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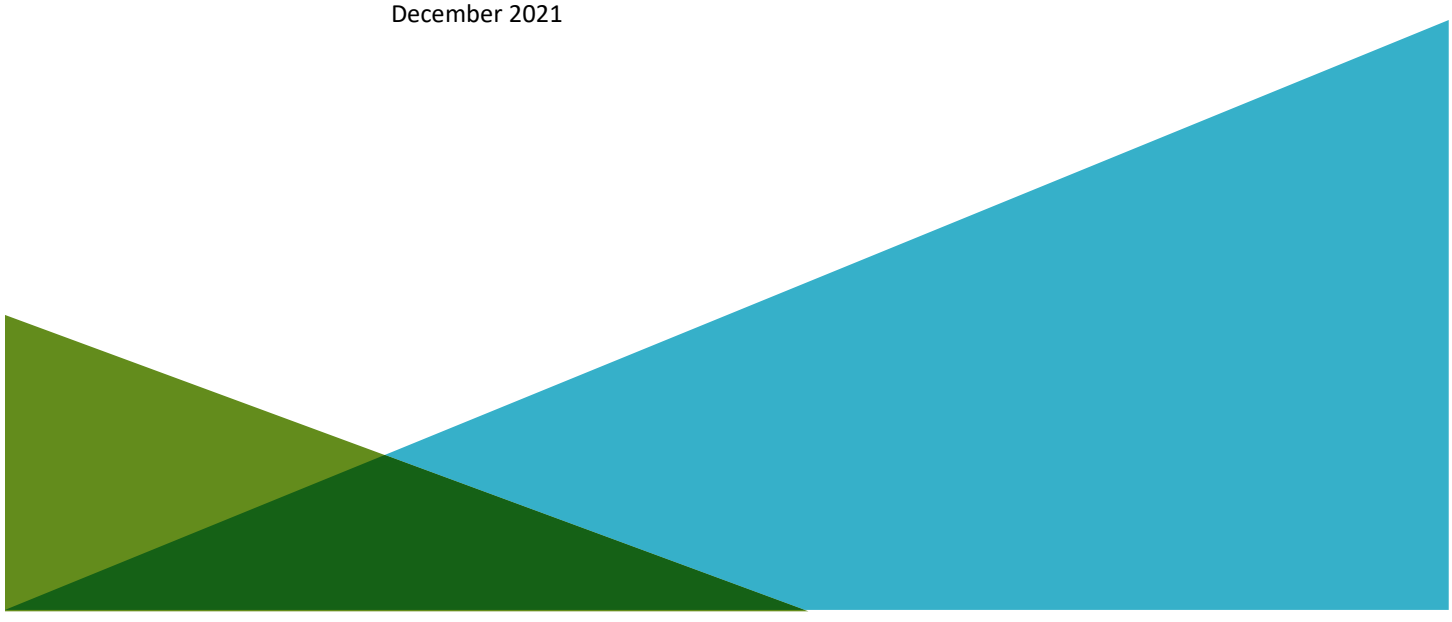
HYDROGEOLOGICAL CONCEPTUAL SITE MODEL, REV. 5
FORT CALHOUN STATION
BLAIR, NEBRASKA

by
Haley & Aldrich, Inc.
Portland, Maine

for
Energy*Solutions*
Blair, Nebraska

File No. 129760
December 2021



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22 December 2021
File No. 129760-006

Mr. Scott Zoller
Energy*Solutions*
9610 Power Lane
Blair, Nebraska 68008

Subject: Hydrogeological Conceptual Site Model, Rev. 5
Fort Calhoun Station
9610 Power Lane
Blair, Nebraska

Dear Mr. Zoller:

Haley & Aldrich is pleased to submit the revised Hydrogeological Conceptual Site Model (CSM) for the Fort Calhoun Station (FCS). This report summarizes the physical setting of FCS with respect to groundwater flow regimes and aquifer properties that may then be used to support the development of Derived Concentration Guideline Levels (DCGLs). It also includes the subsequent groundwater modeling memorandum, well survey, and RESRAD inputs.

This work has been completed consistent with industry standards as well as requirements under the Nebraska Department of Natural Resources (DNR) and the Nuclear Regulatory Commission (NRC). If you have any questions or would like to discuss our findings, please do not hesitate to call Nadia Glucksberg at 207.482.4623 at your convenience.

Sincerely yours,
HALEY & ALDRICH, INC.

Miles van Noordennen
Senior Technical Specialist

Nadia Glucksberg
Program Manager | Hydrogeologist

Enclosures

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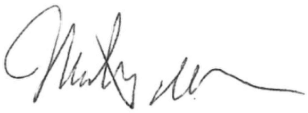
SIGNATURE PAGE FOR

HYDROGEOLOGICAL CONCEPTUAL SITE MODEL, REV. 5
FORT CALHOUN STATION
BLAIR, NEBRASKA

PREPARED FOR
ENERGY*SOLUTIONS*
BLAIR, NEBRASKA

PREPARED BY:



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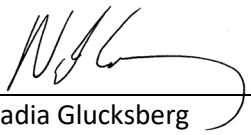

Nadia Glucksberg
Program Manager | Hydrogeologist
Haley & Aldrich, Inc.

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List of Acronyms and Abbreviations

ALARA	As Low as Reasonably Achievable
AOI	Area of Interest
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm/sec	centimeters per second
COC	contaminant of concern
CSM	Conceptual Site Model
DCGL	Derived Concentration Guideline Level
EPA	United States Environmental Protection Agency
FCS	Fort Calhoun Station
ft/ft	feet per feet
ft/yr	feet per year
gpm	gallons per minute
Haley & Aldrich	Haley & Aldrich, Inc.
HSA	Historical Site Assessment
m^3/year	cubic meter per year
MCL	Maximum Contaminant Level
mr/yr	millirem per year
MSL	mean sea level
MW	megawatt
NDNR	Nebraska Department of Natural Resources
NRC	Nuclear Regulatory Commission
OPPD	Omaha Public Power District
PCB	polychlorinated biphenyl
PWR	pressurized water reactor
REMP	Radiological Effluent Monitoring Program
TEDE	Total Effective Dose Equivalent
USACE	United States Army Corps of Engineers

1. Introduction

Haley & Aldrich, Inc. (Haley & Aldrich) has been contracted by Energy*Solutions* to develop a Hydrogeological Conceptual Site Model (CSM) of the Fort Calhoun Station (FCS) located in Blair, Nebraska (Figure 1-1). The purpose of this Hydrogeological CSM is to better understand the hydrogeological setting in support of the site's decommissioning and ongoing Radiological Effluent Monitoring Program (REMP).

This Hydrogeological CSM has been developed to better understand groundwater flow regimes to support the calculations of Derived Concentration Guideline Levels (DCGLs) as part of license termination.

To develop this Hydrogeological CSM, Haley & Aldrich performed the following:

- Completed a file review of existing environmental documents;
- Completed a site walk down;
- Reviewed previously completed geotechnical investigations;
- Collected samples for geotechnical parameters; and
- Conducted hydraulic conductivity testing.

Data will also be used to support License Termination activities by providing input parameters for RESRAD modeling and by assisting with the development of site DCGLs. These activities will be completed under separate cover.

1.1 BACKGROUND

FCS was a 484-megawatt (MW) pressurized water reactor (PWR) that is owned by Omaha Public Power District (OPPD), with Energy*Solutions* currently holding the Nuclear Regulatory Commission (NRC) license. The site is 660.46 acres, approximately 19.4 miles north of Omaha, Nebraska, located on the west bank of the Missouri River at river mile 646.0. About 85 percent of the site area is on relatively level ground located in the alluvial plain of the river. On the western section of the site, the ground rises sharply about 60 feet to a level area which is bounded on the west by Highway 75 (Figure 1-2). The surrounding land use is depicted on Figure 1-3.

1.2 REGULATORY SETTING

The NRC is the primary regulatory stakeholder for license termination. However, it is also recognized that the Nebraska Department of Natural Resources (NDNR) and the United States Environmental Protection Agency (EPA) may also have jurisdiction over the groundwater, soil, and surface waters if they have been impacted by historical site operations.

Below is a brief description of the regulatory requirements for each agency with respect to current and potential future radiological authority.

- **NRC Requirements:** The NRC requires a cleanup goal of 25 millirem per year (mr/yr) Total Effective Dose Equivalent (TEDE) plus As Low as Reasonably Achievable (ALARA). This means that the total radiation dose via all active exposure pathways (e.g., direct, inhalation, and

ingestion) cannot exceed the published regulatory criteria without written approval. However, realistic property uses and associated future scenarios can be used to calculate site-specific DCGLs that correspond to the 25 mr/yr dose limit. For groundwater, it is critical to first understand if there have been any impacts to the aquifer; and if so, to define the extent of the impacts as well as understand the fate and transport of radionuclides in groundwater. This knowledge can then be used to determine the contribution of groundwater dose to the DCGLs.

- **NDNR Requirements:** The State of Nebraska requires that sites meet the 25 mr/yr TEDE plus ALARA for all pathways at license termination. In addition, the NDNR establishes investigation and remediation requirements for hazardous substances, which at a minimum include chemical parameters such as lead, polychlorinated biphenyls (PCBs), and petroleum in soil, groundwater, surface water, and sediments. The NDNR has classified groundwater at the site as Class GB, which is assigned to waters that are currently being used as or have the potential to be used as public or private drinking water supply.
- **EPA Requirements:** The EPA will not regulate radionuclides in the environment at an NRC-licensed site until the license has been terminated. As noted above, the NRC will likely require final DCGLs to correspond to a dose of 25 mr/yr TEDE plus ALARA. However, if groundwater concentrations exceed the EPA drinking water standards (e.g., Maximum Contaminant Levels [MCLs]) at the time of license termination, then the NRC and EPA will hold a consultation. If EPA does not approve of the groundwater quality to be left at the time of license termination, they may invoke regulatory authority under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) to require further investigation and/or remediation.

2. Physical Setting

This section provides an overview of the physical setting of the area, with a focus on the plant itself, and specifically how the physical setting impacts groundwater flow directions and hydrogeological properties.

The site is located at latitude 41 degrees, 31 minutes, and 14 seconds north and longitude 96 degrees, 4 minutes, and 39 seconds west, in Blair, Nebraska, with the area land predominantly being used for agriculture.

2.1 TOPOGRAPHY

FCS is situated within parts of Section 20 and 21, Township 18 North, Range 12 East of Washington County, Nebraska in the Modale quadrangle. The site is part of the Missouri River bottomland, which is a nearly level plain about 15 miles wide at Blair, 8 miles wide at the site, and narrowing to 3 miles wide in the vicinity of Omaha-Council Bluffs. The elevation of this plain averages about 1,000 feet above mean sea level (MSL) at the site.

The surface of the land, starting from the Missouri River at about elevation 997 feet above MSL, falls to an old channel of the river before rising again to approximately 1,004 feet above MSL. Beyond this point, the land then gradually falls off to about 1,000 feet, rises again to approximately 1,020 feet, and then rises approximately 60 feet to a higher plateau at elevation 1,080 feet above MSL.

The Missouri River, which flows generally north to south, forms the northeast to southeast site boundary. This part of the river is referred to by the United States Army Corps of Engineers (USACE) as the Blair Bend. The river limits are under control of the USACE, who have established a structure azimuth line which acts as another site boundary.

The site drainage development program provides proper drainage of the plant site and upstream properties. This system controls runoff of local precipitation; drainage empties into the Missouri River north of the plant. The topography of the site is shown on Figure 2-1.

2.2 GEOLOGY

The soils below the FCS include thick beds of limestone, dolomite, shale, and sandstone with some thin layers of coal beds. The deeper formations were deposited in marine depositions with the shallow soils from the lateral migration of the paleo river channel. The major tectonic features of the mid-continent region began to develop late in the Paleozoic Era, along with most of the important structural features of the Nebraska Iowa Missouri River Valley area. However, there is no record of movement of the fault in historical times, nor is there any indication of activity in recent geologic time.

At the beginning of the Pleistocene period, the Missouri River Valley and its main tributaries were established in their approximate present positions. Subsequently under successive glacial movements, the valleys were filled and reopened several times. During this period, the Peorian loess was deposited on the terraces and adjacent uplands. It is probable that only the upper part of the alluvium in the Missouri River Valley is actually of recent age and that deeper deposits are mostly of the Pleistocene age.

Unconsolidated sediments at the plant site generally range from 65 to 75 feet in thickness. The soils are typically interstratified and cross-bedded. These soils may be grouped generally into two units:

1. An upper fine-grained sandy clay with silt, ranging from 20 to 50 feet in thickness.

2. An underlying fine to coarse sand with some gravel, extending down to the relatively flat-lying carbonate bedrock surface at a depth of approximately 65 to 75 feet below ground surface (bgs).

The upper units represent former river deposits and are not likely continuous, but rather have preferential channels formed by paleo-oxbow deposits. Pennsylvanian-aged limestone and shale (bedrock) of the Kansas City Formation are encountered below the overburden soils. The bedrock below the site consists of various types of limestone formations.

2.3 HYDROGEOLOGY

Groundwater beneath the site is first encountered at depths ranging from approximately 15 to 20 feet bgs and the water table aquifer is in hydraulic communication with the adjacent Missouri River. Groundwater flow directions have been reported to be both toward the Missouri River (northeasterly) and away from the Missouri River (south-southwesterly) depending on the River's stage. Shallow flow directions toward the river represent times when the river levels are at normal or low stages. Shallow flow directions away from the river are likely to occur during times of high river stage (i.e., at flood or near flood stage), causing bank storage effects.

2.4 SURFACE WATER

The plant is bounded on the northeast and southeast by a portion of Blair Bend of the Missouri River. The USACE maintains river structures to prevent further meandering of the channel within the alluvial flood plain; the structures take the form of pile dikes and bank revetments. Fish Creek is an intermittent drainage system that runs along the [plant] north boundary of the Protected Area. This stream discharges into a larger wetland, before flowing into the Missouri River as shown on Figure 2-2.

There are six dams upstream of the site that control river flow. There are no dams, locks, or similar structures on the Missouri River downstream of the site. The site has been flooded several times with the most recent occurring in 2019, where the river overflowed its banks several times throughout the year. A wall is currently being constructed surrounding the plant site to act as a dam/berm to prevent future flooding events during decommissioning activities.

3. Current Site Conditions

The Hydrogeological CSM not only describes the history and hydrogeological setting of the site, but it also describes areas where contaminants of concern (COCs) were used or stored and thereby could potentially be released to the environment. These may be systems, storage tanks, or work practices that could have led to the potential release of radiological constituents to the environment. Each of these Areas of Interest (AOIs) is being evaluated as part of decommissioning with respect to radiological contamination and potential impacts to groundwater quality.

It should be noted that although this Hydrogeological CSM is focused on groundwater characterization, potential or known releases to soils can also migrate through the vadose zone and reach the water table. Generally isolated soils are those below impermeable caps such as building foundations. Contaminants in these soils are less likely to migrate in the subsurface as there is no mechanism for rainwater to percolate through, providing the necessary transport mechanism. However, it should also be noted that radionuclides that are present in isolated soils or beneath impermeable caps must still be characterized (and potentially remediated) to reach NRC License Termination.

3.1 RADIOLOGICAL AREAS OF INTEREST

The most prevalent radionuclides associated with nuclear power stations are cobalt (Co-60), cesium (Cs-137), strontium (Sr-90), and tritium (H-3). Although there is the potential for other hard-to-detect radionuclides to be released, they would typically be co-located with the four isotopes listed above. Therefore, for the purpose of this Hydrogeologic CSM, these four radionuclides are the primary radiological COCs that are considered for potential release to soils and groundwater.

Based on the Historical Site Assessment (HSA) completed previously (TSSD, 2016), there are several structures identified where site impacts could have released radiological contamination to groundwater. They include:

- Containment Structure
- Turbine Building
- Auxiliary Building
- Radwaste Processing Building
- Sanitary Lagoons
- Landfill

Each structure or AOI is described further in the HSA as well as the subsequent *Limited Site Radiological Characterization Survey Report* completed in 2017 (TSSD, 2017). Evaluation of the REMP program with respect to well placement and sampling frequency is provided under separate cover.

3.2 CURRENT GROUNDWATER MONITORING NETWORK

There are currently 17 on-site groundwater monitoring wells at the FCS. Quarterly samples are collected from eight of the existing wells as part of the groundwater protection program. Samples are submitted for tritium analysis. In addition, on an annual basis from seven wells, and quarterly from one well, samples are also submitted for analysis of gamma and hard-to-detect isotopes. Results have all been

below background values or non-detect. Monitoring wells are shown on Figure 3-1. Well construction details are included in Table 3-1.

4. Field Activities

To better understand the geological and hydrogeological setting at the FCS, a field investigation was completed in June 2020 to augment existing data. Direct push methods were used to log soils throughout the site, collect geotechnical samples, and complete hydrological testing in the unsaturated zone. In addition, existing groundwater monitoring wells were used to collect groundwater information and complete hydrological testing in the saturated zone. These activities are discussed in detail below.

4.1 GEOTECHNICAL SOIL SAMPLING

To better understand the site soils, and to collect analytical geotechnical samples to support the RESRAD modeling task, direct push methods were utilized onsite to log and collect soils. Drilling was completed at 28 locations throughout the site, from both inside and outside of the Protected Area. At 21 of the locations, soils were drilled to a total depth of 10 feet bgs. Soils were logged continuously to document conditions and characteristics. At the other seven locations, soils were drilled to a total depth of 20 feet bgs. In addition to logging those soils, samples were collected and submitted for geotechnical analyses. Samples were collected from both the unsaturated and saturated zones to provide the appropriate data for RESRAD input parameters. Field forms are included in Appendix A. Geotechnical results to support the RESRAD modeling are provided under separate cover.

4.2 HYDROLOGICAL CHARACTERIZATION

To better understand the site hydrological setting, including groundwater flow and other information, data was collected from the existing on-site groundwater monitoring well network. A synoptic water level round was conducted, measuring the depth to groundwater at each of the 17 on-site wells. Following the water level round, limited or modified pumping tests and hydraulic conductivity (i.e., “slug”) tests were conducted at seven of the monitoring wells to collect further information on the hydrological characteristics of the aquifers below the site. Results from those investigations are provided in Section 5 below.

4.3 VADOSE ZONE CONDUCTIVITY TESTING

In addition to the geotechnical soil sampling and the hydrological testing discussed above, falling head tests were performed at seven of the direct push locations to evaluate the infiltration rate and facilitate the calculation of hydraulic conductivity of the vadose zone to provide additional input parameters for RESRAD modeling. Locations were drilled to five feet bgs, with the drill casing then pulled up approximately 1 foot, leaving an open borehole with soils exposed from approximately four to five feet bgs. The boreholes were then filled with potable water, with data being collected as the falling water level within the borehole was monitored. These results are discussed in Section 5 below.

5. Findings

Following the field investigation completed in June 2020, geotechnical and hydrological settings at the FCS are now better understood. With the data collected from both 2020 field activities and from previous investigations completed on site, information to support the Hydrological CSM is presented below.

Based on the groundwater depth to water data and corresponding groundwater elevation data, groundwater contours are consistent with historical data and are flowing towards the river. Water levels collected in June 2020 show that the groundwater elevations ranged from 993.51 to 995.54 feet.

It should be noted that the groundwater elevation is in hydraulic communication with the Missouri River. Based on the gauging stations both upriver and downriver, located approximately 25 miles from the plant in each direction, the historical river stage varies widely and is prone to flooding. The past 10 years of river state data from these stations is presented in Appendix C. The data shows an average steady gauge height of 15 to 20 feet. Therefore, it may be assumed that the overall elevation of the groundwater or water table has also been consistent throughout this period.

Horizontal hydraulic gradients at the site are nearly flat with relatively slow groundwater velocity, with only a gentle slope toward the Missouri River. From elevation data collected in June 2020, the approximate average gradient in both the shallow and deeper system was 0.0008 feet/feet (ft/ft). Groundwater contours from June 2020 are presented in Figures 5-1 and 5-2. Groundwater elevation data is provided in Table 5-1, and hydraulic gradient data is presented in Appendix B. In addition to horizontal gradients, vertical gradients were calculated between shallow and deeper paired wells. Upward gradients were observed in well pairs MW-1A/B, MW-2A/B, and MW-4A/B ranging from 0.0004 to 0.059 ft/ft. Downward gradients were observed in well pairs MW-3A/B and MW-5A/B ranging from 0.0007 to 0.0039 ft/ft. These data are also provided in Appendix B.

Based on the classification of fine to medium sands and silts for the shallow soils, expected hydraulic conductivities for the shallow aquifer range from 10^{-5} centimeters per second (cm/sec) (or 10^{-1} feet per day) to 10^{-1} cm/sec (or 100 feet/day). Using the data collected from the modified pumping tests and/or slug tests completed in June 2020, calculated hydraulic conductivities ranged from 9.4×10^{-3} to 1.8×10^{-2} cm/sec. The measures values are within the range for these types of soils. A summary of these results is provided in Table 5-2. The complete analysis is provided in Appendix D.

Using the groundwater contours, horizontal hydraulic gradients, and hydraulic conductivity information discussed above, groundwater velocity data for the shallow and deeper aquifers were calculated. Groundwater velocity calculations are estimated from the June 2020 field measurements and contour plans, where the flow direction is towards the Missouri River. The resulting velocity calculations are therefore representative of this flow direction. Based upon the analysis, the groundwater velocities are very similar, with the shallow system ranging from 5.73 to 34.39 feet per year (ft/yr) and ranging from 5.86 to 35.16 ft/yr in the deeper system. These results are summarized in Appendix B.

In-situ falling head tests were completed at seven open borehole locations to determine the field coefficient of permeability (or hydraulic conductivity) of unsaturated soils (i.e., the vadose zone). The field data collected from these tests was analyzed, with the recommended range for the RESRAD input parameters falling between 2×10^{-6} to 4×10^{-4} cm/sec. A summary of these results is provided in Table 5-3.

The complete analysis is provided in Appendix E. It should be noted that at one location, the water level remained unchanged. Therefore, these results only include the testing information from the other six locations.

Following these tests and to provide input parameters for the RESRAD Basement Fill Model, a simplified 3-dimensional fate and transport groundwater flow model was completed for the subject site. The model runs assume a clean sand backfill with a hydraulic conductivity of 1.0×10^{-2} cm/sec to represent the shallow aquifer soils tested in June 2020. To support the resident farmer scenario, an extraction well is positioned inside or near the basement, pumping at a constant flow rate of 4,450 cubic meters per year (m^3/year) or 2.2 gallons per minute (gpm).

Cesium (Cs-137) and strontium (Sr-90) chemical concentrations are monitored in the well discharge for a period of 1,000 years under various well configurations and model geometries to determine the most conservative geometry, or the scenario that will result in the highest well concentrations. Results from the modeling demonstrate that positioning an extraction well in the basement corner will result in the highest well discharge chemical concentrations, whereas positioning the well in the basement center will result in the lowest concentrations. A detailed summary of the model parameters, simulations, and results are presented in Appendix F.

Finally, the remaining RESRAD inputs are summarized in Appendix G with groundwater modeling runs to support the Basement Fill Model presented in Appendix F. The modeling results were also completed following a review of other potable and irrigation wells in the area. The well survey results are provided in Appendix H.

6. Conclusions

The following conclusions are based on the preliminary Hydrogeologic CSM:

- Geology generally consists of fine to medium sands and silts overlying fine to coarse sands and gravels. Bedrock is encountered approximately 65 to 75 feet bgs.
- The groundwater table is typically 15 to 20 feet bgs, and the water table is in hydraulic communication with the Missouri River.
- Water generally flows in a northeasterly direction towards the river, although when the river stage is high, it is likely that groundwater flows in a south-southwesterly direction, temporarily away from the river.
- Vertical gradients for June 2020 (flow towards the Missouri River) range from approximately 0.0004 to 0.059 ft/ft. The average horizontal gradient is approximately 0.0008 ft/ft.
- Hydraulic conductivity measured in the field corresponds well to look up values and ranges from 9.4×10^{-3} to 1.8×10^{-2} cm/sec.
- Based on available data from June 2020, groundwater velocity towards the river ranges from approximately 5 to 35 feet per year.

References

1. TSSD, 2016. *Historical Site Assessment Report*, Fort Calhoun Nuclear Station, Omaha Public Power District, Blair, Nebraska. October 2016.

2. TSSD, 2017. *Limited Radiological Characterization Survey Report*, Fort Calhoun Nuclear Station, Omaha Public Power District, Blair, Nebraska. January 2017.

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TABLES

Table 3-1
Monitoring Well Construction Details
Fort Calhoun Station
Blair, Nebraska

Well ID	Well Depth (ft bgs)	Screen Length (ft)	Well Diameter (in)	Ground Surface Elevation (ft)	TOC Elevation (ft)
MW-1A	24	10	2	1004.6	1007.02
MW-1B	50	5	2	1004.5	1007.01
MW-2A	24	10	2	1004.9	1007.23
MW-2B	50	5	2	1004.9	1007.21
MW-3A	23	10	2	1004.7	1007.06
MW-3B	50	5	2	1005.2	1007.06
MW-4A	22	10	2	1003.4	1005.75
MW-4B	50	5	2	1003.3	1005.79
MW-5A	22	10	2	1003.5	1006.02
MW-5B	50	5	2	1003.5	1005.96
MW-6	22	10	2	1003.8	1006.21
MW-7	24	10	2	1002.9	1005.42
MW-9	26*	-	2	-	1007.08
MW-10	28*	-	2	-	1006.68
MW-11	25*	-	2	-	1003.89
MW-2	28*	-	2	-	1006.46
MW-3	28*	-	2	-	1006.33

Notes
* Well depths from TOC
- ft bgs: feet below ground surface
- in: inches
- TOC: top of casing

Table 5-1
Groundwater Elevation Data
Fort Calhoun Station
Blair, Nebraska

Well ID (PA)	DTW	TOC Elevation	GW Elevation
MW-1A	13.01	1007.02	994.01
MW-1B	13.01	1007.01	994.00
MW-2A	13.40	1007.23	993.83
MW-2B	13.40	1007.21	993.81
MW-3A	13.44	1007.06	993.62
MW-3B	13.42	1007.06	993.64
MW-4A	10.21	1005.75	995.54
MW-4B	12.05	1005.79	993.74
MW-5A	12.40	1006.02	993.62
MW-5B	12.22	1005.96	993.74
MW-6	12.70	1006.21	993.51
MW-7	11.69	1005.42	993.73
MW-9	13.14	1007.08	993.94
MW-10	12.75	1006.68	993.93
MW-11	10.00	1003.89	993.89
Well ID (Landfill)			
MW-2	12.74	1006.46	993.72
MW-3	12.74	1006.33	993.59

Notes
- Data collected 6/16/2020 - 6/17/2020
- All measured units in feet

DTW - depth to water
PA - Protected Area
TOC - top of casing

Table 5-2
Summary of Hydraulic Conductivity Data
Fort Calhoun Station
Blair, Nebraska

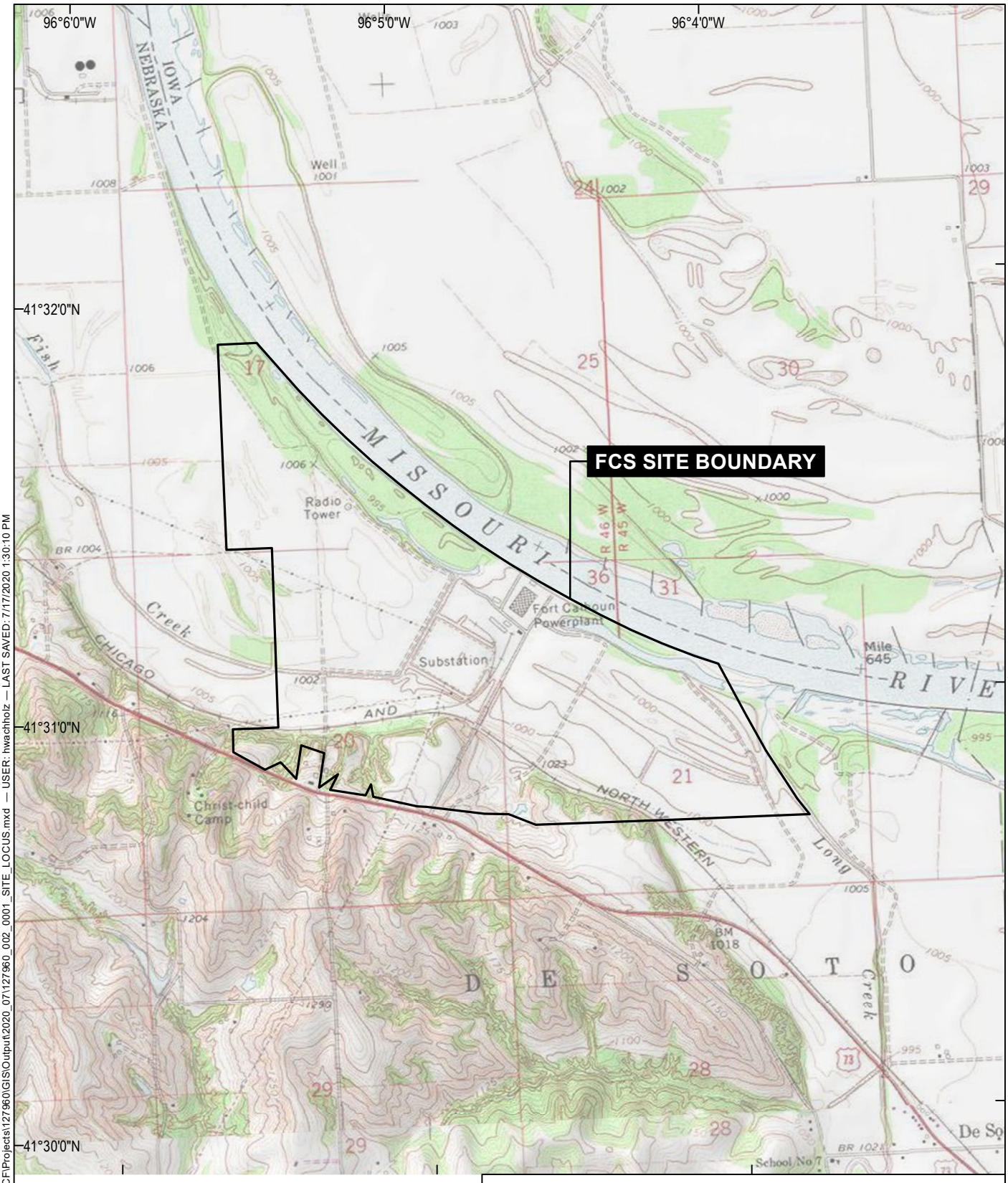
Location	Estimated K (cm/s)	GeoMean
MW-1A	9.05E-03	
MW-1A	2.34E-02	
MW-1A	1.17E-02	
MW-1A	1.40E-02	1.4E-02
MW-2	1.89E-02	
MW-2	1.64E-02	
MW-2	1.80E-02	
MW-2	1.57E-02	1.7E-02
MW-3A	8.75E-03	
MW-3A	1.03E-02	
MW-3A	1.08E-02	
MW-3A	9.11E-03	9.7E-03
MW-3B	1.32E-02	
MW-3B	1.61E-02	
MW-3B	1.55E-02	
MW-3B	1.38E-02	1.5E-02
MW-5A	9.28E-03	
MW-5A	8.55E-03	
MW-5A	1.04E-02	
MW-5A	9.56E-03	9.4E-03
MW-5B	1.76E-02	
MW-5B	1.69E-02	
MW-5B	1.81E-02	
MW-5B	2.07E-02	1.8E-02

TABLE 5-3
SUMMARY OF IN-SITU BOREHOLE PERMEABILITY TEST RESULTS
FORT CALHOUN STATION
BLAIR, NEBRASKA

Test Boring No.	Test Date	Ground Surface Elevation	Top Elevation of Test Zone	Bottom Elevation of Test Zone	Soil Stratum of Test Zone	Coefficient of Permeability, k Schmid (cm/sec)	Coefficient of Permeability, k ILRI (cm/sec)	Coefficient Permeability, k Jarvis (cm/sec)	Average Coefficient of Permeability, k (cm/sec)
SB-08	NA	0	-3.92	-5	fine to medium silt/sand, fairly dense	4E-05	2E-04	4E-05	9E-05
SB-11	NA	0	-3.8333	-5	fine to medium silt, dense	2E-06	4E-06	7E-07	2E-06
SB-17	NA	0	-4.0417	-5	medium to coarse sand AND fine to medium silt	1E-05	4E-05	8E-06	2E-05
SB-25	NA	0	-4	-5	Medium sand AND fine silt	5E-05	2E-04	4E-05	9E-05
SB-32	NA	0	-4	-5	fine to medium sand	1E-04	9E-04	2E-04	4E-04
SB-33	NA	0	-4	-5	fine to medium silt, dense	2E-05	4E-05	9E-06	2E-05

NOTES:
1. Tests were in-situ borehole permeability tests performed by the falling head method by a representative of Haley & Aldrich using Solinst level loggers to monitor the changes in groundwater elevations during the falling head test.

FIGURES



GIS FILE PATH: \\haleyaldrich.com\share\CF\Projects\127960\GIS\Output\2020_07\127960_002_0001_SITE_LOCUS.mxd — USER: hwachholz — LAST SAVED: 7/17/2020 1:30:10 PM

HALEY ALDRICH

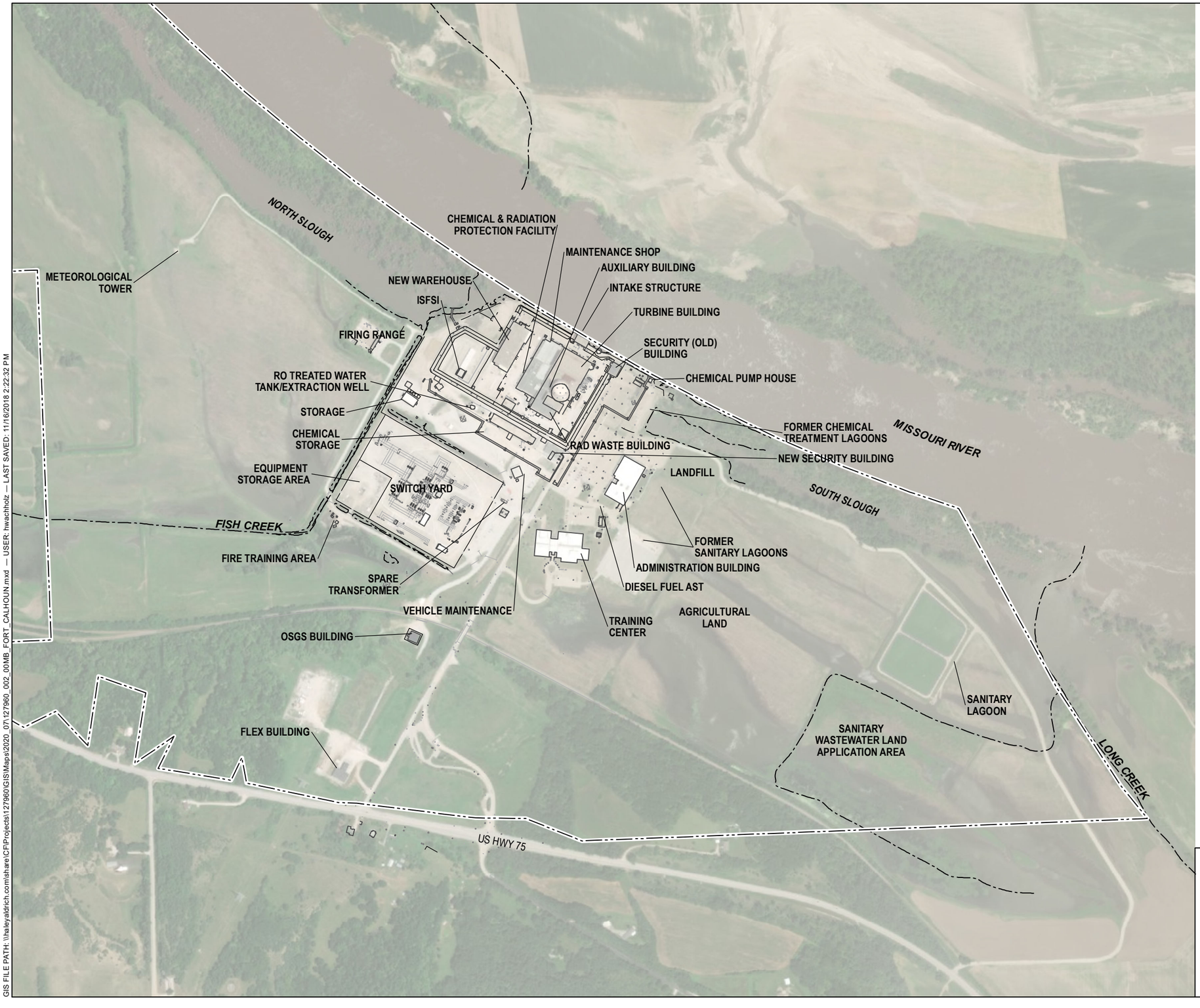
FORT CALHOUN STATION
POWER LANE
BLAIR, NEBRASKA

SITE LOCUS

MAP SOURCE: USGS
SITE COORDINATES: 41°31'12"N, 96°04'45"W

APPROXIMATE SCALE: 1 IN = 2000 FT
JULY 2020

FIGURE 1-1



LEGEND

- EXISTING BUILDING
- UTILITY
- STREAM
- PROPERTY BOUNDARY

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
2. AERIAL IMAGERY SOURCE: ESRI

N

0 700 1,400

SCALE IN FEET

HALEY ALDRICH

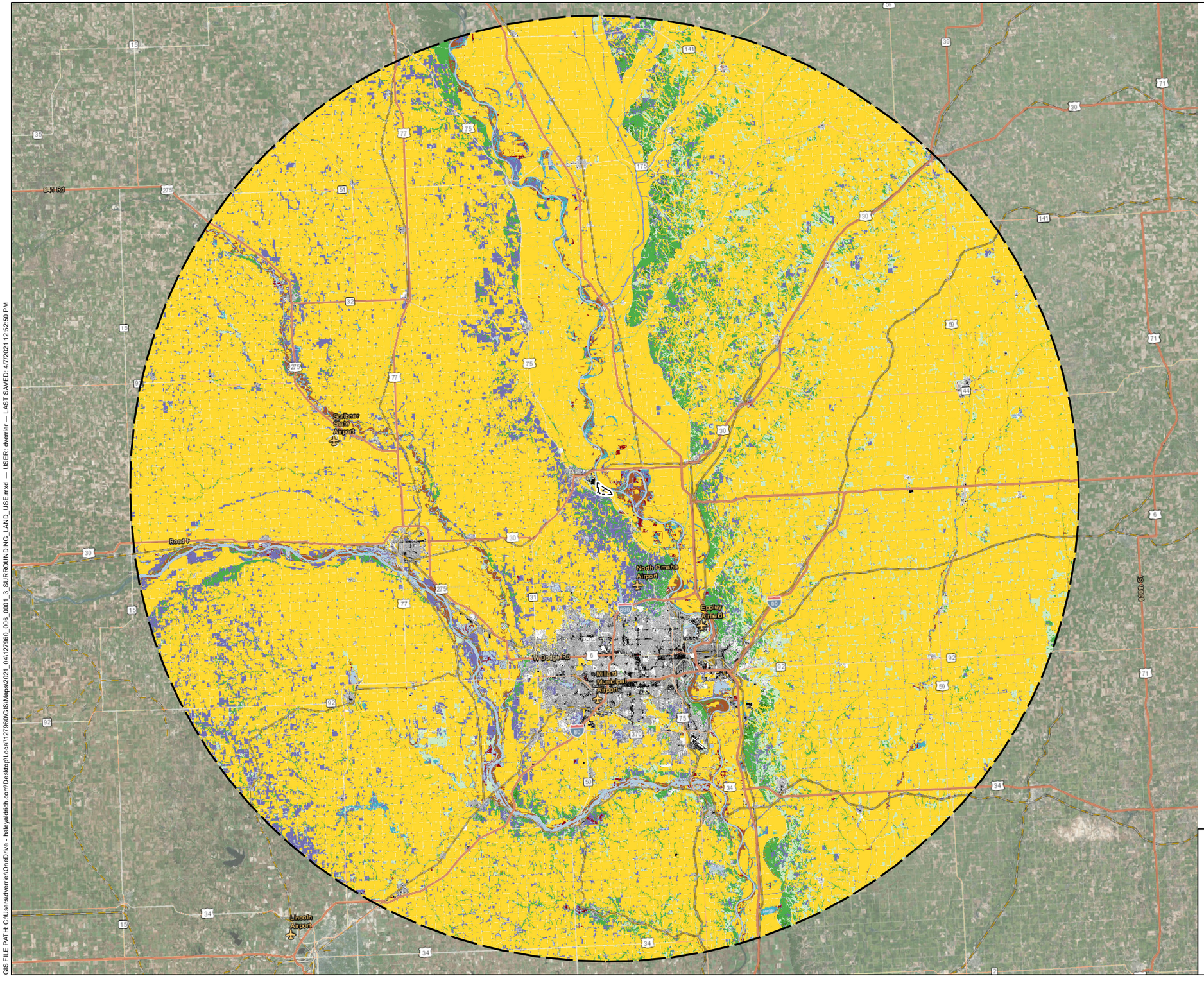
FORT CALHOUN STATION
POWER LANE
BLAIR, NEBRASKA

SITE PLAN

JULY 2020

FIGURE 1-2

GIS FILE PATH: \\haleyaldrich.com\share\CF\Projects\127960\GIS\Maps\2020_07\127960_002_00MB_FORT_CALHOUN.mxd — USER: hwachholz — LAST SAVED: 11/16/2018 2:22:32 PM



LEGEND

- SITE BOUNDARY
- 50-MILE BUFFER AROUND SITE BOUNDARY
- WOODY WETLANDS
- SHRUB/SCRUB
- OPEN WATER
- MIXED FOREST
- HERBACEOUS
- HAY/PASTURE
- EVERGREEN FOREST
- EMERGENT HERBACEOUS WETLANDS
- DEVELOPED, OPEN SPACE
- DEVELOPED, MEDIUM INTENSITY
- DEVELOPED, LOW INTENSITY
- DEVELOPED, HIGH INTENSITY
- DECIDUOUS FOREST
- CULTIVATED CROPS
- BARREN LAND

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
2. LAND COVER DATA SOURCE: UNITED STATES GEOLOGICAL SURVEY (USGS) NATIONAL LAND COVER DATABASE (NLCD), 2016
3. AERIAL IMAGERY SOURCE: ESRI

N

0 10 20
SCALE IN MILES

HALEY ALDRICH

FORT CALHOUN STATION
POWER LANE
BLAIR, NEBRASKA

SURROUNDING LAND USE

APRIL 2021

FIGURE 1-3

GIS FILE PATH: C:\Users\dverrier\OneDrive - haleyaldrich.com\Desktop\Local\127960\GIS\Maps\2021_04\127960_006_0001_3_SURROUNDING_LAND_USE.mxd — USER: dverrier — LAST SAVED: 4/7/2021 12:52:50 PM

LEGEND

- EXISTING BUILDING
- UTILITY
- STREAM OR BODY OF WATER
- PROPERTY BOUNDARY
- MAJOR TOPOGRAPHIC CONTOUR, 5' CONTOUR INTERVAL
- MINOR TOPOGRAPHIC CONTOUR, 1' CONTOUR INTERVAL

NOTES

1. STREAM DATA SOURCE: NATIONAL HYDROGRAPHY DATASET
2. WETLAND DATA SOURCE: NATIONAL WETLAND INVENTORY
3. AERIAL IMAGERY SOURCE: ESRI 2015

PLANT NORTH

TRUE NORTH

0 150 300 600

SCALE IN FEET

SITE TOPOGRAPHY

FORT CALHOUN NUCLEAR PLANT
POWER LANE, BLAIR, NEBRASKA

FIGURE 2-1
JULY 2020

HALEY ALDRICH

\\haleyaldrich.com\share\CFIProjects\127960\GIS\Maps\2020_07\127960_002_000X_SITE_MAP_10_1.mxd - USER: hwachholz - LAST SAVED: 7/23/2020 5:53:09 PM

LEGEND

- EXISTING BUILDING
- UTILITY
- STREAM OR BODY OF WATER
- PROPERTY BOUNDARY
- WETLAND

NOTES

1. STREAM DATA SOURCE: NATIONAL HYDROGRAPHY DATASET
2. WETLAND DATA SOURCE: NATIONAL WETLAND INVENTORY
3. AERIAL IMAGERY SOURCE: ESRI 2015

PLANT NORTH

TRUE NORTH

0 350 700 1,400

SCALE IN FEET

SURFACE WATER FEATURES

FORT CALHOUN NUCLEAR PLANT
POWER LANE, BLAIR, NEBRASKA

FIGURE 2-2
JULY 2020

HALEY ALDRICH

LEGEND

- MONITORING WELL
- PROPERTY BOUNDARY
- STREAM

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
2. AERIAL IMAGERY SOURCE: ESRI

N

0 300 600

SCALE IN FEET

HALEY ALDRICH

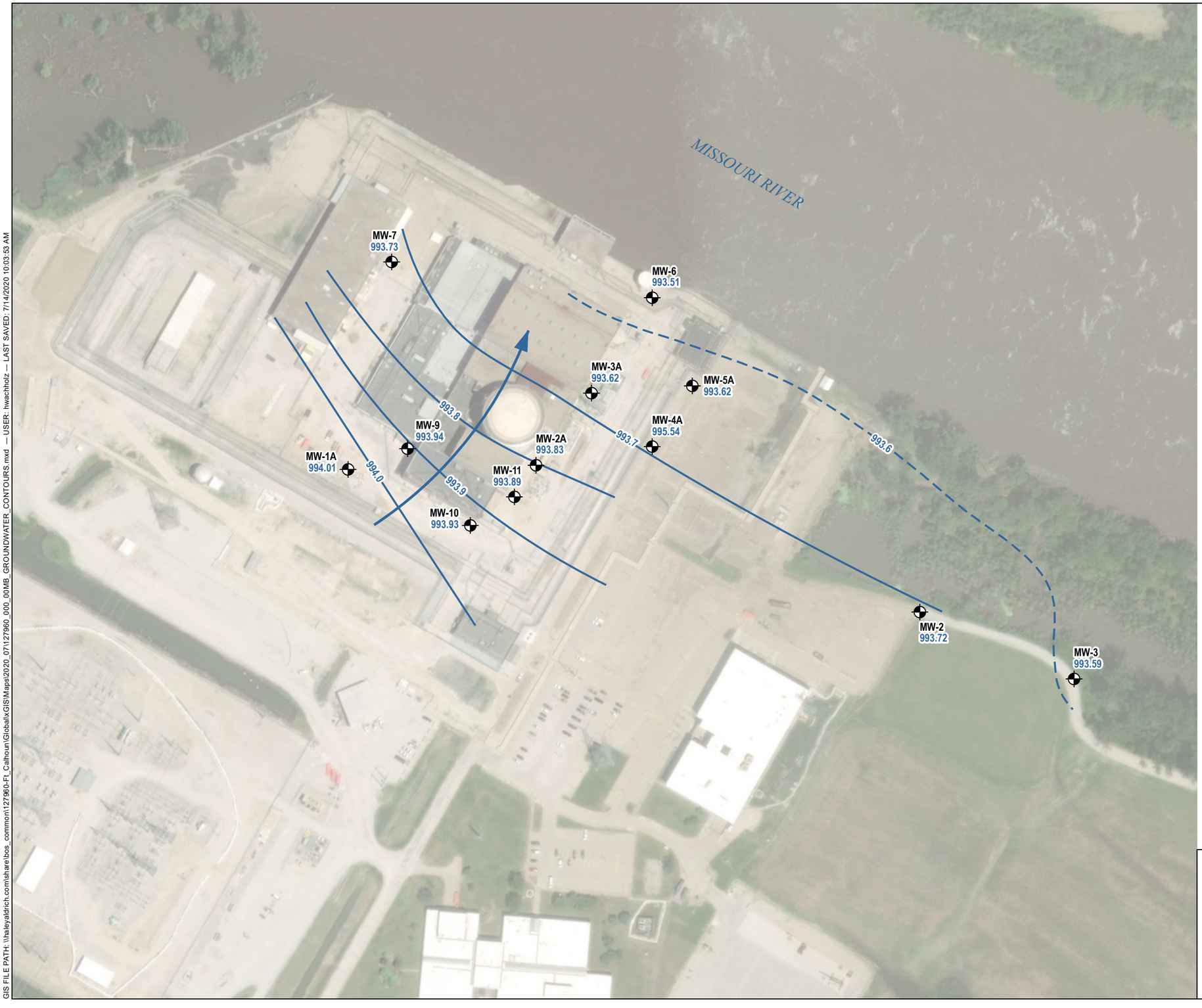
FORT CALHOUN STATION
POWER LANE
BLAIR, NEBRASKA

GROUNDWATER MONITORING WELLS

JULY 2020

FIGURE 3-1

GIS FILE PATH: \\haleyaldrich.com\share\CFProjects\127960\GIS\Maps\2020_07\127960_002_00MB_FORT_CALHOUN.mxd — USER: hwachholz — LAST SAVED: 11/16/2018 2:22:32 PM



LEGEND

- MONITORING WELL WITH GROUNDWATER ELEVATION, IN FEET
- GROUNDWATER FLOW DIRECTION
- GROUDWATER ELEVATION CONTOUR, 0.1-FT INTERVAL
- INFERRED GROUNDWATER ELEVATION CONTOUR, 0.1-FT INTERVAL

NOTES

1. ALL LOCATIONS ARE APPROXIMATE.
2. GROUNDWATER ELEVATIONS WERE COLLECTED 16 JUNE 2020 THROUGH 17 JUNE 2020.
3. AERIAL IMAGERY SOURCE: ESRI

N

0 200 400
SCALE IN FEET

HALEY ALDRICH

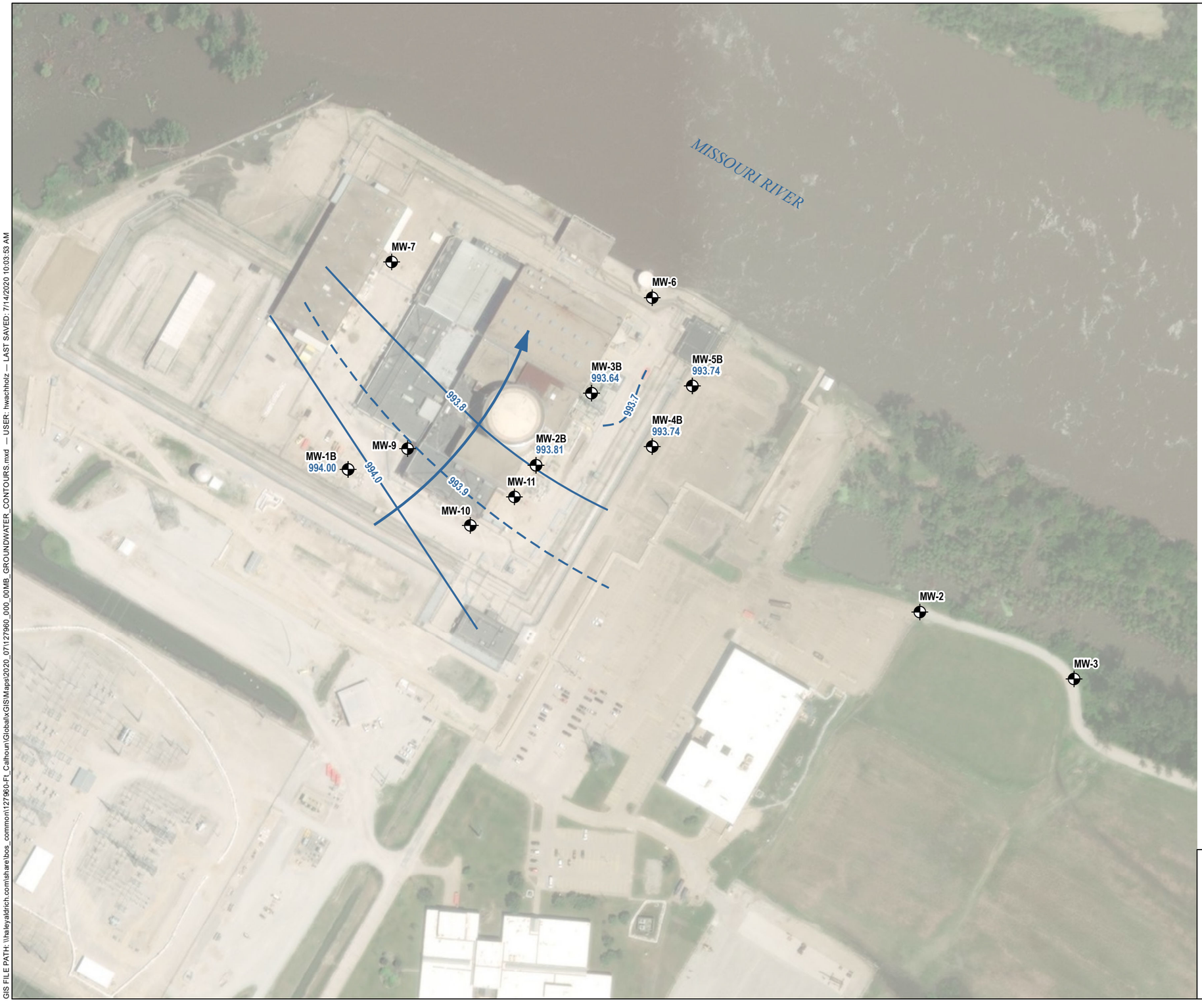
FORT CALHOUN STATION
POWER LANE, BLAIR, NEBRASKA

SHALLOW GROUNDWATER CONTOUR PLAN

JULY 2020

FIGURE 5-1

GIS FILE PATH: \\haleyaldrich.com\share\bos_common\127960-Ft_Calhoun\Globalfx\GIS\Maps\2020_07\127960_000_00\MB_GROUNDWATER_CONTOURS.mxd — USER: hwachholz — LAST SAVED: 7/14/2020 10:03:53 AM



LEGEND

- MONITORING WELL WITH GROUNDWATER ELEVATION, IN FEET
- GROUNDWATER FLOW DIRECTION
- GROUDWATER ELEVATION CONTOUR, 0.1-FT INTERVAL
- INFERRED GROUNDWATER ELEVATION CONTOUR, 0.1-FT INTERVAL

NOTES

1. ALL LOCATIONS ARE APPROXIMATE.
2. GROUNDWATER ELEVATIONS WERE COLLECTED 16 JUNE 2020 THROUGH 17 JUNE 2020.
3. AERIAL IMAGERY SOURCE: ESRI

N

0 200 400
SCALE IN FEET

HALEY ALDRICH

FORT CALHOUN STATION
POWER LANE, BLAIR, NEBRASKA

DEEP GROUNDWATER CONTOUR PLAN

JULY 2020

FIGURE 5-2

GIS FILE PATH: \\haleyaldrich.com\share\bos_common\127960-FL_CalhounGlobalIx\GIS\Maps\2020_07\127960_000_00MB_GROUNDWATER_CONTOURS.mxd — USER: hwachholz — LAST SAVED: 7/14/2020 10:03:53 AM

APPENDIX A

Field Forms

TEST BORING REPORT

Boring No. SB-01

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	9 June 2020
Finish	9 June 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 42	0.0 5.0			SM	0.0-0.4 ft, white gravel 0.4-1.2 ft, brown fine to medium SAND (SM), some silt, no odor, dry										
						SM	1.2-1.6 ft, white stone and gravel 1.6-4.1 ft, brown medium to coarse SAND (SM), some gravel, loose, no odor, dry										
					4.6		4.1-4.6, white stone and gravel										
5		S2 42	5.0 10.0			ML	4.6-5.0 ft, brown medium sandy SILT (ML), dense, no odor, dry 5.0-7.8 ft, brown to gray fine to medium SILT (ML), dense, no odor, dry										
					8.5	ML	7.8-8.5 ft, brown to gray fine to medium SILT (ML), dense, no odor, damp										
						SM	8.5-10.0 ft, brown medium SAND (SM), no odor, wet										
10					10.0		BOTTOM OF EXPLORATION 10.0 FT										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	10
Rock Cored (ft)	-
Samples	2S

Boring No. SB-01

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

TEST BORING REPORT

Boring No. SB-02

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	9 June 2020
Finish	9 June 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 33	0.0 5.0			ML	0.0-0.7 ft, loose white stone and gravel 0.7-5.0 ft, brown to reddish-brown fine to medium SILT (ML), dry										
5		S2 44	5.0 10.0		5.4	ML	5.0-5.4 ft, brown to reddish-brown fine to medium SILT (ML), no odor, dry										
					5.9	SM	5.4-5.9 ft, brown medium to coarse SAND (SM), no odor, dry										
						ML	5.9-8.2, brown fine to medium SILT (ML), no odor, moist 8.2-8.8 ft, brown fine to medium SILT (ML), some sand, no odor, damp										
						ML	8.8-10.0 ft, dark brown to gray fine to medium SILT (ML), very dense, no odor, dry										
10					10.0		BOTTOM OF EXPLORATION 10.0 FT										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	10
Rock Cored (ft)	-
Samples	2S

Boring No. SB-02

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

TEST BORING REPORT

Boring No. SB-03

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	9 June 2020
Finish	9 June 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 40	0.0 5.0			SM	0.0-0.6 ft, white gravel 0.6-2.8 ft, brown and gray SAND with gravel (SM), loose, no odor, dry -FILL-										
					2.8	ML	2.8-5.0 ft, brown to reddish-brown fine to medium SILT (ML), dense, no odor, dry										
5		S2 56	5.0 10.0			ML	5.0-8.6 ft, same										
						ML	8.6-10.0, same, except moist										
10					10.0		BOTTOM OF EXPLORATION 10.0 FT										

Water Level Data					
Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID
- O - Open End Rod
- T - Thin Wall Tube
- U - Undisturbed Sample
- S - Split Spoon Sample

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

Summary

Overburden (ft)	10
Rock Cored (ft)	-
Samples	2S

Boring No. SB-03

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

TEST BORING REPORT

Boring No. SB-04

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	9 June 2020
Finish	9 June 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 46	0.0 5.0			ML	0.0-0.2 ft, stone and gravel 0.2-5.0 ft, brown to reddish-brown fine to medium SILT (ML), dense, no odor, dry										
5		S2 50	5.0 10.0			ML	5.0-8.1 ft, same										
						ML	8.1-8.6 ft, same, except less dense, moist										
						ML	8.6-9.7 ft, brown to reddish-brown fine to medium SILT (ML), dense, no odor, dry										
10					10.0		9.7-10.0 ft, white stone BOTTOM OF EXPLORATION 10.0 FT										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	10
Rock Cored (ft)	-
Samples	2S

Boring No. SB-04

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

TEST BORING REPORT

Boring No. SB-05

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	9 June 2020
Finish	9 June 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 50	0.0 5.0				0.0-0.9 ft, white GRAVEL and STONE										
						ML	0.9-2.0 ft, dark brown fine to medium SILT (ML), some gravel and stone										
						ML	2.0-3.9 ft, dark brow to gray fine to medium SILT (ML), dense										
					3.9	SM	3.9-4.4 ft, dark brown to gray fine to medium SAND (SM), no odor, damp										
					4.4	ML	4.4-5.0 ft, dark brown to gray fine to medium SILT (ML), trace sand, loose, no odor, moist										
5		S2 33	5.0 10.0			ML	5.0-5.4, same										
						ML	5.4-8.5, gray fine to medium SILT (ML), trace sand, no odor, damp										
					8.5	SM	8.5-10.0 ft, light brown to brown medium SAND (SM), no odor, damp										
10					10.0		BOTTOM OF EXPLORATION 10.0 FT										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	10
Rock Cored (ft)	-
Samples	2S

Boring No. SB-05

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

TEST BORING REPORT

Boring No. SB-06

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	9 June 2020
Finish	9 June 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 58	0.0 5.0				0.0-1.1, white GRAVEL and STONE 1.1-2.0 ft, brown coarse SAND and GRAVEL and STONE										
					2.0	ML	2.0-3.6 ft, dark brown to gray fine to medium SILT (ML), dense, no odor, dry										
					3.6	SM	3.6-4.0 ft, dark brown to gray fine to medium SAND (SM), some silt, no odor, damp to wet										
					4.0	ML	4.0-4.5 ft, dark brown fine SILT (ML), dense, no odor, moist										
5		S2 30	5.0 10.0			ML	4.5-5.0 ft, dark brown to gray fine to medium SILT (ML) some sand, no odor, damp										
						ML	5.0-8.1 ft, same										
					8.1	SM	8.1-9.0 ft, light brown medium SAND (SM), no odor, damp										
						SM	9.0-9.8, brown to dark brown fine to medium SAND (SM), no odor, damp										
10					9.8	ML	9.8-10.0 ft, dark brown to gray fine to medium SILT (ML), dense, no odor, moist										
					10.0		BOTTOM OF EXPLORATION 10.0 FT										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	10
Rock Cored (ft)	-
Samples	2S

Boring No. SB-06

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

TEST BORING REPORT

Boring No. SB-07

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	9 June 2020
Finish	9 June 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 45	0.0 5.0				0.0-2.2 ft, white GRAVEL and STONE										
						ML	2.2-3.1 ft, brown fine to medium SILT (ML), trace gravel, no odor, dry										
						ML	3.1-4.1 ft, brown fine to medium SILT (ML), no odor, dry										
							4.1-4.4 ft, white stone										
						ML	4.4-5.0 ft, brown fine to medium SILT (ML), no odor, dry										
5		S2 42	5.0 10.0				5.0-5.8 ft, same										
						ML	5.8-7.2 ft, grayish-brown fine to medium SILT (ML), dense, no odor, moist										
						ML	7.2-9.2 ft, gray fine to medium SILT (ML), loose, no odor, moist										
					9.2												
						SM	9.2-10.0 ft, gray medium SAND (SM), some silt, no odor, damp										
10					10.0		BOTTOM OF EXPLORATION 10.0 FT										

Water Level Data					
Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	10
Rock Cored (ft)	-
Samples	2S

Boring No. SB-07

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

TEST BORING REPORT

Boring No. SB-08

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	9 June 2020
Finish	12 June 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)
0		S1 47	0.0 5.0				0.0-2.2 ft, white and brown stone and gravel
						ML	2.2-3.1 ft, dark brown and gray fine to medium SILT (ML), dense, no odor, dry
					3.1	SM	3.1-3.9 ft, brown medium to coarse SAND (SM), dense, no odor, dry
					3.9	ML	
					4.2	SM	3.9-4.2 ft, gray fine to medium SILT (ML), loose no odor, moist
5		S2 28	5.0 10.0			SM	4.2-5.5 ft, light gray to gray fine to medium SAND (SM), trace silt, no odor, damp
					5.6	ML	5.0-5.6 ft, same
							5.6-8.2 ft, gray fine to medium SILT (ML), some sand, dense, no odor, moist
					8.2	SM/ML	8.2-10.0 ft, gray fine to medium SAND and SILT (SM/ML), dense, no odor, moist
10		S3 60	10.0 15.0		10.0	SM	10.0-11.6 ft, same
						SM	11.6-12.4 ft, gray fine to medium SILT (ML), some sand, no odor, damp
					12.4	ML	12.4-14.1 ft, gray medium SAND (SM), trace silt, no odor, wet
					14.4	ML	14.1-14.4 ft, gray fine to medium SILT (ML), trace sand, no odor, wet
15		S4 60	15.0 20.0			SM	14.4-15.0 ft, gray fine to medium SAND (SM), trace silt, no odor, wet
						SM	15.0-18.1 ft, same
						SM	18.1-20.0 ft, gray medium to coarse SAND (SM), no odor, wet
20					20.0		BOTTOM OF EXPLORATION 20.0 FT

Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	20
Rock Cored (ft)	-
Samples	4S

Boring No. SB-08

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

TEST BORING REPORT

Boring No. SB-09

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	9 June 2020
Finish	9 June 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 33	0.0 5.0		0.4		0.0-0.4 ft -ASPHALT-										
					0.8	ML	0.4-0.8 ft, gray gravel subbase										
						ML	0.8-3.3 ft, brown fine to medium SILT (ML), dense, no odor, dry										
							3.3-3.6 ft, white stone										
						ML	3.6-3.9 ft, brown fine to medium SILT (ML), dense, no odor, dry										
						ML	3.9-4.4 ft, brown fine to medium SILT (ML), loose, no odor, damp										
						ML	4.4-5.0 ft, brown to gray fine to medium SILT (ML), dense, no odor, dry										
5		S2 43	5.0 10.0			ML	5.0-8.7 ft, brown to gray fine to medium SILT (ML), no odor, moist										
						ML	8.7-10.0 ft, brown to gray fine to medium SILT (ML), some sand, no odor, damp										
10					10.0		BOTTOM OF EXPLORATION 10.0 FT										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	10
Rock Cored (ft)	-
Samples	2S

Boring No. SB-09

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

TEST BORING REPORT

Boring No. SB-10

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	8 June 2020
Finish	8 June 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 35	0.0 5.0				0.0-0.8 -CONCRETE-										
					0.8	ML	0.8-4.1 ft, brown fine to medium SILT (ML), no odor, dry										
					4.1	SM	4.1-4.3 ft, light brown to gray medium to coarse SAND (SM), loose, no odor, moist										
5		S2 38	5.0 10.0			SM	4.3-5.0 ft, dark brown to gray medium to coarse SAND (SM), trace silt, no odor, moist										
						SM	5.0-5.8 ft, same										
						SM	5.8-7.1 ft, brown coarse SAND (SM)										
					7.1	ML	7.1-8.4 ft, dark gray fine to medium SILT (ML), no odor, damp										
					8.4	SM	8.4-9.6 ft, dark brown to gray fine to medium SAND (SM), trace silt, no odor, wet										
					9.6	ML	9.6-10.0 ft, dark brown to gray fine to medium SILT (ML), dense, no odor, damp										
10					10.0		BOTTOM OF EXPLORATION 10.0 FT										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	10
Rock Cored (ft)	-
Samples	2S

Boring No. SB-10

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

TEST BORING REPORT

Boring No. SB-11

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	8 June 2020
Finish	18 June 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)
0		S1 35	0.0 5.0		0.4		0.0-0.4 ft -CONCRETE-
					0.9	ML	0.4-0.9 ft, gray gravel -SUBBASE-
						ML	0.9-3.1 ft, brown fine to medium SILT (ML), dense, no odor, dry
						ML	3.1-3.9 ft, brown fine to medium SILT (ML), loose, no odor, dry
					3.9	SM	3.9-4.4 ft, brown medium to coarse SAND (SM), no odor, moist
					4.4	ML	4.4-5.0 ft, fine to medium SILT (ML), dense, no odor, dry
5		S2 53	5.0 10.0			ML	5.0-7.2 ft, same
						ML	7.2-8.1 ft, less dense fine to medium SILT (ML), no odor, damp
						ML	8.1-8.9 ft, fine to medium SILT (ML), no odor, wet
						ML	8.9-9.5 ft, gray fine to medium SILT (ML), trace sand, no odor, damp
					9.5	SM	
10		S3 60	10.0 15.0		10.0	ML	9.5-9.8 ft, black fine to medium SAND (SM), some silt, no odor, damp
						ML	9.8-10.0 ft, white stone
							10.0-11.2 ft, gray fine to medium SILT (ML), trace sand, dense, no odor, wet
					13.2	ML SM	11.2-12.0 ft, dark gray to black fine to medium SILT (ML), dense, no odor, wet
							12.7-13.2 ft, gray fine to medium SILT (ML), some sand, loose, no odor, wet
15		S4 51	15.0 20.0				13.2-15.0 ft, brown to reddish-brown medium to coarse SAND (SM), no odor, wet
							15.0-18.6 ft, same
						SM	18.6-20.0 ft, brown coarse SAND (SM), no odor, wet
20					20.0		BOTTOM OF EXPLORATION 20.0 FT

Gravel		Sand			Fines	Field Test			
% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	Strength

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	20
Rock Cored (ft)	-
Samples	4S

Boring No. SB-11

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

TEST BORING REPORT

Boring No. SB-12

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	8 June 2020
Finish	8 June 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 48	0.0 5.0		0.4	ML	0.0-0.4 ft -CONCRETE-										
							0.4-4.2 ft, brown fine to medium SILT (ML), dense, no odor, dry										
					4.2	SM	4.2-5.0 ft, brown fine to medium SAND (SM), trace silt, dense, no odor, dry										
5		S2 45	5.0 10.0			SM	5.0-5.8 ft, same										
					5.8	ML	5.8-7.8 ft, brown fine to medium SILT (ML), dense, no odor, moist										
						ML	7.8-8.9 ft, brown fine to medium SILT (ML), loose, no odor, damp										
						ML	8.9-9.4 ft, gray SILT (ML), dense, no odor, moist										
					9.4	SM	9.4-9.8 ft, brown to gray-brown medium SAND (SM), trace silt, no odor, damp										
10					10.0	SM	9.8-10.0 ft, brown to grayish-brown medium SAND (SM), some silt, dense, no odor, moist										
							BOTTOM OF EXPLORATION 10.0 FT										

Water Level Data					
Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	10
Rock Cored (ft)	-
Samples	2S

Boring No. SB-12

Field Tests:
Dilatancy: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

TEST BORING REPORT

Boring No. SB-13

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	8 June 2020
Finish	8 June 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 40	0.0 5.0		0.4		0.0-0.4 -CONCRETE-										
						ML	0.4-1.1 ft, light brown fine to medium SILT (ML), no odor, dry										
						ML	1.1-5.0 ft, brown fine to medium SILT (ML), dense, no odor, dry										
5		S2 53	5.0 10.0			ML	5.5-5.6 ft, same										
							5.6-5.9 ft, white gravel										
						ML	5.9-7.1 ft, brown fine to medium SILT (ML), dense, no odor, dry										
						ML	7.1-8.3 ft, brown fine to medium SILT (ML), dense, no odor, damp										
						ML	8.6-10.0 ft, brown fine to medium SILT (ML), dense, no odor, damp										
						ML	8.3-8.6 ft, gray fine to medium SILT (ML), dense, no odor, damp										
10					10.0		BOTTOM OF EXPLORATION 10.0 FT										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	10
Rock Cored (ft)	-
Samples	2S

Boring No. SB-13

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

TEST BORING REPORT

Boring No. SB-14

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	10 June 2020
Finish	10 June 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)
0		S1 43	0.0 5.0			(SM/GM)	0.0-0.7 ft, gray SAND and GRAVEL (SM/GM)
						(SM/GM)	0.7-2.1 ft, brown medium SAND and GRAVEL (SM/GM), some silt, loose
					2.1	ML/SM	2.1-3.0 ft, brown fine to medium SILT and SAND (ML/SM)
					3.0	SM	3.0-3.7 ft, light brown to brown medium to coarse SAND (SM), some silt
						SM	3.7-3.9 ft, white stone 3.9-5.4 ft, light brown to reddish-brown medium SAND (SM), no odor, moist
5		S2 32	5.0 10.0				5.0-8.4 ft, same
					8.4	ML	8.4-8.7 ft, brown fine to medium SILT (ML), no odor, moist
					8.7	SM	8.7-9.4 ft, light brown to reddish-brown medium SAND (SM), no odor, moist
					9.7	SM ML	9.4-9.8 ft, light brown to reddish-brown medium SAND (SM), no odor, damp
10					10.0		9.8-10.0 ft, brown fine to medium SILT (ML), no odor, moist BOTTOM OF EXPLORATION 10.0 FT

Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	10
Rock Cored (ft)	-
Samples	2S

Boring No. SB-14

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

TEST BORING REPORT

Boring No. SB-15

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	10 June 2020
Finish	10 June 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 40	0.0 5.0			ML	0.0-0.6 ft, white GRAVEL and STONE 0.6-3.4 ft, brown fine to medium SILT (ML), dense, no odor, dry										
					3.6	SM	3.4-3.6 ft, white stone 3.6-5.0 ft, light brown to brown medium SAND (SM), no odor, moist										
5		S2 36	5.0 10.0			SM	5.0-5.8 ft, same										
					5.8	ML ML	5.8-6.1 ft, brown fine to medium SILT (ML), some sand, no odor, moist 6.1-10.0 ft, light brown to brown medium to coarse SAND (ML), no odor, moist										
10					10.0		BOTTOM OF EXPLORATION 10.0 FT										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	10
Rock Cored (ft)	-
Samples	2S

Boring No. SB-15

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

TEST BORING REPORT

Boring No. SB-16

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	10 June 2020
Finish	10 June 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 32	0.0 5.0			ML	0.0-0.5 ft, landscaping stone 0.5-3.3 ft, brown to dark brown fine to medium SILT (ML), trace sand, no odor, dry										
						ML	3.3-3.9 ft, same, except moist										
						ML	3.9-4.1 ft, white stone 4.1-4.8 ft, brown to reddish-brown fine to medium SILT (ML), no odor, moist										
5		S2 23	5.0 10.0			ML	4.8-5.0 ft, white stone 5.0-9.1 ft, brown fine to medium SILT (ML), no odor, damp										
					9.1	SM	9.1-9.5 ft, light brown to brown medium to coarse SAND (SM), trace silt, no odor, damp										
					9.5	ML	9.5-10.0 ft, brown to dark brown fine to medium SILT (ML), no odor, samp										
10					10.0		BOTTOM OF EXPLORATION 10.0 FT										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	10
Rock Cored (ft)	-
Samples	2S

Boring No. SB-16

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

TEST BORING REPORT

Boring No. SB-17

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	10 June 2020
Finish	18 June 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 45	0.0 5.0			ML	0.0-0.7 ft, white GRAVEL and STONE 0.7-3.9 ft, brown fine to medium SILT (ML), some sand, no odor, dry										
					3.9	SM	3.9-4.3 ft, brown medium to coarse SAND (SM), loose, no odor, dry										
					4.3	ML	4.3-5.0 ft, brown fine to medium SILT (ML), dense, no odor, dry										
5		S2 33	5.0 10.0			ML	5.0-6.1 ft, same										
					6.1	SM	6.1-9.6 ft, tan to white medium to coarse SAND (SM), loose, no odor, damp										
					9.6	ML											
10		S3 58	10.0 15.0			ML	10.0-12.1 ft, brown to gray fine to medium stiff SILT (ML), dense, no odor, damp										
						ML	12.1-12.8 ft, black fine to medium SILT (ML), some sand, no odor, damp										
						ML	12.8-15.0 ft, gray to black fine to medium SILT (ML), some sand, dense, no odor, wet										
15		S4 57	15.0 20.0			ML	15.0-15.6 ft, same										
					15.6	SM	15.6-20.0 ft, grayish-brown medium to coarse SAND (SM), no odor, wet										
20					20.0		BOTTOM OF EXPLORATION 20.0 FT										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	20
Rock Cored (ft)	-
Samples	4S

Boring No. SB-17

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

TEST BORING REPORT

Boring No. SB-18

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	11 June 2020
Finish	11 June 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 40	0.0 5.0		0.4		0.0-0.4 ft -CONCRETE										
						ML	0.4-1.2 ft, brown fine to medium SILT (ML), no odor, dry										
						ML	1.2-3.3 ft, brown to reddish-brown fine to medium SILT (ML), some sand, no odor, dry										
						ML	3.3-4.0 ft, brown to reddish-brown fine to medium SILT (ML), no odor, dry										
						ML	4.0-4.4 ft, same, except moist										
					4.4												
						SM	4.4-5.0 ft, light brown to brown medium to coarse SAND (SM), no odor, moist										
5		S2 30	5.0 10.0			SM	5.0-5.4 ft, same										
						SM	5.4-8.6 ft, brown fine to medium SAND (SM), trace silt, no odor, moist										
					8.6												
						ML	8.6-8.9 ft, brown fine to medium SILT (ML), dense, no odor, dry										
					8.9	SM	8.9-10.0 ft, tan to light brown medium to coarse SAND (SM), no odor, damp										
10					10.0		BOTTOM OF EXPLORATION 10.0 FT										

Water Level Data					
Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID
- O - Open End Rod
- T - Thin Wall Tube
- U - Undisturbed Sample
- S - Split Spoon Sample

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

Summary

Overburden (ft)	10
Rock Cored (ft)	-
Samples	2S

Boring No. SB-18

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

TEST BORING REPORT

Boring No. SB-19

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	10 June 2020
Finish	10 June 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)
0		S1 46	0.0 5.0				0.0-1.2 ft, white GRAVEL and STONE
						SM/ML	1.2-4.2 ft, brown medium SAND and SILT (SM/ML), trace gravel, no odor, dry
						SM/ML	4.2-4.4 ft, white stone
					4.8	SM/ML	4.4-4.8 ft, brown medium SAND and SILT (SM/ML), trace gravel, no odor, moist
5		S2 34	5.0 10.0			SM	4.8-5.0 ft, tan to white coarse SAND (SM), loose, no odor, moist
						SM	5.0-9.2 ft, same
					9.6	SM	9.2-9.6 ft, brown fine to medium SAND (SM), no odor, damp
10					10.0	ML	9.6-10.0 ft, brown fine to medium SILT (ML), dense, no odor, moist
							BOTTOM OF EXPLORATION 10.0 FT

Gravel		Sand			Fines	Field Test			
% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	Strength

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	10
Rock Cored (ft)	-
Samples	2S

Boring No. SB-19

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

TEST BORING REPORT

Boring No. SB-20

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	10 June 2020
Finish	10 June 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 51	0.0 5.0				0.0-0.7 ft, white GRAVEL and STONE										
						ML	0.7-3.7 ft, brown to reddish-brown fine to medium SILT (ML), dense, no odor, dry										
						ML	3.7-5.0 ft, brown to reddish-brown fine to medium SILT (ML), no odor, moist										
5		S2 42	5.0 10.0			ML	5.0-7.1 ft, same										
						ML	7.1-8.4 ft, gray to dark gray fine to medium SILT (ML), dense, no odor, dry										
					8.4	SM	8.4-9.7 ft, brown to reddish-brown medium to coarse SAND (SM), loose, no odor, moist										
					9.7	ML	9.7-10.0 ft, dark brown to gray fine to medium SILT (ML), some sand, dense, no odor, dry										
10					10.0		BOTTOM OF EXPLORATION 10.0 FT										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	10
Rock Cored (ft)	-
Samples	2S

Boring No. SB-20

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

TEST BORING REPORT

Boring No. SB-21

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	10 June 2020
Finish	10 June 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)
0		S1 57	0.0 5.0			SM/ML	0.0-0.4 ft, white GRAVEL and STONE 0.4-2.2 ft, brown medium SAND and SILT (SM/ML), some gravel, no odor, dry -FILL- 2.2-2.7 ft, white GRAVEL and STONE
					2.7	SM	2.7-3.8 ft, reddish-brown fine to medium SAND (SM), some silt, no odor, dry
					3.8	ML	3.8-5.0 ft, reddish-brown to gray fine to medium SILT (ML), dense, no odor, dry
5		S2 49	5.0 10.0			ML	5.0-7.6 ft, same
					7.6	SM	7.6-8.3 ft, brown medium SAND (SM), trace silt, no odor, damp
					8.3	ML	8.3-9.2 ft, reddish-brown to gray fine to medium SILT (ML), no odor, moist
					9.2	SM	9.2-10.0 ft, reddish-brown fine to medium SAND (SM), some silt, no odor, damp
10					10.0		BOTTOM OF EXPLORATION 10.0 FT

Gravel		Sand			Fines	Field Test			
% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	Strength

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	10
Rock Cored (ft)	-
Samples	2S

Boring No. SB-21

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

TEST BORING REPORT

Boring No. SB-22

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	10 June 2020
Finish	10 June 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 57	0.0 5.0				0.0-0.5 ft, white GRAVEL and STONE										
						ML	0.5-1.9 ft, light brown to brown fine to medium SILT (ML), some gravel, no odor, dry										
						ML	1.9-3.2 ft, brown to dark brown fine to medium SILT (ML), no odor, moist										
							3.2-3.6 ft, white GRAVEL and STONE										
						ML	3.6-5.0 ft, dark brown to gray fine to medium SILT (ML), trace sand, no odor, moist										
5		S2 32	5.0 10.0			ML	5.0-8.1 ft, same										
						ML	8.1-8.7 ft, same, except brown										
					8.7	SM	8.7-9.4 ft, brown fine to medium SAND (SM), some silt, no odor, damp										
					9.4	ML	9.4-10.0 ft, brown fine to medium SILT (ML), some sand, no odor, damp										
10					10.0		BOTTOM OF EXPLORATION 10.0 FT										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	10
Rock Cored (ft)	-
Samples	2S

Boring No. SB-22

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

TEST BORING REPORT

Boring No. SB-23

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	10 June 2020
Finish	10 June 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 35	0.0 5.0		0.5		0.0-0.5 ft -CONCRETE 0.5-3.7 ft, brown and gray fine to medium SILT and SAND, some gravel -FILL-										
					3.9	ML	3.7-3.9 ft, white stone 3.9-4.5 ft, brown to reddish-brown fine to medium SILT (ML), trace sand, no odor, moist										
					4.5	SM	4.5-5.0 ft, brown to reddish brown medium to coarse SAND (SM), no odor, damp										
5		S2 44	5.0 10.0		5.4	SM ML	5.0-5.4 ft, same 5.4-7.2 ft, brown fine to medium SILT (ML), trace sand, no odor, moist										
						ML	7.2-8.1 ft, brown fine to medium SILT (ML), some sand, no odor, wet										
						ML	8.1-10.0 ft, brown to dark brown fine to medium SILT (ML), dense, no odor, dry										
10					10.0		BOTTOM OF EXPLORATION 10.0 FT										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	10
Rock Cored (ft)	-
Samples	2S

Boring No. SB-23

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

TEST BORING REPORT

Boring No. SB-24

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	9 June 2020
Finish	9 June 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 41	0.0 5.0				0.0-0.6 ft, white GRAVEL and STONE										
					0.6	SM/ML	0.6-3.3 ft, loose white and brown SAND and GRAVEL (SM/ML) and STONE										
					3.3	ML	3.3-4.1 ft, brown fine to medium SILT (ML), trace sand, dense, no odor, dry										
					4.1	SM	4.1-4.7 ft, brown fine to medium SAND (SM), some silt, no odor, moist										
					4.7	ML	4.7-5.0 ft, brown to dark brown fine to medium SILT (ML), no odor, damp										
5		S2 32	5.0 10.0			ML	5.0-9.3 ft, same										
					9.3	SM	9.3-10.0 ft, brown to dark brown fine to medium SAND (SM), trace silt, no odor, wet										
10					10.0		BOTTOM OF EXPLORATION 10.0 FT										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	10
Rock Cored (ft)	-
Samples	2S

Boring No. SB-24

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

TEST BORING REPORT

Boring No. SB-25

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	9 June 2020
Finish	19 June 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)
0		S1 41	0.0 5.0				0.0-0.8 ft, white GRAVEL and STONE
					0.8		0.8-1.7 ft, brown SILT and SAND and GRAVEL -FILL-
					1.7	SM	1.7-4.4 ft, brown fine to medium SAND (SM), no odor, moist
					4.4	ML	4.4-4.6 ft, brown fine SILT (ML), dense, no odor, damp
5		S2 37	5.0 10.0		4.6	SM	4.6-5.0 ft, reddish-brown medium SAND (SM), no door, moist
					5.7	SM	5.0-5.7 ft, same
						ML	5.7-7.0 ft, dark brown to gray fine to medium SILT (ML), no odor, damp
						ML	7.0-9.4 ft, dark gray fine to medium SILT (ML), dense, no odor, moist
					9.4	SM	9.4-10.0 ft, brown medium SAND (SM), no odor, wet
10		S3 58	10.0 15.0			SM	10.0-10.9 ft, same
					10.9	ML	10.9-11.4 ft, dark gray fine to medium SILT (ML), no odor, damp
							11.4-13.2 ft, dark brown to gray fine to medium SAND (SM), trace silt, no odor, damp
					13.6	ML	13.2-13.6 ft, gray fine to medium SILT (ML), some sand, no odor, damp
						SM	13.6-15.0 ft, brown to gray medium SAND (SM), no odor, wet
15		S4 53	15.0 20.0			SM	15.0-17.8 ft, same
						SM	17.8-20.0 ft, brown to gray medium to coarse SAND (SM), no odor, wet
20					20.0		BOTTOM OF EXPLORATION 20.0 FT

Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	20
Rock Cored (ft)	-
Samples	4S

Boring No. SB-25

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

TEST BORING REPORT

Boring No. SB-31

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	17 June 2020
Finish	17 June 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 26	0.0 5.0		0.4		0.0-0.4 ft -CONCRETE-										
						ML	0.4-2.6 ft, brown fine to medium SILT (ML), trace gravel, no odor, dry										
						ML	2.6-3.4 ft, brown fine to medium SILT (ML), no odor, moist										
						ML	3.4-5.0 ft, brown to reddish-brown SILT (ML), trace sand, no odor, moist										
5		S2 31	5.0 10.0			ML	5.0-7.6 ft, same										
						ML	7.6-8.1 ft, same, except wet										
						ML	8.1-8.6 ft, brown to reddish-brown SILT (ML), very dense, no odor, dry										
						ML	8.6-10.0 ft, brown to reddish-brown fine to medium SILT (ML), trace sand, no odor, moist										
10					10.0		BOTTOM OF EXPLORATION 10.0 FT										

Water Level Data					
Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID

- O - Open End Rod
- T - Thin Wall Tube
- U - Undisturbed Sample
- S - Split Spoon Sample

Well Diagram

- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

Summary

Overburden (ft)	10
Rock Cored (ft)	-
Samples	2S

Boring No. SB-31

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

TEST BORING REPORT

Boring No. SB-32

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	19 June 2020
Finish	19 June 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 52	0.0 5.0		0.3	ML	0.0-0.3 ft TOPSOIL-										
					1.2	SM	0.3-1.2 ft, brown fine SILT (ML), dense, no odor, dry										
							1.2-2.9 ft, brown to reddish-brown fine silty SAND (SM), no odor, dry										
					2.9	ML	2.9-4.3 ft, brown fine to medium SILT (ML), no odor, moist										
					4.3	SM	4.3-4.8 ft, light brown fine to medium SAND (SM), no odor, moist										
5		S2 58	5.0 10.0		4.8	ML	4.8-5.0 ft, brown fine to medium SILT (ML), some sand, no odor, moist										
						ML	5.0-7.4 ft, same										
						ML	7.4-8.1 ft, brown to reddish-brown fine SILT (ML), dense, no odor, moist										
					8.1	SM	8.1-10.0 ft, brown to reddish-brown fine to medium SAND (SM), some silt, no odor, damp										
10		S3 58	10.0 15.0			SM	10.0-12.1 ft, same										
						SM	12.1-15.0 ft, same, except wet										
15		S4 57	15.0 20.0			SM	15.0-16.2 ft, same										
						SM	16.2-20.0 ft, brown to reddish-brown medium to coarse SAND (SM), some silt, no odor, wet										
20					20.0		BOTTOM OF EXPLORATION 20.0 FT										

Water Level Data					
Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID
- O - Open End Rod
- T - Thin Wall Tube
- U - Undisturbed Sample
- S - Split Spoon Sample

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

Summary

Overburden (ft)	20
Rock Cored (ft)	-
Samples	4S

Boring No. SB-32

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

TEST BORING REPORT

Boring No. SB-33

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	19 June 2020
Finish	19 June 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 31	0.0 5.0		0.4	ML	0.0-0.4 -TOPSOIL/ORGANICS-										
						ML	0.4-1.3 ft, dark brown SILT (ML), loose 1.3-5.0 ft, dark brown fine to medium SILT (ML), no odor, dry										
5		S2 25	5.0 10.0			ML	5.0-8.9 ft, brown to dark brown fine to medium SILT (ML), no odor, moist										
						ML	8.9-10.0 ft, brown to dark brown fine to medium SILT (ML), trace sand, no odor, moist										
10		S3 39	10.0 15.0			ML	10.0-13.2 ft, brown to dark brown fine to medium SILT (ML), dense, no odor, moist										
						ML	13.2-15.0 ft, light brown to brown fine to medium SILT (ML), some sand, some organics (root material), no odor, moist										
15		S4 60	15.0 20.0			ML	15.0-16.3 ft, same										
					16.3	ML/SM	16.3-20.0 ft, light brown to brown fine to medium SILT and SAND (ML/SM), no odor, damp										
20					20.0		BOTTOM OF EXPLORATION 20.0 FT										

Water Level Data					
Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	20
Rock Cored (ft)	-
Samples	4S

Boring No. SB-33

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

TEST BORING REPORT

Boring No. SB-34

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	19 June 2020
Finish	19 June 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 49	0.0 5.0				0.0-1.5 ft, gray GRAVEL and STONE										
					1.5	ML	1.5-4.3 ft, brown to reddish-brown very fine to fine SILT (ML), dense, no odor, dry										
5		S2 51	5.0 10.0			ML	4.3-5.0 ft, brown to gray fine to medium SILT (ML), dense, no odor, dry										
						ML	5.0-7.7 ft, same										
						ML	7.7-9.1 ft, gray fine to medium SILT (ML), some sand, no odor, moist										
					9.1	SM	9.1-10.0 ft, gray fine to medium SAND (SM), some silt, no odor, moist										
10		S3 51	10.0 15.0			SM	10.0-12.9 ft, same										
						SM	12.9-15.0 ft, brown to gray medium SAND (SM), no odor, wet										
15		S4 6	15.0 20.0			SM	15.0-19.2 ft, brown to gray medium to coarse SAND (SM), no odor, wet										
					19.2	ML	19.2-20.0 ft, dark gray fine to medium SILT (ML), trace sand, no door, wet										
20					20.0		BOTTOM OF EXPLORATION 20.0 FT										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	20
Rock Cored (ft)	-
Samples	4S

Boring No. SB-34

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

APPENDIX B

Hydraulic Gradient and Groundwater Velocity Analyses

PROBLEM STATEMENT & OBJECTIVE

The purpose of this calculation set is to estimate the hydraulic horizontal gradients, vertical gradients, and velocity for Fort Calhoun Station in Blair, Nebraska based on field data collected in June 2020.

REFERENCES

1. Groundwater (1979) A. Freeze & J. Cherry, Chapter 2.1 - Darcy's Law.
2. Morris, D.A. and A.I. Johnson, 1967. Summary of hydrologic and physical properties of rock and soil materials as analyzed by the Hydrologic Laboratory of the U.S. Geological Survey, U.S. Geological Survey Water-Supply Paper 1839-D, 42p.

AVAILABLE INFORMATION

1. Haley & Aldrich, June 2020 Shallow Groundwater Contour Plan, Fort Calhoun Station, Blair, Nebraska.
2. Haley & Aldrich, June 2020 Deep Groundwater Contour Plan, Fort Calhoun Station, Blair, Nebraska.
3. Haley & Aldrich, Slug Testing/Aquifer Testing Results, Fort Calhoun Station, Blair, Nebraska.
4. Haley & Aldrich, Well Construction Table, Fort Calhoun Station, Blair, Nebraska.

ASSUMPTIONS

1. For these calculations, gradient will be calculated according to Darcy's Law. Gradient is calculated by dividing the change in hydraulic head by the distance over which the head changes (Δh/ΔL). The change in head values will be calculated by taking the difference between two groundwater contours, and the distance between those two contours will be measured perpendicular to the contours. Vertical gradient will also be calculated for multi-level wells with the same Δh/ΔL approach.

2. Groundwater velocity will be calculated using the following equation from Darcy's Law:

$$V = (Ki)/n_e$$

Where:
V = Velocity (cm/sec)
K = Hydraulic Conductivity (cm/sec)
i = Horizontal Hydraulic Gradient (unitless)
n_e = Effective Porosity (unitless)

3. A range of hydraulic conductivity values will be used for the velocity calculations. Based on the slug testing results in the table below, we will use a range of 1x10-3 cm/sec to 1x10-2 cm/sec for these calculations.

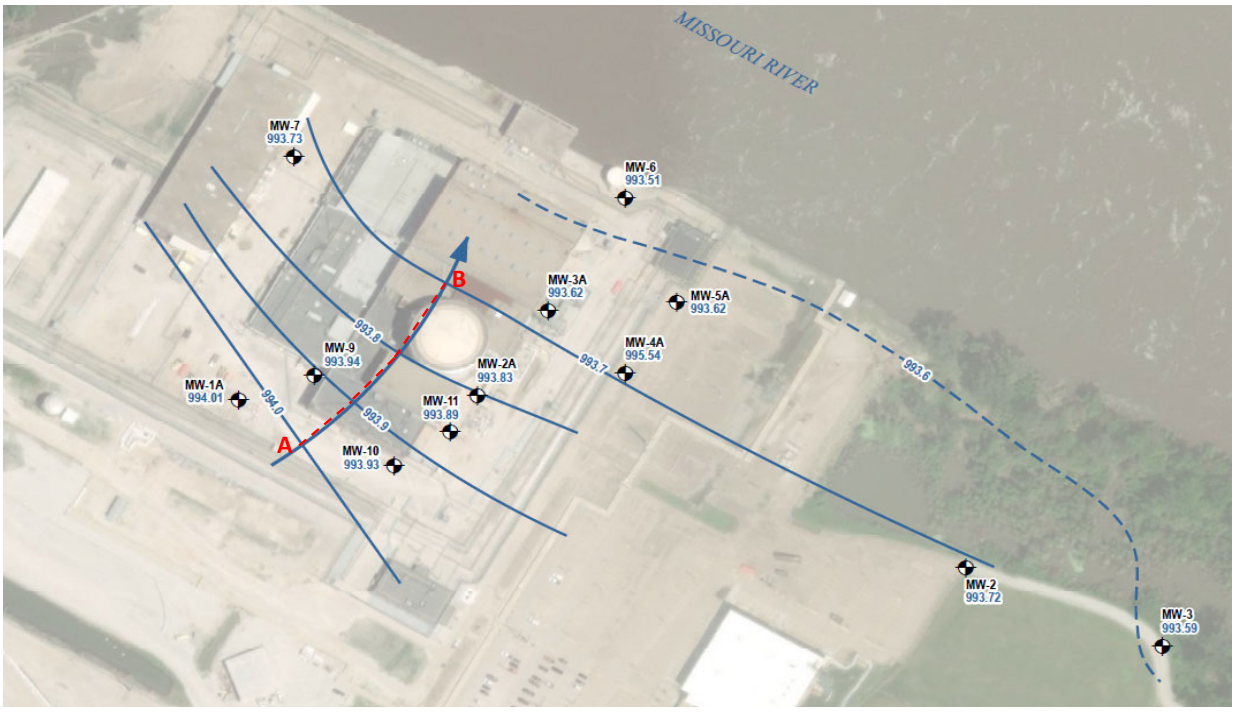
Location	Estimated K (cm/s)		GeoMean
MW-1A	9.05E-03		
MW-1A	2.34E-02		
MW-1A	1.17E-02		
MW-1A	1.40E-02		**1.4E-02**
MW-2	1.89E-02		
MW-2	1.64E-02		
MW-2	1.80E-02		
MW-2	1.57E-02		**1.7E-02**
MW-3A	8.75E-03		
MW-3A	1.03E-02		
MW-3A	1.08E-02		
MW-3A	9.11E-03		**9.7E-03**
MW-3B	1.32E-02		
MW-3B	1.61E-02		
MW-3B	1.55E-02		
MW-3B	1.38E-02		**1.5E-02**
MW-5A	9.28E-03		
MW-5A	8.55E-03		
MW-5A	1.04E-02		
MW-5A	9.56E-03		**9.4E-03**
MW-5B	1.76E-02		
MW-5B	1.69E-02		
MW-5B	1.81E-02		
MW-5B	2.07E-02		**1.8E-02**

4. A range of effective porosity values will also be used for the velocity calculations. Based on ranges provided in Morris and Johnson 1967 for specific yield and porosity, we will assume a range of 0.15 to 0.25 for these calculations.

HALEY ALDRICH	CALCULATIONS	File No.:	127960-005
		Sheet:	2 of 5
Client:	Energy Solutions	Date:	23-Jul-2020
Project:	Fort Calhoun Station, Blair, Nebraska	Computed by:	SLG
Subject:	Hydraulic Gradient and Velocity Calculations	Checked by:	CKJ

HORIZONTAL HYDRAULIC GRADIENT CALCULATIONS

1. Shallow Groundwater Calculations

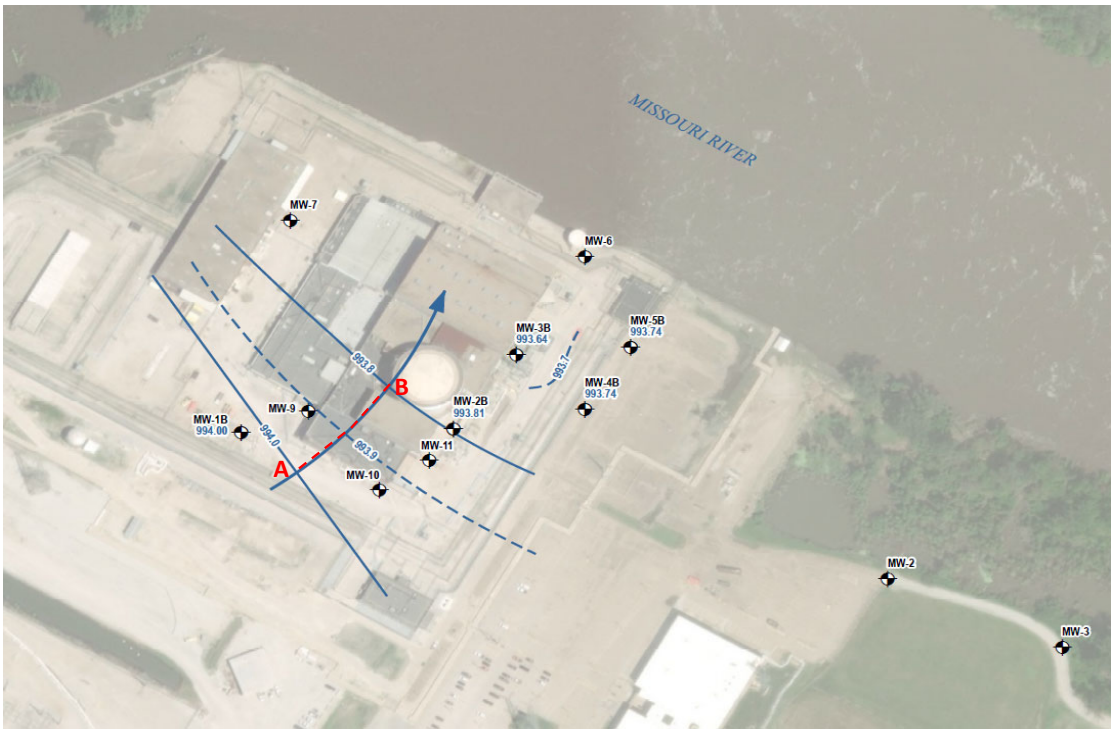


Calculation Line	Head 1 (ft)	Head 2 (ft)	Change in Head (Δh)	Distance in ft (ΔL)	Calculated Gradient
A - B	994.0	993.7	0.3	361.1	8.31E-04

Estimated Gradient	**=**	**8.31E-04**

HORIZONTAL HYDRAULIC GRADIENT CALCULATIONS

2. Deep Groundwater Calculations



Calculation Line	Head 1 (ft)	Head 2 (ft)	Change in Head (Δh)	Distance in ft (ΔL)	Calculated Gradient
A - B	994.0	993.8	0.2	235.5	8.5E-04

Estimated Gradient	**=**	**8.49E-04**

VERTICAL HYDRAULIC GRADIENT CALCULATIONS

1. Vertical hydraulic gradient is calculated by dividing the change in head by the change is distance over which the head change occurs (Δh/ΔL).

2. The change in head is calculated by finding the difference in groundwater elevation between the shallow and deep ports of the multi-level wells.

3. The distance used for these calculations is the difference in depth between the midpoint of the screen interval for both the shallow and deep ports on the multi-level wells. The "Depth" column refers to the screen midpoint depth for each port.

4. Estimated gradients are shown as either positive or negative values. A positive gradient indicates an upward gradient direction. A negative gradient indicates a downward gradient direction.

5. The estimated minimum, maximum, and average gradients presented on this page are calculated using only the magnitude of the estimated gradients. The negative/positive associations are indicative of direction only and are not included in the calculations of the minimum, maximum, and average gradients.

Well ID	Shallow Port (A)		Deep Port (B)		Change in Head	Distance	Estimated Vertical Gradient
	GWE (ft)	Depth bgs (ft)	GWE (ft)	Depth bgs (ft)	Δh	ΔL	Δh/ΔL
MW-1	994.01	19	994.00	47.5	0.01	28.5	0.0004
MW-2	993.83	19	993.81	47.5	0.02	28.5	0.0007
MW-3	993.62	18	993.64	47.5	-0.02	29.5	-0.0007
MW-4	995.54	17	993.74	47.5	1.8	30.5	0.0590
MW-5	993.62	17	993.74	47.5	-0.12	30.5	-0.0039

Minimum Vertical Hydraulic Gradient: **0.0004**

Maximum Vertical Hydraulic Gradient: **0.0590**

Average Vertical Hydraulic Gradient: **0.0129**

GROUNDWATER VELOCITY CALCULATIONS

$V = (Ki)/n_e$

Where:
V = Velocity (cm/sec)
K = Hydraulic Conductivity (cm/sec)
i = Horizontal Hydraulic Gradient (unitless)
n_e = Effective Porosity (unitless)

1. The velocity will be calculated using the average estimated gradient for each contour plan, as shown on previous pages of this calculation set.

2. The velocity will be calculated using a hydraulic conductivity range of $1x10^{-3}$ cm/sec to $1x10^{-2}$ cm/sec.

3. The velociity will be calculated using a range of effective porosity values of 0.15 to 0.25.

Shallow Groundwater Calculations

Hydraulic Conductivity (K) (cm/sec)	Gradient (unitless)	Effective Porosity (unitless)	Estimated Velocity	
			(cm/sec)	(ft/year)
1E-03	8.31E-04	0.15	5.54E-06	5.73
1E-02	8.31E-04	0.25	3.32E-05	34.39
1E-03	8.31E-04	0.15	5.54E-06	5.73
1E-02	8.31E-04	0.25	3.32E-05	34.39

Deep Groundwater Calculations

Hydraulic Conductivity (K) (cm/sec)	Gradient (unitless)	Effective Porosity (unitless)	Estimated Velocity	
			(cm/sec)	(ft/year)
1E-03	8.49E-04	0.15	6E-06	5.86
1E-02	8.49E-04	0.25	3E-05	35.16
1E-03	8.49E-04	0.15	6E-06	5.86
1E-02	8.49E-04	0.25	3E-05	35.16

SUMMARY OF RESULTS

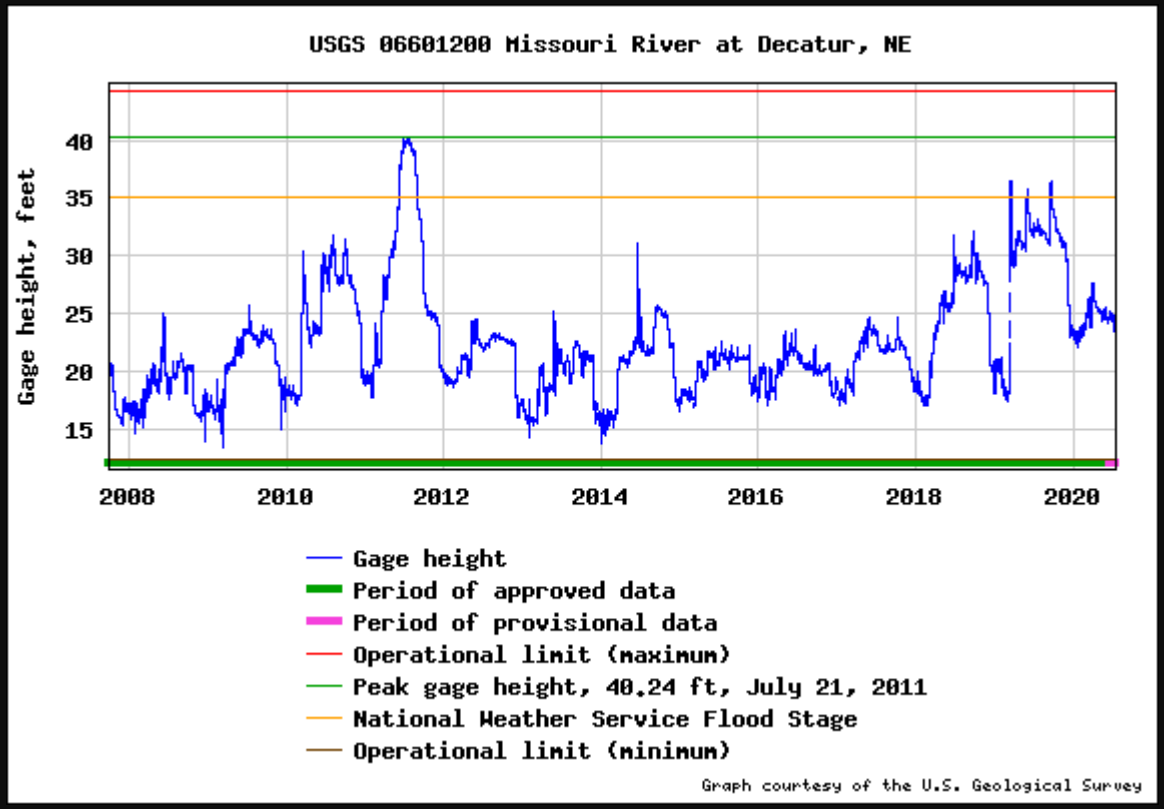
1. For the shallow groundwater contours, the estimated average gradient is 8.31E-04
   The maximum estimated grounwater velocity for the shallow groundwater is 3.32E-05 cm/sec. / 34.39 ft/year
   The minimum estimated groundwater velocity for the shallow groundwater is 5.54E-06 cm/sec. / 5.73 ft/year

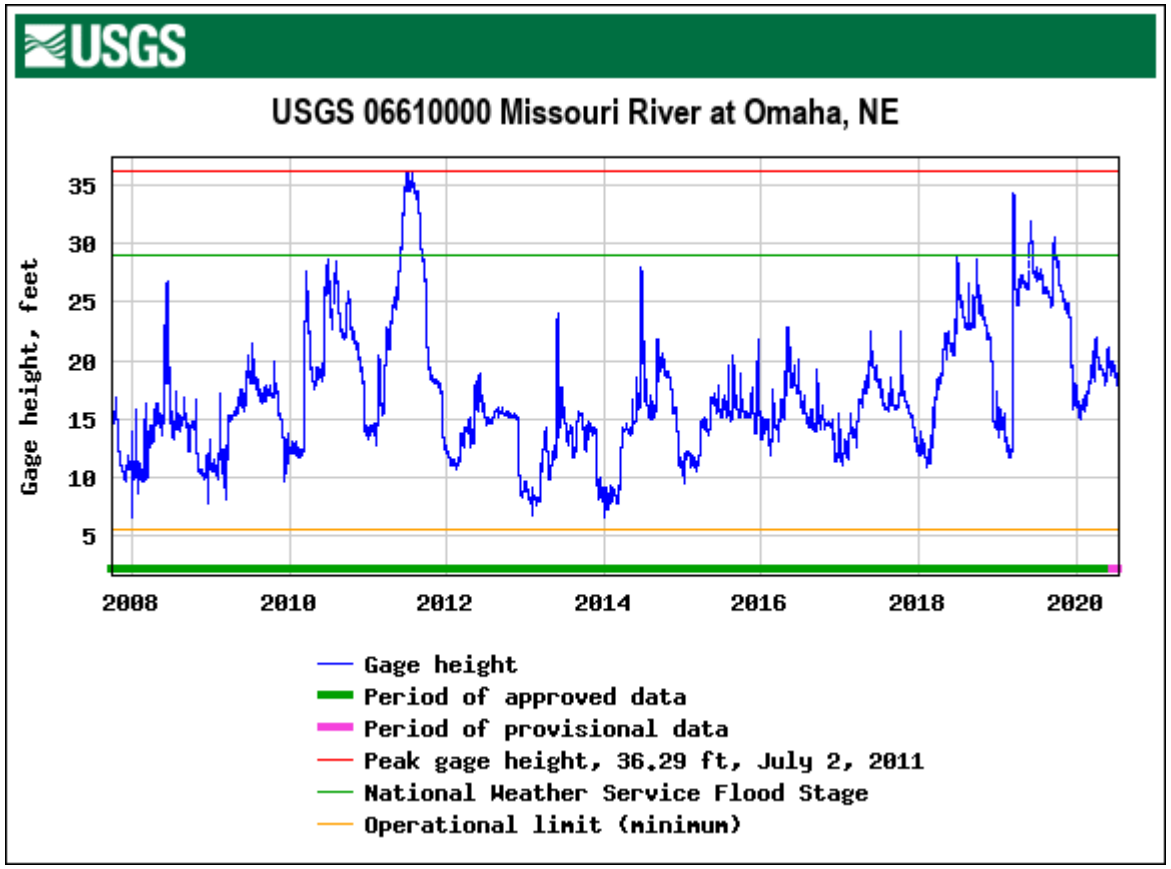
2. For the deep groundwater contours, the estimated average gradient is 8.49E-04
   The maximum estimated grounwater velocity for the deep groundwater is 3E-05 cm/sec. / 35.16 ft/year
   The minimum estimated groundwater velocity for the deep groundwater is 6E-06 cm/sec. / 5.86 ft/year

3. The magnitude of the vertical gradient for the multi-level wells ranges from approximately 0.0004 to 0.06, and the gradient direction is upwards for MW-1, MW-2, and MW-4. The gradient direction for MW-3 and MW-5 is downwards.

APPENDIX C

River Gauging Station Data Graphs


USGS 06601200 Missouri River at Decatur, NE
Gage height, feet
40
35
30
25
20
15
2008
2010
2012
2014
2016
2018
2020
Gage height
Period of approved data
Period of provisional data
Operational limit (maximum)
Peak gage height, 40.24 ft, July 21, 2011
National Weather Service Flood Stage
Operational limit (minimum)
Graph courtesy of the U.S. Geological Survey


USGS
USGS 06610000 Missouri River at Omaha, NE
Gage height, feet
35
30
25
20
15
10
5
2008
2010
2012
2014
2016
2018
2020
Gage height
Period of approved data
Period of provisional data
Peak gage height, 36.29 ft, July 2, 2011
National Weather Service Flood Stage
Operational limit (minimum)

APPENDIX D

Hydraulic Conductivity Analyses

HALEY & ALDRICH, INC
Fort Calhoun Station
Blair Nebraska
127960-006

FALLING HEAD TEST SUMMARY

Monitoring Well ID:	MW-1A
Test Date:	17-Jun-20
H&A Rep.:	S. Kaney

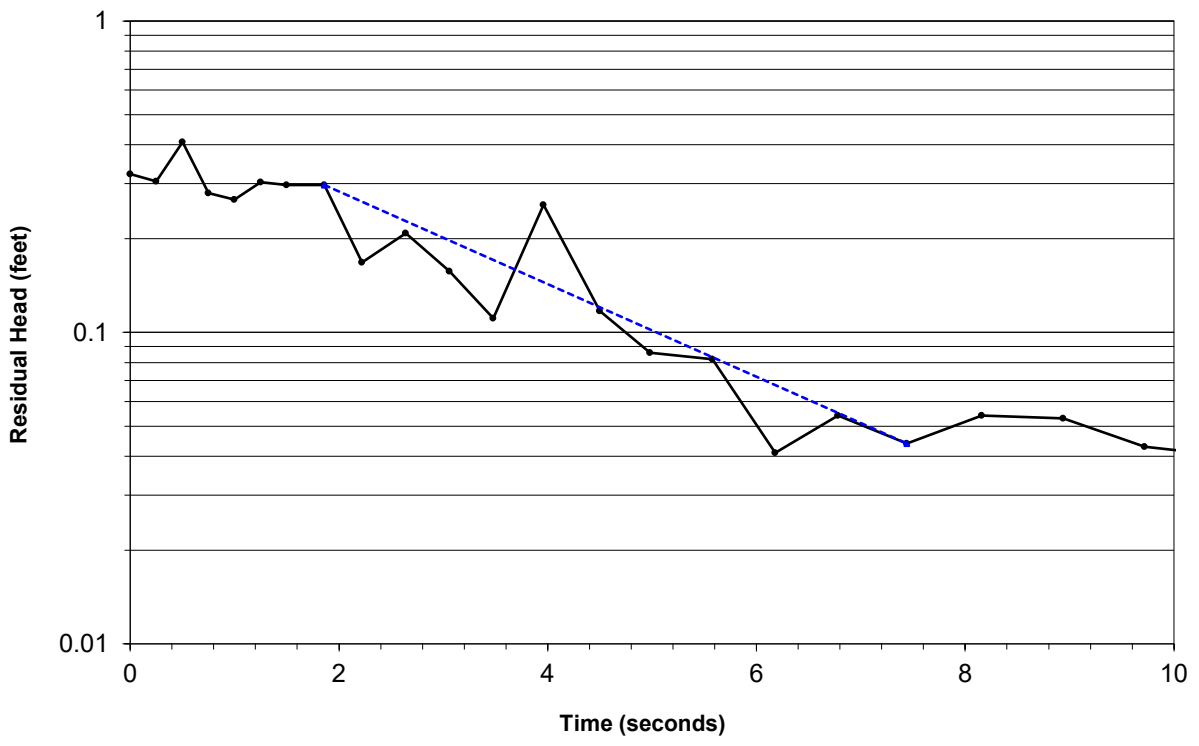
TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	24	
Depth to Static (PVC) in ft.:	13.01	
Well Depth-Static (Lw), in ft.:	10.99	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	10.0	
Test Length Section (Le), in ft.:	10	
A:	3.164	
B:	0.538	
C:	3.136	
Le/rw:	53.333	
Saturated Thickness (H), in ft.:	11	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.334	
For Lw=H - ln(Re/rw):	3.039	
Yo, in ft.:	0.30	
Yt, in ft.:	0.044	
t, in min.:	0.124	

	(Lw<H)	(Lw=H)
Kh (cm/sec) =	9.05E-03	
Kh (m/sec) =	9.05E-05	
Kh (ft/min) =	1.78E-02	
Kh (ft/day) =	2.57E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.322
0.25	0.31
0.5	0.41
0.75	0.28
1	0.27
1.25	0.30
1.5	0.30
1.86	0.30
2.22	0.17
2.64	0.21
3.06	0.16
3.48	0.11
3.96	0.26
4.5	0.12
4.98	0.09
5.58	0.08
6.18	0.04
6.78	0.05
7.44	0.04
8.16	0.05
8.94	0.05
9.72	0.04
10.56	0.04
11.46	0.01
12.42	0.02
13.38	0.02
14.46	0.00



HALEY & ALDRICH, INC

Fort Calhoun Station

Blair Nebraska

127960-006

FALLING HEAD TEST SUMMARY

Monitoring Well ID:	MW-1A
Test Date:	17-Jun-20
H&A Rep.:	S. Kaney

TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

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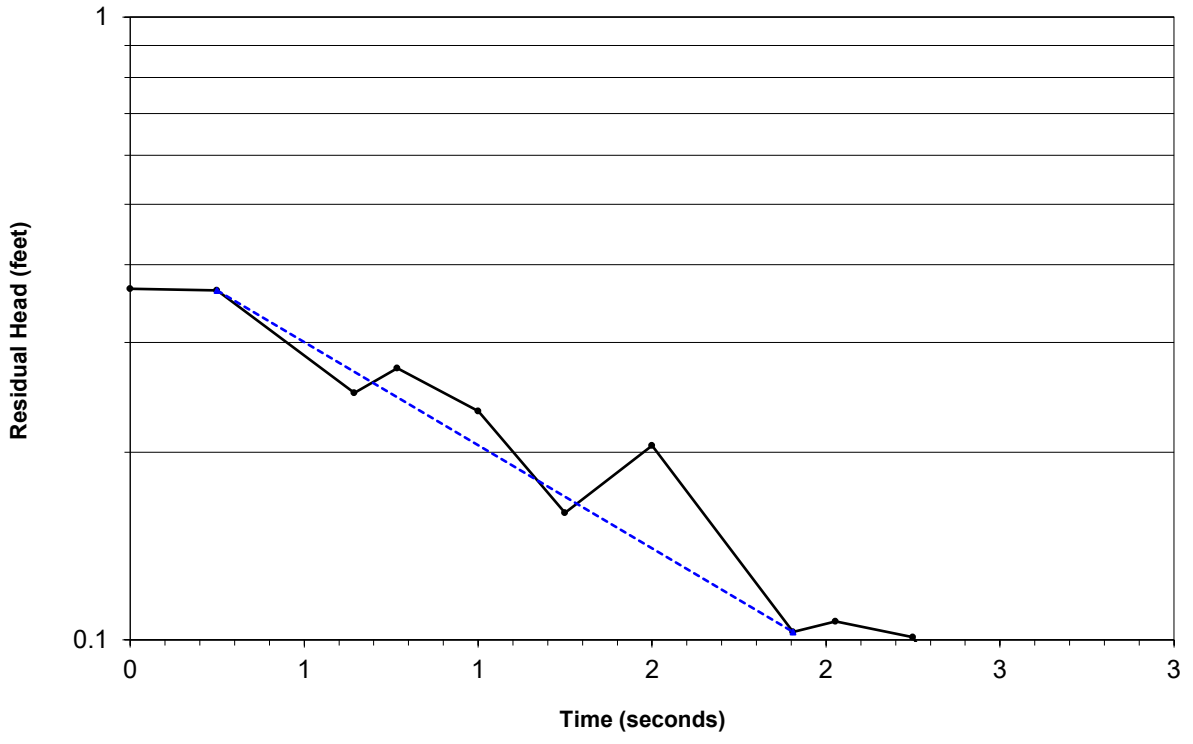
Well Depth-Static (Lw), in ft.:	10.99	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	10.0	
Test Length Section (Le), in ft.:	10	
A:	3.164	
B:	0.538	
C:	3.136	
Le/rw:	53.333	
Saturated Thickness (H), in ft.:	11	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.334	
For Lw=H - ln(Re/rw):	3.039	
Yo, in ft.:	0.36	
Yt, in ft.:	0.103	
t, in min.:	0.032	

	(Lw<H)	(Lw=H)
Kh (cm/sec) =	2.34E-02	
Kh (m/sec) =	2.34E-04	
Kh (ft/min) =	4.60E-02	
Kh (ft/day) =	6.62E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.366
0.25	0.36
0.644	0.25
0.768	0.27
1	0.23
1.25	0.16
1.5	0.21
1.905	0.10
2.028	0.11
2.25	0.10
2.5	0.06
2.75	0.09
3.047	0.04
3.25	0.04
3.5	0.06
3.75	0.04
4	0.04
4.25	0.04
4.5	0.03
4.86	0.02
5.22	0.04
5.64	0.03
6.06	0.01



HALEY & ALDRICH, INC

Fort Calhoun Station

Blair Nebraska

127960-006

FALLING HEAD TEST SUMMARY

Monitoring Well ID:	MW-1A
Test Date:	17-Jun-20
H&A Rep.:	S. Kaney

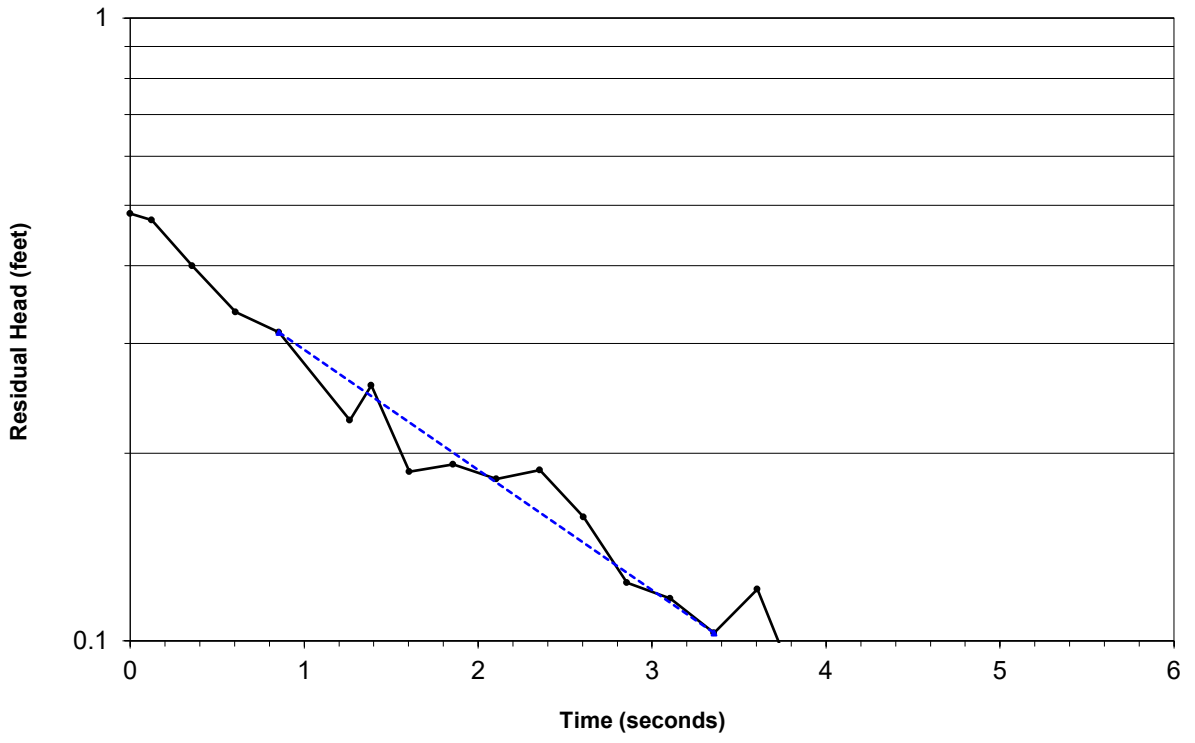
TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	24	
Depth to Static (PVC) in ft.:	13.01	
Well Depth-Static (Lw), in ft.:	10.99	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	10.0	
Test Length Section (Le), in ft.:	10	
A:	3.164	
B:	0.538	
C:	3.136	
Le/rw:	53.333	
Saturated Thickness (H), in ft.:	11	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.334	
For Lw=H - ln(Re/rw):	3.039	
Yo, in ft.:	0.31	
Yt, in ft.:	0.103	
t, in min.:	0.056	

	(Lw<H)	(Lw=H)
Kh (cm/sec) =	1.17E-02	
Kh (m/sec) =	1.17E-04	
Kh (ft/min) =	2.30E-02	
Kh (ft/day) =	3.31E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.485
0.125	0.47
0.356	0.40
0.606	0.34
0.856	0.31
1.262	0.23
1.386	0.26
1.606	0.19
1.856	0.19
2.106	0.18
2.356	0.19
2.606	0.16
2.856	0.12
3.106	0.12
3.356	0.10
3.606	0.12
3.856	0.08
4.216	0.09
4.576	0.06
4.996	0.05
5.416	0.06
5.836	0.05
6.316	0.07
6.856	0.04
7.336	0.03
7.936	0.02
8.536	0.05
9.136	0.04
9.796	0.02
10.516	0.02



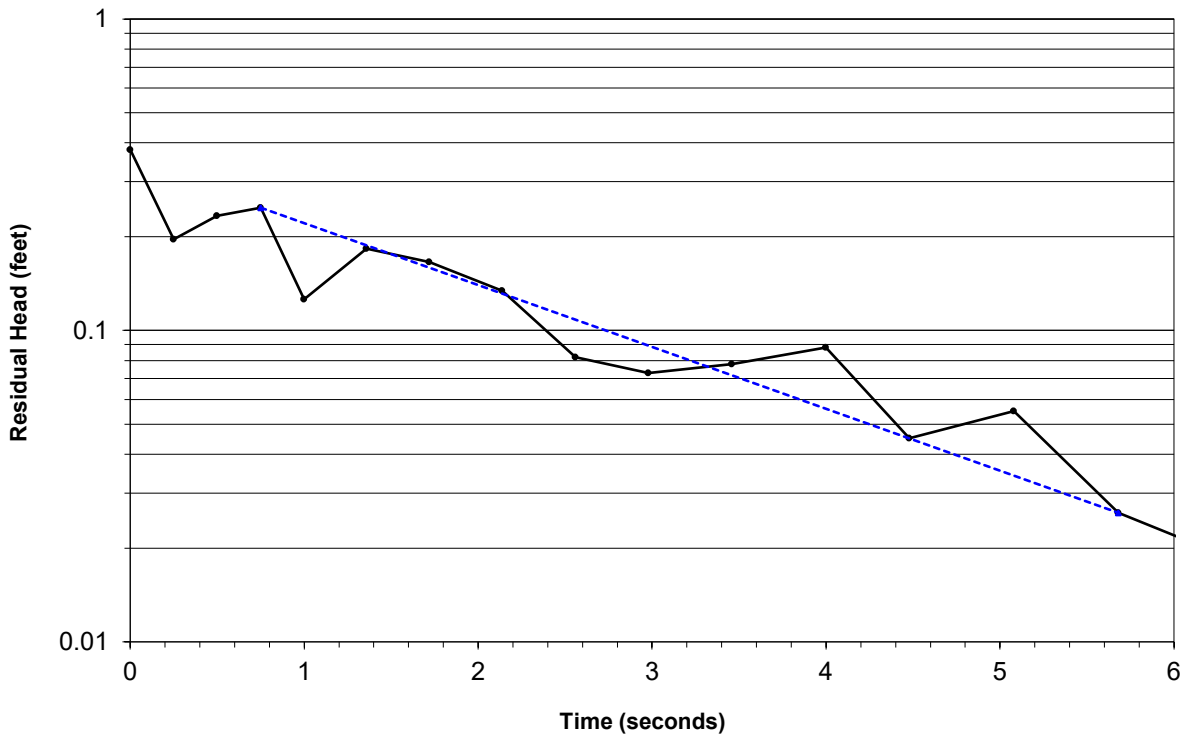
HALEY & ALDRICH, INC	**FALLING HEAD TEST SUMMARY**	
Fort Calhoun Station	Monitoring Well ID:	MW-1A
Blair Nebraska	Test Date:	17-Jun-20
127960-006	H&A Rep.:	S. Kaney

TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	24	
Depth to Static (PVC) in ft.:	13.01	
Well Depth-Static (Lw), in ft.:	10.99	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	10.0	
Test Length Section (Le), in ft.:	10	
A:	3.164	
B:	0.538	
C:	3.136	
Le/rw:	53.333	
Saturated Thickness (H), in ft.:	11	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.334	
For Lw=H - ln(Re/rw):	3.039	
Yo, in ft.:	0.25	
Yt, in ft.:	0.026	
t, in min.:	0.095	
	(Lw<H)	(Lw=H)
Kh (cm/sec) =	1.40E-02	
Kh (m/sec) =	1.40E-04	
Kh (ft/min) =	2.76E-02	
Kh (ft/day) =	3.97E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.38
0.25	0.20
0.5	0.23
0.75	0.25
1	0.13
1.359	0.18
1.72	0.17
2.139	0.13
2.56	0.08
2.979	0.07
3.46	0.08
3.999	0.09
4.479	0.04
5.079	0.05
5.68	0.03
6.279	0.02
6.939	0.03
7.659	0.04
8.439	0.03
9.219	0.02
10.059	0.01



HALEY & ALDRICH, INC

Fort Calhoun Station

Blair Nebraska

127960-006

FALLING HEAD TEST SUMMARY

Monitoring Well ID:	MW-1B
Test Date:	17-Jun-20
H&A Rep.:	S. Kaney

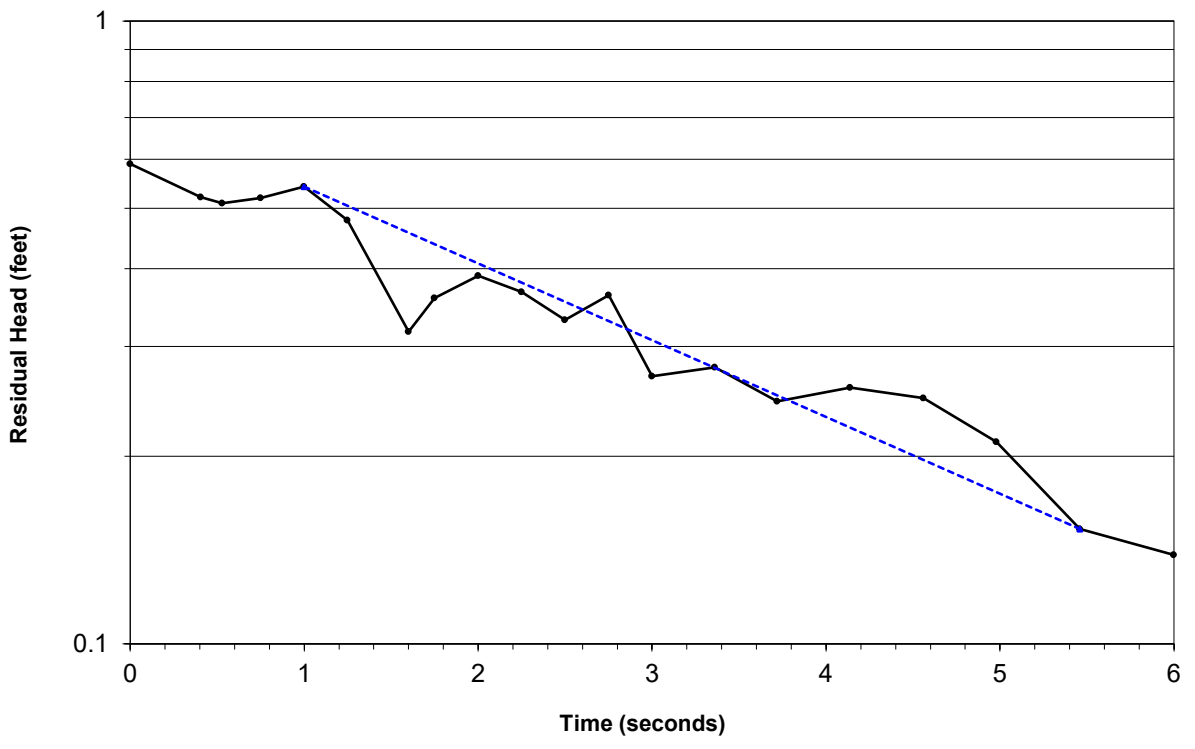
TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	50	
Depth to Static (PVC) in ft.:	13.01	
Well Depth-Static (Lw), in ft.:	36.99	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	5.0	
Test Length Section (Le), in ft.:	5	
A:	2.418	
B:	0.387	
C:	1.991	
Le/rw:	26.667	
Saturated Thickness (H), in ft.:	37	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.903	
For Lw=H - ln(Re/rw):	3.536	
Yo, in ft.:	0.54	
Yt, in ft.:	0.153	
t, in min.:	0.091	

	(Lw<H)	(Lw=H)
Kh (cm/sec) =	1.91E-02	
Kh (m/sec) =	1.91E-04	
Kh (ft/min) =	3.76E-02	
Kh (ft/day) =	5.42E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.589
0.406	0.52
0.529	0.51
0.75	0.52
1	0.54
1.25	0.48
1.6	0.32
1.75	0.36
2	0.39
2.25	0.37
2.5	0.33
2.75	0.36
3	0.27
3.36	0.28
3.72	0.24
4.14	0.26
4.56	0.25
4.98	0.21
5.46	0.15
6	0.14
6.48	0.14
7.08	0.15
7.68	0.12
8.28	0.09
8.94	0.08
9.66	0.05
10.44	0.06
11.22	0.05
12.06	0.07
12.96	0.06
13.92	0.04
14.88	0.08
15.96	0.01



HALEY & ALDRICH, INC

Fort Calhoun Station

Blair Nebraska

127960-006

FALLING HEAD TEST SUMMARY

Monitoring Well ID:	MW-1B
Test Date:	17-Jun-20
H&A Rep.:	S. Kaney

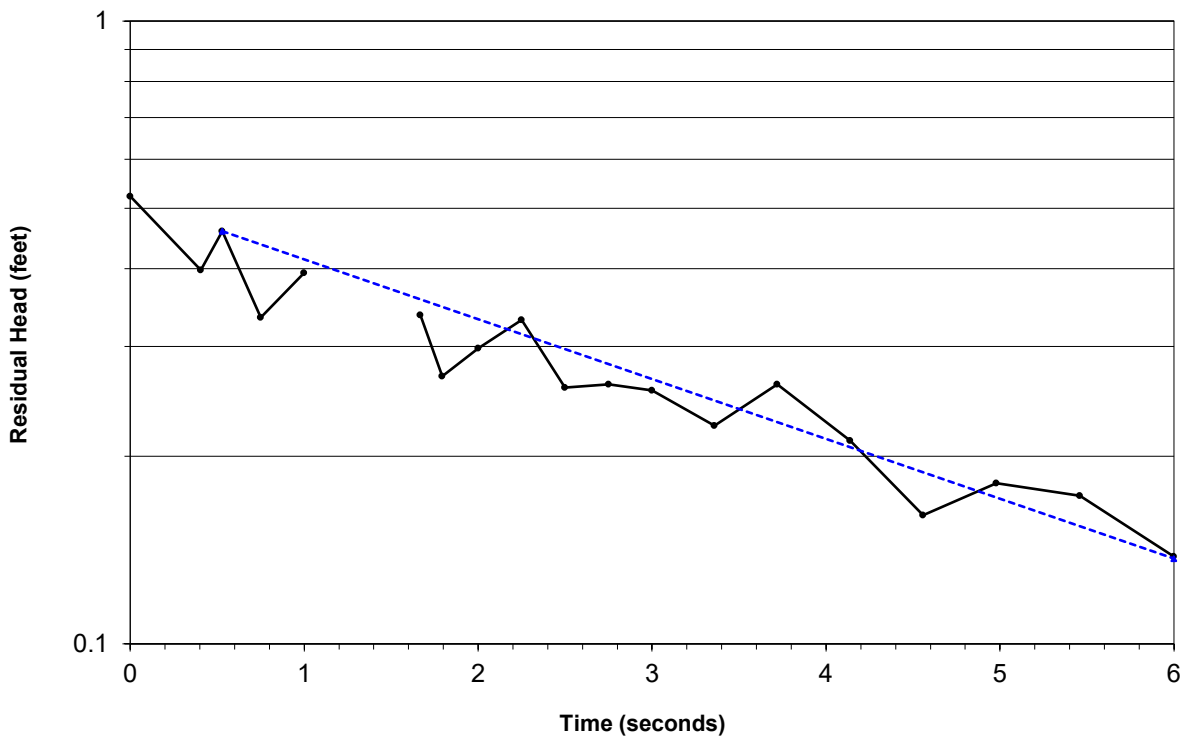
TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	50	
Depth to Static (PVC) in ft.:	13.01	
Well Depth-Static (Lw), in ft.:	36.99	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	5.0	
Test Length Section (Le), in ft.:	5	
A:	2.418	
B:	0.387	
C:	1.991	
Le/rw:	26.667	
Saturated Thickness (H), in ft.:	37	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.903	
For Lw=H - ln(Re/rw):	3.536	
Yo, in ft.:	0.46	
Yt, in ft.:	0.137	
t, in min.:	0.100	

	(Lw<H)	(Lw=H)
Kh (cm/sec) =	1.67E-02	
Kh (m/sec) =	1.67E-04	
Kh (ft/min) =	3.28E-02	
Kh (ft/day) =	4.72E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.523
0.405	0.40
0.529	0.46
0.75	0.33
1	0.39
1.669	0.34
1.793	0.27
2	0.30
2.25	0.33
2.5	0.26
2.75	0.26
3	0.25
3.359	0.22
3.72	0.26
4.139	0.21
4.559	0.16
4.979	0.18
5.46	0.17
5.999	0.14
6.479	0.12
7.079	0.09
7.68	0.09
8.279	0.06
8.939	0.06
9.659	0.05
10.439	0.03



HALEY & ALDRICH, INC

Fort Calhoun Station

Blair Nebraska

127960-006

FALLING HEAD TEST SUMMARY

Monitoring Well ID:	MW-1B
Test Date:	17-Jun-20
H&A Rep.:	S. Kaney

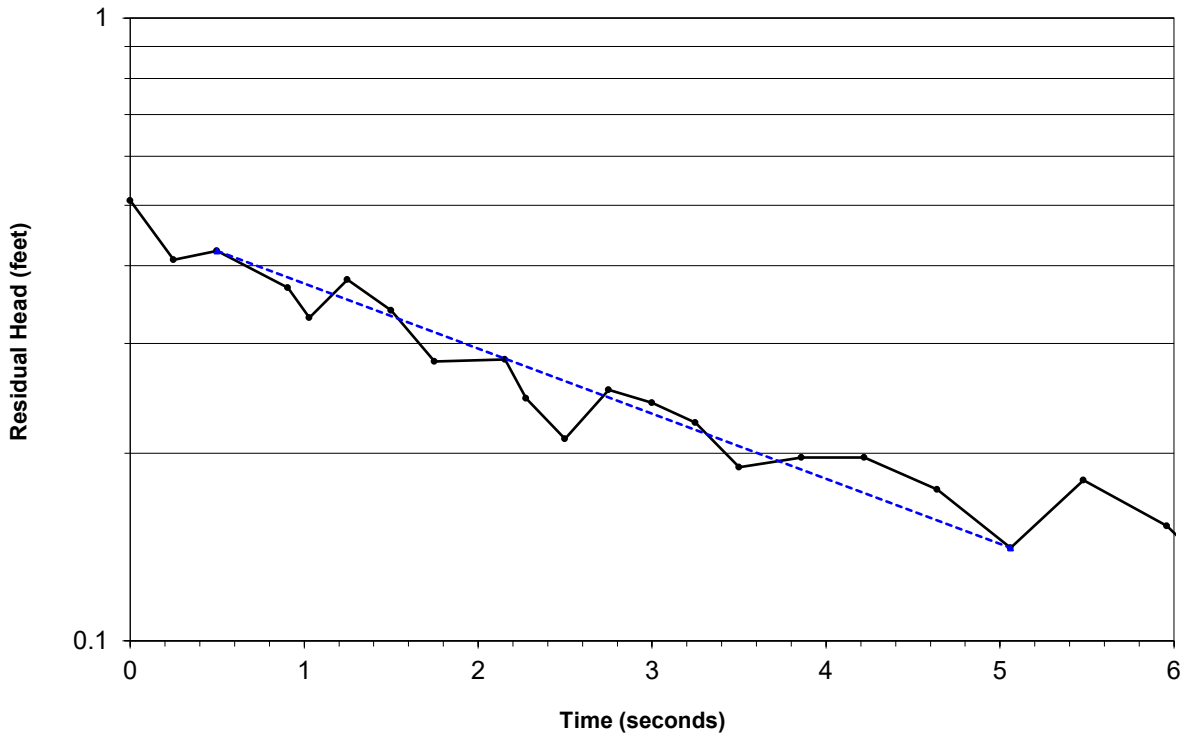
TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	50	
Depth to Static (PVC) in ft.:	13.01	
Well Depth-Static (Lw), in ft.:	36.99	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	5.0	
Test Length Section (Le), in ft.:	5	
A:	2.418	
B:	0.387	
C:	1.991	
Le/rw:	26.667	
Saturated Thickness (H), in ft.:	37	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.903	
For Lw=H - ln(Re/rw):	3.536	
Yo, in ft.:	0.42	
Yt, in ft.:	0.141	
t, in min.:	0.084	

	(Lw<H)	(Lw=H)
Kh (cm/sec) =	1.79E-02	
Kh (m/sec) =	1.79E-04	
Kh (ft/min) =	3.53E-02	
Kh (ft/day) =	5.08E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.509
0.25	0.41
0.5	0.42
0.907	0.37
1.031	0.33
1.25	0.38
1.5	0.34
1.75	0.28
2.154	0.28
2.277	0.25
2.5	0.21
2.75	0.25
3	0.24
3.25	0.22
3.5	0.19
3.86	0.20
4.22	0.20
4.64	0.18
5.06	0.14
5.48	0.18
5.96	0.15
6.5	0.11
6.98	0.09
7.58	0.08
8.18	0.06
8.78	0.04
9.44	0.09
10.16	0.04
10.94	0.03
11.72	0.02
12.56	0.03
13.46	0.10
14.42	0.00



HALEY & ALDRICH, INC

Fort Calhoun Station

Blair Nebraska

127960-006

FALLING HEAD TEST SUMMARY

Monitoring Well ID:	MW-1B
Test Date:	17-Jun-20
H&A Rep.:	S. Kaney

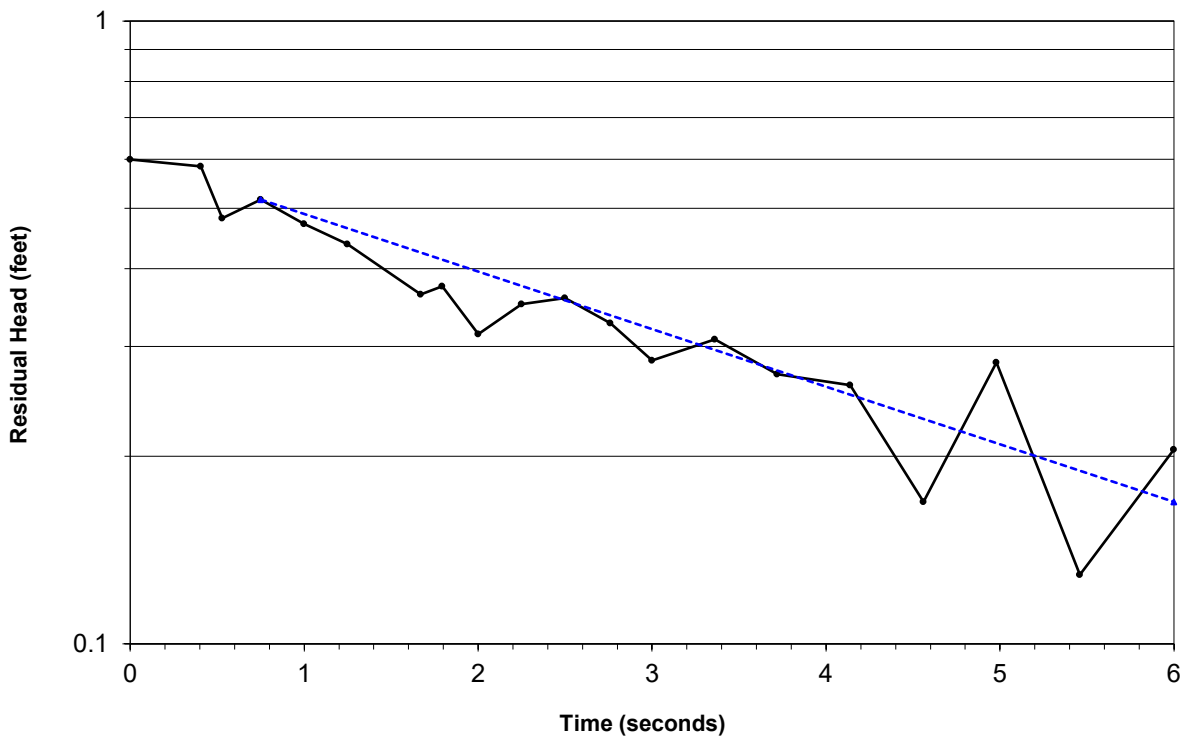
TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	50	
Depth to Static (PVC) in ft.:	13.01	
Well Depth-Static (Lw), in ft.:	36.99	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	5.0	
Test Length Section (Le), in ft.:	5	
A:	2.418	
B:	0.387	
C:	1.991	
Le/rw:	26.667	
Saturated Thickness (H), in ft.:	37	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.903	
For Lw=H - ln(Re/rw):	3.536	
Yo, in ft.:	0.52	
Yt, in ft.:	0.169	
t, in min.:	0.100	

	(Lw<H)	(Lw=H)
Kh (cm/sec) =	1.54E-02	
Kh (m/sec) =	1.54E-04	
Kh (ft/min) =	3.03E-02	
Kh (ft/day) =	4.36E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.599
0.406	0.58
0.53	0.48
0.75	0.52
1	0.47
1.25	0.44
1.67	0.36
1.794	0.38
2	0.31
2.25	0.35
2.5	0.36
2.76	0.33
3	0.29
3.36	0.31
3.72	0.27
4.14	0.26
4.56	0.17
4.98	0.28
5.46	0.13
6	0.21
6.48	0.21
7.08	0.14
7.68	0.15
8.28	0.07
8.94	0.08
9.66	0.15
10.44	0.12
11.22	0.07
12.06	0.05
12.96	0.05
13.92	0.06
14.88	0.03
15.96	0.02



HALEY & ALDRICH, INC

Fort Calhoun Station

Blair Nebraska

127960-006

FALLING HEAD TEST SUMMARY

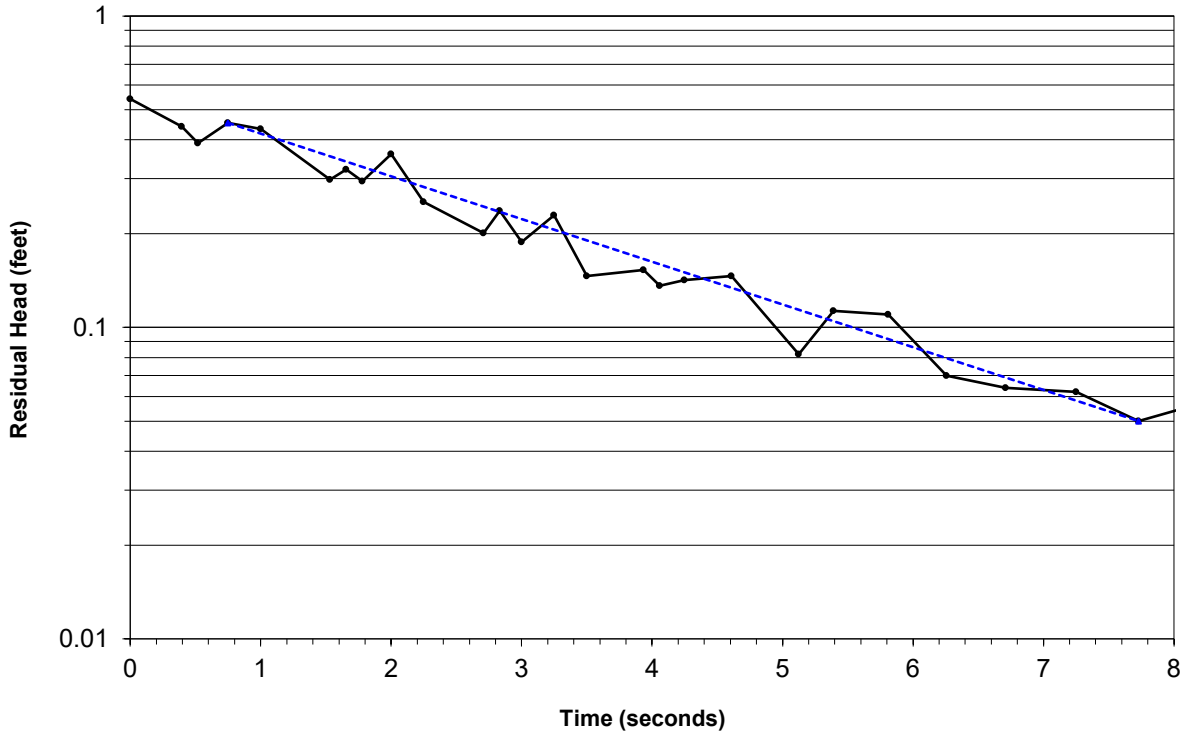
Monitoring Well ID:	MW-2
Test Date:	18-Jun-20
H&A Rep.:	S. Kaney

TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	50	
Depth to Static (PVC) in ft.:	12.74	
Well Depth-Static (Lw), in ft.:	37.26	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	5.0	
Test Length Section (Le), in ft.:	5	
A:	2.418	
B:	0.387	
C:	1.991	
Le/rw:	26.667	
Saturated Thickness (H), in ft.:	38	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.140	
For Lw=H - ln(Re/rw):	3.539	
Yo, in ft.:	0.45	
Yt, in ft.:	0.050	
t, in min.:	0.129	
	(Lw<H)	(Lw=H)
Kh (cm/sec) =	1.89E-02	
Kh (m/sec) =	1.89E-04	
Kh (ft/min) =	3.73E-02	
Kh (ft/day) =	5.37E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.542
0.394	0.44
0.519	0.39
0.75	0.45
1	0.43
1.532	0.30
1.656	0.32
1.781	0.30
2	0.36
2.25	0.25
2.708	0.20
2.832	0.24
3	0.19
3.25	0.23
3.5	0.15
3.936	0.15
4.06	0.14
4.25	0.14
4.61	0.15
5.124	0.08
5.39	0.11
5.81	0.11
6.257	0.07
6.71	0.06
7.25	0.06
7.73	0.05
8.33	0.06
8.93	0.02



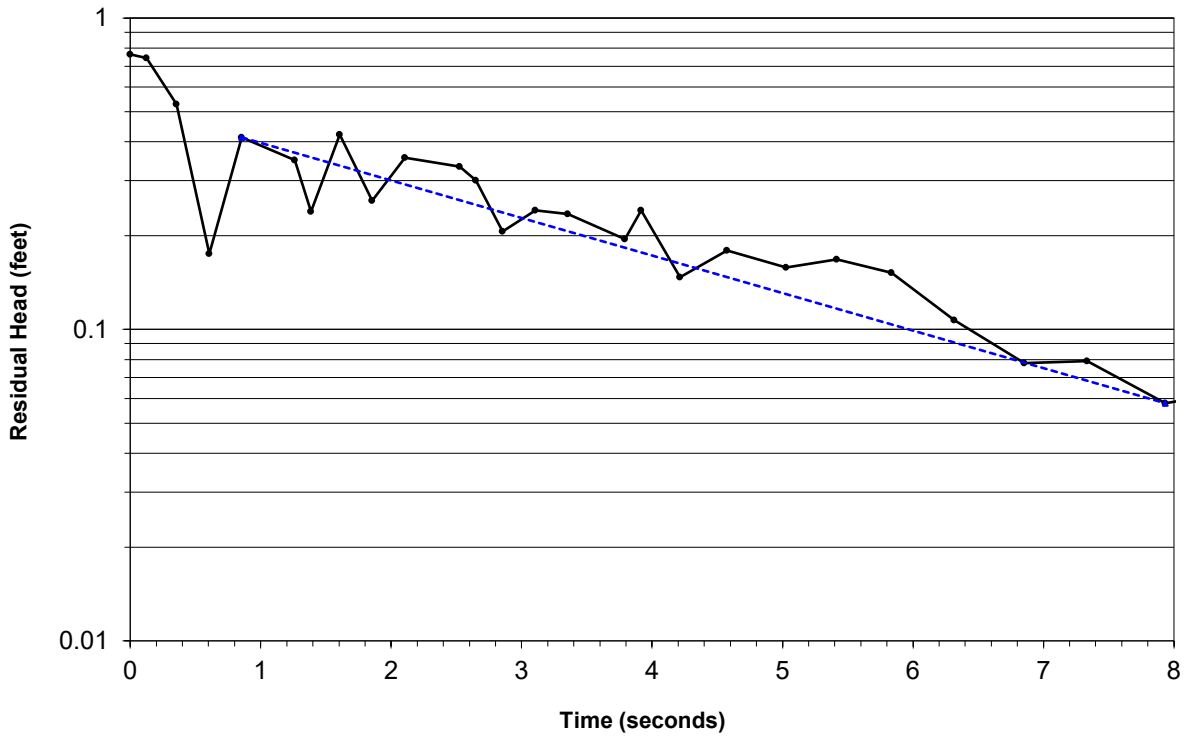
HALEY & ALDRICH, INC	**FALLING HEAD TEST SUMMARY**	
Fort Calhoun Station	Monitoring Well ID:	MW-2
Blair Nebraska	Test Date:	18-Jun-20
127960-006	H&A Rep.:	S. Kaney

TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	50	
Depth to Static (PVC) in ft.:	12.74	
Well Depth-Static (Lw), in ft.:	37.26	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	5.0	
Test Length Section (Le), in ft.:	5	
A:	2.418	
B:	0.387	
C:	1.991	
Le/rw:	26.667	
Saturated Thickness (H), in ft.:	38	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.140	
For Lw=H - ln(Re/rw):	3.539	
Yo, in ft.:	0.41	
Yt, in ft.:	0.058	
t, in min.:	0.132	
	(Lw<H)	(Lw=H)
Kh (cm/sec) =	1.64E-02	
Kh (m/sec) =	1.64E-04	
Kh (ft/min) =	3.23E-02	
Kh (ft/day) =	4.66E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.764
0.125	0.74
0.355	0.53
0.605	0.18
0.855	0.41
1.261	0.35
1.385	0.24
1.605	0.42
1.855	0.26
2.105	0.36
2.525	0.33
2.65	0.30
2.855	0.21
3.105	0.24
3.355	0.24
3.791	0.20
3.915	0.24
4.215	0.15
4.575	0.18
5.028	0.16
5.415	0.17
5.835	0.15
6.315	0.11
6.855	0.08
7.335	0.08
7.935	0.06
8.535	0.06
9.135	0.08
9.795	0.02



HALEY & ALDRICH, INC

Fort Calhoun Station

Blair Nebraska

127960-006

FALLING HEAD TEST SUMMARY

Monitoring Well ID:	MW-2
Test Date:	18-Jun-20
H&A Rep.:	S. Kaney

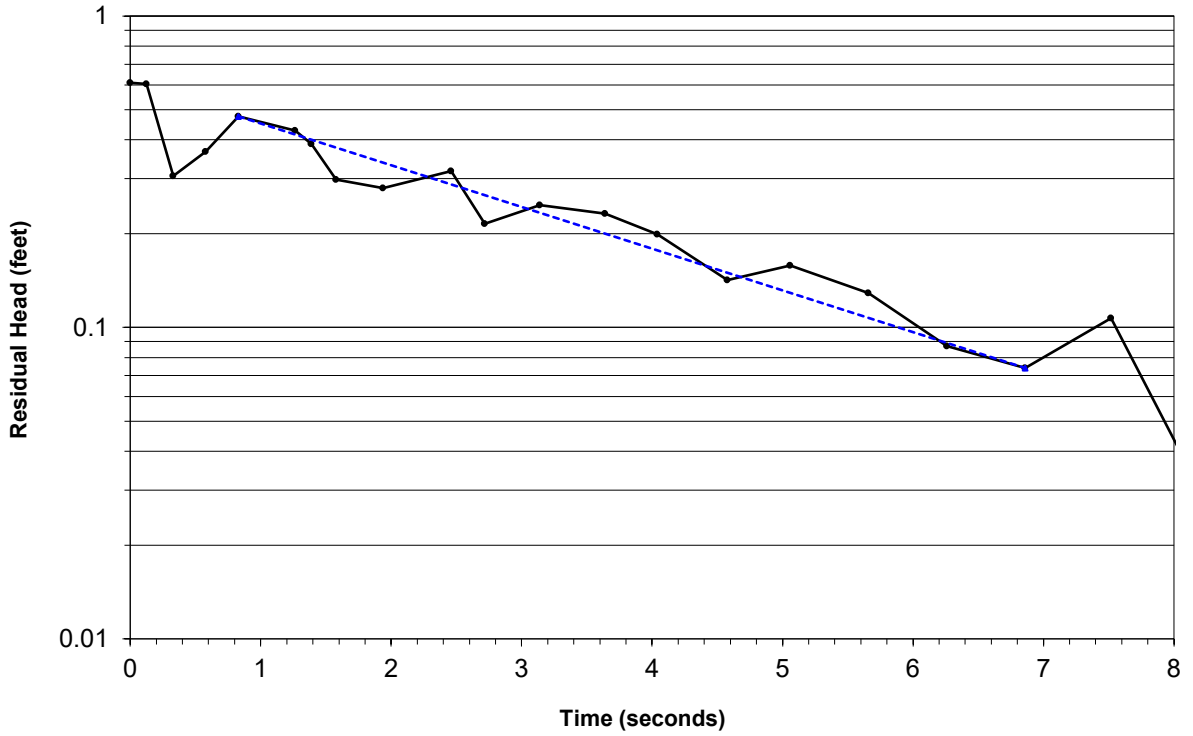
TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	50	
Depth to Static (PVC) in ft.:	12.74	
Well Depth-Static (Lw), in ft.:	37.26	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	5.0	
Test Length Section (Le), in ft.:	5	
A:	2.418	
B:	0.387	
C:	1.991	
Le/rw:	26.667	
Saturated Thickness (H), in ft.:	38	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.140	
For Lw=H - ln(Re/rw):	3.539	
Yo, in ft.:	0.48	
Yt, in ft.:	0.074	
t, in min.:	0.114	

	(Lw<H)	(Lw=H)
Kh (cm/sec) =	1.80E-02	
Kh (m/sec) =	1.80E-04	
Kh (ft/min) =	3.55E-02	
Kh (ft/day) =	5.11E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.611
0.124	0.60
0.329	0.31
0.579	0.37
0.829	0.48
1.265	0.43
1.388	0.39
1.579	0.30
1.939	0.28
2.46	0.32
2.719	0.22
3.139	0.25
3.64	0.23
4.039	0.20
4.579	0.14
5.059	0.16
5.659	0.13
6.259	0.09
6.859	0.07
7.519	0.11
8.239	0.03
9.019	0.06
9.799	0.04
10.639	0.04
11.539	0.03
12.499	0.01
13.459	0.02
14.539	0.00



HALEY & ALDRICH, INC
Fort Calhoun Station
Blair Nebraska
127960-006

FALLING HEAD TEST SUMMARY

Monitoring Well ID:	MW-2
Test Date:	18-Jun-20
H&A Rep.:	S. Kaney

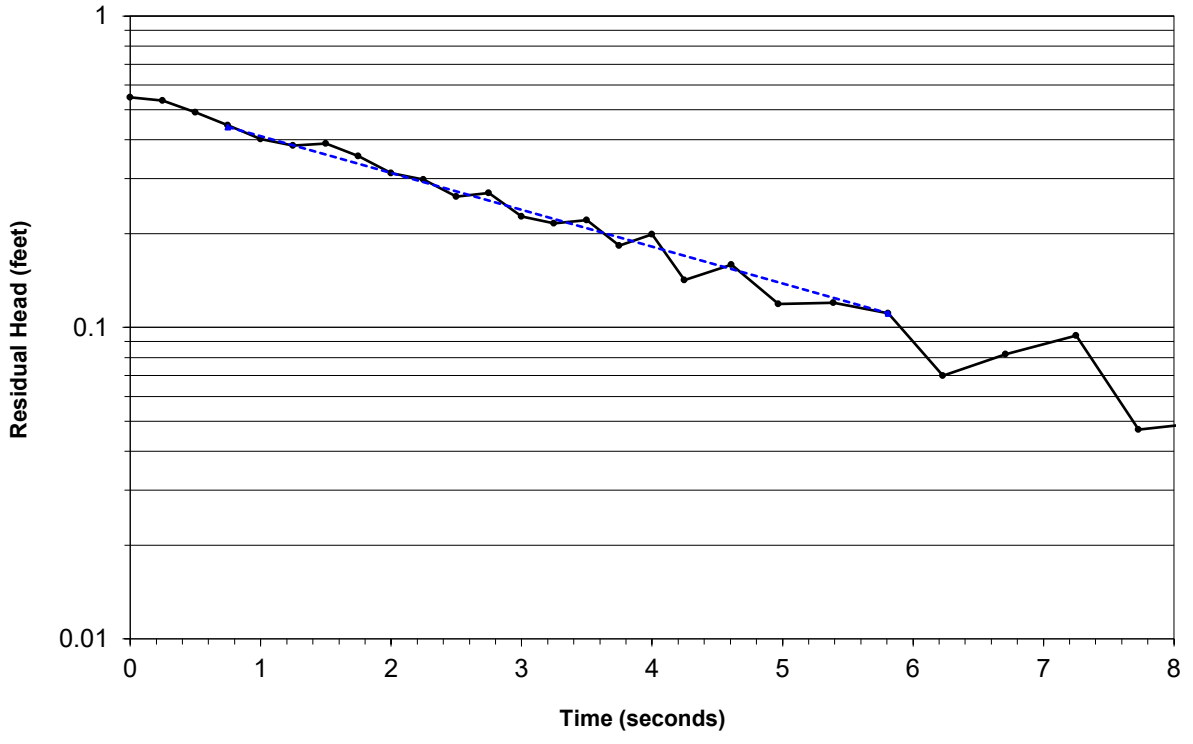
TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	50	
Depth to Static (PVC) in ft.:	12.74	
Well Depth-Static (Lw), in ft.:	37.26	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	5.0	
Test Length Section (Le), in ft.:	5	
A:	2.418	
B:	0.387	
C:	1.991	
Le/rw:	26.667	
Saturated Thickness (H), in ft.:	38	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.140	
For Lw=H - ln(Re/rw):	3.539	
Yo, in ft.:	0.44	
Yt, in ft.:	0.111	
t, in min.:	0.097	

	(Lw<H)	(Lw=H)
Kh (cm/sec) =	1.57E-02	
Kh (m/sec) =	1.57E-04	
Kh (ft/min) =	3.10E-02	
Kh (ft/day) =	4.46E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.547
0.25	0.53
0.5	0.49
0.75	0.44
1	0.40
1.25	0.38
1.5	0.39
1.75	0.35
2	0.31
2.25	0.30
2.5	0.26
2.75	0.27
3	0.23
3.25	0.22
3.5	0.22
3.75	0.18
4	0.20
4.25	0.14
4.61	0.16
4.97	0.12
5.39	0.12
5.81	0.11
6.23	0.07
6.71	0.08
7.25	0.09
7.73	0.05
8.33	0.05
8.93	0.08
9.53	0.01



HALEY & ALDRICH, INC

Fort Calhoun Station

Blair Nebraska

127960-006

FALLING HEAD TEST SUMMARY

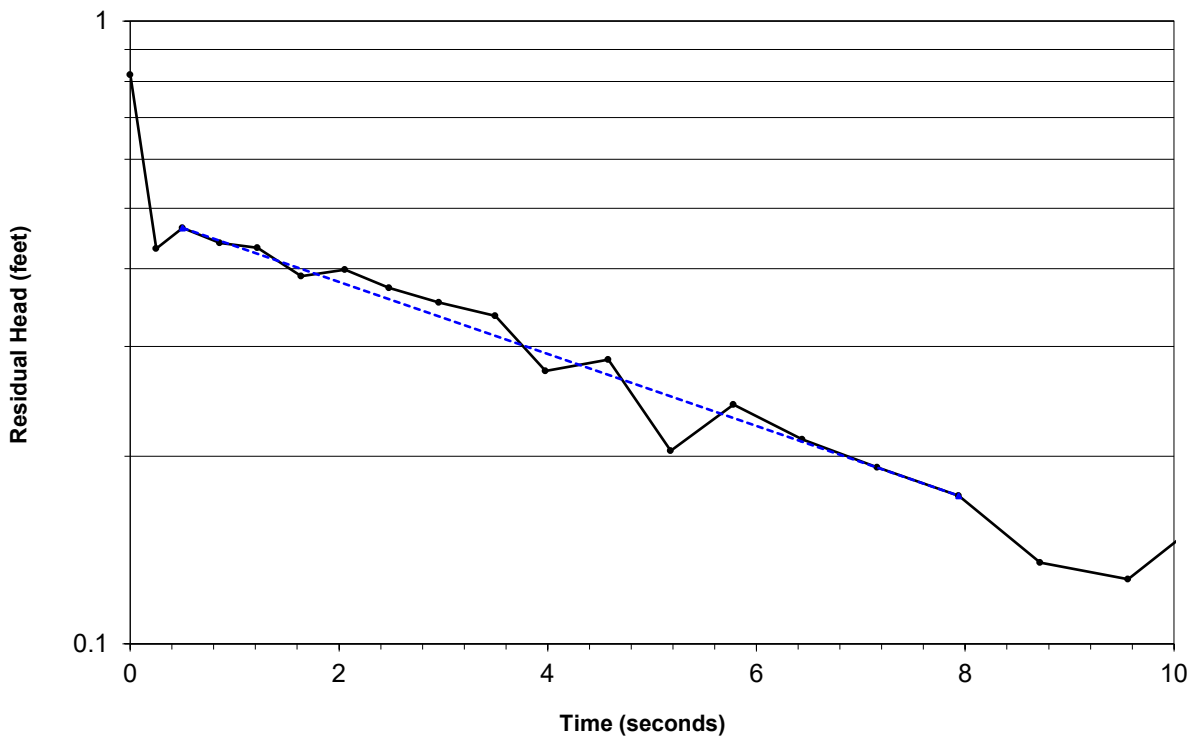
Monitoring Well ID:	MW-3A
Test Date:	17-Jun-20
H&A Rep.:	S. Kaney

TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	23	
Depth to Static (PVC) in ft.:	13.44	
Well Depth-Static (Lw), in ft.:	9.56	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.1241	(Adjust for water-table wells only)
Nominal Screen Length in ft:	10.0	
Test Length Section (Le), in ft.:	9.56	
A:	3.101	
B:	0.526	
C:	3.039	
Le/rw:	50.987	
Saturated Thickness (H), in ft.:	10	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	2.862	
For Lw=H - ln(Re/rw):	2.946	
Yo, in ft.:	0.47	
Yt, in ft.:	0.173	
t, in min.:	0.132	
	(Lw<H)	(Lw=H)
Kh (cm/sec) =	8.75E-03	
Kh (m/sec) =	8.75E-05	
Kh (ft/min) =	1.72E-02	
Kh (ft/day) =	2.48E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.819
0.25	0.43
0.5	0.47
0.86	0.44
1.22	0.43
1.64	0.39
2.06	0.40
2.48	0.37
2.96	0.35
3.5	0.34
3.98	0.27
4.58	0.29
5.18	0.20
5.78	0.24
6.44	0.21
7.16	0.19
7.94	0.17
8.72	0.14
9.56	0.13
10.46	0.17
11.42	0.11
12.38	0.12
13.46	0.13
14.6	0.08
15.8	0.12
17.06	0.04
18.38	0.10
19.82	0.07
21.32	0.03
22.88	0.04
24.56	0.04
26.36	0.03
28.22	0.00



HALEY & ALDRICH, INC

Fort Calhoun Station

Blair Nebraska

127960-006

FALLING HEAD TEST SUMMARY

Monitoring Well ID:	MW-3A
Test Date:	17-Jun-20
H&A Rep.:	S. Kaney

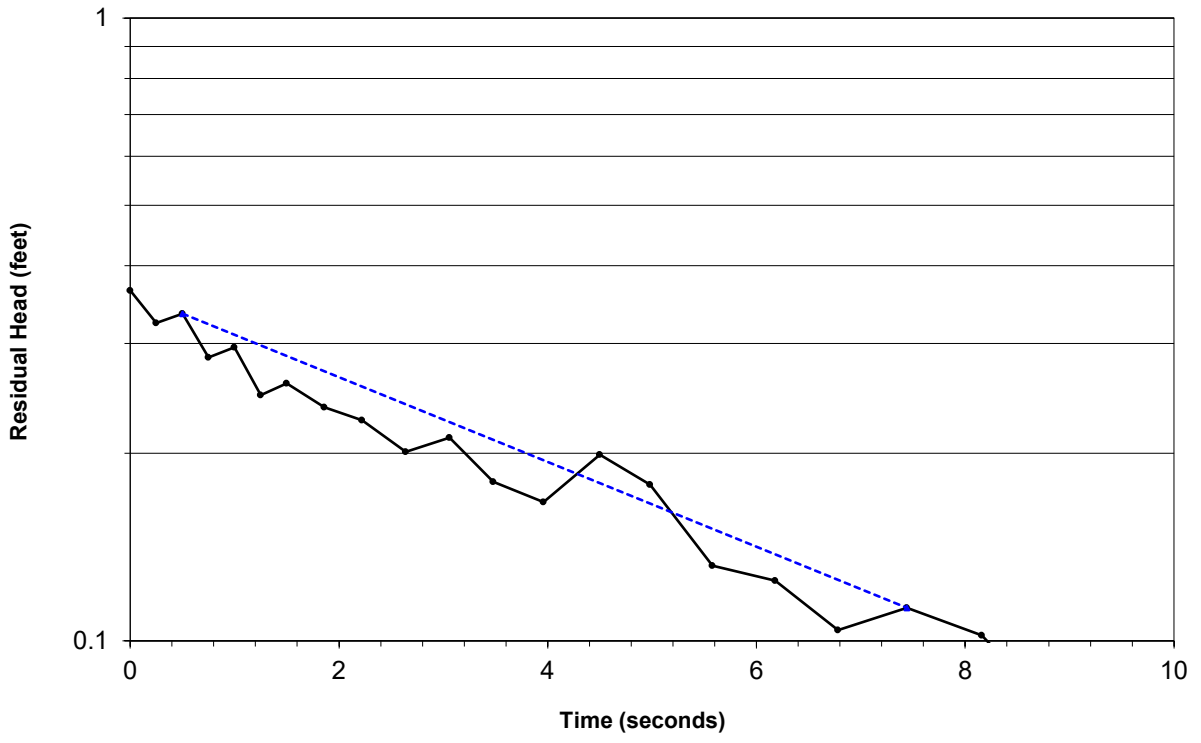
TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	23	
Depth to Static (PVC) in ft.:	13.44	
Well Depth-Static (Lw), in ft.:	9.56	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.1241	(Adjust for water-table wells only)
Nominal Screen Length in ft:	10.0	
Test Length Section (Le), in ft.:	9.56	
A:	3.101	
B:	0.526	
C:	3.039	
Le/rw:	50.987	
Saturated Thickness (H), in ft.:	10	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	2.862	
For Lw=H - ln(Re/rw):	2.946	
Yo, in ft.:	0.34	
Yt, in ft.:	0.113	
t, in min.:	0.124	

	(Lw<H)	(Lw=H)
Kh (cm/sec) =	1.03E-02	
Kh (m/sec) =	1.03E-04	
Kh (ft/min) =	2.02E-02	
Kh (ft/day) =	2.91E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.365
0.25	0.32
0.5	0.33
0.75	0.29
1	0.30
1.25	0.25
1.5	0.26
1.86	0.24
2.22	0.23
2.64	0.20
3.06	0.21
3.48	0.18
3.96	0.17
4.5	0.20
4.98	0.18
5.58	0.13
6.18	0.13
6.78	0.10
7.44	0.11
8.16	0.10
8.94	0.07
9.72	0.07
10.56	0.09
11.46	0.05
12.42	0.05
13.38	0.03
14.46	0.02
15.6	0.00



HALEY & ALDRICH, INC

Fort Calhoun Station

Blair Nebraska

127960-006

FALLING HEAD TEST SUMMARY

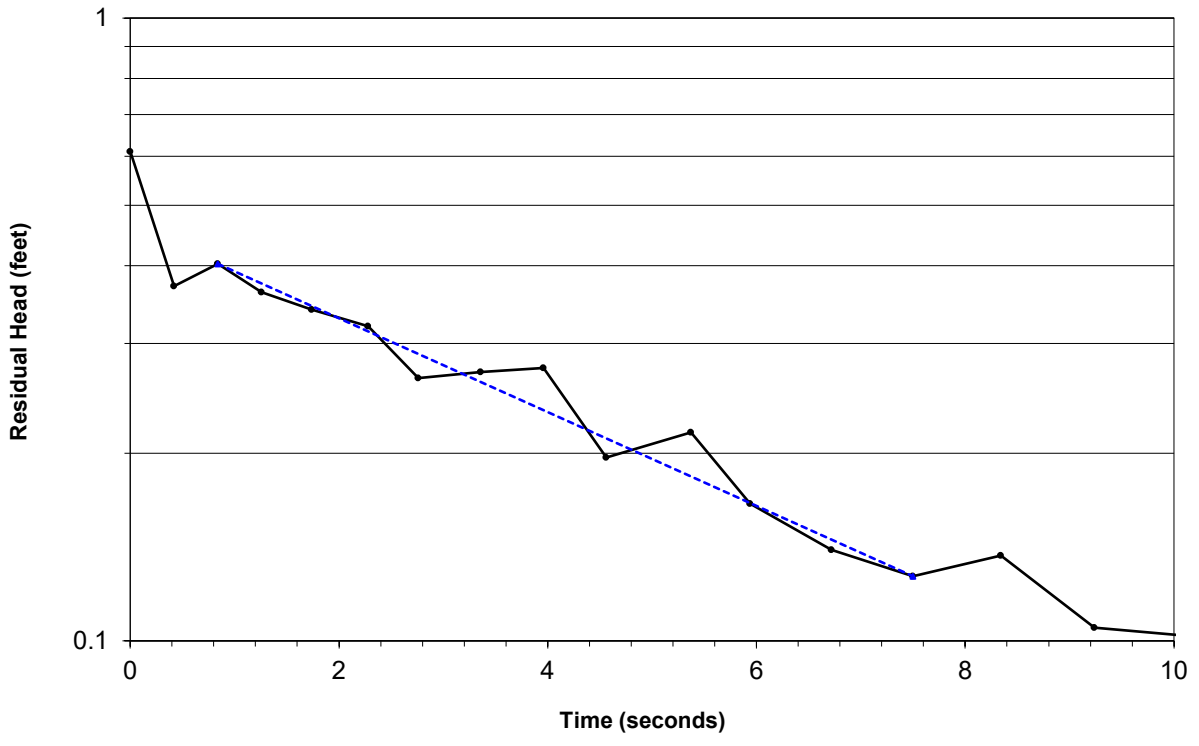
Monitoring Well ID:	MW-3A
Test Date:	17-Jun-20
H&A Rep.:	S. Kaney

TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	23	
Depth to Static (PVC) in ft.:	13.44	
Well Depth-Static (Lw), in ft.:	9.56	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.1241	(Adjust for water-table wells only)
Nominal Screen Length in ft:	10.0	
Test Length Section (Le), in ft.:	9.56	
A:	3.101	
B:	0.526	
C:	3.039	
Le/rw:	50.987	
Saturated Thickness (H), in ft.:	10	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	2.862	
For Lw=H - ln(Re/rw):	2.946	
Yo, in ft.:	0.40	
Yt, in ft.:	0.127	
t, in min.:	0.125	

	(Lw<H)	(Lw=H)
Kh (cm/sec) =	1.08E-02	
Kh (m/sec) =	1.08E-04	
Kh (ft/min) =	2.13E-02	
Kh (ft/day) =	3.07E+01	



Elapsed Time (sec)	Residual Head (ft.)
0	0.61
0.42	0.37
0.84	0.40
1.26	0.36
1.74	0.34
2.28	0.32
2.76	0.26
3.36	0.27
3.96	0.27
4.56	0.20
5.372	0.22
5.94	0.17
6.72	0.14
7.5	0.13
8.34	0.14
9.24	0.10
10.389	0.10
11.16	0.08
12.24	0.09
13.38	0.05
14.58	0.07
15.84	0.04
17.16	0.08
18.6	0.06
20.408	0.02
21.66	0.03
23.34	0.05
25.425	0.03
27	0.05
29.04	0.01
31.14	0.04
33.36	0.02
35.769	0.06
38.28	0.04
40.92	0.02
43.74	0.02
46.74	0.02
49.92	0.02
53.28	0.02
56.88	0.01
60.515	0.04
64.68	0.01
68.88	0.02
73.08	-0.01
77.88	-0.01
83.28	0.06
88.08	0.03
94.08	0.02
100.08	0.03
106.08	-0.01

HALEY & ALDRICH, INC
Fort Calhoun Station
Blair Nebraska
127960-006

FALLING HEAD TEST SUMMARY

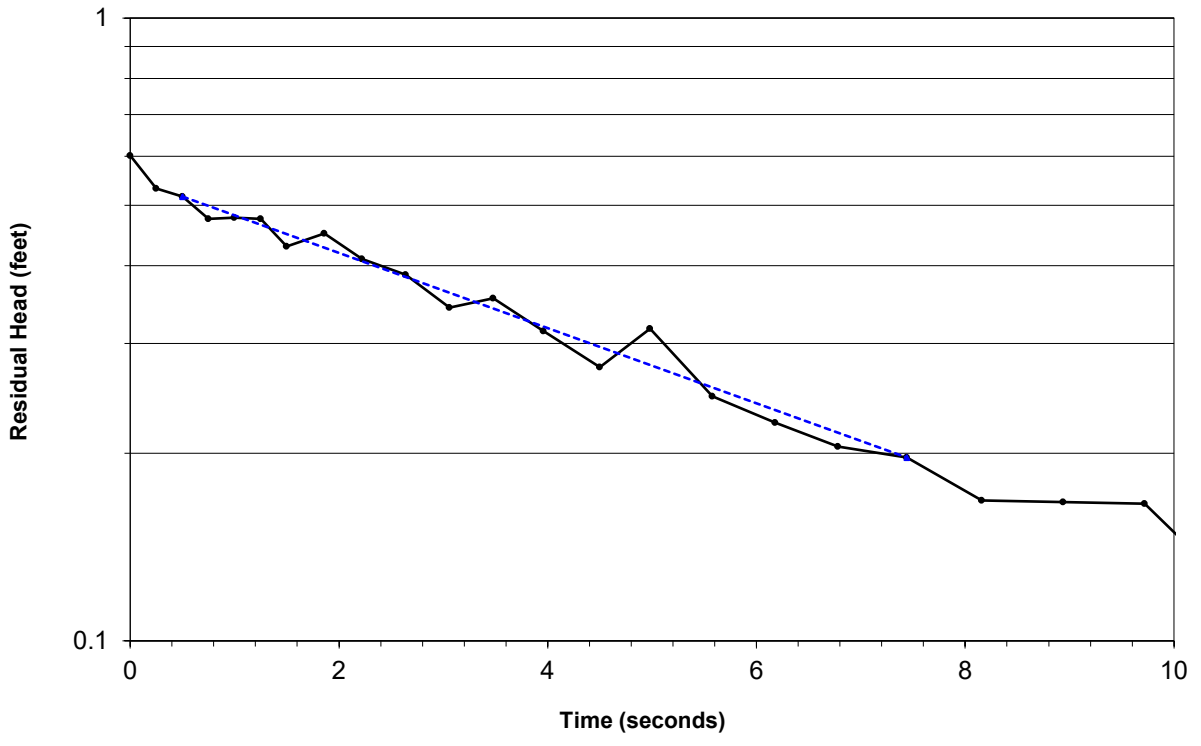
Monitoring Well ID:	MW-3A
Test Date:	17-Jun-20
H&A Rep.:	S. Kaney

TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	23	
Depth to Static (PVC) in ft.:	13.44	
Well Depth-Static (Lw), in ft.:	9.56	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.1241	(Adjust for water-table wells only)
Nominal Screen Length in ft:	10.0	
Test Length Section (Le), in ft.:	9.56	
A:	3.101	
B:	0.526	
C:	3.039	
Le/rw:	50.987	
Saturated Thickness (H), in ft.:	10	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	2.862	
For Lw=H - ln(Re/rw):	2.946	
Yo, in ft.:	0.52	
Yt, in ft.:	0.197	
t, in min.:	0.124	
	(Lw<H)	(Lw=H)
Kh (cm/sec) =	9.11E-03	
Kh (m/sec) =	9.11E-05	
Kh (ft/min) =	1.79E-02	
Kh (ft/day) =	2.58E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.601
0.25	0.53
0.5	0.52
0.75	0.48
1	0.48
1.25	0.48
1.5	0.43
1.86	0.45
2.22	0.41
2.64	0.39
3.06	0.34
3.48	0.36
3.96	0.31
4.5	0.28
4.98	0.32
5.58	0.25
6.18	0.22
6.78	0.21
7.44	0.20
8.159	0.17
8.94	0.17
9.72	0.17
10.56	0.12
11.46	0.09
12.419	0.12
13.379	0.12
14.46	0.11
15.6	0.06
16.8	0.07
18.06	0.03
19.379	0.06
20.82	0.04
22.32	0.04
23.879	0.04
25.56	0.04
27.359	0.01



HALEY & ALDRICH, INC

Fort Calhoun Station

Blair Nebraska

127960-006

FALLING HEAD TEST SUMMARY

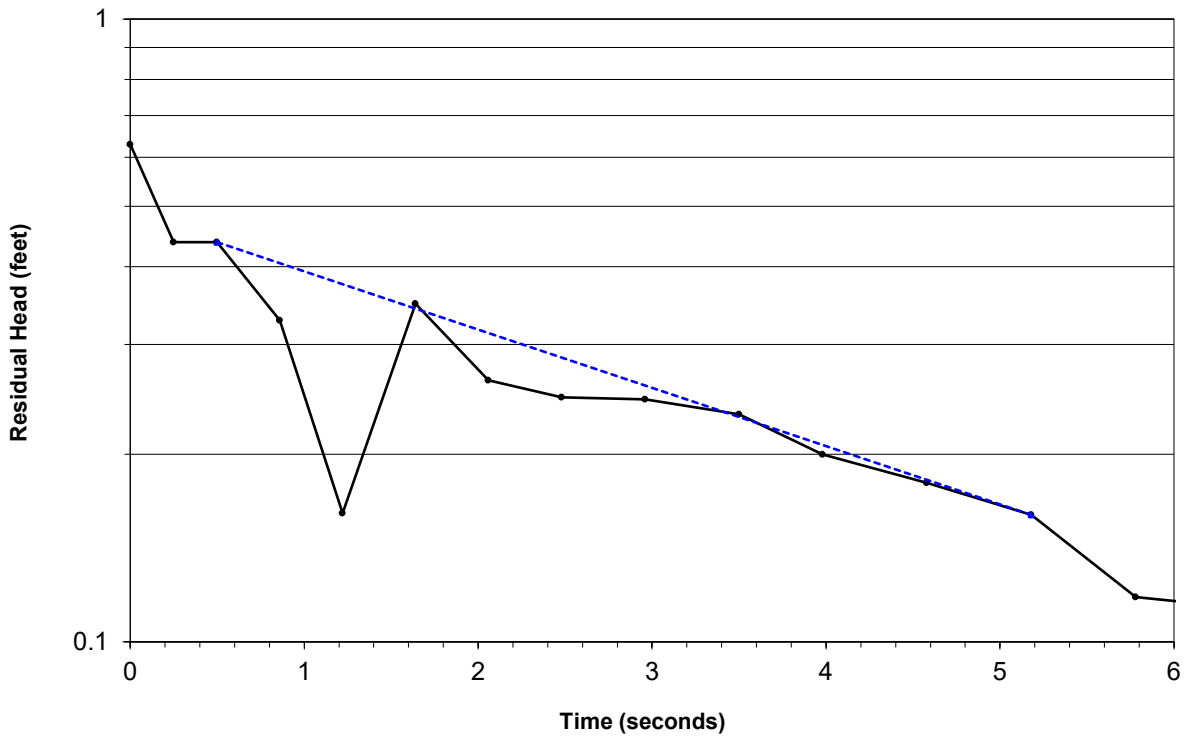
Monitoring Well ID:	MW-3B
Test Date:	17-Jun-20
H&A Rep.:	S. Kaney

TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	50	
Depth to Static (PVC) in ft.:	13.42	
Well Depth-Static (Lw), in ft.:	36.58	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	5.0	
Test Length Section (Le), in ft.:	5	
A:	2.418	
B:	0.387	
C:	1.991	
Le/rw:	26.667	
Saturated Thickness (H), in ft.:	37	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.216	
For Lw=H - ln(Re/rw):	3.530	
Yo, in ft.:	0.44	
Yt, in ft.:	0.160	
t, in min.:	0.086	
	(Lw<H)	(Lw=H)
Kh (cm/sec) =	1.32E-02	
Kh (m/sec) =	1.32E-04	
Kh (ft/min) =	2.60E-02	
Kh (ft/day) =	3.75E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.629
0.25	0.44
0.5	0.44
0.86	0.33
1.22	0.16
1.64	0.35
2.06	0.26
2.48	0.25
2.96	0.25
3.5	0.23
3.98	0.20
4.58	0.18
5.18	0.16
5.78	0.12
6.439	0.11
7.159	0.07
8.075	0.07
8.72	0.10
9.56	0.08
10.46	0.05
11.419	0.02
12.379	0.08
13.46	0.00



HALEY & ALDRICH, INC

Fort Calhoun Station

Blair Nebraska

127960-006

FALLING HEAD TEST SUMMARY

Monitoring Well ID:	MW-3B
Test Date:	17-Jun-20
H&A Rep.:	S. Kaney

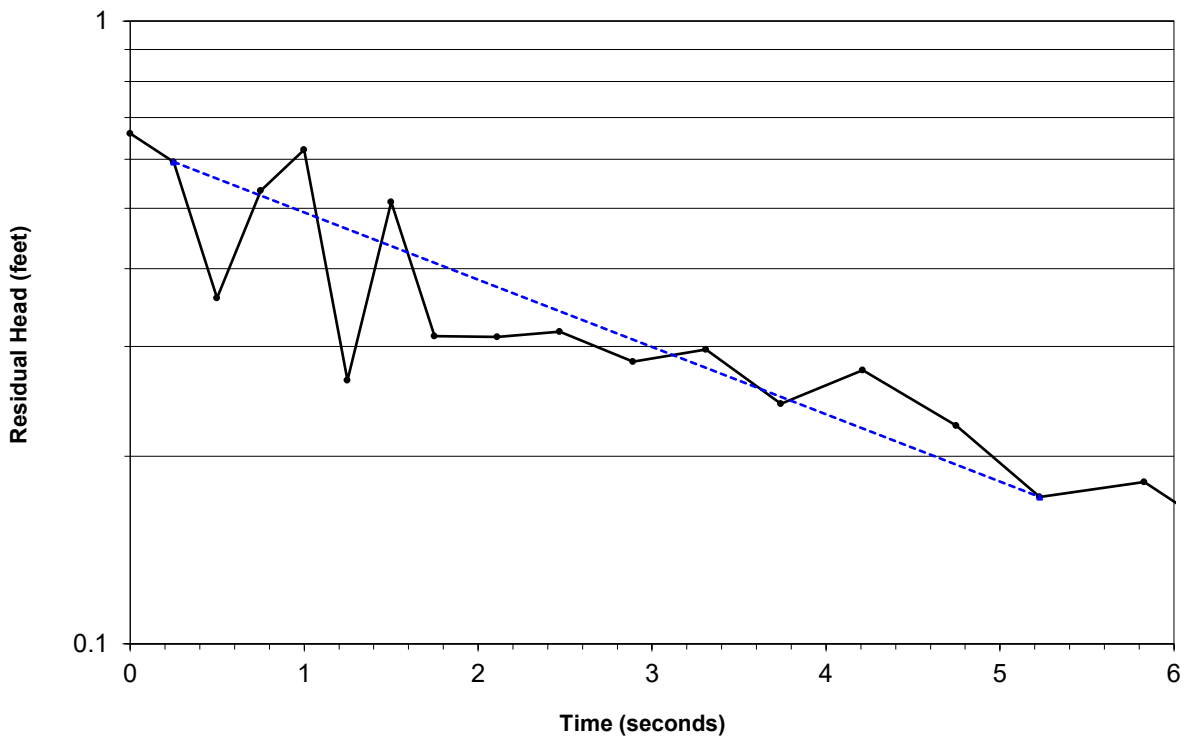
TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	50	
Depth to Static (PVC) in ft.:	13.42	
Well Depth-Static (Lw), in ft.:	36.58	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	5.0	
Test Length Section (Le), in ft.:	5	
A:	2.418	
B:	0.387	
C:	1.991	
Le/rw:	26.667	
Saturated Thickness (H), in ft.:	37	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.216	
For Lw=H - ln(Re/rw):	3.530	
Yo, in ft.:	0.59	
Yt, in ft.:	0.172	
t, in min.:	0.087	

	(Lw<H)	(Lw=H)
Kh (cm/sec) =	1.61E-02	
Kh (m/sec) =	1.61E-04	
Kh (ft/min) =	3.17E-02	
Kh (ft/day) =	4.57E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.659
0.25	0.59
0.5	0.36
0.75	0.53
1	0.62
1.25	0.26
1.5	0.51
1.75	0.31
2.11	0.31
2.47	0.32
2.89	0.28
3.309	0.30
3.741	0.24
4.21	0.27
4.749	0.22
5.229	0.17
5.829	0.18
6.43	0.14
7.029	0.09
7.689	0.11
8.409	0.06
9.189	0.07
9.969	0.07
10.809	0.04
11.71	0.05
12.669	0.04
13.629	0.02
14.71	0.03
15.849	0.05
17.049	0.02
18.309	0.00



HALEY & ALDRICH, INC

Fort Calhoun Station

Blair Nebraska

127960-006

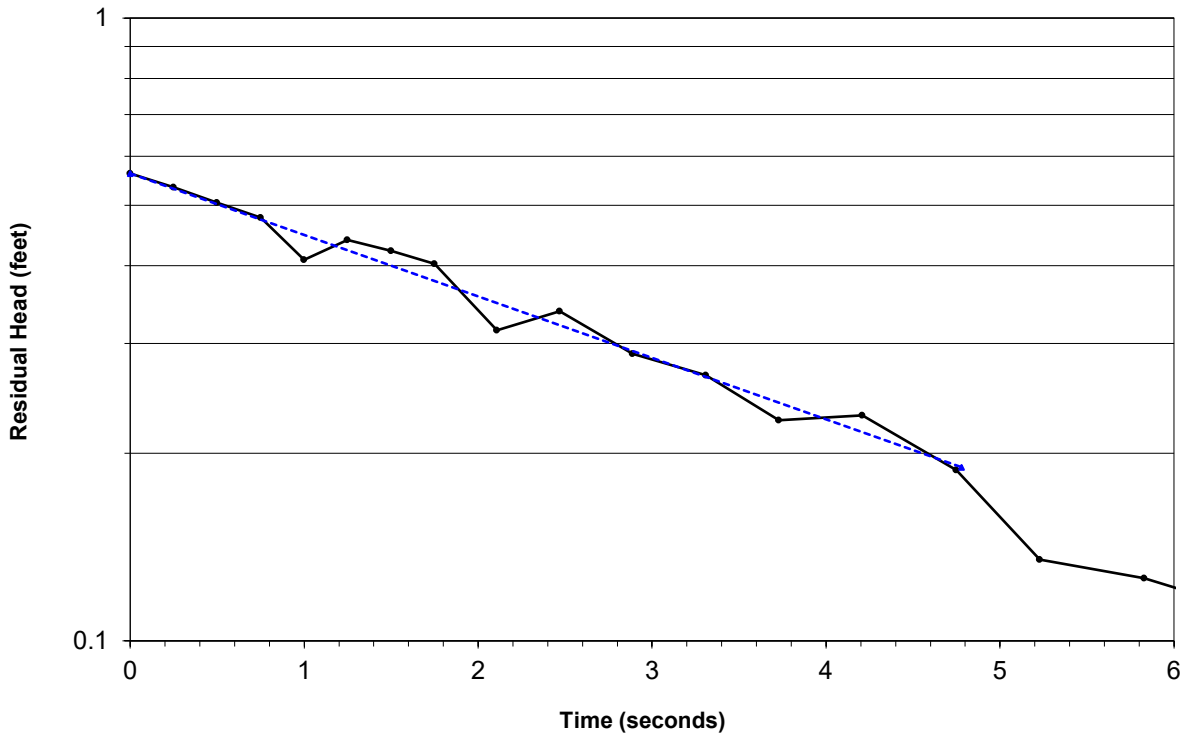
FALLING HEAD TEST SUMMARY

Monitoring Well ID:	MW-3B
Test Date:	17-Jun-20
H&A Rep.:	S. Kaney

TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	50	
Depth to Static (PVC) in ft.:	13.42	
Well Depth-Static (Lw), in ft.:	36.58	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	5.0	
Test Length Section (Le), in ft.:	5	
A:	2.418	
B:	0.387	
C:	1.991	
Le/rw:	26.667	
Saturated Thickness (H), in ft.:	37	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.216	
For Lw=H - ln(Re/rw):	3.530	
Yo, in ft.:	0.56	
Yt, in ft.:	0.190	
t, in min.:	0.080	
	(Lw<H)	(Lw=H)
Kh (cm/sec) =	1.55E-02	
Kh (m/sec) =	1.55E-04	
Kh (ft/min) =	3.04E-02	
Kh (ft/day) =	4.38E+01	



Elapsed Time (sec)	Residual Head (ft.)
0	0.563
0.25	0.54
0.5	0.51
0.75	0.48
1	0.41
1.25	0.44
1.5	0.42
1.75	0.40
2.109	0.32
2.469	0.34
2.889	0.29
3.309	0.27
3.729	0.23
4.209	0.23
4.749	0.19
5.229	0.14
5.829	0.13
6.429	0.11
7.029	0.12
7.689	0.09
8.409	0.07
9.189	0.05
9.969	0.08
10.809	0.05
11.709	0.04
12.669	0.02
13.629	-0.01
14.709	0.03
15.849	0.02
17.049	0.05
18.309	0.00
19.629	0.02
21.069	0.00
22.569	0.00
24.129	0.02
25.809	0.04
27.609	0.02
29.469	0.02
31.509	-0.02
33.609	0.04
35.829	0.01
38.229	0.02
40.749	0.03
43.389	0.03
46.507	0.07
49.209	0.03
52.389	0.06
55.749	0.06
59.349	0.04
62.949	0.08

HALEY & ALDRICH, INC

Fort Calhoun Station

Blair Nebraska

127960-006

FALLING HEAD TEST SUMMARY

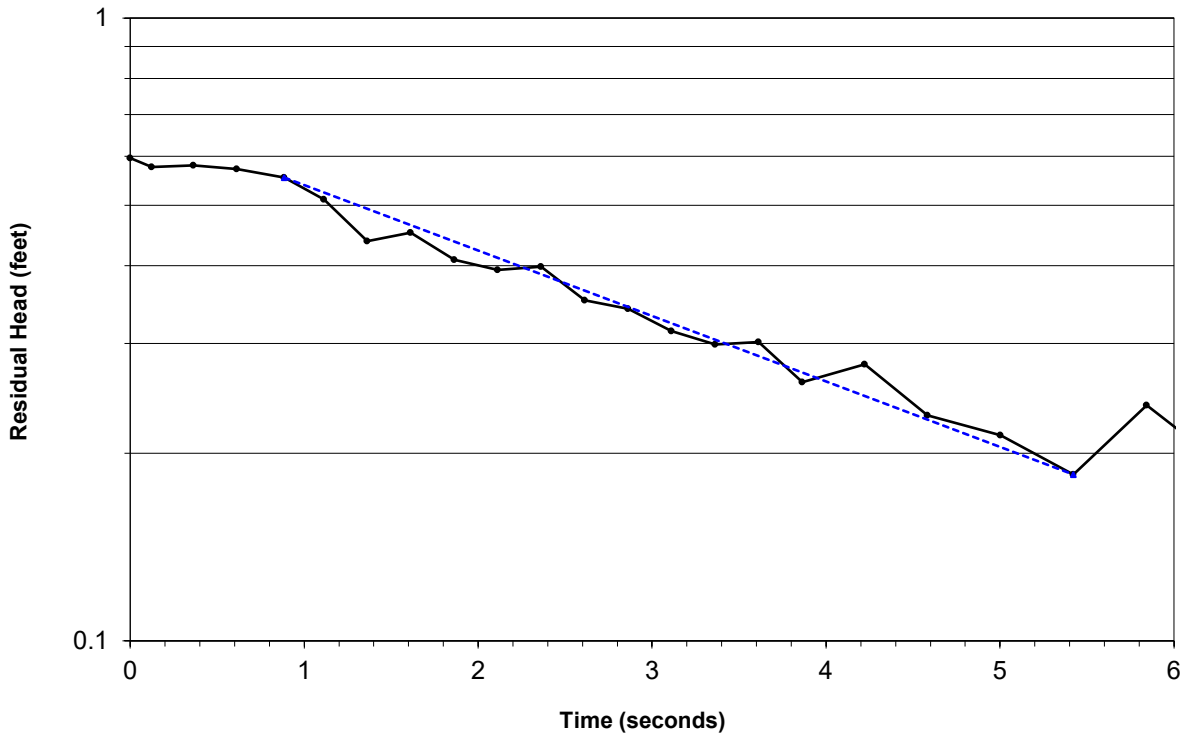
Monitoring Well ID:	MW-3B
Test Date:	17-Jun-20
H&A Rep.:	S. Kaney

TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	50	
Depth to Static (PVC) in ft.:	13.42	
Well Depth-Static (Lw), in ft.:	36.58	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	5.0	
Test Length Section (Le), in ft.:	5	
A:	2.418	
B:	0.387	
C:	1.991	
Le/rw:	26.667	
Saturated Thickness (H), in ft.:	37	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.216	
For Lw=H - ln(Re/rw):	3.530	
Yo, in ft.:	0.55	
Yt, in ft.:	0.185	
t, in min.:	0.090	

	(Lw<H)	(Lw=H)
Kh (cm/sec) =	1.38E-02	
Kh (m/sec) =	1.38E-04	
Kh (ft/min) =	2.71E-02	
Kh (ft/day) =	3.90E+01	



Elapsed Time (sec)	Residual Head (ft.)
0	0.596
0.125	0.58
0.363	0.58
0.613	0.57
0.885	0.55
1.113	0.51
1.363	0.44
1.613	0.45
1.863	0.41
2.113	0.39
2.363	0.40
2.613	0.35
2.863	0.34
3.113	0.31
3.363	0.30
3.613	0.30
3.863	0.26
4.223	0.28
4.583	0.23
5.003	0.21
5.423	0.19
5.843	0.24
6.323	0.19
6.863	0.17
7.343	0.18
7.943	0.18
8.543	0.13
9.143	0.15
9.803	0.11
10.523	0.12
11.303	0.12
12.083	0.11
12.923	0.10
13.823	0.13
14.783	0.10
15.743	0.11
16.823	0.08
17.963	0.08
19.163	0.09
20.423	0.08
21.743	0.10
23.183	0.10
24.683	0.13
26.243	0.07
27.923	0.11
29.723	0.12
31.583	0.13
33.623	0.15
35.723	0.09
37.943	0.10

HALEY & ALDRICH, INC

Fort Calhoun Station

Blair Nebraska

127960-006

FALLING HEAD TEST SUMMARY

Monitoring Well ID:	MW-5A
Test Date:	17-Jun-20
H&A Rep.:	S. Kaney

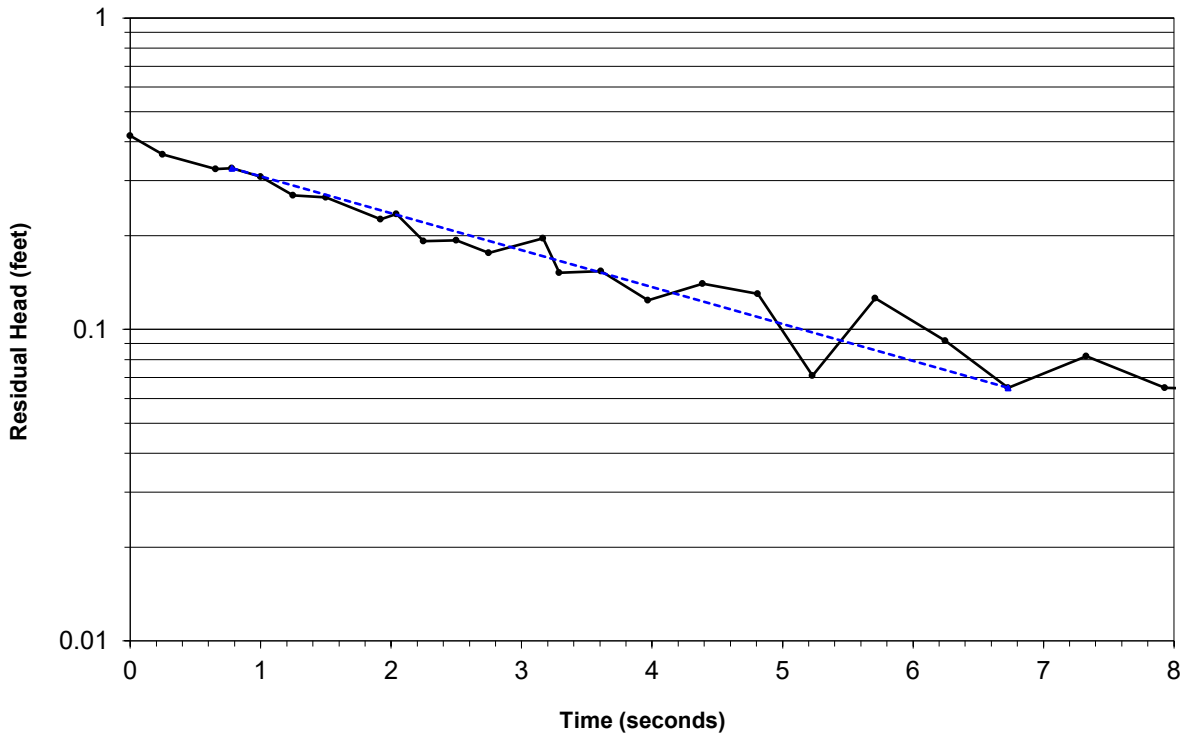
TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	50	
Depth to Static (PVC) in ft.:	12.4	
Well Depth-Static (Lw), in ft.:	37.6	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	10.0	
Test Length Section (Le), in ft.:	10	
A:	3.164	
B:	0.538	
C:	3.136	
Le/rw:	53.333	
Saturated Thickness (H), in ft.:	38	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.643	
For Lw=H - ln(Re/rw):	3.755	
Yo, in ft.:	0.33	
Yt, in ft.:	0.065	
t, in min.:	0.112	

	(Lw<H)	(Lw=H)
Kh (cm/sec) =	9.28E-03	
Kh (m/sec) =	9.28E-05	
Kh (ft/min) =	1.83E-02	
Kh (ft/day) =	2.63E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.418
0.25	0.36
0.657	0.33
0.78	0.33
1	0.31
1.25	0.27
1.5	0.26
1.919	0.23
2.042	0.23
2.25	0.19
2.5	0.19
2.75	0.18
3.165	0.20
3.289	0.15
3.609	0.15
3.97	0.12
4.389	0.14
4.809	0.13
5.229	0.07
5.71	0.13
6.249	0.09
6.729	0.06
7.329	0.08
7.93	0.06
8.529	0.06
9.189	0.02
9.909	0.05
10.689	0.05
11.469	0.04
12.309	0.06
13.209	0.02
14.169	0.03
15.129	-0.01



HALEY & ALDRICH, INC
Fort Calhoun Station
Blair Nebraska
127960-006

FALLING HEAD TEST SUMMARY

Monitoring Well ID:	MW-5A
Test Date:	17-Jun-20
H&A Rep.:	S. Kaney

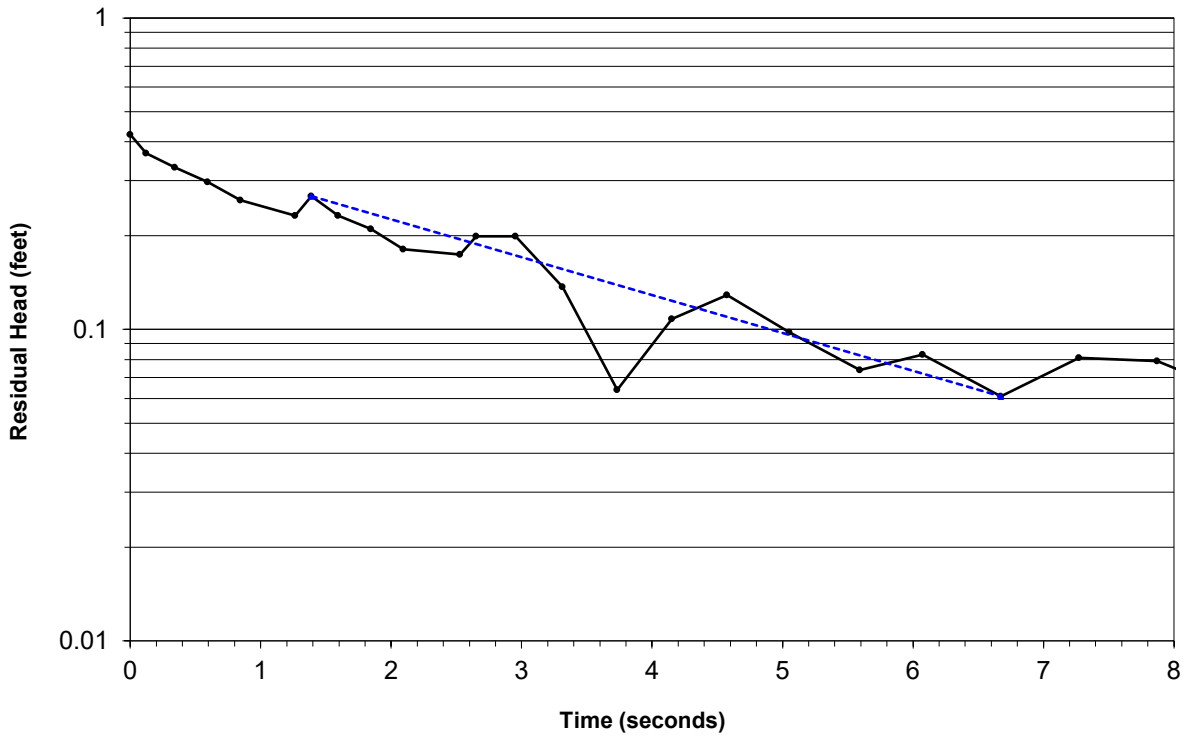
TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	50	
Depth to Static (PVC) in ft.:	12.4	
Well Depth-Static (Lw), in ft.:	37.6	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	10.0	
Test Length Section (Le), in ft.:	10	
A:	3.164	
B:	0.538	
C:	3.136	
Le/rw:	53.333	
Saturated Thickness (H), in ft.:	38	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.643	
For Lw=H - ln(Re/rw):	3.755	
Yo, in ft.:	0.27	
Yt, in ft.:	0.061	
t, in min.:	0.111	

	(Lw<H)	(Lw=H)
Kh (cm/sec) =	8.55E-03	
Kh (m/sec) =	8.55E-05	
Kh (ft/min) =	1.68E-02	
Kh (ft/day) =	2.42E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.422
0.123	0.37
0.344	0.33
0.594	0.30
0.844	0.26
1.265	0.23
1.388	0.27
1.594	0.23
1.844	0.21
2.094	0.18
2.529	0.17
2.652	0.20
2.953	0.20
3.314	0.14
3.733	0.06
4.153	0.11
4.573	0.13
5.054	0.10
5.593	0.07
6.073	0.08
6.673	0.06
7.274	0.08
7.873	0.08
8.533	0.06
9.254	0.05
10.033	0.03
10.813	0.02
11.653	0.02
12.553	0.06
13.513	0.01
14.474	0.01
15.553	0.05
16.693	0.02
17.893	0.00



HALEY & ALDRICH, INC

Fort Calhoun Station

Blair Nebraska

127960-006

FALLING HEAD TEST SUMMARY

Monitoring Well ID:	MW-5A
Test Date:	17-Jun-20
H&A Rep.:	S. Kaney

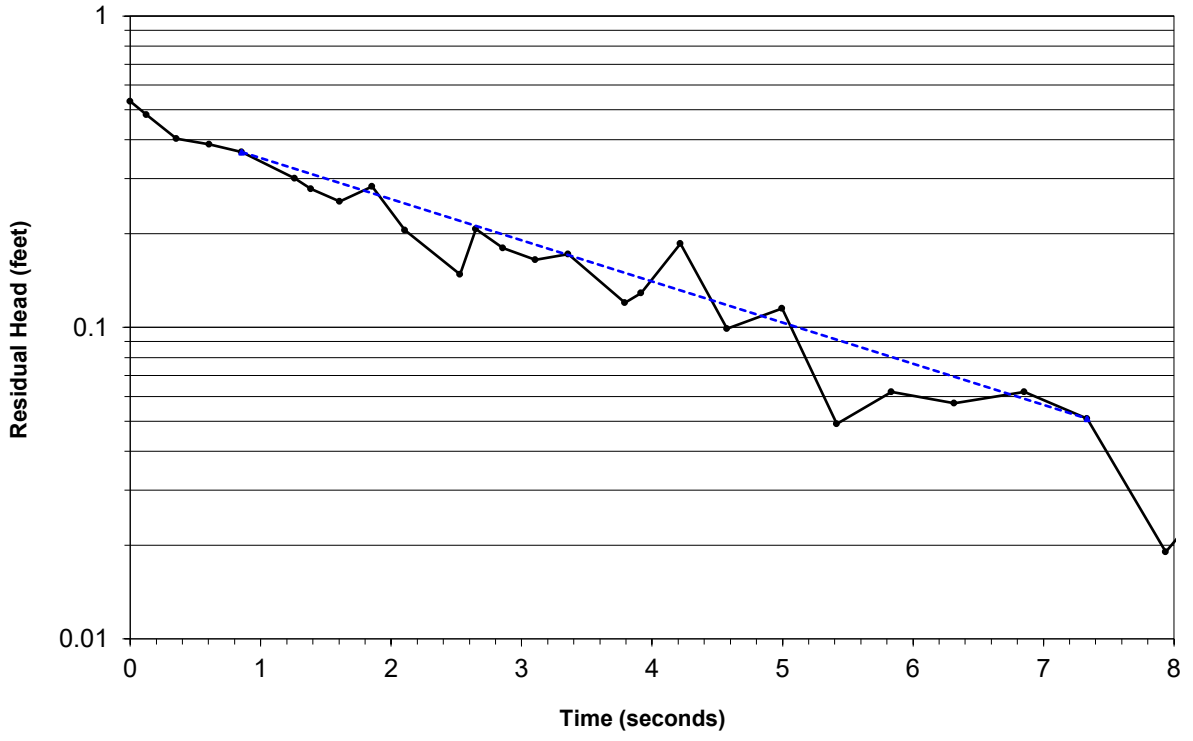
TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	50	
Depth to Static (PVC) in ft.:	12.4	
Well Depth-Static (Lw), in ft.:	37.6	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	10.0	
Test Length Section (Le), in ft.:	10	
A:	3.164	
B:	0.538	
C:	3.136	
Le/rw:	53.333	
Saturated Thickness (H), in ft.:	38	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.643	
For Lw=H - ln(Re/rw):	3.755	
Yo, in ft.:	0.37	
Yt, in ft.:	0.051	
t, in min.:	0.122	

	(Lw<H)	(Lw=H)
Kh (cm/sec) =	1.04E-02	
Kh (m/sec) =	1.04E-04	
Kh (ft/min) =	2.04E-02	
Kh (ft/day) =	2.93E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.532
0.125	0.48
0.356	0.40
0.606	0.39
0.856	0.37
1.263	0.30
1.387	0.28
1.606	0.25
1.856	0.28
2.106	0.21
2.527	0.15
2.65	0.21
2.856	0.18
3.106	0.17
3.356	0.17
3.792	0.12
3.915	0.13
4.216	0.19
4.576	0.10
4.996	0.12
5.416	0.05
5.835	0.06
6.316	0.06
6.855	0.06
7.335	0.05
7.936	0.02
8.536	0.04
9.136	0.01



HALEY & ALDRICH, INC

Fort Calhoun Station

Blair Nebraska

127960-006

FALLING HEAD TEST SUMMARY

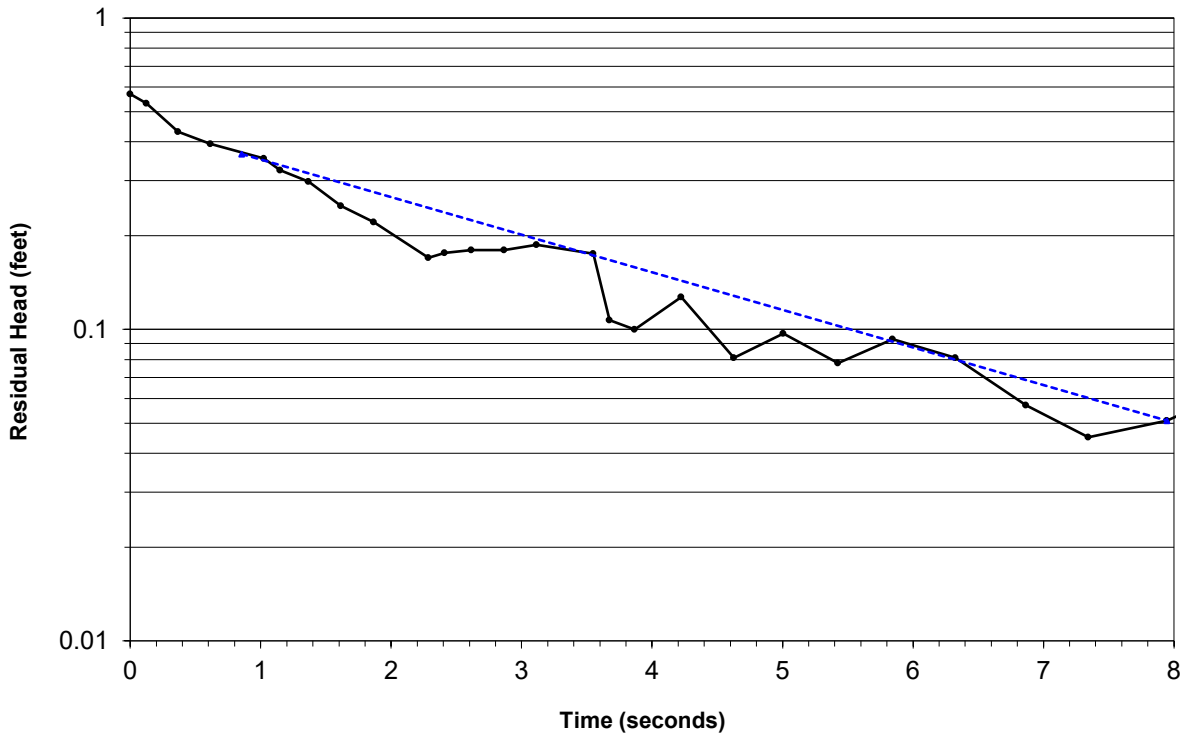
Monitoring Well ID:	MW-5A
Test Date:	17-Jun-20
H&A Rep.:	S. Kaney

TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	50	
Depth to Static (PVC) in ft.:	12.4	
Well Depth-Static (Lw), in ft.:	37.6	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	10.0	
Test Length Section (Le), in ft.:	10	
A:	3.164	
B:	0.538	
C:	3.136	
Le/rw:	53.333	
Saturated Thickness (H), in ft.:	38	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.643	
For Lw=H - ln(Re/rw):	3.755	
Yo, in ft.:	0.37	
Yt, in ft.:	0.051	
t, in min.:	0.132	
	(Lw<H)	(Lw=H)
Kh (cm/sec) =	9.56E-03	
Kh (m/sec) =	9.56E-05	
Kh (ft/min) =	1.88E-02	
Kh (ft/day) =	2.71E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.57
0.124	0.53
0.366	0.43
0.616	0.39
1.024	0.35
1.149	0.32
1.366	0.30
1.616	0.25
1.866	0.22
2.287	0.17
2.411	0.18
2.616	0.18
2.866	0.18
3.116	0.19
3.551	0.18
3.675	0.11
3.866	0.10
4.225	0.13
4.627	0.08
5.005	0.10
5.425	0.08
5.845	0.09
6.326	0.08
6.865	0.06
7.345	0.04
7.945	0.05
8.545	0.07
9.145	0.02
9.805	0.01
10.525	0.03
11.305	0.00



HALEY & ALDRICH, INC

Fort Calhoun Station

Blair Nebraska

127960-006

FALLING HEAD TEST SUMMARY

Monitoring Well ID:	MW-5B
Test Date:	18-Jun-20
H&A Rep.:	S. Kaney

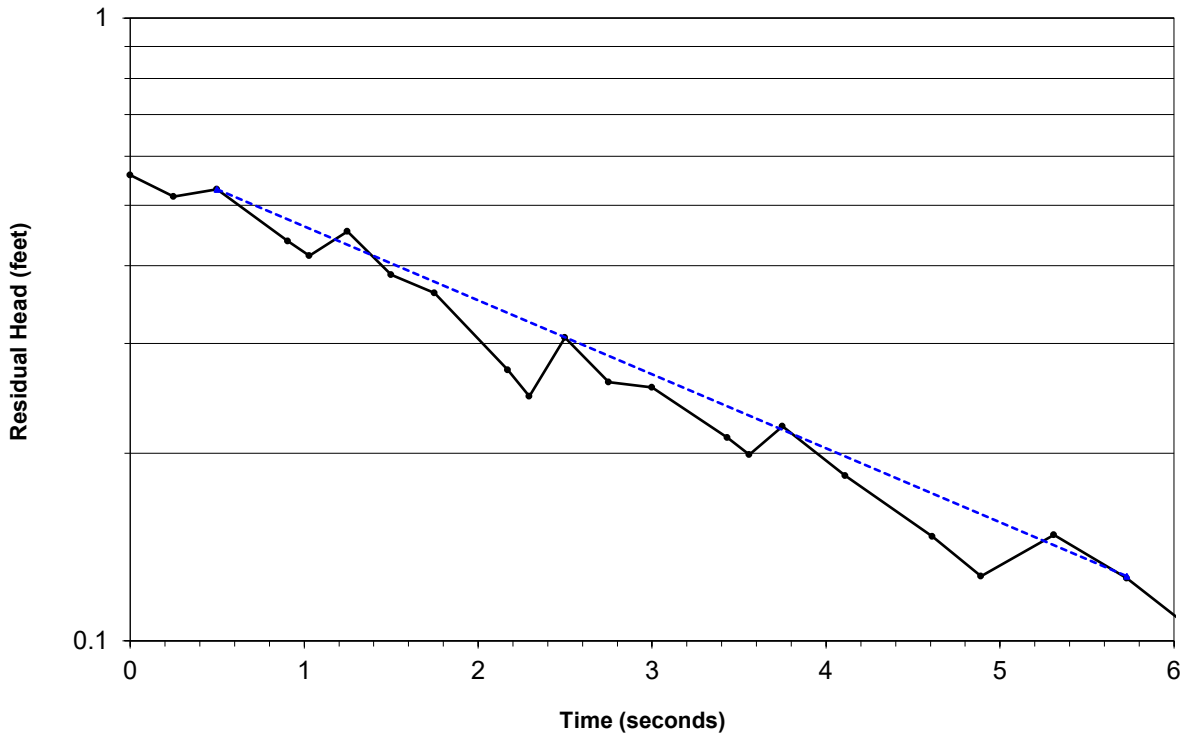
TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	50	
Depth to Static (PVC) in ft.:	12.22	
Well Depth-Static (Lw), in ft.:	37.78	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	5.0	
Test Length Section (Le), in ft.:	5	
A:	2.418	
B:	0.387	
C:	1.991	
Le/rw:	26.667	
Saturated Thickness (H), in ft.:	38	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.330	
For Lw=H - ln(Re/rw):	3.546	
Yo, in ft.:	0.53	
Yt, in ft.:	0.127	
t, in min.:	0.096	

	(Lw<H)	(Lw=H)
Kh (cm/sec) =	1.76E-02	
Kh (m/sec) =	1.76E-04	
Kh (ft/min) =	3.46E-02	
Kh (ft/day) =	4.98E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.559
0.25	0.52
0.5	0.53
0.906	0.44
1.03	0.41
1.25	0.45
1.5	0.39
1.75	0.36
2.172	0.27
2.295	0.25
2.5	0.31
2.75	0.26
3	0.25
3.434	0.21
3.558	0.20
3.75	0.22
4.11	0.18
4.611	0.15
4.89	0.13
5.31	0.15
5.73	0.13
6.21	0.10
6.75	0.09
7.23	0.10
7.83	0.05
8.43	0.08
9.03	0.07
9.69	0.04
10.41	-0.01
11.19	0.02
11.97	0.05
12.81	-0.01
13.71	0.00



HALEY & ALDRICH, INC

Fort Calhoun Station

Blair Nebraska

127960-006

FALLING HEAD TEST SUMMARY

Monitoring Well ID:	MW-5B
Test Date:	18-Jun-20
H&A Rep.:	S. Kaney

TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

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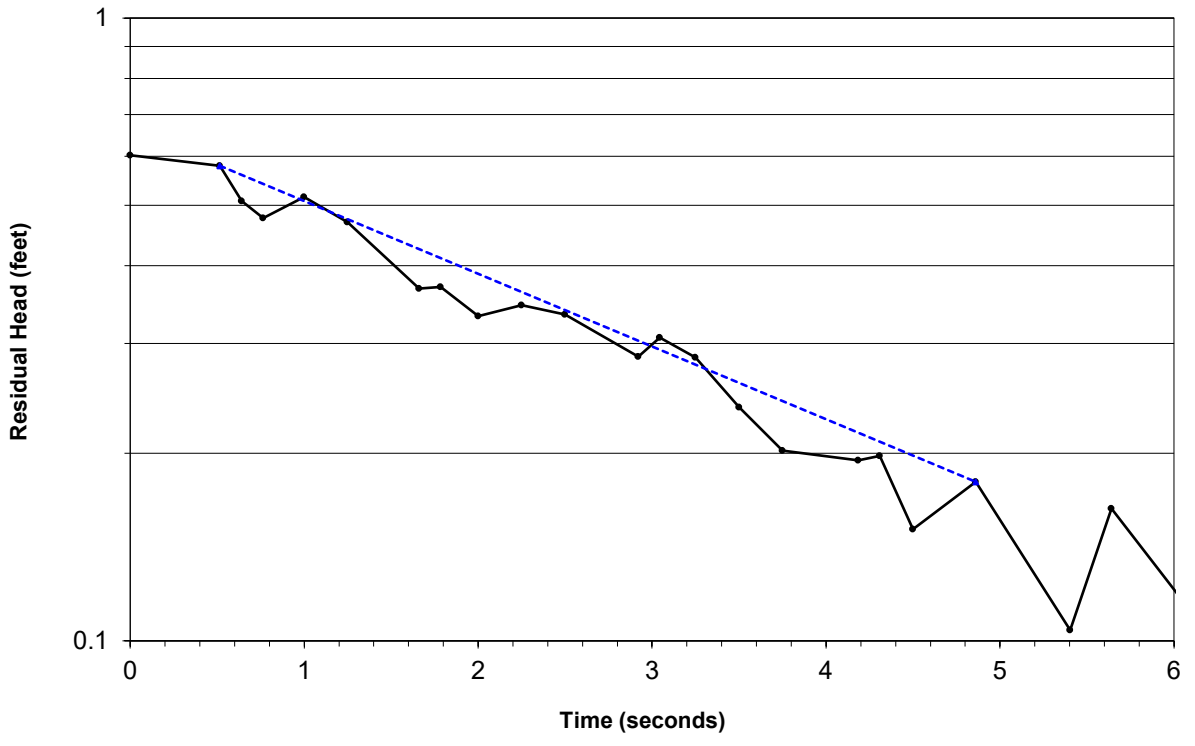
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	5.0	
Test Length Section (Le), in ft.:	5	
A:	2.418	
B:	0.387	
C:	1.991	
Le/rw:	26.667	
Saturated Thickness (H), in ft.:	38	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.330	
For Lw=H - ln(Re/rw):	3.546	
Yo, in ft.:	0.58	
Yt, in ft.:	0.180	
t, in min.:	0.081	
	(Lw<H)	(Lw=H)
Kh (cm/sec) =	1.69E-02	
Kh (m/sec) =	1.69E-04	
Kh (ft/min) =	3.33E-02	
Kh (ft/day) =	4.80E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.602
0.516	0.58
0.64	0.51
0.765	0.48
1	0.52
1.25	0.47
1.66	0.37
1.785	0.37
2	0.33
2.25	0.35
2.5	0.33
2.92	0.29
3.044	0.31
3.25	0.29
3.5	0.24
3.75	0.20
4.185	0.20
4.308	0.20
4.5	0.15
4.86	0.18
5.403	0.10
5.64	0.16
6.06	0.11
6.48	0.14
6.96	0.08
7.5	0.07
7.98	0.09
8.58	0.06
9.18	0.08
9.78	0.06
10.44	0.04
11.16	0.00
11.94	0.04
12.72	0.00
13.56	0.03
14.46	0.04
15.42	-0.01
16.379	0.00



HALEY & ALDRICH, INC
Fort Calhoun Station
Blair Nebraska
127960-006

FALLING HEAD TEST SUMMARY

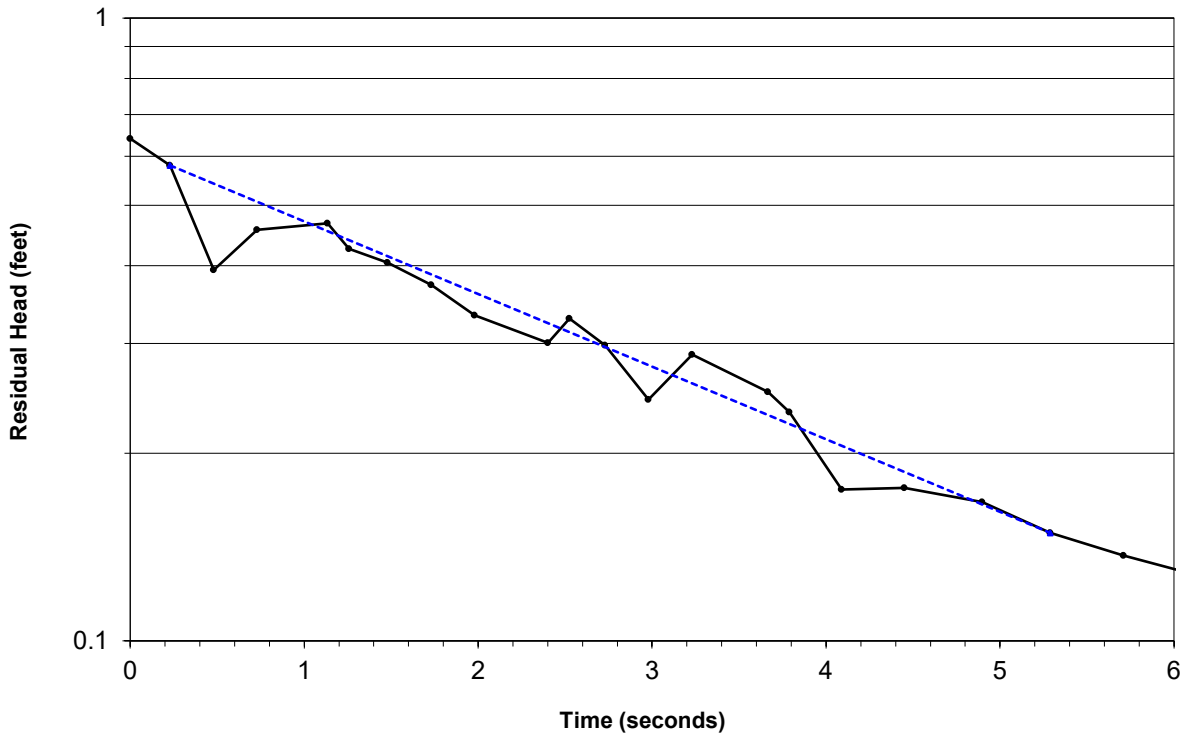
Monitoring Well ID:	MW-5B
Test Date:	18-Jun-20
H&A Rep.:	S. Kaney

TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	50	
Depth to Static (PVC) in ft.:	12.22	
Well Depth-Static (Lw), in ft.:	37.78	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	5.0	
Test Length Section (Le), in ft.:	5	
A:	2.418	
B:	0.387	
C:	1.991	
Le/rw:	26.667	
Saturated Thickness (H), in ft.:	38	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.330	
For Lw=H - ln(Re/rw):	3.546	
Yo, in ft.:	0.58	
Yt, in ft.:	0.149	
t, in min.:	0.088	

	(Lw<H)	(Lw=H)
Kh (cm/sec) =	1.81E-02	
Kh (m/sec) =	1.81E-04	
Kh (ft/min) =	3.56E-02	
Kh (ft/day) =	5.13E+01	



Elapsed Time (sec)	Residual Head (ft.)
0	0.64
0.23	0.58
0.48	0.39
0.73	0.46
1.135	0.47
1.259	0.43
1.48	0.41
1.73	0.37
1.98	0.33
2.401	0.30
2.525	0.33
2.73	0.30
2.98	0.24
3.23	0.29
3.665	0.25
3.789	0.23
4.09	0.18
4.45	0.18
4.899	0.17
5.29	0.15
5.71	0.14
6.251	0.13
6.73	0.09
7.21	0.06
7.81	0.08
8.41	0.03
9.01	0.05
9.669	0.03
10.389	0.03
11.169	0.03
11.949	0.04
12.79	0.02
14.69	0.02
14.815	0.02
15.609	0.02
17.69	0.00
17.83	-0.01
19.03	-0.04
20.29	0.01
21.609	-0.02
23.05	-0.04
24.55	-0.02
26.109	0.02
27.79	0.01
29.589	0.01
31.449	-0.01
33.49	0.03
35.589	0.00
37.809	-0.01
40.21	-0.05

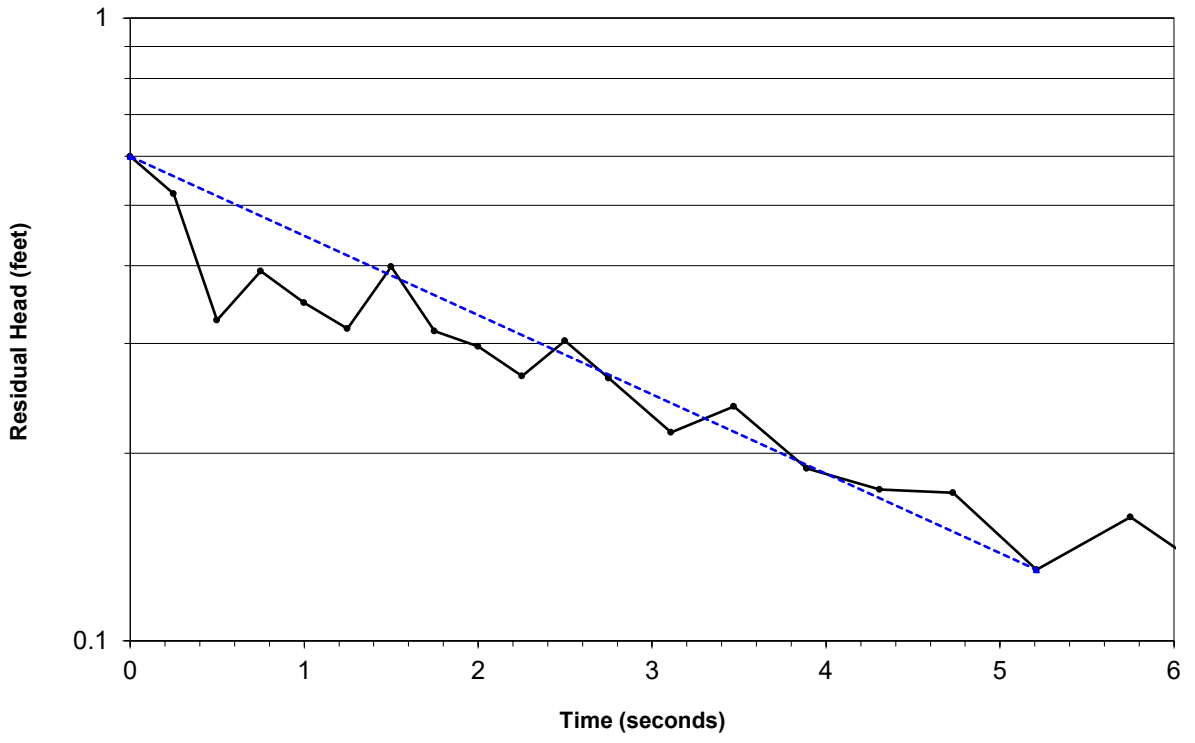
HALEY & ALDRICH, INC	**FALLING HEAD TEST SUMMARY**	
Fort Calhoun Station	Monitoring Well ID:	MW-5B
Blair Nebraska	Test Date:	18-Jun-20
127960-006	H&A Rep.:	S. Kaney

TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	50	
Depth to Static (PVC) in ft.:	12.22	
Well Depth-Static (Lw), in ft.:	37.78	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	5.0	
Test Length Section (Le), in ft.:	5	
A:	2.418	
B:	0.387	
C:	1.991	
Le/rw:	26.667	
Saturated Thickness (H), in ft.:	38	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.330	
For Lw=H - ln(Re/rw):	3.546	
Yo, in ft.:	0.60	
Yt, in ft.:	0.130	
t, in min.:	0.087	
	(Lw<H)	(Lw=H)
Kh (cm/sec) =	2.07E-02	
Kh (m/sec) =	2.07E-04	
Kh (ft/min) =	4.07E-02	
Kh (ft/day) =	5.85E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.599
0.25	0.52
0.5	0.33
0.75	0.39
1	0.35
1.25	0.32
1.5	0.40
1.75	0.31
2	0.30
2.252	0.27
2.5	0.30
2.75	0.26
3.11	0.22
3.47	0.24
3.89	0.19
4.31	0.18
4.73	0.17
5.21	0.13
5.75	0.16
6.23	0.13
6.83	0.10
7.43	0.09
8.03	0.07
8.69	0.08
9.41	0.05
10.19	0.03
10.97	0.05
11.81	0.05
12.71	0.05
13.67	0.06
14.63	0.03
15.71	0.05
16.85	0.02
18.05	0.02
19.31	0.02
20.63	0.04
22.07	0.01



APPENDIX E

Vadose Zone Hydraulic Conductivity Analyses

PROBLEM STATEMENT AND OBJECTIVE

Estimate the coefficient of permeability based on the in-situ falling head infiltration test(s) performed using methods from Schmid, ILRI, and Jarvis.

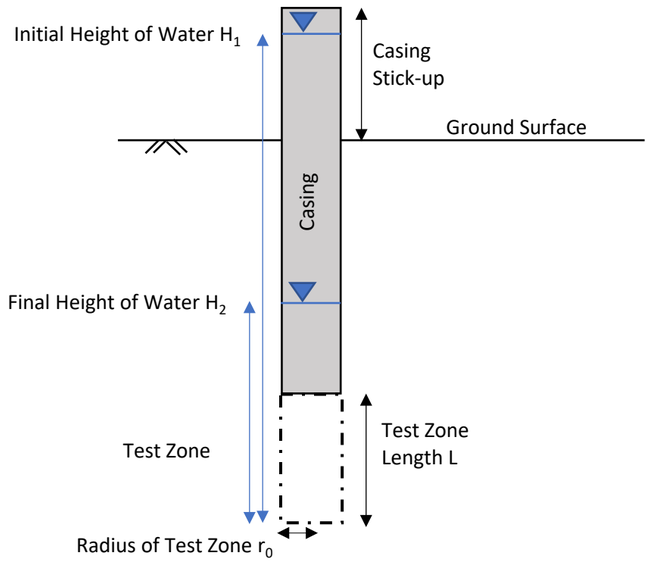
REFERENCES

1. American Society of Testing Materials (ASTM), "Field Determination of Permeability by the Infiltration Tests," Symposium on Permeability and Capillarity of Soils," by W.E. Schmid, 1967.
2. International Institute for Land Reclamation and Improvement (ILRI), Drainage Principles and Applications, 1980.
3. U.S. Department of the Interior, Water and Power Resources Service, Ground Water Manual, Revised Reprint 1981.

ASSUMPTIONS

1. The groundwater level is below the testing interval.
2. The initial and final height of water is measured from the bottom of the test zone.
3. Initial degree of saturation for Schmid method is 10%, final degree of saturation for Schmid method is 90%.
4. Porosity for Schmid method is 0.3.
5. Input depths reference depths from the ground surface.
6. If flush bottom technique was performed, input a small tezt zone length (L) for Jarvis method to compute.

SKETCH



PROCEDURE ***(TAKEN DIRECTLY FROM THE REFERENCES)***

Schmid Method

Let us assume that infiltration takes place from a cased hole whose bottom is a large distance above the ground water table.
We also assume that the wetting front has the shape of a spherical surface defined by the distance x measured from the intersection of the borehole axis and the plane through the bottom of the casing. We observe that the rate of progress of the wetting front is determined by the flow rate Q and the storage capacity of the soil per unit volume. The volume of the wetted soil mass with the wetting front at x will be $V_w = (4/3)\pi x^3$. The volume increment if the front advanced from x to x + Δx will be $\Delta V = (4/3)\pi[(x+\Delta x)^3 - x^3] = 4\pi x^2 \Delta x$ where higher order terms have been neglected. The water storage volume in this volume then will be $\Delta W = n(S_w - S_i)\Delta V = 4\pi n S x^2 \Delta x$.
Since this volume must correspond to the volume leaving the well, we may write, letting $\Delta x \rightarrow dx$, $r_0^2 \pi dh = -4\pi n S x^2 dx$
The solution of this differential equation is $h = -(4n/3r_0^2)Sx^3 + C$
Since we are interested in the rate of change of h, we may differentiate with respect to t and get $dh/dt = (4n/r_0^2)Sx^2 x = (4n/r_0^2)Sx^2(kl/nS) = (4/r_0^2)kdx$
$k = (r_0^2/4)\ln(h_1/h_2)/(x_2t_2 - x_1t_1)$
The equation still contains the variable x which will have to be found by an observation well.
$h_1 - h_2 = (4n/3r_0^2)S(x_2^3 - x_1^3)$
Assuming that initially $x_1 = r_0$, we get
$h_1 - h_2 = (4/3)Snr_0[(x_2^3/r_0^3) - 1] = (4/3)Snr_0[(x^2/r_0)^3 - 1]$ and $x_2 = r_0\,[3(h_1 - h_2)/4Snr_0 + 1]^{1/3}$

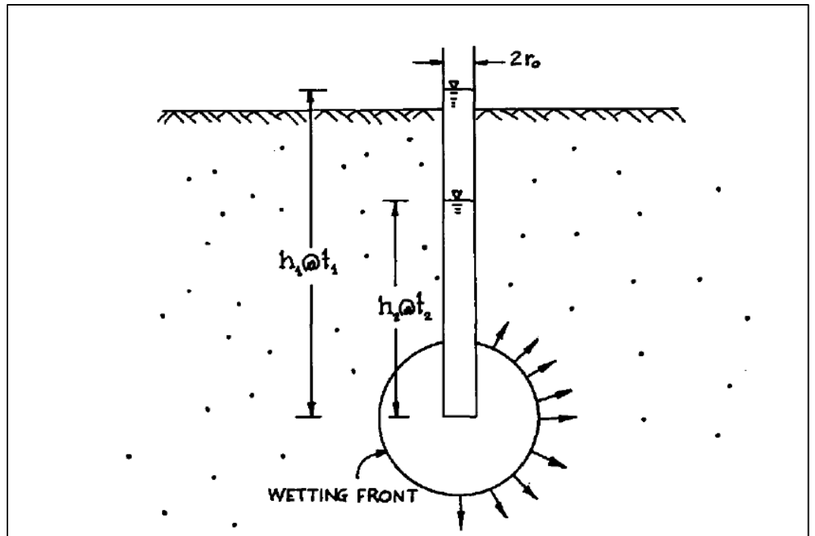
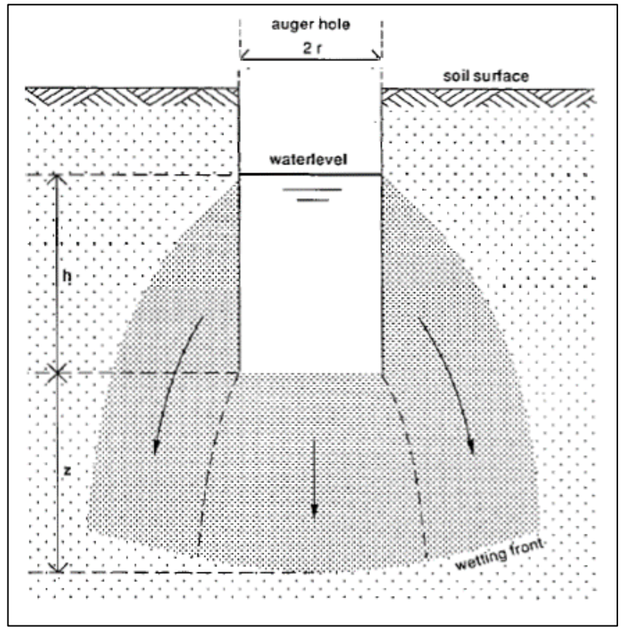
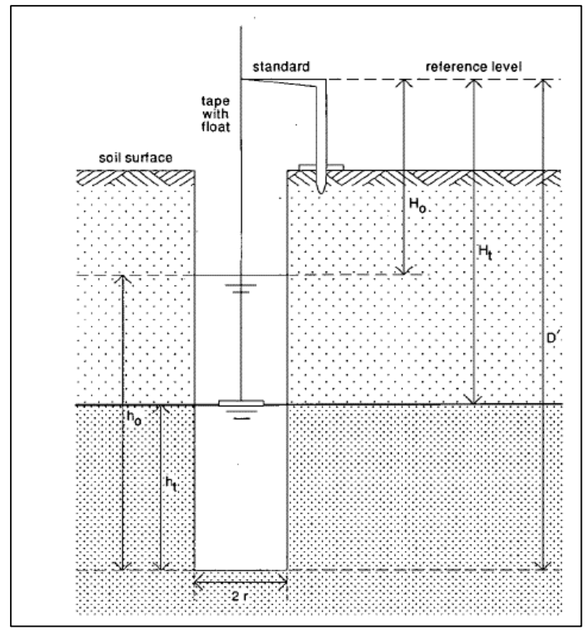


FIG. 3—*Cased well above ground water table falling head test.*

ILRI Method

If one uses a steel cylinder (also called "infiltrometer") to infiltrate water continuously into unsaturated soil, one will find after a certain time that the soil around and below the area becomes almost saturated and that the wetting front is a rather sharp boundary between wet and dry soil.
We shall consider a point just above the wetting front at a distance z below the soil surface in the area where the water infiltrates. The matric head of the soil at the point has a (small) value h_m. The head at the soil surface equals z + h (h=height of water level in the cylinder). The head different between the point at depth z and a point at the soil surface equals $z + h + |h_m|$, and the average hydraulic gradient between the two points is $s = (z + h + |h_m|) / z$
If z is large enough, s approximates unity. Hence, from Darcy's Law, we know that the mean flow velocity in the wetted soil below approaches the hydraulic conductivity (v=K) assuming the wetted soil is practically saturated.
The inversed auger-hole method is based on these principles. If one bores a hole into the soil and fills the hole with water until the soil below and around the hole is practically saturated, the infiltration rate v will become more or less constant. The total infiltration Q will then be equal to v x A (where A is the surface area of infiltration). With v = K, we get Q = k x A.
For the inversed auger-hole method, infiltration occurs both through the bottom and the side walls of the hole. Hence we have $A = \pi r^2 + 2\pi rh$ (where r is the radius of the hole and h is the height of the water column in the hole). So we can write $Q = 2\pi Kr\,(h+0.5r)$. Further, we can find Q from the rate at which the water level in the hole is lowered: $Q = -\pi r^2 dh/dt$. Eliminating Q in both expressions gives $2K(h+0.5r) = -r\,dh/dt$.
Upon integration and rearrangement, we obtain $K = 1.15r\,(\log(h_0+0.5r) - \log(h_t+0.5r))/(t-t_0)$
The values of ht are obtained from ht = D'-Ht where D' is the depth of the hole below reference level and Ht is the depth of the water level in the hole below the reference level. When H and t are measured at appropriate intervals K can be calculated. On semilog paper, plotting ht+0.5r on the log axis and t on the linear axis produces a straight line with a slope $\tan\alpha = \log(h_0+0.5r) - \log(h_t+0.5r)/(t-t_0)$.



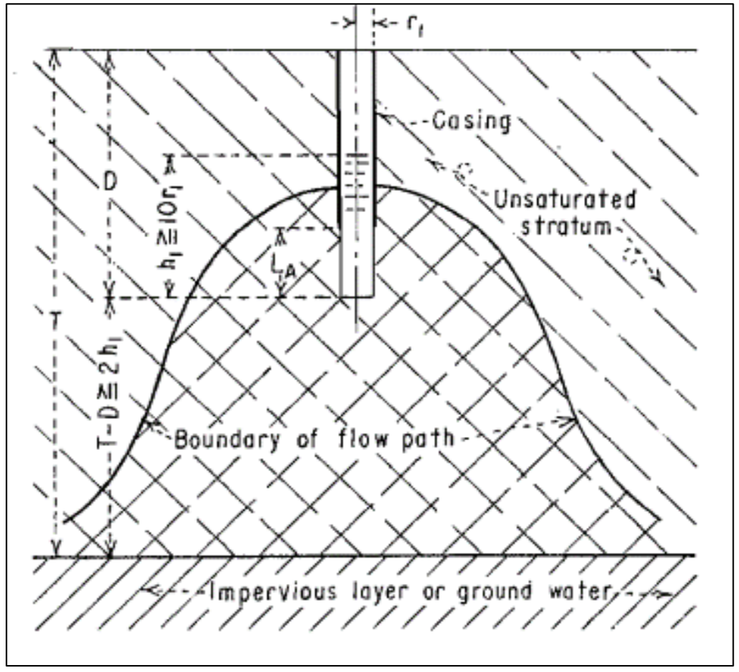


PROCEDURE ***(TAKEN DIRECTLY FROM THE REFERENCES)***

Jarvis Method

Three-dimensional radial flow from a cylindrical well in an unsaturated isotropic pervious bed requires some special treatment. R.E. Glover has developed a precise solution for the steady-state flow from a well into an infinite unsaturated medium. This solution is based on flow from an array of point sources in a uniform stream. The relation between Q, h_1, r_1, and K was found to be $k = Q/(2\pi h_1^{'})[\sin^{-1}(h_1/r_1)-1]$ where h_1 = the depth of water in the test well.

All of the development given here have been applied to partially penetrating wells and to partly cased wells. Therefore, different limits of integration were applied to Glover's solution to yield the more general expression
$k = Q/(2\pi(2Ah_1-A_2)\ [\sin\text{-}1(L_A/r_1)-(L_A/h_1)]$



FORMULAS FROM REFERENCES

Schmid method

$$k = \frac{\left[\frac{r_0}{4}\ln\left(\frac{H_1}{H_2}\right)\right]}{T\left[\frac{3(H_1 - H_2)}{4Snr_0} + 1\right]^{0.33}}$$

from Equation 23 on page 151 of Reference #1.

k = hydraulic conductivity
r_0 = radius of test zone
T = total time of test
H_1 = initial height of water
H_2 = final height of water
S_i = initial degree of saturation
S_r = final degree of saturation
$S = S_r - S_i$

ILRI method

$$k = 1.15 r_0 \frac{\log(H_1 + \frac{1}{2}r_0) - \log\left(H_2 + \frac{1}{2}r_0\right)}{T}$$

from Section 12.6.2 "Inversed Auger-Hole Method" of Reference #2.

k = hydraulic conductivity
r_0 = radius of test zone
T = total time of test
H_1 = initial height of water
H_2 = final height of water

Jarvis method

$$k = \frac{r_0^2}{2LT}\left[\frac{\sinh^{-1}\frac{L}{r_0}}{2}\ln\left(\frac{2H_1 - L}{2H_2 - L}\right) - \ln\left(\frac{2H_1H_2 - LH_2}{2H_1H_2 - LH_1}\right)\right]$$

from Chapter 10 "Permeability Tests in Individual Drill Holes and Well" of Reference #3.

k = hydraulic conductivity
r_0 = radius of test zone
T = total time of test
L = length of test zone (input 0.01 ft if flush bottom technique was performed)

designates input cell

FIELD DATA AND CALCULATIONS

Boring No.	Test Date	Ground Surface Elevation	Casing Stick-Up (ft)	Depth to Top of Test Zone (ft)	Depth to Bottom of Test Zone (ft)	Top Elevation of Test Zone	Bottom Elevation of Test Zone	Length of Test Zone L (ft)	Length of Test Zone L (cm)	Radius of Test Zone r_0 (in)	Radius of Test Zone r_0 (cm)	Soil Strata of Test Zone	Initial Degree of Saturation S_i	Final Degree of Saturation S_r	Porosity n	Initial Height of Water H_1 (ft)	Initial Height of Water H_1 (cm)	Final Height of Water H_2 (ft)	Final Height of Water H_2 (cm)	Total Time of Test T (min)	Total Time of Test T (sec)	Schmid Coefficient of Permeability k (cm/sec)	ILRI Coefficient of Permeability k (cm/sec)	Jarvis Coefficient of Permeability k (cm/sec)
SB-08	na	0	1.1	3.9	5.0	-3.92	-5	1.08	32.9	1.9	4.8	m silt/sand, fairly de	0.1	0.9	0.3	4.98	151.8	4.1	125.0	40	2400	4.E-05	2.E-04	4.E-05
SB-11	na	0	1.2	3.8	5.0	-3.8333	-5	1.16666	35.6	1.9	4.8	nedium silt, dense	0.1	0.9	0.3	5.79	176.5	5.78	176.2	19	1140	2.E-06	4.E-06	7.E-07
SB-17	na	0	1.0	4.0	5.0	-4.0417	-5	0.95833	29.2	1.9	4.8	sand AND fine to m	0.1	0.9	0.3	5.15	157.0	5.06	154.2	19	1140	1.E-05	4.E-05	8.E-06
SB-25	na	0	1.0	4.0	5.0	-4	-5	1	30.5	1.9	4.8	sand AND fine silt	0.1	0.9	0.3	5.29	161.2	5	152.4	11.5	690	5.E-05	2.E-04	4.E-05
SB-32	na	0	1.0	4.0	5.0	-4	-5	1	30.5	1.9	4.8	o medium sand	0.1	0.9	0.2	5.81	177.1	4.68	142.6	9	540	1.E-04	9.E-04	2.E-04
SB-33	na	0	1.0	4.0	5.0	-4	-5	1	30.5	1.9	4.8	nedium silt, dense	0.1	0.9	0.3	6	182.9	5.94	181.1	9	540	2.E-05	4.E-05	9.E-06

Client:
Computed by: SHL Checked by: CJ
Sheet: 4 of 4

HALEY ALDRICH
File No.: 127960-006
Date: 9-Jul-2020
Project: Fort Calhoun Station, Blair Nebraska
Subject: Falling Head Infiltration Permeability Test Data Reduction

APPENDIX F

Groundwater Model Results

HALEY & ALDRICH, INC.
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Portland, Maine 04101
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Appendix F
Summary of Groundwater Modeling Results
Fort Calhoun Station
9610 Power Lane, Blair Nebraska

Haley & Aldrich, Inc. (Haley & Aldrich) has completed a simplified 3-dimensional (3-D) fate and transport groundwater flow model for the subject site. The purpose of this analysis was to estimate the anticipated groundwater cesium (Cs-137) and strontium (Sr-90) chemical constituent concentrations at the subject site over a period of 1000 years using varying well configurations and model geometries.

MODELING APPROACH

The proposed groundwater extraction well was modeled in transient flow condition using Groundwater Vistas Version 8.16. The 3-D groundwater flow modeling was calculated using MODFLOW-2005 (Harbaugh, 2005), particle tracing was calculated using MODPATH version 7 (Pollock, D.W., 2016) and the chemical transport was completed using MT3DMS (Zheng, C. and Wang, P.P., 1999). A representation of the hydrogeologic conditions at the site was incorporated into the groundwater flow model using the available subsurface information and groundwater elevation data. MT3DMS is an add-on to the MODFLOW model and calculates non-reactive contaminant fate and transport.

This simulation was completed in support of the basement fill model to support the development of Derived Concentrations Guideline Levels (DCGLs) using the RESRAD under the resident farmer scenario.

MODEL DOMAIN

The model domain was established to encompass the deeper basement structures that will remain in place following decommissioning.

MODFLOW uses a rectangular grid within the domain and allows for establishing irregular groundwater flow boundary conditions that represent actual and Site-specific features in the study area. The setup is facilitated by assigning boundary types and values to specific grid cells. The three-dimensional finite difference groundwater flow model domain covers a length of 130 meters (m) in the x-direction (west to east), 130m in the y-direction (north to south), and 30 meters in the z-direction (vertical). The model consists of 74 rows, 75 columns, and 6 layers for a total of 33,300 cells. In MODFLOW, the groundwater-flow system is subdivided laterally and vertically into rectilinear blocks called cells. The hydraulic properties of the material in each cell are assigned and assumed to be uniform within each cell. The row and column dimension of each cell is variable based on proximity to the simulated basement. This variability was created to allow for finer resolution within the vicinity of the primary flow pathway and to modify features such as basement walls and floor slabs. Ground surface is assumed to be a flat elevation of 0 m, with overburden assigned a thickness of approximately 20m, and bedrock assigned a thickness of 10m within the model domain. Layer thicknesses were determined through the review of the Site geology, presented in **Section 2.2** of the Hydrogeologic Conceptual Site Model (CSM) Report.

HYDRAULIC MODEL PROPERTIES

Hydraulic properties were assigned consistent with observations presented in borehole logs and in-situ testing for on-site wells, presented in **Section 5** of the Hydrogeologic CSM Report. Values were assigned for horizontal hydraulic conductivity and vertical hydraulic conductivity.

Generally, the site consists of the following layers; fill underlain by fine to medium sands and silts overlying fine to coarse sands and gravels, underlain by bedrock at approximately 65 to 75 ft below ground surface. The available information indicates that the overburden soil hydraulic conductivity measured in the field correspond to a range of 9.4×10^{-3} cm/sec to 1.8×10^{-2} cm/sec. The hydraulic conductivity values used in the model are presented below for the two hydrogeologic units underlying the Site:

- Unconsolidated soil deposits– 28.3 ft/day or 1.0×10^{-2} cm/sec.
- Pennsylvanian-aged limestone and shale (bedrock) – 0.0283 ft/day or 1.0×10^{-5} cm/sec.

Effective Porosity, Storage, and Yield

Effective porosity values are needed for particle tracking and solute transport simulations. The effective porosity values were conservatively estimated based on the soil type through the examination of boring logs. For areas that are generally sandy, an effective porosity of 0.25, specific storage of 0.001 ft^{-1}, and specific yield of 0.25 were utilized.

BOUNDARY CONDITIONS

Boundary conditions define the locations and properties in which water enters and exits the active model domain. The conceptual model for the groundwater system that forms the basis for the model boundaries are as follows:

1. A specified head boundary condition is used to control groundwater flow across the western and eastern model domain to simulate the average horizontal hydraulic gradient (0.0008 m/m), calculated in **Appendix B** of the Hydrogeologic CSM Report;
2. Recharge at the Site creates radial flow away from the Site toward the downgradient specified head boundary condition.
3. A groundwater extraction well is used to simulate extraction from the modeled basement, pumping at a constant rate of 4550 m^3/year under baseline conditions as directed by client.

Specified Head Boundaries

The MODFLOW Time Variant Specified Head Package (Harbaugh, 2005) also known as the Constant Head Package, was used to simulate boundaries along the western and eastern model domain**.** The package is used to fix the head values in selected grid cells regardless of the conditions in the surrounding grid cells. The cell with the assigned constant head acts either as a source of water entering or a sink of water leaving the system. The value for this boundary is set to -0.57 meters along the western domain and -0.68 meters along the eastern domain. This value was estimated based on horizontal hydraulic gradients observed at the Site from groundwater elevation data collected in June 2020, the approximate

average gradient in both the shallow and deeper system was 0.0008. The model domain utilized for this analysis is 130 meters in length with a head difference of 0.11 meters, simulating a gradient of 0.00084. Observed conditions at the Site estimate groundwater depth is approximately 15 to 20 feet below ground surface. For this modeling effort, groundwater depth is assumed to be closer to the surface to further saturate the RESRAD simulated basement walls as a conservative approach to the fate and transport modeling.

Recharge boundaries

Recharge in the model is set to 3.0 inches per year (in./yr) representing 10 percent (%) of an assumed annual precipitation of 30 inches. Within the basement, recharge is set equal to the well extraction rate of 4450 m^3/yr or 48.7 in./yr to simulate a conservative fully saturated condition.

Groundwater Extraction Well

A groundwater extraction well is used to simulate extraction from the overburden aquifer within the vicinity of the modeled basement. Model sensitivity to extraction well position and pumping rate were examined to determine the scenario that resulted in the highest simulated constituent concentrations within the extraction well water. The extraction well cell size was represented for all model simulations as 0.2m x 0.2m, linear adsorption coefficient (Kd) = 0 liters/kilogram (L/Kg) and initial cell constituent concentration = 0 milligrams/liter (mg/L). The extraction well size was discretized to 0.2m x 0.2m to simulate the approximate area of an extraction well. Assignment of zero source concentration and zero linear adsorption coefficient within the extraction well cell represents the removal of porous media from the well location and prevents groundwater extraction from being limited by adsorption processes within the well cell.

The extraction well was simulated in the following locations of the basement:

- Upstream Center
- Upstream Corner
- Downstream Center (inside basement walls)
- Downstream Corner
- Downstream Center (outside basement walls)
- Center of Basement

Under baseline conditions the extraction well pumping rate is set to a constant 4550 m^3/year. Extraction well concentration pumping rate sensitivity was examined by simulating a constant rate of 400 and 10,000 m^3/year.

KEY PARAMETERS FOR TRANSPORT MODELING

The following sections describe the key input parameters of the transport model and how they were derived. The parameters and conditions used for the modeling are selected based on the data available to date. Therefore, simulated timeframes using the parameters described in this section should not be construed as absolute predictions of remedial time frames for various corrective measures.

Dispersivity

Dispersion incorporates the effects of fluid mixing that result from heterogeneities within the groundwater system and molecular diffusion, which is the random movement of ions or molecules. If the molecules of water and dissolved constituents traveled at the average seepage velocity, there would be an abrupt interface and dispersion would be negligible. However, in natural systems water molecules and dissolved contaminants do not all travel at the same rate; some travel faster and some slower. Dispersion in the model accounts for the spreading of the dissolved plume. Diffusion is time dependent and is significant at low velocities. In general, dispersion acts to decrease the contaminant concentration on the leading edge of the plume, while increasing the size and rate of transport of the dissolved plume. Longitudinal dispersion occurs in the direction of advective groundwater flow, while transverse dispersion occurs perpendicular to groundwater flow.

Dispersion in the model typically results in a reduction in plume peak concentrations. Our numerical simulations took a conservative approach by assigning a dispersion value of 0 to the model domain and relied on numerical dispersion generated by the finite difference numerical method with upstream weighting approximation.

First-Order Degradation Rate Constant – Lambda (λ)

Another input parameter for the fate and transport model is the first order degradation rate constant (λ) for the constituent of concern. This rate constant only takes into account degradation of the dissolved constituent during transport, as it leaves the source. This rate constant does not factor in effects of advection, sorption or dispersivity (dispersion). The field-scale degradation rate constant usually can be expressed as a first order decay process. The following first-order decay rate was specified for model simulations:

- Cesium (Cs-137): 30.08 years
- Strontium (Sr-90): 28.90 years

Retardation Effects

Chemical retardation occurs when a solute (contaminant) reacts with the porous media and its rate of movement is retarded relative the advective groundwater velocity. Retardation can occur by a variety of processes including adsorption and mass transfer in porous media. The effects of retardation are often related to site-specific adsorption isotherms. For this modeling purpose, a liner adsorption isotherm is used to account for the effects of transport retardation that may occur for Site-related contaminants. The effects of retardation on contaminant mobility is usually expressed in terms of a retardation factor (R), which is the ratio of the groundwater velocity to contaminant transport velocity (Bedient, P.B., Rifai, H.S., and Newell, C.J., 1994). When a linear adsorption isotherm is used to characterize contaminant mobility, the linear adsorption coefficient (K_d) can be linked to the retardation factor with the mathematical relationship below:

$$R = \frac{v_{gw}}{v_c} = 1 + \frac{\rho_b}{n} \times K_d$$

Where:

R = Retardation factor
v_{gw} = Groundwater velocity
v_c = Contaminant transport
ρ_b = Aquifer solid bulk density
n = Effective transport porosity of the medium
K_d = Linear adsorption coefficient

The following linear adsorption coefficients (Kd) was specified for solution transport modeling based on the geochemical properties and published empirical data:

- Cesium (Cs-137): 158 L/Kg
- Strontium (Sr-90): 6.6 L/Kg

MODEL SCENARIOS

Multiple modeling scenarios were developed to "bracket" the anticipated groundwater concentrations at the site. **Table 1** below outlines scenarios modeled.

Table 1: Simulated fate & transport scenarios

MT3D RUN	60m x 60m basement		60m x 60m bathtub		30m x 30m basement		Pump Rate Sensitivity	Wall Height Sensitivity	Well Depth Sensitivity
Extraction Well Basement Location	1.0m source thickness	0.05m source thickness	1.0m source thickness	0.05m source thickness	1.0m source thickness	0.05m source thickness	1.0m source thickness	1.0m source thickness	1.0m source thickness
Upstream Center	x	-	-	-	-	-	-	-	-
Upstream Corner	x	x	x	x	-	-	-	-	-
Downstream Center (Inside)	x	-	-	-	-	-	-	-	-
Downstream Corner	x	x	x	x	x	x	x	x	x
Downstream Center (Outside)	x	-	-	-	-	-	-	-	-
Center of Basement	x	x	x	x	-	-	-	-	-

The following list of input parameters were used for the various model scenarios:

- All parameters as recommended for RESRAD analysis in the Hydrogeologic CSM Report.
- Cs-137 Kd=158, Sr-90 Kd=6.6
- Well cell 0.2m x 0.2m, Kd=0, initial concentration is 0 mg/L
- Wall height 9.0m
- Well depth 9.0m
- For 1.0m source thickness
  - Wall concentration 1.0 mg/L, Floor concentration 1.07 mg/L
  - Floor layer from 8.0-9.0m
- For 0.05m source thickness
  - Wall concentration 1.0 mg/L, Floor concentration 1.01 mg/L
  - Floor layer from 8.95 to 9.0m
- Well location 1.0m from wall in all simulations.

Cesium and strontium floor source concentrations vary between the 1.0m and 0.05m source thickness scenario runs to account for the difference in surface area and resultant source area mixing between the two scenarios. Assuming a 60m x 60m basement and a wall height of 1.0m, the total wall surface area is $240m^2$. The total wall and floor surface area for this scenario is $3840m^2$, resulting in a floor ratio of $3840m^2/3600m^2$ or 1.07. The same calculation for a 60m x 60m basement and a wall height of 0.05m will result in a floor ratio of $3612m^2/3600m^2$ or 1.01.

For the “bathtub” model scenario, a no-flow boundary condition was assigned along the outside perimeter of the basement walls and below the basement floor slab to create a closed system where water in the extraction well is contributed only by existing water within the saturated basement and infiltrating recharge at a rate of $4450m^3$ at the ground surface.

The “wall height” sensitivity scenario modifies the downstream corner location basement geometry by decreasing wall depth to 0-4 meters, floor depth to 4-5 meters, and well screen interval to 0-5 meters.

To determine dilution effects on extraction well cesium and strontium concentrations, the downstream corner location scenario well screen interval was increased from 0-9 meters to 0-35 meters and the model domain depth increased to 50 meters below ground surface. The sensitivity run referred to as the “mix” case simulates the well screen interval from 0-20 meters in the unconsolidated soil deposits, and partially in the underlying bedrock from 20-35 meters. The sensitivity run referred to as the “sand” case simulates the well screen interval from 0-35 meters in the unconsolidated soil deposits, increasing depth to bedrock in the model to 35 meters to quantify the effect layer permeability has on well dilution. Well depth sensitivity results demonstrate increasing the well screen interval below the modeled basement will decrease cesium and strontium concentrations in the extraction well. Distributing the extraction flow rate across deeper model layers decreases concentrations as permeability of the screened material increases.

ESTIMATED GROUNDWATER CONCENTRATION RATES

Table 1 in Attachment A summarizes the estimated groundwater strontium and cesium concentration rates for each of the scenarios. Individual breakthrough curves for each modeled scenario are presented in Attachment A.

The highest estimated groundwater strontium and cesium concentration rates were encountered in model scenarios simulating an extraction well in the basement corner. Of these scenarios, simulating a 4-meter wall height resulted in the highest concentration at 0.70 mg/L for both strontium and cesium.

CONCLUSIONS

The results of the modeling indicate that positioning an extraction well in the basement corner will result in the highest groundwater concentrations and is the most conservative geometry. Positioning an extraction well in the center of the basement will result in the lowest groundwater concentrations and is the least conservative geometry, as contribution from the basement walls is minimal.

A detailed summary of the individual model results can be found in the enclosed attachment, which includes all fate & transport model outputs.

Attachment:

Attachment A – Contaminant Transport Model Results

ATTACHMENT A

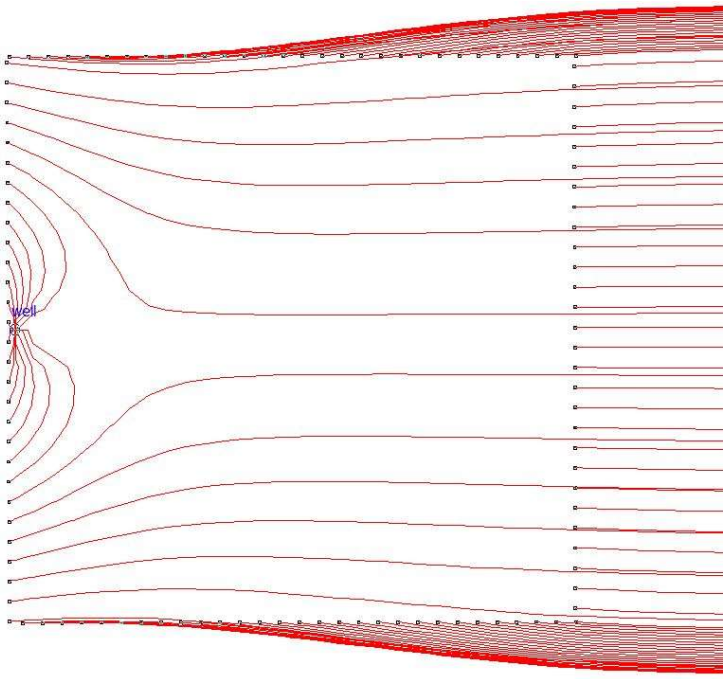
Contaminant Transport Model Results

TABLE I
SUMMARY OF MT3D RESULTS
FORT CALHOUN STATION
BLAIR, NEBRASKA

FILE NO. 0217960-006

MT3D RUN	Maximum Concentration (mg/L) 1.0m source thickness		Maximum Concentration (mg/L) 0.05m source thickness		Maximum Concentration (mg/L) 1.0m source thickness, bathtub		Maximum Concentration (mg/L) 0.05m source thickness, bathtub		Maximum Concentration (mg/L) 1.0m source thickness, 400 m3/yr rate		Maximum Concentration (mg/L) 1.0m source thickness, 10,000 m3/yr rate	
	Cesium	Strontium	Cesium	Strontium	Cesium	Strontium	Cesium	Strontium	Cesium	Strontium	Cesium	Strontium
Upstream Center	0.45	0.45	-	-	-	-	-	-	-	-	-	-
Upstream Corner	0.66	0.65	0.035	0.036	0.61	0.62	0.023	0.024	-	-	-	-
Downstream Center (Inside)	0.40	0.40	-	-	-	-	-	-	-	-	-	-
Downstream Corner	0.66	0.66	0.036	0.036	0.61	0.61	0.025	0.026	0.60	0.63	0.66	0.66
Downstream Center (Outside)	0.37	0.37	-	-	-	-	-	-	-	-	-	-
Center of Basement	0.11	0.11	0.005	0.005	0.12	0.12	0.006	0.006	-	-	-	-
30 x 30, Downstream Corner	0.61	0.62	-	-	0.55	0.56	-	-	-	-	-	-
4m Wall, Downstream Corner	0.70	0.70	-	-	0.65	0.66	-	-	-	-	-	-
35 Meter Well Screen (Sand), Downstream Corner	0.14	0.14	-	-	0.33	0.35	-	-	-	-	-	-
35 Meter Well Screen (Mix), Downstream Corner	0.29	0.30	-	-	0.31	0.32	-	-	-	-	-	-

NOTES
1. EXTRACTION WELL PUMPING RATE IS 4550 M3/YR UNLESS OTHERWISE NOTED.
2. BOX DIMENSIONS ARE 60 METERS X 60 METERS UNLESS OTHERWISE NOTED.
3. BOX WALL HEIGHT IS 8 METERS WITH 1 METER BASEMENT THICKNESS UNLESS OTHERWISE NOTED.
4. SIMULATED CESIUM-137 KD IS 158 L/Kg, STRONTIUM-90 KD IS 6.6 L/Kg.
5. SIMULATED CESIUM-137 HALF LIFE IS 30.08 YEARS, STRONTIUM-90 HALF LIFE IS 28.9 YEARS.
6. SIMULATED 1.0M SOURCE THICKNESS WALL CONCENTRATION IS 1.0 mg/L, FLOOR CONCENTRATION IS 1.07 mg/L.
7. SIMULATED 0.05M SOURCE THICKNESS WALL CONCENTRATION IS 1.0 mg/L, FLOOR CONCENTRATION IS 1.01 mg/L.
8. 35 METER WELL SCREEN SCENARIOS ASSUME TOP OF ROCK IS 20 METERS FOR (SAND) SCENARIO OR 35 METERS FOR (MIX) SCENARIO, ALL OTHER PARAMETERS THE SAME.



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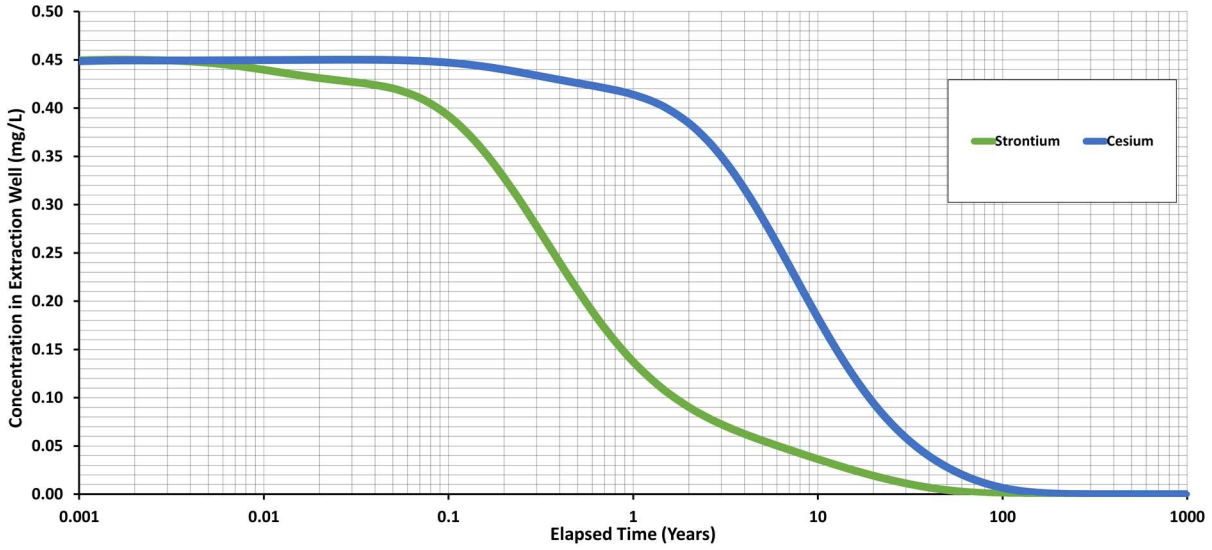
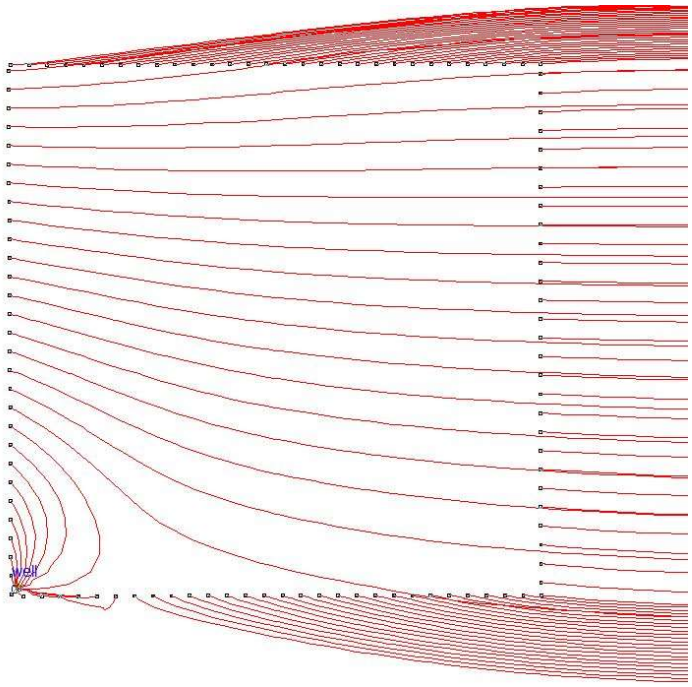


Cesium and Strontium Well Concentration



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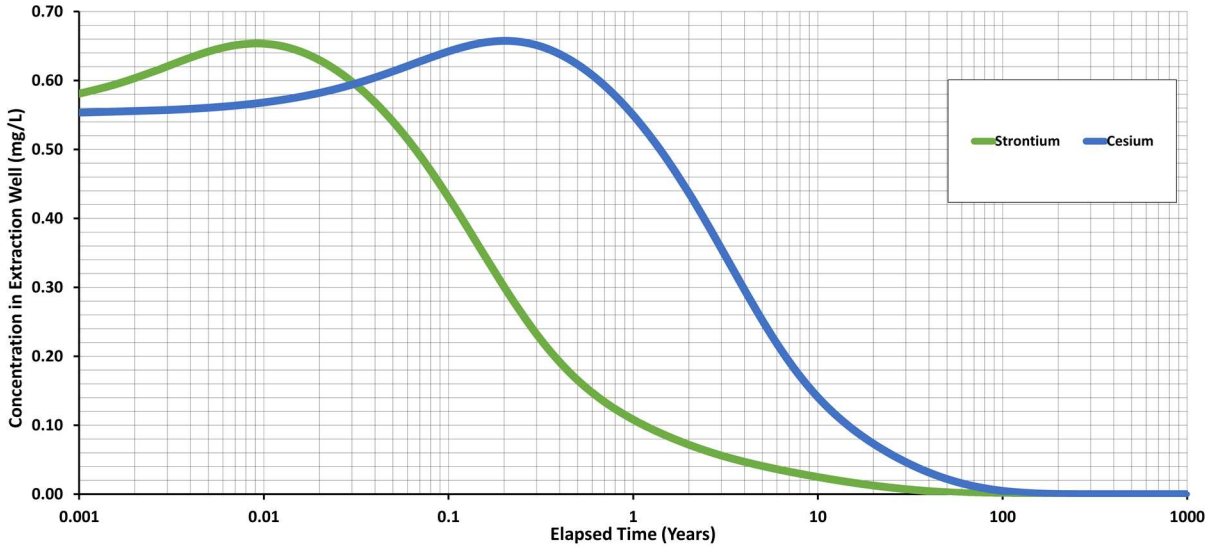

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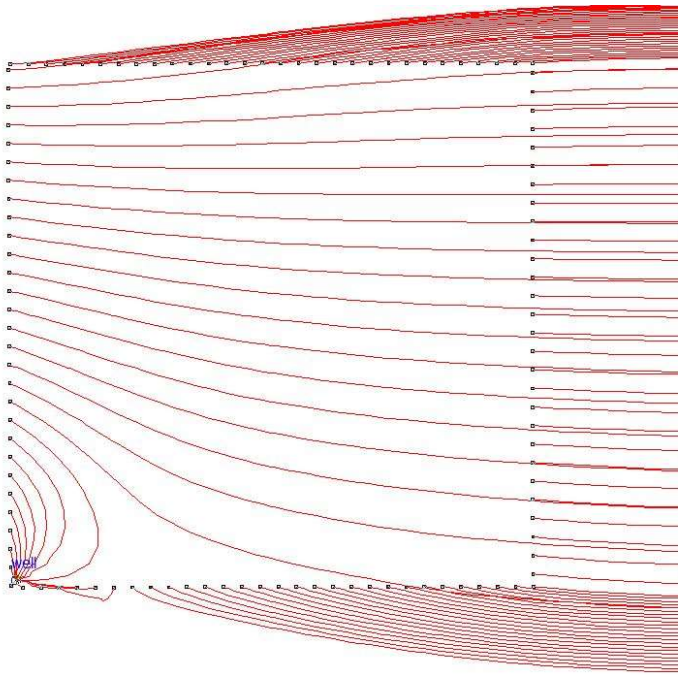

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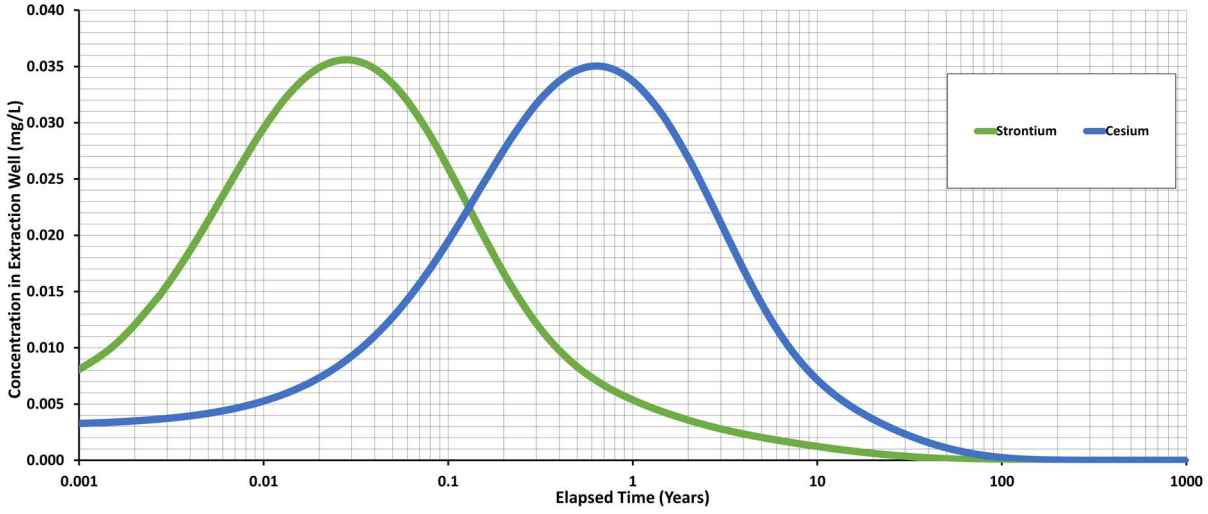

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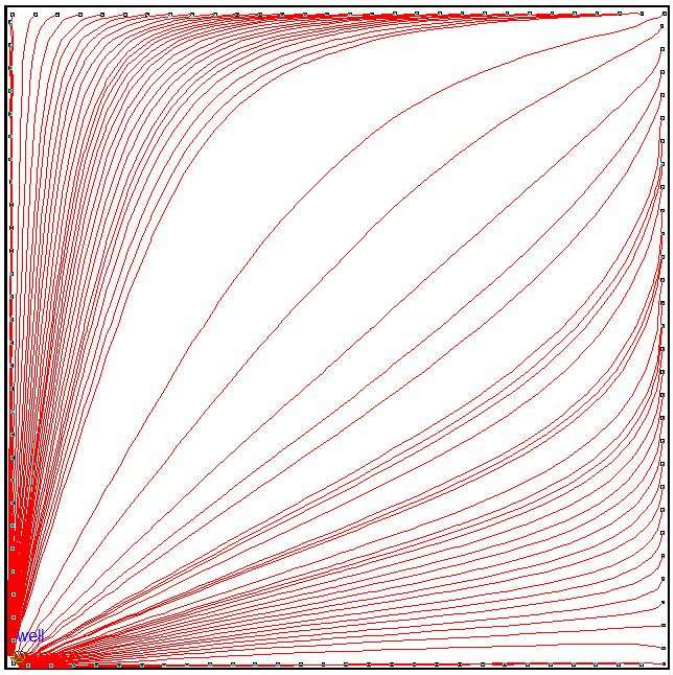

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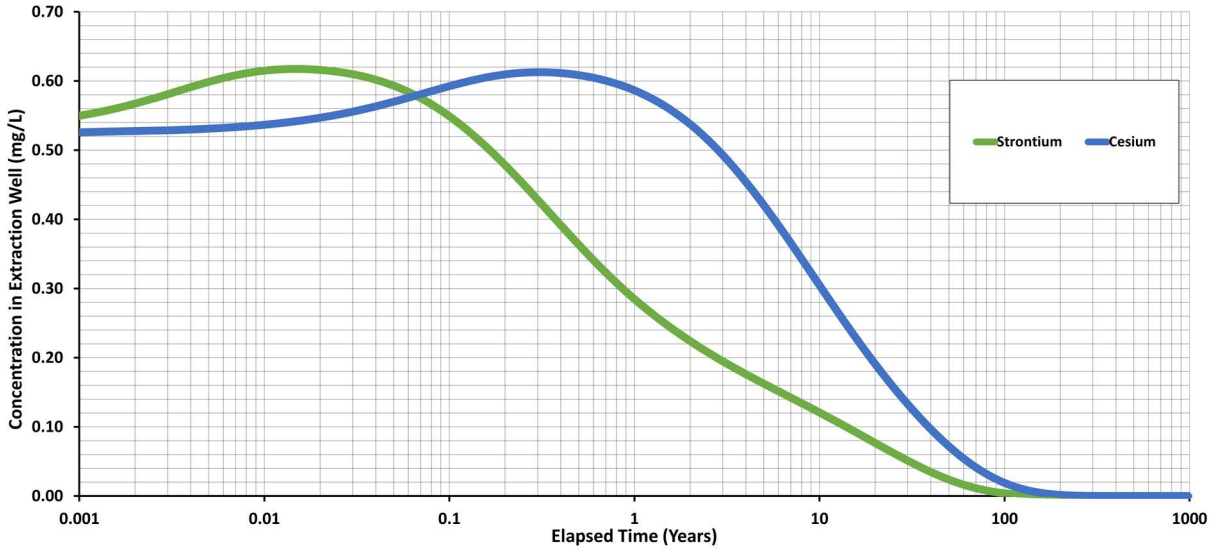
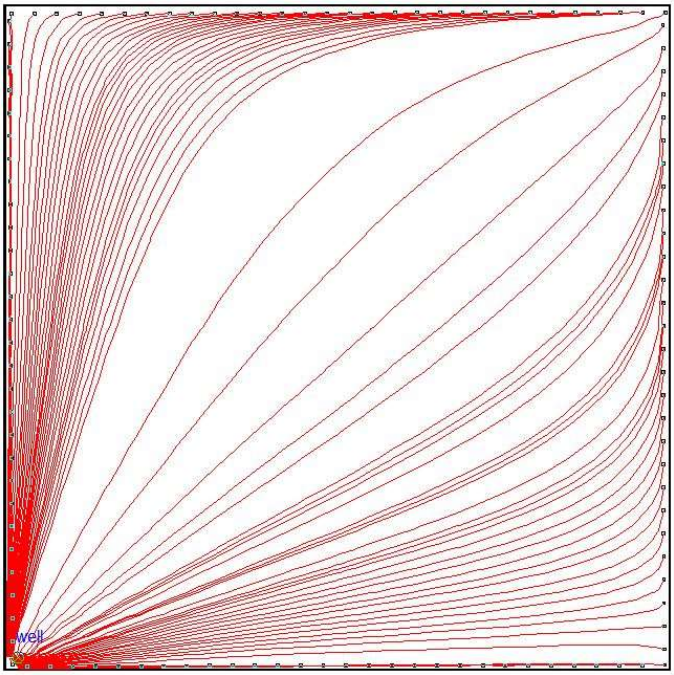


Cesium and Strontium Well Concentration



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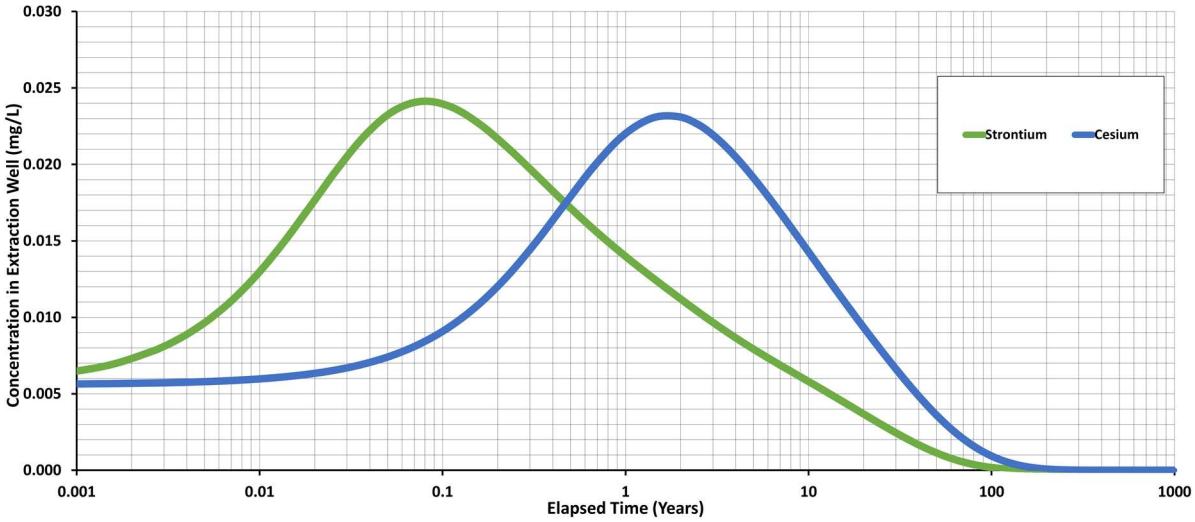
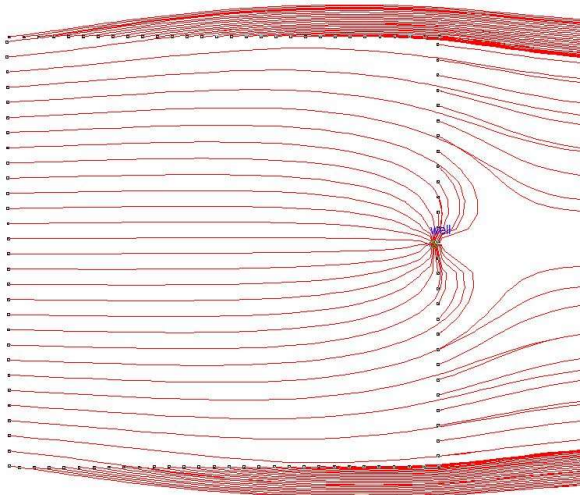


Cesium and Strontium Well Concentration

Fort Calhoun Station
Blair, Nebraska
0127960-006
MT3D: 1 Meter Source Thickness, Downstream Center (Inside)



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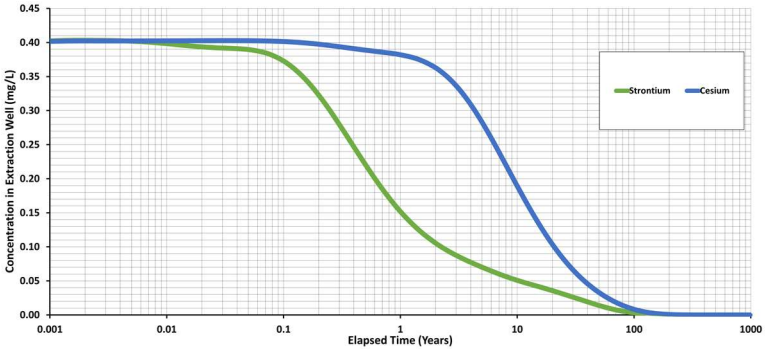
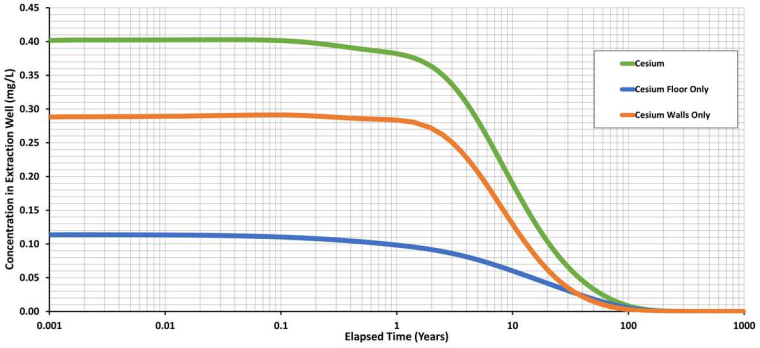
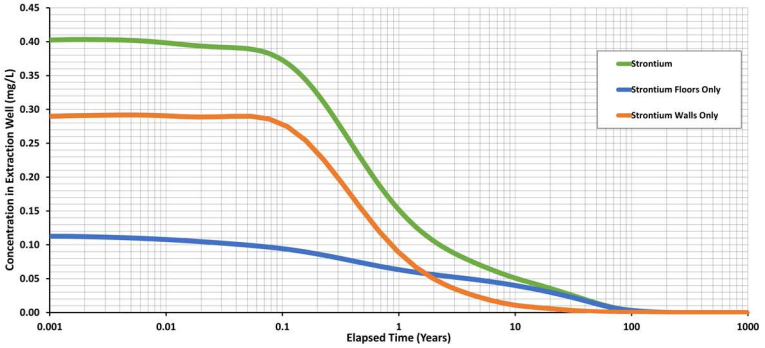


Cesium and Strontium Well Concentration

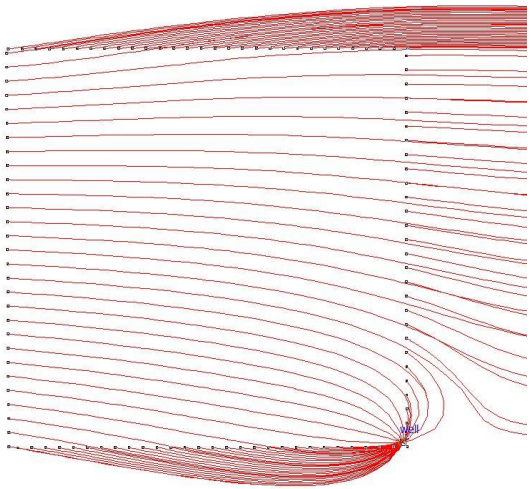


Cesium Well Concentration, Floor and Wall Contribution



Strontium Well Concentration, Floor and Wall Contribution

Fort Calhoun Station
Blair, Nebraska
0127960-006
MT3D: 1 Meter Source Thickness, Downstream Corner



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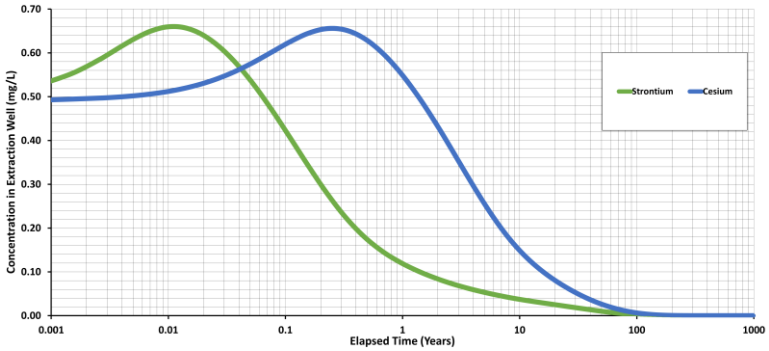
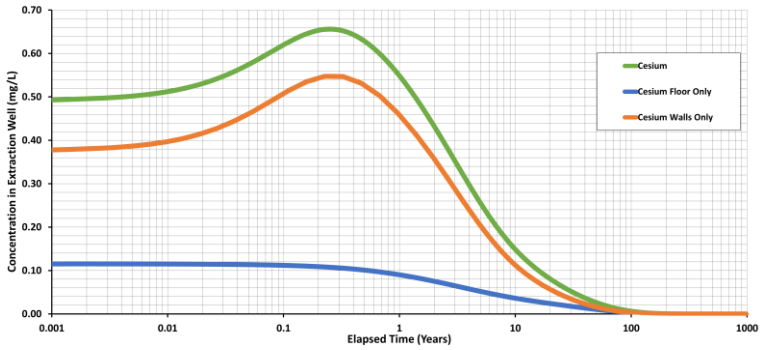
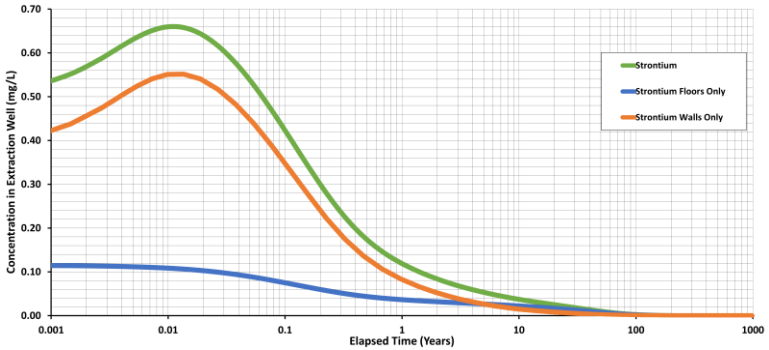


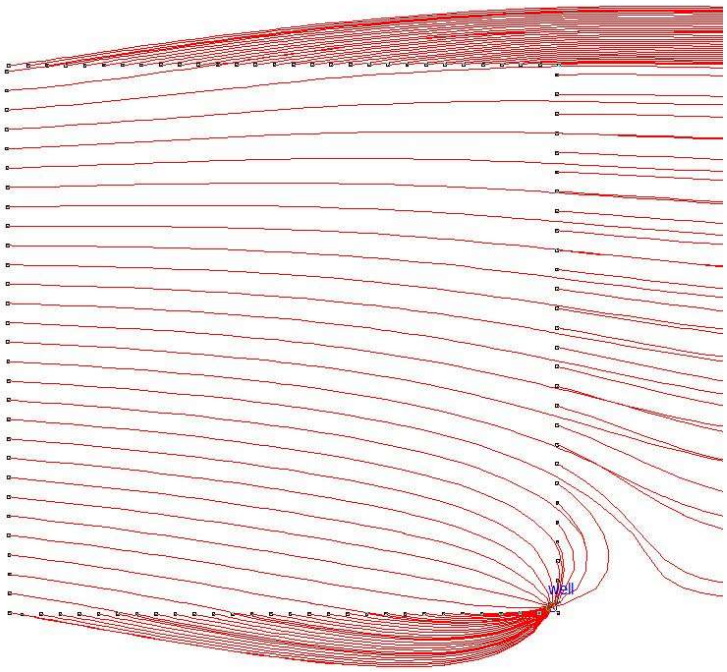
Cesium and Strontium Well Concentration



Cesium Well Concentration, Floor and Wall Contribution



Strontium Well Concentration, Floor and Wall Contribution



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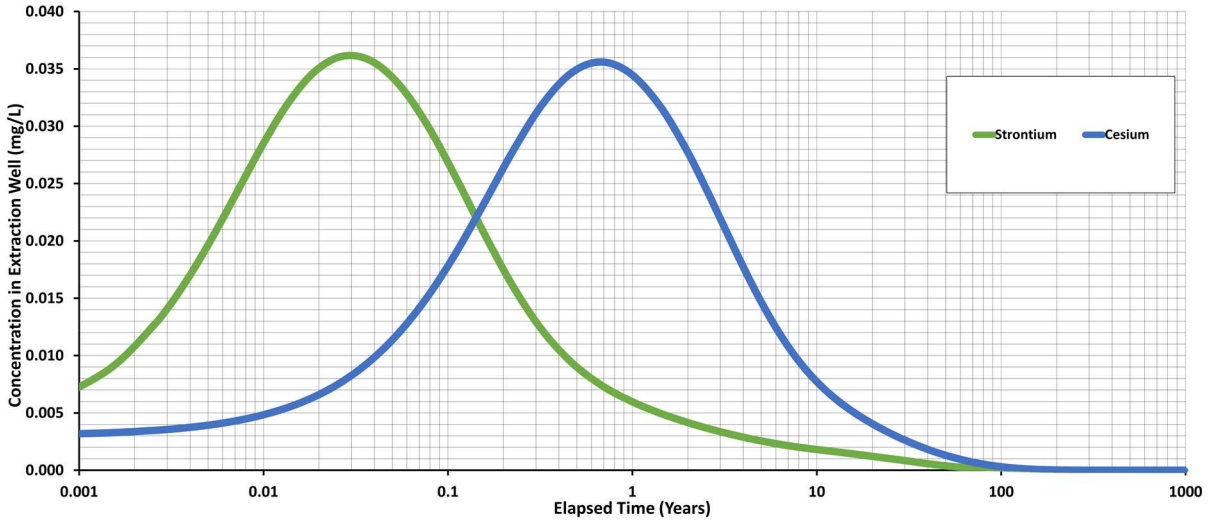
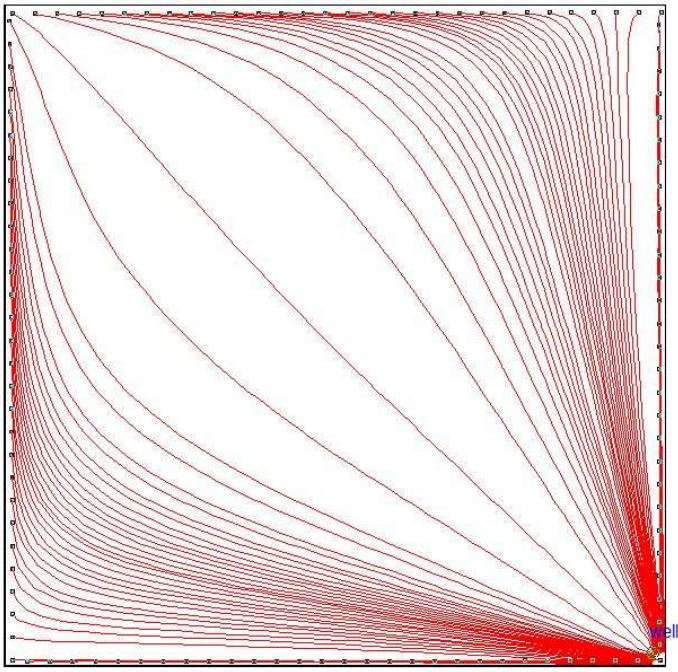


Cesium and Strontium Well Concentration



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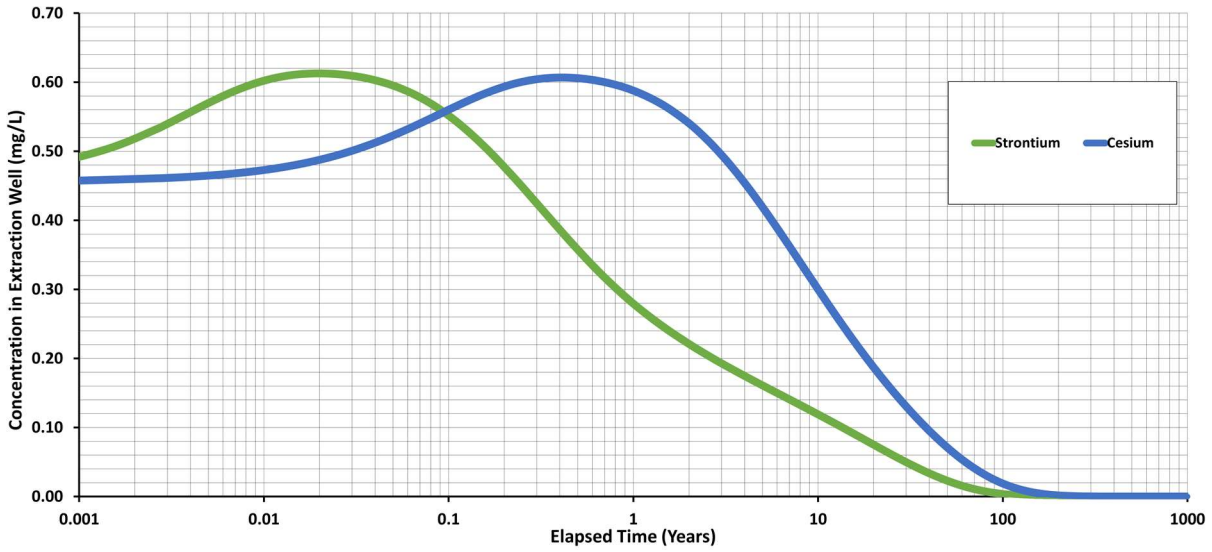
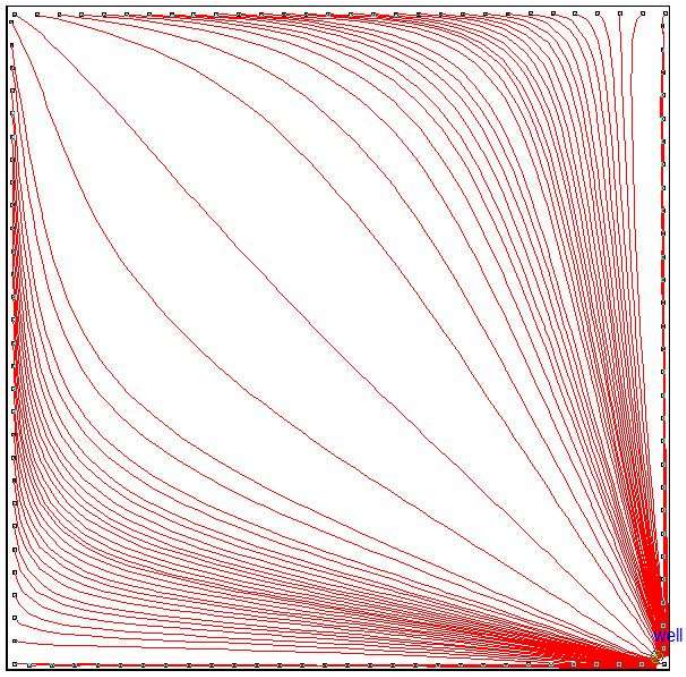


Cesium and Strontium Well Concentration



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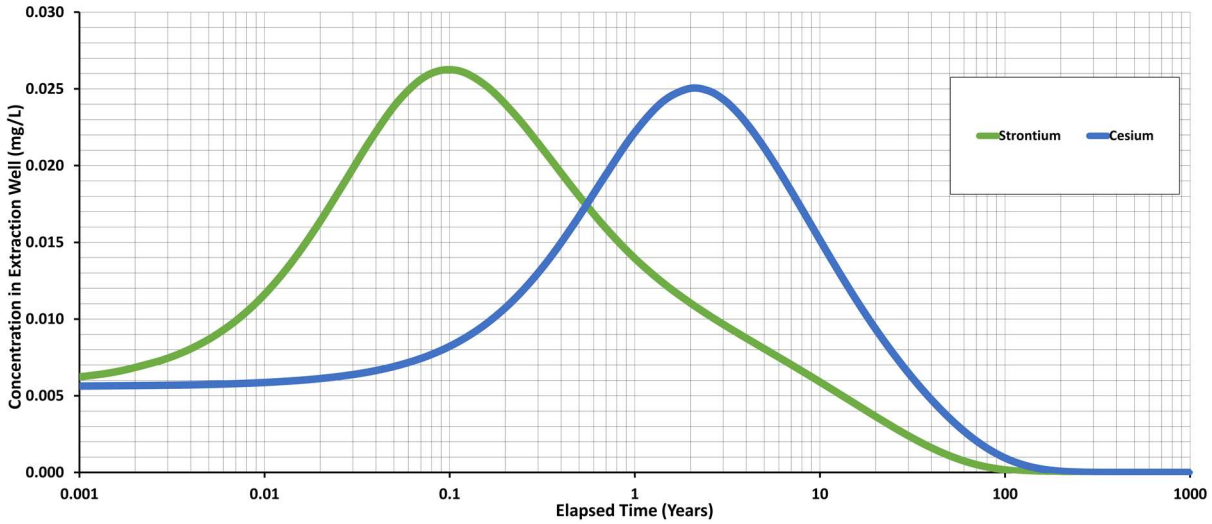

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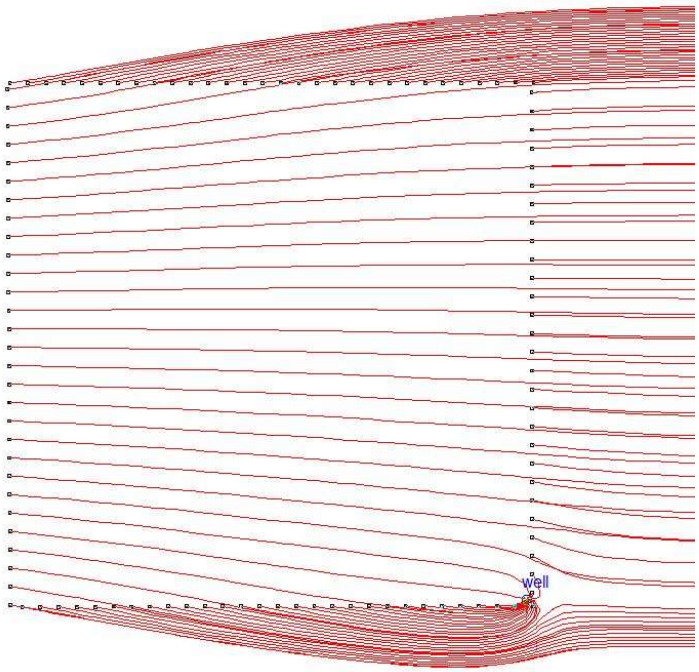

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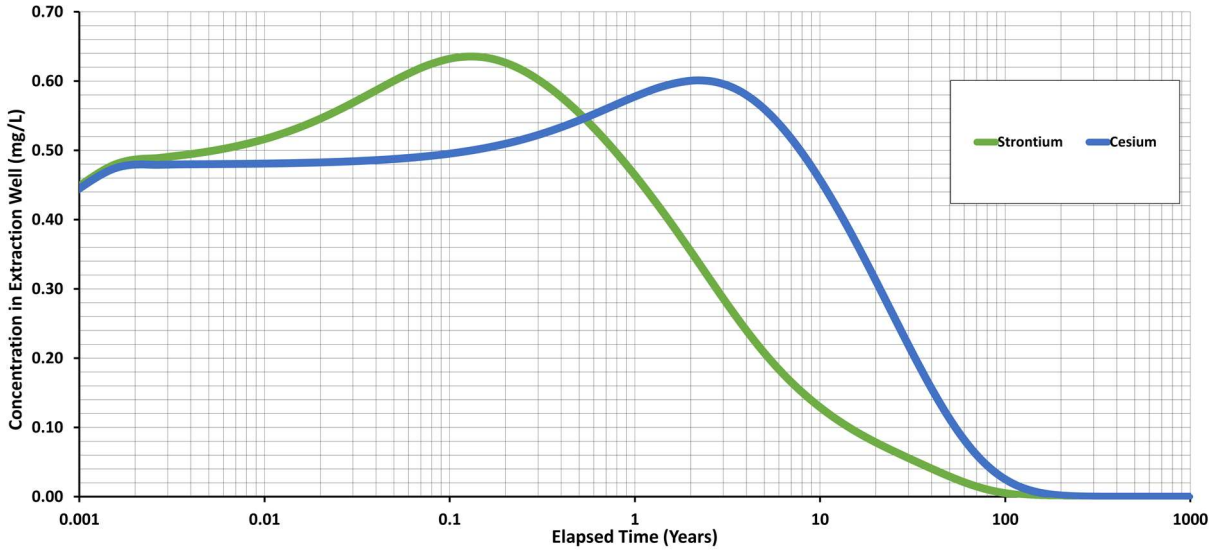

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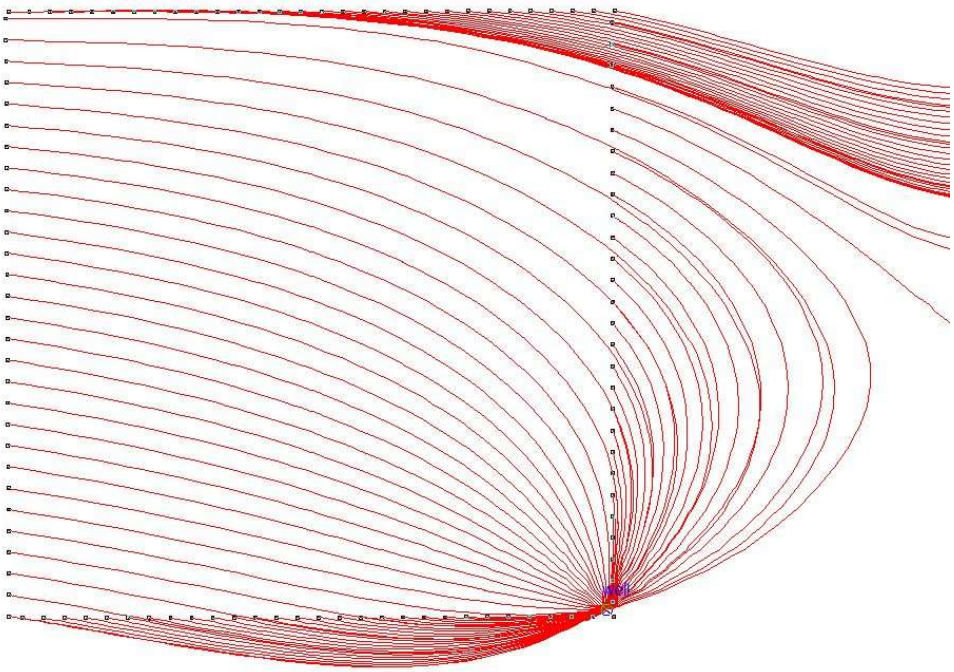

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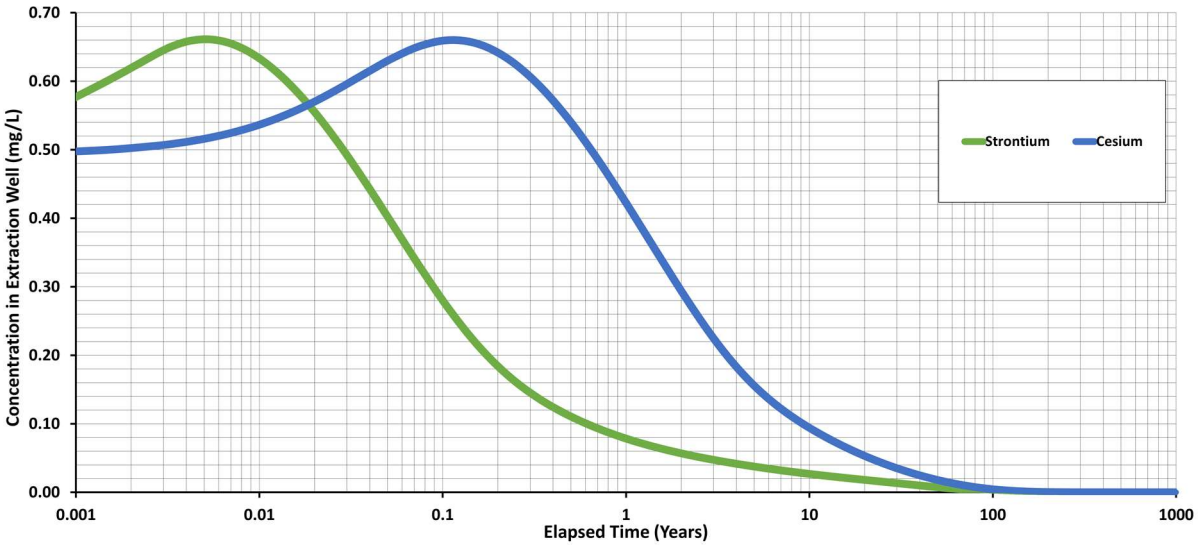

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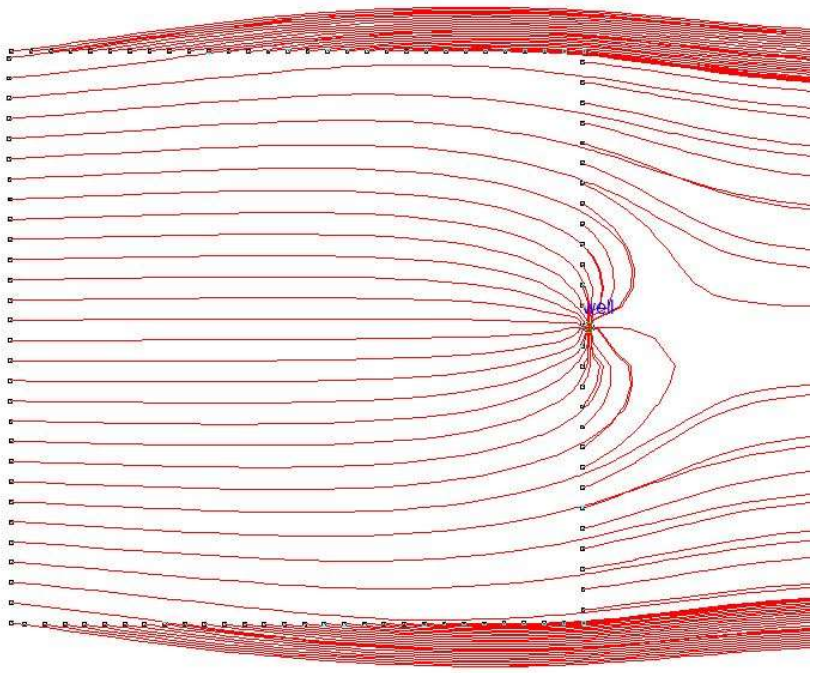

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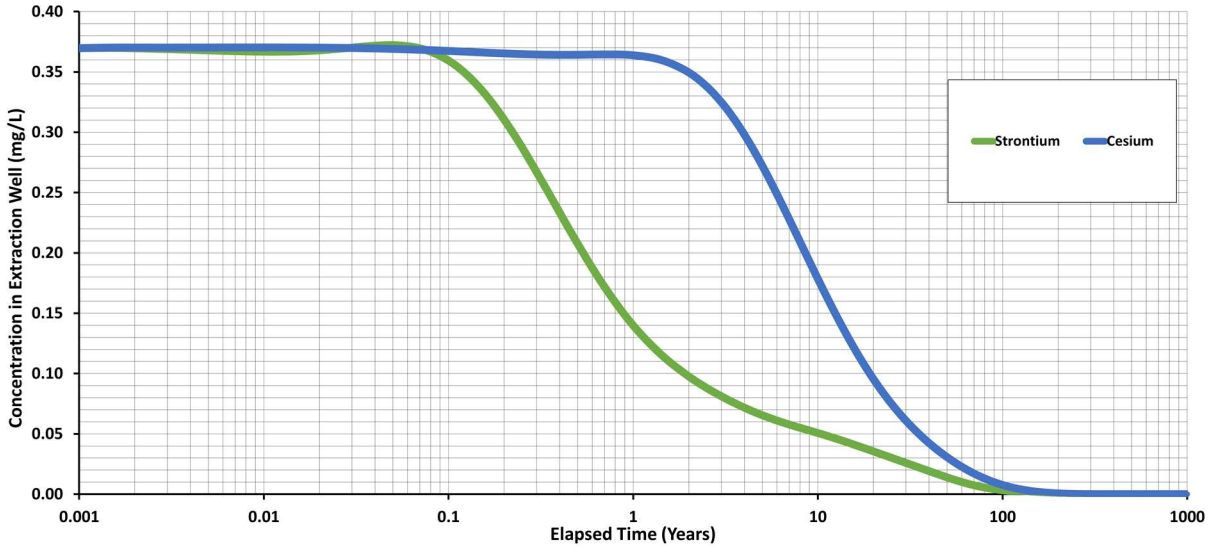

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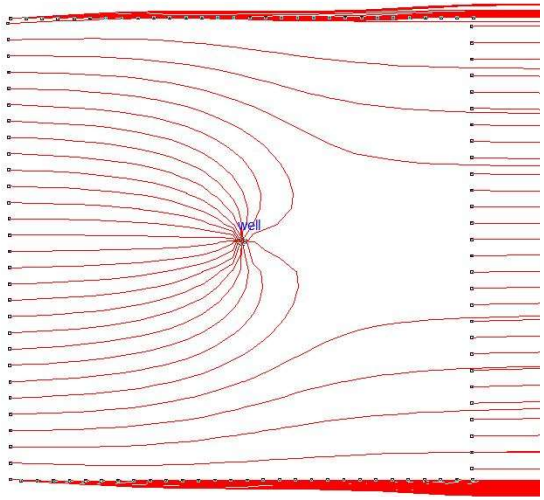

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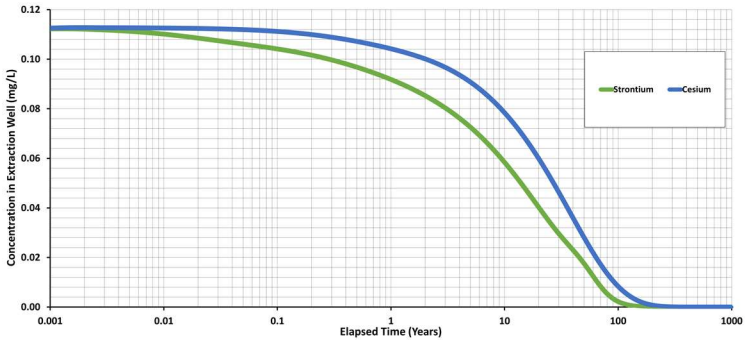

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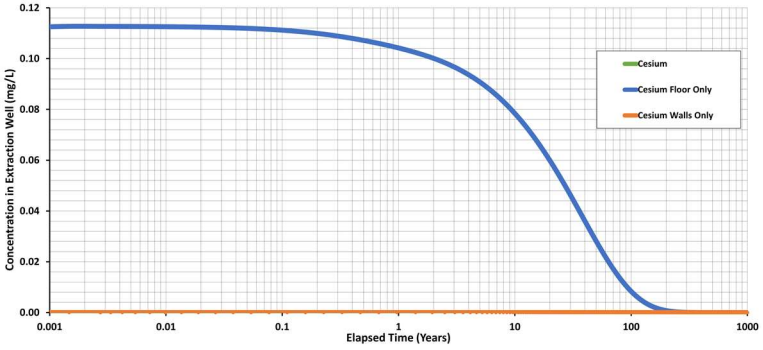
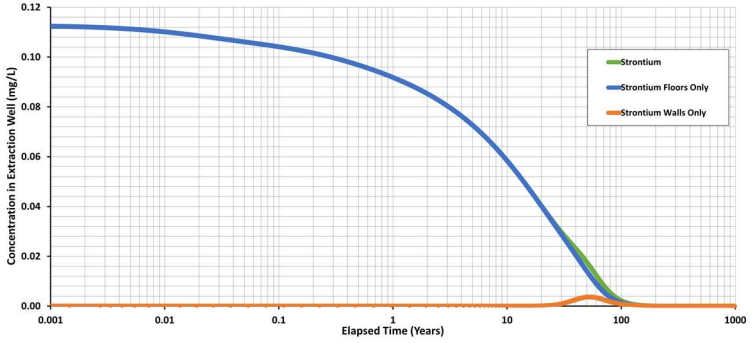


Cesium Well Concentration, Floor and Wall Contribution



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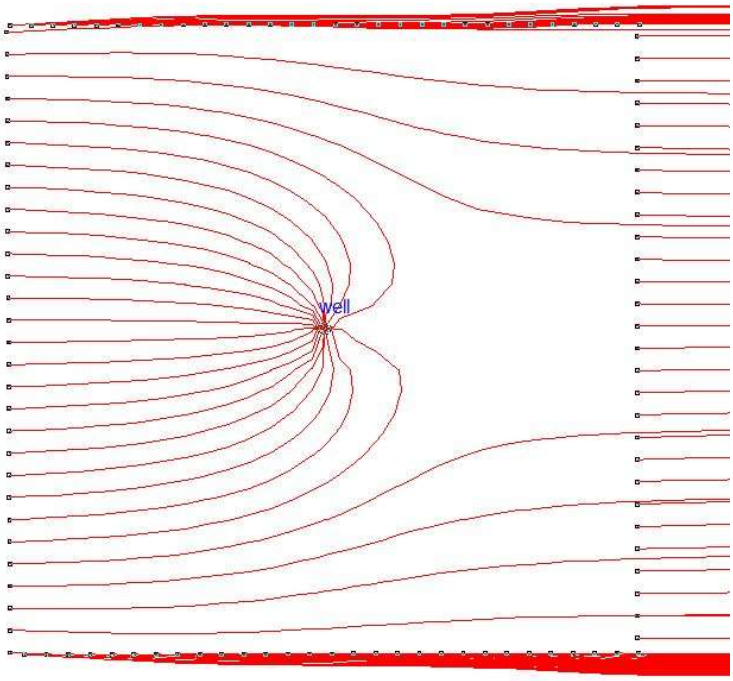

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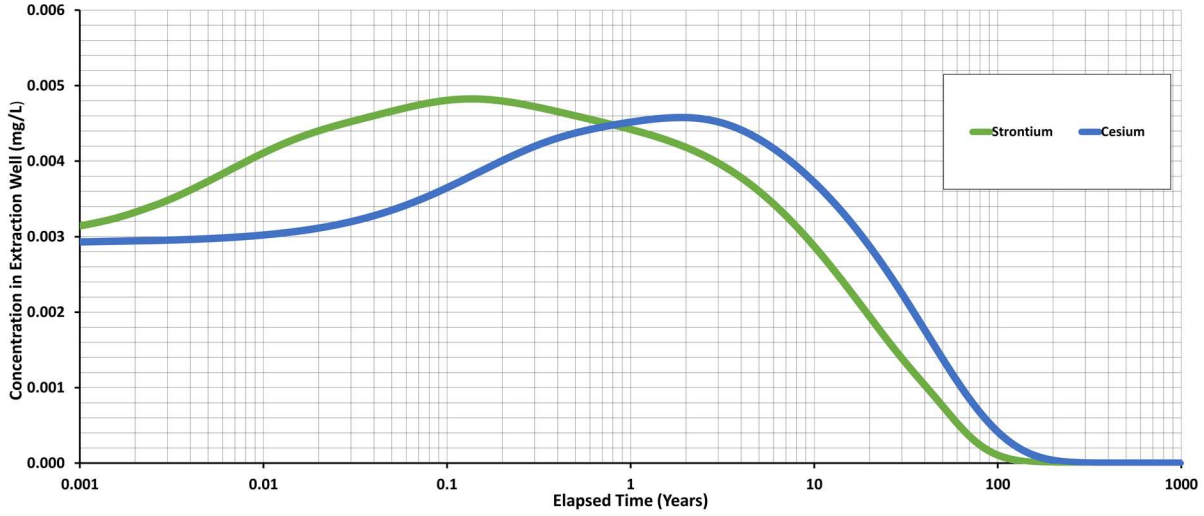

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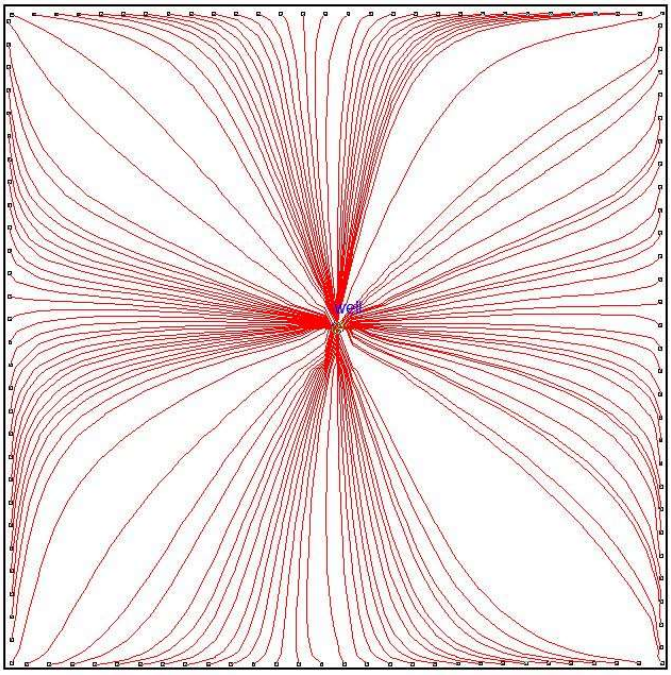

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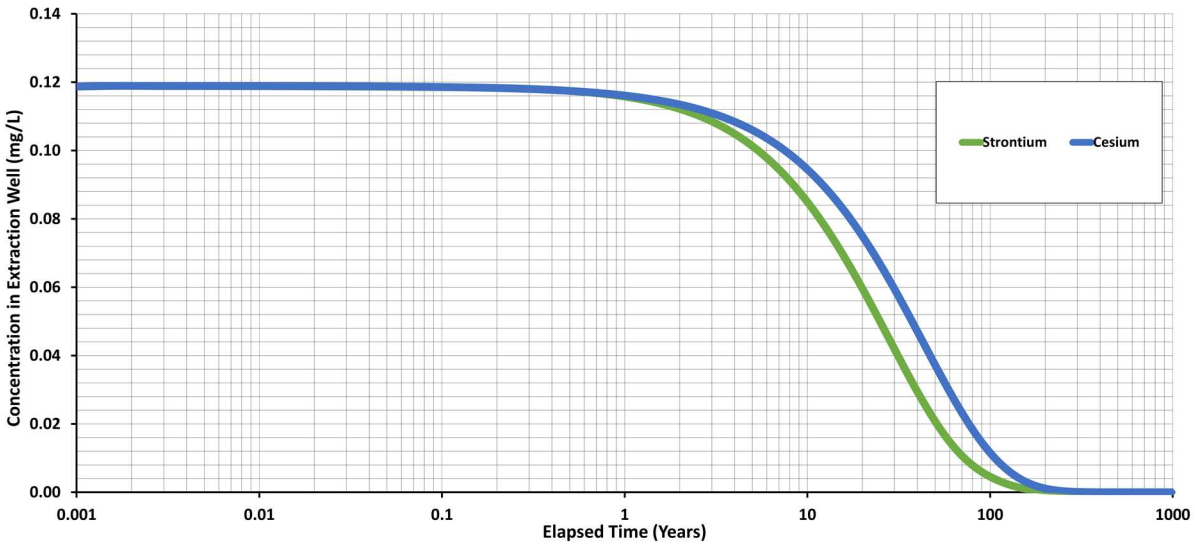

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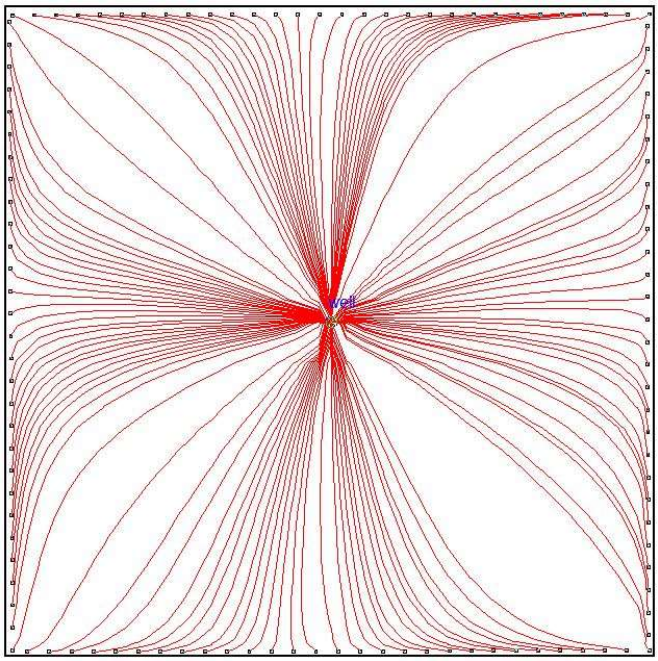

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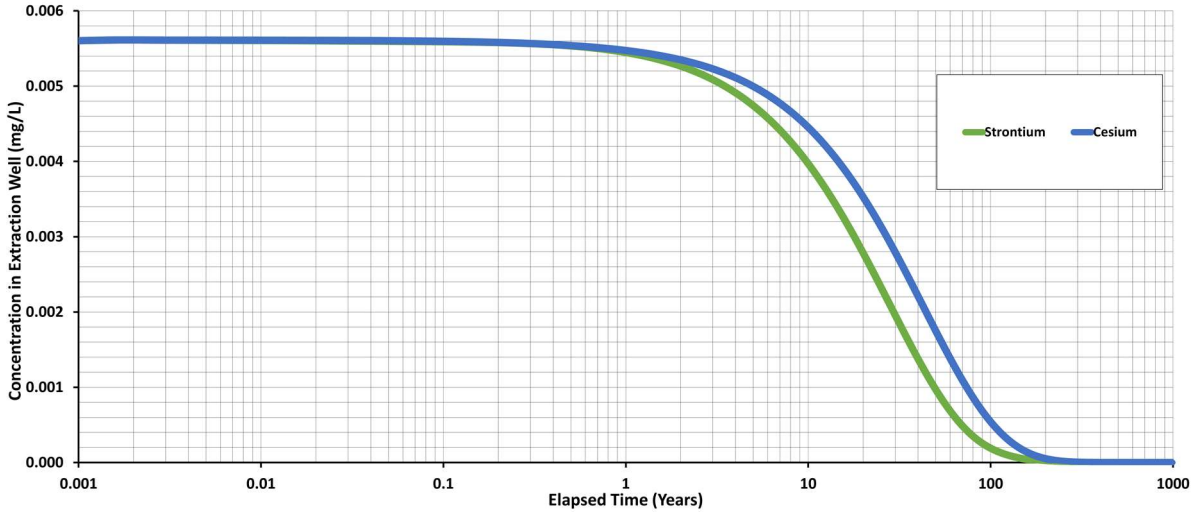

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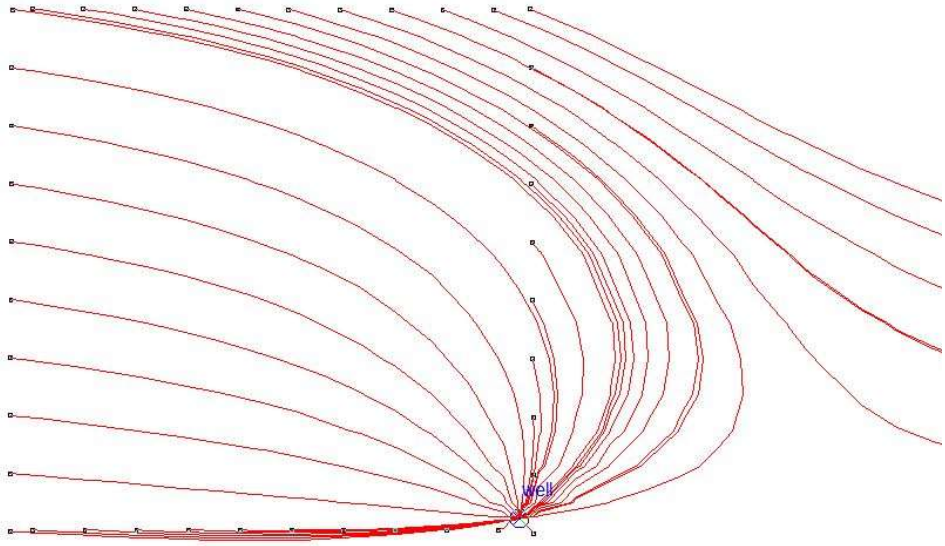

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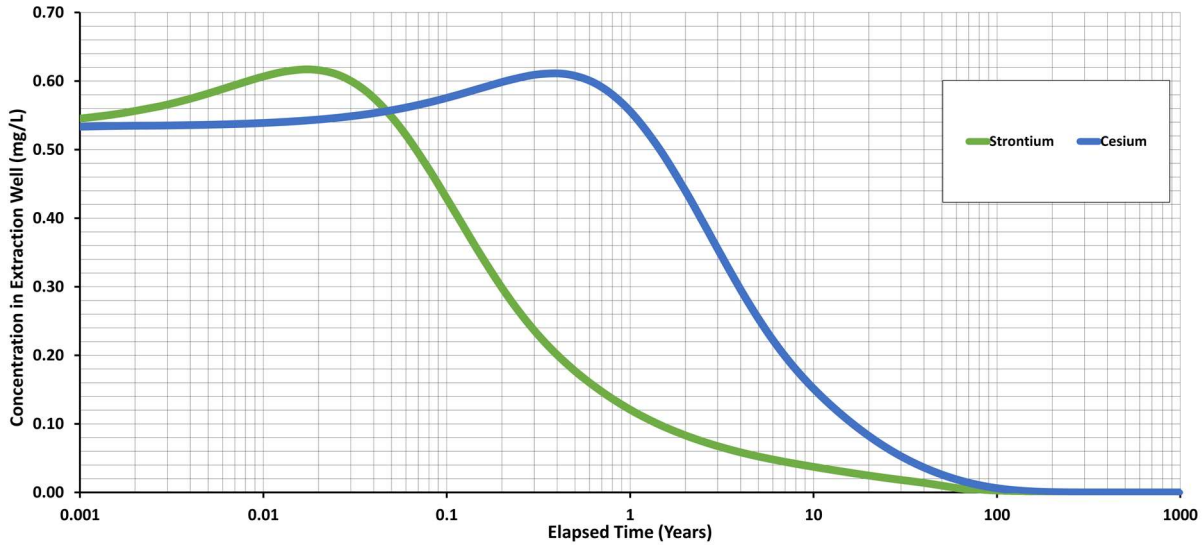

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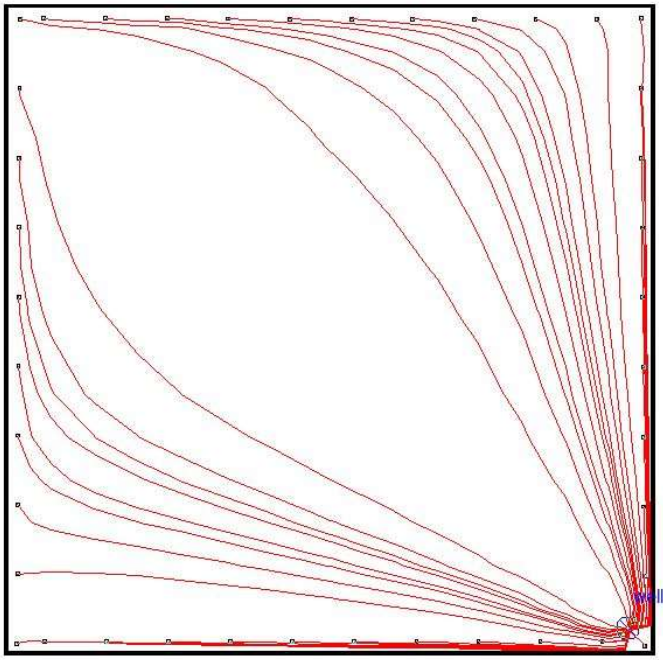

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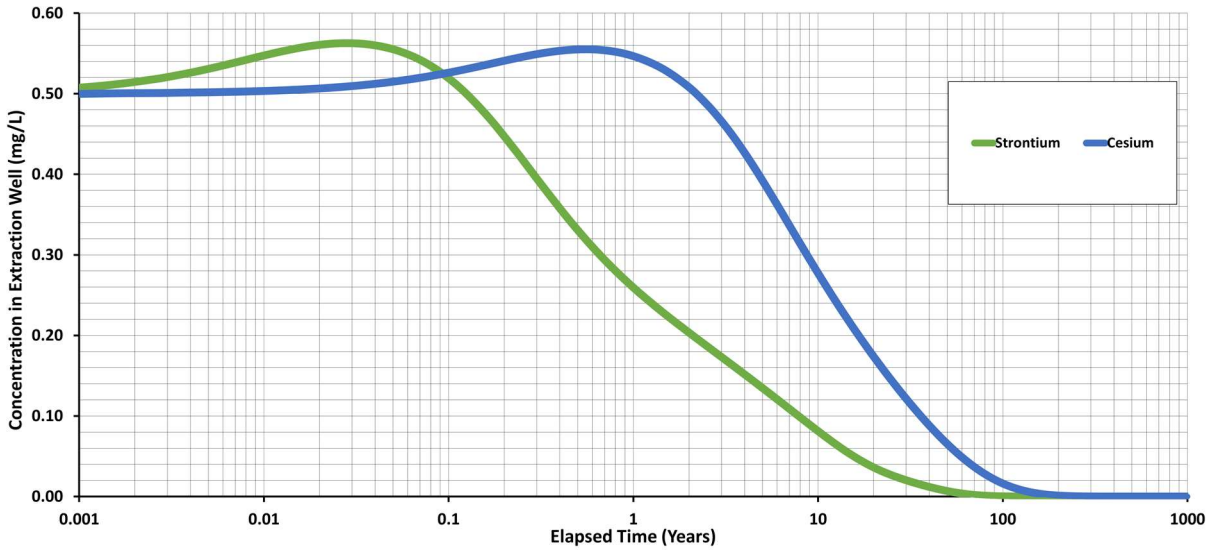

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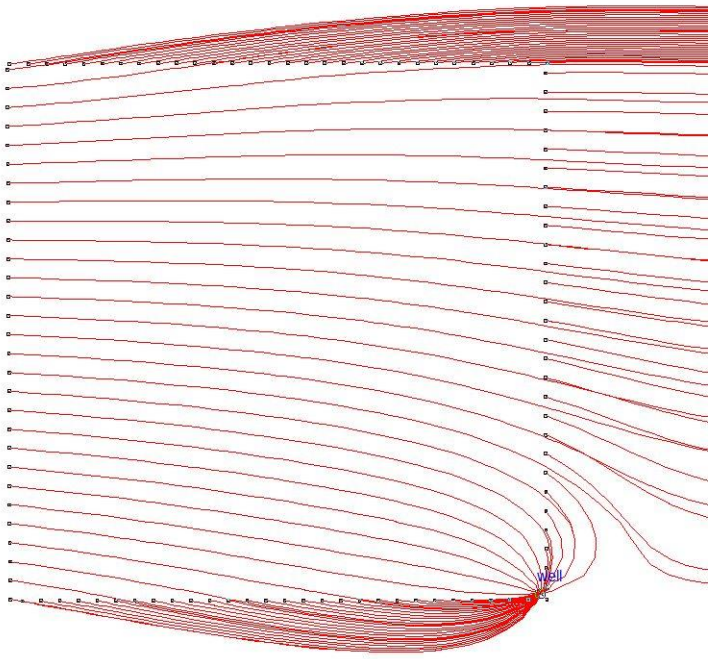

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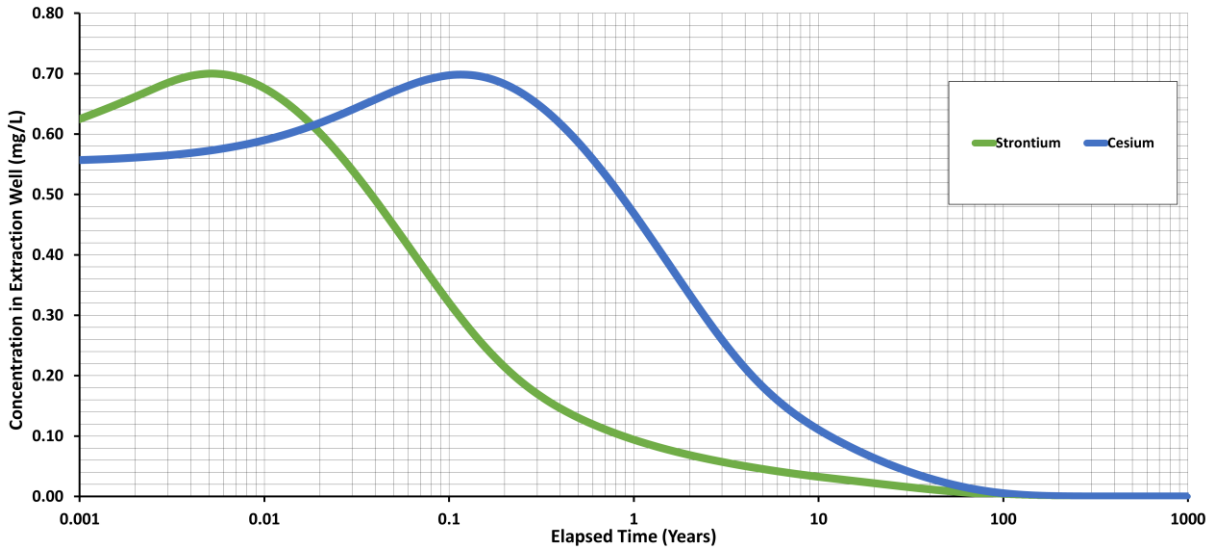

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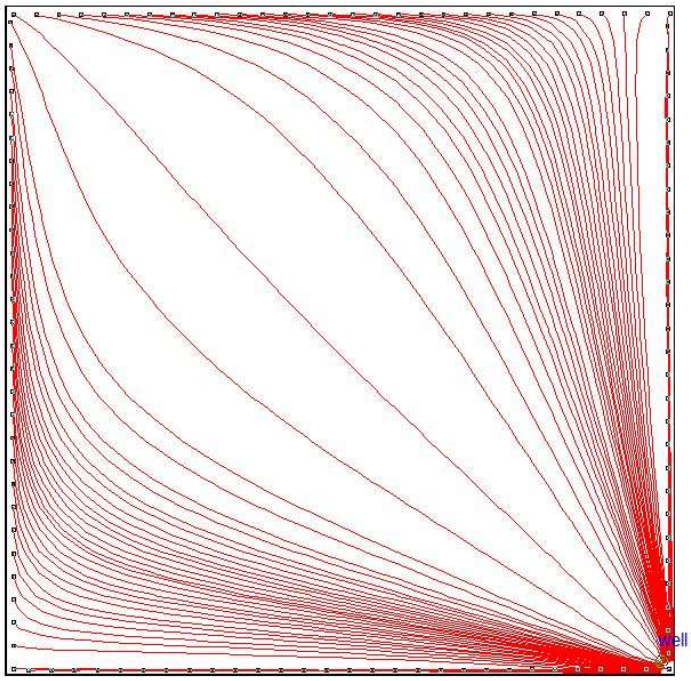

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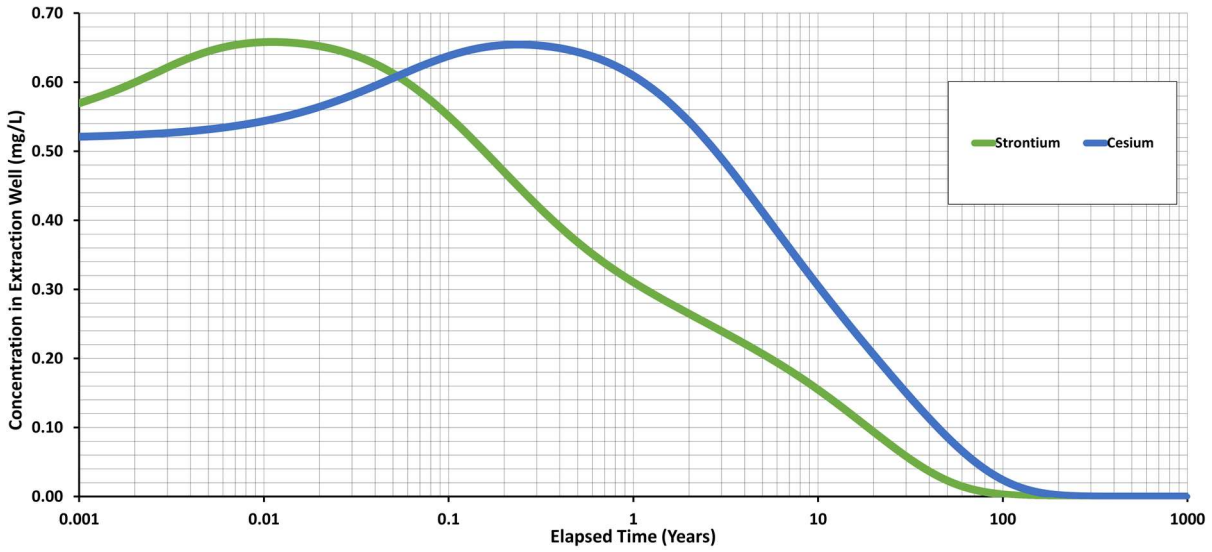

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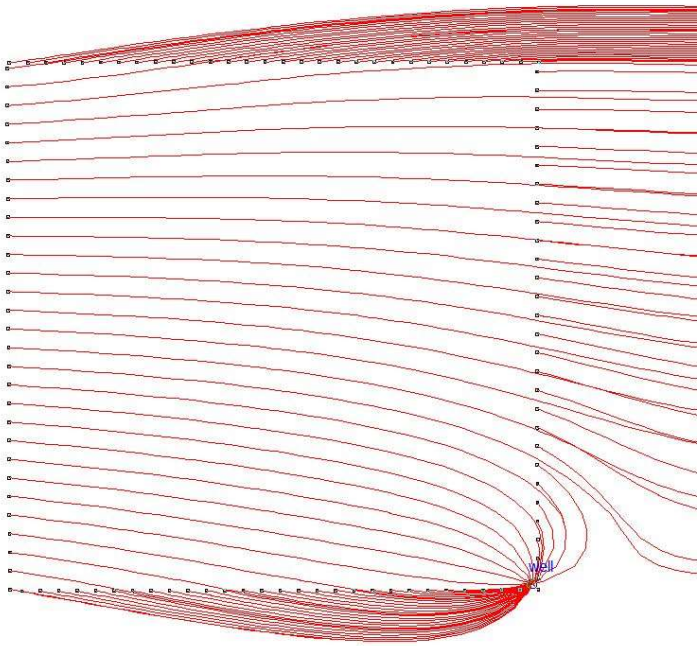

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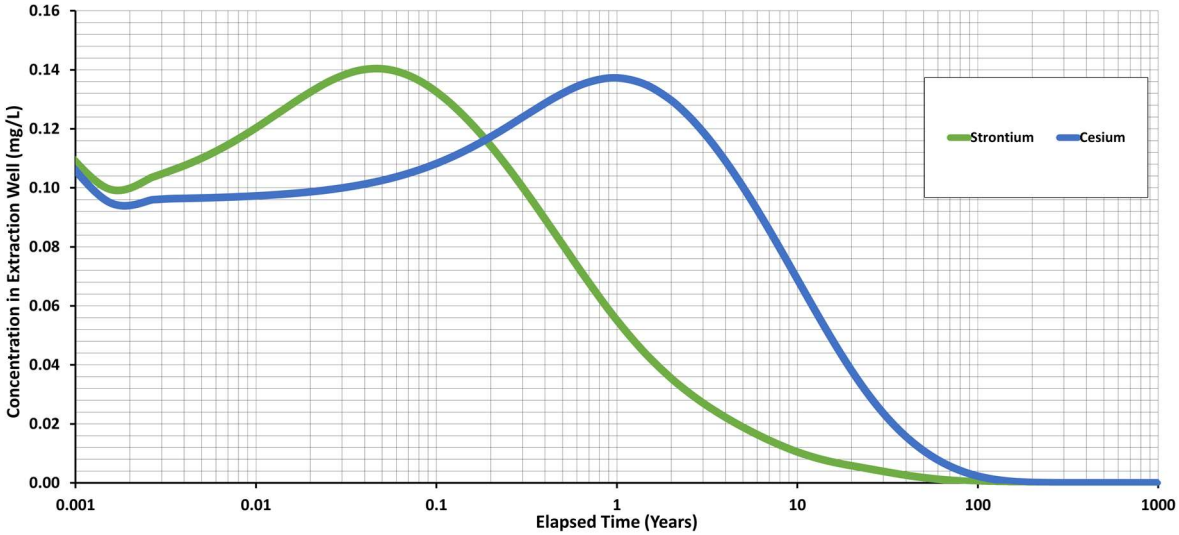

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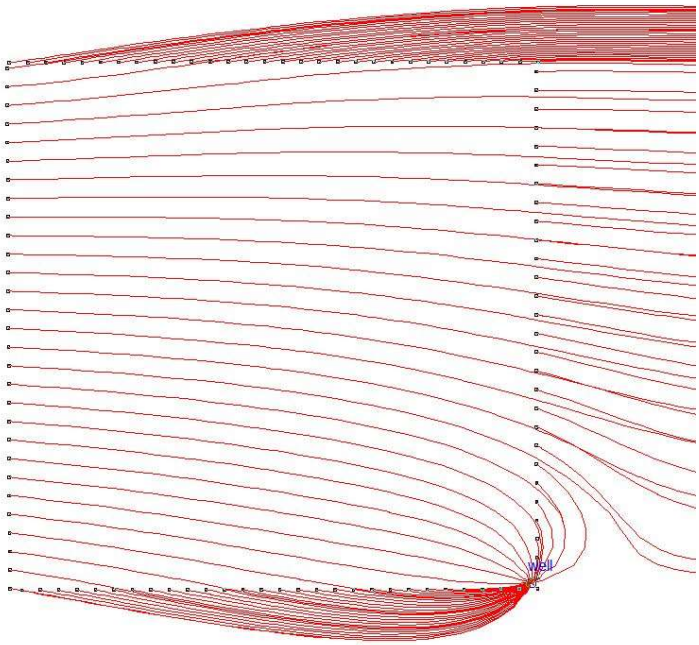

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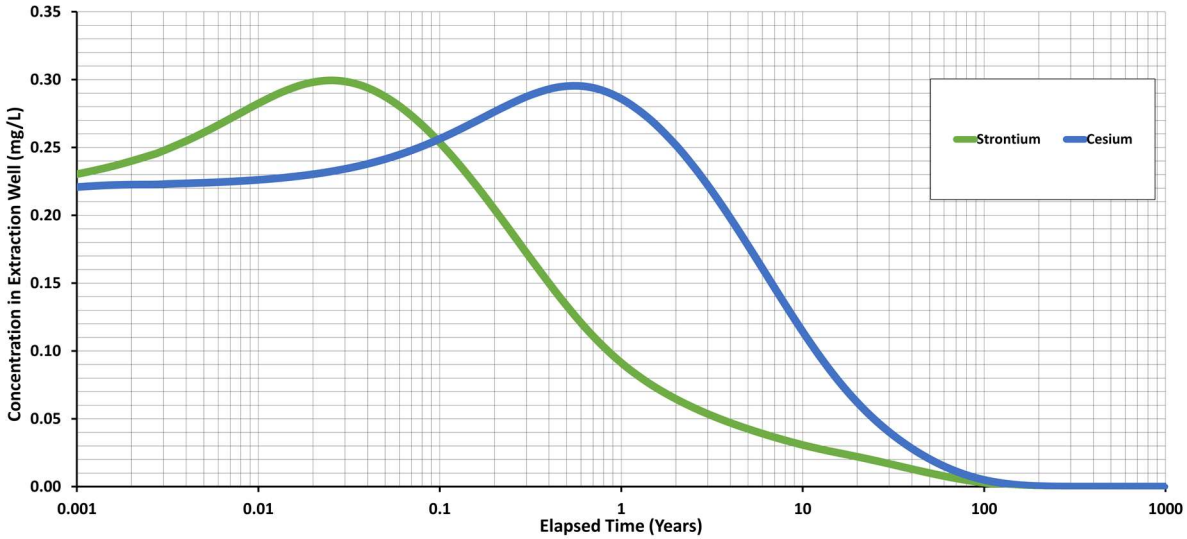
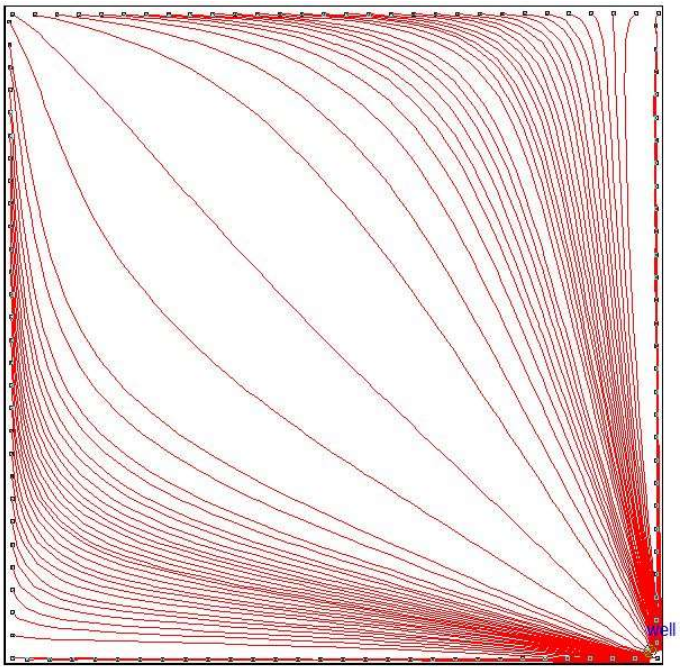


Cesium and Strontium Well Concentration



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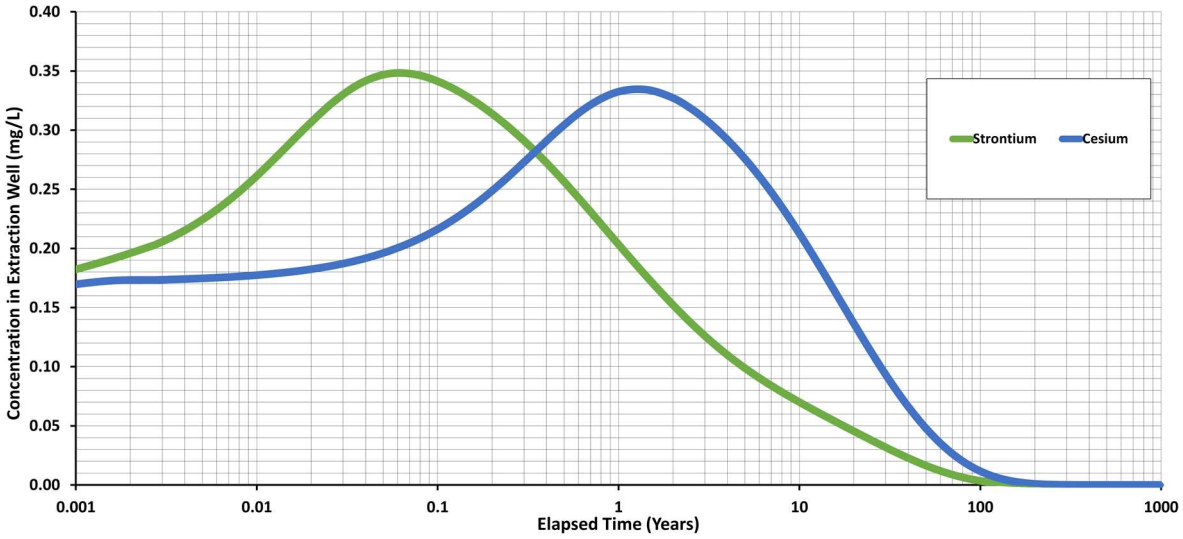
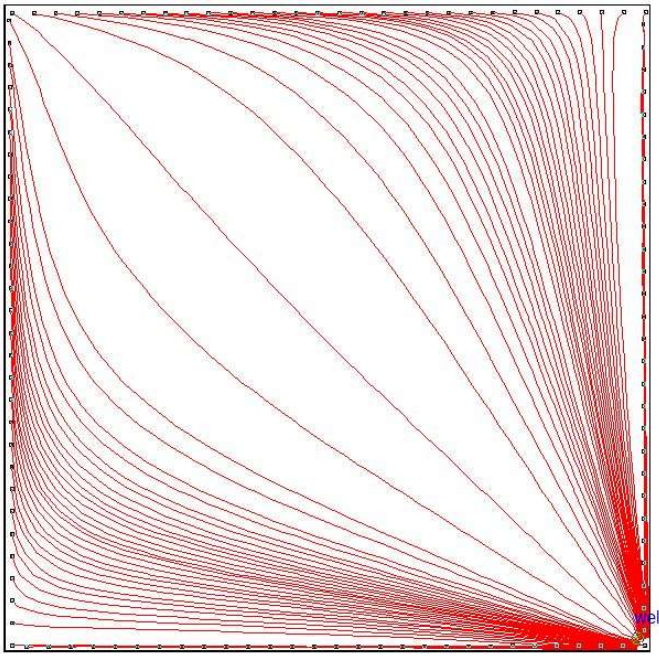


Cesium and Strontium Well Concentration



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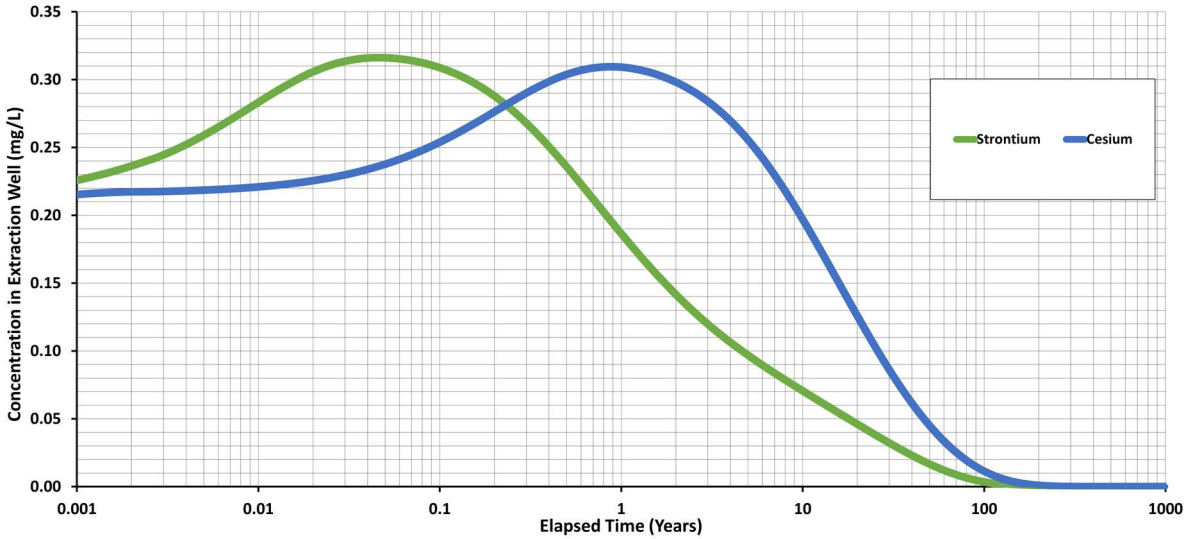

Cesium and Strontium Well Concentration

APPENDIX G

RESRAD Parameter Inputs

HALEY & ALDRICH, INC.
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Suite 1A
Portland, ME 04101
207.482.4600

MEMORANDUM

31 July 2020 (revised 10 May 2021)
File No. 127960

TO: Scott Zoller,
Energy*Solutions*, LLC

FROM: Haley & Aldrich, Inc.
Miles van Noordennen, Senior Technical Specialist
Nadia Glucksberg, Hydrogeologist | Program Manager

SUBJECT: Development of Site-Specific Values for RESRAD Hydrogeological and Hydrological Parameters, Fort Calhoun Station, Blair, Nebraska

Haley & Aldrich has completed our evaluation of the hydrogeological and hydrological characteristics at the Fort Calhoun Station (FCS) in support of the development of Derived Concentration Guideline Levels (DCGLs). More specifically we have developed site-specific values for the input parameters for the RESRAD program, in the form of a Probability Density Function (PDF), when appropriate.

The approach to each parameter is provided below. A summary of the input parameters is provided in Table 1, with the data set, including the mean, range and standard deviations provided in Attachment A. Laboratory data are Provided in Attachment B.

The following provides the description and Site-specific values, PDF or Deterministic, to support the hydrogeological and hydrological RESRAD inputs:

- **Density of Unsaturated and Saturated Zones**. Density is expressed as the ratio of mass to volume of a material. Dry density, as used by RESRAD, is related to the soil particle density and total porosity. Specifically, it is the ratio of the mass of the solid phase of the soil to its total volume (solid and pore volumes together). A total of 13 soil samples were submitted for laboratory analysis of density using ASTM D7263. Of those samples, seven were collected from the unsaturated zone soils and six were collected from the saturated zone soils. Sample results from each zone were averaged, with the calculated densities of the unsaturated zone soils at 1.50 grams per cubic centimeter (g/cm3) and the saturated zone soils at 1.49 g/cm3. These results are in line with the expected values based on the soils onsite, which range from 1.43 – 1.70 g/cm3, with the RESRAD default value set at 1.50 g/cm3.

- **Total Porosity of Unsaturated and Saturated Zones**. Total porosity of a material is the ratio of the pore volume to the total volume of the material. Based on the soil types onsite, the

expected total porosity range for the unsaturated and saturated zones falls between 0.24 and 0.61, with the RESRAD default value set at 0.4. Samples were submitted for laboratory analysis of total porosity using ASTM D7263 from both the unsaturated and saturated zones. Sample results from each zone were averaged, with the calculated total porosities of the unsaturated zone soils at 0.43 and the saturated zone soils at 0.45.

- **Effective Porosity of Unsaturated and Saturated Zones**. The effective porosity of a material is the ratio of the part of the pore volume where the water can circulate to the total volume of the material. Whereas total porosity is related to the percentage of volume occupied by pore spaces, effective porosity is related to pore fluid displacement. Effective porosity is determined by subtracting the field capacity (or irreducible volumetric water content) from the total porosity of a material. Expected values for effective porosity based on the soils onsite range from 0.01 to 0.46, with the RESRAD default value set at 0.2. Based on the 13 samples submitted for total porosity, which were also analyzed for moisture content (used as a surrogate for field capacity) the averaged sample result for the unsaturated zone soil was 0.16 and the averaged sample result for the saturated zone soil was 0.20.

- **Hydraulic Conductivity of Unsaturated Zone**. The hydraulic conductivity of a soil is a measure of the soil's ability to transmit water when subjected to a hydraulic gradient. It depends on the soil grain size and structure and the type and relative amount of soil fluid present. Due to the variability of all factors, the accepted values that RESRAD accepts for the unsaturated zone hydraulic conductivity range from 10^{-3} to 10^{10} meters per year (m/yr), with the default value set at 10 m/yr. To obtain a site-specific value more appropriate to existing conditions and soil types onsite, falling head tests were completed at six open borehole locations to evaluate infiltration rates. Each location was drilled to five feet below ground surface (bgs), with the drill casing then pulled up approximately 1 foot, leaving an open borehole with soils exposed from approximately 4 to 5 feet bgs. The boreholes were then filled with potable water, with data being collected as the falling water level within the borehole was monitored. Using this data, hydraulic conductivity values were calculated for each of the locations. Those values were then averaged, with a final result of 34.37 m/yr. These calculations were provided in the Hydrogeological Conceptual Site Model (CSM)[1]. It is recommended that this value be used as the RESRAD input value for hydraulic conductivity in the unsaturated zone.

- **Hydraulic Conductivity of Saturated Zone**. Similar to the unsaturated hydraulic conductivity, and based on soils onsite, the expected hydraulic conductivity of the saturated zone ranges widely, from 1×10^{-2} to 1×10^{7} m/yr. To obtain a site-specific value appropriate to existing conditions and soil types, pumping tests and slug tests were completed at seven existing monitoring wells onsite. Results from those tests were averaged, with a final hydraulic conductivity result in the saturated zone of 4,352 m/yr. These calculations were provided in the Hydrogeological CSM. This result falls into the expected range based on the soils onsite and is recommended for use as the RESRAD input value.

[1] Haley & Aldrich, DRAFT Hydrogeologic Conceptual Site Model, Fort Calhoun Station, Blair, Nebraska, July 2020

- **Soil *b* Parameter Saturated and Unsaturated Zone.** The soil-specific exponential *b* parameter is an empirical and dimensionless parameter that is used to evaluate the saturation ratio of the soil and is used to calculate the radionuclide leaching rate of the Contaminated Zone. NUREG/CR-6697 suggests empirical formulas to calculate the parameter may be used, but the document also states that a power function is an acceptable form of presenting some of the functions. With this broad range of calculation options, we believe that the look up values by soil type are as accurate and provide a better representation of the parameter.

  Per the NUREG Document[2], a relatively more accurate value of parameter *b* for site-specific soil materials can be obtained from the data listed in Table 2.5.1. For most applications, this approach should suffice because of the difficulties in obtaining laboratory determinations of the soil conductivity function.

  Haley & Aldrich agrees with this evaluation and therefore based on the soil types observed at the site (i.e. silty sands) we suggest a value between 4.05 and 5.3 would be appropriate and are formally suggesting the RESRAD default value of 5.3 for the unsaturated zone. This value represents the condition of a silty loam soil material and although the soils on site did not have sufficient organics present to represent loam, loam does contain the silt particle size observed. A soil *b* parameter is not required for the saturated zone with a water table drop rate value of zero (discussed below).

- **Hydraulic Gradient**. Hydraulic gradient is the change in hydraulic head per unit of distance of the groundwater flow in a given direction. The default value given for the RESRAD input is 0.02; however, this value can range enormously, from 10^{-10} to 10 based upon site conditions. Using groundwater elevation data collected in June 2020 and corresponding groundwater contours and flow directions, hydraulic gradient was calculated at 8.40 x 10-4. These calculations were provided in the Hydrogeological CSM. This value matches expectations based on the fine-grained materials located onsite and is suggested for use as the RESRAD input value.

- **Unsaturated Zone Thickness**. The unsaturated zone thickness describes the portion of the uncontaminated zone that lies above the water table. Based upon water level data collected in June 2020 and comparisons to the gage height of the Missouri River due to the strong hydraulic connection to the river, the unsaturated zone thickness varies onsite between approximately 10-15 feet. We recommend using 12 feet as the RESRAD input value for the unsaturated zone thickness.

- **Field Capacity of Unsaturated and Saturated Zones**. Field capacity is defined as the ratio of the volume of water retained in the soils after all downward gravity drainage has ceased to the total volume of the soils. This value is related to the total and effective porosities of the soils. Based on the soils onsite, the expected field capacity values range from 0.1 to 0.42. To better narrow down the site-specific field capacity values, moisture content was measured as a surrogate

[2] NUREG/CR-6697, Development of Probabilistic RESRAD 6.0 and RESRAD-BUILD 3.0 Computer Codes, Attachment C

analysis on all soil samples submitted for density, porosity, and grain size analyses. Those results were averaged, with a final moisture content value for unsaturated soils at 0.28 and saturated soils at 0.24. Moisture content values are similar to field capacity and are recommended for use as RESRAD input values for field capacity.

- **Water Table Drop Rate**. Water table drop rate represents trends over time of the depth to the water table. In areas of long-term seasonal changes (i.e. due to climate change) or regional overuse of the aquifer, long term trends of lowering water tables are anticipated. The depth to groundwater at the Fort Calhoun Station is directly related to the stage of the adjacent Missouri River. To evaluate this parameter, we reviewed the past ten years of river stage data and determined that there is not a statistical trend in rise or fall of the river stage and therefore the connected water table. We recommend a Water Table Drop Rate of 0.000 m/yr.

- **Backfill Soil Evaluation.** Soils excavated for the rail spur expansion will be used to backfill the deeper basement structures. During the field investigation, soil boring SB-33 was completed in the area proposed to be used for backfilling the deep basement structures. Soils from this portion of the site were classified on the boring log as silts from the ground surface to approximately 16 feet below ground surface (bgs). The last sample collected from 16 to 20 feet bgs transitioned to sandy silt. Both are consistent with silty loams. The homogeneity of the shallow soils was then confirmed when the area was excavated during the rail expansion and the soils stockpiled for future use as backfill. Stockpiled soils were visually surveyed and deemed consistent with those described on the boring logs. Therefore, with the confirmation from the visual inspection of the stockpiled soils, backfill materials are medium silts to sandy silts.

This work was completed based on our understanding of the hydrogeological conceptual site model and in accordance with NUREG CR-6697. A summary of the suggested parameters is provided in Table 1, with the following attachments provided as support documentation:

Attachment A – Analytical Data Summary
Attachment B – Raw Analytical Data

Table 1
Summary of RESRAD Input Values
Fort Calhoun Station
Blair, Nebraska

Input Parameter	Default Value	Expected Value or Range	Recommended Input Value	Parameter Selection Method
Density - Unsaturated Soil	1.5 g/cm^3	1.43 - 1.70 g/cm^3	1.50 g/cm^3	Analytical Data
Density - Saturated Soil			1.49 g/cm^3	Analytical Data
Total Porosity - Unsaturated Zone	0.4	0.24 - 0.61	0.43	Analytical Data
Total Porosity - Saturated Zone			0.45	Analytical Data
Effective Porosity - Unsaturated Zone	0.2	0.01 - 0.46	0.16	Analytical Data
Effective Porosity - Saturated Zone			0.20	Analytical Data
Hydraulic Conductivity - Unsaturated Zone	10 m/yr	1 x 10^{-2} - 1 x 10^{7} m/yr	3.44 x 10^{1}	Field Testing
Hydraulic Conductivity - Saturated Zone	100 m/yr		4.35 x 10^{3}	Field Testing
Soil *b* Parameter - Unsaturated Zone	5.3	4.05 - 5.3	5.3	Default Value
Soil *b* Parameter - Saturated Zone			***	***
Hydraulic Gradient	0.02	NA	8.40 x 10^{-4}	Field Testing
Unsaturated Zone Thickness	NA	NA	12 feet	Field Testing
Field Capacity - Unsaturated Zone	0.2	0.1 - 0.42	0.28	Analytical Data
Field Capacity - Saturated Zone			0.24	Analytical Data
Water Table Drop Rate	0.001 m/yr	NA	0.000 m/yr	River Assessment

Notes:
PDF - Probability Density Function
g/cm3 - grams per cubic centimeter
m/yr - meters per year
NA - Not Applicable
*** - Not required with a water table drop rate of zero

Attachment A

Data Summary

Analytical Data Summary
Fort Calhoun Station
Blair, Nebraska

Sample ID - Saturated Zone	Moisture Content - Field Capacity	Dry Density (pcf)	Dry Density (g/cm3)	Porosity	Effective Porosity	Grain Size Analysis			Soil Classification
						% Sand	% Silt	% Clay	
SB-08 SAT	0.29	93.83	1.50	0.44	0.15	37.8	54.2	8	Silty Loam
SB-11 SAT	0.18	95.74	1.53	0.43	0.25	81.4	18.6		Loamy Sand
SB-17 SAT	0.29	89.02	1.42	0.47	0.18	47.8	50.2	2	Sandy Loam
SB-25 SAT	0.21	101.1	1.62	0.4	0.19	76.1	23.9		Loamy Sand
SB-32 SAT	0.21	88.95	1.42	0.48	0.27	90.9	9.1		Sandy Loam
SB-34 SAT	0.26	91	1.46	0.45	0.19	52.8	47.2		Sandy Loam
Mean	**0.24**	**93.27**	**1.49**	**0.45**	**0.20**				
S.D.	0.05	4.27	0.07	0.03	0.04				

Sample ID - Unsaturated Zone	Moisture Content - Field Capacity	Dry Density (pcf)	Dry Density (g/cm3)	Porosity	Effective Porosity	Grain Size Analysis			Soil Classification
						% Sand	% Silt	% Clay	
SB-08 UNSAT	0.31	88.96	1.42	0.46	0.15	14.1	62.9	23	Sandy Clay Loam
SB-11 UNSAT	0.27	94.27	1.51	0.44	0.17	1.2	86.9	12	Silt Loam
SB-17 UNSAT	0.23	99.23	1.59	0.4	0.17	5.6	82.4	12	Silt Loam
SB-25 UNSAT	0.42	81.72	1.31	0.49	0.07	11.5	67.5	21	Silt Loam
SB-32 UNSAT	0.29	92.02	1.47	0.45	0.17	10.9	81.4	8	Silt
SB-33 UNSAT	0.20	101.9	1.63	0.39	0.19	10.7	74.3	15	Silt Loam
SB-34 UNSAT	0.23	98.36	1.57	0.41	0.18	14.3	72.7	13	Silt Loam
Mean	**0.28**	**93.78**	**1.50**	**0.43**	**0.16**				
S.D.	0.07	6.42	0.11	0.03	0.04				

Notes:
g/cm3 - grams per cubic centimeter
pcf - pounds per cubic foot
S.D. - standard deviation

Attachment B

Laboratory Data

Client:	Haley & Aldrich, Inc.				
Project:	Fort Calhoun Station				
Location:	Blair, NE			Project No:	GTX-311971
Boring ID:	---	Sample Type:	---	Tested By:	ckg
Sample ID:	---	Test Date:	07/07/20	Checked By:	bfs
Depth :	---	Test Id:	562344		

Moisture Content of Soil and Rock - ASTM D2216

Boring ID	Sample ID	Depth	Description	Moisture Content,%
---	SB- 08 SAT	---	Moist, very dark gray sandy silt	29.1
---	SB- 08 UNSAT	---	Moist, dark grayish brown silt	30.7
---	SB- 11 SAT	---	Moist, dark grayish brown silty sand	18.1
---	SB- 11 UNSAT	---	Moist, dark olive brown silt	27.3
---	SB- 17 SAT	---	Moist, very dark grayish brown sandy silt	29.2
---	SB- 17 UNSAT	---	Moist, very dark grayish brown clay	23.3
---	SB- 25 SAT	---	Moist, dark grayish brown silty sand	21.0
---	SB- 25 UNSAT	---	Moist, dark grayish brown silt	42.1

Notes: Temperature of Drying : 110º Celsius

Client:	Haley & Aldrich, Inc.				
Project:	Fort Calhoun Station				
Location:	Blair, NE			Project No:	GTX-311971
Boring ID:	---	Sample Type:	---	Tested By:	ckg
Sample ID:	---	Test Date:	07/07/20	Checked By:	bfs
Depth :	---	Test Id:	562349		

Moisture Content of Soil and Rock - ASTM D2216

Boring ID	Sample ID	Depth	Description	Moisture Content,%
---	SB- 32 SAT	---	Moist, dark grayish brown sand with silt	21.4
---	SB- 32 UNSAT	---	Moist, dark grayish brown clay	28.5
---	SB- 33 UNSAT	---	Moist, dark olive brown clay	19.6
---	SB- 34 SAT	---	Moist, dark grayish brown silty sand	26.2
---	SB- 34 UNSAT	---	Moist, dark grayish brown silt	22.7

Notes: Temperature of Drying : 110º Celsius

GeoTesting EXPRESS

Client:	Haley & Aldrich, Inc.				
Project:	Fort Calhoun Station				
Location:	Blair, NE			Project No:	GTX-311971
Boring ID:	---	Sample Type:	---	Tested By:	ckg
Sample ID:	---	Test Date:	07/10/20	Checked By:	bfs
Depth :	---	Test Id:	562306		

Laboratory Determination of Density (Unit Weight) of Soil Specimens by ASTM D7263

Boring ID	Sample ID	Depth	Visual Description	Bulk Density pcf	Moisture Content %	Dry Density pcf	*
---	SB- 08 SAT	---	Moist, very dark gray sandy silt	121.1	29.08	93.83	(1)
---	SB- 08 UNSAT	---	Moist, dark grayish brown silt	116.3	30.73	88.96	(2)
---	SB- 11 SAT	---	Moist, dark grayish brown silty sand	113.1	18.09	95.74	(3)
---	SB- 11 UNSAT	---	Moist, dark olive brown silt	120.0	27.30	94.27	(4)
---	SB- 17 SAT	---	Moist, very dark grayish brown sandy silt	115.0	29.20	89.02	(5)
---	SB- 17 UNSAT	---	Moist, very dark grayish brown clay	122.4	23.32	99.23	(6)
---	SB- 25 SAT	---	Moist, dark grayish brown silty sand	122.3	20.97	101.1	(7)

* Sample Comments

(1): Method B-Volumetric, Reconstituted (compacted)

(2): Method B-Volumetric, Reconstituted (compacted)

(3): Method B-Volumetric, Reconstituted (compacted)

(4): Method B-Volumetric, Reconstituted (compacted)

(5): Method B-Volumetric, Reconstituted (compacted)

(6): Method B-Volumetric, Reconstituted (compacted)

(7): Method B-Volumetric, Reconstituted (compacted)

Notes: Moisture Content determined by ASTM D2216.

GeoTesting EXPRESS

Client:	Haley & Aldrich, Inc.				
Project:	Fort Calhoun Station				
Location:	Blair, NE			Project No:	GTX-311971
Boring ID:	---	Sample Type:	---	Tested By:	ckg
Sample ID:	---	Test Date:	07/10/20	Checked By:	bfs
Depth :	---	Test Id:	562311		

Laboratory Determination of Density (Unit Weight) of Soil Specimens by ASTM D7263

Boring ID	Sample ID	Depth	Visual Description	Bulk Density pcf	Moisture Content %	Dry Density pcf	*
---	SB- 25 UNSAT	---	Moist, dark grayish brown silt	116.1	42.05	81.72	(1)
---	SB- 32 SAT	---	Moist, dark grayish brown sand with silt	108.0	21.39	88.95	(2)
---	SB- 32 UNSAT	---	Moist, dark grayish brown clay	118.2	28.46	92.02	(3)
---	SB- 34 UNSAT	---	Moist, dark grayish brown silt	120.7	22.74	98.36	(4)
---	SB- 33 UNSAT	---	Moist, dark olive brown clay	121.8	19.58	101.9	(5)
---	SB- 34 SAT	---	Moist, dark grayish brown silty sand	114.8	26.18	91.00	(6)

* Sample Comments

(1): Method B-Volumetric, Reconstituted (compacted)

(2): Method B-Volumetric, Reconstituted (compacted)

(3): Method B-Volumetric, Reconstituted (compacted)

(4): Method B-Volumetric, Reconstituted (compacted)

(5): Method B-Volumetric, Reconstituted (compacted)

(6): Method B-Volumetric, Reconstituted (compacted)

Notes: Moisture Content determined by ASTM D2216.

Client:	Haley & Aldrich, Inc.				
Project:	Fort Calhoun Station				
Location:	Blair, NE			Project No:	GTX-311971
Boring ID:	---	Sample Type:	---	Tested By:	ckg
Sample ID:	---	Test Date:	07/14/20	Checked By:	bfs
Depth :	---	Test Id:	562318		

Specific Gravity of Soils by ASTM D854

Boring ID	Sample ID	Depth	Visual Description	Specific Gravity	Comment
---	SB- 08 SAT	---	Moist, very dark gray sandy silt	2.68	
---	SB- 08 UNSAT	---	Moist, dark grayish brown silt	2.64	
---	SB- 11 SAT	---	Moist, dark grayish brown silty sand	2.71	
---	SB- 11 UNSAT	---	Moist, dark olive brown silt	2.68	
---	SB- 17 SAT	---	Moist, very dark grayish brown sandy silt	2.67	
---	SB- 17 UNSAT	---	Moist, very dark grayish brown clay	2.66	
---	SB- 25 SAT	---	Moist, dark grayish brown silty sand	2.70	
---	SB- 25 UNSAT	---	Moist, dark grayish brown silt	2.57	

Notes: Specific Gravity performed by using method B (oven dried specimens) of ASTM D854
Moisture Content determined by ASTM D2216.

Client:	Haley & Aldrich, Inc.				
Project:	Fort Calhoun Station				
Location:	Blair, NE			Project No:	GTX-311971
Boring ID:	---	Sample Type:	---	Tested By:	ckg
Sample ID:	---	Test Date:	07/14/20	Checked By:	bfs
Depth :	---	Test Id:	562324		

Specific Gravity of Soils by ASTM D854

Boring ID	Sample ID	Depth	Visual Description	Specific Gravity	Comment
---	SB- 32 SAT	---	Moist, dark grayish brown sand with silt	2.72	
---	SB- 32 UNSAT	---	Moist, dark grayish brown clay	2.66	
---	SB- 34 UNSAT	---	Moist, dark grayish brown silt	2.68	
---	SB- 33 UNSAT	---	Moist, dark olive brown clay	2.68	
---	SB- 34 SAT	---	Moist, dark grayish brown silty sand	2.67	

Notes: Specific Gravity performed by using method B (oven dried specimens) of ASTM D854
Moisture Content determined by ASTM D2216.

GeoTesting EXPRESS

Client:	Haley & Aldrich, Inc.
Project Name:	Fort Calhoun Station
Project Location:	Blair, NE
GTX #:	311971
Test Date:	07/14/20
Tested By:	ckg
Checked By:	bfs

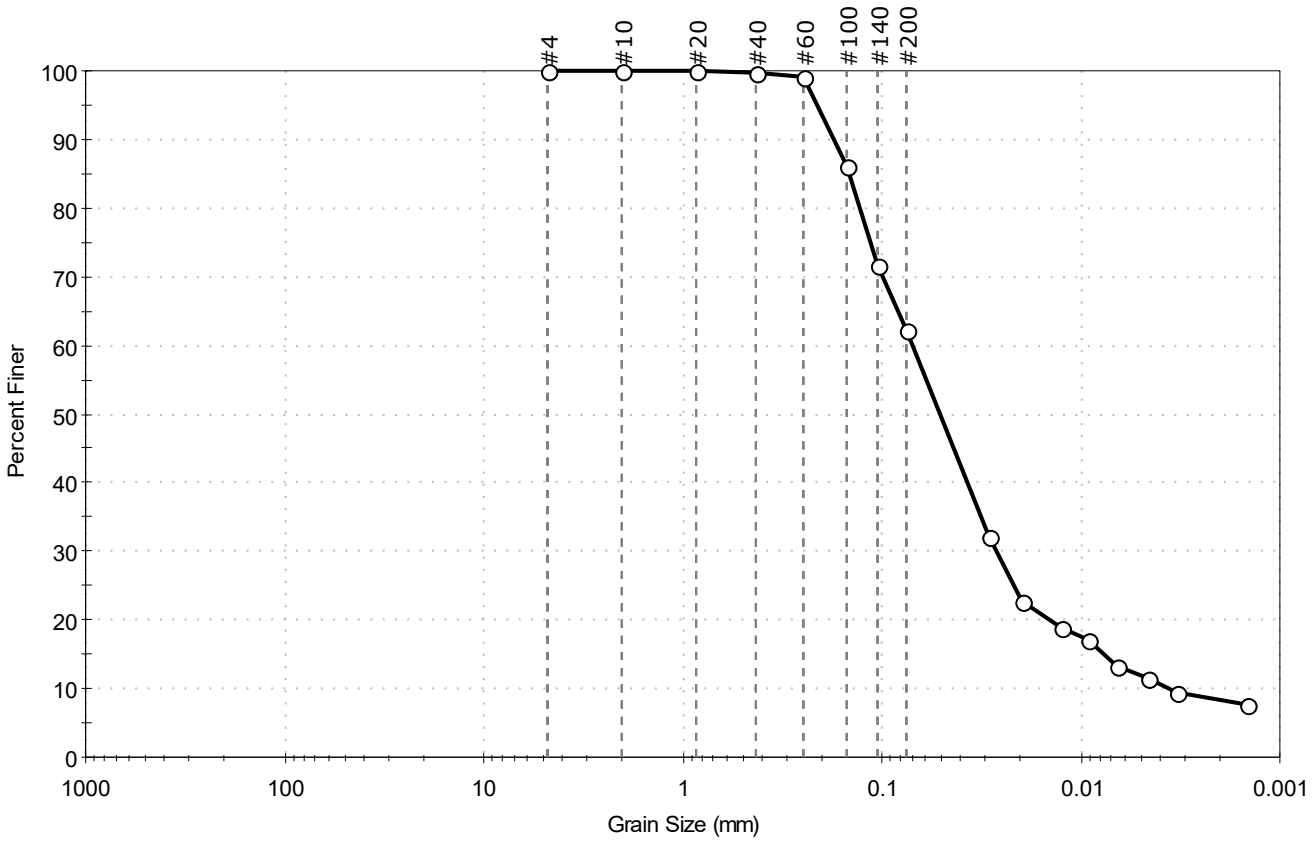
Bulk Density of Soil by - ASTM D7263 with Porosity and Void Ratio Determinations

Boring ID	Sample ID	Depth, ft	Visual Description	Bulk Density, lb/ft^3	Moisture Content, %	Dry Density, lb/ft^3	Specific Gravity @ 20° C	Porosity	Void Ratio
---	SB-08 SAT	---	Moist, very dark gray sandy silt	121.1	29.08	93.83	2.68	0.44	0.78
---	SB-08 UNSAT	---	Moist, dark grayish brown silt with sand	116.3	30.73	88.96	2.64	0.46	0.85
---	SB-11 SAT	---	Moist, dark grayish brown silty sand	113.1	18.09	95.74	2.71	0.43	0.77
---	SB-11 UNSAT	--	Moist, dark olive brown silt	120.0	27.30	94.27	2.68	0.44	0.78
---	SB-17 SAT	--	Moist, very dark grayish brown sandy silt	115.0	29.20	89.02	2.67	0.47	0.87
---	SB-17 UNSAT	--	Moist, very dark grayish brown clay	122.4	23.32	99.23	2.66	0.40	0.67
---	SB-25 SAT	--	Moist, dark grayish brown silty sand	122.3	20.97	101.10	2.70	0.40	0.67
---	SB-25 UNSAT	--	Moist, dark grayish brown silt	116.1	42.05	81.72	2.57	0.49	0.96
---	SB-32 SAT	--	Moist, dark grayish brown sand with silt	108.0	21.39	88.95	2.72	0.48	0.91
---	SB-32 UNSAT	--	Moist, dark grayish brown clay	118.2	28.46	92.02	2.66	0.45	0.81
---	SB-3 UNSAT	--	Moist, dark olive brown clay	121.8	19.58	101.90	2.68	0.39	0.64
---	SB-34 SAT	--	Moist, dark grayish brown silty sand	114.8	26.18	91.00	2.67	0.45	0.83
---	SB-34 UNSAT	--	Moist, dark grayish brown silt with sand	120.7	22.74	98.36	2.68	0.41	0.70

Notes: Density determined on reconstituted samples using Method B-Volumetric of ASTM D7263.

Client:	Haley & Aldrich, Inc.				
Project:	Fort Calhoun Station				
Location:	Blair, NE			Project No:	GTX-311971
Boring ID:	---	Sample Type:	bag	Tested By:	ckg
Sample ID:	SB-08 SAT	Test Date:	07/17/20	Checked By:	bfs
Depth :	---	Test Id:	563213		
Test Comment:	---				
Visual Description:	Moist, very dark gray sandy silt				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	37.8	62.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	100		
#60	0.25	99		
#100	0.15	86		
#140	0.11	72		
#200	0.075	62		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0286	32		
---	0.0198	23		
---	0.0127	19		
---	0.0092	17		
---	0.0066	13		
---	0.0047	11		
---	0.0033	9		
---	0.0015	8		

Coefficients

D_{85} = 0.1459 mm	D_{30} = 0.0262 mm
D_{60} = 0.0698 mm	D_{15} = 0.0077 mm
D_{50} = 0.0506 mm	D_{10} = 0.0036 mm
C_u = 19.389	C_c = 2.732

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Dispersion Device : Apparatus A - Mech Mixer

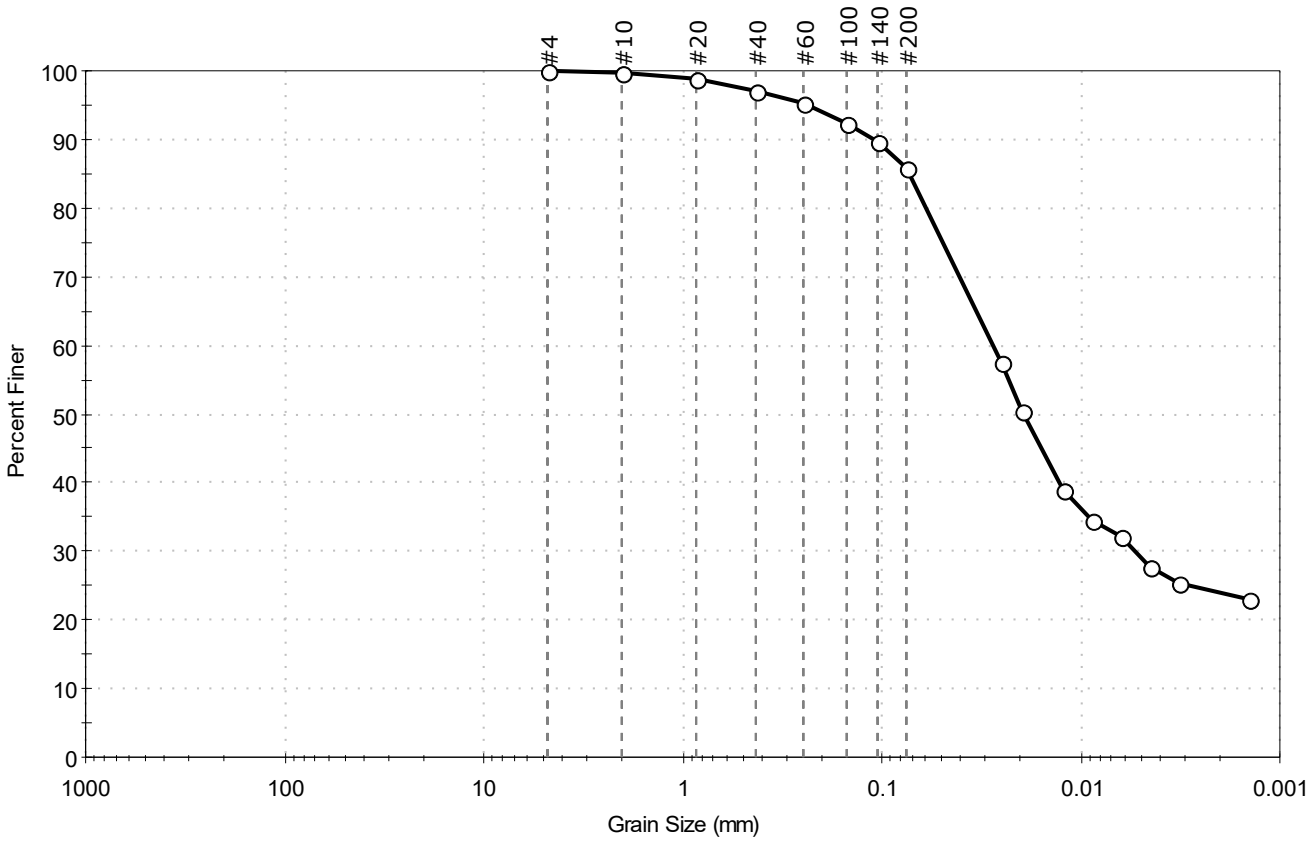
Dispersion Period : 1 minute

Est. Specific Gravity : 2.65

Separation of Sample: #200 Sieve

Client:	Haley & Aldrich, Inc.				
Project:	Fort Calhoun Station				
Location:	Blair, NE			Project No:	GTX-311971
Boring ID:	---	Sample Type:	bag	Tested By:	ckg
Sample ID:	SB-08 UNSAT	Test Date:	07/17/20	Checked By:	bfs
Depth :	---	Test Id:	563212		
Test Comment:	---				
Visual Description:	Moist, dark grayish brown silt				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	14.1	85.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	99		
#40	0.42	97		
#60	0.25	95		
#100	0.15	92		
#140	0.11	90		
#200	0.075	86		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0252	57		
---	0.0199	51		
---	0.0121	39		
---	0.0089	34		
---	0.0064	32		
---	0.0045	28		
---	0.0032	25		
---	0.0014	23		

Coefficients

D_{85} = 0.0724 mm	D_{30} = 0.0054 mm
D_{60} = 0.0277 mm	D_{15} = N/A
D_{50} = 0.0195 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Dispersion Device : Apparatus A - Mech Mixer

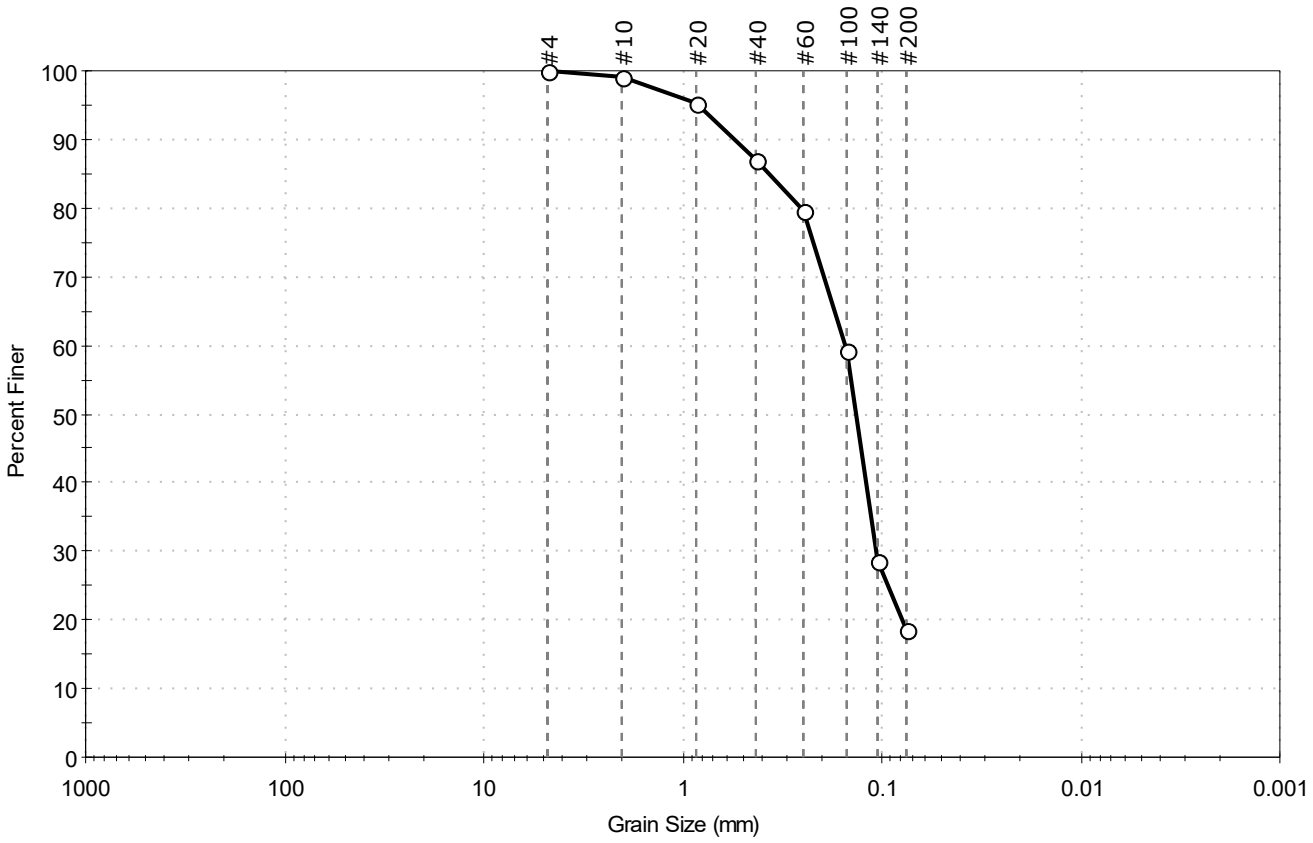
Dispersion Period : 1 minute

Est. Specific Gravity : 2.65

Separation of Sample: #200 Sieve

Client:	Haley & Aldrich, Inc.				
Project:	Fort Calhoun Station				
Location:	Blair, NE			Project No:	GTX-311971
Boring ID:	---	Sample Type:	bag	Tested By:	ckg
Sample ID:	SB-11 SAT	Test Date:	07/17/20	Checked By:	bfs
Depth :	---	Test Id:	563215		
Test Comment:	---				
Visual Description:	Moist, dark grayish brown silty sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	81.4	18.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	99		
#20	0.85	95		
#40	0.42	87		
#60	0.25	80		
#100	0.15	59		
#140	0.11	29		
#200	0.075	19		

Coefficients

D_{85} = 0.3662 mm	D_{30} = 0.1078 mm
D_{60} = 0.1527 mm	D_{15} = N/A
D_{50} = 0.1351 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

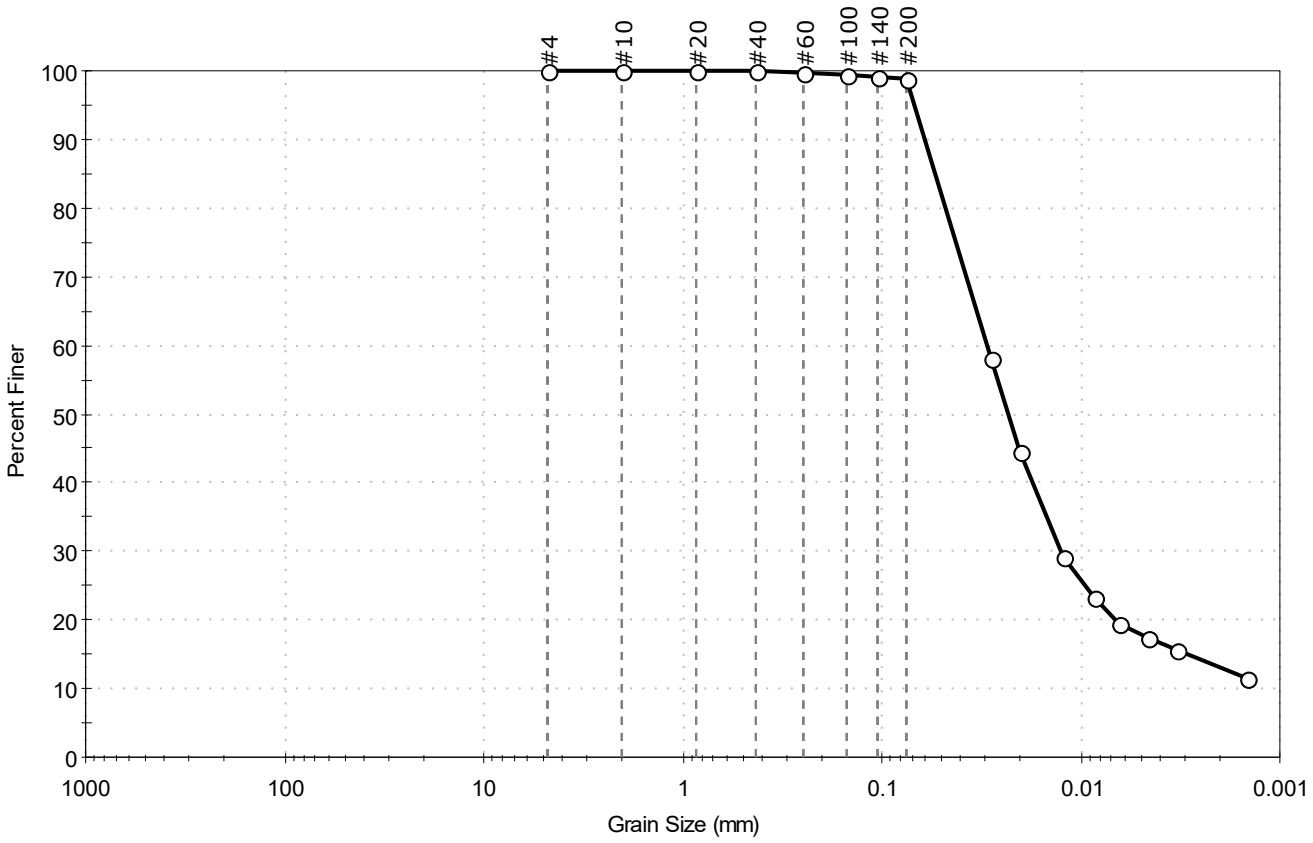
Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

GeoTesting EXPRESS

Client:	Haley & Aldrich, Inc.				
Project:	Fort Calhoun Station				
Location:	Blair, NE			Project No:	GTX-311971
Boring ID:	---	Sample Type:	bag	Tested By:	ckg
Sample ID:	SB-11 UNSAT	Test Date:	07/17/20	Checked By:	bfs
Depth :	---	Test Id:	563214		
Test Comment:	---				
Visual Description:	Moist, dark olive brown silt				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	1.2	98.8

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	100		
#60	0.25	100		
#100	0.15	99		
#140	0.11	99		
#200	0.075	99		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0282	58		
---	0.0204	45		
---	0.0122	29		
---	0.0086	23		
---	0.0064	19		
---	0.0047	17		
---	0.0033	16		
---	0.0015	12		

Coefficients

D_{85} = 0.0539 mm	D_{30} = 0.0126 mm
D_{60} = 0.0295 mm	D_{15} = 0.0029 mm
D_{50} = 0.0232 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Dispersion Device : Apparatus A - Mech Mixer

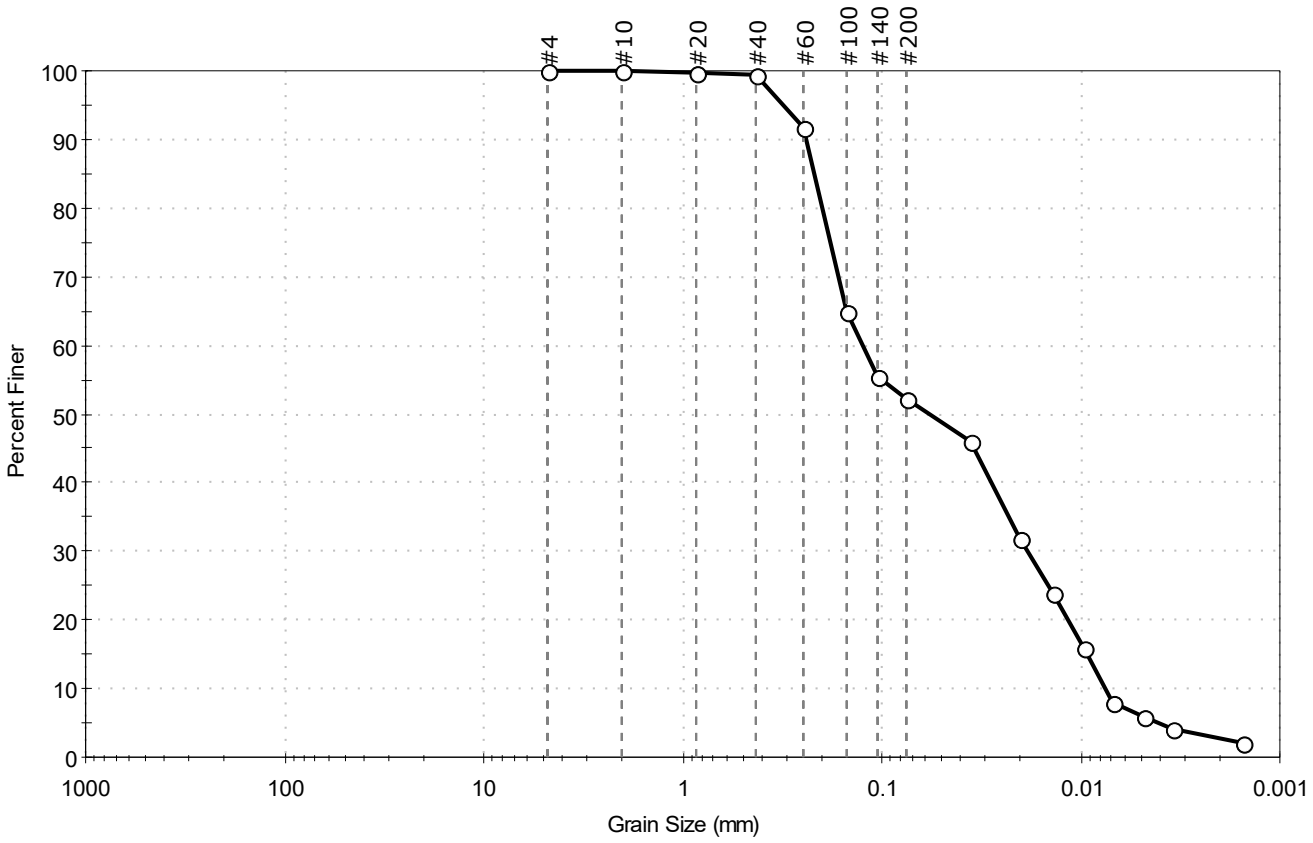
Dispersion Period : 1 minute

Est. Specific Gravity : 2.65

Separation of Sample: #200 Sieve

Client:	Haley & Aldrich, Inc.				
Project:	Fort Calhoun Station				
Location:	Blair, NE			Project No:	GTX-311971
Boring ID:	---	Sample Type:	bag	Tested By:	ckg
Sample ID:	SB-17 SAT	Test Date:	07/17/20	Checked By:	bfs
Depth :	---	Test Id:	563217		
Test Comment:	---				
Visual Description:	Moist, very dark grayish brown sandy silt				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	47.8	52.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	99		
#60	0.25	92		
#100	0.15	65		
#140	0.11	55		
#200	0.075	52		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0361	46		
---	0.0204	32		
---	0.0136	24		
---	0.0097	16		
---	0.0069	8		
---	0.0048	6		
---	0.0034	4		
---	0.0015	2		

Coefficients

D_{85} = 0.2196 mm D_{30} = 0.0185 mm
D_{60} = 0.1255 mm D_{15} = 0.0093 mm
D_{50} = 0.0582 mm D_{10} = 0.0075 mm
C_u = 16.733 C_c = 0.364

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

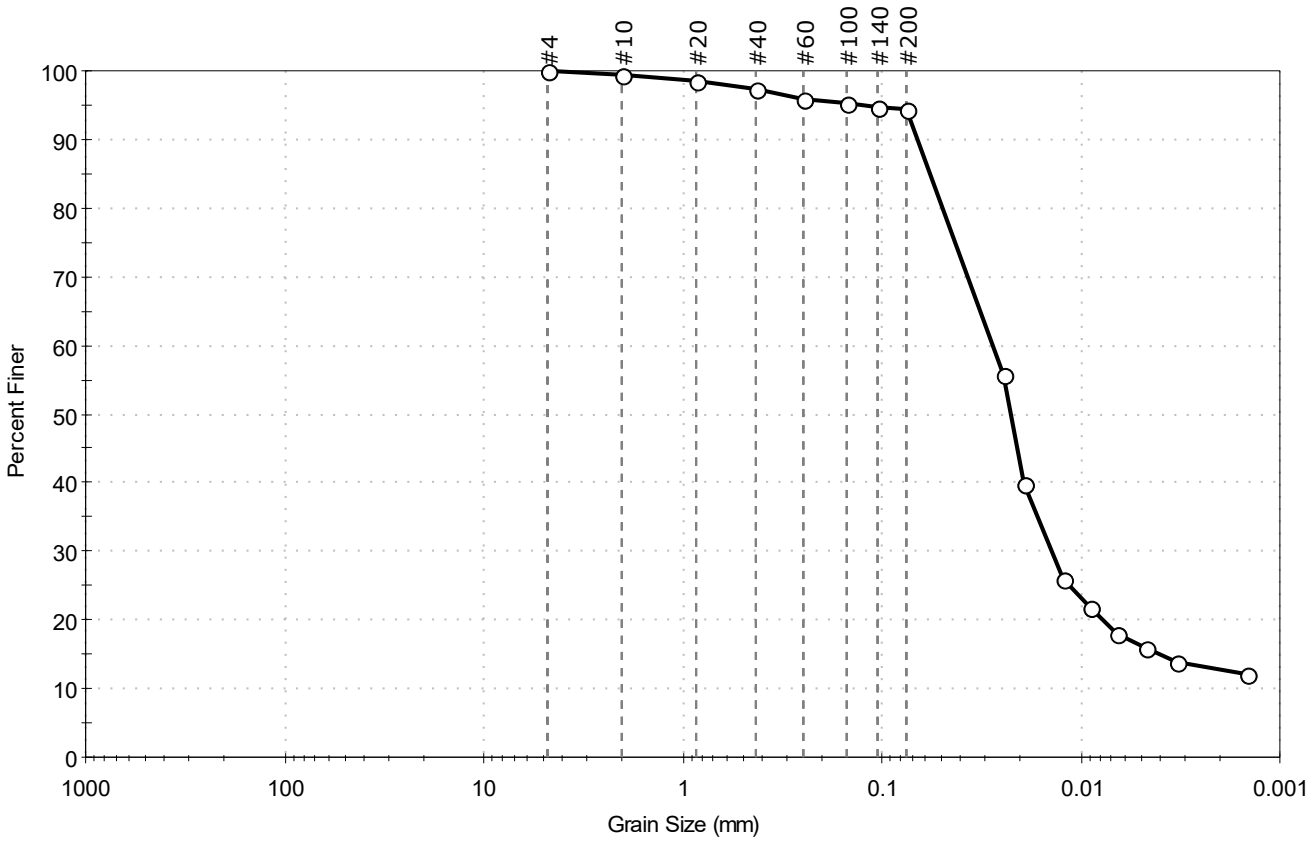
Sample/Test Description

Sand/Gravel Particle Shape : ---
Sand/Gravel Hardness : ---
Dispersion Device : Apparatus A - Mech Mixer
Dispersion Period : 1 minute
Est. Specific Gravity : 2.65
Separation of Sample: #200 Sieve

GeoTesting EXPRESS

Client:	Haley & Aldrich, Inc.				
Project:	Fort Calhoun Station				
Location:	Blair, NE			Project No:	GTX-311971
Boring ID:	---	Sample Type:	bag	Tested By:	ckg
Sample ID:	SB-17 UNSAT	Test Date:	07/17/20	Checked By:	bfs
Depth :	---	Test Id:	563216		
Test Comment:	---				
Visual Description:	Moist, very dark grayish brown clay				
Sample Comment:	---				

Particle Size Analysis ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	5.6	94.4

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	99		
#20	0.85	98		
#40	0.42	97		
#60	0.25	96		
#100	0.15	95		
#140	0.11	95		
#200	0.075	94		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0245	56		
---	0.0194	40		
---	0.0123	26		
---	0.0090	22		
---	0.0065	18		
---	0.0047	16		
---	0.0033	14		
---	0.0015	12		

Coefficients

D_{85} = 0.0572 mm D_{30} = 0.0141 mm
D_{60} = 0.0277 mm D_{15} = 0.0040 mm
D_{50} = 0.0225 mm D_{10} = N/A
C_u = N/A C_c = N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

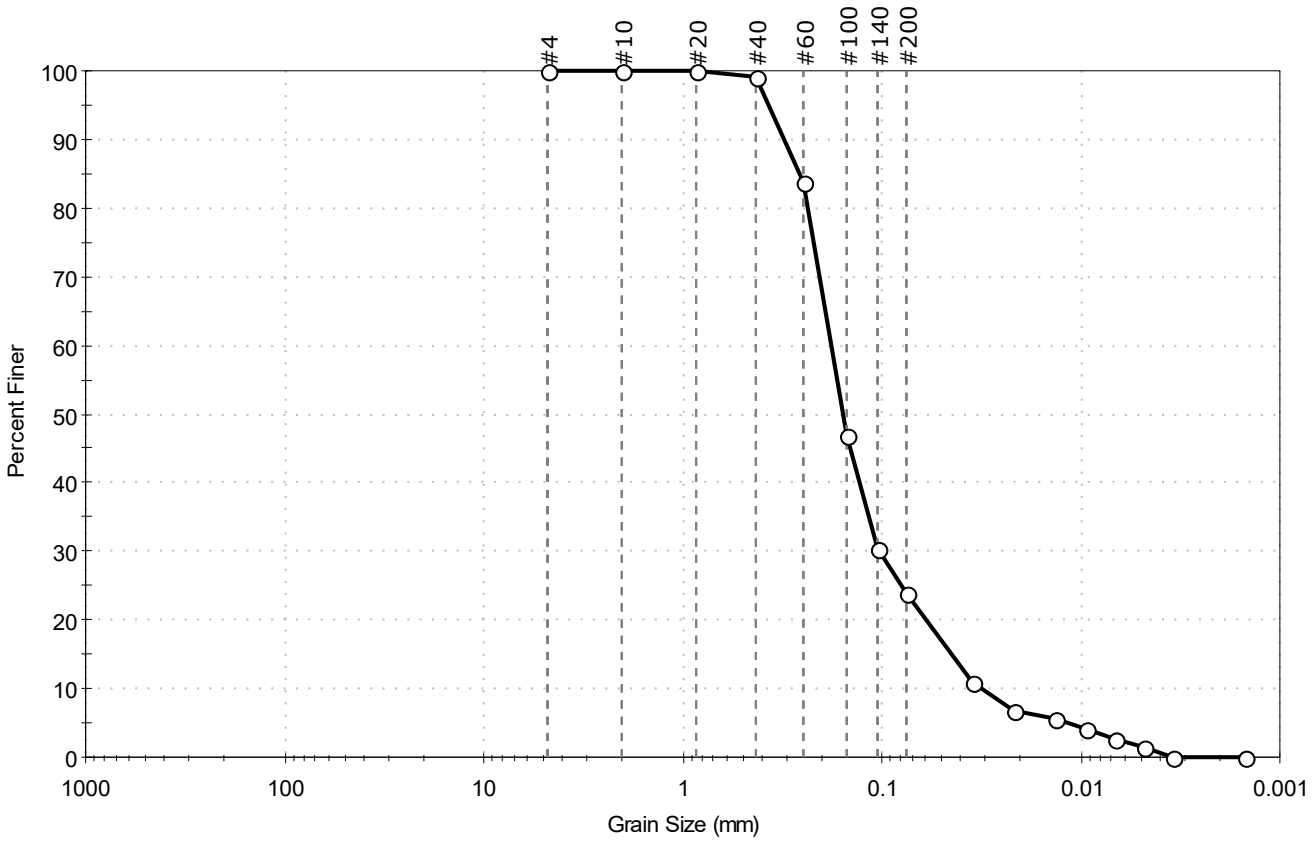
Sample/Test Description

Sand/Gravel Particle Shape : ---
Sand/Gravel Hardness : ---
Dispersion Device : Apparatus A - Mech Mixer
Dispersion Period : 1 minute
Est. Specific Gravity : 2.65
Separation of Sample: #200 Sieve

GeoTesting EXPRESS

Client:	Haley & Aldrich, Inc.				
Project:	Fort Calhoun Station				
Location:	Blair, NE			Project No:	GTX-311971
Boring ID:	---	Sample Type:	bag	Tested By:	ckg
Sample ID:	SB-25 SAT	Test Date:	07/17/20	Checked By:	bfs
Depth :	---	Test Id:	563219		
Test Comment:	---				
Visual Description:	Moist, dark grayish brown silty sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	76.1	23.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	99		
#60	0.25	84		
#100	0.15	47		
#140	0.11	31		
#200	0.075	24		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0354	11		
---	0.0216	7		
---	0.0134	5		
---	0.0095	4		
---	0.0068	3		
---	0.0048	1		
---	0.0034	0		
---	0.0015	0		

Coefficients

D_{85} = 0.2607 mm	D_{30} = 0.1032 mm
D_{60} = 0.1796 mm	D_{15} = 0.0447 mm
D_{50} = 0.1563 mm	D_{10} = 0.0314 mm
C_u = 5.720	C_c = 1.889

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

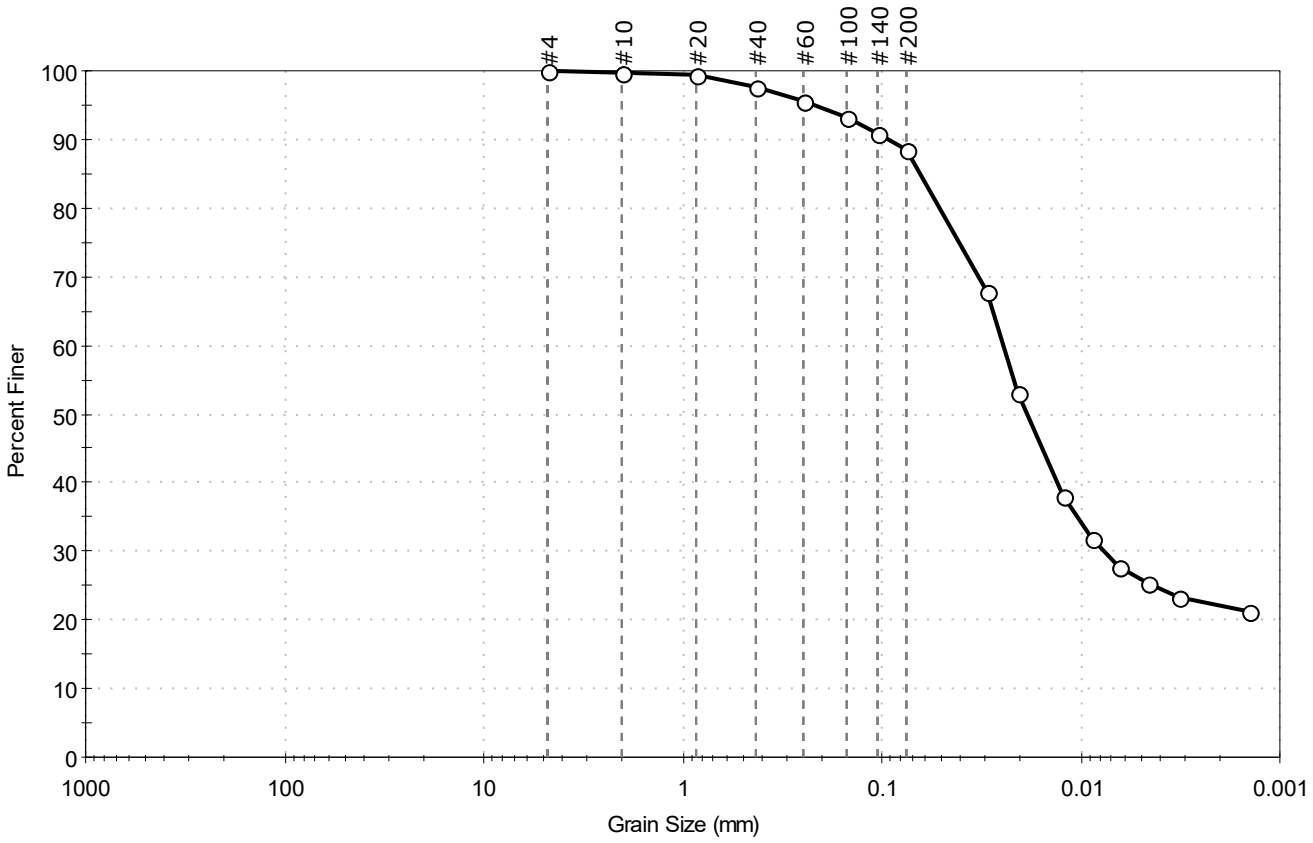
Est. Specific Gravity : 2.65

Separation of Sample: #200 Sieve

GeoTesting EXPRESS

Client:	Haley & Aldrich, Inc.				
Project:	Fort Calhoun Station				
Location:	Blair, NE			Project No:	GTX-311971
Boring ID:	---	Sample Type:	bag	Tested By:	ckg
Sample ID:	SB-25 UNSAT	Test Date:	07/17/20	Checked By:	bfs
Depth :	---	Test Id:	563218		
Test Comment:	---				
Visual Description:	Moist, dark grayish brown silt				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
--	0.0	11.5	88.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	99		
#40	0.42	98		
#60	0.25	96		
#100	0.15	93		
#140	0.11	91		
#200	0.075	89		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0296	68		
---	0.0207	53		
---	0.0124	38		
---	0.0088	32		
---	0.0064	28		
---	0.0046	25		
---	0.0032	23		
---	0.0014	21		

Coefficients

D_{85} = 0.0640 mm D_{30} = 0.0077 mm
D_{60} = 0.0245 mm D_{15} = N/A
D_{50} = 0.0186 mm D_{10} = N/A
C_u = N/A C_c = N/A

Classification

ASTM N/A

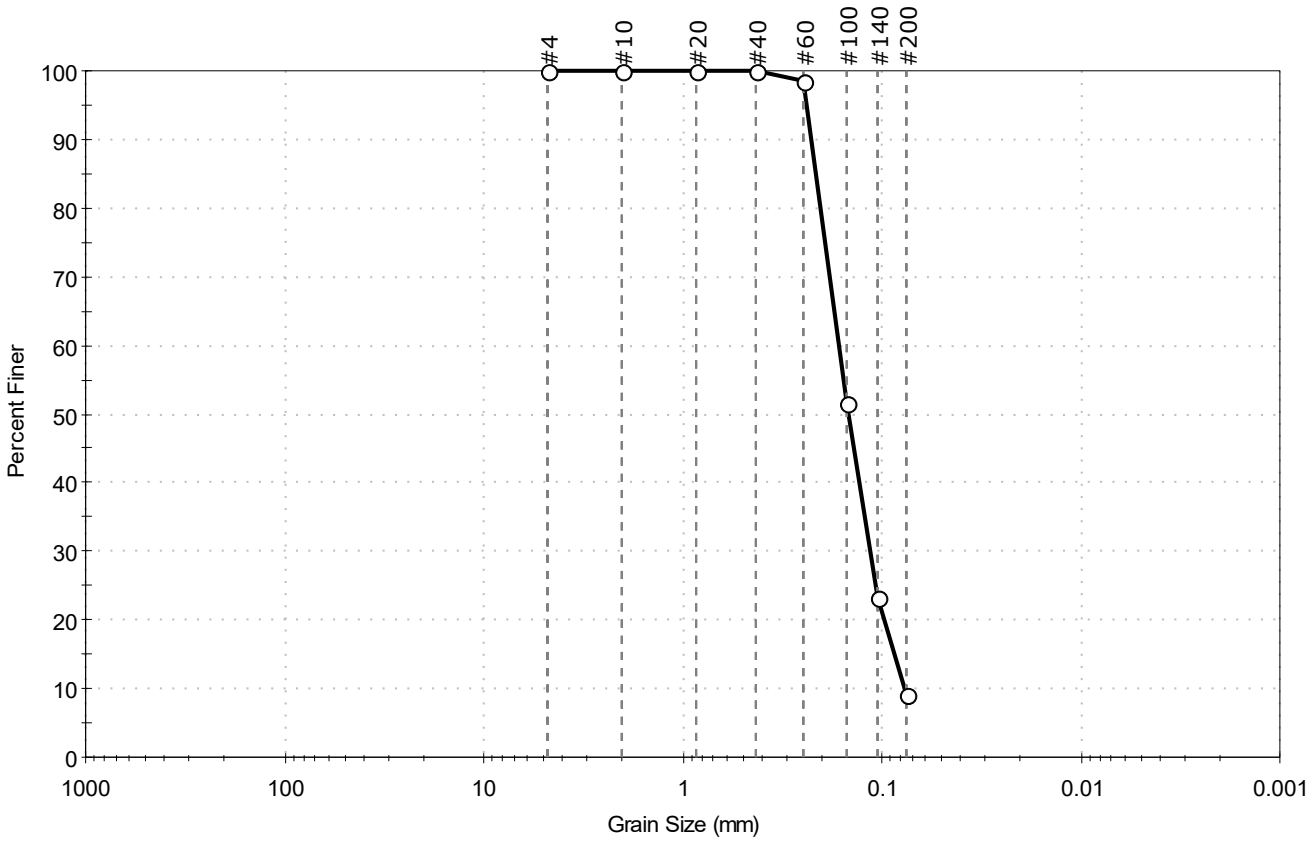
AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---
Sand/Gravel Hardness : ---
Dispersion Device : Apparatus A - Mech Mixer
Dispersion Period : 1 minute
Est. Specific Gravity : 2.65
Separation of Sample: #200 Sieve

Client:	Haley & Aldrich, Inc.				
Project:	Fort Calhoun Station				
Location:	Blair, NE			Project No:	GTX-311971
Boring ID:	---	Sample Type:	bag	Tested By:	ckg
Sample ID:	SB-32 SAT	Test Date:	07/17/20	Checked By:	bfs
Depth :	---	Test Id:	563221		
Test Comment:	---				
Visual Description:	Moist, dark grayish brown sand with silt				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	90.9	9.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	100		
#60	0.25	99		
#100	0.15	52		
#140	0.11	23		
#200	0.075	9.1		

Coefficients

D_{85} = 0.2155 mm
D_{30} = 0.1149 mm
D_{60} = 0.1643 mm
D_{15} = 0.0864 mm
D_{50} = 0.1470 mm
D_{10} = 0.0766 mm
C_u = 2.145
C_c = 1.049

Classification

ASTM N/A

AASHTO Fine Sand (A-3 (1))

Sample/Test Description

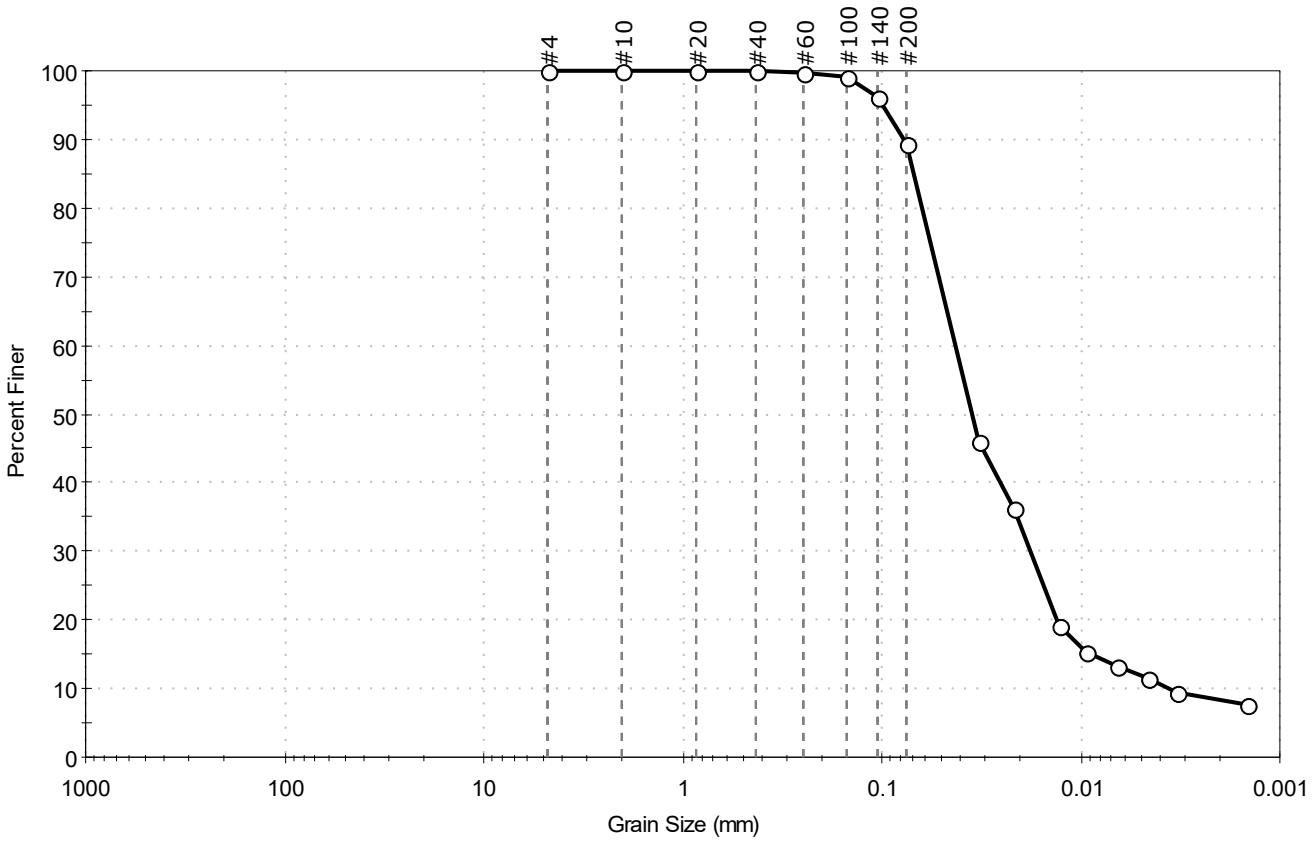
Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

GeoTesting EXPRESS

Client:	Haley & Aldrich, Inc.				
Project:	Fort Calhoun Station				
Location:	Blair, NE			Project No:	GTX-311971
Boring ID:	---	Sample Type:	bag	Tested By:	ckg
Sample ID:	SB-32 UNSAT	Test Date:	07/17/20	Checked By:	bfs
Depth :	---	Test Id:	563220		
Test Comment:	---				
Visual Description:	Moist, dark grayish brown clay				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	10.6	89.4

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	100		
#60	0.25	100		
#100	0.15	99		
#140	0.11	96		
#200	0.075	89		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0328	46		
---	0.0216	36		
---	0.0128	19		
---	0.0093	15		
---	0.0066	13		
---	0.0046	11		
---	0.0033	10		
---	0.0015	8		

Coefficients

D_{85} = 0.0690 mm	D_{30} = 0.0178 mm
D_{60} = 0.0428 mm	D_{15} = 0.0088 mm
D_{50} = 0.0354 mm	D_{10} = 0.0036 mm
C_u = 11.889	C_c = 2.056

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

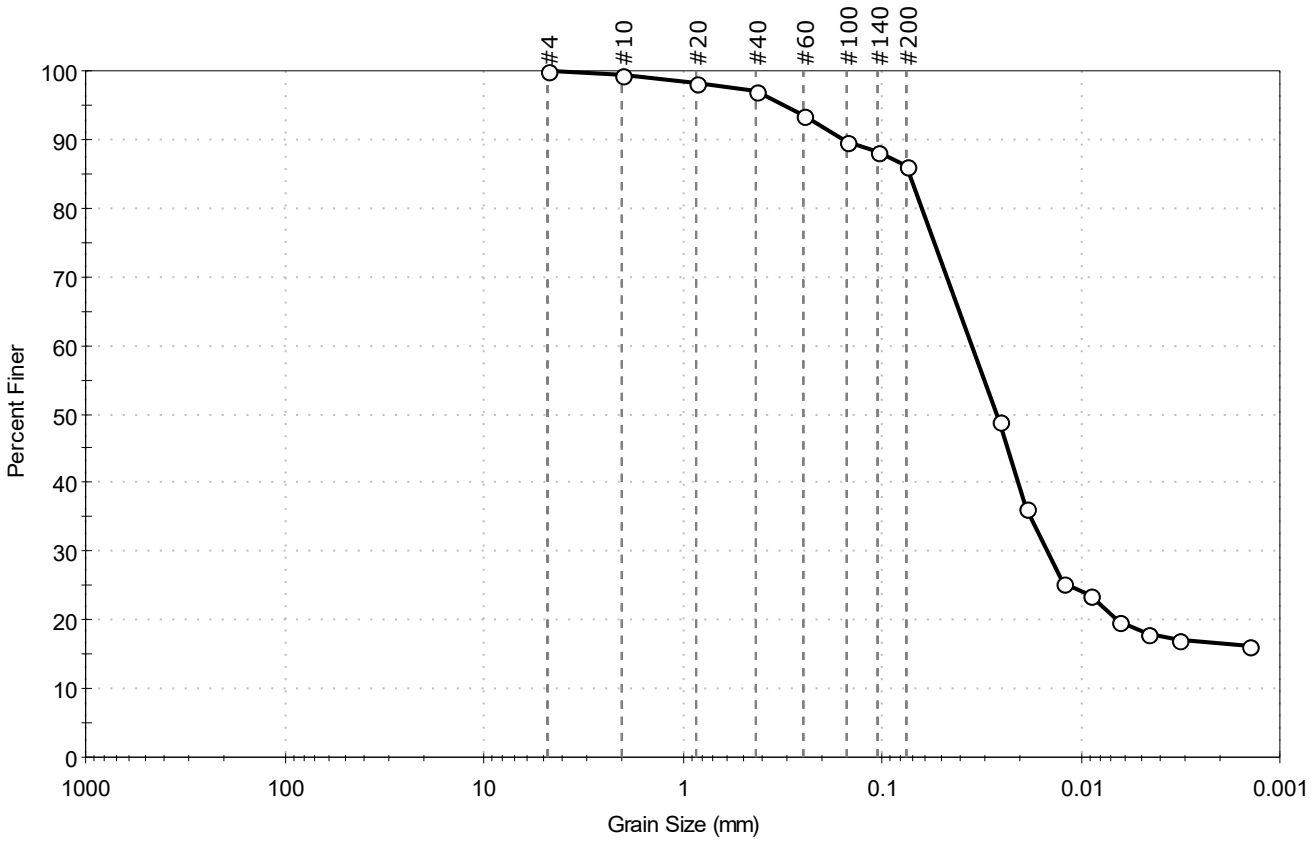
Est. Specific Gravity : 2.65

Separation of Sample: #200 Sieve

GeoTesting EXPRESS

Client:	Haley & Aldrich, Inc.				
Project:	Fort Calhoun Station				
Location:	Blair, NE			Project No:	GTX-311971
Boring ID:	---	Sample Type:	bag	Tested By:	ckg
Sample ID:	SB-33 KD	Test Date:	07/17/20	Checked By:	bfs
Depth :	---	Test Id:	563223		
Test Comment:	---				
Visual Description:	Moist, dark olive brown clay				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	13.7	86.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	99		
#20	0.85	98		
#40	0.42	97		
#60	0.25	93		
#100	0.15	90		
#140	0.11	88		
#200	0.075	86		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0259	49		
---	0.0190	36		
---	0.0122	25		
---	0.0090	24		
---	0.0065	20		
---	0.0046	18		
---	0.0032	17		
---	0.0014	16		

Coefficients

D_{85} = 0.0724 mm	D_{30} = 0.0148 mm
D_{60} = 0.0355 mm	D_{15} = N/A
D_{50} = 0.0267 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

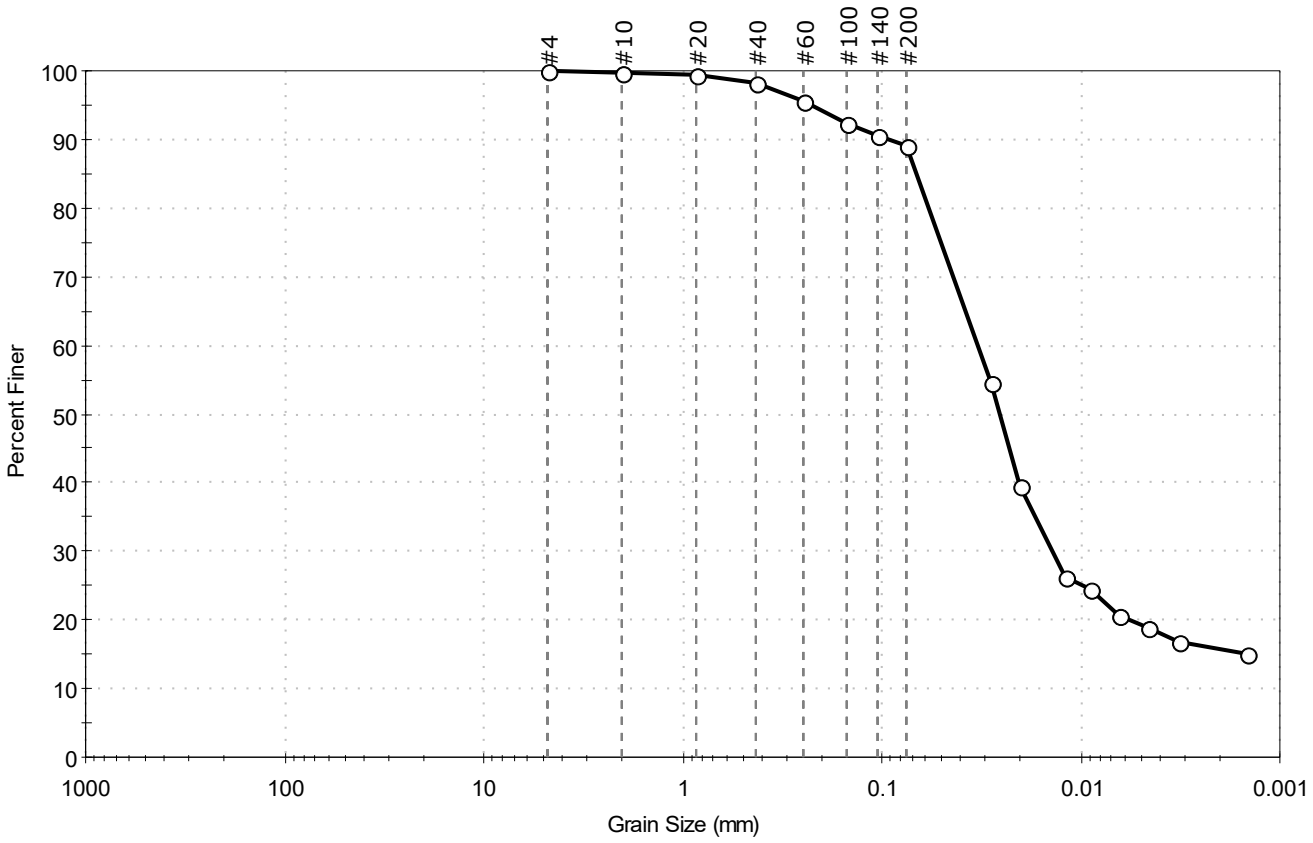
Est. Specific Gravity : 2.65

Separation of Sample: #200 Sieve

GeoTesting EXPRESS

Client:	Haley & Aldrich, Inc.				
Project:	Fort Calhoun Station				
Location:	Blair, NE			Project No:	GTX-311971
Boring ID:	---	Sample Type:	bag	Tested By:	ckg
Sample ID:	SB-33 UNSAT	Test Date:	07/17/20	Checked By:	bfs
Depth :	---	Test Id:	563222		
Test Comment:	---				
Visual Description:	Moist, dark olive brown clay				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	10.7	89.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	99		
#40	0.42	98		
#60	0.25	96		
#100	0.15	92		
#140	0.11	91		
#200	0.075	89		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0279	54		
---	0.0201	39		
---	0.0120	26		
---	0.0089	24		
---	0.0064	21		
---	0.0046	19		
---	0.0033	17		
---	0.0014	15		

Coefficients

D_{85} = 0.0665 mm	D_{30} = 0.0139 mm
D_{60} = 0.0327 mm	D_{15} = N/A
D_{50} = 0.0253 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Dispersion Device : Apparatus A - Mech Mixer

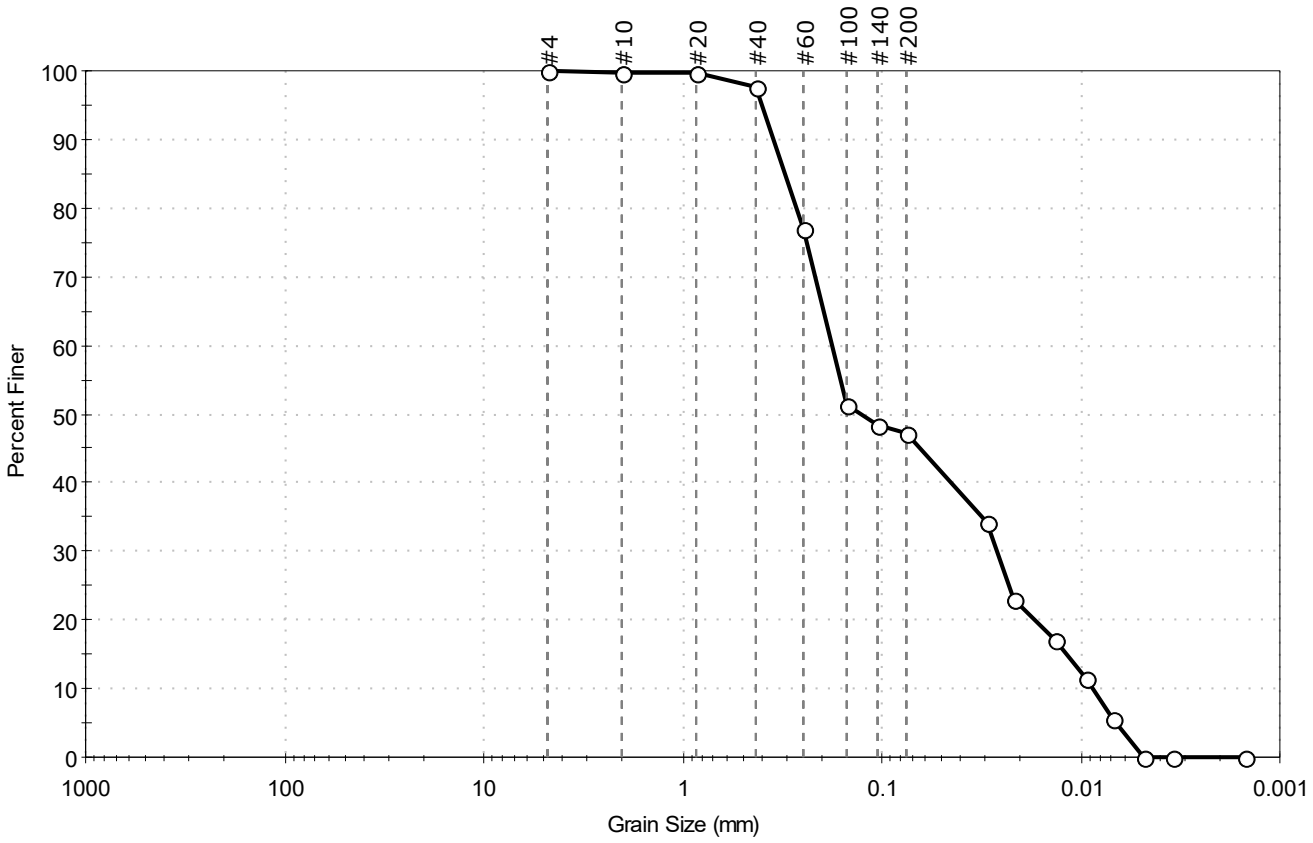
Dispersion Period : 1 minute

Est. Specific Gravity : 2.65

Separation of Sample: #200 Sieve

Client:	Haley & Aldrich, Inc.				
Project:	Fort Calhoun Station				
Location:	Blair, NE			Project No:	GTX-311971
Boring ID:	---	Sample Type:	bag	Tested By:	ckg
Sample ID:	SB-34 SAT	Test Date:	07/17/20	Checked By:	bfs
Depth :	---	Test Id:	563225		
Test Comment:	---				
Visual Description:	Moist, dark grayish brown silty sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	52.8	47.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	98		
#60	0.25	77		
#100	0.15	51		
#140	0.11	48		
#200	0.075	47		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0295	34		
---	0.0215	23		
---	0.0134	17		
---	0.0094	11		
---	0.0069	6		
---	0.0048	0		
---	0.0034	0		
---	0.0015	0		

Coefficients

D_{85} = 0.3067 mm	D_{30} = 0.0262 mm
D_{60} = 0.1778 mm	D_{15} = 0.0117 mm
D_{50} = 0.1268 mm	D_{10} = 0.0087 mm
C_u = 20.437	C_c = 0.444

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Dispersion Device : Apparatus A - Mech Mixer

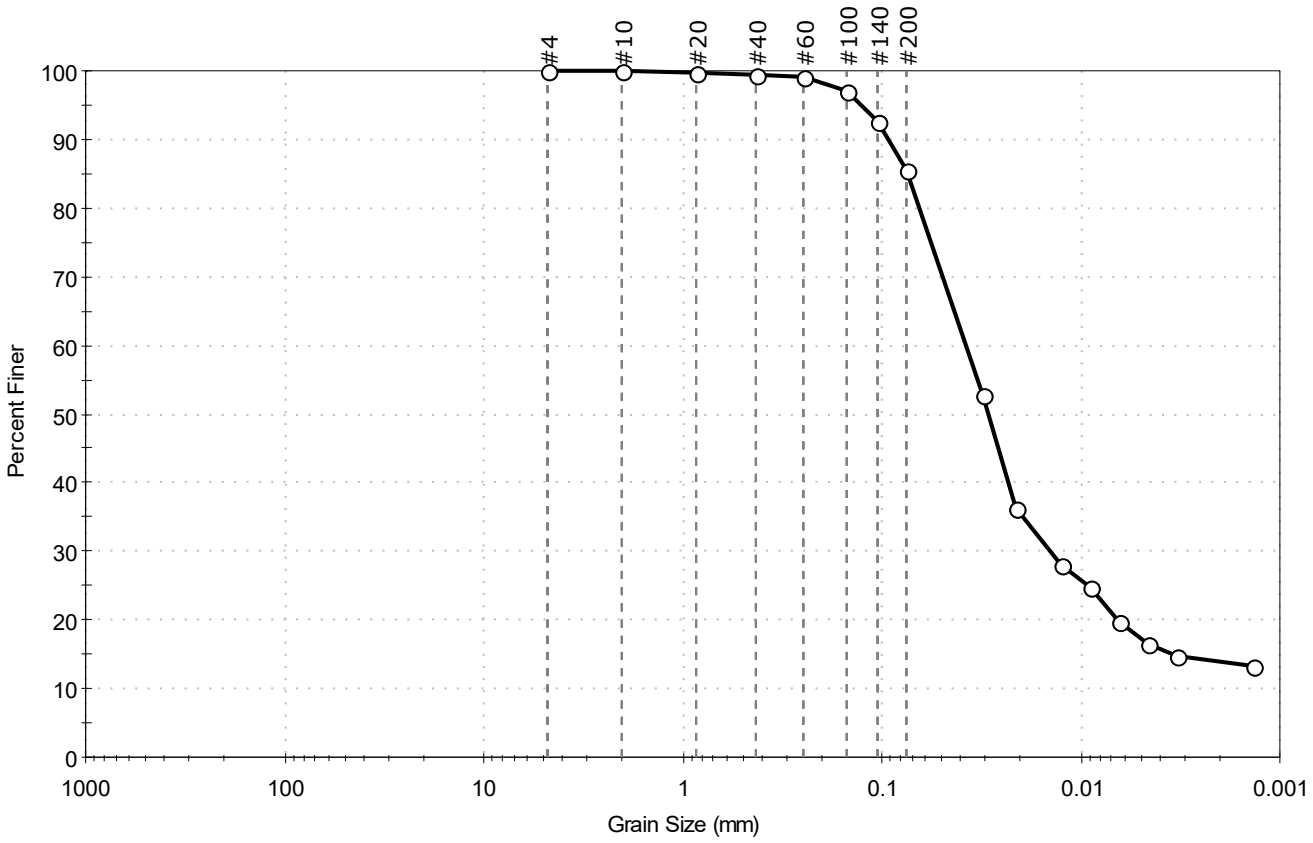
Dispersion Period : 1 minute

Est. Specific Gravity : 2.65

Separation of Sample: #200 Sieve

Client:	Haley & Aldrich, Inc.				
Project:	Fort Calhoun Station				
Location:	Blair, NE			Project No:	GTX-311971
Boring ID:	---	Sample Type:	bag	Tested By:	ckg
Sample ID:	SB-34 UNSAT	Test Date:	07/17/20	Checked By:	bfs
Depth :	---	Test Id:	563224		
Test Comment:	---				
Visual Description:	Moist, dark grayish brown silt				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	14.3	85.7

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	99		
#60	0.25	99		
#100	0.15	97		
#140	0.11	93		
#200	0.075	86		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0309	53		
---	0.0210	36		
---	0.0126	28		
---	0.0090	25		
---	0.0065	20		
---	0.0046	16		
---	0.0033	15		
---	0.0014	13		

Coefficients

D_{85} = 0.0736 mm	D_{30} = 0.0142 mm
D_{60} = 0.0375 mm	D_{15} = 0.0034 mm
D_{50} = 0.0289 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

Est. Specific Gravity : 2.65

Separation of Sample: Sieve

ANALYTICAL REPORT

Lab Number:	L2027791
Client:	Geo Testing Express 125 Nagog Park Acton, MA 01720
ATTN:	Ethan Marro
Phone:	(978) 635-0424
Project Name:	FORT CALHOUN STATION
Project Number:	311971
Report Date:	07/16/20

Certifications & Approvals: MA (M-MA030), NH NELAP (2062), CT (PH-0141), DoD (L2474), FL (E87814), IL (200081), LA (85084), ME (MA00030), MD (350), NJ (MA015), NY (11627), NC (685), OH (CL106), PA (68-02089), RI (LAO00299), TX (T104704419), VT (VT-0015), VA (460194), WA (C954), US Army Corps of Engineers, USDA (Permit #P330-17-00150), USFWS (Permit #206964).

320 Forbes Boulevard, Mansfield, MA 02048-1806
508-822-9300 (Fax) 508-822-3288 800-624-9220 - www.alphalab.com

Project Name: FORT CALHOUN STATION
Project Number: 311971

Lab Number: L2027791
Report Date: 07/16/20

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L2027791-01	SB-33 KD	SOIL	BLAIR, NE		07/01/20

Project Name:	FORT CALHOUN STATION	**Lab Number:**	L2027791
Project Number:	311971	**Report Date:**	07/16/20

Case Narrative

The samples were received in accordance with the Chain of Custody and no significant deviations were encountered during the preparation or analysis unless otherwise noted. Sample Receipt, Container Information, and the Chain of Custody are located at the back of the report.

Results contained within this report relate only to the samples submitted under this Alpha Lab Number and meet NELAP requirements for all NELAP accredited parameters unless otherwise noted in the following narrative. The data presented in this report is organized by parameter (i.e. VOC, SVOC, etc.). Sample specific Quality Control data (i.e. Surrogate Spike Recovery) is reported at the end of the target analyte list for each individual sample, followed by the Laboratory Batch Quality Control at the end of each parameter. Tentatively Identified Compounds (TICs), if requested, are reported for compounds identified to be present and are not part of the method/program Target Compound List, even if only a subset of the TCL are being reported. If a sample was re-analyzed or re-extracted due to a required quality control corrective action and if both sets of data are reported, the Laboratory ID of the re-analysis or re-extraction is designated with an "R" or "RE", respectively.

When multiple Batch Quality Control elements are reported (e.g. more than one LCS), the associated samples for each element are noted in the grey shaded header line of each data table. Any Laboratory Batch, Sample Specific % recovery or RPD value that is outside the listed Acceptance Criteria is bolded in the report. In reference to questions H (CAM) or 4 (RCP) when "NO" is checked, the performance criteria for CAM and RCP methods allow for some quality control failures to occur and still be within method compliance. In these instances, the specific failure is not narrated but noted in the associated QC Outlier Summary Report, located directly after the Case Narrative. QC information is also incorporated in the Data Usability Assessment table (Format 11) of our Data Merger tool, where it can be reviewed in conjunction with the sample result, associated regulatory criteria and any associated data usability implications.

Soil/sediments, solids and tissues are reported on a dry weight basis unless otherwise noted. Definitions of all data qualifiers and acronyms used in this report are provided in the Glossary located at the back of the report.

HOLD POLICY - For samples submitted on hold, Alpha's policy is to hold samples (with the exception of Air canisters) free of charge for 21 calendar days from the date the project is completed. After 21 calendar days, we will dispose of all samples submitted including those put on hold unless you have contacted your Alpha Project Manager and made arrangements for Alpha to continue to hold the samples. Air canisters will be disposed after 3 business days from the date the project is completed.

Please contact Project Management at 800-624-9220 with any questions.

Project Name:	FORT CALHOUN STATION	**Lab Number:**	L2027791
Project Number:	311971	**Report Date:**	07/16/20

Case Narrative (continued)

Total Organic Carbon

WG1389950-1: The required batch QC was prepared; however, the native sample required a different reporting method; therefore, the associated QC results could not be reported.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Authorized Signature: Susan E O'Neil Susan O' Neil

Title: Technical Director/Representative Date: 07/16/20

INORGANICS
&
MISCELLANEOUS

Project Name: FORT CALHOUN STATION
Project Number: 311971
Lab Number: L2027791
Report Date: 07/16/20

SAMPLE RESULTS

Lab ID: L2027791-01
Client ID: SB-33 KD
Sample Location: BLAIR, NE
Sample Depth:
Matrix: Soil

Date Collected:
Date Received: 07/01/20
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Organic Carbon - Mansfield Lab										
Total Organic Carbon	0.613		%	0.010	--	1	-	07/15/20 09:32	1,9060A	SP

Project Name: FORT CALHOUN STATION
Project Number: 311971
Lab Number: L2027791
Report Date: 07/16/20

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Organic Carbon - Mansfield Lab for sample(s): 01 Batch: WG1389950-1										
Total Organic Carbon	ND		%	0.010	--	1	-	07/15/20 09:32	1,9060A	SP

Lab Control Sample Analysis

Batch Quality Control

Project Name: FORT CALHOUN STATION

Project Number: 311971

Lab Number: L2027791

Report Date: 07/16/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Total Organic Carbon - Mansfield Lab Associated sample(s): 01 Batch: WG1389950-2								
Total Organic Carbon	102		-		75-125	-		25

Project Name: FORT CALHOUN STATION
Project Number: 311971

Lab Number: L2027791
Report Date: 07/16/20

Sample Receipt and Container Information

Were project specific reporting limits specified? YES

Cooler Information

Cooler	Custody Seal
A	Absent

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2027791-01A	Bag	A	NA		4.9	Y	Absent		A2-TOC-9060(28)

*Values in parentheses indicate holding time in days

Project Name:	FORT CALHOUN STATION	**Lab Number:**	L2027791
Project Number:	311971	**Report Date:**	07/16/20

GLOSSARY

Acronyms

DL - Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the limit of quantitation (LOQ). The DL includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

EDL - Estimated Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The EDL includes any adjustments from dilutions, concentrations or moisture content, where applicable. The use of EDLs is specific to the analysis of PAHs using Solid-Phase Microextraction (SPME).

EMPC - Estimated Maximum Possible Concentration: The concentration that results from the signal present at the retention time of an analyte when the ions meet all of the identification criteria except the ion abundance ratio criteria. An EMPC is a worst-case estimate of the concentration.

EPA - Environmental Protection Agency.

LCS - Laboratory Control Sample: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.

LCSD - Laboratory Control Sample Duplicate: Refer to LCS.

LFB - Laboratory Fortified Blank: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.

LOD - Limit of Detection: This value represents the level to which a target analyte can reliably be detected for a specific analyte in a specific matrix by a specific method. The LOD includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

LOQ - Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

MDL - Method Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The MDL includes any adjustments from dilutions, concentrations or moisture content, where applicable.

MS - Matrix Spike Sample: A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. For Method 332.0, the spike recovery is calculated using the native concentration, including estimated values.

MSD - Matrix Spike Sample Duplicate: Refer to MS.

NA - Not Applicable.

NC - Not Calculated: Term is utilized when one or more of the results utilized in the calculation are non-detect at the parameter's reporting unit.

NDPA/DPA - N-Nitrosodiphenylamine/Diphenylamine.

NI - Not Ignitable.

NP - Non-Plastic: Term is utilized for the analysis of Atterberg Limits in soil.

RL - Reporting Limit: The value at which an instrument can accurately measure an analyte at a specific concentration. The RL includes any adjustments from dilutions, concentrations or moisture content, where applicable.

RPD - Relative Percent Difference: The results from matrix and/or matrix spike duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD). Values which are less than five times the reporting limit for any individual parameter are evaluated by utilizing the absolute difference between the values; although the RPD value will be provided in the report.

SRM - Standard Reference Material: A reference sample of a known or certified value that is of the same or similar matrix as the associated field samples.

STLP - Semi-dynamic Tank Leaching Procedure per EPA Method 1315.

TEF - Toxic Equivalency Factors: The values assigned to each dioxin and furan to evaluate their toxicity relative to 2,3,7,8-TCDD.

TEQ - Toxic Equivalent: The measure of a sample's toxicity derived by multiplying each dioxin and furan by its corresponding TEF and then summing the resulting values.

TIC - Tentatively Identified Compound: A compound that has been identified to be present and is not part of the target compound list (TCL) for the method and/or program. All TICs are qualitatively identified and reported as estimated concentrations.

Footnotes

Report Format: Data Usability Report

Project Name:	FORT CALHOUN STATION	**Lab Number:**	L2027791
Project Number:	311971	**Report Date:**	07/16/20

1 - The reference for this analyte should be considered modified since this analyte is absent from the target analyte list of the original method.

Terms

Analytical Method: Both the document from which the method originates and the analytical reference method. (Example: EPA 8260B is shown as 1,8260B.) The codes for the reference method documents are provided in the References section of the Addendum.

Difference: With respect to Total Oxidizable Precursor (TOP) Assay analysis, the difference is defined as the Post-Treatment value minus the Pre-Treatment value.

Final pH: As it pertains to Sample Receipt & Container Information section of the report, Final pH reflects pH of container determined after adjustment at the laboratory, if applicable. If no adjustment required, value reflects Initial pH.

Frozen Date/Time: With respect to Volatile Organics in soil, Frozen Date/Time reflects the date/time at which associated Reagent Water-preserved vials were initially frozen. Note: If frozen date/time is beyond 48 hours from sample collection, value will be reflected in 'bold'.

Initial pH: As it pertains to Sample Receipt & Container Information section of the report, Initial pH reflects pH of container determined upon receipt, if applicable.

PAH Total: With respect to Alkylated PAH analyses, the 'PAHs, Total' result is defined as the summation of results for all or a subset of the following compounds: Naphthalene, C1-C4 Naphthalenes, 2-Methylnaphthalene, 1-Methylnaphthalene, Biphenyl, Acenaphthylene, Acenaphthene, Fluorene, C1-C3 Fluorenes, Phenanthrene, C1-C4 Phenanthrenes/Anthracenes, Anthracene, Fluoranthene, Pyrene, C1-C4 Fluoranthenes/Pyrenes, Benz(a)anthracene, Chrysene, C1-C4 Chrysenes, Benzo(b)fluoranthene, Benzo(j)+(k)fluoranthene, Benzo(e)pyrene, Benzo(a)pyrene, Perylene, Indeno(1,2,3-cd)pyrene, Dibenz(ah)+(ac)anthracene, Benzo(g,h,i)perylene. If a 'Total' result is requested, the results of its individual components will also be reported.

PFAS Total: With respect to PFAS analyses, the 'PFAS, Total (5)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA and PFOS. If a 'Total' result is requested, the results of its individual components will also be reported.

The target compound Chlordane (CAS No. 57-74-9) is reported for GC ECD analyses. Per EPA,this compound "refers to a mixture of chlordane isomers, other chlorinated hydrocarbons and numerous other components." (Reference: USEPA Toxicological Review of Chlordane, In Support of Summary Information on the Integrated Risk Information System (IRIS), December 1997.)

Total: With respect to Organic analyses, a 'Total' result is defined as the summation of results for individual isomers or Aroclors. If a 'Total' result is requested, the results of its individual components will also be reported. This is applicable to 'Total' results for methods 8260, 8081 and 8082.

Data Qualifiers

A - Spectra identified as "Aldol Condensates" are byproducts of the extraction/concentration procedures when acetone is introduced in the process.

B - The analyte was detected above the reporting limit in the associated method blank. Flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For MCP-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For DOD-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank AND the analyte was detected above one-half the reporting limit (or above the reporting limit for common lab contaminants) in the associated method blank. For NJ-Air-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte above the reporting limit. For NJ-related projects (excluding Air), flag only applies to associated field samples that have detectable concentrations of the analyte, which was detected above the reporting limit in the associated method blank or above five times the reporting limit for common lab contaminants (Phthalates, Acetone, Methylene Chloride, 2-Butanone).

C - Co-elution: The target analyte co-elutes with a known lab standard (i.e. surrogate, internal standards, etc.) for co-extracted analyses.

D - Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.

E - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.

F - The ratio of quantifier ion response to qualifier ion response falls outside of the laboratory criteria. Results are considered to be an estimated maximum concentration. (DoD and NYSDEC Part 375 PFAS only.)

G - The concentration may be biased high due to matrix interferences (i.e, co-elution) with non-target compound(s). The result should be considered estimated.

H - The analysis of pH was performed beyond the regulatory-required holding time of 15 minutes from the time of sample collection.

I - The lower value for the two columns has been reported due to obvious interference.

J - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

M - Reporting Limit (RL) exceeds the MCP CAM Reporting Limit for this analyte.

ND - Not detected at the reporting limit (RL) for the sample.

NJ - Presumptive evidence of compound. This represents an estimated concentration for Tentatively Identified Compounds (TICs), where the identification is based on a mass spectral library search.

P - The RPD between the results for the two columns exceeds the method-specified criteria.

Q - The quality control sample exceeds the associated acceptance criteria. For DOD-related projects, LCS and/or Continuing Calibration

Report Format: Data Usability Report

Project Name:	FORT CALHOUN STATION	**Lab Number:**	L2027791
Project Number:	311971	**Report Date:**	07/16/20

Data Qualifiers

Standard exceedences are also qualified on all associated sample results. Note: This flag is not applicable for matrix spike recoveries when the sample concentration is greater than 4x the spike added or for batch duplicate RPD when the sample concentrations are less than 5x the RL. (Metals only.)

R - Analytical results are from sample re-analysis.

RE - Analytical results are from sample re-extraction.

S - Analytical results are from modified screening analysis.

Report Format: Data Usability Report

Project Name:	FORT CALHOUN STATION	**Lab Number:**	L2027791
Project Number:	311971	**Report Date:**	07/16/20

REFERENCES

1 Test Methods for Evaluating Solid Waste: Physical/Chemical Methods. EPA SW-846. Third Edition. Updates I - VI, 2018.

LIMITATION OF LIABILITIES

Alpha Analytical performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Alpha Analytical shall be to re-perform the work at it's own expense. In no event shall Alpha Analytical be held liable for any incidental, consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Alpha Analytical.

We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding time and splitting of samples in the field.

Certification Information

The following analytes are not included in our Primary NELAP Scope of Accreditation:

Westborough Facility
EPA 624/624.1: m/p-xylene, o-xylene, Naphthalene
EPA 8260C: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270D: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
SM4500: NPW: Amenable Cyanide; SCM: Total Phosphorus, TKN, NO2, NO3.

Mansfield Facility
SM 2540D: TSS
EPA 8082A: NPW: PCB: 1, 5, 31, 87,101, 110, 141, 151, 153, 180, 183, 187.
EPA TO-15: Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylthiophene, 3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Indan, Indene, 1,2,4,5-Tetramethylbenzene, Benzothiophene, 1-Methylnaphthalene.
EPA TO-12 Non-methane organics
EPA 3C Fixed gases
Biological Tissue Matrix: EPA 3050B

The following analytes are included in our Massachusetts DEP Scope of Accreditation

Westborough Facility:

Drinking Water
EPA 300.0: Chloride, Nitrate-N, Fluoride, Sulfate; **EPA 353.2**: Nitrate-N, Nitrite-N; **SM4500NO3-F**: Nitrate-N, Nitrite-N; **SM4500F-C, SM4500CN-CE, EPA 180.1, SM2130B, SM4500Cl-D, SM2320B, SM2540C, SM4500H-B, SM4500NO2-B**
EPA 332: Perchlorate; **EPA 524.2:** THMs and VOCs; **EPA 504.1:** EDB, DBCP.
Microbiology: **SM9215B; SM9223-P/A, SM9223B-Colilert-QT,SM9222D**.

Non-Potable Water
SM4500H,B, EPA 120.1, SM2510B, SM2540C, SM2320B, SM4500CL-E, SM4500F-BC, SM4500NH3-BH: Ammonia-N and Kjeldahl-N, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **EPA 351.1, SM4500NO3-F, EPA 353.2**: Nitrate-N**, SM4500P-E, SM4500P-B, E, SM4500SO4-E, SM5220D, EPA 410.4, SM5210B, SM5310C, SM4500CL-D, EPA 1664, EPA 420.1, SM4500-CN-CE, SM2540D, EPA 300: Chloride, Sulfate, Nitrate.**
EPA 624.1: Volatile Halocarbons & Aromatics,
EPA 608.3: Chlordane, Toxaphene, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, delta-BHC, Dieldrin, DDD, DDE, DDT, Endosulfan I, Endosulfan II, Endosulfan sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, PCBs
EPA 625.1: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045**: PCB-Oil.
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9221E, EPA 1600, EPA 1603.**

Mansfield Facility:

Drinking Water
EPA 200.7: Al, Ba, Cd, Cr, Cu, Fe, Mn, Ni, Na, Ag, Ca, Zn. **EPA 200.8:** Al, Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, TL, Zn. **EPA 245.1** Hg.
EPA 522.

Non-Potable Water
EPA 200.7: Al, Sb, As, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Sr, TL, Ti, V, Zn.
EPA 200.8: Al, Sb**,** As, Be, Cd, Cr, Cu, Fe, Pb, Mn, Ni, K, Se, Ag, Na, TL, Zn.
EPA 245.1 Hg.
SM2340B

For a complete listing of analytes and methods, please contact your Alpha Project Manager.

CHAIN OF CUSTODY

PAGE OF

Date Rec'd in Lab: 7/2/20

ALPHA Job #: L2027791

Westborough, MA TEL: 508-898-9220 FAX: 508-898-9193
Mansfield, MA TEL: 508-822-9300 FAX: 508-822-3288

Client Information

Client: Geotesting Expres
Address: 125 Nagog park Acton, Ma 01720
Phone: 978-893-1267
Fax:
Email: emarro@geotesting-com
☐ These samples have been Previously analyzed by Alpha

Project Information

Project Name: Fort Calhoun Station
Project Location: Blair, NE
Project #: 311971
Project Manager: Ethan M. Marro
ALPHA Quote #:

Turn-Around Time

☐ Standard ☐ Rush (ONLY IF PRE-APPROVED)
Due Date: Time:

Other Project Specific Requirements/Comments/Detection Limits:

Report Information — Data Deliverables

☐ FAX ☐ EMAIL
☐ ADEx ☐ Add'l Deliverables

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements/Report Limits

State/Fed Program | Criteria

ANALYSIS

EPA 9060 - Total organic carbon

SAMPLE HANDLING
Filtration
☐ Done
☐ Not Needed
☐ Lab to do
Preservation
☐ Lab to do
(Please specify below)

TOTAL # BOTTLES

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	Sample Specific Comments
27791-01	SB-33 KD					

Container Type
Preservative

Relinquished By:	Date/Time	Received By:	Date/Time
	7/1/20 17:17		7/2/20 12:17
	7/2/20 1615		7/2/20 12:17
	7/2/20 0400	T. Hudder	7/2/20 0400
T. Hudder	7/2/20 0570	-AAL	7/2/20 05:10

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Payment Terms.

FORM NO: 01-01D-NJ (rev. 8-JAN-12)

APPENDIX H

Well Survey Results

HALEY & ALDRICH, INC.
75 Washington Road, Suite 1A
Portland, Maine 04101
207.482.4600

MEMORANDUM

13 April 2021
File No. 0127960-006

TO: Scott Zoller
EnergySolutions

FROM: Haley & Aldrich, Inc.
Jeremy Gerger
Senior Scientist
Nadia Glucksberg
Program Manager

SUBJECT: Fort Calhoun Nuclear Power Station - Well Research

A search on the Nebraska Department of Natural Resources Permits & Registrations Division, Groundwater Section database and web viewer, and the Iowa Geological Survey web viewer, yielded 92 active wells within the approximate search radius identified in Figure 1 from the Fort Calhoun Nuclear Power Plant (power plant), located at Power Lane in Blair, Nebraska. The well search was concentrated in the flood plain approximately 2.5-miles upstream and 4.5-miles downstream from the power plant.

A review of the well databases revealed that there are 31 domestic/private wells, seven geothermal heating wells, 13 irrigation wells, six public water wells (for recreation areas), 27 environmental monitoring wells, and four commercial/industrial wells, within the search area identified in Figure 1. Four wells did not have an identifiable purpose. Domestic and irrigation well information is provided on Table 1. Remaining well information is provided on Table 2. A short description of each is below:

- **Domestic Wells.** Fifteen of the 31 domestic wells encountered either shale (six wells between 130 to 255 feet bgs with an average static water level of approximately 137.7 feet bgs) or limestone (nine between 34 to 279 feet bgs with an average static water level of approximately 75.2 feet bgs). Each of the 31 screens were installed in sand or straddled a sand/clay interval.

- **Irrigation Wells.** Of the 13 irrigation wells that were mainly located in Iowa, six encountered bedrock. The deepest irrigation well encountered shale at approximately 180 feet bgs and was screened in sandy clay from 165 to 175 feet bgs. The static water level for this well was approximately 148 feet bgs. Five other irrigation wells encountered limestone ranging from approximately 68 to 110 feet bgs. These wells had an average static water level of approximately 7.4 feet bgs and each were screened in sand and gravel.

- **Public Water Supply Wells.** The six public water supply wells are located in Iowa in either the Wilson Island State Recreation Area or the Desoto National Wildlife Refuge. The database was deficient with information regarding these wells; however, each was terminated less than 100-feet bgs with static water levels ranging from 14 to 36 feet bgs.

- **Geothermal Wells.** Two of the seven geothermal wells encountered bedrock. One of the wells encountered limestone at approximately 190 feet bgs, then shale at 197 feet bgs, and finally limestone again at 200 feet bgs where the boring was terminated. The other geothermal well encountered shale at approximately 200 feet bgs where the boring was terminated. There is no well screen data for these wells as they are 'closed-loop' systems with no well screen present.

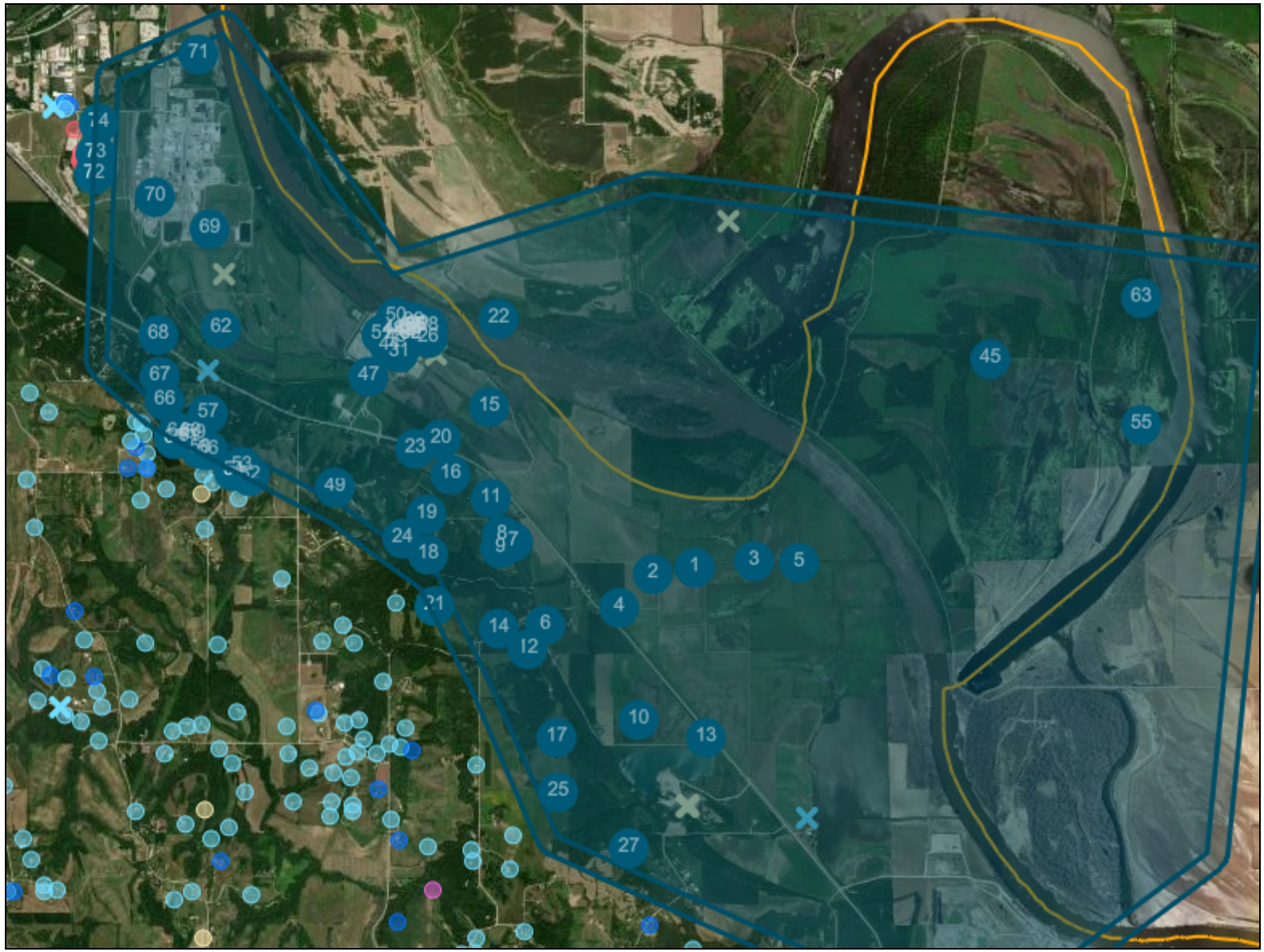
- **Monitoring Wells.** Although monitoring wells are not relevant for a resident farmer scenario, they do provide state water levels of the shallow aquifer. Static water levels of the monitoring wells range/ranged between approximately 5 to 20 feet bgs. The average static water level for the monitoring wells with data available is 15.3 feet bgs. None of the monitoring wells were installed in bedrock (i.e. limestone or shale). Well screens were installed primarily in sand, with the exception of a few wells that straddled a clay and/or silt and sand interval.

- **Commercial/Industrial Wells.** One of the commercial/industrial wells identified did not have a well log available on the database; however, the static water level for the well was 10 feet bgs. Two other commercial/industrial wells were both drilled to approximately 70 feet bgs with one of the wells tagging limestone at the bottom of the boring. The static water level for one of the wells was approximately 18 feet bgs. The static water level for the other commercial/industrial well was inaccurate. Although the well was installed to approximately 70 feet bgs, the static water level was recorded as 100 feet bgs. Both wells were screened in sand and one contained a thin, approximately 2-foot, layer of clay. The final commercial/industrial well identified in the search tagged limestone at approximately 48 feet bgs, had a static water level of 12 feet bgs and was screened from 37 to 47 feet bgs in sand.

- **Other.** Three of the four Nebraska wells with an unidentified purpose tagged limestone at either 54, 74 or 90 feet bgs. Each of the well screens were installed in sand and static water levels ranged from 12 to 35 feet bgs.

NEBRASKA
DEPT. OF NATURAL RESOURCES

Wells Near Ft. Calhoun Power Station



Legend

- Counties
- NRDs
- SubSections
- Active, Registered Wells
- X Unregistered Wells

Well Use Descriptions

- X Aquaculture
- X Commercial/Industrial
- X Dewatering (>90 Days)
- X Domestic
- X Geothermal
- X Ground Heat Exchange
- X Heat Pump Well (Open)
- X Injection
- X Irrigation
- X Livestock
- X Monitoring (Quality)
- X Observation (Quantity)
- X Other
- X Pit (Excavation)
- X Recovery
- X Unspecified

0 1.5 3 mi

Disclaimer

This map is a user generated static output from an Internet mapping site and is for reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable.

THIS MAP IS NOT TO BE USED FOR NAVIGATION

Notes Fort Calhoun Flood Plain Search

Printed Date 2/15/2021 12:51:00 PM

Table 1
Well Survey Results Summary
Domestic and Irrigation Wells
Fort Calhoun Station
Blair, Nebraska

Well ID	Registration Number	Well Type	LAT	LONG	Top of Well Screen	Bottom of Well Screen	Static WL
97900	G-086412	Domestic	41.501357	-96.046138	50	55	9
97575	G-086200	Domestic	41.500798	-96.050597	23	30	9
118425	G-100661	Domestic	41.498117	-96.054085	10	23	9
99336	G-087486	Domestic	41.496799	-96.06209	117	122	100
119033	G-101202	Domestic	41.503439	-96.065526	110	120	92
113251	G-097504	Domestic	41.503929	-96.0667	80	120	53
118170	G-100951	Domestic	41.502898	-96.066919	188	198	160
118965	G-101572	Domestic	41.506907	-96.067862	15	48	11
252761	G-185127	Domestic	41.49475	-96.06394444	45	50	32
95059	G-084528	Domestic	41.4878	-96.044883	30	35	12
142842	G-117591	Domestic	41.496518	-96.067019	245/265	255/275	219
161227	G-129224	Domestic	41.50877778	-96.07216667	120/133	130/138	103
103934	G-093764	Domestic	41.50241	-96.074563	75	85	46
156437	G-125696	Domestic	41.51163889	-96.07325	128	138	100
150630	G-122178	Domestic	41.49830556	-96.07391667	185	195	157
173135	G-137745	Domestic	41.51091667	-96.07602778	164	174	100
187925	G-146499	Domestic	41.48331667	-96.06065	63	73	24
97304	G-085929	Domestic	41.50872	-96.093593	177	187	135
106589	G-091509	Domestic	41.509112	-96.095403	282	292	242
148284	G-120479	Domestic	41.512833	-95.998314	25	35	19
166467	G-132787	Domestic	41.51075	-96.09816667	260	270	218
166184	G-132632	Domestic	41.51369444	-96.09805556	180	200	145
171372	G-136447	Domestic	41.51088889	-96.09891667	238	248	213
262595	G-190170	Domestic	41.51219444	-96.09991666	237	247	194
158928	G-127456	Domestic	41.51177778	-96.10008333	218	228	185
150838	G-122369	Domestic	41.522992	-95.998326	23	33	15
196267	G-151743	Domestic	41.51222222	-96.10138889	241	248	204
243020	G-179398	Domestic	41.51169444	-96.10166667	208	218	183
129525	G-109543	Domestic	41.514705	-96.10278	228	233	195
114634	G-097796	Domestic	41.520023	-96.103383	137	142	92
222614	G-165811	Domestic	41.54251667	-96.09916111			
90060		Irrigation	41.53972222	-96.0805555600	40	60	12
19909		Irrigation	41.545264	-96.069234			5
39044		Irrigation	41.555762	-96.066524	62	82	11
33137		Irrigation	41.556847	-96.060487	70	90	11
33136		Irrigation	41.553427	-96.050821	60	80	10
50940		Irrigation	41.545195	-96.061682	58	78	4
30178		Irrigation	41.527839	-96.060558	54	69	11
29285		Irrigation	41.4952990000	-95.989589	86	110	10
63931		Irrigation	41.4877	-95.9882	61	101	10
29284		Irrigation	41.4858100000	-95.9823110000	61	101	7
36669		Irrigation	41.481306	-95.976588	72	95	4
29283		Irrigation	41.477113	-95.9839950000	41	81	7

Table 2
Well Survey Results Summary
Additional Area Wells
Fort Calhoun Station
Blair, Nebraska

Well ID	Registration Number	Well Type	LAT	LONG	Top of Well Screen	Bottom of Well Screen	Static WL
251574	G-184477	Other	41.50192778	-96.03978056	54	74	12
251575	G-184478	Other	41.50172222	-96.03487778	61/69.5	67/89.5	14
95060	G-084529	Other	41.4891851	-96.05205481	41	51	35
131716	G-109803	Commercial/Industrial	41.51418056	-96.06813333	50.9	60.9	101
94474	G-084129	Livestock	41.487771	-96.060769	165	175	148
140317	G-115791	Ground Heat Exchanger well - Closed Loop Heat Pump well	41.50563889	-96.07472222			
131715	G-109802	Commercial/Industrial	41.521254	-96.06706			10
211531	G-159683	Ground Heat Exchanger well - Closed Loop Heat Pump well	41.50366667	-96.07733333			
131708	G-109801A	Monitoring (Ground Water Quality)	41.519811	-96.074618			18
235784	G-174730	Ground Heat Exchanger well - Closed Loop Heat Pump well	41.47882778	-96.0532			
131709	G-109801B	Monitoring (Ground Water Quality)	41.520634	-96.074622			18
214519	G-161564C	Monitoring (Ground Water Quality)	41.52081111	-96.07563889			10
264053	G-191156C	Monitoring (Ground Water Quality)	41.52000833	-96.076475			13.4
214518	G-161564B	Monitoring (Ground Water Quality)	41.51858889	-96.07773056			5
264051	G-191156A	Monitoring (Ground Water Quality)	41.52005833	-96.076475			13.4
189482	G-147837A	Monitoring (Ground Water Quality)	41.52036667	-96.07621111			15.1
189489	G-147837H	Monitoring (Ground Water Quality)	41.52035278	-96.076225			15
189491	G-147837J	Monitoring (Ground Water Quality)	41.52066389	-96.07602778			15.1
189490	G-147837I	Monitoring (Ground Water Quality)	41.52067778	-96.07601667			13.8
189487	G-147837F	Monitoring (Ground Water Quality)	41.52059444	-96.07653056			16.9
189488	G-147837G	Monitoring (Ground Water Quality)	41.52058333	-96.07654167			17.3
189492	G-147837K	Monitoring (Ground Water Quality)	41.52108889	-96.07611667			15.8
189485	G-147837D	Monitoring (Ground Water Quality)	41.52022222	-96.07704167			17.1
189486	G-147837E	Monitoring (Ground Water Quality)	41.52020833	-96.07705556			17.2
189494	G-147837M	Monitoring (Ground Water Quality)	41.52029722	-96.07723333			
264052	G-191156B	Monitoring (Ground Water Quality)	41.5197	-96.07793611			14.7
133206	G-110639	Monitoring (Ground Water Quality)	41.51908624	-96.07867716			13
251573	G-184476	Other	41.51812778	-96.01452222	76	116	14
189483	G-147837B	Monitoring (Ground Water Quality)	41.52033889	-96.07809722			17.3
214517	G-161564A	Monitoring (Ground Water Quality)	41.51666111	-96.08096944			15
189484	G-147837C	Monitoring (Ground Water Quality)	41.52032222	-96.07839444			17.5
192700	G-149467	Ground Heat Exchanger well - Closed Loop Heat Pump well	41.50775	-96.08461111			
189493	G-147837L	Monitoring (Ground Water Quality)	41.52141667	-96.07801389			14.7
177042	G-140336	Commercial/Industrial	41.52005556	-96.0795	50	70	18
107934	G-092618	Ground Heat Exchanger well - Closed Loop Heat Pump well	41.509412	-96.094423			
262597	G-190173	Ground Heat Exchanger well - Closed Loop Heat Pump well	41.51208333	-96.09944444			194
93726	G-083661A	Monitoring (Ground Water Quality)	41.520549	-96.096737			8
185771	G-145222	Ground Heat Exchanger well - Closed Loop Heat Pump well	41.51663889	-96.10316667			
217573	G-163030	Monitoring (Ground Water Quality)	41.52846667	-96.09792778			13
113636	G-097024	Commercial/Industrial	41.531049	-96.103693	37	47	12
234869	G-174034A	Monitoring (Ground Water Quality)	41.53291389	-96.11023333			5
234870	G-174034B	Monitoring (Ground Water Quality)	41.5345	-96.11011111			4.3
200353	G-153892B	Monitoring (Ground Water Quality)	41.53702	-96.109819			
16911		Public Water Supply	41.548545	-96.027979	50	70	