analysis. The wettest years run consecutively is assumed to be the worst case infiltration event the site is likely to see. The moisture condition (matric potential for each node in the model geometry) at the end of the last year of the respective 'short-term' stage for each admixture design, was used as the initial moisture conditions (matric potential for each node in the new model geometry) for the next 'intermediate' stage.

The third stage of the long-term simulations (intermediate time) in the respective series for each admixture included vegetation from the grassland vegetation analog (Cedar Creek 2014). The grassland community represents undisturbed vegetation and is assumed to represents the vegetation on the cover from about 25 to 100 years after construction (Cedar Creek 2014). The soil input parameters and geometries from the 'short-term' stage was consistent with this 'intermediate' stage. Typical climate conditions were used for ten consecutive years followed by the wettest year on record two years in a row, followed by eight more years of typical climate conditions. The wettest years run consecutively is assumed to be the worst case infiltration events the site is likely to see. The moisture condition (matric potential for each node in the model geometry) at the end of the last year of each respective 'intermediate' stage for each admixture design, was used as the initial moisture conditions (matric potential for each node in the new model geometry) for the next 'long-term' stage.

The fourth stage of the long-term simulations (long-term time) in the respective series for each admixture included vegetation from the shrubland vegetation analog (Cedar Creek 2014). The shrubland community represents undisturbed vegetation and is assumed to represent vegetation on the cover from about 50 to 1,000 years (Cedar Creek 2014). The geometries from the 'intermediate' stage was consistent with this 'long-term' stage. The soil input parameters were changed to that from the soil analog data obtained from the South Drainage Borrow Area that represent an undisturbed soil structure or the long-term status of the soil (Dwyer 2014). Typical climate conditions were used for ten consecutive years followed by the wettest year on record two years in a row, followed by eight more years of typical climate conditions. The wettest years run consecutively is assumed to be the worst case infiltration events the site is likely to see.

8.2 Long-Term Simulations Results

A detailed description of each computer simulation performed with input parameters and respective output including graphics is included in Appendix B. The long-term simulations performed were for the cover profile with the 14-inch-deep surface admixture layer (Figure 13). This profile was used because it was the worst case profile requiring the deepest PODR to minimize flux compared to the other admixture depths. The PODR or depth where flux is minimized at just over 2-ft is easily achieved within the recommended cover profile depth. This despite the climate utilized in the long-term simulation included the wettest year on record in consecutive years run every twenty years. That is, during this 63 year simulation, the wettest year on record occurred six times. Figure 21 shows that a drying trend is established and will continue until relative steady state is achieved (Dwyer 2017). Consequently, modeling the profile for any longer would not produce additional useful data.

For years 1, 2, and 3 (no vegetation), there was a de minims amount of flux estimated but the PODR was reached at a shallow depth (Figure 20). All flux values through the vegetated cover for all subsequent years was zero.

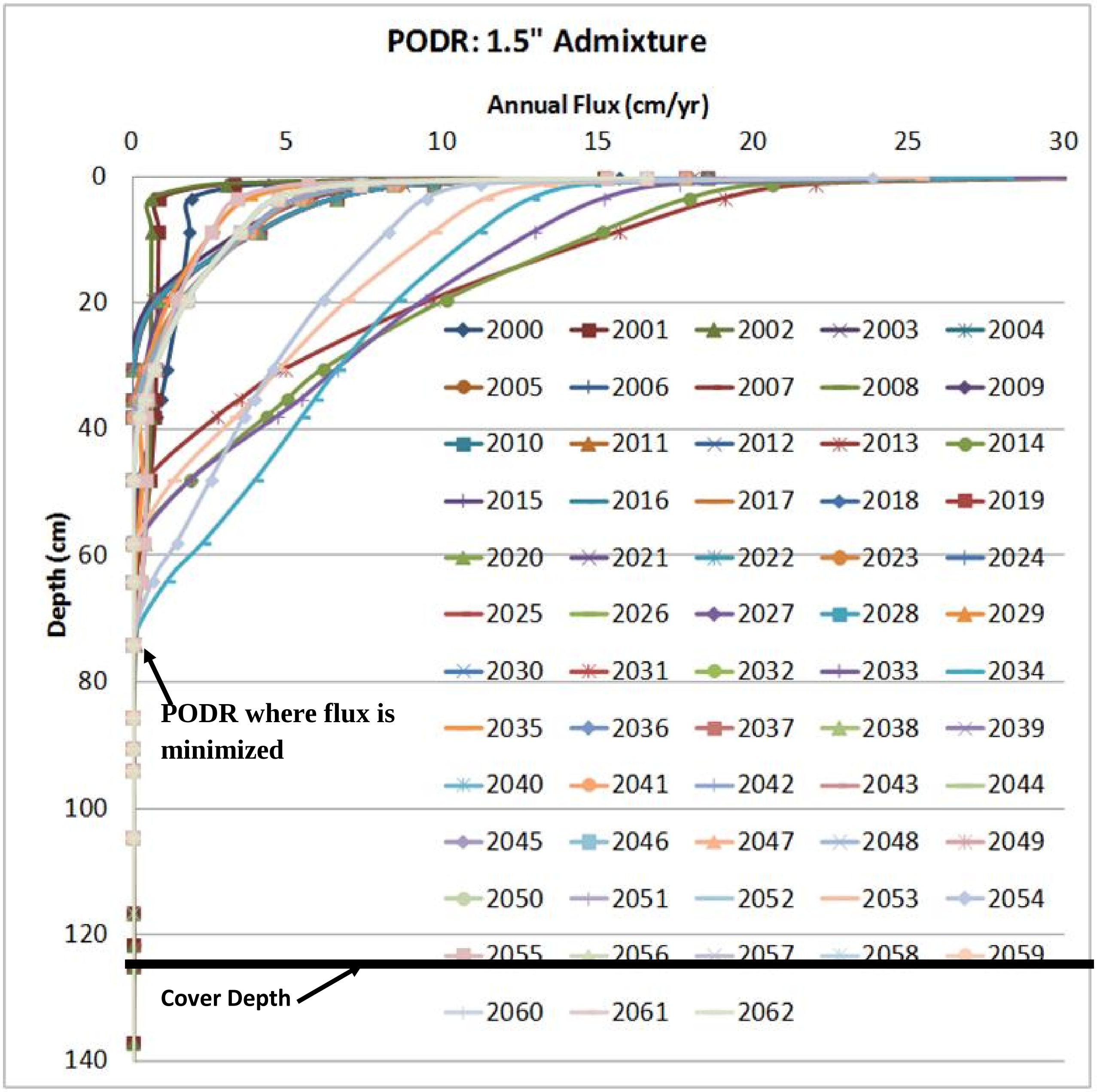


Figure 20. PODR for Long-Term Simulation, 14-inch deep Surface Layer

8.3 Long-Term Simulations Results for Profile B8

Another set of long-term simulations was performed of Profile B8 corresponding to the consolidation and unsaturated flow analysis described in Dwyer (2017). Profile B8 was modeled because it is the only cross section that included fully saturated tailings due to consolidation resulting from placement of the mine spoils and ET cover on the impoundment (Dwyer 2017). This set of simulations included placement of the ET cover over the placed mine spoils over the existing profile including the consolidated tailings. This analysis is to demonstrate that under the most conservative conditions, the cover and underlying mine spoils will not cause moisture build-

up on the underlying radon barrier/liner …. Details of this analyses are included in *Tailings Consolidation and Groundwater Evaluation - 95% Design (*Dwyer 2017).

Suction values within the profile modeled that included the installed moisture condition of all of the mine spoils and ET cover at the suction value corresponding to the respective optimum moisture content (ASTM. 2012) are shown in Figure 21. The optimum moisture content is the wettest condition that the materials will be placed. Per the design specifications, any wetter condition will require removal of the material and drying it or reworking the soil to dry it in place. No material will be placed on top of a wet layer of soil until that underlying soil lift meets the specified conditions. Mine spoils are placed directly on the existing cover/radon barrier less the removal of the existing surface riprap that will be utilized elsewhere in the project.

At the request of the regulatory agencies, another sensitivity analysis was performed similar to that described above; however, the mine spoils and ET cover were all installed 3 percent wet of the optimum moisture content per ASTM D698 (ASTM, 2012). This moisture is beyond that allowed in the design specifications but was included to evaluate the sensitive nature of moisture included in the mine spoils and ET cover during placement. The results are similar to those shown in Figure 21. That is, the moisture content of the installed mine spoils and ET cover will not cause moisture build-up on the underlying radon barrier/liner while the radon barrier/liner continues to dry similarly to that shown in Figure 21.

Figure 21 shows that even though the mine spoils initial suction value is very wet, it quickly dries and continues to dry during the full simulation (middle of mine spoils). The base of the mine spoils and adjacent radon barrier suction values move toward a steady state condition (equal suction values) and then eventually all layers show a drying trend for the duration of the long-term simulation. This drying trend will continue until a steady state condition is reached at a greater suction value than the end of this simulation. This is because no net flux will pass through the vegetated cover system; the initial conditions are the wettest conditions and the profile will only dry as time passes.

Figure 21 illustrates that there is no moisture buildup on the existing radon/barrier and thus no potential for future seepage through the barrier. Dwyer (2017) describes this analysis and results. Dwyer (2017) further illustrates that the wettest condition of the profile modeled is the initial condition and that the profile continues to dry while approaching steady state conditions.

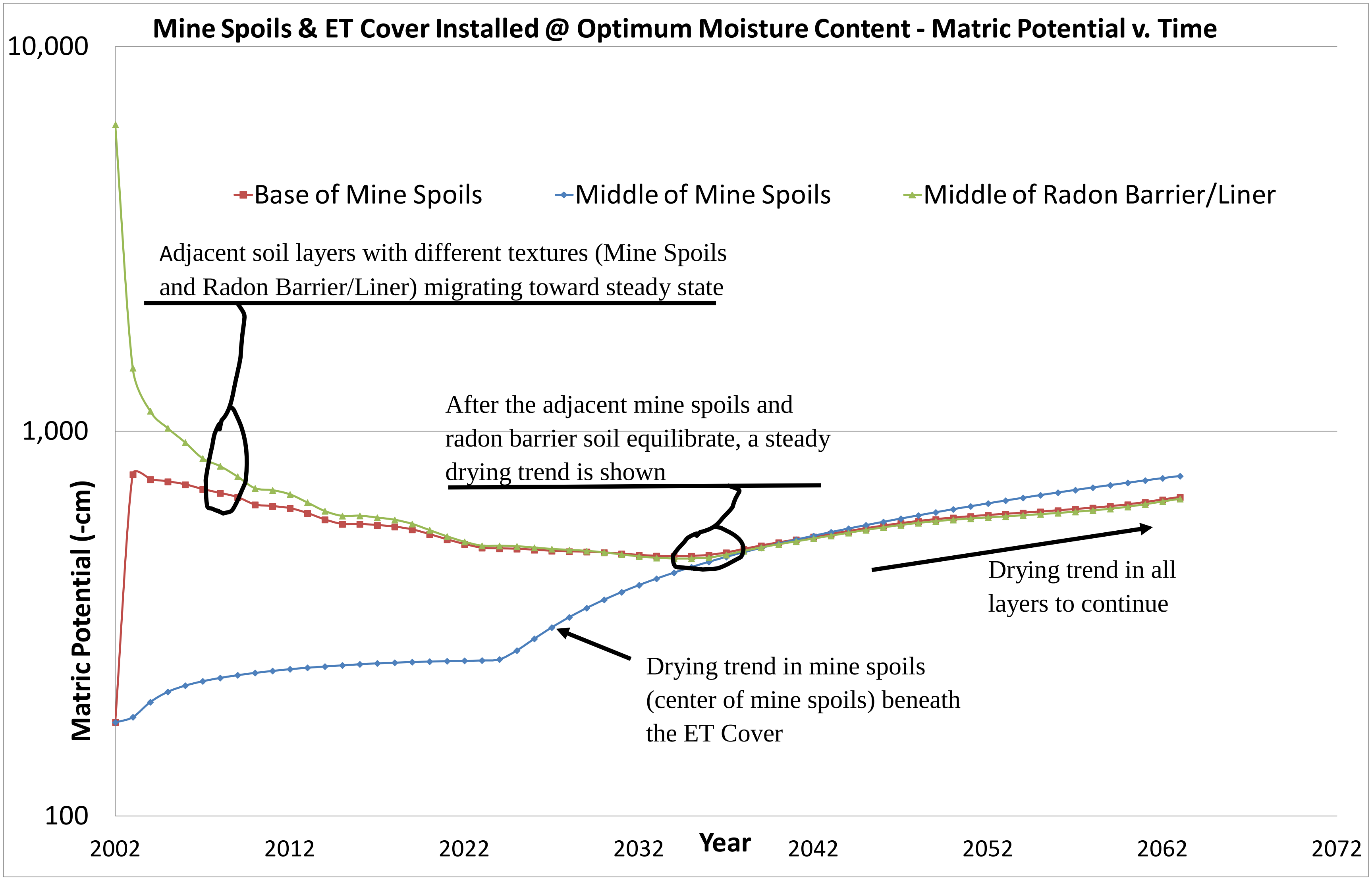


Figure 21. Suction Values for Specified Profile Depth vs. Time

9.0 RADON ATTENUATION

Federal regulations limiting radon releases to the atmosphere are contained in 40 CFR §192.02. The regulations are also typically applied as an ARAR to DOE sites undergoing remediation. These regulations require that release of 222Rn to the atmosphere not exceed: (i) an average release rate of 20 pCi/m^{2}s; ***or*** (ii) increase the annual average concentration of 222Rn in the air at or above any location outside of the disposal site by more than one-half picocurie per liter.

The ET cover soil functions as an effective barrier to gas diffusion, air-filled voids in the soil have to be discontinuous. Gas diffuses slowly through wet soils that contain only occasional, unconnected air bubbles. The ET cover system was evaluated for its ability to limit radon flux (NRC 1989, NRC 2003). The radon flux through the ET cover soil was calculated using the Uranium Mill Tailings Cover Calculator (http://www.wise-uranium.org/ctc.html) that is a clone of the RAECOM code, as described in (Rogers 1984a, 1984b). It performs one-dimensional, steady-state radon diffusion calculations for a multi-layer system.

9.1 Input Data for Radon Flux Modeling

- Layer Data: The profile was modeled with a bottom layer of mine spoils capped with a two layered ET Cover system. The ET Cover profile is 4 feet (1.22 m) thick. The top layer is a 27-inch (69 cm) layer of rock and soil mixed at a ratio of 33 percent rock to 67 percent soil by volume. Of the three admixture designs, this is the most conservative given it has the thickest admixture region that has a reduced porosity and fines content. The bottom layer of the cover is all soil 21-inches thick (53 cm). The mine spoils was assumed to be 5 m thick (NRC, 1989, Section C 1.1.1).

  NUREG Guide 3.64: 'Section C 1.1.1 Layer Thicknesses'

  > *The thickness of the tailings source, xt, will be determined from the applicant's estimates of total tailings production and areal extent of the pile. Because a tailings thickness greater than about 100-200 cm is effectively equivalent to an infinitely thick radon source, a value of xt = 500 cm represents an equivalent infinitely thick tailings source of radon that may be used in the absence of more specific smaller values.*

  Thus, 500 cm is the maximum thickness to be used for tailings in the RADON model. Refer to Table 18 for a layer by layer description of parameters.

- Ra-226 Activity Concentration [pCi/g]: Activity concentration of Radium-226 in each respective layer. The Ra-226 activity concentration for the mine waste rock was a weighted average of that measured in the field. The RA-226 concentration used for the entire 5 m depth of waste rock was 29.7 pCi/g (Table 17). A value of zero was assumed for the cover material since it is constructed of clean cover soil for an engineer approved borrow source (NRC, 1989, Section C 1.1.4).

Table 17. Radium-226 Concentrations in Mine Spoils (provided by Stantec)

	Average Values (pCi/g)	Average of 75th Percentile Values (pCi/g)	Average of 90th Percentile Values (pCi/g)	Total Volumes (CY)
Area 1 - Vent Holes 3 and 8	7.6	2.4	3.5	14,764
Area 2 - Boneyard and NEMSA	21.0	26.7	28.5	50,535
Area 3 - Road, Sandfill 2, Sandfill 3, NECR-2	10.1	11.4	12.2	223,080
Area 4 - North of Pond 3	5.8	5.2	10.0	18,148
Area 5 - TPH Stockpile	9.5	9.6	23.4	30,000
Area 7 - Sandfill 1	35.5	50.5	59.5	35,506
Area 6 - Sediment Pad	74.9	86.3	91.1	56,646
Area 8 - NECR-1	21.8	24.2	28.7	361,382
Area 8 - NECR-1 Step out Material	9.5	9.6	23.4	130,000
Area 11 - TPH Stockpile Area	7.5	9.8	11.5	16,290
Area 9 - Pond 1	60.8	85.2	94.9	44,634
Area 10 - Pond 2	8.0	10.2	11.5	18,948
Area 12 - Pond 3	6.7	7.1	7.3	22,375
Area 13 - Drainage near Highway	7.5	6.5	24.9	41,937
Weighted Average by Volume	**20.5**	**24.0**	**29.7**	

Table 18. Radon Flux Input Parameters

Layer No.	Thickness [m]	Ra-226 Activity Conc. [pCi/g]	Ra-226 Emanat	Porosity	Moisture [dry wt_%]	Rn-222 Diff. Coeff - - *calculated* [m2/s]
Mine Spoils	5	29.7	0.35	0.3774	6	2.253E-06
Bottom Layer of Cover	0.53	0	0.35	0.5216	5.87	3.604E-06
Top Layer (Admixture) of Cover	0.69	0	0.35	0.34945	3.93	2.535E-06

- **Rn-222 Emanation Fraction** is a fraction of the total amount of radon-222 produced by radium decay that escapes from the soil particles and gets into the pores of the soil. It depends on the soil material and the moisture content. It varies over a range of 0.1 - 0.4 or more; typical values are in the range of 0.2 - 0.3. A value of 0.35 was used [NRC 1989, NRC, 2003]

- **Porosity** is the ratio of the pore volume (air- and water-filled) to the total volume of the soil. Refer to Table 18 for the porosity values for each layer. The numerical average value of porosities for the borrow soils listed in Table 11 was used for layer 2. The average value of porosities for the admixture for borrow sources listed in Table 12 was used. The porosity for Sample TT-205-GT1 considered to be typical for the mine spoils was used.
- **Moisture Contents [dry wt_%]** is the percentage of water weight to dry soil weight. The average in situ moisture content for the mine spoils was 8 percent. The average optimum moisture content for the mine spoils is about 12 percent. An initial and long-term moisture content of 6 percent was used for the mine spoils (NRC 1989). NRC (1989) notes that 6 percent represents the lower bound for moisture in western soils and is typically used as a default value for the long term water content of tailings. The average measured gravimetric moisture content for the cover soil borrow sources evaluated was 6.3 percent. However, following guidance in NRC (1989) the average volumetric moisture content associated with the soil samples summarized in Table 11 based on their respective wilting point (soil suction value of 15 bars or 15,000 cm) is 8.41 percent. This converts to a gravimetric moisture content of 5.87 percent utilizing the average dry bulk density of 89.5 pounds per cubic foot for these soil samples. Utilizing the moisture retention data summarized in Table 12, this gravimetric moisture content is reduced to 3.93 percent for the surface admixture layer based on the addition of 33 percent rock. Thus the most conservative values were used: moisture contents of 6 percent was utilized for the mine spoils, 5.87 percent for the bottom cover soil layer, and 3.93 percent for the surface cover admixture layer.
- **Rn-222 Effective Diffusion Coefficient [m^2/s]** defined from Fick's equation as the ratio of the diffusive flux density of radon activity across the pore area to the gradient of the radon activity concentration in the pore or interstitial space. This value was calculated in the model based on the assigned input parameters identified above.

9.2 Output for Radon Flux Modeling

The computed radon flux was **13.73 pCi/m^2s** (Table 19). This value is less than the maximum allowable of 20 pCi/m^2s per 40 CFR 192.02.

Table 19. Radon Flux Calculation Output

Layer No.	Thickness [m]	Exit Flux [pCi/m2s]	Exit Conc. [pCi/L]	MIC
Mine Spoils	5	24.99	15.85E+03	0.802
Bottom of Cover	0.53	16.52	11.92E+03	0.892
Top Admixture Layer of Cover	0.69	13.73	0	0.854

10.0 SUMMARY OF RESULTS

The design methods and calculations demonstrate that the recommended cover design (Figure 13) will meet the objectives of performance for 1,000-years to include limiting meteoric flux into the underlying mine waste, minimize erosion, provide a rooting medium for native vegetation, and attenuate emanation of radon-222 from the mine waste. This conclusion is based on erosion computations, moisture flux modeling, and radon emanation calculations, and which are summarized in the following subsections.

10.1 Erosion Protection

The cover is composed of two layers. The top layer is a rock/soil admixture referred to as a 'desert pavement'. This layer is designed to mitigate erosion by adding rock to the engineer-approved cover soil. This surface layer satisfies NUREG 1623 (NRC, 2002) for the long-term stability of a rocky soil cover. The overall cover thickness including both layers will be a consistent 4 feet (122 m) while the thickness surface admixture (refer to Figure 13) depends on the location and respective slope length. The bottom layer is composed of cover soil only.

The surface desert pavement is a mixture of 33 percent rock to 67 percent soil by volume. For a slope of 5 percent, the admixture top layer contains D_{50} rock of 1.5 inches mixed with soil to a depth of 14 inches for the upper 300 feet of the slope length. From a slope length of 300 to 600 feet, the rock size was increased to 2 inches while the depth of the admixture was increased to 18 inches. Finally, for slope lengths longer than 600 feet with a 5 percent slope, the rock size was increased to 3 inches while the admixture depth was increased to 27 inches.

For slopes of 2 percent, the 1.5-inch rock admixture at a depth of 14 inches was adequate for the full 1,000 ft slope length. The resulting surface slopes meet requirements set forth in Dwyer et al. (1997) and NRC (2002).

The resulting surface was then analyzed utilizing the RUSLE (USDA 1997) for surface water runoff induced soil loss and the WEPS (USDA 2010) for wind induced soil loss. The combined resulting estimated soil loss is significantly less than the USEPA (1991) recommended 2 tons/year/acre.

10.2 Modeling of Cover System

Section 7 summarized the sensitivity analyses evaluating myriad input parameters demonstrating the 4-ft-thick cover system's effectiveness for the 1,000-year performance period. The modeling output provided in Appendix A and B revealed that for typical climatic conditions, a 2-ft cover thickness minimized flux due to precipitation. A cover thickness less than 4 feet effectively minimized flux even while applying the wettest year on record in two consecutive years. This scenario includes the wettest year where much of this precipitation occurred in the winter and early spring and late fall where PET is low and then doubled it by running the year back-to-back to provide conservatism in the design and analysis. The analyses revealed that the 4-ft vegetated ET cover will produce no flux no matter the combination of input parameters possible for the 1,000-year performance period. There was minimal difference in prediction of the PODR for the cover profile from the myriad input parameters modeled including cover soil and vegetation. The most sensitive item was the climate comparing typical to the extreme wet conditions (two consecutive wettest years on record). The 4-ft cover depth is the thickness of soil with the required storage

capacity needed to minimize flux based on the application of the wettest year on record with close to 100 percent infiltration two years in a row. This climatic scenario is beyond anything seen at the site in recorded history and beyond anything likely to occur at the site. The combination of this climatic data and slow application rate to force nearly 100 percent infiltration while minimizing runoff created the worst case infiltration design scenario.

The regulatory agencies requested an additional set of sensitivity analyses be performed of the cover profiles without any vegetation for an extended period of time. The results of this analyses are contained in Appendix C. The results show that a de minims amount of flux is produced but the PODR and thus performance objective to minimize flux is satisfied well within the 4-ft profile. It should be noted that this de minims flux is many orders of magnitude less than the flux through the existing cover on the impoundment (Dwyer 2017).

10.3 Radon Flux

Section 9 provided an overview of the estimated radon release rate through the cover profile. The radon flux through the cover soil was calculated using the RAECOM code, as described in (Rogers 1984a, 1984b). It performs one-dimensional, steady-state radon diffusion calculations for a multi-layer system. The top layer is a 27-inch-thick (69 cm) layer of rock and soil mixed at a ratio of 1 rock to 2 soil by volume. Of the three admixture designs, this is the most conservative given it has the thickest admixture region that has a reduced porosity and fines content. The bottom layer of the cover is a 21-inch-thick (53 cm) soil layer. The mine spoils were assumed to be 5 meters thick (NRC, 1989, Section 1.1.1). The computed radon flux was 13.73 pCi/m^{2}s (Table 19). This value is less than the maximum allowable of 20 pCi/m^{2}s per 40 CFR 192.02.

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ATTACHMENT G.8

Repository Rock Cover Design

Client:	*GE/UNC*	**Sheet:** *1* **of** *4*	
Project:	*Northeast Church Rock Mine Site Removal Action*		
Description:	*Repository Rock Cover Design for the Mill Site Repository*	**Job No:**	*10508639*

ATTACHMENT G.8: REPOSITORY ROCK COVER DESIGN

Revisioning

Rev.	Date	Description	By	Checked	Date
0	*10/05/2017*	*95% Design*	*J. Erickson/ S. Murphy*	*N. Haws*	*10/14/2017*

Location and Format

Electronic copies of these calculations are located on the Stantec internal project team site.

Calculations were generated using the following software:

- Microsoft Excel 2015

Table of Contents

Objective

The objective of this brief is to outline the design of a protective rock cover for the section of the Repository cover with a 20 percent slope.

Background

The Church Rock Mill Site (Mill Site) Repository, which is to be built over the existing Tailings Disposal Area (TDA), will be designed to contain waste from the Northeast Church Rock Mine Site (Mine Site). Dwyer Engineering, LLC

designed a vegetated rock mulch erosion protection for the cover and the perimeter fill material (transition areas) located on the west and southwest sides of the Repository. Stantec designed erosion protection for the 20 percent slope located on the east side of the Repository where, due to the steepness, a rock cover is required for erosion protection rather than a vegetated rock mulch.

Applicable Codes and Standards

The calculation methods used in this analysis are consistent with the following guidance documents:

- NUREG/CR-4620, Methodologies for Evaluation of Long-term Stabilization Designs of Uranium Mill Tailings Impoundments (Nelson et al., 1986)
- Technical Approach Document, Revision II (DOE, 1989)
- Final Staff Technical Position, Design of Erosion Protective Covers for Stabilization of Uranium Mill Tailings Sites (NRC, 1990)
- NUREG-1623, Design of Erosion Protection for Long-Term Stabilization (Johnson, 2002)

Methods

Flow Characterization

In accordance with DOE (1989), NRC (1990) and Johnson (2002), the design event for evaluation of long-term erosional stability for the rock cover is the probable maximum precipitation (PMP) event. A detailed description of the local PMP event is provided in Appendix I.1.

The rational method, as described in Johnson (2002) and Nelson et al. (1986), was used to determine the unit flow rate across the Repository riprap during the PMP (**Equation 1**). A flow concentration factor (k) of 3 was assumed for this design to account for the fact that flow may not run completely parallel down the slope.

$$q = k * C_1 iA \qquad \text{Equation 1}$$

Where:

q = sheet flow unit flow rate (cubic feet per second per foot [cfs/ft])
C_1 = runoff coefficient = 1.0 (Assumed to represent PMP conditions; DOE, 1989)
i = rainfall intensity (in/hr)
A = unit surface area contributing to runoff (acre/ft)

$$A = L * k/43560$$

L = maximum rock cover slope length (185 feet)
K = flow concentration factor (3, upper bound value listed in Abt and Johnson, 1991)

The rainfall intensity (i) is iteratively determined to be equal to the peak intensity that would occur over the duration of time it takes for flow accumulated at the top of the slope to travel to the bottom, or the time of concentration (T_c). The time of concentration was calculated using **Equation 2**, developed by Brant and Oberman (1975) and presented in DOE (1989).

$$T_c = C_2 \left(\frac{L}{S * i^2}\right)^{1/3} \qquad \text{Equation 2}$$

Where:

C_2 = Coefficient = 1.0 (for bare earth)
L = Distance of overland flow (185 feet)
S = Slope of Land (0.2 ft/ft)
i = Rainfall Intensity (inches per hour)

The PMP rainfall distribution presented in Figure 7 of Attachment I.1 provides 10-minute incremental rainfall depths for the 1-hr PMP event and is sufficient to determine the rainfall intensities corresponding to rainfall duration as low as 10-minutes. The incremental rainfall duration percentage relationships presented in DOE (1989) were used to scale the rainfall intensities corresponding to rainfall durations less than 10 minutes to as low as 2.5 minutes. Per DOE (1989) the minimum time of concentration for use in design is 2.5 minutes.

Rock Cover Stone Sizing

Stantec used **Equation 3** to determine the minimum required median stone diameter (D_{50}) for the rock slope. The equation comes from work by Abt and Johnson (1991).

$$D_{50} = 5.23 * S^{0.43} * q_d^{0.56} \qquad \text{Equation 3}$$

Where:

D_{50} = Median rock size (feet)
q_d = design unit flow rate (cfs/ft) ($q_d = 1.35 * q$)
S = slope angle (feet per feet)

Filter Requirements

The interstitial velocity through the voids of the rock cover was analyzed to evaluate the need for a filter layer between the rock cover and underlying soil cover material. The intestinal velocity was estimated using Equation 4 from Abt and et al. (1991).

$$V_i = 0.23(g \times D_{10} \times S)^{0.5} \qquad \text{Equation 4}$$

Where:

V_i = interstitial velocity in the rock voids (feet per second)
g = gravitational acceleration constant (32.2 feet per second)
D_{10} = diameter which is greater than 10% of the stones in gradation (assuming coefficient of uniformity of 6 and a gradation band width of 5)
S = rock cover slope (feet per feet)

Johnson (2002) states that if the interstitial flow velocity is less than 0.5 feet per second then no filter layer is required.

Assumptions

- Assumes no infiltration of flow during the PMP (C_1 = 1)
- Assumes the rock cover gradation will have a coefficient of uniformity equal to 6 and material band width equal to 5.

Client: *GE/UNC* **Sheet:** *4* **of** *4*
Project: *Northeast Church Rock Mine Site Removal Action*
Description: *Repository Rock Cover Design for the Mill Site Repository* **Job No:** *10508639*

Results

Stantec estimated the design unit flow rate on the rock cover slopes to be 0.2 cfs/ft. The time of concentration is 2.5 minutes and the design rainfall intensity is 16.0 inches per hour.

Stantec computed a minimum required median stone diameter of 1.27 inches using Equation 3. No filter will be necessary under the rock cover material as the estimated interstitial flow velocity is 0.4 feet per second.

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Calculation Worksheet

Rock Cover Design Calculation Sheet

Design Input Data		-
Riprap Porosity, p :	0.33	Assumed
Rock Angle of Repose, Φ (Deg)	42	Assumed
Rock Specific Gravity, SG :	2.6	Assumed
Cover Slope, S (ft/ft) :	0.2	Design
Cover Slope, S° (deg) :	11.3	Design
Maximum Cover Slope Length, L (ft) :	185	Design
Flow Characterization : Rational Method		-
Rational Runoff Coefficient, C1 :	1	C = 1 (DOE, 1989) (p. 66)
Tc Coefficient, C2 :	1	Bare Area (DOE, 1989)
1-Hr PMP Rainfall Depth, RD (in/hr) :	6.18	See Appendix I-1
Estimated Storm Duration, D (min) :	2.5	<--- Iterate until D = Tc
ADWR PMP 10-minute Rainfall Depth, RD10 (in) :	1.54	From Figure 7 in Attachment I.1 (ADWR 1-Hr PMP)
ADWR PMP 10-minute Rainfall Intensity, i10 (in/hr) :	9.24	
Scale Factor from 10-min to D :	1.73	
Estimated Rainfall Intensity, i (in/hr) :	16.0	
Time of Concentration, Tc (min) :	2.5	Equation 2 (DOE, 1989)
Flow Concentration Factor, k :	3	Upper bound value from Abt and Johnson (1991)
Surface Area that Contributes to Runoff, A (ac) :	0.0042	A = L*k
Hill Slope Unit Discharge, q (cfs/ft) :	0.20	Equation 1
Hill Slope Design Unit Discharge, qd (cfs/ft) :	0.28	qd = 1.35*qf - Abt and Johnson (1991)
Rock Cover Stone Sizing		-
Mean Rock Size, D50 (in) :	1.27	Equation 3 - Abt and Johnson (1991)
Design Minimum Stone Diameter, D50d (in) :	1.50	
Filter Requirement Check		
If the interstitial flow velocity in the rock voids (Vv) is less than 0.5 fps then no filter is required (NUREG-1623)		
Diameter greater than 10% Rock Cover Materials, D10 (in) :	0.47	Assuming a Gradation Cu = 6 and a Bandwidth = 5
Velocity in the Riprap Voids, Vv (ft/sec) :	0.40	Equation 4 - Abt et al. (1991)
Is a filter layer required? --->	NO	NUREG-1623

Northeast Church Rock
95% Design Report

Appendix H:
Borrow Areas

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LIST OF ACRONYMS / ABBREVIATIONS

AOC	Administrative Settlement Agreement and Order on Consent for Design and Cost Recovery
ARAR	Applicable or Relevant and Appropriate Requirement
ASTM	American Society for Testing and Materials
BMP	best management practice
CC	Construction Contractor
CY	cubic yard(s)
GE/UNC	General Electric/United Nuclear Corporation
GSR	Green and Sustainable Remediation
Mill Site	Church Rock Mill Site
Mine Site	Northeast Church Rock Mine Site
NECR	Northeast Church Rock
NRC	US Nuclear Regulatory Commission
PDS	Pre-Design studies
PTW	principal threat waste
RA	Removal Action
RAL	removal action limit
RAO	Remedial Action Objective or Removal Action Objective
ROD	Record of Decision
SOW	Statement of Work
TDA	Tailings Disposal Area
USEPA	US Environmental Protection Agency

H.1 INTRODUCTION

H.1.1 Project Background

The Northeast Church Rock (NECR) Mine Site (Mine Site) Removal Action (RA) consists of excavation and removal of mine waste consisting of soil, rock and debris. This material will be placed within a repository near the former Church Rock Mill Site (Mill Site). Dwyer Engineering, LLC is designing an evapotranspirative soil and rock cover for the repository (see Appendix G). Clean soil and rock fill will be required for final grading and contouring as well as for erosion protection for the soil cover system and associated site reclamation. This appendix discusses sources for clean soil and rock fill materials required for the project. The Northeast Church Rock Mine Site Removal Action Pre-Design Studies (PDS) Report for the Church Rock Mill Site (MWH, 2014) provide geotechnical characterization of the proposed borrow areas. Specifically, this appendix provides the following information:

- Demonstration that the borrow areas providing cover material for the NECR repository meet requirements of the Performance Standards identified in the 2011 Action Memo (USEPA, 2011), Record of Decision (ROD; USEPA, 2013), and the Administrative Settlement Agreement and Order on Consent for Design and Cost Recovery Statement of Work (AOC SOW; USEPA, 2015). US Nuclear Regulatory Commission (NRC) requirements for soil and rock are included in documents listed above.
- Locations and assumptions for estimates of available borrow material at each proposed on-site soil borrow area, including material management strategies, estimated limits of excavations, and identification of temporary stormwater and erosion controls to be used during borrow activities.
- Excavation and final grading plans for each borrow area.
- Proposed reclamation activities at each borrow area.
- Identification of local rock quarry sources and the quality and quantity of available rock, including determination of rock durability and quarry screening capabilities.
- Considerations for Green and Sustainable Remediation (GSR).

H.2 PERFORMANCE STANDARDS

The Performance Standards presented here are defined in the Action Memorandum: Request for a Non-Time-Critical Removal Action at the Northeast Church Rock Site (2011 Action Memo; USEPA, 2011), the ROD, (USEPA, 2013), and the AOC (USEPA, 2015) including the SOW attached as Appendix D to the AOC, and were developed to define attainment of the Removal Action and Remedial Action Objectives (RAOs) for the Selected Remedy. The Performance Standards include both general and specific standards applicable to the Selected Remedy work elements and associated work components. Table H.2-1 presents performance standards related to the borrow areas and borrow materials for construction and explains how the design accomplishes these standards.

Table H.2-1: Task Specific Performance Standards

Identifying Number*	Location of Performance Standard Requirement	Topic	Performance Standard	Comments
95	2011 Action Memo, V.A.1, Bullet 8 – Site Restoration	Site Restoration	Restoration activities will include the backfilling and regrading of excavation areas for erosion and stormwater control. These areas will also be re-vegetated with native species	Excavated borrow areas will be regraded to provide stable slopes and enhance control of erosion and stormwater. Disturbed areas will be revegetated in accordance with the revegetation plan. See Sections H.4.3, H.4.4 and Appendix U.
43	2013 ROD, Section 2.9.5, Stormwater and Erosion Control	Storm Water and Erosion Control	Disturbed areas will be graded to reduce scouring and erosion potential using gentle slopes, terraces, earthen ridges and catch drains (swales) as necessary. These controls will also be used to minimize the potential for ponded water, reduce the risk of percolation from ponded water, and divert water away from open disposal locations, construction areas, and exposed mine waste. The drainage patterns in the disturbed areas will be integrated with the existing topography and drainage patterns to the extent possible. During construction activities, stormwater controls may include stormwater control channels (header), weirs, spillways, catch basins, check dams, and sediment basins. These controls will be implemented to maintain a safe working environment, to protect human health and the environment, mitigate off-site migration of mine waste, and protect response construction actions.	Borrow areas will be excavated to maintain positive drainage away from the borrow sites. Excavated slopes will not exceed 3H:1V to mitigate against slope instability and erosion. Temporary best management practices (BMPs) for sediment control in disturbed areas will be implemented. Additional stormwater controls are not anticipated to be required due to existing topography at the borrow areas and anticipated storm events. See Sections H.4.2, H.4.3 and H.4.4.

Identifying Number*	Location of Performance Standard Requirement	Topic	Performance Standard	Comments
2	2015 AOC SOW, Paragraph 17 – Soil Transportation and Management	Soil Transport and Management	In the Design, Respondents shall provide detailed plans and specifications explaining how mine waste from the NECR Site and other materials (including borrow, backfill, and cover materials) will be managed and transported. Respondents shall include details for ensuring that Principal Threat Waste from the NECR Site, as described in the 2011 Action Memo, is not transported to the UNC Site or disposed at the Tailings Disposal Area.	Management and transport of mine waste is addressed in appendices C, D, and M. Borrow materials are anticipated to be directly loaded and transported to the repository on haul roads designated for clean material (e.g. roads not used for transportation of mine waste). Rock will be hauled from offsite and will likely be stockpiled in a clean area near the repository. Management of principal threat waste (PTW) is described in Appendix C. See Section H.4.2, and appendices C and D.
12	2015 AOC SOW, Paragraph 27 – Site Restoration	Site Restoration	In the Design, Respondents shall include detailed plans and specifications for restoration of the Tailings Disposal Area and borrow areas on the UNC Site and for restoration of the NECR Site. Respondents shall also include plans and specifications for contouring to promote drainage, and for re-vegetation of the Tailings Disposal Area, borrow pits and NECR Site with native species. Respondents shall include plans and specifications for backfilling and regrading of disturbed (e.g., excavated) areas in the NECR Site and the UNC Site for erosion and storm water control, including re-vegetation of those areas with native species	Design plans and specifications have been prepared with regrading and revegetation plans to promote drainage, control stormwater and erosion. Disturbed areas will be revegetated in accordance with project requirements See Section H.4.4 and Appendix U.
14	2015 AOC SOW, Paragraph 29 – Green Remediation Best Management Practices	Green Remediation Best Management Practices	Respondents shall incorporate applicable Best Management Practices for Green Remediation listed in ASTM-E2893-13 consistent with USEPA's policy Superfund Green Remediation Strategy (2010), found at http://www.epa.gov/superfund/greenremediation/sf-gr-strategy.pdf.	Proposed BMPs for green remediation for the borrow areas are described in Section H.5.

*Refers to identifying numbers listed in Summary of ARARs, Performance Standards and Applicable NRC Design Requirements Table (provided in Attachment 1 to main text of the 95% Design Report)

H.3 ENGINEERING DESIGN DRAWINGS

The engineering design drawings for the borrow areas are contained in Volume II – Design Drawings (Section 8). The complete set of Drawings related to the borrow areas are listed in Table H-3.1 and referenced by sheet number in the text.

Table H.3-1: Engineering Design Drawings

Drawing No.	Drawing Title
8-01	Borrow Areas Location Map
8-02	Jetty Borrow Area
8-03	West Borrow Area
8-04	West Borrow Area Backfilled
8-05	East Borrow Area
8-06	South Borrow Area

H.4 BORROW AREAS

Soil and rock are required for repository construction, including general fill to meet surface design grades, for the cover system and for long-term stormwater controls. As part of the PDS, MWH estimated that approximately 400,000 cubic yards (CY) of soil and rock for the cover system as well as clean general fill will be required for the project (MWH, 2014).

The current repository cover design consists of a 4-foot-thick cover system, separated into an upper erosion protection layer and a lower soil layer (with varying thicknesses of layers). The design erosion protection layer is comprised of a soil rock admixture with median rock sizes varying from 1.5 inches to 3.0 inches, depending on the surface grading, and the rock will be mixed with soil at about 33 percent, or 10 percent, by volume. Design criteria and the preliminary design for the soil cover system are discussed in Appendix G. Stantec does not anticipate that additional fill or cover material from the borrow areas will be required for the excavated Mine Site Area, since clean fill is available within the Mine Site Area for final grading and drainage requirements, if needed.

The estimated soil and rock volumes required for repository construction are provided in Table H.4-1 and detailed in the following sections.

Table H.4-1: Project Soil and Rock Material Volume Requirements

Material Type	Quantity Required (CY)
Soil to fill existing cover swales	11,000
Soil for cover layers	351,000
Clean soil fill for grading around repository	12,000
Rock for repository erosion protection	48,500
Rock for stormwater controls	98,300
Filter material for stormwater controls	32,100

H.4.1 On-Site Borrow

Four proposed on-site borrow areas were identified during the PDS to meet the repository volume and material property requirements. An additional proposed borrow source, the jetty excavation, was identified during the 95% NECR design. The proposed improvements to the jetty area will require a significant volume of excavated material that can be used for construction. Details on the investigation and development of the five proposed borrow areas are provided in Sections H.4.1.1 through H.4.1.7. Additional on-site material, available for use in other project applications, is discussed in Section H.4.1.9. Pending further investigations at the Jetty area, only the West, East, South and North Borrow Areas are currently approved by Dwyer Engineering, LLC for cover soil on the Repository.

H.4.1.1 Borrow Area Investigations

Three borrow area investigations have been completed within the proposed borrow areas. The first investigation was completed in 2008 and consisted of 13 test pits excavated within the East Borrow Area and 12 test pits within the West Borrow Area. The 13 test pits within the East Borrow Area were excavated to depths ranging from 8 to 12 feet, while the depths of test pits located in the West Borrow Area ranged from 4 feet to 12 feet (MWH, 2012).

A second borrow area investigation was performed as part of the PDS in November and December 2013. This investigation was completed to further characterize and estimate available material quantities within the borrow areas. Seventeen boreholes

were completed within four of the proposed borrow areas, with a minimum of two boreholes in each borrow area. Drilling depths varied from 10 to 60 feet depending on borehole location within the borrow area and depths to bedrock. Continuous (dry-core) and bulk samples were collected and sent to a laboratory for geotechnical, analytical, and agronomic testing (MWH, 2014).

Analytical radiologic testing was completed on samples from each proposed borrow area to determine if the borrow material was suitable for use in the repository cover system. Test results indicate that radium-226 levels are between 0.8 and 1.7 pCi/g for the borrow materials tested. These test results are included in the Mill Site PDS Report (MWH, 2014).

Geotechnical and agronomic testing at the jetty excavation site was completed in 2016-2017. . Initial geotechnical test results and interpretation information is included in the Jetty Geotechnical Report (Attachment I.9 of Appendix I of this Design Report). Attachment H.2 contains supplementary geotechnical testing data. A summary of the geotechnical data from the jetty area is included in Section H.4.1.7. The agronomic data for the jetty soils is included in Appendix P.

H.4.1.2 Borrow Areas Grading Plan Design

With the exception of the jetty excavation borrow, data collected from each borrow area investigation was used to develop preliminary borrow area grading plans to estimate available borrow material in each area. The design basis for the borrow area excavation and final grading plans is provided in Table H.4-2. The individual design basis items comply with regulatory requirements and/or generally accepted engineering practice and meet the overall project design criteria as provided in the Design Work Plan (MWH, 2016). The design basis and determination of borrow volume available for the jetty excavation is included in the description of the jetty design provided in Appendix I of this Design Report.

Table H.4-2: Borrow Excavation and Final Grading Design Basis

Design Category	Design Basis	Reference
Borrow Material	Borrow material meets the geotechnical property requirements (fines content) for use in the repository soil cover system.	Repository cover design (Dwyer Engineering, 2017)
Borrow Slopes	The borrow area slopes have been designed with a nominal slope of 5H:1V, with no slopes steeper than 3H:1V. Borrow area slope lengths have been shortened where possible.	New Mexico Energy, Minerals and Natural Resources Department, Mining and Minerals Division – Closeout Plan Guidelines for Existing Mines (NMEMND, 1996)
Archeological/Cultural Sites	Identified archeological/cultural sites have been accounted for in the borrow areas development designs.	New Mexico Energy, Minerals and Natural Resources Department, Mining and Minerals Division – Closeout Plan Guidelines for Existing Mines (NMEMND, 1996)
Radiologic Requirement	Radiologic sampling was completed at each of the proposed borrow locations to confirm that the borrow material did not contain concentrations of RA-226 or Uranium exceeding the RAL (Jetty analytical results pending).	2015 AOC (USEPA, 2015)
Temporary Stormwater/Erosion Controls Design Storm Event	Design Storm for Temporary Stormwater/Erosion Controls: 2-year, 24-hour storm.	Engineer's experience and judgment
Borrow Excavation Depths	Borrow area excavation depths have been developed from review of available information. Borrow area configurations have been designed to maximize suitable available materials, based on known information.	Engineer's experience and judgment based on review of existing site information (MWH, 2014)

Design Category	Design Basis	Reference
Borrow Clearing and Grubbing	Preparation of borrow areas and locations for borrow material stockpiles will include clearing and grubbing to a depth of 12 inches.	Engineer's experience and judgment based on review of existing site information
Long-Term Stormwater/Erosion Control	Excavated borrow areas will be graded to provide for long-term slope stability as well as positive drainage from the borrow area to existing drainages.	New Mexico Energy, Minerals and Natural Resources Department, Mining and Minerals Division – Closeout Plan Guidelines for Existing Mines (NMEMND, 1996)
Site Reclamation	Disturbed areas in and around the proposed borrow areas will be reclaimed and revegetated.	New Mexico Energy, Minerals and Natural Resources Department, Mining and Minerals Division – Closeout Plan Guidelines for Existing Mines (NMEMND, 1996)

Estimated available material volumes for each proposed borrow area and materials currently on site are provided in Table H.4-3 and are discussed in the following sections. The proposed grading plans for the borrow areas provide positive surface drainage. Should additional borrow material be required, borrow slopes may be steepened to maximum slopes of 3H:1V, if stable. Additional on-site materials, discussed in Section H.4.1.9, are also included in Table H.4-3.

Table H.4-3: Available On-Site Material Volumes (Soil and Rock)

Location	Material Type	Estimated Volume (CY)
North Borrow Area	Soil	71,000
South Borrow Area	Soil	160,000
East Borrow Area	Soil	55,000
West Borrow Area	Soil	89,000
Jetty Excavation[1]	Soil	497,500
Jetty Excavation[2]	Rock	49,000
Topsoil Stockpile	Soil	20,000
Stripped Tailings Impoundment Cover	Soil	24,000
Stripped Tailings Impoundment Cover	Rock [3]	17,000
Tailings Impoundment Swales[4]	Rock	2,000
Two 1-inch Rock Stockpiles	Rock	6,000
Various Rock Sizes Stockpiles (6" – 15")	Rock	1,000
Crusher Fines	-	1,300
Road Base	-	700

Notes:

1. The Jetty soils are being further evaluated as cover soils but may be used in other areas of the project for general fill.
2. The sandstone from the jetty excavation will not meet NRC durability requirements for erosion protection and cannot be used on the TDA except as general fill.
3. Erosion protection layer to be removed from existing Tailings Disposal Area (TDA) within the repository contains median 1.5-inch rock.
4. Existing swales within the repository will be stripped of erosion protection rock and filled.

H.4.1.3 West Borrow Area

The West Borrow Area is located southwest of the proposed repository location. Based on borehole and test pit logs, depth to the underlying bedrock within the proposed borrow areas is greater than 35 feet at its deepest location. The clayey sand and

silty or clayey sand overlying bedrock contains between 37 and 49 percent low plasticity fines. An estimated 89,000 CY of borrow material is available within this borrow area. This borrow area, including borrow excavation depths, is shown in the Section 8 Drawings. The West Borrow Haul Road, which is also shown in the Section 8 Drawings, will be used for borrow area access. Design for the West Borrow Haul Road is discussed in Appendix D.

H.4.1.4 East Borrow Area

The East Borrow Area is adjacent to the southeast corner of the proposed repository. This proposed borrow area consists of sandy clay and clayey sand with low plasticity fines ranging from 45 percent to 74 percent by weight. Investigation borehole logs indicate that depth to underlying bedrock ranges from near surface to greater than 20 feet. Approximately 55,000 CY of borrow material is available in this area. The bottom of borrow excavation contours, along with borrow excavation depths, are provided in the Section 8 Drawings. The East Borrow Haul Road will provide access to the borrow material and the design of the haul road is discussed in Appendix D.

H.4.1.5 South Borrow Area

The South Borrow Area, located northeast of the proposed repository, consists of an estimated 160,000 CY of available repository cover borrow material. Investigation borings show this borrow material reaches a maximum depth of greater than 25 feet and is comprised of sandy clay with low-plasticity fines ranging from 53 percent to 79 percent by weight. The South Borrow Area will be accessed by the South Borrow Haul Road, which is discussed in Appendix D. The South Borrow Area and South Borrow Haul Road are both shown in the Section 8 Drawings. Foundations from previous structures in this area, although not encountered during drilling, may affect borrow volumes.

H.4.1.6 North Borrow Area

The North Borrow Area is located to the northeast of the South Borrow Area. The North Borrow Area is in a narrow valley and is furthest away from the repository. This borrow is considered an auxiliary source of cover material, should suitable volumes of borrow material in the four other borrow areas be exhausted, and is not shown in the Section 8 drawings. Field investigation and laboratory data results from samples obtained within this borrow area indicate that the material consists of sandy or silty clay or clayey sand with low plasticity fines content ranging from 44 percent to 51 percent by weight. Approximately 71,000 CY of borrow material is available in this area, based on information from only two investigation boreholes. These boreholes indicate a depth to bedrock of up to 20 feet. Should construction conditions require use of material from the North Borrow, additional geotechnical investigation should be conducted to confirm available material volumes.

H.4.1.7 Jetty Excavation Borrow Area

The excavation for the proposed jetty improvements will be located southeast of the proposed repository and is expected to require an estimated 547,500 CY of soil and rock removal. Investigation borings from the 2016 field program are described in the Jetty Geotechnical Report (Appendix I.9). Excavation on the east side of the arroyo will consist of soil while the west side will be partially in shallow outcropping weathered sandstone. The soil on the east side generally consists of 10 to 15 feet of sand with few fines (SP, SP-SM) over interlayered silty sand (SM) and silty clays (CL, CH) to the depth of the proposed excavation for the jetty. The fines content ranges from about 6 to 18 percent in the upper 15 feet and from about 54 percent to 99 percent by weight below 15 feet. The Jetty Borrow Area will be accessed from access roads on both sides of the arroyo. Table H.4-4 summarizes the laboratory results of the Jetty materials obtained from the investigation borings.

The boring logs indicate that coarser materials will be encountered and excavated within the jetty area before the deeper finer materials. As such, approximately 16,500 CY of coarser (sandy) material may be used as general fill for the steeper (20%) NE slope of the repository. Fifteen hundred additional cubic yards of the coarser (sandy) excavated material, if screened, may meet the requirements for use as filter material within the site-wide surface water drainage channels.

The Jetty Excavation will require as much as 49,000 CY of rock (sandstone) excavation on the west side of the Arroyo in order to construct the Jetty improvements. This material has been tested for durability and is not suitable as erosion protection rock on the TDA. The sandstone can be used as general site fill, road fill, or will be disposed in the West Borrow. Remaining coarse

(sandy) materials, not approved for use as cover fill or filter materials, will be hauled to the West Borrow Area and included in the final reclaimed borrow area grading. Drawing 8-04 includes a conceptual fill plan for the West Borrow Area after the existing borrow soil in that area has been removed. Up to 440,000 CY (soil and rock) can be placed back in the West Borrow, if necessary.

Table H.4-4: Summary of Jetty Geotechnical Laboratory Test Results

Borehole/Test Pit ID	General Location	Sample ID	Depth (ft)		Sample Type[1]	Water Content (by mass, %)	Dry Density (pcf)	Standard Proctor (max. dd@opt. w.c.), (pcf @ %)	Atterberg Limits[3]			USCS % Gravel	USCS % Sand	% Passing No. 200 Sieve	Triaxial Shear Strength Consolidated Undrained (**peak friction angle (φ', degrees), cohesion (psf)**)[2]	USCS Classification[3]	Remolded Saturated Hydraulic Conductivity (cm/sec)[4]	SWCC: Water Content (by mass) (% @ bar)[2]	SWCC: Saturated Water Content (by mass) (%)[5]
									LL (%)	PL (%)	PI (%)								
B4	Jetty – SE Side of Pipeline Arroyo	B4-16.0-16.5	16	16.5	CA	10.4	77.6												
B5		B5-5.5-6.0	5.5	6	CA	9.8	82.4					5	77	18		SM			
B5		B5-10.5-11.0	10.5	11	CA	5.2	82.9												
B5		B5-TW-25-27.0	25	27	ST	21.2	98.8		61	21	40				17.5, 478	CH			
B5		B5-30.5-31.0	30.5	31	CA							0	14	86		CL			
B5		B5-40.5-41.0	40.5	41	CA	22.7	99.6		49	20	29	0	1	99		CL			
B6		B6-12.8-13.5	12.8	13.5	CA							5	89	6		SP-SM			
B6		B6-15.5-16.0	15.5	16	CA	10.7	93.0		42	17	25	0	10	90		CL			
B6		B6-16.5-20.0	16.5	20															
B6		B6-40.5-41.0	40.5	41	CA	17.9	97.0												
B7		B7-TW-5.0-6.5	5	6.5	ST	6.9	94.3												
B7		B7-10.5-11.0	10.5	11	CA	7.0	99.7					0	10	90					
B7		B7-16.0-16.5	16	16.5	CA	17.8	99.3		35	19	16	1	45	54		CL			
B7		B7-30.5-31.0	30.5	31	CA	16.7	102.5		40	16	24					CL			
Composite		Clay	-		Bulk	17.6	96.2	106.6 @ 17.7	43	19	24	0	20	80		CL	4.8E-07	23.0 @ 13.3	38.2
Composite		Sand	-		Bulk	14.8	102.0	112.4 @ 14.2				0	65	36			2.5E-05	12.7 @ 5.2	34.0
TP1	N. of Mine Site	TP1	-		Bulk							0	10	90					
TP2		TP2	-		Bulk							0	43	57					
TP3	Dilco Hill	TP3	-		Bulk							3	56	41					
TP4		TP4	-		Bulk							2	46	52					

Notes: (1) CA = California sample, ST = Shelby tube sample, bulk = bucket

(2) See Appendix I for complete results.

(3) LL = liquid limit, PL = plastic limit PI = plasticity index, USCS = Unified Soil Classification System

(4) Flexible wall permeameter tests conducted on specimens remolded to approximately 90% of the maximum standard Proctor density at 80 psi of cell pressure.

(5) SWCC test conducted on material passing the No. 10 sieve, remolded to approximately 90% of the maximum standard Proctor density and optimum water content initially.

H.4.1.8 Proposed Borrow Areas Materials Evaluation

The soil properties from the first four site borrow areas were used by Dwyer Engineering, LLC for the cover modeling and cover calculations described in the Cover System Design Report (Dwyer, 2017), included as Attachment G.7 to Appendix G. Based on information provided by Dwyer Engineering, the material in any of these borrow areas can be used as needed, and will not require phasing, sequencing, or blending to meet the project cover specifications. Based on test results for the soil from the Jetty Borrow Area; a portion of these soils have similar properties to the other four borrow areas. Materials from the jetty borrow will be further evaluated for use as cover, general fill ,or screened and used as filter material for the site surface water drainage channels.

H.4.1.9 Additional On-Site Materials

H.4.1.9.1 Topsoil Stockpile

A topsoil stockpile is located on General Electric/United Nuclear Corporation (GE/UNC) property west of New Mexico Highway 566 (NM 566) and south of the GE/UNC office. Geotechnical investigation information included in the PDS report indicates that approximately 20,000 CY of soil available in this stockpile (MWH, 2014).

H.4.1.9.2 Existing Impoundment Erosion Protection Layer

The existing tailings impoundment cover is constructed with a 6-inch-thick admixture layer of soil and 1.5-inch D_{50} (median diameter) erosion protection rock. Test gradations (eight samples) indicate the existing mixture contains an average of 45 percent rock by mass. Testing, completed during the tailings impoundment cover construction, indicates the 1.5-inch D_{50} rock meets durability requirements for rock included in the repository cover system. Fines contents range from 57 to 73 percent for the existing cover soil (MWH, 2014).

This existing admixture layer will be stripped from the footprint of the new repository, screened to separate rock and soil, and reused for new cover construction. Assuming the mixture is about 42 percent rock by volume, approximately 24,000 CY of soil and 17,000 CY of rock will be available from the stripped cover soil mixture (MWH, 2014). This rock will be used for rock admixture in the repository cover.

H.4.1.9.3 Comparison of Available Borrow Sources

Stantec reviewed the available geotechnical information for the borrow areas and compared it with samples obtained from the existing soil cover on the tailings impoundment as well as the topsoil stockpile on the west side of NM 566, south of the GE/UNC offices (MWH, 2014). This comparison was made to determine if the tailings impoundment cover, anticipated to be stripped prior to placement of mine waste, and the topsoil stockpile material are suitable for use in the repository soil cover system. Specifically, the borrow area soil gradations and Atterberg Limits were compared with the existing TDA cover soil and topsoil stockpile material. As can be seen in Figures H.4-1 and H.4-2, the existing tailings impoundment cover soils and topsoil stockpile materials have similar index properties to the proposed borrow material.

H.4.1.9.4 Rock Material Stockpiles

There are existing material stockpiles at various locations on-site, as shown in the Section 8 Drawings. These materials were characterized during the Mill Site PDS (MWH, 2014). Estimated volumes contained within each of these stockpiles are provided in Table H.4-3. Because the rock in these stockpiles is not of sufficient D_{50} size for the repository cover or channel erosion protection, this material is anticipated to be utilized for temporary surfacing on the proposed haul roads and Support Area facilities.

H.4.1.9.5 Impoundment Surface Swale Rock Removal

Approximately 2,000 CY of 1.5-inch D_{50} rock will also be removed from the existing swales located within the repository area, on the TDA surface, prior to placement of mine waste. The durability of this rock was tested by Canonie Environmental in 1991,

as part of the existing cover swales design, with results showing the rock meets the NRC durability requirements for erosion protection (Canonie, 1991).

H.4.2 Excavation Methods and Procedures

Excavation of the borrow material will be performed using typical earthmoving equipment, including dozers, motor graders, front-end loaders, excavators, rubber-tired backhoes, water trucks, and haul trucks. The following list provides the anticipated excavation procedures for the borrow areas. These procedures align with generally accepted excavation and material borrow practices.

- Establishment of stormwater and erosion control features at borrow area locations.
- Surface vegetation will be stripped from the proposed excavation and borrow material stockpile areas and placed in a topsoil stockpile adjacent to each borrow area. It is estimated that approximately 12 inches of overburden (clearing and grubbing) will be stripped from the surface of each of these areas. The stockpiled topsoil will be reused during borrow area reclamation activities.
- Excavations will include provisions for drainage away from the current borrow area working face to minimize disruption of the borrow activities due to stormwater.
- Sloped excavations will be completed to design grades (to a maximum 3H:1V slope) and design elevations.
- To the extent possible, excavated borrow materials will be loaded directly into haul trucks, transported, and placed within the repository. Exceptions will be 1) stockpiling of borrow material prior to cover material placement to meet project schedule requirements and 2) stockpiling of excavated sandy material from Jetty borrow to be screened and used as filter materials in stormwater control channels site-wide . Quality control for borrow material will be conducted in accordance with the procedures outlined in Appendix J: Technical Specifications. .

H.4.2.1 Stockpiling of Material

Although it is anticipated that cover material excavated from the borrow areas will be directly loaded into haul trucks for transportation and placement on the repository, borrow material may be stockpiled temporarily within the borrow areas, depending on construction schedules. These temporary stockpiles will be maintained at stable slope angles with dust and other erosion control measures applied as required. Sandy materials excavated from the Jetty borrow may be stockpiled in locations to be determined, prior to being screened for use as filter materials for site surface drainage channels. Rock imported from offsite quarries is anticipated to be stockpiled on the north or west side of the North Cell of the tailings impoundment.

H.4.2.2 Dust Control

Fugitive dust will be suppressed using the following measures:

- Enforcement of speed limits on haul roads
- Application of water to excavation areas, work areas, and haul roads with water trucks
- Application of approved chemical agents such as calcium chloride or magnesium chloride (or others) to haul roads
- Placement of aggregate wearing course on haul roads to mitigate dust generation in highly trafficked areas

H.4.3 Temporary Construction Stormwater and Erosion Control

The Construction Contractor (CC) will be responsible for implementing temporary construction stormwater and erosion BMPs during the borrow excavation activities to mitigate release of sediment due to erosion into existing drainages, as discussed in Appendix E and shown on the Section 5 Drawings. BMPs could include erosion and sediment controls at the outlets of each borrow area and on exposed slopes within borrow areas. Borrow excavation will be completed to allow for drainage away from the current borrow area working face to minimize disruption of the borrow activities.

H.4.4 Borrow Areas Reclamation

A preliminary post-excavation borrow surface, based on estimated depths of available borrow material, has been developed for each proposed on-site borrow area, with the exception of the jetty excavation. The post-excavation surfaces provide positive drainage away from the borrow areas and into surrounding drainages. Preliminary post-excavation borrow area cut slopes are nominally 5H:1V to provide for long-term erosional stability and revegetation. The post-excavation borrow areas will be reclaimed and revegetated as described in Appendix U. Final, post-excavation grading surfaces for each of the borrow areas are shown in the Section 8 drawings.

H.4.5 Off-Site Borrow Areas

Due to scarcity of competent rock sources within the project area, most rock required for erosion protection in the soil cover system, as well as for erosion protection in stormwater channels, will be obtained from an off-site source (quarry). Rock sizes and quantities required for the project are provided in Table H.4-5. Additional rock in larger sizes will be required for channel construction and the jetty improvements. In addition to size requirements, rock used for the project must meet durability requirements given in the NRC's 2002 Design of Erosion Protection for Long-Term Stabilization (NRC, 2002). Results from specific laboratory durability tests are scored using a weighted evaluation system based on rock type. NRC requires laboratory testing to show that a proposed rock source obtains a score of 80 or greater in order to be approved for use in uranium tailings projects, without additional oversizing of the rock. Granular filter materials, sand and gravel, will also be required for riprap bedding in some locations.

Table H.4-5: Repository Rock Requirements

Material Specification	Quantity Required (CY)	Location(s) Used
Type I Filter	9,900	East Repository Drainage Channel, Dilco Hill Channels A and B, Jetty/Pipeline Arroyo
Type II Filter	22,200	East Repository Drainage Channel, Dilco Hill Channels A and B, Jetty/Pipeline Arroyo
D_{50} = 1.5 in.	17,000	Repository Cover System
D_{50} = 2.0 in.	11,000	Repository Cover System
D_{50} = 3.0 in.	20,500	Repository Cover System
D_{50} = 3.0 in.	17,200	East Repository Drainage Channel, Jetty/Pipeline Arroyo, Erosion Protection for West Apron, 5H:1V Cover Slope Erosion Protection
D_{50} = 6.0 in.	700	Dilco Hill Channels A and B, Mine Site Outlet Channel
D_{50} = 9.0 in	1,700	East Repository Drainage Channel, Dilco Hill Channels A and B, Mine Site Outlet Channel
D_{50} = 18.0 in.	700	Mine Site Outlet Channel
D_{50} = 27.0 in.	78,000	Jetty/Pipeline Arroyo

Three off-site quarry sources have been identified for potential use during construction to supplement the available on-site rock. Two sources are located near Gallup, NM (approximately 20 miles west of the project site) and one near Prewitt, NM (approximately 50 miles east of the project site). Each proposed rock source has the capability and capacity to produce sufficient quantities of each required size of rock. The rock from the source near Prewitt, a basalt, was tested for sulfate soundness, specific gravity, absorption, and L.A. abrasion. The rock from the sources near Gallup, a limestone and a granite, were tested for specific gravity, absorption, Schmidt hammer, sulfate soundness, and L.A. abrasion. Test results from the Prewitt Pit quarry and one of the sources near Gallup show that the produced rock meets NRC durability requirements without the need for additional oversizing. Test results from the third pit shows that the rock, a limestone, may need to be oversized 5 percent to meet NRC durability requirements. None of the rock from the three sources contains radium-226 concentrations above the RAL

and rock from any of these three pits is suitable for use (with oversizing, as appropriate) in the repository cover system and for erosion protection. Attachment H.1 provides a summary of the analytical test results and the rock durability test results and scores, for the proposed off-site borrow locations. The project specifications will require the selected contractor to confirm the durability test results by providing the Construction Supervising Contractor with an additional series of durability test results following selection of the quarry and prior to taking delivery of the rock. Petrographic analyses for the offsite limestone and granite sources indicated that both sources are considered suitable. The complete analyses are included in Appendix I.9.

H.5 GREEN AND SUSTAINABLE REMEDIATION CONSIDERATIONS

USEPA's Superfund Green Remediation Strategy Policy (USEPA, 2010) requires incorporation of BMPs for green remediation as listed in ASTM-E2893-16 (ASTM International, 2016). Specific proposed practices for the borrow areas relate to: (1) construction materials (characteristics, manufacturing and transportation considerations), (2) construction methods, and (3) low impact/sustainability measures during construction. The 'BMP Process', as outlined in the 'Standard for Greener Cleanups' (ASTM, 2016), has been followed to select and prioritize BMPs for implementation during remedial action. The BMPs relating to Borrow Areas are listed below, for a complete description of the BMP Process and list of all GSR BMPs see Section 4 and Appendix A (Section A.5) of the 95% Design Report.

H.5.1 Construction Material Considerations

On-site borrow sources have been utilized whenever possible and haul distances have been minimized in order to maximize fuel efficiency and reduce air emissions. Throughout the project the volume of borrow needed will be re-evaluated to avoid excavation of unneeded material.

H.5.2 Construction Methods

The Technical Specifications will encourage the CC to size equipment correctly for the task to minimize use of heavy equipment for small tasks and decreases fuel use and minimize greenhouse gas and dust emissions. Use of the nearest qualifying sources for borrow materials, or use and reuse of materials already onsite, will reduce fuel emissions associated with increased transportation distances. Over-excavation and unnecessary fuel use and emissions may also be reduced by re-evaluating necessary borrow volumes as the project progresses. Restoration and revegetation will be completed in a timely manner to minimize erosion and prevent growth of invasive species.

H.5.3 Low Impact Development/Sustainability

Key considerations of GSR principles as they apply to borrow pit selection and use focus on minimizing disturbance of previously undistributed areas and minimizing haul distance. Previously used borrow sources will be utilized to minimize disturbance of previously undisturbed areas, and selection and sequencing of borrow sources has been designed to minimize haul distance and associated fuel use and emissions.

H.6 REFERENCES

ASTM International, 2016. ASTM Standard E2893-16, "Standard Guide for Greener Cleanups," ASTM International, West Conshohocken, PA, 2016, DOI: 10.1520/E2893-16E01, www.astm.org.

Canonie Environmental (Canonie), 1991. Tailings Reclamation Plan, As Approved by NRC – Church Rock Site, Gallup, New Mexico - License no. SUA -1475, Volume I. Prepared for United Nuclear Corporation. August.

Dwyer Engineering, 2017. Cover System Design Report, Northeast Church Rock Site Closure. October.

MWH, Inc. (MWH), 2012. Potential Borrow Areas and Borrow Characterization Plan, Northeast Church Rock Mill Site, Technical Memorandum prepared for United Nuclear Corporation and General Electric. February 17.

MWH, Inc. (MWH), 2014. Pre-Design Studies Church Rock Mine Site Removal Action: Church Rock Mill Site. Prepared for United Nuclear Corporation and General Electric. October 31.

MWH, Inc. (MWH), 2016. Design Work Plan – Northeast Church Rock Mine Site Removal Action. Prepared for United Nuclear Corporation by MWH Americas, Inc. March 17.

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US Nuclear Regulatory Commission (NRC), 2002. Design of Erosion Protection for Long-Term Stabilization: Final Report. Prepared by T.L. Johnson for NRC. September.

US Environmental Protection Agency (USEPA), 2010. Superfund Green Remediation Strategy. Office of Superfund Remediation and Technology Innovation. September.

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US Environmental Protection Agency (USEPA), 2013. Record of Decision, United Nuclear Corporation Site, McKinley County, New Mexico, EPA ID: NMD030443303. March 29.

US Environmental Protection Agency (USEPA), 2015. Administrative Settlement Agreement and Order on Consent for Design and Cost Recovery, United Nuclear Corporation Superfund Site and Northeast Church Rock Mine Removal Site, McKinley County, New Mexico. April 27.

FIGURES

MWH now part of Stantec

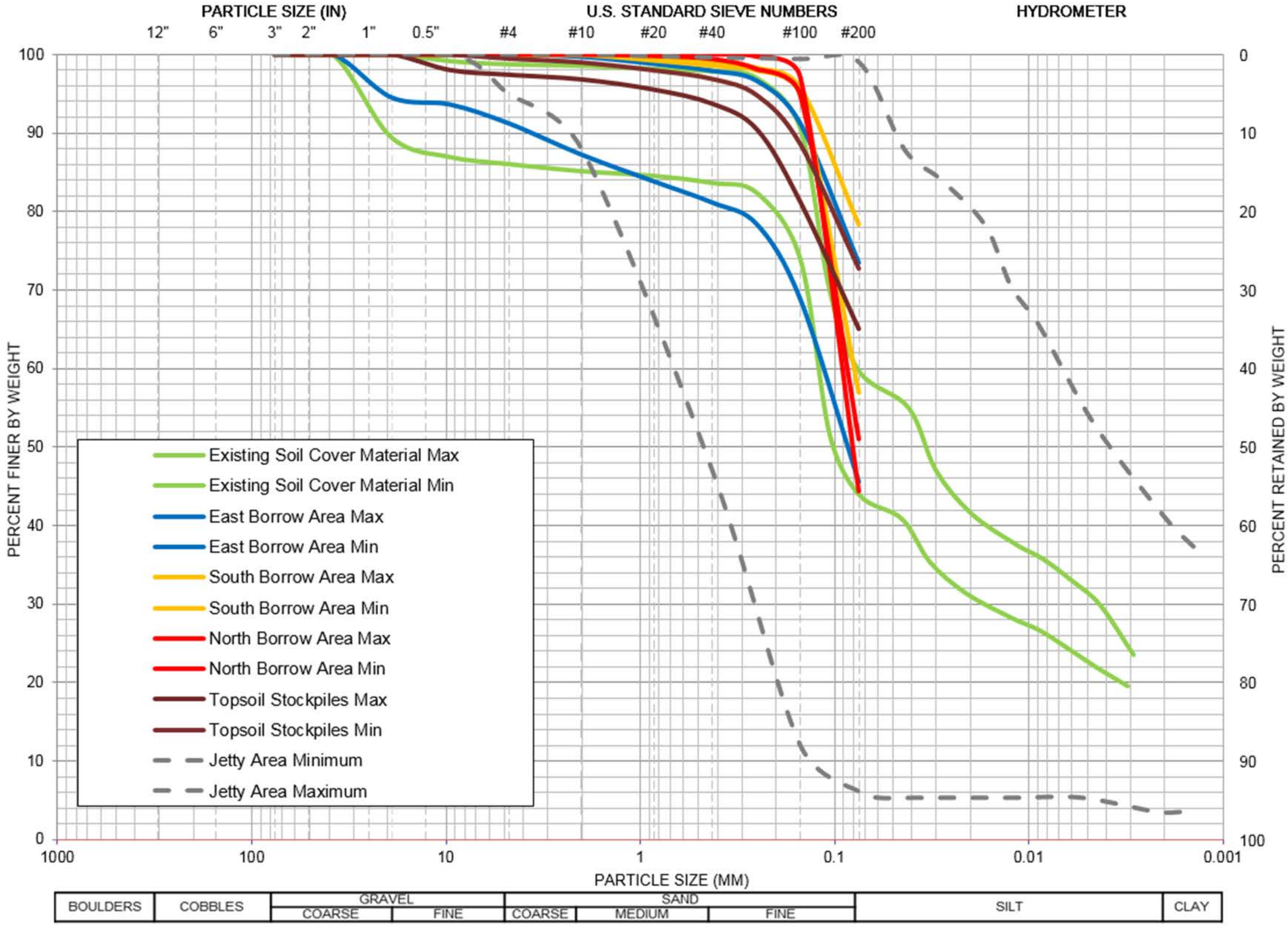


Figure H.4-1: NECR Borrow and Existing Tailings Impoundment Cover Soil Gradations

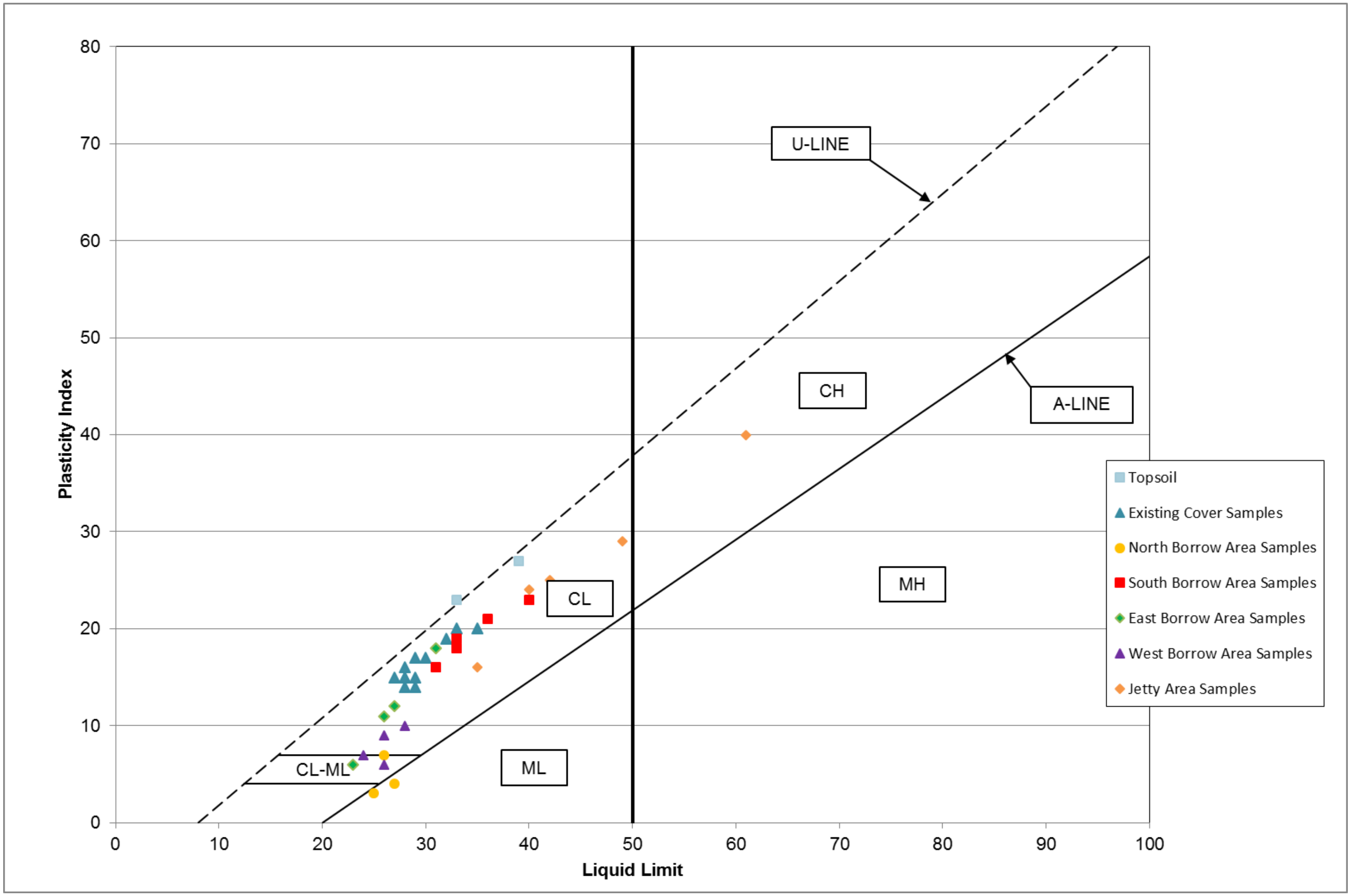


Figure H.4-2: NECR Borrow and Existing Tailings Impoundment Cover Soil Atterberg Limits

ATTACHMENT H.1
Summary of Offsite Rock Durability Testing and Scoring

TECHNICAL MEMORANDUM

TO: United Nuclear Corporation

DATE: July 12, 2016

FROM: Michael Witler

REFERENCE: 10505869

SUBJECT: Summary of Durability and Radiologic Testing for Rock Sources (Attachment H.1)

Revisions						
Revision	**Date**	**Description**	**Author**	**Reviewed**	**Approved**	**Submitted**
0	5/18/2016	First issue	M. Witler	J. Cumbers	C. Strachan	7/15/206

1.0 INTRODUCTION

This memorandum summarizes the results of the durability and radiologic testing of rock sources for the Northeast Church Rock (NECR) Removal Action repository soil cover system. This evaluation has been conducted for United Nuclear Corporation (UNC) by MWH Americas Inc. (MWH, now a part of Stantec).

The current design of the NECR repository soil cover system includes an erosion protection layer, comprised of a soil-rock admixture, as well as rock on the steeper 20 percent side slope on the eastern side of the repository, and rock for stormwater perimeter channels. Testing was previously conducted on basalt samples from the currently inactive Prewitt Pit, located near Thoreau, NM for another UNC project. A representative of UNC collected samples from the Page Pit (limestone) and the Tampico Pit (granite), both near Gallup, NM. The results from testing of samples from these three sources are presented in this memorandum.

2.0 DURABILITY TESTING

A summary of the durability testing scores for each rock source is included in Tables 1 through 3. The test results were scored for durability based on the guidance in NUREG-1623, Table D-1 (NRC, 2002). The individual test scores are based on a range from 0 to 10 with weighting factors based on rock types. Durability testing included; specific gravity, absorption, sodium sulfate soundness, L.A. abrasion, and Schmidt hammer. The supporting laboratory data for the scores are attached. The rock scores for the three sources are calculated on a similar suite of testing, with the exception of the Prewitt Pit calculation, which does not include a Schmidt hammer or Compressive Strength test results. The L.A. abrasion test performed on the basalt

sample was conducted per ASTM for 500 revolutions. The result shown in the table below has been adjusted for 100 revolutions per NUREG-1623.

The rock quality scores are 209/230 (or 91 percent for the Prewitt Pit), 211/260 (or 81 percent for the Page Pit), and 308/410 (or 75 percent for the Tampico Pit). Based on NRC guidance for durability of erosion protection material, material from the Prewitt and Page Pits would be acceptable, without oversizing (score 80 to 100). Rock from the Tampico Pit would require oversizing of 5 percent (increase in the design median (D_{50}) rock sizes).

Table 1. Summary of Scoring Criteria – Prewitt Pit Basalt[a]

Laboratory Test	Result	Score	Weighting Factor[c]	Weighted Score	Maximum Score
Bulk Specific Gravity (ASTM C127)	2.717	9	9	81	90
Absorption, % (ASTM C127)	1.0	5	2	10	20
Sodium Sulfate, % (ASTM C88)	0.2	10	11	110	110
LA Abrasion, % (ASTM C535, 100 revs[b])	5.4	8	1	8	10
			Totals	**209**	**230**
Durability Score = Weighted Score / Maximum Score				**91%**	

Notes:
a) Test results provided by Vinyard and Associates, Albuquerque, NM (2012)
b) 100 revolutions is a deviation from ASTM, per NUREG-1623
c) Weighting factors from Table D-1 NUREG-1623 for igneous (basalt) rock

Table 2. Summary of Scoring Criteria – Page Pit Granite[a]

Laboratory Test	Result	Score	Weighting Factor[d]	Weighted Score	Maximum Score
Bulk Specific Gravity[b] (ASTM C127)	2.585	7	9	63	90
Absorption, % (ASTM C127)	0.8	6	2	12	20
Sodium Sulfate, % (ASTM C88)	0.2	10	11	110	110
LA Abrasion, % (ASTM C535, 100 revs[c])	5.0	8	1	8	10
Schmidt Hammer (ASTM D5873)	49	6	3	18	30
			Totals	**211**	**260**
Durability Score = Weighted Score / Maximum Score				**81%**	

Notes:
a) Test results provided by Ninyo and Moore, Phoenix, AZ (2016)
b) Specific gravity taken as saturated surface dry density
c) 100 revolutions is a deviation from ASTM, per NUREG-1623
d) Weighting factors from Table D-1 NUREG-1623 for igneous (granite)

Table 3. Summary of Scoring Criteria – Tampico Pit Limestone[a]

Laboratory Test	Result	Score	Weighting Factor[d]	Weighted Score	Maximum Score
Bulk Specific Gravity[b] (ASTM C127)	2.682	8	12	96	120
Absorption, % (ASTM C127)	0.4	8.5	13	110	130
Sodium Sulfate, % (ASTM C88)	0.5	10	4	40	40
LA Abrasion, % (ASTM C535, 100 revs[c])	7.0	7	1	7	10
Schmidt Hammer (ASTM D5873)	40	5	11	55	110
			Totals	**308**	**410**
Durability Score = Weighted Score / Maximum Score =				**75%**	

Notes:
a) Test results provided by Ninyo and Moore, Phoenix, AZ (2016)
b) Specific gravity taken as saturated surface dry density
c) 100 revolutions is a deviation from ASTM, per NUREG-1623
d) Weighting factors from Table D-1 NUREG-1623 for limestone

3.0 RADIOLOGIC TESTING

Representative samples from each of the three proposed rock quarries were also sent to AVM Environmental Services Inc., in Grants, NM, for radiologic testing, namely radium-226 activity concentration. The test results were used for comparison with the project Removal Action (RA) levels (2.24 pCi/g) (USEPA, 2011). Based on results from the laboratory testing (included as Attachment B to this memo), rock from each of the three proposed quarries is below the RA level for radium-226, and suitable for use on the project.

4.0 CONCLUSIONS

Based on the durability and radiologic test results, rock material from each of the three proposed quarries are suitable for use as erosion protection rock for the project, either in the repository cover or for erosion protection in channels. One of the identified quarry sources would require oversizing of the design rock sizes.

5.0 REFERENCES

U.S. Nuclear Regulatory Commission (NRC), 2002. Design of Erosion Protection for Long-Term Stabilization," NUREG-1623. September.

U.S. Environmental Protection Agency (USEPA), Region 6 and Region 9, 2011. Action Memorandum: Request for a Non-Time-Critical Removal Action at the Northeast Church Rock Site, McKinley County, New Mexico, Pinedale Chapter of the Navajo Nation. September 29.

ATTACHMENT A

DURABILITY TEST RESULTS

Prewitt Pit Test Results

Sample No.:	407
Date Tested:	9/6/2012
Tested By:	mn

Project No.: 12-2-125
Sample: Proposed Rip Rap material sampled onsite.

SOUNDNESS OF AGGREGATE
(C88-05 Sodium Sulfate)

Sieve Size	Number of Pieces	Grading of original sample %	Wt. of test fraction before test, g	Wt. of test fraction after test, g	% Passing designated sieve after test	Weighted % loss	Container Number
3" to 2 1/2"	12	33.2%	6885.40	6868.40	0.2%	0.1%	A
3 1/2" to 3"	7	33.3%	6912.30	6902.10	0.1%	0.0%	B
4" to 3 1/2"	5	33.5%	6949.50	6925.70	0.3%	0.1%	C
Totals		100.0%	20747.2	20696.2		0.2%	

Absorption and Bulk Specific Gravity of Dimension Stone
C97-02

Specimen No.:	Wt. of dry aggregate A	Wt of aggregate SSD B	Wt of Agg in water C	Bulk Spec Grav (A/(B-C))	Absortion % [(B-A)/A] x 100
407	10049.5	10148.6	6450.4	2.717	1.0
Required				>2.65	

Resistance to Degradation of Large-size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
(ASTM C535-09)

Test results

Sample	Material	Grading	Abrasion Loss
407		1 / 10,000	27.0%

Prewitt Pit Test results

Sample No.: 407
Date Tested: 9/6/2012
Tested By: mn

Project No.: 12-2-125
Sample: Proposed Rip Rap material sampled onsite.

Lab Test	Result	Score	Weight	Score x Weight	Max Score
SP. Grav	2.717	9	9	81	90
Absorp., %	1.0	5	2	10	20
Sod. Sulf., %	0.2	10	11	110	110
L.A. Abr., %	27.0	1	1	1	10

Totals				202	230

Durability Score	= (Score x weight) / (Max Score) =	88	80 min req'd

Table D-1. Scoring criteria for determining rock quality.

Laboratory Test	Weighting Factor			Score										
	Lime-stone	Sand-stone	Igneous	10	9	8	7	6	5	4	3	2	1	0
					Good			Fair			Poor			
Sp. Gravity	12	6	9	2.75	2.70	2.65	2.60	2.55	2.50	2.45	2.40	2.35	2.40	2.25
Absorption, %	13	5	2	.10	.30	.50	.67	.83	1.0	1.5	2.0	2.5	3.0	3.5
Sodium Sulfate, %	4	3	11	1.0	3.0	5.0	6.7	8.3	10.0	12.5	15.0	20.0	25.0	30.0
L/A Abrasion (100 revs), %	1	8	1	1.0	3.0	5.0	6.7	8.3	10.0	12.5	15.0	20.0	25.0	30.0
Schmidt Hammer	11	13	3	70	65	60	54	47	40	32	24	16	8	0

1. Scores were derived from Tables 6.2, 6.5, and 6.7 of NUREG/CR-2642 - "Long-Term Survivability of Riprap for Armoring Uranium Mill Tailings and Covers: A Literature Review," 1982.

2. Weighting Factors are derived from Table 7 of "Petrographic Investigations of Rock Durability and Comparisons of Various Test Procedures," by G. W. DuPuy, Engineering Geology, July 1965. Weighing factors are based on inverse of ranking of test methods for each rock type. Other tests may be used; weighting factors for these tests may be derived using Table 7, by counting upward from the bottom of the table.

3. Test methods should be standardized, if a standard test is available and should be those used in NUREG/CR-2642, so that proper correlations can be made.

SAMPLE INFORMATION:

LOCATION: PAGE PIT
DESCRIPTION: AGGREGATE DURABILITY TESTING
LAB TECHNICIAN: HJG

MECHANICAL SIEVE ANALYSIS			METHOD ASTM C 136
SIEVE SIZE		% PASSING	
US STD	METRIC	RESULTS	SPEC
2"	50	--	--
1.5"	38	--	--
1.25"	31.5	--	--
1"	25	--	--
3/4"	19	--	--
1/2"	12.5	--	--
3/8"	9.5	--	--
1/4"	6.4	--	--
No. 4	4.8	--	--
No. 8	2.36	--	--
No. 10	2.00	--	--
No. 16	1.18	--	--
No. 30	0.60	--	--
No. 40	0.425	--	--
No. 50	0.3	--	--
No. 100	0.15	--	--
No. 200	0.075	NOT TESTED	

COARSE SPECIFIC GRAVITY & ABSORPTION	ASTM C 127	
	RESULTS	SPEC
SPECIFIC GRAVITY, OD	2.565	
SPECIFIC GRAVITY, SSD	2.585	
SPECIFIC GRAVITY, APP	2.617	
% ABSORPTION	0.8	

LA ABRASION		METHOD ASTM C 131
	RESULTS	SPEC
100 REVOLUTIONS % LOSS	5	
200 REVOLUTIONS % LOSS	10	

SODIUM SULFATE SOUNDNESS		ASTM C 88
	RESULTS	SPEC
%LOSS - COARSE AGG	0.2	

SCHMIDT HAMMER		ASTM C 805
	RESULTS	SPEC
HARDNESS NUMBER	49	
STRENGTH (PSI)	8500	

*INDICATES OUT OF TOLERANCE

Ninyo & Moore		SOILS/AGGREGATE DATA SHEET	LAB NO.
PROJECT NO.	DATE SAMPLED	MWH/MISC LABORATORY TESTING PHOENIX, ARIZONA	47539
604667002	4/27/2016		

SAMPLE INFORMATION:

LOCATION: TAMPICO
DESCRIPTION: AGGREGATE DURABILITY TESTING
LAB TECHNICIAN: HJG

MECHANICAL SIEVE ANALYSIS — METHOD: ASTM C 136

SIEVE SIZE US STD	SIEVE SIZE METRIC	% PASSING RESULTS	% PASSING SPEC
2"	50	--	--
1.5"	38	--	--
1.25"	31.5	--	--
1"	25	--	--
3/4"	19	--	--
1/2"	12.5	--	--
3/8"	9.5	--	--
1/4"	6.4	--	--
No. 4	4.8	--	--
No. 8	2.36	--	--
No. 10	2.00	--	--
No. 16	1.18	--	--
No. 30	0.60	--	--
No. 40	0.425	--	--
No. 50	0.3	--	--
No. 100	0.15	--	--
No. 200	0.075	**NOT TESTED**	

COARSE SPECIFIC GRAVITY & ABSORPTION — ASTM C 127

	RESULTS	SPEC
SPECIFIC GRAVITY, OD	2.672	
SPECIFIC GRAVITY, SSD	2.682	
SPECIFIC GRAVITY, APP	2.700	
% ABSORPTION	0.4	

LA ABRASION — METHOD: ASTM C 131

	RESULTS	SPEC
100 REVOLUTIONS % LOSS	7	
200 REVOLUTIONS % LOSS	13	

SODIUM SULFATE SOUNDNESS — ASTM C 88

	RESULTS	SPEC
%LOSS - COARSE AGG	0.5	

SCHMIDT HAMMER — ASTM C 805

	RESULTS	SPEC
HARDNESS NUMBER	40	
STRENGTH (PSI)	6500	

*INDICATES OUT OF TOLERANCE

Ninyo & Moore		**SOILS/AGGREGATE DATA SHEET**	**LAB NO.**
PROJECT NO.	**DATE SAMPLED**	MWH/MISC LABORATORY TESTING PHOENIX, ARIZONA	**47540**
604667002	4/27/2016		

ATTACHMENT B

RADIOLOGIC TESTING RESULTS

AVM Environmental Services, Inc.

Gamma Spectroscopy Run Data

Technician VP

Standard ID	Std & Bkg Count Date & Time	WTst Std wt (gms)	CNst Std Ra-226 (pCi/gm)	CTst Std Count Time (Mins)	CTb Bkg Count time	ROI	PAst Std Peak Area Counts	PAb Bkg Peak Area	PAb Bkg Peak Int Counts
RAS01-1100 Ra-226 Standard, 100.0 pCi/g (Sealed on 08-06-2012)	9/30/12 12:01	1100	100.0	20	20	ROI 3 (Pb-214 351 kev)	91,026	0	660
						ROI 4 (Bi-214 609 kev)	75,662	0	752

Sample Results, Ra-226 pCi/gm

GS Tag Number	Sample ID	Sample Date	Sample Seal Date &Time	Sample Count Date & Time	Ingrowth Period (Days)	WTs Sample wt (gms)	CTs Sample Count time (Mins)	ROI ROIs	PAs Sample Peak Area Counts	Peak Conc	Avg Conc	Uncertainty 95%		LLD		Projected pCi/g
2513	Prewitt Basalt Quary	9/29/2012	9/29/12 11:59	9/30/12 12:25	1	1178	20	ROI 4 (Bi-214 609 kev)	272	0.3	0.3	0.1	0.1	0.2	0.2	<0.5

AVM Environmental Services, Inc.

Gamma Spectroscopy Run Data

Technician VP

Standard ID	Std & Bkg Count Date & Time	WTst Std wt (gms)	CNst Std Ra-226 (pCi/gm)	CTst Std Count Time (Mins)	CTb Bkg Count time	ROI	PAst Std Peak Area Counts	PAb Bkg Peak Area Counts	PAb Bkg Peak Int Counts
RAS01-1100 Ra-226 Standard, 100.0 pCi/g (Sealed on 08-06-2012)	5/6/16 9:15	1100	100.0	20	20	ROI 3 (Pb-214 351 kev)	91,813	35	556
						ROI 4 (Bi-214 609 kev)	75,972	30	642

GS Tag Number	Sample ID	Sample Date	Sample Seal Date &Time	Sample Count Date & Time	Ingrowth Period (Days)	WTs Sample wt (gms)	CTs Sample Count time (Mins)	ROI ROIs	PAs Sample Peak Area Counts	Sample Results, Ra-226 pCi/gm Peak Conc	Avg Conc	Uncertainty 95%		LLD		Projected pCi/g
1	Page Pit, Granite	4/26/2016	5/2/16 9:00	5/6/16 9:30	4	1100	20	ROI 3 (Pb-214 351 kev)	526	0.5	0.8	0.1	0.1	0.2	0.2	1.0
						1100	20	ROI 4 (Bi-214 609 kev)	662	0.8		0.1		0.2		
2	Tampico Pit, Limestone	4/26/2016	5/2/16 9:00	5/6/16 9:55	4	1100	20	ROI 3 (Pb-214 351 kev)	357	0.4	0.4	0.1	0.1	0.2	0.2	0.5
						1100	20	ROI 4 (Bi-214 609 kev)	286	0.3		0.1		0.2		

ATTACHMENT H.2

Supplementary Geotechnical Laboratory Testing

Laboratory Report for

Stantec MWH

NECR Jetty Borrow Soil, P.O. # P30109-N

September 27, 2017

Daniel B. Stephens & Associates, Inc.

4400 Alameda Blvd. NE, Suite C • Albuquerque, New Mexico 87113

September 27, 2017

Stephanie Downey
Stantec MWH
2130 Resort Drive, Suite 350
Steamboat Springs, CO 80487
(970) 871-4389

Re: DBS&A Laboratory Report for Stantec MWH, NECR Jetty Borrow Soil, P.O. # P30109-N Project

Dear Ms. Downey:

Enclosed is the report for the Stantec MWH, NECR Jetty Borrow Soil, P.O. # P30109-N project samples. Please review this report and provide any comments as samples will be held for a maximum of 30 days. After 30 days samples will be returned or disposed of in an appropriate manner.

All testing results were evaluated subjectively for consistency and reasonableness, and the results appear to be reasonably representative of the material tested. However, DBS&A does not assume any responsibility for interpretations or analyses based on the data enclosed, nor can we guarantee that these data are fully representative of the undisturbed materials at the field site. We recommend that careful evaluation of these laboratory results be made for your particular application.

The testing utilized to generate the enclosed report employs methods that are standard for the industry. The results do not constitute a professional opinion by DBS&A, nor can the results affect any professional or expert opinions rendered with respect thereto by DBS&A. You have acknowledged that all the testing undertaken by us, and the report provided, constitutes mere test results using standardized methods, and cannot be used to disqualify DBS&A from rendering any professional or expert opinion, having waived any claim of conflict of interest by DBS&A.

We are pleased to provide this service to Stantec MWH and look forward to future laboratory testing on other projects. If you have any questions about the enclosed data, please do not hesitate to call.

Sincerely,

DANIEL B. STEPHENS & ASSOCIATES, INC.
SOIL TESTING & RESEARCH LABORATORY

Joleen Hines

Joleen Hines
Laboratory Manager

Enclosure

Daniel B. Stephens & Associates, Inc.
Soil Testing & Research Laboratory
4400 Alameda Blvd. NE, Suite C
Albuquerque, NM 87113
505-889-7752
FAX 505-889-0258

Summaries

Summary of Tests Performed

Laboratory Sample Number	Initial Soil Properties[1]			Saturated Hydraulic Conductivity[2]			Moisture Characteristics[3]								Particle Size[4]			Specific Gravity[5]		Air Perm-eability	Atterberg Limits	Proctor Compaction
	G	VM	VD	CH	FH	FW	HC	PP	FP	DPP	RH	EP	WHC	K_{unsat}	DS	WS	H	F	C			
CHR-071117-Clay																X	X				X	
CHR-071117-Clay (90%)	X	X				X	X	X		X	X			X								
CHR-071117-Sand																X	X				X	
CHR-071117-Sand (91%)	X	X				X	X	X		X	X			X								

[1] G = Gravimetric Moisture Content, VM = Volume Measurement Method, VD = Volume Displacement Method
[2] CH = Constant Head Rigid Wall, FH = Falling Head Rigid Wall, FW = Falling Head Rising Tail Flexible Wall
[3] HC = Hanging Column, PP = Pressure Plate, FP = Filter Paper, DPP = Dew Point Potentiometer, RH = Relative Humidity Box, EP = Effective Porosity, WHC = Water Holding Capacity, Kunsat = Calculated Unsaturated Hydraulic Conductivity
[4] DS = Dry Sieve, WS = Wet Sieve, H = Hydrometer
[5] F = Fine (<4.75mm), C = Coarse (>4.75mm)

Notes

Sample Receipt:
Two samples, each in 1-gallon Ziploc bags with custody seals were received on July 14, 2017. The samples were double-bagged, surrounded with paper and delivered in a cardboard box. Both samples arrived in good order.

Sample Preparation and Testing Notes:
A portion of each sample was remolded into a testing ring to target 90% of the respective maximum dry bulk density at the respective optimum moisture content, based on client provided standard proctor compaction testing results. Each of these remolded sub-samples was subjected to initial properties analysis, saturation, and the hanging column and pressure chamber portions of the moisture retention testing. Secondary sub-samples were also prepared, using the same target remold parameters. The secondary sub-samples were then extruded from the testing ring and were subjected to saturated hydraulic conductivity testing via the flexible wall method. The actual percentage of maximum dry bulk density achieved was added to each sub-sample ID.

Separate sub-samples were obtained for the dewpoint potentiometer and relative humidity chamber portions of the moisture retention testing.

Particles larger than 4.75 mm were removed from the bulk material prior to remolding the sub-samples. Oversize correction calculations are not provided since the removed fraction is less than 5% of the bulk sample mass.

Porosity calculations, and the particle diameter calculations in the hydrometer portion of the particle size analysis testing, are based on the use of an assumed specific gravity value of 2.51.

Volumetric water contents were adjusted for changes in volume, where applicable. Due to the irregularities formed on the sample surfaces during swelling, volume measurements obtained after the initial reading should be considered estimates.

Summary of Sample Preparation/Volume Changes

	Proctor Data			Target Remold Parameters[1]				Actual Remold Data				Volume Change Post Saturation[2]				Volume Change Post Drying Curve[3]			
	Opt. Moist. Cont.	Max. Dry Density	Max. Dry Density	Moist. Cont.	Dry Bulk Density	Dry Bulk Density	% of Max. Density	Moist. Cont.	Dry Bulk Density	Dry Bulk Density	% of Max. Density	Dry Bulk Density	Dry Bulk Density	% Volume Change	% of Max. Density	Dry Bulk Density	Dry Bulk Density	% Volume Change	% of Max. Density
Sample ID	(%, g/g)	(g/cm^3)	(pcf)	(%, g/g)	(g/cm^3)	(pcf)	(%)	(%, g/g)	(g/cm^3)	(pcf)	(%)	(g/cm^3)	(pcf)	(%)	(%)	(g/cm^3)	(pcf)	(%)	(%)
CHR-071117-Clay (90%)	17.7	1.71	106.6	17.7	1.54	95.9	90%	17.6	1.54	96.2	90.3%	1.50	93.9	2.5%	88.1%	1.52	94.9	1.4%	89.0%
CHR-071117-Sand (91%)	14.2	1.80	112.4	14.2	1.62	101.2	90%	14.8	1.63	102.0	90.8%	1.63	102.0	---	90.8%	1.63	102.0	---	90.8%

[1]Target Remold Parameters: Provided by the client: 90% of maximum dry density at optimum moisture content.

[2]Volume Change Post Saturation: Volume change measurements were obtained after saturated hydraulic conductivity testing.

[3]Volume Change Post Drying Curve: Volume change measurements were obtained throughout hanging column and pressure plate testing. The 'Volume Change Post Drying Curve' values represent the final sample dimensions after the last pressure plate point.

Notes:

"+" indicates sample swelling, "-" indicates sample settling, and "---" indicates no volume change occurred.

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity

Sample Number	Moisture Content: As Received: Gravimetric (%, g/g)	Moisture Content: As Received: Volumetric (%, cm^3/cm^3)	Moisture Content: Remolded: Gravimetric (%, g/g)	Moisture Content: Remolded: Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
CHR-071117-Clay (90%)	NA	NA	17.6	27.1	1.54	1.81	41.8
CHR-071117-Sand (91%)	NA	NA	14.8	23.9	1.62	1.86	39.0

NA = Not analyzed
--- = This sample was not remolded

Summary of Saturated Hydraulic Conductivity Tests

Sample Number	K_{sat} (cm/sec)	Oversize Corrected K_{sat} (cm/sec)	Method of Analysis: Constant Head Flexible Wall	Method of Analysis: Falling Head Flexible Wall
CHR-071117-Clay (90%)	4.8E-07	---		X
CHR-071117-Sand (89%)	2.5E-05	---		X

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NR = Not requested
NA = Not applicable

Summary of Moisture Characteristics of the Initial Drainage Curve

Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm^3/cm^3)
CHR-071117-Clay (90%)	0	38.2 ‡‡
	57	38.3 ‡‡
	155	36.8 ‡‡
	337	36.4 ‡‡
	1428	31.3 ‡‡
	13563	23.0 ‡‡
	49970	16.6 ‡‡
	130126	12.7 ‡‡
	440554	9.2 ‡‡
	851293	6.9 ‡‡
CHR-071117-Sand (91%)	0	34.0
	12	33.8
	35	33.4
	105	23.8
	337	20.5
	5303	12.7
	28350	7.7
	128189	5.3
	549468	3.7
	851293	3.1

‡‡ Volume adjustments are applicable at this matric potential (see data sheet for this sample).

Summary of Calculated Unsaturated Hydraulic Properties

Sample Number	α (cm^{-1})	N (dimensionless)	θ_r (% vol)	θ_s (% vol)	Oversize Corrected θ_r (% vol)	Oversize Corrected θ_s (% vol)
CHR-071117-Clay (90%)	0.0008	1.2352	0.00	37.78	---	---
CHR-071117-Sand (91%)	0.0285	1.2264	0.00	35.02	---	---

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NR = Not requested

NA = Not applicable

Summary of Particle Size Characteristics

Sample Number	d_{10} (mm)	d_{50} (mm)	d_{60} (mm)	C_u	C_c	Method	ASTM Classification	USDA Classification	
CHR-071117-Clay	0.00016	0.0068	0.015	94	0.50	WS/H	Lean clay with sand (CL)s	Clay Loam	(Est)
CHR-071117-Sand	8.8E-14	0.11	0.14	1.6E+12	3.1E+11	WS/H	Silty sand (SM)	Sandy Loam	(Est)

d_{50} = Median particle diameter

Est = Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

† Greater than 10% of sample is coarse material

Percent Gravel, Sand, Silt and Clay*

Sample Number	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
CHR-071117-Clay	0.2	20.0	44.1	35.8
CHR-071117-Sand	0.0	64.5	23.9	11.6

*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

Summary of Atterberg Tests

Sample Number	Liquid Limit	Plastic Limit	Plasticity Index	Classification
CHR-071117-Clay	43	19	24	CL
CHR-071117-Sand	---	---	---	ML

--- = Soil requires visual-manual classification due to non-plasticity

Initial Properties

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity

Sample Number	Moisture Content: As Received Gravimetric (%, g/g)	Moisture Content: As Received Volumetric (%, cm^3/cm^3)	Moisture Content: Remolded Gravimetric (%, g/g)	Moisture Content: Remolded Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
CHR-071117-Clay (90%)	NA	NA	17.6	27.1	1.54	1.81	41.8
CHR-071117-Sand (91%)	NA	NA	14.8	23.9	1.62	1.86	39.0

NA = Not analyzed
--- = This sample was not remolded

Daniel B. Stephens & Associates, Inc.

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Stantec MWH
Job Number:	DB17.1177.00
Sample Number:	CHR-071117-Clay (90%)
Project Name:	NECR Jetty Borrow Soil
PO Number:	P30109-N

	As Received	Remolded
Test Date:	NA	14-Aug-17
Field weight of sample* (g):		536.85
Tare weight, ring (g):		133.38
Tare weight, pan/plate (g):		0.00
Tare weight, other (g):		0.00
Dry weight of sample (g):		343.08
Sample volume (cm^3):		222.62
Assumed particle density (g/cm^3):		2.65
Gravimetric Moisture Content (% g/g):		17.6
Volumetric Moisture Content (% vol):		27.1
Dry bulk density (g/cm^3):		1.54
Wet bulk density (g/cm^3):		1.81
Calculated Porosity (% vol):		41.8
Percent Saturation:		64.8

Laboratory analysis by:	D. O'Dowd
Data entered by:	J. Falance
Checked by:	J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Stantec MWH
Job Number:	DB17.1177.00
Sample Number:	CHR-071117-Sand (91%)
Project Name:	NECR Jetty Borrow Soil
PO Number:	P30109-N

	As Received	Remolded
Test Date:	NA	14-Aug-17
Field weight of sample* (g):		546.70
Tare weight, ring (g):		133.38
Tare weight, pan/plate (g):		0.00
Tare weight, other (g):		0.00
Dry weight of sample (g):		360.15
Sample volume (cm^3):		222.72
Assumed particle density (g/cm^3):		2.65
Gravimetric Moisture Content (% g/g):		14.8
Volumetric Moisture Content (% vol):		23.9
Dry bulk density (g/cm^3):		1.62
Wet bulk density (g/cm^3):		1.86
Calculated Porosity (% vol):		39.0
Percent Saturation:		61.2

Laboratory analysis by:	D. O'Dowd
Data entered by:	J. Falance
Checked by:	J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Saturated Hydraulic Conductivity

Summary of Saturated Hydraulic Conductivity Tests

Sample Number	K_{sat} (cm/sec)	Oversize Corrected K_{sat} (cm/sec)	Method of Analysis: Constant Head Flexible Wall	Method of Analysis: Falling Head Flexible Wall
CHR-071117-Clay (90%)	4.8E-07	---		X
CHR-071117-Sand (89%)	2.5E-05	---		X

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NR = Not requested
NA = Not applicable

Saturated Hydraulic Conductivity
Flexible Wall Falling Head-Rising Tail Method

Job name: Stantec MWH
Job number: DB17.1177.00
Sample number: CHR-071117-Clay (90%)
Project name: NECR Jetty Borrow Soil
PO Number: P30109-N

Remolded or Initial Sample Properties

Initial Mass (g):	403.21
Diameter (cm):	6.107
Length (cm):	7.592
Area (cm^2):	29.29
Volume (cm^3):	222.38
Dry Density (g/cm^3):	1.54
Dry Density (pcf):	96.3
Water Content (%, g/g):	17.6
Water Content (%, vol):	27.1
Void Ratio (e):	0.63
Porosity (%, vol):	38.5
Saturation (%):	70.2

Post Permeation Sample Properties

Saturated Mass (g):	450.74
Dry Mass (g):	343.01
Diameter (cm):	6.282
Length (cm):	7.619
*Deformation (%)**:*	0.36
Area (cm^2):	30.99
Volume (cm^3):	236.15
Dry Density (g/cm^3):	1.45
Dry Density (pcf):	90.7
Water Content (%, g/g):	31.4
Water Content (%, vol):	45.6
Void Ratio(e):	0.73
Porosity (%, vol):	42.1
Saturation (%):*	108.3

Test and Sample Conditions

Permeant liquid used:	Tap Water
Sample Preparation:	☐ In situ sample, extruded
	☑ Remolded Sample
Number of Lifts:	3
Split:	#4
Percent Coarse Material (%):	0.2
Particle Density(g/cm^3):	2.51 ☑ Assumed ☐ Measured
Cell pressure (PSI):	80.0
Influent pressure (PSI):	79.5
Effluent pressure (PSI):	78.5
Panel Used:	☐ D ☐ E ☑ F
Reading:	☐ Annulus ☑ Pipette

		Date/Time
B-Value (% saturation) prior to test*:	1.00	9/27/17 750
B-Value (% saturation) post to test:	1.00	9/27/17 933

* Per ASTM D5084 percent saturation is ensured (B-Value ≥ 95%) prior to testing, as post test saturation values may be exaggerated during depressurizing and sample removal.
**Percent Deformation: based on initial sample length and post permeation sample length.

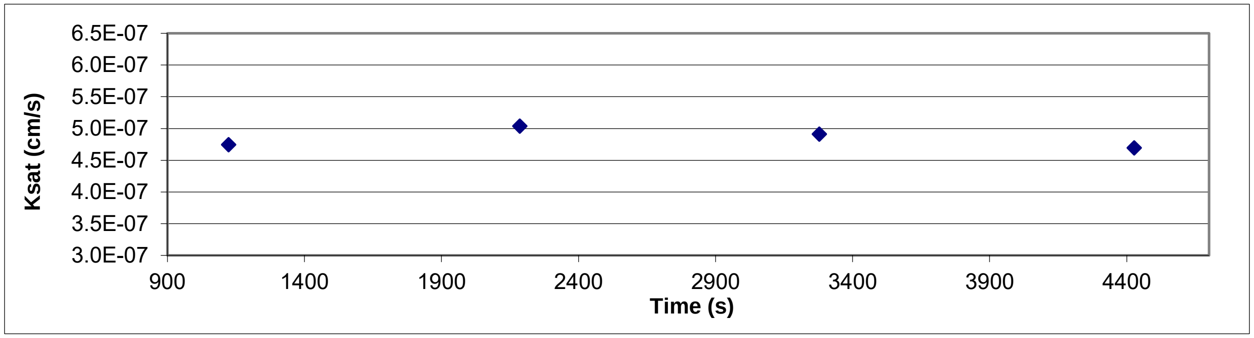
Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines

Saturated Hydraulic Conductivity
Flexible Wall Falling Head-Rising Tail Method

Job name: Stantec MWH
Job number: DB17.1177.00
Sample number: CHR-071117-Clay (90%)
Project name: NECR Jetty Borrow Soil
PO Number: P30109-N

Date	Time	Temp (°C)	Influent Pipette Reading	Effluent Pipette Reading	Gradient (ΔH/ΔL)	Average Flow (cm^3)	Elapsed Time (s)	Ratio (outflow to inflow)	Change in Head (Not to exceed 25%)	k_{sat} T°C (cm/s)	k_{sat} Corrected (cm/s)
Test # 1:											
27-Sep-17	08:14:51	21.8	5.20	20.80	11.60	0.17	1124	1.00	1%	4.96E-07	4.75E-07
27-Sep-17	08:33:35	22.0	5.40	20.60	11.54						
Test # 2:											
27-Sep-17	08:33:35	22.0	5.40	20.60	11.54	0.17	1062	1.00	1%	5.28E-07	5.03E-07
27-Sep-17	08:51:17	22.1	5.60	20.40	11.48						
Test # 3:											
27-Sep-17	08:51:17	22.1	5.60	20.40	11.48	0.17	1093	1.00	1%	5.16E-07	4.91E-07
27-Sep-17	09:09:30	22.1	5.80	20.20	11.41						
Test # 4:											
27-Sep-17	09:09:30	22.1	5.80	20.20	11.41	0.17	1149	1.00	1%	4.93E-07	4.69E-07
27-Sep-17	09:28:39	22.1	6.00	20.00	11.35						

***Average Ksat* (cm/sec):** **4.85E-07**
Calculated Gravel Corrected Average Ksat (cm/sec): ---



ASTM Required Range (+/- 25%)

Ksat (-25%) (cm/s): 3.63E-07

Ksat (+25%) (cm/s): 6.06E-07

Saturated Hydraulic Conductivity
Flexible Wall Falling Head-Rising Tail Method

Job name: Stantec MWH
Job number: DB17.1177.00
Sample number: CHR-071117-Sand (89%)
Project name: NECR Jetty Borrow Soil
PO Number: P30109-N

Remolded or Initial Sample Properties		Post Permeation Sample Properties		Test and Sample Conditions	
Initial Mass (g):	410.42	*Saturated Mass (g):*	439.33	*Permeant liquid used:*	Tap Water
Diameter (cm):	6.095	*Dry Mass (g):*	358.33	*Sample Preparation:*	☐ In situ sample, extruded
Length (cm):	7.632	*Diameter (cm):*	6.081		☑ Remolded Sample
Area (cm^2):	29.18	*Length (cm):*	7.604	*Number of Lifts:*	3
Volume (cm^3):	222.68	*Deformation (%)**:*	0.36	*Split:*	#4
Dry Density (g/cm^3):	1.61	*Area (cm^2):*	29.04	*Percent Coarse Material (%):*	0.0
Dry Density (pcf):	100.5	*Volume (cm^3):*	220.85	*Particle Density(g/cm^3):*	2.51 ☑ Assumed ☐ Measured
Water Content (%, g/g):	14.5	*Dry Density (g/cm^3):*	1.62	*Cell pressure (PSI):*	80.0
Water Content (%, vol):	23.4	*Dry Density (pcf):*	101.3	*Influent pressure (PSI):*	79.2
Void Ratio (e):	0.56	*Water Content (%, g/g):*	22.6	*Effluent pressure (PSI):*	78.8
Porosity (%, vol):	35.9	*Water Content (%, vol):*	36.7	*Panel Used:*	☐ D ☑ E ☐ F
Saturation (%):	65.2	*Void Ratio(e):*	0.55	*Reading:*	☐ Annulus ☑ Pipette
		Porosity (%, vol):	35.4		
		Saturation (%):*	103.7		

		Date/Time
B-Value (% saturation) prior to test*:	1.00	9/27/17 810
B-Value (% saturation) post to test:	1.00	9/27/17 855

* Per ASTM D5084 percent saturation is ensured (B-Value ≥ 95%) prior to testing, as post test saturation values may be exaggerated during depressurizing and sample removal.
**Percent Deformation: based on initial sample length and post permeation sample length.

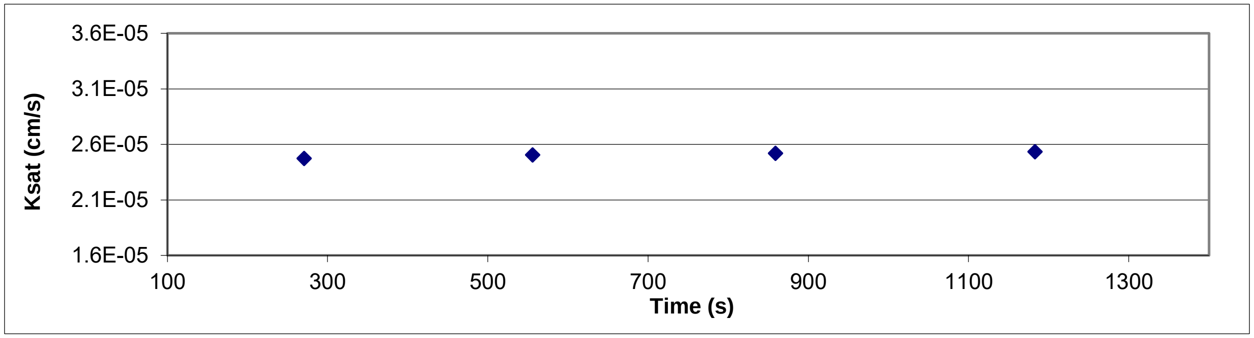
Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines

Saturated Hydraulic Conductivity
Flexible Wall Falling Head-Rising Tail Method

Job name: Stantec MWH
Job number: DB17.1177.00
Sample number: CHR-071117-Sand (89%)
Project name: NECR Jetty Borrow Soil
PO Number: P30109-N

Date	Time	Temp (°C)	Influent Pipette Reading	Effluent Pipette Reading	Gradient (ΔH/ΔL)	Average Flow (cm^3)	Elapsed Time (s)	Ratio (outflow to inflow)	Change in Head (Not to exceed 25%)	k_{sat} T°C (cm/s)	k_{sat} Corrected (cm/s)
Test # 1:											
27-Sep-17	08:23:19	21.9	9.00	18.00	5.07	0.87	271	1.00	6%	2.59E-05	2.47E-05
27-Sep-17	08:27:50	21.9	10.00	17.00	4.76						
Test # 2:											
27-Sep-17	08:27:50	21.9	10.00	17.00	4.76	0.87	285	1.00	6%	2.62E-05	2.50E-05
27-Sep-17	08:32:35	22.0	11.00	16.00	4.46						
Test # 3:											
27-Sep-17	08:32:35	22.0	11.00	16.00	4.46	0.87	303	1.00	7%	2.64E-05	2.52E-05
27-Sep-17	08:37:38	22.0	12.00	15.00	4.16						
Test # 4:											
27-Sep-17	08:37:38	22.0	12.00	15.00	4.16	0.87	324	1.00	7%	2.66E-05	2.53E-05
27-Sep-17	08:43:02	22.0	13.00	14.00	3.85						

***Average Ksat* (cm/sec):** **2.51E-05**
Calculated Gravel Corrected Average Ksat (cm/sec): ---



ASTM Required Range (+/- 25%)

Ksat (-25%) (cm/s): 1.88E-05

Ksat (+25%) (cm/s): 3.13E-05

Moisture Retention Characteristics

Summary of Moisture Characteristics of the Initial Drainage Curve

Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm^3/cm^3)
CHR-071117-Clay (90%)	0	38.2 ‡‡
	57	38.3 ‡‡
	155	36.8 ‡‡
	337	36.4 ‡‡
	1428	31.3 ‡‡
	13563	23.0 ‡‡
	49970	16.6 ‡‡
	130126	12.7 ‡‡
	440554	9.2 ‡‡
	851293	6.9 ‡‡
CHR-071117-Sand (91%)	0	34.0
	12	33.8
	35	33.4
	105	23.8
	337	20.5
	5303	12.7
	28350	7.7
	128189	5.3
	549468	3.7
	851293	3.1

‡‡ Volume adjustments are applicable at this matric potential (see data sheet for this sample).

Summary of Calculated Unsaturated Hydraulic Properties

Sample Number	α (cm^{-1})	N (dimensionless)	θ_r (% vol)	θ_s (% vol)	Oversize Corrected θ_r (% vol)	Oversize Corrected θ_s (% vol)
CHR-071117-Clay (90%)	0.0008	1.2352	0.00	37.78	---	---
CHR-071117-Sand (91%)	0.0285	1.2264	0.00	35.02	---	---

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NR = Not requested
NA = Not applicable

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Moisture Retention Data

Hanging Column / Pressure Plate

(Soil-Water Characteristic Curve)

Job Name:	Stantec MWH	*Dry wt. of sample (g):*	343.08
Job Number:	DB17.1177.00	*Tare wt., ring (g):*	133.38
Sample Number:	CHR-071117-Clay (90%)	*Tare wt., screen & clamp (g):*	24.24
Project Name:	NECR Jetty Borrow Soil	*Initial sample volume (cm³):*	222.62
PO Number:	P30109-N	*Initial dry bulk density (g/cm³):*	1.54
		Assumed particle density (g/cm³):	2.65
		Initial calculated total porosity (%):	41.84

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content† (% vol)	
Hanging column:	15-Aug-17	8:20	587.81	0	38.19	‡‡
	22-Aug-17	9:15	588.73	57.0	38.29	‡‡
	29-Aug-17	16:35	585.15	155.0	36.83	‡‡
Pressure plate:	8-Sep-17	11:00	583.56	337	36.37	‡‡
	20-Sep-17	9:10	571.30	1428	31.28	‡‡

Volume Adjusted Data [1]

	Matric Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calculated Porosity (%)
Hanging column:	0.0	228.10	+2.46%	1.50	43.24
	57.0	229.89	+3.27%	1.49	43.68
	155.0	229.30	+3.00%	1.50	43.54
Pressure plate:	337	227.84	+2.35%	1.51	43.18
	1428	225.72	+1.40%	1.52	42.65

Comments:

[1] Applicable if the sample experienced volume changes during testing. ‘Volume Adjusted’ values represent each of the volume change measurements obtained after saturated hydraulic conductivity testing and throughout hanging column/pressure plate testing. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

† Assumed density of water is 1.0 g/cm^3

‡‡ Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Technician Notes:

Laboratory analysis by: D. O'Dowd
Data entered by: J. Falance
Checked by: J. Hines

Moisture Retention Data

Dew Point Potentiometer / Relative Humidity Box

(Soil-Water Characteristic Curve)

Sample Number: CHR-071117-Clay (90%)

Initial sample bulk density (g/cm^3)*:* 1.54
Fraction of test sample used (<2.00mm fraction) (%): 99.70

Dry weight of dew point potentiometer sample* (g)*:* 159.53
Tare weight, jar (g)*:* 114.42

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)	
Dew point potentiometer:	7-Sep-17	15:05	166.36	13563	22.95	‡‡
	5-Sep-17	10:20	164.47	49970	16.58	‡‡
	29-Aug-17	15:10	163.31	130126	12.69	‡‡
	21-Aug-17	16:35	162.28	440554	9.25	‡‡

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	13563	225.72	+1.40%	1.52	42.65
	49970	225.72	+1.40%	1.52	42.65
	130126	225.72	+1.40%	1.52	42.65
	440554	225.72	+1.40%	1.52	42.65

Comments:

[1] Applicable if the sample experienced volume changes during testing. ‘Volume Adjusted’ values represent the volume change measurements obtained after the last hanging column or pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

† Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.

‡‡ Volume adjustments are applicable at this matric potential (see comment #1).

Laboratory analysis by: D. O'Dowd/A. Bland
Data entered by: J. Falance
Checked by: J. Hines

Moisture Retention Data

Dew Point Potentiometer / Relative Humidity Box

(Soil-Water Characteristic Curve)

Sample Number: CHR-071117-Clay (90%)

Initial sample bulk density (g/cm^3): 1.54
Fraction of test sample used (<2.00mm fraction) (%): 99.70

Dry weight of relative humidity box sample* (g): 63.17
Tare weight (g): 40.78

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)	
Relative humidity box:	1-Sep-17	17:40	64.19	851293	6.91	‡‡

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Relative humidity box:	851293	225.72	+1.40%	1.52	42.65

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the last hanging column or pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

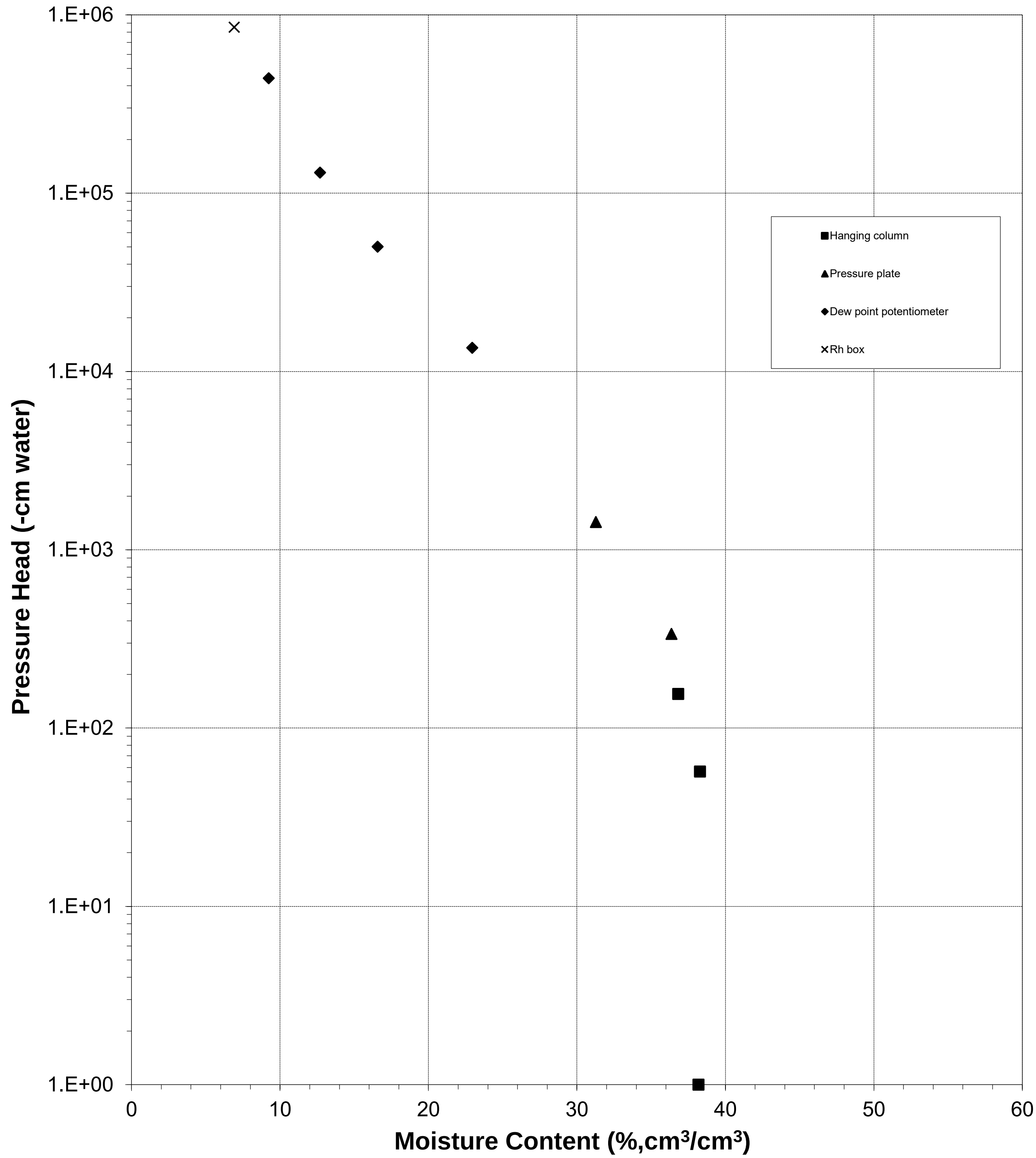
† Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.

‡‡ Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Laboratory analysis by: D. O'Dowd/A. Bland
Data entered by: J. Falance
Checked by: J. Hines

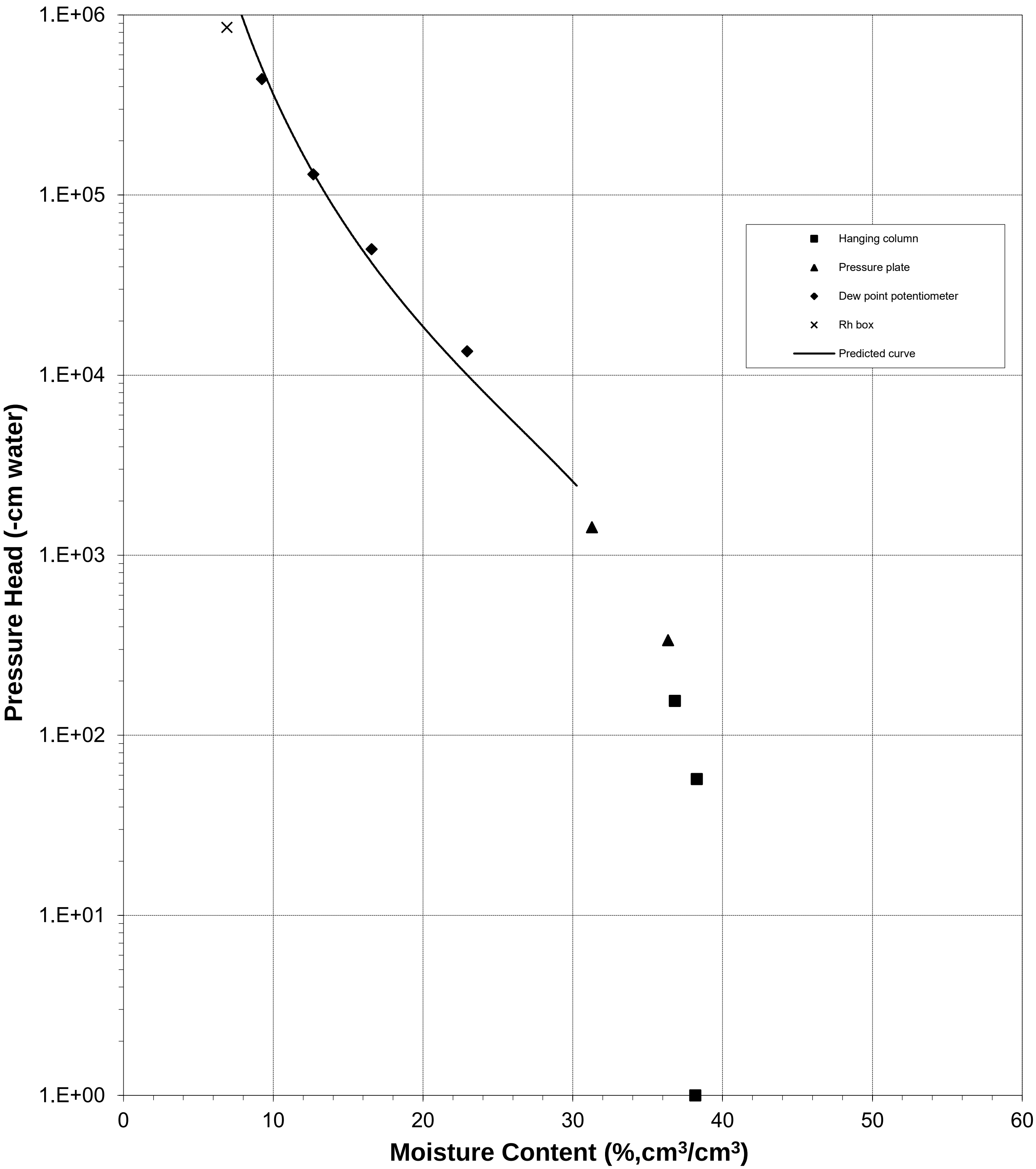
Water Retention Data Points

Sample Number: CHR-071117-Clay (90%)



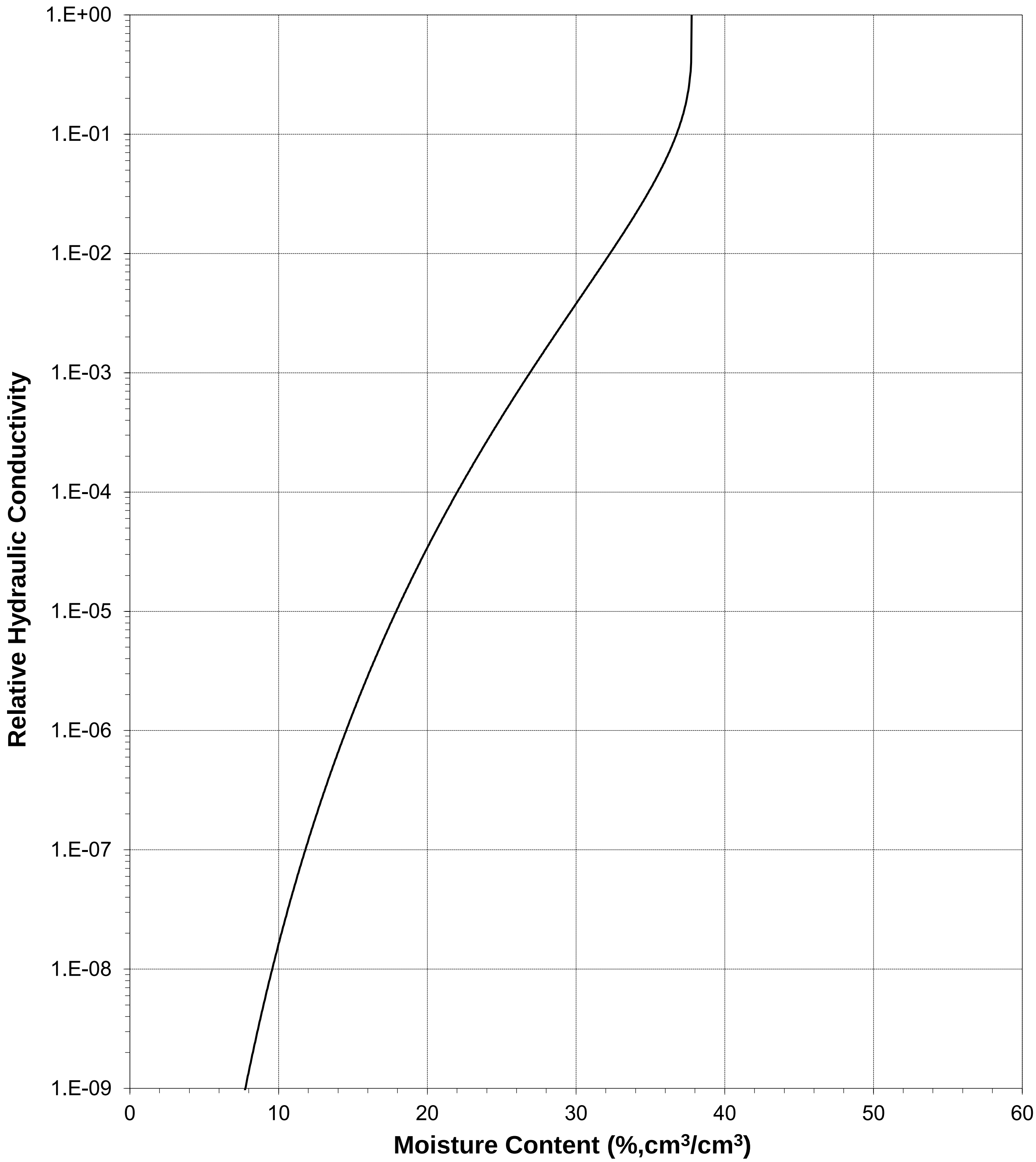
Predicted Water Retention Curve and Data Points

Sample Number: CHR-071117-Clay (90%)



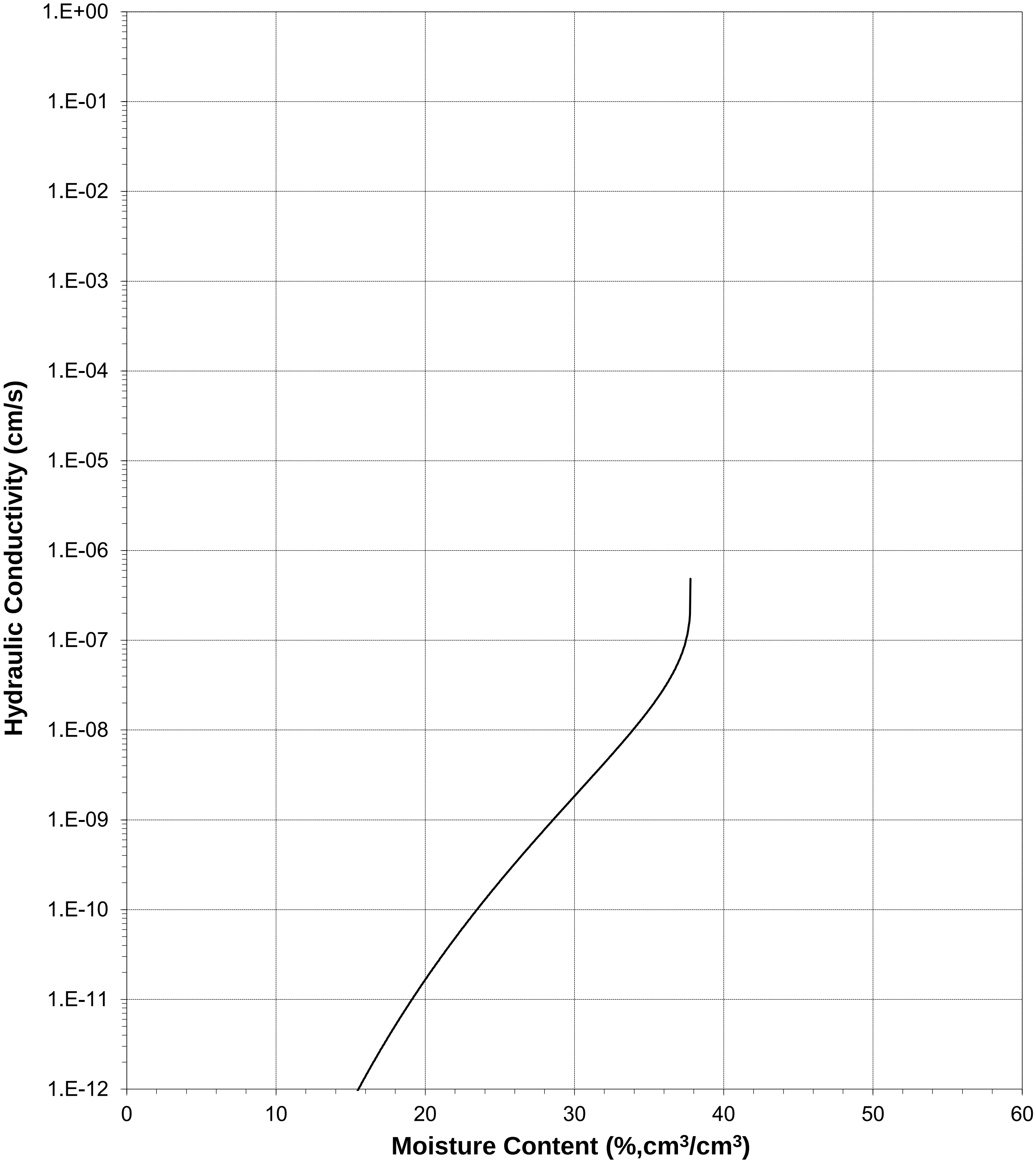
Plot of Relative Hydraulic Conductivity vs Moisture Content

Sample Number: CHR-071117-Clay (90%)



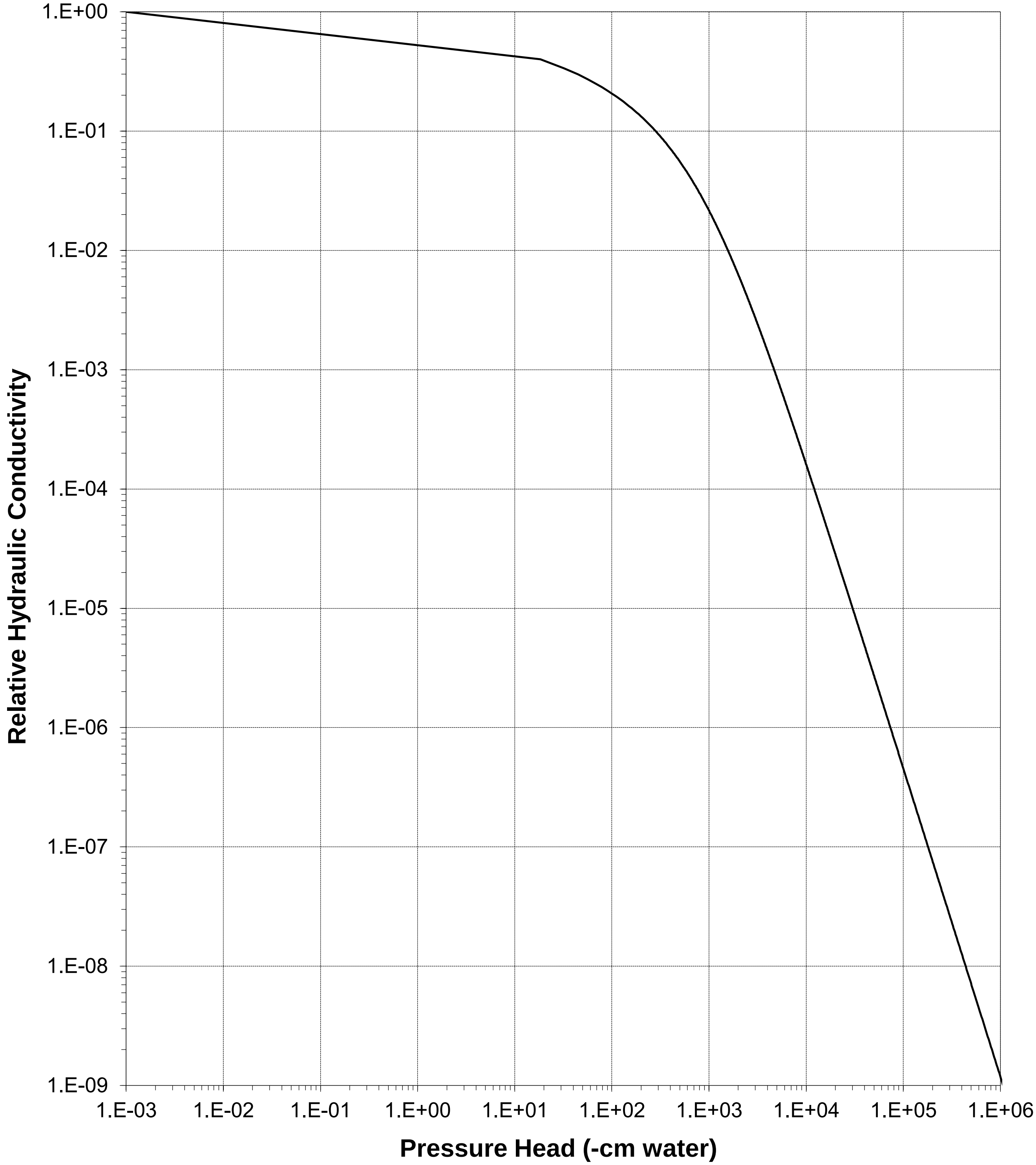
Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: CHR-071117-Clay (90%)



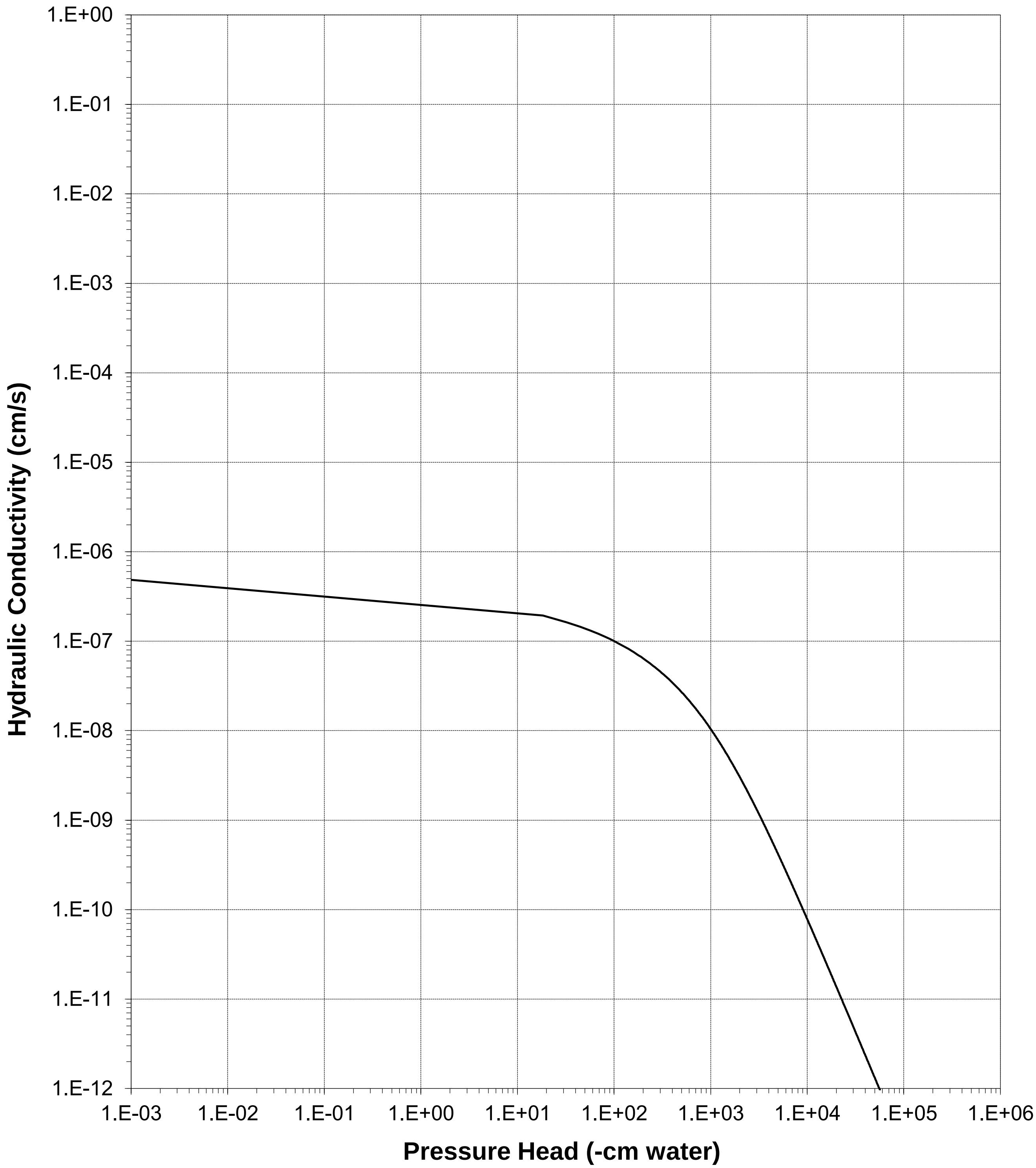
Plot of Relative Hydraulic Conductivity vs Pressure Head

Sample Number: CHR-071117-Clay (90%)



Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: CHR-071117-Clay (90%)



Oversize Correction Data Sheet

Job Name: Stantec MWH
Job Number: DB17.1177.00
Sample Number: CHR-071117-Clay (90%)
Project Name: NECR Jetty Borrow Soil
PO Number: P30109-N

Split (3/4", 3/8", #4): #4

	Coarse Fraction*	Fines Fraction**	Composite
Subsample Mass (g):	0.19	99.81	100.00
Mass Fraction (%):	0.19	99.81	100.00
Initial Sample θ_i			
Bulk Density (g/cm^3):	2.65	1.54	1.54
Calculated Porosity (% vol):	0.00	41.84	41.80
Volume of Solids (cm^3):	0.07	37.66	37.74
Volume of Voids (cm^3):	0.00	27.10	27.10
Total Volume (cm^3):	0.07	64.76	64.84
Volumetric Fraction (%):	0.11	99.89	100.00
Initial Moisture Content (% vol):	0.00	27.13	---
Saturated Sample θ_s			
Bulk Density (g/cm^3):	2.65	1.50	1.51
Calculated Porosity (% vol):	0.00	43.24	43.20
Volume of Solids (cm^3):	0.07	37.66	37.74
Volume of Voids (cm^3):	0.00	28.70	28.70
Total Volume (cm^3):	0.07	66.36	66.43
Volumetric Fraction (%):	0.11	99.89	100.00
Saturated Moisture Content (% vol):	0.00	37.78	---
Residual Sample θ_r			
Bulk Density (g/cm^3):	2.65	1.52	1.52
Calculated Porosity (% vol):	0.00	42.65	42.60
Volume of Solids (cm^3):	0.07	37.66	37.74
Volume of Voids (cm^3):	0.00	28.00	28.00
Total Volume (cm^3):	0.07	65.67	65.74
Volumetric Fraction (%):	0.11	99.89	100.00
Residual Moisture Content (% vol):	0.00	0.00	---
Ksat (cm/sec):	NM	4.8E-07	---

* = Porosity and moisture content of coarse fraction assumed to be zero.
** = Volume adjusted, if applicable. See notes on Moisture Retention Data pages.
NM = Not measured
--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd
Data entered by: J. Falance
Checked by: J. Hines

Moisture Retention Data
Hanging Column / Pressure Plate
(Soil-Water Characteristic Curve)

Job Name:	Stantec MWH	*Dry wt. of sample (g):*	360.15
Job Number:	DB17.1177.00	*Tare wt., ring (g):*	133.38
Sample Number:	CHR-071117-Sand (91%)	*Tare wt., screen & clamp (g):*	24.13
Project Name:	NECR Jetty Borrow Soil	*Initial sample volume (cm^3):*	222.72
PO Number:	P30109-N	*Initial dry bulk density (g/cm^3):*	1.62
		Assumed particle density (g/cm^3):	2.65
		Initial calculated total porosity (%):	38.98

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content † (% vol)
Hanging column:	15-Aug-17	8:15	593.47	0	34.04
	22-Aug-17	8:20	592.96	12.0	33.81
	29-Aug-17	16:40	592.09	35.0	33.42
	5-Sep-17	16:30	570.63	105.0	23.78
Pressure plate:	18-Sep-17	12:40	563.34	337	20.51

Volume Adjusted Data [1]

	Matric Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calculated Porosity (%)
Hanging column:	0.0	---	---	---	---
	12.0	---	---	---	---
	35.0	---	---	---	---
	105.0	---	---	---	---
Pressure plate:	337	---	---	---	---

Comments:

1 Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent each of the volume change measurements obtained after saturated hydraulic conductivity testing and throughout hanging column/pressure plate testing. "---" indicates no volume changes occurred.

2 Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

† Assumed density of water is 1.0 g/cm^3

‡‡ Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Technician Notes:

Laboratory analysis by: D. O'Dowd
Data entered by: J. Falance
Checked by: J. Hines

Moisture Retention Data

Dew Point Potentiometer / Relative Humidity Box

(Soil-Water Characteristic Curve)

Sample Number: CHR-071117-Sand (91%)

Initial sample bulk density (g/cm³)*:* 1.62
Fraction of test sample used (<2.00mm fraction) (%): 100.00

Dry weight of dew point potentiometer sample* (g)*:* 169.66
Tare weight, jar (g)*:* 114.22

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Dew point potentiometer:	11-Sep-17	10:25	174.01	5303	12.68
	6-Sep-17	12:05	172.30	28350	7.71
	30-Aug-17	15:55	171.48	128189	5.32
	28-Aug-17	10:50	170.93	549468	3.69

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm³)	% Volume Change [2] (%)	Adjusted Density (g/cm³)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	5303	---	---	---	---
	28350	---	---	---	---
	128189	---	---	---	---
	549468	---	---	---	---

Comments:

[1] Applicable if the sample experienced volume changes during testing. ‘Volume Adjusted’ values represent the volume change measurements obtained after the last hanging column or pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

† Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm³.

‡‡ Volume adjustments are applicable at this matric potential (see comment #1).

Laboratory analysis by: D. O'Dowd/A. Bland
Data entered by: J. Falance
Checked by: J. Hines

Moisture Retention Data

Dew Point Potentiometer / Relative Humidity Box

(Soil-Water Characteristic Curve)

Sample Number: CHR-071117-Sand (91%)

Initial sample bulk density (g/cm^3)*:* 1.62
Fraction of test sample used (<2.00mm fraction) (%): 100.00

Dry weight of relative humidity box sample* (g)*:* 100.64
Tare weight (g)*:* 85.71

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Relative humidity box:	1-Sep-17	17:40	100.93	851293	3.12

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Relative humidity box:	851293	---	---	---	---

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the last hanging column or pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

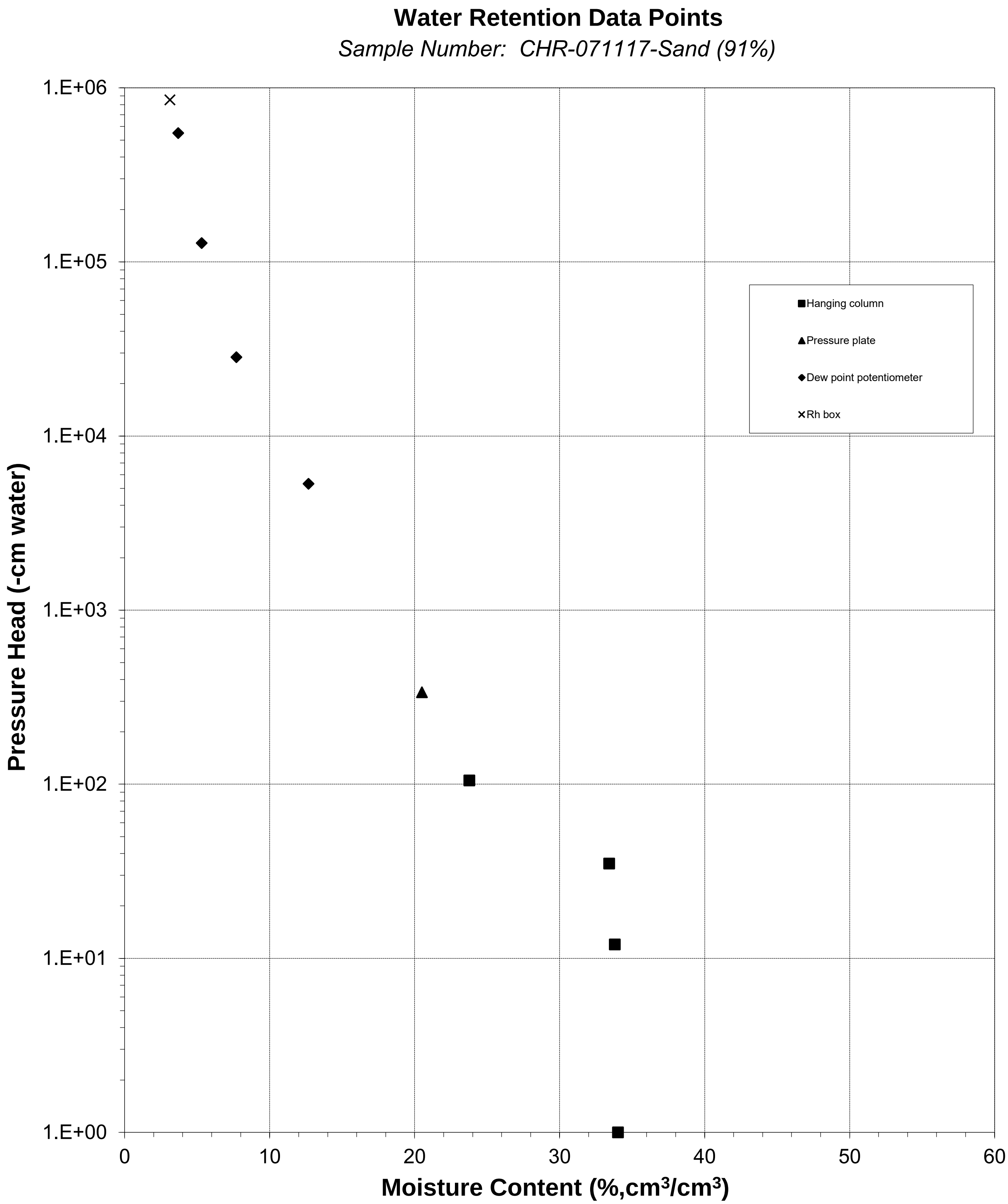
* Weight including tares

† Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.

‡‡ Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

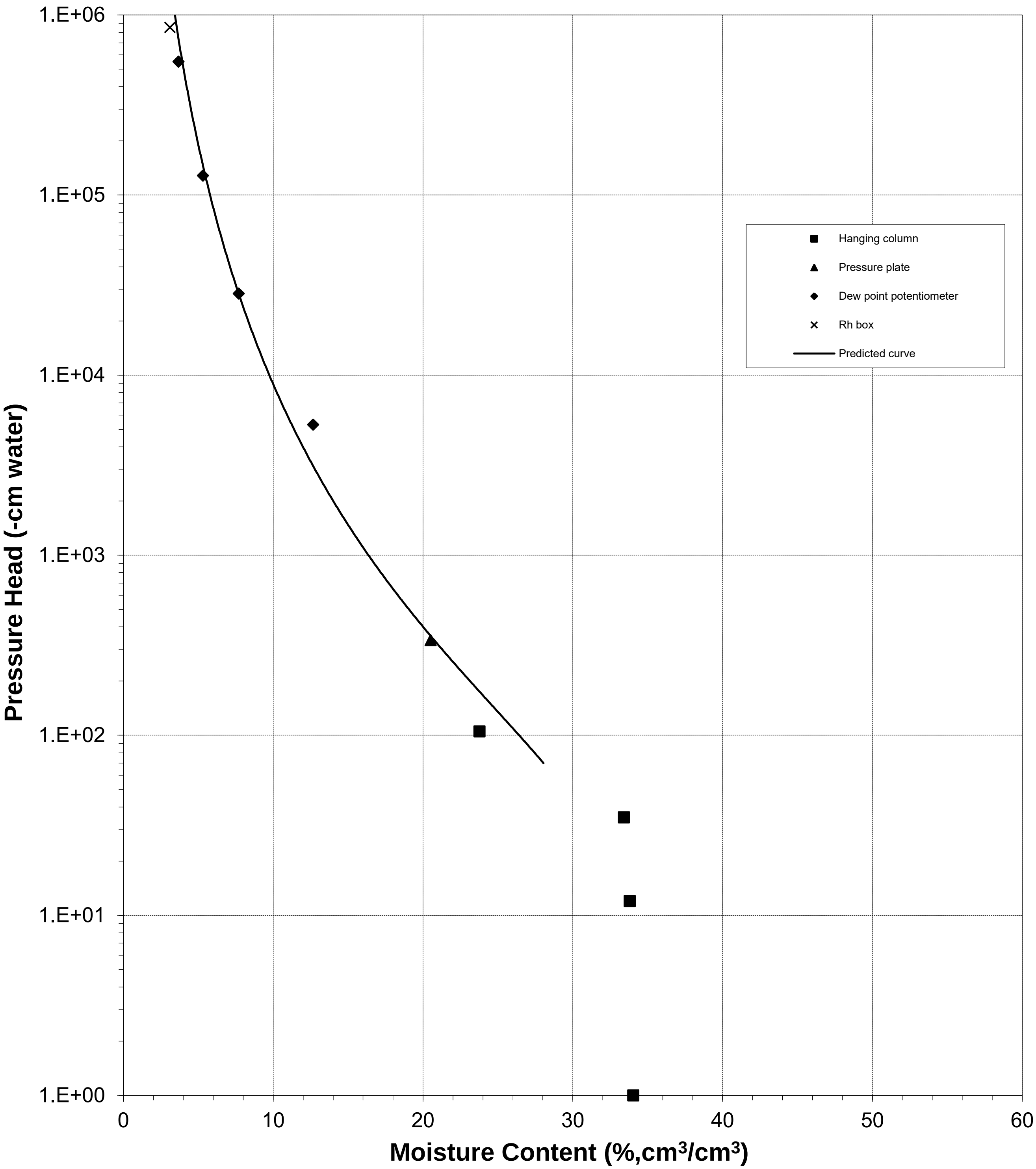
Laboratory analysis by: D. O'Dowd/A. Bland
Data entered by: J. Falance
Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.



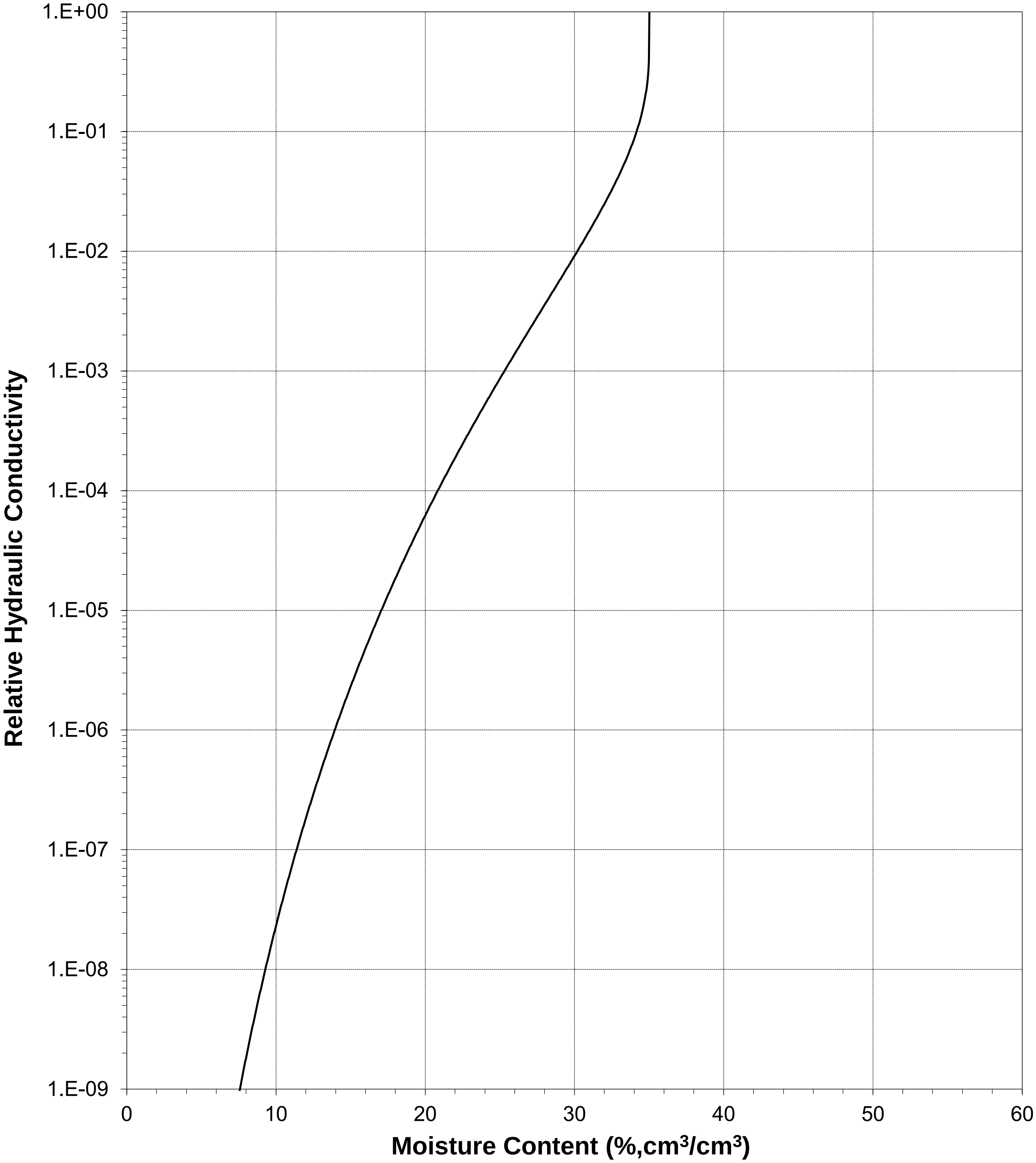
Predicted Water Retention Curve and Data Points

Sample Number: CHR-071117-Sand (91%)



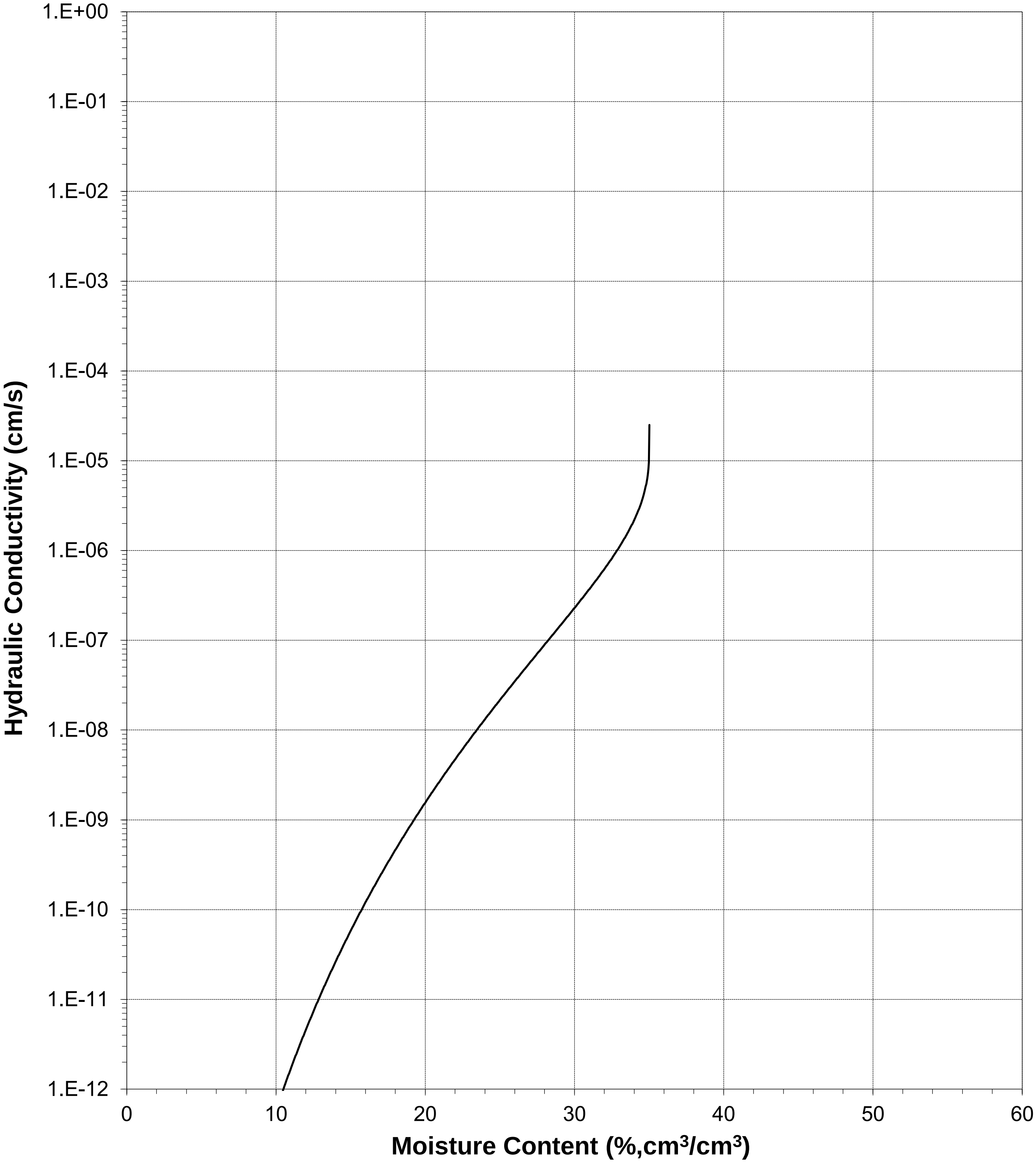
Plot of Relative Hydraulic Conductivity vs Moisture Content

Sample Number: CHR-071117-Sand (91%)



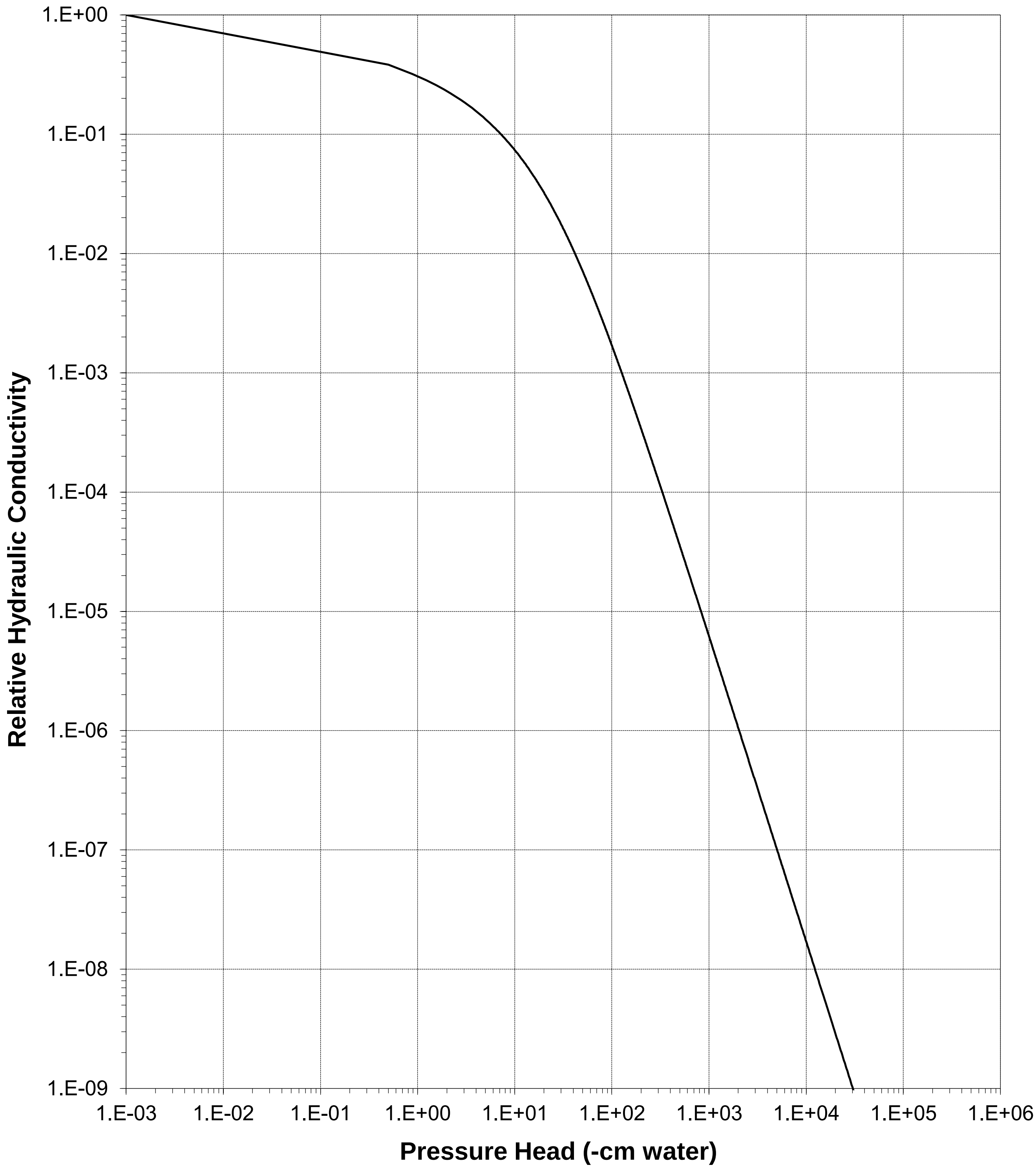
Plot of Hydraulic Conductivity vs Moisture Content

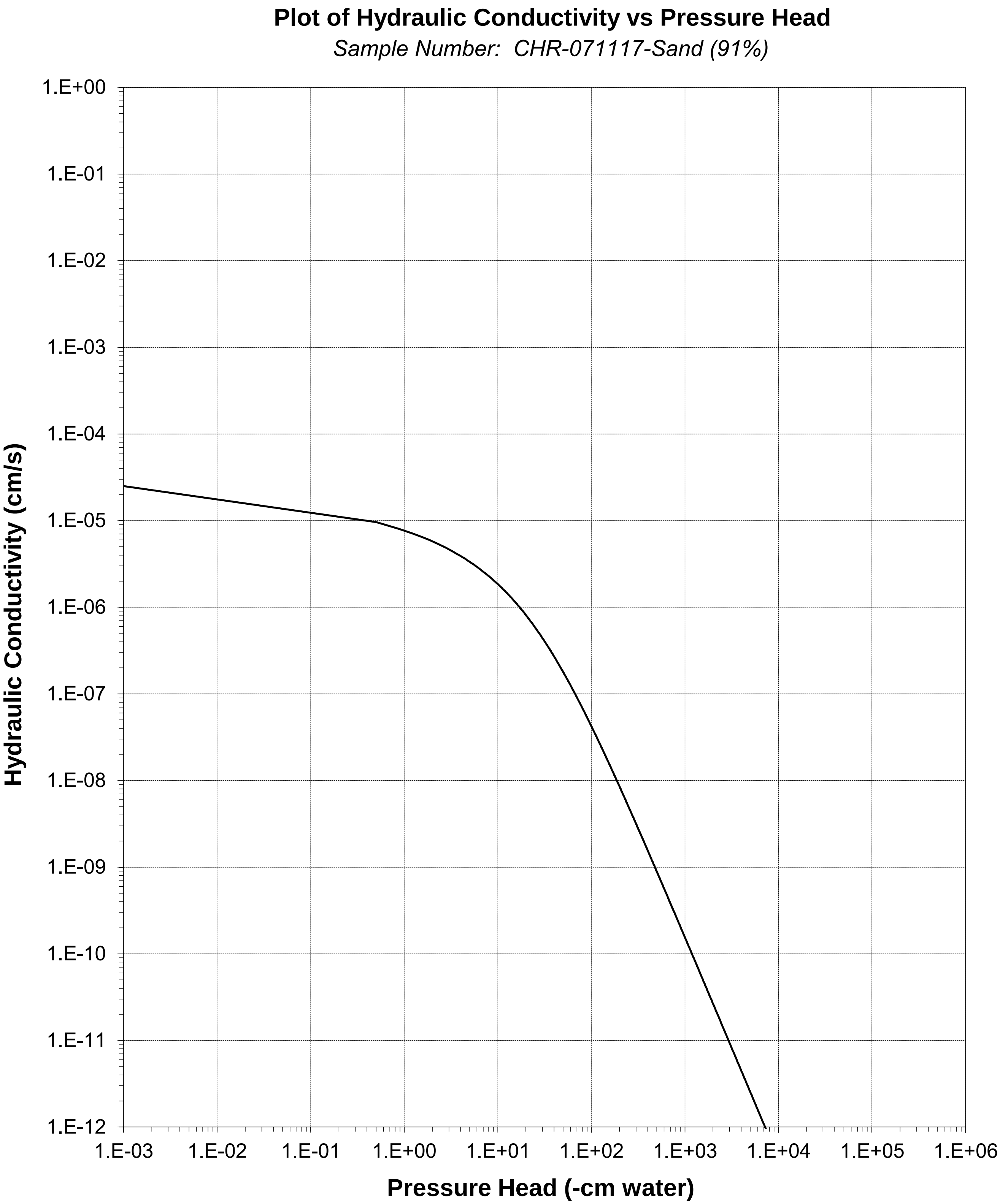
Sample Number: CHR-071117-Sand (91%)



Plot of Relative Hydraulic Conductivity vs Pressure Head

Sample Number: CHR-071117-Sand (91%)




Plot of Hydraulic Conductivity vs Pressure Head
Sample Number: CHR-071117-Sand (91%)
Hydraulic Conductivity (cm/s)
1.E+00
1.E-01
1.E-02
1.E-03
1.E-04
1.E-05
1.E-06
1.E-07
1.E-08
1.E-09
1.E-10
1.E-11
1.E-12
1.E-03
1.E-02
1.E-01
1.E+00
1.E+01
1.E+02
1.E+03
1.E+04
1.E+05
1.E+06
Pressure Head (-cm water)

Daniel B. Stephens & Associates, Inc.

Oversize Correction Data Sheet

Job Name:	Stantec MWH
Job Number:	DB17.1177.00
Sample Number:	CHR-071117-Sand (91%)
Project Name:	NECR Jetty Borrow Soil
PO Number:	P30109-N
Split (3/4", 3/8", #4):	#4

	Coarse Fraction*	Fines Fraction**	Composite
Subsample Mass (g):	0.00	100.00	100.00
Mass Fraction (%):	0.00	100.00	100.00
Initial Sample θ_i			
Bulk Density (g/cm^3):	2.65	1.62	1.62
Calculated Porosity (% vol):	0.00	38.98	38.98
Volume of Solids (cm^3):	0.00	37.74	37.74
Volume of Voids (cm^3):	0.00	24.10	24.10
Total Volume (cm^3):	0.00	61.84	61.84
Volumetric Fraction (%):	0.00	100.00	100.00
Initial Moisture Content (% vol):	0.00	23.87	---
Saturated Sample θ_s			
Bulk Density (g/cm^3):	2.65	1.62	1.62
Calculated Porosity (% vol):	0.00	38.98	38.98
Volume of Solids (cm^3):	0.00	37.74	37.74
Volume of Voids (cm^3):	0.00	24.10	24.10
Total Volume (cm^3):	0.00	61.84	61.84
Volumetric Fraction (%):	0.00	100.00	100.00
Saturated Moisture Content (% vol):	0.00	35.02	---
Residual Sample θ_r			
Bulk Density (g/cm^3):	2.65	1.62	1.62
Calculated Porosity (% vol):	0.00	38.98	38.98
Volume of Solids (cm^3):	0.00	37.74	37.74
Volume of Voids (cm^3):	0.00	24.10	24.10
Total Volume (cm^3):	0.00	61.84	61.84
Volumetric Fraction (%):	0.00	100.00	100.00
Residual Moisture Content (% vol):	0.00	0.00	---
Ksat (cm/sec):	NM	2.5E-05	---

* = Porosity and moisture content of coarse fraction assumed to be zero.
** = Volume adjusted, if applicable. See notes on Moisture Retention Data pages.
NM = Not measured
--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd
Data entered by: J. Falance
Checked by: J. Hines

Particle Size Analysis

Summary of Particle Size Characteristics

Sample Number	d_{10} (mm)	d_{50} (mm)	d_{60} (mm)	C_u	C_c	Method	ASTM Classification	USDA Classification	
CHR-071117-Clay	0.00016	0.0068	0.015	94	0.50	WS/H	Lean clay with sand (CL)s	Clay Loam	(Est)
CHR-071117-Sand	8.8E-14	0.11	0.14	1.6E+12	3.1E+11	WS/H	Silty sand (SM)	Sandy Loam	(Est)

d_{50} = Median particle diameter

Est = Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

† Greater than 10% of sample is coarse material

Percent Gravel, Sand, Silt and Clay*

Sample Number	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
CHR-071117-Clay	0.2	20.0	44.1	35.8
CHR-071117-Sand	0.0	64.5	23.9	11.6

*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name:	Stantec MWH	*Initial Dry Weight of Sample (g):*	199.63
Job Number:	DB17.1177.00	*Weight Passing #10 (g):*	199.03
Sample Number:	CHR-071117-Clay	*Weight Retained #10 (g):*	0.60
Project Name:	NECR Jetty Borrow Soil	*Weight of Hydrometer Sample (g):*	58.86
PO Number:	P30109-N	*Calculated Weight of Sieve Sample (g):*	59.04
Test Date:	23-Aug-17	*Shape:*	Angular
		Hardness:	Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	199.63	100.00
	2"	50	0.00	0.00	199.63	100.00
	1.5"	38.1	0.00	0.00	199.63	100.00
	1"	25	0.00	0.00	199.63	100.00
	3/4"	19.0	0.00	0.00	199.63	100.00
	3/8"	9.5	0.00	0.00	199.63	100.00
	4	4.75	0.37	0.37	199.26	99.81
	10	2.00	0.23	0.60	199.03	99.70
-10			(Based on calculated sieve wt.)			
	20	0.85	0.29	0.47	58.57	99.21
	40	0.425	0.37	0.84	58.20	98.58
	60	0.250	0.61	1.45	57.59	97.55
	140	0.106	6.28	7.73	51.31	86.91
	200	0.075	4.17	11.90	47.14	79.85
	dry pan		1.15	13.05	45.99	
	wet pan			45.99	0.00	

d_{10} (mm):	0.00016	d_{50} (mm):	0.0068
d_{16} (mm):	0.00029	d_{60} (mm):	0.015
d_{30} (mm):	0.0011	d_{84} (mm):	0.092

Median Particle Diameter --d_{50} (mm): 0.0068

Uniformity Coefficient, Cu --$[d_{60}/d_{10}]$ (mm): 94

Coefficient of Curvature, Cc --$[(d_{30})^2/(d_{10}*d_{60})]$ (mm): 0.50

Mean Particle Diameter --$[(d_{16}+d_{50}+d_{84})/3]$ (mm): 0.033

Note: Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

Classification of fines: CL

ASTM Soil Classification: Lean clay with sand (CL)s

USDA Soil Classification: Clay Loam

Laboratory analysis by: J. Falance/E. Bastien

Data entered by: J. Falance

Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Hydrometer Data

Job Name: Stantec MWH
Job Number: DB17.1177.00
Sample Number: CHR-071117-Clay
Project Name: NECR Jetty Borrow Soil
PO Number: P30109-N

Test Date: 21-Aug-17
Start Time: 9:06

Type of Water Used: DISTILLED
Reaction with H_2O_2: NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.51

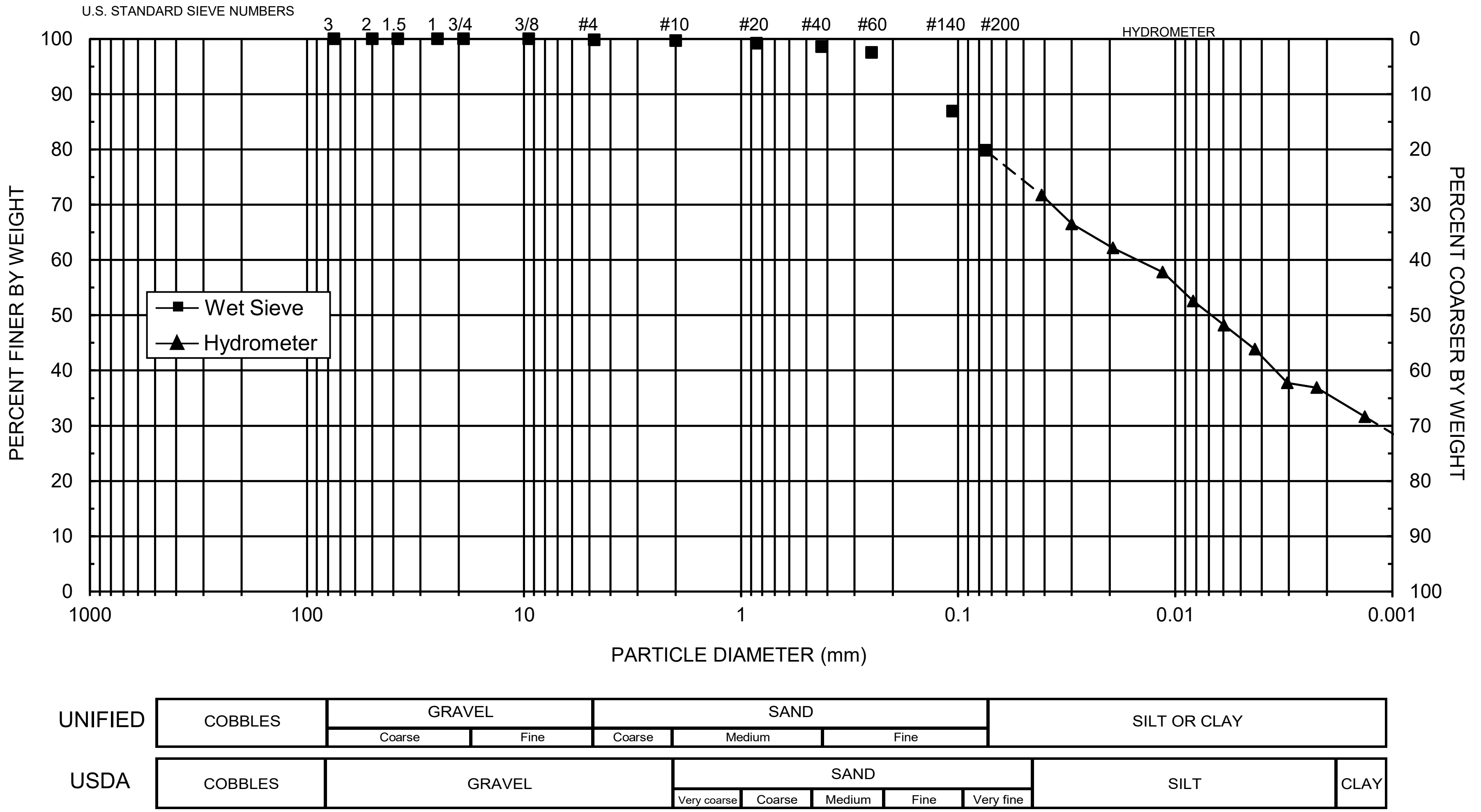
Initial Wt. (g): 58.86
Total Sample Wt. (g): 199.63
Wt. Passing #10 (g): 199.03

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	L (cm)	D (mm)	P (%)	% Finer
21-Aug-17	1	21.5	46.5	5.4	41.1	8.7	0.04119	72.0	71.8
	2	21.5	43.5	5.4	38.1	9.2	0.02994	66.7	66.5
	5	21.5	41.0	5.4	35.6	9.6	0.01935	62.3	62.2
	15	21.5	38.5	5.4	33.1	10.0	0.01141	58.0	57.8
	30	21.5	35.5	5.4	30.1	10.5	0.00826	52.7	52.6
	60	21.5	33.0	5.4	27.6	10.9	0.00596	48.4	48.2
	120	21.5	30.5	5.4	25.1	11.3	0.00429	44.0	43.8
	250	21.6	27.0	5.4	21.6	11.9	0.00304	37.9	37.8
	467	21.8	26.5	5.4	21.2	12.0	0.00223	37.0	36.9
22-Aug-17	1358	21.5	23.5	5.4	18.1	12.4	0.00134	31.7	31.6

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: D. Davis
Data entered by: J. Falance
Checked by: J. Hines



d_{10} = **0.00016**	d_{30} = **0.0011**	d_{50} = **0.0068**	d_{60} = **0.015**	C_u = **94**	C_c = **0.50**

SAMPLE NUMBER	PO NUMBER	ASTM CLASSIFICATION	USDA CLASSIFICATION
CHR-071117-Clay	**P30109-N**	**Lean clay with sand (CL)s**	**Clay Loam**

Note: Reported values for d_{10}, C_u, C_c, and ASTM classification are estimates, since extrapolation was required to obtain the d_{10} diameter

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Stantec MWH
Job Number: DB17.1177.00
Sample Number: CHR-071117-Sand
Project Name: NECR Jetty Borrow Soil
PO Number: P30109-N

Test Date: 23-Aug-17

Initial Dry Weight of Sample (g): 119.56
Weight Passing #10 (g): 119.56
Weight Retained #10 (g): 0.00
Weight of Hydrometer Sample (g): 59.09
Calculated Weight of Sieve Sample (g): 59.09

Shape: Angular
Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	119.56	100.00
	2"	50	0.00	0.00	119.56	100.00
	1.5"	38.1	0.00	0.00	119.56	100.00
	1"	25	0.00	0.00	119.56	100.00
	3/4"	19.0	0.00	0.00	119.56	100.00
	3/8"	9.5	0.00	0.00	119.56	100.00
	4	4.75	0.00	0.00	119.56	100.00
	10	2.00	0.00	0.00	119.56	100.00
-10			(Based on calculated sieve wt.)			
	20	0.85	0.12	0.12	58.97	99.80
	40	0.425	0.68	0.80	58.29	98.65
	60	0.250	4.97	5.77	53.32	90.24
	140	0.106	25.89	31.66	27.43	46.42
	200	0.075	6.48	38.14	20.95	35.45
	dry pan		1.83	39.97	19.12	
	wet pan			19.12	0.00	

d_{10} (mm): 8.8E-14 d_{50} (mm): 0.11
d_{16} (mm): 0.0099 d_{60} (mm): 0.14
d_{30} (mm): 0.062 d_{84} (mm): 0.22

Median Particle Diameter --d_{50} (mm): 0.11
Uniformity Coefficient, Cu --[d_{60}/d_{10}] (mm): 1.6E+12
Coefficient of Curvature, Cc --[$(d_{30})^2/(d_{10}*d_{60})$] (mm): 3.1E+11
Mean Particle Diameter --[$(d_{16}+d_{50}+d_{84})/3$] (mm): 0.11

Note: Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

Classification of fines (visual method): ML

ASTM Soil Classification: Silty sand (SM)
USDA Soil Classification: Sandy Loam

Laboratory analysis by: J. Falance
Data entered by: J. Falance
Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.

Particle Size Analysis
Hydrometer Data

Job Name: Stantec MWH
Job Number: DB17.1177.00
Sample Number: CHR-071117-Sand
Project Name: NECR Jetty Borrow Soil
PO Number: P30109-N

Test Date: 21-Aug-17
Start Time: 9:00

Type of Water Used: DISTILLED
Reaction with H_2O_2: NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.51

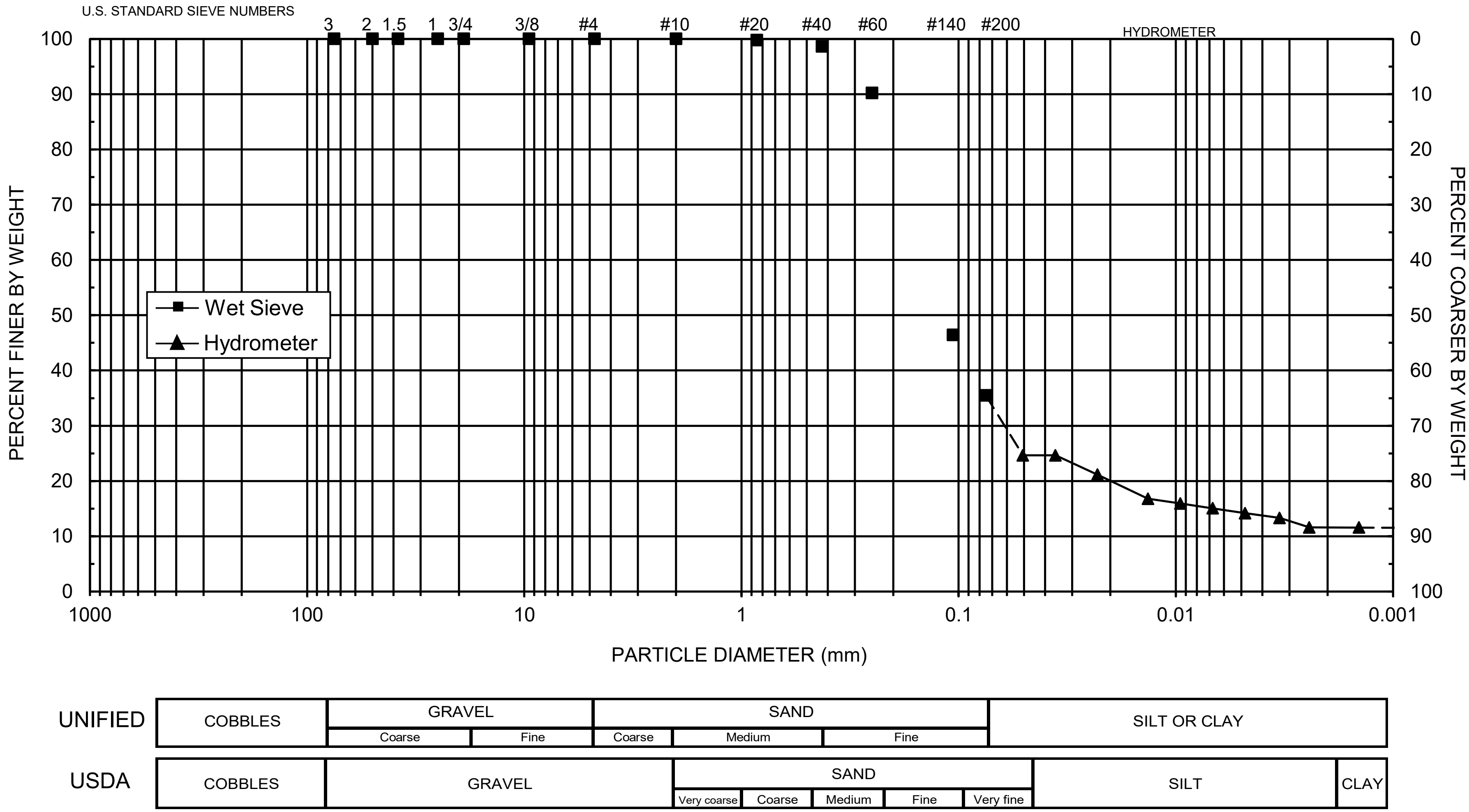
Initial Wt. (g): 59.09
Total Sample Wt. (g): 119.56
Wt. Passing #10 (g): 119.56

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	L (cm)	D (mm)	P (%)	% Finer
21-Aug-17	1	21.5	19.5	5.4	14.1	13.1	0.05062	24.6	24.6
	2	21.5	19.5	5.4	14.1	13.1	0.03579	24.6	24.6
	5	21.5	17.5	5.4	12.1	13.4	0.02292	21.1	21.1
	15	21.5	15.0	5.4	9.6	13.8	0.01343	16.8	16.8
	30	21.5	14.5	5.4	9.1	13.9	0.00953	15.9	15.9
	60	21.5	14.0	5.4	8.6	14.0	0.00676	15.0	15.0
	120	21.5	13.5	5.4	8.1	14.1	0.00479	14.2	14.2
	250	21.6	13.0	5.4	7.6	14.2	0.00332	13.3	13.3
	472	21.8	12.0	5.4	6.7	14.3	0.00243	11.6	11.6
22-Aug-17	1363	21.5	12.0	5.4	6.6	14.3	0.00143	11.6	11.6

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: D. Davis
Data entered by: J. Falance
Checked by: J. Hines



d_{10} = **8.8E-14**	d_{30} = **0.062**	d_{50} = **0.11**	d_{60} = **0.14**	C_u = **1.6E+12**	C_c = **3.1E+11**

SAMPLE NUMBER	PO NUMBER	ASTM CLASSIFICATION	USDA CLASSIFICATION
CHR-071117-Sand	**P30109-N**	**Silty sand (SM)**	**Sandy Loam**

Note: Reported values for d_{10}, C_u, C_c, and ASTM classification are estimates, since extrapolation was required to obtain the d_{10} diameter

Atterberg Limits/ Identification of Fines

Summary of Atterberg Tests

Sample Number	Liquid Limit	Plastic Limit	Plasticity Index	Classification
CHR-071117-Clay	43	19	24	CL
CHR-071117-Sand	---	---	---	ML

--- = Soil requires visual-manual classification due to non-plasticity

Atterberg Limits

Job Name:	Stantec MWH
Job Number:	DB17.1177.00
Sample Number:	CHR-071117-Clay
Project Name:	NECR Jetty Borrow Soil
PO Number:	P30109-N
Test Date:	17-Aug-17

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:	35	25	17
Pan number:	LL1	LL2	LL3
Weight of pan plus moist soil (g):	123.94	127.24	127.73
Weight of pan plus dry soil (g)	120.73	123.40	124.19
Weight of pan (g):	113.17	114.47	116.10
Gravimetric moisture content (% g/g):	42.46	43.00	43.76
Liquid Limit:	43		

Plastic Limit

	Trial 1	Trial 2
Pan number:	PL1	PL2
Weight of pan plus moist soil (g):	121.88	120.07
Weight of pan plus dry soil (g)	120.73	118.90
Weight of pan (g):	114.51	112.67
Gravimetric moisture content (% g/g):	18.49	18.78
Plastic Limit:	19	

Results

Percent of Sample Retained on #40 Sieve:	See Sieve
Liquid Limit:	43
Plastic Limit:	19
Plasticity Index:	24
Classification:	CL

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines

Atterberg Limits

Job Name:	Stantec MWH
Job Number:	DB17.1177.00
Sample Number:	CHR-071117-Sand
Project Name:	NECR Jetty Borrow Soil
PO Number:	P30109-N
Test Date:	17-Aug-17

Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

Results

Percent of Sample Retained on #40 Sieve:	See Sieve
Liquid Limit:	---
Plastic Limit:	---
Plasticity Index:	---
Classification (Visual Method):	ML

Comments:

--- = Soil requires visual-manual classification due to non-plasticity
* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines

Data for Description and Identification of Fines
(Visual-Manual Procedure)

Job Name: Stantec MWH
Job Number: DB17.1177.00
Sample Number: CHR-071117-Sand
Project Name: NECR Jetty Borrow Soil
PO Number: P30109-N

Test Date: 17-Aug-17

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

Descriptive Information:

Color of Moist Sample: Dark Brown (10YR 3/3)
Odor: None
Moisture Condition: Moist
HCl Reaction: Weak

Preliminary Identification:

Dry Strength: None
Dilatency: Rapid
Toughness: Low
Plasticity: Non-plastic

Identification of Inorganic Fine Grained Soils:

Silt (ML)

Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines

Laboratory Tests and Methods

Tests and Methods

Dry Bulk Density:	ASTM D7263
Moisture Content:	ASTM D7263, ASTM D2216
Calculated Porosity:	ASTM D7263
Saturated Hydraulic Conductivity:	
Falling Head Rising Tail: (Flexible Wall)	ASTM D5084
Hanging Column Method:	ASTM D6836 (modified apparatus)
Pressure Plate Method:	ASTM D6836 (modified apparatus)
Water Potential (Dewpoint Potentiometer) Method:	ASTM D6836
Relative Humidity (Box) Method:	Campbell, G. and G. Gee. 1986. Water Potential: Miscellaneous Methods. Chp. 25, pp. 631-632, in A. Klute (ed.), Methods of Soil Analysis. Part 1. American Society of Agronomy, Madison, WI; Karathanasis & Hajek. 1982. Quantitative Evaluation of Water Adsorption on Soil Clays. SSA Journal 46:1321-1325
Moisture Retention Characteristics & Calculated Unsaturated Hydraulic Conductivity:	ASTM D6836; van Genuchten, M.T. 1980. A closed-form equation for predicting the hydraulic conductivity of unsaturated soils. SSSAJ 44:892-898; van Genuchten, M.T., F.J. Leij, and S.R. Yates. 1991. The RETC code for quantifying the hydraulic functions of unsaturated soils. Robert S. Kerr Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Ada, Oklahoma. EPA/600/2091/065. December 1991
Particle Size Analysis:	ASTM D7928, ASTM D6913
USCS (ASTM) Classification:	ASTM D7928, ASTM D6913, ASTM D2487
USDA Classification:	ASTM D7928, ASTM D6913, USDA Soil Textural Triangle
Atterberg Limits:	ASTM D4318
Visual-Manual Description:	ASTM D2488

SAMPLE LOCATION	SAMPLE DEPTH (FT)	FIELD CLASS	MOISTURE (%)	DRY DENSITY (pcf)
B-4	16.0-16.5	--	10.4	77.6
B-5	10.5-11.0	--	5.2	82.9
B-5 (TRIAXIAL)	TW 25.0-27.5	--	21.2	98.8
B-5	40.5-41.0	--	22.7	99.6
B-6	15.5-16.5	--	10.7	93.0
B-6	40.5-41.0	--	17.9	97.0
B-7	TW 5.0-6.5	--	6.9	94.3
B-7	10.5-11.0	--	7.0	99.7
B-7	30.5-31.0	--	16.7	102.5

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2937 & ASTM D 2216

Ninyo & Moore

MOISTURE - DENSITY TEST DATA

FIGURE

STANTEC/MWH/LAB TESTING
PHOENIX, ARIZONA

PROJECT NO.	DATE
604667003	3/17

WEIGHT OF SAMPLE DISPERSED:	51.2	SPECIFIC GRAVITY OF SOLIDS:	2.650	Assumed
PERCENT PASSING #10 SIEVE:	100.0			

HYDROMETER RESULTS (% PASSING)

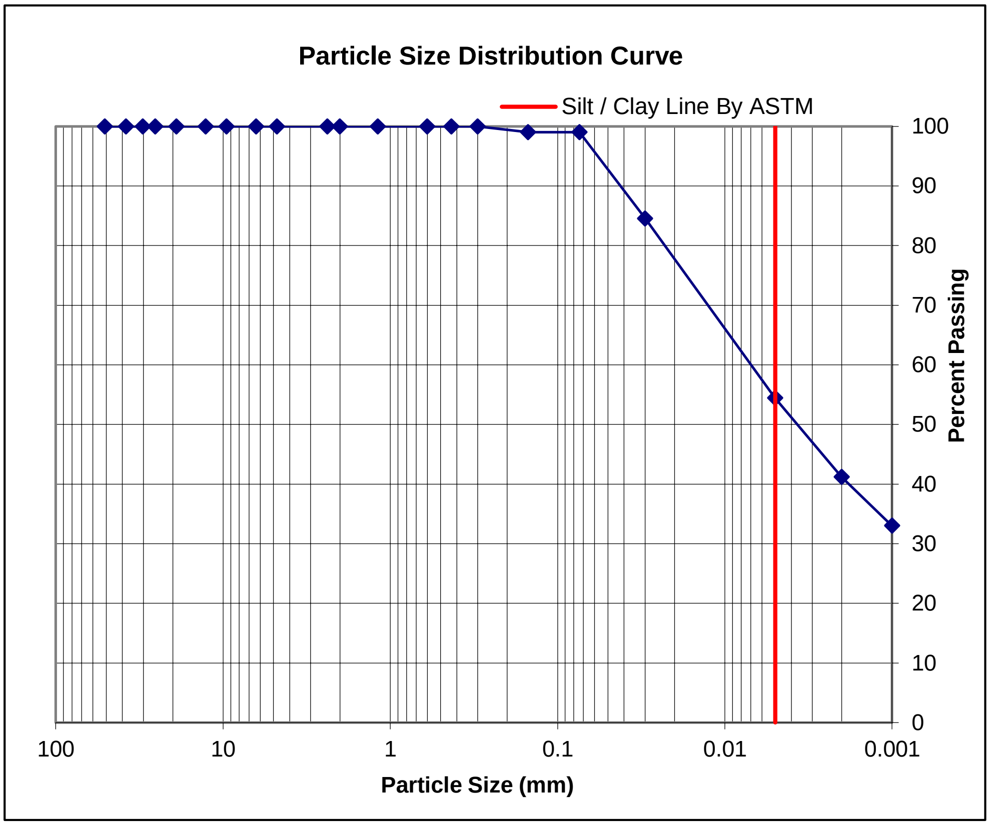
PARTICLE SIZE (DIA. mm)	**0.0438**	**0.0283**	**0.0168**	**0.0123**	**0.0089**	**0.0046**	**0.0020**	**0.0014**
PERCENT SAMPLE TESTED	87.9	84.0	78.2	70.3	65.5	52.8	41.0	37.1
PERCENT TOTAL SAMPLE	87.9	84.0	78.2	70.3	65.5	52.8	41.0	37.1

MECHANICAL SIEVE ANALYSIS AFTER HYDROMETER (% PASSING)

SCREEN SIZE	**#200**	**#100**	**#50**	**#40**	**#30**	**#16**	**#10**
PERCENT TOTAL SAMPLE	99.0	99.4	99.6	99.6	99.8	100.0	100.0

FULL SIEVE ANALYSIS MECHANICAL SIEVE & HYDROMETER

	% Pass	Spec
2 IN	100	
1 1/2 IN	100	
1 1/4 IN	100	
1 IN	100	
3/4 IN	100	
1/2 IN	100	
3/8 IN	100	
1/4 IN	100	
# 4	100	
# 8	100	
# 10	100	
# 16	100	
# 30	100	
# 40	100	
# 50	100	
# 100	99	
# 200	99	
0.03 mm	84.6	
0.005 mm	54.4	
0.002 mm	41.2	
0.001 mm	33.0	



Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	USCS
	B-5	40.5-41.0	49	20	29	--	--	0.007	--	--	99.0	CL

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422

Ninyo & Moore		PARTICLE-SIZE ANALYSIS OF SOILS (ASTM D422)	FIGURE
PROJECT NO.	DATE	STANTEC/MWH/LAB TESTING PHOENIX, ARIZONA	
604667003	3/17		

WEIGHT OF SAMPLE DISPERSED: 50.0

PERCENT PASSING #10 SIEVE: 100.0

SPECIFIC GRAVITY OF SOLIDS: 2.650 Assumed

HYDROMETER RESULTS (% PASSING)

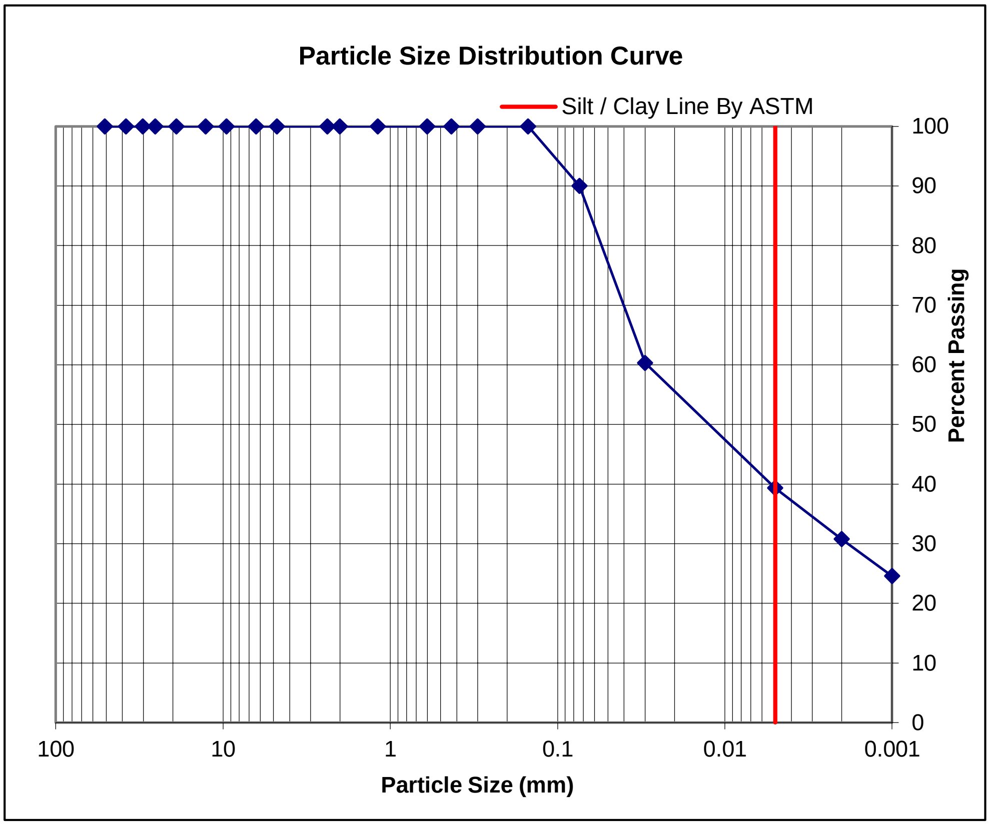
PARTICLE SIZE (DIA. mm)	**0.0485**	**0.0315**	**0.0187**	**0.0134**	**0.0096**	**0.0048**	**0.0021**	**0.0015**
PERCENT SAMPLE TESTED	68.0	61.0	54.0	50.0	46.0	39.0	31.0	28.0
PERCENT TOTAL SAMPLE	68.0	61.0	54.0	50.0	46.0	39.0	31.0	28.0

MECHANICAL SIEVE ANALYSIS AFTER HYDROMETER (% PASSING)

SCREEN SIZE	**#200**	**#100**	**#50**	**#40**	**#30**	**#16**	**#10**
PERCENT TOTAL SAMPLE	89.8	99.6	99.8	100.0	100.0	100.0	100.0

FULL SIEVE ANALYSIS MECHANICAL SIEVE & HYDROMETER

	% Pass	Spec
2 IN	100	
1 1/2 IN	100	
1 1/4 IN	100	
1 IN	100	
3/4 IN	100	
1/2 IN	100	
3/8 IN	100	
1/4 IN	100	
# 4	100	
# 8	100	
# 10	100	
# 16	100	
# 30	100	
# 40	100	
# 50	100	
# 100	100	
# 200	90	
0.03 mm	60.3	
0.005 mm	39.3	
0.002 mm	30.8	
0.001 mm	24.6	



Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	USCS
	B-6	15.0-16.0	42	17	25	--	0.002	0.029	--	--	90.0	CL

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422

Ninyo & Moore

PARTICLE-SIZE ANALYSIS OF SOILS (ASTM D422)

STANTEC/MWH/LAB TESTING

PHOENIX, ARIZONA

FIGURE

PROJECT NO.	DATE
604667003	3/17

WEIGHT OF SAMPLE DISPERSED:	50.0	SPECIFIC GRAVITY OF SOLIDS:	2.650	Assumed
PERCENT PASSING #10 SIEVE:	100.0			

HYDROMETER RESULTS (% PASSING)

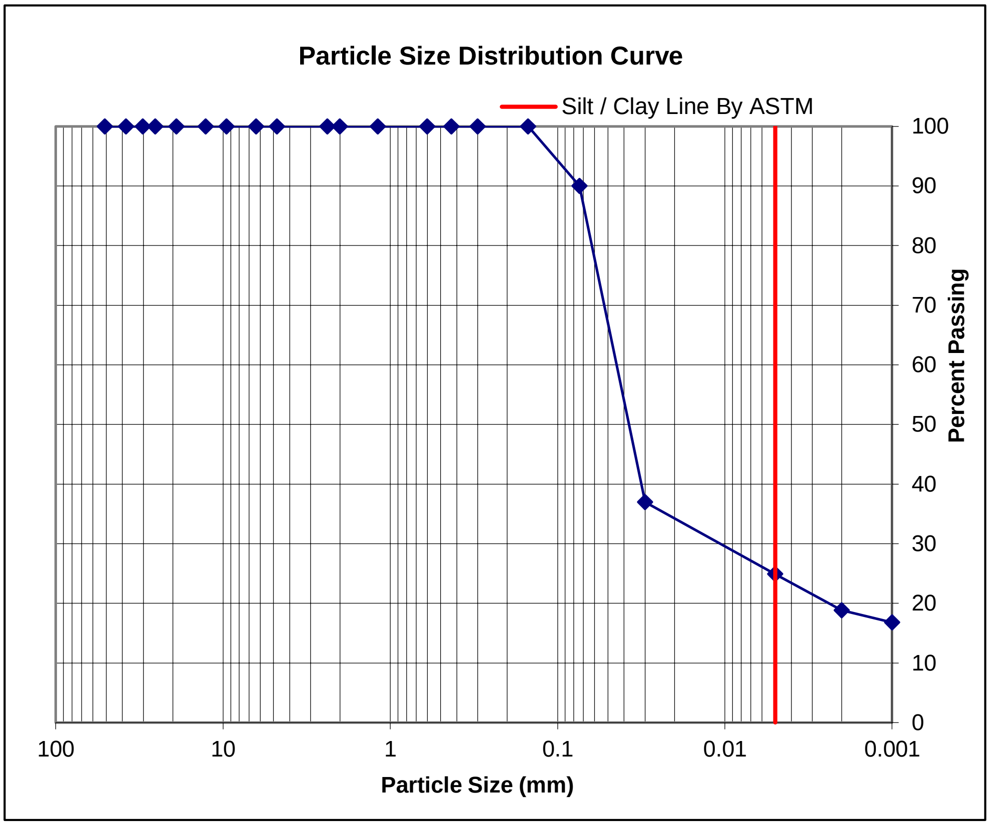
PARTICLE SIZE (DIA. mm)	**0.0535**	**0.0343**	**0.0201**	**0.0143**	**0.0102**	**0.0051**	**0.0021**	**0.0015**
PERCENT SAMPLE TESTED	42.0	38.0	34.0	32.0	29.0	25.0	19.0	18.0
PERCENT TOTAL SAMPLE	42.0	38.0	34.0	32.0	29.0	25.0	19.0	18.0

MECHANICAL SIEVE ANALYSIS AFTER HYDROMETER (% PASSING)

SCREEN SIZE	**#200**	**#100**	**#50**	**#40**	**#30**	**#16**	**#10**
PERCENT TOTAL SAMPLE	89.8	99.6	99.8	100.0	100.0	100.0	100.0

FULL SIEVE ANALYSIS MECHANICAL SIEVE & HYDROMETER

	% Pass	Spec
2 IN	100	
1 1/2 IN	100	
1 1/4 IN	100	
1 IN	100	
3/4 IN	100	
1/2 IN	100	
3/8 IN	100	
1/4 IN	100	
# 4	100	
# 8	100	
# 10	100	
# 16	100	
# 30	100	
# 40	100	
# 50	100	
# 100	100	
# 200	90	
0.03 mm	37.0	
0.005 mm	24.9	
0.002 mm	18.8	
0.001 mm	16.8	



Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	USCS
	B-7	10.5-11.0	--	--	N Test	--	0.011	0.044	--	--	90.0	

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422

Ninyo & Moore	**PARTICLE-SIZE ANALYSIS OF SOILS (ASTM D422)**	FIGURE
PROJECT NO. 604667003	DATE 3/17	STANTEC/MWH/LAB TESTING PHOENIX, ARIZONA

WEIGHT OF SAMPLE DISPERSED: 49.8
PERCENT PASSING #10 SIEVE: 100.0

SPECIFIC GRAVITY OF SOLIDS: 2.650 Assumed

HYDROMETER RESULTS (% PASSING)

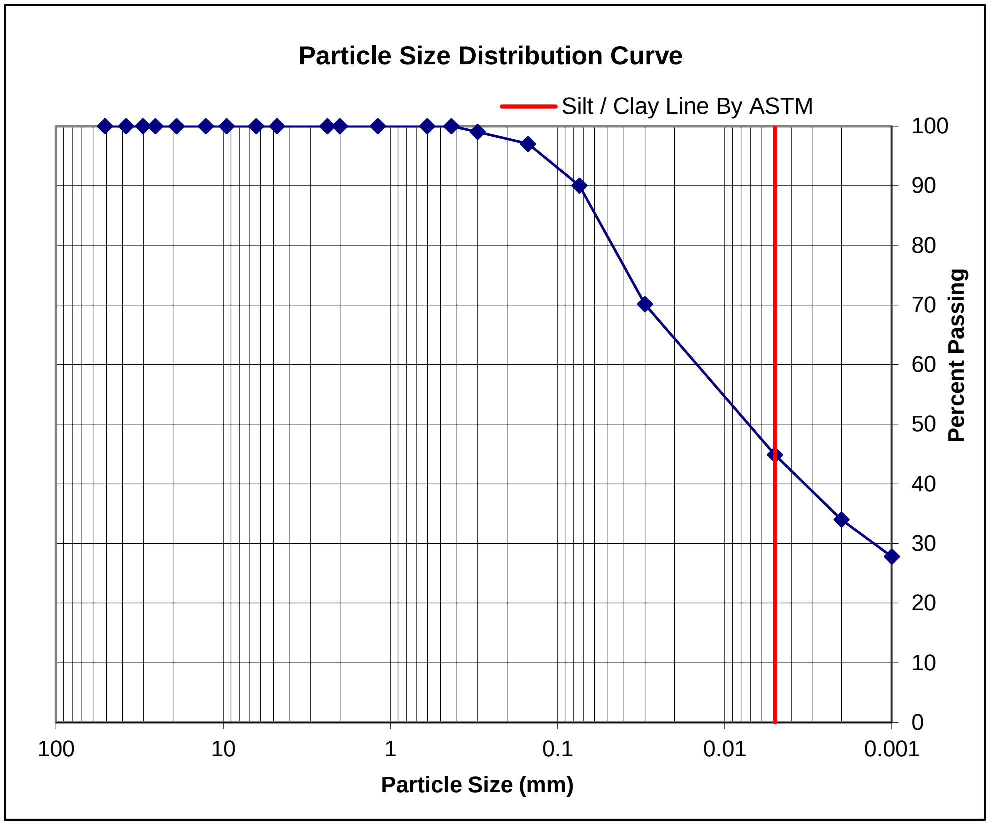
PARTICLE SIZE (DIA. mm)	**0.0470**	**0.0304**	**0.0181**	**0.0131**	**0.0094**	**0.0048**	**0.0020**	**0.0015**
PERCENT SAMPLE TESTED	75.3	70.3	63.2	57.2	53.2	44.2	34.1	31.1
PERCENT TOTAL SAMPLE	75.3	70.3	63.2	57.2	53.2	44.2	34.1	31.1

MECHANICAL SIEVE ANALYSIS AFTER HYDROMETER (% PASSING)

SCREEN SIZE	**#200**	**#100**	**#50**	**#40**	**#30**	**#16**	**#10**
PERCENT TOTAL SAMPLE	90.0	97.0	99.4	99.6	99.6	99.8	100.0

FULL SIEVE ANALYSIS MECHANICAL SIEVE & HYDROMETER

	% Pass	Spec
2 IN	100	
1 1/2 IN	100	
1 1/4 IN	100	
1 IN	100	
3/4 IN	100	
1/2 IN	100	
3/8 IN	100	
1/4 IN	100	
# 4	100	
# 8	100	
# 10	100	
# 16	100	
# 30	100	
# 40	100	
# 50	99	
# 100	97	
# 200	90	
0.03 mm	70.1	
0.005 mm	44.9	
0.002 mm	34.0	
0.001 mm	27.8	



Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	USCS
	TP-1	BUCKET	--	--	N Tested	--	0.001	0.015	--	--	90.0	

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422

Ninyo & Moore

PARTICLE-SIZE ANALYSIS OF SOILS (ASTM D422)

FIGURE

STANTEC/MWH/LAB TESTING
PHOENIX, ARIZONA

PROJECT NO.	DATE
604667003	3/17

WEIGHT OF SAMPLE DISPERSED: 54.5

PERCENT PASSING #10 SIEVE: 99.8

SPECIFIC GRAVITY OF SOLIDS: 2.650 Assumed

HYDROMETER RESULTS (% PASSING)

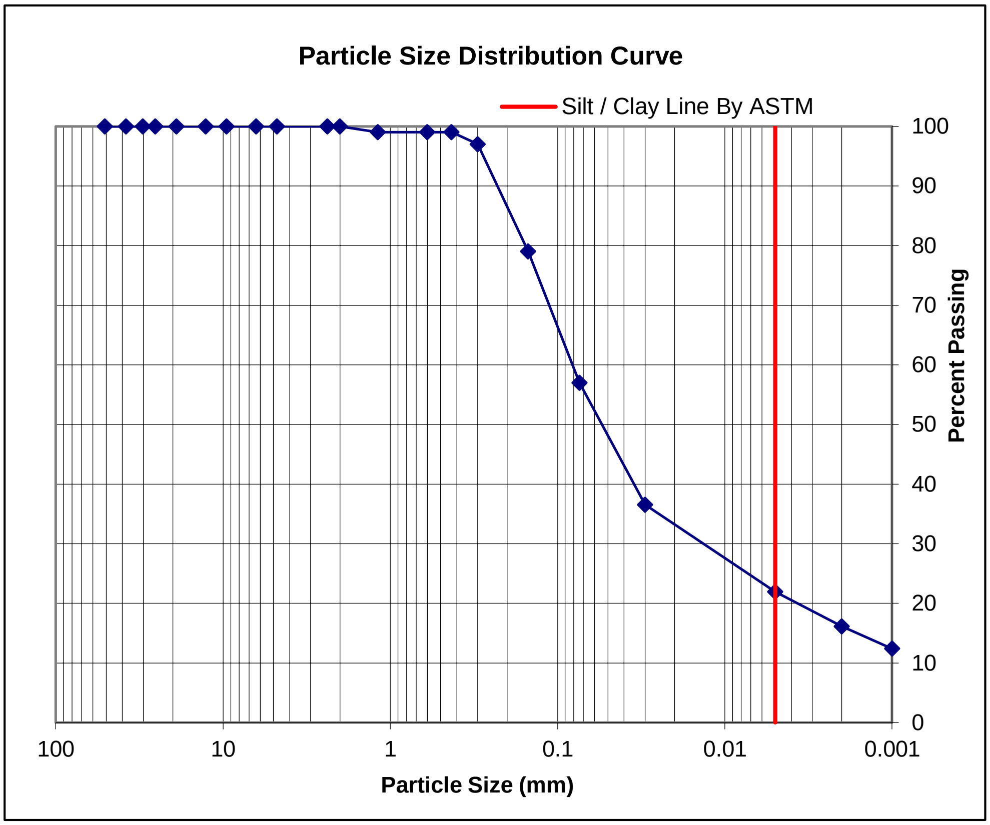
PARTICLE SIZE (DIA. mm)	0.0531	0.0339	0.0199	0.0142	0.0102	0.0051	0.0021	0.0015
PERCENT SAMPLE TESTED	40.4	37.6	33.0	31.2	27.5	22.0	16.5	14.7
PERCENT TOTAL SAMPLE	40.3	37.5	33.0	31.1	27.5	22.0	16.5	14.6

MECHANICAL SIEVE ANALYSIS AFTER HYDROMETER (% PASSING)

SCREEN SIZE	#200	#100	#50	#40	#30	#16	#10
PERCENT TOTAL SAMPLE	56.8	79.3	96.5	98.5	99.1	99.4	99.8

FULL SIEVE ANALYSIS MECHANICAL SIEVE & HYDROMETER

	% Pass	Spec
2 IN	100	
1 1/2 IN	100	
1 1/4 IN	100	
1 IN	100	
3/4 IN	100	
1/2 IN	100	
3/8 IN	100	
1/4 IN	100	
# 4	100	
# 8	100	
# 10	100	
# 16	99	
# 30	99	
# 40	99	
# 50	97	
# 100	79	
# 200	57	
0.03 mm	36.5	
0.005 mm	21.9	
0.002 mm	16.1	
0.001 mm	12.4	



Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	USCS
	TP-2	BUCKET	--	--	N Tested	--	0.013	0.081	--	--	57.0	

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422

Ninyo & Moore

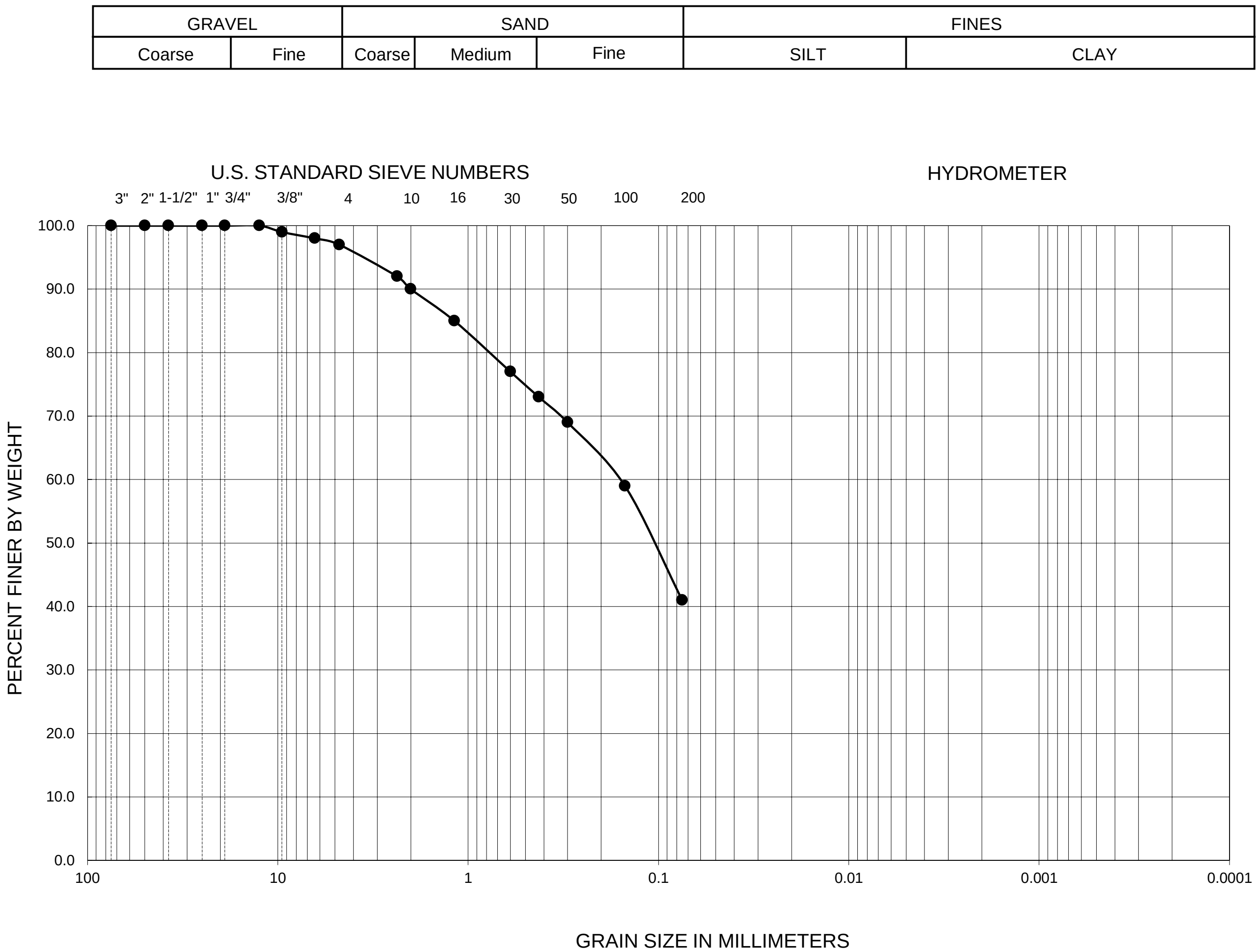
PARTICLE-SIZE ANALYSIS OF SOILS (ASTM D422)

FIGURE

PROJECT NO.	DATE
604667003	3/17

STANTEC/MWH/LAB TESTING

PHOENIX, ARIZONA



Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	USCS
●	TP-3	BUCKET	--	--	NT	--	--	0.16	--	--	41.0	

PERFORMED IN GENERAL ACCORDANCE WITH ASTM C136 AND C117

Ninyo & Moore	GRADATION TEST RESULTS	FIGURE
PROJECT NO. / DATE	STANTEC/MWH/LAB TESTING	
604667003 / 3/17	PHOENIX, ARIZONA	

WEIGHT OF SAMPLE DISPERSED: 51.8

PERCENT PASSING #10 SIEVE: 94.9

SPECIFIC GRAVITY OF SOLIDS: 2.650 Assumed

HYDROMETER RESULTS (% PASSING)

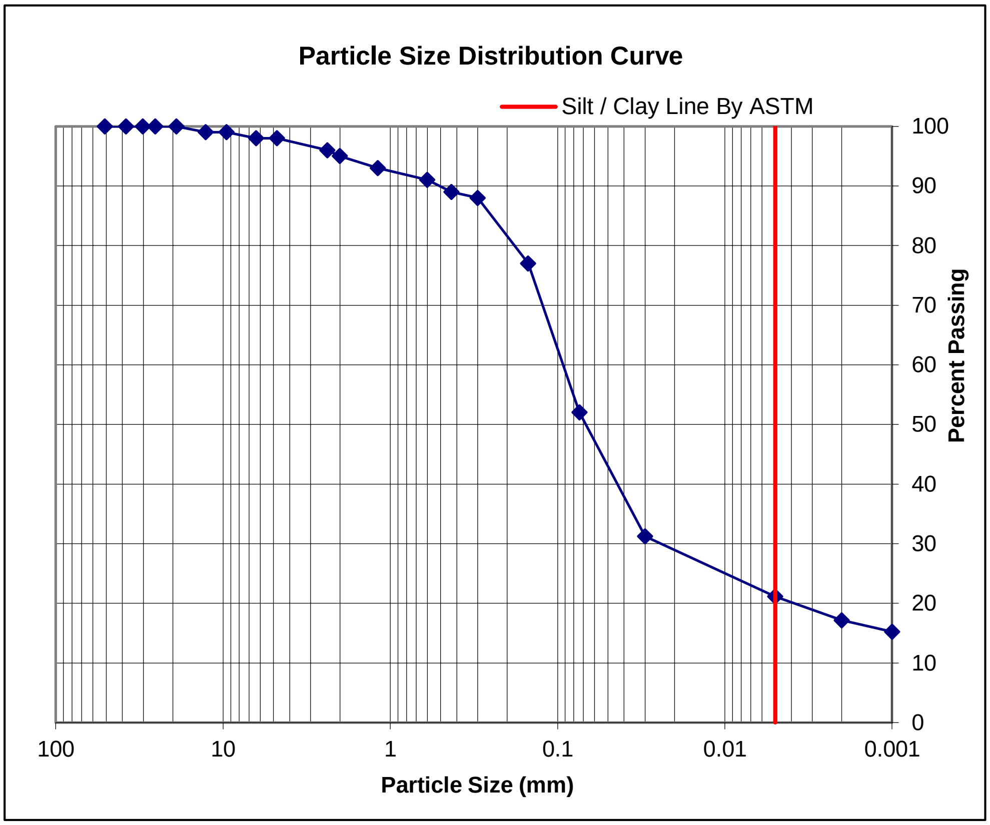
PARTICLE SIZE (DIA. mm)	**0.0544**	**0.0347**	**0.0204**	**0.0145**	**0.0103**	**0.0051**	**0.0022**	**0.0015**
PERCENT SAMPLE TESTED	35.7	32.8	27.0	27.0	24.1	21.2	17.4	16.4
PERCENT TOTAL SAMPLE	33.9	31.1	25.6	25.6	22.9	20.1	16.5	15.6

MECHANICAL SIEVE ANALYSIS AFTER HYDROMETER (% PASSING)

SCREEN SIZE	**#200**	**#100**	**#50**	**#40**	**#30**	**#16**	**#10**
PERCENT TOTAL SAMPLE	51.7	76.8	87.7	89.4	91.0	92.9	94.9

FULL SIEVE ANALYSIS
MECHANICAL SIEVE
& HYDROMETER

	% Pass	Spec
2 IN	100	
1 1/2 IN	100	
1 1/4 IN	100	
1 IN	100	
3/4 IN	100	
1/2 IN	99	
3/8 IN	99	
1/4 IN	98	
# 4	98	
# 8	96	
# 10	95	
# 16	93	
# 30	91	
# 40	89	
# 50	88	
# 100	77	
# 200	52	
0.03 mm	31.2	
0.005 mm	21.1	
0.002 mm	17.2	
0.001 mm	15.2	



Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	USCS
	TP-4	BUCKET	--	--	N Tested	--	0.024	0.093	--	--	52.0	

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PARTICLE-SIZE ANALYSIS OF SOILS (ASTM D422)

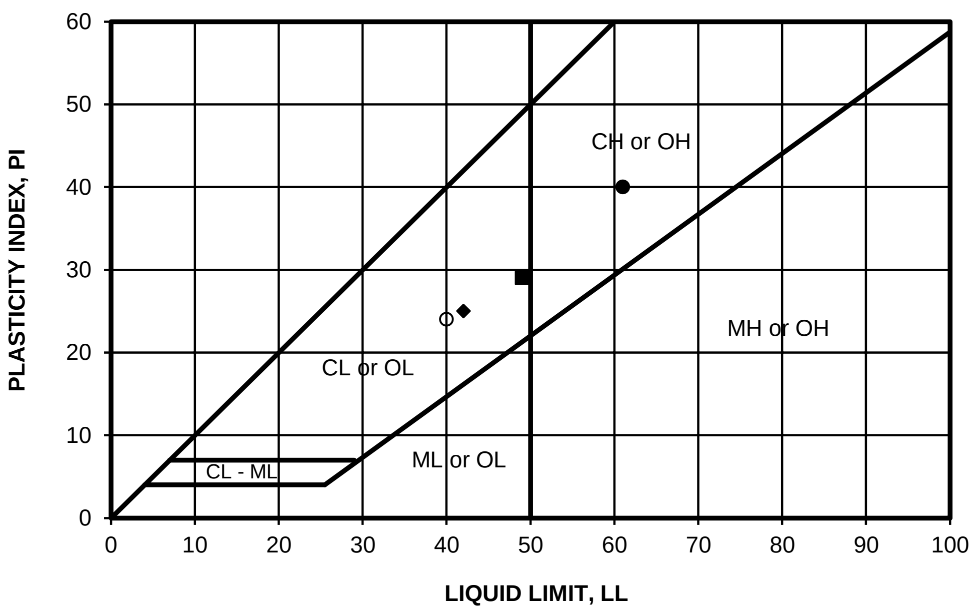
FIGURE

PROJECT NO.	DATE
604667003	3/17

STANTEC/MWH/LAB TESTING
PHOENIX, ARIZONA

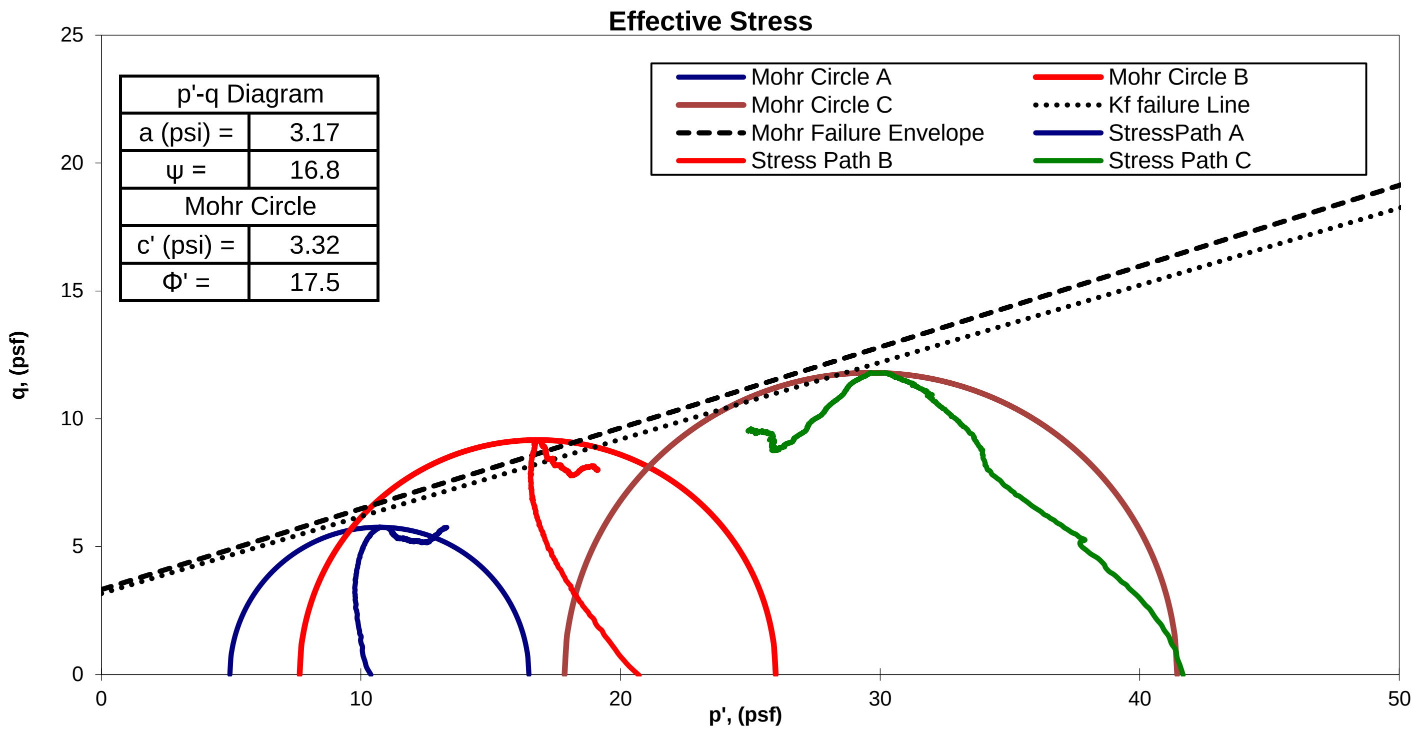
SYMBOL	LOCATION	DEPTH (FT)	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	USCS CLASSIFICATION (Fraction Finer Than No. 40 Sieve)	USCS (Entire Sample)
●	B-5	TW 25-27	61	21	40	CH	CH
■	B-5	40.5-41.0	49	20	29	CL	CL
◆	B-6	15.0-16.0	42	17	25	CL	CL
○	B7	30.5-31.0	40	16	24	CL	CL

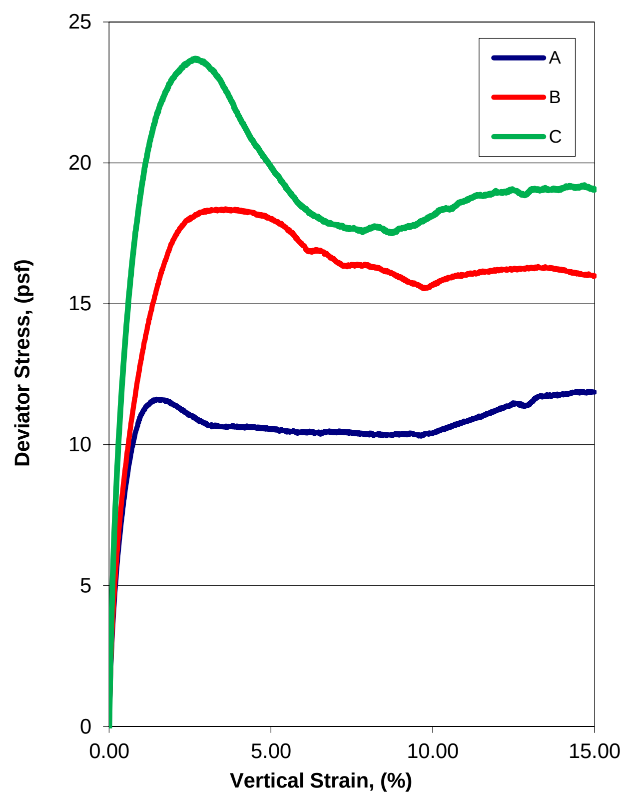
NP - INDICATES NON-PLASTIC



PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4318

Ninyo & Moore	ATTERBERG LIMITS TEST RESULTS	FIGURE
PROJECT NO. 604667003 / DATE 3/17	STANTEC/MWH/LAB TESTING PHOENIX, ARIZONA	





Location:		B-5		
Sample Depth:		TW 25.0-27.0		
Lab Technican:		JCE		
Checked By:		HJG		
Sample ID		A	B	C
Date Tested		2/25/2017	2/25/2017	2/25/2017
Initial	Diameter, in	2.88	2.88	2.87
	Height, in	5.68	5.71	5.68
	Water Content %	21.3%	21.5%	20.8%
	Dry Density, pcf	99.1	98.3	99.0
	Saturation, %	82.3%	81.2%	80.0%
	Void Ratio	0.700	0.714	0.701
Before Shear	Water Content %	26.1%	25.9%	25.0%
	Dry Density, pcf	96.8	98.5	98.4
	Saturation, %	100.0%	100.0%	100.0%
	Void Ratio	0.741	0.710	0.712
	Back pressure, psf	50	50	50
Obliquity Effective Failture %		1.28	3.32	2.89
Obliquity Total Failture %		1.28	3.32	2.89
Effective Confinement, psi		10.4	20.7	41.7
B- Value		0.95	0.95	0.95
Strain Rate, %/min		0.05	0.05	0.05

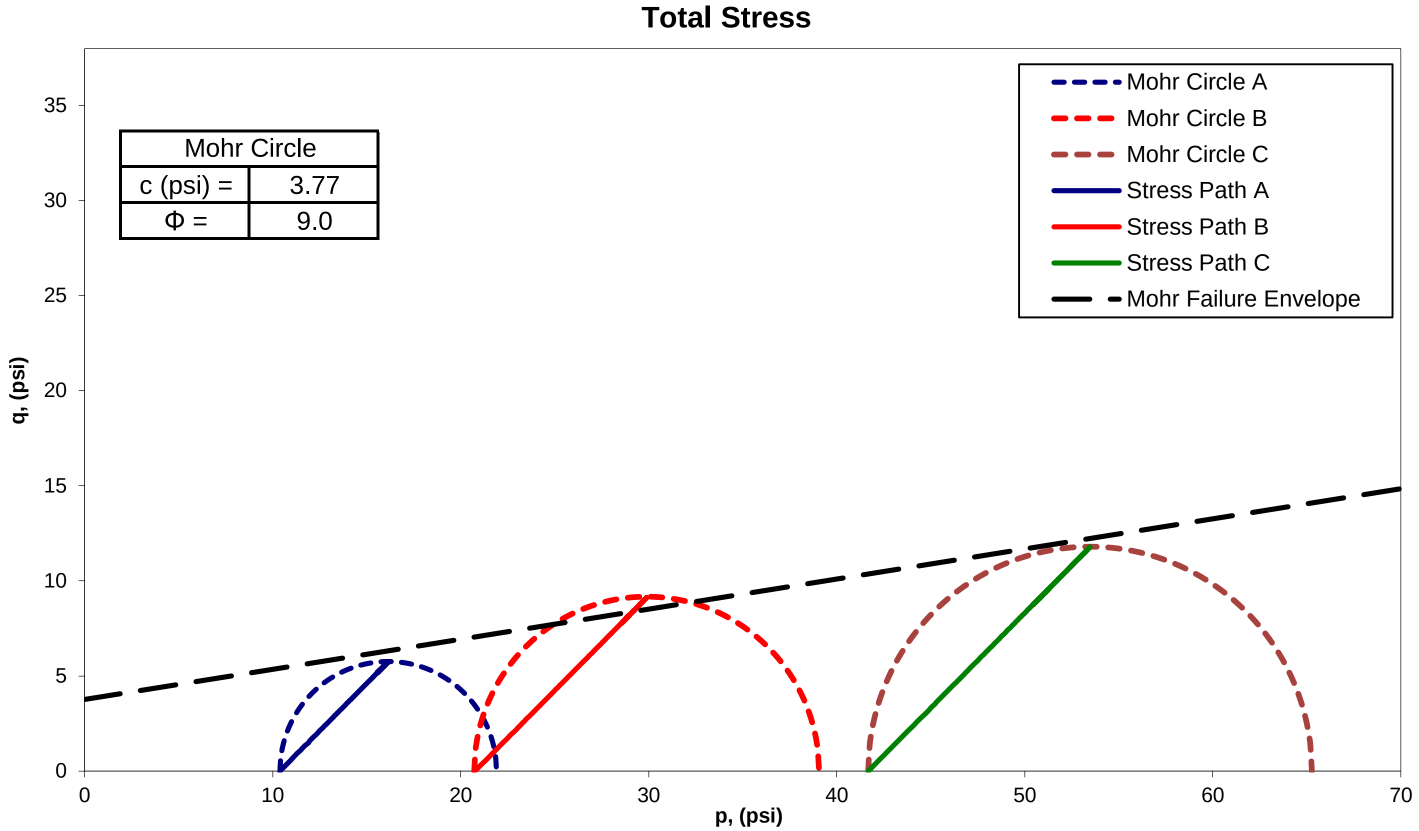
Ninyo & Moore

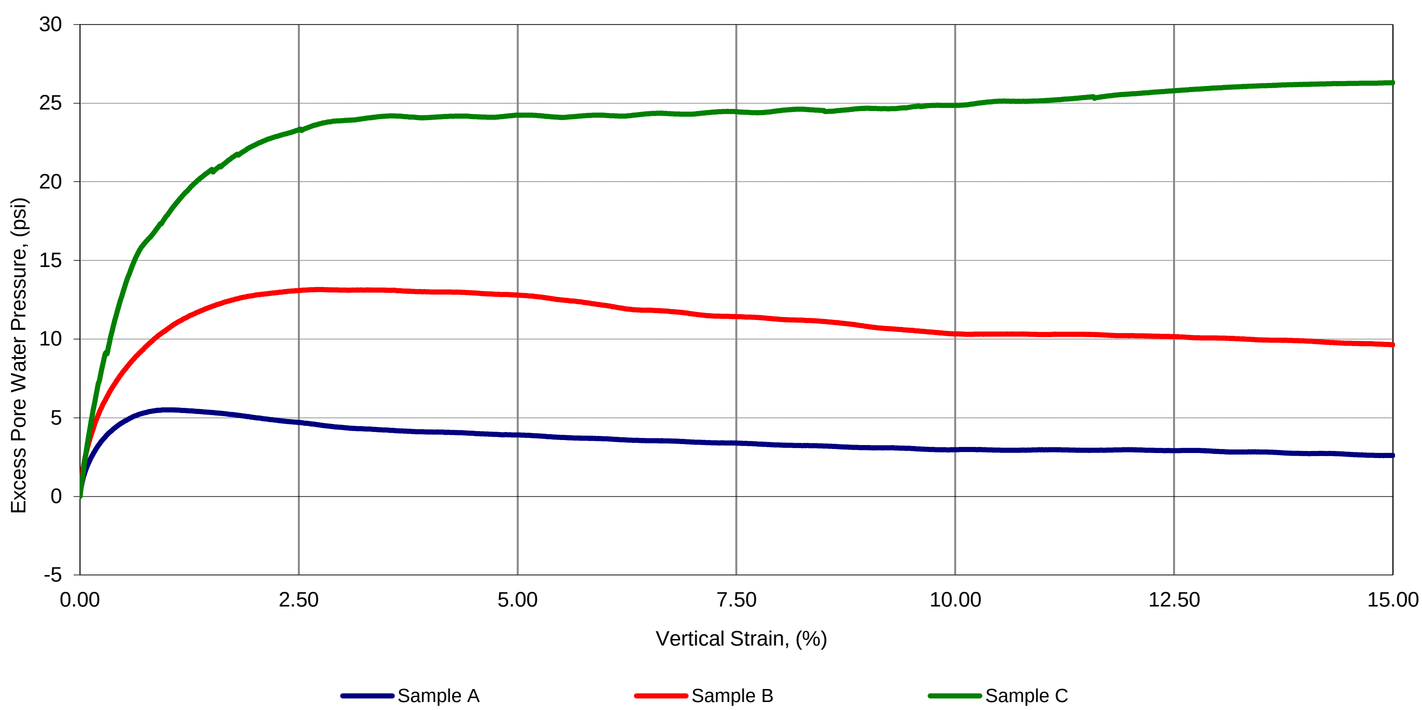
Project Number	Date
604667003	3/17

Consolidated Undrained Triaxial Test Data Sheet

STANTEC/MWH/LAB TESTING
PHOENIX, ARIZONA

Figure





Location:	B-5
Sample Depth (ft):	TW 25.0-27.0
Project Number:	604667003
Date:	3/17

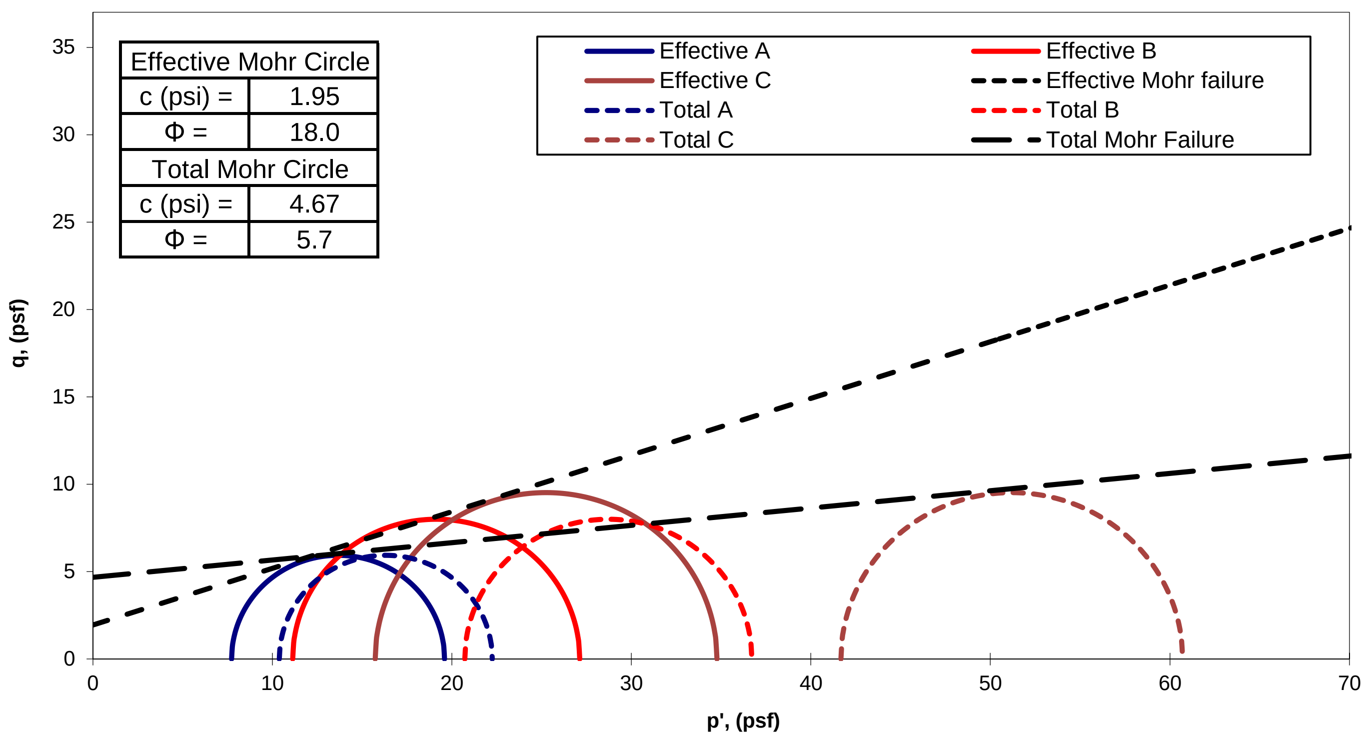
Consolidated Undrained Triaxial Test Data Sheet

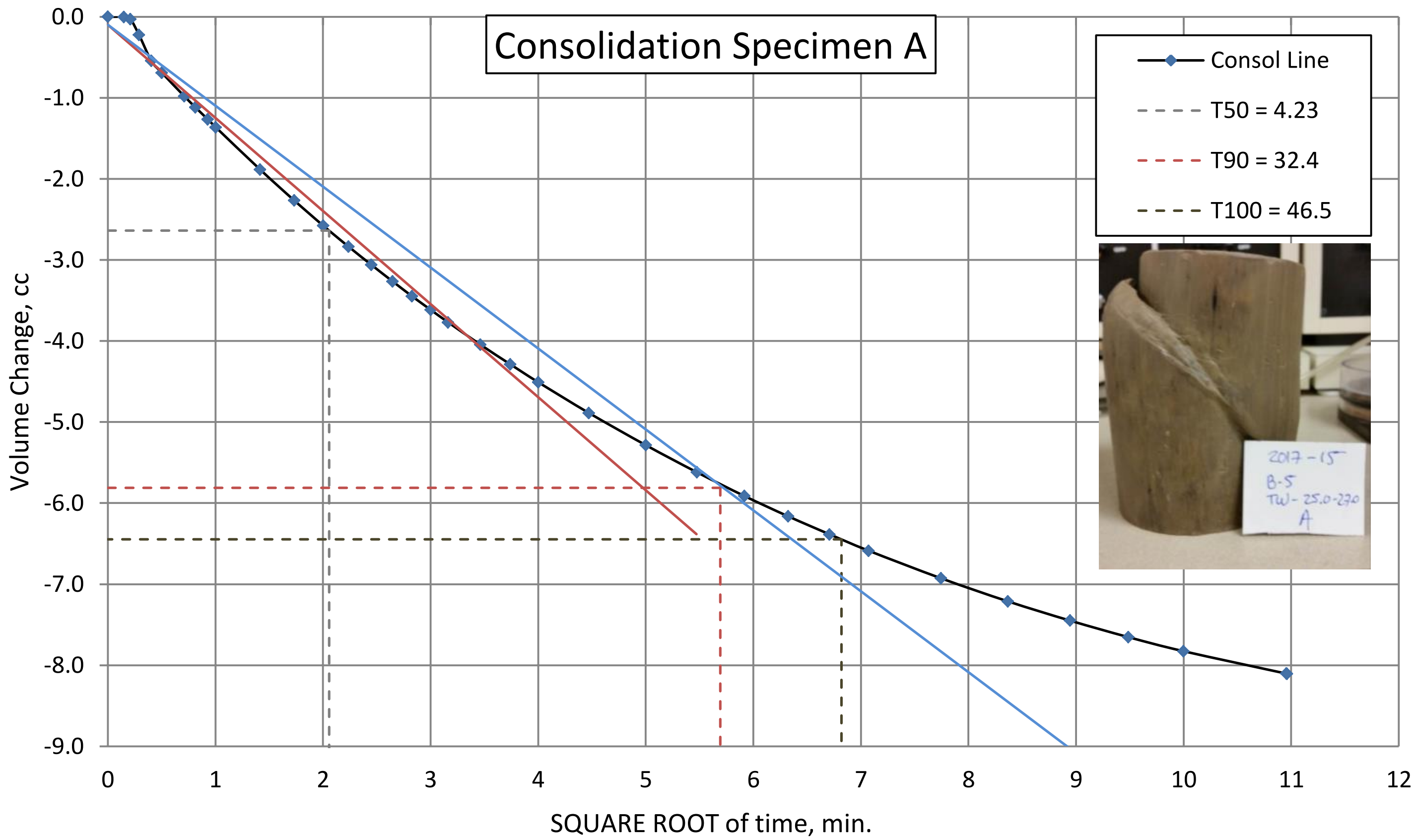
STANTEC/MWH/LAB TESTING

PHOENIX, ARIZONA

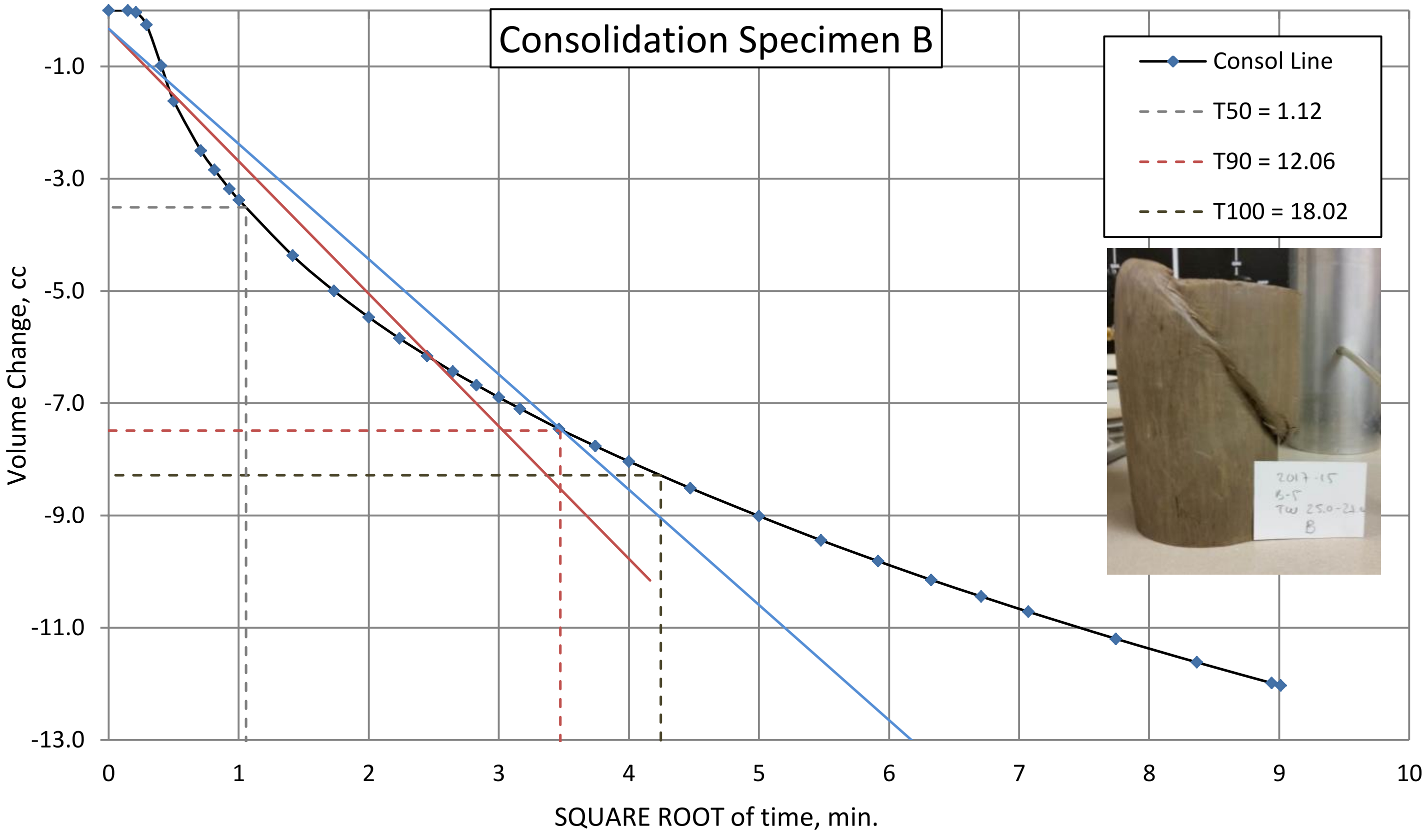
Figure

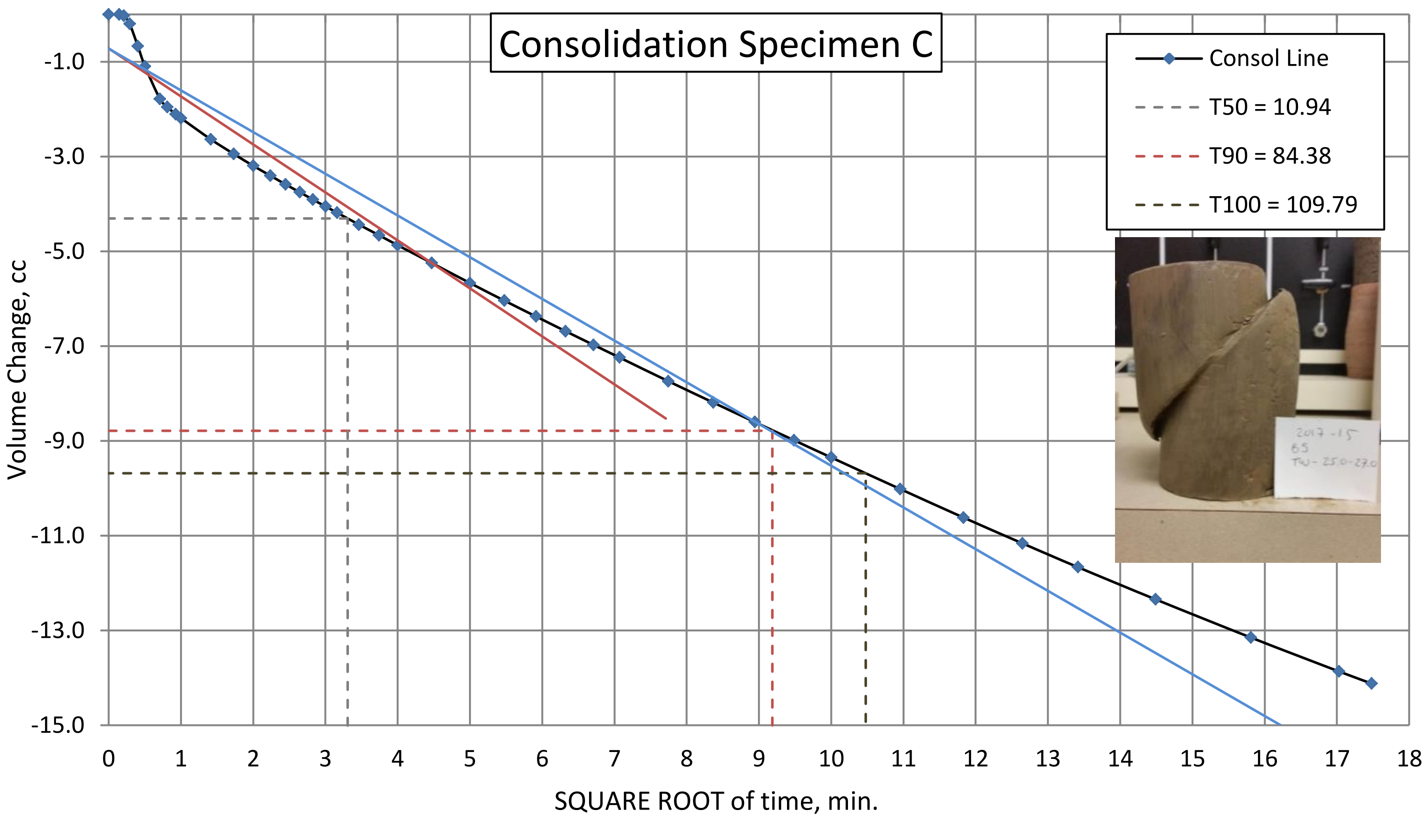
Effective & Total Stress at 15% Shear





Ninyo & Moore		**Consolidated Undrained Triaxial Test Data Sheet**	**Figure**
Location:	**B-5**	STANTEC/MWH/LAB TESTING	
Sample Depth (ft):	**TW 25.0-27.0**	PHOENIX, ARIZONA	
Project Number:	**604667003**		
Date:	**3/17**		





Ninyo & Moore		Consolidated Undrained Triaxial Test Data Sheet	Figure
Location:	B-5		
Sample Depth (ft):	TW 25.0-27.0	STANTEC/MWH/LAB TESTING	
Project Number:	604667003	PHOENIX, ARIZONA	
Date:	3/17		

SAMPLE LOCATION	COMPRESSION STRENGTH Lb/ft2	VOLUMETRIC DENSITY pcf	SPECIFIC GRAVITY	ABSORPTION %	INITIAL MOISTURE %	SULFATE SOUNDNESS % LOSS
B-1 5.3-9.5	1210	117.4	1.871	10.8	5.6	100.0
B-1 17.3-18.0	2560	135.3	2.096	7.4	2.8	81.8
B-2 26.45-27.25	2490	129.1	2.006	8.1	10.3	88.6
B-3 24.2-24.9	1390	115.6	1.937	9.3	3.9	87.7
B-3 24.9-25.6	1230	117.1	1.920	9.7	3.2	100.0

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COMPRESSIVE STRENGTH OF SOIL SPECIMENS

FIGURE

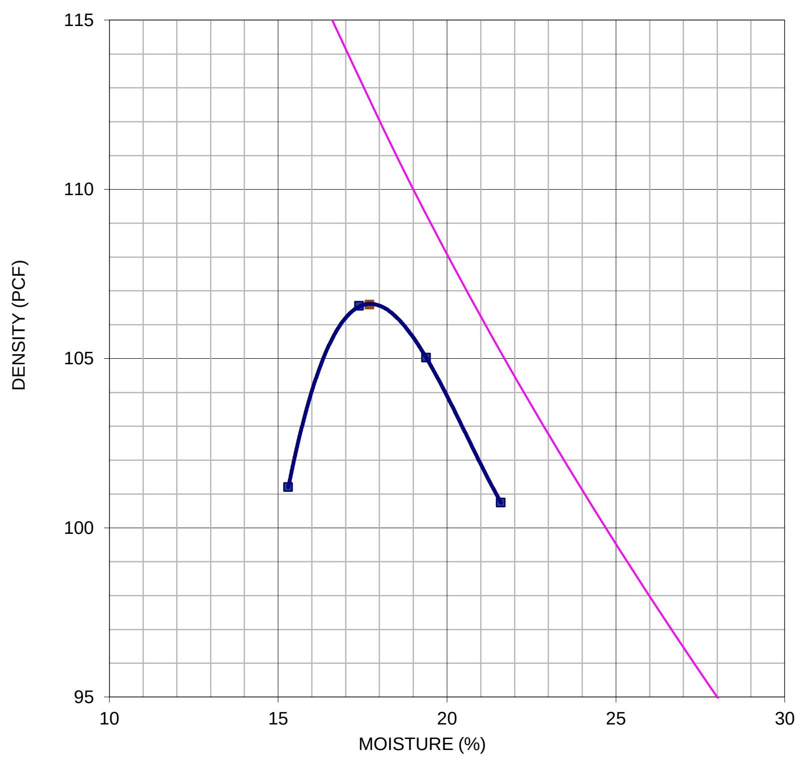
PROJECT NO.	DATE
604667003	3/17

STANTEC/MWH/LAB TESTING
PHOENIX, ARIZONA

SAMPLE INFORMATION:

DESCRIPTION:	CL
LOCATION:	CLAY SAMPLES
DEPTH (FT):	--
LAB TECHNICIAN:	HJG

	METHOD
PROCTOR[1]	ASTM D 698 A
MAXIMUM DRY DENSITY (PCF)	106.6
OPTIMUM MOISTURE CONTENT (%)	17.7
ROCK CONTENT (%)[2]	--

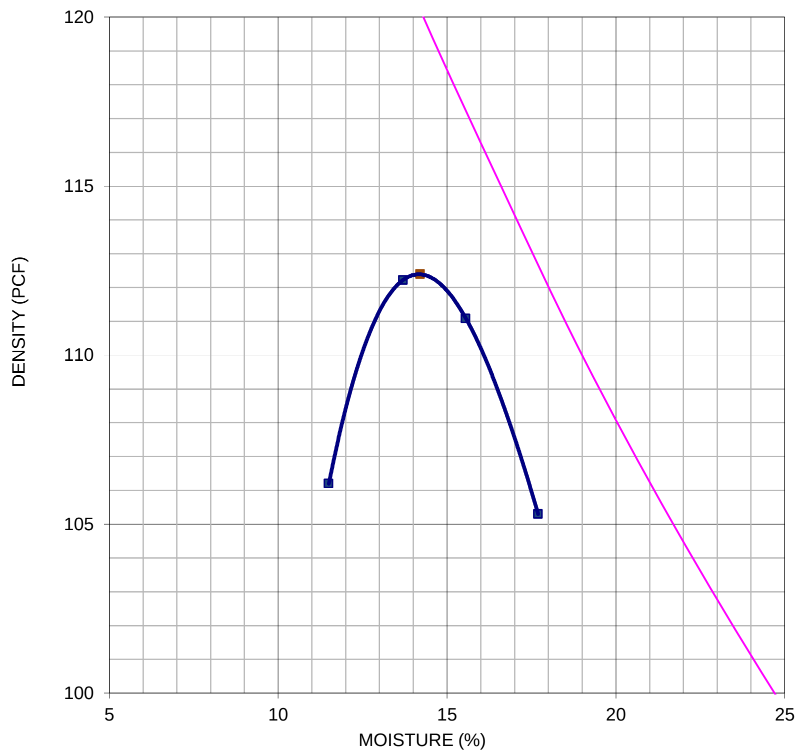


REMARKS: MAXIMUM DENSITY AND OPTIMUM MOISTURE WERE NOT CORRECTED FOR ROCK CONTENT
ROCK CONTENT CALCULATED FROM MATERIAL RETAINED ON NO.4 SCREEN

SAMPLE INFORMATION:

DESCRIPTION: SM
LOCATION: SAND SAMPLES
DEPTH (FT): --
LAB TECHNICIAN: HJG

	METHOD
PROCTOR[1]	ASTM D 698 A
MAXIMUM DRY DENSITY (PCF)	112.4
OPTIMUM MOISTURE CONTENT (%)	14.2
ROCK CONTENT (%)[2]	--



REMARKS: MAXIMUM DENSITY AND OPTIMUM MOISTURE WERE NOT CORRECTED FOR ROCK CONTENT
ROCK CONTENT CALCULATED FROM MATERIAL RETAINED ON NO.4 SCREEN

LAB NUMBER: 2017-72

SOILS/AGGREGATE DATA SHEET
STANTEC/MISC LABORATORY TESTING
PHOENIX, ARIZONA
604667003 | --

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SAMPLE LOCATION	MOISTURE (%)	DENSITY (pcf)	SPECIFIC GRAVITY
B-5 @ 5.5-6.0	9.8	82.4	2.698
B-5 @ 30.5-31.0	--	--	2.498
B-6 @ 12.8-13.5	--	--	2.724
B-6 @ 16.5-20.0	--	--	2.423
B-7 @ 16.0-16.5	17.8	99.3	2.538

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MOISTURE-DENSITY/SPECIFIC GRAVITY DATA

STANTEC/MWH/LAB TESTING

PHOENIX, ARIZONA

604667003 | 8/17

WEIGHT OF SAMPLE DISPERSED:	50.0	SPECIFIC GRAVITY OF SOLIDS:	2.650	Assumed
PERCENT PASSING #10 SIEVE:	91.1			

HYDROMETER RESULTS (% PASSING)

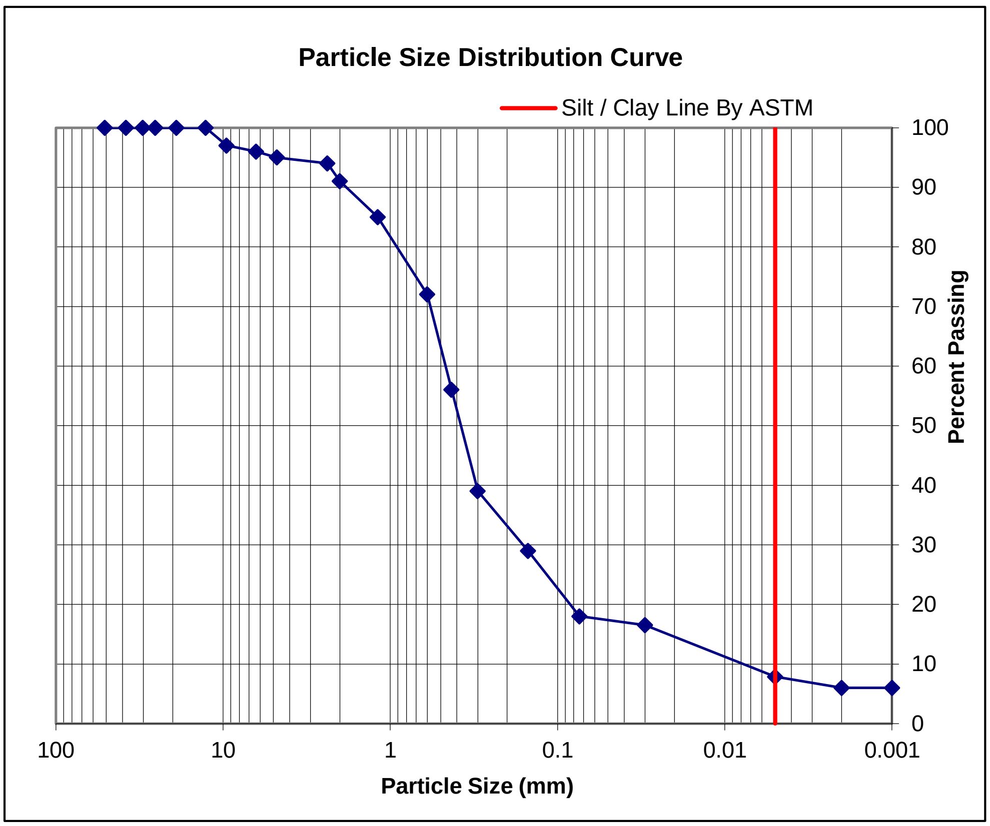
PARTICLE SIZE (DIA. mm)	**0.0567**	**0.0365**	**0.0213**	**0.0152**	**0.0108**	**0.0053**	**0.0022**	**0.0016**
PERCENT SAMPLE TESTED	24.0	18.0	14.0	10.0	10.0	8.0	6.0	6.0
PERCENT TOTAL SAMPLE	21.8	16.4	12.7	9.1	9.1	7.3	5.5	5.5

MECHANICAL SIEVE ANALYSIS AFTER HYDROMETER (% PASSING)

SCREEN SIZE	**#200**	**#100**	**#50**	**#40**	**#30**	**#16**	**#10**
PERCENT TOTAL SAMPLE	17.8	28.6	39.5	55.8	72.3	84.7	91.1

FULL SIEVE ANALYSIS MECHANICAL SIEVE & HYDROMETER

	% Pass	Spec
2 IN	100	
1 1/2 IN	100	
1 1/4 IN	100	
1 IN	100	
3/4 IN	100	
1/2 IN	100	
3/8 IN	97	
1/4 IN	96	
# 4	95	
# 8	94	
# 10	91	
# 16	85	
# 30	72	
# 40	56	
# 50	39	
# 100	29	
# 200	18	
0.03 mm	16.5	
0.005 mm	7.9	
0.002 mm	6.0	
0.001 mm	6.0	



Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	USCS
	B-5	5.5-6.0	--	--	NP	0.008	0.161	0.467	58.4	6.9	18.0	SM

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HYDROMETER TEST RESULTS
STANTEC/MWH/LAB TESTING
PHOENIX, ARIZONA
604667003 | 8/17

WEIGHT OF SAMPLE DISPERSED: 50.0

PERCENT PASSING #10 SIEVE: 100.0

SPECIFIC GRAVITY OF SOLIDS: 2.650 Assumed

HYDROMETER RESULTS (% PASSING)

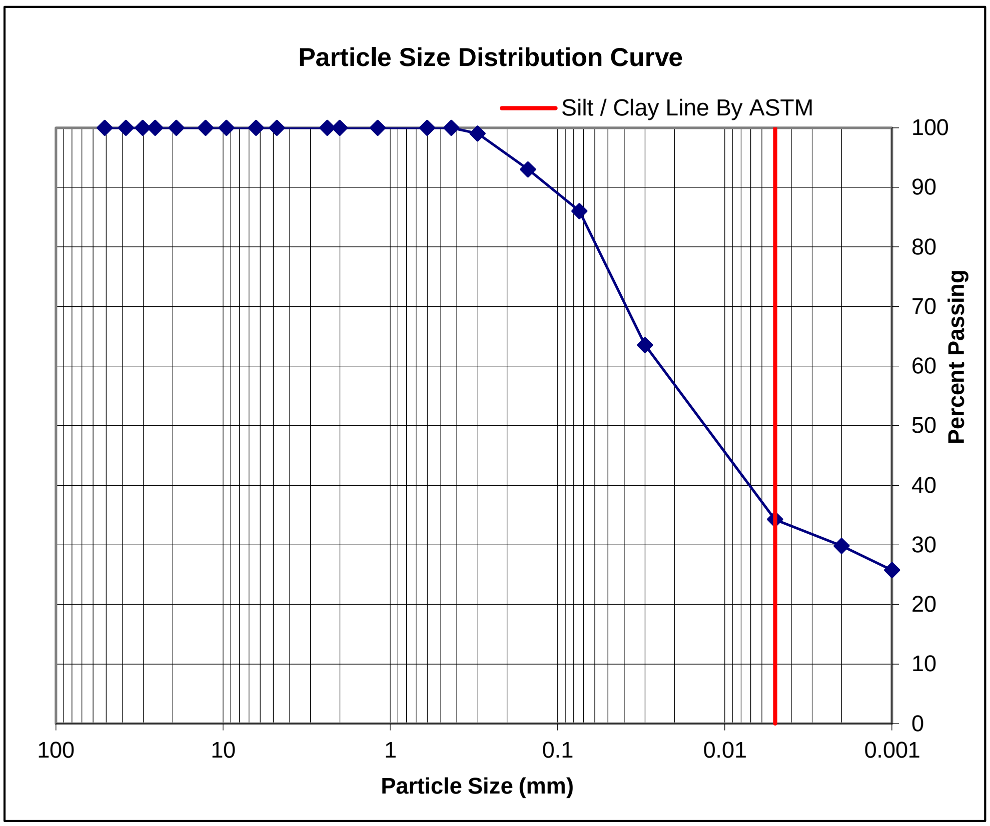
PARTICLE SIZE (DIA. mm)	**0.0477**	**0.0312**	**0.0184**	**0.0135**	**0.0097**	**0.0049**	**0.0021**	**0.0015**
PERCENT SAMPLE TESTED	72.0	64.0	58.0	48.0	44.0	34.0	30.0	28.0
PERCENT TOTAL SAMPLE	72.0	64.0	58.0	48.0	44.0	34.0	30.0	28.0

MECHANICAL SIEVE ANALYSIS AFTER HYDROMETER (% PASSING)

SCREEN SIZE	**#200**	**#100**	**#50**	**#40**	**#30**	**#16**	**#10**
PERCENT TOTAL SAMPLE	86.0	93.1	98.5	99.6	100.0	100.0	100.0

FULL SIEVE ANALYSIS MECHANICAL SIEVE & HYDROMETER

	% Pass	Spec
2 IN	100	
1 1/2 IN	100	
1 1/4 IN	100	
1 IN	100	
3/4 IN	100	
1/2 IN	100	
3/8 IN	100	
1/4 IN	100	
# 4	100	
# 8	100	
# 10	100	
# 16	100	
# 30	100	
# 40	100	
# 50	99	
# 100	93	
# 200	86	
0.03 mm	63.5	
0.005 mm	34.2	
0.002 mm	29.8	
0.001 mm	25.7	



Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	USCS
	B-5	30.5-15.0	--	--	NOT TESTED	--	0.002	0.024	--	--	86.0	CL

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HYDROMETER TEST RESULTS

STANTEC/MWH/LAB TESTING

PHOENIX, ARIZONA

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WEIGHT OF SAMPLE DISPERSED:	50.0	SPECIFIC GRAVITY OF SOLIDS:	2.650	Assumed
PERCENT PASSING #10 SIEVE:	88.4			

HYDROMETER RESULTS (% PASSING)

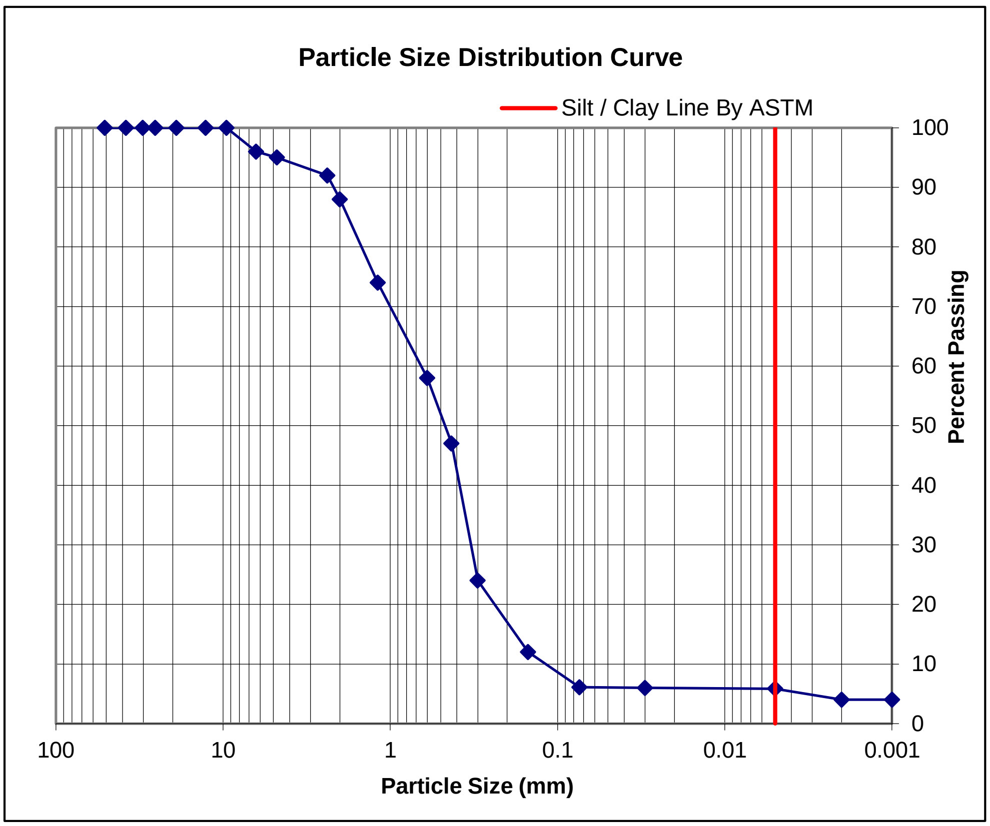
PARTICLE SIZE (DIA. mm)	**0.0597**	**0.0378**	**0.0218**	**0.0154**	**0.0109**	**0.0053**	**0.0022**	**0.0016**
PERCENT SAMPLE TESTED	6.0	6.0	6.0	6.0	6.0	6.0	4.0	4.0
PERCENT TOTAL SAMPLE	5.3	5.3	5.3	5.3	5.3	5.3	3.5	3.5

MECHANICAL SIEVE ANALYSIS AFTER HYDROMETER (% PASSING)

SCREEN SIZE	**#200**	**#100**	**#50**	**#40**	**#30**	**#16**	**#10**
PERCENT TOTAL SAMPLE	6.1	12.0	24.4	47.0	58.4	74.5	88.4

FULL SIEVE ANALYSIS MECHANICAL SIEVE & HYDROMETER

	% Pass	Spec
2 IN	100	
1 1/2 IN	100	
1 1/4 IN	100	
1 IN	100	
3/4 IN	100	
1/2 IN	100	
3/8 IN	100	
1/4 IN	96	
# 4	95	
# 8	92	
# 10	88	
# 16	74	
# 30	58	
# 40	47	
# 50	24	
# 100	12	
# 200	6.1	
0.03 mm	6.0	
0.005 mm	5.8	
0.002 mm	4.0	
0.001 mm	4.0	



Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	USCS
	B-6	12.8-13.5	--	--	NP	0.118	0.330	0.654	5.5	1.4	6.1	SP-SM

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WEIGHT OF SAMPLE DISPERSED:	50.0	SPECIFIC GRAVITY OF SOLIDS:	2.650	Assumed
PERCENT PASSING #10 SIEVE:	94.2			

HYDROMETER RESULTS (% PASSING)

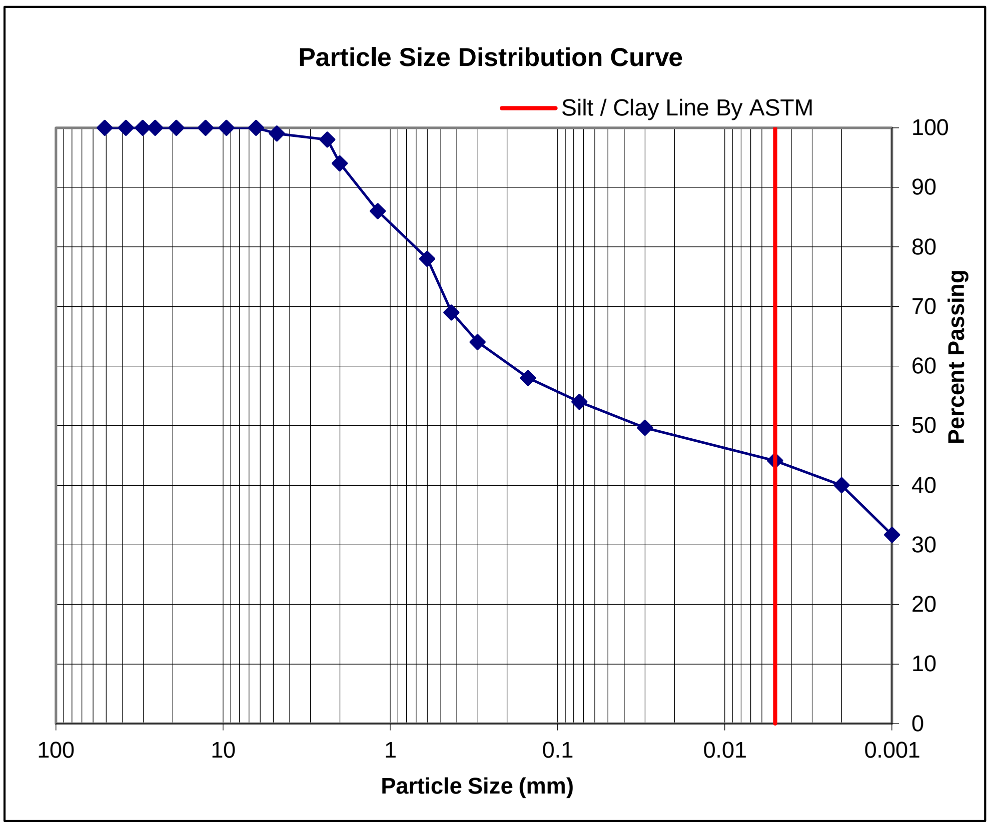
PARTICLE SIZE (DIA. mm)	**0.0512**	**0.0329**	**0.0191**	**0.0136**	**0.0096**	**0.0048**	**0.0020**	**0.0014**
PERCENT SAMPLE TESTED	54.0	50.0	48.0	46.0	46.0	44.0	40.0	36.0
PERCENT TOTAL SAMPLE	50.9	47.1	45.2	43.3	43.3	41.4	37.7	33.9

MECHANICAL SIEVE ANALYSIS AFTER HYDROMETER (% PASSING)

SCREEN SIZE	**#200**	**#100**	**#50**	**#40**	**#30**	**#16**	**#10**
PERCENT TOTAL SAMPLE	54.0	58.0	63.6	69.3	78.3	86.1	94.2

FULL SIEVE ANALYSIS MECHANICAL SIEVE & HYDROMETER

	% Pass	Spec
2 IN	100	
1 1/2 IN	100	
1 1/4 IN	100	
1 IN	100	
3/4 IN	100	
1/2 IN	100	
3/8 IN	100	
1/4 IN	100	
# 4	99	
# 8	98	
# 10	94	
# 16	86	
# 30	78	
# 40	69	
# 50	64	
# 100	58	
# 200	54	
0.03 mm	49.6	
0.005 mm	44.1	
0.002 mm	40.0	
0.001 mm	31.7	



Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	USCS
	B-7	16.0-16.5	35	19	16	--	--	0.189	--	--	54.0	CL

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HYDROMETER TEST RESULTS

STANTEC/MWH/LAB TESTING

PHOENIX, ARIZONA

604667003 | 8/17

SYMBOL	LOCATION	DEPTH (ft)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	USCS CLASSIFICATION (Fraction Finer Than No. 40 Sieve)	USCS
●	B-5	5.5-6.0	--	--	NP	ML	SM
■	B-6	12.8-13.5	--	--	NP	ML	SP-SM
◆	B-7	16.0-16.5	35	19	16	CL	CL

NP - INDICATES NON-PLASTIC

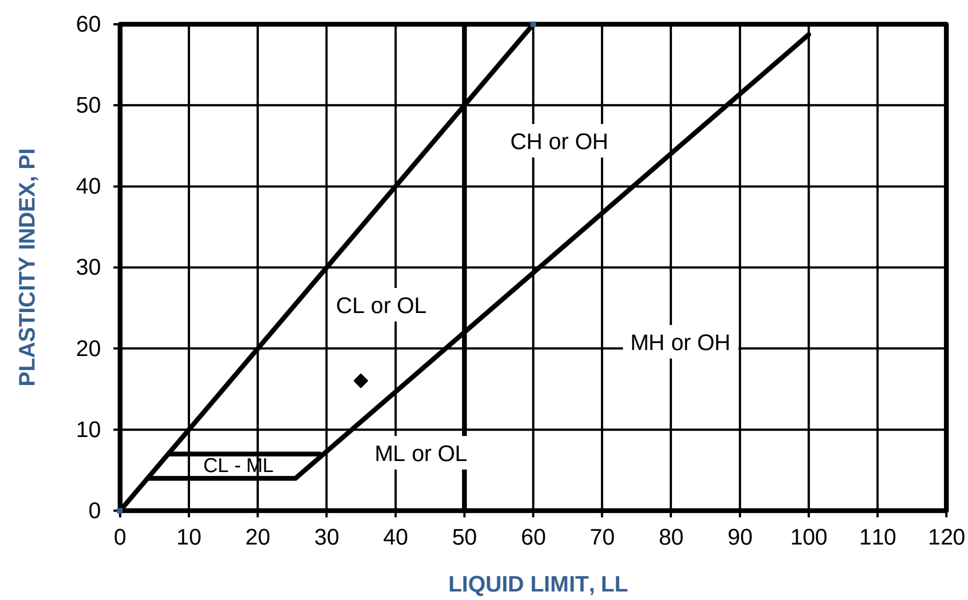

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FIGURE --

ATTERBERG TEST RESULTS

STANTEC/MWH/LAB TESTING

PHOENIX, ARIZONA

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