Geotechnical Field Investigation and Bench Scale Treatability Study

USG Interiors Highway 99 Site
Milton, Washington

Prepared for:

USG Corporation
550 West Adams Street
Chicago, Illinois 60661-3676

August 11, 2021

CDM Smith

A Report Prepared for:

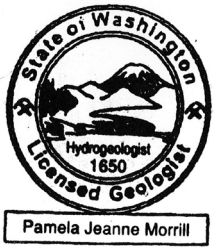
USG Corporation
550 West Adams Street
Chicago, Illinois 60661-3676

GEOTECHNICAL FIELD INVESTIGATION AND BENCH SCALE TREATABILITY STUDY
USG INTERIORS HIGHWAY 99 SITE
MILTON, WASHINGTON

August 11, 2021

Meredith L. Passaro
Geotechnical Engineer

Pamela Morrill, LHG, PMP
Project Manager



Prepared by:
14432 SE Eastgate Way, Suite 100
Bellevue, Washington 98007
425-519-8300

CDM Smith Project No. 19921.251008

Table of Contents

List of Tables

List of Figures

Appendices

Section 1
Introduction

This document presents the findings and evaluation of CDM Smith Inc.'s (CDM Smith) geotechnical field investigation and bench scale treatability study to support in-situ solidification/stabilization (ISS) of residual arsenic-impacted soil at the USG Interiors (USGI) Highway 99 site located in Milton, Washington (site). CDM Smith, Inc. completed this work on behalf of USGI in support of planned cleanup actions being performed under Washington State Department of Ecology (Ecology) Agreed Order No DE 11099. This work was completed in general accordance with the Ecology-approved Geotechnical Field Investigation and Bench Scale Treatability Study Work Plan (CDM Smith 2020b) for USG's Highway 99 and Puyallup sites. The geotechnical field investigation and bench scale studies for both sites were conducted concurrently. The results of the field investigation and treatability testing for the Puyallup site are reported separately.

1.1 Project Background

1.1.1 Site Location and Description

The USGI Highway 99 site is between Pacific Highway East and Interstate 5 (**Figure 1**). It is in a commercial area situated along the east side of Pacific Highway East and is addressed as 7110 Pacific Highway East. Commercial businesses are located to the north and south and residences are located west of the property across Pacific Highway East. The relatively level site is asphalt-paved and is presently occupied by a recreational vehicle (RV) dealership, Discount RV. A mobile office building and a small storage building are situated on the west side of the site. The remainder of the property serves as a lot for RVs. The site plan is presented on **Figure 2.**

Geologically, the site is situated in a north-trending valley that is the floodplain of Hylebos Creek and its tributaries. The valley is located just north of the lower Puyallup River Valley. Hylebos creek presently bounds the east side of the site. Alluvium associated with Hylebos Creek and the lower Puyallup River forms the uppermost native soil at the site. The alluvium consists predominantly of overbank flood, slack water, and bar accretion deposits. Glacially consolidated glacial drift and interglacial deposits hundreds to thousands of feet thick underlie the alluvial deposits.

Above the native sediments, the site is underlain by three different sources of fill, which range from 4.5 to 14 feet below ground surface (bgs). The uppermost fill, Fill-3, was placed during remedial excavation backfilling that occurred in 1985 (Section 1.1.2). Below Fill-3, Fill-2 includes soil mixed with manmade materials and is likely residual fill representative of material that was not excavated during the 1984/1985 remedial excavation. Fill-1 includes soil that as placed during the initial development of the site.

1.1.2 Site History

Industrial waste from USGI's Tacoma plant was used to fill the Highway 99 site (source material) At the time, USGI was using arsenic bearing ASARCO slag as manufacturing feedstock and was the

source of arsenic contamination that exists in soil and groundwater today. The source material was largely removed in 1984/1985, along with some of the impacted native soil in the southern portion of the property in the vicinity of monitoring well 99-1. However, relatively high arsenic concentrations occur in soil below the clean fill; some of which is residual source material and some which leached from the original source material and redeposited on deeper soils and appears to be a continuing source of groundwater contamination.

The final Remedial Investigation (RI), Feasibility Study (FS), and Cleanup Action Plan (CAP) were issued for the Highway 99 site in June 2016 (CDM Smith 2016b; CDM Smith 2016a; and Ecology 2016, respectively). These documents provide a detailed description of the history of the site, source of contamination, interim remedial actions completed, residual contaminant concentrations, remedial actions considered, and the proposed cleanup action. In June 2016, Agreed Order DE 11099 was issued, which provided for implementation of the remedial action at the site as outlined in the CAP. The CAP, issued on June 23, 2016 for the Highway 99 site presented the preferred alternative (Remedial Action Alternative 2) and included the following components:

- ISS of the fill/soils exceeding 500 milligrams per kilogram (mg/kg) by injection of a reagent via auger mixing in the vadose zone;
- Groundwater treatment by in situ chemical oxidation (ISCO) and installing permeable pavement in the core remediation area;
- Excavation and offsite disposal of impacted sediment in Hylebos Creek;
- Groundwater monitoring; and
- Monitored natural attenuation (MNA), and institutional controls.

The CAP included the need for the following studies prior to full scale implementation:

- Delineation of the fill/soil hot spot.
- A bench scale study to assess the optimal solidification/stabilization (S/S) mix design.
- Bench scale and pilot testing to assess soil oxidant demand, select the best oxidant, and determine the delivery system for groundwater treatment with ISCO.

USGI completed the Hot-Spot Characterization and Bench Scale Testing in December 2016 and issued the report on March 23, 2018 to satisfy implementation of the fill/soil hot spot delineation and bench scale testing (CDM Smith 2018b). Bench scale testing was conducted to evaluate S/S mixtures and chemical oxidants for groundwater. Results from the study indicated that cement-based S/S mixtures containing Portland cement (20 percent), bentonite (1 percent), and a 4 to 1 (4:1) iron (FeII) to arsenic mass ratio were most effective in reducing arsenic mobility in soil for purposes of ISS.

The ISCO bench scale study concluded that permanganate and persulfate were more effective chemical oxidants in removing arsenic than hydrogen peroxide and that significant pH reduction occurred with persulfate, but not permanganate. No significant improvements in arsenic removal

efficiency were observed at concentrations of permanganate and persulfate greater than 1 times the soil oxidant demand. Recommendations from the bench scale testing included conducting a pilot study to determine the effects of ISCO to remediate site groundwater.

The ISCO pilot study field work at the Highway 99 site was conducted in January through March 2019. It was found to be highly complicated to implement and did not reduce arsenic concentrations in groundwater to the levels desired (CDM Smith 2020c).

Based on the findings from the ISCO pilot study, USGI developed an alternative approach to the cleanup actions that would be less reliant on ISCO. This included enlarging the area for ISS, particularly targeting high arsenic concentration soils situated in the saturated zone. USGI proposed modifications to the CAP as presented in a Conceptual Design Report (CDR) (CDM Smith 2020a), based on the findings from the ISCO pilot study. The proposed modifications included conducting ISS over a larger area of the site and targeting all soils with arsenic concentrations exceeding 500 mg/kg to treat residual source material in the core remediation area. Groundwater monitoring will be performed after implementation of the ISS to evaluate the effectiveness of the ISS on the groundwater contaminant plume. These modifications were accepted by Ecology on April 15, 2020.

As part of the CDR, a data gap assessment was performed to identify outstanding data needs for design of the ISS at Highway 99. The data gap assessment resulted in recommendations to complete geotechnical and additional bench scale studies to further support the design of the ISS, the results of which are presented in this report.

1.2 Purpose and Scope of Work

The purpose of these studies was to provide sufficient physical and analytical data to design and implement an ISS pilot study with the intent of proceeding to full scale implementation onsite. To achieve this purpose, the scope of work was divided into three tasks: (1) geotechnical investigation; (2) update the site survey; and (3) and bench scale treatability study. More specifically, the purpose of each of these tasks was as follows:

Geotechnical Investigation - The objective of the geotechnical investigation was to identify subsurface soil conditions and characterize the engineering properties of soils. These data were used to finalize design of the bench scale treatability study, and later, will be used to plan the subsequent pilot study and to conduct a constructability evaluation for implementation of the ISS at the site.

Updated Site Survey - The objective of the updated site survey was to identify site topography and existing features and to provide a base map for future design phases of the project.

Bench Scale Treatability Study - The objective of this task was to evaluate the physical and analytical properties of various S/S mix designs to identify a S/S mix design that meets the project performance criteria, as presented in Section 1.3. Data collected from the bench scale treatability study were used to compare and evaluate similarities in mix designs between the Highway 99 and Puyallup sites. The feasibility of conducting a single pilot study for both sites is assessed, based on the degree of similarity in subsurface geotechnical conditions, and consequently, mix designs for the two sites.

CDM Smith conducted the following tasks to complete this geotechnical field investigation and bench scale study:

- Geotechnical Field Investigation – drilled nine borings, excavated three test pits, and collected soil samples to observe and log the soil profile and collect samples for needed for the geotechnical evaluation and bench scale testing.
- Groundwater Sampling – collected groundwater from an existing monitoring well for use in the bench scale testing.
- Geotechnical Index Testing of Site Soils – conducted testing of soil samples collected from various depth intervals to determine geotechnical properties of the untreated soils.
- Baseline Chemical Analytical Testing – conducted baseline chemical analytical testing of soil and groundwater samples.
- Bench Scale Sample Preparation – composited collected soils, prepared various solidification mixes, conducted reagent evaluation, and prepared test cylinders to be subjected for the bench scale testing.
- Bench Scale Testing –S/S test cylinders were cured and then subjected to various testing of geotechnical properties and chemical analyses to evaluate performance.

1.3 Bench Scale Testing Goals and Performance Criteria

The performance criteria of the bench scale testing were as follows:

1. Unconfined Compressive Strength (UCS) – UCS of the S/S test samples were measured to evaluate strength properties using American Society of Testing and Materials International (ASTM) method D2166. The UCS performance criteria of the bench scale treatability study is greater than or equal to 50 pounds per square inch after a curing period of 28 days.
2. Hydraulic Conductivity - Hydraulic conductivities of the S/S test samples were measured using ASTM D5084 method to evaluate the reduction of groundwater flow through the treated material. The estimated hydraulic conductivity of the site soils is currently 1E-04 centimeters per second (cm/s). The hydraulic conductivity performance criteria of the bench scale treatability study is less than or equal to 1E-06 cm/s (EPA 2009).

3. Leaching and Extraction Tests – The samples were subjected to leaching and extraction tests to assist in determining the amount of arsenic that can leach from S/S treated soils. The S/S test sample that best met UCS and hydraulic conductivity standards was subjected to the synthetic precipitation leaching procedure (SPLP) and semi-dynamic leaching (SDL) testing. The performance goal is the Model Toxics Control Act (MTCA) Method A cleanup level of 5 micrograms per liter (µg/L).

1.4 Report Organization

This geotechnical investigation and bench scale study report is organized into the following sections:

Section 1: Introduction – This section provides a summary of site location, scope of work, and project performance criteria.

Section 2: Summary of Field Activities – This section provides a summary of the field activities including test pits, geotechnical test borings, bench scale treatability borings, groundwater collection, and site survey.

Section 3: Bench Scale Treatability Study Rationale – This section describes the bench scale treatability plan rationale including reagent evaluation and mix design.

Section 4: Summary of Laboratory Test Methods– This section provides a summary of the laboratory testing including geotechnical, analytical, and compatibility testing.

Section 5: Summary of Results – This section provides a summary of the laboratory testing and bench scale treatability study results.

Section 6: Conclusions and Recommendations – This section provides conclusions and recommendations based on data provided in this report.

Section 7: References – This section provides a list of references cited within this report.

Section 2

Summary of Field Activities

2.1 Field Investigation

A subsurface exploration program was conducted to conduct the geotechnical evaluation of subsurface conditions and to collect a sufficient volume of soil for physical and analytical samples needed for the bench scale testing. The subsurface exploration program consisted of three different methods of obtaining soil and data: (1) test pits to observe subsurface conditions on a macro scale and collect soils for potential laboratory testing; (2) hollow-stem auger drilling to collect geotechnical data; and (3) sonic drilling to collect soil for bench scale treatability testing. The test pit, auger drilling boring, and sonic boring logs are included in **Appendix A** and the field investigation photolog is included in **Appendix B**. Boring locations and test pits locations are shown in **Figure 3.**

2.1.1 Test Pits

Three test pits (99-TP-1, 99-TP-2, and 99-TP-3) were excavated at the site by IO Environmental of Redmond, Washington using a CAT 307.5 backhoe on July 29, 2020. The test pit excavations were overseen and logged by a CDM Smith geologist.

The test pits were advanced to depths between 8 and 11 feet bgs. Test pits were excavated in lifts to separate material type for classification and logging. Grab samples of each material type were collected for subsequent review and potential laboratory testing. Upon completion, each test pit was backfilled with the excavated soil in the same depth intervals as the material was removed and compacted in 12-inch lifts.

2.1.2 Geotechnical Test Borings

Three borings (99-GEO-1, 99-GEO-2, and 99-GEO-3) were extended using hollow stem auger drilling techniques. The test borings were drilled by Holt Services Inc. of Edgewood, Washington on August 4 and 5, 2020. The drilling was overseen and logged by a CDM Smith geologist. Each boring was advanced to a depth of 32 feet bgs.

Standard Penetration Tests (SPTs) with split-spoon sampling were performed on a continuous basis beginning at the ground surface to a depth of 15 feet, then at 5-foot intervals thereafter. SPTs were conducted in general accordance with ASTM D1586 using a 2-inch-outside diameter (O.D.) split-spoon sampler driven 24 inches by blows from a 140-pound hammer falling freely for 30 inches. The number of blows required to drive the sampler each 6-inch increment was recorded and the SPT N-value was determined as the sum of the blows required to drive the sampler from 6 to 18 inches of penetration. The N-value is defined as the standard penetration resistance, which provides an indication of soil density and is used to empirically correlate geotechnical engineering properties of a soil.

Upon split-spoon sampler retrieval, the soils were examined for visual (i.e., staining, discoloration) or olfactory indications of contamination and arsenic concentrations were

screened using X-ray fluorescence (XRF) spectrometry equipment. XRF readings were recorded on the boring logs. Representative soil samples from each split-spoon were collected and stored in jars for subsequent review and potential laboratory testing.

Upon completion of drilling, boreholes were backfilled to the ground surface with bentonite chips and cement grout.

2.1.3 Bench Scale Treatability Borings

Six borings (99-BS-1, 99-BS-1a, 99-BS-2, 99-BS-3, 99-BS-4, and 99-BS-4a) were extended using sonic drilling techniques. The test borings were drilled by Holt Services Inc. of Edgewood, Washington on August 7, 2020. The drilling was overseen and logged by a CDM Smith geologist. Borings were advanced to depths between 15 feet and 20 feet bgs.

Soil borings were continuously sampled from the ground surface to total depth of the borehole in 5-foot cores. Upon retrieval of the cores, the bags were split open and soils were observed and classified using the Modified Burmeister soil classification and United Soil Classification System (USCS) system. Arsenic concentrations in each soil core sample were also screened with an XRF. Bulk samples for the bench scale study were extracted and separated into five-gallon buckets by material type, XRF readings, and sample depth. Buckets were sealed and transferred to the CDM Smith geotechnical testing laboratory in Bellevue, Washington.

At the completion of sampling activities, each borehole was backfilled to the ground surface using bentonite chips and grout.

2.1.4 Groundwater Collection

Groundwater was collected from an existing on-site monitoring well (99-1) during the field investigation for laboratory analysis and use in the bench scale study. The well was purged and sampled using a peristaltic pump with disposable tubing. The well was purged at a rate of approximately 200 milliliters per minute. Physical parameters were monitored during purging using a YSI meter. The YSI meter was secured in a flow-through cell that was situated after the pump and before the purge water tubing discharge. Parameters measured during purging included: pH, temperature; specific conductance; oxidation-reduction potential (ORP); dissolved oxygen ; and turbidity. The well was purged until the physical parameter measurements stabilized, after which the groundwater collected by disconnecting the tubing from the flow-through cell and directly discharging the water into the sample container.

Samples to be submitted for analytical testing were collected in laboratory-supplied containers containing preservatives appropriate for the analyses to be conducted. Collected samples were stored in chilled coolers and delivered under chain-of-custody protocol to OnSite Environmental, Inc. (OnSite) in Redmond, Washington for analysis.

The groundwater to be used in the bench scale study was discharged into a clean 5-gallon pail, secured with a lid, transported to CDM Smith's Bellevue treatability laboratory, and held in refrigeration until use.

2.1.5 Decontamination and IDW Handling

Decontamination of the drilling and sampling equipment was conducted in accordance with the Site-specific health and safety plan. Investigative derived waste including soil, decontamination water, and drilling wash water were collected in 55-gallon drums. This material was profiled and picked up for disposal by Clean Harbors on December 28, 2020 and January 11, 2021.

2.2 Site Survey

An updated site survey was performed by APEX Engineering in Tacoma, Washington on August 5, 2020. The updated site survey is shown in **Appendix C**. Elevations noted herein are in feet and referenced to the North America Vertical Datum 1988 (NAVD88).

Section 3

Bench Scale Treatability Study Rationale

The USGI Highway 99 bench scale study was designed to evaluate the mixing of contaminated soils with a series of reagents to achieve a product that meets the performance criteria of the project, as identified in Section 1.3. The details of the bench scale study are described herein.

3.1 Reagent Evaluation

CDM Smith considered the following inorganic binding reagents as potential solidification additives.

- Portland cement (PC)
- NewCem Slag

CDM Smith considered the following inorganic binding reagents as potential stabilization additives.

- Ferrous sulfate heptahydrate
- Ferrous chloride

CDM Smith evaluated the aforementioned solidification and stabilization additives against the following selection criteria:

- Ability to achieve the objectives of the remediation program and physical properties suitable for use as fill material on-site;
- Local availability and supply; and
- Usage/Establishment in Remediation.

Based on the results of the reagent evaluation, both PC and NewCem Slag were selected as reagents for solidification additives and both ferrous chloride and ferrous sulfate heptahydrate were evaluated as stabilization additives. Bentonite was also used as a binding agent in low dosages for all mixes performed and the amount of bentonite used was further evaluated.

3.2 Solidification/Stabilization Mix Design and Procedures

Solidification/Stabilization mixing was performed at the CDM Smith geotechnical laboratory in Bellevue. Prior to S/S mixing, a representative composite sample was prepared by combining soil material collected from 99-BS-1, 99-BS-1a, 99-BS-4 and 99-BS-4a that exhibited an average XRF reading of greater than 500 parts per million (ppm) total arsenic. All materials larger than 3/8-inch in diameter were removed from the composite sample. Physical and analytical testing was conducted on the composite sample 99-1 (C1) for preliminary characterization purposes as is summarized in Section 4.2.

S/S mixes were prepared in accordance with the mix design matrix for each design case, as presented in **Table 1**. The mix design matrix provides a summary of the composites, reagents, reagent dosage, cure time and laboratory testing for each mix design evaluation. S/S mixes were prepared in two phases. The first phase focused on achieving two goals. The first goal was to evaluate the effectiveness of ferrous sulfate heptahydrate and NewCem Slag as part of the mix design. The second goal was to vary amounts of PC and bentonite to compare with the mix design identified in the 2018 bench scale study (CDM Smith 2018b). The second phase of S/S mixing focused on optimizing the mix design and refining the additions of PC and bentonite.

During the mixing, reagents were added to the composite samples as a percent by weight and were added as a dry powder or hydrated "grout." A hydrated grout is used for relatively dry soil samples and reagents are generally added as a dry powder for more wet soil samples. Site groundwater collected during the field investigation was the only water source used during the soil mixing process. Once the reagents were added to the composites, samples of the mixes were cast into seven 2-inch by 4-inch cylinder molds and one 3-inch by 6-inch mold per mix design and allowed to cure for various time increments up to 28 days prior to physical and analytical testing. A summary of the physical and analytical testing is presented in Section 4**.** During the mixing, it was observed that the samples became visibly more dry, stiff, and difficult to work with after the addition of each reagent. The higher the percentage of PC or NewCem Slag added, the more difficult the mixing of the samples became.

Section 4

Summary of Laboratory Test Methods

4.1 Geotechnical Index Testing

Samples collected from the geotechnical test borings were transported to the CDM Smith geotechnical laboratory in Chelmsford, Massachusetts and submitted for preliminary geotechnical index testing. Geotechnical index tests were performed on representative samples collected from the borings. The following laboratory tests were performed as part of the preliminary sample characterization:

- Grain Size without Hydrometer (ASTM D6913 and ASTM D1140) – 8 tests
- Grain Size with Hydrometer (ASTM D7928 and ASTM D1140) – 7 tests
- Moisture Content (ASTM D2216) – 14 tests
- Atterberg Limits (ASTM D4318) – 3 tests
- Organic Content (ASTM D2974) – 1 test

4.2 Preliminary Composite Sample Characterization

As described in Section 3.2, soils collected from borings 99-BS-1, 99-BS-1a, 99-BS-4 and 99-BS-4a that exhibited average XRF readings greater than 500 ppm arsenic were collected for use in the bench scale testing. These soils were combined and mixed to create a composite sample.

4.2.1 Geotechnical Index Testing

A sample of the composited soil was submitted for geotechnical index testing. The following laboratory tests were performed on the composited sample as part of the preliminary sample characterization:

- Grain Size no Hydrometer (ASTM D6913 and ASTM D1140)
- Grain Size with Hydrometer (ASTM D7928 and ASTM D1140)
- Moisture Content (ASTM D2216)
- USCS Classification (ASTM D2488)
- Dry Density (ASTM D7263)
- Specific Gravity (ASTM D854)
- Organic Content (ASTM D2974)

4.2.2 Baseline Soil Composite Analytical Testing

A sample of the composited soil was also submitted to OnSite for laboratory analysis of the following:

- Total Metals (EPA 6010D/7471B)
- SPLP arsenic (EPA 1312/6010D)

4.3 Groundwater Chemistry Characterization

The groundwater sample was submitted to OnSite for laboratory analysis. OnSite subcontracted some of the analyses to AM Test Inc. in Kirkland, Washington. The groundwater sample was analyzed for the following:

- Total Suspended Solids – SM 2540D
- Total Arsenic - EPA 200.8
- Total Dissolved Solids– SM 2540C
- Dissolved Metals – EPA 6010D/200.8/7470A
- Dissolved Silica – EPA 200.7
- Alkalinity – SM 2320B
- Nitrate + Nitrite (as Nitrogen) – EPA 353.2
- Bromide, Chloride, Fluoride, Sulfate – EPA 300.0

4.4 Compatibility Testing

Compatibility titration testing was conducted at the CDM Smith geotechnical laboratory in Bellevue by adding the selected reagents, PC (Type I/II) and NewCem slag, to site groundwater samples and then monitoring continuously over a 24-hour period to observe if any reactions occurred between the site groundwater and selected reagents. A total of two tests were conducted for each reagent type.

4.5 S/S Sample Testing

4.5.1 Physical Testing

The following physical tests were performed on S/S specimen cylinders at the CDM Smith geotechnical laboratory in Chelmsford:

- Unconfined Compression Test (ASTM D2166) – A total of 30 tests; 10 conducted after 7 days of curing, 10 conducted after 14 days of curing, and 10 conducted after 28 days of curing.
- Hydraulic Conductivity using Flexible Wall Permeameter (ASTM D5084) – A total of 10 tests were conducted on cylinders after 21 days of curing.

4.5.2 Arsenic Leaching Tests

Analytical testing was performed on S/S soil mixture samples to evaluate the potential leaching of arsenic. Two types of leaching tests were conducted: SPLP and SDL. The SPLP procedure is an aggressive single-point-in-time leaching performed by mixing (tumbling) the treated material that has been disaggregated to less than 2-millimeter grain size. The stated purpose of the SPLP test method is to evaluate leaching of soils by rain (precipitation). The SPLP conditions (aggressive mixing and material grain reduction) are not representative of the in-situ environment. The SDL leaching procedure is designed to evaluate the mass transfer rates (release rates) of inorganic analytes contained in a monolithic or compacted granular material as a function of leaching time. The conditions of the SDL procedure better represent conditions at the site because: (1) treated material is in place and not subjected to artificial disaggregation; (2) the leaching solution (rainwater and/or surface water) is replaced in the environment periodically; and (3) aggressive mixing of the leaching solution and the treated soil is not a condition observed at the site.

Analytical testing methods and the laboratories responsible for conducting the analytical testing and evaluations are described in further detail in the following sections.

4.5.2.1 SPLP Modified

Soil mixture samples that met the project performance criteria for compressive strength and permeability were selected for analytical testing by the SPLP method. The following mixes were selected for leachate testing:

- C1-H4 – Phase 1 mix that had the lowest percent addition of bentonite.
- C1-H9 – Phase 2 mix that had the lowest percent addition of PC.

The SPLP leaching test was performed using a modified EPA method 1312. The standard leaching procedure method was modified by changing the solid to water (precipitation) ratio from 1:20 (grams per milliliter) to 1:2. This modification was performed to better represent typical leaching conditions in the field by groundwater. The solution ("synthetic precipitation") used for leaching was the method's extraction fluid #2 at a pH of 5.0 ± 0.05 standard units. This solution is intended to represent rain in the Western United States.

S/S samples were received at the CDM Smith Denver Treatability Laboratory (DTL) as 2-inch X 4-inch monoliths molded in a cylinder. Each monolith was removed from its mold and the top 1.5-inch was removed using a hacksaw with a new blade. The 1.5-inch removed portions of the monolith were disaggregated using a ceramic mortar and pestle to less than 2 millimeters prior to leaching (standard procedure for SPLP).

The leaching fluid was added to the disaggregated samples in a 500-milliliter polyethylene bottle and placed in a rotary tumbler for 18 hours (standard SPLP procedure). Measurements of pH and conductivity were performed on each leachate before leaching and after the 18-hour tumbling period. The leachate was then filtered through a 0.45-micron filter, preserved with nitric acid and sent to OnSite for analysis of dissolved arsenic by EPA method 6020B.

4.5.2.2 Semi-Dynamic Leaching Tests

To determine leaching mechanisms, the potential of long-term leaching, and to calculate release rates, SDL tests were performed using a modified SW-846 method 1315 (SOP 1-10, Synthetic Precipitation Leaching Procedure and Semi-Dynamic Leaching Procedure for Amended Soils). The selected molded mixture (C1-H4) was placed into a glass jar with a cap and synthetic rainwater (SW-846 Method 1312 Western rainwater at pH 5.0) was added to the container. As with the SPLP method, this solution is intended to represent rainwater in the Western United States. The treated-sample surface-area-to-water ratio was 1:10 (square centimeters to milliliter). On average, approximately 1,620 milliliters of SPLP water was added to the container for each leaching period. The leachate was removed from the container and filtered through a 0.45-micron filter and replaced with fresh SPLP water at the following time intervals, as detailed in DTL SOP 1-10 and modified from SW-846 Method 1315: 2 hours, 24 hours, 48 hours, 72 hours, 7 days, 14 days, 21 days, 28 days, and 42 days. Leachate samples were submitted to Onsite for analysis of dissolved arsenic.

Section 5
Summary of Results

5.1 Geotechnical Field Investigation

The geotechnical investigation performed by CDM Smith indicated the following subsurface conditions based on the engineering properties of the soils, as described below and summarized on **Table 2.** The interpreted soil profile is presented on **Figure 4.**

- Pavement: The site is mostly paved. Three to six inches of asphalt or concrete pavement was encountered at five test boring locations and three test pits.
- Upper Sand and Gravel: This unit was encountered at the ground surface or just below pavement at eight test borings and three test pit locations and ranged from 4 to 10.7 feet thick. This layer consists of medium dense to very dense, gray or brown, fine to coarse SAND with varying amounts of fine to coarse gravel and silt. USCS classifications included SM and GM.
- Upper Clay & Silt: This unit was encountered immediately below the Upper Sand and Gravel layer at three test boring locations and ranged from 2.25to 5 feet thick. This layer consists of medium stiff, gray, CLAY & SILT with trace fine sand with a USCS classification of CL.
- Sand and Silt: This unit typically occurs just below the upper sand and gravel layer and was encountered at all nine test boring locations and one test pit location. The Sand and Silt unit ranged from 1 to 25 feet thick. This layer consists of loose to medium dense or very soft to hard, brown to dark brown, fine to medium SAND and SILT with trace fine gravel. USCS classifications included SM, SP-SM, and ML.
- Lower Clay & Silt: This unit was encountered below the sand and silt layer at two test boring locations with thicknesses of 0.5 foot and 5.4 feet. This layer consists of stiff to hard, light brown or gray, CLAY & SILT with trace fine sand with a USCS classifications of CL.
- Lower Sand and Gravel: This unit was encountered below the Lower Clay and Silt unit at two test boring locations with thickness of 1.5 foot and 5 feet. This layer consisted of medium dense to dense, gray or brown, fine to coarse GRAVEL with some fine to coarse sand and trace silt with a USCS classification of GW-GM.

Groundwater levels measured in the test borings ranged from 8.0 feet bgs (Elevation 13.2 feet) to 14.0 feet bgs (Elevation. 7.2 feet).

5.2 Geotechnical Index Testing

Geotechnical index testing results for test boring samples and the composite sample are included in **Table 3** and are described in the following paragraphs**.** Laboratory data sheets are included in **Appendix D**.

5.2.1 Grain Size Analyses and USCS Classification

The grain size distributions were measured using sieve analyses with and without hydrometers in accordance with ASTM D6913, ASTM D7928, and ASTM D1140. Results of this testing are summarized as follows:

- Test Boring Samples (99-GEO-1, 99-GEO-2, and 99-GEO-3): sand content ranged from 3.3 percent to 89.7 percent, fines content from 9.9 percent to 96.7 percent, and gravel content from 0 percent to 46.8 percent. USCS Classifications were identified as GM, ML, SM, SP-SM, CL, and GW-GM.
- Composite-1: sand content was 56.7 percent, fines content was 42.5 percent, and gravel content was 0.8 percent. USCS Classification was identified as SM.

5.2.2 Moisture Content

Moisture contents were measured in accordance with ASTM D2216. Results of this testing are summarized as follows:

- Test Boring Samples (99-GEO-1, 99-GEO-2, and 99-GEO-3): results ranged from 5.7 percent to 40.3 percent.
- Composite-1: result was 39.1 percent.

5.2.3 Dry Density

The dry density was measured only in the composite sample, in accordance with ASTM D7263. The result of this testing is summarized as follows:

- Composite-1: result was 77 pounds per cubic foot.

5.2.4 Specific Gravity

Specific gravity was measured only in the composite sample, in accordance with ASTM D854. The result of this testing is summarized as follows:

- Composite-1: result was 2.60.

5.3. Baseline Soil Composite Analytical Test Results

The soil analytical results for the composite sample prior to additive mixing are presented in **Table 4.** The results of the analytical testing are summarized as follows:

- The concentration of total arsenic concentration was 270 milligrams per kilogram (mg/kg). As noted previously, during the field investigation, samples were screened with the XRF and segregated by arsenic concentration. Samples exceeding 500 ppm were collected in buckets. At the lab, a composite sample was created. During composition, larger pieces of debris and gravel were screened out. The C1 sample, created in the laboratory, resulted in a lower concentration of total arsenic than what was originally screened in the field.
- The SPLP arsenic concentration was 680 µg/L.

- Concentrations of the other analytes did not indicate compatibility issues with the proposed mix design and results will be provided to the contractor as part of the baseline data package.

The analytical laboratory report is included in **Appendix E**.

5.4 Groundwater Chemistry Characterization Results

The groundwater analytical results for well 99-1 are summarized in **Table 5.** The dissolved arsenic concentration in this groundwater sample was 3,600 µg/L. Concentrations of the other analytes did not indicate compatibility issues with the proposed mix design and results will be provided to the contractor as part of the baseline data package.

The analytical laboratory report is included in **Appendix E**.

5.5 Compatibility Test Results

Compatibility testing of site groundwater with PC and NewCem Slag indicated no observed reactions between the reagents and site groundwater. Photographs of titration samples were collected at various times and are included in **Appendix B**.

5.6 S/S Composite Sample Results

5.6.1 Unconfined Compression Strength

UCS tests were performed in accordance with ASTM D1633. Testing was performed on samples after 7, 14, and 28 days of curing. The results from the laboratory tests are summarized in **Table 6.** Laboratory test reports are included in **Appendix D.** The laboratory test photolog is included in **Appendix B.** Plots of the results of the UCS tests for each composite sample are included in **Figure 5** through **Figure 8**. The following subsections summarize the results of the UCS laboratory testing for each mix.

5.6.1.1 PC with Bentonite and Ferrous Sulfate/Ferrous Chloride Additives

- Compressive strengths after 7 days of curing ranged from 54.6 psi (C1-H9) to 408 psi (C1-H1).
- Compressive strengths after 14 days of curing ranged from 63.6 psi (C1-H9) to 490 psi (C1-H1).
- Compressive strengths after 28 days of curing ranged from 69.0 psi (C1-H10) to 469 psi (C1-H1).

All of these mixes reached the desired 50 psi compressive strength after 7, 14, and 28 days.

5.6.1.2 PC with Ferrous Sulfate Additive

- Compressive strength after 7 days of curing was 222 psi (C1-H3).
- Compressive strength after 14 days of curing was 234 psi (C1-H3).
- Compressive strength after 28 days of curing was 279 psi (C1-H3).

The one mix with 20 percent PC and ferrous sulfate additive met the desired 50 psi criteria after 7, 14, and 28 days.

5.6.1.3 NewCem Slag with Bentonite and Ferrous Sulfate Additives

- Compressive strengths after 7 days of curing were 4.5 psi (C1-H6) and 28.5 psi (C1-H5).
- Compressive strengths after 14 days of curing were 4.7 psi (C1-H6) and 44.6 psi (C1-H5).
- Compressive strengths after 28 days of curing were 6.7 psi (C1-H6) and 39.5 psi (C1-H5).

Both of these mixes recorded compressive strengths below the desired 50 psi strength.

5.6.2 Hydraulic Conductivity

Hydraulic conductivity tests were performed in accordance with ASTM D5084. A summary of the results is presented in **Table 6.** Laboratory test reports are included in **Appendix D**. The hydraulic conductivity measured in the lab ranged from 4.06E-07 cm/s (C1-H4) to 1.81E-03 cm/s (C1-H1). Seven samples (C1-H3, C1-H4, C1-H6, C1-H7, C1-H8, C1-H9, and C1-H10) indicated that the required hydraulic conductivity of 1.0E-06 cm/s or less was achieved.

5.6.3 Potential Leaching of Arsenic in S/S Soil Mixtures

The results of the SPLP and SDL tests are discussed in the following sections. The laboratory reports are included in **Appendix E**.

5.6.3.1 SPLP Results for Arsenic in S/S Soil

Table 7 summarizes the results of the total arsenic in each of the S/S samples, dissolved arsenic in each SPLP leachate, the percentage of available arsenic that was leached from each sample and the percent leaching decrease between the treated soil and the untreated soil (baseline composite soil result). **Table 7** also summarizes starting and ending measurement parameters, including pH and ORP and the mass of S/S material and leaching solution used.

The concentration of total arsenic in the S/S samples (as measured by XRF in the DTL) were 178 ppm in C1-H4 and 188 ppm in C1-H9). The concentration of arsenic in the leachates were 190 µg/L in C1-H4 and 200 µg/L in C1-H9. Note that the arsenic concentration in the SPLP in the untreated composite sample was 680 µg/L (**Table 4**).

Sample C1-H4, solidified with 13 percent PC, 1 percent bentonite and stabilized with ferrous sulfate heptahydrate, performed best at decreasing the amount of available arsenic leached. C1-H4 showed a 72 percent decrease of the available arsenic leached. In sample C1-H9, solidified with 10 percent PC, 3 percent bentonite and stabilized with ferrous sulfate heptahydrate, arsenic leaching was reduced by 70 percent.

Due to the disaggregation and rotary tumbling, the SPLP tests do not represent actual leaching of solidified soil by groundwater. However, the SPLP test results were used as a screening test to select the most appropriate sample for the more extensive and representative SDL testing. Based on the SPLP test results, sample C1-H4 was selected for additional leach testing following the SDL procedures.

5.6.3.2 SDL Results for Arsenic in S/S Soil

This section presents a summary of the results of the SDL testing on the S/S soil. The full evaluation is detailed in **Appendix F. Table 8** summarizes the results for the dissolved arsenic analysis performed by Onsite and the measurement parameters pH and ORP performed at the DTL during this procedure. As shown in **Table 8**, dissolved arsenic concentrations ranged from 3.6 µg/L (2 hours) to 22 µg/L (7 days).

Starting at 24 hours after the initial leachate (2 hours) was collected, all remaining dissolved arsenic concentrations for all plots were consistent, ranging from 8.7 to 22 µg/L. In addition to the measured concentrations at each time interval, additional calculations and evaluations were performed to determine leaching mechanisms, the potential of long-term leaching and to calculate release rates for arsenic. The calculations and conclusions for the SDL test for mixture C1-H4 is provided in **Appendix F**. In summary, the initial arsenic concentration result of 3.6 µg/L is the result of delayed diffusion or dissolution. After the 2-hours measurement, arsenic concentrations ranged between 8.7 µg/L (42 days) and 22 µg/L (7 days). The primary release mechanisms after 2-hour is mainly because of diffusion from the core. **Appendix F** provides graphs of the log of the cumulative mass released versus the log of the leaching time. As shown, the coefficient of determination (r^2) is excellent at 0.99. The resulting equations were used to predict leachate concentrations of dissolved arsenic at future time periods between 1 and 10 years at the interface between the treated soil and the aqueous phase (surface water). The concentrations for Year 1 through Year 10 were calculated to be less than the practical quantitation limit (2 to 3 µg/L). These concentrations would decrease as the water at the interface migrates and mixes with additional surface or groundwater.

Section 6
Conclusions and Recommendations

6.1 Conclusions

Based on the results of the geotechnical field investigation and treatability study with respect to the evaluation criteria, the following conclusions are made for the Highway 99 site:

- The site soils predominantly consist of silty sand with varying amounts of fine to coarse gravel. The Composite 1 soil sample is representative of the silty sand with an average arsenic concentration of about 200 ppm. Gravels observed at the site were sieved out to enable preparation of the small-scale test cylinders but could account for a range of 15 to 30 percent of the site soils during in situ mixing, based on observed soil conditions.
- PC was found to be the most consistent and effective reagent to meet the project performance criteria for unconfined compressive strength and permeability. This reagent is locally available. PC was effective in controlling leaching of arsenic, as indicated by the SPLP test results.
- NewCem slag was evaluated as part of the bench scale study due to local availability and potential cost savings. NewCem slag resulted in the lowest UCS results and did not meet the project performance criteria of 50 psi after 28 days. Permeability results for the two mixes were not consistent and the additive did not appear to make a significant impact in lowering the permeability of the soil matrix.
- The bentonite addition was evaluated for the various mixes at 1-percent, 3-percent and 6-percent by weight. Mixes at all percent additions met the project performance criteria. Results at the higher additions of 3 and 6-percent bentonite appeared to yield more consistent results as all four mixes from the phase 2 mixing effort exceeded the performance criteria for the project.
- Ferrous sulfate heptahydrate was evaluated as part of the bench scale study because it is a more cost-effective alternative to the previously evaluated ferrous chloride. Based on results of the SPLP and SDL testing, ferrous sulfate heptahydrate appears to be effective in stabilizing arsenic.
- The UCS test results indicate that additional water may be required for complete curing of the PC if the natural moisture content of the soils is below the optimum (standard proctor) moisture content.
- The UCS test results indicate that of the reagents tests, soil-PC mixtures exhibited the highest strengths after curing.
- The SDL test results indicate that mixture C1-H4 will result in very low leaching of arsenic over time. Concentrations of dissolved arsenic in Years 1 to 10 will be less than the MTCA

Method A cleanup level and concentrations will continue decrease as the water at the interface migrates and mixes with additional groundwater.

6.2 Recommendations

Based on the results of the geotechnical field investigation and treatability study and an evaluation of site information with respect to the evaluation criteria, the following is recommended for future pilot testing on the Highway 99 site:

- PC at a dosage rate of 13 percent by weight, bentonite at a dosage of 1 percent by weight, and ferrous sulfate heptahydrate at a molar ratio of 4:1 to the arsenic concentration is recommended to achieve the project objectives of achieving adequate strength and permeability reduction of site soils.
- The soils may be mixed with the reagent at their natural moisture content for stabilization purposes. However, additional water may need to be added to the soil-reagent mixture to achieve moisture contents equal to or up to 2 percent greater than the optimum (standard proctor) moisture content of the soils to achieve complete curing and strength gain.
- Prior to soils being treated on site, a pilot study should be performed to qualify the following factors prior to design and full-scale production:
  - Confirm the proposed mix design is feasible and compatible with site conditions,
  - Understand how implementation affects construction aspects such as auger diameter, rate of mixing, and column overlaps to meet the project criteria.
  - Identify the additional volume of water needed to fully cure the in-situ soils during mixing.
  - Identify the "swell" or soil bulking factor after in-situ mixing is complete.
  - Develop the appropriate quality assurance procedures to assess compliance with the project performance criteria.

6.3 Impacts to the Conceptual Design

The conclusions and recommendations presented above do not indicate any significant changes to the conceptual design approach presented in the Highway 99 - Conceptual Design Report (CDM Smith 2020a) will be required. Based on the results of the field investigation, it is recommended that the extents of the proposed treatment area be increased (compared to the Conceptual Design Report) to fully encapsulate the highly impacted source area. The proposed treatment area will be further developed as part of the ISS design.

The recommended mix design was optimized based on cost effectiveness, local availability of reagents, and performance and will be further evaluated during the pilot study implementation. Based on the results of both the Highway 99 and Puyallup bench scale treatability studies, it is recommended that only one pilot study be performed to evaluate both sites. This was concluded by confirming consistency between the subsurface conditions encountered at both sites and

similarity in the overall recommended mix design approach. It is also recommended that the pilot study be conducted at the Puyallup site to reduce impacts to ongoing operations at the Highway 99 site.

Section 7
References

Camp Dresser & McKee, Inc. (CDM, now CDM Smith). 2007. *Soil and Groundwater Quality Assessment/Source Evaluation Report, USG-Fife Site, 7110 Pacific Highway East, Milton, Washington*. Prepared for USG Corporation. January 31, 2007.

CDM Smith Inc. 2016a*. Feasibility Study, USG Interiors Highway 99 Site, Milton, Washington.* June 23, 2016.

CDM Smith Inc. 2016b. *Remedial Investigation Report, USG Interiors Highway 99 Site, Milton, Washington*. June 23, 2016.

CDM Smith Inc. 2018a. *Field Pilot Study Work Plan, USG Interiors Highway 99 Site, 7110 Pacific Highway East, Milton, Washington, 98354.* July 25, 2018.

CDM Smith Inc. 2018b. *Hot-Spot Characterization and Bench-Testing, USG Interiors Highway 99 Site, 7110 Pacific Highway East, Milton, WA 98354.* March 23, 2018.

CDM Smith, 2020a. *Conceptual Design Report, USG Interiors Highway 99 Site, Milton, Washington.* April 16, 2020.

CDM Smith, 2020b. *Geotechnical Field Investigation and Bench Scale Treatability Study Work Plan, USG Interiors Highway 99 Site, Milton Washington and USG Interior Puyallup Site, Puyallup, Washington.* May 26, 2020.

CDM Smith 2020c*. Field Pilot Study Evaluation Report, USG Interiors Highway 99 Site, 7110 Pacific Highway East, Milton, WA 98354.* June 12, 2020.

Ecology, 2016. *Cleanup Action Plan, USG Interiors Highway 99 Site, Milton, Washington*. Prepared for USG Corporation. Issued by Washington State Department of Ecology Toxics Cleanup Program, Southwest Regional Office. June 23, 2016.

Environmental Protection Agency (EPA), Office of Research and Development, et al. 2009. *Technology Performance Review: Selecting and Using Solidification/Stabilization Treatment for Site Remediation.* Publication No. EPA/600/R-09/148.

Tables

USG Interiors
Highway 99 Site
Milton, WA

Table 1 Summary of Bench Scale Study Mix Design

Sample ID	Mix ID	Additive	Additive %	Unconfined Compression Testing			SPLP	Permeability Test	SDL	PP	Extra	Rationale
				7-day	14-day	28-day						
Phase 1												
Composite 1	H1	Portland Cement	20	x	x	x	x	x	x	x	x	CONTROL MIX - ORIGINAL BASELINE BENCH SCALE TUDY
		Bentonite	1									
		Ferrous Chloride	4:1 (FE(II))									
	H2	Portland Cement	20	x	x	x	x	x	x	x	x	Control Mix - With Ferrous Sulfate
		Bentonite	1									
		Ferrous Sulfate Heptahydrate	4:1 (FE(II))									
	H3	Portland Cement	20	x	x	x	x	x	x	x	x	Control Mix - Without Bentonite and using Ferrous Sulfate instead of Ferrous Chloride
		Ferrous Sulfate Heptahydrate	4:1 (FE(II))									
	H4	Portland Cement	13	x	x	x	x	x	x	x	x	Control Mix - With lower % of Portland Cement (matches Puyallup) and Ferrous Sulfate
		Bentonite	1									
		Ferrous Sulfate Heptahydrate	4:1 (FE(II))									
	H5	NewCem Slag	30	x	x	x	x	x	x	x	x	Control Mix - With NewCem Slag (upper bound) instead of Portland Cement and Ferrous Sulfate instead of Ferrous Chloride
		Bentonite	1									
		Ferrous Sulfate Heptahydrate	4:1 (FE(II))									
	H6	NewCem Slag	10	x	x	x	x	x	x	x	x	Control Mix - With lower % NewCem Slag (lower bound) instead of Portland Cement and Ferrous Sulfate instead of Ferrous Chloride
		Bentonite	1									
		Ferrous Sulfate Heptahydrate	4:1 (FE(II))									
Phase 2												
Composite 1	H7	Portland Cement	13	x	x	x	x	x	x	x	x	Mix mimicking C1-P8 from Puyallup Mix Design for pilot study evaluation
		Bentonite	3									
		Ferrous Sulfate Heptahydrate	4:1 (FE(II))									
	H8	Portland Cement	13	x	x	x	x	x	x	x	x	Mix mimicking C1-P9 from Puyallup Mix Design for pilot study evaluation
		Bentonite	6									
		Ferrous Sulfate Heptahydrate	4:1 (FE(II))									
	H9	Portland Cement	10	x	x	x	x	x	x	x	x	Mix mimicking C1-P10 from Puyallup Mix Design for pilot study evaluation and also to evaluate lower % Portland Cement at the site.
		Bentonite	3									
		Ferrous Sulfate Heptahydrate	4:1 (FE(II))									
	H10	Portland Cement	10	x	x	x	x	x	x	x	x	Mix mimicking C1-P11 from Puyallup Mix Design for pilot study evaluation and also to evaluate lower % Portland Cement at the site.
		Bentonite	6									
		Ferrous Sulfate Heptahydrate	4:1 (FE(II))									

Notes:

	Mixes that met the project goals for unconfined compressive strength and hydraulic conductivity.
SPLP	Synthetic Precipitation Leaching Procedure
SDL	Semi-dynamic Leaching Test
PP	Pocket Penetrometer
% - percent	

USG Interiors
Highway 99 Site
Milton, WA

Table 2 Summary of Subsurface Exploration Findings

Exploration ID	Approximate Ground Surface Elevation.[1]	Exploration Depth	Strata												Depth to Groundwater
			Asphalt		Upper Sand & Gravel		Upper Clay & Silt		Sand and Silt		Lower Clay & Silt		Lower Sand and Gravel		
			Depth Interval	Thickness	Depth Interval	Thickness	Depth Interval	Thickness	Depth Interval	Thickness	Depth Interval	Thickness	Depth Interval	Thickness	
	(ft)	(ft)	(ft bgs)	(ft)	(ft bgs)	(ft)	(ft bgs)	(ft)	(ft bgs)	(ft)	(ft bgs)	(ft)	(ft bgs)	(ft)	(ft bgs)[2]
99-BS-1	22.6	20	0-0.3	0.3	0.3-8.0	7.7	8.0-13.0	5	13.0-20	+7	--	--	--	--	NR
99-BS-1a	22.6	15	--	--	--	--	10.0-13.0	3	13.0-15.0	+2	--	--	--	--	NR
99-BS-2	22.0	20	0-0.2	0.2	0.2-10.0	9.8	--	--	10.0-20.0	+10	--	--	--	--	NR
99-BS-3	21.4	20	--	--	0-6.0	6	--	--	6.0-20.0	+14	--	--	--	--	NR
99-BS-4	22.3	20	0-0.3	0.3	0.3-9.0	8.7	--	--	9.0-20.0	+11	--	--	--	--	NR
99-BS-4a	22.1	15	--	--	5.0-8.5	3.5	--	--	8.5-15.0	+7.5	--	--	--	--	NR
99-GEO-1	22.7	32	0-0.3	0.3	0.3-9.0	8.7	9.0-11.25	2.25	11.25-21.5	10.25	21.5-27	5.5	27.0-32.0	+5	14.0
99-GEO-2	22.1	32	0-0.3	0.3	0.3-11.0	10.7	--	--	11.0-30.0	19	30.0-30.5	0.5	30.5-32.0	+1.5	8.0
99-GEO-3	21.2	32	--	--	0-7.0	7	--	--	7.0-32.0	+25	--	--	--	--	8.5
99-TP-1	21.7	8.5	0-0.3	0.3	0.3-8.5	+8.2	--	--	--	--	--	--	--	--	NR
99-TP-2	22.1	11	0-0.3	0.3	0.3-10.0	9.7	--	--	10.0-11.0	+1	--	--	--	--	NR
99-TP-3	21.2	8	0-0.5	0.5	0.5-8.0	+7.5	--	--	--	--	--	--	--	--	NR

Notes:

1. Elevations are approximate and referenced to the North American Vertical Datum of 1988 (NAVD88).
2. Groundwater level readings were taken upon completion of the test boring.

+ Indicates strata not fully penetrated
-- Indicates no value
NR - Indicates not recorded
ft - feet
bgs - below ground surface

USG Interiors
Highway 99 Site
Milton, WA

Table 3 Summary of Geotechnical Laboratory Test Results

Exploration Number	Sample Number	Sample Depth (ft)	Strata	USCS [1]	Grain Size Analysis [2]							Atterberg Limits [3]			Water Content (%) [4]	Organic Content (%)[5]
					Gravel (%)		Sand (%)			Fines (%)		LL(%)	PL(%)	PI(%)		
					Coarse	Fine	Coarse	Medium	Fine	Silt	Clay					
99-GEO-1	S-2	3-5	Silty Gravel w/ sand	GM	23.1	21.5	7.0	9.5	13.6	25.3	--	--	--	--	5.7	--
99-GEO-1	S-4	7-9	Silty Gravel w/ sand	GM	9.2	24.8	10.0	8.2	14.7	25.7	7.4	--	--	--	12.2	--
99-GEO-1	S-5	9-11	Silt w/ sand	ML	--	--	--	--	--	--	--	47.0	28.0	19.0	29.1	1.1
99-GEO-1	S-7	13-15	Silty Sand	SM	0.0	0.0	0.0	0.6	54.7	44.7	--	--	--	--	27.2	--
99-GEO-1	S-8a	20-22	Sand w/ silt	SP-SM	0.0	0.0	3.8	22.5	63.4	9.0	1.3	--	--	--	23.3	--
99-GEO-1	S-9	25-27	Clay	CL	0.0	0.0	0.0	0.2	3.1	49.0	47.7	36.0	24.0	12.0	40.3	--
99-GEO-1	S-10	30-32	Gravel w/ silt and sand	GW-GM	5.2	41.6	12.6	20.9	9.8	9.9	--	--	--	--	10.9	--
99-GEO-2	S-4	7-9	Silty Sand w/ gravel	SM	6.2	32.4	11.3	15.7	12.2	22.2	--	--	--	--	12.7	--
99-GEO-2	S-6	11-13	Silt w/ sand	ML	0.0	1.0	0.2	0.7	15.4	76.5	6.2	--	--	--	26.3	--
99-GEO-2	S-8	20-22	Silty Sand	SM	0.0	1.2	1.1	11.5	72.4	13.8	--	--	--	--	20.6	--
99-GEO-2	S-9	25-27	Silty Sand	SM	0.0	0.8	0.8	4.7	77.4	14.6	1.7	--	--	--	25.9	--
99-GEO-3	S-1	1-3	Silty Sand w/ gravel	SM	0.0	18.9	10.7	15.2	19.0	36.2	--	--	--	--	13.7	--
99-GEO-3	S-4	7-9	Silty Sand w/ gravel	SM	4.9	16.9	8.4	11.3	18.6	29.7	10.2	--	--	--	27.3	--
99-GEO-3	S-7	13-15	Silt w/ sand	ML	0.0	0.0	0.1	0.2	21.6	72.2	5.9	--	--	--	28.1	--
99-GEO-3	S-8	20-22	Silty Sand	SM	0.0	0.0	0.2	3.0	70.6	26.2	--	--	--	--	27.9	--
99-GEO-3	S-9	25-27	Silty Sand	SM	0.0	0.0	0.7	9.6	63.6	23.2	2.9	NP	NP	NP	22.4	--
Composite	C1	(note 6)	SIlty Sand	SM	0.0	0.8	0.1	2.4	54.2	34.6	7.9	--	--	--	39.1	2.9

Notes:

1. USCS performed in accordance with ASTM D 2487.
2. Grain size analysis performed in accordance with ASTM D7928 & D6913 and ASTM D1140.
3. Atterberg limit performed in accordance with ASTM D4318.
4. Water Content performed in accorfance with ASTM D2216
5. Organic Content performed in accordance with ASTM D2974
6. Composite sample includes soil from the following borings 99-BS-1 (10-15 ft), 99-BS-1a (10-15 ft), 99-BS-4 (5-10 ft), 99-BS-4a (10-15 ft)

-- Not conducted

LL - Liquid Limit
PL - Plastic Limit
PI - Plasticity Index
NP - Non plastic

% - percent
USCS - Unified Soil Classification System

USG Interiors
Highway 99 Site
Milton, WA

Table 4 Baseline Composite Soil Analytical Results

Analyte and Analytical Method	Unit	Result
Leachable Arsenic (SPLP) (EPA 1312/6010D)		
SPLP Arsenic	µg/L	680
Total Metals (EPA 6010D/7471B)		
Aluminum	mg/kg	6,100
Antimony	mg/kg	<6.8
Arsenic	mg/kg	270
Barium	mg/kg	33
Beryllium	mg/kg	<0.68
Cadmium	mg/kg	<0.68
Calcium	mg/kg	3,000
Chromium	mg/kg	17
Cobalt	mg/kg	4.9
Copper	mg/kg	14
Iron	mg/kg	7,700
Lead	mg/kg	<6.8
Magnesium	mg/kg	1,900
Manganese	mg/kg	140
Mercury	mg/kg	<0.34
Nickel	mg/kg	12
Potassium	mg/kg	440
Selenium	mg/kg	<14
Silver	mg/kg	<1.4
Sodium	mg/kg	760
Thallium	mg/kg	<3.4
Vanadium	mg/kg	47
Zinc	mg/kg	26

Notes:

SPLP - Synthetic Precipitation Leaching Procedure

µg/L - micrograms per liter

mg/kg - milligrams per kilogram

< - not detected at or greater than the listed concentration

USG Interiors
Highway 99 Site
Milton, WA

Table 5 Groundwater Chemistry Characterization - Monitoring Well 99-1

Analytical Method and Analyte	Unit	Result
SM 2540D/2540C		
TSS	mg/L	16
TDS	mg/L	230
SM 2320B		
Carbonate Alkalinity	mg CaCO3/L	<2.0
Bicarbonate Alkalinity	mg CaCO3/L	200
EPA 353.2		
Nitrate + Nitrite	mg/L	<0.050
EPA 300.0		
Bromide	mg/L	0.05
Chloride	mg/L	9.59
Fluoride	mg/L	0.48
Sulfate	mg/L	2.95
EPA 200.7		
Dissolved Silica	µg/L	44,000
Dissolved Metals (EPA Methods 6010D/7470A)		
Aluminum	µg/L	<110
Antimony	µg/L	<5.0
Arsenic	µg/L	3,600
Barium	µg/L	<25
Beryllium	µg/L	<10
Cadmium	µg/L	<4.0
Calcium	µg/L	33,000
Chromium	µg/L	<10
Cobalt	µg/L	<10
Copper	µg/L	<10
Iron	µg/L	9,400
Lead	µg/L	<1.0
Magnesium	µg/L	18,000
Manganese	µg/L	860
Mercury	µg/L	<0.50
Nickel	µg/L	<20
Potassium	µg/L	3,400
Selenium	µg/L	<5.0
Silver	µg/L	<10
Sodium	µg/L	16,000
Thallium	µg/L	<5.0
Vanadium	µg/L	<10
Zinc	µg/L	<25

Notes:

TSS - Total Suspended Solids

TDS - Total Dissolved Solids

µg/L - micrograms per liter

mg/L milligrams per liter

mg CaCO3/L - milligrams per liter as calcium carbonate

< - not detected at or greater than the listed concentration

USG Interiors
Highway 99 Site
Milton, WA

Table 6 Summary of S/S Composite Sample Geotechnical Laboratory Test Results

Mix Designation	Date Mixed	UCS Testing [1]															Hydraulic Conductivity [2]
		7 Day Cure					14 Day Cure					28 Day Cure					
		UCS Strength	Dry Bulk Density	Wet Bulk Density	Moisture Content	Pocket Penetrometer Reading	UCS Strength	Dry Bulk Density	Wet Bulk Density	Moisture Content	Pocket Penetrometer Reading	UCS Strength	Dry Bulk Density	Wet Bulk Density	Moisture Content	Pocket Penetrometer Reading	
		(psi)	(pcf)	(pcf)	(%)	(psi)	(psi)	(pcf)	(pcf)	(%)	(psi)	(psi)	(pcf)	(pcf)	(%)	(psi)	(cm/s)
Phase 1																	
C1-H1	8/17/2020	408	93.4	116	24.2	>62.5	490	92.2	114	24.2	>62.5	469	90.4	112	23.7	>62.5	1.81E-03
C1-H2	8/17/2020	97.4	84.7	106	24.4	>62.5	105	85.0	106	24.3	>62.5	149	87.0	107	23.5	>62.5	3.27E-04
C1-H3	8/17/2020	223	90.7	113	24.3	>62.5	234	89.3	111	24.1	>62.5	279	89.1	110	23.4	>62.5	4.24E-06
C1-H4	8/17/2020	111	88.4	113	28.0	>62.5	151	88.5	113	27.8	>62.5	189	88.1	112	27.4	>62.5	4.06E-07
C1-H5	8/17/2020	28.5	86.5	109	26.2	>62.5	44.6	87.8	111	25.8	>62.5	39.5	85.9	108	25.4	>62.5	2.43E-04
C1-H6	8/17/2020	4.50	87.6	116	32.3	13.9	4.70	87.3	115	32.0	20.8	6.70	84.7	112	32.0	27.8	1.76E-06
Phase 2																	
C1-H7	10/28/2020	74.6	82.6	112	35.0	>62.5	100	81.5	109	34.2	>62.5	130	81.5	110	34.5	>62.5	2.10E-07
C1-H8	10/28/2020	79.7	82.5	111	33.9	>62.5	113	84.1	112	33.4	>62.5	144	83.4	111	32.8	>62.5	1.03E-07
C1-H9	10/28/2020	54.6	81.3	111	36.4	>62.5	63.6	80.2	109	35.7	>62.5	98.6	81.4	110	35.5	>62.5	3.96E-07
C1-H10	10/28/2020	55.8	80.3	110	36.4	>62.5	75.9	80.4	110	36.4	>62.5	69.0	80.0	109	36.4	>62.5	2.41E-07

Notes:
Mixes that met the project goals for unconfined compressive strength and hydraulic conductivity and were selected for Synthetic Precipitation Leaching Procedure (SPLP) testing (Table 7)
1. Unconfined compressive strength testing was conducted in accordance with ASTM D1633.
2. Hydraulic Conductivity testing was conducted in accordance with ASTM D5084.
psi - pounds per square inch
pcf - pounds per cubic foot
cm/s - centimeter per second
% - percent
> - exceeds

USG Interiors
Highway 99 Site
Milton, WA

Table 7 Total Arsenic in S/S Composite Soils and SPLP Leachate Results

Mix Designation	Date Mixed	Date Leached	Solids Results	SPLP Leaching Data									
			Arsenic[1]	Solid Mass	SPLP Extraction Fluid # 2 Mass	Initial pH	Final pH	Initial ORP	Final ORP	SPLP Arsenic Result	Available Arsenic Leached	Leaching Decrease Between Treated and Untreated Soil
			(ppm)	(g)	(g)	(su)	(su)	(mv)	(mv)	(µg/L)	(%)	(%)
C1-H4	8/17/2020	3/8/2021	178	91.7	181.9	10.9	11.6	214	172	190	0.21	72.06%
C1-H9	10/28/2020	3/8/2021	188	128.2	261.2	10.5	11.1	224	160	200	0.21	70.59%

Notes:
1. As measured by an X-Ray Fluorescence meter
mg/kg - milligram per kilogram
µg/L - micrograms per liter
g - grams
su - standard unit
mv - millivolt
% - percent
ORP - oxidation reduction potential
SPLP - Synthetic Precipitation Leaching Procedure

USG Interiors
Highway 99 Site
Milton, WA

Table 8 Semi-Dynamic Leach Testing Results

Mix Designation	Sample ID	Date Leachate	SDL Arsenic Result	pH	ORP	Observations
			µg/L	(su)	(mv)	
C1-H4	C1-H4-SDL-2-Hour	3/29/2021	3.6	11.23	205	
	C1-H4-SDL-24-Hour	3/30/2021	11	11.06	184	Sediment Observed in the bottom of the container
	C1-H4-SDL-48-Hour	3/31/2021	9.7	10.96	211	Sediment stable
	C1-H4-SDL-72-Hour	4/1/2021	9.6	11.06	206	Sediment stable
	C1-H4-SDL-72-Hour-Dup	4/1/2021	9.9	11.41	209	
	C1-H4-SDL-7-Day	4/5/2021	22	11.23	215	Sediment increasing
	C1-H4-SDL-14-Day	4/12/2021	18	11.11	211	Sediment Stable
	C1-H4-SDL-21-Day	4/19/2021	16	11.08	211	Sediment Stable
	C1-H4-SDL-28-Day	4/26/2021	13	10.98	204	Sediment stable
	C1-H4-SDL-42-Day	5/10/2021	8.7	11.22	221	Sediment stable

Notes:

Core Dimension before SDL 2"x3"
Core Dimension before SDL 2"x3"
Core Mass - beginning 266.68g, ending 262.31g
Core surface area - 162 cm^2
Volume of SPLP water used - 1620 mL
mg/kg - milligrams per kilogram
g - grams
µg/L - micrograms per liter
ppm - parts per million
su - standard unit
mv - millivolt
ORP - oxidation reduction potential
SPLP - Synthetic Precipitation Leaching Procedure

Figures

SOURCE: ESRI WORLD IMAGERY, 2020

CDM Smith

USG INTERIORS/HIGHWAY 99 SITE
MILTON, WASHINGTON

Figure 1
Vicinity Map

DOCUMENT PATH: E:_Projects\USG Interiors - Hwy 99\MapDocuments\Pre-Pilot Study\Figure-1_HWY-99_Vicinity-Map.mxd; 3/26/2021 11:29:28 AM;
CAD XREFS: ARSENIC-11X17BD, ARSENIC-SITEBASE, FIGURE 1 (PROPOSED BORINGS).

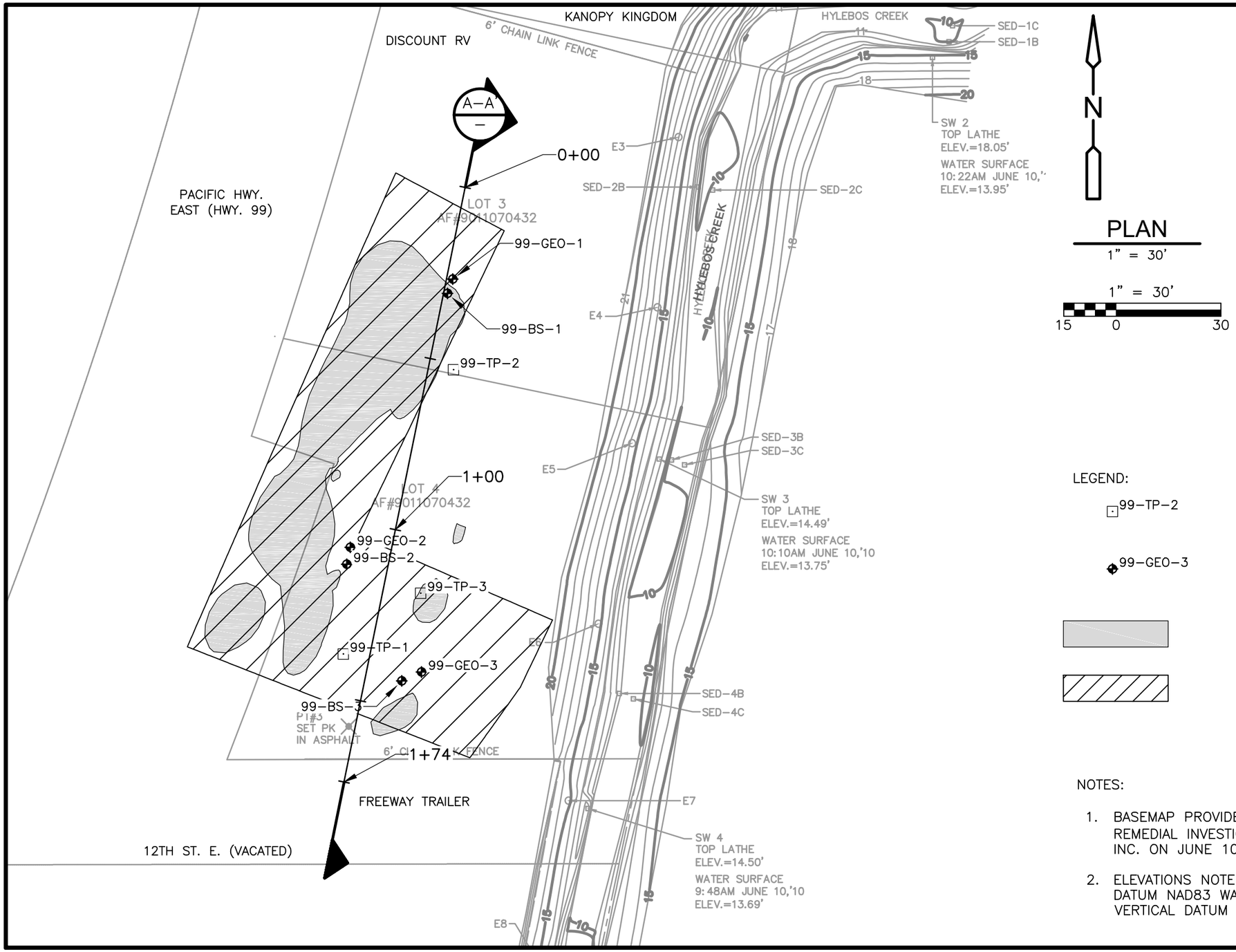
SOURCE: GOOGLE EARTH PRO, 2016

CDM Smith

USG INTERIORS/HIGHWAY 99 SITE
MILTON, WASHINGTON

Figure 2
Site Plan

DOCUMENT PATH: E:_Projects\USG Interiors - Hwy 99\MapDocuments\Pre-Pilot Study\Figure-2_HWY-99-Site-Plan.mxd; 3/26/2021 10:59:35 AM; CAD XREFS: ARSENIC-11X17BD, ARSENIC-SITEBASE, FIGURE 1 (PROPOSED BORINGS).



LEGEND:

99-TP-2	DESIGNATION AND APPROXIMATE LOCATION OF TEST PITS EXCAVATED ON JULY 29, 2020.
99-GEO-3	DESIGNATION AND APPROXIMATE LOCATION OF TEST BORINGS DRILLED ON AUGUST 4 AND AUGUST 5, 2020.
	MODELED IMPACTED SOILS EXCEEDING 500 PPM TOTAL ARSENIC
	PROPOSED EXTENTS OF ISS BASED ON CONCEPTUAL DESIGN REPORT

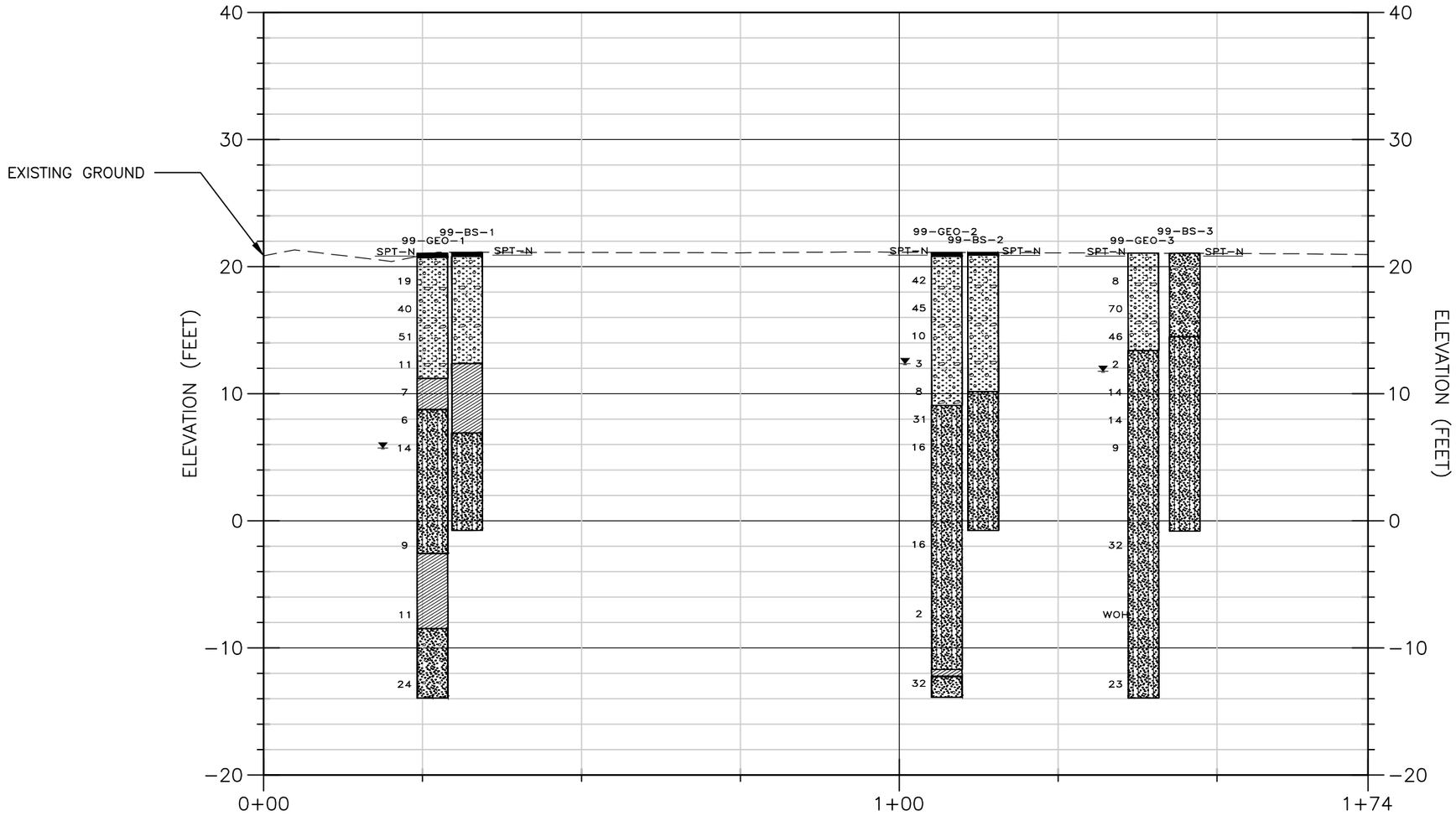
NOTES:

1. BASEMAP PROVIDED FROM DRAWING ENTITLED "USG HWY 99 REMEDIAL INVESTIGATION SURVEY" PREPARED BY WH PACIFIC INC. ON JUNE 10, 2020.
2. ELEVATIONS NOTED ARE IN FEET AND BASED ON HORIZONTAL DATUM NAD83 WASHINGTON STATE PLANE, SOUTH ZONE AND VERTICAL DATUM NGVD-88

CDM Smith

USG INTERIORS/HIGHWAY 99 SITE
MILTON, WASHINGTON

FIGURE 3
BORING AND TEST PIT LOCATION MAP



SECTION A-A'

HORIZONTAL:1"=20'
VERTICAL:1"=10'

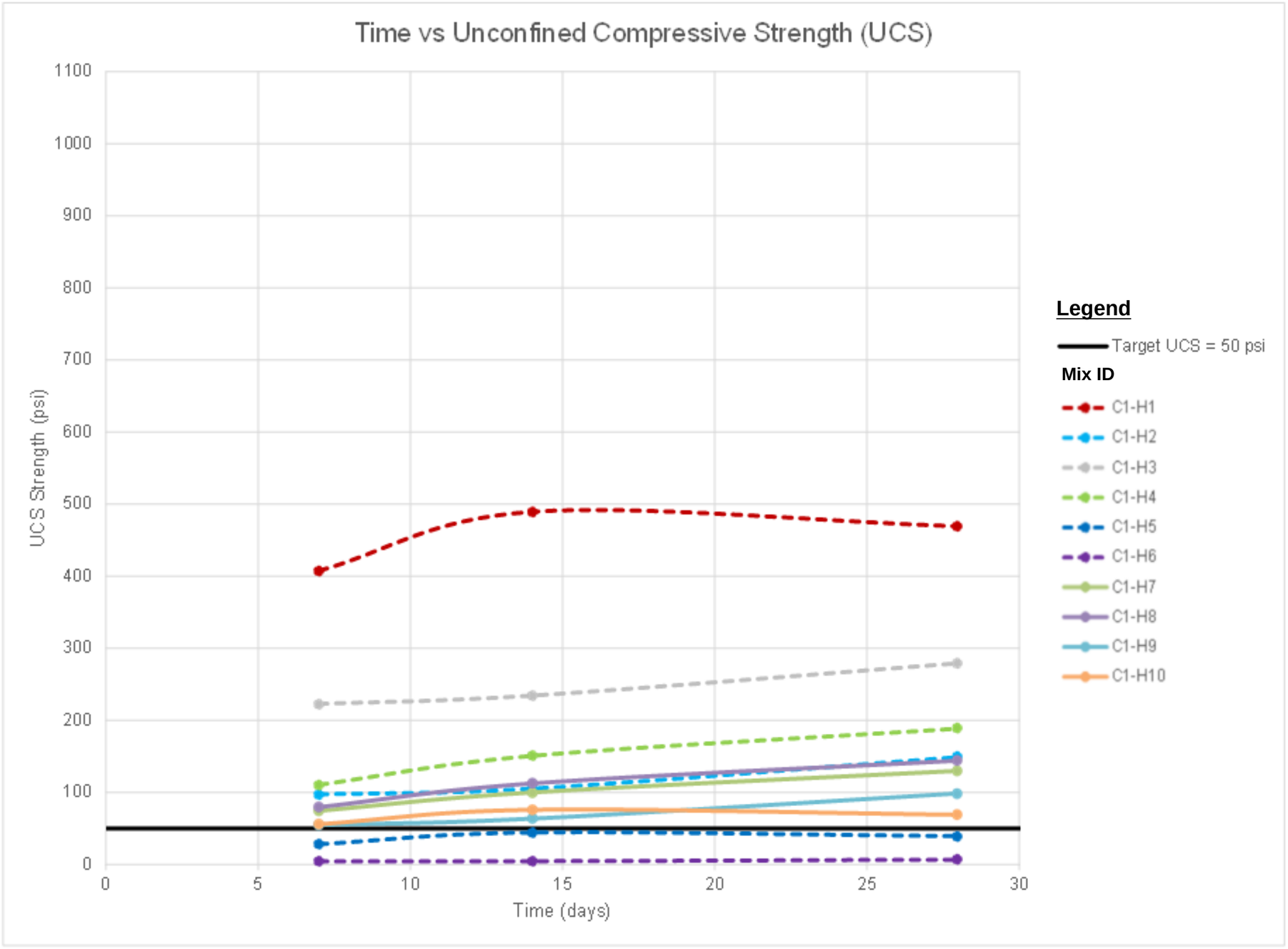
LEGEND:

- ASPHALT
- UPPER SAND AND GRAVEL
- SAND AND SILT
- LOWER SAND AND GRAVEL
- CLAY AND SILT

CDM Smith

USG INTERIORS/HIGHWAY 99 SITE
MILTON, WASHINGTON

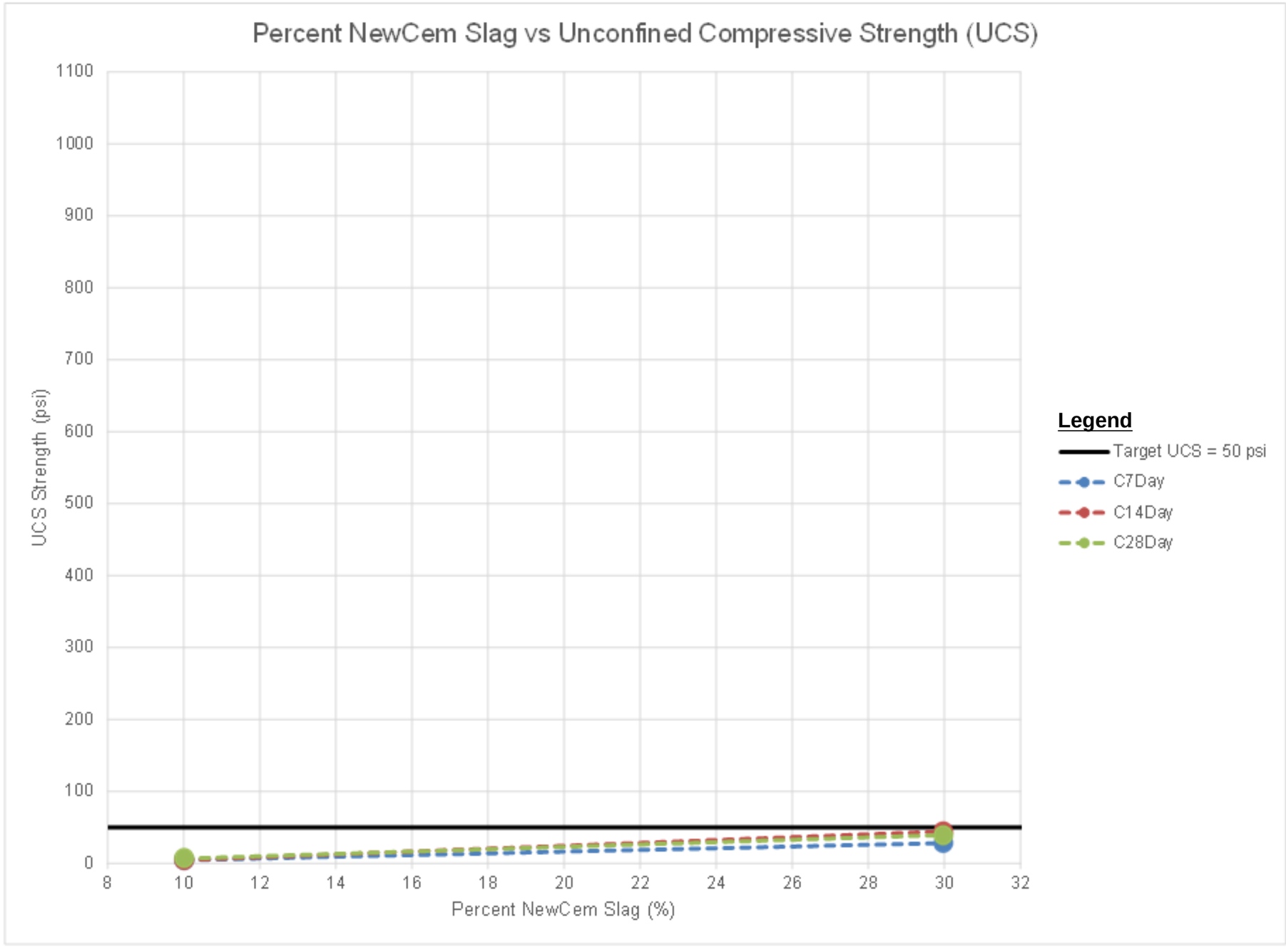
FIGURE 4
SOIL PROFILE



CDM Smith

USG INTERIORS/HIGHWAY 99 SITE
MILTON, WASHINGTON

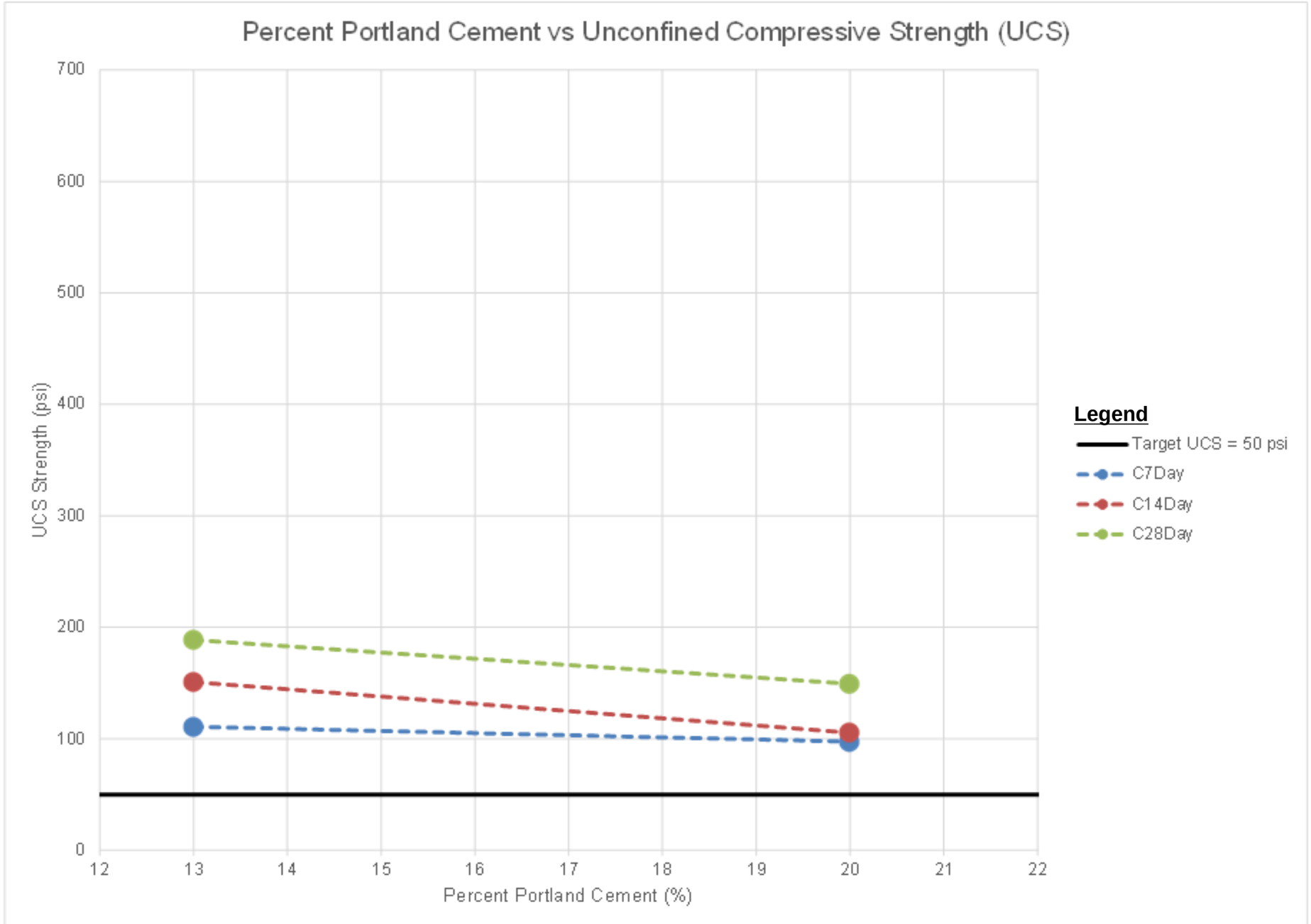
FIGURE 5
SUMMARY OF UCS VERSUS DAYS CURED - ALL CASES



CDM Smith

USG INTERIORS/HIGHWAY 99 SITE
MILTON, WASHINGTON

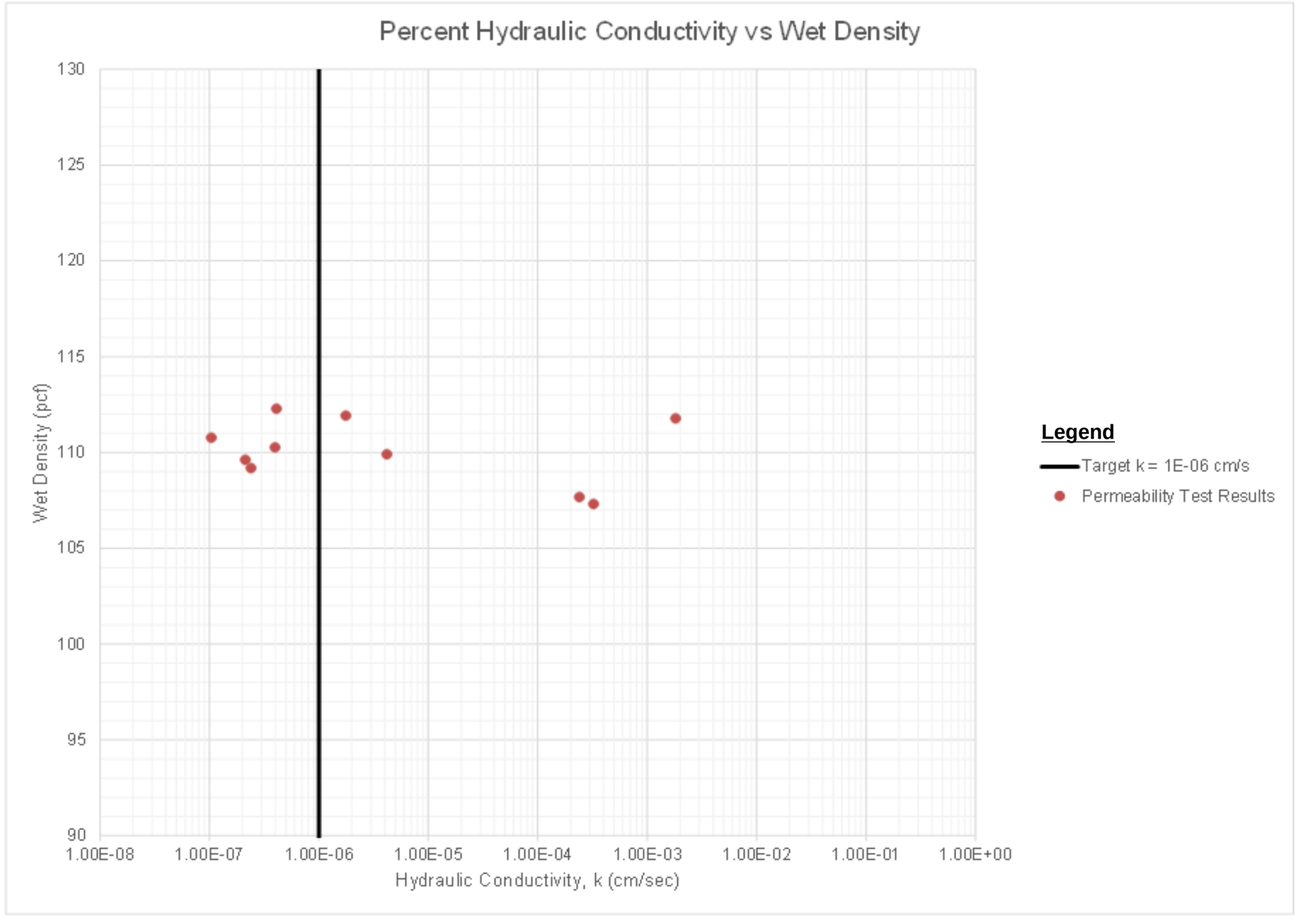
FIGURE 6
SUMMARY OF UCS VERSUS DAYS CURED - NEWCEM SLAG MIXES



CDM Smith

USG INTERIORS/HIGHWAY 99 SITE
MILTON, WASHINGTON

FIGURE 7
SUMMARY OF UCS VERSUS DAYS CURED - PC MIXES



CDM Smith

USG INTERIORS/HIGHWAY 99 SITE
MILTON, WASHINGTON

FIGURE 8
SUMMARY OF HYDRAULIC CONDUCTIVITY VERSUS WET DENISTY

Appendix A

Boring Logs

Boring Number: 99-BS-1

Client: USG
Project Name: Highway 99 PDI and Bench Scale Study
Project Location: Milton, Washington
Project Number: 251008

Drilling Contractor/Driller: Holt Services / J. Jones
Drilling Method/Casing/Core Barrel Size: Sonic / 6 in /
Hammer Weight/Drop Height/ Spoon Size: NA lb / NA in /NA in O.D.
Bore Hole Location: 703082.02, 1184720.05
Drilling Date: Start: 8/7/2020 **End:** 8/7/2020

Surface Elevation (ft.): 22.61
Total Depth (ft.): 20
Depth to Initial Water Level (ft):

Depth	Date	Time
NR		

Abandonment Method: Backfilled with grout
Logged By: H.Provinsal

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	PID (ppm)	XRF Reading (ppm)	Graphic Log	Strata	Material Description
22.6 / 0	SC	Core 1	60		57		NA	0		Upper Sand and Gravel	Top 3": Asphalt Middle 4": Moist, tan-brown, fine to coarse GRAVEL and fine to coarse SAND (GM) Bottom 52": Moist, gray, fine to coarse GRAVEL and fine to coarse SAND (GM)
17.6 / 5	SC	Core 2	60		60		NA	144			Top 40": Moist, gray, fine to coarse GRAVEL and fine to coarse SAND, trace silt, trace cobbles (4") (GM)
12.6 / 10	SC	Core 3	60		58		NA	1271		Upper Clay & Silt	Bottom 20": Moist, gray-green, Slightly Organic CLAY & SILT, some fine to coarse sand (organic matter consists of wood fragments) (CL) Top 38": Wet, dark brown, Slightly Organic CLAY & SILT (organic matter consists of wood fragments) (CL)
7.6 / 15	SC	Core 4	60		48		NA	46		Sand and Silt	Bottom 20": Wet, dark brown, Slightly Organic fine to coarse SAND, some silt (organic matter consists of wood) (SM) Wet, dark brown, fine to coarse SAND, some silt (SM)
2.6											

Sample Types

AS - Auger/Grab Sample
SC - Sonic Core
GP - Geoprobe
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample

Consistency vs Blowcount/Foot

Granular (Sand):

V. Loose:	0-4	Dense:	30-50
Loose:	4-10	V. Dense:	>50
M. Dense:	10-30		

Fine Grained (Clay):

V. Soft:	<2	Stiff:	8-15
Soft:	2-4	V. Stiff:	15-30
M. Stiff:	4-8	Hard:	>30

Burmister Classification

and	35-50%
some	20-35%
little	10-20%
trace	<10%

moisture, density, color

Reviewed by: M. Passaro | **Date: 11/1/2020** | **Boring Number: 99-BS-1**

BL HIGHWAY 99 08242020.GPJ - 4/5/21

Boring Number: 99-BS-1

Client: USG
Project Name: Highway 99 PDI and Bench Scale Study
Project Location: Milton, Washington
Project Number: 251008

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	PID (ppm)	XRF Reading (ppm)	Graphic Log	Strata	Material Description
2.6											
20											Test boring 99-BS-1 terminated at 20 ft bgs.
-2.4											
25											
-7.4											
30											
-12.4											
35											
-17.4											
40											
-22.4											
45											

Boring Number: 99-BS-1A

Client: USG
Project Name: Highway 99 PDI and Bench Scale Study
Project Location: Milton, Washington
Project Number: 251008

Drilling Contractor/Driller: Holt Services / J. Jones
Drilling Method/Casing/Core Barrel Size: Sonic / 6 in /
Hammer Weight/Drop Height/ Spoon Size: NA lb / NA in /NA in O.D.
Bore Hole Location: 703077.13, 1184720.05
Drilling Date: Start: 8/7/2020 **End:** 8/7/2020

Surface Elevation (ft.): 22.61
Total Depth (ft.): 15
Depth to Initial Water Level (ft):

Depth	Date	Time
NR		

Abandonment Method: Backfilled with grout
Logged By: H.Provinsal

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	PID (ppm)	XRF Reading (ppm)	Graphic Log	Strata	Material Description
22.6 / 0											Discrete sample interval from 10 to 15 feet bgs. No samples collected from ground surface to 10 feet bgs.
17.6 / 5											
12.6 / 10	SC	Core 1	60		48		NA	748		Sand and Silt Upper Clay &Silt	Top 30": Wet, dark brown, Slightly Organic CLAY & SILT, little fine to coarse sand (organic matter consists of wood) (CL)
7.6											Bottom 18": Wet, dark brown, Slightly Organic fine to coarse SAND, some silt (organic matter consists of wood) (SM)
15 / 2.6											Test boring 99-BS-1A terminated at 15 ft bgs.

Sample Types

AS - Auger/Grab Sample
SC - Sonic Core
GP - Geoprobe
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample

Consistency vs Blowcount/Foot

Granular (Sand):

V. Loose:	0-4	Dense:	30-50
Loose:	4-10	V. Dense:	>50
M. Dense:	10-30		

Fine Grained (Clay):

V. Soft:	<2	Stiff:	8-15
Soft:	2-4	V. Stiff:	15-30
M. Stiff:	4-8	Hard:	>30

Burmister Classification

and	35-50%
some	20-35%
little	10-20%
trace	<10%

moisture, density, color

Reviewed by: M. Passaro **Date: 11/1/2020** **Boring Number: 99-BS-1A**

BL HIGHWAY 99 08242020.GPJ - 4/5/21

Boring Number: 99-BS-2

Client: USG
Project Name: Highway 99 PDI and Bench Scale Study
Project Location: Milton, Washington
Project Number: 251008

Drilling Contractor/Driller: Holt Services / J. Jones
Surface Elevation (ft.): 22
Drilling Method/Casing/Core Barrel Size: Sonic / 6 in /
Total Depth (ft.): 20
Hammer Weight/Drop Height/ Spoon Size: NA lb / NA in /NA in O.D.
Depth to Initial Water Level (ft):
Bore Hole Location: 703009.33, 1184692.2

Depth	Date	Time
NR		

Drilling Date: Start: 8/7/2020 **End:** 8/7/2020
Abandonment Method: Backfilled with grout
Logged By: H.Provinsal

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	PID (ppm)	XRF Reading (ppm)	Graphic Log	Strata	Material Description
22.0											
0	SC	Core 1	60		58		NA	12		Upper Sand and Gravel	Top 2": Asphalt Top 10": Dry, gray, fine to coarse SAND and fine to coarse GRAVEL, trace cobbles (3") (SM) Middle 8": Dry, red-orange, fine to coarse SAND and fine to coarse GRAVEL, little silt (SM) Middle 20": Moist, gray, fine to coarse SAND and fine to coarse GRAVEL, little silt, trace debris (fabric liner) (SM) Bottom 20": Moist, light gray, fine to coarse SAND, some fine to coarse gravel, little silt (SM)
17.0											
5	SC	Core 2	60		25		NA	7			Moist, gray, fine to coarse GRAVEL and fine to coarse SAND, some silt, little cobbles (3") (SM)
12.0											
10	SC	Core 3	60		60		NA	80		Sand and Silt	Wet, gray, SILT, little fine to coarse sand (ML)
7.0											
15	SC	Core 4	60		56		NA	38			Wet, dark brown, SILT, little fine to coarse sand (ML)
2.0											

Sample Types

AS - Auger/Grab Sample
SC - Sonic Core
GP - Geoprobe
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample

Consistency vs Blowcount/Foot

Granular (Sand):

V. Loose:	0-4	Dense:	30-50
Loose:	4-10	V. Dense:	>50
M. Dense:	10-30		

Fine Grained (Clay):

V. Soft:	<2	Stiff:	8-15
Soft:	2-4	V. Stiff:	15-30
M. Stiff:	4-8	Hard:	>30

Burmister Classification

and	35-50%
some	20-35%
little	10-20%
trace	<10%

moisture, density, color

Reviewed by: M. Passaro **Date: 11/1/2020** **Boring Number: 99-BS-2**

BL HIGHWAY 99 08242020.GPJ - 4/5/21

Boring Number: 99-BS-2

Client: USG
Project Name: Highway 99 PDI and Bench Scale Study
Project Location: Milton, Washington
Project Number: 251008

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	PID (ppm)	XRF Reading (ppm)	Graphic Log	Strata	Material Description
2.0											
20											Test boring 99-BS-2 terminated at 20 ft bgs.
-3.0											
25											
-8.0											
30											
-13.0											
35											
-18.0											
40											
-23.0											
45											

Boring Number: 99-BS-3

Client: USG
Project Name: Highway 99 PDI and Bench Scale Study
Project Location: Milton, Washington
Project Number: 251008

Drilling Contractor/Driller: Holt Services / J. Jones
Drilling Method/Casing/Core Barrel Size: Sonic / 6 in /
Hammer Weight/Drop Height/ Spoon Size: NA lb / NA in /NA in O.D.
Bore Hole Location: 702973.60, 1184712.62
Drilling Date: Start: 8/7/2020 **End:** 8/7/2020

Surface Elevation (ft.): 21.35
Total Depth (ft.): 20
Depth to Initial Water Level (ft):

Depth	Date	Time
NR		

Abandonment Method: Backfilled with grout
Logged By: H.Provinsal

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	PID (ppm)	XRF Reading (ppm)	Graphic Log	Strata	Material Description
21.4 / 0											
	SC	Core 1	60		48		NA	12		Upper Sand and Gravel	Top 16": Dry, tan-brown, fine to coarse SAND and fine to coarse GRAVEL, trace silt (SM) Middle 23": Moist, gray, Slightly Organic Silty CLAY, some fine to coarse gravel (organic matter consists of wood) (CL) Bottom 9": Moist, gray, fine to coarse SAND, little silt, little fine to coarse gravel (SM)
16.4 / 5	SC	Core 2	60		44		NA	6		Upper Sand and Gravel / Sand and Silt	Top 6": Moist, brown-gray, fine to coarse SAND, some fine to coarse gravel (SM) Middle 8": Moist, gray, SILT and fine to coarse SAND, some fine to coarse gravel (ML) Bottom 30": Wet, gray, SILT and fine to coarse SAND, little fine to coarse gravel (ML)
11.4 / 10	SC	Core 3	60		60		NA	74		Sand and Silt	Top 30": Wet, gray, fine SAND, little silt (ML) Bottom 30": Wet, gray, SILT and fine SAND (ML)
6.4 / 15	SC	Core 4	60		50		NA	25		Sand and Silt	Top 32": Wet, gray, SILT and fine SAND (ML) Bottom 18": Wet, dark gray, SILT and fine to coarse SAND (ML)
1.4											

Sample Types

AS - Auger/Grab Sample
SC - Sonic Core
GP - Geoprobe
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample

Consistency vs Blowcount/Foot

Granular (Sand):

V. Loose:	0-4	Dense:	30-50
Loose:	4-10	V. Dense:	>50
M. Dense:	10-30		

Fine Grained (Clay):

V. Soft:	<2	Stiff:	8-15
Soft:	2-4	V. Stiff:	15-30
M. Stiff:	4-8	Hard:	>30

Burmister Classification

and	35-50%
some	20-35%
little	10-20%
trace	<10%

moisture, density, color

Reviewed by: M. Passaro | **Date: 11/1/2020** | **Boring Number: 99-BS-3**

BL HIGHWAY 99 08242020.GPJ - 4/5/21

Boring Number: 99-BS-3

Client: USG
Project Name: Highway 99 PDI and Bench Scale Study
Project Location: Milton, Washington
Project Number: 251008

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	PID (ppm)	XRF Reading (ppm)	Graphic Log	Strata	Material Description
1.4											
20											Test boring 99-BS-3 terminated at 20 ft bgs.
-3.7											
25											
-8.7											
30											
-13.7											
35											
-18.7											
40											
-23.7											
45											

Boring Number: 99-BS-4

Client: USG
Project Name: Highway 99 PDI and Bench Scale Study
Project Location: Milton, Washington
Project Number: 251008

Drilling Contractor/Driller: Holt Services / J. Jones
Drilling Method/Casing/Core Barrel Size: Sonic / 6 in /
Hammer Weight/Drop Height/ Spoon Size: NA lb / NA in /NA in O.D.
Bore Hole Location: 703055.54, 1184705.32
Drilling Date: Start: 8/7/2020 **End:** 8/7/2020

Surface Elevation (ft.): 22.3
Total Depth (ft.): 20
Depth to Initial Water Level (ft):

Depth	Date	Time
NR		

Abandonment Method: Backfilled with grout
Logged By: H.Provinsal

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	PID (ppm)	XRF Reading (ppm)	Graphic Log	Strata	Material Description
22.3 / 0											Top 3": Asphalt
	SC	Core 1	60		46		NA	9		Upper Sand and Gravel	Bottom 46": Dry, gray, fine to coarse SAND and fine to coarse GRAVEL, trace silt (SM)
17.3 / 5	SC	Core 2	60		45		NA	236			Top 33": Moist, gray, fine to coarse SAND, some fine to coarse gravel, trace silt (SM)
12.3 / 10	SC	Core 3	60		60		NA	392		Sand and Silt	Bottom 12": Moist, green-gray, Slightly Organic SILT and fine SAND, little cobbles (3") (organic matter consists of roots) (ML) Top 30": Wet, dark gray, fine SAND, some silt (SM) Bottom 30" Wet, dark brown, fine to coarse SAND, some silt (SM)
7.3 / 15	SC	Core 4	60		60		NA	57			Wet, dark brown, SILT and fine to coarse SAND (ML)
2.3											

Sample Types

AS - Auger/Grab Sample
SC - Sonic Core
GP - Geoprobe
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample

Consistency vs Blowcount/Foot

Granular (Sand):

V. Loose:	0-4	Dense:	30-50
Loose:	4-10	V. Dense:	>50
M. Dense:	10-30		

Fine Grained (Clay):

V. Soft:	<2	Stiff:	8-15
Soft:	2-4	V. Stiff:	15-30
M. Stiff:	4-8	Hard:	>30

Burmister Classification

and	35-50%
some	20-35%
little	10-20%
trace	<10%

moisture, density, color

Reviewed by: M. Passaro | **Date: 11/1/2020** | **Boring Number: 99-BS-4**

BL HIGHWAY 99 08242020.GPJ - 4/5/21

Boring Number: 99-BS-4

Client: USG
Project Name: Highway 99 PDI and Bench Scale Study
Project Location: Milton, Washington
Project Number: 251008

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	PID (ppm)	XRF Reading (ppm)	Graphic Log	Strata	Material Description
2.3											
20											Test boring 99-BS-4 terminated at 20 ft bgs.
-2.7											
25											
-7.7											
30											
-12.7											
35											
-17.7											
40											
-22.7											
45											

Boring Number: 99-BS-4A

Client: USG
Project Name: Highway 99 PDI and Bench Scale Study
Project Location: Milton, Washington
Project Number: 251008

Drilling Contractor/Driller: Holt Services / J. Jones
Drilling Method/Casing/Core Barrel Size: Sonic / 6 in /
Hammer Weight/Drop Height/ Spoon Size: NA lb / NA in /NA in O.D.
Bore Hole Location: 703050.45, 1184705.26
Drilling Date: Start: 8/7/2020 **End:** 8/7/2020

Surface Elevation (ft.): 22.3
Total Depth (ft.): 15
Depth to Initial Water Level (ft):

Depth	Date	Time
NR		

Abandonment Method: Backfilled with grout
Logged By: H.Provinsal

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	PID (ppm)	XRF Reading (ppm)	Graphic Log	Strata	Material Description
22.3 / 0											Discrete sample interval from 5 to 15 feet bgs. No samples collected from ground surface to 5 feet bgs.
17.3 / 5	SC	Core 1	60		43		NA	177		Upper Sand and Gravel	Top 24": Wet, gray, fine to coarse SAND, some fine to coarse gravel, trace silt (SM)
12.3 / 10	SC	Core 2	60		50		NA	355		Sand and Silt	Bottom 19": Wet, brown-green, Slightly Organic SILT and fine to coarse SAND (organic matter consists of wood fragments) (ML) Wet, brown, Slightly Organic fine to coarse SAND, some silt (organic matter consists of wood fragments) (SM)
7.3 / 15											Test boring 99-BS-4A terminated at 15 ft bgs.
2.3											

Sample Types

AS - Auger/Grab Sample
SC - Sonic Core
GP - Geoprobe
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample

Consistency vs Blowcount/Foot

Granular (Sand):

V. Loose:	0-4	Dense:	30-50
Loose:	4-10	V. Dense:	>50
M. Dense:	10-30		

Fine Grained (Clay):

V. Soft:	<2	Stiff:	8-15
Soft:	2-4	V. Stiff:	15-30
M. Stiff:	4-8	Hard:	>30

Burmister Classification

and	35-50%
some	20-35%
little	10-20%
trace	<10%

moisture, density, color

Reviewed by: M. Passaro | **Date: 11/1/2020** | **Boring Number: 99-BS-4A**

BL HIGHWAY 99 08242020.GPJ - 4/5/21

Boring Number: 99-GEO-1

Client: USG
Project Name: Highway 99 PDI and Bench Scale Study
Project Location: Milton, Washington
Project Number: 251008

Drilling Contractor/Driller: Holt Services / R. Darling/ K. Osborne
Drilling Method/Casing/Core Barrel Size: HSA / 4 in /
Hammer Weight/Drop Height/ Spoon Size: 140 lbs lb / 30" in /2" in O.D.
Bore Hole Location: 703086.09, 1184721.53
Drilling Date: Start: 8/5/2020 **End:** 8/5/2020

Surface Elevation (ft.): 22.65
Total Depth (ft.): 32
Depth to Initial Water Level (ft):

Depth	Date	Time
14	8/5/2020	0915

Abandonment Method: Backfilled with bentonite chips
Logged By: H.Provinsal

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	PID (ppm)	XRF Reading (ppm)	Graphic Log	Strata	Material Description
22.7											
0											Top 4": Asphalt
	SS	S-1	24	16 10 9 17	16	19	NA	10		Upper Sand and Gravel	Top 9": Dry, medium dense, brown-gray, fine to coarse SAND and fine to coarse GRAVEL, trace silt (GM)
											Bottom 7": Moist, very stiff, brown, Silty CLAY, trace coarse gravel (CL)
	SS	S-2	24	14 21 19 16	10	40	NA	6			Moist, dense, gray, fine to coarse GRAVEL, some fine to coarse sand, some silt (GM)
17.7											
5	SS	S-3	24	9 21 30 15	14	51	NA	6			Moist, very dense, gray, fine to coarse GRAVEL, some fine to coarse sand, some silt (GM)
	SS	S-4	24	1 5 6 1	3	11	NA	8			Moist, medium dense, gray, fine to coarse GRAVEL, some fine to coarse sand, some silt (GM)
12.7											
10	SS	S-5	24	1 3 4 3	13	7	NA	235		Upper Clay & Silt	Moist, medium stiff, gray, CLAY & SILT, trace fine sand (CL)
	SS	S-6	24	1 3 3 6	22	6	NA	269			Top 3": Moist, medium stiff, gray, CLAY & SILT, trace fine sand (CL)
											Bottom 19": Moist, loose, brown, fine SAND and SILT (SM)
▼	SS	S-7	24	3 6 8 8	18	14	NA	42		Sand and Silt	Wet, loose, brown, fine SAND and SILT (SM)
7.7											
15											
2.7											

Sample Types

AS - Auger/Grab Sample
SC - Sonic Core
GP - Geoprobe
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample

Consistency vs Blowcount/Foot

Granular (Sand):

V. Loose:	0-4	Dense:	30-50
Loose:	4-10	V. Dense:	>50
M. Dense:	10-30		

Fine Grained (Clay):

V. Soft:	<2	Stiff:	8-15
Soft:	2-4	V. Stiff:	15-30
M. Stiff:	4-8	Hard:	>30

Burmister Classification

and	35-50%
some	20-35%
little	10-20%
trace	<10%

moisture, density, color

Reviewed by: M. Passaro | **Date: 11/1/2020** | **Boring Number: 99-GEO-1**

BL HIGHWAY 99 08242020.GPJ - 4/5/21

Boring Number: 99-GEO-1

Client: USG
Project Name: Highway 99 PDI and Bench Scale Study
Project Location: Milton, Washington
Project Number: 251008

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	PID (ppm)	XRF Reading (ppm)	Graphic Log	Strata	Material Description
2.7											
20	SS	S-8	24	6 5 4 3	24	9	NA	104			Top 19": Wet, loose, brown, fine to coarse SAND, little silt (SP-SM)
-2.4										Lower Clay & Silt	Bottom 5": Wet, stiff, light brown, CLAY & SILT, trace fine sand (CL)
25	SS	S-9	24	4 5 6 8	23	11	NA	33			Wet, stiff, light brown, CLAY & SILT, trace fine sand (CL)
-7.4										Lower Sand and Gravel	
30	SS	S-10	24	8 12 12 13	22	24	NA	9			Wet, medium dense, brown, fine to coarse GRAVEL, some fine to coarse sand, trace silt (GW-GM)
-12.4											Terminated test boring at 32 ft bgs.
35											
-17.4											
40											
-22.4											
45											

Boring Number: 99-GEO-2

Client: USG
Project Name: Highway 99 PDI and Bench Scale Study
Project Location: Milton, Washington
Project Number: 251008

Drilling Contractor/Driller: Holt Services / R. Darling/ K. Osborne
Drilling Method/Casing/Core Barrel Size: HSA / 4 in /
Hammer Weight/Drop Height/ Spoon Size: 140 lbs lb / 30" in /2" in O.D.
Bore Hole Location: 703004.46, 1184691.19
Drilling Date: Start: 8/5/2020 **End:** 8/5/2020

Surface Elevation (ft.): 22.13
Total Depth (ft.): 32
Depth to Initial Water Level (ft):

Depth	Date	Time
8	8/5/2020	1140

Abandonment Method: Backfilled with bentonite chips
Logged By: H.Provinsal

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	PID (ppm)	XRF Reading (ppm)	Graphic Log	Strata	Material Description
22.1											
0											Top 4": Asphalt
	SS	S-1	24	20 22 20 21	20	42	NA	9		Upper Sand and Gravel	Top 13": Dry, dense, brown, fine to coarse SAND, some fine to coarse gravel, trace silt (SM) Bottom 7": Moist, dense, gray, fine to coarse SAND, some fine to coarse gravel, little silt (SM)
	SS	S-2	24	20 24 21 19	12	45	NA	21			Moist, dense, gray, fine to coarse SAND, some fine to coarse gravel, little silt (SM)
17.1 5	SS	S-3	24	8 7 3 3	7	10	NA	105			Moist, medium dense, gray, fine to coarse SAND, little silt, trace fine to coarse gravel (SM)
▼	SS	S-4	24	1 1 2 2	13	3	NA	10			Wet, very loose, gray, fine to coarse SAND and fine to coarse GRAVEL, some silt (SM)
12.1 10	SS	S-5	24	0 4 4 9	14	8	NA	131			Top 12": Wet, very loose, gray, fine to coarse SAND and fine to coarse GRAVEL, some silt (SM) Bottom 2": Wet, loose, brown, fine to coarse SAND, trace silt (SM)
	SS	S-6	24	6 17 14 15	16	31	NA	79		Sand and Silt	Wet, hard, brown, SILT, little fine to coarse sand, trace fine gravel (ML)
	SS	S-7	24	7 10 6 6	10	16	NA	44			Wet, very stiff, brown, SILT, little fine to coarse sand (ML)
7.1 15											
2.1											

Sample Types

AS - Auger/Grab Sample
SC - Sonic Core
GP - Geoprobe
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample

Consistency vs Blowcount/Foot

Granular (Sand):

V. Loose:	0-4	Dense:	30-50
Loose:	4-10	V. Dense:	>50
M. Dense:	10-30		

Fine Grained (Clay):

V. Soft:	<2	Stiff:	8-15
Soft:	2-4	V. Stiff:	15-30
M. Stiff:	4-8	Hard:	>30

Burmister Classification

and	35-50%
some	20-35%
little	10-20%
trace	<10%

moisture, density, color

Reviewed by: M. Passaro | **Date: 11/1/2020** | **Boring Number: 99-GEO-2**

BL HIGHWAY 99 08242020.GPJ - 4/5/21

Boring Number: 99-GEO-2

Client: USG
Project Name: Highway 99 PDI and Bench Scale Study
Project Location: Milton, Washington
Project Number: 251008

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	PID (ppm)	XRF Reading (ppm)	Graphic Log	Strata	Material Description
2.1											
20	SS	S-8	24	4 7 9 12	24	16	NA	11		Sand and Silt	Wet, medium dense, dark brown, fine to coarse SAND, little silt, trace fine gravel (SM)
-2.9											
25	SS	S-9	24	2 1 1 1	24	2	NA	25			Wet, very loose, dark brown, fine to coarse SAND, little silt, trace fine gravel (SM)
-7.9											
30	SS	S-10	24	12 17 15 18	24	32	NA	14			Top 6": Wet, hard, gray, CLAY & SILT, trace fine sand (CL) [Lower Clay & Silt] Bottom 18": Wet, dense, gray, fine to coarse GRAVEL, some fine to coarse sand, trace silt (GW-GM) [Lower Sand and Gravel] Terminated test boring at 32 ft bgs.
-12.9											
35											
-17.9											
40											
-22.9											
45											

Boring Number: 99-GEO-3

Client: USG
Project Name: Highway 99 PDI and Bench Scale Study
Project Location: Milton, Washington
Project Number: 251008

Drilling Contractor/Driller: Holt Services / R. Darling/ K. Osborne
Drilling Method/Casing/Core Barrel Size: HSA / 4 in /
Hammer Weight/Drop Height/ Spoon Size: 140 lbs lb / 30" in /2" in O.D.
Bore Hole Location: 702971.05, 1184706.97
Drilling Date: Start: 8/4/2020 **End:** 8/4/2020

Surface Elevation (ft.): 21.21
Total Depth (ft.): 32
Depth to Initial Water Level (ft):

Depth	Date	Time
8.5	8/4/2020	1340

Abandonment Method: Backfilled with bentonite chips
Logged By: H.Provinsal

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	PID (ppm)	XRF Reading (ppm)	Graphic Log	Strata	Material Description
21.2 0										Upper Sand and Gravel	
	SS	S-1	24	3 3 5 5	10	8	NA	7			Dry, loose, brown, fine to coarse SAND and SILT, little fine gravel (SM)
	SS	S-2	24	7 32 38 42	15	70	NA	12			Dry to moist, very dense, gray, fine to coarse SAND, some fine to coarse gravel, little silt (SM)
16.2 5	SS	S-3	24	13 26 20 19	16	46	NA	7			Moist, dense, gray, fine to coarse SAND, some fine to coarse gravel, little silt (SM)
▼	SS	S-4	24	1 1 1 1	9	2	NA			Sand and Silt	Moist to wet, soft, gray, SILT and fine to coarse SAND, little fine to coarse gravel (SM)
11.2 10	SS	S-5	24	3 8 6 6	16	14	NA				Wet, stiff, gray, SILT and fine to coarse SAND, little fine to coarse gravel (ML)
	SS	S-6	24	5 6 8 6	15	14	NA	40			Wet, stiff, brown, SILT and fine to coarse SAND (ML)
6.2	SS	S-7	24	2 4 5 6	19	9	NA	35			Wet, stiff, brown, SILT, some fine to coarse sand (ML)
15 1.2											

Sample Types

AS - Auger/Grab Sample
SC - Sonic Core
GP - Geoprobe
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample

Consistency vs Blowcount/Foot

Granular (Sand):

V. Loose:	0-4	Dense:	30-50
Loose:	4-10	V. Dense:	>50
M. Dense:	10-30		

Fine Grained (Clay):

V. Soft:	<2	Stiff:	8-15
Soft:	2-4	V. Stiff:	15-30
M. Stiff:	4-8	Hard:	>30

Burmister Classification

and	35-50%
some	20-35%
little	10-20%
trace	<10%

moisture, density, color

Reviewed by: M. Passaro | **Date: 11/1/2020** | **Boring Number: 99-GEO-3**

Boring Number: 99-GEO-3

Client: USG
Project Name: Highway 99 PDI and Bench Scale Study
Project Location: Milton, Washington
Project Number: 251008

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	PID (ppm)	XRF Reading (ppm)	Graphic Log	Strata	Material Description
1.2											
20	SS	S-8	24	6 14 18 16	24	32	NA	14		Sand and Silt	Wet, medium dense, brown, fine SAND, some silt (SM)
-3.8											
25	SS	S-9	24	WOH WOH WOH WOH	24	WOH	NA	24			Wet, very loose, brown, fine to medium SAND, some silt (SM)
-8.8											
30	SS	S-10	24	6 11 12 10	24	23	NA	5			Wet, medium dense, brown, fine to coarse SAND, some silt, trace fine gravel (SM)
-13.8											Termination of test boring at 32 ft bgs.
35											
-18.8											
40											
-23.8											
45											

CDM Smith

Test Pit Log

14432 SE Eastegate Way
Suite 100
Bellevue, WA 98007

Client:	USG Interiors	Contractor:	G. Smith/ IO Environmental	Test Pit No.	99-TP-1
Project Name:	Highway 99 Site	Equipment:	CAT 307.5 Backhoe	Logged By:	H. Provinsal
Project Location:	Milton, WA	Depth to Water:	NE	Date:	7/29/2020
Project Number:	251008	Ground Surface EL (ft):	21.68	Page:	1 of 1

DEPTH (feet)	SOIL DESCRIPTION	STRATA CHANGE	EXCAV. EFFORT
	Top 3" Asphalt	**Upper Sand**	
1	Dry, light brown, fine to coarse GRAVEL and fine to coarse SAND, little cobbles	**and Gravel**	**M**
2			
3			
	Moist, gray, fine to coarse SAND, some gravel, trace cobbles		**M**
4			
5			
6			
7			
8	Wet, gray, fine to coarse SAND, some gravel, trace cobbles		**M**
9	End of test pit at 8.5 ft bgs. Material collapsing in.		
10			
11			
12			

T.P. DIMENSIONS	
Width (ft):	3
Length (ft):	15
Depth (ft):	8.5
Vol (ft^3):	382.5

TEST PIT PLAN

Please refer to Figure 2-1 for test pit location.

COBBLE/BOULDER COUNT	
6 in-12 in:	50
12 in-18 in:	2
18 in-24 in:	0
24 in-30 in:	0

DESCRIPTION
and : 35 to 50 %
some : 20 to 35 %
little : 10 to 20 %
trace : 1 to 10 %

EXCAVATION EFFORT

E : Easy
M : Moderate
D : Difficult

Reviewed By: **M. Passaro** **11/1/2020**

Remarks: Test Pit Location: N: 702978.77 E: 1184690.21
Backfilled with spoils

CDM Smith

14432 SE Eastegate Way
Suite 100
Bellevue, WA 98007

Test Pit Log

Client:	USG Interiors	Contractor:	G. Smith/ IO Environmental	Test Pit No.	99-TP-2
Project Name:	Highway 99 Site	Equipment:	CAT 307.5 Backhoe	Logged By:	H. Provinsal
Project Location:	Milton, WA	Depth to Water:	NE	Date:	7/29/2020
Project Number:	251008	Ground Surface EL (ft):	22.10	Page:	1 of 1

DEPTH (feet)	SOIL DESCRIPTION	STRATA CHANGE	EXCAV. EFFORT
	Top 3" Asphalt	**Upper Sand and Gravel**	**M**
1	Dry, light brown, fine to coarse GRAVEL and fine to coarse SAND, little cobbles		
2			
3			
	Moist, gray, fine to coarse SAND, some gravel, trace cobbles		**M**
4			
	Cloth liner present across the test pit		
5			
6			
7			
8			**M**
9			
10			
	Moist, dark brown, fine to coarse SAND and SILT (Foul Odor, Fe Staining)	**Sand and Silt**	**H**
11			
	End of test pit at 11.0 ft bgs.		
12			

T.P. DIMENSIONS

Width (ft):	3
Length (ft):	15
Depth (ft):	11
Vol (ft^3):	495

TEST PIT PLAN

Please refer to Figure 2-1 for test pit location.

COBBLE/BOULDER COUNT

6 in-12 in:	50
12 in-18 in:	4
18 in-24 in:	0
24 in-30 in:	0

DESCRIPTION
and : 35 to 50 %
some : 20 to 35 %
little : 10 to 20 %
trace : 1 to 10 %

EXCAVATION EFFORT

E : Easy
M : Moderate
D : Difficult

Reviewed By: **M. Passaro** **11/1/2020**

Remarks: Test Pit Location: N: 703060.14 E: 1184721.74
Backfilled with spoils

CDM Smith

Test Pit Log

14432 SE Eastegate Way
Suite 100
Bellevue, WA 98007

Client:	USG Interiors	Contractor:	G. Smith/ IO Environmental	Test Pit No.	99-TP-3
Project Name:	Highway 99 Site	Equipment:	CAT 307.5 Backhoe	Logged By:	H. Provinsal
Project Location:	Milton, WA	Depth to Water:	NE	Date:	7/29/2020
Project Number:	251008	Ground Surface EL (ft):	21.21	Page:	1 of 1

DEPTH (feet)	SOIL DESCRIPTION	STRATA CHANGE	EXCAV. EFFORT
	Top 6" Concrete	**Upper Sand**	
1	Dry, light brown, fine to coarse GRAVEL and fine to coarse SAND, little cobbles	**and Gravel**	**M**
2			
3			
	Moist, gray, fine to coarse SAND, some gravel, trace cobbles		**M**
4			
5			
6			
7			
	Wet, gray, fine to coarse SAND, some gravel, trace cobbles		**M**
8			
	End of test pit at 8.0 ft bgs. Material collapsing in.		
9			
10			
11			
12			

T.P. DIMENSIONS	
Width (ft):	3
Length (ft):	15
Depth (ft):	8
Vol (ft^3):	360

TEST PIT PLAN

Please refer to Figure 2-1 for test pit location.

COBBLE/BOULDER COUNT	
6 in-12 in:	50
12 in-18 in:	4
18 in-24 in:	0
24 in-30 in:	0

DESCRIPTION
and : 35 to 50 %
some : 20 to 35 %
little : 10 to 20 %
trace : 1 to 10 %

EXCAVATION EFFORT

E : Easy
M : Moderate
D : Difficult

Reviewed By: **M. Passaro** **11/1/2020**

Remarks: Test Pit Location: N: 702996.15 E: 1184712.36
Backfilled with spoils

Appendix B

Field Investigation and Laboratory Photolog

APPENDIX B-1
FIELD INVESTIGATION PHOTOLOG

Picture Date:	Wednesday 07/29/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-TP-1 Top 3 ft of material

Picture Date:	Wednesday 07/29/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-TP-1 Material from 3 to 8.5 ft bgs

Picture Date:	Wednesday 07/29/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-TP-2

Picture Date:	Wednesday 07/29/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-TP-2

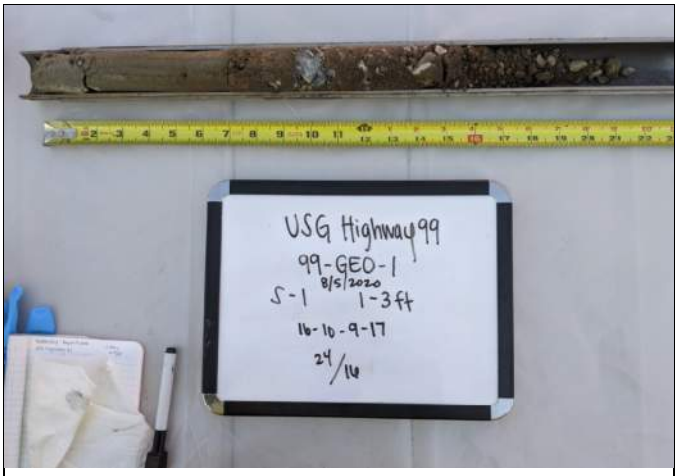
Picture Date:	Wednesday 07/29/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-TP-2 Top 3 ft of material

Picture Date:	Wednesday 07/29/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-TP-2 Material from 3 ft to 11 ft bgs

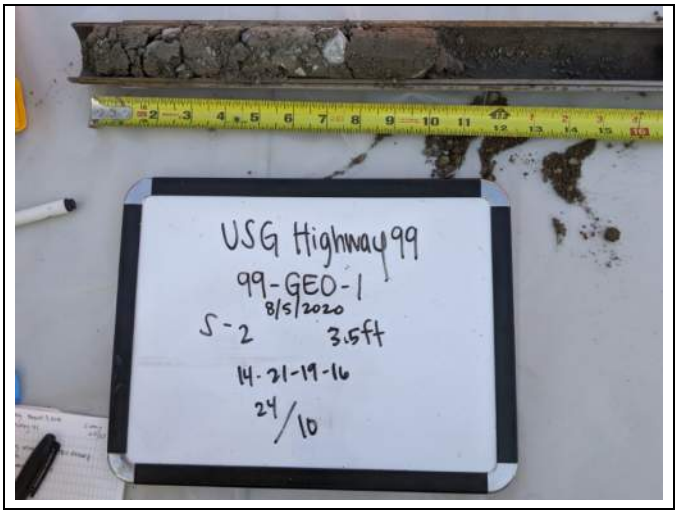
Picture Date:	Wednesday 07/29/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-TP-3

Picture Date:	Wednesday 07/29/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-TP-3

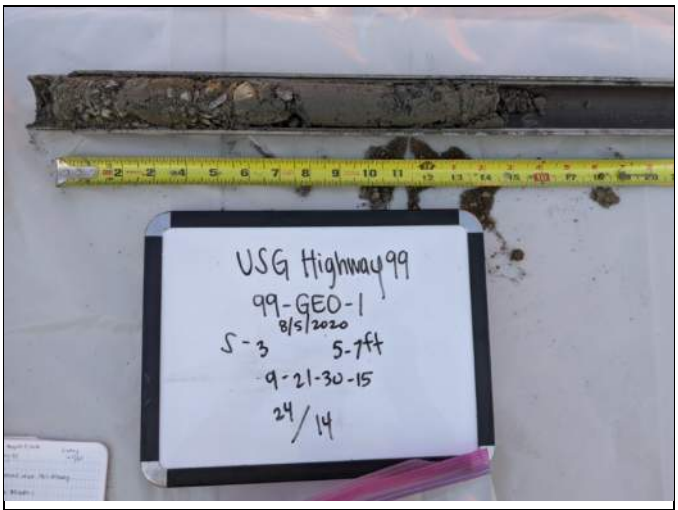
Picture Date:	Wednesday 07/29/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	Material from 99-TP-3



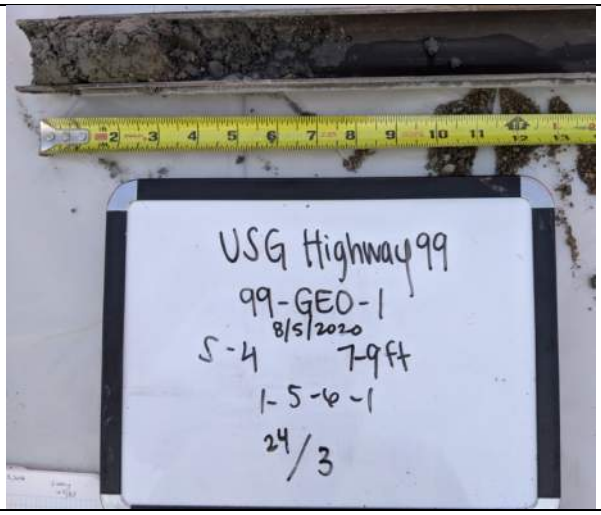
Picture Date:	Wednesday 08/5/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	Boring 99-GEO-1, S-1 (1-3 ft bgs)



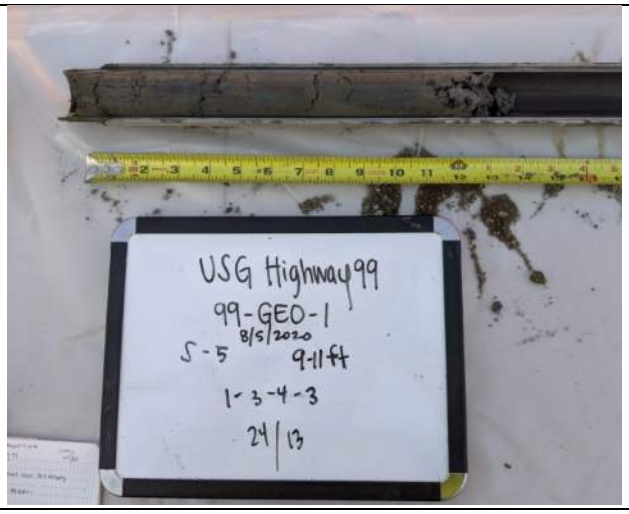
Picture Date:	Wednesday 08/5/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-GEO-1, S-2 (3.5 ft bgs)



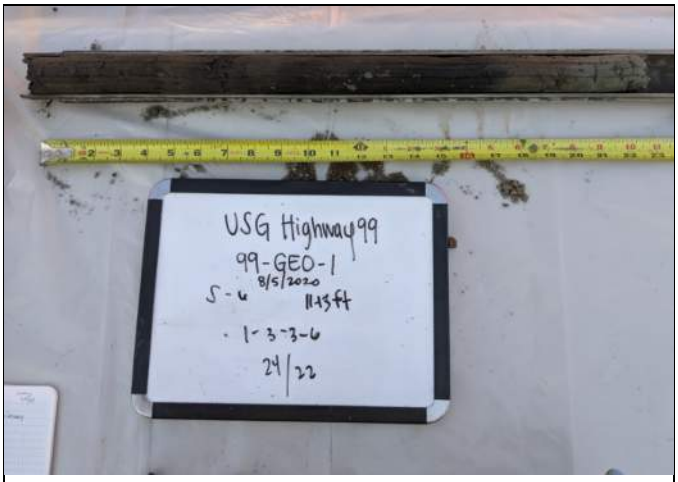
Picture Date:	Wednesday 08/5/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-GEO-1, S-3 (5-7 ft bgs)



Picture Date:	Wednesday 08/5/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-GEO-1, S-4 (7-9 ft bgs)



Picture Date:	Wednesday 08/5/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-GEO-1, S-5 (9-11 ft bgs)



Picture Date:	Wednesday 08/5/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-GEO-1, S-6 (11-13 ft bgs)

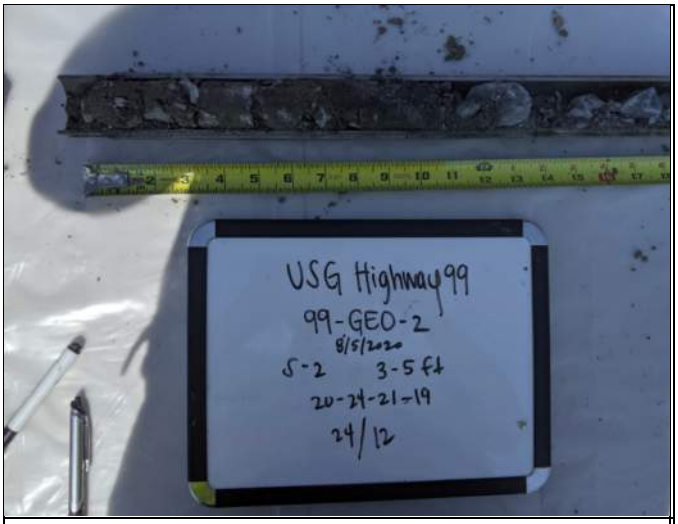
Picture Date:	Wednesday 08/5/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-GEO-1, S-7 (13-15 ft bgs)

Picture Date:	Wednesday 08/5/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-GEO-1, S-8 (20-22 ft bgs)

Picture Date:	Wednesday 08/5/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-GEO-1,S-9 (25-27 ft bgs)

Picture Date:	Wednesday 08/5/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-GEO-1, S-10 (30-32 ft bgs)

Picture Date:	Wednesday 08/5/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-GEO-2, S-1 (1-3 ft bgs)

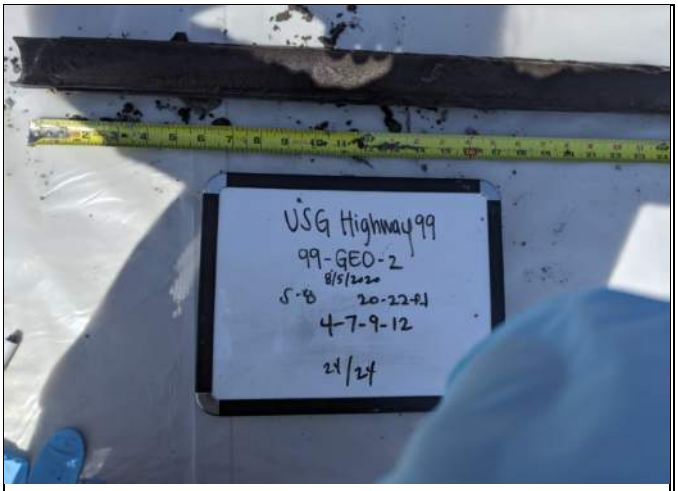


Picture Date:	Wednesday 08/5/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-GEO-2, S-2 (3-5 ft bgs)

Picture Date:	Wednesday 08/5/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-GEO-2, S-3 (5-7 ft bgs)

Picture Date:	Wednesday 08/5/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-GEO-2, S-4 (7-9 ft bgs)

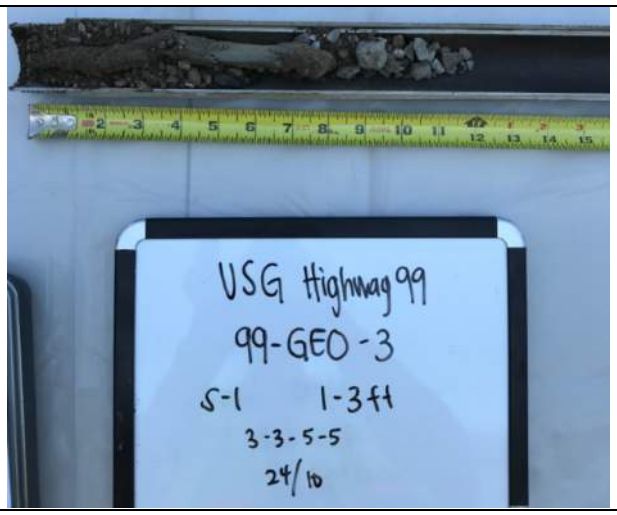
Picture Date:	Wednesday 08/5/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-GEO-2, S-6 (11-13 ft bgs)



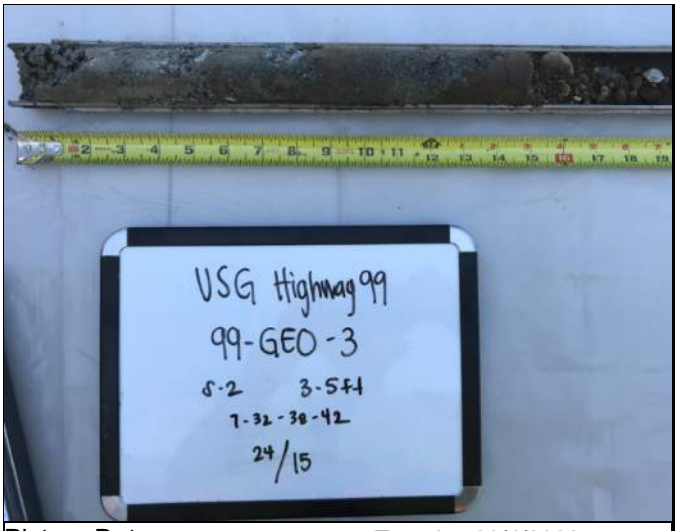
Picture Date:	Wednesday 08/5/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-GEO-2, S-8 (20-22 ft bgs)

Picture Date:	Wednesday 08/5/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-GEO-2, S-9 (25-27 ft bgs)

Picture Date:	Wednesday 08/5/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-GEO-2, S-10 (30-32 ft bgs)

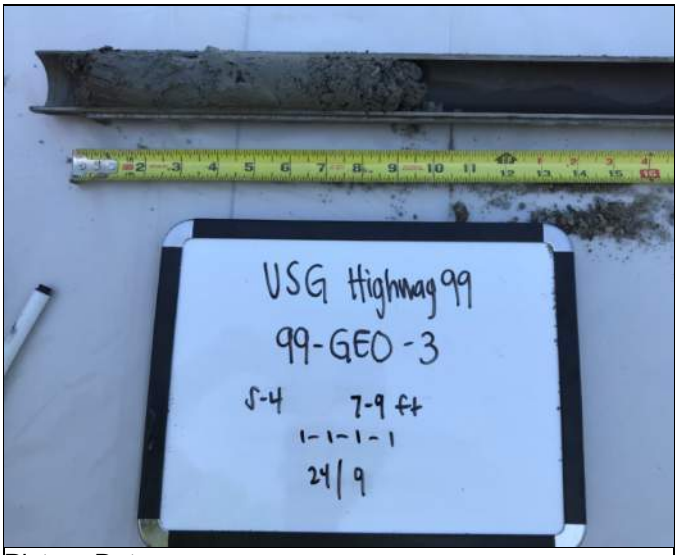


Picture Date:	Tuesday 08/4/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-GEO-3, S-1 (1-3 ft bgs)



Picture Date:	Tuesday 08/4/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-GEO-3, S-2 (3-5 ft bgs)

Picture Date:	Tuesday 08/4/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-GEO-3, S-3 (5-7 ft bgs)



Picture Date:	Tuesday 08/4/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-GEO-3, S-4 (7-9 ft bgs)

Picture Date:	Tuesday 08/4/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-GEO-3, S-5 (9-11 ft bgs)

Picture Date:	Tuesday 08/4/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-GEO-3, S-6 (11-13 ft bgs)

Picture Date:	Tuesday 08/4/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-GEO-3, S-7 (board mislabeled) (11-13 ft bgs)

Picture Date:	Tuesday 08/4/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-GEO-3, S-8 (20-22 ft bgs)

Picture Date:	Tuesday 08/4/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-GEO-3, S-9 (25-27 ft bgs)

Picture Date:	Tuesday 08/4/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-GEO-3, S-10 (30-32 ft bgs)

Picture Date:	Friday 08/7/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-BS-1, C-1 (0-5 ft bgs)

Picture Date:	Friday 08/7/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-BS-1, C-2 (5-10 ft bgs)

Picture Date:	Friday 08/7/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-BS-1, C-3 (10-15 ft bgs)

Picture Date:	Friday 08/7/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-BS-1, C-4 (15-20 ft bgs)

Picture Date:	Friday 08/7/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-BS-1, C-4 wood debris

Picture Date:	Friday 08/7/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-BS-1a, C-1 (10-15 ft bgs)

Picture Date:	Friday 08/7/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
,Description:	99-BS-2, C-1 (0-5 ft bgs)

Picture Date:	Friday 08/7/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-BS-2, C-2 (5-10 ft bgs)

Picture Date:	Friday 08/7/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-BS-2, C-4 (15 20 ft bgs)

Picture Date:	Friday 08/7/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-BS-2

Picture Date:	Friday 08/7/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-BS-3, C-1 (0-5 ft bgs)

Picture Date:	Friday 08/7/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-BS-3, C-2 (5-10 ft bgs)

Picture Date:	Friday 08/7/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-BS-3, C-3 (10-15 ft bgs)

Picture Date:	Friday 08/7/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-BS-3, C-3 coloration

Picture Date:	Friday 08/7/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-BS-3, C-4 (15-20 ft bgs)

Picture Date:	Friday 08/7/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-BS-3

Picture Date:	Friday 08/7/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-BS-4, C-1 (0-5 ft bgs)

Picture Date:	Friday 08/7/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-BS-4, C-2 (5-10 ft bgs)

Picture Date:	Friday 08/7/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Project Description:	99-BS-4, C-2 roots and coloration

Picture Date:	Friday 08/7/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-BS-4, C-3 (10-15 ft bgs)

Picture Date:	Friday 08/7/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-BS-4a, C-1 (5-10 ft bgs) (mislabeled in picture)

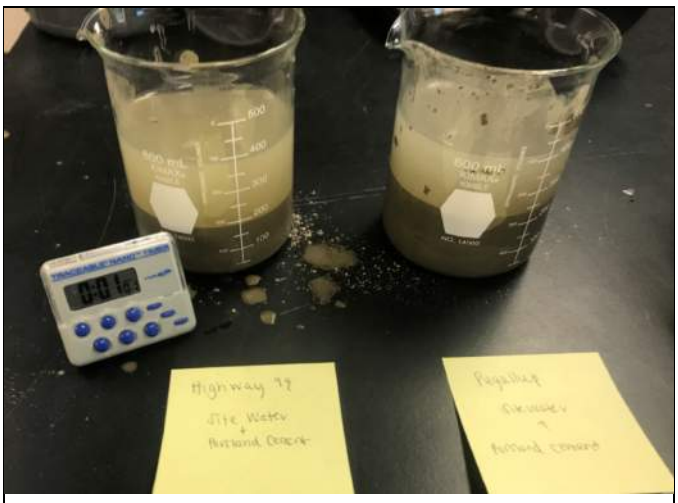
Picture Date:	Friday 08/7/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-BS-4a, C-2 coloration

Picture Date:	Friday 08/7/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Milton, Washington
Project Name:	USG Highway 99 Site
Description:	99-BS-4a, C-2 (10-15 ft bgs) (mislabeled in picture)

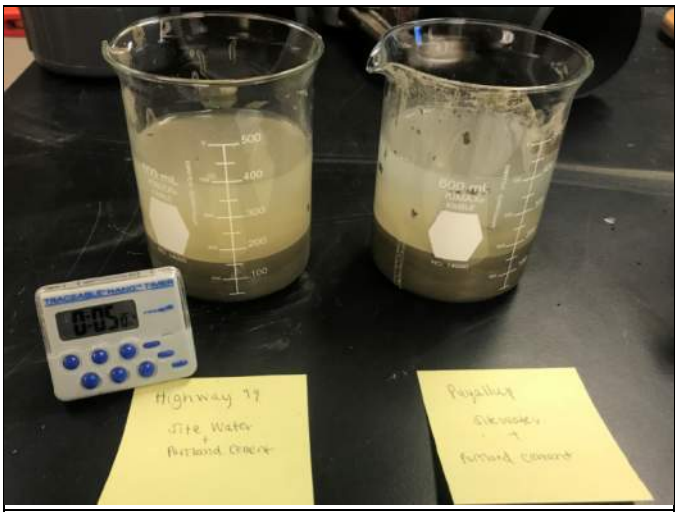
APPENDIX B-2
COMPATABILITY TESTING PHOTOLOG

Picture Date:	Tuesday 08/11/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Bellevue, Washington
Project Name:	USG Highway 99/Puyallup Sites
Project Description:	Highway 99 Site Initial Activation with Portland Cement and site water

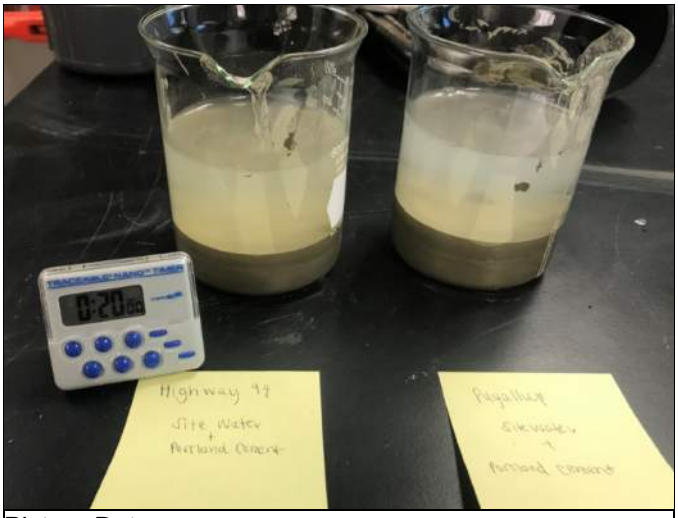
Picture Date:	Tuesday 08/11/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Bellevue, Washington
Project Name:	USG Highway 99/Puyallup Sites
Project Description:	Puyallup Site Initial Activation with Portland Cement and site water



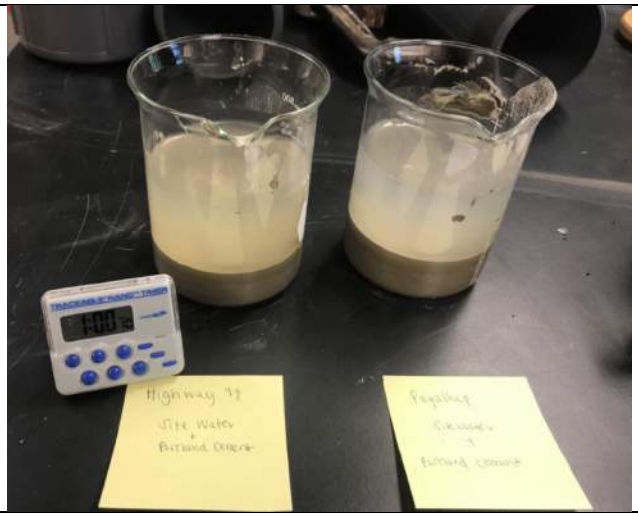
Picture Date:	Tuesday 08/11/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Bellevue, Washington
Project Name:	USG Highway 99/Puyallup Sites
Project Description:	Time passed = 1 minute Portland Cement and site water



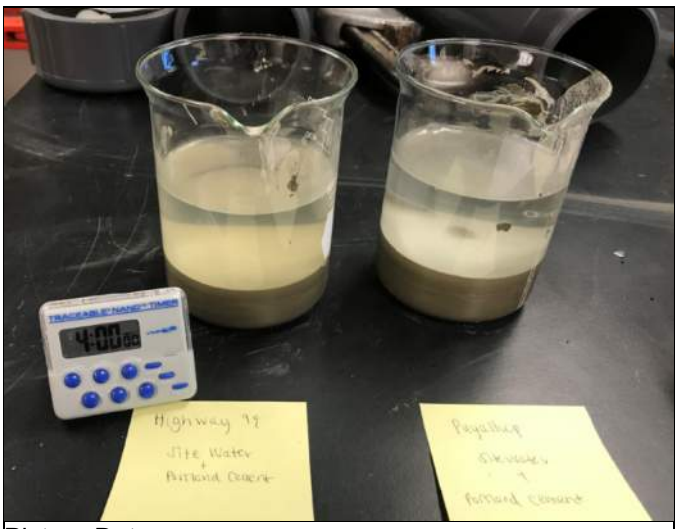
Picture Date:	Tuesday 08/11/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Bellevue, Washington
Project Name:	USG Highway 99/Puyallup Sites
Project Description:	Time Passed = 5 minutes Portland Cement and site water



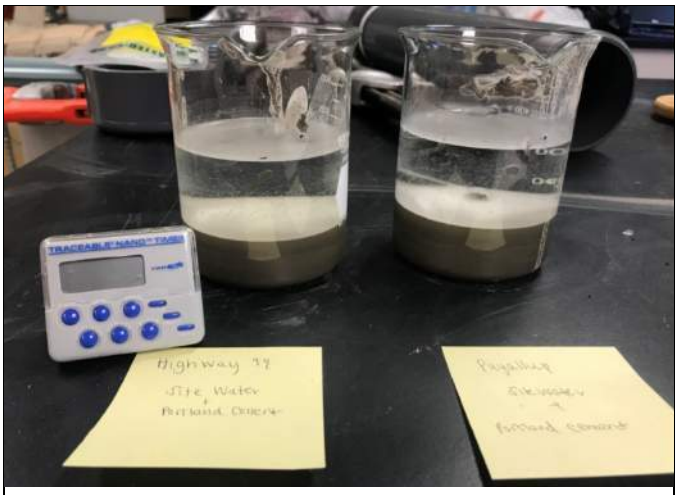
Picture Date:	Tuesday 08/11/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Bellevue, Washington
Project Name:	USG Highway 99/Puyallup Sites
Project Description:	Time Passed = 20 minutes Portland Cement and site water



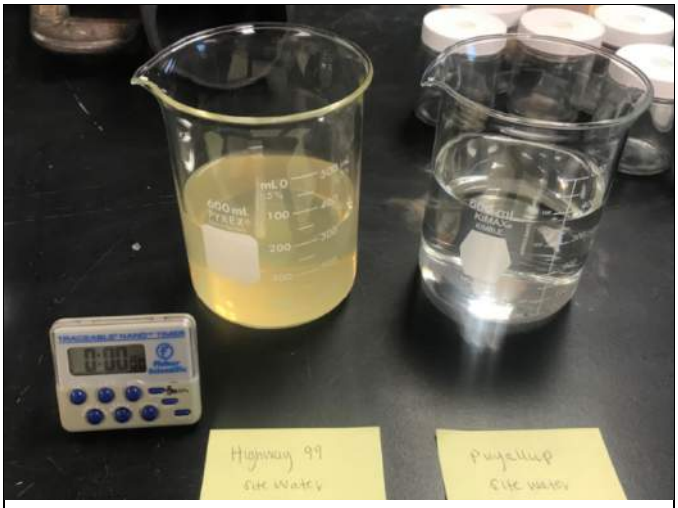
Picture Date:	Tuesday 08/11/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Bellevue, Washington
Project Name:	USG Highway 99/Puyallup Sites
Project Description:	Time Passed = 1 hour Portland Cement and site water



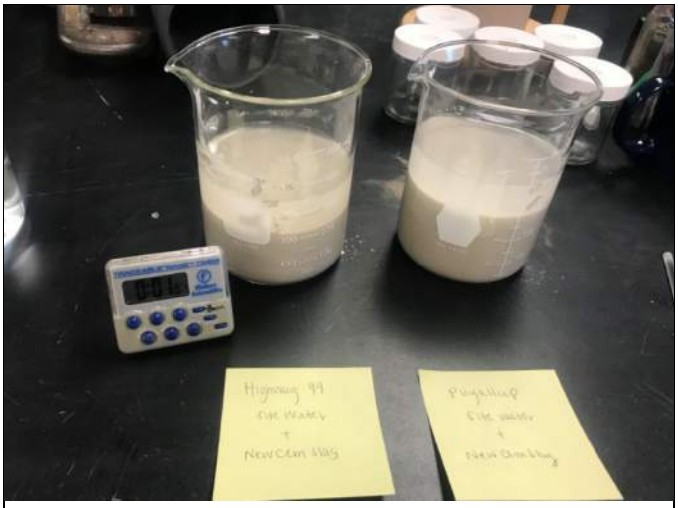
Picture Date:	Tuesday 08/11/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Bellevue, Washington
Project Name:	USG Highway 99/Puyallup Sites
Project Description:	Time Passed = 4 hours Portland Cement and site water



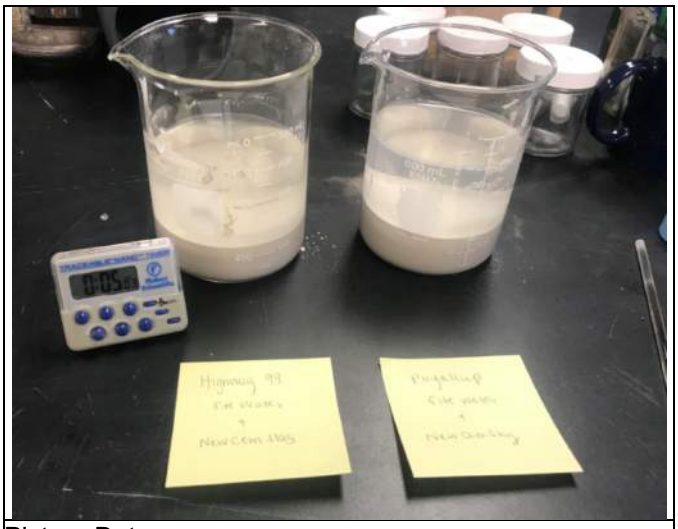
Picture Date:	Wednesday 08/12/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Bellevue, Washington
Project Name:	USG Highway 99/Puyallup Sites
Project Description:	Time Passed = 24 hours Portland Cement and site water



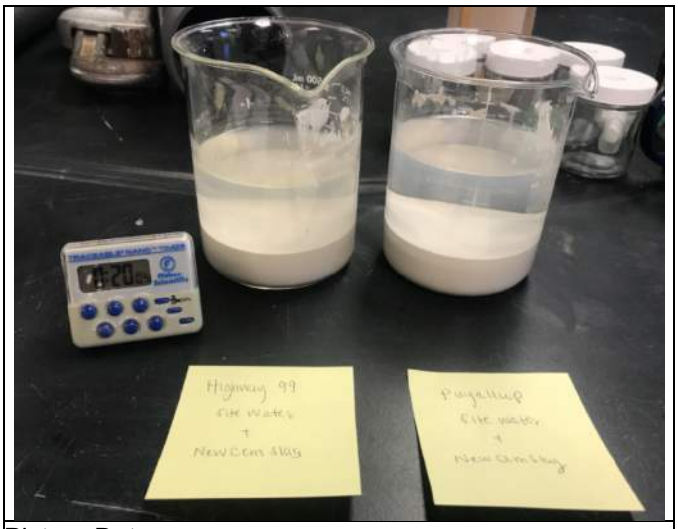
Picture Date:	Tuesday 08/11/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Bellevue, Washington
Project Name:	USG Highway 99/Puyallup Sites
Project Description:	Initial site water



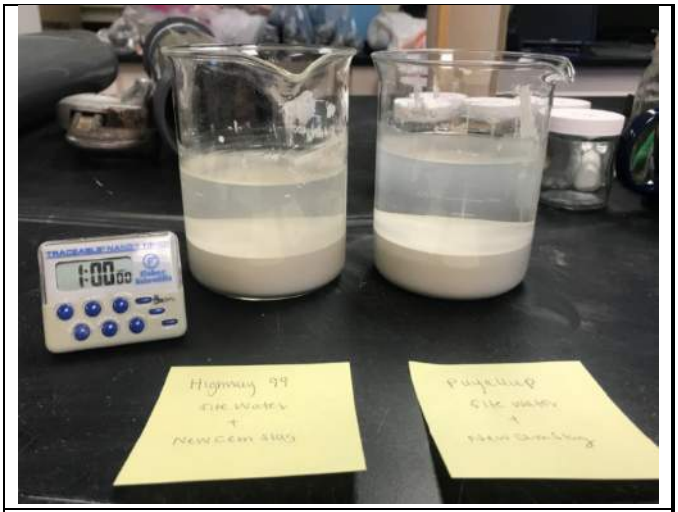
Picture Date:	Tuesday 08/11/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Bellevue, Washington
Project Name:	USG Highway 99/Puyallup Sites
Project Description:	Time passed = 1 minute NewCem Slag and site water



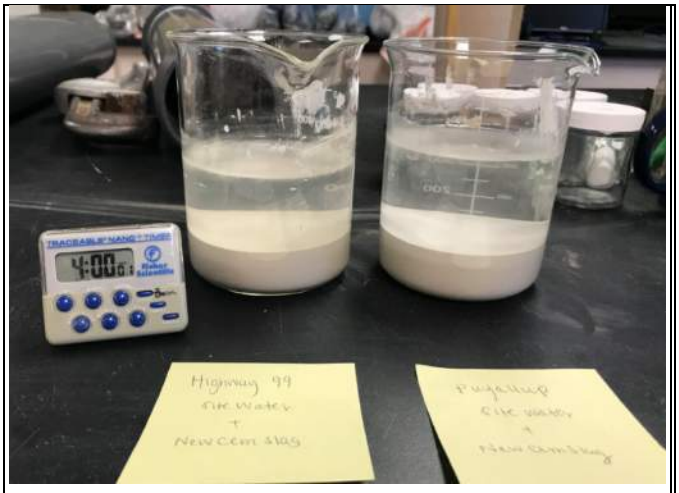
Picture Date:	Tuesday 08/11/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Bellevue, Washington
Project Name:	USG Highway 99/Puyallup Sites
Project Description:	Time passed = 5 minute NewCem Slag and site water



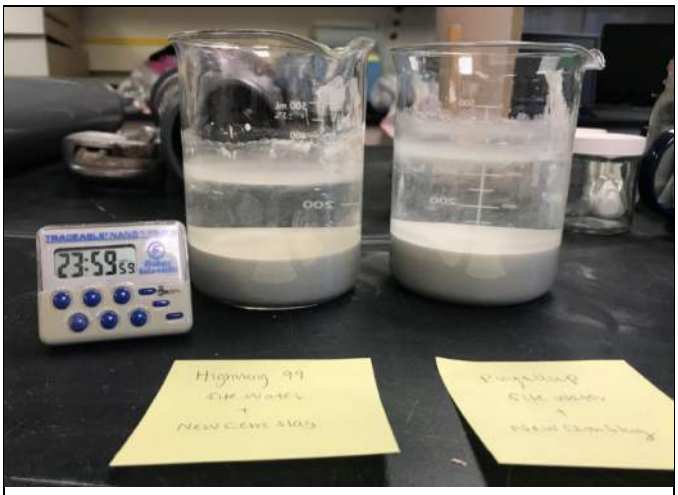
Picture Date:	Tuesday 08/11/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Bellevue, Washington
Project Name:	USG Highway 99/Puyallup Sites
Project Description:	Time passed = 20 minute NewCem Slag and site water



Picture Date:	Tuesday 08/11/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Bellevue, Washington
Project Name:	USG Highway 99/Puyallup Sites
Project Description:	Time passed = 1 hour NewCem Slag and site water



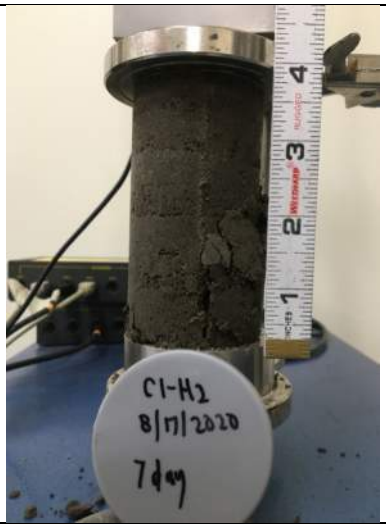
Picture Date:	Tuesday 08/11/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Bellevue, Washington
Project Name:	USG Highway 99/Puyallup Sites
Project Description:	Time passed = 4 hours NewCem Slag and site water



Picture Date:	Wednesday 08/12/2020
Picture Taken By:	Haley Provinsal
Picture Location:	Bellevue, Washington
Project Name:	USG Highway 99/Puyallup Sites
Project Description:	Time passed = 24 hours NewCem Slag and site water

APPENDIX B-3
UCS LABORATORY TESTING PHOTOLOG

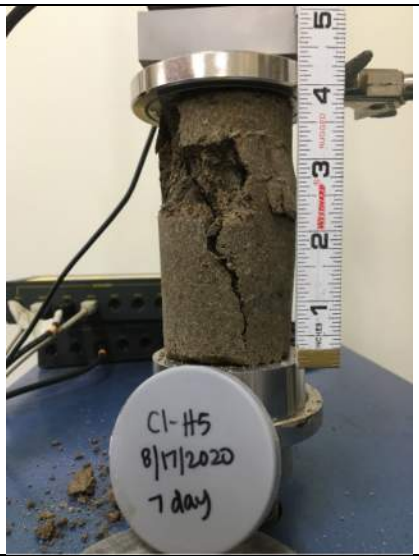
Picture Date:	Monday 08/24/2020
Picture Taken By:	Matt Polsky
Picture Location:	Chelmsford, Massachusetts
Project Name:	USG Highway 99 Site
Project Description:	C1-H1 UCS 7-day break



Picture Date:	Monday 08/24/2020
Picture Taken By:	Matt Polsky
Picture Location:	Chelmsford, Massachusetts
Project Name:	USG Highway 99 Site
Project Description:	C1-H2 UCS 7-day break

Picture Date:	Monday 08/24/2020
Picture Taken By:	Matt Polsky
Picture Location:	Chelmsford, Massachusetts
Project Name:	USG Highway 99 Site
Project Description:	C1-H3 UCS 7-day break

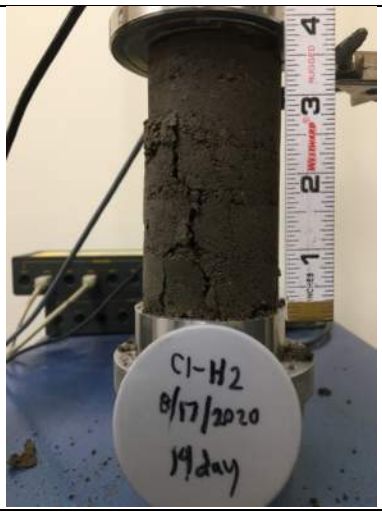
Picture Date:	Monday 08/24/2020
Picture Taken By:	Matt Polsky
Picture Location:	Chelmsford, Massachusetts
Project Name:	USG Highway 99 Site
Project Description:	C1-H4 UCS 7-day break



Picture Date:	Monday 08/24/2020
Picture Taken By:	Matt Polsky
Picture Location:	Chelmsford, Massachusetts
Project Name:	USG Highway 99 Site
Project Description:	C1-H5 UCS 7-day break

Picture Date:	Monday 08/24/2020
Picture Taken By:	Matt Polsky
Picture Location:	Chelmsford, Massachusetts
Project Name:	USG Highway 99 Site
Project Description:	C1-H6 UCS 7-day break

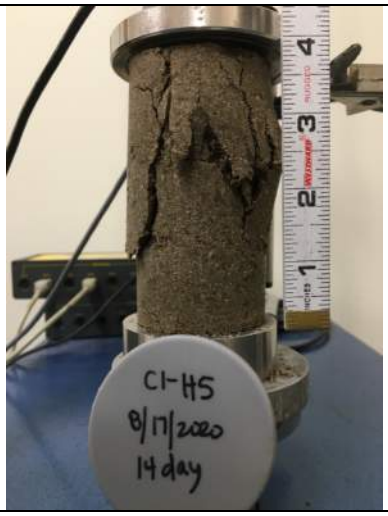
Picture Date:	Monday 08/31/2020
Picture Taken By:	Matt Polsky
Picture Location:	Chelmsford, Massachusetts
Project Name:	USG Highway 99 Site
Project Description:	C1-H1 UCS 14-day break



Picture Date:	Monday 08/31/2020
Picture Taken By:	Matt Polsky
Picture Location:	Chelmsford, Massachusetts
Project Name:	USG Highway 99 Site
Project Description:	C1-H2 UCS 14-day break

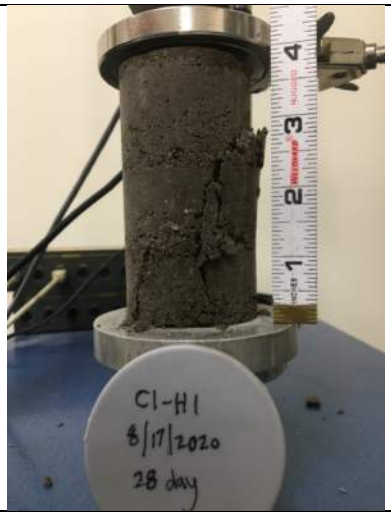
Picture Date:	Monday 08/31/2020
Picture Taken By:	Matt Polsky
Picture Location:	Chelmsford, Massachusetts
Project Name:	USG Highway 99 Site
Project Description:	C1-H3 UCS 14-day break

Picture Date:	Monday 08/31/2020
Picture Taken By:	Matt Polsky
Picture Location:	Chelmsford, Massachusetts
Project Name:	USG Highway 99 Site
Project Description:	C1-H4 UCS 14-day break

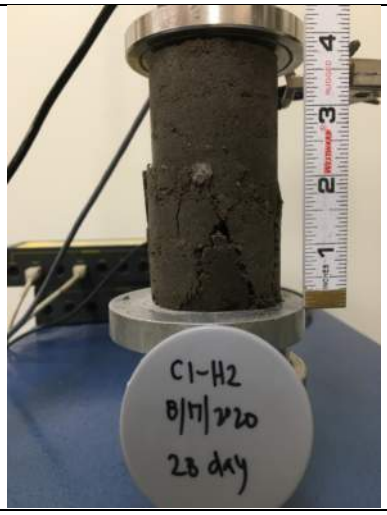


Picture Date:	Monday 08/31/2020
Picture Taken By:	Matt Polsky
Picture Location:	Chelmsford, Massachusetts
Project Name:	USG Highway 99 Site
Project Description:	C1-H5 UCS 14-day break

Picture Date:	Monday 08/31/2020
Picture Taken By:	Matt Polsky
Picture Location:	Chelmsford, Massachusetts
Project Name:	USG Highway 99 Site
Project Description:	C1-H6 UCS 14-day break



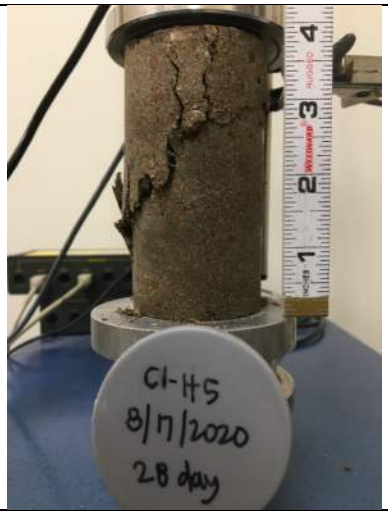
Picture Date:	Monday 09/14/2020
Picture Taken By:	Matt Polsky
Picture Location:	Chelmsford, Massachusetts
Project Name:	USG Highway 99 Site
Project Description:	C1-H1 UCS 28-day break



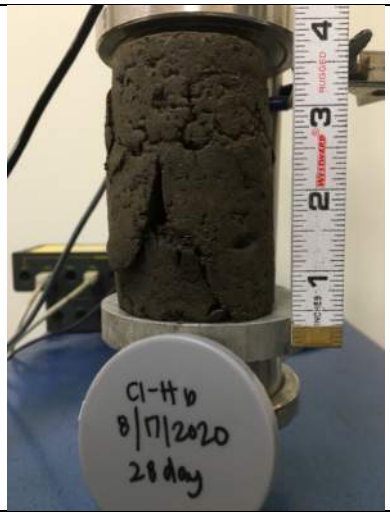
Picture Date:	Monday 09/14/2020
Picture Taken By:	Matt Polsky
Picture Location:	Chelmsford, Massachusetts
Project Name:	USG Highway 99 Site
Project Description:	C1-H2 UCS 28-day break

Picture Date:	Monday 09/14/2020
Picture Taken By:	Matt Polsky
Picture Location:	Chelmsford, Massachusetts
Project Name:	USG Highway 99 Site
Project Description:	C1-H3 UCS 28-day break

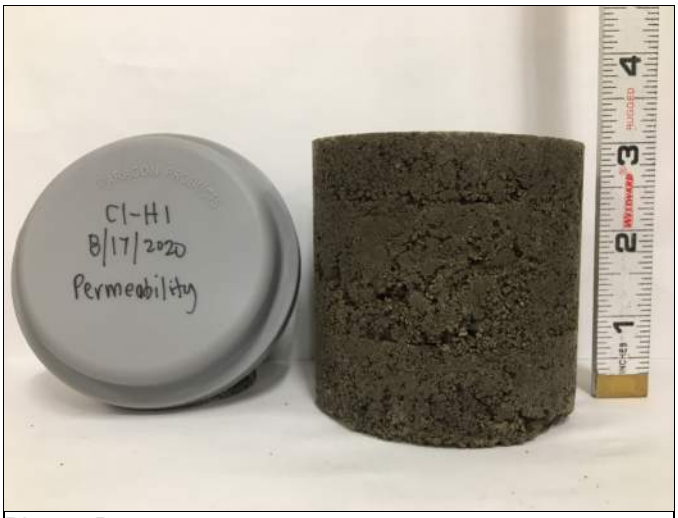
Picture Date:	Monday 09/14/2020
Picture Taken By:	Matt Polsky
Picture Location:	Chelmsford, Massachusetts
Project Name:	USG Highway 99 Site
Project Description:	C1-H4 UCS 28-day break



Picture Date:	Monday 09/14/2020
Picture Taken By:	Matt Polsky
Picture Location:	Chelmsford, Massachusetts
Project Name:	USG Highway 99 Site
Project Description:	C1-H5 UCS 28-day break



Picture Date:	Monday 09/14/2020
Picture Taken By:	Matt Polsky
Picture Location:	Chelmsford, Massachusetts
Project Name:	USG Highway 99 Site
Project Description:	C1-H6 UCS 28-day break



Picture Date:	Tuesday 09/8/2020
Picture Taken By:	Matt Polsky
Picture Location:	Chelmsford, Massachusetts
Project Name:	USG Highway 99 Site
Project Description:	C1-H1 Permeability Test

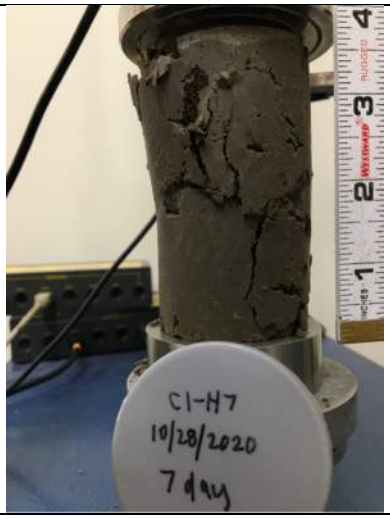
Picture Date:	Tuesday 09/8/2020
Picture Taken By:	Matt Polsky
Picture Location:	Chelmsford, Massachusetts
Project Name:	USG Highway 99 Site
Project Description:	C1-H2 Permeability Test

Picture Date:	Tuesday 09/8/2020
Picture Taken By:	Matt Polsky
Picture Location:	Chelmsford, Massachusetts
Project Name:	USG Highway 99 Site
Project Description:	C1-H3 Permeability Test

Picture Date:	Tuesday 09/8/2020
Picture Taken By:	Matt Polsky
Picture Location:	Chelmsford, Massachusetts
Project Name:	USG Highway 99 Site
Project Description:	C1-H4 Permeability Test

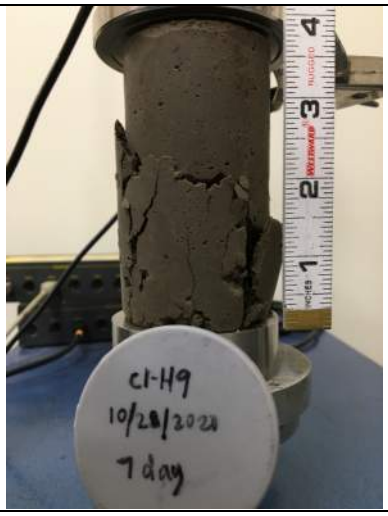
Picture Date:	Wednesday 09/9/2020
Picture Taken By:	Matt Polsky
Picture Location:	Chelmsford, Massachusetts
Project Name:	USG Highway 99 Site
Project Description:	C1-H5 Permeability Test

Picture Date:	Wednesday 09/9/2020
Picture Taken By:	Matt Polsky
Picture Location:	Chelmsford, ıssachusetts
Project Name:	USG Highway 99 Site
Project Description:	C1-H6 Permeability Test



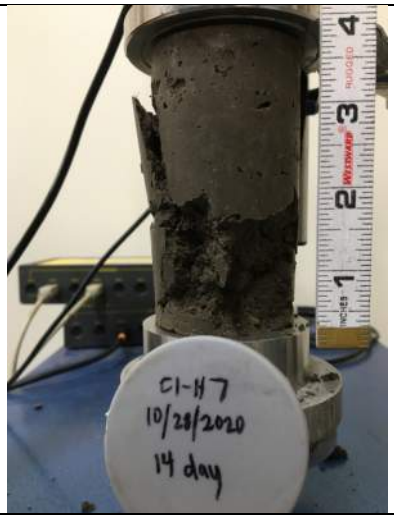
Picture Date:	Wednesday 11/4/2020
Picture Taken By:	Matt Polsky
Picture Location:	Chelmsford, Massachusetts
Project Name:	USG Highway 99 Site
Project Description:	C1-H7 UCS 7-day Break

Picture Date:	Wednesday 11/4/2020
Picture Taken By:	Matt Polsky
Picture Location:	Chelmsford, Massachusetts
Project Name:	USG Highway 99 Site
Project Description:	C1-H8 UCS 7-day Break

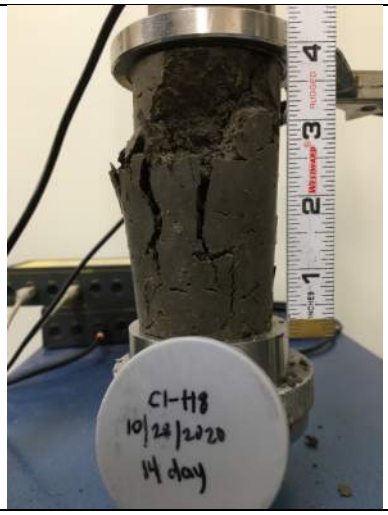


Picture Date:	Wednesday 11/4/2020
Picture Taken By:	Matt Polsky
Picture Location:	Chelmsford, Massachusetts
Project Name:	USG Highway 99 Site
Project Description:	C1-H9 UCS 7-day Break

Picture Date:	Wednesday 11/4/2020
Picture Taken By:	Matt Polsky
Picture Location:	Chelmsford, Massachusetts
Project Name:	USG Highway 99 Site
Project Description:	C1-H10 UCS 7-day Break



Picture Date:	Wednesday 11/11/2020
Picture Taken By:	Matt Polsky
Picture Location:	Chelmsford, Massachusetts
Project Name:	USG Highway 99 Site
Project Description:	C1-H7 UCS 14-day Break



Picture Date:	Wednesday 11/11/2020
Picture Taken By:	Matt Polsky
Picture Location:	Chelmsford, Massachusetts
Project Name:	USG Highway 99 Site
Project Description:	C1-H8 UCS 14-day Break

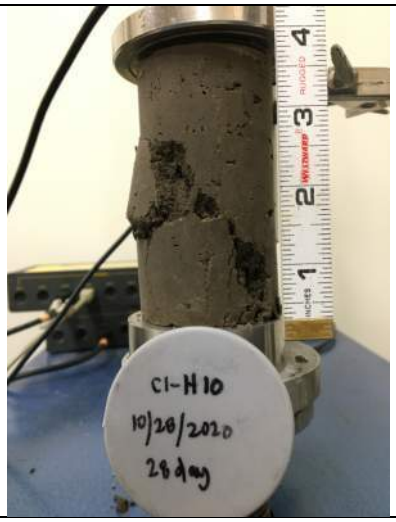
Picture Date:	Wednesday 11/11/2020
Picture Taken By:	Matt Polsky
Picture Location:	Chelmsford, Massachusetts
Project Name:	USG Highway 99 Site
Project Description:	C1-H9 UCS 14-day Break

Picture Date:	Wednesday 11/11/2020
Picture Taken By:	Matt Polsky
Picture Location:	Chelmsford, Massachusetts
Project Name:	USG Highway 99 Site
Project Description:	C1-H10 UCS 14-day Break

Picture Date:	Wednesday 11/25/2020
Picture Taken By:	Matt Polsky
Picture Location:	Chelmsford, Massachusetts
Project Name:	USG Highway 99 Site
Project Description:	C1-H7 28-day Break

Picture Date:	Wednesday 11/25/2020
Picture Taken By:	Matt Polsky
Picture Location:	Chelmsford, Massachusetts
Project Name:	USG Highway 99 Site
Project Description:	C1-H8 28-day Break

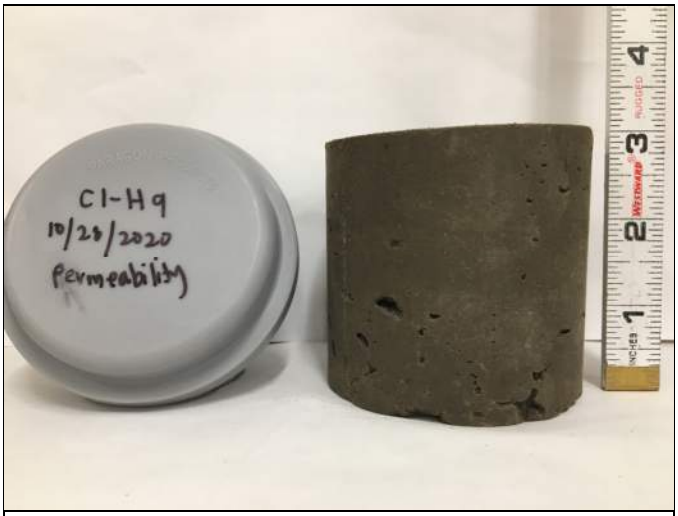
Picture Date:	Wednesday 11/25/2020
Picture Taken By:	Matt Polsky
Picture Location:	Chelmsford, Massachusetts
Project Name:	USG Highway 99 Site
Project Description:	C1-H9 28-day Break



Picture Date:	Wednesday 11/25/2020
Picture Taken By:	Matt Polsky
Picture Location:	Chelmsford, Massachusetts
Project Name:	USG Highway 99 Site
Project Description:	C1-H10 28-day Break

Picture Date:	Thursday 11/19/2020
Picture Taken By:	Matt Polsky
Picture Location:	Chelmsford, Massachusetts
Project Name:	USG Highway 99 Site
Project Description:	C1-H7 Permeability Test

Picture Date:	Friday 11/20/2020
Picture Taken By:	Matt Polsky
Picture Location:	Chelmsford, Massachusetts
Project Name:	USG Highway 99 Site
Project Description:	C1-H8 Permeability Test



Picture Date:	Friday 11/20/2020
Picture Taken By:	Matt Polsky
Picture Location:	Chelmsford, Massachusetts
Project Name:	USG Highway 99 Site
Project Description:	C1-H9 Permeability Test

Picture Date:	Wednesday 11/25/2020
Picture Taken By:	Matt Polsky
Picture Location:	Chelmsford, Massachusetts
Project Name:	USG Highway 99 Site
Project Description:	C1-H10 Permeability Test

Appendix C

Site Survey

MILTON SITE: WELL LOCATIONS

ASBUILT SURVEY

THE NORTHWEST QUARTER AND THE SOUTHWEST QUARTER OF THE SOUTHWEST QUARTER OF SECTION 5, TOWNSHIP 20 NORTH, RANGE 04 EAST, W.M.

PIERCE COUNTY, WASHINGTON

HORIZONTAL DATUM

NAD '83, '11, WASHINGTON COORDINATE SYSTEM SOUTH ZONE.
BASED ON RTK GPS MEASUREMENTS CONSTRAINED TO THE WASHINGTON STATE REFERENCE NETWORK.

VERTICAL DATUM

NAVD '88 BASED ON RTK GPS MEASUREMENTS CONSTRAINED TO THE WASHINGTON STATE REFERENCE NETWORK AND GEOID 2012 MODEL.

METHODS AND EQUIPMENT

SURVEY PERFORMED WITH A 1" TOPCON TOTAL STATION, USING TRAVERSE AND RADIAL STAKEOUT METHODS AND GPS OBSERVATIONS WITH A TOPCON HYPER LITE GPS RECEIVER UTILIZING RTK METHODS AND THE WASHINGTON STATE REFERENCE NETWORK. SURVEY MEETS OR EXCEEDS ACCURACY REQUIREMENTS CONTAINED IN W.A.C. 332-130-090.

REFERENCES

1. BASE MAP BY WW, PACIFIC HAMED, USE, HWY 99 REGIONAL INVESTIGATION, SURVEY UNDER APEX JOB #180702 AND DRAWING NAME: 30146-SURV-TPOI.
2. MILTON SHORT PLAT, AF#9011070432–A.H.R. ENGINEERS, INC. RECORDS OF PIERCE COUNTY, WA
3. RIGHT-OF-WAY PLAT, CITY OF MILTON LOT LINE ADJUSTMENT AF#9111270607
4. BASELINE, RECORDS OF PIERCE COUNTY, WA NOVEMBER 27, 1991

SURVEY NOTES

1. DATA FOR THIS SURVEY WAS GATHERED BY FIELD TRAVERSE UTILIZING ELECTRONIC DATA COLLECTION ON 12-7-2018.
2. THE PURPOSE OF THIS SURVEY IS TO PROVIDE A AS-BUILT BASE MAP OF THE EXISTING MONITORING WELLS
3. ALL DISTANCES AND DIMENSIONS SHOWN ARE U.S. SURVEY FEET GROUND MEASUREMENTS.

NEW MONITORING WELL TABLE

NUMBER	NORTH	EAST	LATITUDE	LONGITUDE	ELEVATION	DESC
M2	702961.20	1184704.51	N47.246419	W122.334956	21.63 N. RIM	MONITORING WELL
AS2	702966.44	1184701.03	N47.246433	W122.334971	21.49 N. RIM	MONITORING WELL
INJ2	702968.85	1184686.45	N47.246474	W122.335028	21.59 N. RIM	MONITORING WELL
M1	702967.12	1184682.12	N47.246468	W122.335048	21.66 N. RIM	MONITORING WELL
INJ1	702967.36	1184698.52	N47.246490	W122.334991	21.81 N. RIM	MONITORING WELL
AS1	702967.81	1184699.53	N47.246492	W122.334979	21.75 N. RIM	MONITORING WELL
M3	702970.51	1184708.68	N47.246514	W122.334946	21.98 N. RIM	MONITORING WELL
M4	702971.51	1184708.99	N47.246519	W122.334939	21.76 N. RIM	MONITORING WELL
MW-2	702989.56	1184652.71	N47.246521	W122.335168	22.76 N. RIM	NEW WELL VALUE
MW-1	702988.27	1184672.58	N47.246443	W122.335071	23.31 N. RIM	NEW WELL VALUE
MW-9	702988.07	1184715.80	N47.246493	W122.334913	21.50 N. RIM	NEW WELL VALUE
MW-99-1	702978.95	1184715.54	N47.246468	W122.334913	21.66 N. RIM	NEW WELL VALUE

* MONITORING WELLS MW-2, MW-9, MW-99-1 AND MW-7 ARE EXISTING WELLS. CLIENT REQUESTED THAT APEX UPDATE THE WELLS WITH NEW VALUES BASED ON THE CURRENT SURVEY.

LEGEND

- SURVEY CONTROL– REBAR
- SURVEY CONTROL– PK NAIL
- SURVEY MONUMENT
- MONITOR WELL
- SEDIMENT & SW SAMPLE
- BORING
- SOIL SAMPLE
- CHAIN LINK FENCE
- PROPERTY LINE
- CENTERLINE
- 1' CONTOUR
- 5' CONTOUR
- MONITORING WELL SURVEYED BY APEX–12/7/18

GRAPHIC SCALE
20 0 10 20 40
(IN FEET)
1 inch = 20 ft.

APEX

REV NO	REVISION DESCRIPTION	DATE	BY

Apex Engineering PLLC
2601 South 35th, Suite 200
Tacoma, Washington 98409–7319
(253) 475-4464 FAX: (253) 475-9599

TITLE

MILTON SITE
7110 PACIFIC HIGHWAY E
MILTON, WA

CLIENT

CDM SMITH
14432 SE EASTGATE WAY, SUITE 100
BELLEVUE, WA 98007
ATTN: PAMELA J. MORRILL

DATE SEALED 12/13/18

TIMOTHY J. MONTGOMERY
STATE OF WASHINGTON
45792
REGISTERED
PROFESSIONAL LAND SURVEYOR

PROJECT MANAGER JM
DESIGN
DRAWN DAB
CHECKED
SEC 05 T 20 R 04
FILE NO 34642-C30.dwg
DATE 12/11/2018
SCALE 1"=20'

SHEET 1 OF 1
FILE NO 34642.00

I:\34642 CDM Smith Milton Site\Survey\34642-C30.dwg

Appendix D

Geotechnical Laboratory Test Results

CDM Smith Geotechnical Laboratory Testing Summary Sheet

Client: USG | Project Number: 19921-251008 | Reviewed By: M. Polsky - Lab Manager

Project Name: Highway 99 | Task: Task 3

Project Location: Milton, WA | Assigned By: M. Passaro/H. Provinsal | Date Reviewed: 9/10/2020

Sample Date	Boring Number	Sample	Depth (ft)	Identification Tests								Strength Tests				Soil Description
				Water Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	Dry unit wt. pcf	$\bar{\sigma}_c$ psi	Failure Criteria (CIU)	$\sigma_1 - \sigma_3$ or τ psi	Strain %	
8/5/2020	99-GEO-1	S-2	3-5	5.7			44.6	30.1	25.3							Gray silty gravel with sand
8/5/2020	99-GEO-1	S-4	7-9	12.2			34.0	32.9	33.1							Gray silty gravel with sand
8/5/2020	99-GEO-1	S-5	9-11	29.1	47	28				1.1						Gray silt with sand
8/5/2020	99-GEO-1	S-7	13-15	27.2			0.0	55.3	44.7							Dark gray silty sand
8/5/2020	99-GEO-1	S-8a	20-22	23.3			0.0	89.7	10.3							Dark gray poorly graded sand with silt
8/5/2020	99-GEO-1	S-9	25-27	40.3	36	24	0.0	3.3	96.7							Gray lean clay
8/5/2020	99-GEO-1	S-10	30-32	10.9			46.8	43.3	9.9							Gray-brown well-graded gravel with silt and sand
8/5/2020	99-GEO-2	S-4	7-9	12.7			38.6	39.2	22.2							Gray silty sand with gravel
8/5/2020	99-GEO-2	S-6	11-13	26.3			1.0	16.3	82.7							Brown silt with sand
8/5/2020	99-GEO-2	S-8	20-22	20.6			1.2	85.0	13.8							Dark brown silty sand
8/5/2020	99-GEO-2	S-9	25-27	25.9			0.8	82.9	16.3							Gray silty sand
8/4/2020	99-GEO-3	S-1	1-3	13.7			18.9	44.9	36.2							Brown silty sand with gravel
8/4/2020	99-GEO-3	S-4	7-9	27.3			21.8	38.3	39.9							Gray-brown silty sand with gravel
8/4/2020	99-GEO-3	S-7	13-15	28.1			0.0	21.9	78.1							Dark brown silt with sand
8/4/2020	99-GEO-3	S-8	20-22	27.9			0.0	73.8	26.2							Dark gray silty sand
8/4/2020	99-GEO-3	S-9	25-27	22.4	NP	NP	0.0	73.9	26.1							Dark gray silty sand

CDM Smith Geotechnical Laboratory Testing Summary Sheet

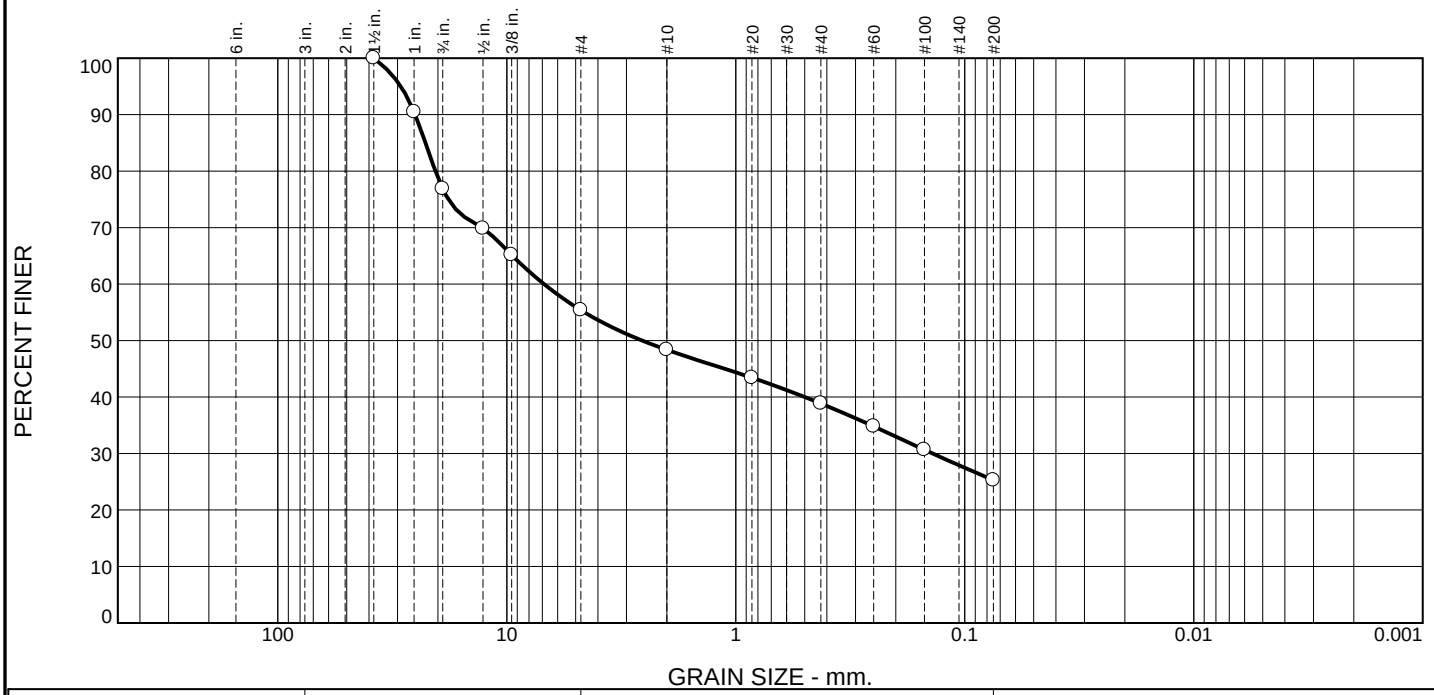
Client: USG | Project Number: 19921-251008 | Reviewed By: M. Polsky - Lab Manager

Project Name: Highway 99 | Task: Task 3

Project Location: Milton, WA | Assigned By: M. Passaro/H. Provinsal | Date Reviewed: 9/28/2020

Sample Date	Boring Number	Sample	Depth (ft)	Identification Tests									Strength Tests			Soil Description
				Water Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	Dry unit wt. pcf	Specific Gravity	Failure Criteria (CIU)	$\sigma_1 - \sigma_3$ or τ psi	Strain %	
8/5/2020	Composite		N/A	39.1			0.8	56.7	42.5		77.2	2.603				Gray-brown silty sand with organics

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	23.1	21.5	7.0	9.5	13.6	25.3	

Test Results (ASTM D6913 & ASTM D1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.5"	100.0		
1"	90.5		
0.75"	76.9		
0.5"	69.9		
0.375"	65.2		
#4	55.4		
#10	48.4		
#20	43.4		
#40	38.9		
#60	34.8		
#100	30.6		
#200	25.3		

* (no specification provided)

Material Description

Gray silty gravel with sand

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= GM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 25.1239 D_{85}= 22.6558 D_{60}= 6.8825
D_{50}= 2.5634 D_{30}= 0.1383 D_{15}=
D_{10}= C_u= C_c=

Remarks

As received MC = 5.7%

Date Received: 8/28/2020 **Date Tested:** 9/3/2020

Tested By: AS/MP

Checked By: MP

Title: Laboratory Manager

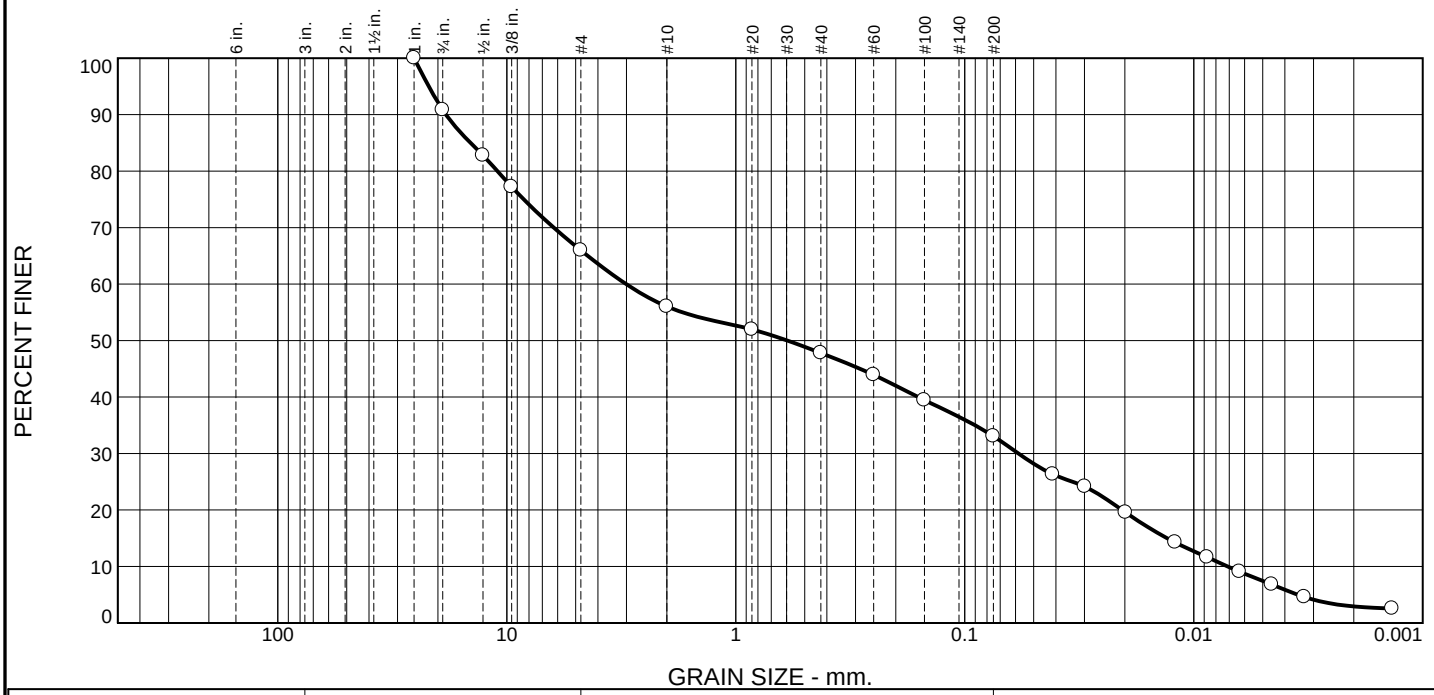
Source of Sample: 99-GEO-1 **Depth:** 3-5' **Date Sampled:** 8/5/2020
Sample Number: S-2

CDM Smith

Boston, Massachusetts

Client: USG
Project: Highway 99
Milton, NH
Project No: 19921.251008

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	9.2	24.8	10.0	8.2	14.7	25.7	7.4

Test Results (ASTM D6913 & D7928 & ASTM D1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1"	100.0		
0.75"	90.8		
0.5"	82.8		
0.375"	77.2		
#4	66.0		
#10	56.0		
#20	52.0		
#40	47.8		
#60	43.9		
#100	39.5		
#200	33.1		
0.0413 mm.	26.3		
0.0299 mm.	24.1		
0.0199 mm.	19.6		
0.0121 mm.	14.3		
0.0087 mm.	11.6		
0.0063 mm.	9.1		
0.0046 mm.	6.8		
0.0033 mm.	4.6		
0.0014 mm.	2.6		

* (no specification provided)

Material Description

Gray silty gravel with sand

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= GM **AASHTO (M 145)=** A-2-4(0)

Coefficients

D_{90}= 18.4379 D_{85}= 14.4022 D_{60}= 3.0101
D_{50}= 0.5950 D_{30}= 0.0582 D_{15}= 0.0131
D_{10}= 0.0071 C_u= 423.17 C_c= 0.16

Remarks

As received MC = 12.2%

Date Received: 8/28/2020 **Date Tested:** 9/2/2020

Tested By: AS/MP

Checked By: MP

Title: Laboratory Manager

Source of Sample: 99-GEO-1 **Depth:** 7-9' **Date Sampled:** 8/5/2020
Sample Number: S-4

CDM Smith

Boston, Massachusetts

Client: USG
Project: Highway 99
Milton, NH
Project No: 19921.251008

CDM Smith

Geotechnical Engineering Laboratory

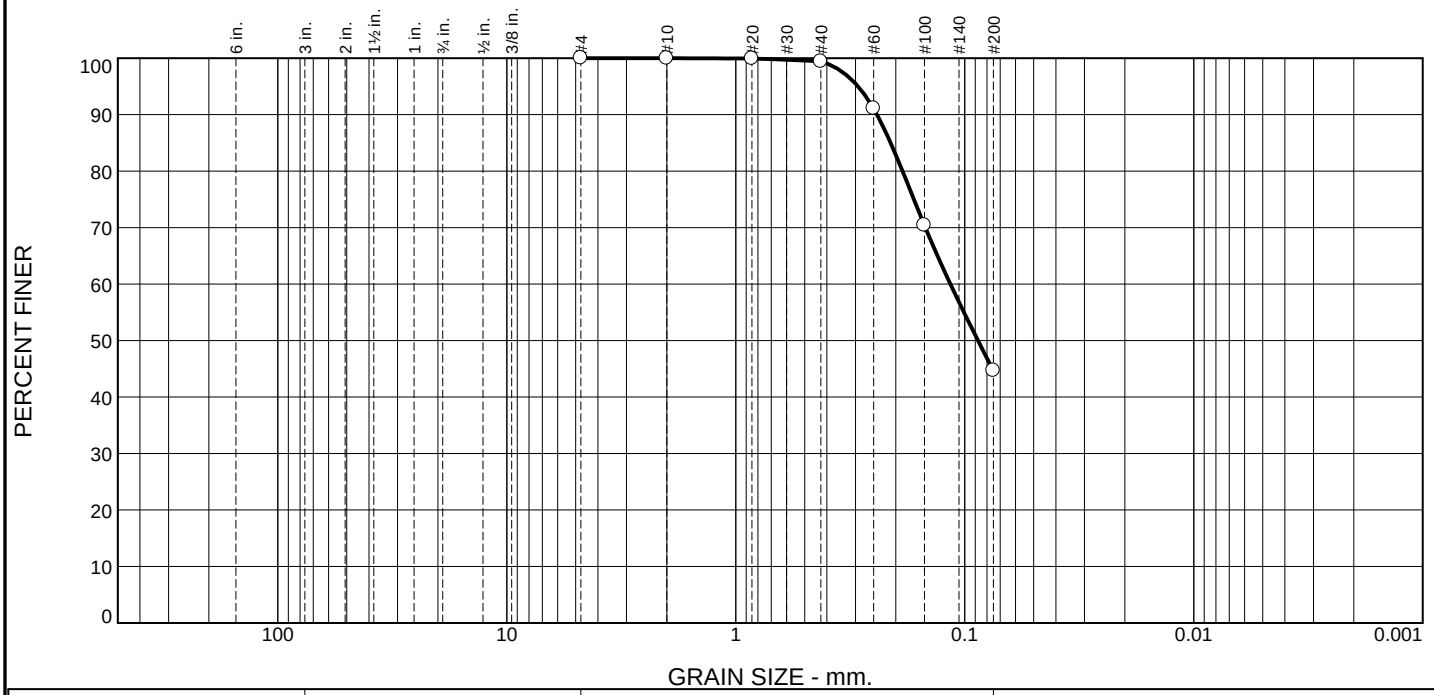
Standard Test Method for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils (ASTM D2974)

Client:	USG		
Project Name:	Highway 99	Tested By:	MP
Project Location:	Milton, NH	Test Date:	9/8/2020
Project Number:	19921-251008		
Boring Number:	99-GEO-1	Procedure:	C
Sample Number:	S-5	Temperature:	440° C
Sample Depth (ft):	9-11		
Sample Date:	8/5/2020		

AS RECEIVED MOISTURE CONTENT	
Tin Mass (g)	85.00
Wet Mass of Sample & Tin (g)	201.53
Dry Mass of Sample & Tin (g)	175.25
Mass of Water (g)	26.28
Mass of Dry Soil (g)	90.25
Moisture Content (%)	**29.1**

ASH CONTENT	
Porcelain Dish Mass (g)	85.00
Porcelain Dish + Oven Dried Soil (g)	175.25
Mass of Oven Dried Soil (g)	90.25
Mass of Dish & Burned Soil (g)	174.29
Mass of Burned Soil (g)	89.29
Mass of Organic Material (g)	0.96
Ash Content (%)	98.9
Organic Content (%)	**1.1**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.6	54.7	44.7	

Test Results (ASTM D6913 & ASTM D1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	100.0		
#20	99.9		
#40	99.4		
#60	91.1		
#100	70.4		
#200	44.7		

* (no specification provided)

Material Description

Dark gray silty sand

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-4(0)

Coefficients

D_{90}= 0.2416 D_{85}= 0.2107 D_{60}= 0.1156
D_{50}= 0.0875 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

As received MC = 27.2%

Date Received: 8/28/2020 **Date Tested:** 9/3/2020

Tested By: AS/MP

Checked By: MP

Title: Laboratory Manager

Source of Sample: 99-GEO-1 **Depth:** 13-15'
Sample Number: S-7

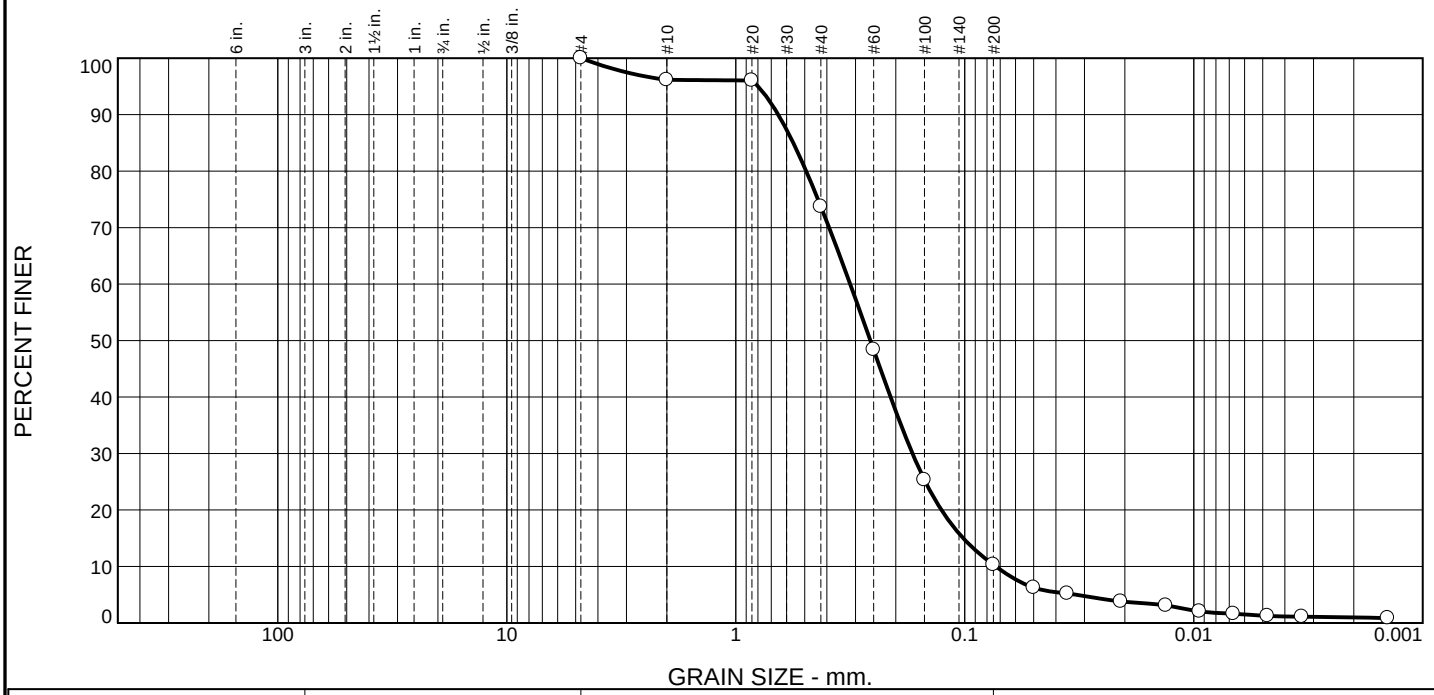
Date Sampled: 8/5/2020

CDM Smith

Boston, Massachusetts

Client: USG
Project: Highway 99
Milton, NH
Project No: 19921.251008

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	3.8	22.5	63.4	9.0	1.3

Test Results (ASTM D6913 & D7928 & ASTM D1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	96.2		
#20	96.0		
#40	73.7		
#60	48.4		
#100	25.3		
#200	10.3		
0.0500 mm.	6.3		
0.0356 mm.	5.2		
0.0208 mm.	3.8		
0.0132 mm.	3.1		
0.0094 mm.	2.1		
0.0067 mm.	1.6		
0.0048 mm.	1.3		
0.0034 mm.	1.1		
0.0014 mm.	0.9		

* (no specification provided)

Material Description

Dark gray poorly graded sand with silt

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SP-SM **AASHTO (M 145)=** A-3

Coefficients

D_{90}= 0.6524 D_{85}= 0.5610 D_{60}= 0.3165
D_{50}= 0.2582 D_{30}= 0.1692 D_{15}= 0.1015
D_{10}= 0.0732 C_u= 4.32 C_c= 1.23

Remarks

As received MC = 23.3%

Date Received: 8/28/2020 **Date Tested:** 9/2/2020

Tested By: AS/MP

Checked By: MP

Title: Laboratory Manager

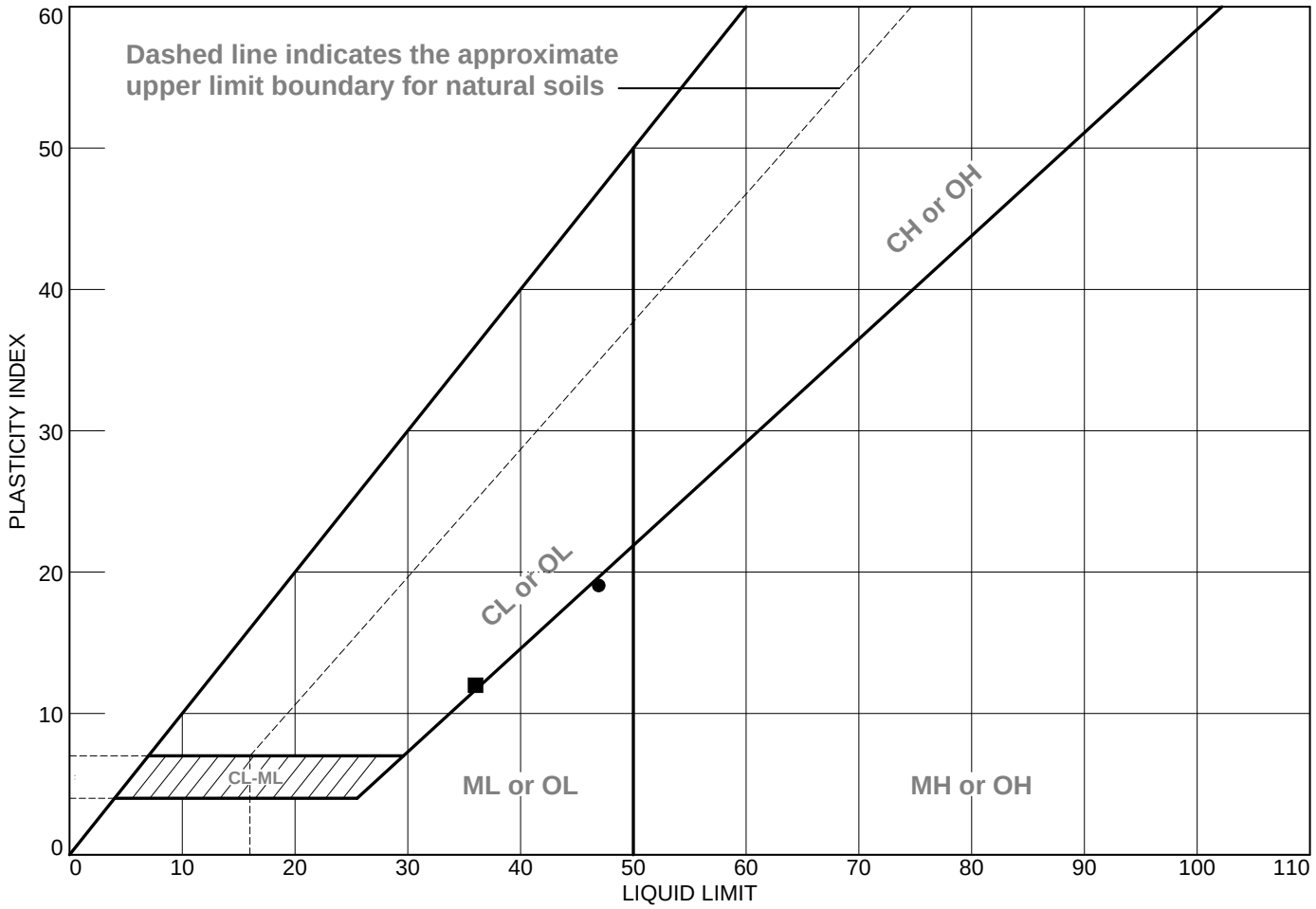
Source of Sample: 99-GEO-1 **Depth:** 20-22' **Date Sampled:** 8/5/2020
Sample Number: S-8a

CDM Smith

Boston, Massachusetts

Client: USG
Project: Highway 99
Milton, NH
Project No: 19921.251008

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	99-GEO-1	S-5	9-11'	29.1	28	47	19	ML
■	99-GEO-1	S-9	25-27'	40.3	24	36	12	CL

CDM Smith

Boston, Massachusetts

Client: USG
Project: Highway 99
Milton, NH
Project No.: 19921.251008

Tested By: MP **Checked By:** MP

CDM Smith

Geotechnical Engineering Laboratory

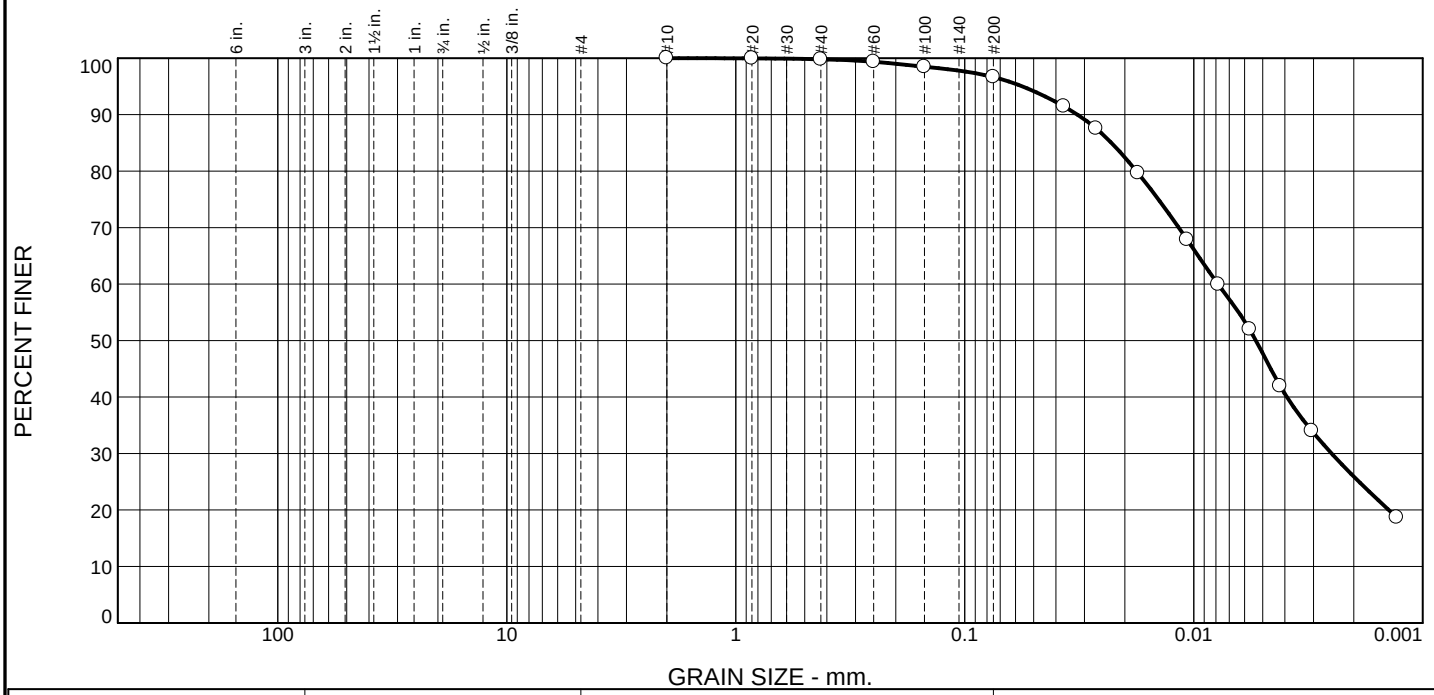
Standard Test Method for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils (ASTM D2974)

Client:	USG		
Project Name:	Highway 99	Tested By:	MP
Project Location:	Milton, NH	Test Date:	9/8/2020
Project Number:	19921-251008		
Boring Number:	99-GEO-1	Procedure:	C
Sample Number:	S-5	Temperature:	440° C
Sample Depth (ft):	9-11		
Sample Date:	8/5/2020		

AS RECEIVED MOISTURE CONTENT	
Tin Mass (g)	85.00
Wet Mass of Sample & Tin (g)	201.53
Dry Mass of Sample & Tin (g)	175.25
Mass of Water (g)	26.28
Mass of Dry Soil (g)	90.25
Moisture Content (%)	**29.1**

ASH CONTENT	
Porcelain Dish Mass (g)	85.00
Porcelain Dish + Oven Dried Soil (g)	175.25
Mass of Oven Dried Soil (g)	90.25
Mass of Dish & Burned Soil (g)	174.29
Mass of Burned Soil (g)	89.29
Mass of Organic Material (g)	0.96
Ash Content (%)	98.9
Organic Content (%)	**1.1**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.2	3.1	49.0	47.7

Test Results (ASTM D6913 & D7928 & ASTM D1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#10	100.0		
#20	100.0		
#40	99.8		
#60	99.4		
#100	98.5		
#200	96.7		
0.0370 mm.	91.5		
0.0267 mm.	87.5		
0.0175 mm.	79.7		
0.0107 mm.	67.9		
0.0078 mm.	59.9		
0.0057 mm.	52.0		
0.0042 mm.	41.9		
0.0030 mm.	34.0		
0.0013 mm.	18.7		

* (no specification provided)

Material Description

Gray lean clay

Atterberg Limits (ASTM D 4318)

PL= 24 **LL=** 36 **PI=** 12

Classification

USCS (D 2487)= CL **AASHTO (M 145)=** A-6(13)

Coefficients

D_{90}= 0.0322 D_{85}= 0.0229 D_{60}= 0.0078
D_{50}= 0.0054 D_{30}= 0.0025 D_{15}=
D_{10}= C_u= C_c=

Remarks

As received MC = 40.3%

Date Received: 8/28/2020 **Date Tested:** 9/2/2020

Tested By: AS/MP

Checked By: MP

Title: Laboratory Manager

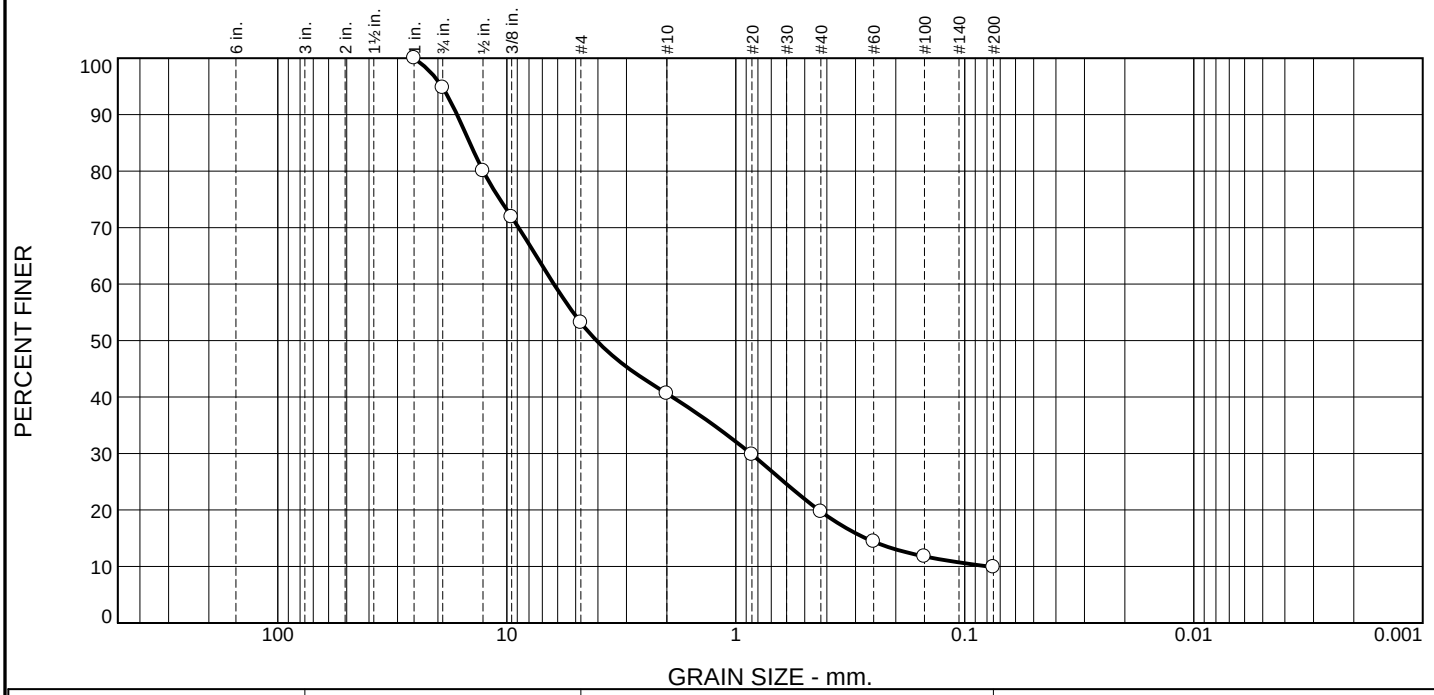
Source of Sample: 99-GEO-1 **Depth:** 25-27' **Date Sampled:** 8/5/2020
Sample Number: S-9

CDM Smith

Boston, Massachusetts

Client: USG
Project: Highway 99
Milton, NH
Project No: 19921.251008

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	5.2	41.6	12.6	20.9	9.8	9.9	

Test Results (ASTM D6913 & ASTM D1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1"	100.0		
0.75"	94.8		
0.5"	80.1		
0.375"	71.9		
#4	53.2		
#10	40.6		
#20	29.8		
#40	19.7		
#60	14.4		
#100	11.8		
#200	9.9		

* (no specification provided)

Material Description

Gray-brown well-graded gravel with silt and sand

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= GW-GM **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 16.4922 D_{85}= 14.5045 D_{60}= 6.2268
D_{50}= 4.0582 D_{30}= 0.8609 D_{15}= 0.2705
D_{10}= 0.0790 C_u= 78.79 C_c= 1.51

Remarks

As received MC = 10.9%

Date Received: 8/28/2020 **Date Tested:** 9/3/2020

Tested By: AS/MP

Checked By: MP

Title: Laboratory Manager

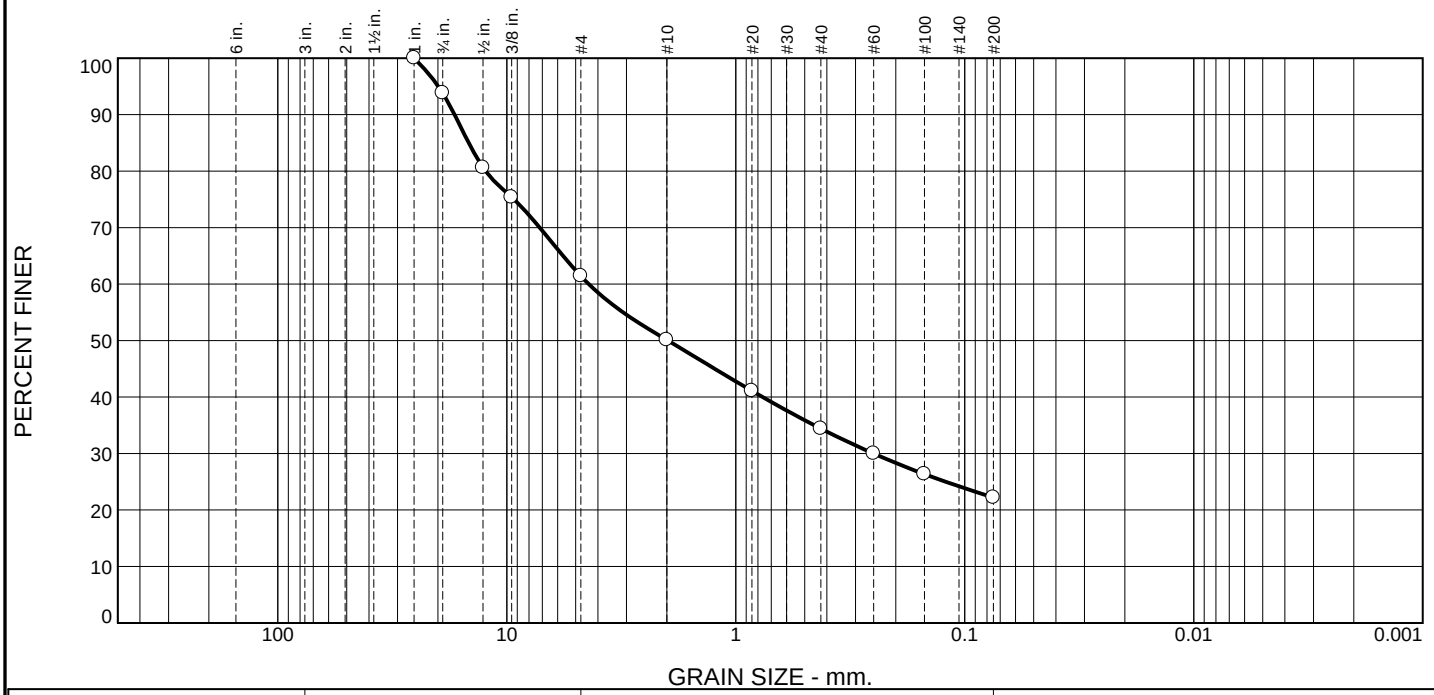
Source of Sample: 99-GEO-1 **Depth:** 30-32' **Date Sampled:** 8/5/2020
Sample Number: S-10

CDM Smith

Boston, Massachusetts

Client: USG
Project: Highway 99
Milton, NH
Project No: 19921.251008

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	6.2	32.4	11.3	15.7	12.2	22.2	

Test Results (ASTM D6913 & ASTM D1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1"	100.0		
0.75"	93.8		
0.5"	80.6		
0.375"	75.4		
#4	61.4		
#10	50.1		
#20	41.1		
#40	34.4		
#60	30.0		
#100	26.3		
#200	22.2		

* (no specification provided)

Material Description

Gray silty sand with gravel

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 16.9090 D_{85}= 14.6658 D_{60}= 4.3857
D_{50}= 1.9799 D_{30}= 0.2501 D_{15}=
D_{10}= C_u= C_c=

Remarks

As received MC = 12.7%

Date Received: 8/28/2020 **Date Tested:** 9/3/2020

Tested By: AS/MP

Checked By: MP

Title: Laboratory Manager

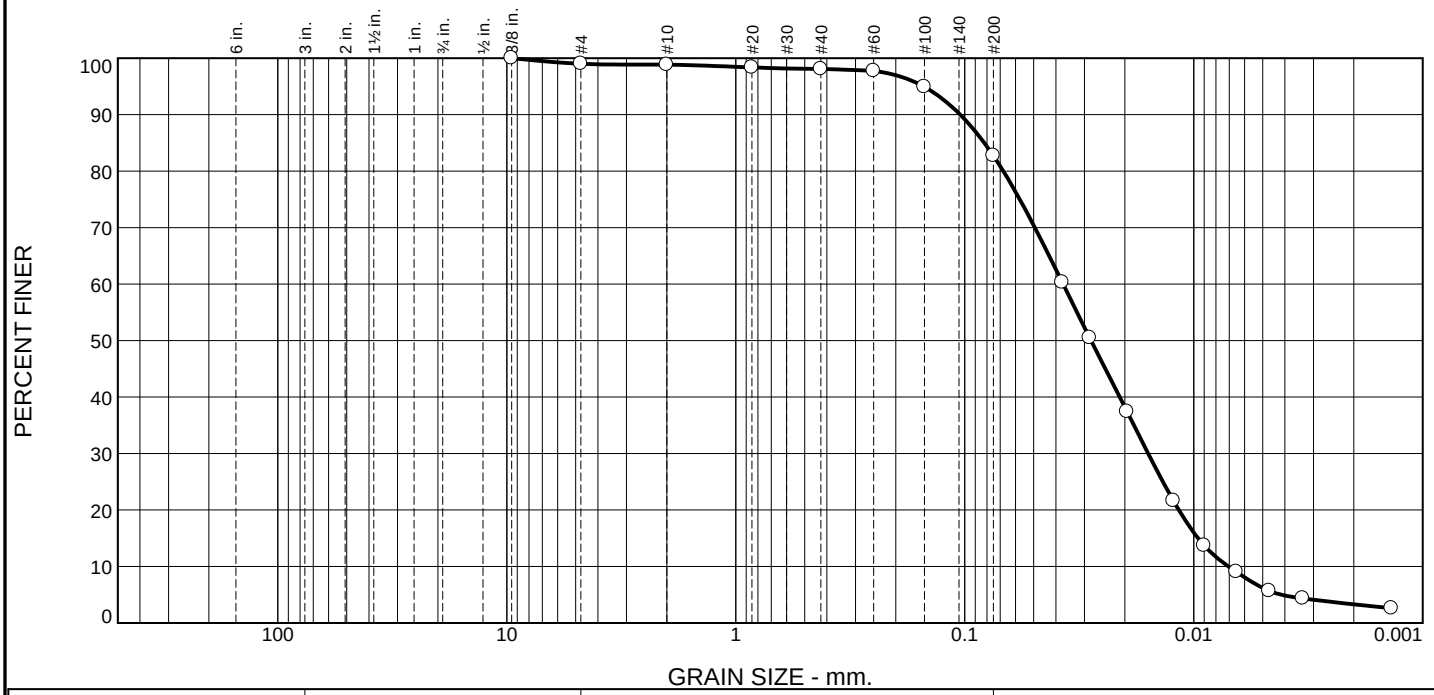
Source of Sample: 99-GEO-2 **Depth:** 7-9' **Date Sampled:** 8/5/2020
Sample Number: S-4

CDM Smith

Boston, Massachusetts

Client: USG
Project: Highway 99
Milton, NH
Project No: 19921.251008

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.0	0.2	0.7	15.4	76.5	6.2

Test Results (ASTM D6913 & D7928 & ASTM D1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.375"	100.0		
#4	99.0		
#10	98.8		
#20	98.4		
#40	98.1		
#60	97.8		
#100	94.9		
#200	82.7		
0.0375 mm.	60.3		
0.0285 mm.	50.5		
0.0195 mm.	37.4		
0.0123 mm.	21.7		
0.0090 mm.	13.7		
0.0065 mm.	9.1		
0.0047 mm.	5.7		
0.0033 mm.	4.3		
0.0014 mm.	2.6		

* (no specification provided)

Material Description

Brown silt with sand

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= ML **AASHTO (M 145)=** A-4(0)

Coefficients

D_{90}= 0.1046 D_{85}= 0.0821 D_{60}= 0.0372
D_{50}= 0.0281 D_{30}= 0.0158 D_{15}= 0.0096
D_{10}= 0.0071 C_u= 5.27 C_c= 0.95

Remarks

As received MC = 26.3%

Date Received: 8/28/2020 **Date Tested:** 9/2/2020

Tested By: AS/MP

Checked By: MP

Title: Laboratory Manager

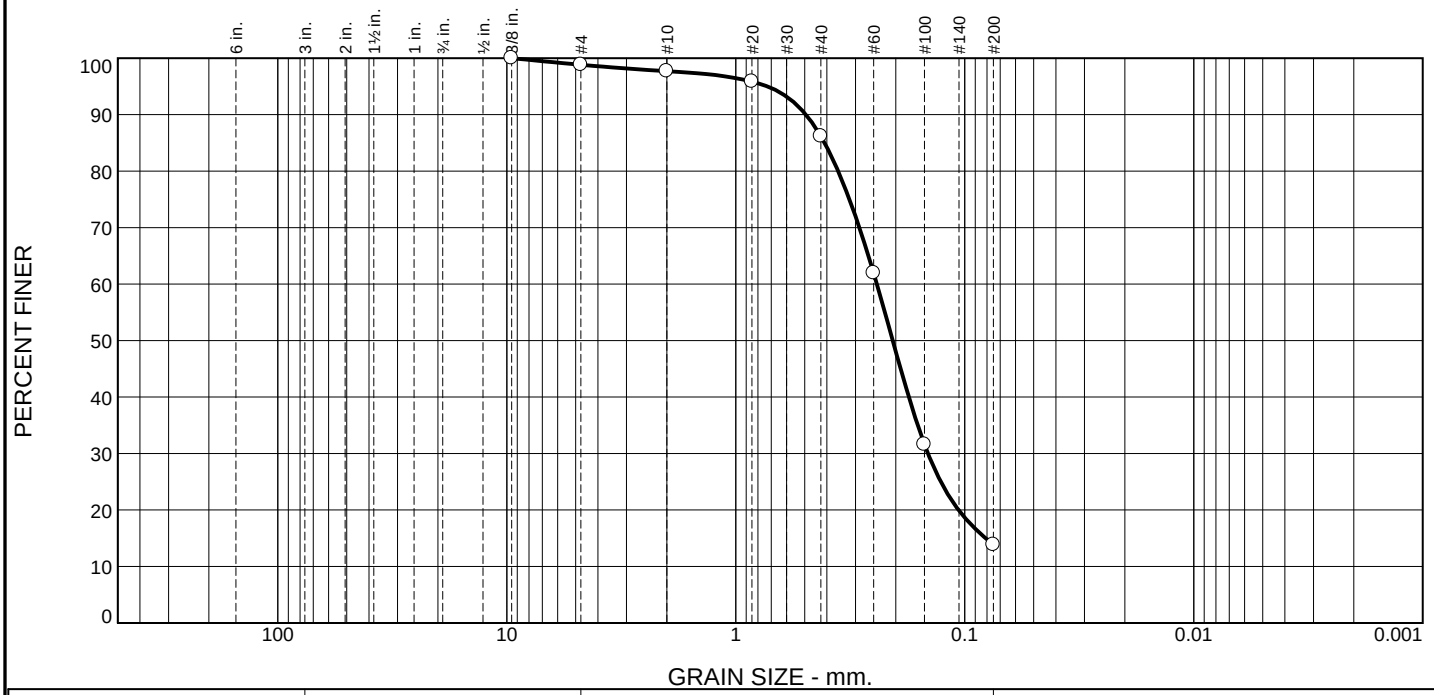
Source of Sample: 99-GEO-2 **Depth:** 11-13' **Date Sampled:** 8/5/2020
Sample Number: S-6

CDM Smith

Boston, Massachusetts

Client: USG
Project: Highway 99
Milton, NH
Project No: 19921.251008

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.2	1.1	11.5	72.4	13.8	

Test Results (ASTM D6913 & ASTM D1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.375"	100.0		
#4	98.8		
#10	97.7		
#20	95.8		
#40	86.2		
#60	62.0		
#100	31.6		
#200	13.8		

* (no specification provided)

Material Description

Dark brown silty sand

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-2-4(0)

Coefficients

D_{90}= 0.4942 D_{85}= 0.4094 D_{60}= 0.2420
D_{50}= 0.2063 D_{30}= 0.1448 D_{15}= 0.0810
D_{10}= C_u= C_c=

Remarks

As received MC = 20.6%

Date Received: 8/28/2020 **Date Tested:** 9/3/2020

Tested By: AS/MP

Checked By: MP

Title: Laboratory Manager

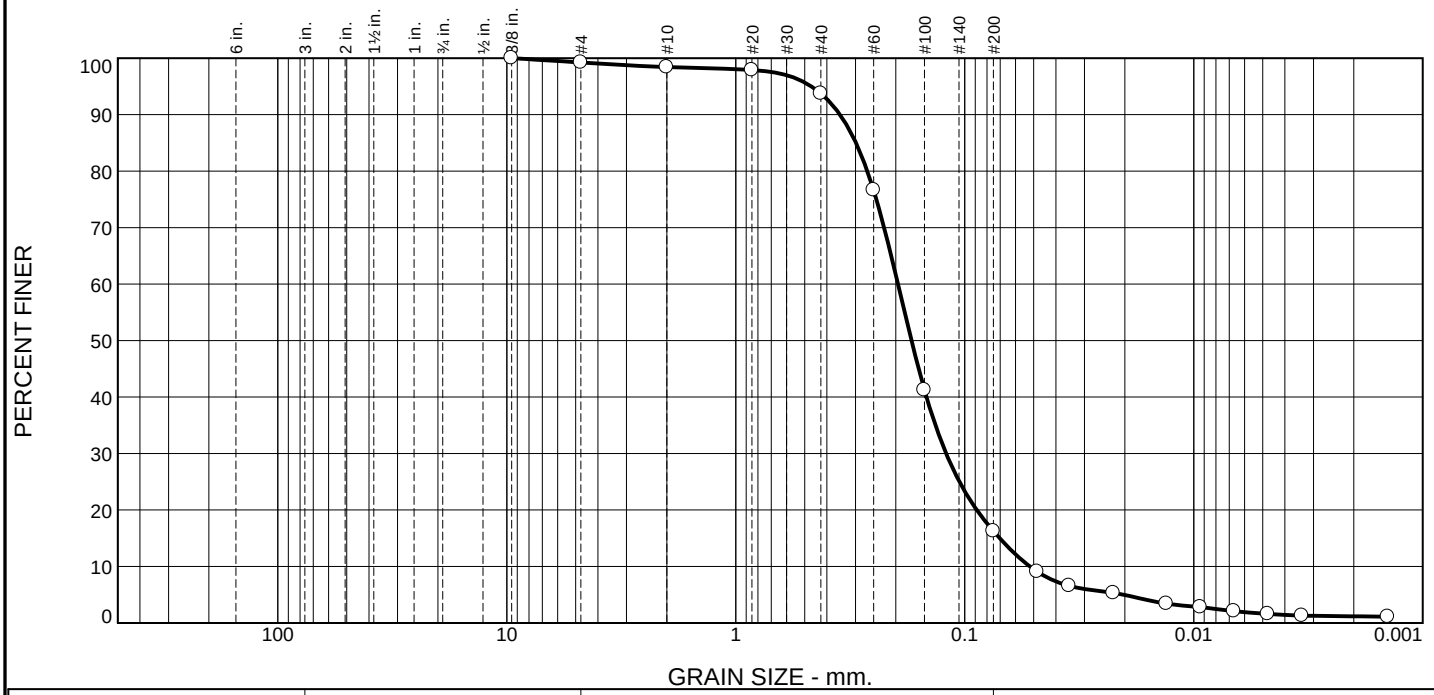
Source of Sample: 99-GEO-2 **Depth:** 20-22' **Date Sampled:** 8/5/2020
Sample Number: S-8

CDM Smith

Boston, Massachusetts

Client: USG
Project: Highway 99
Milton, NH
Project No: 19921.251008

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.8	0.8	4.7	77.4	14.6	1.7

Test Results (ASTM D6913 & D7928 & ASTM D1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.375"	100.0		
#4	99.2		
#10	98.4		
#20	97.9		
#40	93.7		
#60	76.6		
#100	41.3		
#200	16.3		
0.0483 mm.	9.1		
0.0350 mm.	6.6		
0.0224 mm.	5.3		
0.0132 mm.	3.4		
0.0094 mm.	2.8		
0.0067 mm.	2.1		
0.0047 mm.	1.6		
0.0034 mm.	1.3		
0.0014 mm.	1.1		

* (no specification provided)

Material Description

Gray silty sand

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-2-4(0)

Coefficients

D_{90}= 0.3505 D_{85}= 0.2985 D_{60}= 0.1956
D_{50}= 0.1708 D_{30}= 0.1206 D_{15}= 0.0704
D_{10}= 0.0520 C_u= 3.76 C_c= 1.43

Remarks

As received MC = 25.9%

Date Received: 8/28/2020 **Date Tested:** 9/2/2020

Tested By: AS/MP

Checked By: MP

Title: Laboratory Manager

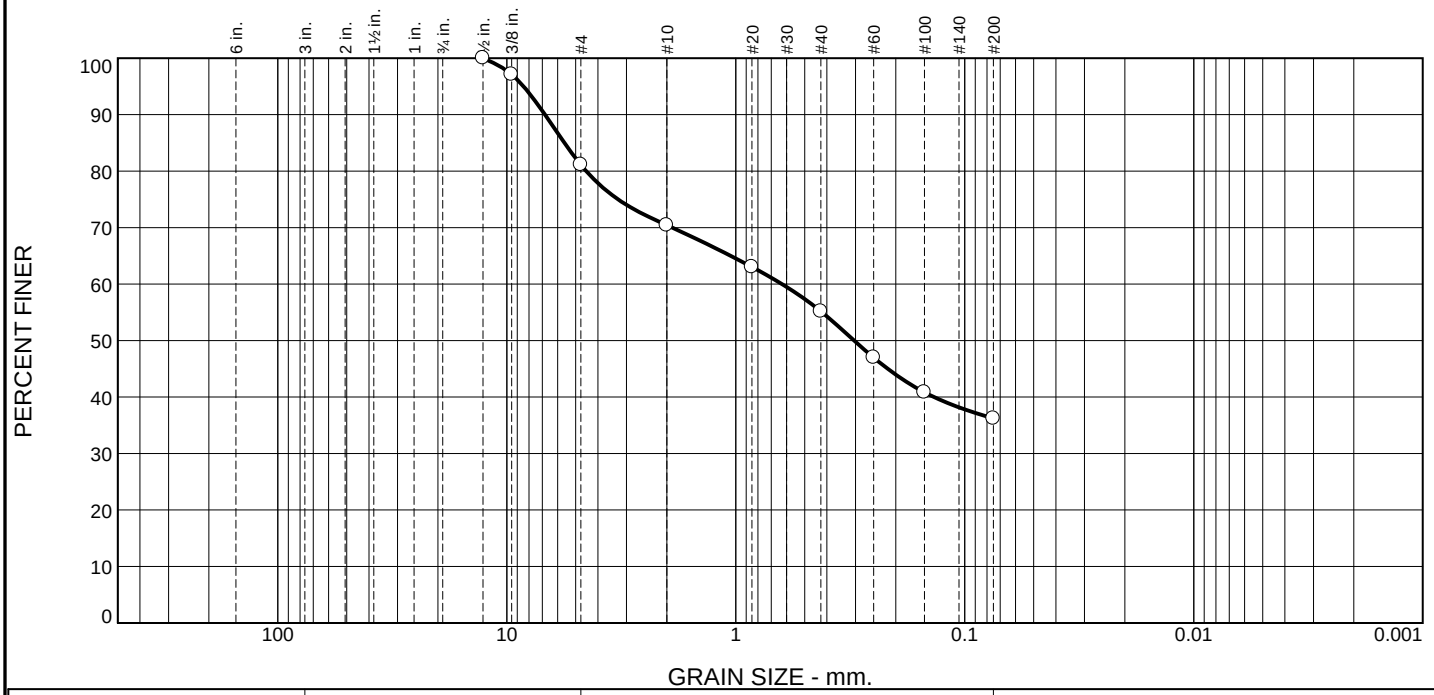
Source of Sample: 99-GEO-2 **Depth:** 25-27' **Date Sampled:** 8/5/2020
Sample Number: S-9

CDM Smith

Boston, Massachusetts

Client: USG
Project: Highway 99
Milton, NH
Project No: 19921.251008

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	18.9	10.7	15.2	19.0	36.2	

Test Results (ASTM D6913 & ASTM D1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.5"	100.0		
0.375"	97.1		
#4	81.1		
#10	70.4		
#20	63.0		
#40	55.2		
#60	47.0		
#100	40.8		
#200	36.2		

* (no specification provided)

Material Description

Brown silty sand with gravel

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-4(0)

Coefficients

D_{90}= 6.8104 D_{85}= 5.6010 D_{60}= 0.6284
D_{50}= 0.3040 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

As received MC = 13.7%

Date Received: 8/28/2020 **Date Tested:** 9/3/2020

Tested By: AS/MP

Checked By: MP

Title: Laboratory Manager

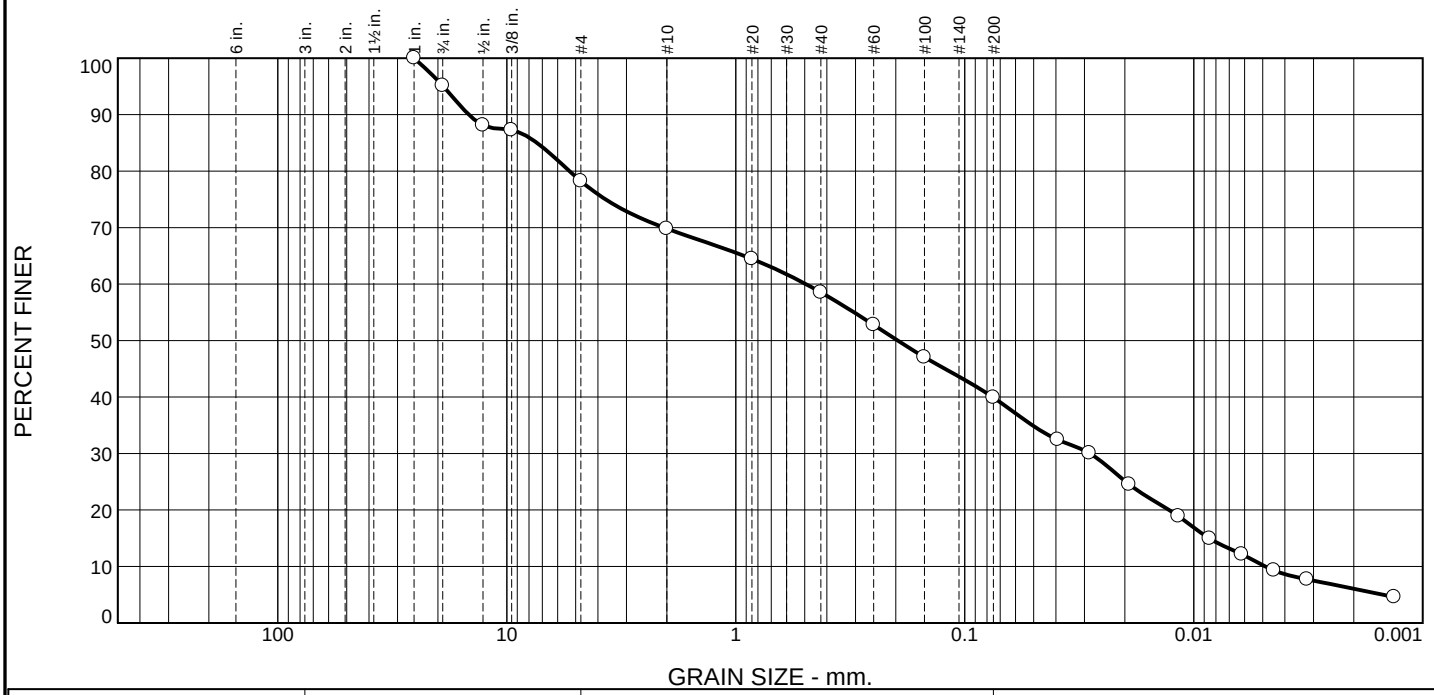
Source of Sample: 99-GEO-3 **Depth:** 1-3' **Date Sampled:** 8/4/2020
Sample Number: S-1

CDM Smith

Boston, Massachusetts

Client: USG
Project: Highway 99
Milton, NH
Project No: 19921.251008

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	4.9	16.9	8.4	11.3	18.6	29.7	10.2

Test Results (ASTM D6913 & D7928 & ASTM D1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1"	100.0		
0.75"	95.1		
0.5"	88.1		
0.375"	87.3		
#4	78.2		
#10	69.8		
#20	64.5		
#40	58.5		
#60	52.8		
#100	47.1		
#200	39.9		
0.0393 mm.	32.4		
0.0286 mm.	30.1		
0.0191 mm.	24.5		
0.0117 mm.	18.9		
0.0085 mm.	14.9		
0.0062 mm.	12.2		
0.0045 mm.	9.3		
0.0032 mm.	7.7		
0.0013 mm.	4.6		

* (no specification provided)

Material Description

Gray-brown silty sand with gravel

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-4(0)

Coefficients

D_{90}= 14.6625 D_{85}= 7.3743 D_{60}= 0.4946
D_{50}= 0.1962 D_{30}= 0.0284 D_{15}= 0.0086
D_{10}= 0.0049 C_u= 101.60 C_c= 0.33

Remarks

As received MC = 27.3%

Date Received: 8/28/2020 **Date Tested:** 9/4/2020

Tested By: AS/MP

Checked By: MP

Title: Laboratory Manager

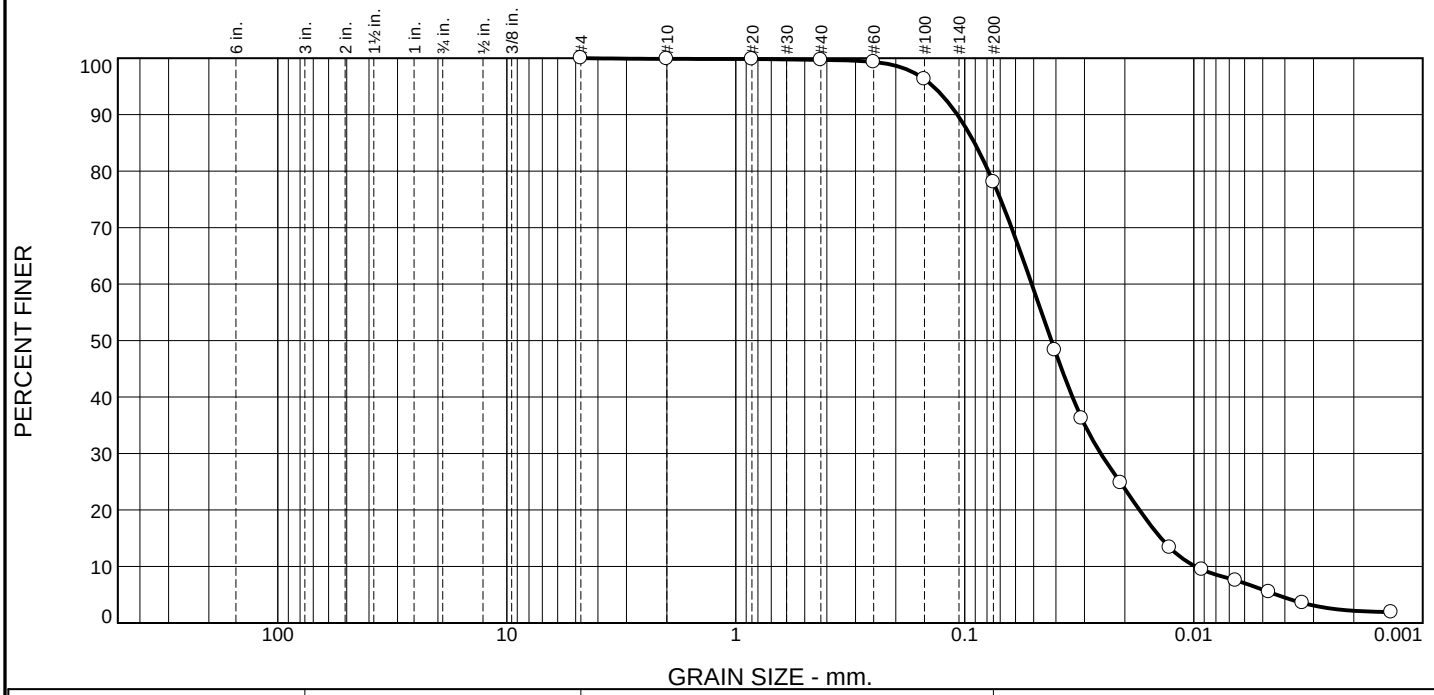
Source of Sample: 99-GEO-3 **Depth:** 7-9' **Date Sampled:** 8/4/2020
Sample Number: S-4

CDM Smith

Boston, Massachusetts

Client: USG
Project: Highway 99
Milton, NH
Project No: 19921.251008

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	0.2	21.6	72.2	5.9

Test Results (ASTM D6913 & D7928 & ASTM D1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	99.9		
#20	99.8		
#40	99.7		
#60	99.3		
#100	96.3		
#200	78.1		
0.0405 mm.	48.3		
0.0309 mm.	36.3		
0.0209 mm.	24.8		
0.0127 mm.	13.4		
0.0092 mm.	9.4		
0.0066 mm.	7.5		
0.0047 mm.	5.5		
0.0034 mm.	3.5		
0.0014 mm.	1.9		

* (no specification provided)

Material Description

Dark brown silt with sand

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= ML **AASHTO (M 145)=** A-4(0)

Coefficients

D_{90}= 0.1077 D_{85}= 0.0907 D_{60}= 0.0510
D_{50}= 0.0418 D_{30}= 0.0255 D_{15}= 0.0139
D_{10}= 0.0098 C_u= 5.19 C_c= 1.29

Remarks

As received MC = 28.1%

Date Received: 8/28/2020 **Date Tested:** 9/2/2020

Tested By: AS/MP

Checked By: MP

Title: Laboratory Manager

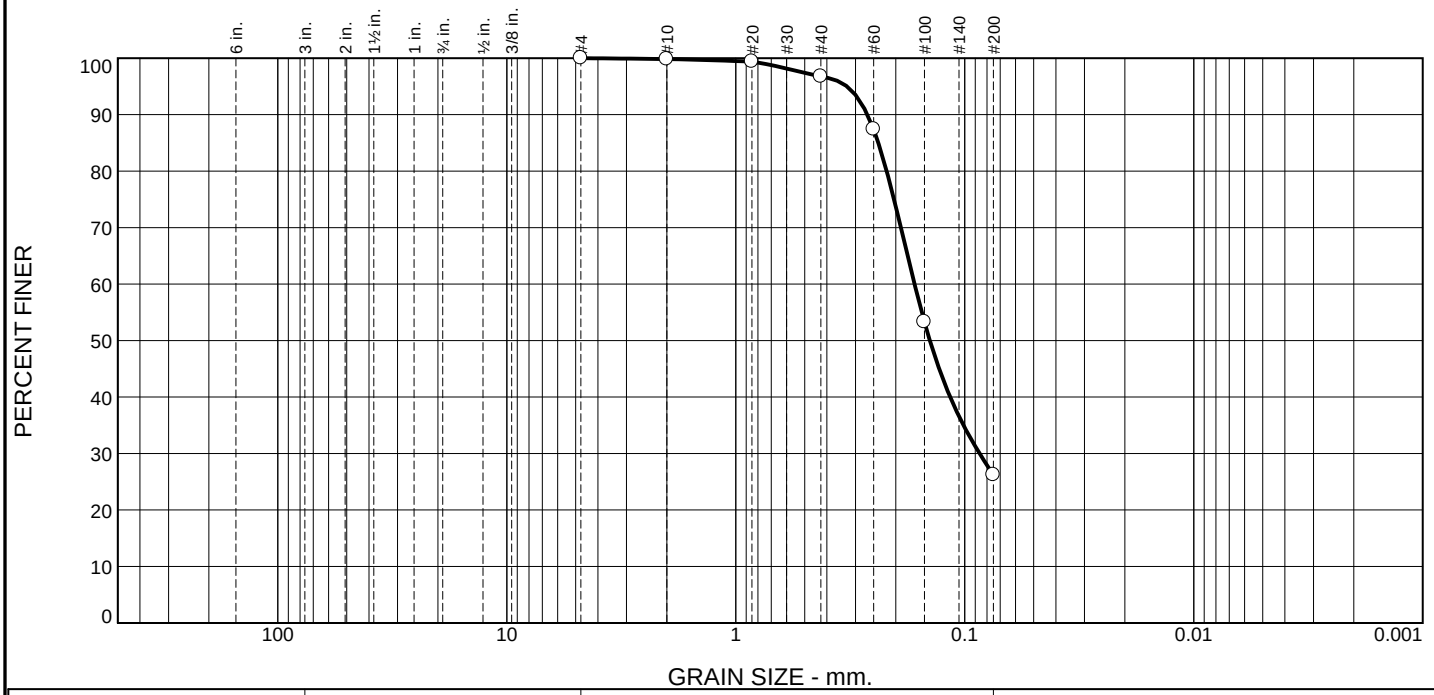
Source of Sample: 99-GEO-3 **Depth:** 13-15' **Date Sampled:** 8/4/2020
Sample Number: S-7

CDM Smith

Boston, Massachusetts

Client: USG
Project: Highway 99
Milton, NH
Project No: 19921.251008

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.2	3.0	70.6	26.2	

Test Results (ASTM D6913 & ASTM D1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	99.8		
#20	99.4		
#40	96.8		
#60	87.4		
#100	53.3		
#200	26.2		

* (no specification provided)

Material Description

Dark gray silty sand

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-2-4(0)

Coefficients

D_{90}= 0.2659 D_{85}= 0.2385 D_{60}= 0.1656
D_{50}= 0.1420 D_{30}= 0.0861 D_{15}=
D_{10}= C_u= C_c=

Remarks

As received MC = 27.9%

Date Received: 8/28/2020 **Date Tested:** 9/3/2020

Tested By: AS/MP

Checked By: MP

Title: Laboratory Manager

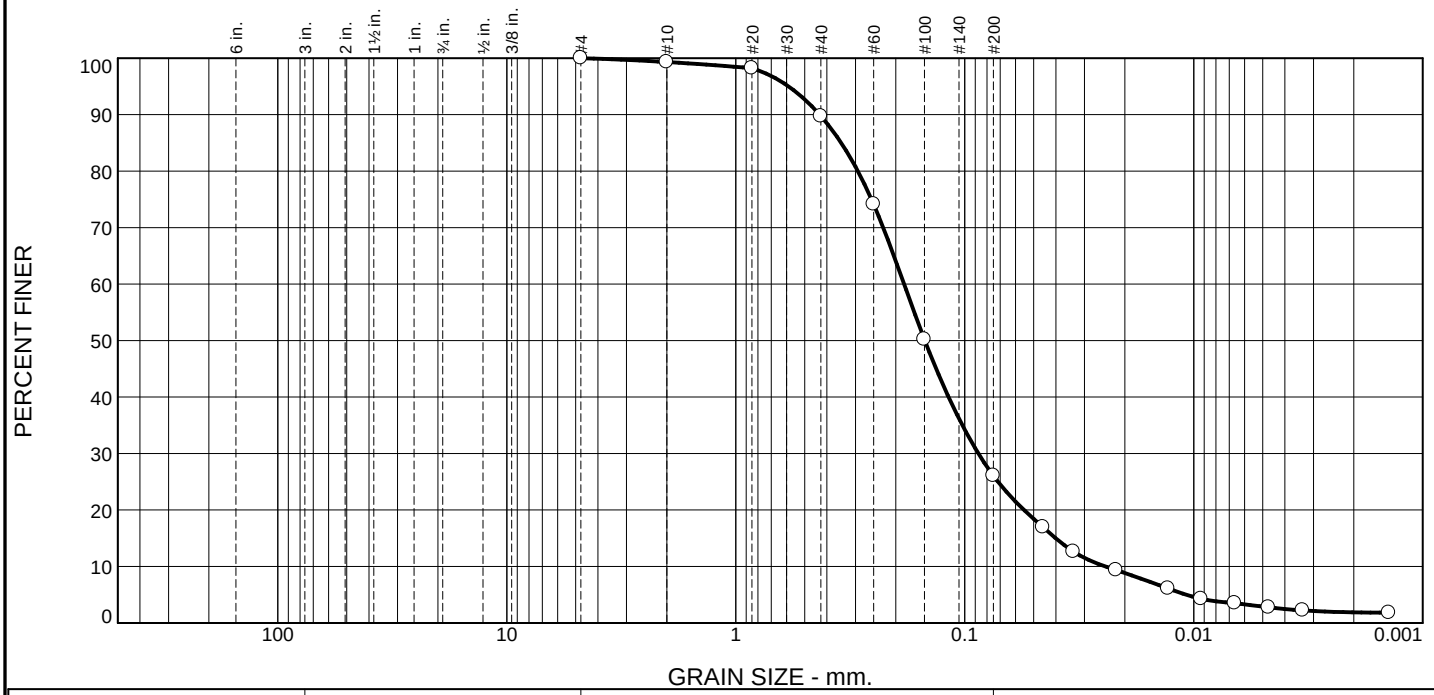
Source of Sample: 99-GEO-3 **Depth:** 20-22' **Date Sampled:** 8/4/2020
Sample Number: S-8

CDM Smith

Boston, Massachusetts

Client: USG
Project: Highway 99
Milton, NH
Project No: 19921.251008

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.7	9.6	63.6	23.2	2.9

Test Results (ASTM D6913 & D7928 & ASTM D1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	99.3		
#20	98.2		
#40	89.7		
#60	74.1		
#100	50.2		
#200	26.1		
0.0455 mm.	17.0		
0.0335 mm.	12.6		
0.0218 mm.	9.4		
0.0129 mm.	6.1		
0.0093 mm.	4.3		
0.0066 mm.	3.5		
0.0047 mm.	2.8		
0.0033 mm.	2.2		
0.0014 mm.	1.8		

* (no specification provided)

Material Description

Dark gray silty sand

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NP **PI=** NP

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-2-4(0)

Coefficients

D_{90}= 0.4304 D_{85}= 0.3465 D_{60}= 0.1840
D_{50}= 0.1494 D_{30}= 0.0872 D_{15}= 0.0401
D_{10}= 0.0243 C_u= 7.57 C_c= 1.70

Remarks

As received MC = 22.4%

Date Received: 8/28/2020 **Date Tested:** 9/2/2020

Tested By: AS/MP

Checked By: MP

Title: Laboratory Manager

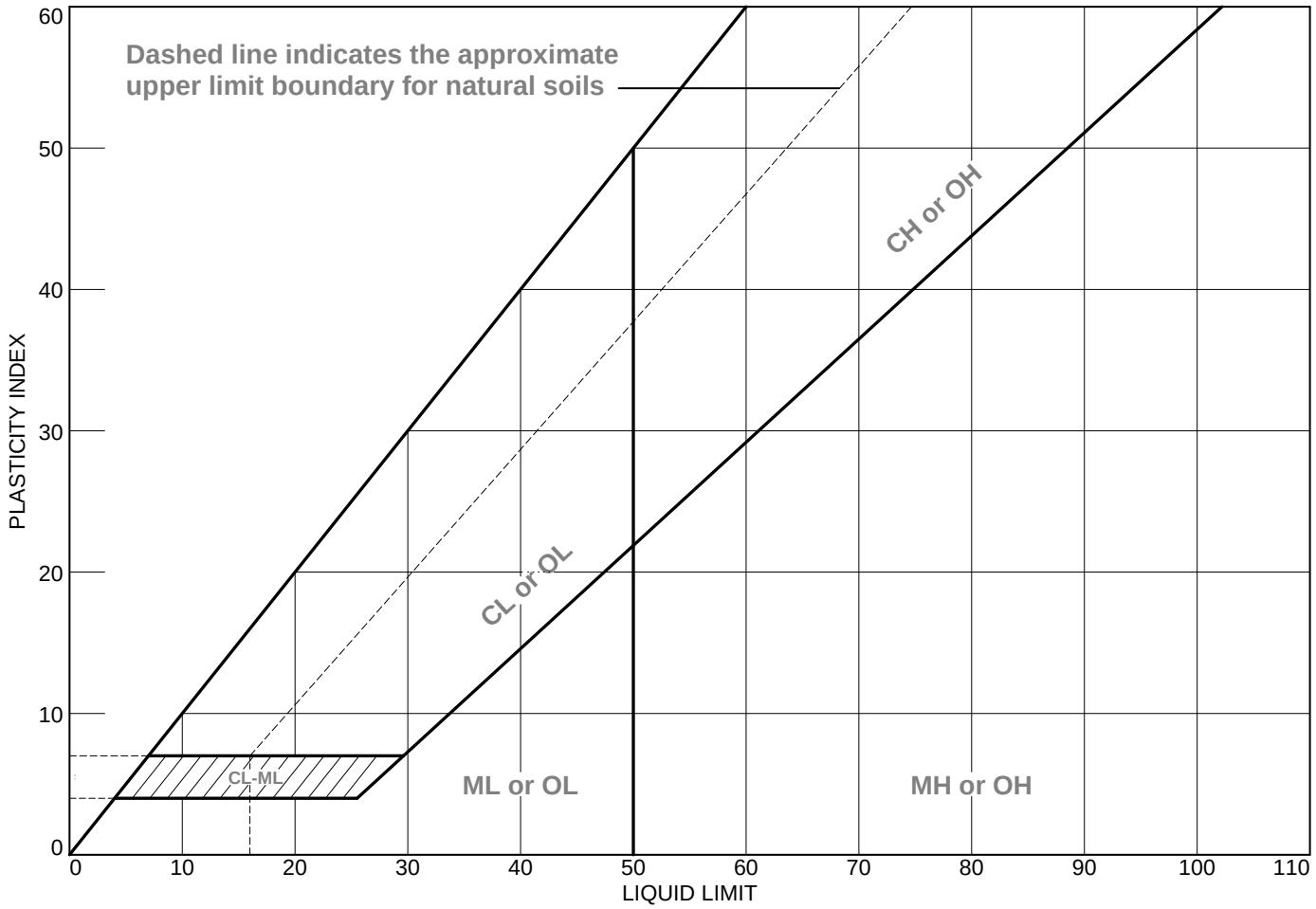
Source of Sample: 99-GEO-3 **Depth:** 25-27' **Date Sampled:** 8/4/2020
Sample Number: S-9

CDM Smith

Boston, Massachusetts

Client: USG
Project: Highway 99
Milton, NH
Project No: 19921.251008

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	99-GEO-3	S-9	25-27'	22.4	NP	NP	NP	SM

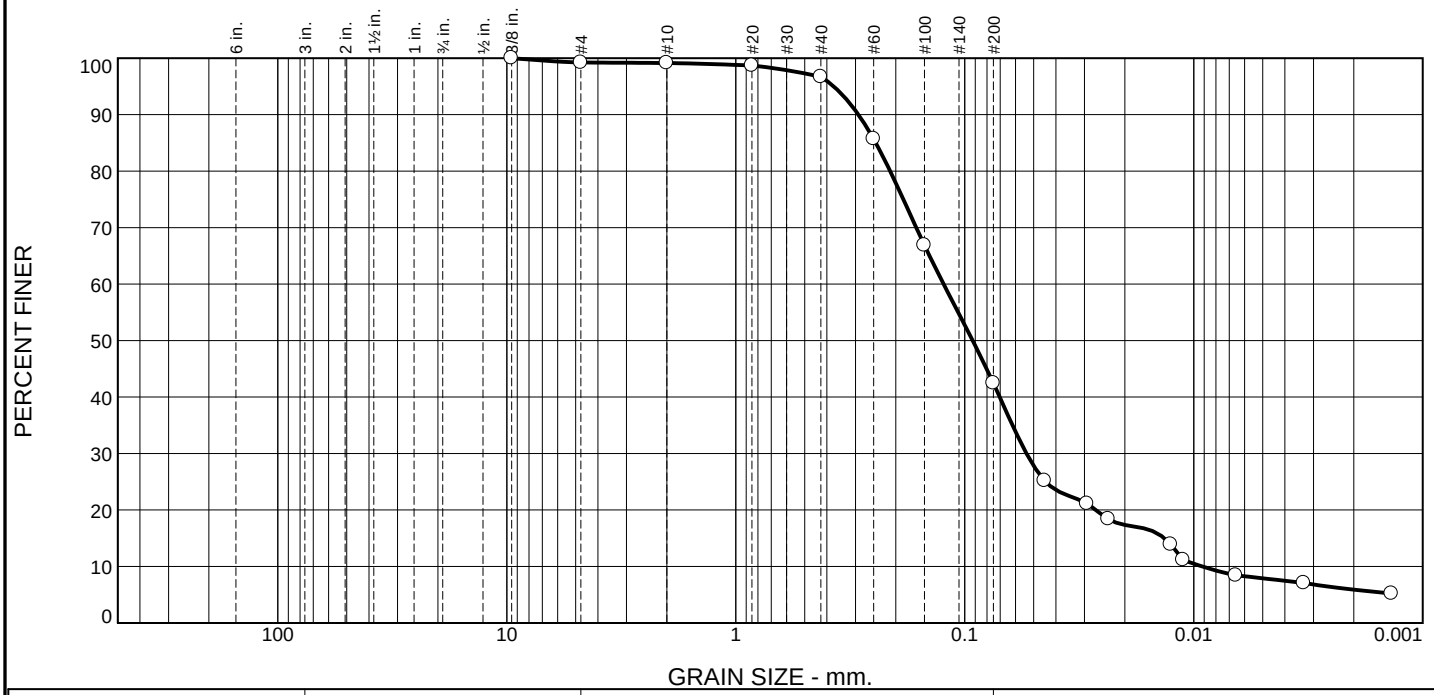
CDM Smith

Boston, Massachusetts

Client: USG
Project: Highway 99
Milton, NH
Project No.: 19921.251008

Tested By: MP **Checked By:** MP

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.8	0.1	2.4	54.2	34.6	7.9

Test Results (ASTM D6913 & D7928 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
.375"	100.0		
#4	99.2		
#10	99.1		
#20	98.7		
#40	96.7		
#60	85.7		
#100	66.9		
#200	42.5		
0.0448 mm.	25.2		
0.0293 mm.	21.1		
0.0236 mm.	18.4		
0.0126 mm.	13.9		
0.0111 mm.	11.2		
0.0065 mm.	8.4		
0.0033 mm.	7.1		
0.0014 mm.	5.2		

* (no specification provided)

Material Description

Gray-brown silty sand with trace organics

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-4(0)

Coefficients

D_{90}= 0.2914 D_{85}= 0.2446 D_{60}= 0.1237
D_{50}= 0.0924 D_{30}= 0.0537 D_{15}= 0.0134
D_{10}= 0.0092 C_u= 13.47 C_c= 2.54

Remarks

As received MC = 39.1%

Date Received: **Date Tested:** 8/14/2020

Tested By: HKP

Checked By: MP

Title: Laboratory Manager

Source of Sample: Composite
Sample Number: 1

Date Sampled:

CDM Smith

Boston, Massachusetts

Client: USG
Project: Highway 99
Milton, WA
Project No: 19921.251008

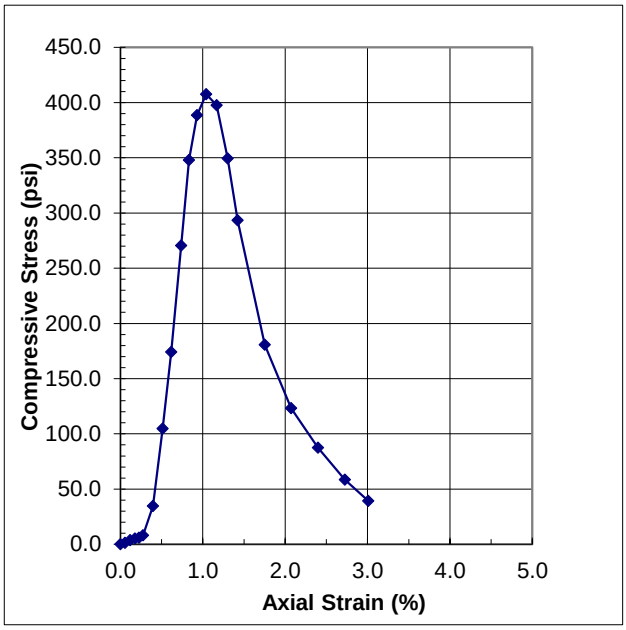
CDM Smith
Geotechnical Engineering Laboratory

Unconfined Compressive Strength (ASTM D1633)

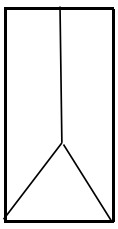
Client:	USG	Test Performed by :	AS
Project Name :	Highway 99 Bench Scale Study	Test Date :	8/24/20
Project Location:	Milton, WA		
Project Number:	19921-251008		
Sample Material :	C1-H1	Soil Type :	Soil - Cement
Sample Mix:			
Sample Date:	8/17/2020	Preparation Method:	Smoothed ends
Sample Age:	7 days		
		Pocket Penetrometer:	**>62.5 psi**

Water Content (%):	**24.2**		
Mass (g):	402.7	Loading Rate (in/min) :	0.05
Area (sq in) :	3.29	Dial Rate :	5.8
Diameter (in) :	2.05	Strain Rate (%/min)	1.27
Height (in) :	4.01	Strain at Failure (%):	1.04
Height to Dia. Ratio :	2.0	U. C. Strength (psi) :	**407.6**
Wet Density (pcf) :	**116.1**	Shear Strength (psi):	203.8
Dry Density (pcf) :	**93.4**		

Time (sec)	Displ. (in)	Load (lbs)	Cross Sectional Area (in^2)	Axial Strain (%)	Compress Strength (psi)
0	0.000	0.0	3.29	0.00	0.00
3	0.002	4.5	3.29	0.06	1.38
6	0.005	12.3	3.29	0.12	3.73
9	0.007	16.9	3.29	0.17	5.15
12	0.009	19.8	3.29	0.22	6.01
15	0.011	26.9	3.29	0.28	8.18
21	0.016	113.6	3.29	0.40	34.51
27	0.021	345.2	3.29	0.51	104.83
33	0.025	573.2	3.29	0.62	174.09
39	0.030	890.7	3.29	0.74	270.52
45	0.033	1145.1	3.29	0.83	347.80
51	0.037	1278.9	3.29	0.93	388.44
57	0.042	1342.1	3.29	1.04	407.63
63	0.047	1308.8	3.29	1.17	397.50
69	0.052	1150.1	3.29	1.30	349.31
75	0.057	965.9	3.29	1.42	293.35
90	0.070	594.6	3.29	1.75	180.59
105	0.083	405.3	3.29	2.07	123.11
120	0.096	288.2	3.29	2.40	87.53
135	0.109	192.8	3.29	2.73	58.55
150	0.121	128.9	3.29	3.01	39.14



Failure Sketch



Remarks: None.

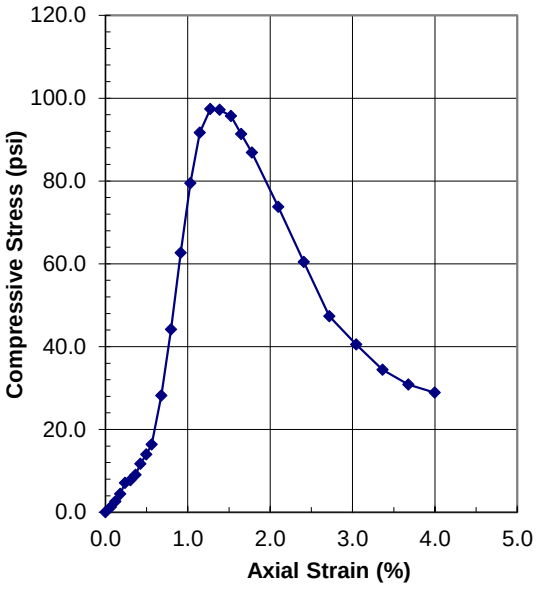
CDM Smith
Geotechnical Engineering Laboratory

Unconfined Compressive Strength (ASTM D1633)

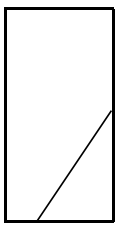
Client:	USG	Test Performed by :	AS
Project Name :	Highway 99 Bench Scale Study	Test Date :	8/24/20
Project Location:	Milton, WA		
Project Number:	19921-251008		
Sample Material :	C1-H2	Soil Type :	Soil - Cement
Sample Mix:			
Sample Date:	8/17/2020	Preparation Method:	Smoothed ends
Sample Age:	7 days		
		Pocket Penetrometer:	**>62.5 psi**

Water Content (%):	**24.4**		
Mass (g):	363.9	Loading Rate (in/min) :	0.05
Area (sq in) :	3.29	Dial Rate :	5.8
Diameter (in) :	2.05	Strain Rate (%/min)	1.18
Height (in) :	4.00	Strain at Failure (%):	1.27
Height to Dia. Ratio :	2.0	U. C. Strength (psi) :	**97.4**
Wet Density (pcf) :	**105.4**	Shear Strength (psi):	48.7
Dry Density (pcf) :	**84.7**		

Time (sec)	Displ. (in)	Load (lbs)	Cross Sectional Area (in^2)	Axial Strain (%)	Compress Strength (psi)
0	0.000	0.0	3.29	0.00	0.00
3	0.003	4.1	3.29	0.06	1.25
6	0.005	8.7	3.29	0.12	2.64
9	0.007	14.6	3.29	0.18	4.45
12	0.010	23.3	3.29	0.24	7.10
15	0.012	25.3	3.29	0.30	7.71
18	0.015	29.8	3.29	0.36	9.05
21	0.017	38.5	3.29	0.42	11.70
24	0.020	46.0	3.29	0.49	13.99
27	0.022	53.8	3.29	0.56	16.36
33	0.027	92.5	3.29	0.68	28.15
39	0.032	145.1	3.29	0.80	44.14
45	0.037	206.0	3.29	0.91	62.67
51	0.041	261.1	3.29	1.03	79.44
57	0.046	301.3	3.29	1.15	91.65
63	0.051	320.0	3.29	1.27	97.36
69	0.055	319.4	3.29	1.39	97.15
75	0.061	314.6	3.29	1.52	95.72
81	0.066	300.2	3.29	1.65	91.34
87	0.071	285.6	3.29	1.78	86.89
102	0.084	242.4	3.29	2.10	73.75
117	0.096	198.6	3.29	2.41	60.41
132	0.109	155.6	3.29	2.72	47.34
147	0.122	133.3	3.29	3.05	40.55
162	0.135	113.1	3.29	3.36	34.40
177	0.147	101.4	3.29	3.68	30.83
192	0.160	94.9	3.29	4.00	28.87



Failure Sketch



Remarks: None.

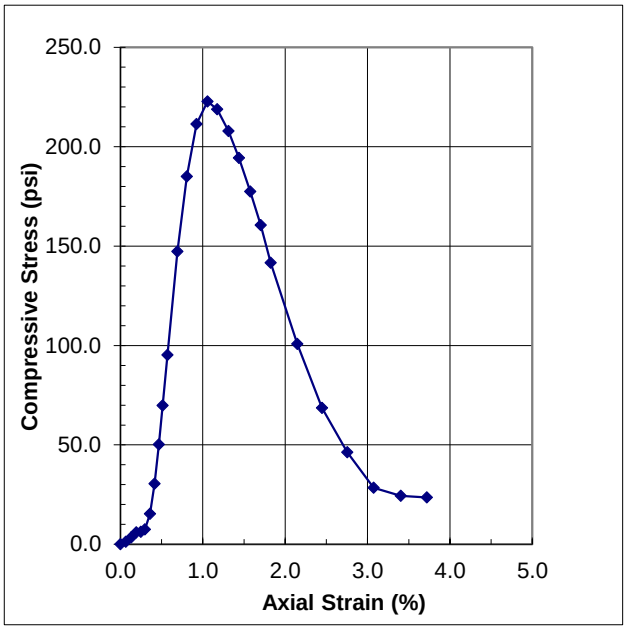
CDM Smith
Geotechnical Engineering Laboratory

Unconfined Compressive Strength (ASTM D1633)

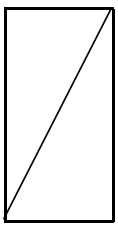
Client:	USG	Test Performed by :	AS
Project Name :	Highway 99 Bench Scale Study	Test Date :	8/24/20
Project Location:	Milton, WA		
Project Number:	19921-251008		
Sample Material :	C1-H3	Soil Type :	Soil - Cement
Sample Mix:			
Sample Date:	8/17/2020	Preparation Method:	Smoothed ends
Sample Age:	7 days		
		Pocket Penetrometer:	**>62.5 psi**

Water Content (%):	**24.3**		
Mass (g):	387.4	Loading Rate (in/min) :	0.05
Area (sq in) :	3.29	Dial Rate :	5.8
Diameter (in) :	2.05	Strain Rate (%/min)	1.24
Height (in) :	3.98	Strain at Failure (%):	1.06
Height to Dia. Ratio :	1.9	U. C. Strength (psi) :	**222.8**
Wet Density (pcf) :	**112.7**	Shear Strength (psi):	111.4
Dry Density (pcf) :	**90.7**		

Time (sec)	Displ. (in)	Load (lbs)	Cross Sectional Area (in^2)	Axial Strain (%)	Compress Strength (psi)
0	0.000	0.0	3.29	0.00	0.00
3	0.003	4.0	3.29	0.07	1.23
6	0.005	11.1	3.29	0.13	3.39
9	0.008	19.7	3.29	0.19	5.98
12	0.010	20.6	3.29	0.25	6.27
15	0.012	24.7	3.29	0.30	7.50
18	0.014	50.2	3.29	0.36	15.26
21	0.017	99.9	3.29	0.41	30.40
24	0.019	165.3	3.29	0.47	50.26
27	0.020	229.6	3.29	0.51	69.83
30	0.023	312.9	3.29	0.57	95.16
36	0.028	484.3	3.29	0.69	147.28
42	0.032	608.4	3.29	0.81	185.01
48	0.037	695.0	3.29	0.92	211.35
54	0.042	732.6	3.29	1.06	222.79
60	0.047	719.7	3.29	1.17	218.86
66	0.052	683.4	3.29	1.31	207.85
72	0.057	639.2	3.29	1.44	194.38
78	0.063	583.6	3.29	1.58	177.47
84	0.068	527.8	3.29	1.70	160.51
90	0.073	465.7	3.29	1.82	141.62
105	0.085	331.3	3.29	2.15	100.75
120	0.097	225.6	3.29	2.45	68.61
135	0.110	152.1	3.29	2.75	46.26
150	0.122	93.5	3.29	3.07	28.43
165	0.135	80.2	3.29	3.40	24.40
180	0.148	77.5	3.29	3.72	23.57



Failure Sketch



Remarks: None.

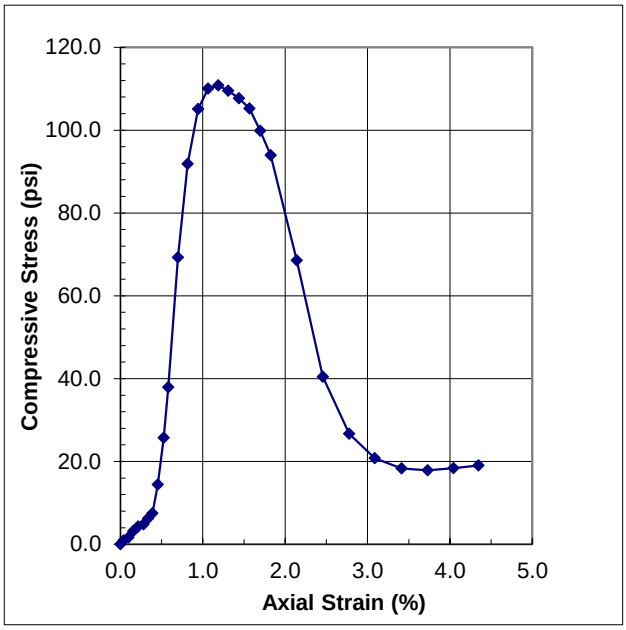
CDM Smith
Geotechnical Engineering Laboratory

Unconfined Compressive Strength (ASTM D1633)

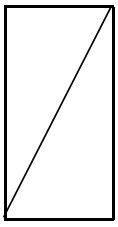
Client:	USG	Test Performed by :	AS
Project Name :	Highway 99 Bench Scale Study	Test Date :	8/24/20
Project Location:	Milton, WA		
Project Number:	19921-251008		
Sample Material :	C1-H4	Soil Type :	Soil - Cement
Sample Mix:			
Sample Date:	8/17/2020	Preparation Method:	Smoothed ends
Sample Age:	7 days		
		Pocket Penetrometer:	**>62.5 psi**

Water Content (%):	**28.0**		
Mass (g):	389.1	Loading Rate (in/min) :	0.05
Area (sq in) :	3.29	Dial Rate :	5.8
Diameter (in) :	2.05	Strain Rate (%/min)	1.21
Height (in) :	3.99	Strain at Failure (%):	1.19
Height to Dia. Ratio :	1.9	U. C. Strength (psi) :	**110.8**
Wet Density (pcf) :	**113.1**	Shear Strength (psi):	55.4
Dry Density (pcf) :	**88.4**		

Time (sec)	Displ. (in)	Load (lbs)	Cross Sectional Area (in^2)	Axial Strain (%)	Compress Strength (psi)
0	0.000	0.0	3.29	0.00	0.00
2	0.002	3.1	3.29	0.04	0.93
5	0.004	5.3	3.29	0.10	1.62
8	0.006	10.5	3.29	0.16	3.20
11	0.009	14.1	3.29	0.21	4.28
14	0.011	15.8	3.29	0.28	4.81
17	0.013	20.5	3.29	0.34	6.23
20	0.015	24.6	3.29	0.39	7.49
23	0.018	47.4	3.29	0.45	14.41
26	0.021	84.6	3.29	0.52	25.74
29	0.023	124.6	3.29	0.58	37.90
35	0.028	227.8	3.29	0.70	69.30
41	0.032	301.9	3.29	0.81	91.86
47	0.038	345.5	3.29	0.94	105.11
53	0.042	361.7	3.29	1.06	110.05
59	0.047	364.3	3.29	1.19	110.82
65	0.052	360.0	3.29	1.31	109.52
71	0.057	354.0	3.29	1.44	107.70
77	0.062	345.9	3.29	1.57	105.22
83	0.068	328.3	3.29	1.70	99.87
89	0.073	308.8	3.29	1.82	93.94
104	0.085	225.4	3.29	2.14	68.56
119	0.098	132.9	3.29	2.46	40.42
134	0.111	87.7	3.29	2.78	26.69
149	0.123	68.2	3.29	3.09	20.76
164	0.136	60.2	3.29	3.41	18.32
179	0.149	58.8	3.29	3.73	17.89
194	0.161	60.5	3.29	4.04	18.40
209	0.173	62.5	3.29	4.35	19.03



Failure Sketch



Remarks: None.

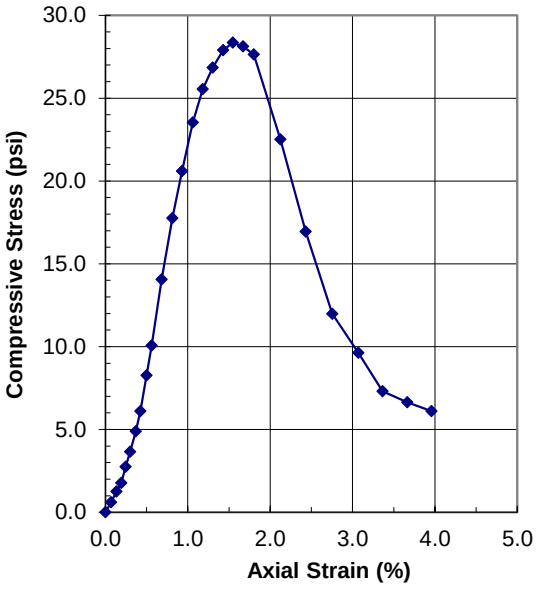
CDM Smith
Geotechnical Engineering Laboratory

Unconfined Compressive Strength (ASTM D1633)

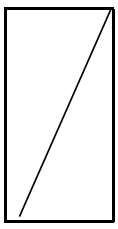
Client:	USG	Test Performed by :	AS
Project Name :	Highway 99 Bench Scale Study	Test Date :	8/24/20
Project Location:	Milton, WA		
Project Number:	19921-251008		
Sample Material :	C1-H5	Soil Type :	Soil - Cement
Sample Mix:			
Sample Date:	8/17/2020	Preparation Method:	Smoothed ends
Sample Age:	7 days		
		Pocket Penetrometer:	**>62.5 psi**

Water Content (%):	**26.2**		
Mass (g):	375.4	Loading Rate (in/min) :	0.05
Area (sq in) :	3.27	Dial Rate :	5.8
Diameter (in) :	2.04	Strain Rate (%/min)	1.23
Height (in) :	4.00	Strain at Failure (%):	1.55
Height to Dia. Ratio :	2.0	U. C. Strength (psi) :	**28.4**
Wet Density (pcf) :	**109.2**	Shear Strength (psi):	14.2
Dry Density (pcf) :	**86.5**		

Time (sec)	Displ. (in)	Load (lbs)	Cross Sectional Area (in^2)	Axial Strain (%)	Compress Strength (psi)
0	0.000	0.0	3.27	0.00	0.00
3	0.003	2.0	3.27	0.07	0.61
6	0.005	4.1	3.27	0.13	1.25
9	0.008	5.8	3.27	0.19	1.77
12	0.010	9.0	3.27	0.24	2.75
15	0.012	11.9	3.27	0.30	3.65
18	0.015	16.0	3.27	0.37	4.89
21	0.017	20.0	3.27	0.42	6.11
24	0.020	27.0	3.27	0.50	8.26
27	0.022	33.0	3.27	0.56	10.07
33	0.027	46.0	3.27	0.68	14.05
39	0.033	58.2	3.27	0.81	17.76
45	0.037	67.4	3.27	0.93	20.59
51	0.042	77.1	3.27	1.06	23.53
57	0.047	83.6	3.27	1.18	25.54
63	0.052	87.9	3.27	1.30	26.84
69	0.057	91.4	3.27	1.43	27.90
75	0.062	92.8	3.27	1.55	28.35
81	0.067	92.1	3.27	1.67	28.12
87	0.072	90.5	3.27	1.80	27.64
102	0.085	73.7	3.27	2.12	22.52
117	0.097	55.5	3.27	2.43	16.95
132	0.110	39.2	3.27	2.76	11.98
147	0.123	31.5	3.27	3.07	9.63
162	0.135	23.9	3.27	3.36	7.31
177	0.147	21.8	3.27	3.67	6.65
192	0.158	20.0	3.27	3.96	6.11



Failure Sketch



Remarks: None.

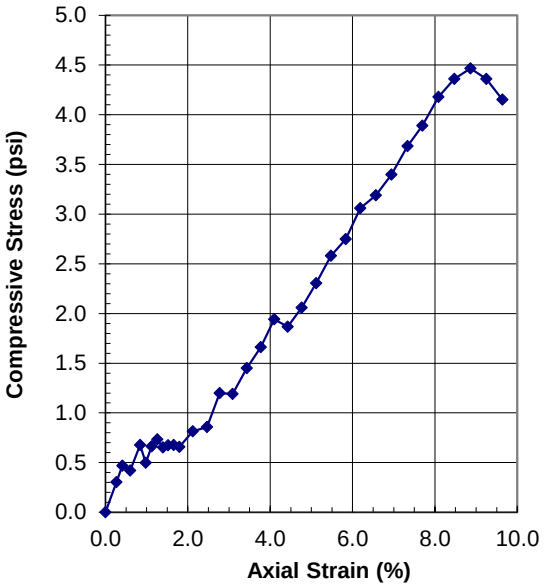
CDM Smith
Geotechnical Engineering Laboratory

Unconfined Compressive Strength (ASTM D1633)

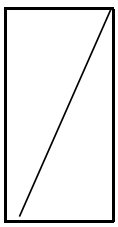
Client:	USG	Test Performed by :	AS
Project Name :	Highway 99 Bench Scale Study	Test Date :	8/24/20
Project Location:	Milton, WA		
Project Number:	19921-251008		
Sample Material :	C1-H6	Soil Type :	Soil - Cement
Sample Mix:			
Sample Date:	8/17/2020	Preparation Method:	Smoothed ends
Sample Age:	7 days		
		Pocket Penetrometer:	**13.9 psi**

Water Content (%):	**32.3**		
Mass (g):	380.3	Loading Rate (in/min) :	0.06
Area (sq in) :	3.31	Dial Rate :	5.8
Diameter (in) :	2.05	Strain Rate (%/min)	1.49
Height (in) :	3.78	Strain at Failure (%):	8.86
Height to Dia. Ratio :	1.8	U. C. Strength (psi) :	**4.5**
Wet Density (pcf) :	**115.9**	Shear Strength (psi):	2.2
Dry Density (pcf) :	**87.6**		

Time (sec)	Displ. (in)	Load (lbs)	Cross Sectional Area (in^2)	Axial Strain (%)	Compress Strength (psi)
0	0.000	0.0	3.31	0.00	0.00
6	0.010	1.0	3.31	0.27	0.30
12	0.015	1.5	3.31	0.41	0.47
18	0.023	1.4	3.31	0.60	0.42
27	0.032	2.2	3.31	0.84	0.68
39	0.037	1.6	3.31	0.98	0.50
45	0.042	2.2	3.31	1.12	0.66
51	0.048	2.4	3.31	1.26	0.73
57	0.053	2.2	3.31	1.40	0.65
63	0.057	2.2	3.31	1.52	0.67
69	0.063	2.2	3.31	1.66	0.68
75	0.068	2.2	3.31	1.79	0.66
81	0.080	2.7	3.31	2.12	0.81
96	0.093	2.8	3.31	2.47	0.86
111	0.105	4.0	3.31	2.77	1.20
126	0.117	3.9	3.31	3.09	1.19
141	0.130	4.8	3.31	3.43	1.45
156	0.142	5.5	3.31	3.77	1.66
171	0.155	6.4	3.31	4.10	1.94
186	0.167	6.2	3.31	4.43	1.87
201	0.180	6.8	3.31	4.76	2.06
216	0.193	7.6	3.31	5.12	2.30
231	0.207	8.5	3.31	5.48	2.58
246	0.221	9.1	3.31	5.84	2.75
261	0.234	10.1	3.31	6.18	3.06
276	0.248	10.5	3.31	6.57	3.19
291	0.262	11.2	3.31	6.94	3.40
306	0.277	12.2	3.31	7.33	3.69
321	0.291	12.9	3.31	7.69	3.89
336	0.306	13.8	3.31	8.09	4.18
351	0.320	14.4	3.31	8.47	4.36
366	0.335	14.8	3.31	8.86	4.47
381	0.350	14.4	3.31	9.25	4.36
396	0.364	13.7	3.31	9.64	4.15



Failure Sketch



Remarks: None.

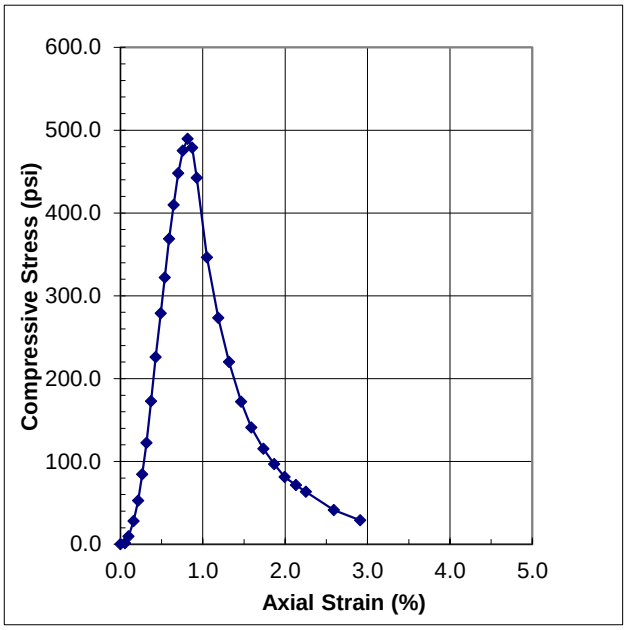
CDM Smith
Geotechnical Engineering Laboratory

Unconfined Compressive Strength (ASTM D1633)

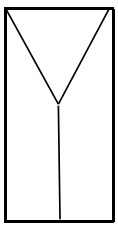
Client:	USG	Test Performed by :	AS
Project Name :	Highway 99 Bench Scale Study	Test Date :	8/31/20
Project Location:	Milton, WA		
Project Number:	19921-251008		
Sample Material :	C1-H1	Soil Type :	Soil - Cement
Sample Mix:			
Sample Date:	8/17/2020	Preparation Method:	Smoothed ends
Sample Age:	14 days		
		Pocket Penetrometer:	**>62.5 psi**

Water Content (%):	**24.2**		
Mass (g):	393.2	Loading Rate (in/min) :	0.04
Area (sq in) :	3.29	Dial Rate :	5.8
Diameter (in) :	2.05	Strain Rate (%/min)	1.05
Height (in) :	3.98	Strain at Failure (%):	0.82
Height to Dia. Ratio :	1.9	U. C. Strength (psi) :	**489.5**
Wet Density (pcf) :	**114.4**	Shear Strength (psi):	244.7
Dry Density (pcf) :	**92.2**		

Time (sec)	Displ. (in)	Load (lbs)	Cross Sectional Area (in^2)	Axial Strain (%)	Compress Strength (psi)
0	0.000	0.0	3.29	0.00	0.00
3	0.002	4.8	3.29	0.05	1.47
6	0.004	31.1	3.29	0.10	9.44
9	0.006	92.5	3.29	0.16	28.10
12	0.009	173.0	3.29	0.21	52.56
15	0.010	278.3	3.29	0.26	84.54
18	0.013	402.8	3.29	0.31	122.38
21	0.015	568.6	3.29	0.37	172.75
24	0.017	743.4	3.29	0.43	225.87
27	0.019	917.9	3.29	0.49	278.87
30	0.021	1059.4	3.29	0.54	321.87
33	0.024	1214.2	3.29	0.59	368.89
36	0.026	1348.8	3.29	0.65	409.78
39	0.028	1474.2	3.29	0.70	447.88
42	0.030	1564.4	3.29	0.76	475.29
46	0.032	1611.1	3.29	0.82	489.49
49	0.035	1576.3	3.29	0.87	478.91
52	0.037	1456.6	3.29	0.93	442.54
58	0.042	1140.1	3.29	1.05	346.38
64	0.047	899.3	3.29	1.19	273.22
70	0.052	724.1	3.29	1.32	220.00
76	0.058	566.8	3.29	1.47	172.20
82	0.063	464.2	3.29	1.59	141.02
88	0.069	379.2	3.29	1.74	115.22
94	0.074	319.0	3.29	1.87	96.93
100	0.079	267.6	3.29	1.99	81.30
106	0.085	235.0	3.29	2.13	71.40
112	0.090	208.7	3.29	2.25	63.42
127	0.103	136.3	3.29	2.59	41.40
142	0.116	95.0	3.29	2.91	28.85



Failure Sketch



Remarks: None.

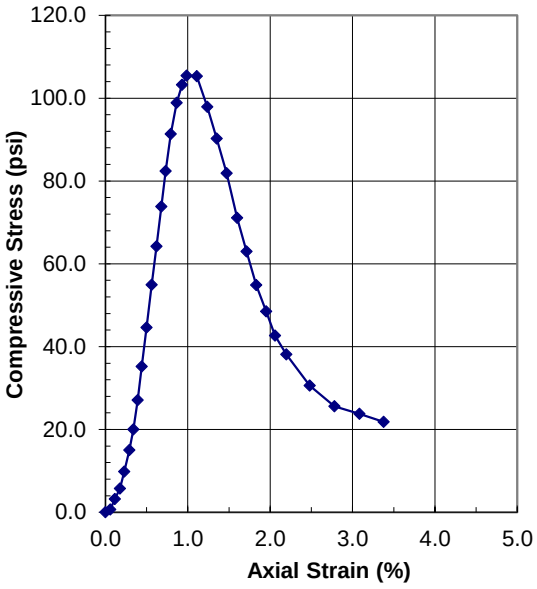
CDM Smith
Geotechnical Engineering Laboratory

Unconfined Compressive Strength (ASTM D1633)

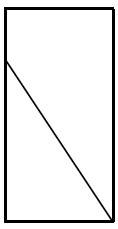
Client:	USG	Test Performed by :	AS
Project Name :	Highway 99 Bench Scale Study	Test Date :	8/31/20
Project Location:	Milton, WA		
Project Number:	19921-251008		
Sample Material :	C1-H2	Soil Type :	Soil - Cement
Sample Mix:			
Sample Date:	8/17/2020	Preparation Method:	Smoothed ends
Sample Age:	14 days		
		Pocket Penetrometer:	**>62.5 psi**

Water Content (%):	**24.3**		
Mass (g):	365.5	Loading Rate (in/min) :	0.05
Area (sq in) :	3.28	Dial Rate :	5.8
Diameter (in) :	2.04	Strain Rate (%/min)	1.24
Height (in) :	4.02	Strain at Failure (%):	0.98
Height to Dia. Ratio :	2.0	U. C. Strength (psi) :	**105.4**
Wet Density (pcf) :	**105.7**	Shear Strength (psi):	52.7
Dry Density (pcf) :	**85.0**		

Time (sec)	Displ. (in)	Load (lbs)	Cross Sectional Area (in^2)	Axial Strain (%)	Compress Strength (psi)
0	0.000	0.0	3.28	0.00	0.00
3	0.002	2.2	3.28	0.06	0.68
6	0.005	10.5	3.28	0.12	3.20
9	0.007	18.8	3.28	0.17	5.72
12	0.009	32.1	3.28	0.23	9.80
15	0.012	49.2	3.28	0.29	14.99
18	0.014	65.6	3.28	0.34	20.01
21	0.016	88.8	3.28	0.39	27.08
24	0.018	115.6	3.28	0.44	35.22
27	0.020	146.4	3.28	0.50	44.64
30	0.023	180.2	3.28	0.56	54.93
33	0.025	210.6	3.28	0.62	64.20
36	0.027	242.2	3.28	0.68	73.82
39	0.029	270.3	3.28	0.73	82.39
42	0.032	299.7	3.28	0.79	91.36
45	0.035	324.4	3.28	0.86	98.89
48	0.037	338.6	3.28	0.93	103.20
51	0.040	345.8	3.28	0.98	105.40
57	0.045	345.5	3.28	1.11	105.30
63	0.050	321.2	3.28	1.24	97.91
69	0.054	296.0	3.28	1.35	90.23
75	0.059	268.7	3.28	1.47	81.89
82	0.064	233.3	3.28	1.60	71.12
88	0.069	206.7	3.28	1.71	63.00
94	0.073	179.9	3.28	1.83	54.84
100	0.078	159.2	3.28	1.95	48.52
106	0.083	140.0	3.28	2.06	42.67
112	0.088	125.0	3.28	2.20	38.10
127	0.100	100.3	3.28	2.48	30.58
142	0.112	83.9	3.28	2.78	25.58
157	0.124	78.0	3.28	3.08	23.78
172	0.136	71.6	3.28	3.38	21.81



Failure Sketch



Remarks: None.

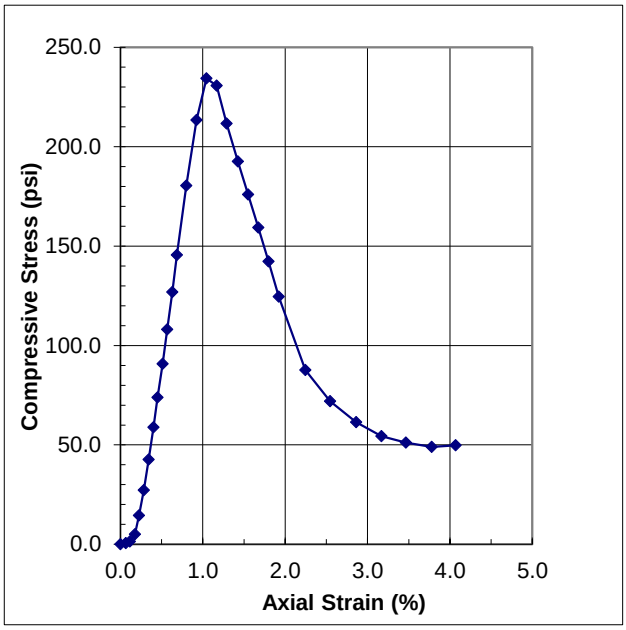
CDM Smith
Geotechnical Engineering Laboratory

Unconfined Compressive Strength (ASTM D1633)

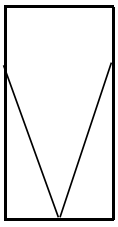
Client:	USG	Test Performed by :	AS
Project Name :	Highway 99 Bench Scale Study	Test Date :	8/31/20
Project Location:	Milton, WA		
Project Number:	19921-251008		
Sample Material :	C1-H3	Soil Type :	Soil - Cement
Sample Mix:			
Sample Date:	8/17/2020	Preparation Method:	Smoothed ends
Sample Age:	14 days		
		Pocket Penetrometer:	**>62.5 psi**

Water Content (%):	**24.1**		
Mass (g):	384.9	Loading Rate (in/min) :	0.05
Area (sq in) :	3.29	Dial Rate :	5.8
Diameter (in) :	2.05	Strain Rate (%/min)	1.20
Height (in) :	4.02	Strain at Failure (%):	1.04
Height to Dia. Ratio :	2.0	U. C. Strength (psi) :	**234.4**
Wet Density (pcf) :	**110.8**	Shear Strength (psi):	117.2
Dry Density (pcf) :	**89.3**		

Time (sec)	Displ. (in)	Load (lbs)	Cross Sectional Area (in^2)	Axial Strain (%)	Compress Strength (psi)
0	0.000	0.0	3.29	0.00	0.00
3	0.003	1.7	3.29	0.06	0.52
6	0.005	4.6	3.29	0.11	1.39
9	0.007	16.5	3.29	0.18	5.02
12	0.009	47.7	3.29	0.23	14.49
15	0.011	89.7	3.29	0.28	27.24
18	0.014	140.2	3.29	0.34	42.57
21	0.016	193.8	3.29	0.40	58.87
24	0.018	243.2	3.29	0.45	73.86
27	0.021	298.7	3.29	0.51	90.73
30	0.023	355.8	3.29	0.57	108.05
33	0.025	417.7	3.29	0.63	126.87
36	0.028	479.3	3.29	0.69	145.58
42	0.032	594.0	3.29	0.80	180.41
48	0.037	702.5	3.29	0.92	213.35
54	0.042	771.6	3.29	1.04	234.36
60	0.047	759.8	3.29	1.17	230.77
66	0.052	696.8	3.29	1.29	211.64
73	0.057	634.0	3.29	1.43	192.56
79	0.062	579.5	3.29	1.55	176.00
85	0.067	524.5	3.29	1.67	159.29
91	0.072	468.6	3.29	1.80	142.31
97	0.077	410.0	3.29	1.92	124.53
112	0.090	288.8	3.29	2.24	87.71
127	0.102	237.0	3.29	2.55	71.98
142	0.115	202.2	3.29	2.86	61.42
157	0.127	179.0	3.29	3.17	54.38
172	0.139	168.5	3.29	3.47	51.16
187	0.152	161.4	3.29	3.78	49.01
202	0.164	163.9	3.29	4.07	49.76



Failure Sketch



Remarks: None.

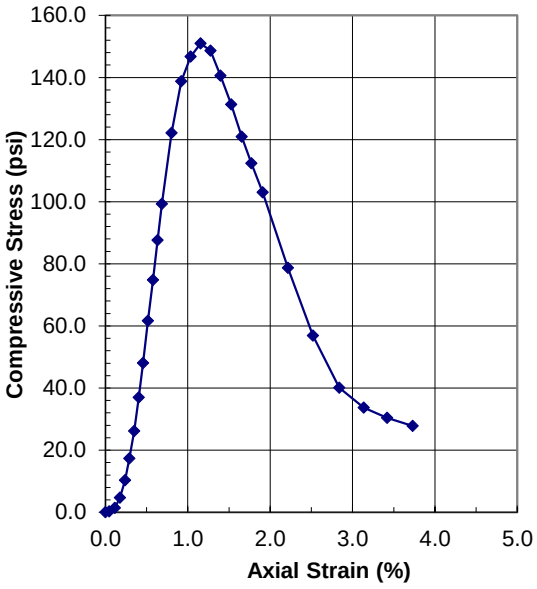
CDM Smith
Geotechnical Engineering Laboratory

Unconfined Compressive Strength (ASTM D1633)

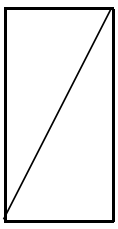
Client:	USG	Test Performed by :	AS
Project Name :	Highway 99 Bench Scale Study	Test Date :	8/31/20
Project Location:	Milton, WA		
Project Number:	19921-251008		
Sample Material :	C1-H4	Soil Type :	Soil - Cement
Sample Mix:			
Sample Date:	8/17/2020	Preparation Method:	Smoothed ends
Sample Age:	14 days		
		Pocket Penetrometer:	**>62.5 psi**

Water Content (%):	**27.8**		
Mass (g):	392.1	Loading Rate (in/min) :	0.05
Area (sq in) :	3.29	Dial Rate :	5.8
Diameter (in) :	2.05	Strain Rate (%/min)	1.16
Height (in) :	4.01	Strain at Failure (%):	1.15
Height to Dia. Ratio :	2.0	U. C. Strength (psi) :	**150.9**
Wet Density (pcf) :	**113.1**	Shear Strength (psi):	75.5
Dry Density (pcf) :	**88.5**		

Time (sec)	Displ. (in)	Load (lbs)	Cross Sectional Area (in^2)	Axial Strain (%)	Compress Strength (psi)
0	0.000	0.0	3.29	0.00	0.00
3	0.002	0.9	3.29	0.05	0.28
6	0.005	4.5	3.29	0.12	1.37
9	0.007	15.5	3.29	0.18	4.72
12	0.009	34.0	3.29	0.24	10.34
15	0.012	57.0	3.29	0.29	17.32
18	0.014	86.1	3.29	0.35	26.17
21	0.016	121.7	3.29	0.41	36.98
24	0.018	158.3	3.29	0.46	48.09
27	0.021	202.9	3.29	0.52	61.65
30	0.023	246.3	3.29	0.58	74.83
33	0.025	288.4	3.29	0.63	87.61
36	0.027	326.9	3.29	0.68	99.31
42	0.032	402.0	3.29	0.80	122.13
48	0.037	456.8	3.29	0.92	138.78
54	0.041	483.0	3.29	1.03	146.73
60	0.046	496.8	3.29	1.15	150.93
66	0.051	489.1	3.29	1.28	148.59
72	0.056	462.6	3.29	1.40	140.55
79	0.061	432.2	3.29	1.53	131.32
85	0.066	398.0	3.29	1.65	120.93
91	0.071	369.9	3.29	1.77	112.37
97	0.077	339.1	3.29	1.91	103.03
112	0.089	258.9	3.29	2.22	78.66
127	0.101	187.1	3.29	2.52	56.85
142	0.114	132.1	3.29	2.84	40.12
157	0.126	110.9	3.29	3.13	33.69
172	0.137	99.9	3.29	3.42	30.36
187	0.150	91.4	3.29	3.73	27.77



Failure Sketch



Remarks: None.

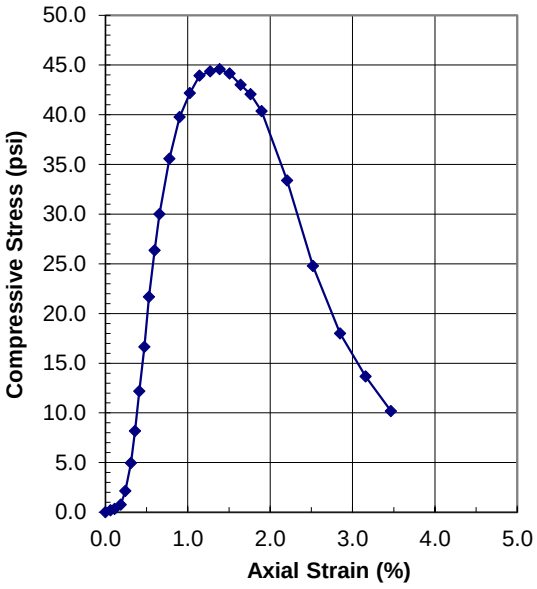
CDM Smith
Geotechnical Engineering Laboratory

Unconfined Compressive Strength (ASTM D1633)

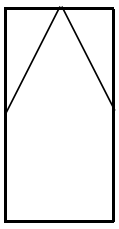
Client:	USG	Test Performed by :	AS
Project Name :	Highway 99 Bench Scale Study	Test Date :	8/31/20
Project Location:	Milton, WA		
Project Number:	19921-251008		
Sample Material :	C1-H5	Soil Type :	Soil - Cement
Sample Mix:			
Sample Date:	8/17/2020	Preparation Method:	Smoothed ends
Sample Age:	14 days		
		Pocket Penetrometer:	**>62.5 psi**

Water Content (%):	**25.8**		
Mass (g):	380.1	Loading Rate (in/min) :	0.05
Area (sq in) :	3.28	Dial Rate :	5.8
Diameter (in) :	2.04	Strain Rate (%/min)	1.23
Height (in) :	4.00	Strain at Failure (%):	1.39
Height to Dia. Ratio :	2.0	U. C. Strength (psi) :	**44.6**
Wet Density (pcf) :	**110.5**	Shear Strength (psi):	22.3
Dry Density (pcf) :	**87.8**		

Time (sec)	Displ. (in)	Load (lbs)	Cross Sectional Area (in^2)	Axial Strain (%)	Compress Strength (psi)
0	0.000	0.0	3.28	0.00	0.00
3	0.002	0.6	3.28	0.06	0.19
6	0.004	1.1	3.28	0.11	0.33
9	0.007	2.5	3.28	0.19	0.75
12	0.010	7.0	3.28	0.24	2.15
15	0.012	16.3	3.28	0.31	4.97
18	0.014	26.8	3.28	0.36	8.18
21	0.016	39.9	3.28	0.41	12.18
24	0.019	54.5	3.28	0.47	16.64
27	0.021	70.9	3.28	0.53	21.66
30	0.024	86.3	3.28	0.60	26.34
33	0.026	98.2	3.28	0.66	29.99
39	0.031	116.5	3.28	0.78	35.56
45	0.036	130.2	3.28	0.90	39.77
51	0.041	138.1	3.28	1.02	42.16
57	0.046	143.9	3.28	1.14	43.93
63	0.051	145.3	3.28	1.27	44.37
69	0.055	146.0	3.28	1.39	44.57
75	0.060	144.6	3.28	1.51	44.16
82	0.066	140.8	3.28	1.64	43.00
88	0.071	137.8	3.28	1.76	42.07
94	0.076	132.2	3.28	1.90	40.35
109	0.088	109.4	3.28	2.21	33.39
124	0.101	81.2	3.28	2.52	24.78
139	0.114	58.9	3.28	2.85	17.98
154	0.126	44.8	3.28	3.16	13.67
169	0.139	33.4	3.28	3.47	10.19



Failure Sketch



Remarks: None.

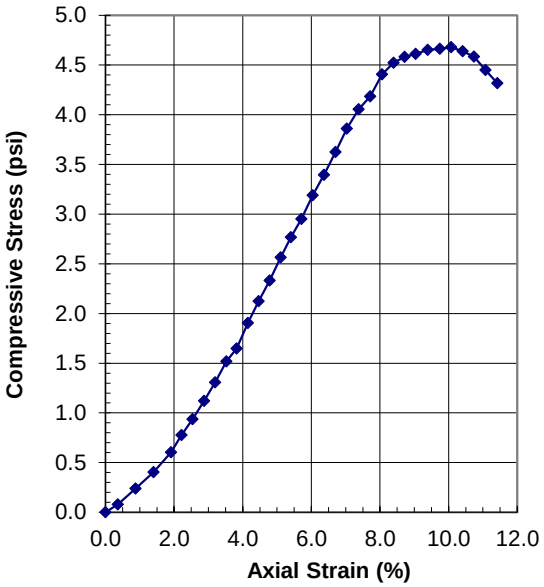
CDM Smith
Geotechnical Engineering Laboratory

Unconfined Compressive Strength (ASTM D1633)

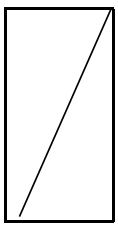
Client:	USG	Test Performed by :	AS
Project Name :	Highway 99 Bench Scale Study	Test Date :	8/31/20
Project Location:	Milton, WA		
Project Number:	19921-251008		
Sample Material :	C1-H6	Soil Type :	Soil - Cement
Sample Mix:			
Sample Date:	8/17/2020	Preparation Method:	Smoothed ends
Sample Age:	14 days		
		Pocket Penetrometer:	**20.8 psi**

Water Content (%):	**32.0**		
Mass (g):	378.5	Loading Rate (in/min) :	0.05
Area (sq in) :	3.30	Dial Rate :	5.8
Diameter (in) :	2.05	Strain Rate (%/min)	1.25
Height (in) :	3.80	Strain at Failure (%):	10.08
Height to Dia. Ratio :	1.9	U. C. Strength (psi) :	**4.7**
Wet Density (pcf) :	**115.2**	Shear Strength (psi):	2.3
Dry Density (pcf) :	**87.3**		

Time (sec)	Displ. (in)	Load (lbs)	Cross Sectional Area (in^2)	Axial Strain (%)	Compress Strength (psi)
0	0.000	0.0	3.30	0.00	0.00
18	0.014	0.3	3.30	0.36	0.08
42	0.033	0.8	3.30	0.88	0.24
67	0.053	1.3	3.30	1.40	0.40
91	0.073	2.0	3.30	1.91	0.60
106	0.084	2.6	3.30	2.21	0.78
121	0.096	3.1	3.30	2.54	0.94
136	0.109	3.7	3.30	2.87	1.12
151	0.121	4.3	3.30	3.20	1.31
166	0.134	5.0	3.30	3.53	1.52
181	0.145	5.4	3.30	3.82	1.65
196	0.158	6.3	3.30	4.15	1.90
211	0.170	7.0	3.30	4.47	2.12
226	0.182	7.7	3.30	4.78	2.33
241	0.194	8.4	3.30	5.10	2.56
256	0.205	9.1	3.30	5.41	2.77
271	0.217	9.7	3.30	5.71	2.95
286	0.229	10.5	3.30	6.04	3.19
301	0.242	11.2	3.30	6.37	3.39
316	0.255	11.9	3.30	6.70	3.62
331	0.267	12.7	3.30	7.04	3.86
346	0.280	13.4	3.30	7.38	4.05
361	0.293	13.8	3.30	7.71	4.18
376	0.306	14.5	3.30	8.06	4.41
391	0.319	14.9	3.30	8.40	4.52
406	0.331	15.1	3.30	8.72	4.58
421	0.343	15.2	3.30	9.04	4.61
436	0.357	15.3	3.30	9.39	4.65
451	0.370	15.4	3.30	9.74	4.66
466	0.383	15.4	3.30	10.08	4.68
482	0.395	15.3	3.30	10.41	4.64
497	0.408	15.1	3.30	10.74	4.59
512	0.421	14.7	3.30	11.07	4.45
527	0.434	14.2	3.30	11.42	4.32



Failure Sketch



Remarks: None.

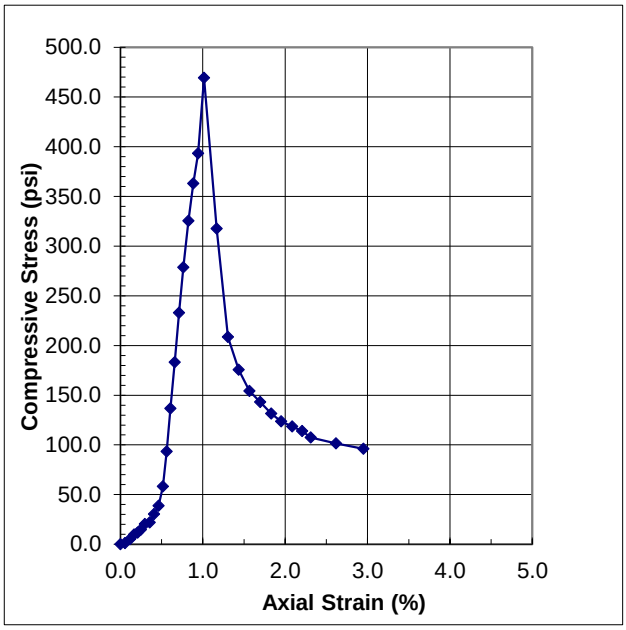
CDM Smith
Geotechnical Engineering Laboratory

Unconfined Compressive Strength (ASTM D1633)

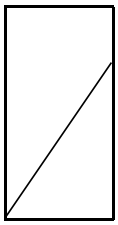
Client:	USG	Test Performed by :	AS
Project Name :	Highway 99 Bench Scale Study	Test Date :	9/14/20
Project Location:	Milton, WA		
Project Number:	19921-251008		
Sample Material :	C1-H1	Soil Type :	Soil - Cement
Sample Mix:			
Sample Date:	8/17/2020	Preparation Method:	Smoothed ends
Sample Age:	28 days		
		Pocket Penetrometer:	**>62.5 psi**

Water Content (%):	**23.7**		
Mass (g):	384.9	Loading Rate (in/min) :	0.04
Area (sq in) :	3.30	Dial Rate :	5.8
Diameter (in) :	2.05	Strain Rate (%/min)	1.06
Height (in) :	3.98	Strain at Failure (%):	1.01
Height to Dia. Ratio :	1.9	U. C. Strength (psi) :	**469.3**
Wet Density (pcf) :	**111.8**	Shear Strength (psi):	234.7
Dry Density (pcf) :	**90.4**		

Time (sec)	Displ. (in)	Load (lbs)	Cross Sectional Area (in^2)	Axial Strain (%)	Compress Strength (psi)
0	0.000	0.0	3.30	0.00	0.00
3	0.002	3.3	3.30	0.05	1.01
6	0.005	17.2	3.30	0.12	5.22
9	0.007	32.1	3.30	0.17	9.73
12	0.008	38.8	3.30	0.21	11.76
15	0.010	48.7	3.30	0.25	14.78
18	0.012	66.9	3.30	0.30	20.29
21	0.014	72.2	3.30	0.36	21.90
24	0.016	99.9	3.30	0.41	30.32
27	0.018	128.1	3.30	0.46	38.87
30	0.020	191.9	3.30	0.51	58.24
34	0.022	307.5	3.30	0.56	93.30
37	0.024	450.5	3.30	0.61	136.68
40	0.026	603.3	3.30	0.66	183.07
43	0.028	767.8	3.30	0.71	232.97
46	0.030	918.2	3.30	0.76	278.61
49	0.033	1072.7	3.30	0.83	325.50
52	0.035	1196.6	3.30	0.88	363.07
55	0.037	1295.8	3.30	0.94	393.18
58	0.040	1546.7	3.30	1.01	469.32
64	0.046	1046.6	3.30	1.17	317.55
70	0.052	687.1	3.30	1.30	208.49
76	0.057	578.5	3.30	1.44	175.53
82	0.062	508.5	3.30	1.57	154.30
88	0.068	472.0	3.30	1.70	143.22
94	0.073	433.8	3.30	1.83	131.62
100	0.078	407.2	3.30	1.95	123.54
106	0.083	390.5	3.30	2.08	118.48
112	0.088	375.4	3.30	2.21	113.90
118	0.092	353.6	3.30	2.31	107.30
133	0.104	334.1	3.30	2.62	101.37
148	0.117	316.6	3.30	2.95	96.05



Failure Sketch



Remarks: None.

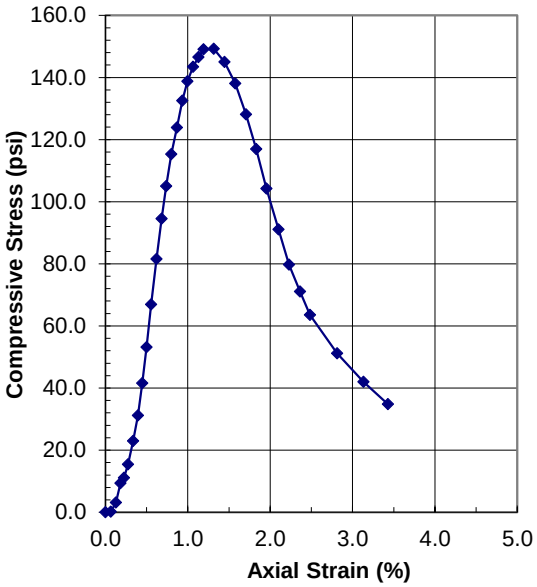
CDM Smith
Geotechnical Engineering Laboratory

Unconfined Compressive Strength (ASTM D1633)

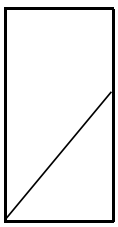
Client:	USG	Test Performed by :	AS
Project Name :	Highway 99 Bench Scale Study	Test Date :	9/14/20
Project Location:	Milton, WA		
Project Number:	19921-251008		
Sample Material :	C1-H2	Soil Type :	Soil - Cement
Sample Mix:			
Sample Date:	8/17/2020	Preparation Method:	Smoothed ends
Sample Age:	28 days		
		Pocket Penetrometer:	**>62.5 psi**

Water Content (%):	**23.5**		
Mass (g):	368.6	Loading Rate (in/min) :	0.05
Area (sq in) :	3.29	Dial Rate :	5.8
Diameter (in) :	2.05	Strain Rate (%/min)	1.25
Height (in) :	3.98	Strain at Failure (%):	1.32
Height to Dia. Ratio :	1.9	U. C. Strength (psi) :	**149.2**
Wet Density (pcf) :	**107.3**	Shear Strength (psi):	74.6
Dry Density (pcf) :	**87.0**		

Time (sec)	Displ. (in)	Load (lbs)	Cross Sectional Area (in^2)	Axial Strain (%)	Compress Strength (psi)
0	0.000	0.0	3.29	0.00	0.00
3	0.003	0.7	3.29	0.06	0.22
6	0.005	10.4	3.29	0.13	3.17
9	0.007	30.7	3.29	0.18	9.34
12	0.009	36.3	3.29	0.22	11.06
15	0.011	50.6	3.29	0.27	15.39
18	0.013	75.5	3.29	0.34	22.96
21	0.016	102.4	3.29	0.39	31.15
24	0.018	136.6	3.29	0.45	41.54
27	0.020	174.6	3.29	0.50	53.12
30	0.022	220.0	3.29	0.55	66.94
33	0.025	267.9	3.29	0.62	81.51
36	0.027	310.9	3.29	0.68	94.57
39	0.029	345.0	3.29	0.74	104.96
42	0.032	379.1	3.29	0.80	115.33
45	0.034	407.2	3.29	0.87	123.86
48	0.037	435.7	3.29	0.93	132.55
51	0.040	456.1	3.29	1.00	138.74
54	0.042	471.5	3.29	1.06	143.43
57	0.045	481.8	3.29	1.13	146.57
60	0.047	489.9	3.29	1.19	149.02
66	0.052	490.6	3.29	1.32	149.24
72	0.057	476.6	3.29	1.44	145.00
78	0.063	453.7	3.29	1.57	138.02
84	0.068	421.0	3.29	1.71	128.07
90	0.073	384.5	3.29	1.83	116.96
96	0.078	342.7	3.29	1.96	104.26
102	0.084	299.3	3.29	2.10	91.06
108	0.089	261.9	3.29	2.23	79.69
114	0.094	233.5	3.29	2.36	71.04
120	0.099	209.0	3.29	2.48	63.57
135	0.112	168.3	3.29	2.81	51.20
150	0.125	138.0	3.29	3.13	41.99
165	0.136	114.5	3.29	3.43	34.85



Failure Sketch



Remarks: None.

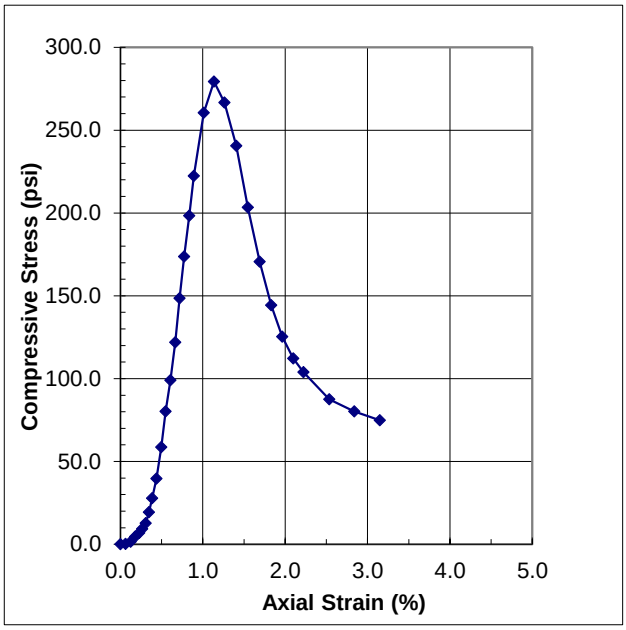
CDM Smith
Geotechnical Engineering Laboratory

Unconfined Compressive Strength (ASTM D1633)

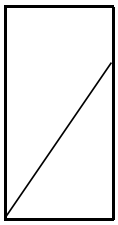
Client:	USG	Test Performed by :	AS
Project Name :	Highway 99 Bench Scale Study	Test Date :	9/14/20
Project Location:	Milton, WA		
Project Number:	19921-251008		
Sample Material :	C1-H3	Soil Type :	Soil - Cement
Sample Mix:			
Sample Date:	8/17/2020	Preparation Method:	Smoothed ends
Sample Age:	28 days		
		Pocket Penetrometer:	**>62.5 psi**

Water Content (%):	**23.4**		
Mass (g):	381.2	Loading Rate (in/min) :	0.05
Area (sq in) :	3.29	Dial Rate :	5.8
Diameter (in) :	2.05	Strain Rate (%/min)	1.14
Height (in) :	4.02	Strain at Failure (%):	1.14
Height to Dia. Ratio :	2.0	U. C. Strength (psi) :	**279.4**
Wet Density (pcf) :	**109.9**	Shear Strength (psi):	139.7
Dry Density (pcf) :	**89.1**		

Time (sec)	Displ. (in)	Load (lbs)	Cross Sectional Area (in^2)	Axial Strain (%)	Compress Strength (psi)
0	0.000	0.0	3.29	0.00	0.00
3	0.003	0.5	3.29	0.06	0.15
6	0.005	4.9	3.29	0.12	1.49
10	0.007	15.1	3.29	0.18	4.60
13	0.009	22.5	3.29	0.23	6.84
16	0.011	30.7	3.29	0.27	9.34
19	0.012	41.5	3.29	0.31	12.62
22	0.014	63.6	3.29	0.35	19.34
25	0.015	91.5	3.29	0.39	27.83
28	0.018	130.6	3.29	0.44	39.70
31	0.020	192.9	3.29	0.50	58.66
34	0.022	263.8	3.29	0.55	80.19
37	0.024	325.9	3.29	0.61	99.07
40	0.027	401.2	3.29	0.67	121.97
43	0.029	488.4	3.29	0.72	148.49
46	0.031	571.0	3.29	0.77	173.59
49	0.034	652.2	3.29	0.83	198.27
52	0.036	731.4	3.29	0.89	222.37
58	0.041	856.6	3.29	1.01	260.42
64	0.046	919.0	3.29	1.14	279.38
70	0.051	877.0	3.29	1.26	266.61
76	0.056	791.3	3.29	1.41	240.57
82	0.062	669.2	3.29	1.55	203.44
88	0.068	561.1	3.29	1.69	170.58
94	0.074	474.9	3.29	1.83	144.38
101	0.079	412.1	3.29	1.97	125.29
107	0.084	369.0	3.29	2.10	112.17
113	0.089	341.8	3.29	2.22	103.91
128	0.102	287.8	3.29	2.53	87.50
143	0.114	263.8	3.29	2.84	80.20
158	0.127	246.4	3.29	3.15	74.90



Failure Sketch



Remarks: None.

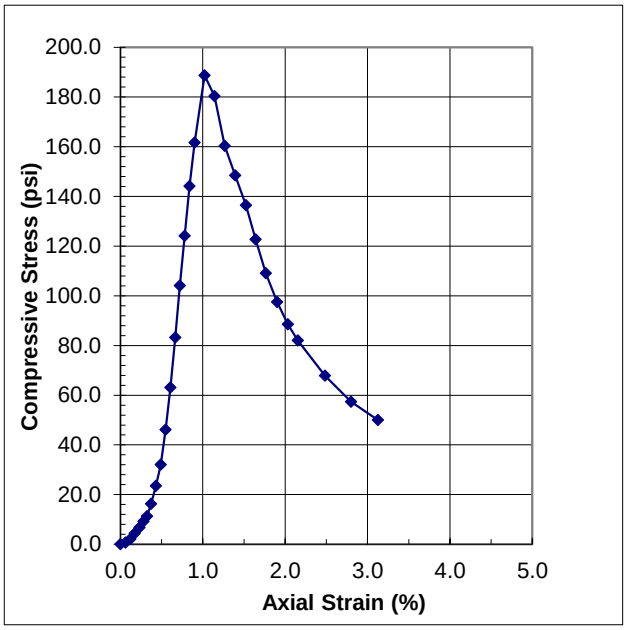
CDM Smith
Geotechnical Engineering Laboratory

Unconfined Compressive Strength (ASTM D1633)

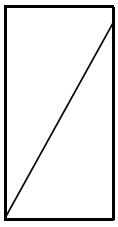
Client:	USG	Test Performed by :	AS
Project Name :	Highway 99 Bench Scale Study	Test Date :	9/14/20
Project Location:	Milton, WA		
Project Number:	19921-251008		
Sample Material :	C1-H4	Soil Type :	Soil - Cement
Sample Mix:			
Sample Date:	8/17/2020	Preparation Method:	Smoothed ends
Sample Age:	28 days		
		Pocket Penetrometer:	**>62.5 psi**

Water Content (%):	**27.4**		
Mass (g):	386.8	Loading Rate (in/min) :	0.05
Area (sq in) :	3.29	Dial Rate :	5.8
Diameter (in) :	2.05	Strain Rate (%/min)	1.17
Height (in) :	3.99	Strain at Failure (%):	1.02
Height to Dia. Ratio :	1.9	U. C. Strength (psi) :	**188.7**
Wet Density (pcf) :	**112.3**	Shear Strength (psi):	94.4
Dry Density (pcf) :	**88.1**		

Time (sec)	Displ. (in)	Load (lbs)	Cross Sectional Area (in^2)	Axial Strain (%)	Compress Strength (psi)
0	0.000	0.0	3.29	0.00	0.00
3	0.003	2.2	3.29	0.06	0.68
6	0.005	6.7	3.29	0.12	2.03
9	0.007	14.3	3.29	0.17	4.36
12	0.009	22.0	3.29	0.23	6.69
15	0.011	30.4	3.29	0.28	9.23
18	0.013	37.1	3.29	0.32	11.28
21	0.015	53.5	3.29	0.37	16.26
24	0.017	77.3	3.29	0.43	23.49
27	0.020	105.4	3.29	0.49	32.03
30	0.022	151.7	3.29	0.55	46.10
33	0.024	207.7	3.29	0.61	63.11
36	0.026	273.8	3.29	0.66	83.18
39	0.029	342.6	3.29	0.72	104.10
42	0.031	408.5	3.29	0.78	124.10
45	0.033	474.3	3.29	0.84	144.10
48	0.036	532.2	3.29	0.90	161.68
54	0.041	621.2	3.29	1.02	188.72
61	0.045	593.6	3.29	1.14	180.34
67	0.051	527.9	3.29	1.27	160.38
73	0.056	488.4	3.29	1.39	148.40
79	0.061	449.2	3.29	1.52	136.46
85	0.065	403.8	3.29	1.64	122.69
91	0.070	359.0	3.29	1.77	109.07
97	0.076	320.7	3.29	1.90	97.44
103	0.081	291.5	3.29	2.03	88.56
109	0.086	270.0	3.29	2.15	82.02
124	0.099	223.4	3.29	2.48	67.86
139	0.112	188.9	3.29	2.80	57.39
154	0.125	164.5	3.29	3.13	49.99



Failure Sketch



Remarks: None.

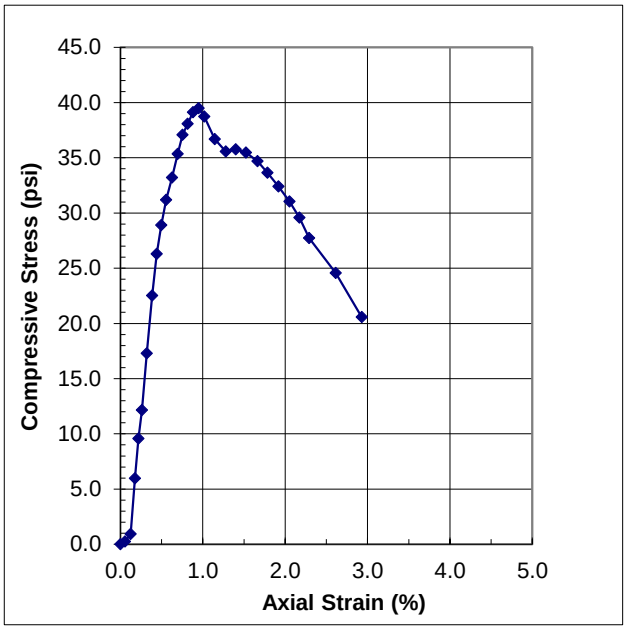
CDM Smith
Geotechnical Engineering Laboratory

Unconfined Compressive Strength (ASTM D1633)

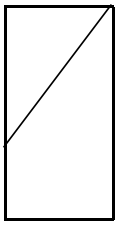
Client:	USG	Test Performed by :	AS
Project Name :	Highway 99 Bench Scale Study	Test Date :	9/14/20
Project Location:	Milton, WA		
Project Number:	19921-251008		
Sample Material :	C1-H5	Soil Type :	Soil - Cement
Sample Mix:			
Sample Date:	8/17/2020	Preparation Method:	Smoothed ends
Sample Age:	28 days		
		Pocket Penetrometer:	**>62.5 psi**

Water Content (%):	**25.4**		
Mass (g):	372.6	Loading Rate (in/min) :	0.05
Area (sq in) :	3.28	Dial Rate :	5.8
Diameter (in) :	2.04	Strain Rate (%/min)	1.30
Height (in) :	4.02	Strain at Failure (%):	0.95
Height to Dia. Ratio :	2.0	U. C. Strength (psi) :	**39.5**
Wet Density (pcf) :	**107.7**	Shear Strength (psi):	19.7
Dry Density (pcf) :	**85.9**		

Time (sec)	Displ. (in)	Load (lbs)	Cross Sectional Area (in^2)	Axial Strain (%)	Compress Strength (psi)
0	0.000	0.0	3.28	0.00	0.00
3	0.002	0.8	3.28	0.05	0.24
6	0.005	3.0	3.28	0.12	0.93
9	0.007	19.6	3.28	0.18	5.97
12	0.009	31.4	3.28	0.22	9.58
15	0.011	39.8	3.28	0.26	12.15
18	0.013	56.7	3.28	0.32	17.30
21	0.015	73.8	3.28	0.38	22.52
24	0.018	86.1	3.28	0.44	26.28
28	0.020	94.7	3.28	0.50	28.91
31	0.022	102.1	3.28	0.55	31.18
34	0.025	108.7	3.28	0.62	33.20
37	0.028	115.8	3.28	0.69	35.36
40	0.030	121.5	3.28	0.75	37.08
43	0.033	124.7	3.28	0.81	38.08
46	0.035	128.1	3.28	0.88	39.11
49	0.038	129.3	3.28	0.95	39.48
52	0.041	126.8	3.28	1.02	38.72
58	0.046	120.2	3.28	1.14	36.69
64	0.051	116.5	3.28	1.28	35.57
70	0.056	117.2	3.28	1.40	35.77
76	0.061	116.2	3.28	1.52	35.48
82	0.067	113.6	3.28	1.67	34.69
88	0.072	110.2	3.28	1.78	33.65
95	0.077	106.1	3.28	1.92	32.40
101	0.083	101.7	3.28	2.05	31.04
107	0.087	96.9	3.28	2.17	29.59
113	0.092	90.8	3.28	2.29	27.74
128	0.105	80.5	3.28	2.61	24.57
143	0.118	67.4	3.28	2.93	20.57



Failure Sketch



Remarks: None.

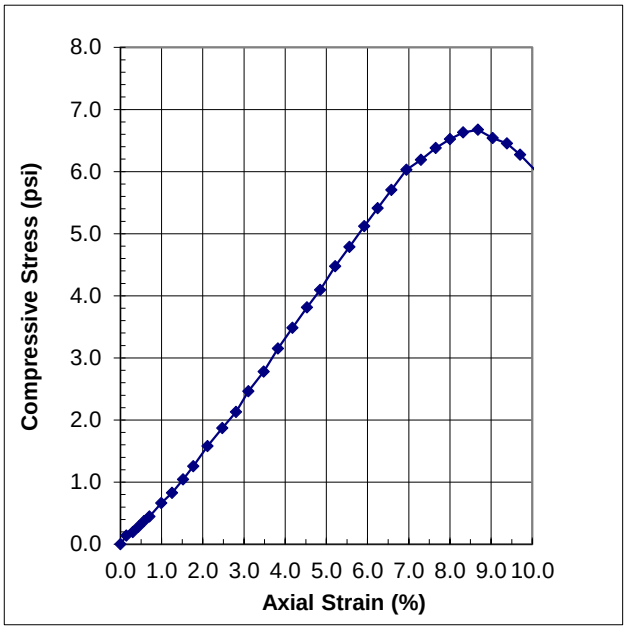
CDM Smith
Geotechnical Engineering Laboratory

Unconfined Compressive Strength (ASTM D1633)

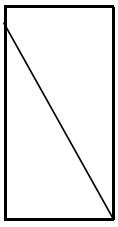
Client:	USG	Test Performed by :	AS
Project Name :	Highway 99 Bench Scale Study	Test Date :	9/14/20
Project Location:	Milton, WA		
Project Number:	19921-251008		
Sample Material :	C1-H6	Soil Type :	Soil - Cement
Sample Mix:			
Sample Date:	8/17/2020	Preparation Method:	Smoothed ends
Sample Age:	28 days		
		Pocket Penetrometer:	**>62.5 psi**

Water Content (%):	**32.0**		
Mass (g):	379.8	Loading Rate (in/min) :	0.05
Area (sq in) :	3.39	Dial Rate :	5.8
Diameter (in) :	2.08	Strain Rate (%/min)	1.36
Height (in) :	3.81	Strain at Failure (%):	8.68
Height to Dia. Ratio :	1.8	U. C. Strength (psi) :	**6.7**
Wet Density (pcf) :	**111.9**	Shear Strength (psi):	3.3
Dry Density (pcf) :	**84.7**		

Time (sec)	Displ. (in)	Load (lbs)	Cross Sectional Area (in^2)	Axial Strain (%)	Compress Strength (psi)
0	0.000	0.0	3.39	0.00	0.00
6	0.005	0.5	3.39	0.14	0.14
12	0.011	0.7	3.39	0.30	0.20
18	0.017	1.0	3.39	0.44	0.28
24	0.022	1.3	3.39	0.57	0.37
30	0.027	1.5	3.39	0.71	0.45
42	0.038	2.2	3.39	0.99	0.66
54	0.048	2.8	3.39	1.25	0.83
66	0.058	3.5	3.39	1.52	1.05
78	0.067	4.3	3.39	1.77	1.26
93	0.081	5.4	3.39	2.12	1.58
108	0.094	6.3	3.39	2.47	1.87
123	0.107	7.2	3.39	2.80	2.13
138	0.119	8.3	3.39	3.11	2.46
153	0.133	9.4	3.39	3.48	2.78
168	0.146	10.7	3.39	3.82	3.15
183	0.159	11.8	3.39	4.18	3.49
198	0.173	12.9	3.39	4.53	3.81
213	0.185	13.9	3.39	4.85	4.09
228	0.199	15.2	3.39	5.22	4.48
243	0.212	16.2	3.39	5.56	4.79
258	0.226	17.4	3.39	5.92	5.12
273	0.238	18.4	3.39	6.24	5.41
288	0.251	19.3	3.39	6.58	5.70
303	0.265	20.4	3.39	6.94	6.03
318	0.278	21.0	3.39	7.30	6.19
334	0.292	21.6	3.39	7.66	6.38
349	0.305	22.1	3.39	8.00	6.52
364	0.318	22.5	3.39	8.32	6.63
379	0.331	22.6	3.39	8.68	6.67
394	0.345	22.2	3.39	9.04	6.54
409	0.358	21.9	3.39	9.39	6.45
424	0.370	21.3	3.39	9.71	6.27
439	0.385	20.4	3.39	10.08	6.01



Failure Sketch



Remarks: None.

CDM Smith

Geotechnical Engineering Laboratory

Hydraulic Conductivity Using Flexible Wall Permeameter (ASTM D5084)

Client:	USG	Tested by:	ACS
Project Name:	Highway 99 Bench Scale Study	Checked by:	MBP
Project Location:	Milton, WA	Start Test Date:	9/8/2020
Project Number:	19921-251008	Permeant Fluid:	De-aired water
Sample Number:	C1-H1	Sample Preparation Procedures:	
Sample Date:	8/17/2020		
Depth (ft):			
Sample Description:	Soil-cement		
Test Type:	ASTM D5084		

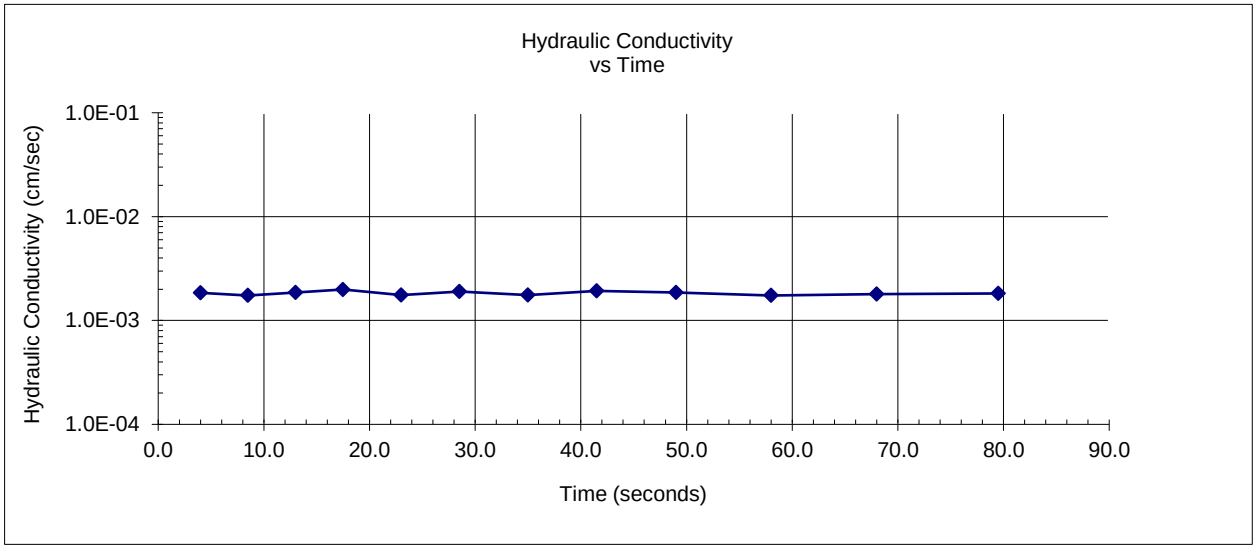
Sample Characteristics	Initial	Final
Avg. length of specimen (in)	3.01	3.01
Avg. dia. of specimen (in)	3.01	3.01
Area (sq in)	7.09	7.09
Volume (cubic in)	21.31	21.31
Moist mass (g)	578.2	620.0
Moist unit weight (pcf)	103.4	110.8
Moisture content (%)	24.0	32.9
Dry density (pcf)	83.4	83.4
Specific gravity (assumed)	2.68	2.68
Void ratio	1.01	1.01

Test Specifications	
B-Value (%):	
Consolidation stress (psi):	5.0
Gradient (in/in):	3.0
Cell pressure (psi):	85.0
Head pressure (psi):	80.3
Tail pressure (psi):	80.0
Max effective stress (psi):	5.0
Min effective stress (psi):	4.7

Comments: _____

Hydraulic Conductivity at 20 ^{o}C = **1.81E-03** cm/sec

Average of last 6 readings



CDM Smith

Geotechnical Engineering Laboratory

Hydraulic Conductivity Using Flexible Wall Permeameter (ASTM D5084)

Client:	USG	Tested by:	ACS
Project Name:	Highway 99 Bench Scale Study	Checked by:	MBP
Project Location:	Milton, WA	Start Test Date:	9/8/2020
Project Number:	19921-251008	Permeant Fluid:	De-aired water
Sample Number:	C1-H2	Sample Preparation Procedures:	
Sample Date:	8/17/2020		
Depth (ft):			
Sample Description:	Soil-cement		
Test Type:	ASTM D5084		

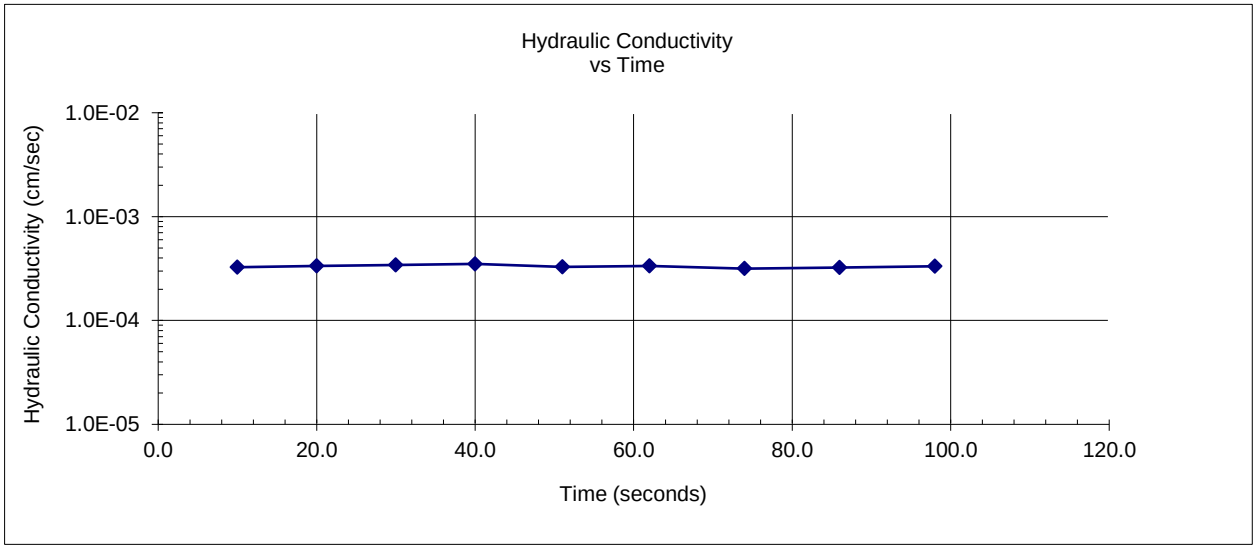
Sample Characteristics	Initial	Final
Avg. length of specimen (in)	3.43	3.43
Avg. dia. of specimen (in)	3.01	3.01
Area (sq in)	7.10	7.10
Volume (cubic in)	24.36	24.36
Moist mass (g)	698.6	731.3
Moist unit weight (pcf)	109.3	114.4
Moisture content (%)	22.8	28.6
Dry density (pcf)	89.0	89.0
Specific gravity (assumed)	2.68	2.68
Void ratio	0.88	0.88

Test Specifications	
B-Value (%):	
Consolidation stress (psi):	5.0
Gradient (in/in):	6.5
Cell pressure (psi):	85.0
Head pressure (psi):	80.5
Tail pressure (psi):	80.0
Max effective stress (psi):	5.0
Min effective stress (psi):	4.5

Comments: _____

Hydraulic Conductivity at 20 ^{o}C = **3.27E-04** cm/sec

Average of last 5 readings



CDM Smith

Geotechnical Engineering Laboratory

Hydraulic Conductivity Using Flexible Wall Permeameter (ASTM D5084)

Client:	USG	Tested by:	ACS
Project Name:	Highway 99 Bench Scale Study	Checked by:	MBP
Project Location:	Milton, WA	Start Test Date:	9/8/2020
Project Number:	19921-251008	Permeant Fluid:	De-aired water
Sample Number:	C1-H3	Sample Preparation Procedures:	
Sample Date:	8/17/2020		
Depth (ft):			
Sample Description:	Soil-cement		
Test Type:	ASTM D5084		

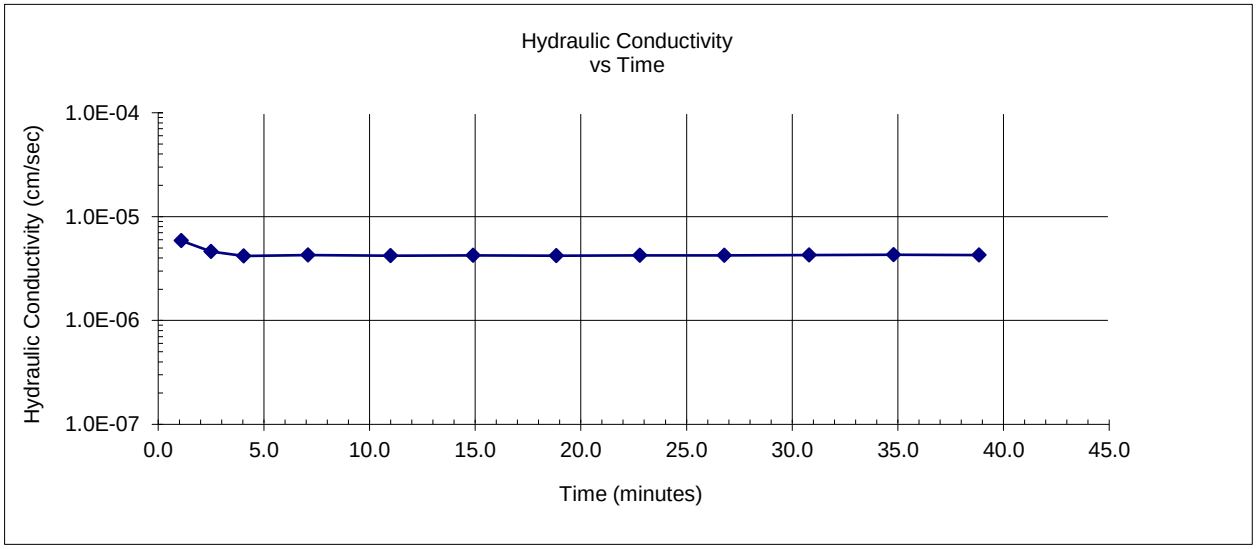
Sample Characteristics	Initial	Final
Avg. length of specimen (in)	3.22	3.22
Avg. dia. of specimen (in)	3.01	3.01
Area (sq in)	7.11	7.11
Volume (cubic in)	22.86	22.86
Moist mass (g)	622.3	644.4
Moist unit weight (pcf)	103.7	107.4
Moisture content (%)	23.7	28.1
Dry density (pcf)	83.9	83.9
Specific gravity (assumed)	2.68	2.68
Void ratio	1.00	1.00

Test Specifications	
B-Value (%):	
Consolidation stress (psi):	5.0
Gradient (in/in):	10.8
Cell pressure (psi):	85.0
Head pressure (psi):	81.0
Tail pressure (psi):	80.0
Max effective stress (psi):	5.0
Min effective stress (psi):	4.0

Comments: _____

Hydraulic Conductivity at 20 ^{o}C = **4.24E-06** cm/sec

Average of last 10 readings



CDM Smith

Geotechnical Engineering Laboratory

Hydraulic Conductivity Using Flexible Wall Permeameter (ASTM D5084)

Client:	USG	Tested by:	ACS
Project Name:	Highway 99 Bench Scale Study	Checked by:	MBP
Project Location:	Milton, WA	Start Test Date:	9/8/2020
Project Number:	19921-251008	Permeant Fluid:	De-aired water
Sample Number:	C1-H4	Sample Preparation Procedures:	
Sample Date:	8/17/2020		
Depth (ft):			
Sample Description:	Soil-cement		
Test Type:	ASTM D5084		

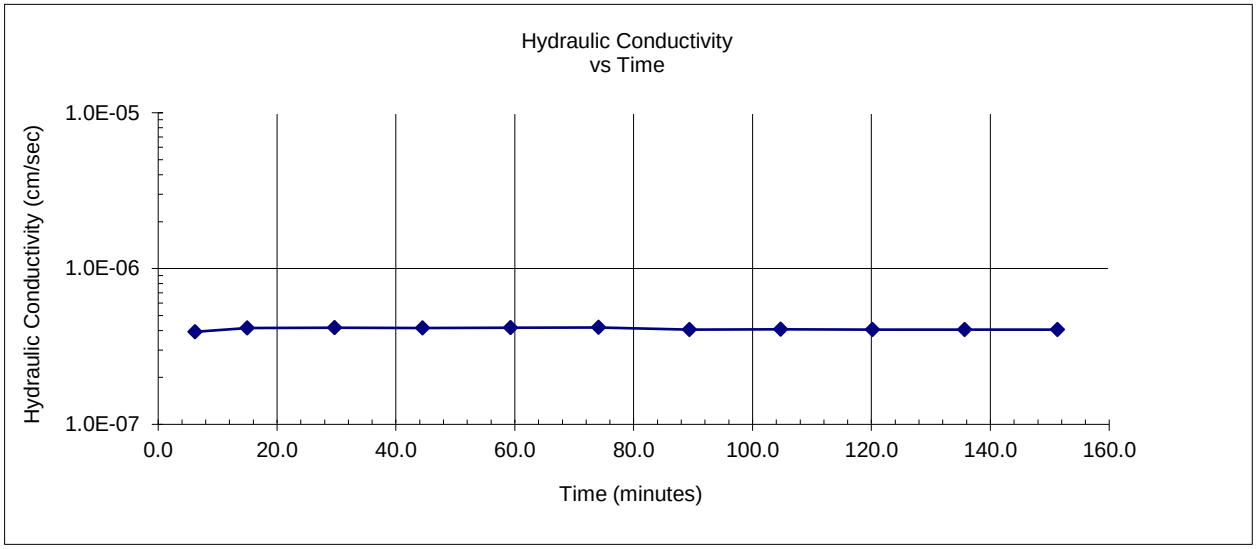
Sample Characteristics	Initial	Final
Avg. length of specimen (in)	2.27	2.27
Avg. dia. of specimen (in)	3.01	3.01
Area (sq in)	7.09	7.09
Volume (cubic in)	16.10	16.10
Moist mass (g)	479.5	491.7
Moist unit weight (pcf)	113.5	116.4
Moisture content (%)	27.1	30.4
Dry density (pcf)	89.3	89.3
Specific gravity (assumed)	2.68	2.68
Void ratio	0.87	0.87

Test Specifications	
B-Value (%):	
Consolidation stress (psi):	5.0
Gradient (in/in):	28.6
Cell pressure (psi):	65.0
Head pressure (psi):	62.0
Tail pressure (psi):	60.0
Max effective stress (psi):	5.0
Min effective stress (psi):	3.0

Comments: _____

Hydraulic Conductivity at 20 ^{o}C = **4.06E-07** cm/sec

Average of last 5 readings



CDM Smith

Geotechnical Engineering Laboratory

Hydraulic Conductivity Using Flexible Wall Permeameter (ASTM D5084)

Client:	USG	Tested by:	ACS
Project Name:	Highway 99 Bench Scale Study	Checked by:	MBP
Project Location:	Milton, WA	Start Test Date:	9/9/2020
Project Number:	19921-251008	Permeant Fluid:	De-aired water
Sample Number:	C1-H5	Sample Preparation Procedures:	
Sample Date:	8/17/2020		
Depth (ft):			
Sample Description:	Soil-cement		
Test Type:	ASTM D5084		

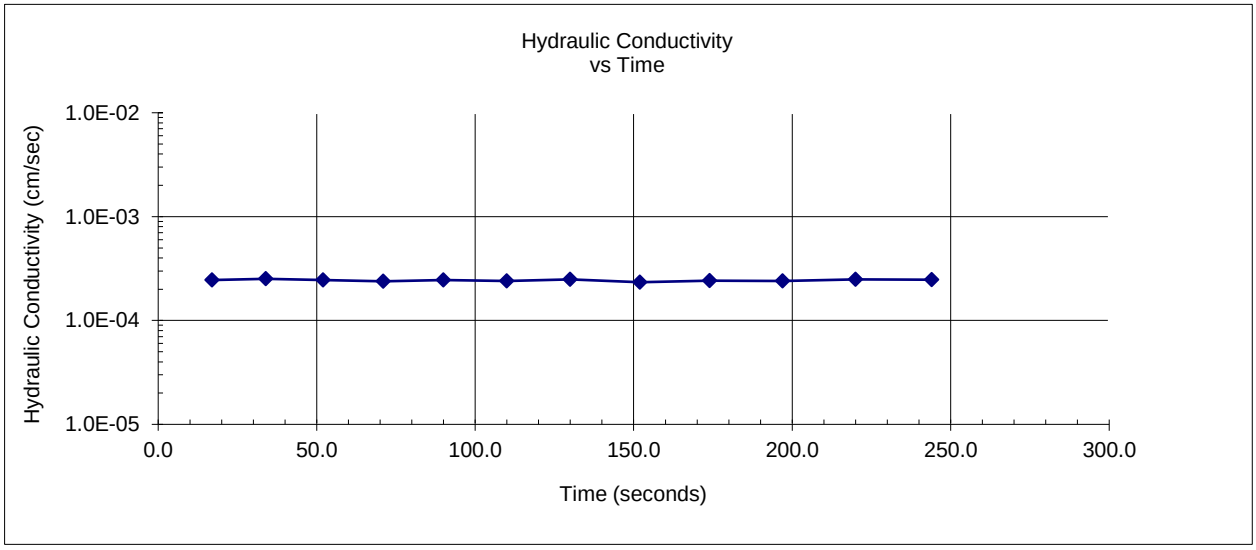
Sample Characteristics	Initial	Final
Avg. length of specimen (in)	3.66	3.66
Avg. dia. of specimen (in)	3.01	3.01
Area (sq in)	7.11	7.11
Volume (cubic in)	26.02	26.02
Moist mass (g)	725.0	781.9
Moist unit weight (pcf)	106.1	114.5
Moisture content (%)	26.4	36.3
Dry density (pcf)	84.0	84.0
Specific gravity (assumed)	2.68	2.68
Void ratio	0.99	0.99

Test Specifications	
B-Value (%):	
Consolidation stress (psi):	5.0
Gradient (in/in):	2.6
Cell pressure (psi):	85.0
Head pressure (psi):	80.3
Tail pressure (psi):	80.0
Max effective stress (psi):	5.0
Min effective stress (psi):	4.7

Comments: _____

Hydraulic Conductivity at 20 ^{o}C = **2.43E-04** cm/sec

Average of last 8 readings



CDM Smith

Geotechnical Engineering Laboratory

Hydraulic Conductivity Using Flexible Wall Permeameter (ASTM D5084)

Client:	USG	Tested by:	ACS
Project Name:	Highway 99 Bench Scale Study	Checked by:	MBP
Project Location:	Milton, WA	Start Test Date:	9/9/2020
Project Number:	19921-251008	Permeant Fluid:	De-aired water
Sample Number:	C1-H6	Sample Preparation Procedures:	
Sample Date:	8/17/2020		
Depth (ft):			
Sample Description:	Soil-cement		
Test Type:	ASTM D5084		

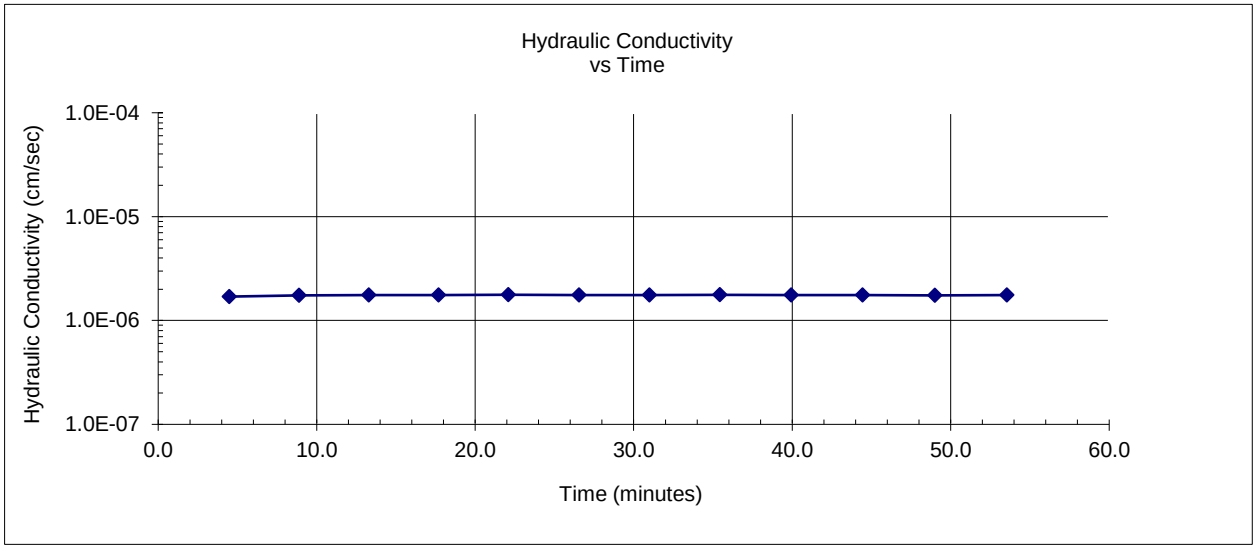
Sample Characteristics	Initial	Final
Avg. length of specimen (in)	2.84	2.79
Avg. dia. of specimen (in)	3.00	2.98
Area (sq in)	7.07	6.98
Volume (cubic in)	20.05	19.48
Moist mass (g)	607.5	599.3
Moist unit weight (pcf)	115.4	117.2
Moisture content (%)	33.4	31.6
Dry density (pcf)	86.5	89.1
Specific gravity (assumed)	2.68	2.68
Void ratio	0.93	0.88

Test Specifications	
B-Value (%):	
Consolidation stress (psi):	5.0
Gradient (in/in):	23.4
Cell pressure (psi):	85.0
Head pressure (psi):	82.0
Tail pressure (psi):	80.0
Max effective stress (psi):	5.0
Min effective stress (psi):	3.0

Comments: _____

Hydraulic Conductivity at 20 ^{o}C = **1.76E-06** cm/sec

Average of last 6 readings



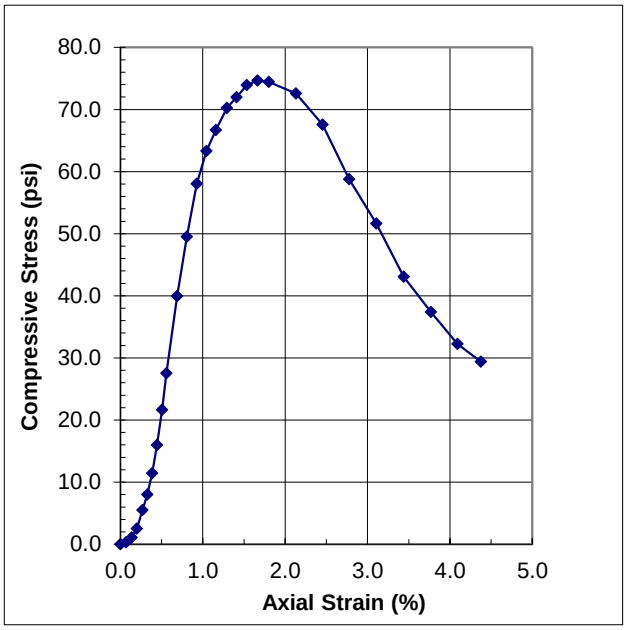
CDM Smith
Geotechnical Engineering Laboratory

Unconfined Compressive Strength (ASTM D1633)

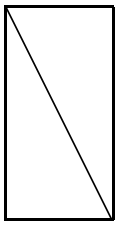
Client:	USG	Test Performed by :	AS
Project Name :	Highway 99 Bench Scale Study	Test Date :	11/4/20
Project Location:	Milton, WA		
Project Number:	19921-251008		
Sample Material :	C1-H7	Soil Type :	Soil - Cement
Sample Mix:			
Sample Date:	10/28/2020	Preparation Method:	Smoothed ends
Sample Age:	7 days		
		Pocket Penetrometer:	**>62.5 psi**

Water Content (%):	**35.0**		
Mass (g):	365.0	Loading Rate (in/min) :	0.05
Area (sq in) :	3.28	Dial Rate :	5.8
Diameter (in) :	2.04	Strain Rate (%/min)	1.21
Height (in) :	3.80	Strain at Failure (%):	1.66
Height to Dia. Ratio :	1.86	U. C. Strength (psi) :	**74.6**
Wet Density (pcf) :	**111.5**	Shear Strength (psi):	37.3
Dry Density (pcf) :	**82.6**		

Time (sec)	Displ. (in)	Load (lbs)	Cross Sectional Area (in^2)	Axial Strain (%)	Compress Strength (psi)
0	0.000	0.0	3.28	0.00	0.00
6	0.003	1.0	3.28	0.07	0.30
9	0.005	3.6	3.28	0.14	1.10
12	0.008	8.3	3.28	0.20	2.53
15	0.010	18.0	3.28	0.27	5.50
18	0.012	26.2	3.28	0.33	8.01
21	0.015	37.5	3.28	0.39	11.43
24	0.017	52.4	3.28	0.44	16.00
27	0.019	71.0	3.28	0.50	21.66
30	0.021	90.3	3.28	0.56	27.54
36	0.026	130.9	3.28	0.69	39.93
42	0.031	162.2	3.28	0.80	49.50
48	0.035	190.2	3.28	0.93	58.02
54	0.040	207.6	3.28	1.05	63.33
60	0.044	218.5	3.28	1.16	66.67
66	0.049	230.2	3.28	1.29	70.23
72	0.054	235.9	3.28	1.41	71.98
78	0.058	242.3	3.28	1.53	73.92
84	0.063	244.6	3.28	1.66	74.64
90	0.069	243.9	3.28	1.80	74.42
105	0.081	237.8	3.28	2.13	72.57
120	0.093	221.4	3.28	2.45	67.55
135	0.106	192.7	3.28	2.78	58.78
150	0.118	169.2	3.28	3.11	51.62
165	0.131	141.2	3.28	3.44	43.07
180	0.143	122.5	3.28	3.77	37.38
195	0.156	105.7	3.28	4.09	32.26
210	0.166	96.4	3.28	4.38	29.41



Failure Sketch



Remarks: None.

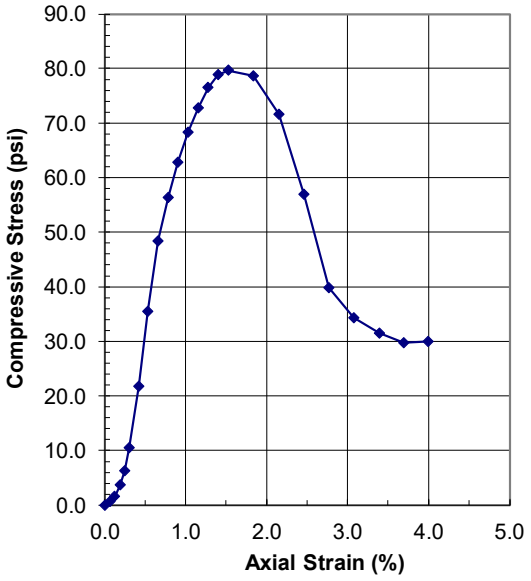
CDM Smith
Geotechnical Engineering Laboratory

Unconfined Compressive Strength (ASTM D1633)

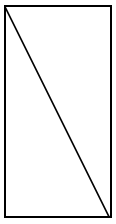
Client:	USG	Test Performed by :	AS
Project Name :	Highway 99 Bench Scale Study	Test Date :	11/4/20
Project Location:	Milton, WA		
Project Number:	19921-251008		
Sample Material :	C1-H8	Soil Type :	Soil - Cement
Sample Mix:			
Sample Date:	10/28/2020	Preparation Method:	Smoothed ends
Sample Age:	7 days		
		Pocket Penetrometer:	**>62.5 psi**

Water Content (%):	**33.9**		
Mass (g):	377.7	Loading Rate (in/min) :	0.05
Area (sq in) :	3.29	Dial Rate :	5.8
Diameter (in) :	2.05	Strain Rate (%/min)	1.24
Height (in) :	3.96	Strain at Failure (%):	1.53
Height to Dia. Ratio :	1.94	U. C. Strength (psi) :	**79.7**
Wet Density (pcf) :	**110.5**	Shear Strength (psi):	39.8
Dry Density (pcf) :	**82.5**		

Time (sec)	Displ. (in)	Load (lbs)	Cross Sectional Area (in^2)	Axial Strain (%)	Compress Strength (psi)
0	0.000	0.0	3.29	0.00	0.00
3	0.003	2.4	3.29	0.07	0.72
6	0.005	5.4	3.29	0.13	1.66
9	0.008	12.1	3.29	0.19	3.67
12	0.010	20.8	3.29	0.25	6.33
15	0.012	34.6	3.29	0.31	10.52
21	0.017	71.5	3.29	0.42	21.76
27	0.021	116.7	3.29	0.53	35.50
33	0.026	159.0	3.29	0.66	48.38
39	0.031	185.2	3.29	0.78	56.35
45	0.036	206.4	3.29	0.91	62.81
51	0.041	224.4	3.29	1.03	68.27
57	0.046	239.2	3.29	1.16	72.80
63	0.051	251.4	3.29	1.28	76.51
69	0.056	259.1	3.29	1.40	78.83
75	0.060	261.8	3.29	1.53	79.67
90	0.073	258.3	3.29	1.84	78.59
105	0.085	235.3	3.29	2.15	71.62
120	0.098	187.3	3.29	2.47	56.99
135	0.110	130.7	3.29	2.77	39.78
150	0.122	112.8	3.29	3.08	34.34
165	0.134	103.7	3.29	3.39	31.55
180	0.146	97.9	3.29	3.69	29.78
195	0.158	98.7	3.29	4.00	30.03



Failure Sketch



Remarks: None.

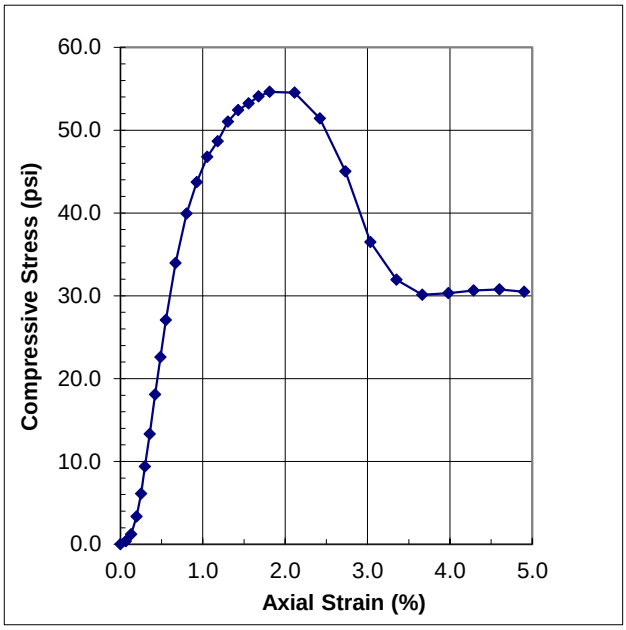
CDM Smith
Geotechnical Engineering Laboratory

Unconfined Compressive Strength (ASTM D1633)

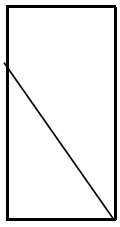
Client:	USG	Test Performed by :	AS
Project Name :	Highway 99 Bench Scale Study	Test Date :	11/4/20
Project Location:	Milton, WA		
Project Number:	19921-251008		
Sample Material :	C1-H9	Soil Type :	Soil - Cement
Sample Mix:			
Sample Date:	10/28/2020	Preparation Method:	Smoothed ends
Sample Age:	7 days		
		Pocket Penetrometer:	**>62.5 psi**

Water Content (%):	**36.4**		
Mass (g):	377.0	Loading Rate (in/min) :	0.05
Area (sq in) :	3.28	Dial Rate :	5.8
Diameter (in) :	2.04	Strain Rate (%/min)	1.25
Height (in) :	3.96	Strain at Failure (%):	1.81
Height to Dia. Ratio :	1.94	U. C. Strength (psi) :	**54.6**
Wet Density (pcf) :	**110.8**	Shear Strength (psi):	27.3
Dry Density (pcf) :	**81.3**		

Time (sec)	Displ. (in)	Load (lbs)	Cross Sectional Area (in^2)	Axial Strain (%)	Compress Strength (psi)
0	0.000	0.0	3.28	0.00	0.00
3	0.003	1.2	3.28	0.07	0.37
6	0.005	4.0	3.28	0.13	1.22
9	0.008	11.0	3.28	0.20	3.34
12	0.010	20.0	3.28	0.25	6.12
15	0.012	30.8	3.28	0.30	9.40
18	0.014	43.6	3.28	0.36	13.30
21	0.017	59.2	3.28	0.42	18.07
24	0.019	74.0	3.28	0.49	22.60
27	0.022	88.7	3.28	0.55	27.09
33	0.026	111.2	3.28	0.67	33.96
39	0.032	130.8	3.28	0.80	39.94
45	0.037	143.2	3.28	0.93	43.72
51	0.042	153.2	3.28	1.05	46.79
57	0.047	159.4	3.28	1.18	48.67
63	0.052	167.1	3.28	1.30	51.03
69	0.056	171.7	3.28	1.43	52.42
75	0.062	174.4	3.28	1.56	53.25
81	0.066	177.1	3.28	1.68	54.08
87	0.072	178.9	3.28	1.81	54.62
102	0.084	178.6	3.28	2.12	54.53
117	0.096	168.4	3.28	2.42	51.42
132	0.108	147.5	3.28	2.73	45.03
147	0.120	119.5	3.28	3.04	36.48
162	0.133	104.6	3.28	3.35	31.94
177	0.145	98.7	3.28	3.66	30.13
192	0.157	99.3	3.28	3.98	30.31
207	0.170	100.4	3.28	4.29	30.65
222	0.182	100.8	3.28	4.60	30.77
237	0.194	99.9	3.28	4.90	30.48



Failure Sketch



Remarks: None.

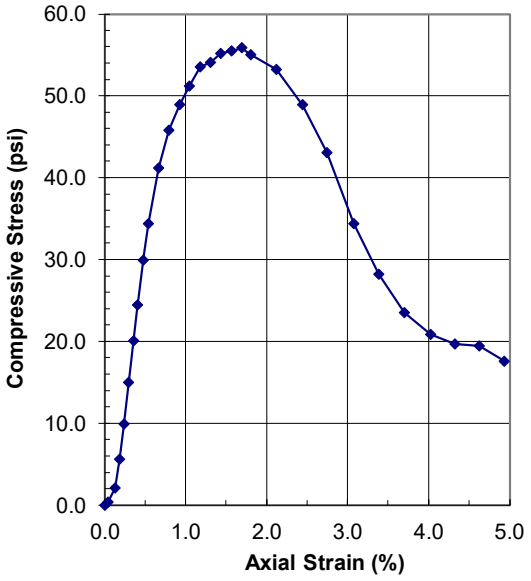
CDM Smith
Geotechnical Engineering Laboratory

Unconfined Compressive Strength (ASTM D1633)

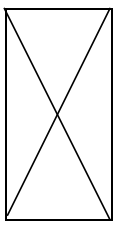
Client:	USG	Test Performed by :	AS
Project Name :	Highway 99 Bench Scale Study	Test Date :	11/4/20
Project Location:	Milton, WA		
Project Number:	19921-251008		
Sample Material :	C1-H10	Soil Type :	Soil - Cement
Sample Mix:			
Sample Date:	10/28/2020	Preparation Method:	Smoothed ends
Sample Age:	7 days		
		Pocket Penetrometer:	**>62.5 psi**

Water Content (%):	**36.4**		
Mass (g):	370.9	Loading Rate (in/min) :	0.05
Area (sq in) :	3.28	Dial Rate :	5.8
Diameter (in) :	2.04	Strain Rate (%/min)	1.27
Height (in) :	3.93	Strain at Failure (%):	1.69
Height to Dia. Ratio :	1.92	U. C. Strength (psi) :	**55.8**
Wet Density (pcf) :	**109.5**	Shear Strength (psi):	27.9
Dry Density (pcf) :	**80.3**		

Time (sec)	Displ. (in)	Load (lbs)	Cross Sectional Area (in^2)	Axial Strain (%)	Compress Strength (psi)
0	0.000	0.0	3.28	0.00	0.00
7	0.002	1.3	3.28	0.05	0.40
10	0.005	7.0	3.28	0.13	2.13
13	0.007	18.4	3.28	0.19	5.61
16	0.009	32.4	3.28	0.24	9.89
19	0.012	49.2	3.28	0.29	14.99
22	0.014	65.9	3.28	0.36	20.07
25	0.016	80.3	3.28	0.41	24.47
28	0.019	98.1	3.28	0.48	29.90
31	0.021	112.8	3.28	0.54	34.39
37	0.026	135.0	3.28	0.67	41.14
43	0.031	150.2	3.28	0.80	45.78
49	0.037	160.5	3.28	0.93	48.91
55	0.041	168.0	3.28	1.05	51.21
61	0.047	175.6	3.28	1.18	53.53
67	0.051	177.3	3.28	1.31	54.04
73	0.056	181.0	3.28	1.43	55.19
79	0.062	182.0	3.28	1.57	55.48
85	0.067	183.2	3.28	1.69	55.84
91	0.071	180.4	3.28	1.81	55.00
106	0.083	174.6	3.28	2.12	53.21
121	0.096	160.3	3.28	2.45	48.87
136	0.108	141.1	3.28	2.75	43.01
151	0.121	112.8	3.28	3.08	34.40
166	0.133	92.5	3.28	3.39	28.21
181	0.145	77.0	3.28	3.70	23.48
196	0.158	68.4	3.28	4.03	20.84
211	0.170	64.6	3.28	4.33	19.69
226	0.182	63.7	3.28	4.63	19.42
241	0.194	57.7	3.28	4.94	17.59



Failure Sketch



Remarks: None.

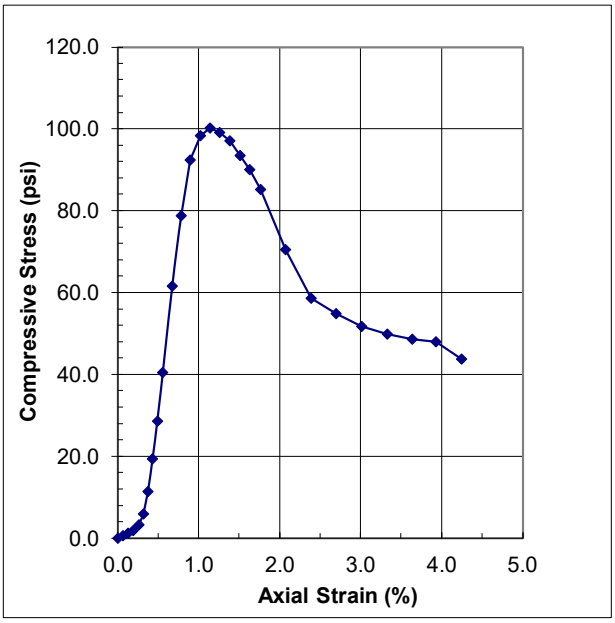
CDM Smith
Geotechnical Engineering Laboratory

Unconfined Compressive Strength (ASTM D1633)

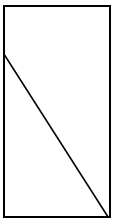
Client:	USG	Test Performed by :	AS
Project Name :	Highway 99 Bench Scale Study	Test Date :	11/11/20
Project Location:	Milton, WA		
Project Number:	19921-251008		
Sample Material :	C1-H7	Soil Type :	Soil - Cement
Sample Mix:			
Sample Date:	10/28/2020	Preparation Method:	Smoothed ends
Sample Age:	14 days		
		Pocket Penetrometer:	**>62.5 psi**

Water Content (%):	**34.2**		
Mass (g):	371.7	Loading Rate (in/min) :	0.05
Area (sq in) :	3.29	Dial Rate :	5.8
Diameter (in) :	2.05	Strain Rate (%/min)	1.20
Height (in) :	3.93	Strain at Failure (%):	1.14
Height to Dia. Ratio :	1.92	U. C. Strength (psi) :	**100.2**
Wet Density (pcf) :	**109.4**	Shear Strength (psi):	50.1
Dry Density (pcf) :	**81.5**		

Time (sec)	Displ. (in)	Load (lbs)	Cross Sectional Area (in^2)	Axial Strain (%)	Compress Strength (psi)
0	0.000	0.0	3.29	0.00	0.00
13	0.003	1.9	3.29	0.07	0.57
16	0.005	4.1	3.29	0.13	1.25
19	0.008	6.3	3.29	0.20	1.90
22	0.010	10.8	3.29	0.26	3.29
25	0.013	19.5	3.29	0.32	5.93
28	0.015	37.5	3.29	0.38	11.38
31	0.017	63.8	3.29	0.43	19.37
34	0.019	94.1	3.29	0.49	28.57
37	0.022	133.1	3.29	0.56	40.42
43	0.027	202.7	3.29	0.68	61.57
49	0.031	259.5	3.29	0.78	78.81
55	0.035	304.0	3.29	0.90	92.33
61	0.040	323.5	3.29	1.02	98.25
67	0.045	329.8	3.29	1.14	100.18
73	0.050	326.3	3.29	1.26	99.11
79	0.054	319.7	3.29	1.39	97.11
85	0.059	307.6	3.29	1.51	93.42
91	0.064	296.2	3.29	1.63	89.96
97	0.069	280.6	3.29	1.76	85.23
112	0.081	232.2	3.29	2.07	70.53
127	0.094	192.7	3.29	2.39	58.53
142	0.106	180.6	3.29	2.70	54.85
157	0.119	170.4	3.29	3.02	51.74
172	0.131	164.0	3.29	3.33	49.80
187	0.143	160.1	3.29	3.64	48.64
202	0.155	158.1	3.29	3.93	48.02



Failure Sketch



Remarks: None.

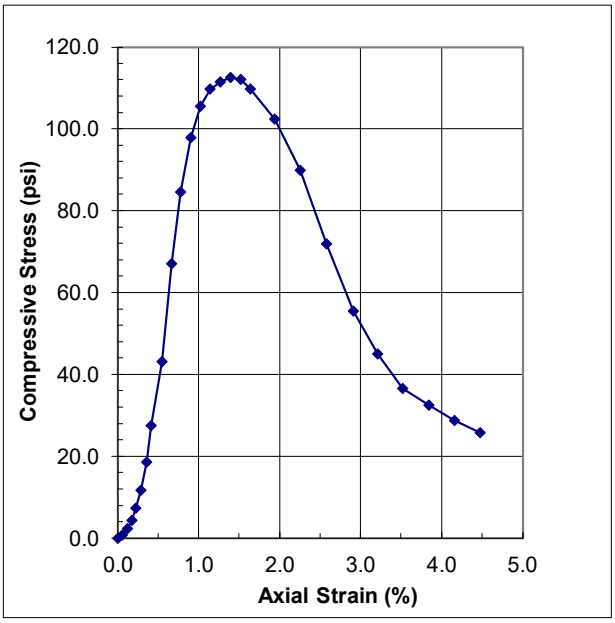
CDM Smith
Geotechnical Engineering Laboratory

Unconfined Compressive Strength (ASTM D1633)

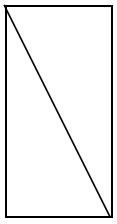
Client:	USG	Test Performed by :	AS
Project Name :	Highway 99 Bench Scale Study	Test Date :	11/11/20
Project Location:	Milton, WA		
Project Number:	19921-251008		
Sample Material :	C1-H8	Soil Type :	Soil - Cement
Sample Mix:			
Sample Date:	10/28/2020	Preparation Method:	Smoothed ends
Sample Age:	14 days		
		Pocket Penetrometer:	**>62.5 psi**

Water Content (%):	**33.4**		
Mass (g):	378.3	Loading Rate (in/min) :	0.05
Area (sq in) :	3.25	Dial Rate :	5.8
Diameter (in) :	2.03	Strain Rate (%/min)	1.24
Height (in) :	3.95	Strain at Failure (%):	1.39
Height to Dia. Ratio :	1.94	U. C. Strength (psi) :	**112.5**
Wet Density (pcf) :	**112.2**	Shear Strength (psi):	56.3
Dry Density (pcf) :	**84.1**		

Time (sec)	Displ. (in)	Load (lbs)	Cross Sectional Area (in^2)	Axial Strain (%)	Compress Strength (psi)
0	0.000	0.0	3.25	0.00	0.00
3	0.002	2.6	3.25	0.06	0.80
6	0.005	7.3	3.25	0.12	2.25
9	0.007	14.3	3.25	0.18	4.40
12	0.009	23.9	3.25	0.23	7.35
15	0.011	37.8	3.25	0.29	11.65
18	0.014	60.4	3.25	0.36	18.60
21	0.016	89.0	3.25	0.41	27.41
27	0.022	139.8	3.25	0.55	43.04
33	0.026	217.9	3.25	0.67	67.08
39	0.031	274.4	3.25	0.78	84.49
45	0.036	317.7	3.25	0.90	97.84
51	0.041	342.8	3.25	1.03	105.55
57	0.045	356.0	3.25	1.15	109.63
63	0.050	361.8	3.25	1.27	111.41
69	0.055	365.4	3.25	1.39	112.53
75	0.060	363.9	3.25	1.52	112.05
81	0.065	356.4	3.25	1.64	109.74
96	0.077	332.6	3.25	1.94	102.43
111	0.089	291.7	3.25	2.26	89.82
126	0.102	233.4	3.25	2.58	71.87
141	0.115	180.3	3.25	2.91	55.52
156	0.127	146.0	3.25	3.21	44.95
171	0.139	118.8	3.25	3.52	36.58
186	0.152	105.5	3.25	3.85	32.50
201	0.165	93.5	3.25	4.16	28.79
216	0.177	83.7	3.25	4.48	25.76



Failure Sketch



Remarks: None.

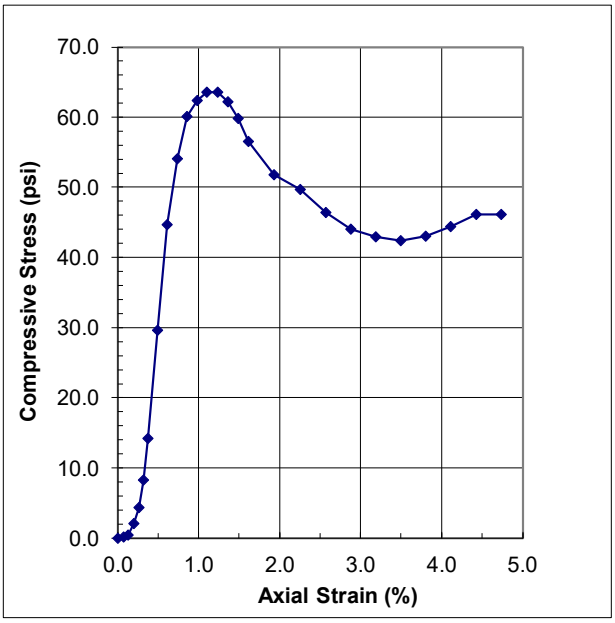
CDM Smith
Geotechnical Engineering Laboratory

Unconfined Compressive Strength (ASTM D1633)

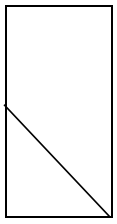
Client:	USG	Test Performed by :	AS
Project Name :	Highway 99 Bench Scale Study	Test Date :	11/11/20
Project Location:	Milton, WA		
Project Number:	19921-251008		
Sample Material :	C1-H9	Soil Type :	Soil - Cement
Sample Mix:			
Sample Date:	10/28/2020	Preparation Method:	Smoothed ends
Sample Age:	14 days		
		Pocket Penetrometer:	**>62.5 psi**

Water Content (%):	**35.7**		
Mass (g):	374.1	Loading Rate (in/min) :	0.05
Area (sq in) :	3.29	Dial Rate :	5.8
Diameter (in) :	2.05	Strain Rate (%/min)	1.27
Height (in) :	3.98	Strain at Failure (%):	1.10
Height to Dia. Ratio :	1.95	U. C. Strength (psi) :	**63.6**
Wet Density (pcf) :	**108.8**	Shear Strength (psi):	31.8
Dry Density (pcf) :	**80.2**		

Time (sec)	Displ. (in)	Load (lbs)	Cross Sectional Area (in^2)	Axial Strain (%)	Compress Strength (psi)
0	0.000	0.0	3.29	0.00	0.00
3	0.003	0.7	3.29	0.08	0.20
6	0.005	1.5	3.29	0.13	0.47
9	0.008	6.8	3.29	0.20	2.06
12	0.011	14.2	3.29	0.27	4.33
15	0.013	27.0	3.29	0.32	8.23
18	0.015	46.6	3.29	0.38	14.17
24	0.020	97.2	3.29	0.49	29.58
30	0.025	146.9	3.29	0.62	44.68
36	0.029	177.6	3.29	0.74	54.02
42	0.034	197.4	3.29	0.86	60.05
48	0.039	204.9	3.29	0.98	62.32
54	0.044	208.9	3.29	1.10	63.56
60	0.049	208.9	3.29	1.24	63.54
66	0.054	204.3	3.29	1.36	62.14
72	0.059	196.6	3.29	1.49	59.80
78	0.064	185.9	3.29	1.62	56.54
93	0.077	170.1	3.29	1.93	51.75
108	0.090	163.3	3.29	2.25	49.69
123	0.103	152.5	3.29	2.57	46.38
138	0.115	144.7	3.29	2.88	44.03
153	0.127	141.1	3.29	3.18	42.92
168	0.139	139.3	3.29	3.50	42.39
183	0.152	141.5	3.29	3.80	43.05
198	0.164	145.9	3.29	4.11	44.39
213	0.176	151.5	3.29	4.43	46.09
228	0.189	151.7	3.29	4.74	46.16



Failure Sketch



Remarks: None.

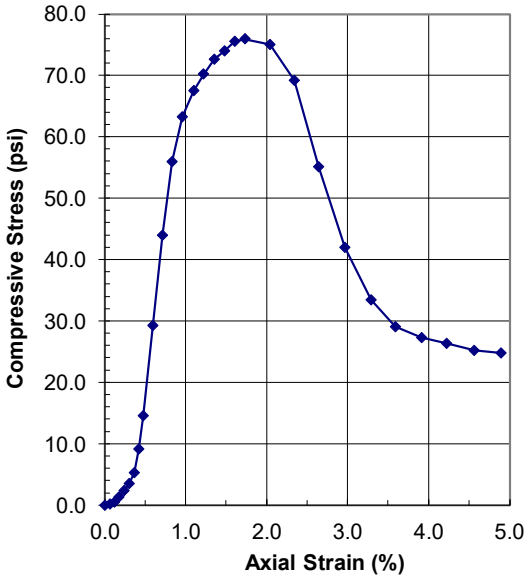
CDM Smith
Geotechnical Engineering Laboratory

Unconfined Compressive Strength (ASTM D1633)

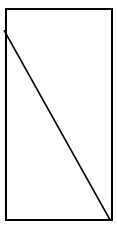
Client:	USG	Test Performed by :	AS
Project Name :	Highway 99 Bench Scale Study	Test Date :	11/11/20
Project Location:	Milton, WA		
Project Number:	19921-251008		
Sample Material :	C1-H10	Soil Type :	Soil - Cement
Sample Mix:			
Sample Date:	10/28/2020	Preparation Method:	Smoothed ends
Sample Age:	14 days		
		Pocket Penetrometer:	**>62.5 psi**

Water Content (%):	**36.4**		
Mass (g):	362.3	Loading Rate (in/min) :	0.05
Area (sq in) :	3.28	Dial Rate :	5.8
Diameter (in) :	2.05	Strain Rate (%/min)	1.29
Height (in) :	3.83	Strain at Failure (%):	1.73
Height to Dia. Ratio :	1.87	U. C. Strength (psi) :	**75.9**
Wet Density (pcf) :	**109.7**	Shear Strength (psi):	38.0
Dry Density (pcf) :	**80.4**		

Time (sec)	Displ. (in)	Load (lbs)	Cross Sectional Area (in^2)	Axial Strain (%)	Compress Strength (psi)
0	0.000	0.0	3.28	0.00	0.00
3	0.002	0.5	3.28	0.06	0.14
6	0.005	1.7	3.28	0.12	0.51
9	0.007	4.5	3.28	0.18	1.37
12	0.009	7.9	3.28	0.24	2.42
15	0.012	11.4	3.28	0.31	3.48
18	0.014	17.4	3.28	0.37	5.29
21	0.016	29.9	3.28	0.42	9.12
24	0.018	47.7	3.28	0.48	14.52
30	0.023	95.9	3.28	0.60	29.22
36	0.027	144.3	3.28	0.72	43.96
42	0.032	183.5	3.28	0.84	55.90
48	0.037	207.5	3.28	0.96	63.19
54	0.042	221.6	3.28	1.10	67.51
60	0.047	230.5	3.28	1.22	70.20
66	0.052	238.3	3.28	1.35	72.58
72	0.057	242.7	3.28	1.48	73.92
78	0.062	248.0	3.28	1.61	75.53
84	0.066	249.3	3.28	1.73	75.94
99	0.078	246.4	3.28	2.04	75.05
114	0.090	227.2	3.28	2.34	69.21
129	0.101	181.0	3.28	2.64	55.14
144	0.114	137.8	3.28	2.97	41.96
159	0.126	109.6	3.28	3.29	33.38
174	0.138	95.3	3.28	3.59	29.02
189	0.150	89.7	3.28	3.92	27.32
204	0.162	86.5	3.28	4.23	26.34
219	0.175	82.7	3.28	4.57	25.18
234	0.187	81.4	3.28	4.89	24.79



Failure Sketch



Remarks: None.

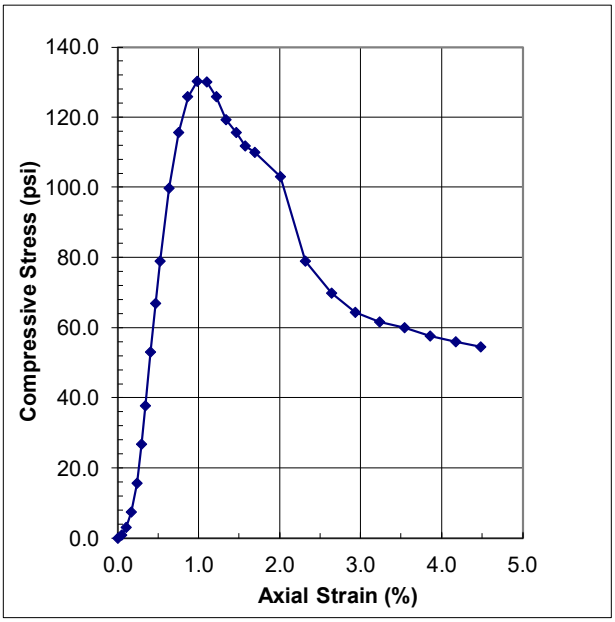
CDM Smith
Geotechnical Engineering Laboratory

Unconfined Compressive Strength (ASTM D1633)

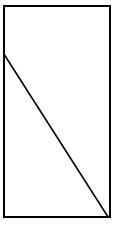
Client:	USG	Test Performed by :	AS
Project Name :	Highway 99 Bench Scale Study	Test Date :	11/25/20
Project Location:	Milton, WA		
Project Number:	19921-251008		
Sample Material :	C1-H7	Soil Type :	Soil - Cement
Sample Mix:			
Sample Date:	10/28/2020	Preparation Method:	Smoothed ends
Sample Age:	28 days		
		Pocket Penetrometer:	**>62.5 psi**

Water Content (%):	**34.5**		
Mass (g):	376.3	Loading Rate (in/min) :	0.05
Area (sq in) :	3.29	Dial Rate :	5.8
Diameter (in) :	2.05	Strain Rate (%/min)	1.17
Height (in) :	3.97	Strain at Failure (%):	0.99
Height to Dia. Ratio :	1.94	U. C. Strength (psi) :	**130.2**
Wet Density (pcf) :	**109.6**	Shear Strength (psi):	65.1
Dry Density (pcf) :	**81.5**		

Time (sec)	Displ. (in)	Load (lbs)	Cross Sectional Area (in^2)	Axial Strain (%)	Compress Strength (psi)
0	0.000	0.0	3.29	0.00	0.00
3	0.002	2.8	3.29	0.05	0.84
6	0.004	10.0	3.29	0.11	3.04
9	0.007	24.7	3.29	0.17	7.49
12	0.009	51.5	3.29	0.24	15.66
15	0.012	88.0	3.29	0.30	26.75
18	0.014	124.4	3.29	0.35	37.79
21	0.016	174.6	3.29	0.41	53.04
24	0.019	219.9	3.29	0.47	66.82
27	0.021	260.0	3.29	0.52	78.99
33	0.025	328.3	3.29	0.64	99.74
39	0.030	380.2	3.29	0.76	115.51
45	0.035	414.0	3.29	0.87	125.79
51	0.039	428.5	3.29	0.99	130.17
57	0.044	428.0	3.29	1.10	130.03
63	0.049	413.8	3.29	1.22	125.71
69	0.053	392.6	3.29	1.34	119.27
75	0.058	380.3	3.29	1.46	115.53
81	0.063	368.0	3.29	1.57	111.82
87	0.067	362.1	3.29	1.70	110.00
102	0.080	338.8	3.29	2.01	102.94
117	0.092	259.6	3.29	2.32	78.86
132	0.105	229.7	3.29	2.64	69.79
147	0.117	211.9	3.29	2.93	64.37
162	0.129	202.8	3.29	3.24	61.62
177	0.141	197.1	3.29	3.55	59.90
192	0.153	189.3	3.29	3.86	57.52
207	0.166	184.3	3.29	4.17	56.00
222	0.178	179.3	3.29	4.49	54.48



Failure Sketch



Remarks: None.

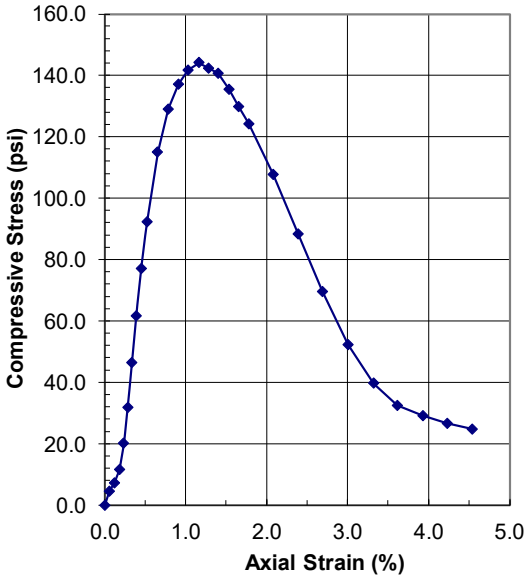
CDM Smith
Geotechnical Engineering Laboratory

Unconfined Compressive Strength (ASTM D1633)

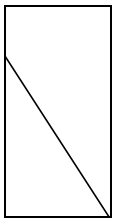
Client:	USG	Test Performed by :	AS
Project Name :	Highway 99 Bench Scale Study	Test Date :	11/25/20
Project Location:	Milton, WA		
Project Number:	19921-251008		
Sample Material :	C1-H8	Soil Type :	Soil - Cement
Sample Mix:			
Sample Date:	10/28/2020	Preparation Method:	Smoothed ends
Sample Age:	28 days		
		Pocket Penetrometer:	**>62.5 psi**

Water Content (%):	**32.8**		
Mass (g):	382.5	Loading Rate (in/min) :	0.05
Area (sq in) :	3.29	Dial Rate :	5.8
Diameter (in) :	2.05	Strain Rate (%/min)	1.24
Height (in) :	3.99	Strain at Failure (%):	1.16
Height to Dia. Ratio :	1.95	U. C. Strength (psi) :	**144.2**
Wet Density (pcf) :	**110.8**	Shear Strength (psi):	72.1
Dry Density (pcf) :	**83.4**		

Time (sec)	Displ. (in)	Load (lbs)	Cross Sectional Area (in^2)	Axial Strain (%)	Compress Strength (psi)
0	0.000	0.0	3.29	0.00	0.00
3	0.003	14.6	3.29	0.06	4.44
6	0.005	23.8	3.29	0.12	7.22
9	0.007	38.3	3.29	0.18	11.64
12	0.009	66.5	3.29	0.24	20.20
15	0.011	105.0	3.29	0.29	31.87
18	0.014	152.7	3.29	0.34	46.34
21	0.016	203.2	3.29	0.39	61.69
24	0.018	254.1	3.29	0.46	77.11
27	0.021	303.8	3.29	0.53	92.22
33	0.026	378.8	3.29	0.66	114.99
39	0.031	425.2	3.29	0.79	129.07
45	0.036	451.9	3.29	0.91	137.16
51	0.041	466.8	3.29	1.03	141.68
57	0.046	474.9	3.29	1.16	144.15
63	0.051	468.8	3.29	1.29	142.28
69	0.056	463.5	3.29	1.41	140.69
75	0.061	446.1	3.29	1.54	135.39
81	0.066	427.4	3.29	1.65	129.72
87	0.071	408.9	3.29	1.78	124.10
102	0.083	355.1	3.29	2.08	107.78
117	0.095	291.3	3.29	2.39	88.42
132	0.108	229.5	3.29	2.69	69.66
147	0.120	172.5	3.29	3.01	52.36
162	0.133	130.6	3.29	3.32	39.65
177	0.144	106.8	3.29	3.61	32.41
192	0.157	95.8	3.29	3.93	29.07
207	0.169	87.7	3.29	4.24	26.63
222	0.181	81.3	3.29	4.54	24.68



Failure Sketch



Remarks: None.

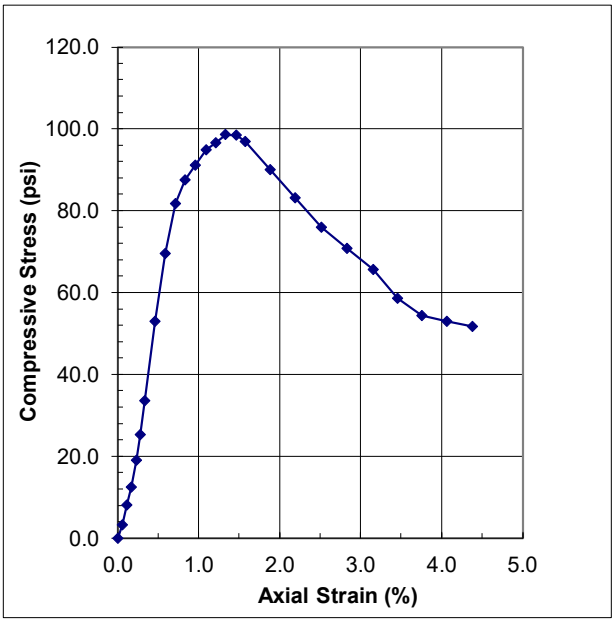
CDM Smith
Geotechnical Engineering Laboratory

Unconfined Compressive Strength (ASTM D1633)

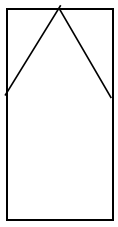
Client:	USG	Test Performed by :	AS
Project Name :	Highway 99 Bench Scale Study	Test Date :	11/25/20
Project Location:	Milton, WA		
Project Number:	19921-251008		
Sample Material :	C1-H9	Soil Type :	Soil - Cement
Sample Mix:			
Sample Date:	10/28/2020	Preparation Method:	Smoothed ends
Sample Age:	28 days		
		Pocket Penetrometer:	**>62.5 psi**

Water Content (%):	**35.5**		
Mass (g):	374.8	Loading Rate (in/min) :	0.05
Area (sq in) :	3.28	Dial Rate :	5.8
Diameter (in) :	2.04	Strain Rate (%/min)	1.24
Height (in) :	3.95	Strain at Failure (%):	1.33
Height to Dia. Ratio :	1.93	U. C. Strength (psi) :	**98.6**
Wet Density (pcf) :	**110.3**	Shear Strength (psi):	49.3
Dry Density (pcf) :	**81.4**		

Time (sec)	Displ. (in)	Load (lbs)	Cross Sectional Area (in^2)	Axial Strain (%)	Compress Strength (psi)
0	0.000	0.0	3.28	0.00	0.00
3	0.002	10.7	3.28	0.06	3.27
6	0.005	26.4	3.28	0.11	8.04
9	0.007	41.0	3.28	0.17	12.52
12	0.009	62.2	3.28	0.23	18.97
15	0.011	82.8	3.28	0.28	25.26
18	0.013	110.2	3.28	0.34	33.62
24	0.018	173.4	3.28	0.46	52.88
30	0.023	228.1	3.28	0.59	69.56
36	0.028	267.9	3.28	0.72	81.72
42	0.033	286.7	3.28	0.83	87.46
48	0.038	298.8	3.28	0.96	91.15
54	0.043	310.8	3.28	1.09	94.79
60	0.048	316.5	3.28	1.21	96.53
66	0.053	323.1	3.28	1.33	98.55
72	0.058	322.9	3.28	1.46	98.49
78	0.062	317.7	3.28	1.58	96.89
93	0.074	295.1	3.28	1.88	90.02
108	0.087	272.5	3.28	2.20	83.12
123	0.099	248.9	3.28	2.52	75.92
138	0.112	232.2	3.28	2.84	70.84
153	0.125	214.9	3.28	3.15	65.54
168	0.137	192.3	3.28	3.46	58.66
183	0.149	178.3	3.28	3.76	54.39
198	0.161	173.7	3.28	4.07	52.98
213	0.173	169.4	3.28	4.38	51.68



Failure Sketch



Remarks: None.

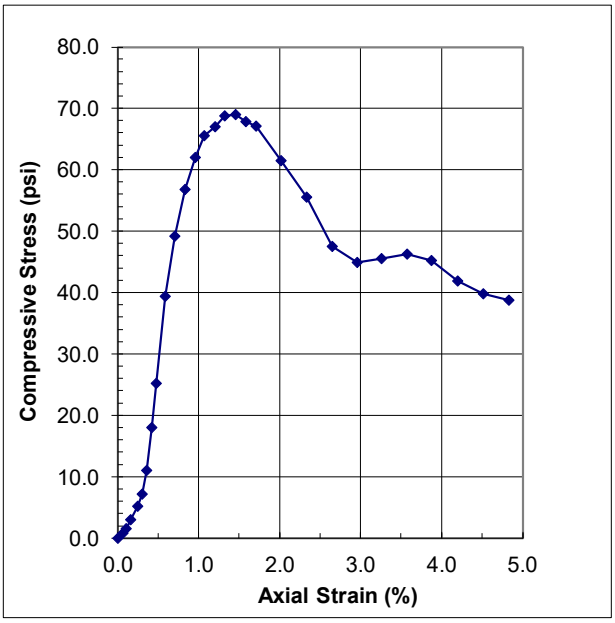
CDM Smith
Geotechnical Engineering Laboratory

Unconfined Compressive Strength (ASTM D1633)

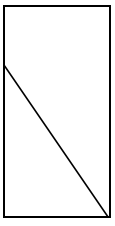
Client:	USG	Test Performed by :	AS
Project Name :	Highway 99 Bench Scale Study	Test Date :	11/25/20
Project Location:	Milton, WA		
Project Number:	19921-251008		
Sample Material :	C1-H10	Soil Type :	Soil - Cement
Sample Mix:			
Sample Date:	10/28/2020	Preparation Method:	Smoothed ends
Sample Age:	28 days		
		Pocket Penetrometer:	**>62.5 psi**

Water Content (%):	**36.4**		
Mass (g):	374.1	Loading Rate (in/min) :	0.05
Area (sq in) :	3.29	Dial Rate :	5.8
Diameter (in) :	2.05	Strain Rate (%/min)	1.25
Height (in) :	3.97	Strain at Failure (%):	1.46
Height to Dia. Ratio :	1.94	U. C. Strength (psi) :	**69.0**
Wet Density (pcf) :	**109.2**	Shear Strength (psi):	34.5
Dry Density (pcf) :	**80.0**		

Time (sec)	Displ. (in)	Load (lbs)	Cross Sectional Area (in^2)	Axial Strain (%)	Compress Strength (psi)
0	0.000	0.0	3.29	0.00	0.00
3	0.003	2.6	3.29	0.06	0.80
6	0.004	4.9	3.29	0.11	1.48
9	0.007	9.9	3.29	0.16	3.02
12	0.010	17.0	3.29	0.25	5.18
15	0.012	23.7	3.29	0.31	7.21
18	0.014	36.1	3.29	0.36	11.00
21	0.017	59.0	3.29	0.43	17.96
24	0.019	82.9	3.29	0.48	25.22
30	0.024	129.2	3.29	0.59	39.32
36	0.028	161.5	3.29	0.71	49.14
42	0.033	186.6	3.29	0.83	56.78
48	0.038	203.8	3.29	0.96	62.02
54	0.043	215.2	3.29	1.07	65.50
60	0.048	220.1	3.29	1.20	66.98
66	0.053	225.9	3.29	1.32	68.75
72	0.058	226.8	3.29	1.46	69.01
78	0.063	222.8	3.29	1.58	67.79
84	0.068	220.3	3.29	1.71	67.04
99	0.080	201.8	3.29	2.02	61.42
114	0.093	182.3	3.29	2.34	55.47
129	0.105	156.1	3.29	2.65	47.51
144	0.117	147.6	3.29	2.96	44.92
159	0.130	149.5	3.29	3.26	45.50
174	0.142	151.8	3.29	3.57	46.20
189	0.154	148.6	3.29	3.87	45.21
204	0.167	137.7	3.29	4.20	41.89
219	0.180	130.6	3.29	4.52	39.75
234	0.192	127.2	3.29	4.83	38.71



Failure Sketch



Remarks: None.

CDM Smith

Geotechnical Engineering Laboratory

Hydraulic Conductivity Using Flexible Wall Permeameter (ASTM D5084)

Client:	USG	Tested by:	ACS
Project Name:	Highway 99 Bench Scale Study	Checked by:	MBP
Project Location:	Milton, WA	Start Test Date:	11/19/2020
Project Number:	19921-251008	Permeant Fluid:	De-aired water
Sample Number:	C1-H7	Sample Preparation Procedures:	
Sample Date:	10/28/2020		
Depth (ft):			
Sample Description:	Soil-cement		
Test Type:	ASTM D5084		

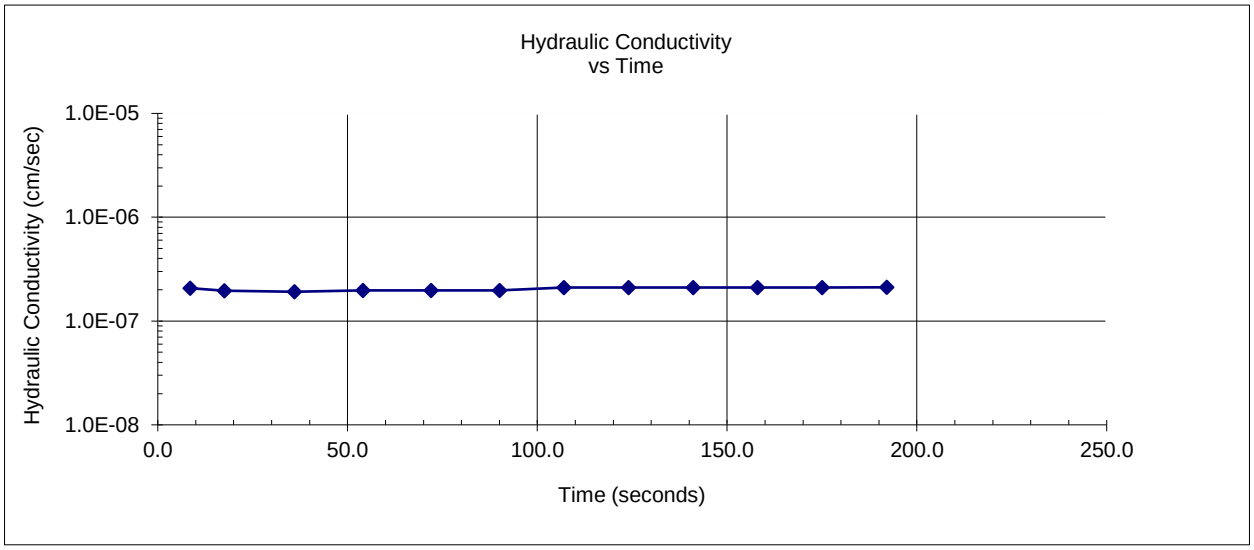
Sample Characteristics	Initial	Final
Avg. length of specimen (in)	3.28	3.28
Avg. dia. of specimen (in)	3.02	3.02
Area (sq in)	7.16	7.16
Volume (cubic in)	23.45	23.45
Moist mass (g)	685.9	700.3
Moist unit weight (pcf)	111.4	113.8
Moisture content (%)	33.8	36.6
Dry density (pcf)	83.3	83.3
Specific gravity (assumed)	2.68	2.68
Void ratio	1.01	1.01

Test Specifications	
B-Value (%):	
Consolidation stress (psi):	5.0
Gradient (in/in):	20.0
Cell pressure (psi):	65.0
Head pressure (psi):	62.0
Tail pressure (psi):	60.0
Max effective stress (psi):	5.0
Min effective stress (psi):	3.0

Comments: _____

Hydraulic Conductivity at 20 °C = **2.10E-07** cm/sec

Average of last 6 readings



CDM Smith

Geotechnical Engineering Laboratory

Hydraulic Conductivity Using Flexible Wall Permeameter (ASTM D5084)

Client:	USG	Tested by:	ACS
Project Name:	Highway 99 Bench Scale Study	Checked by:	MBP
Project Location:	Milton, WA	Start Test Date:	11/20/2020
Project Number:	19921-251008	Permeant Fluid:	De-aired water
Sample Number:	C1-H8	Sample Preparation Procedures:	
Sample Date:	10/28/2020		
Depth (ft):			
Sample Description:	Soil-cement		
Test Type:	ASTM D5084		

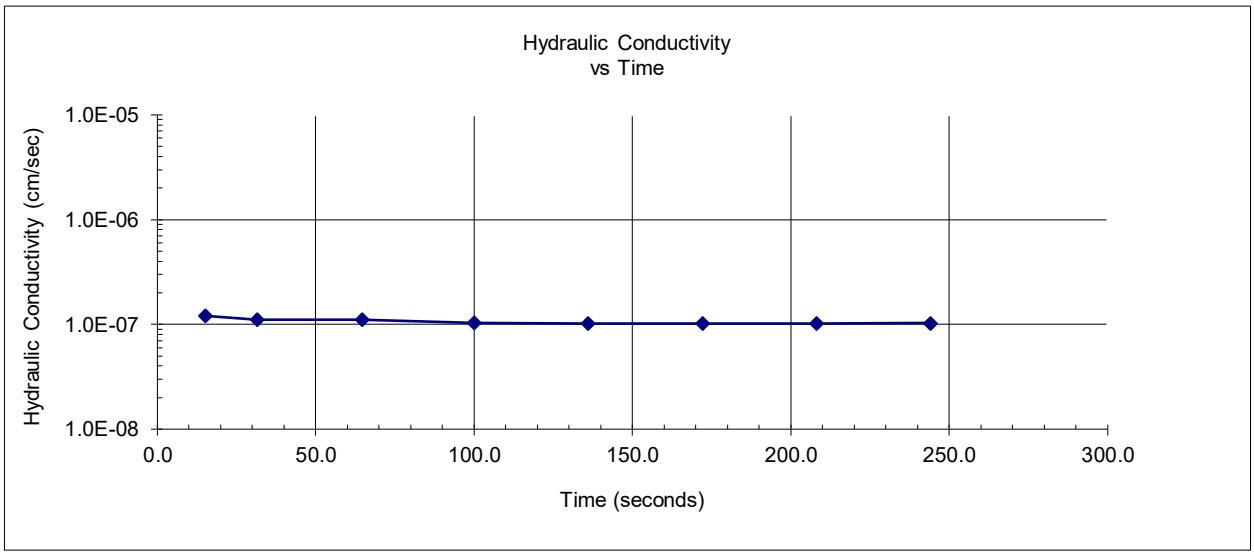
Sample Characteristics	Initial	Final
Avg. length of specimen (in)	3.37	3.37
Avg. dia. of specimen (in)	3.02	3.02
Area (sq in)	7.15	7.15
Volume (cubic in)	24.10	24.10
Moist mass (g)	711.5	728.4
Moist unit weight (pcf)	112.5	115.1
Moisture content (%)	32.0	35.1
Dry density (pcf)	85.2	85.2
Specific gravity (assumed)	2.68	2.68
Void ratio	0.96	0.96

Test Specifications	
B-Value (%):	
Consolidation stress (psi):	5.0
Gradient (in/in):	19.3
Cell pressure (psi):	65.0
Head pressure (psi):	62.0
Tail pressure (psi):	60.0
Max effective stress (psi):	5.0
Min effective stress (psi):	3.0

Comments: _____

Hydraulic Conductivity at 20 °C = **1.03E-07** cm/sec

Average of last 5 readings



CDM Smith

Geotechnical Engineering Laboratory

Hydraulic Conductivity Using Flexible Wall Permeameter (ASTM D5084)

Client:	USG	Tested by:	ACS
Project Name:	Highway 99 Bench Scale Study	Checked by:	MBP
Project Location:	Milton, WA	Start Test Date:	11/19/2020
Project Number:	19921-251008	Permeant Fluid:	De-aired water
Sample Number:	C1-H9	Sample Preparation Procedures:	
Sample Date:	10/28/2020		
Depth (ft):			
Sample Description:	Soil-cement		
Test Type:	ASTM D5084		

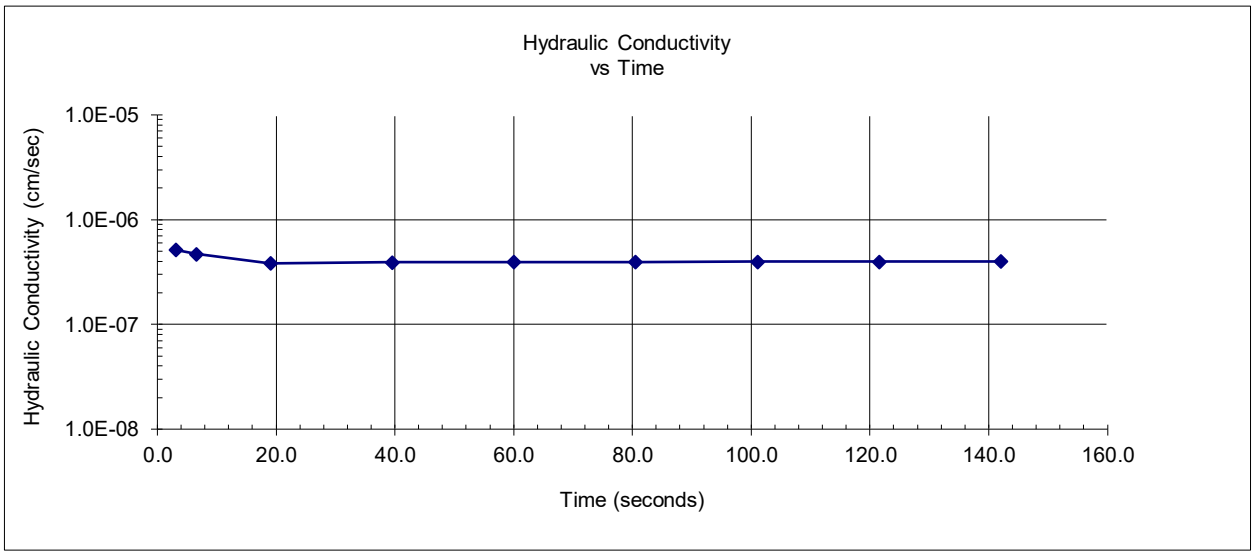
Sample Characteristics	Initial	Final
Avg. length of specimen (in)	2.95	2.95
Avg. dia. of specimen (in)	3.02	3.02
Area (sq in)	7.14	7.14
Volume (cubic in)	21.05	21.05
Moist mass (g)	616.0	629.3
Moist unit weight (pcf)	111.5	113.9
Moisture content (%)	35.3	38.2
Dry density (pcf)	82.4	82.4
Specific gravity (assumed)	2.68	2.68
Void ratio	1.03	1.03

Test Specifications	
B-Value (%):	
Consolidation stress (psi):	5.0
Gradient (in/in):	22.2
Cell pressure (psi):	65.0
Head pressure (psi):	62.0
Tail pressure (psi):	60.0
Max effective stress (psi):	5.0
Min effective stress (psi):	3.0

Comments: _____

Hydraulic Conductivity at 20 °C = **3.96E-07** cm/sec

Average of last 6 readings



CDM Smith

Geotechnical Engineering Laboratory

Hydraulic Conductivity Using Flexible Wall Permeameter (ASTM D5084)

Client:	USG	Tested by:	ACS
Project Name:	Highway 99 Bench Scale Study	Checked by:	MBP
Project Location:	Milton, WA	Start Test Date:	11/24/2020
Project Number:	19921-251008	Permeant Fluid:	De-aired water
Sample Number:	C1-H10	Sample Preparation Procedures:	
Sample Date:	10/28/2020		
Depth (ft):			
Sample Description:	Soil-cement		
Test Type:	ASTM D5084		

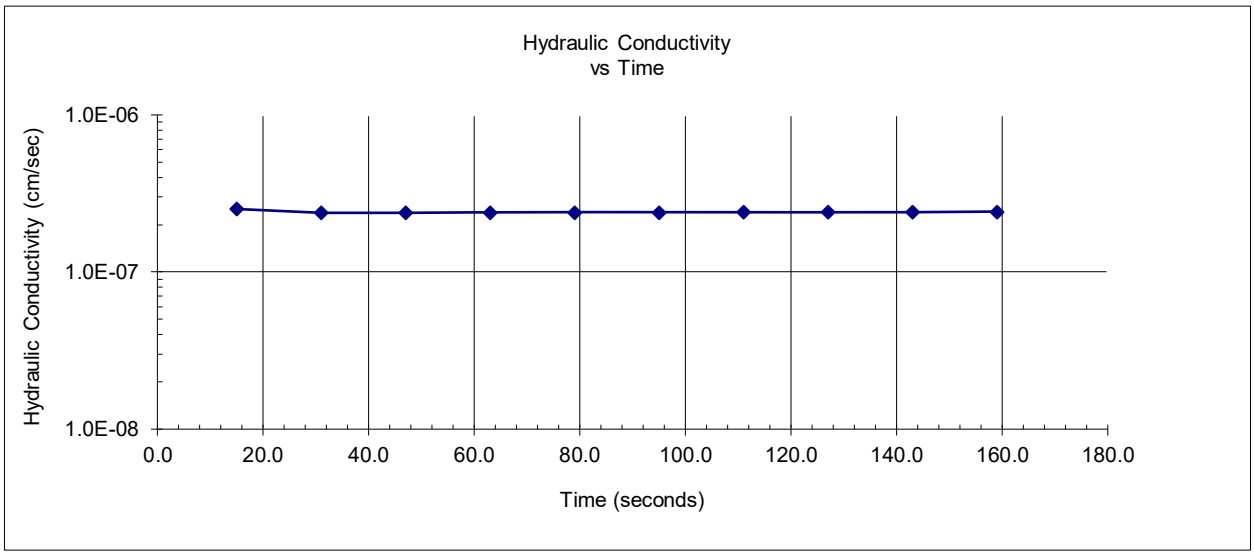
Sample Characteristics	Initial	Final
Avg. length of specimen (in)	3.53	3.53
Avg. dia. of specimen (in)	3.02	3.02
Area (sq in)	7.16	7.16
Volume (cubic in)	25.27	25.27
Moist mass (g)	735.1	750.3
Moist unit weight (pcf)	110.8	113.1
Moisture content (%)	36.3	39.1
Dry density (pcf)	81.3	81.3
Specific gravity (assumed)	2.68	2.68
Void ratio	1.06	1.06

Test Specifications	
B-Value (%):	
Consolidation stress (psi):	5.0
Gradient (in/in):	18.5
Cell pressure (psi):	65.0
Head pressure (psi):	62.0
Tail pressure (psi):	60.0
Max effective stress (psi):	5.0
Min effective stress (psi):	3.0

Comments: _____

Hydraulic Conductivity at 20 °C = **2.41E-07** cm/sec

Average of last 6 readings



Appendix E

Chemical Analytical Laboratory Reports

OnSite Environmental Inc.
14648 NE 95th Street, Redmond, WA 98052 • (425) 883-3881

August 25, 2020

Pam Morrill
CDM Smith, Inc.
14432 SE Eastgate Way, Suite 100
Bellevue, WA 98007-6493

Re: Analytical Data for Project 246239/233028
Laboratory Reference No. 2008-087

Dear Pam:

Enclosed are the analytical results and associated quality control data for samples submitted on August 7, 2020.

The standard policy of OnSite Environmental, Inc. is to store your samples for 30 days from the date of receipt. If you require longer storage, please contact the laboratory.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning the data, or need additional information, please feel free to call me.

Sincerely,

David Baumeister
Project Manager

Enclosures

Date of Report: August 25, 2020
Samples Submitted: August 7, 2020
Laboratory Reference: 2008-087
Project: 246239/233028

Case Narrative

Samples were collected on August 6 and 7, 2020 and received by the laboratory on August 7, 2020. They were maintained at the laboratory at a temperature of 2°C to 6°C.

Please note that any and all soil sample results are reported on a dry-weight basis, unless otherwise noted below.

General QA/QC issues associated with the analytical data enclosed in this laboratory report will be indicated with a reference to a comment or explanation on the Data Qualifier page. More complex and involved QA/QC issues will be discussed in detail below.

Date of Report: August 25, 2020
Samples Submitted: August 7, 2020
Laboratory Reference: 2008-087
Project: 246239/233028

TOTAL ARSENIC
EPA 200.8

Matrix: Water
Units: ug/L (ppb)

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	**Purge-1_080620**					
Laboratory ID:	08-087-02					
Arsenic	**2700**	83	EPA 200.8	8-14-20	8-14-20	

Date of Report: August 25, 2020
Samples Submitted: August 7, 2020
Laboratory Reference: 2008-087
Project: 246239/233028

TOTAL ARSENIC
EPA 200.8
QUALITY CONTROL

Matrix: Water
Units: ug/L (ppb)

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
METHOD BLANK						
Laboratory ID:	MB0814WM1					
Arsenic	**ND**	3.3	EPA 200.8	8-14-20	8-14-20	

Analyte	Result		Spike Level		Source Result	Percent Recovery		Recovery Limits	RPD	RPD Limit	Flags
DUPLICATE											
Laboratory ID:	07-326-03										
	ORIG	DUP									
Arsenic	**ND**	**ND**	NA	NA		NA		NA	NA	20	
MATRIX SPIKES											
Laboratory ID:	07-326-03										
	MS	MSD	MS	MSD		MS	MSD				
Arsenic	**114**	**126**	111	111	ND	**103**	**113**	75-125	10	20	

Date of Report: August 25, 2020
Samples Submitted: August 7, 2020
Laboratory Reference: 2008-087
Project: 246239/233028

TOTAL SUSPENDED SOLIDS
SM 2540D

Matrix: Water
Units: mg/L

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	**P3-1_08062020**					
Laboratory ID:	08-087-01					
Total Suspended Solids	**11**	4.0	SM 2540D	8-11-20	8-12-20	
Client ID:	**99-1_08072020**					
Laboratory ID:	08-087-03					
Total Suspended Solids	**16**	4.0	SM 2540D	8-11-20	8-12-20	

Date of Report: August 25, 2020
Samples Submitted: August 7, 2020
Laboratory Reference: 2008-087
Project: 246239/233028

TOTAL SUSPENDED SOLIDS
SM 2540D
QUALITY CONTROL

Matrix: Water
Units: mg/L

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
METHOD BLANK						
Laboratory ID:	MB0811W1					
Total Suspended Solids	**ND**	4.0	SM 2540D	8-11-20	8-12-20	

Analyte	Result		Spike Level	Source Result	Percent Recovery	Recovery Limits	RPD	RPD Limit	Flags
DUPLICATE									
Laboratory ID:	08-087-03								
	ORIG	DUP							
Total Suspended Solids	**16.0**	**17.0**	NA	NA	NA	NA	6	21	
SPIKE BLANK									
Laboratory ID:	SB0811W1								
	SB		SB		SB				
Total Suspended Solids	**95.0**		100	NA	95	57-126	NA	NA	

Date of Report: August 25, 2020
Samples Submitted: August 7, 2020
Laboratory Reference: 2008-087
Project: 246239/233028

TOTAL DISSOLVED SOLIDS
SM 2540C

Matrix: Water
Units: mg/L

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	**P3-1_08062020**					
Laboratory ID:	08-087-01					
Total Dissolved Solids	**240**	13	SM 2540C	8-12-20	8-13-20	
Client ID:	**99-1_08072020**					
Laboratory ID:	08-087-03					
Total Dissolved Solids	**230**	13	SM 2540C	8-12-20	8-13-20	

Date of Report: August 25, 2020
Samples Submitted: August 7, 2020
Laboratory Reference: 2008-087
Project: 246239/233028

TOTAL DISSOLVED SOLIDS
SM 2540C
QUALITY CONTROL

Matrix: Water
Units: mg/L

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
METHOD BLANK						
Laboratory ID:	MB0812W1					
Total Dissolved Solids	**ND**	13	SM 2540C	8-12-20	8-13-20	

Analyte	Result		Spike Level	Source Result	Percent Recovery	Recovery Limits	RPD	RPD Limit	Flags
DUPLICATE									
Laboratory ID:	08-087-03								
	ORIG	DUP							
Total Dissolved Solids	**229**	**228**	NA	NA	NA	NA	0	21	
SPIKE BLANK									
Laboratory ID:	SB0812W1								
	SB		SB		SB				
Total Dissolved Solids	**492**		500	NA	98	84-110	NA	NA	

Date of Report: August 25, 2020
Samples Submitted: August 7, 2020
Laboratory Reference: 2008-087
Project: 246239/233028

DISSOLVED METALS
EPA 6010D/200.8/7470A

Matrix: Water
Units: ug/L (ppb)

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	**P3-1_08062020**					
Laboratory ID:	08-087-01					
Aluminum	**ND**	110	EPA 6010D		8-17-20	
Antimony	**110**	5.0	EPA 200.8		8-17-20	
Arsenic	**6000**	150	EPA 200.8		8-17-20	
Barium	**ND**	25	EPA 200.8		8-17-20	
Beryllium	**ND**	10	EPA 200.8		8-17-20	
Cadmium	**ND**	4.0	EPA 200.8		8-17-20	
Calcium	**39000**	1100	EPA 6010D		8-17-20	
Chromium	**ND**	10	EPA 200.8		8-17-20	
Cobalt	**ND**	10	EPA 200.8		8-17-20	
Copper	**ND**	10	EPA 200.8		8-17-20	
Iron	**ND**	56	EPA 6010D		8-17-20	
Lead	**ND**	1.0	EPA 200.8		8-17-20	
Magnesium	**11000**	1100	EPA 6010D		8-17-20	
Manganese	**590**	500	EPA 200.8		8-17-20	
Mercury	**ND**	0.50	EPA 7470A		8-14-20	
Nickel	**ND**	20	EPA 200.8		8-17-20	
Potassium	**4400**	1100	EPA 6010D		8-17-20	
Selenium	**ND**	5.0	EPA 200.8		8-17-20	
Silver	**ND**	10	EPA 200.8		8-17-20	
Sodium	**12000**	1100	EPA 6010D		8-17-20	
Thallium	**ND**	5.0	EPA 200.8		8-17-20	
Vanadium	**ND**	10	EPA 200.8		8-17-20	
Zinc	**ND**	25	EPA 200.8		8-17-20	

Date of Report: August 25, 2020
Samples Submitted: August 7, 2020
Laboratory Reference: 2008-087
Project: 246239/233028

DISSOLVED METALS
EPA 6010D/200.8/7470A

Matrix: Water
Units: ug/L (ppb)

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	**99-1_08072020**					
Laboratory ID:	08-087-03					
Aluminum	**ND**	110	EPA 6010D		8-17-20	
Antimony	**ND**	5.0	EPA 200.8		8-17-20	
Arsenic	**3600**	150	EPA 200.8		8-17-20	
Barium	**ND**	25	EPA 200.8		8-17-20	
Beryllium	**ND**	10	EPA 200.8		8-17-20	
Cadmium	**ND**	4.0	EPA 200.8		8-17-20	
Calcium	**33000**	1100	EPA 6010D		8-17-20	
Chromium	**ND**	10	EPA 200.8		8-17-20	
Cobalt	**ND**	10	EPA 200.8		8-17-20	
Copper	**ND**	10	EPA 200.8		8-17-20	
Iron	**9400**	56	EPA 6010D		8-17-20	
Lead	**ND**	1.0	EPA 200.8		8-17-20	
Magnesium	**18000**	1100	EPA 6010D		8-17-20	
Manganese	**860**	500	EPA 200.8		8-17-20	
Mercury	**ND**	0.50	EPA 7470A		8-14-20	
Nickel	**ND**	20	EPA 200.8		8-17-20	
Potassium	**3400**	1100	EPA 6010D		8-17-20	
Selenium	**ND**	5.0	EPA 200.8		8-17-20	
Silver	**ND**	10	EPA 200.8		8-17-20	
Sodium	**16000**	1100	EPA 6010D		8-17-20	
Thallium	**ND**	5.0	EPA 200.8		8-17-20	
Vanadium	**ND**	10	EPA 200.8		8-17-20	
Zinc	**ND**	25	EPA 200.8		8-17-20	

Date of Report: August 25, 2020
Samples Submitted: August 7, 2020
Laboratory Reference: 2008-087
Project: 246239/233028

DISSOLVED METALS
EPA 6010D/200.8/7470A
QUALITY CONTROL

Matrix: Water
Units: ug/L (ppb)

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
METHOD BLANK						
Laboratory ID:	MB0817D1					
Antimony	**ND**	5.0	EPA 200.8		8-17-20	
Arsenic	**ND**	3.0	EPA 200.8		8-17-20	
Barium	**ND**	25	EPA 200.8		8-17-20	
Beryllium	**ND**	10	EPA 200.8		8-17-20	
Cadmium	**ND**	4.0	EPA 200.8		8-17-20	
Chromium	**ND**	10	EPA 200.8		8-17-20	
Cobalt	**ND**	10	EPA 200.8		8-17-20	
Copper	**ND**	10	EPA 200.8		8-17-20	
Lead	**ND**	1.0	EPA 200.8		8-17-20	
Manganese	**ND**	10	EPA 200.8		8-17-20	
Nickel	**ND**	20	EPA 200.8		8-17-20	
Selenium	**ND**	5.0	EPA 200.8		8-17-20	
Silver	**ND**	10	EPA 200.8		8-17-20	
Thallium	**ND**	5.0	EPA 200.8		8-17-20	
Vanadium	**ND**	10	EPA 200.8		8-17-20	
Zinc	**ND**	25	EPA 200.8		8-17-20	
Laboratory ID:	MB0817D1					
Aluminum	**ND**	110	EPA 6010D		8-17-20	
Calcium	**ND**	1100	EPA 6010D		8-17-20	
Iron	**ND**	56	EPA 6010D		8-17-20	
Magnesium	**ND**	1100	EPA 6010D		8-17-20	
Potassium	**ND**	1100	EPA 6010D		8-17-20	
Sodium	**ND**	1100	EPA 6010D		8-17-20	
Laboratory ID:	MB0810F1					
Mercury	**ND**	0.50	EPA 7470A	8-10-20	8-14-20	

Date of Report: August 25, 2020
Samples Submitted: August 7, 2020
Laboratory Reference: 2008-087
Project: 246239/233028

DISSOLVED METALS
EPA 6010D/200.8/7470A
QUALITY CONTROL

Matrix: Water
Units: ug/L (ppb)

Analyte	Result		Spike Level		Source Result	Percent Recovery	Recovery Limits	RPD	RPD Limit	Flags
DUPLICATE										
Laboratory ID:	08-087-03									
	ORIG	DUP								
Antimony	**ND**	**ND**	NA	NA		NA	NA	NA	20	
Arsenic	**3590**	**3550**	NA	NA		NA	NA	1	20	
Barium	**ND**	**ND**	NA	NA		NA	NA	NA	20	
Beryllium	**ND**	**ND**	NA	NA		NA	NA	NA	20	
Cadmium	**ND**	**ND**	NA	NA		NA	NA	NA	20	
Chromium	**ND**	**ND**	NA	NA		NA	NA	NA	20	
Cobalt	**ND**	**ND**	NA	NA		NA	NA	NA	20	
Copper	**ND**	**ND**	NA	NA		NA	NA	NA	20	
Lead	**ND**	**ND**	NA	NA		NA	NA	NA	20	
Manganese	**859**	**831**	NA	NA		NA	NA	3	20	
Nickel	**ND**	**ND**	NA	NA		NA	NA	NA	20	
Selenium	**ND**	**ND**	NA	NA		NA	NA	NA	20	
Silver	**ND**	**ND**	NA	NA		NA	NA	NA	20	
Thallium	**ND**	**ND**	NA	NA		NA	NA	NA	20	
Vanadium	**ND**	**ND**	NA	NA		NA	NA	NA	20	
Zinc	**ND**	**ND**	NA	NA		NA	NA	NA	20	
Laboratory ID:	08-087-01									
Aluminum	**ND**	**ND**	NA	NA		NA	NA	NA	20	
Calcium	**38500**	**37600**	NA	NA		NA	NA	2	20	
Iron	**ND**	**ND**	NA	NA		NA	NA	NA	20	
Magnesium	**11100**	**10900**	NA	NA		NA	NA	1	20	
Potassium	**4400**	**4270**	NA	NA		NA	NA	3	20	
Sodium	**12000**	**11900**	NA	NA		NA	NA	1	20	
Laboratory ID:	08-076-24									
Mercury	**ND**	**ND**	NA	NA		NA	NA	NA	20	

Date of Report: August 25, 2020
Samples Submitted: August 7, 2020
Laboratory Reference: 2008-087
Project: 246239/233028

DISSOLVED METALS
EPA 6010D/200.8/7470A
QUALITY CONTROL

Matrix: Water
Units: ug/L (ppb)

Analyte	Result		Spike Level		Source Result	Percent Recovery		Recovery Limits	RPD	RPD Limit	Flags
MATRIX SPIKES											
Laboratory ID:	08-087-03										
	MS	MSD	MS	MSD		MS	MSD				
Antimony	**79.0**	**79.4**	80.0	80.0	ND	**99**	**99**	75-125	1	20	
Arsenic	**7350**	**7470**	4000	4000	3590	**94**	**97**	75-125	2	20	
Barium	**90.8**	**89.0**	80.0	80.0	ND	**114**	**111**	75-125	2	20	
Beryllium	**82.2**	**79.4**	80.0	80.0	ND	**103**	**99**	75-125	3	20	
Cadmium	**77.0**	**78.6**	80.0	80.0	ND	**96**	**98**	75-125	2	20	
Chromium	**71.2**	**70.2**	80.0	80.0	ND	**89**	**88**	75-125	1	20	
Cobalt	**77.2**	**75.2**	80.0	80.0	ND	**97**	**94**	75-125	3	20	
Copper	**74.6**	**72.8**	80.0	80.0	ND	**93**	**91**	75-125	2	20	
Lead	**70.4**	**69.4**	80.0	80.0	ND	**88**	**87**	75-125	1	20	
Manganese	**4430**	**4490**	4000	4000	859	**89**	**91**	75-125	1	20	
Nickel	**70.6**	**69.6**	80.0	80.0	ND	**88**	**87**	75-125	1	20	
Selenium	**89.6**	**88.4**	80.0	80.0	ND	**112**	**111**	75-125	1	20	
Silver	**66.0**	**65.0**	80.0	80.0	ND	**83**	**81**	75-125	2	20	
Thallium	**69.8**	**69.0**	80.0	80.0	ND	**87**	**86**	75-125	1	20	
Vanadium	**73.4**	**71.8**	80.0	80.0	ND	**92**	**90**	75-125	2	20	
Zinc	**80.2**	**79.2**	80.0	80.0	ND	**100**	**99**	75-125	1	20	
Laboratory ID:	08-087-01										
Aluminum	**22500**	**22900**	22200	22200	ND	**102**	**103**	75-125	1	20	
Calcium	**58400**	**58800**	22200	22200	38500	**90**	**92**	75-125	1	20	
Iron	**24800**	**24400**	22200	22200	ND	**112**	**110**	75-125	1	20	
Magnesium	**33900**	**34200**	22200	22200	11100	**103**	**104**	75-125	1	20	
Potassium	**27200**	**27600**	22200	22200	4400	**103**	**105**	75-125	2	20	
Sodium	**32600**	**33000**	22200	22200	12000	**93**	**95**	75-125	1	20	
Laboratory ID:	08-076-24										
Mercury	**11.6**	**11.9**	12.5	12.5	ND	**93**	**95**	75-125	2	20	

Date of Report: August 25, 2020
Samples Submitted: August 7, 2020
Laboratory Reference: 2008-087
Project: 246239/233028

DISSOLVED SILICA
EPA 200.7

Matrix: Water
Units: ug/L

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	**P3-1_08062020**					
Laboratory ID:	08-087-01					
Silica	**53000**	1600	EPA 200.7		8-17-20	
Client ID:	**99-1_08072020**					
Laboratory ID:	08-087-03					
Silica	**44000**	1600	EPA 200.7		8-17-20	

Date of Report: August 25, 2020
Samples Submitted: August 7, 2020
Laboratory Reference: 2008-087
Project: 246239/233028

DISSOLVED SILICA
EPA 200.7
QUALITY CONTROL

Matrix: Water
Units: ug/L

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
METHOD BLANK						
Laboratory ID:	MB0817D1					
Silica	**ND**	360	EPA 200.7		8-17-20	

Analyte	Result		Spike Level		Source Result	Percent Recovery		Recovery Limits	RPD	RPD Limit	Flags
DUPLICATE											
Laboratory ID:	08-087-01										
	ORIG	DUP									
Silica	**52700**	**52800**	NA		NA	NA		NA	0	20	
MATRIX SPIKES											
Laboratory ID:	08-087-01										
	MS	MSD	MS	MSD		MS	MSD				
Silica	**91000**	**91500**	42800	42800	52700	89	91	75-125	1	20	
SPIKE BLANK											
Laboratory ID:	SB0817D1										
	SB		SB			SB					
Silica	**4650**		4750		NA	98		85-115	NA	NA	

Date of Report: August 25, 2020
Samples Submitted: August 7, 2020
Laboratory Reference: 2008-087
Project: 246239/233028

ALKALINITY
SM 2320B

Matrix: Water
Units: mg CaCO3/L

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	**P3-1_08062020**					
Laboratory ID:	08-087-01					
Carbonate Alkalinity	**ND**	2.0	SM 2320B	8-11-20	8-11-20	
Bicarbonate Concentration	**140**	2.0	SM 2320B	8-11-20	8-11-20	
Client ID:	**99-1_08072020**					
Laboratory ID:	08-087-03					
Carbonate Alkalinity	**ND**	2.0	SM 2320B	8-11-20	8-11-20	
Bicarbonate Concentration	**200**	2.0	SM 2320B	8-11-20	8-11-20	

Date of Report: August 25, 2020
Samples Submitted: August 7, 2020
Laboratory Reference: 2008-087
Project: 246239/233028

ALKALINITY
SM 2320B
QUALITY CONTROL

Matrix: Water
Units: mg CaCO3/L

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
METHOD BLANK						
Laboratory ID:	MB0811W1					
Carbonate Alkalinity	**ND**	2.0	SM 2320B	8-11-20	8-11-20	
Bicarbonate Concentration	**ND**	2.0	SM 2320B	8-11-20	8-11-20	

Analyte	Result		Spike Level	Source Result	Percent Recovery	Recovery Limits	RPD	RPD Limit	Flags
DUPLICATE									
Laboratory ID:	08-087-01								
	ORIG	DUP							
Total Alkalinity	**138**	**136**	NA	NA	NA	NA	1	10	
SPIKE BLANK									
Laboratory ID:	SB0811W1								
	SB		SB		SB				
Total Alkalinity	**96.0**		100	NA	96	89-110	NA	NA	

Date of Report: August 25, 2020
Samples Submitted: August 7, 2020
Laboratory Reference: 2008-087
Project: 246239/233028

NITRATE + NITRITE (as Nitrogen)
EPA 353.2

Matrix: Water
Units: mg/L

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	**P3-1_08062020**					
Laboratory ID:	08-087-01					
Nitrate+Nitrite	**0.064**	0.050	EPA 353.2	8-11-20	8-11-20	
Client ID:	**99-1_08072020**					
Laboratory ID:	08-087-03					
Nitrate+Nitrite	**ND**	0.050	EPA 353.2	8-11-20	8-11-20	

Date of Report: August 25, 2020
Samples Submitted: August 7, 2020
Laboratory Reference: 2008-087
Project: 246239/233028

NITRATE + NITRITE (as Nitrogen)
EPA 353.2
QUALITY CONTROL

Matrix: Water
Units: mg/L

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
METHOD BLANK						
Laboratory ID:	MB0811W1					
Nitrate+Nitrite	**ND**	0.050	EPA 353.2	8-11-20	8-11-20	

Analyte	Result	Spike Level	Source Result	Percent Recovery	Recovery Limits	RPD	RPD Limit	Flags
DUPLICATE								
Laboratory ID:	08-087-01							
	ORIG DUP							
Nitrate+Nitrite	**0.0635** **0.0605**	NA	NA	NA	NA	5	15	
MATRIX SPIKE								
Laboratory ID:	08-087-01							
	MS	MS		MS				
Nitrate+Nitrite	**2.33**	2.00	0.0635	113	89-123	NA	NA	
SPIKE BLANK								
Laboratory ID:	SB0811W1							
	SB	SB		SB				
Nitrate+Nitrite	**2.00**	2.00	NA	100	90-119	NA	NA	

OnSite Environmental Inc.

Data Qualifiers and Abbreviations

A - Due to a high sample concentration, the amount spiked is insufficient for meaningful MS/MSD recovery data.

B - The analyte indicated was also found in the blank sample.

C - The duplicate RPD is outside control limits due to high result variability when analyte concentrations are within five times the quantitation limit.

E - The value reported exceeds the quantitation range and is an estimate.

F - Surrogate recovery data is not available due to the high concentration of coeluting target compounds.

H - The analyte indicated is a common laboratory solvent and may have been introduced during sample preparation, and be impacting the sample result.

I - Compound recovery is outside of the control limits.

J - The value reported was below the practical quantitation limit. The value is an estimate.

K - Sample duplicate RPD is outside control limits due to sample inhomogeneity. The sample was re-extracted and re-analyzed with similar results.

L - The RPD is outside of the control limits.

M - Hydrocarbons in the gasoline range are impacting the diesel range result.

M1 - Hydrocarbons in the gasoline range (toluene-naphthalene) are present in the sample.

N - Hydrocarbons in the lube oil range are impacting the diesel range result.

N1 - Hydrocarbons in diesel range are impacting lube oil range results.

O - Hydrocarbons indicative of heavier fuels are present in the sample and are impacting the gasoline result.

P - The RPD of the detected concentrations between the two columns is greater than 40.

Q - Surrogate recovery is outside of the control limits.

S - Surrogate recovery data is not available due to the necessary dilution of the sample.

T - The sample chromatogram is not similar to a typical _____.

U - The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

U1 - The practical quantitation limit is elevated due to interferences present in the sample.

V - Matrix Spike/Matrix Spike Duplicate recoveries are outside control limits due to matrix effects.

W - Matrix Spike/Matrix Spike Duplicate RPD are outside control limits due to matrix effects.

X - Sample extract treated with a mercury cleanup procedure.

X1- Sample extract treated with a sulfuric acid/silica gel cleanup procedure.

Y - The calibration verification for this analyte exceeded the 20% drift specified in methods 8260 & 8270, and therefore the reported result should be considered an estimate. The overall performance of the calibration verification standard met the acceptance criteria of the method.

Z -

ND - Not Detected at PQL
PQL - Practical Quantitation Limit
RPD - Relative Percent Difference

Am Test Inc.
13600 NE 126TH PL
Suite C
Kirkland, WA 98034
(425) 885-1664

Professional Analytical Services

Aug 25 2020
On-Site Environmental
14648 NE 95th ST
Redmond, WA 98052
Attention: David Baumeister

Dear David Baumeister:

Enclosed please find the analytical data for your 246239/233028 project.

The following is a cross correlation of client and laboratory identifications for your convenience.

CLIENT ID	MATRIX	AMTEST ID	TEST
P3-1_08062020	Water	20-A012281	CONV, MIN
99-1_08072020	Water	20-A012282	CONV, MIN

Your samples were received on Tuesday, August 11, 2020. At the time of receipt, the samples were logged in and properly maintained prior to the subsequent analysis.

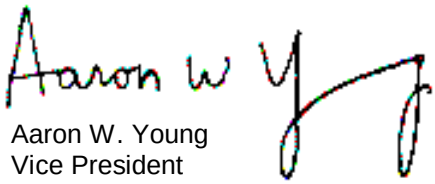
The analytical procedures used at AmTest are well documented and are typically derived from the protocols of the EPA, USDA, FDA or the Army Corps of Engineers.

Following the analytical data you will find the Quality Control (QC) results.

Please note that the detection limits that are listed in the body of the report refer to the Practical Quantitation Limits (PQL's), as opposed to the Method Detection Limits (MDL's).

If you should have any questions pertaining to the data package, please feel free to contact me.

Sincerely,



Aaron W. Young
Vice President

PO Number: 08-087

BACT = Bacteriological
CONV = Conventionals
MET = Metals
ORG = Organics
NUT=Nutrients
DEM=Demand
MIN=Minerals

Am Test Inc.
13600 NE 126TH PL
Suite C
Kirkland, WA 98034
(425) 885-1664
www.amtestlab.com

Professional Analytical Services

ANALYSIS REPORT

On-Site Environmental
14648 NE 95th ST
Redmond, WA 98052
Attention: David Baumeister
Project Name: 246239/233028
PO Number: 08-087
All results reported on an as received basis.

Date Received: 08/11/20
Date Reported: 8/25/20

AMTEST Identification Number **20-A012281**
Client Identification **P3-1_08062020**
Sampling Date **08/06/20, 12:10**

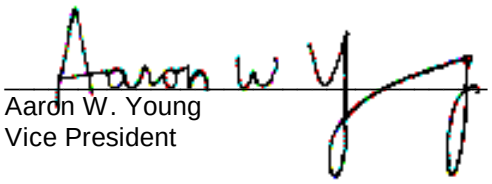
Minerals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Bromide	0.05	mg/l		0.05	EPA 300.0	AY	08/11/20
Chloride	6.62	mg/l		0.05	EPA 300.0	AY	08/11/20
Fluoride	0.12	mg/l		0.05	EPA 300.0	AY	08/11/20
Sulfate	19.4	mg/l		0.1	EPA 300.0	AY	08/12/20

AMTEST Identification Number **20-A012282**
Client Identification **99-1_08072020**
Sampling Date **08/07/20, 11:37**

Minerals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Bromide	0.05	mg/l		0.05	EPA 300.0	AY	08/11/20
Chloride	9.59	mg/l		0.05	EPA 300.0	AY	08/11/20
Fluoride	0.48	mg/l		0.05	EPA 300.0	AY	08/11/20
Sulfate	2.95	mg/l		0.1	EPA 300.0	AY	08/11/20



Aaron W. Young
Vice President

Am Test Inc.
13600 NE 126th PL
Suite C
Kirkland, WA, 98034
(425) 885-1664
www.amtestlab.com

Professional Analytical Services

QC Summary for sample numbers: 20-A012281 to 20-A012282

DUPLICATES

SAMPLE #	ANALYTE	UNITS	SAMPLE VALUE	DUP VALUE	RPD
20-A012050	Chloride	mg/l	< 0.05	< 0.05	

MATRIX SPIKES

SAMPLE #	ANALYTE	UNITS	SAMPLE VALUE	SMPL+ SPK	SPK AMT	RECOVERY
20-A012050	Chloride	mg/l	< 0.05	2.11	2.00	105.50 %

STANDARD REFERENCE MATERIALS

ANALYTE	UNITS	TRUE VALUE	MEASURED VALUE	RECOVERY
Bromide	mg/l	2.0	2.1	105. %
Bromide	mg/l	2.0	2.1	105. %
Chloride	mg/l	2.00	2.12	106. %
Chloride	mg/l	2.00	2.03	102. %
Fluoride	mg/l	2.00	1.98	99.0 %
Fluoride	mg/l	2.00	2.00	100. %
Sulfate	mg/l	2.00	2.11	106. %
Sulfate	mg/l	2.00	2.09	104. %
Sulfate	mg/l	2.00	2.04	102. %

BLANKS

ANALYTE	UNITS	RESULT
Bromide	mg/l	< 0.05
Bromide	mg/l	< 0.05
Chloride	mg/l	< 0.05
Chloride	mg/l	< 0.05
Fluoride	mg/l	< 0.05
Fluoride	mg/l	< 0.05
Sulfate	mg/l	< 0.1
Sulfate	mg/l	< 0.1
Sulfate	mg/l	< 0.1

Chain of Custody

Page 1 of 1

OnSite Environmental Inc.
Analytical Laboratory Testing Services
14648 NE 95th Street • Redmond, WA 98052
Phone: (425) 883-3881 • www.onsite-env.com

Company: CDM Smith
Project Number: 246239 / 233028
Project Name: Puyallup / Hwy 99
Project Manager: Pamela Morrill
Sampled by: Morgan Simon

Turnaround Request (in working days)
(Check One)
☐ Same Day ☐ 1 Day
☐ 2 Days ☐ 3 Days
☒ Standard (7 Days)
☐ _____ (other)

Laboratory Number: ~~08-075~~ 08-087

Lab ID	Sample Identification	Date Sampled	Time Sampled	Matrix	Number of Containers
1	P3-1_08062020	8/6/20	1210	water	5
2	Purge-1_080620	8/6/20	1620	water	1
3	99-1_08072020	8/7/20	1137	water	5

Lab ID	NWTPH-HCID	NWTPH-Gx/BTEX	NWTPH-Gx	NWTPH-Dx (☐ Acid / SG Clean-up)	Volatiles 8260C	Halogenated Volatiles 8260C	~~EDB EPA 8011 (Waters Only)~~ Bromide 300.0	~~Semivolatiles 8270D/SIM (with low-level PAHs)~~ Chloride 300.0	~~PAHs 8270D/SIM (low level)~~ Fluoride 300.0	~~PCBs 8082A~~ Sulfate 300.0	Organochlorine Pesticides 8081B	Organophosphorus Pesticides 8270D/SIM	Chlorinated Acid Herbicides 8151A	Total ~~RCRA~~ Metals ARSENIC FAILED QC	~~Total~~ Total MTCA Metals	~~TCLP Metals~~ Total Suspended Solids	TDS	HEM (oil and grease) 1664A	TAL dissolved	Silica	+Carbonate/bicarbonate	Nitrate+nitrate	% Moisture
1							X	X	X	X					X	X			X	X	X	X	
2														X	X	X			X	X	X	X	20.3
3							X	X	X	X					X	X			X	X	X	X	

	Signature	Company	Date	Time
Relinquished	Morgan Simon	CDM Smith	8/7/20	5:15PM
Received	[illegible]	OSE	8/17/20	515
Relinquished				
Received				
Relinquished				
Received				
Reviewed/Date		Reviewed/Date		

Comments/Special Instructions

Data Package: Standard ☐ Level III ☐ Level IV ☐

Chromatograms with final report ☐ Electronic Data Deliverables (EDDs) ☐

OnSite Environmental Inc.
14648 NE 95th Street, Redmond, WA 98052 • (425) 883-3881

August 27, 2020

Pam Morrill
CDM Smith, Inc.
14432 SE Eastgate Way, Suite 100
Bellevue, WA 98007-6493

Re: Analytical Data for Project 251008
Laboratory Reference No. 2008-156

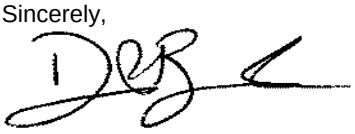
Dear Pam:

Enclosed are the analytical results and associated quality control data for samples submitted on August 17, 2020.

The standard policy of OnSite Environmental, Inc. is to store your samples for 30 days from the date of receipt. If you require longer storage, please contact the laboratory.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning the data, or need additional information, please feel free to call me.

Sincerely,



David Baumeister
Project Manager

Enclosures

Date of Report: August 27, 2020
Samples Submitted: August 17, 2020
Laboratory Reference: 2008-156
Project: 251008

Case Narrative

Samples were collected on August 17, 2020 and received by the laboratory on August 17, 2020. They were maintained at the laboratory at a temperature of 2°C to 6°C.

Please note that any and all soil sample results are reported on a dry-weight basis, unless otherwise noted below.

General QA/QC issues associated with the analytical data enclosed in this laboratory report will be indicated with a reference to a comment or explanation on the Data Qualifier page. More complex and involved QA/QC issues will be discussed in detail below.

Total Metals EPA 6010D/7471B Analysis

Due to the high concentration of Aluminum and Iron in the QC sample, the amount spiked was insufficient for meaningful MS/MSD recovery data. The Spike Blank recovery was 100% for Aluminum and 96% for Iron.

The duplicate RPD for Aluminum , Arsenic, Calcium, Iron and Magnesium is outside control limits due to sample inhomogeneity. The sample was re-extracted and re-analyzed with similar results.

The Matrix Spike/ Matrix Spike Duplicate recoveries for Calcium , Magnesium and Manganese are outside control limits due to matrix inhomogeneity . The samples were re-extracted and re-analyzed with similar results. The Spike Blank recovery was 96 % Calcium , for 101%. Magnesium and 96 % for Manganese .

Any other QA/QC issues associated with this extraction and analysis will be indicated with a footnote reference and discussed in detail on the Data Qualifier page.

Date of Report: August 27, 2020
Samples Submitted: August 17, 2020
Laboratory Reference: 2008-156
Project: 251008

TOTAL METALS
EPA 6010D/7471B

Matrix: Soil
Units: mg/Kg (ppm)

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	**99-1**					
Laboratory ID:	08-156-01					
Aluminum	**6100**	1400	EPA 6010D	8-24-20	8-25-20	
Antimony	**ND**	6.8	EPA 6010D	8-21-20	8-24-20	
Arsenic	**270**	14	EPA 6010D	8-21-20	8-24-20	
Barium	**33**	3.4	EPA 6010D	8-24-20	8-25-20	
Beryllium	**ND**	0.68	EPA 6010D	8-24-20	8-25-20	
Cadmium	**ND**	0.68	EPA 6010D	8-24-20	8-25-20	
Calcium	**3000**	1400	EPA 6010D	8-24-20	8-25-20	
Chromium	**17**	0.68	EPA 6010D	8-24-20	8-25-20	
Cobalt	**4.9**	0.68	EPA 6010D	8-24-20	8-25-20	
Copper	**14**	1.4	EPA 6010D	8-24-20	8-25-20	
Iron	**7700**	1400	EPA 6010D	8-24-20	8-25-20	
Lead	**ND**	6.8	EPA 6010D	8-24-20	8-25-20	
Magnesium	**1900**	1400	EPA 6010D	8-24-20	8-25-20	
Manganese	**140**	0.68	EPA 6010D	8-24-20	8-25-20	
Mercury	**ND**	0.34	EPA 7471B	8-25-20	8-25-20	
Nickel	**12**	3.4	EPA 6010D	8-24-20	8-25-20	
Potassium	**440**	100	EPA 6010D	8-24-20	8-25-20	
Selenium	**ND**	14	EPA 6010D	8-24-20	8-25-20	
Silver	**ND**	1.4	EPA 6010D	8-24-20	8-25-20	
Sodium	**760**	100	EPA 6010D	8-24-20	8-25-20	
Thallium	**ND**	3.4	EPA 6010D	8-24-20	8-25-20	
Vanadium	**47**	0.68	EPA 6010D	8-24-20	8-25-20	
Zinc	**26**	3.4	EPA 6010D	8-24-20	8-25-20	

Date of Report: August 27, 2020
Samples Submitted: August 17, 2020
Laboratory Reference: 2008-156
Project: 251008

TOTAL METALS
EPA 6010D/7471B
QUALITY CONTROL

Matrix: Soil
Units: mg/Kg (ppm)

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
METHOD BLANK						
Laboratory ID:	MB0821SH1					
Antimony	**ND**	5.0	EPA 6010D	8-21-20	8-24-20	
Arsenic	**ND**	10	EPA 6010D	8-21-20	8-24-20	
Laboratory ID:	MB0824SH1					
Aluminum	**ND**	50	EPA 6010D	8-24-20	8-25-20	
Barium	**ND**	2.5	EPA 6010D	8-24-20	8-25-20	
Beryllium	**ND**	0.50	EPA 6010D	8-24-20	8-25-20	
Cadmium	**ND**	0.50	EPA 6010D	8-24-20	8-25-20	
Calcium	**ND**	50	EPA 6010D	8-24-20	8-25-20	
Chromium	**ND**	0.50	EPA 6010D	8-24-20	8-25-20	
Cobalt	**ND**	0.50	EPA 6010D	8-24-20	8-25-20	
Copper	**ND**	1.0	EPA 6010D	8-24-20	8-25-20	
Iron	**ND**	50	EPA 6010D	8-24-20	8-25-20	
Lead	**ND**	5.0	EPA 6010D	8-24-20	8-25-20	
Magnesium	**ND**	50	EPA 6010D	8-24-20	8-25-20	
Manganese	**ND**	0.50	EPA 6010D	8-24-20	8-25-20	
Nickel	**ND**	2.5	EPA 6010D	8-24-20	8-25-20	
Potassium	**ND**	75	EPA 6010D	8-24-20	8-25-20	
Selenium	**ND**	10	EPA 6010D	8-24-20	8-25-20	
Silver	**ND**	1.0	EPA 6010D	8-24-20	8-25-20	
Sodium	**ND**	75	EPA 6010D	8-24-20	8-25-20	
Thallium	**ND**	2.5	EPA 6010D	8-24-20	8-25-20	
Vanadium	**ND**	0.50	EPA 6010D	8-24-20	8-25-20	
Zinc	**ND**	2.5	EPA 6010D	8-24-20	8-25-20	
Laboratory ID:	MB0825S1					
Mercury	**ND**	0.25	EPA 7471B	8-25-20	8-25-20	

Date of Report: August 27, 2020
Samples Submitted: August 17, 2020
Laboratory Reference: 2008-156
Project: 251008

TOTAL METALS
EPA 6010D/7471B
QUALITY CONTROL

Matrix: Soil
Units: mg/Kg (ppm)

Analyte	Result		Spike Level		Source Result	Percent Recovery	Recovery Limits	RPD	RPD Limit	Flags
DUPLICATE										
Laboratory ID:	08-156-01									
	ORIG	DUP								
Aluminum	**4510**	**6030**	NA	NA		NA	NA	29	20	K
Barium	**24.8**	**22.6**	NA	NA		NA	NA	9	20	
Beryllium	**ND**	**ND**	NA	NA		NA	NA	NA	20	
Cadmium	**ND**	**ND**	NA	NA		NA	NA	NA	20	
Calcium	**2240**	**2970**	NA	NA		NA	NA	28	20	K
Chromium	**12.3**	**11.9**	NA	NA		NA	NA	4	20	
Cobalt	**3.66**	**3.72**	NA	NA		NA	NA	1	20	
Copper	**10.1**	**9.45**	NA	NA		NA	NA	6	20	
Iron	**5690**	**7890**	NA	NA		NA	NA	32	20	K
Lead	**ND**	**ND**	NA	NA		NA	NA	NA	20	
Magnesium	**1410**	**1840**	NA	NA		NA	NA	27	20	K
Manganese	**103**	**102**	NA	NA		NA	NA	2	20	
Nickel	**8.80**	**8.75**	NA	NA		NA	NA	1	20	
Potassium	**323**	**284**	NA	NA		NA	NA	13	20	
Selenium	**ND**	**ND**	NA	NA		NA	NA	NA	20	
Silver	**ND**	**ND**	NA	NA		NA	NA	NA	20	
Sodium	**559**	**500**	NA	NA		NA	NA	11	20	
Thallium	**ND**	**ND**	NA	NA		NA	NA	NA	20	
Vanadium	**34.8**	**32.7**	NA	NA		NA	NA	6	20	
Zinc	**19.5**	**18.9**	NA	NA		NA	NA	3	20	
Laboratory ID:	08-156-01									
Mercury	**ND**	**ND**	NA	NA		NA	NA	NA	20	
Laboratory ID:	08-156-01									
	ORIG	DUP								
Antimony	**ND**	**ND**	NA	NA		NA	NA	NA	20	
Arsenic	**203**	**149**	NA	NA		NA	NA	31	20	K

Date of Report: August 27, 2020
Samples Submitted: August 17, 2020
Laboratory Reference: 2008-156
Project: 251008

TOTAL METALS
EPA 6010D/7471B
QUALITY CONTROL

Matrix: Soil
Units: mg/Kg (ppm)

Analyte	Result		Spike Level		Source Result	Percent Recovery		Recovery Limits	RPD	RPD Limit	Flags
MATRIX SPIKES											
Laboratory ID:	08-156-01										
	MS	MSD	MS	MSD		MS	MSD				
Aluminum	**8830**	**8400**	1000	1000	4510	**432**	**389**	75-125	5	20	A
Barium	**115**	**113**	100	100	24.8	**90**	**88**	75-125	1	20	
Beryllium	**45.5**	**45.5**	50.0	50.0	ND	**91**	**91**	75-125	0	20	
Cadmium	**41.4**	**41.3**	50.0	50.0	ND	**83**	**83**	75-125	0	20	
Calcium	**4710**	**4550**	1000	1000	2240	**247**	**231**	75-125	3	20	V
Chromium	**99.1**	**98.6**	100	100	12.3	**87**	**86**	75-125	1	20	
Cobalt	**47.4**	**47.3**	50.0	50.0	3.66	**87**	**87**	75-125	0	20	
Copper	**54.6**	**53.8**	50.0	50.0	10.1	**89**	**87**	75-125	2	20	
Iron	**8900**	**8530**	1000	1000	5690	**321**	**284**	75-125	4	20	A
Lead	**217**	**216**	250	250	ND	**87**	**86**	75-125	1	20	
Magnesium	**3130**	**2990**	1000	1000	1410	**173**	**158**	75-125	5	20	V
Manganese	**121**	**117**	25.0	25.0	103	**72**	**53**	75-125	4	20	V
Nickel	**94.6**	**94.4**	100	100	8.80	**86**	**86**	75-125	0	20	
Potassium	**1290**	**1270**	1000	1000	323	**97**	**94**	75-125	2	20	
Selenium	**89.6**	**89.1**	100	100	ND	**90**	**89**	75-125	1	20	
Silver	**19.7**	**19.6**	25.0	25.0	ND	**79**	**78**	75-125	0	20	
Sodium	**1670**	**1660**	1000	1000	559	**111**	**110**	75-125	0	20	
Thallium	**43.0**	**42.3**	50.0	50.0	ND	**86**	**85**	75-125	2	20	
Vanadium	**79.2**	**78.0**	50.0	50.0	34.8	**89**	**87**	75-125	2	20	
Zinc	**107**	**104**	100	100	19.5	**88**	**85**	75-125	3	20	
Laboratory ID:	08-156-01										
Mercury	**0.540**	**0.556**	0.500	0.500	0.0105	**106**	**109**	80-120	3	20	
Laboratory ID:	08-156-01										
	MS	MSD	MS	MSD		MS	MSD				
Antimony	**91.8**	**95.8**	100	100	ND	**92**	**96**	75-125	4	20	
Arsenic	**316**	**318**	100	100	203	**112**	**115**	75-125	1	20	

Date of Report: August 27, 2020
Samples Submitted: August 17, 2020
Laboratory Reference: 2008-156
Project: 251008

SPLP ARSENIC
EPA 1312/6010D

Matrix: SPLP Extract
Units: mg/L (ppm)

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	**99-1**					
Laboratory ID:	08-156-01					
Arsenic	**0.68**	0.40	EPA 6010D	8-25-20	8-25-20	

Date of Report: August 27, 2020
Samples Submitted: August 17, 2020
Laboratory Reference: 2008-156
Project: 251008

SPLP ARSENIC
EPA 1312/6010D
QUALITY CONTROL

Matrix: SPLP Extract
Units: mg/L (ppm)

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
METHOD BLANK						
Laboratory ID:	MB0826SPM1					
Arsenic	**ND**	0.40	EPA 6010D	8-25-20	8-25-20	

Analyte	Result		Spike Level		Source Result	Percent Recovery		Recovery Limits	RPD	RPD Limit	Flags
DUPLICATE											
Laboratory ID:	08-157-01										
	ORIG	DUP									
Arsenic	**3.22**	**3.17**	NA	NA		NA		NA	1	20	
MATRIX SPIKES											
Laboratory ID:	08-157-01										
	MS	MSD	MS	MSD		MS	MSD				
Arsenic	**7.32**	**7.40**	4.00	4.00	3.22	**103**	**105**	75-125	1	20	

Date of Report: August 27, 2020
Samples Submitted: August 17, 2020
Laboratory Reference: 2008-156
Project: 251008

% MOISTURE

Client ID	Lab ID	% Moisture	Date Analyzed
99-1	08-156-01	**26**	8-21-20

OnSite Environmental Inc.

Data Qualifiers and Abbreviations

A - Due to a high sample concentration, the amount spiked is insufficient for meaningful MS/MSD recovery data.

B - The analyte indicated was also found in the blank sample.

C - The duplicate RPD is outside control limits due to high result variability when analyte concentrations are within five times the quantitation limit.

E - The value reported exceeds the quantitation range and is an estimate.

F - Surrogate recovery data is not available due to the high concentration of coeluting target compounds.

H - The analyte indicated is a common laboratory solvent and may have been introduced during sample preparation, and be impacting the sample result.

I - Compound recovery is outside of the control limits.

J - The value reported was below the practical quantitation limit. The value is an estimate.

K - Sample duplicate RPD is outside control limits due to sample inhomogeneity. The sample was re-extracted and re-analyzed with similar results.

L - The RPD is outside of the control limits.

M - Hydrocarbons in the gasoline range are impacting the diesel range result.

M1 - Hydrocarbons in the gasoline range (toluene-naphthalene) are present in the sample.

N - Hydrocarbons in the lube oil range are impacting the diesel range result.

N1 - Hydrocarbons in diesel range are impacting lube oil range results.

O - Hydrocarbons indicative of heavier fuels are present in the sample and are impacting the gasoline result.

P - The RPD of the detected concentrations between the two columns is greater than 40.

Q - Surrogate recovery is outside of the control limits.

S - Surrogate recovery data is not available due to the necessary dilution of the sample.

T - The sample chromatogram is not similar to a typical _____.

U - The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

U1 - The practical quantitation limit is elevated due to interferences present in the sample.

V - Matrix Spike/Matrix Spike Duplicate recoveries are outside control limits due to matrix effects.

W - Matrix Spike/Matrix Spike Duplicate RPD are outside control limits due to matrix effects.

X - Sample extract treated with a mercury cleanup procedure.

X1- Sample extract treated with a sulfuric acid/silica gel cleanup procedure.

Y - The calibration verification for this analyte exceeded the 20% drift specified in methods 8260 & 8270, and therefore the reported result should be considered an estimate. The overall performance of the calibration verification standard met the acceptance criteria of the method.

Z -

ND - Not Detected at PQL
PQL - Practical Quantitation Limit
RPD - Relative Percent Difference

Chain of Custody

Page 1 of 1

OnSite Environmental Inc.
Analytical Laboratory Testing Services
14648 NE 95th Street • Redmond, WA 98052
Phone: (425) 883-3881 • www.onsite-env.com

Company: CDM Smith
Project Number: 251008
Project Name: US6 - Hwy 99
Project Manager: Pam Morrill
Sampled by: HKP

Turnaround Request (in working days)

(Check One)

- ☐ Same Day
- ☐ 1 Day
- ☐ 2 Days
- ☐ 3 Days
- ☒ Standard (7 Days)
- ☐ _____ (other)

Laboratory Number: 08-156

Lab ID	Sample Identification	Date Sampled	Time Sampled	Matrix	Number of Containers	NWTPH-HCID	NWTPH-Gx/BTEX	NWTPH-Gx	NWTPH-Dx (☐ Acid / SG Clean-up)	Volatiles 8260C	Halogenated Volatiles 8260C	EDB EPA 8011 (Waters Only)	Semivolatiles 8270D/SIM (with low-level PAHs)	PAHs 8270D/SIM (low-level)	PCBs 8082A	Organochlorine Pesticides 8081B	Organophosphorus Pesticides 8270D/SIM	Chlorinated Acid Herbicides 8151A	Total RCRA Metals	Total MTCA Metals	TCLP Metals	HEM (oil and grease) 1664A	TAL metals	SPLP - As			% Moisture
1	99-1	8/17/20	1023	Soil	2																		X	X			X

	Signature	Company	Date	Time
Relinquished	Pam Morrill	CDM Smith	8/17/20	435
Received		CDM Smith	8/17/20	1625
Relinquished				
Received				
Relinquished				
Received				
Reviewed/Date		Reviewed/Date		

Comments/Special Instructions

Data Package: Standard ☐ Level III ☐ Level IV ☐

Chromatograms with final report ☐ Electronic Data Deliverables (EDDs) ☐

OnSite Environmental Inc.
14648 NE 95th Street, Redmond, WA 98052 • (425) 883-3881

March 19, 2021

Todd Burgesser
CDM Smith, Inc.
14432 SE Eastgate Way, Suite 100
Bellevue, WA 98007-6493

Re: Analytical Data for Project USG Hwy 99
Laboratory Reference No. 2103-124

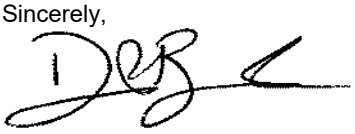
Dear Todd:

Enclosed are the analytical results and associated quality control data for samples submitted on March 11, 2021.

The standard policy of OnSite Environmental, Inc. is to store your samples for 30 days from the date of receipt. If you require longer storage, please contact the laboratory.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning the data, or need additional information, please feel free to call me.

Sincerely,



David Baumeister
Project Manager

Enclosures

Date of Report: March 19, 2021
Samples Submitted: March 11, 2021
Laboratory Reference: 2103-124
Project: USG Hwy 99

Case Narrative

Samples were collected on March 10, 2021 and received by the laboratory on March 11, 2021. They were maintained at the laboratory at a temperature of 2°C to 6°C.

Please note that any and all soil sample results are reported on a dry-weight basis, unless otherwise noted below.

General QA/QC issues associated with the analytical data enclosed in this laboratory report will be indicated with a reference to a comment or explanation on the Data Qualifier page. More complex and involved QA/QC issues will be discussed in detail below.

Date of Report: March 19, 2021
Samples Submitted: March 11, 2021
Laboratory Reference: 2103-124
Project: USG Hwy 99

DISSOLVED ARSENIC
EPA 6020B

Matrix: Water
Units: ug/L (ppb)

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	**C1-H4**					
Laboratory ID:	03-124-01					
Arsenic	**190**	5.0	EPA 6020B		3-19-21	
Client ID:	**C1-H9**					
Laboratory ID:	03-124-02					
Arsenic	**200**	5.0	EPA 6020B		3-19-21	

Date of Report: March 19, 2021
Samples Submitted: March 11, 2021
Laboratory Reference: 2103-124
Project: USG Hwy 99

DISSOLVED ARSENIC
EPA 6020B
QUALITY CONTROL

Matrix: Water
Units: ug/L (ppb)

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
METHOD BLANK						
Laboratory ID:	MB0319D1					
Arsenic	**ND**	2.0	EPA 6020B		3-19-21	

Analyte	Result		Spike Level		Source Result	Percent Recovery		Recovery Limits	RPD	RPD Limit	Flags
DUPLICATE											
Laboratory ID:	03-124-05										
	ORIG	DUP									
Arsenic	**39.2**	**40.0**	NA	NA		NA		NA	2	20	
MATRIX SPIKES											
Laboratory ID:	03-124-05										
	MS	MSD	MS	MSD		MS	MSD				
Arsenic	**121**	**124**	80.0	80.0	39.2	**103**	**106**	75-125	2	20	

OnSite Environmental Inc.

Data Qualifiers and Abbreviations

A - Due to a high sample concentration, the amount spiked is insufficient for meaningful MS/MSD recovery data.

B - The analyte indicated was also found in the blank sample.

C - The duplicate RPD is outside control limits due to high result variability when analyte concentrations are within five times the quantitation limit.

E - The value reported exceeds the quantitation range and is an estimate.

F - Surrogate recovery data is not available due to the high concentration of coeluting target compounds.

H - The analyte indicated is a common laboratory solvent and may have been introduced during sample preparation, and be impacting the sample result.

I - Compound recovery is outside of the control limits.

J - The value reported was below the practical quantitation limit. The value is an estimate.

K - Sample duplicate RPD is outside control limits due to sample inhomogeneity. The sample was re-extracted and re-analyzed with similar results.

L - The RPD is outside of the control limits.

M - Hydrocarbons in the gasoline range are impacting the diesel range result.

M1 - Hydrocarbons in the gasoline range (toluene-naphthalene) are present in the sample.

N - Hydrocarbons in the lube oil range are impacting the diesel range result.

N1 - Hydrocarbons in diesel range are impacting lube oil range results.

O - Hydrocarbons indicative of heavier fuels are present in the sample and are impacting the gasoline result.

P - The RPD of the detected concentrations between the two columns is greater than 40.

Q - Surrogate recovery is outside of the control limits.

S - Surrogate recovery data is not available due to the necessary dilution of the sample.

T - The sample chromatogram is not similar to a typical _____.

U - The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

U1 - The practical quantitation limit is elevated due to interferences present in the sample.

V - Matrix Spike/Matrix Spike Duplicate recoveries are outside control limits due to matrix effects.

W - Matrix Spike/Matrix Spike Duplicate RPD are outside control limits due to matrix effects.

X - Sample extract treated with a mercury cleanup procedure.

X1- Sample extract treated with a sulfuric acid/silica gel cleanup procedure.

Y - The calibration verification for this analyte exceeded the 20% drift specified in methods 8260 & 8270, and therefore the reported result should be considered an estimate. The overall performance of the calibration verification standard met the acceptance criteria of the method.

Z -

ND - Not Detected at PQL
PQL - Practical Quantitation Limit
RPD - Relative Percent Difference

OnSite Environmental Inc.
14648 NE 95th Street, Redmond, WA 98052 • (425) 883-3881

March 19, 2021

Todd Burgesser
CDM Smith, Inc.
14432 SE Eastgate Way, Suite 100
Bellevue, WA 98007-6493

Re: Analytical Data for Project USG Hwy 99
Laboratory Reference No. 2103-124

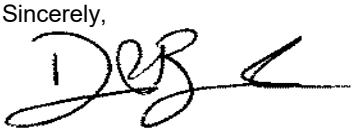
Dear Todd:

Enclosed are the analytical results and associated quality control data for samples submitted on March 11, 2021.

The standard policy of OnSite Environmental, Inc. is to store your samples for 30 days from the date of receipt. If you require longer storage, please contact the laboratory.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning the data, or need additional information, please feel free to call me.

Sincerely,



David Baumeister
Project Manager

Enclosures

Date of Report: March 19, 2021
Samples Submitted: March 11, 2021
Laboratory Reference: 2103-124
Project: USG Hwy 99

Case Narrative

Samples were collected on March 10, 2021 and received by the laboratory on March 11, 2021. They were maintained at the laboratory at a temperature of 2°C to 6°C.

Please note that any and all soil sample results are reported on a dry-weight basis, unless otherwise noted below.

General QA/QC issues associated with the analytical data enclosed in this laboratory report will be indicated with a reference to a comment or explanation on the Data Qualifier page. More complex and involved QA/QC issues will be discussed in detail below.

Date of Report: March 19, 2021
Samples Submitted: March 11, 2021
Laboratory Reference: 2103-124
Project: USG Hwy 99

DISSOLVED ARSENIC
EPA 6020B

Matrix: Water
Units: ug/L (ppb)

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
Client ID:	**C1-H4**					
Laboratory ID:	03-124-01					
Arsenic	**190**	5.0	EPA 6020B		3-19-21	
Client ID:	**C1-H9**					
Laboratory ID:	03-124-02					
Arsenic	**200**	5.0	EPA 6020B		3-19-21	

Date of Report: March 19, 2021
Samples Submitted: March 11, 2021
Laboratory Reference: 2103-124
Project: USG Hwy 99

DISSOLVED ARSENIC
EPA 6020B
QUALITY CONTROL

Matrix: Water
Units: ug/L (ppb)

Analyte	Result	PQL	Method	Date Prepared	Date Analyzed	Flags
METHOD BLANK						
Laboratory ID:	MB0319D1					
Arsenic	**ND**	2.0	EPA 6020B		3-19-21	

Analyte	Result		Spike Level		Source Result	Percent Recovery		Recovery Limits	RPD	RPD Limit	Flags
DUPLICATE											
Laboratory ID:	03-124-05										
	ORIG	DUP									
Arsenic	**39.2**	**40.0**	NA	NA		NA		NA	2	20	
MATRIX SPIKES											
Laboratory ID:	03-124-05										
	MS	MSD	MS	MSD		MS	MSD				
Arsenic	**121**	**124**	80.0	80.0	39.2	**103**	**106**	75-125	2	20	

OnSite Environmental Inc.

Data Qualifiers and Abbreviations

A - Due to a high sample concentration, the amount spiked is insufficient for meaningful MS/MSD recovery data.

B - The analyte indicated was also found in the blank sample.

C - The duplicate RPD is outside control limits due to high result variability when analyte concentrations are within five times the quantitation limit.

E - The value reported exceeds the quantitation range and is an estimate.

F - Surrogate recovery data is not available due to the high concentration of coeluting target compounds.

H - The analyte indicated is a common laboratory solvent and may have been introduced during sample preparation, and be impacting the sample result.

I - Compound recovery is outside of the control limits.

J - The value reported was below the practical quantitation limit. The value is an estimate.

K - Sample duplicate RPD is outside control limits due to sample inhomogeneity. The sample was re-extracted and re-analyzed with similar results.

L - The RPD is outside of the control limits.

M - Hydrocarbons in the gasoline range are impacting the diesel range result.

M1 - Hydrocarbons in the gasoline range (toluene-naphthalene) are present in the sample.

N - Hydrocarbons in the lube oil range are impacting the diesel range result.

N1 - Hydrocarbons in diesel range are impacting lube oil range results.

O - Hydrocarbons indicative of heavier fuels are present in the sample and are impacting the gasoline result.

P - The RPD of the detected concentrations between the two columns is greater than 40.

Q - Surrogate recovery is outside of the control limits.

S - Surrogate recovery data is not available due to the necessary dilution of the sample.

T - The sample chromatogram is not similar to a typical _____.

U - The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

U1 - The practical quantitation limit is elevated due to interferences present in the sample.

V - Matrix Spike/Matrix Spike Duplicate recoveries are outside control limits due to matrix effects.

W - Matrix Spike/Matrix Spike Duplicate RPD are outside control limits due to matrix effects.

X - Sample extract treated with a mercury cleanup procedure.

X1- Sample extract treated with a sulfuric acid/silica gel cleanup procedure.

Y - The calibration verification for this analyte exceeded the 20% drift specified in methods 8260 & 8270, and therefore the reported result should be considered an estimate. The overall performance of the calibration verification standard met the acceptance criteria of the method.

Z -

ND - Not Detected at PQL
PQL - Practical Quantitation Limit
RPD - Relative Percent Difference

03-124

CHAIN OF CUSTODY RECORD

CDM Smith

USG Puyallup and Hwy 99

NOTES:
Report to Todd Burgesser burgesserte@cdmsmith.com

COC #: 196

USG Puyallup and Hwy 99 Treatability Study

	SAMPLE NUMBER	DATE	TIME	MATRIX	Preservative	No. of Containers	Analysis: Dissolved Arsenic (6020)								
1	C1-H4	3/10/2021	0900	Water	HNO3 and Ice	1	X								Please email results to burgesserte@cdmsmith.com
2	C1-H9	3/10/2021	0900	Water	HNO3 and Ice	1	X								
3	P12	3/10/2021	0900	Water	HNO3 and Ice	1	X								
4	P13	3/10/2021	0900	Water	HNO3 and Ice	1	X								
5	P10	3/10/2021	0900	Water	HNO3 and Ice	1	X								

Relinquished by: (*Signature*)	Date/Time	Received for Laboratory by: (*Signature*)	Laboratory: Onsite
	3/11/21 0830		
Received by: (*Signature*)	**Date/Time**	**Airbill No.(s)**	
		NA	

Appendix F

Semi-Dynamic Leach Evaluation

Appendix F

Semi-Dynamic Leach Evaluation

The objective of the SW-846 method 1315 leaching procedure is to provide "material parameters" (e.g., concentrations, mass quantities, release rates from the treated soil sample) for the release of the contaminant of concern (arsenic) from the material (treated soil) to the eluent (leaching solution) under controlled leaching conditions. Evaluations of Method 1315 results and total sample concentrations are used to determine the release mechanisms of the arsenic from the treated soil. These mechanisms can include surface wash off, diffusion, depletion of mass, dissolution, or a combination of these mechanisms over different time. The evaluations are based on a plot of the log of the cumulative mass released versus the log of the leaching time. When the mechanism(s) is identified and the release rates are "well behaved" (i.e., the equations from the plots have a reasonable coefficient of determination, r^2), contaminant aqueous phase concentrations into the future (years) at the water/exposed surface of the treated soil interface can be predicted.

When diffusion is the controlling mechanism, a plot of the logarithm of the cumulative mass released versus the logarithm of time should have a slope (rc) of 0.5±0.15 (>0.35 to <0.65). In the current evaluation, the slope between each successive interval (called the "EPA slope") was calculated using the interval in question (i) and the previous interval (i-1). Intervals that deviate from the ideal diffusion slope are characterized by another release process. For example, the first leaching intervals may be influenced by "surface wash off." Contaminants of concern (arsenic) that are at the surface of the sample can be released by desorption or dissolution alone without diffusion through the sample matrix. Intervals near the end of the test may be affected by "depletion," in which the near surface contaminant (arsenic) concentrations become depleted. The European Union "TANK" procedure (EA 2005), which is also an SDL test similar to Method 1315, provides a detailed procedure to identify the relevant release processes for specific sets of intervals. The processes were evaluated using the TANK methodology by calculating the slope (rc) between specific time intervals of the plot of the log of the cumulative mass released versus the log of the leaching time for each of the tested samples. Release mechanisms were identified for the various time intervals based on the calculated slope.

To complete the evaluations, several calculations were required and are summarized below.

The mass of contaminant of concern released for each interval (M_{ti}) was calculated as follows:

$$M_{ti} = \frac{C_i V_i}{A}$$

Where,

C_i = The concentration of contaminant within leachate solution for interval i (mg/L)

V_i = The volume of leaching solution used for interval i (L)

A = The surface area of the sample (m^2)

These data were used to calculate the sample volumes using the following:

$$V_{sample} = h\pi r^2$$

Where,

V_{sample} = The volume of the sample (m^3)

h = The height of the sample (m)

r = The radius of the sample (m)

The exposed surface areas of the samples were calculated as follows:

$$A = 2rh\pi + 2\pi r^2$$

Where,

r = The radius of the sample

h = The height of the sample (m)

The resulting calculations and conclusions for the SDL mixture is provided in Table F-1 for mixture C1-H4. The initial arsenic concentration (2-hours) was 3.6 µg/L. Starting at 24-hours after the initial leachate (2-hours), dissolved arsenic concentrations in all remaining samples ranged from 8.7 µg/L at 42-days to 22 µg/L at 7-days and were plotted. The initial arsenic concentration (2-hours) is the result of delayed diffusion or dissolution. After this initial concentration, the remaining concentrations are mainly because of diffusion or depletion of the arsenic in the sample.

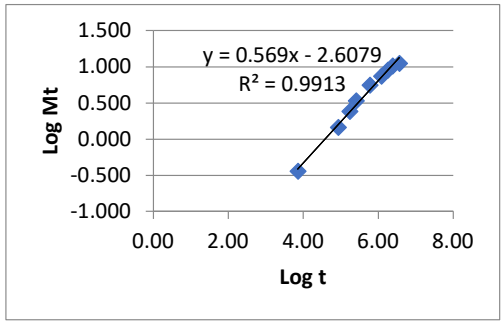
Table F-1 provides a graph of the log of the cumulative mass released versus the log of the leaching time for the tested sample. The coefficient of determination (r^2) is excellent at 0.99. Therefore, the equations can be used to predict leachate concentrations at future time periods. Based on the equations, the future concentrations of dissolved arsenic at 1, 2, 5, and 10 years at the interface between the treated soil and the aqueous phase (surface water) were calculated. These calculations included a correction factor for the volume of water that would pass by the interface based on the hydraulic conductivity of 2 ft/day. The concentrations for year 1 through year 10 were less than the practical quantitation limit (2 to 3 µg/L) and ranged from 0.17 µg/L (year 1) to 0.05 µg/L (year 10). These concentrations would decrease as the water at the interface migrates and mixes with additional surface or groundwater.

References

EA. 2005. *Leaching Characteristics of Moulded or Monolithic Building and Waste Materials. Determination of Leaching of Inorganic Components with the Diffusion Test. 'The Tank Test'.* Environmental Agency EA NEN 7375:2004.

Table F-1 Cummulative Graph and Log Mass Release vs Log of the Leaching

USG Highway 99	As		
D_{obs} =	**Observed diffusivity**	**0.00E+00**	**m^2/s**
ρ =	Density of the sample	1727	kg/m^3
SA =	Surface area of sample	0.0162	m^2
V =	Volume of Solution	1.62	L
C_0 =	Constituent in solid (weighted avg.)	270	mg/kg
π =		3.14	



EU Tank Leaching Mechanisms				
Increment	**CFa-b**	**EPA Slope**	**Std Dev rc**	**Conclusion**
2 - 7	28.82	0.478	0.077	Diffusion
5 - 8	34.50	0.321	0.076	Depletion
4 - 7	32.88	0.207	0.063	Depletion
3 - 6	29.73	0.504	0.076	Diffusion
2 - 5	26.23	0.732	0.107	Dissolution
1 - 4	17.03	0.723	0.100	Delayed Diffusion or Dissolution

Interval	t (sec interval)	t (sec cumulative)	Days	M_{ti} (E^*_i)	Mt-cumlt (ε^*_n)	Log[Mt]	Log t	C(soln) mg/L	C(soln) ug/L	D_i^{obs}	EPA slope	ε_n (mg/m^2)	log ε_n (mg/m^2)
1	7200	7200	0.083333	0.360	0.360	-0.444	3.86	0.00360	3.6	6.50E-17		0.360	-0.444
2	79200	86400	1	1.100	1.460	0.164	4.94	0.01100	11	9.99E-17	0.563	1.546	0.189
3	86400	172800	2	0.970	2.430	0.386	5.24	0.00970	9.7	2.29E-16	0.735	3.312	0.520
4	86400	259200	3	0.975	3.405	0.532	5.41	0.00975	9.75	3.93E-16	0.832	5.313	0.725
5	345600	604800	7	2.200	5.605	0.749	5.78	0.02200	22	2.42E-16	0.588	6.370	0.804
6	604800	1209600	14	1.800	7.405	0.870	6.08	0.01800	18	1.13E-16	0.402	6.146	0.789
7	604800	1814400	21	1.600	9.005	0.954	6.26	0.01600	16	1.51E-16	0.482	8.719	0.940
8	604800	2419200	28	1.300	10.305	1.013	6.38	0.01300	13	1.41E-16	0.469	9.703	0.987
9	1209600	3628800	42	0.870	11.175	1.048	6.56	0.00870	8.7	2.24E-17	0.200	4.741	0.676
		31536000	365	34.420	45.595	1.659	7.50	0.00017	0.17				
		63072000	730	22.045	67.641	1.830	7.80	0.00010	0.10				
		157680000	1825	46.289	113.929	2.057	8.20	0.00007	0.07				
		315360000	3650	55.084	169.013	2.228	8.50	0.00005	0.05				

Values that meet EPA slope criteria of 0.5±0.15 criteria