Final Construction Completion Report
Gas Hills, Wyoming Site

VOLUME V
GAS HILLS POND NO. 2

June 2007

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FINAL CONSTRUCTION COMPLETION REPORT INDEX
GAS HILLS, WYOMING SITE

Volume I	Overview*
Volume II	Heap Leach Construction Completion Report
Volume III	Above-Grade Tailings Impoundment Construction Completion Report
Volume IV	Construction Completion Report for the A-9 Repository and C-18 Pit
Volume V	GHP-2 Construction Completion Report

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* Although Volumes II through V are intended to be largely stand-alone reports, Volume I is necessary as it presents important information related to license termination and transfer of the site. It also documents all erosion protection quality control test results—e.g., rock durability and gradation tests—which apply to all construction areas.

For Volumes II through V, two binders are provided. The first includes the main text and appendices documenting the quality control test results. Plates are provided separately in the second binder.

Volume V Contents

Volume V Contents

VOLUME V LIST OF TABLES

VOLUME V LIST OF FIGURES

Volume V Contents

GHP-2 DRAWINGS AND PLATES

Volume V Contents

Volume V Contents

Definition of Terms

Acronym / Abbreviation	Definition
ASTM	American Society for Testing and Materials
CH	Fat Clay
CL	Lean Clay
cm/s	centimeter per second
cm^2/s	centimeters squared per second
CY	cubic yards
D_{50}	Minimum median particle size
FSSR	Final Status Survey Report
GHP	Gas Hills Pond (e.g., GHP-1)
g/cm^3	grams per cubic centimeter
ISRM	International Society for Rock Mechanics
µR/hr	microRoentgens per hour
n	number
NA	Not Applicable
NESHAPS	National Emission Standards for Hazardous Air Pollutants
NP	non-plastic
NRC	U. S. Nuclear Regulatory Commission
pcf	pounds per cubic foot
pCi/g	picoCuries per gram
pCi/m^2s	picoCuries per square meter per second
PI	plastic index
PM	percent moisture
Ra-226	Radium-226
SC	Clayey sand (ASTM designation)
SM	Silty sand (ASTM designation)
SSD	Saturated surface dry
TER	Technical Evaluation Report

1.0 INTRODUCTION

This volume of the Construction Completion Report documents the conduct and completion of reclamation construction activities for the Gas Hills Pond No.2 (GHP-2)/Mill Area at the Umetco Minerals Corporation (Umetco) former uranium mill site located in East Gas Hills, Wyoming (Figure 1.1). The Gas Hills site is licensed by the U.S. Nuclear Regulatory Commission (NRC) under Source Materials License SUA-648, Docket No. 40-0299 to possess byproduct material in the form of uranium tailings, as well as other radioactive wastes generated by past milling operations. All construction work described herein was performed in accordance with the specifications documented in the design report entitled *Final Design and Reclamation Plan for GHP No. 2/Mill Area* (Umetco 2003a) and the *Report Amending Final Design and Reclamation Plan for GHP No. 2/Mill Area* (Umetco 2006a). This plan was approved by the NRC on November 1, 2003 (License Amendment 52). Drawing 1 shows the final as-built topography and erosion protection placement for GHP-2 demonstrating construction completion.

1.1 Area Description and Background

GHP-2 is a former 17-acre groundwater evaporation pond that was constructed in the former mill process area at the site in 1996. During pond construction, it was necessary to remove remaining mill foundations, process facilities, and related mill utilities. Groundwater was pumped into the pond until March 2002, when the groundwater corrective action program was terminated upon the NRC's approval of Umetco's Alternate Concentration Limits proposal.

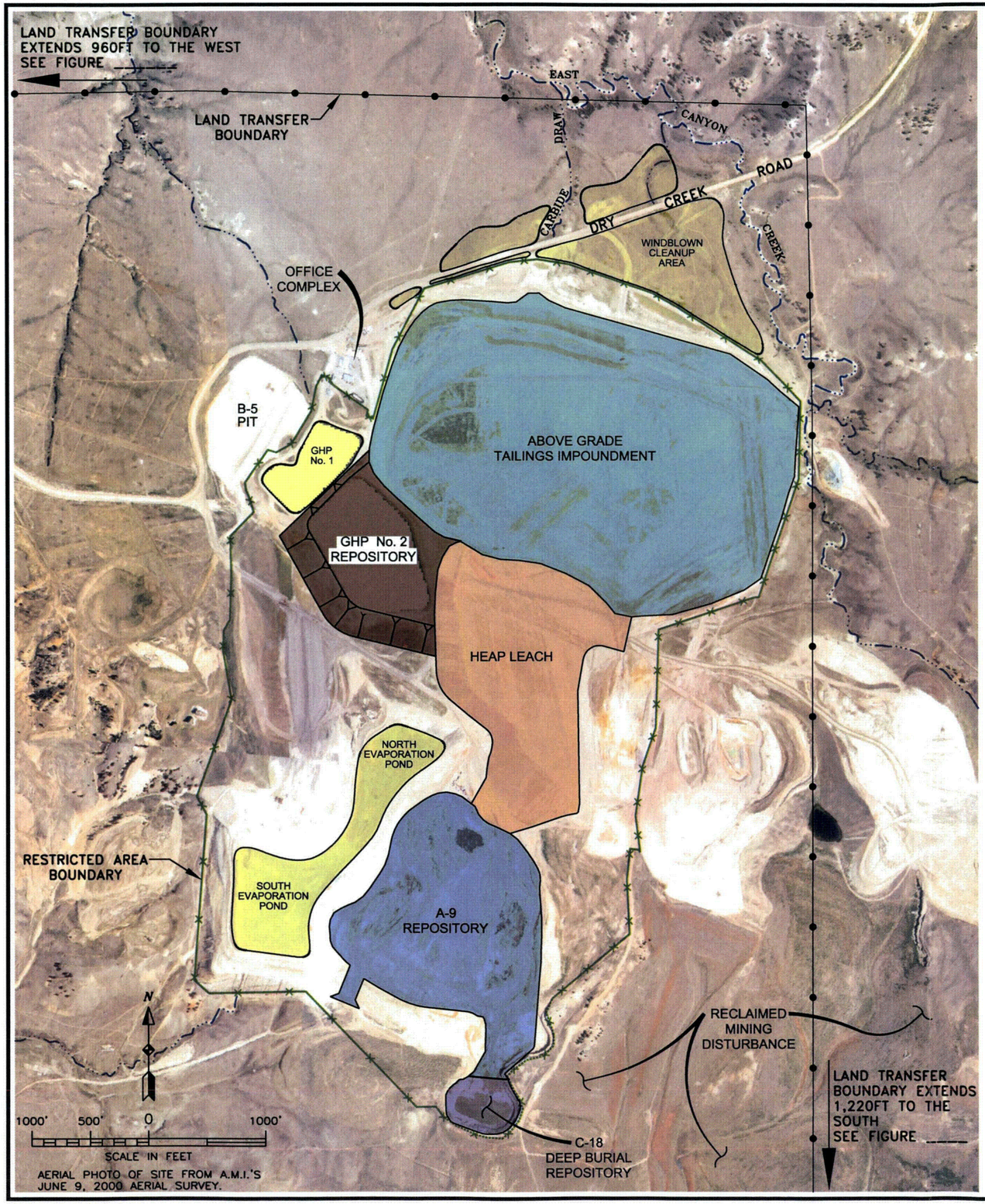
Although initially addressed in the 1996 reclamation plan entitled *Heap Leach Reclamation Plan Modifications and Reclamation Plan for GHP No. 2/Mill Area*, not enough data were available to support a design at that time, as groundwater corrective action activities were still ongoing. Therefore, Umetco submitted a revised plan in 2003—*Design and Reclamation Plan for GHP No. 2/Mill Area*—which was approved by License Amendment 52 on November 10, 2003 (see Attachment 1). The key components of the plan—i.e., the primary scope of work addressed herein—included solidification of the remaining liquids, removal of the pond lining system, and placement of an engineered cover consisting of a 1-ft thick radon barrier, a 4.5-ft thick frost protection layer, and erosion protection material.

1.2 License Condition and Related Submittals

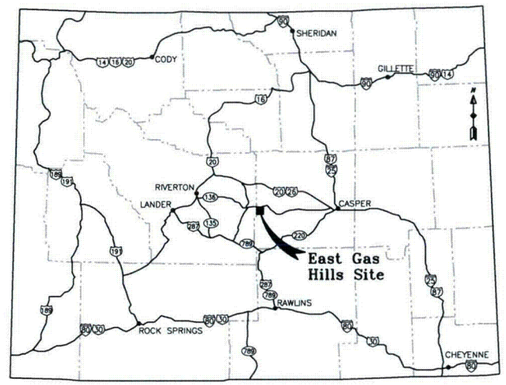
The requirements for reclamation of GHP-2 are established in SUA-648 License Condition 61, which states the following:

> The reclamation of Pond No. 2 will be performed according to the final plan submitted on September 11, 2003, as supplemented by a revised submittal dated February 7, 2006. [Applicable Amendments: 52, 58]

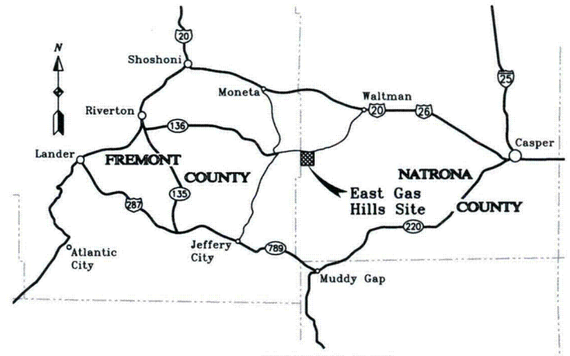
This report will demonstrate that the conditions of this license condition have been met and that the completed construction at the GHP-2 satisfies the requirements set forth in 10 CFR 40 Appendix A regarding stability and radon flux.



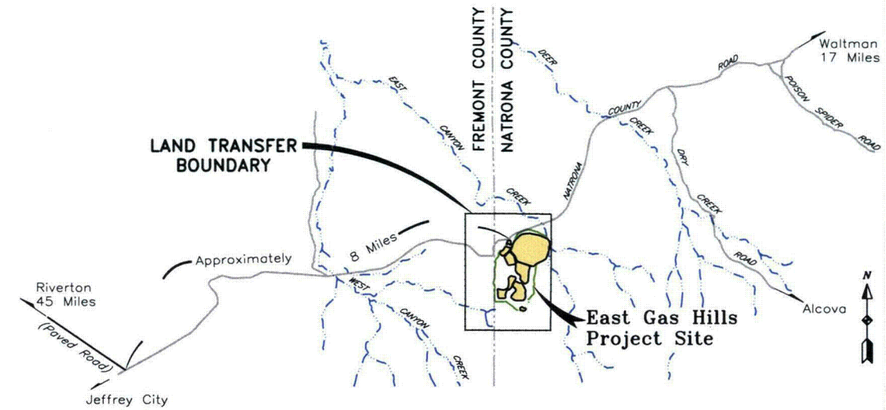
AERIAL PHOTO OF SITE FROM A.M.I.'S JUNE 9, 2000 AERIAL SURVEY.



STATE OF WYOMING
NOT TO SCALE



VICINITY MAP
NOT TO SCALE



LOCATION MAP
NOT TO SCALE

LEGEND:

- ABOVE-GRADE TAILINGS IMPOUNDMENT
  RADON BARRIER LIMITS = 170.59 AC
  REPOSITORY LIMITS = 170.24 AC
- HEAP LEACH REPOSITORY
  RADON BARRIER LIMITS = 48.91 AC
  REPOSITORY LIMITS = 56.93 AC
- A-9 REPOSITORY
  RADON BARRIER LIMITS = 51.29 AC
  REPOSITORY LIMITS = 61.70 AC
- GHP No. 2 REPOSITORY
  RADON BARRIER LIMITS = 35.73 AC
  REPOSITORY LIMITS = 46.14 AC
- C-18 DEEP BURIAL REPOSITORY
  REPOSITORY LIMITS = 5.97 AC
- FINAL STATUS SURVEY AREAS
- LAND TRANSFER BOUNDARY
- RESTRICTED AREA BOUNDARY
- FEATURE BOUNDARIES
- DRAINAGEWAYS

LEGAL DESCRIPTION OF LAND TRANSFER BOUNDARY:

LAND TRANSFER BOUNDARY INCLUDES ALL OF SECTION 15, THE NORTH HALF OF SECTION 22, THE NORTHEAST QUARTER OF SECTION 21, THE EAST HALF OF SECTION 16, THE SOUTHEAST QUARTER OF SECTION 9 AND THE SOUTH HALF OF SECTION 10, ALL LOCATED IN TOWNSHIP 33 NORTH, RANGE 89 WEST OF THE SIXTH PRINCIPAL MERIDIAN. SAID LAND CONTAINS APPROXIMATELY 1920 ACRES.

UMETCO MINERALS CORPORATION

SITE PLAN AND LOCATION MAP

GAS HILLS, WYOMING

JUNE 2007 FIGURE 1.1

GH-Loc-Map-Fig-1-1.dwg

As discussed in Volume I, this Construction Completion Report is the final in a series of submittals demonstrating that the Gas Hills site meets the requirements for license termination. The other two key submittals related to GHP-2 reclamation are described in the following bulleted items:

- *Report Amending Final Design and Reclamation Plan for GHP No.2/Mill Area* (February 7, 2006). This report is key in that it documents the data and rationales supporting Umetco's request to modify the radiological cover criteria for GHP-2 and also documents the results of the radon barrier verification sampling. These issues are discussed at greater length in Sections 2 and 7 (also refer to Attachment 2, License 58).

- *Final Status Survey Report Addendum 3* (January 22, 2007). The third and final addendum to Umetco's Final Status Survey Report, this submittal documents the radon-222 emission rate measurements and gamma exposure survey for the GHP-2 cover, which demonstrate conformance with the applicable criteria in 10 CFR 40, Appendix A. As of June 2007, the NRC is currently reviewing this report.

1.3 Volume V Organization

The completion of this work in accordance with the approved plan is demonstrated primarily in the quality assurance/quality control test records provided in the appendices and the as-built drawings. To facilitate review, final as-built drawings are provided in two formats—standard plates (provided in the following binder), allowing examination of all construction details and final topography and, for easier access and reference, 11 x 17 inch format. Although this volume is intended to serve largely as a stand-alone report, Volume I is requisite reading, as it presents important information regarding the quality and placement of erosion protection materials for all repository areas (Volume I, Section 5).

Following this introduction, Section 2 presents pertinent background information, in particular discussing the recent License Amendment (No. 58) which modified the GHP-2 cover criteria. Section 3 provides an overview of the GHP-2 reclamation plan, including a summary of all related submittals and NRC comments and subsequent approvals. Section 4 summarizes the construction activities, documenting the volumes of material placed and corresponding quality control testing procedures. Section 5 describes the construction activities and summarizes the results of the quality control testing for all soil placement (contaminated fill placement, radon barrier, and frost protection).

Section 6 documents the erosion protection placement, referencing Volume I for additional details. Section 7 documents the final radiological status of GHP-2, including the frost protection radium-226 (Ra-226) content, results of radon-222 flux measurements, and gamma exposure survey results. Section 8 summarizes the findings of this construction completion report; references are provided in Section 9. Quality control test results are provided in the appendices.

Finally, Attachments 1 and 2 duplicate the key NRC approval letters and supporting Technical Evaluation Reports (TERs) affecting the GHP-2 reclamation. These include the approval of the September 2003 design plan (License Amendment 52, Attachment 1), and the more recent modifications to the radiological cover criteria (License Amendment 58, Attachment 2).

2.0 BACKGROUND

2.1 Initial Construction and Characterization Activities

GHP No. 2 was constructed in the former mill process area at the Gas Hills site in 1995 and 1996. Construction activities included removing remaining mill foundations, process facilities, and related mill utilities. The primary function of the pond was to contain and evaporate groundwater extracted under the NRC-approved groundwater corrective action plan. Pumping of groundwater into the pond was terminated in March 2002, upon the NRC's approval of the Alternate Concentration Limits for the site (Amendment 48, March 29, 2002).

Site characterization studies conducted during the early phase of pond construction (summer and fall of 1995) indicated that the pond area contained a significant volume of contaminated soil and foundation debris that had not removed during the initial mill demolition activities at the site. Although the pond was built on natural mineralization, given its location coinciding with the former mill process area, combined with the presence of byproduct material resulting from the groundwater corrective action program, Umetco elected to cover the pond in place as documented in the following sections.

2.2 GHP-2 Cover Radiological Criteria Modifications

At the outset, it is important to address the fact that the allowable Ra-226 cover (frost protection) content and gamma exposure rate for Gas Hills repositories—initially 10 picoCuries per gram (pCi/g) and 30 microRoentgen per hour (μR/hr) for the Heap, Above-Grade Tailings Impoundment, and the A-9 Repository—were ultimately increased for GHP-2. As approved by License Amendment 58 (November 22, 2006)[†], the allowable Ra-226 cover (frost protection) content for GHP-2 was increased from 10 to 15 pCi/g, with a concomitant increase in the allowable gamma exposure rate from 30 μR/hr to 40 μR/hr.

The factors underlying this approved modification in the GHP-2 cover criteria are documented in detail in the February 2006 submittal entitled *Report Amending Final Design and Reclamation Plan for GHP No.2/Mill Area* (Umetco 2006a) and only briefly summarized here.

Between 1997 and 2004, close to 1.5 million cubic yards of frost protection material excavated from various borrow areas were placed on the Heap Leach, Above-Grade, and A-9 repositories (see Volume I, Section 3). By the time GHP-2 reclamation activities commenced in 2005, the volume of available soils meeting the initially established 10 pCi/g (background) criterion was diminishing. This was due to the highly variable radium content of background soils at and surrounding the Gas Hills site, an issue that has been addressed at length in the Final Status Survey Report (FSSR, Umetco 2003, 2004). The conclusions drawn in the FSSR were corroborated in the September 27, 2004 TER documenting the NRC's approval:

> *"Background Ra-226 and uranium values are difficult to quantify because the site is on land containing natural deposits of uranium, open pit uranium mines are on and adjacent to the site, and the Wyoming Abandoned Mines Program has used*

[†] This amendment also approved an increase in the allowable Ra-226 in C-18 Pit backfill soils from 5 pCi/g to 10 pCi/g as documented in Volume IV.

mine overburden (spoils) to fill some adjacent open pit mines so that surface soil contains up to 20 pCi/g Ra-226."

During placement of frost protection materials in 2005, it was apparent that, due to the fact that the cleanest borrow area soils—i.e., those containing the lowest Ra-226 content—were essentially depleted from construction of the previous repository covers. As part of the quality control program for the other repositories, Umetco had rejected a substantial volume of frost protection material in order to meet the previously established 10 pCi/g criterion. Therefore, on February 7, 2006, Umetco submitted a request for an amendment to License Condition 61, summarized above. This amendment was approved by the NRC by License Amendment 58 on November 22, 2006. The supporting TER (October 12, 2006, provided in Attachment 2), stated the following:

"After reviewing site background data, the NRC determined that a Ra-226 activity of 15 pCi/g is a more realistic value than the previously approved 10 pCi/g. This complies with Appendix A, Criterion 6(5)..."

and, regarding the allowable gamma exposure rate:

Evaluation of area surveys on and off the site indicates that background values vary greatly, from 16 to 97 μR/hr. Determining an accurate background for the site is subject to bias due to the great variance of the area's radiation levels. An appropriate background would be one that is conservatively estimated considering site background data and radium values in the area. NRC staff has concluded that the proposed value of 40 μR/hr does not pose a significant risk to public health, safety, and the environment. NRC staff has determined that the new average allowable exposure rate of 40 μR/hr satisfies 10 CFR Part 40, Appendix A, Criterion 6(1).

3.0 OVERVIEW OF GHP-2 RECLAMATION PLAN AND MODIFICATIONS

This section presents an overview of the 2003 reclamation plan—*Final Design and Reclamation Plan for GHP No. 2/Mill Area*—on which the GHP-2 cover design and construction documented herein was based. This plan was initially submitted by letter dated May 9, 2003. In response to the NRC's request for additional information (August 14, 2003), a final revised plan was submitted on September 11, 2003. To facilitate review, Table 3.1 provides a cross-reference to this plan. Table 3.2 documents the plan submittal history, including revisions and NRC approvals. Tables 3.3 and 3.4 summarize the parameters used for the GHP-2 radon flux modeling (i.e., the cover radon attenuation design), a key component of the design plan. These table reflect two runs, the first representing a conservative upper-bound (in terms of tailings radium content), and a second more representative run, which utilized updated measurements.

3.1 Scope of Work

The reclamation design for the GHP No. 2 pond area was developed to provide long-term closure and stabilization of the area in accordance with the requirements of 10 CFR Part 40, Appendix A. Initial work included solidification of the remaining liquids and evaporative residue (2005) followed by removal and disposal of the pond liner. The key components of the design and ultimate construction included the following:

- Placement of a 12-inch thick radon barrier layer[‡] (with verification sampling);
- Placement of a 54-inch thick frost protection layer; and
- Placement of an erosion protection on a one-percent top slope and 20 percent side slope as shown on Drawings 1 and 12.

In this final plan, because significantly less contaminated material would be placed in the pond, the radon barrier was reduced from 18 to 12 inches (with more rigorous testing and verification requirements). Also, the erosion protection layer thickness for the side slope was increased by one inch and the diameter of the rock increased in the final plan.

3.2 2003 Plan Modifications and NRC Approval

As summarized in Table 3.2, after the initial May 2003 submittal, only one modification was necessary to finalize the reclamation plan in response to NRC comments. Design endpoints modified included revisions to the radon attenuation model (e.g., Ra-226 content of radon barrier), a revised toe apron design, and inclusion of a bedding layer in the channel. Since approval of the plan on November 10, 2003 (Attachment 1), the only major modification in design criteria was that corresponding to radiological criteria discussed in Section 2.2 (see Attachment 2).

[‡] One of the major differences in the final design for GHP-2 (vs. the preliminary design submitted in 1996) is that, because, significantly less contaminated material was placed in the pond than initially estimated, the radon barrier thickness was reduced from 18 to 12 inches (with subsequent Ra-226 verification sampling).

Table 3.1 2003 Final Design and Reclamation Plan for GHP No. 2/Mill Area: Summary of Contents

Preface: The reclamation plan, entitled *Final Design and Reclamation Plan for GHP No. 2/Mill Area, Revision1* was submitted in September 11, 2003 and was approved by the NRC with modifications on November 22, 2006 (Amendment No. 58, License Condition 61).

Part or Section No.	Title	Description of Contents (left blank if section title is sufficiently descriptive)
Design and Specifications		
Section 1	Introduction	Background information and design overview
Section 2	Radon Attenuation Design	Radon flux modeling input parameters for contaminated fill, radon barrier cover and frost protection cover, and model results
Section 3	Geotechnical Design	Cover design and analyses for slope stability, settlement, cover cracking, liquefaction and frost protection
Section 4	Erosion Protection	Design storm and erosion protection design for cover and channel including layer thickness, scour depth and toe apron, filter requirements, gradations and sedimentation
Section 5	GHP No. 2 Reclamation Specifications	Liner removal and waste solidification, site grading, and placement of radon barrier, frost protection and erosion protection
Section 6	Quality Control Plan	QC testing procedures, documentation and frequencies
Appendices		
Appendix A	Radon Attenuation Design	Radon Attenuation Model and Subsurface Radium Data
Appendix B	Erosion Protection Calculations	

Table 3.2. GHP-2 Reclamation Plan Submittal History

Preface: License Condition 61, the primary license condition pertaining to the reclamation of GHP No. 2, states the following: The reclamation of Pond No. 2 will be performed according to the final plan submitted on September 11, 2003, as supplemented by a revised submittal dated February 7, 2006. [Applicable Amendments: 52, 58] *(The latter language reflects the most recent revised license as of April 2007.)* To facilitate review, the following table summarizes the contents of each of these submittals and any associated license condition changes.

Report or Submittal	Submittal Date(s)	Summary of Contents
Heap Leach Reclamation Plan Modifications and Reclamation Plan for GHP No. 2/Mill Area	September 25, 1996	Although GHP No.2 was initially addressed in this plan (its cover design was the same as that for the Heap Leach), in response to NRC questions, Umetco determined in February 1998 that data for the pond were limited because disposal there was not complete (i.e., the groundwater corrective action program was still ongoing). Umetco committed to submitting a final design for closure of Pond No. 2 when the required data were available. This occurred in 2003.
Final Design and Reclamation Plan for GHP No. 2/Mill Area	May 9, 2003	Submitted in accordance with Umetco's letter dated February 11, 1998 in which Umetco committed to provide a final design for closure of GHP No. 2/Mill Area when necessary data became available, i.e., volume and activity of remaining contaminated soils, etc
Submittals in Response to Subsequent NRC Written and Verbal Comments		
Final Design and Reclamation Plan for GHP No. 2/Mill Area, Revision 1	September 11, 2003	Umetco's responses to NRC comments and request for additional information dated August 14, 2003. Design endpoints modified included: • revisions to the radon attenuation model (e.g., Ra-226 content of radon barrier); • a revised toe apron design, and • inclusion of a bedding layer in the channel.
Note: Above revised plan approved by the NRC as License Amendment 52 dated November 10, 2003.		
Report Amending Final Design and Reclamation Plan, GHP No. 2/Mill Area	February 7, 2006	Revised to increase allowable radium-226 content in the frost protection and adjust exposure rate accordingly
Note: Above amendment approved by the NRC as License Amendment 58 dated November 22, 2006.		

Table 3.3 RADON Code Input Parameters Used as the Basis for the Reclamation Plan for GHP-2/Mill Area Design: Run 1

Input Parameter	Tailings	Radon Barrier	Frost Protection	Comment (Basis)
Radium content (average)	62 pCi/g	2 pCi/g	15 pCi/g	Radium value is maximum measured
Layer Thickness	16 ft	1.5 ft	4.5 ft	Value assumed for tailings value is default
Emanation Coefficient	0.262	0.20	0.262	Default values used for all input parameter layers.
Specific Gravity	2.65	2.65	2.65	Default value
Dry Density * (average)	1.75 g/cm^3 (109.2 pcf)	1.59 g/cm^3 (99.3 pcf)	1.75 g/cm^3 (109.2 pcf)	Site-specific measurements
Porosity	0.34	0.40	0.34	RADON-code calculated
Moisture Content (average long-term)	6 %	12%	6%	Default values used for tailings and frost values. For Radon Barrier used NRC parameter used for Heap Leach TER of 12%.
Diffusion coefficient* (all units = cm^2/s)	2.32 x 10^{-2} Calculated	3.1 x 10^{-3} Calculated	2.32 x 10^{-2} Calculated	RADON-code calculated

pcf pound per cubic foot

pCi/g picoCuries per gram

All values and assumptions listed above were accepted by the NRC, as documented in the Technical Evaluation Report supporting their approval of the modification of GHP-2 and C-18 Pit covers and corresponding license amendment (see Attachment 2). This modeling yielded radon flux values of 18.7 picoCuries per meter squared second (pCi/m^{2}s) for Run 1 and 14.7 pCi/m^{2}s for the Run 2 for GHP-2. NESHAPS sampling conducted in 2006 yielded an average radon flux of 6.8 pCi/m^{2}s. Both modeled and measured values are below the 20 pCi/m^{2}s criterion required by 10 CFR Part 40, Appendix A, Criterion 6(2).

Table 3.4 RADON Code Input Parameters Used as the Basis for the Reclamation Plan for GHP-2/Mill Area Design: Run 2

Input Parameter	Tailings	Radon Barrier	Frost Protection	Comment (Basis)
Radium content (average)	27 pCi/g	2 pCi/g	15 pCi/g	Tailings Ra-226 value based on 2006 drill data of subgrade. Radon and frost values are as specified in GHP-2 reclamation plan.
Layer Thickness	16 ft	1.5 ft	4.5 ft	Value assumed for tailings value is default
Emanation Coefficient	0.262	0.17	0.262	Default values used for tailings and frost values. Measured values used for Radon Barrier.
Specific Gravity	2.65	2.65	2.65	Default value
Dry Density * (average)	1.75 g/cm^3 (109.2 pcf)	1.59 g/cm^3 (99.3 pcf)	1.75 g/cm^3 (109.2 pcf)	Site-specific measurements
Porosity	0.34	0.40	0.34	RADON-code calculated
Moisture Content (average long-term)	6 %	12%	6%	Default values used for tailings and frost values. For Radon Barrier used NRC parameter used for Heap Leach TER of 12%.
Diffusion coefficient* (all units = cm^2/s)	2.32 x 10^{-2} Calculated	3.1 x 10^{-3} Calculated	2.32 x 10^{-2} Calculated	RADON-code calculated

pcf pounds per cubic foot

pCi/g picoCuries per gram

All values and assumptions listed above were accepted by the NRC, as documented in the Technical Evaluation Report supporting their approval of the Modification of Gas Hills Pond 2 and C-18 Covers and corresponding license amendment (License Amendment 58, November 22, 2006, TER dated October 12, 2006). This modeling yielded radon flux values of 18.7 picoCuries per meter squared second (pCi/m^{2}s) for Run 1 and 14.7 pCi/m^{2}s for the Run 2 for GHP-2. NESHAPS sampling conducted in 2006 yielded an average radon flux of 6.8 pCi/m^{2}s. Both modeled and measured values are below the 20 pCi/m^{2}s criterion required by 10 CFR Part 40, Appendix A, Criterion 6(2).

4.0 OVERVIEW OF GHP-2 CONSTRUCTION ACTIVITIES AND QUALITY CONTROL PROGRAM REQUIREMENTS

As a prelude to Section 5, this section provides an overview of the GHP-2 reclamation construction activities conducted in 2005 and 2006. Section 4.1 describes the initial activities which preceded the cover construction. Section 4.2 summarizes the quality control testing frequencies and methods implemented throughout the reclamation. Tables 4.1 summarizes the GHP-2 reclamation construction activities and associated quantities.

4.1 Initial (Pre-Construction) Activities

As summarized in Table 4.1, initial activities included solidification of the remaining pond liquids, followed by removal of the synthetic pond liner, which was sized and placed and compacted as contaminated fill. The remaining clay liner was then removed and stockpiled for use as radon barrier fill.

4.2 Quality Control Test Frequencies and Methods

As discussed in Volume I and as reflected in the approved GHP-2 reclamation plan, Umetco implemented a rigorous quality control testing program for all repository reclamation. Tables 4.2 and 4.3 summarize the GHP-2 plan specifications and quality control test frequencies.

As demonstrated in the following section and supporting appendices, the required test frequencies were met and usually exceeded. Field density and moisture tests documented in the appendices and summarized in the following sections were taken using a nuclear density gauge. The gauge was field standardized at each test location and was correlated by a sand-cone test at a minimum frequency of one for every ten nuclear gauge tests. For non-clay material, field rock corrections were performed at each compaction test location. Material placed at densities lower than the specified minimum density or at moisture contents outside the specified acceptable range of moisture content were reworked to meet the density and moisture requirements or removed and replaced by acceptable fill compacted to meet these requirements.

For all soil placement, a sand-cone correlation test was performed for every 10 nuclear gauge tests or higher frequency. Correlations were deemed acceptable if the average of ten nuclear gauge test vs. sand cone test result comparisons met the following criteria: 1) wet density variation less than or equal to 3 percent, and moisture content variation less than or equal to 2 percent. As demonstrated in the appendices, the majority of results for discrete tests (vs. running average) were below the latter criteria.

Table 4.1. GHP-2 Construction Activities and Associated Quantities

Year	Activity	Cubic Yards Placed
	Contaminated Fill Layer	
2005	Reshaping and compaction of the contaminated fill layer	198,753
2006	" "	9,939
	Total Quantities Placed, Contaminated Fill:	**208,692**
	Radon Barrier Layer (1-ft thick)	
2005	Placement and compaction of clay for radon barrier layer	71,808
2006	" "	4,818
	Total Quantities Placed, Radon Barrier Layer:	**76,626**
	Frost Protection Layer (4.5 ft thick)	
2005	Placement and compaction of the frost protection layer	359,874
2006	" "	49,356
	Total Quantities Placed, Frost Protection Layer:	**309,230**
	Toe Apron	
2006	Placement and compaction of toe apron backfill	26,463
	Total Quantities Placed, Toe Protection:	**26,463**
Erosion Protection Placement (2006)		
Type A Rock – Bedding Material and top of cover		29,950
Type B Rock – Dike/channel area and tie-in to Heap and the Above-Grade		9,920
Type C Rock – Sideslope and channel outlet		15,488
	Total Quantities Placed, Erosion Protection:	**55,358**

Table 4.2 GHP-2 Reclamation Construction Specifications

Layer	Specifications / Requirements
Solidified Pond Liquids (Contaminated Fill)	• Lift thickness ≤ 12 inches (compacted depth) • Percent compaction: ≥ 95 percent of Standard Proctor maximum density
Radon Barrier (12-inch thick)	Soil Characteristics * • ≥ 50 % passing the No. 200 sieve • Maximum particle size of 1 inch • Liquid limit ≥ 25 percent • Plasticity index ≥ 10 • Average Ra-226 level = 2 pCi/g Placement • Lift thickness ≤ 6 inches (compacted depth) • Percent compaction: ≥ 95 percent of maximum density • Moisture content: ≥ Optimum, ≤ Optimum + 4 percent
Frost Protection (54-inch thick)	Soil Characteristics • Classification as SC and/or SC-SM (clayey and/or silty sand) • Initially < 10 pCi/g, later modified by License Amendment 58 approving < 15 pCi/g criterion (see Sections 2 and 7, TER provided in Attachment 2). Placement • Lift thickness ≤ 12 inches when compacted • Percent compaction: ≥ 95 percent of Standard Proctor maximum density • Moisture content: ≥ Optimum minus 2 percent
Erosion Protection	Placement of Type A, B, and C rock at the locations shown on Drawings 11 through 13.

Source: Final Design and Reclamation Plan for GHP No. 2/Mill Area (September 2003).

Table 4.3 GHP-2 Quality Control Test Frequencies and Methods

Test	Procedure	Standard	Frequency
Radon Barrier, Frost Protection Layer and Erosion Protection			
Field Moisture and Density	QC GHP – 10	ASTM D2922 ASTM D3017	1 test per 500 CY
Sand Cone Correlation	QC GHP – 10	ASTM D1556 ASTM D2216	1 test for every 10 nuclear gauge tests
Laboratory Compaction	QC GHP – 9	ASTM D698	1 test for every 10 or 15 field tests depending on the variability of soils.
Soil Classification • Particle Size Analysis • Atterberg Limits	QC GHP – 7 QC GHP - 8 QC GHP – 12	ASTM D2487 ASTM D4318 ASTM D1140 ASTM D422	1 test per 1000 CY
^{226}Ra Activity	Gamma Spectrometry	2 pCi/g average	1 test per 800 CY
Rock Durability • Gradation • Specific Gravity (SSD) • Absorption • Sodium Sulfate (5 cycles) • Abrasion (100 rev) • Schmidt Hardness • Petrographic Analysis	QC GHP – 12	ASTM C117, C136 ASTM C127 ASTM C127 ASTM C88 ASTM C131 ISMR Method ASTM C295	1 test per 10,000 CY Results of this testing are documented in Volume I, Section 5.
Contaminated Fill			
Field Moisture and Density	QC GHP – 10	ASTM D2922 ASTM D3017	1 test per 1000 CY
Sand Cone Correlation	QC GHP – 10	ASTM D1556 ASTM D2216	1 test for every 10 nuclear gauge tests
Laboratory Compaction	QC GHP – 9	ASTM D698	1 test for every 10 or 15 field tests depending on variability of soils.
Soil Classification • Particle Size Analysis • Atterberg Limits	QC GHP – 7 QC GHP - 8 QC GHP – 12	ASTM D2487 ASTM D4318 ASTM D1140 ASTM D422	1 test per 2000 CY

CY - cubic yards; NA - Not Applicable; SSD – saturated surface dry

5.0 CONSTRUCTION ACTIVITIES AND QUALITY CONTROL TEST RESULTS

This section describes the GHP-2 reclamation construction activities performed between 2005 and 2006 and summarizes the corresponding field and laboratory quality control test results. However, the completion of construction activities in accordance with the enhanced reclamation plan is demonstrated largely by the quality control test documentation provided in the appendices and in the following as-built drawings and plates:

Layer/Aspect	Drawing/Plate No.(s)
Final GHP-2 Site Plan	1
Contaminated Fill	2 and 3
Radon Barrier	4 – 6
Frost Protection	7 and 9
Toe Protection	8 and 10
Erosion Protection (addressed in Section 6)	11 – 13

For each layer or construction aspect, these drawings show the final contours and survey verification points, representative cross-sections, and corresponding quality control test locations. As stated in the introduction, these drawings are provided in two formats: standard plate (provided in the following binder) and, for easier access and reference, 11 x 17 format. Geotechnical quality control tests conducted during placement of these materials and documented in detail in the appendices include field density tests, laboratory Standard Proctors, sand-cone correlation tests, gradations, and Atterberg Limits.

5.1 Contaminated Fill

In 2005 and 2006, 208,692 cubic yards of contaminated fill material were placed as part of the GHP-2 reclamation (Table 4.1). Placement (daily load counts) and quality control test records associated with contaminated fill placement are documented in detail in Appendix A. Table A.1 lists the daily quantities and corresponding daily testing frequencies. Field compaction tests are documented in Table A.2. Table A.3 documents the Standard Proctor Test results, and Table A.4 presents the sand-cone correlation tests. As-built Drawing 2 shows the final contours and survey verification points; Drawing 3 shows the compaction test locations. Quality control tests results associated with these activities are summarized in Tables 5.1 and 5.2 for field and laboratory tests, respectively.

5.1.1 Placement

In accordance with the enhanced reclamation plan, fill materials were placed in maximum lift thicknesses of 12 inches (compacted depth) and were compacted to a minimum of 95 percent of the maximum density (ASTM D698). Of the 214 field compaction tests performed, only two tests failed (Appendix A, Table A.2), a very low percentage considering the volume of material. These areas were re-worked and re-tested yielding a testing frequency of 1 for every 975 cubic yards of material placed.

Table 5.1 Summary of Field Quality Control Test Results for the GHP-2 Cover Construction: 2005-2006

Layer	Total Yards Placed	Design (Plan) Requirements	Nuclear Density Gauge Test Results				Sand-Cone Correlation
			Frequency (No. of Tests)	Dry Density (pcf)	Percent Moisture	Percent Compaction	Frequency (No. of Tests)
Contaminated Fill	208,692 CY	Frequency: 1:1000 CY % Compaction: ≥ 95% % Moisture: NA	1:975 CY (n = 214)	*avg:* 114.8 *range:* 108.0 - 122.7	*avg:* 11.4 *range:* 5.4 - 19.1	*avg:* 97.9 *range:* 95.0 - 103.3	1:5 (n = 43)
Radon Barrier	76,626 CY	Frequency: 1:500 CY % Compaction: ≥ 95 % Moisture (PM): Opt. ≤ PM ≤ Opt.+4	1:470 CY (n = 163)	*avg:* 102.8 *range:* 96.2 - 108.6	*avg:* 22.1 *range:* 19.0 - 24.8	*avg:* 98.2 *range:* 95.0 - 102.7	1: 9 (n = 19)
Frost Protection	309,230 CY	Frequency: 1:500 CY % Compaction: ≥ 95 % Moisture: ≥ Opt. -2	1:486 CY (n = 636)	*avg:* 114.6 *range:* 104.8 – 124.1	*avg:* 13.1 *range:* 9.1 – 22.0	*avg:* 97.1 *range:* 94.8 - 102.9	1:9 (n = 71)
Toe Apron (2006)	26,463 CY	Frequency: 1:500 CY % Compaction: ≥ 95 % Moisture: ≥ Opt. -2	1:413 CY (n = 64)	*avg:* 116.4 *range:* 112.7- 124.3	*avg:* 12.4 *range:* 9.5 - 16.8	*avg:* 97.2 *range:* 94.9 - 104.2	1:8 (n = 8)

*All compaction results summarized above reflect percentages of the Standard Proctor maximum density (ASTM D698).
This summary reflects passing tests only; failed field tests resulted in re-compaction of the area and re-testing, as documented in detail in the appendices.

Abbreviations

avg	average (arithmetic mean)
CY	cubic yards
n	number
NA	Not Applicable
Opt.	Optimum
pcf	pounds per cubic foot
%	percent

Table 5.2 Summary of Laboratory Quality Control Test Results for the GHP-2 Reclamation Cover Construction

Layer	Design (Plan) Requirements	Laboratory Standard Proctor 1			Atterberg Limits			Soil Classification & Gradation
		Frequency (Number of Tests)	Maximum Dry Density (pcf)	Optimum Moisture (%)	Frequency (Number of Tests)	Liquid Limit Results	Plastic Index (PI) Results*	
Contaminated Fill: 208,692 CY	Gradation-Atterberg Frequency: 1:2000 CY	1:4743 CY (n = 44)	avg: 117.10 range: 112.7 – 119.5	avg: 13.1 range: 11.2 – 15.3	1:1897 CY (n = 110)	avg: 32.6 range: NP – 40	avg: 17.2 range: NP - 26	SC 91.8% SM 5.5% Other 2.7% (see Appendix A)
Radon Barrier 76,626 CY	Gradation-Atterberg Frequency: 1:1000 CY Liquid limit: ≥ 25 Plasticity index: ≥ 10 ≥ 50% passing #200 sieve Max. particle size = 1 inch	1:4257 CY = 1: 9.1 field tests (n = 18)	avg: 104.5 range: 101.0 – 107.9	avg: 20.3 range: 18.5 – 22.6	1: 923 CY (n = 83)	avg: 55.6 range: 44 – 72	avg: 38.9 range: 30 - 53	Fat Clay (CH): 96.4% Lean Clay (CL): 3.6% Percent passing #200 sieve: avg = 92.1% *range:* 82.0 – 97.5% Maximum particle size = <3/8" (#4 sieve).
Frost Protection 309,230 CY	Gradation-Atterberg Frequency: 1:1000 CY Unified Soil Classification: SC and/or SC-SM	1:4548 CY = 1: 9.4 field tests (n = 68)	avg: 118.1 range: 109.4 - 121.9	avg: 12.7 range: 10.2 - 16.6	1:954 CY (n = 324)	avg: 31.8 range: 26 - 41	avg: 16.3 range: 8 - 28	SC 79.0% SM 17.9% CL 1.5% Other 1.6% (see Appendix C)

[1] Proctor frequency requirements Proctor frequency requirements for all layers was 1 test for every 10 or 15 field tests, depending on the variability of soils. PI averages exclude non-plastic results for contaminated fill and frost protection material; see appendices for details.

Abbreviations

avg	average (arithmetic mean)
NP	non-plastic
CY	cubic yards
n	number
NA	Not Applicable
Opt.	Optimum
pcf	pounds per cubic foot

ASTM 2487 Term Definitions

CH	Fat Clay
CL	Lean Clay
SC	Clayey Sand
SM	Silty Sand

5.1.2 Quality Control Test Results

As summarized in Table 5.1 and in the inset below, based on 214 passing tests, contaminated fill soils were compacted to an average of 97.9 percent of the maximum Standard Proctor dry density, ranging from 95.0 to 103.3 percent. The maximum Standard Proctor dry density ranges from 112.7 to 119.5 pounds per cubic foot (pcf) (average of 117.1 pcf), with optimum moisture content ranging from 11.2 to 15.3 percent (average of 13.1 percent).

GHP-2 Contaminated Fill Field and Laboratory Compaction Test Results

	Dry Density (pcf)	**Percent Moisture**	**Percent Compaction**	**Maximum Dry Density** (pcf)	**Optimum Moisture** (%)
average:	114.8	11.4	97.9	117.1	13.1
range:	108.0 – 122.7	5.4 – 19.1	95.0 – 103.3	112.7 – 119.5	11.2 – 15.3
std. deviation:	2.6	2.6	2.0	1.4	0.9

Nuclear Gauge N = 214; frequency = 1 test for every 975 cubic yards placed
Proctor N = 44; frequency = 1 test for every 4743 cubic yards placed

Soil Classification. Although the reclamation plan required soil classification testing (particle size analysis and Atterberg Limits) at a frequency of 1:2000 cubic yards, there were no specifications as to the characteristics of the fill material—i.e., this testing was required for characterization purposes rather than as an indicator of cover integrity. As summarized in Table 5.2, the GHP-2 contaminated fill material consists primarily of SC (clayey sand, 92%), with 6 percent classified as (silty sand), and a small percentage ($\leq$ 1%) of other soil types. Additional information, including gradation results and Atterberg Limits, is provided in Appendix A, Table A.5

5.2 Radon Barrier

Construction activities for extension of the radon barrier involved placement of 76,626 cubic yards of Cody Shale clay material in 2005 and 2006. Placement (daily load counts) and quality control test records associated with radon barrier placement are documented in detail in Appendix B. Table B.1 lists the daily quantities and corresponding daily testing frequencies. Field compaction tests are documented in Table B.2. Tables B.3 and B.4 provide the laboratory Standard Proctor and sand-cone correlation test results, respectively. Radon barrier soil classification and gradation test results are listed in Table B.5. Quality control tests results are summarized in Tables 5.1 and 5.2 for field and laboratory tests, respectively.

5.2.1 Placement

Clayey soils for construction of the radon barrier were excavated from the Clay Borrow area, discussed in detail in Section 4 of Volume I. In accordance with the GHP-2 reclamation plan, this material was placed in equal continuous layers not exceeding 6 inches compacted depth and compacted to a minimum of 95 percent of maximum Standard Proctor dry density (ASTM D698), at a moisture content between optimum and 4 percent above optimum (Table 5.2, Appendix B, Table B.2). The plan also required verification sampling for Ra-226 content at a frequency of 1 for every 800 cubic yards. The latter results are documented in the February 2006 license amendment request submittal and summarized below.

Drawing 4 shows the placement areas, thickness, final grades, and survey verification points for the GHP-2 radon barrier. This drawing also provides several cross-sections that show the tie-ins to the adjacent Heap Leach and Above-Grade Tailings Impoundment covers. Drawing 5 shows the compaction test locations, demonstrating their high density and extensive spatial coverage.

5.2.2 Quality Control Test Results

Field Compaction Test Results. As summarized in Table 5.1 and detailed in Appendix B, Table B.2, based on 163 passing tests, radon barrier soils were compacted to a average of 98.2 percent of the maximum Standard Proctor dry density, ranging from 95.0 to 102.7 percent. The average dry density of this material ranges from 96.2 to 108.6 pcf (average of 102.8 pcf). Moisture content of the material ranges from 19.0 percent to 24.8 percent (average of 22.1 percent).

GHP-2 Radon Barrier Field Compaction Test Results

	Dry Density (pcf)	**% Moisture**	**% Compaction**
average:	102.8	22.1	98.2
range:	96.2 – 108.6	19.0 – 24.8	95.0 – 102.7
std. deviation:	2.1	1.1	1.8

N = 163; frequency = 1 test for every 470 cubic yards placed

Correlation results documented in Table B.4 indicate good agreement between the nuclear gauge and sand-cone test, with averages of 2.1 and 1.0 percent variation (absolute value) for wet density and moisture, respectively. Although not specified in the enhanced reclamation plan, Umetco conducted regular checks of the in-place thickness of the radon barrier layer to ensure that depths met the 12-inch specification. Based on 226 tests at the locations shown on Drawing 6, depths ranged from 1.0 to 2.2 feet, with an average depth of 1.3 feet and standard deviation of 0.2 feet (~ 2 inches). Appendix B, Table B.6 documents the results of these depth verification samples.

Standard Proctor Test Results. As summarized in Table 5.2 and in the inset below, the Standard Proctor maximum dry density of the radon barrier material ranges from 101.0 to 107.9 pcf (average of 104.5 pcf), with optimum moisture content ranging from 18.5 to 22.6 percent (average of 20.3 percent moisture).

GHP-2 Radon Barrier Standard Proctor Test Results

	Maximum Dry Density (pcf)	**Optimum Moisture** (%)
average:	104.5	20.3
range:	101.0 – 107.9	18.5 – 22.6
std. deviation:	1.6	0.9

Proctor N = 18; frequency = 1 test for every 4,257 cubic yards placed

Soil Classification, Atterberg Limits, and Gradations. The GHP-2 reclamation plan included the following specifications for radon barrier material characteristics:

- classification as CL or CH (lean clay or fat clay)*
- at least 50 percent passing the No. 200 sieve
- maximum particle size of 1 inch
- minimum liquid limit of 25 percent; and
- minimum plasticity index of 10

The CL or CH soil classification requirement was not stated directly in the plan, but this was applied to radon barrier placement at all Gas Hills repository areas and can be inferred from the other criteria)

As documented in Table B.5 and summarized in Table 5.2, all GHP-2 soil classification tests met the design specifications. The maximum particle size was less than 3/8 inch (100 percent of the material from all samples passed the No. 4 sieve); an average of 92.1% passed the #200 sieve. Liquid limits and plastic indices were all well above the plan requirements. Liquid limits ranged from 44 to 72 percent (average of 55.6 percent). Plastic indices (PIs) ranged from 30 to 53 percent (average of 38.9 percent). All unified soil classifications were either CH (Fat Clay, 96 percent) or CL (Lean Clay, 4 percent).

The reclamation plan also specified a maximum hydraulic conductivity of 1E-7 cm/s when compacted to 95 percent of maximum standard Proctor dry density (ASTM D 698). Because the homogeneity of the clay borrow material used for radon barrier construction and satisfaction of this requirement had already been demonstrated for the Heap Leach (see Volume I, Section 4), these tests were not repeated for subsequent repository reclamation.

Soil Verification Sampling. In accordance with Section 5.4 of the GHP-2 reclamation plan, soil samples were to be collected during radon barrier construction at a frequency of 1 sample for every 800 cubic yards. Therefore, 99 samples from the clay were collected and analyzed for Ra-226 content in May and July 2005, corresponding to a frequency of 1 test for every 774 cubic yards. After ingrowth, the average Ra-226 content of the 99 tests was 2.3 pCi/g, with a standard deviation of 0.6 pCi/g. These results are documented in Appendix A, Table A.2 of the February 2006 submittal.

5.3 Frost Protection Material

Between 2005 and 2006, 309,230 cubic yards of frost protection material were placed as part of the GHP-2 cover construction. Placement (daily load counts) and quality control test records associated with frost protection placement are documented in detail in Appendix C. Table C.1 lists the daily quantities and corresponding daily testing frequencies. Field compaction tests are documented in Table C.2. Tables C.3 and C.4 provide the laboratory Standard Proctor and sand-cone correlation test results, respectively. Results of soil classification and gradation tests are documented in Table C.5. These results are summarized in Tables 5.1 and 5.2 for field and laboratory tests, respectively. Primary findings are discussed below.

5.3.1 Placement

The frost protection layer for the GHP-2 cover was constructed with soils obtained primarily from the Moore Ranch borrow area located west of GHP-2 and from the B-Spoils borrow area. Sources and characteristics of this material are discussed in detail in Volume I, Section 4 and shown on Figure 4.5. During construction, frost protection soils were placed in equal continuous layers not exceeding 12-inches compacted depth and compacted to a minimum of 95 percent of maximum Standard Proctor density (ASTM D698), and at a moisture content greater than or equal to optimum minus 2 percent. The final contours and survey verification points are shown on Drawing 7; Drawing 8 shows the compaction test locations.

5.3.2 Quality Control Test Results

Field Compaction Test Results. As summarized in Table 5.1 and in the inset below, based on 636 passing tests, frost protection soils were compacted to an average of 97.1 percent of the maximum Standard Proctor dry density, ranging from 94.8 to 102.9 percent. The average dry density of the compacted material was 114.6 pcf, ranging from 104.8 pcf to 124.1 pcf. The average moisture content was 13.1 percent, ranging from 9.1 percent to 22.0 percent (Appendix C, Table C.2). Drawing 9 demonstrates the high density and extensive spatial coverage of the compaction test locations. Based on the total volume placed of 309,230 cubic yards, the testing frequency was 1 test for every 486 cubic yards placed, satisfying plan requirements.

GHP-2 Frost Protection Field Compaction Test Results

	Dry Density (pcf)	**% Moisture**	**% Compaction**
average:	114.6	13.1	97.1
range:	104.8 – 124.1	9.1 – 22.0	94.8 – 102.9
std. deviation:	3.1	2.1	1.6

N = 636; frequency = 1 test for every 486 cubic yards placed

Standard Proctor Test Results. Table 5.2 summarizes the Standard Proctor results, which yielded an average maximum dry density for frost protection materials of 118.1 pcf, ranging from 109.4 to 121.9 pcf. The optimum moisture was 12.7 percent, ranging from 10.2 to 16.6 percent.

GHP-2 Frost Protection Standard Proctor Test Results

	Maximum Dry Density (pcf)	**Optimum Moisture** (%)
average:	118.1	12.7
range:	109.4 – 121.9	10.2 – 16.6
std. deviation:	3.0	1.4

Proctor N = 68; frequency = 1 test for every 4,548 cubic yards placed

Soil Classification. The GHP-2 reclamation plan specified that frost protection materials be classified as SC and/or SC-SM based on the Unified Soil Classification System. As documented in Appendix C, Table C.5 and summarized in Table 5.2, these requirements were generally met. Based on the 324 soil classification tests performed (1:954 CY frequency), 97 percent of the frost protection soils tested met these requirements. The majority (79%) classified as SC (clayey sand) and 18 percent classified as SM (silty sand). The remaining small percentage were classified as CL (lean clay, 1.5%), and SP-SM, SW-SC, and SW-SM (1.5% total).

5.4 Toe Apron

Placement (daily load counts) and quality control test records associated with construction of the GHP-2 toe apron are documented in Appendix D and summarized in the inset below. Although not specifically stated in the reclamation plan, placement of soils for the toe apron, Umetco implemented a field testing program comparable to that for the frost protection soils—i.e., testing frequency of 1:500 cubic yards, a minimum compaction of 95 percent of maximum standard Proctor Standard Proctor dry density and moisture content greater than or equal to optimum (no gradations were required). As demonstrated in the inset below and in Appendix D, these specifications were met.

GHP-2 Toe Apron Field Compaction Test Results

	Dry Density (pcf)	**% Moisture**	**% Compaction**
average:	116.4	12.4	97.2
range:	112.7 – 124.3	9.5 – 16.8	94.9 – 104.2
std. deviation:	2.6	1.5	1.9

N = 64; frequency = 1 test for every 413 cubic yards placed (total volume = 26,463 cubic yards)

Drawing 8 shows the final contours and survey verification points for the toe apron subgrade. Corresponding compaction test locations are shown on Drawing 10. As demonstrated in the appendix tables and as-builts, all construction activities for the GHP-2 toe apron were conducted in accordance with the approved reclamation plan.

6.0 EROSION PROTECTION

Upon completion of the work described in the previous section, approximately 55,358 cubic yards of erosion protection material were placed on the GHP-2 cover. As-built Drawing 11 shows the Type A Bedding survey verification points and cross-sections. Drawing 12 shows the placement areas, final contours and survey verification points, and cross-sections showing the channel outlet and the tie-ins to the Heap Leach and Above-Grade Tailings Impoundment covers. Drawing 13 shows the corresponding visual depth check and in-place gradation test locations.

For detailed information regarding rock quality and gradation test results, refer to Volume I, Section 5. This section demonstrates that the combination of the erosion protection source and the quality control program used during production and placement at the Gas Hills site repositories has resulted in a finished product which satisfies the erosion protection requirements of 10 CFR 40, Appendix A.

6.1 General Scope of Work

The scope of work for the GHP-2 erosion protection placement is summarized in Table 6.1 and demonstrated in Drawings 11 through 13. Three sizes of riprap were used as erosion protection for the GHP-2 cover. These three sizes are categorized as Type A, Type B, and Type C, having median grain sizes (D_{50}) of 0.5, 3.0, and 6.0 inches, respectively. Type A riprap was used on the top cover and was also placed as bedding material for the larger riprap shown on Drawing 12. Type B rock was used in the dike/channel area and the tie-ins to the Heap and the Above-Grade. Type C rock was placed on the sideslopes and channel outlet.

Table 6.1 Summary of GHP-2 Erosion Protection Placement: 2006

Rock Type	Area(s) Placed	Total Volume Placed (cubic yards)	D_{50} and In-Place Thickness
Type A	Bedding Material and top of GHP-1 (1 percent slope)	29,950	D_{50} = 0.5 inches, minimum in-place thickness of 3 inches for bedding material and 6 inches (0.5 ft) for the top cover
Type B	Dike/channel area and tie-in to Heap and the Above-Grade (see Drawings 11-12)	9,920	D_{50} = 3.0 inches, minimum in-place thickness of 0.5 feet
Type C	Sideslope and channel outlet	15,488	D_{50} = 6.0 inches; minimum in-place thickness of 10 inches

Details regarding the design and underlying assumptions are documented in detail in the 2003 design report and in the technical evaluations accompanying the NRC's approval of the plan modifications (Attachment 1). Corresponding gradation curves are shown on Figure 6.1.

6.2 Rock Placement – General Procedures

In accordance with the approved GHP-2 reclamation plan, the following requirements were met:

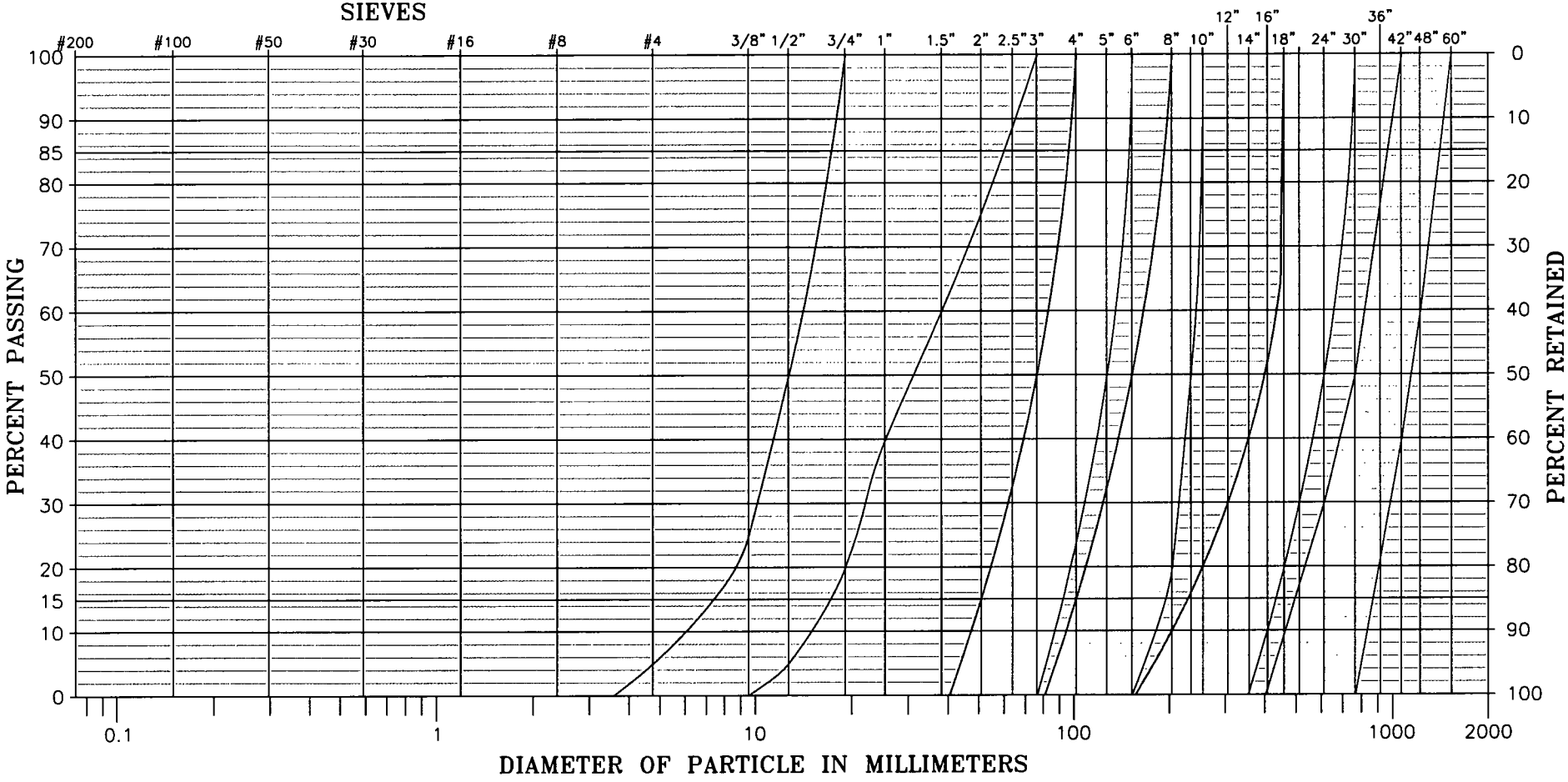
- The riprap met or exceeded the size requirements presented in the Construction Drawings and design report.
- When necessary, riprap was oversized in accordance with the NRC Staff Technical Position, Appendix D.
- Riprap material was placed to the lines and grades shown in Drawings 10 and 11, consistent with the design plan.
- Placement of all riprap materials was accomplished in a manner providing well-keyed, densely placed layers of the specified thickness.
- For placement control purposes one test section (approximately 30 feet wide by 50 feet long) was constructed for each type of riprap material to be placed.

6.3 Quality Control Test Results

As indicated in the introduction to this section, the reader is referred to Section 5 of Volume 1 for detailed information regarding rock quality, gradation test results, and in-place visual depth check documentation. As demonstrated in Volume I (Tables 5.5 through 5.14) and in Drawings 11 through 13, placement of erosion protection materials on GHP-2 was conducted in accordance with plan requirements and satisfies the criteria set forth in 10 CFR Part 40, Appendix A for the following criteria:

> *Criterion 4(c)* – provides requirements for the long-term stability of the embankment and cover slopes for tailings;
>
> *Criterion 4(d)* – requires establishment of a self-sustaining vegetative cover or employment of a rock cover to reduce wind and water erosion to negligible levels, that individual rock fragments are suited for the job, and that the impoundment surfaces are contoured to avoid concentrated surface runoff or abrupt changes in slope gradient.

GHRIPRAP-REV2002.DWG



Type A Specification (D_{50} = 0.5")

SIEVE	PERCENT PASSING
3"	100
1.5"	60 – 100
1"	40 – 100
3/4"	20 – 100
1/2"	5 – 50
3/8"	0 – 25
#4	0 – 5

Type B Specification (D_{50} = 3")

SIEVE	PERCENT PASSING
6"	100
5"	50 – 100
4"	30 – 100
3"	0 – 50
2"	0 – 15

Type C Specification (D_{50} = 6")

SIEVE	PERCENT PASSING
10"	100
9"	50 – 100
8"	20 – 100
6"	0 – 50
4"	0 – 15

Type D Specification (D_{50} = 16")

SIEVE	PERCENT PASSING
30"	100
24"	50 – 100
18"	20 – 100
12"	0 – 30
8"	0 – 10

Type E Specification ($D_{50\ MIN}$ = 30")

SIEVE	PERCENT PASSING
60"	100
48"	60 – 100
42"	40 – 100
30"	0 – 50
24"	0 – 30

LEGEND:

- TYPE A RIPRAP
- TYPE B RIPRAP
- TYPE C RIPRAP
- TYPE D RIPRAP
- TYPE E RIPRAP

FIGURE 6.1
RIPRAP GRADATIONS
UMETCO GAS HILLS SITE
JUNE, 2002

7.0 FINAL RADIOLOGICAL STATUS

To verify that the completed GHP-2 repository cover meets the criteria set forth in 10 CFR 40, Appendix A, Criterion 6(1) and Criterion 6(2), this section summarizes: 1) verification data documenting the Ra-226 content of frost protection materials; 2) radon emission rate measurements; and 3) the results of the GHP-2 gamma exposure rate survey. The latter information is already documented in Addendum 3 of the *Final Status Survey Report* (Umetco 2007)—the reader is referred to that document for maps showing sample/measurement locations and detailed data. These results are summarized below.

7.1 Cover Radium Content (Frost Protection)

As discussed in Section 2, the allowable radium content (i.e., background Ra-226) for frost protection materials was initially 10 pCi/g for all Gas Hills repositories. This criterion was initially specified in the September 2003 reclamation plan. However, due to the depletion of borrow materials with lower radium content, that criterion was ultimately increased to 15 pCi/g for GHP-2. The request to modify License Condition 61 was approved by the NRC on November 22, 2006, as License Amendment 58. Additional information is provided in the *Report Amending Final Design and Reclamation Plan for GHP-2/Mill Area* and the Technical Evaluation Report documenting the NRC's approval of this request (see Attachment 2).

During construction of the GHP-2 frost protection layer, frost protection materials were continuously gamma surveyed and the upper two feet sampled and analyzed for Ra-226. Tables 7.1 and 7.2 (following page) summarize the results of the frost protection verification sampling, yielding average Ra-226 activities of 13.2 pCi/g and 13.5 pCi/g for the 0-1 ft and 1-2 ft soil horizons, respectively. Both results meet the amended 15 pCi/g requirement.

7.2 Radon Emanation (NESHAPS)

The radon-222 emission rates from the top of the GHP-2 Repository frost protection cover layer were measured in two phases. Fifty-eight canisters were deployed on October 24, 2005; the remaining forty two were deployed on May 22, 2006. Individual canister results are in reported in the *National Emissions Standards for Hazardous Air Pollutants (NESHAPS), 2005-2006 Radon Flux Measurement Program, GHP-2 Repository, Gas Hills, Wyoming*, (Tellco 2006a) submitted to the NRC on December 13, 2006. The average radon-222 emission rate over the entire GHP-2 Repository is 6.8 picoCuries per meter squared second (pCi/m^2s) which meets the requirement of 20 pCi/m^2s specified in 10 CFR 40, Appendix A, Criterion 6(1).

Table 7.1 GHP-2 Repository Cover Average Radium-226 Activity for the 0 to 1 Soil Horizon

Grid ID	Count Date	Ra-226 (pCi/g)[a]	Error Term
1	12/6/05	14.6	± 0.60
2	6/13/06	15.3	± 0.66
3	12/9/05	11.8	± 0.53
4	6/13/06	9.89	± 0.45
5	12/7/05	12.3	± 0.50
6	6/13/06	11.0	± 0.50
7	12/8/05	14.0	± 0.60
8	12/6/05	14.8	± 0.60
9	12/5/05	14.2	± 0.56
10	12/8/05	10.8	± 0.45
11	12/9/05	14.7	± 0.61
12	12/6/05	15.3	± 0.61
13	12/9/05	16.2	± 0.64
14	12/6/05	14.2	± 0.59
15	6/14/06	9.02	± 0.46

[a] Radium-226 results reflect in-growth after 21 days.

Table 7.2 GHP-2 Repository Cover Average Radium-226 Activity for the 1 to 2 Foot Soil Horizon

Grid ID	Count Date	Ra-226 (pCi/g)[a]	Error Term
1	12/6/05	12.2	± 0.52
2	6/13/06	11.7	± 0.51
3	12/9/05	16.4	± 0.66
4	6/13/06	8.20	± 0.41
5	12/7/05	11.2	± 0.47
6	6/13/06	11.9	± 0.49
7	12/8/05	13.1	± 0.57
8	12/6/05	13.6	± 0.57
9	12/5/05	15.7	± 0.60
10	12/8/05	13.2	± 0.54
11	12/9/05	15.0	± 0.64
12	12/6/05	14.7	± 0.58
13	12/9/05	15.2	± 0.62
14	12/6/05	13.8	± 0.56
15	6/14/06	17.2	± 0.68

[a] Radium-226 results reflect in-growth after 21 days.

7.3 Direct Gamma Exposure Rates

Direct gamma exposure surveys were performed over the completed frost protection layer using the methods described in Addendum 3 (Section 4) of the Final Status Survey Report (Umetco 2007). Only exposure measurements using a bare detector were collected, since shine from the surrounding area did not have a significant impact.

The majority of the survey was performed on October 24, 2005. The results of this survey indicated that the average exposure rate was greater than 30 μR/hr. As discussed in Section 2, a request to change the allowable exposure rate from the GHP-2 Repository frost protection materials from 30 μR/hr to 40 μR/hr was made in the *Report Amending Final Design and Reclamation Plan for GHP-2/Mill Area.* This request was approved by the NRC as Amendment 58 to the License (see Attachment 2). The amendment adjusted the allowable exposure rate to reflect the increase in the radium-226 activity of the frost protection layer and better reflect the range of exposure rates observed in the background soils.

The remaining portion of the repository was surveyed in May 2006. Results of the combined gamma radiation surveys (2005-2006) indicate that the average exposure rate over the repository is 38 μR/hr, which meets the amended requirement (for locations, see Addendum 3, Figure 4.1).

8.0 SUMMARY AND CONCLUSIONS

In summary, this Construction Completion Report demonstrates that all work documented herein for Gas Hills Pond No. 2 was performed in accordance with the designs and procedures in the approved reclamation plan. Additionally, it verifies that the completed cover satisfies the requirements established in 10 CFR 40, Appendix A, Criteria 4 (c), (d), (e), 6(1), and 6(2) with regard to reasonable assurance of stability and control of the contaminated material and limitation of the radon flux from the disposal areas to the atmosphere to 20 pCi/m^2-s.

9.0 REFERENCES

Tellco Environmental (Tellco). 2006a. *National Emissions Standards for Hazardous Air Pollutants, 2005-2006 Radon Flux Measurement Program, GHP-2 Repository, Gas Hills, Wyoming*. December 2006.

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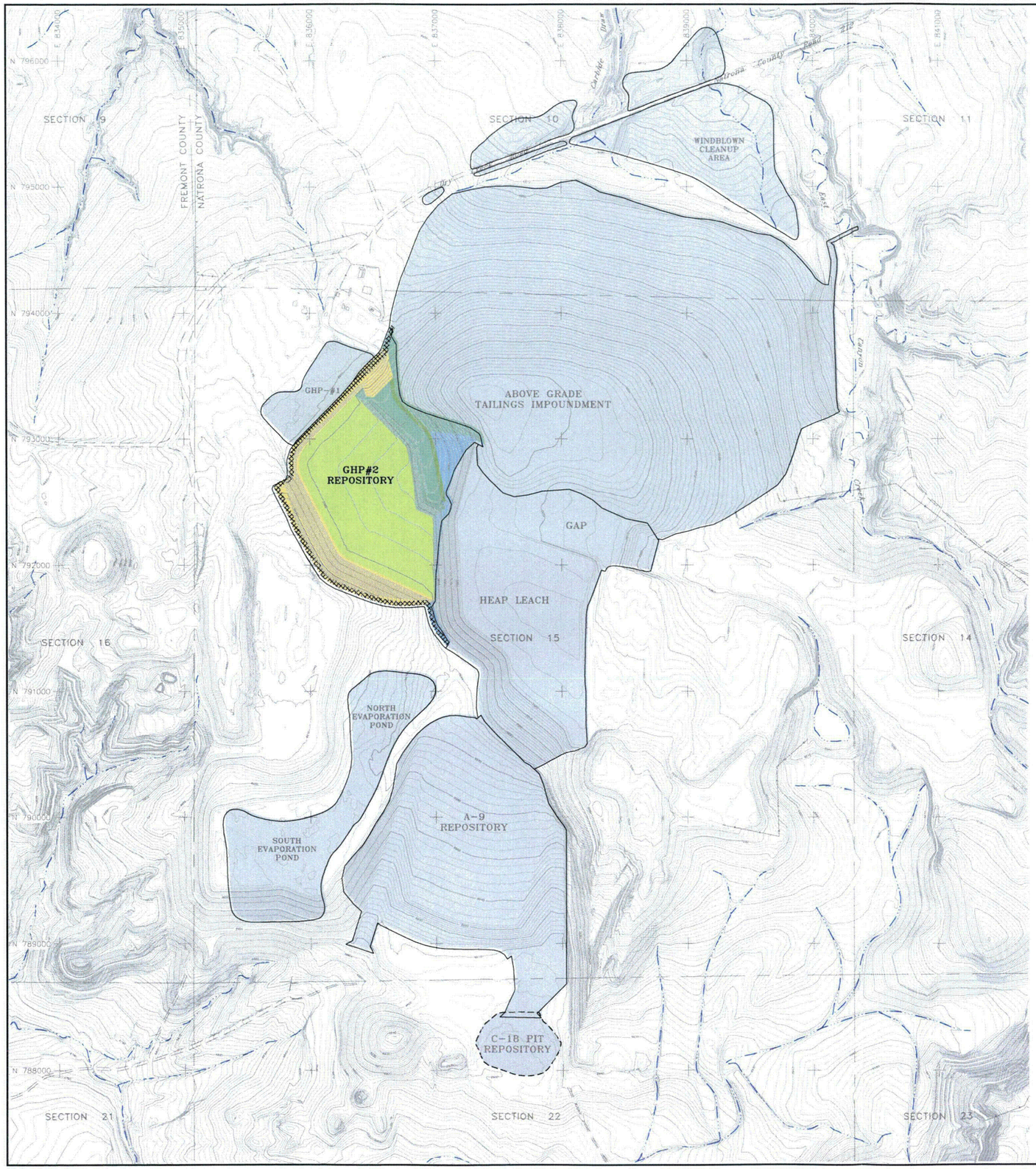
Umetco Minerals Corporation (Umetco). 2006b. *Technical Memorandum. Rationales Supporting Proposed Change to License Condition 5.* Included as attachment to letter submitted to the NRC on February 7, 2006.

Umetco Minerals Corporation. 2007. Final Status Survey Report Addendum 3, East Gas Hills Wyoming Site. Submitted by letter dated January 22, 2007.

U.S. Nuclear Regulatory Commission (NRC). 2006. *Technical Evaluation Report for Umetco Minerals Corporation's Modification to Pond No. 2 and C-18 Cover Design Criteria at the Gas Hills Uranium Mill Site.* October 12, 2006. Submitted by letter from K. I. McConnell (NRC) to T. Gieck (Umetco) dated November 22, 2006.

U.S. Nuclear Regulatory Commission (NRC). 2006b. Letter from K. I. McConnell to T. Gieck (Umetco). RE: License Amendment No. 58 to Umetco's License SUA-648 – Modification of Gas Hills Pond No.2 and C-18 Covers (TAC LU0143). Letter dated November 22, 2006.

DRAWINGS



SHEET NO.	TITLE
1 OF 13	FINAL GHP-2 REPOSITORY SITE PLAN REFLECTING POST-RECLAMATION CONSTRUCTION FINAL GRADES
2 OF 13	GHP-2 REPOSITORY FINAL CONTOURS AND SURVEY VERIFICATION POINTS CONTAMINATED FILL AREA
3 OF 13	GHP-2 REPOSITORY COMPACTION TEST LOCATIONS CONTAMINATED FILL AREA
4 OF 13	GHP-2 REPOSITORY FINAL CONTOURS AND SURVEY VERIFICATION POINTS RADON BARRIER FILL AREA
5 OF 13	GHP-2 REPOSITORY COMPACTION TEST LOCATIONS RADON BARRIER FILL AREA
6 OF 13	GHP-2 REPOSITORY VISUAL DEPTH CHECK LOCATIONS RADON BARRIER FILL
7 OF 13	GHP-2 REPOSITORY FINAL CONTOURS AND SURVEY VERIFICATION POINTS FROST PROTECTION FILL
8 OF 13	GHP-2 REPOSITORY FINAL CONTOURS AND SURVEY VERIFICATION POINTS TOE APRON SUBGRADE
9 OF 13	GHP-2 REPOSITORY COMPACTION TEST LOCATIONS FROST PROTECTION FILL AREA
10 OF 13	GHP-2 REPOSITORY COMPACTION TEST LOCATIONS TOE APRON BACKFILL
11 OF 13	GHP-2 REPOSITORY SURVEY VERIFICATION POINTS EROSION PROTECTION TYPE "A" RIPRAP BEDDING MATERIAL
12 OF 13	GHP-2 REPOSITORY FINAL CONTOURS AND SURVEY VERIFICATION POINTS EROSION PROTECTION PLACEMENT
13 OF 13	GHP-2 REPOSITORY IN-PLACE GRADATION AND VISUAL DEPTH CHECK TEST LOCATIONS EROSION PROTECTION PLACEMENT

LEGEND

- 7000 — 2006 FINISHED GRADE TOPOGRAPHY
- DRAINAGE PATH/PONDED WATER
- UN-PAVED ROADS
- N 794,000 — UMETCO 1000' SITE GRID
- 6-INCHES OF RIPRAP TYPE "A" D_{50} = 0.5 INCH
- 6-INCHES OF RIPRAP TYPE "B" D_{50} = 3.0 INCH
- 6-INCHES OF RIPRAP TYPE "B" D_{50} = 3.0 INCH WITH 6-INCHES OF FILTER TYPE "A" D_{50} = 0.5 INCH
- 6-INCHES OF RIPRAP TYPE "B" D_{50} = 3.0 INCH WITH 3-INCHES OF FILTER TYPE "A" D_{50} = 0.5 INCH
- 10-INCHES OF RIPRAP TYPE "C" D_{50} = 6.0 INCH WITH 3-INCHES OF FILTER TYPE "A" D_{50} = 0.5 INCH
- BELOW-GRADE APRON

N

400' 0 400'

SCALE IN FEET

CONTOUR INTERVAL : 2'

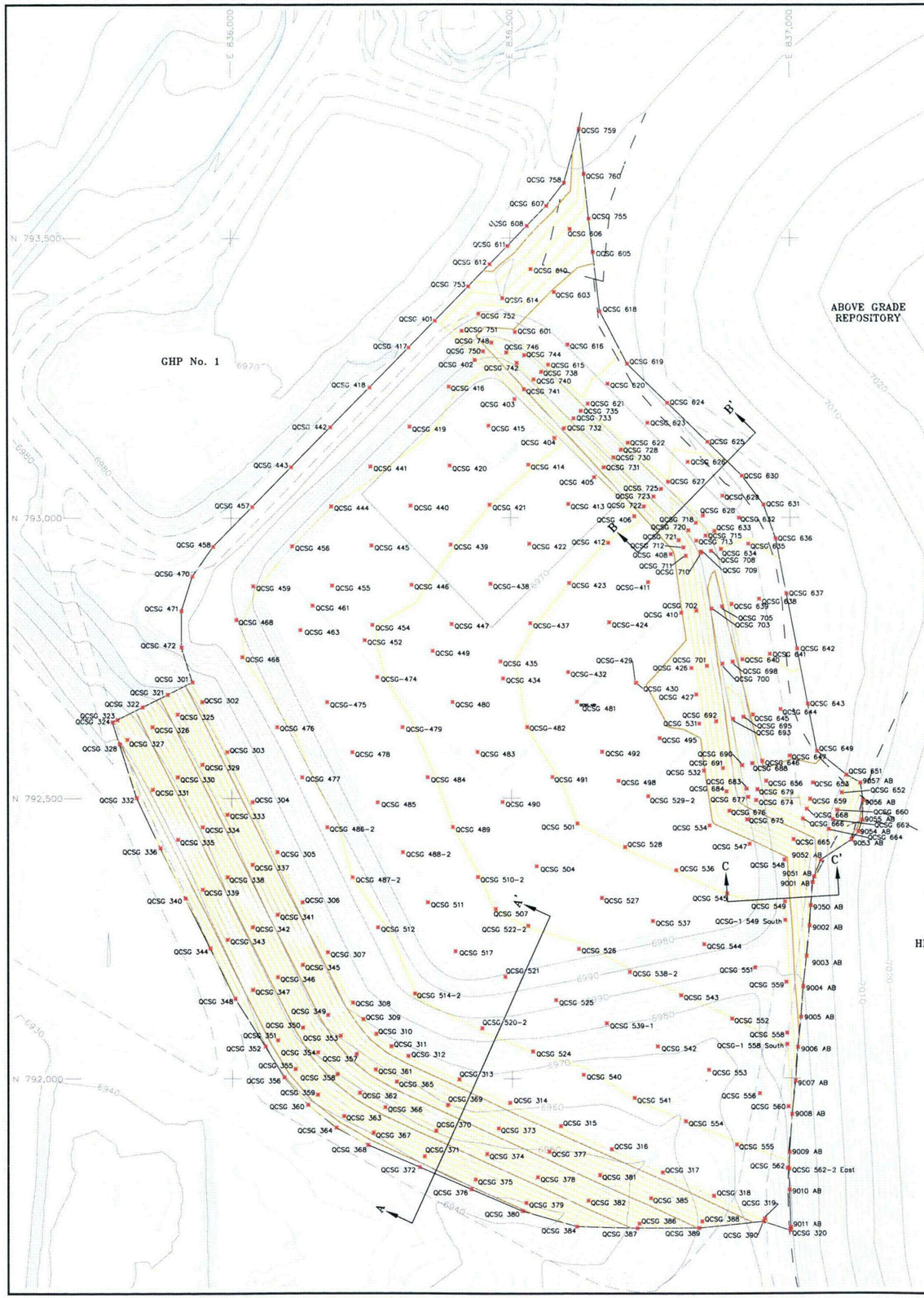
Umetco Minerals Corporation
2754 COMPASS DRIVE, SUITE 280, GRAND JUNCTION, CO 81506

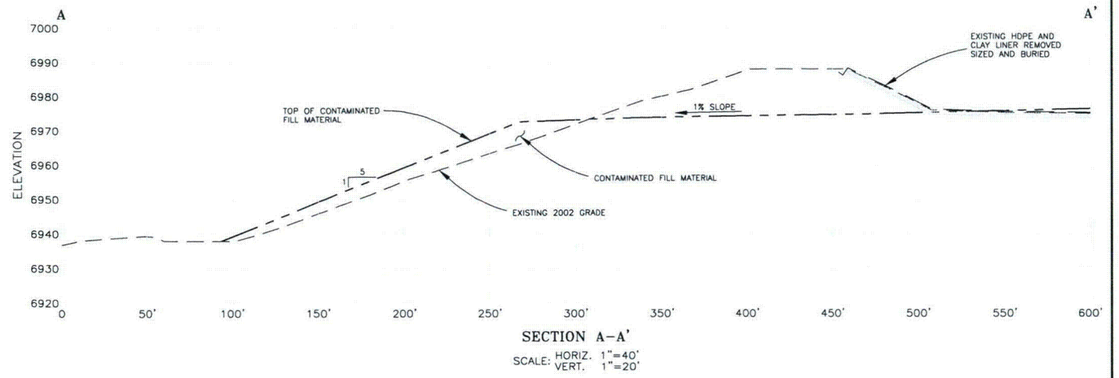
AS BUILT

FINAL GHP-2 REPOSITORY SITE PLAN REFLECTING POST-RECLAMATION CONSTRUCTION FINAL GRADES

GAS HILLS, WYOMING

DATE: JUNE 2007 DWG: GH-GHP2-01-AB SHEET 1 OF 13





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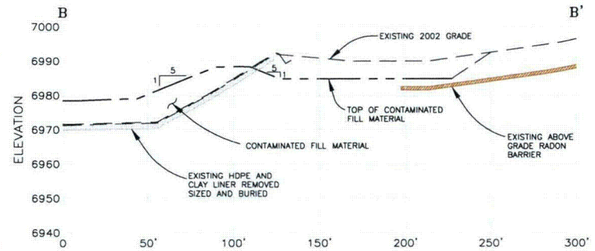

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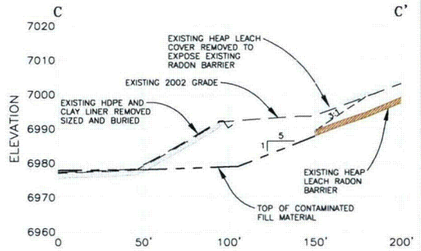


SECTION C–C'
SCALE: HORIZ. 1"=40'
VERT. 1"=20'

PROFILE LEGEND:

- EXISTING GROUND SURFACE
- HDPE POND LINER
- EXISTING POND CLAY LINER
- EXISTING ABOVE–GRADE AND HEAP LEACH RADON BARRIER
- TOP OF THE CONTAMINATED FILL

N

100' 0 100'

SCALE IN FEET
CONTOUR INTERVAL : 2'

LEGEND:

- EXISTING 2000 AERIAL TOPOGRAPHY UPDATED WITH 2002 SURVEYS
- DRAINAGE PATH/PONDED WATER
- UN–PAVED ROADS
- UMETCO 1000' SITE GRID
- FINISH GRADE TOPOGRAPHY CONTAMINATED FILL AREA
- CONTAMINATED FILL SURVEY VERIFICATION POINT

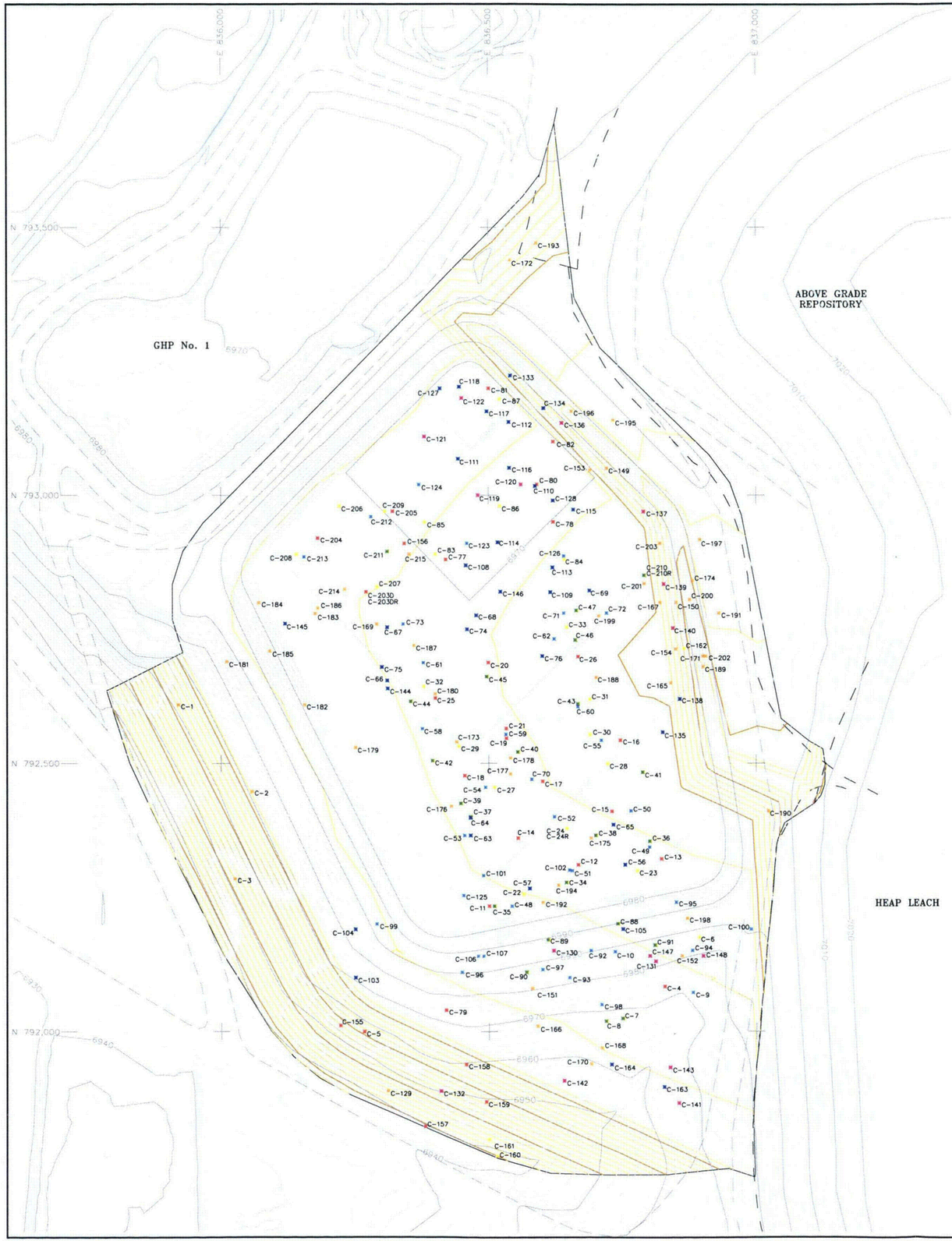
Umetco Minerals Corporation
2754 COMPASS DRIVE, SUITE 280, GRAND JUNCTION, CO 81506

AS BUILT

GHP–2 REPOSITORY
FINAL CONTOURS AND
SURVEY VERIFICATION POINTS
CONTAMINATED FILL AREA

GAS HILLS, WYOMING

DATE: JUNE 2007 DWG: GH–GHP2–02–AB SHEET 2 OF 13



N

100' 0 100'

SCALE IN FEET

CONTOUR INTERVAL : 2'

LEGEND:

- 7000 — 2000 AERIAL TOPOGRAPHY UPDATED WITH 2002 SURVEYS
- DRAINAGE PATH/PONDED WATER
- UN-PAVED ROADS
- N 794,000 — UMETCO 1000' SITE GRID
- 6960 — FINISH GRADE TOPOGRAPHY GHP-2 CONTAMINATED FILL AREA
- C-11 — CONTAMINATED FILL COMPACTION TEST LOCATION - FIRST LIFT
- C-31 — CONTAMINATED FILL COMPACTION TEST LOCATION - SECOND LIFT
- C-45 — CONTAMINATED FILL COMPACTION TEST LOCATION - THIRD LIFT
- C-71 — CONTAMINATED FILL COMPACTION TEST LOCATION - FOURTH LIFT
- C-112 — CONTAMINATED FILL COMPACTION TEST LOCATION - FIFTH LIFT
- C-140 — CONTAMINATED FILL COMPACTION TEST LOCATION - SIXTH LIFT
- C-184 — CONTAMINATED FILL COMPACTION TEST LOCATION - FINISHED GRADE

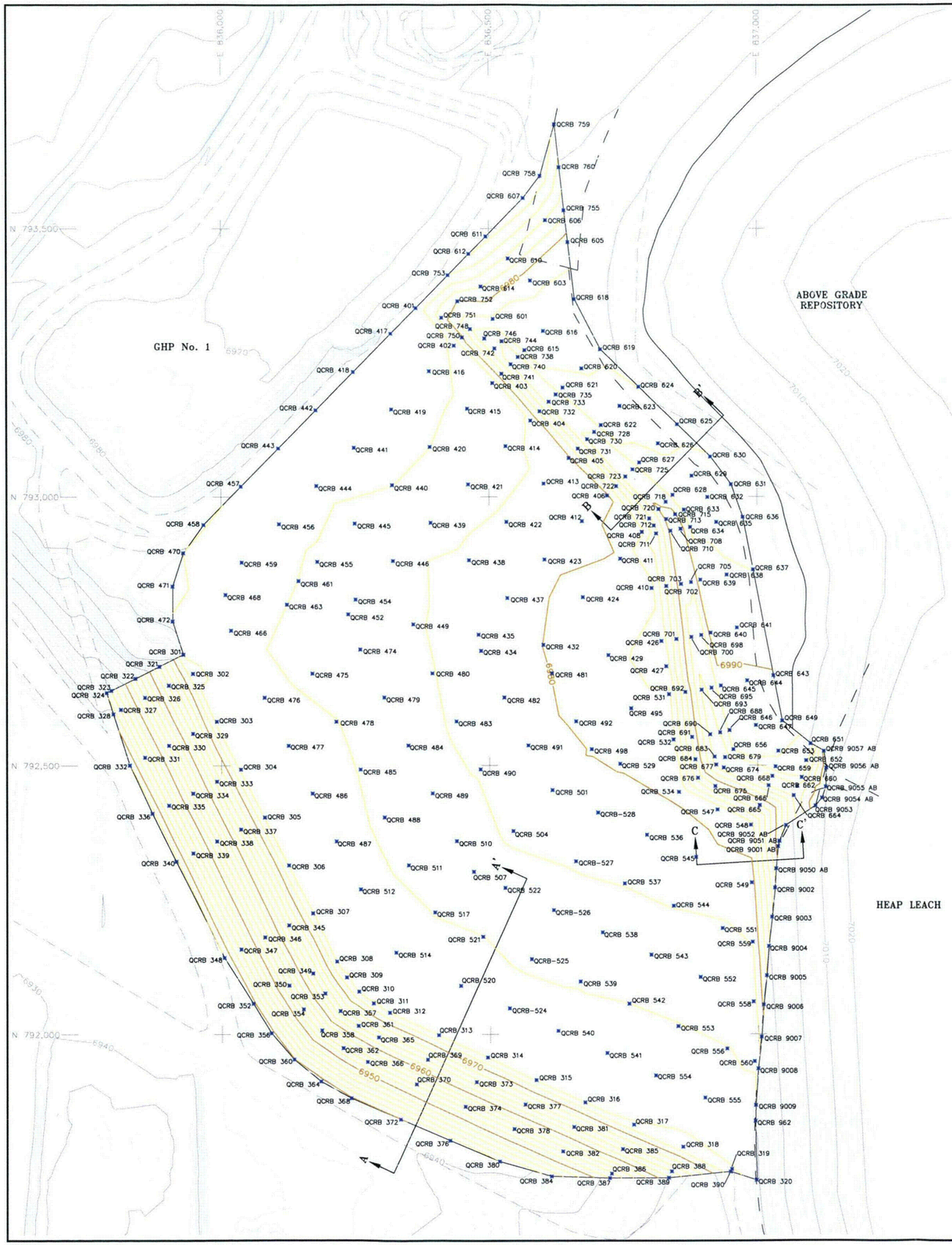
Umetco Minerals Corporation
2754 COMPASS DRIVE, SUITE 280, GRAND JUNCTION, CO 81506

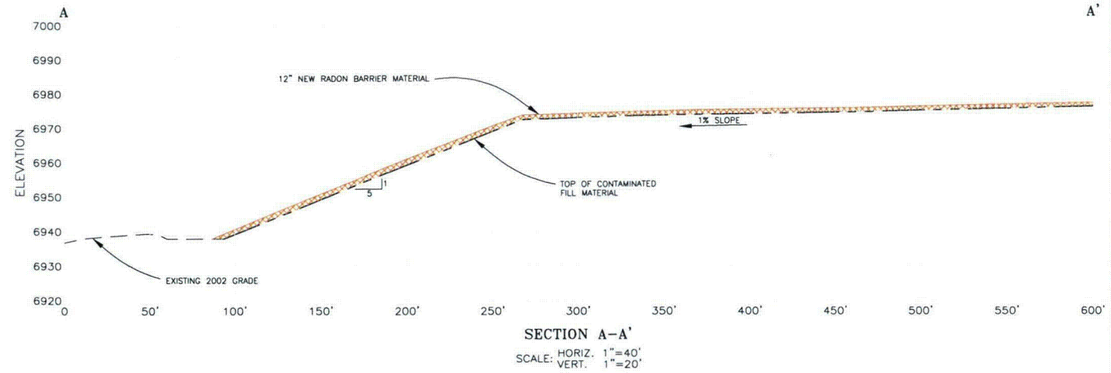
AS BUILT

GHP-2 REPOSITORY
COMPACTION TEST LOCATIONS
CONTAMINATED FILL AREA

GAS HILLS, WYOMING

DATE: JUNE 2007 DWG: GH-GHP2-03-AB SHEET 3 OF 13





SECTION A–A'
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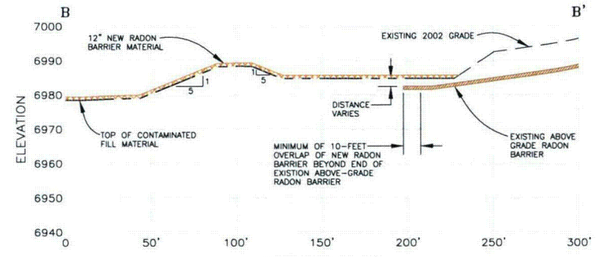
VERT. 1"=20'



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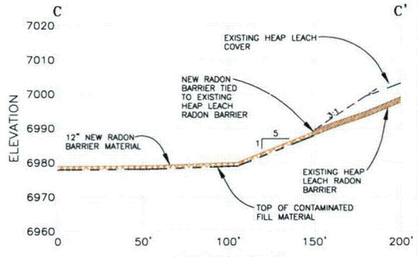


SECTION C–C'
SCALE: HORIZ. 1"=40'
VERT. 1"=20'

PROFILE LEGEND:

- EXISTING GROUND SURFACE
- HDPE POND LINER
- EXISTING POND CLAY LINER
- EXISTING ABOVE–GRADE AND HEAP LEACH RADON BARRIER
- TOP OF THE CONTAMINATED FILL
- 12" NEW RADON BARRIER

N

100' 0 100'

SCALE IN FEET
CONTOUR INTERVAL : 2'

LEGEND:

- EXISTING 2000 AERIAL TOPOGRAPHY UPDATED WITH 2002 SURVEYS
- DRAINAGE PATH/PONDED WATER
- UN–PAVED ROADS
- UMETCO 1000' SITE GRID
- EXISTING RADON BARRIER LIMITS FOR THE ABOVE–GRADE AND HEAP LEACH REPOSITORIES
- FINISH GRADE TOPOGRAPHY RADON BARRIER FILL AREA
- QCRB 480 — RADON BARRIER FILL SURVEY VERIFICATION POINT

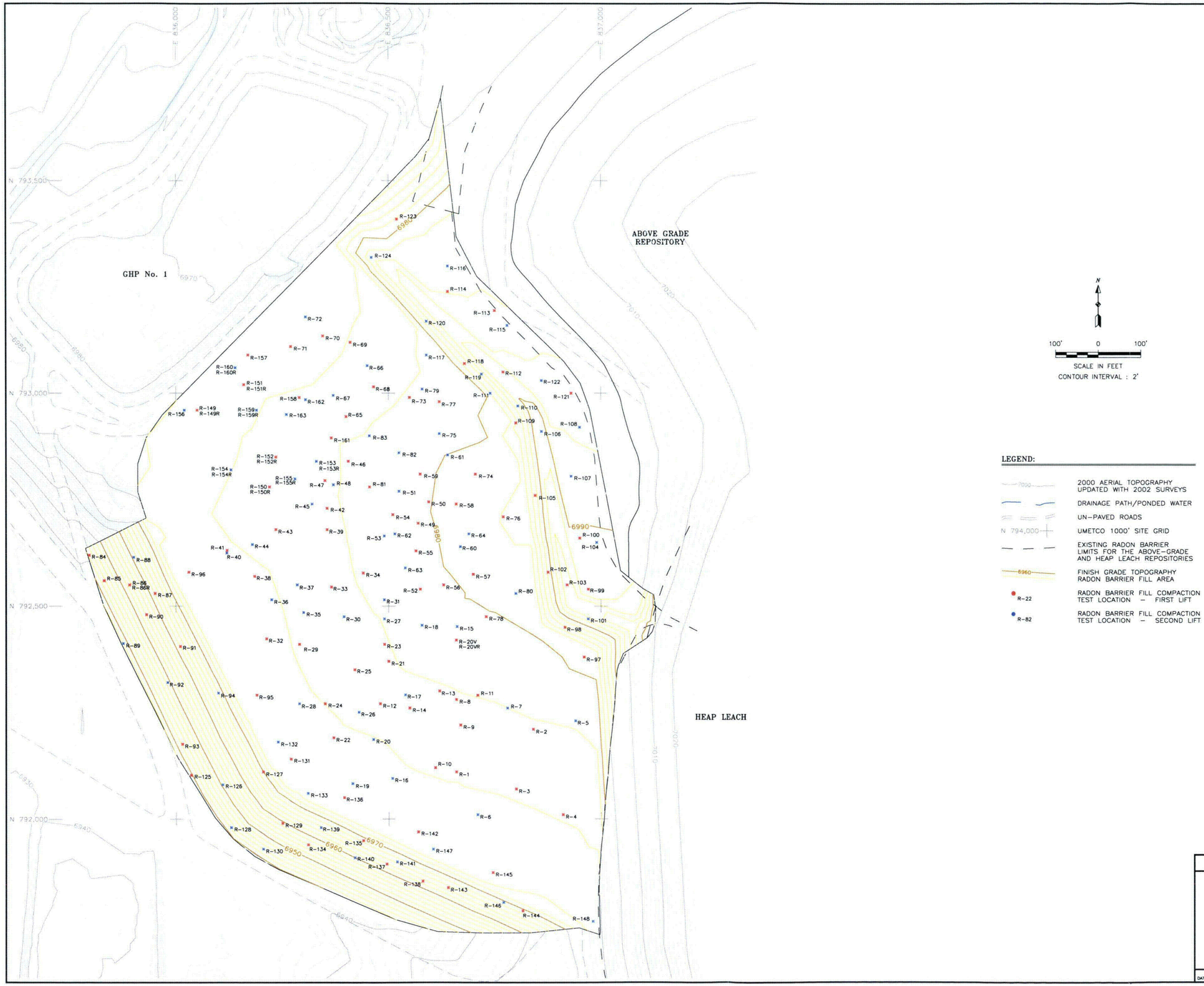
Umetco Minerals Corporation
2754 COMPASS DRIVE, SUITE 280, GRAND JUNCTION, CO 81506

AS BUILT

GHP–2 REPOSITORY FINAL CONTOURS AND SURVEY VERIFICATION POINTS RADON BARRIER FILL AREA

GAS HILLS, WYOMING

DATE: JUNE 2007 DWG: GH–GHP2–04–AB SHEET 4 OF 13



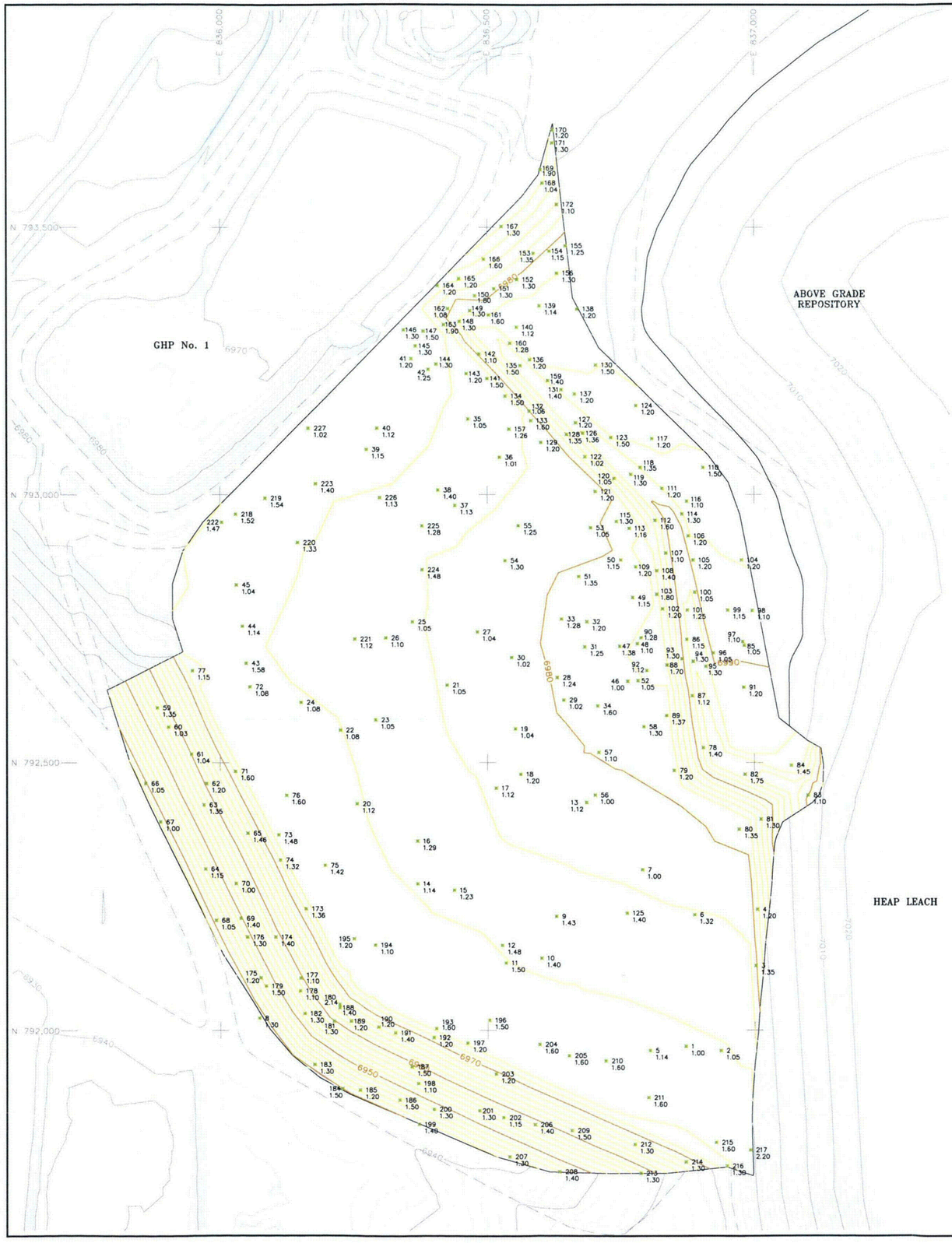
Umetco Minerals Corporation
2754 COMPASS DRIVE, SUITE 280, GRAND JUNCTION, CO 81506

AS BUILT

GHP-2 REPOSITORY
COMPACTION TEST LOCATIONS
RADON BARRIER FILL AREA

GAS HILLS, WYOMING

DATE: JUNE 2007 DWG: GH-GHP2-05-AB SHEET 5 OF 13



N

100' 0 100'

SCALE IN FEET
CONTOUR INTERVAL : 2'

LEGEND:

- 7000 — 2000 AERIAL TOPOGRAPHY UPDATED WITH 2002 SURVEYS
- DRAINAGE PATH/PONDED WATER
- UN-PAVED ROADS
- N 794,000 — UMETCO 1000' SITE GRID
- EXISTING RADON BARRIER LIMITS FOR THE ABOVE-GRADE AND HEAP LEACH REPOSITORIES
- 6960 — FINISH GRADE TOPOGRAPHY RADON BARRIER FILL AREA
- 49 / 1.15 — RADON BARRIER FILL VISUAL DEPTH CHECK 49 = TEST LOCATION NUMBER 1.15 = MEASURED THICKNESS

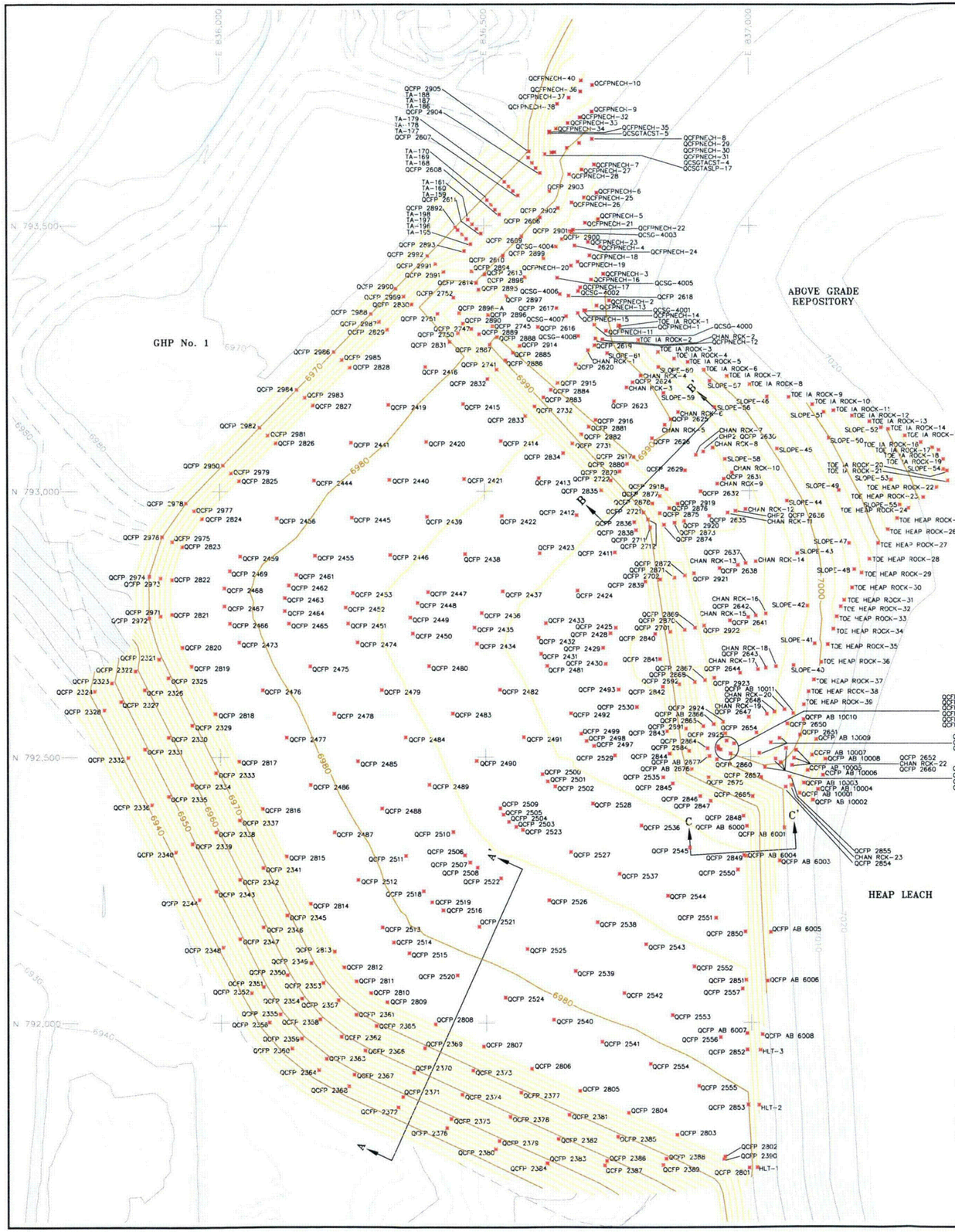
Umetco Minerals Corporation
2754 COMPASS DRIVE, SUITE 280, GRAND JUNCTION, CO 81506

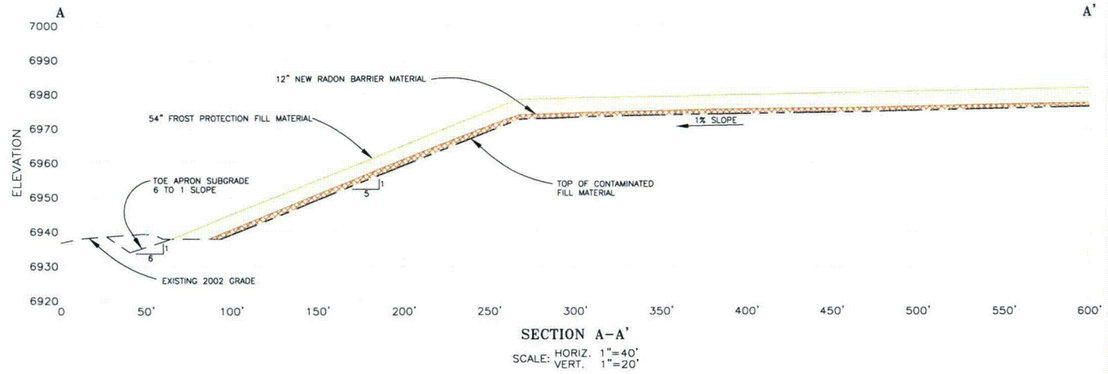
AS BUILT

GHP-2 REPOSITORY
VISUAL DEPTH CHECK LOCATIONS
RADON BARRIER FILL

GAS HILLS, WYOMING

DATE: JUNE 2007 DWG: GH-GHP2-06-AB SHEET 6 OF 13





SECTION A–A'
SCALE: HORIZ. 1"=40'
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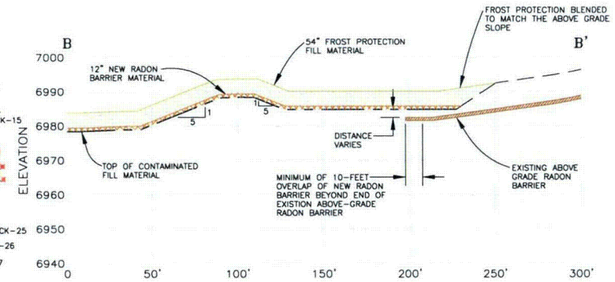

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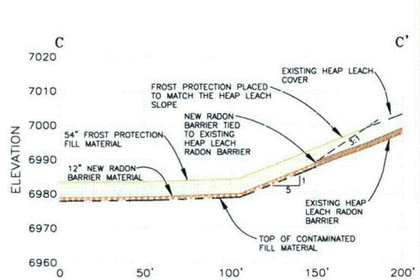


SECTION C–C'
SCALE: HORIZ. 1"=40'
VERT. 1"=20'

PROFILE LEGEND:

- EXISTING GROUND SURFACE
- HDPE POND LINER
- EXISTING POND CLAY LINER
- EXISTING ABOVE-GRADE AND HEAP LEACH RADON BARRIER
- TOP OF THE CONTAMINATED FILL
- 12" NEW RADON BARRIER
- 54" FROST PROTECTION FILL

LEGEND:

- EXISTING 2000 AERIAL TOPOGRAPHY UPDATED WITH 2002 SURVEYS
- DRAINAGE PATH/PONDED WATER
- UN-PAVED ROADS
- UMETCO 1000' SITE GRID
- FINISH GRADE TOPOGRAPHY FROST PROTECTION FILL AREA
- FROST PROTECTION FILL SURVEY VERIFICATION POINT

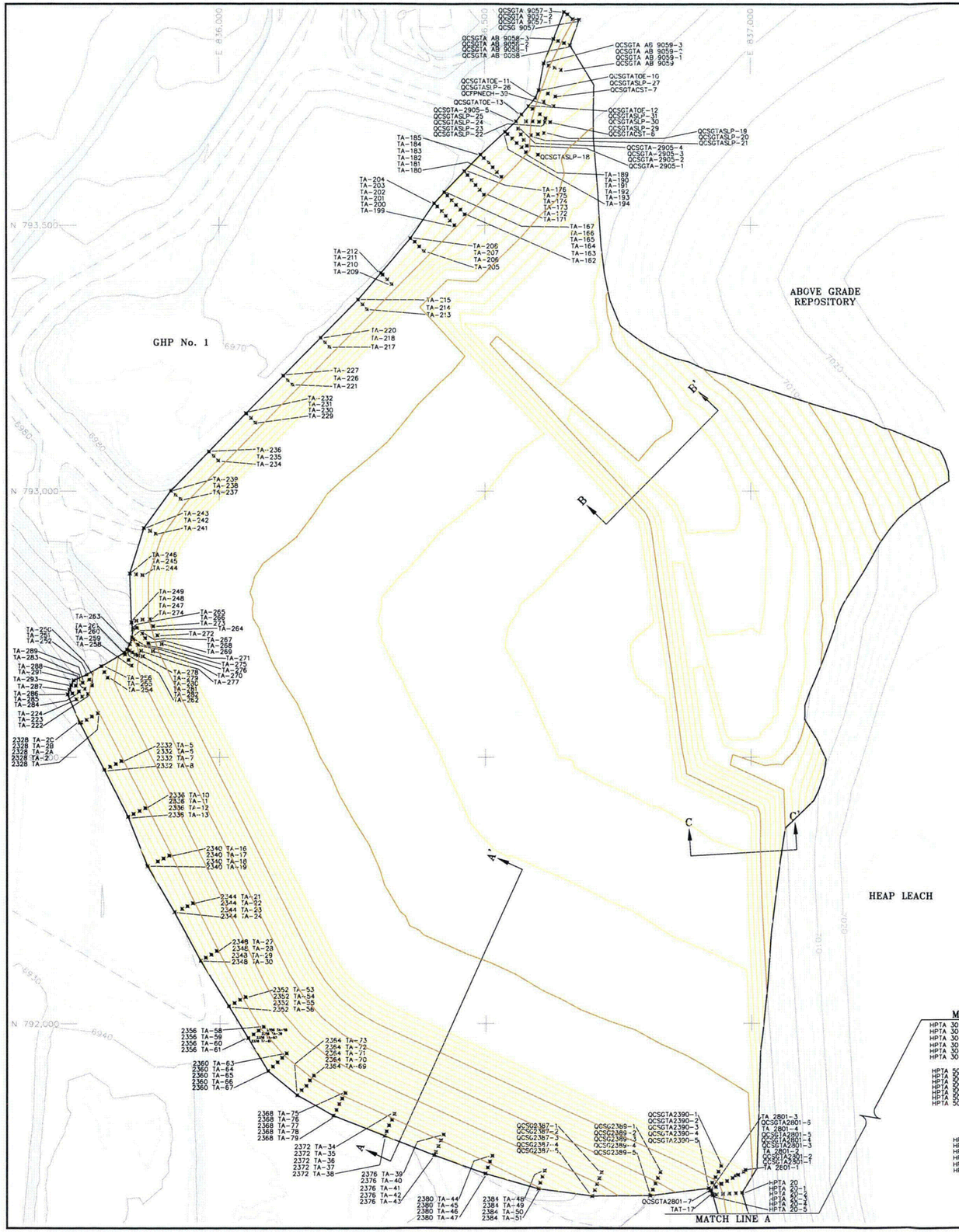
Umetco Minerals Corporation
2754 COMPASS DRIVE, SUITE 280, GRAND JUNCTION, CO 81506

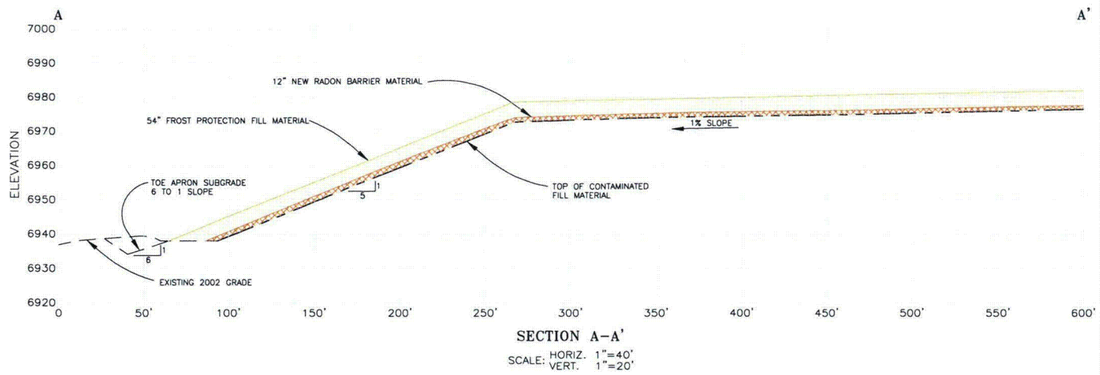
AS BUILT

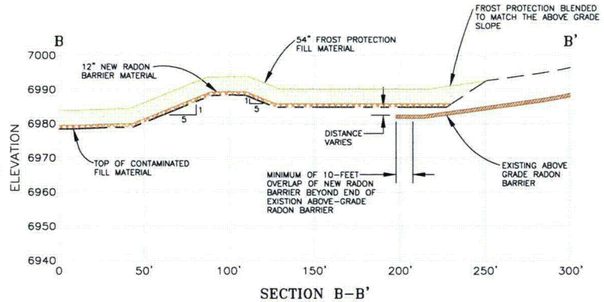
GHP-2 REPOSITORY FINAL CONTOURS AND SURVEY VERIFICATION POINTS FROST PROTECTION FILL

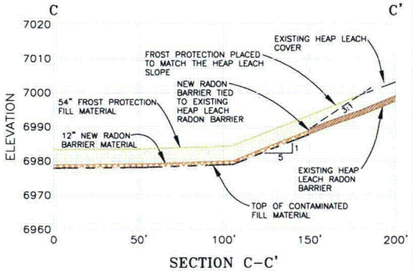
GAS HILLS, WYOMING

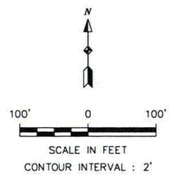
DATE: JUNE 2007 DWG: GH-GHP2-07-AB











PROFILE LEGEND:

- EXISTING GROUND SURFACE
- HDPE POND LINER
- EXISTING POND CLAY LINER
- EXISTING ABOVE-GRADE AND HEAP LEACH RADON BARRIER
- TOP OF THE CONTAMINATED FILL
- 12" NEW RADON BARRIER
- 54" FROST PROTECTION FILL

LEGEND:

- EXISTING 2000 AERIAL TOPOGRAPHY UPDATED WITH 2002 SURVEYS
- DRAINAGE PATH/PONDED WATER
- UN-PAVED ROADS
- UMETCO 1000' SITE GRID
- EXISTING RADON BARRIER LIMITS FOR THE ABOVE-GRADE AND HEAP LEACH REPOSITORIES
- FINISH GRADE TOPOGRAPHY RADON BARRIER FILL AREA
- TOE APRON SUBGRADE SURVEY VERIFICATION POINT

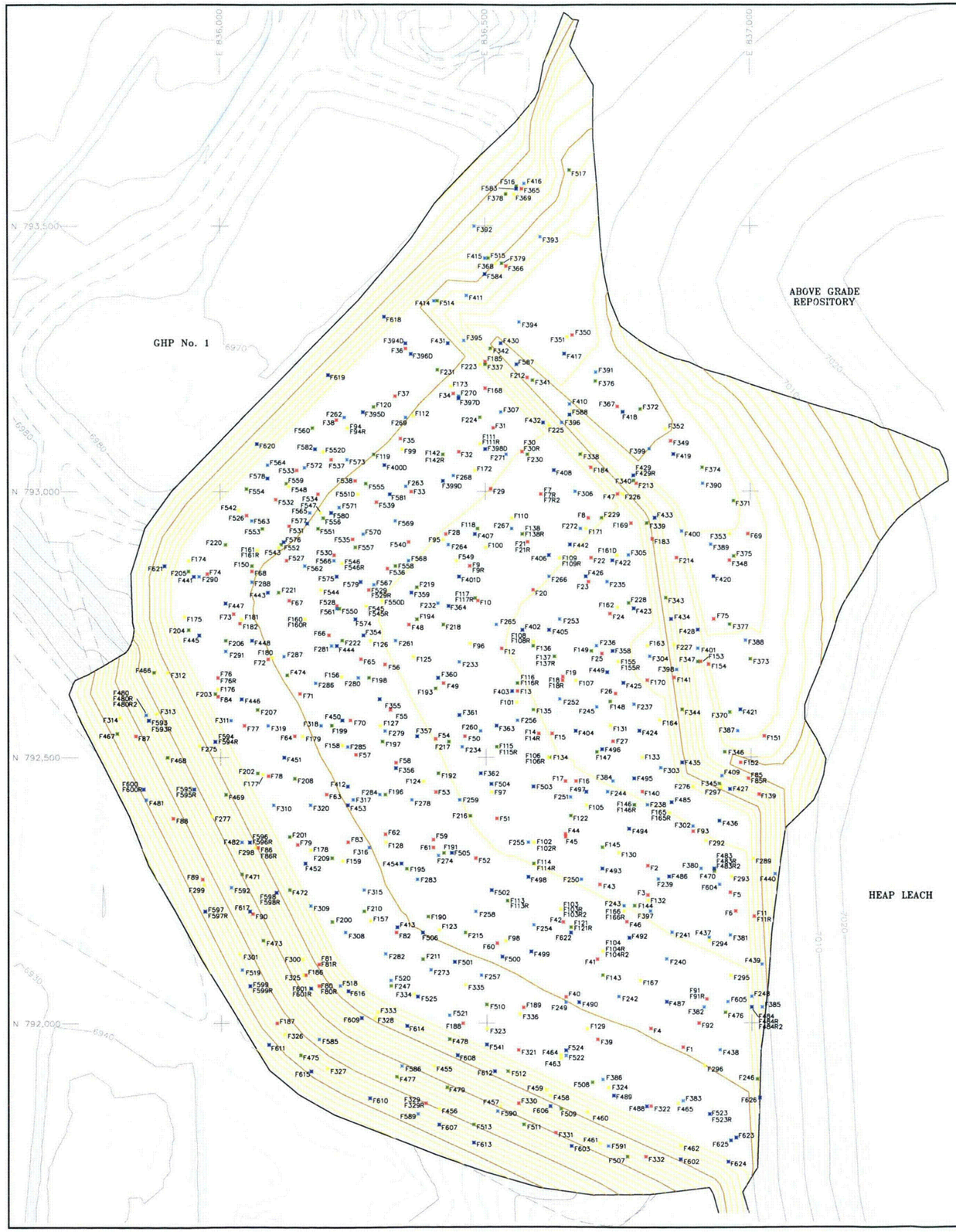
Umetco Minerals Corporation
2754 COMPASS DRIVE, SUITE 280, GRAND JUNCTION, CO 81506

AS BUILT

GHP-2 REPOSITORY FINAL CONTOURS AND SURVEY VERIFICATION POINTS TOE APRON SUBGRADE

GAS HILLS, WYOMING

DATE: JUNE 2007 DWG: GH-GHP2-08-AB



N

100' 0 100'

SCALE IN FEET
CONTOUR INTERVAL : 2'

LEGEND:

- 2000 AERIAL TOPOGRAPHY UPDATED WITH 2002 SURVEYS
- DRAINAGE PATH/PONDED WATER
- UN-PAVED ROADS
- N 794,000 — UMETCO 1000' SITE GRID
- 6960 — FINISH GRADE TOPOGRAPHY FROST PROTECTION FILL AND TOE APRON SUBGRADE
- F-761 — FROST PROTECTION FILL COMPACTION TEST LOCATION – FIRST LIFT
- F-772 — FROST PROTECTION FILL COMPACTION TEST LOCATION – SECOND LIFT
- F-784 — FROST PROTECTION FILL COMPACTION TEST LOCATION – THIRD LIFT
- F-835 — FROST PROTECTION FILL COMPACTION TEST LOCATION – FOURTH LIFT
- F-973 — FROST PROTECTION FILL COMPACTION TEST LOCATION – FIFTH LIFT

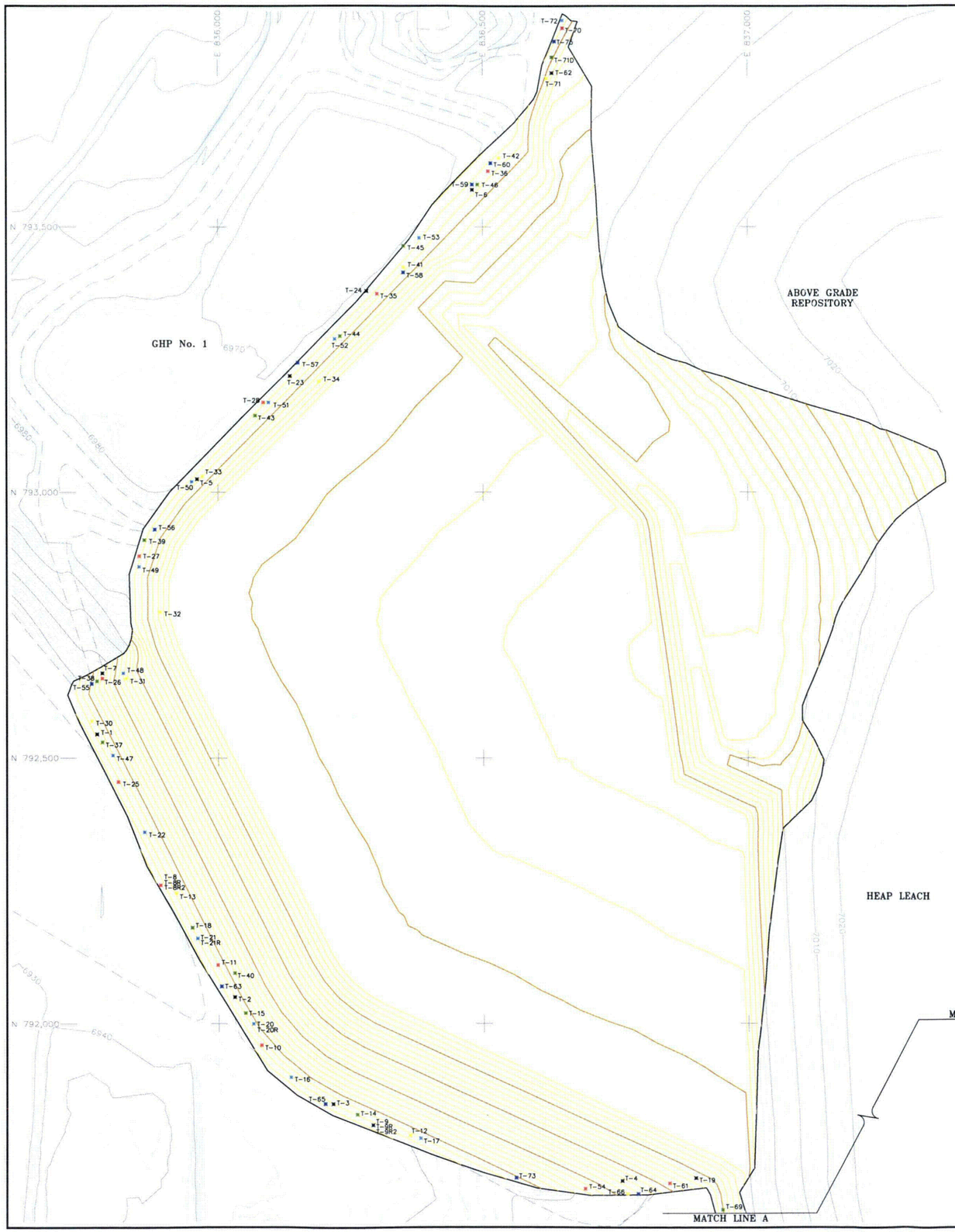
Umetco Minerals Corporation
2754 COMPASS DRIVE, SUITE 280, GRAND JUNCTION, CO 81506

AS BUILT

GHP-2 REPOSITORY
COMPACTION TEST LOCATIONS
FROST PROTECTION FILL AREA

GAS HILLS, WYOMING

DATE: JUNE 2007 DWG: GH-GFHP2-09-AB SHEET 9 OF 13



N

100' 0 100'

SCALE IN FEET
CONTOUR INTERVAL : 2'

LEGEND:

7000	2000 AERIAL TOPOGRAPHY UPDATED WITH 2002 SURVEYS
	DRAINAGE PATH/PONDED WATER
	UN-PAVED ROADS
N 794,000	UMETCO 1000' SITE GRID
6960	FINISH GRADE TOPOGRAPHY FROST PROTECTION FILL AND TOE APRON SUBGRADE
T-23	TOE APRON FILL COMPACTION TEST LOCATION - SUBGRADE
T-28	TOE APRON FILL COMPACTION TEST LOCATION - FIRST LIFT
T-34	TOE APRON FILL COMPACTION TEST LOCATION - SECOND LIFT
T-43	TOE APRON FILL COMPACTION TEST LOCATION - THIRD LIFT
T-52	TOE APRON FILL COMPACTION TEST LOCATION - FOURTH LIFT
T-57	TOE APRON FILL COMPACTION TEST LOCATION - FINISHED GRADE

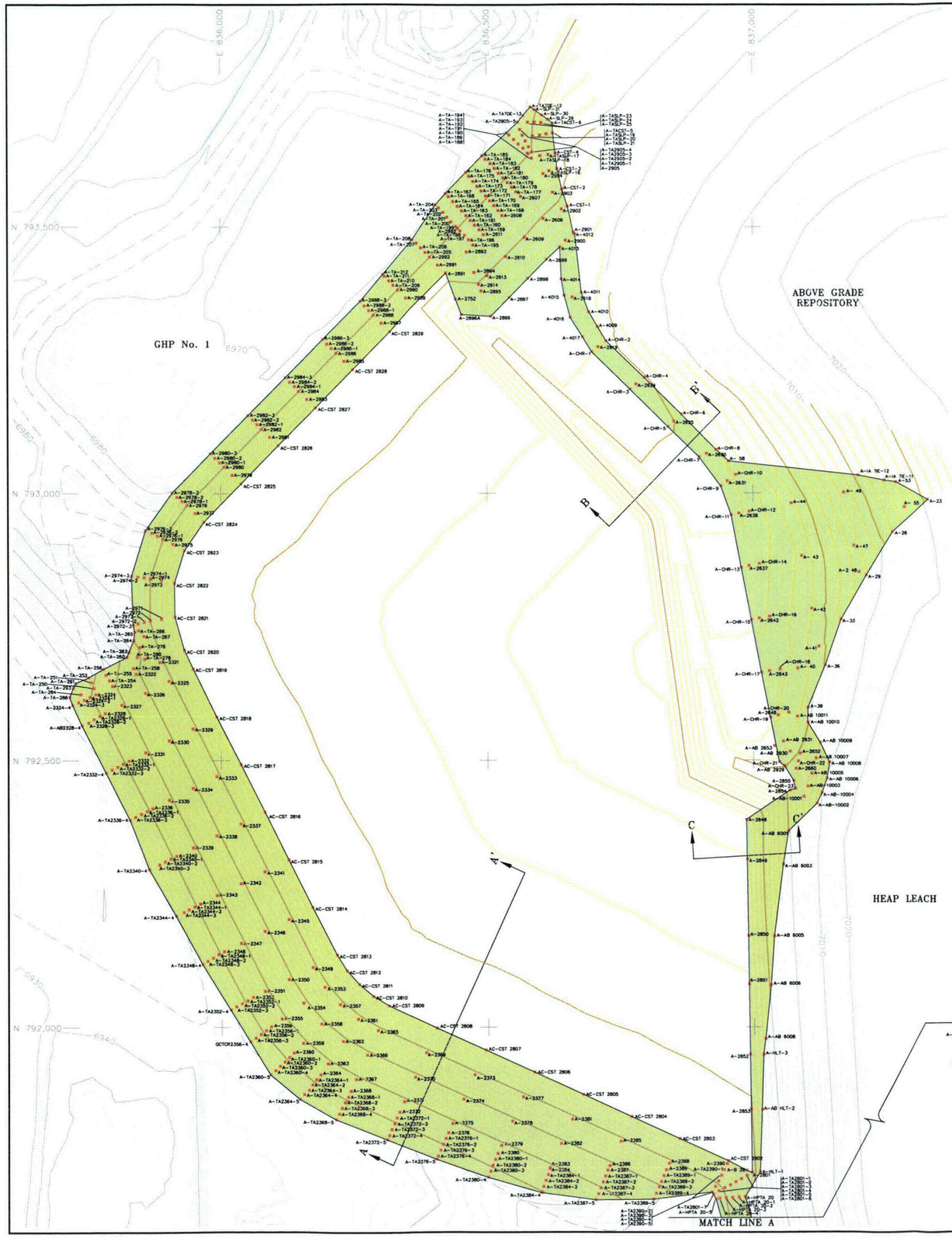
Umetco Minerals Corporation
2754 COMPASS DRIVE, SUITE 280, GRAND JUNCTION, CO 81506

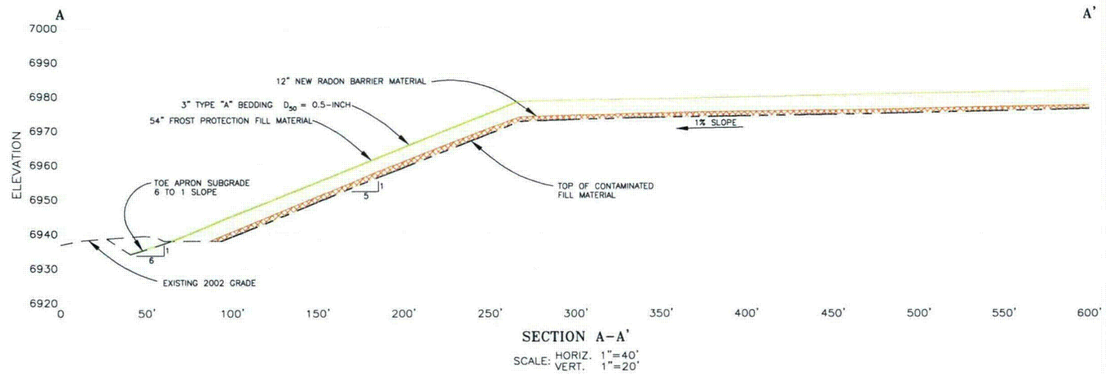
AS BUILT

GHP-2 REPOSITORY
COMPACTION TEST LOCATIONS
TOE APRON BACKFILL

GAS HILLS, WYOMING

DATE: JUNE 2007 DWG: GH-GHP2-10-AB SHEET 10 OF 13





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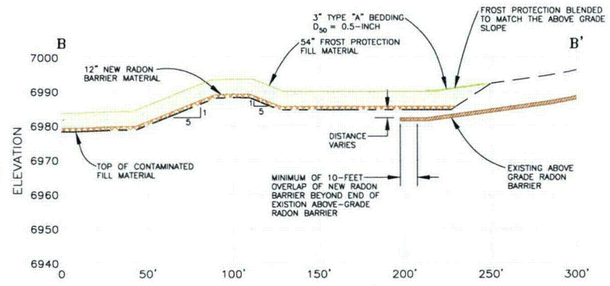

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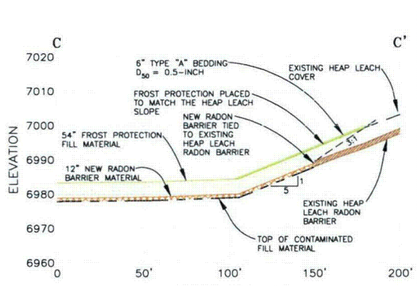

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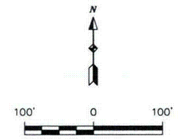


SCALE IN FEET
CONTOUR INTERVAL : 2'

PROFILE LEGEND:

- EXISTING GROUND SURFACE
- HDPE POND LINER
- EXISTING POND CLAY LINER
- EXISTING ABOVE–GRADE AND HEAP LEACH RADON BARRIER
- TOP OF THE CONTAMINATED FILL
- 12" NEW RADON BARRIER
- 54" FROST PROTECTION FILL
- TYPE "A" BEDDING D_{50} = 0.5–INCH

LEGEND:

- 7000 — 2000 AERIAL TOPOGRAPHY UPDATED WITH 2002 SURVEYS
- DRAINAGE PATH/PONDED WATER
- UN–PAVED ROADS
- N 794,000 — UMETCO 1000' SITE GRID
- 6960 — FINISH GRADE TOPOGRAPHY FROST PROTECTION FILL AND TOE APRON SUBGRADE
- A-2385 — TYPE "A" BEDDING PLACEMENT VERIFICATION POINT
- TYPE "A" RIPRAP BEDDING D_{50} = 0.5–INCH

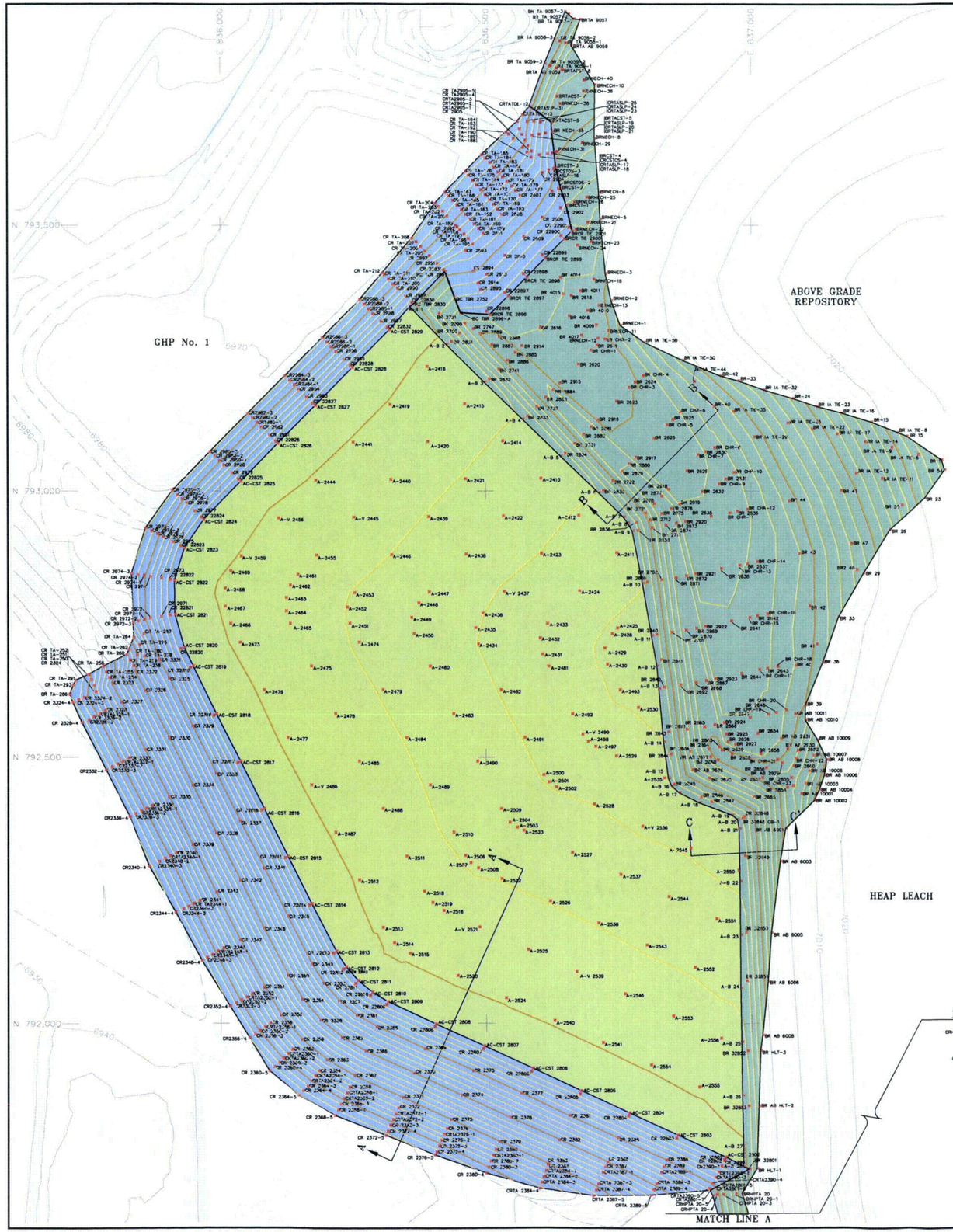
Umetco Minerals Corporation
2754 COMPASS DRIVE, SUITE 280, GRAND JUNCTION, CO 81506

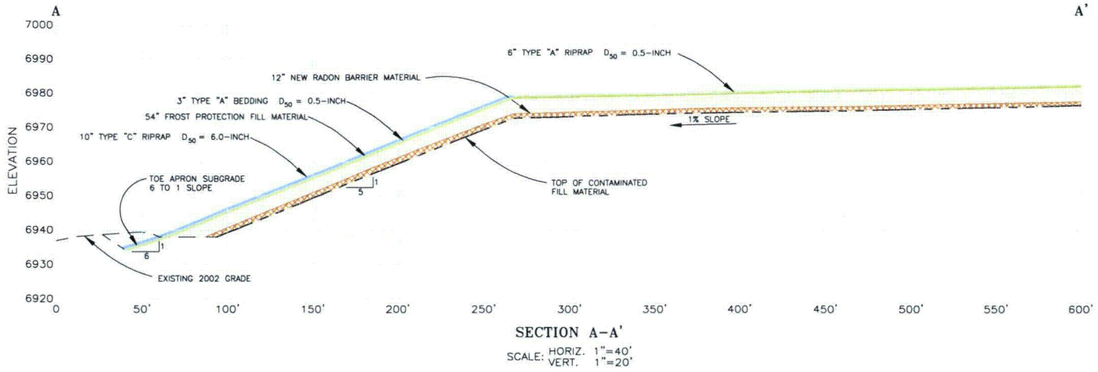
AS BUILT

GHP–2 REPOSITORY
SURVEY VERIFICATION POINTS
EROSION PROTECTION
TYPE "A" RIPRAP BEDDING MATERIAL

GAS HILLS, WYOMING

DATE: JUNE 2007 DWG: GH–GHP2–11–AB SHEET 11 OF 13





SECTION A-A'
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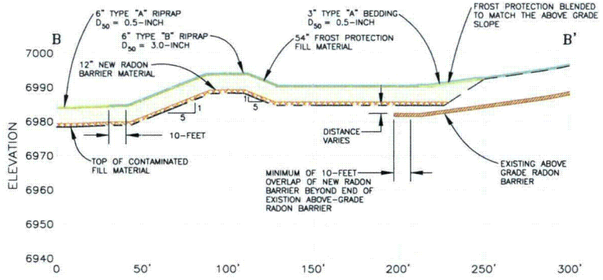
VERT. 1"=20'



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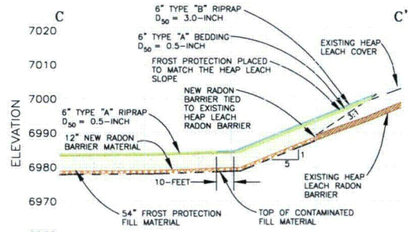


SECTION C-C'
SCALE: HORIZ. 1"=40'
VERT. 1"=20'

N

100' 0 100'

SCALE IN FEET
CONTOUR INTERVAL : 2'

LEGEND:

- 7000 — 2000 AERIAL TOPOGRAPHY UPDATED WITH 2002 SURVEYS
- DRAINAGE PATH/PONDED WATER
- UN-PAVED ROADS
- N 794,000 — UMETCO 1000' SITE GRID
- 6960 — FINISH GRADE TOPOGRAPHY EROSION PROTECTION
- A-2385 — FINAL GRADE RIPRAP PLACEMENT VERIFICATION POINT
- TYPE "A" RIPRAP D_{50} = 0.5-INCH
- TYPE "B" RIPRAP D_{50} = 3.0-INCH
- TYPE "C" RIPRAP D_{50} = 6.0-INCH

PROFILE LEGEND:

- EXISTING GROUND SURFACE
- HDPE POND LINER
- EXISTING POND CLAY LINER
- EXISTING ABOVE-GRADE AND HEAP LEACH RADON BARRIER
- TOP OF THE CONTAMINATED FILL
- 12" NEW RADON BARRIER
- 54" FROST PROTECTION FILL
- TYPE "A" BEDDING & RIPRAP D_{50} = 0.5-INCH
- TYPE "B" BEDDING D_{50} = 3.0-INCH
- TYPE "C" BEDDING D_{50} = 6.0-INCH

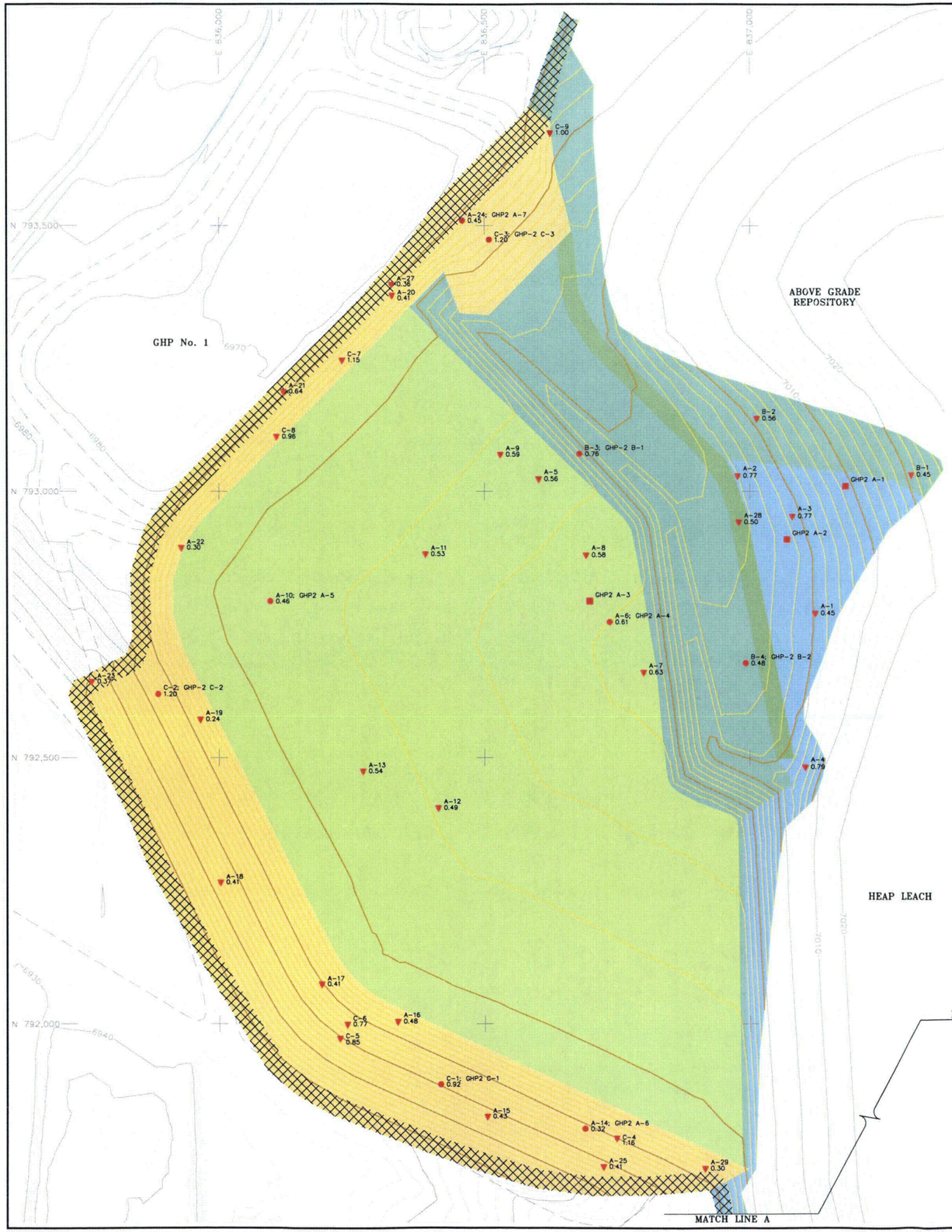
Umetco Minerals Corporation
2754 COMPASS DRIVE, SUITE 280, GRAND JUNCTION, CO 81506

AS BUILT

GHP-2 REPOSITORY FINAL CONTOURS AND SURVEY VERIFICATION POINTS EROSION PROTECTION PLACEMENT

GAS HILLS, WYOMING

DATE: JUNE 2007 DWG: GH-GHP2-12-AB SHEET 12 OF 13



N

100' 0 100'

SCALE IN FEET

CONTOUR INTERVAL : 2'

LEGEND:

- 2000 AERIAL TOPOGRAPHY UPDATED WITH 2002 SURVEYS
- DRAINAGE PATH/PONDED WATER
- UN–PAVED ROADS
- N 794,000 — UMETCO 1000' SITE GRID
- 6960 — FINISH GRADE TOPOGRAPHY FROST PROTECTION FILL AND TOE APRON SUBGRADE
- ● A–6; GHP2 A–4 0.61 — IN–PLACE VISUAL DEPTH CHECK AND IN–PLACE GRADATION SAMPLE
  A–6 = VISUAL DEPTH CHECK FIELD IDENTIFICATION NUMBER
  GHP2 A–4 = IN–PLACE GRADATION SAMPLE FIELD IDENTIFICATION NUMBER
  0.61 = DEPTH MEASURED IN FEET
- ▼ A–11 0.53 — IN–PLACE VISUAL DEPTH CHECK
  A–11 = VISUAL DEPTH CHECK FIELD IDENTIFICATION NUMBER
  0.53 = DEPTH MEASURED IN FEET
- ■ GHP2 A–1 — IN–PLACE GRADATION SAMPLE
  GHP2 A–1 = IN–PLACE GRADATION SAMPLE FIELD IDENTIFICATION NUMBER
- 6–INCHES OF TYPE "A" RIPRAP D_{50} = 0.5–INCH
- 6–INCHES OF TYPE "B" RIPRAP D_{50} = 3.0–INCH
- 6–INCHES OF TYPE "B" RIPRAP D_{50} = 3.0–INCH WITH 3–INCHES OF TYPE "A" BEDDING D_{50} = 0.5–INCH
- 10–INCHES OF TYPE "C" RIPRAP D_{50} = 6.0–INCH WITH 3–INCHES OF TYPE "A" BEDDING D_{50} = 0.5–INCH
- 6–INCHES OF TYPE "B" RIPRAP D_{50} = 3.0–INCH WITH 6–INCHES OF TYPE "A" BEDDING D_{50} = 0.5–INCH
- BELOW –GRADE APRON

Umetco Minerals Corporation
2754 COMPASS DRIVE, SUITE 280, GRAND JUNCTION, CO 81506

AS BUILT

GHP–2 REPOSITORY
IN–PLACE GRADATIONS
AND VISUAL DEPTH CHECK TEST LOCATIONS
EROSION PROTECTION PLACEMENT

GAS HILLS, WYOMING

DATE: JUNE 2007 DWG: GH–GHP2–13–AB SHEET 13 OF 13

Attachment 1

ATTACHMENT 1

NRC Approval of the Gas Hills Pond No. 2 Final Design/Reclamation Plan: License Amendment 52

Submitted by letter dated November 10, 2003
TER dated October 27, 2003

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

November 10, 2003

Mr. Curtis O. Sealy, General Manager
Umetco Minerals Corporation
P.O. Box 1029
Grand Junction, CO 81502

SUBJECT: LICENSE AMENDMENT NO. 52, THE UMETCO MINERALS CORPORATION'S ANNUAL SURETY UPDATE AND FINAL DESIGN FOR POND NO. 2 FOR THE GAS HILLS URANIUM MILL SITE, SUA-648 (TACS L52526 and L52522)

Dear Mr. Sealy:

The U.S. Nuclear Regulatory Commission (NRC) staff has completed its review of the annual surety update submitted by Umetco Minerals Corporation's (Umetco) letter dated June 12, 2003. The licensee had requested decreasing the surety amount by $1,433,471, based in large part on the final design for Pond No. 2 that was submitted to the NRC by letter dated May 9, 2003, and revised September 11, 2003. Because there is less contaminated material in the pond than estimated in 1996, the final design involves less radon barrier and minor changes to the erosion protection (rock size and layer thickness) for the pond cover than was assumed in the preliminary design for Pond No. 2. The preliminary design was approved by the NRC staff with the Heap Leach Impoundment design in Amendment No. 38 (May 28, 1998). The staff's technical evaluation report (TER) of Pond No. 2's final design (Enclosure 1) determined that the design was acceptable. Therefore, the NRC staff has approved the decrease in surety amount. Other decommissioning cost estimates were properly increased to reflect the annual change in consumer price index so that the approved surety amount for the NRC portion of the site is $14,845,246. As discussed in Section 5.0 of the TER, Umetco should consider re-baselining its cost estimate for the 2004 surety update.

License Condition 55 has been revised to reflect the new surety amount and License Condition 61 has been revised to include the proposed design for Pond No. 2. The amended license is enclosed (Enclosure 2). An environmental review was not performed since this action is categorically excluded under 10 CFR 51.22(c)(10), as a change to a surety and under 10 CFR 51.22(c)(11) concerning a change in process operations for the minor design changes for Pond No. 2 (discussed at the end of the TER).

If you have any questions concerning this letter or the enclosures, please contact Ms. Elaine Brummett of my staff at (301) 415-6606 or by e-mail at esb@nrc.gov.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Sincerely,

Gary S. Janosko, Chief
Fuel Cycle Facilities Branch
Division of Fuel Cycle Safety
and Safeguards
Office of Nuclear Material Safety
and Safeguards

Docket No. 40-0299
License No. SUA–648

Enclosures: 1. Technical Evaluation Report for Pond. No. 2
2. License Amendment 52

cc: M. Moxley, DEQ WY
L. Setlow, EPA

TECHNICAL EVALUATION REPORT
FOR UMETCO MINERALS CORPORATION'S
FINAL DESIGN FOR POND NO. 2
AT THE GAS HILLS URANIUM MILL SITE

Docket No.: 40-0299 **License No.:** SUA-648

DATE: October 27, 2003

FACILITY: Umetco Minerals Corporation - Gas Hills Uranium Tailings Site, Wyoming

TECHNICAL REVIEWERS: Elaine Brummett, Jill Caverly, Daniel Rom

PROJECT MANAGER: Elaine Brummett

SUMMARY AND CONCLUSIONS:

By letter dated May 9, 2003, Umetco Minerals Corporation (Umetco) submitted the "Final Design and Reclamation Plan for GHP No. 2/Mill Area" (Plan) and requested NRC approval of the Plan by amendment of license SUA-648. The plan addressed the cover radon attenuation design, the geotechnical design for cell and cover stability, and the erosion protection design.

The NRC staff requested additional information by letter dated August 14, 2003, and the Umetco response and revised plan are dated September 11, 2003. The NRC staff used the NUREG-1620 Standard Review Plan (SRP) to evaluate the design against the 10 CFR Part 40, Appendix A, criteria. The staff determined that the proposed plan meets the applicable criteria and protects health, safety, and the environment.

BACKGROUND:

Gas Hills Pond No. 2 is a 17-acre evaporation pond that covers most of the former mill site. The pond was used for the ground water corrective action program (pump and evaporate), so it contains byproduct material. It was built on natural mineralization and mill-related uranium and will be covered in place to avoid trying to distinguish natural from licensed material during excavation. The pond is located adjacent to the west side of the completed Heap-Leach and Above-Grade cells. Pond No. 1 was on the north side of Pond No. 2, but has been excavated according to an approved plan.

The proposed final design differs somewhat from the preliminary design submitted September 25, 1996, and approved by NRC with the Heap Leach Impoundment design in amendment No. 38 (May 28, 1998). Because significantly less contaminated material will be placed in the pond, the radon barrier can be reduced from 18 to 12 inches. Also, the erosion protection layer thickness for the side slope was increased by one inch and the diameter of the rock increased in the final plan.

The key components of the Plan are: solidify the remaining liquids, remove the pond lining system, and place the cover. Pumping of the ground water into Pond No. 2 ceased on March 29, 2002, although liquid was still received from portions of the A-9 disposal cell (e.g., runoff). When the pond liquid decreases to a level of 1.5 million gallon or less, local mine spoils (overburden) soil will be mixed with the solution and the shredded synthetic liner materials so that the material can be compacted to 95 percent standard Proctor density.

Umetco already has NRC approval for the soil decommissioning plan and for the health and safety program. Also, the surety update currently under review by staff addresses the changes to reclamation costs proposed in the final design.

TECHNICAL EVALUATION:

1.0 Radon Attenuation

The limit for the average (over at least a year) long-term release of radon-222 (Rn-222) from uranium byproduct materials to the atmosphere is 20 $pCi/m^2/s$ from the surface of the tailings cell for 1000 years, to the extent reasonably achievable, but at least 200 years, as stated in Criterion 6(1) of 10 CFR Part 40, Appendix A. Rn-222 is the decay product of radium-226, is a gas, has a short half-life, and decays to a solid particle. The long-term Rn-222 flux rate can be estimated from the physical and radiological characteristics of the contaminated and barrier materials that would affect movement and concentration of the gas, using a series of calculations or a computer code.

Umetco proposed a radon barrier composed of a 12-inch-thick clayey soil layer and a 54-inch-thick layer of silty-clayey sand for the frost protection. Together, these two layers should retard the radon movement until it decays so that the flux limit is met. These materials have been evaluated with the approved cover design for the Heap-Leach cell. The staff's review included evaluation of the pertinent design criteria and also evaluated Umetco's use of the RADON computer code (NRC, 1989), including parameter input values used to calculate the radon flux limit. Finally, the staff performed an independent analysis of the design using the RADON code.

Radon Flux Model Parameters:

The staff evaluated the input into the RADON computer code to ensure that the values are either based on site-specific testing or are conservative estimates. The staff also evaluated the justification and assumptions made in choosing these values and confirmed that each input value was representative of the proposed material, consistent with anticipated construction specifications, and based on long-term conditions. For all three materials, the diffusion coefficient was calculated by the RADON code which, for many soil types, is conservative.

The licensee's flux model used a contaminated material thickness of 500 cm (16.4 feet), which is conservative. The average Ra-226 activity level of 62 picocuries per gram (pCi/g) was derived from 20 average (over 3-foot intervals) values estimated from 6-inch intervals of borehole gamma logs. Umetco commits (Page 7 of the submittal) to measure the Ra-226 activity concentration over 500 cm in composite samples from 3-foot intervals of each borehole specimen (at least one borehole for each acre) before cover placement. This will allow modeling by layers to reflect any influence of higher radium content in the upper layers.

The contaminated material density value of 1.75 g/cm^3 was based on test results and used to calculate a porosity of 0.34. The emanation coefficient input to the code was 0.26, based on the previously approved value for the frost protection soil and its similarity to the material that will be used to solidify the pond liquid. The diffusion coefficient was the code calculated value. The long-term moisture content of the contaminated material was a conservative estimate of 6 percent.

Most radon barrier parameter values were derived from measurements of five samples. The 95 percent of maximum density value was 1.59 g/cm^3 and the calculated porosity 0.4. The average Ra-226 value was 2 pCi/g, the measured emanation coefficient 0.17 (based on nine samples). Umetco also used another model with the more conservative emanation coefficient of 0.20 and the code calculated diffusion coefficient. The previously approved long-term moisture content for this material was 12 percent. This is a conservative value for clay soil (95 percent of the material passes a 200 sieve).

The frost protection material density value of 1.75 g/cm^3 was based on 95 percent of the average measured maximum density and the calculated porosity of 0.34. The average Ra-226 value was assumed to be the site-wide background value of 10 pCi/g, but Umetco indicated that it would scan the material before placement to keep the maximum value at or below 10 pCi/g. This complies with Appendix A, Criterion 6(5) that states "...near surface cover must be essentially the same, as far as radioactivity is concerned, as that of surrounding surface soils." To be conservative, Umetco used the cover Ra-226 values in the model, although it is not required (the standard applies only to the radon emissions from byproduct material). The average measured emanation coefficient of 0.26, and a conservative estimated moisture value of 6 percent were used in the model.

Modeling Results:

Umetco used the RADON computer code to calculate the long-term radon flux (NRC Regulatory Guide 3.64, 1989). The Umetco conservative flux model (emanation coefficient of 0.20) results indicate that the proposed 12-inch radon barrier and 54-inch frost protection layer will result in an estimated radon flux of 19.4 pCi/m^2/s. The other model resulted in a flux of 14.3 pCi/m^2/s. The NRC staff also performed modeling using higher Ra-226 levels and the radon flux level met the limit.

Cover Integrity:

To protect the clay radon barrier from freeze-thaw effects and to assist with radon attenuation, the same material and thickness previously approved for the Heap-Leach and Above Grade Cells is proposed. Biointrusion has also been addressed in these previous designs/plans.

Conclusions:

The NRC staff determined that the radon flux was calculated appropriately. However, since the Ra-226 level of the contaminated material can only be roughly estimated at this time, Umetco committed to measure the Ra-226 in at least 17 locations and for at least three (3-foot) layers after the pond sludge is solidified. The Ra-226 data must be submitted to NRC, before radon barrier placement begins, to justify that the Ra-226 values used in the radon flux model are representative. If the measured Ra-226 values are significantly higher than the estimated

values, Umetco will provide a revised model to estimate the long-term radon flux and demonstrate that the long-term radon flux from the cover should meet the limit in Criterion 6(1).

2.0 Cover Gamma Attenuation and Radioactivity Content

Umetco indicated that gamma measurements would be made on the completed radon barrier to demonstrate that the cover reduces the gamma exposure rate to background levels, as required by Part 40, Appendix A, Criterion 6(1). The radioactivity content of the cover materials will be measured to assure that it is within the range of background soil, as was done under previously approved cover designs at the site. The cover materials are from the surrounding area and do not contain waste or ore with elevated Ra-226 content. Therefore, the cover design ensures that surface radon exhalation is not significantly above background because of the cover material, as required by Criterion 6(5).

3.0 Geotechnical Design

The licensee provided information regarding the geometric design of the GHP No. 2 area, and indicated that the embankments will be constructed with 5H:1V exterior slopes. Representative soil tests provided design parameters for determination of embankment stability. Static and pseudo-static slope stability analyses were performed to confirm that the long-term stability would be satisfactory.

A horizontal seismic coefficient of 0.2 g was assumed in the pseudo-static slope stability analyses, and a safety factor in excess of unity was calculated using the SLOPE/W, Version 5, Software Package. Similarly, short-term and static analyses yielded safety factors in excess of required minimum values.

Settlement of the embankments is expected to be minimal, and to occur rapidly. Much of the foundation is relatively incompressible, and the thin silt lenses are dry. The stabilized soils will be well-compacted at a moisture content near optimum. Since settlement will be controlled, cover cracking is unlikely to occur. Since ground water is quite deep, the foundation soils would not be expected to become saturated and collapse. The frost protection design is based on the previously approved model for the Heap Leach, Above-Grade, and A-9 disposal cells.

A satisfactory Construction Specification for the material handling and placement operations was also provided. Test methods and intervals were specified, and are in accordance with standard practice. The staff also reviewed the calculations, analyses, and construction specifications and concludes that these are acceptable.

Conclusions:

Based on review of the information submitted by the licensee, the NRC staff concludes that the licensee has provided an adequate design to assure that tailings and contaminated material will not be released during the post-operational period. Based on review of stability calculations for the pond embankments, the staff concludes that the requirements of 10 CFR 40 Appendix A, Criterion 5, have been met regarding the geotechnical engineering design.

4.0 Surface Water Hydrology and Erosion Protection

Criterion 1 of 10 CFR Part 40, Appendix A, addresses the general goals of siting and designing facilities to provide for permanent isolation of tailings and minimizing the potential for dispersion by natural forces without the need for active maintenance. The reclamation plan for the Umetco Gas Hills Wyoming uranium mill site addresses these criteria by providing drainage and erosion protection which will control dispersion of the radiological material by both wind and water.

This review addresses the design changes proposed with submittals provided by Umetco under letters dated May 9, 2003, and September 11, 2003. This review was performed using NRC staff guidance of NUREG -1620, Rev 1, "Standard Review Plan for the Review of Reclamation Plan for Mill Tailings Sites Under Title II of the Uranium Mill Tailings Radiation Control Act of 1978."

Scope of Changes Concerning Surface Water Hydrology and Erosion Protection:

The submittal for design of reclamation for the Pond No. 2 area includes the 17-acre evaporation pond constructed in the former mill process and stockpile area of the facility. The reclamation cover was designed to meet the criteria in 10 CFR Part 40, Appendix A. The tailings located in the pond area will be stabilized in place with an engineered cover. A diversion channel will be constructed to route runoff from the neighboring heap leach pile away from the tailings in the Pond No. 2 area.

Hydrologic Characterization and Flooding Determinations:

The hydrologic basis for the erosion protection of the Pond No. 2 area is the probable maximum precipitation (PMP) event which is the maximum precipitation that can be expected to occur at this location. The design flood was developed using the PMP and methods developed by the National Weather Service in Hydrometeorological Report 55A. This method calculates the maximum flood flow that may occur during the 1000-year design period as required in Part 40. This has been previously reviewed and accepted by the NRC under Amendment 38 to Source Materials License SUA-648

The design for the area of the pond includes a regrading of the area to allow for drainage from the top of the reclaimed area. Pond No. 2 will be regraded to have a gradual slope on the tops of the newly created impoundment and steeper slopes on the side. A channel on the upstream side of the impoundment drainage will redirect runoff from the reclaimed heap leach area. The heap leach reclamation design has already been accepted by the NRC.

Acceptable methods were used to determine the unit flow associated with the impoundment slopes. The runoff coefficient, time of concentration and rainfall intensity were accurately and conservatively calculated. The staff has completed its review of the hydrologic characterization and flooding determination of the Pond No. 2 reclamation plan and concludes that the characterization, general surface water hydrology, and flooding calculations are reasonable and comply with the requirements of 10 CFR Part 40, Appendix A.

Water Surface Profiles, Channel Velocities and Shear Stresses:

The dimensions of the channel, including depth and width, were accurately determined using Manning's equation which is a standard hydraulic engineering equation to determine the channel dimensions for uniform flow. Manning's roughness coefficient used in the design provided a reasonable amount of conservatism. Additionally, shear stress computations were performed in accordance with NRC guidance. On the basis of the information submitted, the staff concludes that the design meets the requirements of 10 CFR Part 40, Appendix A, which requires that the design include the long-term stability of the site without requiring maintenance.

Design of Erosion Protection:

Erosion protection was designed for the Pond No. 2 impoundment along the flatter top slopes and the steeper side slopes. The velocity of the flow in the channel that redirects flow from the heap leach away from the pond impoundment area was analyzed and determined to require erosion protection. The design requires rock riprap to be placed on all surfaces of the reclaimed Pond No. 2 area. The Stephenson method for calculating riprap size was used on the impoundment area, while the Safety Factors Method was used to determine rock size along the channel. Both of these methods have been described in NRC guidance, Design of Erosion for Long-Term Stabilization (NUREG-1623).

Interstitial flow velocities for the submitted design of the channel were evaluated in accordance with the above cited guidance. A rock bedding layer will be placed below the erosion protection in the channel. The submittal commits Umetco to test rock durability according to the guidance stated in NUREG-1623 and that rock used for erosion protection will have a durability score of no less than 80. Additionally, the rock gradation proposed is acceptable.

Conclusions:

The staff has completed its review of the design of erosion protection for the design of Pond No. 2. On the basis of the information submitted, the review concluded that the erosion protections designs are acceptable and meet the criteria of 10 CFR Part 40, Appendix A which requires uranium mill tailings be stabilized for a period of 1000 years, to the extent reasonably achievable, without active maintenance.

5.0 Decommissioning Cost Estimates

Table 2 of the June 12, 2003, submittal summarizes the changes in radon barrier and erosion protection costs associated with the final reclamation design for the Pond No. 2. The staff reviewed both the unit costs and quantities associated with this action and finds that the estimated costs and quantities are acceptable. However, it should be noted that the review is based on drawings provided by the licensee and not a field inspection.

The last update was approved by NRC by letter of August 23, 2002. The staff determined that the inflation adjustment for the 2003 surety update was properly calculated by the increase in consumer price index, based primarily on cost estimates submitted on December 2, 2000. For the 2004 update, Umetco should consider re-baselining the cost estimates.

The proposed amount of $14,845,246 for the NRC portion of the financial surety, reflecting the changes for the final reclamation of Pond No. 2 and inflation, is acceptable.

ENVIRONMENTAL IMPACT EVALUATION:

The requested changes to the approved preliminary reclamation plan for Pond No. 2 are minor and are encompassed by the environmental assessment and by the Finding of no Significant Impact for the reclamation plan published in the **Federal Register** on May 6, 1998. Because there is less contaminated material and the cover design meets regulatory criteria, there should be no change in type, or increase in the amounts of effluents that may be released offsite, no significant increase in occupational exposure, and no increase in potential for radiological accidents due to the requested action. Also, no significant construction impact is expected from the requested changes, somewhat less construction activity will occur because of a thinner radon barrier and shorter side slopes, i.e., less cover material to place. Therefore, in accordance with the categorical exclusion contained in Paragraph (c)(11) of 10 CFR 51.22, concerning a change in process operations, an environmental assessment is not required for this licensing action, and submittal of an environmental report is not necessary.

PROPOSED LICENSE CONDITION CHANGES:

License Condition 55 should be revised to reflect the change in surety amount to $14,845,246.

License Condition 61 should have the following paragraph added:

The reclamation of Pond No. 2 will be performed according to the final plan submitted on September 11, 2003. In addition, the Ra-226 data for the solidified pond sludge shall be submitted to the NRC, before radon barrier placement begins, to justify that the Ra-226 values used in the radon flux model are representative. If the measured values are significantly higher than the estimated values, Umetco will provide a revised radon flux model to demonstrate that the long-term radon flux from the cover should meet the limit in Part 40, Appendix A, Criterion 6(1).

REFERENCES:

Lawrence Livermore National Laboratory, 1994. "Seismic Hazard Potential of Title II Reclamation Plans," for the U.S. Nuclear Regulatory Commission, Washington, D.C.

Umetco Minerals Corporation, "Final Design and Reclamation Plan for GHP No. 2/Mill Area." Submittal to the NRC by letter dated May 9, 2003.

U.S. Department of Energy (DOE), 1989. "Technical Approach Document: Revision II," Uranium Mill Tailings Remedial Action Project.

U.S. Nuclear Regulatory Commission, 1977. "Design, Construction, and Inspection of Embankment Retention Systems for Uranium Mills," Regulatory Guide 3.11, Washington, D.C.

U.S. Nuclear Regulatory Commission, 1989. "Calculation of Radon Flux Attenuation by Earthen Uranium Mill Tailings Covers," Regulatory Guide 3.64, Washington, D.C.

U.S. Nuclear Regulatory Commission, 2002. "Design of Ersosion Protection for Long-Term Stabilization." NUREG-1623, Washington , D.C.

U.S. Nuclear Regulatory Commission, 2003. "Standard Review Plan for the Review of a Reclamation Plan for Mill Tailings Sites Under Title II of the Uranium Mill Tailings Radiation Control Act." NUREG-1620, Rev. 1., Washington , D.C.

Attachment 2

ATTACHMENT 2

NRC Technical Evaluation Supporting License Amendment 58: Modified Radiological Cover Criteria for Gas Hills Pond No. 2

Submitted by letter dated November 22, 2006
TER dated October 12, 2006

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

November 22, 2006

Mr. Thomas Gieck, Remediation Manager
Umetco Minerals Corporation
PO Box 1029
Grand Junction, CO 81502

SUBJECT: LICENSE AMENDMENT NO. 58 TO UMETCO MINERALS CORPORATION'S LICENSE SUA-648 - MODIFICATION OF GAS HILLS POND NO. 2 AND C-18 COVERS (TAC LU0143)

Dear Mr. Gieck:

The U.S. Nuclear Regulatory Commission (NRC) staff has completed its review of the requests submitted by Umetco Minerals Corporation (Umetco), both dated February 7, 2006. Based on the review of the aforementioned submittals, the staff determined that the Gas Hills Pond No. 2 cover and the C-18 cover designs are adequate. The NRC staff's review is documented in the enclosed technical evaluation report (Enclosure 1).

License Condition (LC) 58 has been revised to include the updated soil radium data for the topsoil of the C-18 cover. LC 61 has been revised to include the changes in design for Gas Hills Pond No. 2 cover. License Amendment No. 58 is enclosed (Enclosure 2).

In addition to the above amendments, LC 60 has been revised to reflect NRC organizational changes within the NRC. All correspondence related to this license shall be sent to the following address: Deputy Director, Decommissioning and Uranium Recovery Licensing Directorate, Division of Waste Management and Environmental Protection, Office of Federal and State Materials and Environmental Management Programs, Mailstop T7-E18, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by express delivery to 11545 Rockville Pike, Rockville, MD 20852-2738.

If you have any questions concerning this letter or the enclosures, please contact Robert Lukes, at (301) 415-4025, or by e-mail, at rgl@nrc.gov.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice for Domestic Licensing Proceedings and Issuance of Orders," a copy of this letter will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records component of NRC's Agencywide Documents Access and Management System (ADAMS). ADAMS is accessible from the NRC Web site at: http://www.nrc.gov/reading-rm/adams.html.

Sincerely,

Keith I. McConnell, Deputy Director
Decommissioning and Uranium Recovery
Licensing Directorate
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Docket No.: 40-0299
License No.: SUA-648

Enclosures: 1. Technical Evaluation Report
2. License Amendment No. 58

cc: M. Moxley, DEQ WY

TECHNICAL EVALUATION REPORT FOR UMETCO MINERALS CORPORATION'S MODIFICATION TO POND NO. 2 AND C-18 COVER DESIGN CRITERIA AT THE GAS HILLS URANIUM MILL SITE

DOCKET NO.: 40-0299 **LICENSE NO.:** SUA-648

DATE: October 12, 2006

FACILITY: Umetco Minerals Corporation - Gas Hills Uranium Mill Tailings Site, Natrona County, Wyoming

TECHNICAL REVIEWER: Robert Lukes

PROJECT MANAGER: Robert Lukes

BACKGROUND:

By two letters, each dated February 7, 2006, Umetco Minerals Corporation (Umetco) submitted requests for amendments to Source Materials License SUA-648, License Conditions 58 and 61 to U.S. Nuclear Regulatory Commission (NRC) staff (Umetco, 2006a & b). In one letter, modification of License Condition 58, the licensee requested a change to the average allowable radium-226 (Ra-226) content for the C-18 pit topsoil from 5 to 10 picocuries per gram (pCi/g). In the second letter, modification of License Condition 61, the licensee requested that NRC staff change the allowable Ra-226 content in the cover materials of Gas Hills Pond No. 2 (GHP-2) from 10 to 15 pCi/g. Umetco also requested, in the second letter, a change to the allowable background exposure limit on the cover from 30 microRoentgens per hour (μR/hr) to 40 μR/hr. Both issues are being evaluated in a single Technical Evaluation Report because the issues are similar in scope.

During the review of the request to modify License Condition 61 a potential violation was noted by NRC technical reviewers. Subsequently, NRC staff requested that Region IV inspect the Umetco facility. The inspection revealed a violation did occur, as noted in IR04000299-06-001, which involved improper verification of soil materials prior to placement over tailings. This license amendment request is the corrective action to the issued violation.

TECHNICAL EVALUATION:

GHP-2 Frost Protection and Exposure Rate Criteria

Radon Attenuation

The limit for the average long-term release of radon-222 (Rn-222) from uranium byproduct materials to the atmosphere is 20 picocuries per square meter per second ($pCi/m^2/s$) from the surface of the tailings cell for 1000 years, to the extent reasonably achievable, but at least 200

years, as stated in Criterion 6(1) of 10 CFR Part 40, Appendix A. Rn-222, the decay product of Ra-226, is a gas with a short half-life, that decays to a solid particle. The long-term Rn-222 flux rate can be estimated from the physical and radiological characteristics of the contaminated and barrier materials using a series of hand calculations or a computer code.

Radon Flux Model Parameters:

The staff evaluated the licensee's input used in the RADON computer code to ensure that the values are either based on site-specific testing or conservative estimates. The staff also evaluated the licensee's justification and assumptions made in choosing these values and confirmed that each input value was representative of the proposed material, consistent with anticipated construction specifications, and based on long-term conditions.

The licensee's flux model used a contaminated material thickness of 500 centimeters (cm), which is conservative. Data from recent subgrade samples indicate that the Ra-226 activity levels have decreased and range from 21 to 31pCi/g. Additionally, sampling also indicated that an emanation coefficient of 0.17 and a diffusion coefficient of 0.0031 centimeters squared per second (cm^2/s) are more realistic values than that of the default radon code parameters. The contaminated material density value of 1.75 grams per cubic centimeter (g/cm^3) was based on test results and used to calculate a porosity of 0.34. The diffusion coefficient was the code calculated value and the long-term moisture content of the contaminated material was a conservative estimate of 6 percent.

The average Ra-226 value for the frost protection layer used in the model is 15 pCi/g. After reviewing site background data, NRC staff determined that a Ra-226 activity of 15 pCi/g for the frost protection layer is a more realistic value than the previously approved 10 pCi/g. This complies with Appendix A, Criterion 6(5) that states "...near surface cover must be essentially the same, as far as radioactivity is concerned, as that of surrounding surface soils." To be conservative, Umetco used the cover Ra-226 values in the model, although it is not required (the standard applies only to the radon emissions from byproduct material).

Modeling Results:

Umetco used the RADON computer code to calculate the long-term radon flux (NRC Regulatory Guide 3.64, 1989). The Umetco flux model results indicate that the proposed change to the Ra-226 activity level along with the more realistic tailings data will change the expected radon flux from the previously calculated 14.3 $pCi/m^2/s$ to 14.6 $pCi/m^2/s$. The NRC staff also performed modeling using higher Ra-226 levels (62 pCi/g), a more conservative emanation coefficient (.20), and the code calculated diffusion coefficient (.01277 cm^2/s) which resulted in flux levels that were also less then the limit of 20.0 $pCi/m^2/s$.

Conclusions:

The NRC staff determined that the radon flux was calculated appropriately. NRC staff has determined the cover is adequate to meet the requirements set forth in Criterion 6(1) of 10 CFR Part 40, Appendix A.

Cover Gamma Attenuation and Radioactivity Content

Umetco radiation surveys of the GHP-2 cover indicate that the average exposure rate over the cover is 38 µR/hr. The previously established background for the Umetco site is 30 µR/hr. 10 CFR Part 40, Appendix A, Criterion 6(1), states that the direct gamma exposure rate should be reduced to background levels. Evaluation of area surveys on and off the site indicate that background values vary greatly from 16 - 97 µR/hr. Determining an accurate background for the site is subject to bias due to the great variance of the area's radiation levels. An appropriate background would be one that is conservatively estimated considering site background data and radium levels in the area. NRC staff has concluded that the proposed value of 40 µR/hr is appropriate considering Ra-226 activity and area radiation levels. Furthermore, changing the allowable average exposure rate inside the site boundary from 30 to 40 µR/hr does not pose a significant risk to public health, safety, and the environment. NRC staff has determined that the new average allowable exposure rate of 40 µR/hr satisfies 10 CFR Part 40, Appendix A, Criterion 6(1).

Top Soil Criteria for the C-18 Pit

NRC staff agrees that the required value of 5 pCi/g of Ra-226 concentration in the 30-cm growth medium is overly conservative and not a realistic estimate of actual background activity on site. NRC staff has reviewed the survey data and agrees that the appropriate background activity can be estimated to be 10 pCi/g for areas within the site boundary. Additionally, NRC staff calculated the radon exit flux from the elevated Ra-226 concentration in the top soil and found it to be much less than the required 20.0 $pCi/m^2/s$. The elevated Ra-226 level in the top soil does not pose a significant risk to the public health, safety, and the environment and is a conservative estimate of Ra-226 concentration background within the site boundary.

ENVIRONMENTAL IMPACT EVALUATION:

The requested changes to the approved reclamation plan for Pond No. 2 and the C-18 pit are minor and meet regulatory criteria. Additionally, there is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite, no significant increase in individual or cumulative occupational exposure, and no increase in potential for radiological accidents due to the requested action. Furthermore, no significant construction impact due to the requested action is expected. Therefore, in accordance with the categorical exclusion contained in Paragraph (c)(11) of 10 CFR 51.22, concerning a change in process operations, an environmental assessment is not required for this licensing action, and submittal of an environmental report is not necessary.

PROPOSED LICENSE CONDITION CHANGES:

License Condition 58 should be revised as follows:

For the A-9 cover, the top 2 feet of frost protection soil will contain an average Ra-226 concentration that does not exceed the NRC-approved Ra-226 value based on data for surface soil surrounding the site. Reclamation of the A-9 Repository, C-18 pit, and of the north and south evaporation ponds, and the site grading shall be in accordance with the "Design for Enhancement of the Previously Approved Reclamation Plan for the A-9 Repository" in the

licensee's submittal dated October 27, 1998, as modified by submittals dated December 10, 1998, March 29, 1999, and February 7, 2006.

[Applicable Amendments: 42, 53, 58]

License Condition 60 has been revised to reflect NRC organizational changes within the NRC:

All correspondence related to this license shall be sent to the following address: Deputy Director, Decommissioning and Uranium Recovery Licensing Directorate, Division of Waste Management and Environmental Protection, Office of Federal and State Materials and Environmental Management Programs, Mailstop T7-E18, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by express delivery to 11545 Rockville Pike, Rockville, MD 20852. Required telephone notification shall be made to the NRC Operations Center at (301) 816-5100, unless otherwise specified.

[Applicable Amendments: 32, 45, 58, 58]

License Condition 61 should be revised as follows:

The final reclamation of the heap leach impoundment shall be in accordance with the reclamation plan submitted September 25, 1996, as supplemented or revised by submittals dated June 6, August 19, and October 15, 1997, and January 15, and February 11 and 13, 1998, and December 20, 2000.

The reclamation of Pond No. 2 will be performed according to the final plan submitted on September 11, 2003, as supplemented by a revised submittal dated February 7, 2006. In addition, the Ra-226 data for the solidified pond sludge shall be submitted to the NRC, before radon barrier placement begins, to justify that the Ra-226 values used in the radon flux model are representative. If the measured values are significantly higher than the estimated values, Umetco will provide a revised radon flux model to demonstrate that the long-term radon flux from the cover should meet the limit in Criterion 6(1).

[Applicable Amendments: 38, 44, 52, 58]

REFERENCES:

U.S. Nuclear Regulatory Commission, 1989. "Calculation of Radon Flux Attenuation by Earthen Uranium Mill Tailings Covers," Regulatory Guide 3.64, Washington, D.C.

U.S. Nuclear Regulatory Commission, 2003. "Standard Review Plan for the Review of a Reclamation Plan for Mill Tailings Sites Under Title II of the Uranium Mill Tailings Radiation Control Act." NUREG-1620, Rev. 1., Washington , D.C.

Umetco Minerals Corporation, "Final Status Survey Plan", September 30, 2000, [ADAMS Accession No. ML003752893]

Umetco Minerals Corporation, "Final Background Characterization Report", September 30, 2000, [ADAMS Accession No. ML003752978]

U.S. Nuclear Regulatory Commission (2001a) Environmental Assessment for Umetco Minerals Corporation's, Gas Hills Uranium Mill Site, East Gas Hills, Natrona County, Wyoming. February 23, 2001 [Adams Accession No. ML010460319]

U.S. Nuclear Regulatory Commission (2001b) Finding of No Significant Impact in *Federal Register* concerning Approval of Amendment to Source Material License SUA-648 for Soil Decommissioning. February 23, 2001 [Adams Accession No. ML010580211]

Umetco Minerals Corporation, "Revision 1 of Final Design & Reclamation Plan for GHP No. 2/Mill Area - Umetco Gas Hills. Pages 1 Through Appendex A.", September 30, 2003, [ADAMS Accession No. ML032660329]

Appendix A
Contaminated Fill

Table A.1. Daily Quantities and Quality Control Test Frequencies Frequencies for the GHP-2 Contaminated Fill Layer: 2005-2006

Note: This table lists only those days that fill was placed and/or testing performed. CY = Cubic Yards; NG = Nuclear Gauge (test), i.e., field compaction test.
Testing Frequency Requirements: *Field Compaction Tests:* 1: 1000 CY *Proctors:* 1: 5000 CY *Sand-Cones:* 1:10 NG tests

Date	Total Quantities Placed		Field Compaction Test Frequency			Proctor Test Frequency			Sand-Cone Test Frequency		
	Daily Yardage	Cumulative Yardage	Daily Tests Performed	Cumulative No. of Tests	Ratio (per CY)	Daily Tests Performed	Cumulative No. of Tests	Ratio (per CY)	Daily Tests Performed	Cumulative No. of Tests	Ratio (/NG tests)
6/7/05	4,956	4,956		0	--		0	--		0	--
6/8/05	567	5,523		0	--		0	--		0	--
6/13/05	2,289	7,812		0	--		0	--		0	--
6/14/05	0	7,812	3	3	1: 2604	1	1	1: 7812		0	--
6/15/05	210	8,022		3	1: 2674		1	1: 8022		0	--
6/16/05	1,302	9,324		3	1: 3108		1	1: 9324		0	--
6/17/05	0	9,324	2	5	1: 1865		1	1: 9324		0	--
6/20/05	2,037	11,361		5	1: 2272		1	1: 11361		0	--
6/21/05	5,061	16,422	2	7	1: 2346	1	2	1: 8211		0	--
6/22/05	3,801	20,223		7	1: 2889		2	1: 10112		0	--
6/23/05	4,137	24,360	3	10	1: 2436		2	1: 12180	1	1	1: 10
6/24/05	1,386	25,746		10	1: 2575		2	1: 12873		1	1: 10
6/28/05	5,754	31,500	5	15	1: 2100	1	3	1: 10500	1	2	1: 8
6/29/05	13,757	45,257	13	28	1: 1616	3	6	1: 7543	2	4	1: 7
7/6/05	12,873	58,130	5	33	1: 1762	1	7	1: 8304	1	5	1: 7
7/7/05	11,214	69,344	14	47	1: 1475	3	10	1: 6934	4	9	1: 5
7/8/05	11,256	80,600	8	55	1: 1465	2	12	1: 6717	1	10	1: 6
7/9/05	10,815	91,415	10	65	1: 1406	2	14	1: 6530	1	11	1: 6
7/11/05	11,025	102,440	4	69	1: 1485		14	1: 7317	1	12	1: 6
7/12/05	8,043	110,483	15	84	1: 1315	3	17	1: 6499	4	16	1: 5
7/14/05	9,576	120,059	3	87	1: 1380	1	18	1: 6670		16	1: 5
7/18/05	7,287	127,346	18	105	1: 1213	4	22	1: 5788	5	21	1: 5
7/19/05	8,232	135,578	7	112	1: 1211	1	23	1: 5895	1	22	1: 5
7/20/05	8,337	143,915	6	118	1: 1220	1	24	1: 5996		22	1: 5
7/21/05	8,127	152,042	11	129	1: 1179	2	26	1: 5848		22	1: 6
7/25/05	6,174	158,216	3	132	1: 1199	1	27	1: 5860	1	23	1: 6
7/26/05	4,410	162,626	14	146	1: 1114	3	30	1: 5421	3	26	1: 6
7/27/05	4,662	167,288	8	154	1: 1086	1	31	1: 5396	1	27	1: 6
7/28/05	6,139	173,427	10	164	1: 1057	2	33	1: 5255	1	28	1: 6
8/1/05	5,166	178,593	4	168	1: 1063	1	34	1: 5253	3	31	1: 5
8/2/05	6,426	185,019	12	180	1: 1028	3	37	1: 5001	3	34	1: 5
8/3/05	4,872	189,891	7	187	1: 1015	1	38	1: 4997	2	36	1: 5

Table A.1. Daily Quantities and Quality Control Test Frequencies Frequencies for the GHP-2 Contaminated Fill Layer: 2005-2006

Note: This table lists only those days that fill was placed and/or testing performed. CY = Cubic Yards; NG = Nuclear Gauge (test), i.e., field compaction test.
Testing Frequency Requirements: *Field Compaction Tests:* 1: 1000 CY *Proctors:* 1: 5000 CY *Sand-Cones:* 1:10 NG tests

Date	Total Quantities Placed		Field Compaction Test Frequency			Proctor Test Frequency			Sand-Cone Test Frequency		
	Daily Yardage	Cumulative Yardage	Daily Tests Performed	Cumulative No. of Tests	Ratio (per CY)	Daily Tests Performed	Cumulative No. of Tests	Ratio (per CY)	Daily Tests Performed	Cumulative No. of Tests	Ratio (/NG tests)
8/4/05	4,158	194,049	11	198	1: 980	2	40	1: 4851	2	38	1: 5
8/8/05	1,344	195,393	3	201	1: 972	1	41	1: 4766		38	1: 5
8/9/05	1,953	197,346		201	1: 982		41	1: 4813		38	1: 5
8/10/05	630	197,976		201	1: 985		41	1: 4829		38	1: 5
8/24/05	777	198,753		201	1: 989		41	1: 4848		38	1: 5
9/13/05	0	198,753	2	203	1: 979		41	1: 4848	2	40	1: 5
4/28/06	525	199,278		203	1: 982		41	1: 4860		40	1: 5
5/1/06	1,200	200,478		203	1: 988		41	1: 4890		40	1: 5
5/2/06	1,251	201,729		203	1: 994		41	1: 4920		40	1: 5
5/3/06	0	201,729	1	204	1: 989	1	42	1: 4803		40	1: 5
5/4/06	672	202,401	2	206	1: 983		42	1: 4819		40	1: 5
5/5/06	336	202,737		206	1: 984		42	1: 4827		40	1: 5
5/8/06	618	203,355	1	207	1: 982		42	1: 4842		40	1: 5
5/9/06	1,074	204,429	2	209	1: 978		42	1: 4867	1	41	1: 5
5/10/06	2,280	206,709	2	211	1: 980	1	43	1: 4807		41	1: 5
5/11/06	1,983	208,692	5	216	1: 966	1	44	1: 4743	2	43	1: 5

Total Quantities of Fill Placed, Summary by Year

Year	Cu Yds Placed
2005	198,753
2006	9,939
TOTAL:	**208,692**

Table A.2. Field Compaction Test Results for the GHP-2 Contaminated Fill Placement

Note: R denotes Re-Test sample. To facilitate review, re-tests are shown directly under the corresponding failed test result (note dates). * Indicates that Sand-Cone Correlation perform
Max.= Maximum; FG = Finish Grade; P = Pass; F Comp = Fails Compaction. See summary statistics at the end of this table.

Compaction Test ID		Date	Location		Lift	Laboratory Standard Proctor			Field Compaction Tests			Pass/Fail	Comments
			Northing	Easting		Proctor ID	Max. Dry Density (lbs/cu ft)	Optimum Moisture (%)	Dry Density (lbs/cu ft)	Percent Moisture	Percent Compaction		
									Requirements:	NA	≥ 95		
C-1		6/14/05	792610	835920	FG	CM-1	116.0	14.4	111.6	7.2	96.2	P	
C-2		6/14/05	792448	836057	FG	CM-1	116.0	14.4	111.5	10.0	96.1	P	
C-3		6/14/05	792285	836025	FG	CM-1	116.0	14.4	112.6	8.5	97.1	P	
C-4		6/17/05	792083	836828	1	CM-1	116.0	14.4	114.9	12.2	99.1	P	
C-5		6/17/05	792000	836266	1	CM-1	116.0	14.4	111.2	15.8	95.9	P	
C-6		6/21/05	792175	836892	2	CM-2	117.7	13.2	114.5	11.5	97.3	P	
C-7		6/21/05	792024	836749	3	CM-2	117.7	13.2	113.0	11.8	96.0	P	
C-8	*	6/23/05	792019	836718	3	CM-2	117.7	13.2	115.2	14.8	97.9	P	
C-9		6/23/05	792072	836881	4	CM-2	117.7	13.2	114.5	12.2	97.3	P	
C-10		6/23/05	792148	836735	4	CM-2	117.7	13.2	112.3	12.3	95.4	P	
C-11		6/28/05	792233	836500	1	CM-3	117.0	13.2	111.6	14.7	95.4	P	
C-12		6/28/05	792310	836666	1	CM-3	117.0	13.2	112.4	9.4	96.1	P	
C-13	*	6/28/05	792321	836822	1	CM-3	117.0	13.2	114.5	10.2	97.9	P	
C-14		6/28/05	792360	836554	1	CM-3	117.0	13.2	113.4	9.8	96.9	P	
C-15		6/28/05	792410	836729	1	CM-3	117.0	13.2	117.9	10.1	100.8	P	
C-16		6/29/05	792543	836745	1	CM-4	117.6	13.4	117.0	11.7	99.5	P	
C-17		6/29/05	792466	836600	1	CM-4	117.6	13.4	114.0	10.9	96.9	P	
C-18	*	6/29/05	792477	836455	1	CM-4	117.6	13.4	112.3	8.3	95.5	P	
C-19		6/29/05	792554	836532	1	CM-4	117.6	13.4	113.6	8.3	96.6	P	
C-20		6/29/05	792688	836499	1	CM-4	117.6	13.4	112.1	12.9	95.3	P	
C-21	*	6/29/05	792565	836532	1	CM-5	117.5	13.6	113.5	8.4	96.6	P	
C-22		6/29/05	792255	836564	2	CM-5	117.5	13.6	112.6	13.1	95.8	P	
C-23		6/29/05	792299	836776	2	CM-5	117.5	13.6	114.2	11.5	97.2	P	
C-24		6/29/05	792378	836644	2	CM-5	117.5	13.6	110.2	15.7	**93.8**	F Comp	Fails Compaction
C-24R		6/29/05	792354	836587	2	CM-5	117.5	13.6	115.8	10.5	98.6	P	Retest
C-25		6/29/05	792622	836400	1	CM-6	117.6	12.0	112.3	9.4	95.5	P	
C-26		6/29/05	792699	836666	1	CM-6	117.6	12.0	112.6	15.5	95.7	P	
C-27		6/29/05	792455	836510	2	CM-6	117.6	12.0	114.4	16.3	97.3	P	
C-28		6/29/05	792499	836721	2	CM-6	117.6	12.0	113.3	12.3	96.3	P	
C-29		7/6/05	792532	836444	2	CM-6	117.6	12.0	119.1	10.7	101.3	P	
C-30	*	7/6/05	792554	836688	2	CM-7	116.0	13.1	114.7	8.0	98.9	P	
C-31		7/6/05	792620	836688	2	CM-7	116.0	13.1	117.1	11.5	100.9	P	
C-32		7/6/05	792644	836378	2	CM-7	116.0	13.1	110.4	10.3	95.2	P	
C-33		7/6/05	792754	836644	2	CM-7	116.0	13.1	113.9	12.2	98.2	P	

Table A.2. Field Compaction Test Results for the GHP-2 Contaminated Fill Placement

Note: R denotes Re-Test sample. To facilitate review, re-tests are shown directly under the corresponding failed test result (note dates). * Indicates that Sand-Cone Correlation perform
Max.= Maximum; FG = Finish Grade; P = Pass; F Comp = Fails Compaction. See summary statistics at the end of this table.

Compaction Test ID	Date	Location		Lift	Laboratory Standard Proctor			Field Compaction Tests			Pass/Fail	Comments
		Northing	Easting		Proctor ID	Max. Dry Density (lbs/cu ft)	Optimum Moisture (%)	Dry Density (lbs/cu ft)	Percent Moisture	Percent Compaction		
								Requirements:	NA	≥ 95		
C-34	7/7/05	792277	836644	3	CM-7	116.0	13.1	117.8	11.9	101.6	P	
C-35	7/7/05	792233	836510	3	CM-8	118.3	12.0	117.9	6.9	99.7	P	
C-36	7/7/05	792354	836800	3	CM-8	118.3	12.0	113.7	9.4	96.1	P	
C-37	7/7/05	792400	836466	3	CM-8	118.3	12.0	115.2	13.2	97.4	P	
C-38 *	7/7/05	792365	836699	3	CM-8	118.3	12.0	116.3	10.0	98.3	P	
C-39	7/7/05	792425	836448	3	CM-8	118.3	12.0	113.8	11.1	96.2	P	
C-40	7/7/05	792521	836554	3	CM-9	117.0	13.1	113.0	13.1	96.6	P	
C-41 *	7/7/05	792483	836787	3	CM-9	117.0	13.1	114.5	11.7	97.9	P	
C-42	7/7/05	792505	836395	3	CM-9	117.0	13.1	113.7	7.4	97.2	P	
C-43 *	7/7/05	792611	836666	3	CM-9	117.0	13.1	113.7	14.7	97.2	P	
C-44	7/7/05	792616	836354	3	CM-9	117.0	13.1	115.4	13.2	98.6	P	
C-45	7/7/05	792662	836496	3	CM-10	117.7	12.4	116.3	11.6	98.8	P	
C-46	7/7/05	792730	836661	3	CM-10	117.7	12.4	113.7	13.4	96.6	P	
C-47 *	7/7/05	792785	836663	3	CM-10	117.7	12.4	113.8	14.4	96.7	P	
C-48	7/8/05	792233	836543	4	CM-10	117.7	12.4	112.8	11.6	95.8	P	
C-49	7/8/05	792343	836800	4	CM-10	117.7	12.4	112.2	9.5	95.3	P	
C-50	7/8/05	792411	836765	4	CM-11	116.5	14.3	111.6	15.5	95.8	P	
C-51	7/8/05	792299	836655	4	CM-11	116.5	14.3	113.7	11.3	97.6	P	
C-52	7/8/05	792400	836622	4	CM-11	116.5	14.3	115.0	10.9	98.7	P	
C-53	7/8/05	792365	836455	4	CM-11	116.5	14.3	112.8	11.4	96.8	P	
C-54	7/8/05	792455	836494	4	CM-11	116.5	14.3	111.2	14.8	95.5	P	
C-55 *	7/8/05	792543	836710	4	CM-12	117.2	13.3	113.2	11.7	96.6	P	
C-56	7/9/05	792310	836754	5	CM-12	117.2	13.3	115.7	7.6	98.7	P	
C-57	7/9/05	792266	836576	5	CM-12	117.2	13.3	113.5	13.1	96.8	P	
C-58	7/9/05	792565	836376	4	CM-12	117.2	13.3	114.7	14.7	97.9	P	
C-59	7/9/05	792554	836532	4	CM-12	117.2	13.3	113.9	11.3	97.2	P	
C-60	7/9/05	792611	836666	4	CM-13	116.4	13.8	111.6	12.6	95.9	P	
C-61	7/9/05	792688	836378	4	CM-13	116.4	13.8	112.6	13.5	96.7	P	
C-62	7/9/05	792732	836622	4	CM-13	116.4	13.8	111.5	13.6	95.8	P	
C-63 *	7/9/05	792365	836466	5	CM-13	116.4	13.8	116.7	12.1	100.3	P	
C-64	7/9/05	792398	836466	5	CM-13	116.4	13.8	118.1	12.2	101.5	P	
C-65	7/9/05	792385	836732	5	CM-14	115.4	14.0	117.1	9.8	101.5	P	
C-66	7/11/05	792655	836310	5	CM-14	115.4	14.0	118.8	6.4	102.9	P	
C-67	7/11/05	792754	836310	5	CM-14	115.4	14.0	113.3	6.6	98.2	P	

Table A.2. Field Compaction Test Results for the GHP-2 Contaminated Fill Placement

Note: R denotes Re-Test sample. To facilitate review, re-tests are shown directly under the corresponding failed test result (note dates). * Indicates that Sand-Cone Correlation perform
Max.= Maximum; FG = Finish Grade; P = Pass; F Comp = Fails Compaction. See summary statistics at the end of this table.

Compaction Test ID		Date	Location		Lift	Laboratory Standard Proctor			Field Compaction Tests			Pass/Fail	Comments
			Northing	Easting		Proctor ID	Max. Dry Density (lbs/cu ft)	Optimum Moisture (%)	Dry Density (lbs/cu ft)	Percent Moisture	Percent Compaction		
									Requirements:	NA	≥ 95		
C-68		7/11/05	792776	836477	5	CM-14	115.4	14.0	114.0	14.4	98.9	P	
C-69	*	7/11/05	792822	836688	5	CM-14	115.4	14.0	114.1	11.8	98.9	P	
C-70		7/12/05	792470	836580	4	CM-15	115.0	14.1	110.9	15.4	96.4	P	
C-71		7/12/05	792780	836640	4	CM-15	115.0	14.1	109.7	10.4	95.4	P	
C-72		7/12/05	792780	836720	4	CM-15	115.0	14.1	112.3	16.8	97.7	P	
C-73		7/12/05	792760	836340	4	CM-15	115.0	14.1	112.3	12.7	97.7	P	
C-74		7/12/05	792750	836460	5	CM-15	115.0	14.1	113.6	15.6	98.8	P	
C-75		7/12/05	792680	836300	5	CM-16	118.0	12.2	112.3	12.7	95.2	P	
C-76		7/12/05	792700	836600	5	CM-16	118.0	12.2	119.9	12.8	101.6	P	
C-77		7/12/05	792880	836420	1	CM-16	118.0	12.2	114.8	6.9	97.3	P	
C-78	*	7/12/05	792950	836620	1	CM-16	118.0	12.2	116.2	8.1	98.5	P	
C-79		7/12/05	792040	836420	1	CM-16	118.0	12.2	112.2	16.0	95.1	P	
C-80		7/12/05	793020	836590	1	CM-17	115.4	13.9	112.9	10.4	97.8	P	
C-81	*	7/12/05	793200	836500	1	CM-17	115.4	13.9	114.1	13.1	98.9	P	
C-82	*	7/12/05	793100	836620	1	CM-17	115.4	13.9	114.2	10.1	99.0	P	
C-83		7/12/05	792890	836400	2	CM-17	115.4	13.9	114.1	9.4	98.9	P	
C-84	*	7/12/05	792880	836640	2	CM-17	115.4	13.9	112.8	9.3	97.7	P	
C-85		7/14/05	792950	836380	2	CM-18	116.7	13.4	114.3	7.6	97.9	P	
C-86		7/14/05	792980	836520	2	CM-18	116.7	13.4	111.5	15.2	95.5	P	
C-87		7/14/05	793180	836520	2	CM-18	116.7	13.4	113.1	11.5	96.9	P	
C-88		7/18/05	792200	836740	3	CM-18	116.7	13.4	118.0	10.9	101.1	P	
C-89		7/18/05	792170	836610	3	CM-18	116.7	13.4	114.3	10.6	97.9	P	
C-90	*	7/18/05	792110	836570	3	CM-19	117.0	13.2	114.5	8.8	97.9	P	
C-91		7/18/05	792160	836810	3	CM-19	117.0	13.2	116.2	7.7	99.3	P	
C-92		7/18/05	792150	836690	4	CM-19	117.0	13.2	117.4	7.8	100.3	P	
C-93		7/18/05	792100	836650	4	CM-19	117.0	13.2	120.3	9.3	102.8	P	
C-94		7/18/05	792150	836880	4	CM-19	117.0	13.2	117.8	8.1	100.7	P	
C-95	*	7/18/05	792240	836850	4	CM-20	117.9	13.7	113.3	7.9	96.1	P	
C-96	*	7/18/05	792110	836450	4	CM-20	117.9	13.7	113.5	15.2	96.3	P	
C-97		7/18/05	792115	836600	4	CM-20	117.9	13.7	113.7	10.0	96.4	P	
C-98		7/18/05	792050	836710	4	CM-20	117.9	13.7	112.8	7.7	95.7	P	
C-99	*	7/18/05	792200	836290	4	CM-20	117.9	13.7	118.8	11.9	100.8	P	
C-100	*	7/18/05	792190	836990	4	CM-21	117.3	13.4	115.6	11.3	98.6	P	
C-101		7/18/05	792290	836490	4	CM-21	117.3	13.4	118.9	7.3	101.4	P	

Table A.2. Field Compaction Test Results for the GHP-2 Contaminated Fill Placement

Note: R denotes Re-Test sample. To facilitate review, re-tests are shown directly under the corresponding failed test result (note dates). * Indicates that Sand-Cone Correlation perform
Max.= Maximum; FG = Finish Grade; P = Pass; F Comp = Fails Compaction. See summary statistics at the end of this table.

Compaction Test ID	Date	Location		Lift	Laboratory Standard Proctor			Field Compaction Tests			Pass/Fail	Comments
		Northing	Easting		Proctor ID	Max. Dry Density (lbs/cu ft)	Optimum Moisture (%)	Dry Density (lbs/cu ft)	Percent Moisture	Percent Compaction		
								Requirements:	NA	≥ 95		
C-102	7/18/05	792300	836650	4	CM-21	117.3	13.4	120.3	8.1	102.6	P	
C-103	7/18/05	792100	836250	5	CM-21	117.3	13.4	118.1	8.1	100.7	P	
C-104	7/18/05	792190	836250	5	CM-21	117.3	13.4	113.5	10.4	96.8	P	
C-105	7/18/05	792190	836750	5	CM-22	117.5	13.1	112.0	13.8	95.3	P	
C-106	7/19/05	792140	836480	4	CM-22	117.5	13.1	115.0	10.7	97.9	P	
C-107	7/19/05	792140	836490	4	CM-22	117.5	13.1	113.8	11.6	96.9	P	
C-108	7/19/05	792869	836458	5	CM-22	117.5	13.1	117.3	14.1	99.8	P	
C-109	7/19/05	792819	836615	5	CM-22	117.5	13.1	115.8	12.1	98.6	P	
C-110	7/19/05	793017	836587	5	CM-23	116.9	13.5	116.5	7.6	99.7	P	
C-111	7/19/05	793068	836444	5	CM-23	116.9	13.5	116.2	13.6	99.4	P	
C-112	7/19/05	793137	836538	5	CM-23	116.9	13.5	114.0	12.5	97.5	P	
C-113	7/20/05	792865	836619	5	CM-23	116.9	13.5	117.4	10.7	100.4	P	
C-114	7/20/05	792912	836517	5	CM-23	116.9	13.5	115.0	11.4	98.4	P	
C-115 *	7/20/05	792973	836658	5	CM-24	117.3	13.3	118.5	13.1	101.0	P	
C-116	7/20/05	793051	836539	5	CM-24	117.3	13.3	113.9	12.8	97.1	P	
C-117	7/20/05	793157	836497	5	CM-24	117.3	13.3	112.1	13.3	95.6	P	
C-118	7/20/05	793203	836446	5	CM-24	117.3	13.3	117.8	8.4	100.4	P	
C-119	7/21/05	793000	836480	6	CM-24	117.3	13.3	114.4	11.2	97.5	P	
C-120	7/21/05	793020	836560	6	CM-25	116.7	13.3	113.7	15.1	97.4	P	
C-121	7/21/05	793110	836380	6	CM-25	116.7	13.3	111.1	16.4	95.2	P	
C-122	7/21/05	793182	836450	6	CM-25	116.7	13.3	111.7	12.2	95.7	P	
C-123	7/21/05	792910	836460	4	CM-25	116.7	13.3	116.4	11.2	99.7	P	
C-124	7/21/05	793020	836370	4	CM-25	116.7	13.3	114.1	11.7	97.8	P	
C-125	7/21/05	792253	836453	4	CM-26	115.3	13.6	112.1	12.7	97.2	P	
C-126	7/21/05	792880	836640	4	CM-26	115.3	13.6	118.2	8.8	102.5	P	
C-127	7/21/05	793200	836410	5	CM-26	115.3	13.6	119.1	8.9	103.3	P	
C-128	7/21/05	792990	836620	5	CM-26	115.3	13.6	115.9	10.7	100.5	P	
C-129	7/21/05	791890	836310	FG	CM-26	115.3	13.6	116.3	9.8	100.9	P	
C-130	7/25/05	792150	836620	6	CM-27	118.3	12.4	113.1	7.0	95.6	P	
C-131 *	7/25/05	792130	836811	6	CM-27	118.3	12.4	113.2	11.4	95.7	P	
C-132	7/25/05	791890	836410	6	CM-27	118.3	12.4	114.1	15.4	96.4	P	
C-133	7/26/05	793224	836541	5	CM-27	118.3	12.4	119.9	9.0	101.4	P	
C-134	7/26/05	793163	836603	5	CM-27	118.3	12.4	114.2	12.0	96.5	P	
C-135 *	7/26/05	792558	836825	5	CM-28	118.1	12.4	116.1	10.7	98.3	P	

Table A.2. Field Compaction Test Results for the GHP-2 Contaminated Fill Placement

Note: R denotes Re-Test sample. To facilitate review, re-tests are shown directly under the corresponding failed test result (note dates). * Indicates that Sand-Cone Correlation perform
Max.= Maximum; FG = Finish Grade; P = Pass; F Comp = Fails Compaction. See summary statistics at the end of this table.

Compaction Test ID	Date	Location		Lift	Laboratory Standard Proctor			Field Compaction Tests			Pass/Fail	Comments
		Northing	Easting		Proctor ID	Max. Dry Density (lbs/cu ft)	Optimum Moisture (%)	Dry Density (lbs/cu ft)	Percent Moisture	Percent Compaction		
								Requirements:	NA	≥ 95		
C-136 *	7/26/05	793135	836636	6	CM-28	118.1	12.4	118.4	11.3	100.3	P	
C-137	7/26/05	792969	836789	6	CM-28	118.1	12.4	121.5	9.9	102.9	P	
C-138	7/26/05	792620	836857	5	CM-28	118.1	12.4	116.4	8.6	98.6	P	
C-139	7/26/05	792834	836827	6	CM-28	118.1	12.4	114.7	8.6	97.1	P	
C-140	7/26/05	792752	836844	6	CM-29	112.7	15.3	111.7	7.0	99.1	P	
C-141	7/26/05	791867	836854	6	CM-29	112.7	15.3	108.0	14.5	95.8	P	
C-142	7/26/05	791909	836639	6	CM-29	112.7	15.3	108.3	12.7	96.1	P	
C-143 *	7/26/05	791933	836838	6	CM-29	112.7	15.3	108.3	12.7	96.1	P	
C-144	7/26/05	792640	836311	5	CM-29	112.7	15.3	111.1	10.9	98.5	P	
C-145	7/26/05	792761	836119	5	CM-30	114.8	14.2	116.7	9.2	101.7	P	
C-146	7/26/05	792820	836522	5	CM-30	114.8	14.2	113.4	12.7	98.8	P	
C-147 *	7/27/05	792140	836800	6	CM-30	114.8	14.2	112.4	12.7	97.9	P	
C-148	7/27/05	792140	836900	6	CM-30	114.8	14.2	117.2	5.4	102.1	P	
C-149	7/27/05	793050	836720	FG	CM-30	114.8	14.2	114.5	19.1	99.7	P	
C-150	7/27/05	792800	836850	FG	CM-31	118.7	12.5	118.6	17.0	99.9	P	
C-151	7/27/05	792080	836580	FG	CM-31	118.7	12.5	120.0	12.5	101.1	P	
C-152	7/27/05	792140	836860	FG	CM-31	118.7	12.5	117.6	14.5	99.1	P	
C-153	7/27/05	793047	836689	FG	CM-31	118.7	12.5	119.3	13.3	100.5	P	
C-154	7/27/05	792713	836849	FG	CM-31	118.7	12.5	114.8	15.4	96.7	P	
C-155	7/28/05	792011	836221	1	CM-32	118.2	12.9	117.6	13.3	99.5	P	
C-156	7/28/05	792910	836342	1	CM-32	118.2	12.9	115.6	14.0	97.8	P	
C-157	7/28/05	791804	836380	1	CM-32	118.2	12.9	114.1	14.5	96.5	P	
C-158 *	7/28/05	791939	836457	1	CM-32	118.2	12.9	114.6	15.4	97.0	P	
C-159	7/28/05	791870	836494	1	CM-32	118.2	12.9	112.4	13.1	95.1	P	
C-160	7/28/05	791769	836494	2	CM-33	119.2	12.3	113.2	15.5	95.0	P	
C-161	7/28/05	791800	836499	2	CM-33	119.2	12.3	113.4	13.6	95.1	P	
C-162	7/28/05	792714	836864	2	CM-33	119.2	12.3	114.8	13.0	96.3	P	
C-163	7/28/05	791897	836827	5	CM-33	119.2	12.3	113.2	14.0	95.0	P	
C-164	7/28/05	791939	836728	5	CM-33	119.2	12.3	116.7	13.2	97.9	P	
C-165 *	8/1/05	792650	836840	FG	CM-34	118.4	11.8	114.2	10.2	96.5	P	
C-166 *	8/1/05	792010	836590	FG	CM-34	118.4	11.8	114.0	14.6	96.3	P	
C-167 *	8/1/05	792800	836820	FG	CM-34	118.4	11.8	113.0	15.7	95.4	P	
C-168	8/1/05	791970	836710	FG	CM-34	118.4	11.8	113.3	11.2	95.7	P	
C-169	8/2/05	792760	836290	FG	CM-34	118.4	11.8	115.2	11.5	97.3	P	

Table A.2. Field Compaction Test Results for the GHP-2 Contaminated Fill Placement

Note: R denotes Re-Test sample. To facilitate review, re-tests are shown directly under the corresponding failed test result (note dates). * Indicates that Sand-Cone Correlation perform
Max.= Maximum; FG = Finish Grade; P = Pass; F Comp = Fails Compaction. See summary statistics at the end of this table.

Compaction Test ID	Date	Location		Lift	Laboratory Standard Proctor			Field Compaction Tests			Pass/Fail	Comments
		Northing	Easting		Proctor ID	Max. Dry Density (lbs/cu ft)	Optimum Moisture (%)	Dry Density (lbs/cu ft)	Percent Moisture	Percent Compaction		
								Requirements:	NA	≥ 95		
C-170	8/2/05	791940	836690	FG	CM-35	117.4	12.5	114.4	11.4	97.4	P	
C-171	8/2/05	792700	836900	FG	CM-35	117.4	12.5	115.7	11.8	98.6	P	
C-172	8/2/05	793440	836540	FG	CM-35	117.4	12.5	113.5	17.0	96.7	P	
C-173 *	8/2/05	792540	836440	FG	CM-35	117.4	12.5	113.0	11.3	96.3	P	
C-174 *	8/2/05	792840	836880	FG	CM-35	117.4	12.5	112.2	15.9	95.6	P	
C-175	8/2/05	792360	836690	FG	CM-36	115.3	14.1	114.2	8.2	99.0	P	
C-176	8/2/05	792420	836430	FG	CM-36	115.3	14.1	112.8	8.5	97.8	P	
C-177	8/2/05	792480	836540	FG	CM-36	115.3	14.1	112.6	11.8	97.7	P	
C-178 *	8/2/05	792510	836540	FG	CM-36	115.3	14.1	113.0	14.9	98.0	P	
C-179	8/2/05	792530	836250	FG	CM-36	115.3	14.1	117.0	11.0	101.5	P	
C-180	8/2/05	792630	836400	FG	CM-37	119.0	11.3	115.6	7.4	97.1	P	
C-181	8/3/05	792690	836010	FG	CM-37	119.0	11.3	115.6	9.9	97.1	P	
C-182	8/3/05	792610	836155	FG	CM-37	119.0	11.3	120.0	7.9	100.8	P	
C-183 *	8/3/05	792780	836175	FG	CM-37	119.0	11.3	114.5	7.3	96.2	P	
C-184	8/3/05	792800	836070	FG	CM-37	119.0	11.3	115.6	11.8	97.1	P	
C-185 *	8/3/05	792710	836090	FG	CM-38	117.6	11.2	112.1	14.6	95.3	P	
C-186	8/3/05	792790	836180	FG	CM-38	117.6	11.2	113.6	8.8	96.6	P	
C-187	8/3/05	792720	836360	FG	CM-38	117.6	11.2	118.3	9.8	100.1	P	
C-188 *	8/4/05	792660	836700	FG	CM-38	117.6	11.2	117.5	13.1	99.9	P	
C-189	8/4/05	792680	836900	FG	CM-38	117.6	11.2	112.5	7.9	95.7	P	
C-190	8/4/05	792411	837022	FG	CM-39	118.7	13.0	115.9	13.1	97.6	P	
C-191	8/4/05	792780	836930	FG	CM-39	118.7	13.0	116.1	12.1	97.8	P	
C-192	8/4/05	792240	836600	FG	CM-39	118.7	13.0	117.6	10.6	99.1	P	
C-193	8/4/05	793471	836589	FG	CM-39	118.7	13.0	116.9	10.3	98.5	P	
C-194	8/4/05	792272	836629	FG	CM-39	118.7	13.0	115.4	15.1	97.3	P	
C-195	8/4/05	793140	836732	FG	CM-40	119.5	12.1	122.7	10.9	102.6	P	
C-196 *	8/4/05	793157	836654	FG	CM-40	119.5	12.1	118.6	7.2	99.2	P	
C-197	8/4/05	792917	836894	FG	CM-40	119.5	12.1	121.1	10.6	101.3	P	
C-198	8/4/05	792210	836870	FG	CM-40	119.5	12.1	113.8	14.1	95.2	P	
C-199	8/8/05	792775	836705	FG	CM-40	119.5	12.1	121.2	9.8	101.4	P	
C-200	8/8/05	792805	836875	FG	CM-41	115.9	13.2	111.7	11.9	96.4	P	
C-201	8/8/05	792835	836790	FG	CM-41	115.9	13.2	114.3	11.3	98.6	P	
C-202 *	9/13/05	792700	836905	FG	CM-41	115.9	13.2	118.6	8.1	102.3	P	
C-203 *	9/13/05	792910	836820	FG	CM-41	115.9	13.2	114.5	6.6	98.8	P	

Table A.2. Field Compaction Test Results for the GHP-2 Contaminated Fill Placement

Note: R denotes Re-Test sample. To facilitate review, re-tests are shown directly under the corresponding failed test result (note dates). * Indicates that Sand-Cone Correlation perform
Max.= Maximum; FG = Finish Grade; P = Pass; F Comp = Fails Compaction. See summary statistics at the end of this table.

Compaction Test ID	Date	Location		Lift	Laboratory Standard Proctor			Field Compaction Tests			Pass/Fail	Comments
		Northing	Easting		Proctor ID	Max. Dry Density (lbs/cu ft)	Optimum Moisture (%)	Dry Density (lbs/cu ft)	Percent Moisture	Percent Compaction		
								Requirements:	NA	≥ 95		
C-205	5/4/06	792970	836320	1	CM-42	119.0	12.4	113.3	11.8	95.2	P	
C-206	5/8/06	792980	836220	2	CM-42	119.0	12.4	118.1	7.8	99.2	P	
C-207	5/9/06	792830	836290	2	CM-42	119.0	12.4	117.7	11.8	98.9	P	
C-208 *	5/9/06	792890	836140	2	CM-43	118.6	12.1	113.6	16.2	95.8	P	
C-209	5/10/06	792970	836305	2	CM-43	118.6	12.1	114.0	9.6	96.1	P	
C-210	5/10/06	792850	836790	3	CM-43	118.6	12.1	109.2	10.1	92.1	F Comp	Fails Compaction
C-210R	5/11/06	792850	836790	3	CM-43	118.6	12.1	116.4	9.2	98.1	P	Retest
C-211 *	5/11/06	792895	836310	3	CM-43	118.6	12.1	115.6	8.3	97.5	P	
C-212	5/11/06	792960	836280	4	CM-43	118.6	12.1	116.2	11.0	98.0	P	
C-213 *	5/11/06	792885	836155	4	CM-44	118.2	12.8	113.5	11.0	96.0	P	
C-214	5/11/06	792825	836230	FG	CM-44	118.2	12.8	115.1	7.6	97.4	P	
C-215	5/11/06	792890	836351	FG	CM-44	118.2	12.8	115.2	9.1	97.5	P	

Field density and moisture tests were taken using a nuclear density gauge. The gauge was field standardized at each test location and was correlated by a Sand Cone Test at a frequency of one for every five nuclear gauge tests. Field rock corrections were performed at each compaction test location.

Total Number of Tests (N):	214	(N reflects passing tests only)	
Total Quantities placed:	208,692	cubic yards (CY)	
Frequency:	1: 975 CY	Meets the required frequency of 1:1000 CY.	
average:	**114.8**	**11.4**	**97.9**
minimum:	108.0	5.4	95.0
maximum:	122.7	19.1	103.3
standard deviation:	2.6	2.6	2.0
# Failed:	NA	NA	2
# Retested:	NA	NA	2

Table A.3. Standard Proctor Test Summary for the GHP-2 Contaminated Fill

Date	Laboratory Standard Proctor		
	Proctor ID	Maximum Dry Density (lbs/cu ft)	Optimum Moisture (%)
5/4/05	CM-1	116	14.4
5/4/05	CM-2	117.7	13.2
6/22/05	CM-3	117	13.2
6/26/05	CM-4	117.6	13.4
6/28/05	CM-5	117.5	13.6
6/28/05	CM-6	117.6	12.0
6/28/05	CM-7	116	13.1
7/6/05	CM-8	118.3	12.0
7/6/05	CM-9	117	13.1
7/7/05	CM-10	117.7	12.4
7/7/05	CM-11	116.5	14.3
7/8/05	CM-12	117.2	13.3
7/8/05	CM-13	116.4	13.8
7/9/05	CM-14	115.4	14.0
7/11/05	CM-15	115	14.1
7/11/05	CM-16	118	12.2
7/12/05	CM-17	115.4	13.9
7/12/05	CM-18	116.7	13.4
7/14/05	CM-19	117	13.2
7/14/05	CM-20	117.9	13.7
7/18/05	CM-21	117.3	13.4
7/18/05	CM-22	117.5	13.1
7/19/05	CM-23	116.9	13.5
7/19/05	CM-24	117.3	13.3
7/20/05	CM-25	116.7	13.3
7/20/05	CM-26	115.3	13.6
7/21/05	CM-27	118.3	12.4
7/25/05	CM-28	118.1	12.8
7/25/05	CM-29	112.7	15.3
7/26/05	CM-30	114.8	14.2
7/27/05	CM-31	118.7	12.5
7/27/05	CM-32	118.2	12.9
7/27/05	CM-33	119.2	12.3
8/1/05	CM-34	118.4	11.8
8/2/05	CM-35	117.4	12.5
8/2/05	CM-36	115.3	14.1
8/2/05	CM-37	119	11.3
8/3/05	CM-38	117.6	11.2
8/4/05	CM-39	118.7	13.0
8/4/05	CM-40	119.5	12.1
8/8/05	CM-41	115.9	13.2
4/10/06	CM-42	116	14.4
5/9/06	CM-43	118.6	12.1
4/25/06	CM-44	118.3	12.7
	count:	44	44
	average:	**117.1**	**13.1**
	standard deviation:	1.4	0.9
	minimum:	112.7	11.2
	maximum:	119.5	15.3

Total cubic yards placed: 208,692

Proctor Frequency: 1: 4743 CY cubic yards

Table A.4. Sand-Cone Correlation Documentation for the GHP-2 Contaminated Fill

Date	Compaction Test ID	Nuclear Gauge Test		Sand-Cone Compaction Tests		Sand-Cone Correlation Results	
		In-Place Wet Unit Weight (pcf)	Moisture Content (%)	In-Place Wet Unit Weight (pcf)	Moisture Content (%)	Wet Unit Weight Variation (%)	Moisture Content Variation (%)
6/23/05	C-8	132.2	14.8	131.7	12.6	-0.4	-2.2
6/28/05	C-13	126.2	10.2	126.5	10.0	0.2	-0.2
6/29/05	C-18	121.6	8.3	122.5	8.4	0.7	0.1
6/29/05	C-21	122.9	8.4	120.9	8.2	-1.6	-0.2
7/6/05	C-30	123.9	8.0	121.8	7.1	-1.7	-0.9
7/7/05	C-38	127.9	10.0	127.2	9.4	-0.5	-0.6
7/7/05	C-41	128.0	11.7	125.7	11.6	-1.8	-0.1
7/7/05	C-43	130.4	14.7	131.8	13.4	1.1	-1.3
7/7/05	C-47	130.2	14.4	129.9	11.9	-0.2	-2.5
7/8/05	C-55	126.5	11.7	122.8	10.2	-2.9	-1.5
7/9/05	C-63	130.8	12.1	128.1	12.1	-2.1	0.0
7/11/05	C-69	127.6	11.8	126.9	10.5	-0.5	-1.3
7/12/05	C-78	125.6	8.1	124.0	8.5	-1.3	0.4
7/12/05	C-81	129.1	13.1	135.7	11.3	5.1	-1.8
7/12/05	C-82	125.7	10.1	123.3	8.5	-1.9	-1.6
7/12/05	C-84	123.4	9.3	124.5	7.4	0.9	-1.9
7/18/05	C-90	124.6	8.8	112.9	7.7	-9.4	-1.1
7/18/05	C-95	122.2	7.9	113.3	6.0	-7.3	-1.9
7/18/05	C-96	130.8	15.2	133.7	12.8	2.2	-2.4
7/18/05	C-99	132.7	11.9	129.5	12.4	-2.4	0.5
7/18/05	C-100	128.7	11.3	127.5	10.3	-0.9	-1.0
7/19/05	C-115	125.3	7.6	127.3	6.3	1.6	-1.3
7/25/05	C-131	126.1	11.4	125.6	10.1	-0.4	-1.3
7/26/05	C-135	128.5	10.7	127.9	9.4	-0.5	-1.3
7/26/05	C-143	122.1	12.7	121.6	10.6	-0.4	-2.1
7/26/05	C-136	131.7	11.3	133.4	10.6	1.3	-0.7
7/27/05	C-147	126.6	12.7	129.8	11.3	2.5	-1.4
7/28/05	C-158	132.3	15.4	130.9	11.6	-1.1	-3.8
8/1/05	C-165	126.5	10.2	121.3	8.7	-4.1	-1.5
8/1/05	C-166	130.7	14.6	130.5	12.1	-0.2	-2.5
8/1/05	C-167	130.8	15.7	131.0	13.3	0.2	-2.4
8/2/05	C-173	125.8	11.3	130.2	9.7	3.5	-1.6
8/2/05	C-178	129.9	14.9	132.5	13.0	2.0	-1.9
8/2/05	C-174	130.0	15.9	132.5	13.4	1.9	-2.5
8/3/05	C-183	122.9	7.3	118.7	7.7	-3.4	0.4
8/3/05	C-185	128.5	14.6	127.4	12.7	-0.9	-1.9
8/4/05	C-188	133.0	13.1	131.2	11.5	-1.4	-1.6
8/4/05	C-196	127.1	7.2	127.3	7.1	0.2	-0.1
9/13/05	C-202	128.2	8.1	127.9	6.1	-0.2	-2.0
9/13/05	C-203	122.1	6.6	119.0	5.4	-2.5	-1.2
5/9/06	C-208	132.0	16.2	129.8	13.7	-1.7	-2.5
5/11/06	C-211	125.2	8.3	125.4	8.5	0.2	0.2
5/11/06	C-213	126.1	11.0	129.5	10.5	2.7	-0.5
					Number of sand-cone tests:	43	
					average percent variation (on absolute value):	**1.8**	**1.4**
					standard deviation:	1.9	0.9

pcf - pounds per cubic foot

Note:
For the GHP-2 contaminated fill, a sand-cone correlation test was performed for every ten nuclear gauge tests. Correlations were deemed acceptable if the average of ten nuclear test results vs. sand cone test results comparisons met the following criteria:

sand-cone method wet density: +/- 3%
sand-cone method moisture content: +/- 2%

Table A.5. Soil Classification Test Results for the GHP No. 2 Contaminated Fill

Date Sampled	Gradation Sample ID	PARTICLE SIZE ANALYSIS Seive Size (% Passing)												Atterberg Sample ID	Atterberg Limits		Unified Soil Classification
		6"	3"	1 1/2"	3/4"	3/8"	#4	#8	#16	#30	#50	#100	#200		Liquid Limit	Plastic Index	
5/4/05	CM-1	-	-	100	99.6	98.2	96.2	93.9	88.5	78.5	66.5	53.9	41.2	CM-1	36	14	SC
6/17/05	C-4	-	-	-	100	99.1	98.5	96.6	91.1	80.9	68.4	55.9	42.3	C-4	40	26	SC
5/4/05	CM-2	-	-	100	97.6	95.5	93.7	89.5	80.2	64.8	48.4	37.3	29.5	CM-2	33	19	SC
6/21/05	C-7	-	-	100	99.2	98.2	96.4	93.2	85.7	72.1	56.9	42.6	30.8	C-7	30	17	SC
6/23/05	C-8	-	-	100	98.7	97.5	96.8	95.1	91.3	84.0	75.0	67.2	61.2	C-8	37	23	CL
6/23/05	C-10	-	-	100	98.6	95.1	92.6	88.1	80.3	67.3	51.8	33.7	20.1	C-10	33	18	SC
6/28/05	C-11	-	-	100	97.6	94.5	92.7	88.8	81.2	66.3	50.8	34.5	21.7	C-11	36	10	SC
6/28/05	C-13	-	-	-	100	97.3	95.8	92.8	87.3	75.6	61.2	43.3	29.6	C-13	37	23	SC
6/28/05	C-15	-	-	-	100	99.1	98.7	97.3	94.7	87.0	72.4	56.2	43.1	C-15	31	15	SC
6/29/05	C-17	-	-	-	100	99.4	98.8	97.1	88.8	70.1	49.5	32.4	21.0	C-17	31	12	SC
6/29/05	C-19	-	-	100	97.3	96.4	94.1	89.8	79.4	61.2	41.2	24.3	14.6	C-19	29	14	SC
6/29/05	C-21	-	-	-	100	98.1	96.2	93.5	87.8	76.0	55.2	30.5	17.9	C-21	27	10	SC
6/29/05	C-23	-	-	-	100	99.4	98.7	96.5	89.4	71.5	46.1	26.8	16.7	C-23	28	9	SC
6/29/05	C-24	-	-	100	98.9	98.2	97.1	94.0	87.0	69.9	49.6	33.7	20.4	C-24	31	16	SC
6/29/05	C-25	-	-	100	97.7	96.9	95.4	92.5	85.8	72.2	52.3	30.9	16.5	C-25	35	18	SC
6/29/05	C-27	-	-	100	98.8	98.6	97.5	94.9	89.7	82.4	73.6	56.5	38.2	C-27	38	21	SC
7/6/05	C-29	-	-		100	99.7	99.4	97.8	89.8	70.6	49.9	35.4	26.7	C-29	34	19	SC
7/6/05	C-31	-	-	100	97.5	95.6	94.1	90.3	80.8	62.1	42.1	27.7	18.8	C-31	29	12	SC
7/6/05	C-33	-	-	100	98.9	97.4	96.2	92.6	82.8	65.6	50.7	40.6	31.4	C-33	37	20	SC
7/7/05	CM-10	-	-	100	99.0	98.7	97.4	95.3	89.9	75.3	51.3	33.1	21.2	CM-10	29	11	SC
7/7/05	C-35	-	100	94.9	93.5	91.0	88.1	83.5	71.8	53.2	37.1	26.2	19.9	C-35	32	15	SC
7/7/05	C-37	-	-	-	100	99.9	98.1	94.6	86.1	65.0	45.4	29.7	18.4	C-37	30	12	SC
7/7/05	C-39	-	-		100	99.6	97.7	94.7	88.4	77.2	62.4	41.4	26.1	C-39	36	19	SC
7/7/05	C-41	-	-	100	99.2	98.4	97.1	94.4	86.0	65.5	47.6	36.4	28.0	C-41	33	20	SC
7/7/05	C-43	-	-	100	99.0	97.5	96.4	94.4	88.6	74.4	56.9	42.9	32.8	C-43	32	14	SC
7/7/05	C-45	-	-	100	98.1	96.4	95.3	91.9	83.6	66.8	47.5	34.1	26.3	C-45	29	18	SC
7/7/05	C-47	-	-	100	99.5	99.0	98.5	97.1	93.2	84.6	72.5	59.6	47.0	C-47	34	21	SC
7/7/05	CM-11	-	-		100	99.4	98.3	96.2	92.3	76.5	54.7	38.2	23.4	CM-11	34	18	SC
7/8/05	CM-12	-	-	100	99.2	97.7	96.0	92.5	84.9	70.8	52.9	32.9	20.4	CM-12	33	16	SC
7/8/05	C-49	-	-	100	99.3	98.7	94.3	89.8	81.6	67.1	50.5	33.1	19.9	C-49	34	18	SC
7/8/05	C-51	-	-		100	99.2	98.2	95.5	87.6	71.0	52.8	39.2	30.8	C-51	29	12	SC
7/8/05	C-53	-	-		100	99.8	99.2	97.4	92.5	81.8	67.1	53.8	43.5	C-53	32	14	SC
7/8/05	C-55	-	-	100	99.0	97.9	96.3	93.0	85.2	70.8	54.6	42.2	32.9	C-55	30	10	SC
7/8/05	CM-13	-	-	100	98.1	96.0	94.1	90.7	82.5	63.4	43.4	26.6	16.3	CM-13	31	14	SC
7/9/05	CM-14	-	-	100	99.0	98.6	97.5	93.0	86.4	71.2	51.4	32.9	22.0	CM-14	36	23	SC
7/9/05	C-57	-	-	100	99.0	94.9	91.9	88.4	81.4	67.7	53.7	41.3	30.0	C-57	37	21	SC
7/9/05	C-59	-	-	100	99.6	98.5	97.1	94.4	88.3	76.6	63.0	51.1	40.6	C-59	36	21	SC
7/9/05	C-61	-	-	100	98.8	96.1	94.9	91.3	83.8	67.1	50.3	37.8	28.9	C-61	30	15	SC
7/9/05	C-63	-	100	98.2	95.7	91.7	90.1	86.6	79.0	66.3	52.8	37.8	25.6	C-63	34	20	SC
7/9/05	C-65	-	100	91.4	88.7	86.3	83.8	77.7	54.2	39.9	35.3	31.4	30.1	C-65	36	20	SC
7/11/05	C-67	-	-	100	98.2	96.7	95.0	90.9	80.9	62.2	44.1	31.8	24.0	C-67	31	15	SC
7/11/05	C-69	-	-	100	98.9	97.4	94.8	90.3	80..6	64.4	48.6	38.2	30.8	C-69	31	16	SC
7/11/05	CM-15	-	-	100	99.6	99.4	98.3	94.8	87.6	75.1	60.3	40.8	25.8	CM-15	37	23	SC

Table A.5. Soil Classification Test Results for the GHP No. 2 Contaminated Fill

Date Sampled	Gradation Sample ID	PARTICLE SIZE ANALYSIS Seive Size (% Passing)												Atterberg Sample ID	Atterberg Limits		Unified Soil Classification
		6"	3"	1 1/2"	3/4"	3/8"	#4	#8	#16	#30	#50	#100	#200		Liquid Limit	Plastic Index	
7/11/05	CM-16	-	-		100	98.3	96.5	94.0	89.4	80.2	68.4	51.2	33.6	CM-16	38	24	SC
7/12/05	CM-17	-	-		100	99.2	98.4	96.3	89.4	72.4	44.6	24.9	18.3	CM-17	NP	NP	SM
7/12/05	C-71	-	100	94.2	93.1	89.9	97.1	82.4	73.6	58.1	31.8	26.4	17.6	C-71	30	15	SC
7/12/05	C-73	-	-	100	99.5	99.2	98.3	95.7	89.0	75.8	57.5	37.2	24.1	C-73	32	13	SC
7/12/05	C-75	-	-	100	98.6	97.9	97.3	93.4	84.5	62.5	39.9	24.1	15.1	C-75	NP	NP	SM
7/12/05	C-77	-	-	100	99.5	98.9	98.2	94.5	86.9	72.6	51.1	33.8	25.3	C-77	37	26	SC
7/12/05	C-79	-	-	100	98.8	97.8	96.1	93.2	85.0	69.5	53.9	42.4	32.8	C-79	35	20	SC
7/12/05	C-81	-	-	100	97.4	93.8	91.3	87.8	81.3	71.0	59.9	50.7	41.7	C-81	39	25	SC
7/12/05	C-83	-	-	100	97.9	95.0	93.2	89.5	83.1	70.5	58.1	48.1	39.0	C-83	38	21	SC
7/12/05	CM-18	-	-		100	99.3	97.3	93.7	85.7	65.7	45.8	32.0	20.8	CM-18	32	15	SC
7/14/05	C-85	-	-	100	99.0	98.5	97.1	93.2	80.2	49.1	28.0	16.3	10.1	C-85	NP	NP	SW-SM
7/14/05	C-87	-	-	100	99.4	98.7	98.0	96.2	96.3	76.8	59.5	44.8	35.8	C-87	28	12	SC
7/14/05	CM-19	-	-	100	98.3	96.9	95.1	92.3	72.3	67.7	47.4	32.9	23.9	CM-19	30	14	SC
7/14/05	CM-20	-	-	100	98.5	95.9	94.2	89.9	81.0	65.0	46.7	31.9	20.4	CM-20	30	16	SC
7/18/05	CM-21	-	-		100	99.3	98.6	96.5	89.8	74.8	55.7	39.7	27.5	CM-21	30	17	SC
7/18/05	CM-22	-	-	100	96.0	95.1	93.2	90.4	85.5	73.2	56.8	38.5	26.0	CM-22	31	16	SC
7/18/05	C-89	-	-	100	97.1	94.3	93.1	90.7	81.6	67.1	51.7	35.9	25.4	C-89	32	14	SC
7/18/05	C-91	-	-	100	98.8	98.1	97.1	95.2	91.0	79.4	63.6	49.0	37.6	C-91	33	19	SC
7/18/05	C-93	-	-		100	98.5	97.5	94.4	84.9	66.5	47.9	35.3	28.2	C-93	31	17	SC
7/18/05	C-97	-	-	100	99.8	99.2	96.9	94.1	86.9	73.5	57.8	42.6	28.3	C-97	33	18	SC
7/18/05	C-99	-	-		100	99.2	96.4	89.6	77.6	59.4	45.4	32.7	21.2	C-99	33	12	SC
7/18/05	C-103	-	-		100	99.4	98.5	95.5	86.0	58.3	34.5	21.8	14.5	C-103	NP	NP	SM
7/19/05	CM-23	-	-		100	99.2	97.8	94.2	87.5	73.0	58.1	44.2	32.4	CM-23	33	16	SC
7/19/05	C-107	-	-	100	99.3	98.9	98.0	95.4	89.1	76.7	63.5	51.2	38.8	C-107	32	18	SC
7/19/05	C-109	-	-	100	97.6	92.4	89.6	83.5	73.2	55.7	42.2	31.0	21.1	C-109	31	17	SC
7/19/05	C-111	-	-	100	99.5	98.7	98.0	95.4	90.3	77.6	59.8	45.0	34.9	C-111	32	18	SC
7/19/05	CM-24	-	-	100	98.6	98.0	96.4	93.0	85.7	73.1	58.0	44.4	35.2	CM-24	32	19	SC
7/20/05	C-113	-	-	100	97.1	95.8	94.7	909.0	82.6	63.2	43.8	32.0	24.9	C-113	31	18	SC
7/20/05	C-115	-	-	100	98.1	96.3	95.1	92.6	87.8	77.7	66.0	56.4	48.7	C-115	30	17	SC
7/20/05	C-117	-	-	100	97.8	96.5	94.9	92.6	86.9	76.3	63.1	50.8	41.3	C-117	35	21	SC
7/20/05	CM-25	-	-	100	98.0	95.9	93.2	88.9	78.9	62.1	43.9	29.1	20.0	CM-25	33	20	SC
7/20/05	CM-26	-	100	98.5	97.6	96.3	95.1	92.6	86.8	73.2	58.6	46.2	36.4	CM-26	35	22	SC
7/21/05	C-123	-	-	100	97.0	94.4	92.8	88.6	78.5	61.5	46.5	35.9	29.1	C-123	30	15	SC
7/21/05	C-127	-	100	98.7	92.3	90.0	87.9	83.5	75.1	61.0	46.9	37.2	30.7	C-127	32	22	SC
7/21/05	CM-27	-	-	100	99.7	98.3	95.2	88.9	78.0	63.0	48.9	36.9	25.6	CM-27	30	16	SC
7/25/05	CM-28	-	-	-	100	97.3	94.6	89.6	80.7	64.6	51.5	41.8	31.4	CM-28	30	16	SC
7/25/05	CM-29	-	100	98.2	93.8	91.7	89.6	84.2	73.8	59.5	45.0	30.4	19.8	CM-29	30	16	SC
7/26/05	C-133	-	-	100	98.9	97.3	96.0	93.2	86.9	75.0	60.9	49.9	43.2	C-133	32	19	SC
7/26/05	C-135	-	-	100	99.7	99.5	88.3	82.4	72.7	53.4	25.2	7.4	1.9	C-135	NP	NP	SP
7/26/05	C-137	-	-	100	99.5	97.6	96.0	93.2	86.4	73.4	59.6	46.3	35.3	C-137	35	19	SC
7/26/05	C-139	-	-	100	99.1	98.0	96.3	93.2	86.7	72.3	58.0	47.4	39.4	C-139	36	21	SC
7/26/05	C-143	-	-		100	98.6	97.3	94.2	85.4	67.7	48.1	33.9	26.2	C-143	29	14	SC
7/27/05	CM-31	-	-	100	96.8	95.2	93.4	90.3	82.2	68.0	52.7	41.4	33.5	CM-31	31	16	SC

Table A.5. Soil Classification Test Results for the GHP No. 2 Contaminated Fill

Date Sampled	Gradation Sample ID	PARTICLE SIZE ANALYSIS Seive Size (% Passing)												Atterberg Sample ID	Atterberg Limits		Unified Soil Classification
		6"	3"	1 1/2"	3/4"	3/8"	#4	#8	#16	#30	#50	#100	#200		Liquid Limit	Plastic Index	
7/27/05	C-153	-	-	100	99.3	98.7	97.6	95.7	90.6	79.7	65.6	53.4	42.8	C-153	33	18	SC
7/28/05	C-159	-	-	100	99.8	96.0	94.1	90.0	80.5	63.9	45.3	30.0	22.5	C-159	NP	NP	SM
7/28/05	C-163	-	-	100	99.8	98.5	97.2	94.5	88.0	74.4	57.4	42.7	30.8	C-163	30	17	SC
8/1/05	CM-34	-	-	100	99.7	98.6	96.9	93.0	82.3	62.6	44.2	31.2	22.0	CM-34	29	13	SC
8/1/05	C-167	-	-	100	97.1	96.2	94.7	91.4	83.0	68.8	53.7	41.3	32.9	C-167	32	18	SC
8/2/05	CM-36	-	-	100	99.8	98.3	96.4	91.2	80.9	62.7	42.5	27.0	19.5	CM-36	29	14	SC
8/2/05	CM-37	-	-		100	96.5	93.0	87.9	75.3	52.2	32.9	23.1	18.1	CM-37	29	12	SC
8/2/05	C-171	-	-		100	98.7	97.5	94.5	87.9	73.7	59.7	48.0	37.9	C-171	35	20	SC
8/2/05	C-179	-	100	98.6	95.6	92.5	90.1	86.8	81.6	71.3	59.5	46.5	36.0	C-179	35	20	SC
8/3/05	CM-38	-	-	100	98.4	97.4	95.8	93.2	87.5	74.3	59.4	47.5	37.4	CM-38	35	20	SC
8/3/05	C-183	-	-	100	92.0	90.0	87.6	84.7	78.7	68.4	56.8	40.9	25.4	C-183	35	16	SC
8/4/05	C-189	-	-	100	99.6	98.2	96.1	90.4	83.6	71.2	57.7	45.6	32.9	C-189	33	18	SC
8/4/05	C-191	-	-	100	97.6	95.8	93.2	89.2	81.4	69.1	56.2	44.1	34.8	C-191	36	23	SC
8/4/05	C-195	-	-	100	99.5	99.1	98.5	97.0	92.7	83.3	70.5	56.8	43.6	C-195	34	20	SC
8/8/05	C-199	-	-	100	96.7	92.0	89.0	84.2	75.7	59.1	42.6	30.8	24.7	C-199	29	15	SC
8/8/05	C-201	-	100	98.5	95.8	92.5	89.4	85.2	78.4	68.8	60.2	43.5	32.3	C-201	35	17	SC
9/13/05	C-203	-	-	100	99.8	99.3	98.4	96.7	92.0	81.2	64.5	49.9	40.1	C-203	33	17	SC
4/10/06	CM-42	-	100	95.2	93.2	89.8	87.6	84.1	76.2	63.0	47.3	34.9	27.0	CM-42	28	14	SC
5/4/06	C-204	-	100	96.9	96.0	95.2	93.8	88.9	76.0	51.7	28.4	17.7	12.7	C-204	NP	NP	SM
5/8/06	C-206	-	-		100	98.9	98.3	95.6	85.6	61.2	32.7	18.9	12.6	C-206	NP	NP	SM
4/10/06	CM-43	-	100	97.8	94.7	91.7	89.4	85.0	76.3	61.7	46.3	35.9	27.8	CM-43	31	17	SC
4/25/06	CM-44	-	100	96.8	92.4	85.8	83.4	79.1	69.9	55.1	41.5	29.8	22.8	CM-44	30	15	SC
5/11/06	C-210R	-	-	100	99.4	97.8	96.3	90.5	78.4	61.0	47.7	37.3	26.5	C-210R	31	16	SC
5/11/06	C-212	-	100	92.4	91.1	88.6	85.8	81.8	73.6	60.1	46.5	36.5	28.5	C-212	31	21	SC
	averages:	--	100.0	99.4	98.3	96.7	95.1	99.0	83.8	68.8	52.2	38.4	28.3				

Total Number of Tests (N): 110

average:	**32.6**	**17.2**
minimum:	NP	NP
maximum:	40.0	26.0
standard deviation:	2.9	3.7

Total Quantities placed: 208,692 cubic yards (CY)

Testing Frequency: 1: 1897 CY Meets the 1:2000 CY requirement.

SC: 91.8% (n=101)
SM: 5.5% (n=6)
other: 2.7% (n=3)