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WEST VALLEY DEMONSTRATION PROJECT NORTH PLATEAU BACKGROUND SOIL CHARACTERIZATION REPORT

Cognizant Author: D.P. KLENK

Cognizant Manager: J.R. GERBER



West Valley Environmental Services LLC
10282 Rock Springs Road
West Valley, New York USA 14171-9799

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WEST VALLEY DEMONSTRATION PROJECT NORTH PLATEAU BACKGROUND SOIL CHARACTERIZATION REPORT

1.0 INTRODUCTION

1.1 General

This report has been prepared by URS Group, Inc. (URS) for West Valley Environmental Services Company LLC (WVES) to present the findings of the 2008 north plateau background subsurface soil investigation conducted at the West Valley Demonstration Project (WVDP), located in the town of Ashford, Cattaraugus County, New York. The subsurface investigation activities were implemented and completed following requirements detailed in WVDP-466, *Sampling and Analyses Plan for Background Subsurface Soil on the North Plateau* (SAP), prepared by WVES for the U.S. Department of Energy. This SAP was approved by the New York State Department of Environmental Conservation (NYSDEC) in its correspondence dated November 5, 2007.

The objective of the investigation was to obtain supplemental background subsurface soil data for metals and radiological constituents from areas of the north plateau that are interpreted to be unaffected by site operations and activities (i.e., where there are no suspected sources of contamination). The investigative activities described in this report augment previous Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) activities performed in accordance with the RCRA 3008(h) Administrative Order on Consent, conducted in 1993. The RFI activities included acquisition of soil samples from two soil borings, one each on the north and south plateaus, to identify background subsurface soil conditions for selected metals on the WVDP. Radiological data obtained during this investigation will be used to confirm that background boring locations have not been impacted by site activities. These background sampling results will also be used to establish site-specific soil concentrations for metals to be used in future site evaluations. Results of the investigative activities, as well as summary and conclusions, are presented in the following sections.

1.2 Site Location and Background

The WVDP is located in western New York state about 30 miles south of Buffalo, New York. The WVDP facilities occupy a security-fenced area of about 167 acres within the 3,338-acre Western New York Nuclear Services Center (WNYNSC), Figure 1.

The WNYNSC was established in 1961 under the direction of the New York State Office of Atomic Development (OAD). Nuclear Fuels Services, Inc. (NFS) leased the property from the OAD and operated a nuclear fuel reprocessing facility at the site from 1966 to 1972, the only commercial nuclear fuel reprocessing plant to have operated in the United States.

The U.S. Department of Energy (DOE) assumed control of the Main Plant Process Building (MPPB) and related facilities that comprise the WVDP from NFS in 1981. Subsequently, DOE has been engaged in carrying out Public Law 96-368 (the WVDP Act). DOE's responsibilities are limited to carrying out certain specific activities set forth in the Act.

The WVDP is bisected by Erdman Brook, which separates the site into two areas known as the north plateau and south plateau, Figure 2. The north plateau area includes the MPPB. The location of the background characterization area and the sampling locations are presented on Figure 3.

1.3 Previous Investigations

The WVDP, including the north plateau and MPPB area has been the focus of significant historical subsurface characterization activities. In 1993, gross beta activity in excess of 1.0E-06 microcuries per millimeter was detected in surface water on the north plateau. The gross beta activity was determined to primarily be a result of strontium-90 (Sr-90). Records review and subsequent subsurface investigations identified the presumed primary source of the Sr-90 plume as originating beneath the southwest corner of the MPPB during NFS operations, and that the groundwater plume is slowly migrating towards the northeast quadrant of the north plateau. The investigation of the MPPB source area and the surrounding environs have been reported as follows:

- West Valley Nuclear Services Company, Inc (WVNSCO), 1995, *Subsurface Probing Investigation on the North Plateau at the West Valley Demonstration Project*, WVDP-220;
- WVNSCO and Dames and Moore, 1996. *Resource Conservation and Recovery Act Facility Investigation Report Volume 6, Low-Level Waste Storage Area*, WVDP-RFI-022; and
- WVNSCO, 1998, *1998 Geoprobe® Investigation of the Core Area of the North Plateau Groundwater Plume*, WVDP-346.

During the scope of the RFI activities, background subsurface soil sampling on the north plateau was limited to three samples collected from borehole BH-38, advanced on October 26, 1993, as reported in WVDP-RFI-022. The location of BH-38 is shown on Figure 3 and the analytical results for radiological constituents and metals in subsurface soil are summarized in Tables 2 through 5. Later investigative activities were focused on subsurface soil conditions in the plume source area, and in particular the identification and delineation of impacts to groundwater quality. In 1990, prior to many of the above investigations, soil background data were collected in support of preparation of the WVDP-EIS-008, *Environmental Information Document, Volume IV, Soils Characterization* (WVNSCO, 1994).

1.4 Site Investigation Objectives

The objective of this investigation was to obtain supplemental background soil data from areas of the north plateau that were interpreted to be unaffected by site operations and activities (i.e., where there were no suspected sources of contamination). Geoprobe® sample locations were selected to provide additional data to represent background conditions by accounting for heterogeneity of the area's glacial and fluvial deposits. Areas interpreted to provide sufficient thickness of the sand and gravel (S&G) unit, upgradient of current and former WVDP facilities, were identified.

1.5 Report Organization

This report presents a summary of the investigation field activities and analytical results, as well as an evaluation of the data and proposed new site-specific background concentrations for metals. The report has been organized into the following remaining sections:

- Section 2 - Site Investigation Activities;
- Section 3 - Physical Conditions;
- Section 4 - Soil Quality; and
- Section 5 - Summary and Conclusions.

2.0 SITE INVESTIGATION ACTIVITIES

2.1 General

This section of the characterization report presents a description of the field procedures that were performed during implementation of the field investigation. As a precaution for the potential presence of radiological constituents, all soil samples were screened during sample collection for radiological activity using a portable GeigerMuller (GM) meter. The samples were also screened for the presence of organic vapors with an organic vapor meter (OVM). Additional protocols required for health and safety purposes were performed in accordance with WVDP-010, *WVDP Radiological Controls Manual*.

2.2 Geoprobe® Soil Sampling

To accomplish the investigation objective, five soil borings were advanced at the site by SJB Services, Inc., Hamburg, New York (SJB) during the period of July 14 and 15, 2008, under oversight by URS personnel. URS staff were responsible for field activities as follows:

- Coordinating SJB site activities;
- Screening and logging of samples;
- Selection of sample intervals for laboratory analyses; and
- Initiating and maintaining chain-of custody documentation for release of samples to the URS Environmental Laboratory.

At each boring location a Geoprobe® Large Bore (LB) sampler equipped with a disposable, clear plastic liner was advanced from ground surface through the S&G unit into the Unweathered Lavery till (ULT) unit (approximately two feet). Total depth of the soil borings ranged from seven to 30 feet below ground surface. The LB sampler acquires a nominal 1-inch diameter sample.

The borings were advanced by attaching a sealed LB soil sampler to the leading Geoprobe® rod and advancing the assembly to the top of the sampling interval. The piston stop-pin was detached from the inner rod allowing the LB piston top to retract and the sampler to be driven 24 inches to obtain a discrete interval soil sample. The probe rods were retracted from the hole with the sample assembly. The sampler was detached from the rods and was screened by the radiological technician for the potential presence of radioactivity. The soil sample was removed from the liner and the samples placed onto clean plastic and re-screened by the radiological technician for radiological activity. There were no detections of radioactivity above site background levels in any of the soil borings as established by the radiological technician through procedure RC-ADM-22, *Performing Routine Radiological Control Technician Tasks*.

The samples were subsequently screened by the site geologist for the presence of organic vapors with an OVM prior to handling. There were no detections of organic vapors during the sample screening process. The sample soil lithology was characterized using the Unified Soil Classification System (USCS) and Burmister lithologic descriptions in accordance with EM-500, *Drilling, Soil Sampling and Geologic Logging Procedures*. Soil boring logs (Appendix A) contain the field screening data and soil descriptions. Discussion of the subsurface conditions is presented in Section 3.2.

Samples selected for laboratory analyses were placed in appropriate sample jars or containers. Each jar was labeled with a unique Environmental Laboratory Information Management System (ELIMS) sample number, location, depth interval, date, time of sample collection, sampler, and required analyses. The containerized samples were surveyed by the radiological technician, and placed in shipping coolers for delivery to the respective laboratory under chain-of-custody.

Soils samples that were not selected for laboratory analyses were containerized as noted above, except for the ELIMS sample number and "required analysis". The samples were held in storage for future use, or reference as necessary, in accordance with the SAP.

The process described above was repeated at each subsequent sampling location. The borings were abandoned upon completion by backfilling with bentonite chips. The downhole Geoprobe[®] equipment was decontaminated prior to each use and the Geoprobe[®] rig and equipment were decontaminated prior to leaving the site in accordance with procedures identified in Section 3.5 of the SAP. Soil and other related investigative derived waste was managed in accordance with Section 3.6 of the SAP.

Upon receipt of the samples under chain-of-custody from the field staff, URS Environmental Laboratory and data validation personnel were responsible for the following activities:

- Receiving samples from the field personnel, maintaining chain-of-custody documentation;
- Review of soil sample pre-screening data to determine radiological classification for appropriate shipping protocols;
- Shipment of the metals samples to a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP)-certified laboratory for metals analyses;
- Shipment of samples to an off-site laboratory for analysis of radiological constituents in accordance with established WVDP protocols and procedures;
- Receipt of sample analytical results and upload of data to the ELIMS;
- Coordination with the off-site laboratory to resolve data problems or questions; and
- Validation of the data in accordance with data quality objectives (DQOs).

The following URS documents outlining investigative, documentation and laboratory and data validation procedures and protocols were utilized in support of the investigative activities:

- EM-52, *Environmental Sample Receipt, Handling, Storage, Packaging and Shipment*;
- EM-109, *Quality Assurance Plan*;
- EM-108, *Data Validation*; and
- EM-74, *Radioanalytical Data Validation*.

2.3 Site Survey

On November 5, 2008, a New York State-licensed surveyor located and surveyed each Geoprobe[®] boring location with respect to the existing site coordinate system. Vertical control was also established for the ground surface at each soil boring location and referenced to the site-specific datum. The respective survey data for each soil boring location is summarized in Table 1.

3.0 PHYSICAL CONDITIONS

3.1 Topography, Land Usage, Drainage

The WVDP, which includes the north plateau, ranges in elevation from 1,300 to about 1,445 feet above mean-sea-level. The undeveloped part of the larger WNYNSC that surrounds the WVDP remains a mixture of forest, wetlands and abandoned farmland.

The three named streams in the vicinity of the WVDP are Erdman Brook, Franks Creek, and Quarry Creek. The MPPB and related facilities are located on the north plateau (Figure 2).

3.2 Site Geology

The subsurface conditions on the north plateau encountered during the implementation of the soil characterization program can be generally characterized as follows:

- S&G unit – encountered from ground surface to approximately 28 feet - brown to grey silty sand with variable angular gravel and trace clay; and
- ULT unit – encountered from bottom of S&G unit to approximately 30 feet - dark grey dense silty clay with little to some fine gravel.

A layer of soil, described as disturbed (i.e., re-worked) gravel and sand, was encountered at boring locations GPBG01-08 through GPBG04-08. For purposes of this investigation, this material is comparable with the S&G unit. The S&G and ULT units were present at all background boring locations, but the S&G unit was very thin (i.e., slightly over three feet thick) at boring GPBG02-08. The S&G unit is known to pinch out from northeast to southwest across the WVDP near Rock Springs Road. Therefore, this subsurface observation is expected. The S&G unit ranged in thickness from approximately 3.4 feet (GPBG02-08, includes re-worked soil) to approximately 28.4 feet (GPBG03-08, includes re-worked soil). The top of the ULT unit was encountered at depths ranging from 3.4 feet below the ground surface (GPBG02-08) to 28.4 feet (GPBG03-08).

The SAP called for termination of the borings at approximately two feet into the ULT. However, the total depth of the individual borings and the selection of the intervals for subsequent laboratory analysis were modified in the field, based on encountered conditions, as deemed appropriate by the field sampling team and Project Manager.

The geologic units included in the subsurface soil characterization program, including the BH-38 samples, were as follows:

- S&G unit - 10 samples submitted for laboratory analysis (see Tables 1 and 2, Figure 3); and
- ULT - seven samples submitted for laboratory analysis (see Tables 1 and 2, Figure 3).

The number of samples collected was dictated by the SAP and actual encountered field conditions. Depth to groundwater in the proximity of the background soil borings is typically in the range of about eight feet below grade, subject to seasonal variations. In the surrounding north plateau area depth to groundwater ranges from surface to about 16 feet below grade. Groundwater in the MPPB area generally flows northeastward toward Franks Creek.

4.0 SOIL QUALITY

The SAP outlined the basic requirements for the sampling and analysis activities to be performed. The implementation of the SAP resulted in 15 samples (14 samples plus one field duplicate).

URS personnel collected representative samples for laboratory analyses from the recovered Geoprobe® core samples during field investigation activities. A brief summary of the sample identification method, the analytical results, the constituents of concern, and data validation results are presented below. The sample locations are presented on Figure 3. Analytical results are discussed in Sections 4.2 and 4.3, and are summarized in Tables 2 and 3.

Sampling activities were conducted on July 14 and 15, 2008. URS staff shipped the samples to the off-site laboratory under appropriate chain-of-custody protocols in accordance with EM-52 procedures. Radiological and metals analysis for this project was performed by GEL Laboratories, LLC (GEL), a NYSDOH ELAP-Certified Laboratory located in Charleston, South Carolina. GEL analyzed metals samples, including all quality assurance/quality control (QA/QC) samples, as specified in the SAP,

according to U.S. Environmental Protection Agency (USEPA) Solid Waste 846 (SW-846) Methodology, Method 7471 for mercury and Method 6010 for all other metal constituents. GEL services were performed in conformance with site procedure EM-109, *Quality Assurance Plan*.

4.1 Sample Identification

Each sample was uniquely identified in such a manner that the sample number identifies the location of the sample collection point and the type of sample. This alphanumeric system included a two-letter prefix describing the sample method, followed by a two-letter prefix describing the sample type, a two-digit number indicating the sample location, and a two digit number representing the year. The bottles containing samples for laboratory analyses were labeled with a unique ELIMS sample number as described in WVDP-466. Information on the labels also included the sample location, depth interval, date, time of sample collection, sampler, and required analysis.

4.2 Soil Analytical Results

Background soil samples were collected for analysis of radiological and chemical parameters. The radiological data was used to determine which background soil borings have or have not been impacted by WVDP activities. Then, the boring locations that have not been impacted by WVDP activities, and resultant chemical data, can be used to quantify background soil concentrations for metals. Soil analytical results for metals were assessed in accordance with the NYSDEC Technical and Administrative Guidance Memorandum (TAGM) #4046, *Determination of Soil Cleanup Objectives and Cleanup Levels*, January 24, 1994 (TAGM 4046). Specifically, the last paragraph of Section 2, *Basis for Soil Cleanup Objectives*, of TAGM 4046 states that "...soil background data near the site, if available, is preferable and should be used as the cleanup objective for such metals. Background samples should be free from the influences of this site and any other source contaminants. Ideal background samples may be obtained from uncontaminated upgradient and upwind locations."

4.2.1 Radiological Data

A total of 15 soil samples, including one duplicate, were collected from five soil boring locations (GPBG01-08 to GPBG05-08). These 15 sample sets were tested for 19 radiological analytes known to be present as contaminants on the site. The samples were transported under chain-of-custody for radiological constituent analyses under WVDP protocols. Due to the size of the laboratory reports, they are not included with this report. This data will be made available upon request.

Radiological data from the five background soil borings advanced as part of this investigation, and BH-38, advanced in support of RFI activities, are summarized in Table 2. The quality assurance/quality control protocol outlined in WVDP-RFI-014, *West Valley Demonstration Project RCRA Facility Investigation Work Plan* (WVNSCO, 1993) used to support RFI activities is comparable to that used for the current investigation. The radiological concentrations are presented by boring location with the uncertainty value associated with each reported concentration. The uncertainty is defined in DOE's Environmental Management Laboratory's *Procedure Manual* (HASL-300, 1997) as "The range of values within which the true value is estimated to lie. It is the best estimate of possible inaccuracy due to both random and systematic errors." Based on comparison of the radiological concentration, the uncertainty, and the data validation results, the significance of each result was qualified (i.e., not detected, detected estimated value) in the "qualifier" column next to each result in Table 2.

Table 3 has been generated from Table 2 to present only the positive detections of radioactivity in the newly collected background samples. To evaluate whether the newly collected background soil sample have been radiologically, and thus potentially chemically impacted by site activities, these radiological data were compared to two off-site soil

samples (SSOOANW and SSOOBNW) collected on August 9, 1990, from one location in a pasture located two kilometers upwind and upgradient of the WVDP on Dutch Hill Road. The two samples were collected from depths of ground surface to six inches and from 12 to 18 inches. The radiological data from this off-site sampling location is reported in Table 3-2 of the WVDP soils characterization document WVDP-EIS-008. Table 3 provides a comparison of the analytical results from these two off-site locations with the positive detections of three samples from BH-38 and from the 15 samples collected from the five background soil borings for all comparable radiological parameters analyzed.

The data comparison shown in Table 3 indicates that only potassium-40 (K-40) and gross beta have detections in the new background data slightly higher than the maximum of the two off-site soil sample results for the radiological parameters analyzed for in both data sets. However, the gross beta concentrations observed in the new data were lower than the gross beta in BH-38. Although there is a difference in gross beta concentration between BH-38 and the off-site soil samples, in only the surface soil sample at BH-38 were there any detections of Sr-90 or cesium-137 (Cs-137), suggesting the gross beta detected in BH-38 is most likely not anthropogenic. This concentration of K-40, which occurs naturally in soils, is consistent amongst all of the newly collected background soil samples and only slightly above the off-site background.

Gross alpha and uranium-238 (U-238) were measured at detectable concentrations in all of the newly collected concentrations at levels below the maximum of the two off-site soil sample results. U-238 occurs abundantly in natural soils and is a contributor to the very low but detectable gross alpha result. There was one positive detection of Cs-137 in a borehole duplicate and two detections of Sr-90 in the newly collected background soil samples, all at levels below the two off-site background results. Nearly all of the new background soil samples contained very low but detectable levels of U-233/234 and U-235/236. These positive detections are not shown in Table 2 because the surface soil samples were not analyzed for these parameters. However, the observed uranium isotopic activity ratios in the new background soil samples are consistent with normal expected natural distribution ratios (Shlein et al., 1998).

Because of worldwide radioactivity fallout (surface background) and other natural daughter product influences (subsurface background), there are expected differences between the subsurface soils and the near-surface soils. These differences notwithstanding, either data set is useable as a background reference. Therefore, the six boreholes (excluding the surface soil sample at BH-38 taken in fill material in an area within the Cs-137-impacted surficial area identified in previous investigations) appear to be representative of conditions indicating no impact from WVDP activities.

4.2.2 Metals Data

A total of 15 soil samples, including one duplicate sample, were collected from five Geoprobe® boring locations (see Figure 3) for metals analyses during this investigation. A summary of the metals analytical results is presented in Tables 4 and 5, and the laboratory reports are available upon request.

The tables also include the data from borehole BH-38 installed in 1993 as an initial north plateau background subsurface soil sampling location. The BH-38 metals data set was reviewed in comparison to the current background soil sampling program data.

As presented in Section 3.2, a total of 10 soil samples from the S&G unit were collected, both from the previous RFI activities (one sample), and this background soil characterization effort (nine samples). The analytical data associated with these 10 samples are presented in Table 4. The laboratory reports are not presented in this document based on the volume of paperwork, but are available upon request. The last

column of Table 4 identifies the maximum reported concentration for a given analyte from the S&G unit samples.

A total of seven soil samples were evaluated from the ULT: one sample from the previous RFI activities and six samples from the current background soil characterization effort. The analytical data associated with these seven samples are presented in Table 5 and the laboratory reports are available upon request. The last column of Table 5 identifies the maximum reported concentration for a given analyte from the ULT unit samples.

Table 6 presents the maximum reported concentrations for the S&G and ULT units, as summarized in Tables 4 and 5, respectively. As such, Table 6 presents the site-specific background metals concentrations for the S&G and ULT units at the WVDP.

4.3 Data Validation

In accordance with the SAP, metals and radiological analytical data packages were validated by URS, in accordance with EM-108 and EM-74 procedures for inorganics (e.g., metals) and radiological sample analyses, respectively. The data validation process included review of laboratory data documentation as follows:

- completeness;
- holding time compliance;
- QC data (blank, surrogates, recoveries, laboratory controls, etc.);
- system performance; and
- data qualifier assessment.

The data validation reports are available upon request.

During the review process, laboratory qualified and unqualified data were verified against the supporting documentation. Based on this review, additional qualifier codes were entered into the ELIMS and added to the data summary tables (Tables 2 through 5) that may not be present on the final data packages received from the analytical laboratory.

5.0 SUMMARY AND CONCLUSIONS

5.1 Radiological Background Data

Radiological data generated for the background soil characterization effort were compared to off-site soil sample radiological data. The off-site samples were collected from property on Dutch Hill Road, located upwind and upgradient to the WVDP. The two off-site soil samples were collected from depths of ground surface to six inches and from 12 to 18 inches. The data radiological evaluation focused on radionuclides common to both data sets to evaluate if significant differences existed to then determine if the background samples were impacted by site activities.

The comparison indicated that a majority of the radiological parameters (six of the nine evaluated in Table 3) were below off-site soil levels. For those parameters that were greater than off-site soil, principally gross beta and K-40, the concentrations were slightly less than an order of magnitude higher. These differences may be attributed to worldwide fallout (e.g., gross alpha and beta) and the heterogeneity of soils associated with naturally occurring radionuclides (e.g., K-40). Therefore, the six boreholes (excluding the BH-38 0'-2' sample taken in fill material) were determined to be comparable to off-site conditions thereby indicating no impact from WVDP activities.

5.2 Metals Background Data

To provide analytical data that are not impacted by site activities, five upgradient and upwind sampling locations were identified in the SAP. Radiological data were compared to off-site data to determine whether radiological impacts were present in the background soil borings. As presented above, the background radiological data indicate that the tested background sample locations are not impacted by site activities and the resultant metals data would be representative of background soil conditions. The analytical data generated for the background soil characterization program were validated by URS personnel. All data were determined to be useable and representative for the project. The maximum detectable metals concentrations for the S&G and ULT units, as presented in Table 6, are proposed as site-specific background concentrations for the WVDP.

6.0 REFERENCES

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TABLES

Table 1. Geoprobe® Soil Boring Summary

Boring Location	Ground Surface Elevation (feet)	Top of Sand & Gravel Elevation (feet)	Sand & Gravel Thickness (feet)	Sand & Gravel Sampling Intervals	Top of Unweathered Lavery Till Elevation (feet)	Unweathered Lavery Till Sampling Intervals
GPBG01-08	1430.79	1430.79*	10.5*	4–6' 6–8' 8–10'	1420.29	No ULT Sample
GPBG02-08	1403.81	1403.81*	3.42*	No S&G Sample	1400.39	3–5' 5–7' (**)
GPBG03-08	1423.79	1423.79*	28.42*	5–7' 13–15'	1395.37	28–30'
GPBG04-08	1405.76	1405.76*	18.50*	5–7' 13–15'	1387.26	19–25'
GPBG05-08	1395.68	1395.68	7.5	5–7' 7–8'	1388.18	8–11'

Notes:

* Includes reworked near surface soils

** Duplicate sample also collected at this depth and location

Table 2. Soil Analytical Data Summary – Radiological Constituents

Boring ID Sample Depth Geologic Unit Analyte	GPBG01-08 4'-6' Reworked Sand & Gravel		GPBG01-08 6'-8' Sand & Gravel		GPBG01-08 8'-10' Sand & Gravel		GPBG02-08 3'-5' Unweathered Lavery Till		GPBG02-08 5'-7' Unweathered Lavery Till	
	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Gross Beta	2.50E+01±4.19E+00		2.11E+01±4.05E+00		2.04E+01±3.09E+00		3.00E+01±3.73E+00		3.22E+01±4.94E+00	
Gross Alpha	9.97E+00±4.46E+00	J	1.00E+01±4.61E+00	J	1.34E+01±4.28E+00	J	1.09E+01±3.93E+00	J	9.08E+00±4.39E+00	J
H-3	1.45E+00±4.24E+00	ND	1.09E+00±4.33E+00	ND	3.85E+00±4.43E+00	ND	1.84E+00±4.88E+00	ND	-8.52E-1±4.66E+00	ND
C-14	1.31E-01±1.01E-01	ND	-1.48E-01±9.44E-02	ND	-2.12E-01±9.40E-02	ND	-1.11E-01±9.56E-02	ND	-1.67E-01±9.53E-02	ND
Sr-90	1.49E-02±1.79E-02	ND	-1.37E-03±2.00E-02	ND	2.36E-02±2.39E-02	ND	-1.83E-03±1.37E-02	ND	-1.12E-03±1.18E-02	ND
Tc-99	-2.08E-01±3.83E-01	ND	-7.58E-02±3.22E-01	ND	-3.97E-01±3.91E-01	ND	-3.32E-01±2.99E-01	ND	-2.47E-01±3.56E-01	ND
I-129	-9.56E-02±2.03E-01	ND	-2.20E-01±2.35E-01	ND	1.57E-01±2.41E-01	ND	1.04E-02±2.19E-01	ND	-9.64E-02±2.00E-01	ND
K-40	2.11E+01±1.68E+00		1.78E+01±1.48E+00		2.12E+01±1.79E+00		2.67E+01±2.11E+00		2.16E+01±2.04E+00	
Co-60	-4.47E-03±2.77E-02	ND	-6.17E-03±2.92E-02	ND	-3.72E-03±2.94E-02	ND	1.82E-02±2.47E-02	ND	-1.99E-02±3.07E-02	ND
Cs-137	-4.42E-03±2.51E-02	ND	-1.28E-02±2.55E-02	ND	-9.52E-03±2.90E-02	ND	-1.34E-02±2.21E-02	ND	1.18E-02±2.74E-02	ND
Eu-154	1.26E-02±8.94E-02	ND	-1.31E-02±8.09E-02	ND	5.30E-02±1.01E-01	ND	6.19E-02±7.43E-02	ND	-9.51E-02±9.07E-02	ND
U-233/234	8.74E-01±1.40E-01		7.15E-01±1.11E-01		8.59E-01±1.25E-01		8.25E-01±1.35E-01		7.86E-01±1.36E-01	
U-235/236	2.85E-02±3.18E-02	ND	8.57E-02±3.86E-02		1.17E-01±4.60E-02		7.53E-02±4.56E-02	J	8.64E-03±2.64E-02	ND
U-238	9.28E-01±1.43E-01		8.75E-01±1.23E-01		9.20E-01±1.29E-01		9.45E-01±1.44E-01		7.01E-01±1.30E-01	
Np-237	3.34E-03±1.24E-02	ND	-1.83E-03±9.47E-03	ND	1.63E-03±1.24E-02	ND	-1.14E-02±1.17E-02	ND	-1.94E-03±8.35E-03	ND
Pu-239/240	1.66E-02±1.87E-02	ND	-3.22E-03±9.50E-03	ND	0.00E+00±1.04E-02	ND	8.82E-03±1.41E-02	ND	3.28E-03±8.69E-03	ND
Pu-241	-4.50E-02±3.19E-01	ND	1.84E-02±3.28E-01	ND	-2.05E-02±3.64E-01	ND	-2.14E-01±3.86E-01	ND	-1.69E-01±3.30E-01	ND
Am-241	-8.10E-03±1.13E-02	ND	-1.30E-03±1.11E-02	ND	-8.23E-03±1.22E-02	ND	-6.50E-03±1.11E-02	ND	-5.35E-03±9.58E-03	ND
Cm-244	2.83E-03±1.13E-02	ND	0.00E+00±1.08E-02	ND	-1.42E-03±1.19E-02	ND	2.60E-03±1.04E-02	ND	4.90E-03±9.60E-03	ND

Notes:

- (1) All results reported in picocuries per gram (pCi/g).
- (2) ND: Not detected
- (3) J: Estimated concentration
- (4) Q: Qualifier

Table 2. Soil Analytical Data Summary – Radiological Constituents (*continued*)

Boring ID Sample Depth Geologic Unit Analyte	GPBG02-08 DUPLICATE 5'–7' Unweathered Lavery Till		GPBG03-08 5'–7' Sand & Gravel		GPBG03-08 13'–15' Sand & Gravel		GPBG03-08 28'–30' Unweathered Lavery Till		GPBG04-08 5'–7' Sand & Gravel	
	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Gross Beta	3.57E+01±5.01E+00		1.50E+01±3.33E+00		2.68E+01±4.38E+00		2.20E+01±3.85E+00		2.71E+01±4.18E+00	
Gross Alpha	1.36E+01±5.49E+00	J	1.44E+01±5.28E+00	J	7.74E+00±4.08E+00	J	7.22E+00±4.04E+00	J	1.69E+01±5.39E+00	J
H-3	2.62E+00±4.44E+00	ND	4.28E-01±4.72E+00	ND	-4.21E-1±4.62E+00	ND	2.40E+00±4.78E+00	ND	2.83E+01±5.51E+00	
C-14	-1.87E-01±9.81E-02	ND	9.11E-02±1.00E-01	ND	1.54E-01±1.19E-01	ND	8.25E-02±1.18E-01	ND	5.74E-02±1.14E-01	ND
Sr-90	1.29E-02±1.70E-02	ND	-1.10E-02±1.78E-02	ND	1.30E-03±1.28E-02	ND	-8.07E-03±2.22E-02	ND	1.89E-02±2.38E-02	ND
Tc-99	-4.21E-02±2.85E-01	ND	-3.79E-01±5.48E-01	ND	2.59E-01±4.40E-01	ND	-2.69E-01±3.94E-01	ND	4.17E-01±4.99E-01	ND
I-129	7.20E-03±2.28E-01	ND	1.87E-01±2.21E-01	ND	6.81E-02±1.85E-01	ND	1.93E-01±1.80E-01	ND	5.17E-02±2.06E-01	ND
K-40	2.21E+01±1.35E+00		1.40E+01±1.13E+00		1.92E+01±1.64E+00		2.06E+01±1.85E+00		1.80E+01±1.38E+00	
Co-60	1.30E-02±1.03E-02	ND	5.66E-03±2.42E-02	ND	-1.50E-02±2.85E-02	ND	1.01E-02±2.53E-02	ND	-1.47E-02±1.89E-02	ND
Cs-137	2.87E-01±3.93E-02		-2.40E-02±2.56E-02	ND	1.23E-03±2.52E-02	ND	-1.30E-02±2.30E-02	ND	3.72E-03±1.79E-02	ND
Eu-154	-2.64E-02±3.30E-02	ND	-5.14E-02±7.42E-02	ND	3.22E-02±8.53E-02	ND	-6.41E-02±7.78E-02	ND	-1.49E-02±5.94E-02	ND
U-233/234	7.72E-01±1.39E-01		8.01E-01±1.39E-01		8.41E-01±1.38E-01		9.02E-01±1.43E-01		8.80E-01±1.31E-01	
U-235/236	3.28E-02±2.88E-02	J	2.90E-02±3.23E-02	ND	8.55E-02±4.33E-02	J	9.63E-02±4.75E-02		7.77E-02±3.96E-02	J
U-238	9.85E-01±1.58E-01		9.87E-01±1.50E-01		8.95E-01±1.41E-01		9.23E-01±1.44E-01		8.53E-01±1.28E-01	
Np-237	-3.18E-03±9.39E-03	ND	-3.05E-03±8.98E-03	ND	3.15E-03±8.36E-03	ND	4.10E-03±8.04E-03	ND	3.22E-03±8.54E-03	ND
Pu-239/240	4.28E-03±8.38E-03	ND	-1.74E-03±7.49E-03	ND	7.63E-03±1.22E-02	ND	-2.74E-03±1.18E-02	ND	-3.49E-03±1.50E-02	ND
Pu-241	7.35E-02±4.38E-01	ND	-1.43E-01±3.15E-01	ND	-8.15E-02±4.82E-01	ND	-4.47E-02±3.53E-01	ND	-1.80E-01±3.33E-01	ND
Am-241	5.41E-03±1.07E-02	ND	-5.43E-03±1.04E-02	ND	-6.55E-03±9.68E-03	ND	6.62E-03±1.24E-02	ND	-9.80E-03±1.27E-02	ND
Cm-244	4.14E-03±1.10E-02	ND	-1.28E-03±1.08E-02	ND	1.47E-02±1.94E-02	ND	-4.36E-03±1.29E-02	ND	-4.31E-03±1.27E-02	ND

Notes:

- (1) All results reported in picocuries per gram (pCi/g).
- (2) ND: Not detected
- (3) J: Estimated concentration
- (4) Q: Qualifier

Table 2. Soil Analytical Data Summary – Radiological Constituents (continued)

Boring ID Sample Depth Geologic Unit Analyte	GPBG04-08 13'–15' Sand & Gravel		GPBG04-08 19'–25' Unweathered Lavery Till		GPBG05-08 5'–7' Sand & Gravel		GPBG05-08 7'–8' Sand & Gravel		GPBG05-08 8'–11' Unweathered Lavery Till	
	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Gross Beta	1.88E+01±4.01E+00		3.58E+01±4.22E+00		2.24E+01±3.44E+00		3.38E+01±4.60E+00		3.14E+01±4.31E+00	
Gross Alpha	8.44E+00±4.34E+00	J	1.29E+01±4.64E+00	J	1.22E+01±4.06E+00	J	1.07E+01±4.30E+00	J	1.31E+01±4.61E+00	J
H-3	2.70E+00±4.72E+00	ND	2.97E+00±4.75E+00	ND	5.24E+00±4.47E+00	ND	1.20E+00±4.13E+00	ND	1.37E+00±4.39E+00	ND
C-14	-6.81E-02±1.14E-01	ND	2.32E-01±1.20E-01	J	2.04E-01±4.70E-01	ND	-1.01E+00±4.56E-01	ND	-8.30E-01±4.46E-01	ND
Sr-90	-4.99E-03±2.01E-02	ND	5.90E-03±2.76E-02	ND	1.24E-01±2.78E-02		3.13E-02±1.89E-02		-2.68E-03±1.20E-02	ND
Tc-99	1.72E-01±4.90E-01	ND	1.85E-01±3.77E-01	ND	-5.85E-01±9.13E-01	ND	-3.29E-01±9.65E-01	ND	-5.14E-01±8.62E-01	ND
I-129	1.39E-01±1.67E-01	ND	-1.28E-01±1.98E-01	ND	-8.72E-02±1.76E-01	ND	-1.06E-01±1.71E-01	ND	-8.92E-02±1.95E-01	ND
K-40	1.61E+01±1.40E+00		2.67E+01±2.62E+00		2.11E+01±1.54E+00		2.67E+01±1.91E+00		2.66E+01±2.08E+00	
Co-60	7.95E-03±2.39E-02	ND	2.93E-02±2.56E-02	ND	5.96E-03±2.18E-02	ND	9.64E-03±2.69E-02	ND	2.91E-03±2.49E-02	ND
Cs-137	-1.69E-02±2.08E-02	ND	1.82E-02±2.76E-02	ND	-2.04E-02±1.80E-02	ND	-2.80E-03±2.42E-02	ND	-1.51E-02±2.05E-02	ND
Eu-154	1.16E-02±7.26E-02	ND	3.36E-02±9.07E-02	ND	3.22E-03±6.33E-02	ND	-1.11E-01±8.68E-02	ND	-3.08E-02±7.42E-02	ND
U-233/234	7.80E-01±1.35E-01		1.08E+00±1.50E-01		6.83E-01±1.15E-01		7.79E-01±1.25E-01		8.94E-01±1.39E-01	
U-235/236	3.60E-02±3.23E-02	ND	4.89E-02±3.45E-02	J	3.20E-02±3.11E-02	ND	7.68E-02±4.08E-02		9.22E-02±4.75E-02	
U-238	7.98E-01±1.36E-01		1.11E+00±1.53E-01		6.63E-01±1.14E-01		8.50E-01±1.31E-01		8.94E-01±1.40E-01	
Np-237	3.99E-03±7.82E-03	ND	-5.01E-03±9.28E-03	ND	-2.97E-03±8.77E-03	ND	-1.97E-03±8.50E-03	ND	0.00E+00±1.91E-02	ND
Pu-239/240	-3.77E-03±1.11E-02	ND	-9.94E-04±8.35E-03	ND	1.07E-02±1.85E-02	ND	-4.57E-03±1.03E-02	ND	-1.10E-03±9.24E-03	ND
Pu-241	-1.99E-01±3.32E-01	ND	-2.08E-01±5.07E-01	ND	2.47E-02±2.94E-01	ND	-9.28E-02±3.45E-01	ND	-5.99E-01±7.48E-01	ND
Am-241	-6.44E-03±1.12E-02	ND	-1.57E-04±1.04E-02	ND	3.52E-03±1.26E-02	ND	-2.69E-03±1.11E-02	ND	-1.50E-03±1.04E-02	ND
Cm-244	-2.42E-03±1.04E-02	ND	5.31E-03±1.04E-02	ND	-1.42E-03±1.19E-02	ND	-2.58E-03±1.11E-02	ND	1.03E-02±1.43E-02	ND

Notes:

- (1) All results reported in picocuries per gram (pCi/g).
- (2) ND: Not detected
- (3) J: Estimated concentration
- (4) Q: Qualifier

Table 2. Soil Analytical Data Summary – Radiological Constituents (*concluded*)

Boring ID Sample Depth Geologic Unit Analyte	BH38 0'-2' Fill		BH38 12'-14' Sand & Gravel		BH38 26'-28' Unweathered Lavery Till	
	Result	Q	Result	Q	Result	Q
Gross Beta	7.10E+01±4.00E+00		6.10E+01±4.00E+00		5.50E+01±4.00E+00	
Gross Alpha	4.80E+00±4.70E+00		1.30E+01±6.00E+00		1.40E+01±6.00E+00	
H-3	Not Analyzed		Not Analyzed		Not Analyzed	
C-14	Not Analyzed		Not Analyzed		Not Analyzed	
Sr-90	8.20E-01±8.00E-02		2.50E-02±2.90E-02	ND	2.50E-02±2.70E-02	ND
Tc-99	Not Analyzed		Not Analyzed		Not Analyzed	
I-129	Not Analyzed		Not Analyzed		Not Analyzed	
K-40	Not Analyzed		Not Analyzed		Not Analyzed	
Co-60	Not Analyzed		Not Analyzed		Not Analyzed	
Cs-137	1.10E+01±1.00E+00		1.30E-02±2.70E-02	ND	2.30E-02±2.40E-02	ND
Eu-154	Not Analyzed		Not Analyzed		Not Analyzed	
U-233/234	1.90E-01±4.00E-02		1.30E-01±3.00E-02		1.70E-01±3.00E-02	
U-235/236	1.04E-02±8.78E-03		7.62E-03±9.05E-03	ND	1.14E-02±9.74E-03	
U-238	1.10E-01±3.00E-02		1.00E-01±3.00E-02		1.30E-01±3.00E-02	
Np-237	Not Analyzed		Not Analyzed		Not Analyzed	
Pu-239/240	1.60E-01±4.00E-02		4.30E-04±4.25E-03	ND	1.80E-03±1.83E-02	ND
Pu-241	2.10E-00±1.50E+00		6.40E-01±9.80E-01	ND	-1.40E+00±5.30E+00	ND
Am-241	3.70E-01±8.00E-02		7.70E-04±7.73E-03	ND	8.20E-04±8.19E-03	ND
Cm-244	Not Analyzed		Not Analyzed		Not Analyzed	

Notes:

- (1) All results reported in picocuries per gram (pCi/g).
- (2) ND: Not detected.
- (3) J: Estimated concentration
- (4) Q: Qualifier

Table 3. Soil Analytical Data Summary of Positive Detections – Radiological Constituent Comparison

Sample Location Sample Depth Analyte	SSOOANW 0–6" pCi/g	SSOOBNW 6–18" pCi/g	GPBG01-08 4'–6' pCi/g	GPBG01-08 6'–8' pCi/g	GPBG01-08 8–10' pCi/g	GPBG02-08 3'–5' pCi/g	GPBG02-08 5'–7' pCi/g	GPBG0208DUP 5'–7' pCi/g	GPBG03-08 5'–7' pCi/g
Gross Beta	1.91E+01	1.39E+01	2.50E+01	2.11E+01	2.04E+01	3.00E+01	3.22E+01	3.57E+01	1.50E+01
Gross Alpha	9.61E+00	1.71E+01	9.97E+00	1.00E+01	1.34E+01	1.09E+01	9.08E+00	1.36E+01	1.44E+01
Sr-90	6.04E-01	1.86E+00							
K-40	1.43E+01	1.31E+01	2.11E+01	1.78E+01	2.12E+01	2.67E+01	2.16E+01	2.21E+01	1.40E+01
Co-60	<4.5E-02	<4.4E-02							
Cs-137	4.12E-01	4.79E-02						2.87E-01	
U-238	1.36E+00	1.01E+00	9.28E-01	8.75E-01	9.20E-01	9.45E-01	7.01E-01	9.85E-01	9.87E-01
Pu-239/240	<2.5E-02	<5.7E-02							
Am-241	3.88E-01	9.45E-02							

Sample Location Sample Depth Analyte	SSOOANW 0–6" pCi/g	SSOOBNW 6–18" pCi/g	GPBG03-08 13–15' pCi/g	GPBG03-08 28–30' pCi/g	GPBG04-08 5–7' pCi/g	GPBG04-08 13–15' pCi/g	GPBG04-08 19–25' pCi/g	GPBG05-08 5–7' pCi/g	GPBG05-08 7–8' pCi/g
Gross Beta	1.91E+01	1.39E+01	2.68E+01	2.20E+01	2.71E+01	1.88E+01	3.58E+01	2.24E+01	3.38E+01
Gross Alpha	9.61E+00	1.71E+01	7.74E+00	7.22E+00	1.69E+01	8.44E+00	1.29E+01	1.22E+01	1.07E+01
Sr-90	6.04E-01	1.86E+00						1.24E-01	3.13E-02
K-40	1.43E+01	1.31E+01	1.92E+01	2.06E+01	1.80E+01	1.61E+01	2.67E+01	2.11E+01	2.67E+01
Co-60	<4.5E-02	<4.4E-02							
Cs-137	4.12E-01	4.79E-02							
U-238	1.36E+00	1.01E+00	8.95E-01	9.23E-01	8.53E-01	7.98E-01	1.11E+00	6.63E-01	8.50E-01
Pu-239/240	<2.5E-02	<5.7E-02							
Am-241	3.88E-01	9.45E-02							

Notes:

- (1) All results reported in picocuries per gram (pCi/g).
- (2) Not detected.

Table 3. Soil Analytical Data Summary of Positive Detections – Radiological Constituent Comparison (*concluded*)

Sample Location Sample Depth Analyte	SSOOANW 0–6" pCi/g	SSOOBNW 6–18" pCi/g	GPBG05-08 8–11' pCi/g	BH-38 0'–2' pCi/g	BH-38 12'–14' pCi/g	BH-38 26'–28' pCi/g
Gross Beta	1.91E+01	1.39E+01	3.14E+01	7.10E+01	6.10E+01	5.50E+01
Gross Alpha	9.61E+00	1.71E+01	1.31E+01	4.80E+00	1.30E+01	1.40E+01
Sr-90	6.04E-01	1.86E+00		8.20E-01		
K-40	1.43E+01	1.31E+01	2.66E+01			
Co-60	<4.5E-02	<4.4E-02				
Cs-137	4.12E-01	4.79E-02		1.10E+01		
U-238	1.36E+00	1.01E+00	8.94E-01	1.10E-01	1.00E-01	1.30E-01
Pu-239/240	<2.5E-02	<5.7E-02		1.60E-01		
Am-241	3.88E-01	9.45E-02		3.70E-01		

Notes:

- (1) All results reported in picocuries per gram (pCi/g).
- (2) ND: Not detected.

Table 4. Soil Analytical Data Summary – Metal Constituents – Sand & Gravel Unit

Sample Location Sample Depth Sample ID	GPBG0108			GPBG0308		GPBG0408		GPBG0508		BH-38 12–14' RFI-00397	Maximum Concentration Reported
	4–6'	6–8'	8–10'	5–7'	13–15'	5–7'	13–15'	5–7'	7–8'		
	2008-04811	2008-04809	2008-04807	2008-04819	2008-04821	2008-04825	2008-04827	2008-04831	2008-04833		
Aluminum	11,100	9,970	15,400	13,900	9,820	10,400	12,800	7,410	12,200	12,500	15,400
Antimony	0.553 J	0.967 J	0.883 J	0.946 J	0.536 J	0.903 J	0.585 J	0.982 J	1.7 J	2.04	2.04
Arsenic	11	11.6	8.8	10.1	12.5	8.15	11.4	8.88	7.03	6.06	12.5
Barium	110 J	77.1 J	110 J	38.9 J	65.8 J	49.7 J	107 J	62.8	108	139	139
Beryllium	0.679	0.54	0.814	0.658	0.585	0.454 J	0.788	0.38 J	0.644	0.602	0.814
Cadmium	0.382 J	0.269 J	0.533 J	0.259 J	0.453 J	0.279 J	0.282 J	<0.108	<0.111	<0.226	0.533 J
Calcium	2,180	1,810	25,000	1,450	1,230	977	8,850	4,670	25,300	17,400	25,300
Chromium	14.2 J	11.8 J	21.8 J	17 J	12.9 J	11 J	16.8 J	9.86	17.6	NE	21.8 J
Cobalt	8.19	9.16	13.4	9.75	8.19	7.04	10.6	5.94	9.94	11.2	13.4
Copper	32.8	21.6	26	24.6	33.1	19.6	26.5	23.2	25.8	24.8	33.1
Iron	26,400	23,600	29,400	27,200	28,000	22,800	29,100	19,700	27,300	26,800	29,400
Lead	26.5	30.9	13.3	16.9	24.5	28.1	12.7	19.1	11.8	14.0	30.9
Magnesium	3,410	3,120	8,910	4,480	3,710	3,500	6,660	2,830	7,460	6,050	8,910
Manganese	463	740	339	451	846	487	328	494	361	486	846
Mercury	0.0131	0.00767 J	0.0109 J	0.0153	0.0146	0.00812 J	0.00503 J	0.00555 J	0.0106 J	0.02	0.02
Nickel	20.1 J	19.5 J	37.3 J	26.1 J	21.8 J	18.2 J	26.2 J	15.7	28.6	27.0	37.3 J
Potassium	773 J	856	1,860 J	1,020 J	849 J	720 J	1,150 J	736 J	1,340 J	1,700	1,860 J
Selenium	4.4	3.2	0.574	8.2	6	5.3	8.8	3.95 J	1.16	<0.107	8.8
Silver	0.5 J	0.621	0.134 J	0.226 J	<0.112	<0.11	<0.106	0.157 J	<0.111	<0.339	0.621
Sodium	331	308	143	39.3	63	90.7	106	97.7	113	76.0	331
Thallium	0.143 J	0.205 J	0.256 J	0.109 J	0.157 J	0.135	0.141 J	0.137 J	0.308 J	<0.107	0.308 J
Vanadium	14.5	15.8	20.9	13.8	14.9	15.5	15.5	14.8	25.3	16.9	25.3
Zinc	99.7 J	65 J	70.2 J	82.6 J	94.2 J	66.1 J	81.9 J	61.8	68.9	80.0	99.7 J

Notes:

- (1) All values shown in milligrams per kilogram or parts per million.
- (2) Borehole BH-38 installed on October 26, 1993 to establish background soil conditions in the north plateau area of the WVDP site in support of the RCRA Facility Investigation process, as reported in WVDP-RFI-022.
- (3) Laboratory analyses for metal constituents from samples from the 2008 Geoprobe borings were performed by GEL Laboratories LLC, Charleston, South Carolina under SW-846 protocols.
- (4) J = reported value is less than the CRQL but greater than or equal to the MDL.

Table 5. Soil Analytical Data Summary – Metal Constituents – Unweathered Lavery Till

Sample Location Sample Depth Sample ID	3–5' 2008-04813	GPBG0208 5–7' 2008-04815	5–7' DUP 2008-04837	GPBG0308 28–30' 2008-04823	GPBG0408 19–25' 2008-04829	GPBG0508 8–11' 2008-04835	BH-38 26–28' RFI-00670	Maximum Concentration Reported
Aluminum	5,490 J	14,000	13,300 J	9,140	9,980	12,700	14,000	14,000
Antimony	<0.363	0.907 J	1.28	<0.345	0.873 J	1.3 J	2.28	2.28
Arsenic	9.12	8.46	6.67	10	9.08	9.58	5.09	10
Barium	29.2 J	98.2 J	81.6 J	71.7 J	71.7 J	114	15.1	114
Beryllium	0.314 J	0.744	0.653	0.521 J	0.558 J	0.724	0.691	0.744
Cadmium	0.186 J	0.483 J	0.432 J	0.3 J	0.462 J	<0.111	<0.247	0.483 J
Calcium	30,000	29,800	32,500	23,700	57,600	27,200	29,400	57,600
Chromium	8.05 J	20.2 J	17.3 J	14.3 J	16.6 J	19.4	NE	20.2 J
Cobalt	5.53 J	12.1	11.2 J	8.93	10.1	13.7	13.2	13.7
Copper	19.1	26.7	24.1	26.4	26.1	30	23.5	30
Iron	15,600 J	27,700	25,700 J	23,100	25,400	30,700	28,000	30,700
Lead	10.4	14.4	13.2	12.6	12.5	14.5	16.7	16.7
Magnesium	10,500	10,900	10,800	9,320	10,400	9,010	10,800	10,900
Manganese	310	438	399	380	484	435	433	484
Mercury	0.0134	0.00837 J	0.0126	0.00463 J	0.0126	0.00955 J	0.0212	0.0212
Nickel	13.6 J	32.9 J	29.5 J	23.1 J	27.6 J	34.5	32.6	32.9 J
Potassium	885 J	1,920 J	1,730 J	1,340 J	1,550 J	1,500 J	2,580	2,980
Selenium	5.4 J	6.2	0.99 J	7.2	4.1	1.58 J	<0.125	7.2
Silver	0.212 J	0.14 J	0.36 J	0.449 J	<0.121	0.174 J	<0.370	0.449 J
Sodium	101	122	113	101	150	125	127	150
Thallium	0.225 J	0.313 J	0.268 J	0.226 J	0.27 J	0.3255	<0.125	0.313 J
Vanadium	13.5 J	26.4	27.3 J	17.3	18.5	29.1	20.9	27.3 J
Zinc	40.6 J	65.8 J	61.3 J	74.3 J	56.9 J	76.4	65.8	76.4

Notes:

- (1) All values shown in milligrams per kilogram or parts per million.
- (2) Borehole BH-38 installed on October 26, 1993 to establish background soil conditions in the north plateau area of the WVDP site in support of the RCRA Facility Investigation process, as reported in WVDP-RFI-022.
- (3) Laboratory analyses for metal constituents from samples from the 2008 Geoprobe borings were performed by GEL Laboratories LLC, Charleston, SC under SW-846 protocols.
- (4) J = reported value is less than the CRQL but greater than or equal to the MDL.

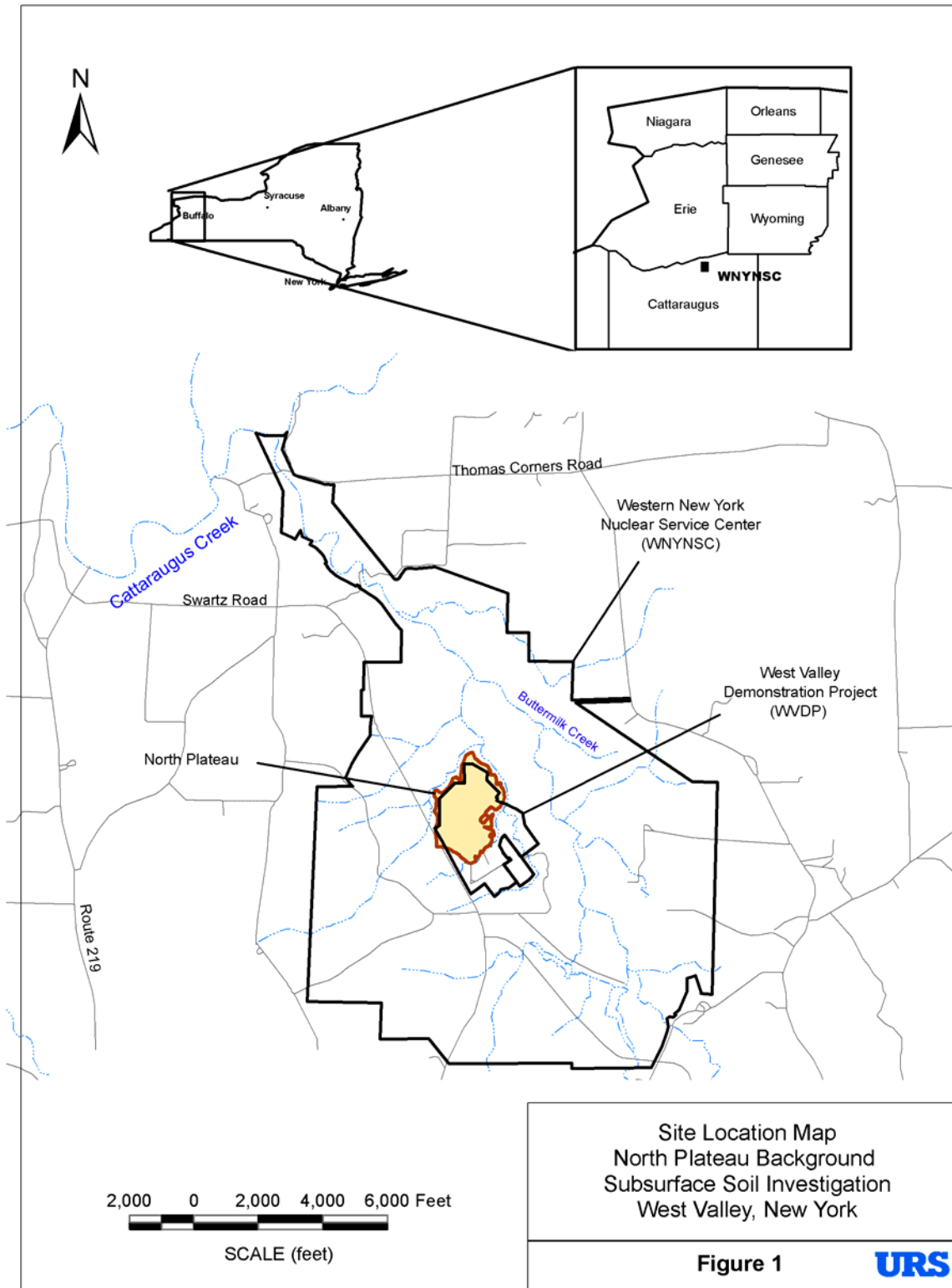
Table 6. Soil Analytical Data Summary – Proposed Site-Specific Background Metal Concentrations

Analyte	Sand & Gravel Unit Site-Specific Concentration	Unweathered Lavery Till Unit Site-Specific Concentration
Aluminum	15,400	14,000
Antimony	2.04	2.28
Arsenic	12.5	10
Barium	139	114
Beryllium	0.814	0.744
Cadmium	0.533	0.483
Calcium	25,300	57,600
Chromium	21.8	20.2
Cobalt	13.4	13.7
Copper	33.1	30
Iron	29,400	30,700
Lead	30.9	16.7
Magnesium	8,910	10,900
Manganese	846	484
Mercury	0.02	0.0212
Nickel	37.3	32.9
Potassium	1,860	2,980
Selenium	8.8	7.2
Silver	0.621	0.449
Sodium	331	150
Thallium	0.308	0.313
Vanadium	25.3	27.3
Zinc	99.7	76.4

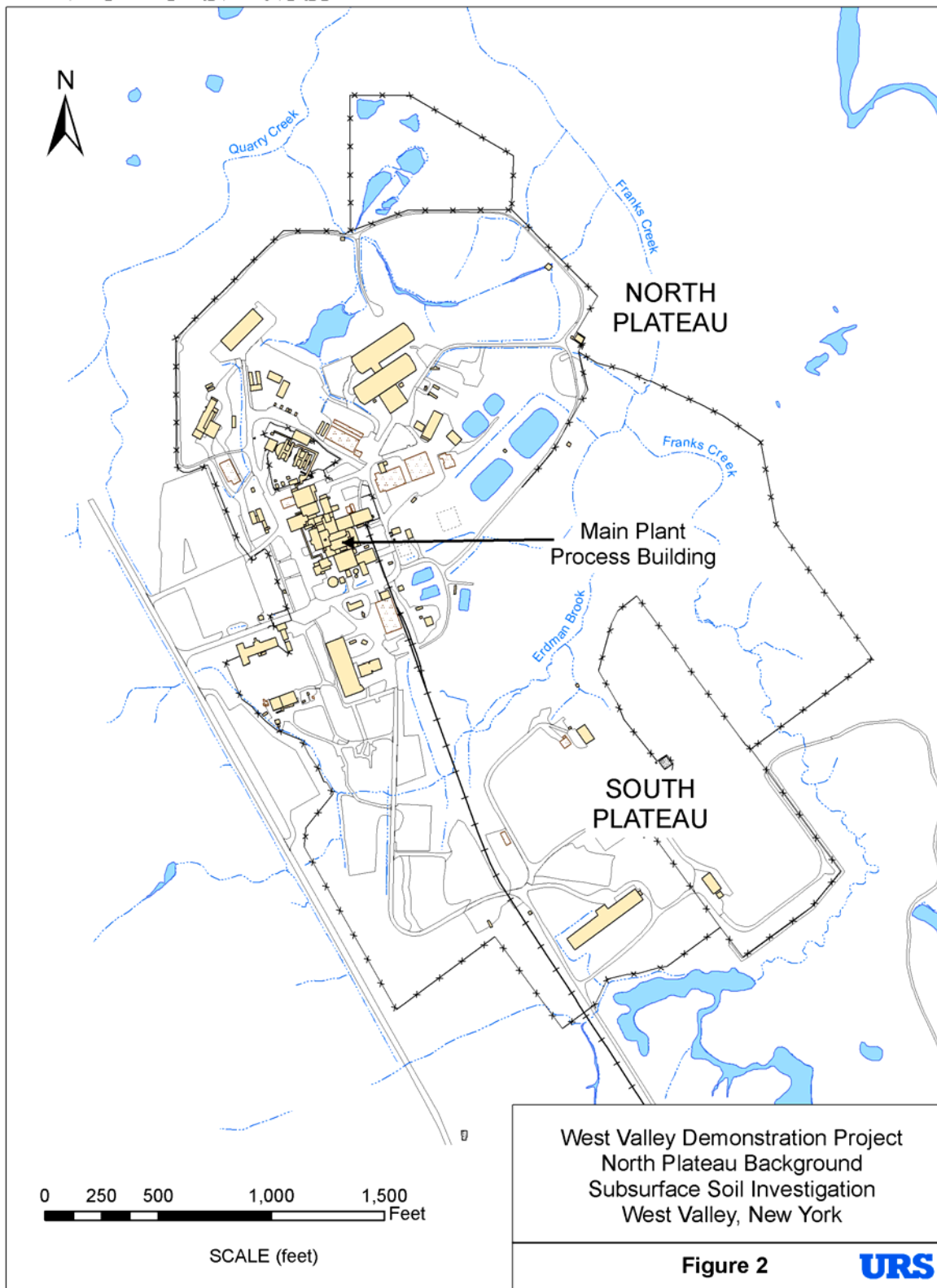
Note: All values shown in milligrams per kilogram or parts per million.

FIGURES

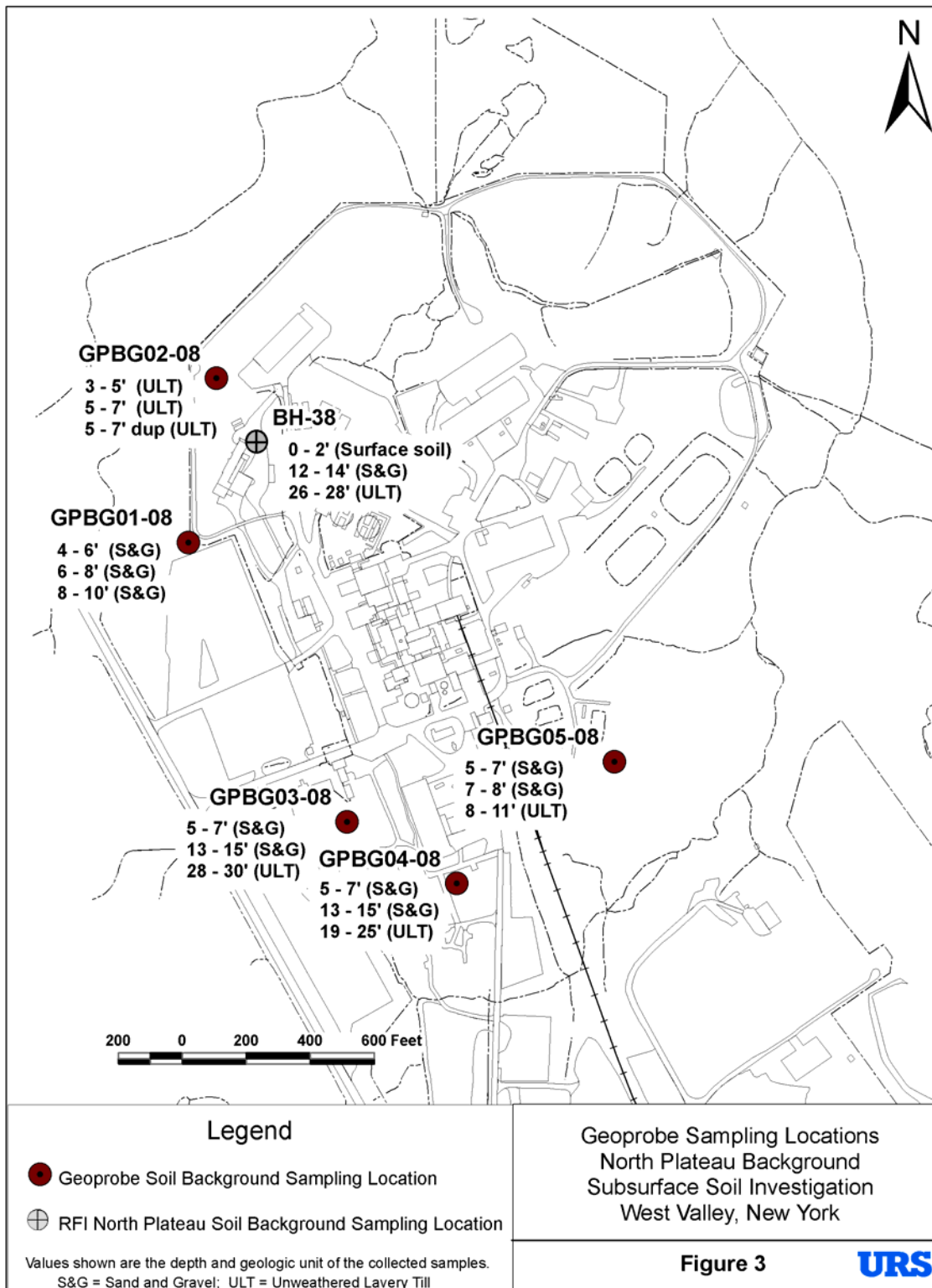
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Appendix A

Geoprobe Boring Logs

URS BORING LOG														
WVDP 2008 NORTH PLATEAU BACKGROUND SOILS CHARACTERIZATION (WVDP-466)										BORING NUMBER GPBG05-08				
CLIENT: WVES					PROJECT # 39400-399					WELL NO: N/A				
DRILLING CONTRACTOR: SJB Services, Inc.										BORING LOCATION: 892422.76 1129673.73				
GROUNDWATER				CAS.		SAMPLER		CORE		TUBE		GROUND ELEVATION: 1395.68' Above MSL		
DATE	TIME	LEVEL		TYPE	Geoprobe		-		-		DATE STARTED: 7/15/2008 12:50			
				DIA.	1"		-		-		DATE FINISHED: 7/15/2008 13:48			
				WT.	-		-		-		DRILLER: Matt Matthies			
				FALL	-		-		-		GEOLOGIST: Martin Regan/Jennifer Kelly			
Background = 100 cpm										REVIEWED BY: Francine Cohen/Alison Steiner				
SAMPLE DESCRIPTION														
DEPTH FEET B.G.S.	STRATA	NO.	TYPE	BLOWS PER 6"	REC (in)	MATERIAL DESCRIPTION						RAD	USCS	
	S&G	1	GP		3	Dry large GRAVEL. Dry grass in boring.						BKG	GC	
		2	GP		10	Dry, Silty SAND, large angular GRAVEL.						BKG	GM	
5		3	GP		10	Dry SAND and smaller GRAVEL.						BKG	GP	
		4	GP		9	Top 5" SAND and GRAVEL, some roots. Bottom 4" wet with some roots and a 1-inch sized weathered cobble. <i>Sample collected (5-7')</i>						BKG	GW	
	TILL	5	GP		24	Top 6" Saturated SAND and assorted GRAVEL. Next 12" Saturated brown-gray dense CLAY. <i>Sample collected (7-8')</i>						BKG	SW/GW-CL	
10		6	GP		22	Dark gray CLAY, some small Gravel, saturated. (Top 4" sand and gravel fall-in from shallower interval.) <i>Sample collected (8-11')</i>						BKG	CL	
15														
20														
25														
30														
35														
Comments: Surface: Soil and Grass, tall Weeds. E.O.B. 11' B.G.S. Boring was backfilled with Bentonite to grade upon completion. All Radiological Meter readings NDA>BKG. All Organic Vapor Meter readings 0.0 ppm.														

URS BORING LOG											
WVDP 2008 NORTH PLATEAU BACKGROUND SOILS CHARACTERIZATION (WVDP-466)								BORING NUMBER GPBG02-08			
CLIENT: WVES		PROJECT # 39400-399						WELL NO: N/A			
DRILLING CONTRACTOR: SJB Services, Inc.								BORING LOCATION: 893618.14 1128428.68			
GROUNDWATER				CAS.	SAMPLER	CORE	TUBE	GROUND ELEVATION: 1403.81' Above MSL			
DATE	TIME	LEVEL		TYPE	Geoprobe	-	-	DATE STARTED: 7/15/2008 14:35			
				DIA.	1"	-	-	DATE FINISHED: 7/15/2008 15:05			
				WT.	-	-	-	DRILLER: Matt Matthies			
				FALL	-	-	-	GEOLOGIST: Martin Regan/Jennifer Kelly			
								REVIEWED BY: Francine Cohen/Alison Steiner			
								p/y background = 100 cpm			
SAMPLE DESCRIPTION											
DEPTH FEET B.G.S.	STRATA	NO.	TYPE	BLOWS PER 6"	REC (in)	MATERIAL DESCRIPTION			RAD	USCS	
	Disturbed S&G TILL	1	GP		12	Brown CLAY, some small Gravel. Boring soils include some dry grass and			BKG	CL	
		2	GP		24	Damp gray SILT and SAND with some Clay, fine.			BKG	ML+SP	
5		3	GP		21	Top 5" same as above. Bottom 16" dark gray dense CLAY, trace small gravel. <i>Sample collected (3-5').</i>			BKG	ML+SP/ CL	
		4	GP		15	Damp dark gray dense CLAY. <i>Sample and duplicate collected (5-7').</i>			BKG	CL	
10											
15											
20											
25											
30											
35											
Comments: Surface: Soil and Tall Grass. E.O.B. 7' B.G.S. Boring was backfilled with Bentonite to grade upon completion. All Radiological Meter readings NDA>BKG. All Organic Vapor Meter readings 0.0 ppm.											

URS BORING LOG													
WVDP 2008 NORTH PLATEAU BACKGROUND SOILS CHARACTERIZATION (WVDP-466)								BORING NUMBER					
CLIENT: WVES PROJECT # 39400-399								GPBG03-08					
DRILLING CONTRACTOR: SJB Services, Inc.								WELL NO: N/A					
GROUNDWATER								BORING LOCATION: 892235.24 1128837.38					
CAS. SAMPLER CORE TUBE								GROUND ELEVATION: 1423.79' Above MSL					
DATE TIME LEVEL TYPE								DATE STARTED: 7/14/2008 13:34					
DIA. 1" - -								DATE FINISHED: 7/14/2008 15:40					
WT. - - -								DRILLER: Matt Matthies					
FALL - - -								GEOLOGIST: Martin Regan/Jennifer Kelly					
#/y background = 56 cpm								REVIEWED BY: Francine Cohen/Alison Steiner					
SAMPLE DESCRIPTION													
DEPTH FEET B.G.S.	STRATA	NO.	TYPE	BLOWS PER 6"	REC (in)	MATERIAL DESCRIPTION					RAD	USCS	
	Disturbed S&G	1	GP		10	Brown Silty SAND and GRAVEL, some organics, reworked.					BKG	GM	
		2	GP		19	Brown Silty GRAVEL, fill material.					BKG	GM	
		3	GP		14	Same as above.					BKG	GM	
5													
	S&G	4	GP		15	Top 4" same as above. Next 14" dry, Silty SAND, large angular Gravel, trace clay. <i>Sample collected (5-7')</i>					BKG	SM	
		5	GP		20	Dry, Silty SAND, large angular Gravel, trace clay.					BKG	SM	
10			6	GP		23	Dry, Silty SAND, large angular Gravel, trace clay. Bottom 3" includes a weathered iron-rich cobble.					BKG	SM
		7	GP		18	Top 8" same as above, brown, smaller angular Gravel. Next 10" damp, larger sized GRAVEL.					BKG	SM	
		8	GP		14	Top 10" same as above, with smaller Gravel, trace clay. Bottom 4" saturated, weathered GRAVEL. <i>Sample collected (13-15')</i>					BKG	SM-GW	
15			9	GP		18	Top 12" Same as above, saturated, with rounded, assorted pebbles grading to larger Gravel.					BKG	SM-GW
		10	GP		24	Saturated various sized GRAVEL, some SAND, Clay from 18-18.5' Decay odor.					BKG	GW-CL	
20			11	GP		12	Same as above, saturated, smaller Gravel, some larger Gravel, trace clay.					BKG	GW
		12	GP		17	Same as above, saturated, smaller Gravel throughout.					BKG	GP	
		13	GP		16	Top 12" same as above, larger Gravel, saturated. Bottom 4" Fine SAND on top of Dense CLAY, smaller Gravel.					BKG	GP-SP-CL	
25		14	GP		0	No Recovery.							
	TILL	15	GP		24	Top 17" same as above, with small Gravel. Bottom 7" saturated brown CLAY. <i>Sample collected (28-30')</i>					BKG	GP-CL	
30			16	GP		12	Dense Silty grayish dark brown CLAY.					BKG	CL
35													
Comments: Surface: Silty FILL. E.O.B. 30 ' B.G.S. Boring was backfilled with Bentonite to grade upon completion. All Radiological Meter readings NDA>BKG. All Organic Vapor Meter readings 0.0 ppm.													

URS BORING LOG											
WVDP 2008 NORTH PLATEAU BACKGROUND SOILS CHARACTERIZATION (WVDP-466)								BORING NUMBER GPBG04-08			
CLIENT: WVES				PROJECT # 39400-399				WELL NO: N/A			
DRILLING CONTRACTOR: SJB Services, Inc.								BORING LOCATION: 892042.71 1129180.34			
GROUNDWATER				CAS.	SAMPLER	CORE	TUBE	GROUND ELEVATION: 1405.78' Above MSL			
DATE	TIME	LEVEL	TYPE	Geoprobe		-	-	DATE STARTED: 7/15/2008 8:40			
			DIA.	1"		-	-	DATE FINISHED: 7/15/2008 10:50			
			WT.	-		-	-	DRILLER: Matt Matthies			
			FALL	-		-	-	GEOLOGIST: Martin Regan/Jennifer Kelly			
				β background = 100 cpm				REVIEWED BY: Francine Cohen/Alison Steiner			
SAMPLE DESCRIPTION											
DEPTH FEET	B.G.S.	STRATA	NO.	TYPE	BLOWS PER 6"	REC (in)	MATERIAL DESCRIPTION			RAD	USCS
		Disturbed S&G	1	GP		8	GRAVEL and Silty SAND, moist. Top 6" contain some organic material.			BKG	GM
			2	GP		24	Reworked Silty SAND, some Gravel, trace clay, dry.			BKG	SM-GM
5		S&G	3	GP		19	Dry SAND and GRAVEL.			BKG	SW-GW
			4	GP		13	Top 3" dry SAND and GRAVEL. Next 10" wet SAND and GRAVEL. <i>Sample collected (5-7')</i> .			BKG	SW-GW
			5	GP		22	Saturated Sandy Silty various sized GRAVEL.			BKG	GM
10			6	GP		21	Saturated Silty Sandy smaller sized GRAVEL.			BKG	GM
			7	GP		12	Top 12" same as above, saturated. Bottom 12" larger sized GRAVEL with some Clay.			BKG	GM-GC
15			8	GP		12	Saturated Silty SAND and various sized GRAVEL. <i>Sample collected (13-15')</i> .			BKG	SM-GM
			9	GP		22	Saturated Silty SAND and various sized GRAVEL, some Clay.			BKG	SM-GM-GC
			10	GP		12	Top 10" Saturated Silty SAND and large sized GRAVEL, some Clay. Bottom 2" dense brown gray CLAY.			BKG	GM-GC-CL
20		TILL	11	GP		4	Saturated dense gray brown CLAY. (12" of silty sand and gravel fall-in). <i>Sample collected (19-25')</i> .			BKG	CL
			12	GP		0	No Recovery.				
25			13	GP		9	Saturated gray dark brown dense CLAY.			BKG	CL
30											
35											

Comments:
 Surface: Soil and Grass. E.O.B. 25' B.G.S. Boring was backfilled with Bentonite to grade upon completion. All Radiological Meter readings NDA>BKG. All Organic Vapor Meter readings 0.0 ppm.

URS BORING LOG											
WVDP 2008 NORTH PLATEAU BACKGROUND SOILS CHARACTERIZATION (WVDP-466)							BORING NUMBER GPBG05-08				
CLIENT: WVES			PROJECT # 39400-399				WELL NO: N/A				
DRILLING CONTRACTOR: SJB Services, Inc.							BORING LOCATION: 892422.76 1129873.73				
GROUNDWATER			CAS.	SAMPLER	CORE	TUBE	GROUND ELEVATION: 1395.68' Above MSL				
DATE	TIME	LEVEL	TYPE	Geoprobe		-	-	DATE STARTED: 7/15/2008 12:50			
			DIA.	1"		-	-	DATE FINISHED: 7/15/2008 13:48			
			WT.	-		-	-	DRILLER: Matt Matthies			
			FALL	-		-	-	GEOLOGIST: Martin Regan/Jennifer Kelly			
							REVIEWED BY: Francine Cohen/Alison Steiner				
							B/V background = 100 cpm				
SAMPLE DESCRIPTION											
DEPTH FEET B.G.S.	STRATA	NO.	TYPE	BLOWS PER 6"	REC (in)	MATERIAL DESCRIPTION				RAD	USCS
	S&G	1	GP		3	Dry large GRAVEL. Dry grass in boring.				BKG	GC
		2	GP		10	Dry, Silty SAND, large angular GRAVEL.				BKG	GM
5		3	GP		10	Dry SAND and smaller GRAVEL.				BKG	GP
		4	GP		9	Top 5" SAND and GRAVEL, some roots. Bottom 4" wet with some roots and a 1-inch sized weathered cobble. <i>Sample collected (5-7')</i> .				BKG	GW
	TILL	5	GP		24	Top 6" Saturated SAND and assorted GRAVEL. Next 12" Saturated brown-gray dense CLAY. <i>Sample collected (7-8')</i> .				BKG	SW/GW-CL
10		6	GP		22	Dark gray CLAY, some small Gravel, saturated. (Top 4" sand and gravel fall-in from shallower interval.) <i>Sample collected (8-11')</i> .				BKG	CL
15											
20											
25											
30											
35											
Comments: Surface: Soil and Grass, tall Weeds. E.O.B. 11' B.G.S. Boring was backfilled with Bentonite to grade upon completion. All Radiological Meter readings NDA>BKG. All Organic Vapor Meter readings 0.0 ppm.											

WVDP RECORD OF REVISION

<u>Rev. No.</u>	<u>Description of Changes</u>	<u>Revision On Page(s)</u>	<u>Dated</u>
0	Original Issue ESHQ and Deputy Regulatory Strategy impacted by this document.	All	12/16/08
1	General text revisions for consistency. Revision to Table 2 to remove "ND" from BH-38 (0–2"). Revision to Table 6 to change barium data point for Unweathered Lavery till. ESHQ and Deputy Regulatory Strategy impacted by this document.	All	12/29/08