APPENDIX B

Treatability Study Results – In Situ Solidification and Sediment Conditioning Report

TREATABILITY STUDY RESULTS - *IN SITU* SOLIDIFICATION AND SEDIMENT CONDITIONING

R.G. Haley Site, Bellingham, Washington

November 13, 2019

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Acronyms and Abbreviations

ASTM	American Society for Testing and Materials
BMC	Bellingham Municipal Code
cPAH	carcinogenic poly aromatic hydrocarbons
cm/s	centimeters per second
CRETE	CRETE Consulting Incorporated, PC
cy	cubic yards
EPA	United States Environmental Protection Agency
GGBFS	ground granulated blast furnace slag
HASP	Site Specific Health and Safety Plan
kg	kilograms
LEAF	Leaching Environmental Assessment Framework
LNAPL	Light non-aqueous phase liquid
Ft	feet
ft bgs	feet below ground surface
ft/day	feet per day
ft-lbs/in^2	foot-pounds per square inch
ID	inner diameter
ISS	*in situ* solidification
mg/kg	milligrams per kilogram
OD	outer diameter
PCP	pentachlorophenol
Psi	pounds per square inch
RI/FS	Remedial Investigation and Feasibility Study
SPT	standard penetration test
TPH	total petroleum hydrocarbon
UCS	unconfined compressive strength

1 Introduction

Crete Consulting Incorporated, PC (CRETE) has prepared this report to summarize the results of treatability testing performed for the RG Haley Site (Site) in Bellingham, Washington. The work was performed in accordance with the Treatability Study Work Plan (Work Plan; CRETE 2015) to provide a pre-remedial design site-specific assessment of: 1) *in situ* soil solidification (ISS); and, 2) conditioning of removed intertidal sediment prior to upland and sediment consolidation at the site. ISS and removal of intertidal sediment were selected as part of the preferred cleanup remedy in the Remedial Investigation and Feasibility Study (RI/FS; GeoEngineers 2015) that was submitted by the City of Bellingham to the Washington State Department of Ecology (Ecology) under Agreed Order No. DE 2186, as amended. The Work Plan contains additional discussion on the development of specific performance criteria and the rationale used to develop the approach to the testing.

The preliminary extent of ISS and intertidal sediment removal are shown on Figure 1. The preliminary ISS volume identified in the FS is approximately 15,300 cubic yards (cy), with a treatment zone thickness that varies between 8 and 13 feet (ft), to a depth of about 19 ft below current grade. The intertidal sediment removal and conditioning volume is estimated at 6,200 in-place cy. The extent of ISS and intertidal sediment removal will be refined during the remedial design process.

1.1 Background/Site Conditions

The site is located on the shore of Bellingham Bay and historically operated as a lumber mill and a wood treating site. Portions of previous site operations were initially constructed on wharves supported by wood piles. Many wood piles remain exposed in the bank, intertidal, and subtidal areas while other areas of piling were subsequently buried when the site was filled. As a result of lumber operations, there are significant deposits of sawdust and other wood waste. Wood treating operations resulted in soil, groundwater, and sediment contamination with total petroleum hydrocarbons (TPH; medium aromatic carrier oil) and pentachlorophenol (PCP). The petroleum hydrocarbon smear zone is primarily contained within the Upland Fill and Marine Fill units, although smaller discontinuous Wood Fill areas are impacted. These lithologic units were described in detail in the RI/FS. The key lithologic units as they relate to the treatability testing include the following:

- Upland Fill – consists predominantly of poorly-graded silty sand, sand, and gravel, with some silt and variable amounts of coal fragments, brick fragments, wood debris, construction debris, and sawdust.
- Wood Fill - contains roughly 50 percent or more woody material mixed with silt, sand, and gravel. The woody material includes sawdust, wood chips, dimensional lumber, and log ends.
- Marine Fill - highly variable and includes silt, silty sand, and poorly-graded fine- to medium-grained sand with shell fragments and occasional wood fragments. Distinct

wood waste layers consisting of 50 to 100 percent sawdust also are intermixed with the marine fill. The fill also occasionally contains other debris including glass, brick, and plastic.

The proposed extent of ISS extends slightly vertically and laterally beyond the extent of the footprint of potentially mobile light non-aqueous phase liquid (LNAPL).

Intertidal sediment proposed for removal is predominantly in the Wood Fill unit.

Site Soil Strength

The *in situ* strength of soil in the ISS area was estimated to develop a minimum strength goal for the ISS performance criteria. Average standard penetration test (SPT) blow counts were calculated for the upper 15 feet of boreholes TL-MW-13 through TL-MW-16. The average SPT N blow counts ranged from 6 blows per foot in TL-MW-16 to 13 blows per foot in TL-MW-15. Using these blow count data, the unconfined compressive strength (UCS) of the site soil in the ISS area was estimated at 10 to 24 pounds per square inch (psi).

The blow counts listed on the borehole logs were developed using a 2.4-inch inner diameter (ID) split barrel sampler using a 300 pound hammer and a 30-inch drop. This sampler was assumed to be what is referred to as a Dames & Moore sampler (2.4-inch ID, 3.25-inch outer diameter [OD]) which results in sampling system energy of 211.3 foot-pounds per square inch (ft-lbs/in^2). The SPT setup uses a smaller sampler (1.375-inch ID, 2-inch OD), a 140 pound hammer, and a 30-inch drop which results in a sampling system energy of 198.8 ft-lbs/in^2. The field values were multiplied by the energy ratio (198.8/211.3 = 0.94) to convert the field blows to SPT-N equivalent blows. Given that this is a general correlation to develop an average strength over a wide area, the rod length and hammer type were not considered in the calculation.

The converted blow counts were averaged within the depth of interest (upper 15 ft) and the average SPT blow counts were used along with conversion factors (Table 45.2; Terzaghi and Peck, 1967) to estimate the UCS for the soil. The range of soil strength reported (10 to 24 psi) was developed to encompass the range in blow counts, the general nature of the relationship between the converted blow counts and UCS (reference table generally developed for cohesive soil when our soil is variable), and the variability of the soils encountered in the field.

1.2 Test Objectives

The overall objectives of the ISS treatability testing are to demonstrate that ISS can achieve the preliminary performance criteria (Section 1.3) and to provide an estimated amendment recipe that is expected to achieve the performance criteria. An additional goal is to develop an economical mix that uses locally available products.

The objective of the intertidal sediment conditioning is to demonstrate that the sediment can be conditioned/improved such that it is geotechnically suitable to be compacted and consolidated beneath the low-permeability cap with other contaminated soil.

Additional ISS bench testing may be performed during the remedial design by the bidding Contractors, and is expected to be performed by the selected Contractor to optimize the mix design. At the beginning of field implementation, a test cell will be treated to verify performance of the mix design and effectiveness of the mixing process (e.g. the number of mixing passes needed to adequately mix the amendments and soil) under field conditions. Quality control testing will be performed during field implementation to demonstrate that performance objectives are achieved.

1.3 Preliminary Performance Criteria

The full development of preliminary performance criteria is described in the Work Plan. Results from the ISS treatability testing were evaluated against the following performance criteria:

- **ISS Hydraulic conductivity:** the preliminary hydraulic conductivity target for this project is less than $1x10^{-5}$ centimeter per second (cm/s), which is more than two orders of magnitude below the average and median Fill Unit conductivities of $3.9x10^{-3}$ cm/s (11.0 feet per day [ft/day]) and $1.1x10^{-3}$ cm/s (3.2 ft/day), respectively.
- **ISS Strength:** the preliminary target range for 28-day UCS is between 30 and 200 psi. The lower limit of 30 psi is modified from the 50 psi presented in the Work Plan. The new lower limit was derived based on the site soil strength estimate discussed in Section 1.1 so that the ISS mass would not be weaker than the surrounding soil.

ISS ductility is also a consideration but is not set as a performance criterion. The diffusion-controlled release of chemicals from an ISS mass is a function of surface area and that surface area could be increased if significant cracks form in the ISS mass as a result of a seismic event. Strength, permeability, and ductility can be competing properties so the approach taken was to evaluate the mix designs that achieved the strength/permeability performance requirements and also showed higher axial strain values at failure.

Leach testing was performed consistent with the Leaching Environmental Assessment Framework (LEAF). Environmental Protection Agency (EPA) Method 1315 was designed specifically to estimate the mass transfer rates (release rates) of analytes contained in a monolith, under diffusion-controlled release conditions, as a function of leaching time. There are no specific performance criteria for these tests. The ability of ISS to support achievement of groundwater cleanup standards will be considered during remedial design using the data generated from the LEAF testing. This remedial design work will include simplified fate and transport modeling to assess attenuation of upland groundwater discharging to intertidal marine sediment and surface water through planned sediment caps.

The overall goal for intertidal sediment conditioning is to remove free water and create a material that is workable and compactable using standard construction equipment. The ability to achieve this condition will be based on an evaluation of moisture content, Atterberg Limits, and moisture-density relationships (Proctor compaction testing). Specific performance criteria were not developed since the criteria are dependent on the properties of the sediment.

2 Sample Collection

Upland test pitting was performed on December 16, 2015 and intertidal hand augers were advanced on December 14, 2015. Intertidal hand augers were advanced between 9 and 11 PM, once the tide was below +5 ft MLLW. Two upland test pit locations were slightly modified during utility locating on December 9, 2015: TP-TTWP-LF was moved about 30 ft true south (project southeast) off of a concrete slab and TP-TTWP-WF was moved about 40 ft true east-northeast (project north-northeast) to avoid buried power lines. The sample locations are shown on Figure 1.

2.1 Upland Sampling

Treatability soil samples were collected from 5 upland test pit locations. Test pit excavation was performed using an excavator operated by Strider Construction of Bellingham, WA. Test pitting was generally performed as described in the Work Plan with soil samples collected from the excavation spoils pile. Test pit logs are provided in Appendix A. A photographic log is included in Appendix B. Test pitting was performed in substantive compliance with the City of Bellingham Grading Performance standards (Bellingham Municipal Code [BMC] 16.70.070) and Stormwater Management Code (BMC 15.42).

Table 1 provides the basis for the location of each test pit that was included in the Work Plan. Field observations that are relevant to the basis are included in the table. In general, significant wood and lumber debris was observed. Vertical timber piles were observed at three test pit locations (TP-TTWP-C, TP-TTWP-N, and TP-TTWP-LF) and a pile cap and wood wall were also observed at TP-TTWP-N. Figure 2 provides a subset of photographs to illustrate the extent and type of debris that was observed.

Based on the observed test pit conditions, it was decided to create ISS South and ISS North treatability samples. ISS South includes landfill debris and sawdust and was expected to have lower chemical concentrations. ISS North includes wood debris and wood fill and was expected to have higher chemical concentrations. Each treatability sample consisted of two 5-gallon buckets as follows:

ISS South

- Bucket 1 – 5 gallons from TP-TTWP-LF
- Bucket 2 – 5 gallons from TP-TTWP-S

ISS North

- Bucket 3 – 4 gallons from TP-TTWP-N and 1 gallon from TP-TTWP-WF
- Bucket 4 - 4 gallons from TP-TTWP-C and 1 gallon from TP-TTWP-WF

A bucket consisting of 2.5 gallons from each of TP-TTWP-N and TP-TTWP-C was also created to represent intertidal sediment conditions within the smear zone.

Table 1 Upland Sample Collection Summary

Sample ID	Basis	Observations
TP-TTWP-LF **(5-14 ft bgs)**	- Elevated TPH and cPAH - Moderate LNAPL accumulation observed in nearby well TL-MW-12 - Assess debris content in area where ISS overlaps with Cornwall Landfill - Near the shoreline and can observe for possible turbidity impacts	- Landfill debris from about 1.5 to 6 ft bgs - No turbidity in the Bay - Top of vertical timber pile observed at 7 to 8 ft bgs
TP-TTWP-S **(5-14 ft bgs)**	- Elevated TPH and PCP - Moderate to low LNAPL accumulation observed in nearby well TL-MW-10 - Sawdust present - Near the shoreline and can observe for possible turbidity impacts	- Sawdust - Large chunks of concrete and other debris - No turbidity in Bay
TP-TTWP-C **(5-14 ft bgs)**	- Elevated TPH and PCP - Thickest LNAPL accumulation on site in nearby well TL-MW-2 - Check for size and frequency of wood debris that could interfere with ISS	- Large chunks of concrete and dimensional lumber - Top of one vertical timber pile observed at 4 to 5 ft bgs - Straw and a sand bag indicate that the area may have been previously disturbed
TP-TTWP-N **(5-13 ft bgs)**	- Elevated TPH and PCP - Moderate to low LNAPL accumulation in nearby wells TL-MW-5A & TL-MW-7 - Check for size and frequency of wood debris that could interfere with ISS - Check extent and spacing of wood piles that will need to be removed prior to *in situ* soil mixing	- Significant and large dimensional lumber debris - Top of two vertical timber piles observed at 3 to 4 ft bgs; one pile removed during test pit (see Appendix B photos) - Top of timber pile cap and wall observed at 3 ft bgs
TP-TTWP-WF **(9-10 ft bgs)**	- Collect wood fill sample for possible inclusion in treatability samples (wood fill zone is shallow and close to the water table at this location)	- Smaller dimensional lumber debris

2.2 Intertidal Sampling

Intertidal samples were collected from outside the smear zone using hand-held tools (hand auger and post-hole digger), generally as described in the Work Plan. The intertidal sampling was performed under Nationwide Permit (NWP) 6, *Survey Activities* NWS-2015-779, issued to the City of Bellingham on September 22, 2015 (USACE 2015).

Location IT-TTWP-N was advanced to the full 5 feet and the 5-gallon bucket of sediment was collected as planned. The sediment consisted of silt with sand and gravel. IT-TTWP-S was attempted at numerous locations and the sediment could not be penetrated below 30 inches. A 5-gallon bucket of material was collected that consisted of poorly graded sand with gravel. Wood waste was not encountered at the frequency anticipated, although wood debris was present. A review of sediment sampling logs indicated that significant wood waste may be present subtidal, but confirmed that it was not previously observed in the intertidal area.

Five gallons of soil were also collected from the upland test pits (2.5 gallons from each of TP-TTWP-C and N) from the same elevation and lithologic horizon that is present in the intertidal area. This soil was used to represent intertidal conditions within the smear zone.

2.3 Free Product Collection

Two liters of free product were collected on February 18, 2016 from monitoring well TL-MW-02. The free product was collected to spike the ISS North treatability sample. The sample was spiked because chemical concentrations in the baseline analysis (discussed in Section 3.1) were not representative of average to high concentrations in the ISS area.

2.4 Decontamination and Residuals Management

Sample equipment used to collect, composite, and fill sample buckets was decontaminated between each sample location and prior to leaving the site using a wash of Liqui-nox™ and rinsed with distilled/deionized water.

Water collected during decontamination, extra soil from collection of treatability samples, and personal protective equipment and plastic totes were all placed in separate labeled 55-gallon drums in the soil handling area.

3 ISS Treatability Testing

ISS treatability samples were submitted to KEMRON Environmental Services, Inc. in Atlanta, GA (KEMRON). KEMRON subcontracted the analytical testing portion of the testing to Test America in Nashville, TN, a certified Washington State laboratory. Copies of analytical laboratory reports are included in Appendix C.

The soil was homogenized at the laboratory to ensure uniform materials for the study. Homogenization was performed by placing the contents of each bucket into a pre-cleaned plastic mixing pan and gently blending by hand using a stainless steel spoon until visually homogenous. Any particles measuring greater than 0.5 inches in diameter were broken into more manageable sizes or were removed in order to facilitate bench-scale treatment and adhere to particle-size limits outlined in certain ASTM and EPA test methods.

After homogenizing each bucket separately, KEMRON combined and homogenized the buckets labeled “TP-TTWP-S” and “TP-TTWP-LF” together to form the “ISS South” composite, and the buckets labeled “TP-TTWP-C&WF” and “TP-TTWP-N&WF” were combined and homogenized together to form “ISS North” composite.

3.1 ISS Baseline Analysis

The results of the baseline analysis of the untreated material are presented in Table 2 (physical testing) and Table 3 (analytical testing). Results indicated that the ISS South and ISS North composite materials are classified as black silty sands (SM) with a slightly acidic pH of 6. The ISS South material has a significantly higher organic content (9.18%) and soluble sulfate concentration (35.43 grams SO4/kg soil) than the ISS North material (3.61% and 15.65 grams SO4/kg soil).

The soluble sulfate concentration results indicated that the soil at the site represents severe to very severe sulfate exposure (Hayes 2007). Publications are available describing mitigation measures to prevent sulfate attack of Portland Cement (Bhatty and Taylor 2006; Lafarge 2016). One of the mitigation measures is to use an amendment mix that includes ground granulated blast furnace slag (GGBFS) such that the maximum ratio of Type I Portland Cement to GGBFS is 2:1.

In addition to physical properties testing, untreated composite materials were subjected to analytical testing. In general, the results of analytical testing indicate that the untreated ISS North was slightly more impacted than the untreated ISS South. Concentrations of PAHs and PCP were relatively low in both untreated composite samples. A summary of the results of the analytical testing are provided on Table 3, and analytical reports for the untreated materials are included in Appendix C.

The results of the analytical testing indicated lower contaminant concentrations in ISS North than expected when compared to previous analytical testing of site samples. The

ISS North sample was spiked to provide a material with a significantly higher degree of contaminant concentrations and more closely match anticipated site conditions. The spiked material was prepared by blending 1,380 grams of light non-aqueous phase liquid (LNAPL) obtained from the site (from monitoring well TL-MW-02) with 46 kilograms of the untreated ISS North sample. Spiking was performed by placing the entire 46 kilograms of the ISS North sample into a large mixing bin at the laboratory. The LNAPL was then introduced and blended thoroughly with the soil. The spiked ISS North was then returned to the storage containers, placed in a 4-degree-Celsius (°C) walk-in cooler, and allowed to equilibrate for a period of 24 hours. Duplicate aliquots of the spiked ISS North material ("ISS North Spiked") were then sampled and forwarded to Test America for the untreated material analyses previously outlined.

Analytical testing results from the ISS North Spiked sample showed increases in concentrations of indicator hazardous substances (IHSs). The PCP concentration increased from 2.17 milligrams per kilograms (mg/kg) to 20.2 mg/kg (duplicate sample result of 20.1 mg/kg). TPH concentrations increased with the C10-C24 range rising from 859 mg/kg to 18,700 mg/kg (duplicate sample result of 9,580 mg/kg) and the C24-C40 range rising from 35.7 mg/kg to 599 mg/kg (duplicate sample result of 372 mg/kg). The 1-Methylnaphthalene concentration increased from 24.8 mg/kg to 226 mg/kg (duplicate sample result of 141 mg/kg) and 2-Methylnaphthalene concentration increased from 34.8 mg/kg to 359 mg/kg (duplicate sample result of 218 mg/kg). These results are summarized on Table 3.

Comparing the spiked results to the existing soil data in the ISS area presented in Section 6 of the RI/FS[1], suggests that the spiked data represents above average soil conditions. Existing data from the ISS area includes the highest PCP result in site soil samples, soil from test pit TP-6 at 6 ft bgs with a concentration of 221 mg/kg. Including this sample, the average PCP concentration in the ISS area is approximately 17.8 mg/kg and the median concentration is 0.73 mg/kg, lower than the spiked result of 20.2 mg/kg. Excluding the highest sample, the average PCP concentration in the ISS area is approximately 2.3 mg/kg and the median concentration is 0.91 mg/kg. The ISS area encompasses the LNAPL plume and represents some of the highest concentrations of TPH in soil and groundwater. The average soil concentration of TPH (sum of diesel and lube oil range TPH) in the ISS area is approximately 11,444 mg/kg and the median is 4,376 mg/kg, lower than the spiked result of 19,299 mg/kg.

[1] Averages were determined using the plume area shown on RI/FS Figures 6-29 and 6-30 for PCP and figures 6-9 and 6-10 for TPH. These figures present data from samples collected 5-15 ft bgs, consistent with ISS test pit depths. Data from the following samples were included in the average calculation: TP-6, TL-DP-2,TL-MW-1, TP-3, TL-MW-15, TP-2, HEI-SP-A, TL-DP-4, TP-14, HS-MW-8, HS-MW-13, TL-DP-2, TL-MW-14 and TL-MW-15.

3.2 ISS Preliminary Screening

The following reagents were used to formulate amendment mixtures after reviewing the physical and chemical characterization of the untreated and spiked material:

Reagent	**Supplier**
Richmond Type I Portland Cement	Lafarge North America, Inc., Seattle, WA
Type II/V Portland Cement	LeHigh Cement Company, Redding, CA
GGBFS Grade 100	Lafarge North America, Inc., Seattle, WA
Hydrogel Bentonite	Wyo-Ben, Inc., Billings, MT
Centralia Class F Fly Ash	LaFarge North America, Inc., Seattle, WA
Lime Kiln Dust (Tacoma LKD)	LeHigh Cement Company, Tacoma, WA

Tap water was used in preparing the amendment mixtures, similar to what would occur during full-scale cleanup. Eighteen samples were prepared in the preliminary screening phase of the study. These samples included nine amendment mixture designs for the ISS South material and nine for the ISS North Spiked material. The nine amendment mixes are summarized in Table 4.

All samples were prepared using a bench-scale Hobart-type mixer at the laboratory. Samples were prepared by placing an aliquot of the untreated material into the mixing chamber. The appropriate reagents were then added as a slurry to the untreated material while the mixer was operating. All reagents (including water) were added on a weight basis. Each sample was blended for a period of 60 to 90 seconds at a rate of approximately 60 revolutions per minute.

The following is a summary of material testing performed on the treated samples, and brief descriptions of the protocols utilized for the stabilization evaluations:

- Pocket penetrometer testing on the mixtures at cure times of 1, 3, and 5 days. Approximately 100 grams of each treated material was placed into a small plastic cup then cured and tested at the above intervals to evaluate the potential setting characteristics. Results of the pocket penetrometer testing are summarized on Table 4.
- After 7 days of curing, the UCS of each of the 18 mixtures was tested. UCS testing was performed in accordance with ASTM Method D1633 by first removing each cured sample specimen from its cylindrical mold. The weight and physical dimensions of the sample were recorded on the appropriate data sheet and the specimen was placed on a UCS load frame and compressed at a rate of 1% strain per minute until the sample failed or 15% strain had been achieved. UCS test results are presented on Table 4.

Seven of the nine samples developed with each of the ISS South and the ISS North Spiked material achieved pocket penetrometer strength gains in excess of 3 tons per square foot.

The results of the 7-day UCS tests show values ranging from 3.9 psi to 31.5 psi. The mixtures developed using Class F Fly Ash and Lime Kiln Dust at addition rates of 10% combined with a 4% Portland cement addition exhibited the lowest strength values. Mixtures including Wyo-Ben Hydrogel Bentonite showed some decrease in strength compared with the same mixtures without the use of bentonite. This strength decrease was more significant in the ISS South samples than the ISS North Spiked samples.

3.3 ISS Advanced Screening

Five amendment mixtures for each sample (ISS South and ISS North Spiked) were selected for advanced screening evaluations based on the results of the preliminary screening. The reagent blends were added to the untreated material using the previously outlined protocol in the preliminary screening evaluations. Lime kiln dust and fly ash were not used as amendments due to the generally low strength results obtained during the preliminary screening. Type II/V (sulfate resistant) Portland Cement was not used as it did not show increased benefit relative to Type I Portland Cement.

The following is a summary of treated material testing performed on the treated samples, and brief descriptions of the protocols utilized for the stabilization evaluations:

- Pocket penetrometer testing on the mixtures following cure times of 1, 3, 5, 7, 14 and 28 days was performed. Approximately 100 grams of each treated material was put into a small plastic cup then cured and tested at the above intervals to evaluate the potential setting characteristics. Results of the pocket penetrometer testing are summarized on Table 5.
- After 7 and 28 days of curing, the UCS of each of the 10 samples was tested. UCS testing was performed in accordance with ASTM Method D1633 by first removing each cured sample specimen from its cylindrical mold. The weight and physical dimensions of the sample were recorded on the appropriate data sheet. The specimen was then placed on the load frame and compressed at a rate of 1% strain per minute until the sample failed or 15% strain had been achieved. UCS test results are presented on Table 5.
- Hydraulic Conductivity testing was conducted on 6 of the 10 samples after 28 days of curing, in accordance with ASTM D5084. Hydraulic Conductivity test results are presented on Table 5.

All of the treated materials achieved a penetrometer strength in excess of 4.5 tons per square foot within 7 days of curing. The results of the 28-day UCS test indicated that all of the treated materials exceeded the performance criteria of 30 psi, with UCS values ranging from 44.1 to 84.9 psi. Since all ten samples achieved the UCS performance criterion, the samples were selected for hydraulic conductivity testing based on lower cement percentages, lower total amendment percentages, and higher axial strain at failure during UCS testing. The hydraulic conductivity testing indicated that all six of the samples met the performance criteria of 1 x 10^{-5} cm/s, each by more than an order of magnitude.

The results of UCS and hydraulic conductivity testing were used to select four samples for the LEAF EPA Method 1315 leaching procedure at the 28 day cure period. Since all of the samples achieved the UCS and hydraulic conductivity performance criteria, the samples were selected for leach testing so that the same two amendment mixes were tested for ISS North Spiked and ISS South and results could be compared. The mixes selected for LEAF leach testing were:

- 4.0% Richmond Type I Portland Cement #1047/8.0% NewCem GGBFS 100 #1049 – ISS South Sample 0600-019 and ISS North Spiked Sample 0600-024
- 6.0% Richmond Type I Portland Cement #1047/8.0% NewCem GGBFS 100 #1049/1.0%Wyo-Ben Hydrogel Bentonite #807– ISS South Sample 0600-022 and ISS North Spiked Sample 0600-027

EPA Method 1315 was designed specifically to estimate the mass transfer rates (release rates) of analytes contained in a monolith, under diffusion-controlled release conditions, as a function of leaching time. The leach testing was performed using deionized water. There are no specific performance criteria for these tests since test leachate concentrations do not directly translate to expected groundwater concentrations near the solidified mass (monolith). Hydraulic modelling estimates of groundwater flow around the solidified mass are used along with the leach testing results to estimate resulting IHS groundwater concentrations leaving the area of solidification and assess the ability of the full-scale cleanup to achieve cleanup standards.

Eluate samples were collected at leaching intervals of 2 hours, 24 hours, 48 hours, 7 days, 14 days, 28 days, 42 days, 49 days, and 63 days. At each interval, the solidified sample was moved to a fresh deionized water bath, and the resulting eluate was analyzed to determine pH, specific conductivity, and oxidation-reduction potential.

The leachate was then sampled and analyzed for PAHs, PCP, and TPH diesel range. Complete analytical reports and the completed EPA Method 1315 (LEAF) data sheets are included in Appendix C. The analytical data was used to calculate interval flux and cumulative flux for each IHS. The flux was calculated as follows:

- Interval flux is the mass of IHS leached per unit surface area of the ISS sample per unit time for each of the discrete time intervals (milligrams per square meter per second; $mg/m^2/s$). Interval flux is calculated by multiplying the analytical result by the volume of eluate to derive mass IHS leached. The mass is then divided by both the surface area of the ISS sample and the time interval duration.

- The cumulative flux (also called cumulative release) is the cumulative IHS mass released through the most recent time interval divided by the ISS sample surface area through the sampling time interval (milligrams per square meter; mg/m^2).

Results for each of the leach tests followed the expected pattern for diffusion-controlled release (ITRC 2011). This pattern is to generally follow a slope of +0.5 for cumulative flux (or -0.5 for interval flux) since diffusion-controlled release is a function of the square root of time. The cumulative flux results for detected IHSs (PCP, 1- and 2-methylnaphthalene, and acenaphthene) are shown on Figure 3. The other IHSs (cPAH TEQ and benzo(a)anthracene) were not detected.

Figure 4 shows the interval flux for PCP from each of the amendment mixtures tested (two for ISS North Spike and two for ISS South). For all four samples tested, the graph illustrates decreasing interval flux with time as diffusion occurs from further within the solidified mass, where the time to release as leachate is proportionate to the distance from the outer edge of the solidified mass. The flux from the ISS South sample mixes is more than two orders of magnitude below the flux from ISS North Spiked sample while the difference between the flux for the two amendment mixtures for each of ISS South and ISS North Spiked is small (less than a factor of two). Further evaluation of the leach test flux data will be performed during remedial design.

Leachate concentrations observed during testing are not representative of groundwater concentrations expected in the area surrounding the solidified mass since the test baths do not reflect the groundwater flow processes of dispersion and advection that will occur when IHSs are released from the solidified mass. Therefore, the laboratory leachate concentrations observed during this test should not be compared to groundwater cleanup levels. However, leachate testing results will be used as a conservative source concentration to inform simplified fate and transport modeling to support cap design.

4 Intertidal Sediment Testing Results

Intertidal sediment treatability samples were delivered to the Materials Testing & Consulting, Inc. (MTC) laboratory in Tukwila, WA for physical testing. The 5-gallon sample from IT-TTWP-S was kept separate from the other samples based on field observation of grain size. To verify field observations, a grain size analysis was performed on IT-TTWP-S. Due to the coarse-grained and free draining nature of the sample (poorly graded sand with gravel, SP), it was not included in the sediment conditioning evaluation.

The other two buckets of sample material (designated as “IT-TTWP-N” and “2.5 gal C + 2.5 gal N”) were homogenized by the laboratory. The composite sample was identified as IT-TTWP-N. The grain size analysis indicated the composite sample IT-TTWP-N was a silty sand (SM) with gravel that contained 2.1% organics and 25% moisture. A Proctor test was completed on composite sample IT-TTWP-N with the results showing an optimum moisture content of 7.4%. The results indicated that the *in situ* moisture content of the composited sample (25%) was higher than the optimum moisture content (7.4%) which may present handling/compaction difficulties for the soil.

The ability of IT-TTWP-N to free drain in a soil stockpile to nearer optimum moisture content was assessed using the paint filter test. Free water was not generated during the paint filter test, indicating that the sediment would not free drain in a stockpile. As a result, a preliminary conditioning assessment was performed by amending samples of the sediment with 1%, 3%, and 5% Lafarge Type I Portland Cement. Proctor tests were run on the three samples after they cured for 3 days.

The 5% Portland Cement sample was compactable with the sample moisture content only slightly above optimum moisture content. The 1% Portland Cement sample was still very fluid and not compactable. The 3% Portland Cement sample was above optimum moisture content and pumped slightly to moderately during Proctor testing but this sample was expected to perform adequately with additional curing time. Based on these observations, the remainder of the sediment was amended with 3% Portland Cement and allowed to cure for 28 days prior to additional testing. The sediment amended with 3% Portland Cement was tested for:

- Standard Proctor – ASTM D698
- Atterberg Limits – ASTM D4318
- Particle Size w/Hydrometer – ASTM D422
- Hydraulic Conductivity – ASTM D5084
- Consolidated, Undrained Trixial Shear Test – ASTM D4767 (Three point)

The laboratory reports are provided in Appendix D. The results indicated that the amended sediment was non-plastic silty sand (SM) with a hydraulic conductivity of 1.8 x 10^{-4} cm/s. Proctor testing indicated that the optimum moisture content was 11.3%, slightly below the 13% measured moisture content. At 13% moisture, the sediment amended with 3%

Portland Cement is expected to compact to at least 95% of the ASTM D698 maximum dry density after 28 days of curing, thereby providing a workable and compactable material.

A three point consolidated, undrained triaxial test was also performed on the sediment amended with 3% Portland Cement. Testing was performed under confining pressures of 10, 20, and 25 psi, where 25 psi represents about 30 ft of overlying fill soil, consistent with the maximum fill depth identified in conceptual redevelopment plans for the site as a park. These test results can be used during remedial design to evaluate the geotechnical suitability of the amended sediment as upland fill material and stability of the resulting fill slope.

The three triaxial tests exhibited shear failure on a well-defined shear plane. The samples showed very little change in height as a result of initial consolidation, and failed at relatively low strains between 1.5% and 2% strain. Application of additional sample strain after initial failure resulted in relatively minor strength loss, and no significant elevation in sample pore pressure (generally reduction in pore pressure with strain) until the test was stopped at around 12% strain.

These results suggest that the amended material should exhibit relatively little consolidation upon placement. Deformation and behavior should be similar to a well-drained granular soil if/when subsequent loading is sufficient to exceed the shear strength of the amended material.

5 Summary of Results

ISS treatability testing demonstrated that numerous combinations of Type I Portland Cement, GGBFS, and bentonite were capable of achieving the preliminary performance criteria for compressive strength and hydraulic conductivity. The most cost effective amendment mix included 4% Richmond Type I Portland Cement and 8% GGBFS (ISS Mix). These amendments are both locally available with the Portland Cement manufactured in Richmond, British Columbia and the GGBFS, a recycled industrial byproduct, available in Seattle, Washington.

This ISS Mix achieved a 28-day compressive strength of 61 psi for ISS South and 52 psi for ISS North Spiked, and a hydraulic conductivity of 2.4×10^{-7} cm/s for ISS South and 1.4×10^{-7} for ISS North Spiked. The ISS Mix satisfies the performance criteria by achieving the minimum compressive strength of 30 psi and the maximum hydraulic conductivity of 1×10^{-5} cm/s. Sulfate compatibility of the amendment mix was achieved by using a Portland Cement to GGBFS ratio of 0.5, well below the maximum allowable ratio of 2.

Axial strain was also considered during ISS amendment mix development to reduce the potential for fracture of the solidified matrix during a significant seismic event. Axial strain for the most cost-effective mix was measured during UCS testing at 1.32% for ISS South and 1.53% for ISS North Spiked. The strain value was the highest reported for the ISS North Spiked sample and was 93% of the maximum strain value reported for the ISS South samples.

Intertidal sediment conditioning treatability testing was performed to estimate how much amendment would be required to create a workable, soil-like material that could be placed in the upland and be geotechnically suitable for the planned future land use as a park. Testing indicated that amendment with 3% Type I Portland Cement resulted in a suitable material. Additional geotechnical evaluation of the amended sediment will be performed during remedial design based on the data generated during treatability testing.

6 Discussion and Recommendations

Given a preferred ISS mix of 4% Richmond Type I Portland Cement and 8% GGBFS, this section discusses some specific issues that have been raised by Ecology with respect to the effectiveness of ISS, specifically:

- pH of groundwater downgradient of the ISS matrix
- Leaching of arsenic due to elevated pH
- Clarity of LEAF testing results

Recommendations for application of ISS to the site are also presented.

6.1 Groundwater pH

The measured pH of water during the LEAF testing was typically 11.5 after the first few exchanges of water. This is anticipated since the pore solution of hydrating cement typically has a pH of about 12 to 13 while the use of GGBFS in the ISS mix decreases the pH relative to a 100% Portland cement mix.

While the ISS mix is not identical to a concrete mix, it can be informative to consider information from studies on concrete. As concrete cures, the connectivity of the voids within the concrete decreases, reducing the permeability of the concrete and the connection between the pore solution and the concrete surface (Kosmatka and Wilson 2011). In addition, weathering or carbonation of the concrete further reduces pH at the concrete surface. The California Department of Transportation performed research (CTC & Associates 2016) and identified four literature citations related to measuring the effects of concrete construction within waterways on surface water pH. The research showed that surface water pH declines to neutral levels with a few days of construction.

Our research identified limited groundwater pH data associated with two solidification/stabilization sites: Pepper Steel and Sydney Tar Ponds. Solidification/stabilization performed in 1993 at Pepper Steel used a mix of Portland Cement and fly ash. Groundwater data was collected from the Pepper Steel site in 2017 from four perimeter wells and two wells located within the monolith (USEPA 2017). The pH measured during groundwater sampling ranged between 7.16 and 8.85. ISS was performed at Sydney Tar Ponds between 2010 and 2012. Groundwater monitoring was performed quarterly during construction (Dillon 2012). Thirteen of the wells were located within about 100 feet of the ISS monolith. The seven wells located downgradient of the ISS area had pH ranging from 7.3 to 8. Four of the upgradient wells had pH ranging from 7 to 7.6; however, two of the upgradient wells had pH of 11.7. One of these locations was adjacent to active ISS-related construction but it was unclear why the other upgradient well had elevated pH.

Based on this analysis, we would expect the pH to drop rapidly from the face of the ISS monolith to downgradient groundwater.

6.2 Leaching of Arsenic

The potential for non-IHS metals present in site soil or metals introduced through ISS amendments to leach into groundwater at concentrations that present a risk to human health and the environment is discussed in this section

The solubility of most metals is lowest at a pH between 9 and 12 and the solubility of dissolved organic carbon tends to increase rapidly above pH 11 (ITRC 2011). Other metals such as arsenic and hexavalent chromium, depending on speciation, may not respond in a similar manner. For this site, Ecology expressed concern regarding the potential for the elevated pH to increase the leaching and, therefore, the groundwater concentration of arsenic. To assess this potential, we reviewed the following:

- Metals introduced in ISS amendments
- Current metals concentrations at the site
- Arsenic speciation
- Case study data

6.2.1 Metals in ISS Amendments

Analyses for metals in Richmond Type I Portland Cement and GGBFS (NewCem) were provided by Lafarge at the outset of the project. Total and TCLP metals were provided for NewCem GGBFS while only TCLP data were provided for Richmond Type I Portland Cement.

Analyte	**GGBFS (NewCem)**		**Richmond Type I PC**
	Total Metals (mg/kg)	**TCLP Metals (mg/L)**	**TCLP Metals (mg/L)**
Arsenic	<32.2	<0.011	<0.011
Barium	**393**	**0.38**	**0.84**
Cadmium	<0.32	<0.0016	<0.0016
Chromium	**13.0**	<0.0034	**0.70**
Lead	<16.1	<0.0042	<0.0042
Selenium	<4.0	<0.017	<0.017
Silver	<0.81	<0.0035	<0.0035
Mercury	<0.091	<0.00011	<0.00011

TCLP testing does not provide the most representative data due to the acidic conditions created during the test, but this is the only data available.

6.2.2 Metals in Site Soil

Arsenic and hexavalent chromium are not IHSs the Site; arsenic has only been detected at low concentrations and hexavalent chromium has not been detected. The data presented below are from Table 6-4 of the RI/FS (GeoEngineers 2015) for two investigation locations upgradient of the proposed ISS area.

Sample ID	Arsenic (mg/kg)	Chromium (mg/kg)	Hexavalent Chromium (mg/kg)
HS-DP-1-4-6	**4.35**	**36.7**	<2
HS-DP-1-8-10	**7.39**	**41.4**	<1.9
HS-DP-1-12-14	**7.67**	**68.3**	<1.7
HS-DP-5B-0-2	**3.29**	**13.2**	<2
HS-DP-5B-8-10	**1.54**	**19.1**	<1.8
HS-DP-5B-12-16	**3.42**	**43.3**	<1.6

6.2.3 Arsenic Speciation

Arsenic solubility is affected by pH, but it is also affected by redox conditions, the presence of sulfides, and other factor that influence speciation. In general, arsenite (As(III)) is present in less reducing conditions and arsenate (As(V)) is present under more reducing conditions. As(III) is both more soluble and more toxic.

Oxidation-reduction potential (ORP) measurements from site groundwater typically ranged between -350 and -100 millivolts (mV) while eluate ORP was measured during bench testing at about +10 to +15 mV after the first several water exchanges. In order to convert ORP to redox potential (Eh) using the standard electrode, 200 to 250 mV needs to be added to the ORP results. As a result, the typical Eh measured in site groundwater ranges between -150 and +150 mV while the Eh for the ISS mix ranges between approximately +200 and +250 mV. Applying these Eh values and the pH data presented above to the Eh-pH diagram for arsenic-water systems we get the following results:

- For current site conditions, AS(III) is present as H_3AsO_3
- For the ISS data, As(V) is present as $HAsO_4^{2-}$

This is a highly simplified review of site data and it is important to note that the eluate water was exposed to air.

The use of GGBFS in addition to cement introduces iron sulfide that is naturally present in the slag and provides reducing capability.

6.2.4 Case Study Data

Based on available case studies, leachable metals typically were not evaluated at sites where these metals were not the source of contamination, including sites that use GGBFS. However, sites where these metals were a source of contamination have been successfully addressed using cement-based solidification/stabilization. Several examples have been presented in the literature, including Pepper Steel, American Creosote and Sydney Tar Ponds (CCLR et al 2010; Bates and Hills 2015; Public Works and Government Services Canada 2014).

At Pepper Steel, arsenic concentrations were present in soil at up to 50 mg/kg along with PCBs and lead. Using a cement and fly ash amendment, SPLP results from cores taken 16 years after project implementation had arsenic results of 4 to 8 ug/L. In addition, groundwater samples were collected from the Pepper Steel site in 2017 from four perimeter wells and two wells located within the monolith (USEPA 2017). Arsenic concentrations were 1.7 and 5.6 ug/L in the monolith samples and ranged between <1 and 1.1 ug/L in the perimeter wells.

At American Creosote in 1999 and 2000, a cement, fly ash, and activated carbon amendment was used to address elevated arsenic, PCP, PAH, and dioxins. It was reported that SPLP leachate concentrations were reduced from 9,600 ug/L for PCP and 155 ug/L for cPAH TEQ in untreated soil to <100 ug/L and <1 ug/L, respectively, after ISS. Cores were also collected in 2003 and tested using SPLP. Leachate from 4 of 5 samples tested had no detectable arsenic. The fifth core had a reported SPLP leachate concentration of 20 ug/L arsenic.

At Sydney Tar Ponds, ISS was performed in 2010 through 2012 using Portland Cement to address PAHs, PCBs, TPH, and metals. Quarterly groundwater monitoring was performed during the construction years (Dillon 2012). Thirteen of the wells were located within about 100 feet of the ISS monolith. The seven wells located downgradient of the ISS area had arsenic concentrations ranging from <0.6 to 8.6 ug/L. The six wells upgradient of the ISS area had arsenic concentrations ranging from <0.6 to 21 ug/L.

6.3 LEAF Testing Data

It is not possible to directly compare measurements from the bench test to expected field results. LEAF results reflect the diffusion of compounds from the ISS matrix in the absence of groundwater flow conditions, thus neglecting the mixing and dilution that will occur in situ. While these results are expected to represent initial conditions after ISS placement rather than a long-term contaminant source, the LEAF results were considered during evaluation of groundwater conditions that may need to be addressed by the adjacent sediment cap. Simplified fate and transport modeling to support cap design utilized the LEAF results as conservative source concentration for modeling.

Eluate measurements typically had detectable concentration of 1-methylnaphthalene, 2-methylnaphthalene, diesel-range petroleum, and PCP. Other compounds detected included acenaphthene, anthracene naphthalene, and fluorene, and oil-range petroleum. As expected, concentrations were higher in the ISS North spiked sample than the ISS South sample. Figures 5 and 6 present the diesel range petroleum and PCP eluate concentration data, respectively.

6.4 Recommendations

Additional mix design testing will occur when the selected contractor develops the final mix to satisfy the performance criteria provided in the construction specifications. The performance criteria provided in the specifications will be developed based on the preliminary performance criteria used for treatability testing, these treatability testing results, and the evaluation of leach flux data during remedial design.

ISS treatability sample collection test pits confirmed the presence of significant debris. Pieces of dimensional lumber are present in most locations while bricks, concrete, pipes, and larger wood piles and structures are present less consistently. Small- and medium-sized debris can be incorporated during the ISS mixing process. The larger debris, wood piling, and large pieces of dimensional lumber and concrete will likely prevent *in situ* mixing equipment, such as augers, from working effectively. As a result, this large debris will need to be removed by excavators prior to or during the *in situ* mixing process or the ISS mixing process will need to be performed entirely using excavators. Either approach can be used to effectively solidify the ISS area. The ISS mixing approach decision will be further detailed in the design process and may be left up to the contractor. The QA/QC testing program will verify that performance criteria are achieved during the mixing.

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Tables

Table 2 Untreated Physical Properties Characterization

Testing Parameter (1)	Test Method	Unit	Untreated Material	
			ISS South	ISS North
Particle Size Distribution	ASTM D422			
Gravel		%	5.2	4.5
Sand		%	77.4	70.2
Silt		%	12.1	16.3
Clay		%	5.3	9.0
Sample Description	USCS ASTM D2487		Black Silty Sand	Black Silty Sand
Sample Classification	USCS ASTM D2487		SM	SM
Loss on Ignition	ASTM D2974			
Average ASTM Moisture Content		%	64.66	39.25
Average Loss on Ignition @ 440°C		%	9.18	3.61
Material pH	EPA Method 9045	S.U.	6.44	6.26
Atterberg Limits	ASTM D4318 Method B			
Plastic Limit			NP	NP
Liquid Limit			N/A	N/A
Plasticity Index			N/A	N/A
Soluble Sulfate	ASTM C1580-15	g SO_4/ kg soil	35.43	15.65

Notes:
Sample color determined by the Munsell Soil Color Charts
%= Percent
S.U. = Standard Units
g SO_4/kg soil = grams of Sulfate per kilogram pf soil
(1) = Testing was performed on homogenized material screen through a 0.5 inch sieve
NP = Nonplastic
N/A = Not Applicable
USCS = Unified Soil Clasification System

Table 3 Untreated Analytical Results

Parameter	Units	ISS South			ISS North			ISS North Spiked			ISS North Spiked (Duplicate)		
		Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL
Polycyclic Aromatic Hydrocarbons (PAH) 8270D													
1-Methylnaphthalene	mg/Kg	**4.47**	E	0.0140	**24.8**	E	0.0699	**226**	E	0.416	**141**	E	0.422
2-Methylnaphthalene	mg/Kg	**1.88**		0.0160	**34.8**	E	0.0799	**359**	E	0.475	**218**	E	0.482
Acenaphthene	mg/Kg	**0.550**		0.00998	**1.62**	F1	0.00998	**14.4**		0.297	**9.38**		0.301
Acenaphthylene	mg/Kg	**0.106**		0.00899	ND		0.00899	**1.69**		0.0134	**4.07**		0.0136
Anthracene	mg/Kg	**0.124**		0.00899	**0.342**	F1	0.00899	**1.80**		0.0134	**1.30**		0.0136
Benzo[a]anthracene	mg/Kg	ND		0.0150	**0.0878**		0.0150	**0.350**		0.0223	**0.315**		0.0226
Benzo[a]pyrene	mg/Kg	ND		0.0120	**0.0661**	J	0.0120	**0.223**		0.0178	**0.191**		0.0181
Benzo[b]fluoranthene	mg/Kg	**0.0450**	J	0.0120	**0.0693**		0.0120	**0.276**		0.0178	**0.218**		0.0181
Benzo[g,h,i]perylene	mg/Kg	ND		0.00899	**0.0390**	J	0.00899	**0.139**		0.0134	**0.127**		0.0136
Benzo[k]fluoranthene	mg/Kg	ND		0.0140	**0.0470**	J	0.0140	**0.125**		0.0208	**0.0910**	J	0.0211
Chrysene	mg/Kg	ND		0.00899	**0.102**		0.00899	**0.575**		0.0134	**0.510**		0.0136
Dibenz(a,h)anthracene	mg/Kg	ND		0.00699	ND		0.00699	ND		0.0104	ND		0.0105
Fluoranthene	mg/Kg	**0.0658**	J	0.00899	**0.240**		0.00899	**1.10**		0.0134	**0.975**		0.0136
Fluorene	mg/Kg	**0.317**		0.0120	**1.32**	F1	0.0120	**13.3**		0.356	**8.24**		0.362
Indeno[1,2,3-cd]pyrene	mg/Kg	ND		0.00998	ND		0.00998	**0.101**		0.0149	**0.0793**	J	0.0151
Naphthalene	mg/Kg	**0.105**		0.00899	**1.09**	F1	0.00899	**7.73**		0.267	**5.16**		0.0136
Phenanthrene	mg/Kg	**0.597**		0.00899	**3.74**		0.0449	**33.0**		0.267	**21.0**		0.271
Pyrene	mg/Kg	**0.122**		0.0120	**0.438**		0.0120	**3.31**		0.0178	**2.64**		0.0181
North West - Total Petroleum Hydrocarbon Diesel (NW-TPH Diesel)													
C10-C24	mg/Kg	**452**	B	6.98	**859**	B	13.8	**18,700**		293	**9,580**		300
C24-C40	mg/Kg	**220**		9.98	**35.7**		1.98	**599**		29.3	**372**		30.0
Pentachlorophenol 8151A													
Pentachlorophenol	mg/Kg	**0.0488**		0.0217	**2.17**		1.08	**20.2**		3.21	**20.1**		6.52

Notes:
mg/Kg = milligram per kilogram
MDL = Method Detect Limit
E = Result exceeded calibration range
J = Results is less than the Reporting Limit but greater than or equal to the Method Detection Limit and the concentration is an approximate value
B = Compound was found in the blank and sample
F1 = Matrix Spike (MS) and/or Matrix Spike Duplicate (MSD) Recovery is outside acceptance limits

Table 4 Preliminary Screening Evaluation Results

KEMRON Sample Number	Untreated Material Type	Reagent Type and Identification Number(s)	Reagent Addition % by Wet Soil wt.	Water Addition % by Reagent wt.	Pocket Penotrometer (TSF)			Cure Day	Unconfined Compressive Strength ASTM D2166				Predicted Strength		Axial Strain
					1 Day	3 Day	5 Day		Moisture Content (%)	Bulk Density (lb/ft^3)	Dry Density (lb/ft^3)	UCS (lb/in^2)	28-Day UCS (lb/in^2)	Final UCS (lb/in^2)	(%)
0600-001	ISS South	Richmond Type I PC #1047/NewCem GGBFS 100 #1049	5.25/2.25	80.0	2.00	3.75	4.25	7	61.66	97.3	60.2	17.5	23.3	26.8	2.8%
0600-002	ISS South	Richmond Type I PC #1047/NewCem GGBFS 100 #1049	7.00/3.00	80.0	2.25	4.50	>4.50	7	63.91	98.3	60.0	24.6	32.8	**37.7**	2.2%
0600-003	ISS South	Richmond Type I PC #1047/NewCem GGBFS 100 #1049	4.00/8.00	80.0	2.50	3.75	>4.50	7	64.81	96.8	58.7	28.0	37.3	**42.9**	1.9%
0600-004	ISS South	Richmond Type I PC #1047/Centralia Class F Fly Ash #1048	6.00/1.50	80.0	2.75	3.00	3.75	7	65.27	97.2	58.8	15.4	20.5	23.6	3.6%
0600-005	ISS South	Richmond Type I PC #1047/Centralia Class F Fly Ash #1048	8.00/2.00	80.0	2.50	>4.50	>4.50	7	64.52	98.2	59.7	22.2	29.6	**34.0**	2.8%
0600-006	ISS South	Richmond Type I PC #1047/Centralia Class F Fly Ash #1048	4.00/10.00	80.0	1.00	1.75	2.00	7	61.42	102.1	63.2	9.2	12.3	14.1	3.5%
0600-007	ISS South	Richmond Type I PC #1047/Tacoma LKD #919	4.00/10.00	80.0	0.00	0.75	1.25	7	58.93	100.0	62.9	7.2	9.6	11.0	5.9%
0600-008	ISS South	LeHigh Type II/V PC #1042/NewCem GGBFS #1049	4.00/8.00	80.0	1.75	3.75	>4.50	7	62.87	97.2	59.7	31.5	42.0	**48.3**	2.0%
0600-009	ISS South	Richmond Type I PC #1047/NewCem GGBFS 100 #1049/Wyo-Ben Hydrogel Bentonite #807	5.25/2.25/1.00	125.0	0.50	1.50	2.00	7	75.58	92.5	52.7	11.2	14.9	17.2	3.7%
0600-010	ISS North Spiked	Richmond Type I PC #1047/NewCem GGBFS 100 #1049	5.25/2.25	80.0	1.50	3.00	4.25	7	43.47	107.2	74.7	20.0	26.7	**30.7**	1.9%
0600-011	ISS North Spiked	Richmond Type I PC #1047/NewCem GGBFS 100 #1049	7.00/3.00	80.0	2.00	4.50	>4.50	7	46.18	105.4	72.1	29.8	39.7	**45.7**	2.3%
0600-012	ISS North Spiked	Richmond Type I PC #1047/NewCem GGBFS 100 #1049	4.00/8.00	80.0	0.25	2.75	4.00	7	44.64	105.1	72.7	21.4	28.5	**32.8**	2.8%
0600-013	ISS North Spiked	Richmond Type I PC #1047/Centralia Class F Fly Ash #1048	6.00/1.50	80.0	1.50	2.00	3.25	7	44.04	106.1	73.7	19.2	25.6	29.4	2.9%
0600-014	ISS North Spiked	Richmond Type I PC #1047/Centralia Class F Fly Ash #1048	8.00/2.00	80.0	2.50	>4.5	>4.50	7	45.31	105.8	72.8	30.2	40.3	**46.3**	2.3%
0600-015	ISS North Spiked	Richmond Type I PC #1047/Centralia Class F Fly Ash #1048	4.00/10.00	80.0	0.00	0.75	1.25	7	47.14	106.1	72.1	8.7	11.6	13.3	3.0%
0600-016	ISS North Spiked	Richmond Type I PC #1047/Tacoma LKD #919	4.00/10.00	80.0	0.00	0.00	0.00	7	46.07	107.8	73.8	3.9	5.2	6.0	8.4%
0600-017	ISS North Spiked	LeHigh Type II/V PC #1042/NewCem GGBFS #1049	4.00/8.00	80.0	1.00	2.75	>4.50	7	42.18	106.3	74.8	27.1	36.1	**41.6**	1.2%
0600-018	ISS North Spiked	Richmond Type I PC #1047/NewCem GGBFS 100 #1049/Wyo-Ben Hydrogel Bentonite #807	5.25/2.25/1.00	125.0	0.25	2.75	3.25	7	49.15	103.3	69.3	19.1	25.5	29.3	3.5%

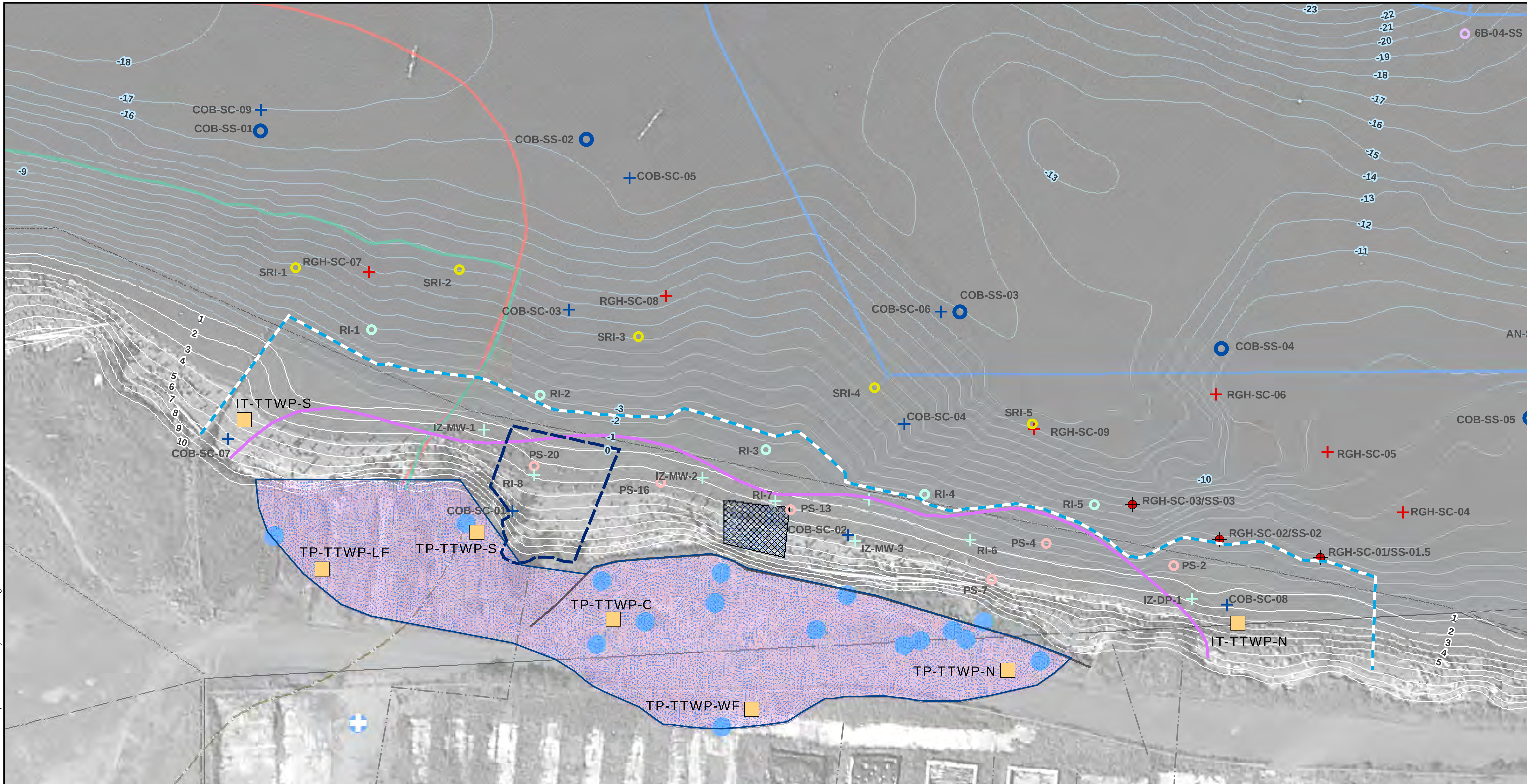
Notes:
% = Percent
lb/ft^3 = pounds per cubic foot
lb/in^2 = pounds per square inch
UCS = Unconfined Compressive Strength
TSF = Tons per square foot
Wt= Weight
GGBFS = Grangulated Ground Blast Furnace Slag
PC = Portland Cement
LKD = Lime Kiln Dust

Table 5 Summary of Advanced Screening

Reagent Type and Identification Number(s)	Reagent Addition % by Wet Soil wt.	ISS South: KEMRON Sample ID	ISS South: Axial Strain (%) 28 day	ISS South: UCS (lb/in^2) 28 day	ISS South: Hydraulic Conductivity (cm/sec) 28 day	ISS North Spiked: KEMRON Sample ID	ISS North Spiked: Axial Strain (%) 28 day	ISS North Spiked: UCS (lb/in^2) 28 day	ISS North Spiked: Hydraulic Conductivity (cm/sec) 28 day
	Performance Critiera			**> 30 psi**	**< 1.0E-5**			**> 30 psi**	**< 1.0E-5**
Richmond Type I PC #1047/NewCem GGBFS 100 #1049	4.00/8.00	0600-019	1.32	61.0	2.4E-07	0600-024	1.53	51.5	1.4E-07
Richmond Type I PC #1047/NewCem GGBFS 100 #1049/Wyo-Ben Hydrogel Bentonite #807	6.00/8.00/1.00	0600-022	1.42	84.9	8.0E-08	0600-027	1.17	79.8	3.5E-08
The following mixtures were not carried forward for leachability testing									
Richmond Type I PC #1047/NewCem GGBFS 100 #1049/Wyo-Ben Hydrogel Bentonite #807	5.00/10.00/1.00	0600-020	1.40	80.1	1.5E-08	0600-025	1.17	44.1	Not Tested
Richmond Type I PC #1047/NewCem GGBFS 100 #1049/Wyo-Ben Hydrogel Bentonite #807	8.00/4.00/1.00	0600-023	1.41	57.6	Not Tested	0600-028	1.27	65.8	9.8E-08
Richmond Type I PC #1047/NewCem GGBFS 100 #1049	6.00/6.00	0600-021	1.28	73.2	Not Tested	0600-026	1.03	59.9	Not Tested

Notes:
% = Percent
K = hydraulic conductivity cm/sec - Performace Critieria of 1x10-5 cm/sec
lb/in^2 = pounds per square inch
UCS = Unconfined Compressive Strength - Performace Critiera of 30 lb/in2, based on site data of SPT logs of 10 to 24 psi.
TSF = Tons per square foot
GGBFS = Grangulated Ground Blast Furnace Slag
PC = Portland Cement

Figures



Sediment Sample Type

- Surface Sediment Sample Location
- Subsurface Sediment Sample Location
- Surface and Subsurface Sediment Sample Location
- Current Measurable LNAPL in Well
- Trace LNAPL in Well 2012/2013 and Earlier
- Potentially Mobile LNAPL
- Western Extent of Sediment Removal (Preferred Remedy)
- Western Extent of Smear Zone
- Approximate Boundary of Interim Action Area
- Treatability Study Test Pit Locations
- 2001 Sediment Removal Area
- Proposed Footprint of In Situ Soil Solidification (Preferred Remedy)

True North
Project North

0 30 60
Feet

Reference: Aerial from Google Earth, August 2011.
Contour elevation displayed is referenced to NAVD88 vertical datum.

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document.

GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Bench-Scale Treatability Study Sample Locations

R.G. Haley Site
Bellingham, Washington

GEOENGINEERS

Figure 1

Path: P:\0\0356114\GIS\MXDs\Fig_1_TestPitLocations_rev111215.mxd Map Revised: 22 July 2016 maugust

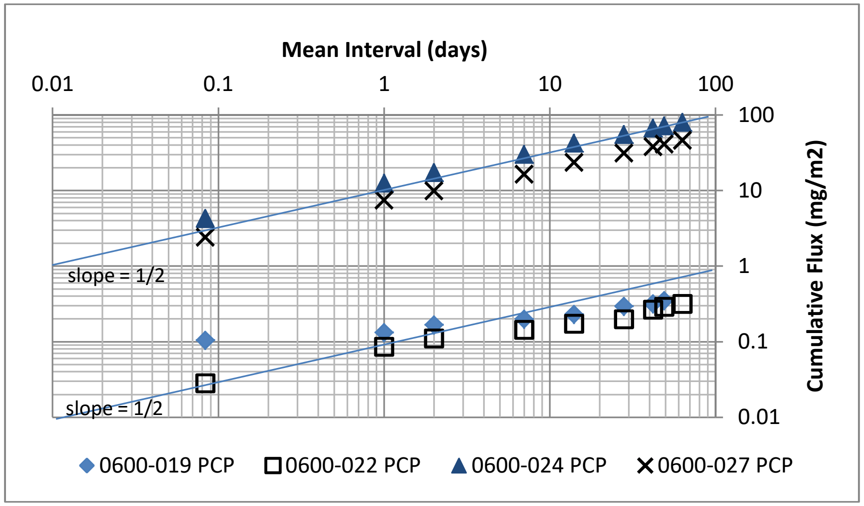
Woody debris in TP-TTWP-S (left) high volume of wooden piles and timbers. TP-TTWP-N (right) significant large dimensional lumber debris present.

Concrete debris in the surface of TP-TWP-S (left) and woody debris in TP-TTWP-WF (right).

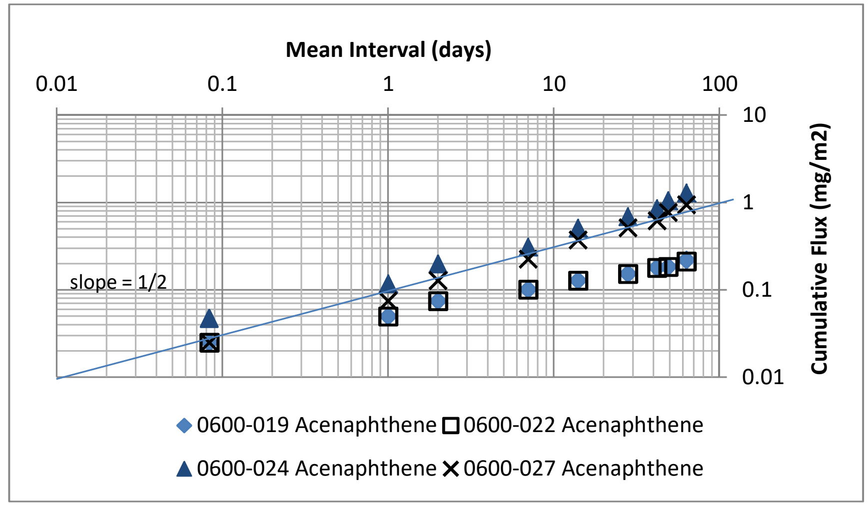
CRETE CONSULTING, INC.

Treatability Study Results R.G. Haley Site, Bellingham Washington November 13, 2019	Figure 2 Examples of Debris Found in Test Pits

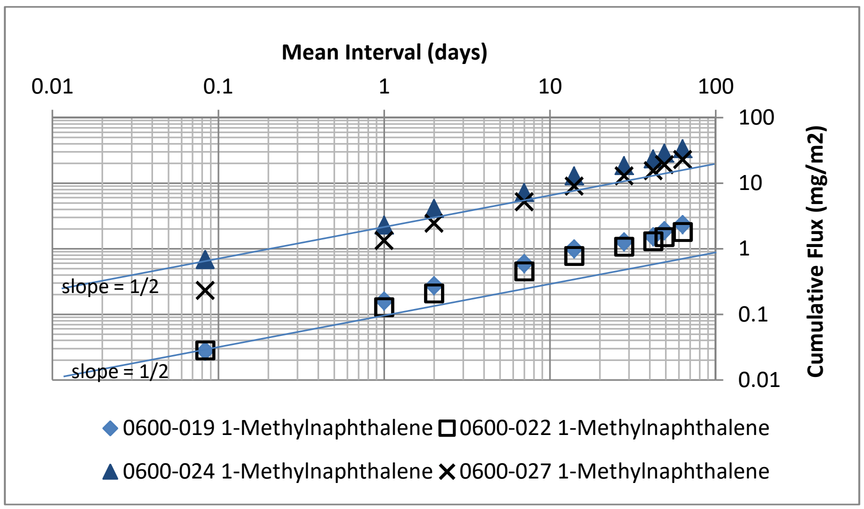
Pentachlorophenol Cumulative Flux



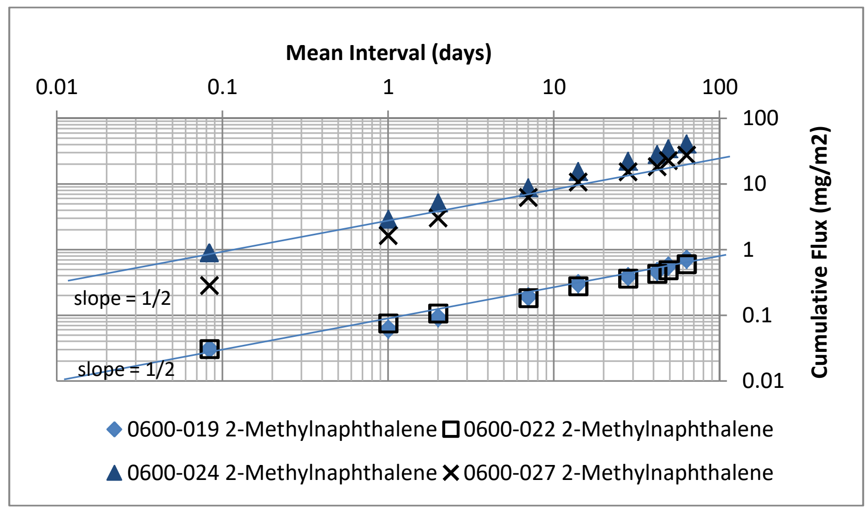
Acenaphthene Cumulative Flux



1-methylnaphthalene Cumulative Flux

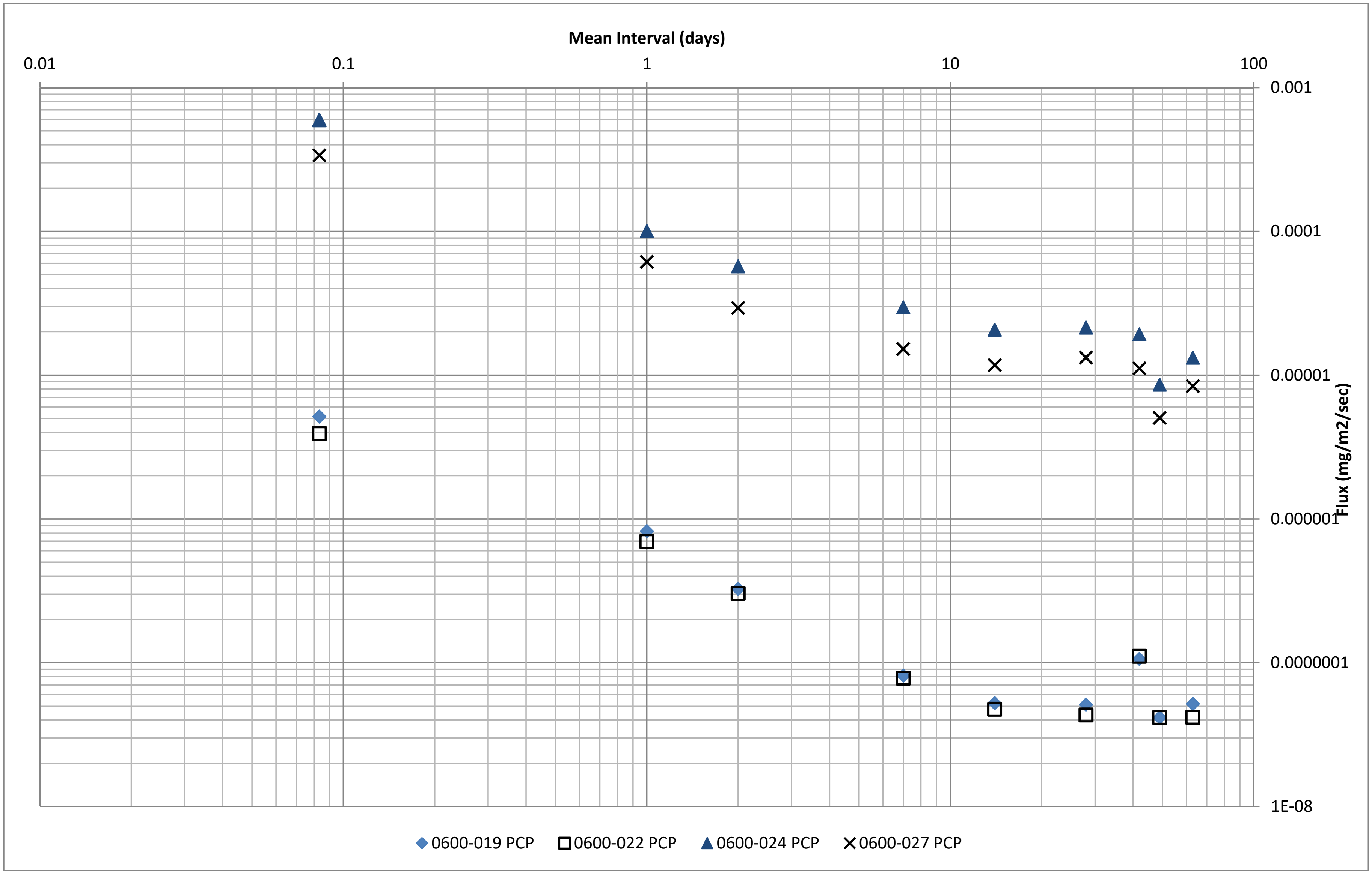


2-methylnaphthalene Cumulative Flux



CRETE CONSULTING, INC.

Treatability Study Results R.G. Haley Site, Bellingham Washington November 13, 2019	Figure 3 Cumulative Flux for Detected IHSs



CRETE CONSULTING, INC.

Treatability Study Results
R.G. Haley Site, Bellingham Washington
November 13, 2019

Figure 4
Interval Flux for Pentachlorophenol

Appendix A

Test Pit Logs

10:30 – 11:15

TP-TTWP – LF

CRETE CONSULTING, INC.

FIELD LOG OF TEST PIT

Project: RG Haley
Job No.:
Location: Former RG Haley Bellingham

Inspector: GKS
Date: 12-16-15
Weather: Clear, Upper 30s

Contractor: Strider Const.
Equipment: Hitachi 160 Excavator
Checked By:

Operator: Mike
Date:

Soil Description & Remarks	Ground Water	Samples	Depth in Feet
Sand w/ silts some gravels w/ organics to 18"			
MSW w/ oily lense immediately below MSW			2'
silty f.m sand w/ occasional MSW and some wood debris. Oily Residue at 10'			4'
becomes more gray chunky silt w/ some sand and some wood debris			6'
insitu pile @ approx 7-8' bgs.			8'
~~Bottom of~~			10'
			12'
Bottom of Test Pit @ 14'			14'

Sketch of ______ pit side Surface Elevation (ft): Datum:

Horizontal Distance in Feet

9:40–10:25

TP – TTWP – C

CRETE CONSULTING, INC.

FIELD LOG OF TEST PIT

Project : RG Haley
Job No. :
Location : Former RG Haley Belling-
Inspector : GKS
Date : 12-16-15
Weather : Clear, Cold 30s
Contractor : Strider Const.
Equipment : Hitachi 160 Excavator
Operator : Mike
Checked By :
Date :

Soil Description & Remarks	Ground Water	Samples	Depth in Feet
sand and silt w/ gravels and some plastic debris			
silt and sand with cobbles and boulders up to 18" in length some concrete debris and straw			2'
wood debris is fragmented, broken dimensional wood w/ heavy sheen and oily odor Not the same component (% of material) as the 'North' and 'Wood Fill' Test Pits. Straw is present at all depths Encountered intact sand bag at 12'			4'
			6'
			8'
			10'
blackish gray fine sand w/ substantial shell fragments			12'
Bottom of Test Pit @ 13'–14'			14'

Sketch of ______ pit side Surface Elevation (ft) : Datum :

Horizontal Distance in Feet

CRETE CONSULTING, INC.

9:10 – 9:40

TP-TTWP-WF

FIELD LOG OF TEST PIT

Project : RG Haley
Job No. :
Location : Former RG Haley Bellingham
Inspector : GVS
Date : 12-16-15
Weather : Clear, Cold 30s
Contractor : Strider Const.
Equipment : Hitachi 160 Excavator
Operator : Mike
Checked By :
Date :

Soil Description & Remarks	Ground Water	Samples	Depth in Feet
Sand with silt organics and gravels w/ some drain pipe remnants and concrete pieces			2'
Water at approx. 5'-6'			4'
Gravel and silts w/ sand and lots of wood debris w/ heavy sheen and oily odor. Wood debris was fragmented/broken dimensional wood waste up to 24" in length, wood chips and chunks of solidified sawdust			6' 8' 10'
Test pit to approx. 10'			12'

Sketch of ______ pit side
Surface Elevation (ft) :
Datum :
Horizontal Distance in Feet

8:15 - 9:00

TP-TTWP-N

CRETE CONSULTING, INC.

FIELD LOG OF TEST PIT

Project : RG Haley
Job No. :
Location : Former RG Haley Belling.

Inspector : GKS
Date : 12-16-15
Weather : Clear, Cold Low 30s

Contractor : Strider Const.
Equipment : Hitach, 160 Excavator
Operator : MIKE

Checked By :
Date :

Soil Description & Remarks	Ground Water	Samples	Depth in Feet
f/m sand w/ silt gravel and organics			
chunky, bluish gray coarse sand			2'
			3'
brownish gray silty sand with subrounded cobbles up to 4"Ø. Lots of wood debris including chunks of dimensional lumber, fragmented wood, in-situ piles.			4'
Water at 5'			6'
Cuttings had oily odor and heavy sheen			8'
			10
			12'
At approx 13', soils become dark gray f/m sand w/ shell fragments			14'

Sketch of ______ pit side   Surface Elevation (ft) :   Datum :

Horizontal Distance in Feet

11:40–12:15

TP-TTWP-5

CRETE CONSULTING, INC.

FIELD LOG OF TEST PIT

Project : RG Haley
Job No. :
Location : Former RG Haley Belling

Inspector : GRS
Date : 12-16-15
Weather : Clear Upper 30s/Low 40s

Contractor : Strider Const.
Equipment : Hitachi 160 Excavator
Checked By :

Operator : Mike
Date :

Soil Description & Remarks	Ground Water	Samples	Depth in Feet
brown, sand w/ silt and substantial chunky concrete debris 24"x24"			2'
concrete debris not present			4'
wet free flowing brownish gray silt w/ substantial angular cobbles up to 12"–18" in length with some large ϕ and long sections of broken pile debris material was stained, but did not have the pronounced oily odor in 'North', 'Wood Fill' and 'Central'			6' 8' 10' 12'
reddish brown sawdust			
black fine sand w/ shell fragments			14'

Bottom at approx 14'

Sketch of ______ pit side
Surface Elevation (ft) :
Datum :
Horizontal Distance in Feet

Appendix B

Photographic Log

Photo 1: Excavator and start of test pitting (at location TP-TTWP-C)

Photo 2: Typical soil stockpile on plastic (at location TP-TTWP-LF)

Photo 3: Typical completed test pit surface (at location TP-TTWP-C)

Photo 4: TP-TTWP-S – High volume of wood debris

Photo 5: TP-TTWP-S – Wood debris

Photo 6: TP-TTWP-LF – Landfill debris (Wood pile not photographed)

Photo 7: TP-TTWP-C – Wood pile

Photo 8: TP-TTWP-C – Abundance of straw and organic debris

Photo 9: TP-TTWP-WF – High volume of wood debris, stained TPH soil

Photo 10: TP-TTWP-WF

Photo 11: TP-TTWP-N –Wood pile and pile cap (wood wall behind pile cap not shown)

Photo 12: TP-TTWP-N – Second large pile encountered

Photo 13: TP-TTWP-N - High volume of large dimensional woody debris in oil-stained saturated layer

Photo 14: Upland Samples – TP-TTWP-WF (Left) and TP-TTWP-N (Right)

Photo 15: Upland Samples - TP-TTWP-C (both sample containers)

Photo 16: Upland Samples – TP-TTWP-LF (Left) and TP-TTWP-S (Right)

Appendix C

ISS Treatability Laboratory Data Report

Washington Wood Preserving
In-Situ Soil Stabilization Bench Scale Treatability Study
SH0600
Interim Report

Prepared For:

CRETE Consulting, Inc.
108 South Washington Street
Suite 300
Seattle, WA 98104

Prepared by:

KEMRON Environmental Services, Inc.
1359-A Ellsworth Industrial Boulevard
Atlanta, Georgia 30318

July 18 , 2016

Table of Contents

List of Tables and Appendices

1.0 INTRODUCTION

KEMRON Environmental Services, Inc. (KEMRON) is pleased to present CRETE Consulting, Inc. (CRETE), with this interim report of the In-Situ Stabilization (ISS) Bench Scale Treatability Study performed on material sampled from the Washington Wood Preserving Site, located in Seattle, Washington. This report provides the methodology and protocols used, as well as the results of testing performed on the untreated and treated site materials.

The objective of the treatability study was to evaluate potential readily available reagents and addition rates capable of achieving the performance criteria, primarily strength and permeability, for ISS and for the reduction of the leachability of contaminants of concern (COCs) from the site soils.

2.0 MATERIAL RECEIPT, HOMOGENIZATION, AND CHARACTERIZATION

On January 8, 2016, KEMRON received four 5-gallon buckets of soil from the site labeled as follows: "TP-TTWP-S, TP-TTWP-LF, TP-TTWP-C&WF, and TP-TTWP-N&WF. Immediately following sample receipt, KEMRON logged the materials into a sample tracking database and placed the soil in a 4-degree-Celsius (°C) walk-in cooler for storage.

Prior to conducting any testing on the untreated site materials, KEMRON homogenized each material type separately to ensure uniform materials for the study. Homogenization was performed by placing the contents of each bucket into a pre-cleaned plastic mixing pan and gently blending by hand using a stainless steel spoon until visually homogenous. Any particles measuring greater than 0.5 inches in diameter were broken into more manageable sizes or were removed in order to facilitate bench-scale treatment and adhere to particle-size limits outlined in certain ASTM and EPA test methods. Approximately 11lbs of oversized debris were removed from the TP-TTWP-N&WF material, 8.5 pounds from the TP-TTWP-C&WF material, 7 pounds from the TP-TTWP-LF material, and 5 pounds from the TP-TTWP-S material. After homogenizing each bucket separately, KEMRON combined and homogenized the buckets labeled "TP-TTWP-S" and "TP-TTWP-LF" together to form the "ISS South Composite", and the buckets labeled "TP-TTWP-C&WF" and "TP-TTWP-N&WF" were combined and homogenized together to form "ISS North Composite."

In order to assist in the selection of potential appropriate reagent(s) and addition rates, as well as to provide geotechnical information, KEMRON evaluated selected physical properties of the homogenized material by conducting the following tests:

PARAMETER	METHOD
Material pH	EPA Method 9040
Loss on Ignition (@440C)	ASTM D2974
Atterberg Limits	ASTM D4318
Particle Size (w/ Hydrometer)	ASTM D422
Soluble Sulfate	ASTM C1580

A summary of the results of the physical properties testing are provided on **Table 1**, and physical properties data sheets for the untreated materials are included in **Appendix A**.

CRETE CONSULTING INC, PC
WASHINGTON WOOD PRESERVING ISS
KEMRON Project No. SH0600

TABLE 1

UNTREATED PHYSICAL PROPERTIES CHARACTERIZATION

Testing Parameter (1)	Test Method	Unit	Untreated Material	
			ISS South Composite	ISS North Composite
Particle Size Distribution	ASTM D422			
Gravel		%	5.2	4.5
Sand		%	77.4	70.2
Silt		%	12.1	16.3
Clay		%	5.3	9.0
Sample Description	USCS ASTM D2487		Black Silty Sand	Black Silty Sand
Sample Classification	USCS ASTM D2487		SM	SM
Loss on Ignition	ASTM D2974			
Average ASTM Moisture Content		%	64.66	39.25
Average Loss on Ignition @ 440°C		%	9.18	3.61
Material pH	EPA Method 9045	S.U.	6.44	6.26
Atterberg Limits	ASTM D4318 Method B			
Plastic Limit			NP	NP
Liquid Limit			N/A	N/A
Plasticity Index			N/A	N/A
Soluble Sulfate	ASTM C1580-15	g SO_4/ kg soil	35.43	15.65

Notes:
Sample color determined by the Munsell Soil Color Charts
%= Percent
S.U. = Standard Units
g SO_4/kg soil = grams of Sulfate per kilogram pf soil
(1) = Testing was performed on homogenized material screen through a 0.5 inch sieve
NP = Nonplastic
N/A = Not Applicable
USCS = Unified Soil Clasification System

The results of untreated material characterization testing presented in **Table 1** indicate that the ISS South Composite and ISS North Composite material are classified as black silty sands(SM) with a slightly acidic pH (6 s.u.). The ISS North Composite material has a significantly higher organic content (9.18%) and soluable sulfate concentration (200 grams SO4/kg soil) than the ISS South Composite material.

In addition to physical properties testing, aliquots of the untreated composite materials were subjected to the following analytical tests, at Test America Laboratories, Inc. in Nashville, TN, in accordance with the outlined testing methods:

PARAMETER	**METHOD**
Total PAH	EPA Method 8270
Total Pentachlorophenol	EPA Method 8151
NW-TPH Diesel (North West – Total Petroleum Hydrocarbon Diesel)	Washington Method

A summary of the results of the analytical testing are provided on **Table 2**, and analytical report for the untreated materials are included in **Appendix B**.

CRETE CONSULTING INC, PC
WASHINGTON WOOD PRESERVING ISS
KEMRON Project No. SH0600

TABLE 2

UNTREATED ANALYTICAL CHARACTERIZATION
PAHs, NW-TPH Diesel, and Pentachlorophenol

Parameter	Units	ISS South Composite			ISS North Composite		
		Results	Qual.	MDL	Results	Qual.	MDL
Polycyclic Aromatic Hydrocarbons (PAH) 8270D							
Acenaphthene	mg/Kg	**0.550**		0.00998	**1.62**	**F1**	0.00998
Acenaphthylene	mg/Kg	**0.106**		0.00899	ND		0.00899
Anthracene	mg/Kg	**0.124**		0.00899	**0.342**	**F1**	0.00899
Benzo[a]anthracene	mg/Kg	ND		0.0150	**0.0878**		0.0150
Benzo[a]pyrene	mg/Kg	ND		0.0120	**0.0661**	**J**	0.0120
Benzo[b]fluoranthene	mg/Kg	**0.0450**	**J**	0.0120	**0.0693**		0.0120
Benzo[g,h,i]perylene	mg/Kg	ND		0.00899	**0.0390**	**J**	0.00899
Benzo[k]fluoranthene	mg/Kg	ND		0.0140	**0.0470**	**J**	0.0140
Chrysene	mg/Kg	ND		0.00899	**0.102**		0.00899
Dibenz(a,h)anthracene	mg/Kg	ND		0.00699	ND		0.00699
Fluoranthene	mg/Kg	**0.0658**	**J**	0.00899	**0.240**		0.00899
Fluorene	mg/Kg	**0.317**		0.0120	**1.32**	**F1**	0.0120
Indeno[1,2,3-cd]pyrene	mg/Kg	ND		0.00998	ND		0.00998
Naphthalene	mg/Kg	**0.105**		0.00899	**1.09**	**F1**	0.00899
Phenanthrene	mg/Kg	**0.597**		0.00899	**3.74**		0.0449
Pyrene	mg/Kg	**0.122**		0.0120	**0.438**		0.0120
North West - Total Petroleum Hydrocarbon Diesel (NW-TPH Diesel)							
C10-C24	mg/Kg	**452**	**B**	6.98	**859**	**B**	13.8
C24-C40	mg/Kg	**220**		9.98	**35.7**		1.98
Pentachlorophenol 8151A							
Pentachlorophenol	mg/Kg	**0.0488**		0.0217	**2.17**		1.08

Notes:
mg/Kg = milligram per kilogram
MDL = Method Detect Limit
J = Results is less than the Reporting Limit but greater than or equal to the Method Detection Limit and the concentration is an approximate value
B = Compound was found in the blank and sample
F1 = Matrix Spike (MS) and/or Matrix Spike Duplicate (MSD) Recovery is outside acceptance limits

In general, the results of analytical testing indicated that the untreated ISS North Composite was slightly more impacted than the untreated ISS South Composite. Concentrations of PAHs and pentachlorophenol were relatively low in both untreated composite materials with the PAH compounds phenanthrene and acenaphthene detected at the highest concentrations in the ISS North Composite at values of 3.74 and 1.62 milligrams per kilogram (mg/KG) respectively, and pentachlorophenol was detected in the ISS North Composite at a concentration of 2.17 mg/Kg. The Northwest Total Petroleum Hydrocarbon Diesel (NW-TPH) analyses indicated hydrocarbon concentrations of 452 mg/kg and 859 mg/kg in the C10-C24 range for the ISS South Composite and ISS North Composite, respectively. In addition, the NW-TPH analyses indicated hydrocarbon concentrations of 220 mg/kg and 35.7 mg/kg in the C24-C40 range for the ISS South Composite and ISS North Composite, respectively.

The results of the analytical testing indicated lower contaminant concentrations than expected. Therefore, KEMRON spiked the ISS North Composite material, per CRETE’s request, to provide a material with a significantly higher degree of contaminant of concern (COC) concentrations and more closely mimic anticipated site conditions. The spiked material was prepared by blending 1,380 grams of Light Non-aqueous Phase Liquid (LNAPL) provided from the site with the 46 kilograms of the untreated ISS North Composite material. Spiking was performed by placing the entire 46 kilograms of the ISS North Composite into a large mixing bin. The LNAPL was then introduced and blended thoroughly with the soil. The spiked ISS North Composite was then returned to the storage containers, placed in a 4-degree-Celsius (°C) walk-in cooler, and allowed to equilibrate for a period of 24 hours. Duplicate aliquots of the spiked ISS North Composite material were then sampled and forwarded to Test America for the untreated material analyses previously outlined.

A summary of the results of the analytical testing on the spiked material are provided on **Table 3**, and the complete analytical report for the spiked ISS North Composite material are included in **Appendix C**. The term “ISS North Composite” used in the remainder of this report refers to the “spiked ISS North Composite” material.

CRETE CONSULTING INC, PC
WASHINGTON WOOD PRESERVING ISS
KEMRON Project No. SH0600

TABLE 3

SPIKED UNTREATED ANALYTICAL CHARACTERIZATION
PAHs, NW-TPH Diesel, and Pentachlorophenol

Parameter	Units	ISS North Composite			ISS North Composite (Duplicate)		
		Results	Qual.	MDL	Results	Qual.	MDL
Polycyclic Aromatic Hydrocarbons (PAH) 8270D							
Acenaphthene	mg/Kg	**14.4**		0.297	**9.38**		0.301
Acenaphthylene	mg/Kg	**1.69**		0.0134	**4.07**		0.0136
Anthracene	mg/Kg	**1.80**		0.0134	**1.30**		0.0136
Benzo[a]anthracene	mg/Kg	**0.350**		0.0223	**0.315**		0.0226
Benzo[a]pyrene	mg/Kg	**0.223**		0.0178	**0.191**		0.0181
Benzo[b]fluoranthene	mg/Kg	**0.276**		0.0178	**0.218**		0.0181
Benzo[g,h,i]perylene	mg/Kg	**0.139**		0.0134	**0.127**		0.0136
Benzo[k]fluoranthene	mg/Kg	**0.125**		0.0208	**0.0910**	**J**	0.0211
Chrysene	mg/Kg	**0.575**		0.0134	**0.510**		0.0136
Dibenz(a,h)anthracene	mg/Kg	ND		0.0104	ND		0.0105
Fluoranthene	mg/Kg	**1.10**		0.0134	**0.975**		0.0136
Fluorene	mg/Kg	**13.3**		0.356	**8.24**		0.362
Indeno[1,2,3-cd]pyrene	mg/Kg	**0.101**		0.0149	**0.0793**	**J**	0.0151
Naphthalene	mg/Kg	**7.73**		0.267	**5.16**		0.0136
Phenanthrene	mg/Kg	**33.0**		0.267	**21.0**		0.271
Pyrene	mg/Kg	**3.31**		0.0178	**2.64**		0.0181
North West - Total Petroleum Hydrocarbon Diesel (NW-TPH Diesel)							
C10-C24	mg/Kg	**18,700**		293	**9,580**		300
C24-C40	mg/Kg	**599**		29.3	**372**		30.0
Pentachlorophenol 8151A							
Pentachlorophenol	mg/Kg	**20.2**		3.21	**20.1**		6.52

Notes:
mg/Kg = milligram per kilogram
MDL = Method Detect Limit
J = Results is less than the Reporting Limit but greater than or equal to the Method Detection Limit and the concentration is an approximate value

The results of the analytical testing of the spiked ISS North Composite showed increases in concentrations of COCs. Pentachlorophenol concentration increased from 2.17 mg/kg to approximately 20 mg/kg, and the NW-TPH Diesel concentrations also increased with the concentration in the C10-C24 range rising from 859 mg/kg to 18,700 mg/kg and the C24-C40 range from 35.7 mg/kg to 599 mg/kg.

3.0 STABILIZATION EVALUATIONS

After reviewing the physical and chemical characterization of the untreated material and spiked material, CRETE and KEMRON decided to use the following reagents to formulate mixture designs:

REAGENT	SUPPLIER
Type I Portland Cement	Lafarge North America, Inc., Seattle, WA
Type II/V Portland Cement	LeHigh Cement Company, Redding, CA
Ground Granulated Blast Furnace Slag (GGBFS) Grade 100	Lafarge North America, Inc., Seattle, WA
Hydrogel Bentonite	Wyo-Ben, Inc., Billings, MT
Centralia Class F Fly Ash	LaFarge North America, Inc.
Lime Kiln Dust	LeHigh Cement Company, Tacoma, WA
City Water	City of Atlanta

3.1 Preliminary Screening Evaluations

KEMRON prepared a total of 18 mixtures in the first round of the preliminary screening phase of the study. The mixture design sheets are located in **Appendix D**. The mixture designs are summarized in **Table 4** below. These mixtures included nine (9) mixture designs for the ISS South Composite material and nine (9) for the ISS North Composite material.

The reagent blends were added to the untreated material as a pumpable slurry. In mixtures where bentonite was included, the bentonite was hydrated with a portion of the water used in the mixture development overnight before blending with the other reagent materials and subsequent mixing with the untreated material. The reagent additions were calculated on a by-weight basis according to the quantity of untreated material utilized. The water used in each mixture was based on the total weight of the reagents utilized in the mixture. For example in a mixture with 7.5 percent (%) Portland cement, and 7.5% GGBF Slag with a 75% water addition, for every 100g of untreated material, 7.5 grams (g) of Portland cement was blended with 7.5g of GGBF Slag and then slurried with 11.25g of water and mixed with the untreated material. For mixtures involving bentonite, the water used to hydrated the bentonite overnight is included in the water addition rate reported in the **Table 4.**

All mixtures were prepared using a bench-scale Hobart-type mixer. The mixer has a 4½ quart stainless steel mixing bowl and “flat beater” type paddles. Treatment utilizing this mixer is intended to simulate potential full-scale remediation options, to the closest extent possible on the bench-scale. This approach is routinely utilized to simulate a wide range of potential full-scale remediation approaches, including both in-situ and ex-situ applications. Mixtures were prepared by placing an aliquot of the untreated material into the mixing chamber. The appropriate reagents were then added as a slurry to the untreated material, while mixing. All reagents (including water) were added on a by-weight basis. Each mixture was blended for a period of approximately 60 to 90 seconds at a rate of approximately 60 revolutions per minute (rpm).

The following is a summary of treated material curing techniques, testing performed on the treated samples, and brief descriptions of the protocols utilized for the stabilization evaluations:

- The 18 mixtures were poured into cylindrical curing molds. Each sample mold was firmly tapped on a hard surface to remove any air bubbles, and allowed to cure at ambient temperature (68 ˚F to 72 ˚F) in moisture-sealed containers.

- Pocket penetrometer testing was performed by KEMRON on the mixtures at cure times including 1, 3, and 5 days. Approximately 100 grams of each treated material was placed into a small plastic cup then cured and tested at the above intervals to evaluate the potential setting characteristics. Results of the pocket penetrometer testing are noted individually on each of the mixture design sheets provided in **Appendix D**, and are summarized on **Table 4** below.

- After 7 days of curing, KEMRON tested the unconfined compressive strength (UCS) of each of the 18 mixtures. UCS testing was performed in accordance with ASTM Method D1633 by first removing each cured sample specimen from its cylindrical mold. The weight and physical dimensions of the sample were recorded on the appropriate data sheet, and the specimen was placed on a UCS load frame and compressed at a rate of 1% strain per minute until the sample failed or 15% strain had been achieved. Throughout the testing, KEMRON documented the load at specific strain values. A representative aliquot of the post-test specimen was then subjected to moisture content testing. UCS test results are presented on **Table 4**, and the data sheets are provided in **Appendix E**.

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TABLE 4

PRELIMINARY SCREENING EVALUATIONS
Mixture Designs, Pocket Penetrometer and Unconfined Compressive Strength

KEMRON Sample Number	Untreated Material Type	Reagent Type and Identification Number(s)	Reagent Addition % by Wet Soil wt.	Water Addition % by Reagent wt.	Pocket Penotrometer (TSF)			Cure Day	Unconfined Compressive Strength ASTM D2166			
					1 Day	3 Day	5 Day		Moisture Content (%)	Bulk Density (lb/ft^3)	Dry Density (lb/ft^3)	UCS (lb/in^2)
0600-001	ISS South Composite	Richmond Type I PC #1047/NewCem GGBFS 100 #1049	5.25/2.25	80.0	2.00	3.75	4.25	7	61.66	97.3	60.2	17.5
0600-002	ISS South Composite	Richmond Type I PC #1047/NewCem GGBFS 100 #1049	7.00/3.00	80.0	2.25	4.50	>4.50	7	63.91	98.3	60.0	24.6
0600-003	ISS South Composite	Richmond Type I PC #1047/NewCem GGBFS 100 #1049	4.00/8.00	80.0	2.50	3.75	>4.50	7	64.81	96.8	58.7	28.0
0600-004	ISS South Composite	Richmond Type I PC #1047/Centralia Class F Fly Ash #1048	6.00/1.50	80.0	2.75	3.00	3.75	7	65.27	97.2	58.8	15.4
0600-005	ISS South Composite	Richmond Type I PC #1047/Centralia Class F Fly Ash #1048	8.00/2.00	80.0	2.50	>4.50	>4.50	7	64.52	98.2	59.7	22.2
0600-006	ISS South Composite	Richmond Type I PC #1047/Centralia Class F Fly Ash #1048	4.00/10.00	80.0	1.00	1.75	2.00	7	61.42	102.1	63.2	9.2
0600-007	ISS South Composite	Richmond Type I PC #1047/Tacoma LKD #919	4.00/10.00	80.0	0.00	0.75	1.25	7	58.93	100.0	62.9	7.2
0600-008	ISS South Composite	LeHigh Type II/V PC #1042/NewCem GGBFS #1049	4.00/8.00	80.0	1.75	3.75	>4.50	7	62.87	97.2	59.7	31.5
0600-009	ISS South Composite	Richmond Type I PC #1047/NewCem GGBFS 100 #1049/Wyo-Ben Hydrogel Bentonite #807	5.25/2.25/1.00	125.0	0.50	1.50	2.00	7	75.58	92.5	52.7	11.2
0600-010	ISS North Composite	Richmond Type I PC #1047/NewCem GGBFS 100 #1049	5.25/2.25	80.0	1.50	3.00	4.25	7	43.47	107.2	74.7	20.0
0600-011	ISS North Composite	Richmond Type I PC #1047/NewCem GGBFS 100 #1049	7.00/3.00	80.0	2.00	4.50	>4.50	7	46.18	105.4	72.1	29.8
0600-012	ISS North Composite	Richmond Type I PC #1047/NewCem GGBFS 100 #1049	4.00/8.00	80.0	0.25	2.75	4.00	7	44.64	105.1	72.7	21.4
0600-013	ISS North Composite	Richmond Type I PC #1047/Centralia Class F Fly Ash #1048	6.00/1.50	80.0	1.50	2.00	3.25	7	44.04	106.1	73.7	19.2
0600-014	ISS North Composite	Richmond Type I PC #1047/Centralia Class F Fly Ash #1048	8.00/2.00	80.0	2.50	>4.5	>4.50	7	45.31	105.8	72.8	30.2
0600-015	ISS North Composite	Richmond Type I PC #1047/Centralia Class F Fly Ash #1048	4.00/10.00	80.0	0.00	0.75	1.25	7	47.14	106.1	72.1	8.7
0600-016	ISS North Composite	Richmond Type I PC #1047/Tacoma LKD #919	4.00/10.00	80.0	0.00	0.00	0.00	7	46.07	107.8	73.8	3.9
0600-017	ISS North Composite	LeHigh Type II/V PC #1042/NewCem GGBFS #1049	4.00/8.00	80.0	1.00	2.75	>4.50	7	42.18	106.3	74.8	27.1
0600-018	ISS North Composite	Richmond Type I PC #1047/NewCem GGBFS 100 #1049/Wyo-Ben Hydrogel Bentonite #807	5.25/2.25/1.00	125.0	0.25	2.75	3.25	7	49.15	103.3	69.3	19.1

Notes:
% = Percent
lb/ft^3 = pounds per cubic foot
lb/in^2 = pounds per square inch
UCS = Unconfined Compressive Strength
TSF = Tons per square foot
Wt= Weight
GGBFS = Grangulated Ground Blast Furnace Slag
PC = Portland Cement
LKD = Lime Kiln Dust

Review of the test data presented in **Table 4** indicates that of the nine mixtures using the untreated ISS South Composite material, seven of the mixtures achieved pocket penetrometer strength gains in excess of 3.0 tons per square foot (tsf) and eight of the nine mixtures developed using the untreated ISS North Composite material achieved pocket penetrometer strength gains in excess of 3.0 tsf after 5 days of curing.

The results of the 7-day UCS tests indicate that the treated materials exhibited UCS values ranging from 3.9 pounds per square inch (psi) to 31.5 psi. The results indicate that the mixtures developed using Class F Fly Ash and Lime Kiln Dust at an addition rates of 10% combined with a 4% Portland cement addition exhibited the lowest strength values. Mixtures including Wyoming Bentonite showed some decrease in strength compared with the same mixtures without the use of bentonite. This strength decrease was more significant in the treatment of the ISS South Composite than the Spiked ISS North Composite.

3.2 Advanced Screening Evaluations

After review of the results of the Preliminary Screening Evaluations, it was determined that an additional 10 mixtures would be developed using ISS South Composite and ISS North Composite for a second round of screening evaluations. These mixture designs were also provided by CRETE based on recommendations from KEMRON. The mixture design sheets are located in **Appendix F**. The mixture designs are summarized in **Table 5** below.

The reagent blends were added to the untreated material using the previously outlined protocol in the preliminary screening evaluations. The following is a summary of treated material curing techniques, testing performed on the treated samples, and brief descriptions of the protocols utilized for the stabilization evaluations:

- The 10 mixtures were poured into cylindrical curing molds and allowed to cure at ambient temperature (68 ˚F to 72 ˚F) in moisture-sealed containers.

- Pocket penetrometer testing was performed by KEMRON on the mixtures following cure times of 1, 3, 5, 7, 14 and 28 days. Approximately 100 grams of each treated material was put into a small plastic cup then cured and tested at the above intervals to evaluate the potential setting characteristics. Results of the pocket penetrometer testing are noted individually on each of the mixture design sheets provided in **Appendix F**, and are summarized on **Table 5** below.

- After 7 and 28 days of curing, KEMRON tested the unconfined compressive strength (UCS) of each of the 10 mixtures. UCS testing was performed in accordance with ASTM Method D1633 by first removing each cured sample specimen from its cylindrical mold. The weight and physical dimensions of the sample were recorded on the appropriate data sheet. The specimen was then placed on the load frame and compressed at a rate of 1% strain per minute until the sample failed or 15% strain had been achieved. Throughout the testing, KEMRON documented the load at specific strain values. A representative aliquot of the post-test specimen was then subjected to moisture content testing. UCS test results are presented on **Table 5**, and the data sheets are provided in **Appendix G**.

- Hydraulic Conductivity testing was conducted on 6 of the 10 mixtures selected by CRETE after 28 days of curing, in accordance with ASTM D5084. The mixtures were removed from the curing molds, and the weights and physical dimensions of the samples were recorded on the appropriate data sheets. The permeameter was assembled, and the samples were saturated to a minimum value of 95%, and then consolidated using a standard 10-psi confining pressure. Water was then passed through the samples, and the Hydraulic Conductivity was determined. Hydraulic Conductivity test results are presented on **Table 5** below, and the data sheets are provided in **Appendix G**.

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TABLE 5

ADVANCED SCREENING EVALUATIONS
Mixture Designs, Pocket Penetrometer, Unconfined Compressive Strength, and Hydraulic Conductivity

KEMRON Sample Number	Untreated Material Type	Reagent Type and Identification Number(s)	Reagent Addition % by Wet Soil wt.	Water Addition % by Reagent wt.	Pocket Penotrometer (TSF)						Cure Day	Unconfined Compressive Strength ASTM D2166				Hydraulic Conductivity ASTM D5084			
					1 Day	3 Day	5 Day	7 Day	14 Day	28 Day		Moisture Content (%)	Bulk Density (lb/ft^3)	Dry Density (lb/ft^3)	UCS (lb/in^2)	Moisture Content (%)	Bulk Density (lb/ft^3)	Dry Density (lb/ft^3)	K (cm/sec)
0600-019	ISS South Composite	Richmond Type I PC #1047/NewCem GGBFS 100 #1049	4.00/8.00	80.0	1.50	>4.50	>4.50	>4.50	>4.50	>4.50	7	66.75	95.9	57.5	32.9				
											28	61.72	96.6	59.7	61.0	60.3	98	61.3	2.4E-07
0600-020	ISS South Composite	Richmond Type I PC #1047/NewCem GGBFS 100 #1049/Wyo-Ben Hydrogel Bentonite #807	5.00/10.00/1.00	100.0	1.00	>4.50	>4.50	>4.50	>4.50	>4.50	7	67.04	94.5	56.6	43.8				
											28	64.94	95.4	57.9	80.1	62.7	96	59.0	1.5E-08
0600-021	ISS South Composite	Richmond Type I PC #1047/NewCem GGBFS 100 #1049	6.00/6.00	80.0	2.00	4.50	>4.50	>4.50	>4.50	>4.50	7	60.07	96.3	60.1	34.5				
											28	57.77	97.6	61.8	73.2				
0600-022	ISS South Composite	Richmond Type I PC #1047/NewCem GGBFS 100 #1049/Wyo-Ben Hydrogel Bentonite #807	6.00/8.00/1.00	100.0	1.00	3.50	>4.50	>4.50	>4.50	>4.50	7	65.33	94.8	57.4	34.4				
											28	65.13	94.5	57.2	84.9	63.0	95	58.1	8.0E-08
0600-023	ISS South Composite	Richmond Type I PC #1047/NewCem GGBFS 100 #1049/Wyo-Ben Hydrogel Bentonite #807	8.00/4.00/1.00	100.0	1.75	>4.50	>4.50	>4.50	>4.50	>4.50	7	66.89	95.8	57.4	34.7				
											28	59.63	97.0	60.7	57.6				
0600-024	ISS North Composite	Richmond Type I PC #1047/NewCem GGBFS 100 #1049	4.00/8.00	80.0	0.50	3.00	>4.50	>4.50	>4.50	>4.50	7	46.01	106.8	73.2	10.7				
											28	46.60	105.5	71.9	51.5	45.0	105	72.7	1.4E-07
0600-025	ISS North Composite	Richmond Type I PC #1047/NewCem GGBFS 100 #1049/Wyo-Ben Hydrogel Bentonite #807	5.00/10.00/1.00	100.0	0.50	3.50	>4.50	>4.50	>4.50	>4.50	7	46.53	105.6	72.0	27.8				
											28	48.89	104.0	69.9	44.1				
0600-026	ISS North Composite	Richmond Type I PC #1047/NewCem GGBFS 100 #1049	6.00/6.00	80.0	0.75	4.25	>4.50	>4.50	>4.50	>4.50	7	40.35	107.5	76.6	29.2				
											28	39.76	106.3	76.0	59.9				
0600-027	ISS North Composite	Richmond Type I PC #1047/NewCem GGBFS 100 #1049/Wyo-Ben Hydrogel Bentonite #807	6.00/8.00/1.00	100.0	0.00	2.00	2.75	>4.50	>4.50	>4.50	7	48.36	104.7	70.5	15.6				
											28	47.60	103.0	69.8	79.8	59.5	101	63.1	3.5E-08
0600-028	ISS North Composite	Richmond Type I PC #1047/NewCem GGBFS 100 #1049/Wyo-Ben Hydrogel Bentonite #807	8.00/4.00/1.00	100.0	1.50	3.25	>4.50	>4.50	>4.50	>4.50	7	42.17	105.6	74.3	36.9				
											28	43.61	105.3	73.3	65.8	44.8	104	72.0	9.8E-08

Notes:
% = Percent
lb/ft^3 = pounds per cubic foot
lb/in^2 = pounds per square inch
UCS = Unconfined Compressive Strength
TSF = Tons per square foot
Wt= Weight
GGBFS = Grangulated Ground Blast Furnace Slag
PC = Portland Cement
= Testing not requested

Review of the test data presented in **Table 5** indicates that all of the treated materials achieved a penetrometer strength in excess of 4.5 tons per square foot within 7 days of curing. The results of the 7-day UCS tests indicate that only seven of the 10 mixtures met or exceeded the performance criteria of 30 psi. The results of the 28-day UCS test indicate that all of the treated materials exceeded the performance criteria of 30 psi, with UCS values ranging from 44.1 to 84.9 psi. The hydraulic conductivity testing all 6 of the candidate mixtures met the performance criteria of 1 x 10^{-5} cm/sec.

Based on the results of UCS and permeability testing CRETE selected four candidate mixtures for testing utilizing the EPA Method 1315 (LEAF) leaching procedure at the 28 day cure period. The samples were removed from their cylindrical molds and placed in a deionized-water bath in airtight polypropylene containers. The leaching procedure reported in this interim report include 2 hours, 24 hours, 48 hours,, 7 days, 14 days, and 28 days. At each interval, the sample was moved to a fresh DI water bath, and the resulting eluate was analyzed to determine pH, specific conductivity, and oxidation-reduction potential. These parameters are reported in the LEAF data sheets in Appendix H. The leachate was then sampled and shipped to Test America for laboratory analysis of total PAHs, Pentachlorophenol, and NW-TPH Diesel. The results of analytical testing are presented in **Tables 6a, 6b, 6c, and 6d** which are presented below. Complete analytical reports are included in **Appendix I** and the EPA Method 1315 (LEAF) data sheets are provided in **Appendix H**.

Review of analytical results performed up to the time of this interim report on the LEAF eluate from the four candidate mixtures indicate that mixture 0600-019 did not exhibit detectible concentrations of through the 28 day leaching interval. Naphthalene was the only PAH compound detected in the LEAF eluate from mixture 0600-022, and at concentrations below the reporting limit but above the method detection limit. Analysis of the eluate from mixtures 0600-024 and 027 exhibited several PAH compounds but at concentrations which may be considered relatively low and may meet the treatment goals for the site. The analysis for NW-TPH show that mixture 0600-022 had the lowest detectible concentrations of TPHs in the C10-24 range but no detections in the C24-C40 range. The eluate from mixture 0600-024 had the highest maximum concentration of NW-TPH in the C10-C24 range of 1,040 µg/L. The results of the Pentachlorophenol analysis show that the eluate from mixtures 0600-019 and 0600-022 exhibited the lowest leachable concentrations of the candidate mixtures subjected to LEAF testing.

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TABLE 6a

EPA METHOD 1315 ANALYTICAL RESULTS - 0600-019
SVOCs, NW-TPH Diesel, and Pentachlorophenol

Parameter	Units	0600-019 (2 hour)			0600-019 (24 hour)			0600-019 (48 hour)			0600-019 (7 day)			0600-019 (14 day)			0600-019 (28 day)			0600-019 (42 day)			0600-019 (49 day)			0600-019 (63 day)		
		Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL
Polycyclic Aromatic Hydrocarbons (PAH) 8270D																												
1-Methylnaphthalene	µg/L	ND		0.310	**1.48**	J	0.310	**1.28**	J	0.310	**3.60**		0.333	**4.45**		0.333	**3.18**		0.310									
2-Methylnaphthalene	µg/L	ND		0.345	ND		0.345	ND		0.345	**1.11**	J	0.370	**1.26**	J	0.370	**0.929**	J	0.345									
Acenaphthene	µg/L	ND		0.276	ND		0.276	ND		0.276	ND		0.296	ND		0.296	ND		0.276									
Acenaphthylene	µg/L	ND		0.302	ND		0.302	ND		0.302	ND		0.324	ND		0.324	ND		0.302									
Anthracene	µg/L	ND		0.328	ND		0.328	ND		0.328	ND		0.352	ND		0.352	ND		0.328									
Benzo[a]anthracene	µg/L	ND		0.276	ND		0.276	ND		0.276	ND		0.296	ND		0.296	ND		0.276									
Benzo[a]pyrene	µg/L	ND		0.328	ND		0.328	ND		0.328	ND		0.352	ND		0.352	ND		0.328									
Benzo[b]fluoranthene	µg/L	ND		0.310	ND		0.310	ND		0.310	ND		0.333	ND		0.333	ND		0.310									
Benzo[g,h,i]perylene	µg/L	ND		0.534	ND		0.534	ND		0.534	ND		0.574	ND		0.574	ND		0.534									
Benzo[k]fluoranthene	µg/L	ND		0.319	ND		0.319	ND		0.319	ND		0.343	ND		0.343	ND		0.319									
Chrysene	µg/L	ND		0.284	ND		0.284	ND		0.284	ND		0.306	ND		0.306	ND		0.284									
Dibenz(a,h)anthracene	µg/L	ND		0.388	ND		0.388	ND		0.388	ND		0.417	ND		0.417	ND		0.388									
Fluoranthene	µg/L	ND		0.276	ND		0.276	ND		0.276	ND		0.296	ND		0.296	ND		0.276									
Fluorene	µg/L	ND		0.276	ND		0.276	ND		0.276	ND		0.296	ND		0.296	ND		0.276									
Indeno[1,2,3-cd]pyrene	µg/L	ND		0.353	ND		0.353	ND		0.353	ND		0.380	ND		0.380	ND		0.353									
Naphthalene	µg/L	ND		0.319	ND		0.319	ND		0.319	ND		0.343	ND		0.343	ND		0.319									
Phenanthrene	µg/L	ND		0.362	ND		0.362	ND		0.362	ND		0.389	ND		0.389	ND		0.362									
Pyrene	µg/L	ND		0.302	ND		0.302	ND		0.302	ND		0.324	ND		0.324	ND		0.302									
North West - Total Petroleum Hydrocarbon Diesel (NW-TPH Diesel)																												
C10-C24	µg/L	**83.7**	J	26.4	**216**		26.4	**151**		26.4	**532**		26.2	**371**		26.2	**392**		26.2									
C24-C40	µg/L	ND		47.2	ND		47.2	ND		47.2	**51.3**	J	46.7	**49.0**	J	46.7	ND		46.7									
Pentachlorophenol 8151A																												
Pentachloropheno	µg/L	**0.412**	J	0.279	**0.755**	J	0.279	ND		0.300	**0.390**	J,p	0.279	**0.352**	J,p	0.279	**0.344**	J,p	0.279									

Notes:
µg/L = microgram per Liter
ND - Non Detect
MDL = Method Detect Limit
J = Results is less than the Reporting Limit but greater than or equal to the Method Detection Lim
and the concentration is an approximate valu
p = The %RPD between the primary and confirmation column/detector is >40%. The lower value ha
been reported

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TABLE 6b

EPA METHOD 1315 ANALYTICAL RESULTS - 0600-022
SVOCs, NW-TPH Diesel, and Pentachlorophenol

Parameter	Units	0600-022 (2 hour)			0600-022 (24 hour)			0600-022 (48 hour)			0600-022 (7 day)			0600-022 (14 day)			0600-022 (28 day)			0600-022 (42 day)			0600-022 (49 day)			0600-022 (63 day)		
		Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL
Polycyclic Aromatic Hydrocarbons (PAH) 8270D																												
1-Methylnaphthalene	µg/L	**0.318**	J	0.310	**1.12**	J	0.310	**0.908**	J	0.310	**2.73**		0.333	**3.60**		0.333	**3.45**		0.310									
2-Methylnaphthalene	µg/L	ND		0.345	**0.500**	J	0.345	ND		0.345	**0.866**	J	0.370	**1.04**	J	0.370	**0.963**	J	0.345									
Acenaphthene	µg/L	ND		0.276	ND		0.276	ND		0.276	ND		0.296	ND		0.296	ND		0.276									
Acenaphthylene	µg/L	ND		0.302	ND		0.302	ND		0.302	ND		0.324	ND		0.324	ND		0.302									
Anthracene	µg/L	ND		0.328	ND		0.328	ND		0.328	ND		0.352	ND		0.352	ND		0.328									
Benzo[a]anthracene	µg/L	ND		0.276	ND		0.276	ND		0.276	ND		0.296	ND		0.296	ND		0.276									
Benzo[a]pyrene	µg/L	ND		0.328	ND		0.328	ND		0.328	ND		0.352	ND		0.352	ND		0.328									
Benzo[b]fluoranthene	µg/L	ND		0.310	ND		0.310	ND		0.310	ND		0.333	ND		0.333	ND		0.310									
Benzo[g,h,i]perylene	µg/L	ND		0.534	ND		0.534	ND		0.534	ND		0.574	ND		0.574	ND		0.534									
Benzo[k]fluoranthene	µg/L	ND		0.319	ND		0.319	ND		0.319	ND		0.343	ND		0.343	ND		0.319									
Chrysene	µg/L	ND		0.284	ND		0.284	ND		0.284	ND		0.306	ND		0.306	ND		0.284									
Dibenz(a,h)anthracene	µg/L	ND		0.388	ND		0.388	ND		0.388	ND		0.417	ND		0.417	ND		0.388									
Fluoranthene	µg/L	ND		0.276	ND		0.276	ND		0.276	ND		0.296	ND		0.296	ND		0.276									
Fluorene	µg/L	ND		0.276	ND		0.276	ND		0.276	ND		0.296	ND		0.296	ND		0.276									
Indeno[1,2,3-cd]pyrene	µg/L	ND		0.353	ND		0.353	ND		0.353	ND		0.380	ND		0.380	ND		0.353									
Naphthalene	µg/L	ND		0.319	**0.334**	J	0.319	ND		0.319	ND		0.343	**0.353**	J	0.343	ND		0.319									
Phenanthrene	µg/L	ND		0.362	ND		0.362	ND		0.362	ND		0.389	ND		0.389	ND		0.362									
Pyrene	µg/L	ND		0.302	ND		0.302	ND		0.302	ND		0.324	ND		0.324	ND		0.302									
North West - Total Petroleum Hydrocarbon Diesel (NW-TPH Diesel)																												
C10-C24	µg/L	**44.7**	J	26.4	**182**		26.4	**89.4**	J	26.4	**387**		26.2	**290**		26.2	**450**		26.2									
C24-C40	µg/L	ND		47.2	ND		47.2	ND		47.2	ND		46.7	ND		46.7	ND		46.7									
Pentachlorophenol 8151A																												
Pentachloropheno	µg/L	**0.314**	J	0.279	**0.640**	J	0.279	ND		0.279	**0.375**	J	0.279	**0.319**	J,p	0.279	**0.291**	J,p	0.279									

Notes:
µg/L = microgram per Liter
ND - Non Detect
MDL = Method Detect Limit
J = Results is less than the Reporting Limit but greater than or equal to the Method Detection Lim
and the concentration is an approximate valu
p = The %RPD between the primary and confirmation column/detector is >40%. The lower value ha
been reported

CRETE CONSULTING INC, PC
WASHINGTON WOOD PRESERVING ISS
KEMRON Project No. SH0600

TABLE 6c

EPA METHOD 1315 ANALYTICAL RESULTS - 0600-024
SVOCs, NW-TPH Diesel, and Pentachlorophenol

Parameter	Units	0600-024 (2 hour)			0600-024 (24 hour)			0600-024 (48 hour)			0600-024 (7 day)			0600-024 (14 day)			0600-024 (28 day)			0600-024 (42 day)			0600-024 (49 day)			0600-024 (63 day)		
		Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL
Polycyclic Aromatic Hydrocarbons (PAH) 8270D																												
1-Methylnaphthalene	µg/L	**7.62**		0.310	**18.1**		0.310	**20.4**		0.310	**34.7**		0.333	**63.1**		0.333	**62.3**		0.310									
2-Methylnaphthalene	µg/L	**9.90**		0.345	**22.7**		0.345	**24.8**		0.345	**40.4**		0.370	**74.5**	E	0.370	**74.8**		0.690									
Acenaphthene	µg/L	**0.522**	J	0.276	**0.786**	J	0.276	**0.889**	J	0.276	**1.24**	J	0.296	**2.23**		0.296	**1.97**		0.276									
Acenaphthylene	µg/L	ND		0.302	ND		0.302	ND		0.302	ND		0.324	ND		0.324	ND		0.302									
Anthracene	µg/L	ND		0.328	ND		0.328	ND		0.328	ND		0.352	**0.438**	J	0.352	ND		0.328									
Benzo[a]anthracene	µg/L	ND		0.276	ND		0.276	ND		0.276	ND		0.296	ND		0.296	ND		0.276									
Benzo[a]pyrene	µg/L	ND		0.328	ND		0.328	ND		0.328	ND		0.352	ND		0.352	ND		0.328									
Benzo[b]fluoranthene	µg/L	ND		0.310	ND		0.310	ND		0.310	ND		0.333	ND		0.333	ND		0.310									
Benzo[g,h,i]perylene	µg/L	ND		0.534	ND		0.534	ND		0.534	ND		0.574	ND		0.574	ND		0.534									
Benzo[k]fluoranthene	µg/L	ND		0.319	ND		0.319	ND		0.319	ND		0.343	ND		0.343	ND		0.319									
Chrysene	µg/L	ND		0.284	ND		0.284	ND		0.284	ND		0.306	ND		0.306	ND		0.284									
Dibenz(a,h)anthracene	µg/L	ND		0.388	ND		0.388	ND		0.388	ND		0.417	ND		0.417	ND		0.388									
Fluoranthene	µg/L	ND		0.276	ND		0.276	ND		0.276	ND		0.296	ND		0.296	ND		0.276									
Fluorene	µg/L	**0.477**	J	0.276	**0.781**	J	0.276	**0.794**	J	0.276	**0.928**	J	0.296	**1.80**	J	0.296	**1.56**	J	0.276									
Indeno[1,2,3-cd]pyrene	µg/L	ND		0.353	ND		0.353	ND		0.353	ND		0.380	ND		0.380	ND		0.353									
Naphthalene	µg/L	**0.678**	J	0.319	**2.10**		0.319	**2.08**		0.319	**4.13**		0.343	**8.04**		0.343	**7.37**		0.319									
Phenanthrene	µg/L	**1.22**	J	0.362	**1.40**	J	0.362	**1.33**	J	0.362	**1.04**	J	0.389	**2.22**		0.389	**1.85**		0.362									
Pyrene	µg/L	ND		0.302	ND		0.302	ND		0.302	ND		0.324	ND		0.324	ND		0.302									
North West - Total Petroleum Hydrocarbon Diesel (NW-TPH Diesel)																												
C10-C24	µg/L	**369**		26.4	**841**		26.4	**506**		26.4	**1,040**		26.2	**976**		26.2	**947**		26.2									
C24-C40	µg/L	ND		47.2	**59.4**	J	47.2	ND		47.2	**70.1**	J	46.7	**53.8**	J	46.7	**48.6**	J	46.7									
Pentachlorophenol 8151A																												
Pentachloropheno	µg/L	**47.6**	J	14.0	**92.6**	J	14.0	**52.6**	J	14.0	**142**		14.0	**139**		14.0	**144**		14.0									

Notes:
µg/L = microgram per Liter
ND - Non Detect
MDL = Method Detect Limit
J = Results is less than the Reporting Limit but greater than or equal to the Method Detection Lim
and the concentration is an approximate valu
E = Result exceeded calibration range

CRETE CONSULTING INC, PC
WASHINGTON WOOD PRESERVING ISS
KEMRON Project No. SH0600

TABLE 6d

EPA METHOD 1315 ANALYTICAL RESULTS - 0600-027
SVOCs, NW-TPH Diesel, and Pentachlorophenol

Parameter	Units	0600-027 (2 hour)			0600-027 (24 hour)			0600-027 (48 hour)			0600-027 (7 day)			0600-027 (14 day)			0600-027 (28 day)			0600-027 (42 day)			0600-027 (49 day)			0600-027 (63 day)		
		Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL
Polycyclic Aromatic Hydrocarbons (PAH) 8270D																												
1-Methylnaphthalene	µg/L	**2.58**		0.310	**12.3**		0.310	**12.7**		0.310	**30.5**		0.333	**43.2**		0.333	**43.7**		0.310									
2-Methylnaphthalene	µg/L	**3.19**		0.345	**15.1**		0.345	**15.7**		0.345	**36.0**		0.370	**50.1**		0.370	**50.9**		0.345									
Acenaphthene	µg/L	ND		0.276	**0.549**	J	0.276	**0.591**	J	0.276	**1.08**	J	0.296	**1.63**	J	0.296	**1.57**	J	0.276									
Acenaphthylene	µg/L	ND		0.302	ND		0.302	ND		0.302	ND		0.324	ND		0.324	ND		0.302									
Anthracene	µg/L	ND		0.328	ND		0.328	ND		0.328	ND		0.352	**0.356**	J	0.352	ND		0.328									
Benzo[a]anthracene	µg/L	ND		0.276	ND		0.276	ND		0.276	ND		0.296	ND		0.296	ND		0.276									
Benzo[a]pyrene	µg/L	ND		0.328	ND		0.328	ND		0.328	ND		0.352	ND		0.352	ND		0.328									
Benzo[b]fluoranthene	µg/L	ND		0.310	ND		0.310	ND		0.310	ND		0.333	ND		0.333	ND		0.310									
Benzo[g,h,i]perylene	µg/L	ND		0.534	ND		0.534	ND		0.534	ND		0.574	ND		0.574	ND		0.534									
Benzo[k]fluoranthene	µg/L	ND		0.319	ND		0.319	ND		0.319	ND		0.343	ND		0.343	ND		0.319									
Chrysene	µg/L	ND		0.284	ND		0.284	ND		0.284	ND		0.306	ND		0.306	ND		0.284									
Dibenz(a,h)anthracene	µg/L	ND		0.388	ND		0.388	ND		0.388	ND		0.417	ND		0.417	ND		0.388									
Fluoranthene	µg/L	ND		0.276	ND		0.276	ND		0.276	ND		0.296	ND		0.296	ND		0.276									
Fluorene	µg/L	ND		0.276	**0.510**	J	0.276	**0.551**	J	0.276	**0.904**	J	0.296	**1.36**	J	0.296	**1.23**	J	0.276									
Indeno[1,2,3-cd]pyrene	µg/L	ND		0.353	ND		0.353	ND		0.353	ND		0.380	ND		0.380	ND		0.353									
Naphthalene	µg/L	ND		0.319	**1.40**	J	0.319	**1.32**	J	0.319	**3.54**		0.343	**5.03**		0.343	**4.79**		0.319									
Phenanthrene	µg/L	**0.630**	J	0.362	**0.881**	J	0.362	**1.07**	J	0.362	**1.17**	J	0.389	**1.81**	J	0.389	**1.53**	J	0.362									
Pyrene	µg/L	ND		0.302	ND		0.302	ND		0.302	ND		0.324	ND		0.324	ND		0.302									
North West - Total Petroleum Hydrocarbon Diesel (NW-TPH Diesel)																												
C10-C24	µg/L	**179**		26.4	**364**		26.4	**309**		26.4	**873**		26.2	**731**		26.2	**737**		26.2									
C24-C40	µg/L	ND		47.2	ND		47.2	ND		47.2	**62.9**	J	46.7	ND		46.7	ND		46.7									
Pentachlorophenol 8151A																												
Pentachloropheno	µg/L	**27.0**	J	5.58	**56.5**	J	14.0	**27.0**	J	6.00	**72.9**	J	14.0	**78.9**	J	14.0	**89.1**	J	14.0									

Notes:
µg/L = microgram per Liter
ND - Non Detect
MDL = Method Detect Limit
J = Results is less than the Reporting Limit but greater than or equal to the Method Detection Lim

4.0 CONCLUSIONS

KEMRON evaluated a variety of solidification/stabilization treatments recommended by CRETE Consulting, Inc. potentially capable of improving the physical properties of the study materials, and reducing leachability of contaminates of concern (TPH and pentachlorphenol). The treatments utilized various combinations of Type I Portland Cement (PC), Portland Type II/V Portland Cement blend, Ground Granulated Blast Furnace Slag (GGBFS) Grade 100, Hydrogel Bentonite, Class F Fly Ash, and Lime Kiln Dust. The stabilization study was performed in a phased approach to identify and optimize candidate treatment applications.

Untreated material characterization testing identified that the ISS North Composite material was slightly more impacted with COCs than the ISS South Composite material. However, the concentrations of the material were lower than the average concentrations at the site. Therefore, CRETE instructed KEMRON to spike the ISS North Composite material with site NAPL. Both of the composite materials were classified as silty sand (SM), but the ISS South Composite material exhibited a higher percentage of organic matter, a higher moisture content, and a higher amount of soluble sulfate.

After evaluating a preliminary screening of 18 mixture designs (9 mix designs for each of the two composite materials, KEMRON develop 10 additional mixture designs during the advanced screening phase of testing. The UCS testing results in the advanced screening phase, presented on **Table 5** show that all of the treatment mixtures exceeded the site specific treatment criteria of 30 psi at the 28 day curing interval for UCS and a Hydraulic Conductivity performance criteria of 10^{-5} cm/sec.

Based on a review of the preliminary and advance screening evaluations, CRETE selected four mixtures to evaluate leaching using EPA Method 1315 (LEAF). The LEAF procedures performed on the four candidate mixtures. KEMRON has completed the first 6 of 9 sampling intervals. The results from the remaining three intervals will be reported under a separate cover.

This report should be reviewed in its entirety including all attachments prior to making decisions concerning a remedial approach. This study is intended to suggest what will occur in the field but does not guarantee the same results.

If you have any questions concerning the data provided in this report, please do not hesitate to contact us at 404-601-6927.

Sincerely,

KEMRON Environmental Services, Inc.

Tomecia N. Riley
Chemical Engineer II

Tommy A. Jordan, P.G
Program Manager

TABLES

CRETE CONSULTING INC, PC
WASHINGTON WOOD PRESERVING ISS
KEMRON Project No. SH0600

TABLE 1

UNTREATED PHYSICAL PROPERTIES CHARACTERIZATION

Testing Parameter (1)	Test Method	Unit	Untreated Material	
			ISS South Composite	ISS North Composite
Particle Size Distribution	ASTM D422			
Gravel		%	5.2	4.5
Sand		%	77.4	70.2
Silt		%	12.1	16.3
Clay		%	5.3	9.0
Sample Description	USCS ASTM D2487		Black Silty Sand	Black Silty Sand
Sample Classification	USCS ASTM D2487		SM	SM
Loss on Ignition	ASTM D2974			
Average ASTM Moisture Content		%	64.66	39.25
Average Loss on Ignition @ 440°C		%	9.18	3.61
Material pH	EPA Method 9045	S.U.	6.44	6.26
Atterberg Limits	ASTM D4318 Method B			
Plastic Limit			NP	NP
Liquid Limit			N/A	N/A
Plasticity Index			N/A	N/A
Soluble Sulfate	ASTM C1580-15	g SO_4/ kg soil	35.43	15.65

Notes:
Sample color determined by the Munsell Soil Color Charts
%= Percent
S.U. = Standard Units
g SO_4/kg soil = grams of Sulfate per kilogram pf soil
(1) = Testing was performed on homogenized material screen through a 0.5 inch sieve
NP = Nonplastic
N/A = Not Applicable
USCS = Unified Soil Clasification System

CRETE CONSULTING INC, PC
WASHINGTON WOOD PRESERVING ISS
KEMRON Project No. SH0600

TABLE 2

UNTREATED ANALYTICAL CHARACTERIZATION
PAHs, NW-TPH Diesel, and Pentachlorophenol

Parameter	Units	ISS South Composite			ISS North Composite		
		Results	Qual.	MDL	Results	Qual.	MDL
Polycyclic Aromatic Hydrocarbons (PAH) 8270D							
Acenaphthene	mg/Kg	**0.550**		0.00998	**1.62**	**F1**	0.00998
Acenaphthylene	mg/Kg	**0.106**		0.00899	ND		0.00899
Anthracene	mg/Kg	**0.124**		0.00899	**0.342**	**F1**	0.00899
Benzo[a]anthracene	mg/Kg	ND		0.0150	**0.0878**		0.0150
Benzo[a]pyrene	mg/Kg	ND		0.0120	**0.0661**	**J**	0.0120
Benzo[b]fluoranthene	mg/Kg	**0.0450**	**J**	0.0120	**0.0693**		0.0120
Benzo[g,h,i]perylene	mg/Kg	ND		0.00899	**0.0390**	**J**	0.00899
Benzo[k]fluoranthene	mg/Kg	ND		0.0140	**0.0470**	**J**	0.0140
Chrysene	mg/Kg	ND		0.00899	**0.102**		0.00899
Dibenz(a,h)anthracene	mg/Kg	ND		0.00699	ND		0.00699
Fluoranthene	mg/Kg	**0.0658**	**J**	0.00899	**0.240**		0.00899
Fluorene	mg/Kg	**0.317**		0.0120	**1.32**	**F1**	0.0120
Indeno[1,2,3-cd]pyrene	mg/Kg	ND		0.00998	ND		0.00998
Naphthalene	mg/Kg	**0.105**		0.00899	**1.09**	**F1**	0.00899
Phenanthrene	mg/Kg	**0.597**		0.00899	**3.74**		0.0449
Pyrene	mg/Kg	**0.122**		0.0120	**0.438**		0.0120
North West - Total Petroleum Hydrocarbon Diesel (NW-TPH Diesel)							
C10-C24	mg/Kg	**452**	**B**	6.98	**859**	**B**	13.8
C24-C40	mg/Kg	**220**		9.98	**35.7**		1.98
Pentachlorophenol 8151A							
Pentachlorophenol	mg/Kg	**0.0488**		0.0217	**2.17**		1.08

Notes:
mg/Kg = milligram per kilogram
MDL = Method Detect Limit
J = Results is less than the Reporting Limit but greater than or equal to the Method Detection Limit and the concentration is an approximate value
B = Compound was found in the blank and sample
F1 = Matrix Spike (MS) and/or Matrix Spike Duplicate (MSD) Recovery is outside acceptance limits

CRETE CONSULTING INC, PC
WASHINGTON WOOD PRESERVING ISS
KEMRON Project No. SH0600

TABLE 3

SPIKED UNTREATED ANALYTICAL CHARACTERIZATION
PAHs, NW-TPH Diesel, and Pentachlorophenol

Parameter	Units	ISS North Composite			ISS North Composite (Duplicate)		
		Results	Qual.	MDL	Results	Qual.	MDL
Polycyclic Aromatic Hydrocarbons (PAH) 8270D							
Acenaphthene	mg/Kg	**14.4**		0.297	**9.38**		0.301
Acenaphthylene	mg/Kg	**1.69**		0.0134	**4.07**		0.0136
Anthracene	mg/Kg	**1.80**		0.0134	**1.30**		0.0136
Benzo[a]anthracene	mg/Kg	**0.350**		0.0223	**0.315**		0.0226
Benzo[a]pyrene	mg/Kg	**0.223**		0.0178	**0.191**		0.0181
Benzo[b]fluoranthene	mg/Kg	**0.276**		0.0178	**0.218**		0.0181
Benzo[g,h,i]perylene	mg/Kg	**0.139**		0.0134	**0.127**		0.0136
Benzo[k]fluoranthene	mg/Kg	**0.125**		0.0208	**0.0910**	**J**	0.0211
Chrysene	mg/Kg	**0.575**		0.0134	**0.510**		0.0136
Dibenz(a,h)anthracene	mg/Kg	ND		0.0104	ND		0.0105
Fluoranthene	mg/Kg	**1.10**		0.0134	**0.975**		0.0136
Fluorene	mg/Kg	**13.3**		0.356	**8.24**		0.362
Indeno[1,2,3-cd]pyrene	mg/Kg	**0.101**		0.0149	**0.0793**	**J**	0.0151
Naphthalene	mg/Kg	**7.73**		0.267	**5.16**		0.0136
Phenanthrene	mg/Kg	**33.0**		0.267	**21.0**		0.271
Pyrene	mg/Kg	**3.31**		0.0178	**2.64**		0.0181
North West - Total Petroleum Hydrocarbon Diesel (NW-TPH Diesel)							
C10-C24	mg/Kg	**18,700**		293	**9,580**		300
C24-C40	mg/Kg	**599**		29.3	**372**		30.0
Pentachlorophenol 8151A							
Pentachlorophenol	mg/Kg	**20.2**		3.21	**20.1**		6.52

Notes:
mg/Kg = milligram per kilogram
MDL = Method Detect Limit
J = Results is less than the Reporting Limit but greater than or equal to the Method Detection Limit and the concentration is an approximate value

CRETE CONSULTING INC, PC
WASHINGTON WOOD PRESERVING ISS
KEMRON Project No. SH0600

TABLE 4

PRELIMINARY SCREENING EVALUATIONS
Mixture Designs, Pocket Penetrometer and Unconfined Compressive Strength

KEMRON Sample Number	Untreated Material Type	Reagent Type and Identification Number(s)	Reagent Addition % by Wet Soil wt.	Water Addition % by Reagent wt.	Pocket Penotrometer (TSF)			Cure Day	Unconfined Compressive Strength ASTM D2166			
					1 Day	3 Day	5 Day		Moisture Content (%)	Bulk Density (lb/ft^3)	Dry Density (lb/ft^3)	UCS (lb/in^2)
0600-001	ISS South Composite	Richmond Type I PC #1047/NewCem GGBFS 100 #1049	5.25/2.25	80.0	2.00	3.75	4.25	7	61.66	97.3	60.2	17.5
0600-002	ISS South Composite	Richmond Type I PC #1047/NewCem GGBFS 100 #1049	7.00/3.00	80.0	2.25	4.50	>4.50	7	63.91	98.3	60.0	24.6
0600-003	ISS South Composite	Richmond Type I PC #1047/NewCem GGBFS 100 #1049	4.00/8.00	80.0	2.50	3.75	>4.50	7	64.81	96.8	58.7	28.0
0600-004	ISS South Composite	Richmond Type I PC #1047/Centralia Class F Fly Ash #1048	6.00/1.50	80.0	2.75	3.00	3.75	7	65.27	97.2	58.8	15.4
0600-005	ISS South Composite	Richmond Type I PC #1047/Centralia Class F Fly Ash #1048	8.00/2.00	80.0	2.50	>4.50	>4.50	7	64.52	98.2	59.7	22.2
0600-006	ISS South Composite	Richmond Type I PC #1047/Centralia Class F Fly Ash #1048	4.00/10.00	80.0	1.00	1.75	2.00	7	61.42	102.1	63.2	9.2
0600-007	ISS South Composite	Richmond Type I PC #1047/Tacoma LKD #919	4.00/10.00	80.0	0.00	0.75	1.25	7	58.93	100.0	62.9	7.2
0600-008	ISS South Composite	LeHigh Type II/V PC #1042/NewCem GGBFS #1049	4.00/8.00	80.0	1.75	3.75	>4.50	7	62.87	97.2	59.7	31.5
0600-009	ISS South Composite	Richmond Type I PC #1047/NewCem GGBFS 100 #1049/Wyo-Ben Hydrogel Bentonite #807	5.25/2.25/1.00	125.0	0.50	1.50	2.00	7	75.58	92.5	52.7	11.2
0600-010	ISS North Composite	Richmond Type I PC #1047/NewCem GGBFS 100 #1049	5.25/2.25	80.0	1.50	3.00	4.25	7	43.47	107.2	74.7	20.0
0600-011	ISS North Composite	Richmond Type I PC #1047/NewCem GGBFS 100 #1049	7.00/3.00	80.0	2.00	4.50	>4.50	7	46.18	105.4	72.1	29.8
0600-012	ISS North Composite	Richmond Type I PC #1047/NewCem GGBFS 100 #1049	4.00/8.00	80.0	0.25	2.75	4.00	7	44.64	105.1	72.7	21.4
0600-013	ISS North Composite	Richmond Type I PC #1047/Centralia Class F Fly Ash #1048	6.00/1.50	80.0	1.50	2.00	3.25	7	44.04	106.1	73.7	19.2
0600-014	ISS North Composite	Richmond Type I PC #1047/Centralia Class F Fly Ash #1048	8.00/2.00	80.0	2.50	>4.5	>4.50	7	45.31	105.8	72.8	30.2
0600-015	ISS North Composite	Richmond Type I PC #1047/Centralia Class F Fly Ash #1048	4.00/10.00	80.0	0.00	0.75	1.25	7	47.14	106.1	72.1	8.7
0600-016	ISS North Composite	Richmond Type I PC #1047/Tacoma LKD #919	4.00/10.00	80.0	0.00	0.00	0.00	7	46.07	107.8	73.8	3.9
0600-017	ISS North Composite	LeHigh Type II/V PC #1042/NewCem GGBFS #1049	4.00/8.00	80.0	1.00	2.75	>4.50	7	42.18	106.3	74.8	27.1
0600-018	ISS North Composite	Richmond Type I PC #1047/NewCem GGBFS 100 #1049/Wyo-Ben Hydrogel Bentonite #807	5.25/2.25/1.00	125.0	0.25	2.75	3.25	7	49.15	103.3	69.3	19.1

Notes:
% = Percent
lb/ft^3 = pounds per cubic foot
lb/in^2 = pounds per square inch
UCS = Unconfined Compressive Strength
TSF = Tons per square foot
Wt= Weight
GGBFS = Grangulated Ground Blast Furnace Slag
PC = Portland Cement
LKD = Lime Kiln Dust

CRETE CONSULTING INC, PC
WASHINGTON WOOD PRESERVING ISS
KEMRON Project No. SH0600

TABLE 5

ADVANCED SCREENING EVALUATIONS
Mixture Designs, Pocket Penetrometer, Unconfined Compressive Strength, and Hydraulic Conductivity

KEMRON Sample Number	Untreated Material Type	Reagent Type and Identification Number(s)	Reagent Addition % by Wet Soil wt.	Water Addition % by Reagent wt.	Pocket Penotrometer (TSF)						Cure Day	Unconfined Compressive Strength ASTM D2166				Hydraulic Conductivity ASTM D5084			
					1 Day	3 Day	5 Day	7 Day	14 Day	28 Day		Moisture Content (%)	Bulk Density (lb/ft^3)	Dry Density (lb/ft^3)	UCS (lb/in^2)	Moisture Content (%)	Bulk Density (lb/ft^3)	Dry Density (lb/ft^3)	K (cm/sec)
0600-019	ISS South Composite	Richmond Type I PC #1047/NewCem GGBFS 100 #1049	4.00/8.00	80.0	1.50	>4.50	>4.50	>4.50	>4.50	>4.50	7	66.75	95.9	57.5	32.9				
											28	61.72	96.6	59.7	61.0	60.3	98	61.3	2.4E-07
0600-020	ISS South Composite	Richmond Type I PC #1047/NewCem GGBFS 100 #1049/Wyo-Ben Hydrogel Bentonite #807	5.00/10.00/1.00	100.0	1.00	>4.50	>4.50	>4.50	>4.50	>4.50	7	67.04	94.5	56.6	43.8				
											28	64.94	95.4	57.9	80.1	62.7	96	59.0	1.5E-08
0600-021	ISS South Composite	Richmond Type I PC #1047/NewCem GGBFS 100 #1049	6.00/6.00	80.0	2.00	4.50	>4.50	>4.50	>4.50	>4.50	7	60.07	96.3	60.1	34.5				
											28	57.77	97.6	61.8	73.2				
0600-022	ISS South Composite	Richmond Type I PC #1047/NewCem GGBFS 100 #1049/Wyo-Ben Hydrogel Bentonite #807	6.00/8.00/1.00	100.0	1.00	3.50	>4.50	>4.50	>4.50	>4.50	7	65.33	94.8	57.4	34.4				
											28	65.13	94.5	57.2	84.9	63.0	95	58.1	8.0E-08
0600-023	ISS South Composite	Richmond Type I PC #1047/NewCem GGBFS 100 #1049/Wyo-Ben Hydrogel Bentonite #807	8.00/4.00/1.00	100.0	1.75	>4.50	>4.50	>4.50	>4.50	>4.50	7	66.89	95.8	57.4	34.7				
											28	59.63	97.0	60.7	57.6				
0600-024	ISS North Composite	Richmond Type I PC #1047/NewCem GGBFS 100 #1049	4.00/8.00	80.0	0.50	3.00	>4.50	>4.50	>4.50	>4.50	7	46.01	106.8	73.2	10.7				
											28	46.60	105.5	71.9	51.5	45.0	105	72.7	1.4E-07
0600-025	ISS North Composite	Richmond Type I PC #1047/NewCem GGBFS 100 #1049/Wyo-Ben Hydrogel Bentonite #807	5.00/10.00/1.00	100.0	0.50	3.50	>4.50	>4.50	>4.50	>4.50	7	46.53	105.6	72.0	27.8				
											28	48.89	104.0	69.9	44.1				
0600-026	ISS North Composite	Richmond Type I PC #1047/NewCem GGBFS 100 #1049	6.00/6.00	80.0	0.75	4.25	>4.50	>4.50	>4.50	>4.50	7	40.35	107.5	76.6	29.2				
											28	39.76	106.3	76.0	59.9				
0600-027	ISS North Composite	Richmond Type I PC #1047/NewCem GGBFS 100 #1049/Wyo-Ben Hydrogel Bentonite #807	6.00/8.00/1.00	100.0	0.00	2.00	2.75	>4.50	>4.50	>4.50	7	48.36	104.7	70.5	15.6				
											28	47.60	103.0	69.8	79.8	59.5	101	63.1	3.5E-08
0600-028	ISS North Composite	Richmond Type I PC #1047/NewCem GGBFS 100 #1049/Wyo-Ben Hydrogel Bentonite #807	8.00/4.00/1.00	100.0	1.50	3.25	>4.50	>4.50	>4.50	>4.50	7	42.17	105.6	74.3	36.9				
											28	43.61	105.3	73.3	65.8	44.8	104	72.0	9.8E-08

Notes:
% = Percent
lb/ft^3 = pounds per cubic foot
lb/in^2 = pounds per square inch
UCS = Unconfined Compressive Strength
TSF = Tons per square foot
Wt= Weight
GGBFS = Grangulated Ground Blast Furnace Slag
PC = Portland Cement
= Testing not requested

CRETE CONSULTING INC, PC
WASHINGTON WOOD PRESERVING ISS
KEMRON Project No. SH0600

TABLE 6a

EPA METHOD 1315 ANALYTICAL RESULTS - 0600-019
SVOCs, NW-TPH Diesel, and Pentachlorophenol

Parameter	Units	0600-019 (2 hour)			0600-019 (24 hour)			0600-019 (48 hour)			0600-019 (7 day)			0600-019 (14 day)			0600-019 (28 day)			0600-019 (42 day)			0600-019 (49 day)			0600-019 (63 day)		
		Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL
Polycyclic Aromatic Hydrocarbons (PAH) 8270D																												
Acenaphthene	µg/L	ND		0.276	ND		0.276	ND		0.276	ND		0.296	ND		0.296	ND		0.276									
Acenaphthylene	µg/L	ND		0.302	ND		0.302	ND		0.302	ND		0.324	ND		0.324	ND		0.302									
Anthracene	µg/L	ND		0.328	ND		0.328	ND		0.328	ND		0.352	ND		0.352	ND		0.328									
Benzo[a]anthracene	µg/L	ND		0.276	ND		0.276	ND		0.276	ND		0.296	ND		0.296	ND		0.276									
Benzo[a]pyrene	µg/L	ND		0.328	ND		0.328	ND		0.328	ND		0.352	ND		0.352	ND		0.328									
Benzo[b]fluoranthene	µg/L	ND		0.310	ND		0.310	ND		0.310	ND		0.333	ND		0.333	ND		0.310									
Benzo[g,h,i]perylene	µg/L	ND		0.534	ND		0.534	ND		0.534	ND		0.574	ND		0.574	ND		0.534									
Benzo[k]fluoranthene	µg/L	ND		0.319	ND		0.319	ND		0.319	ND		0.343	ND		0.343	ND		0.319									
Chrysene	µg/L	ND		0.284	ND		0.284	ND		0.284	ND		0.306	ND		0.306	ND		0.284									
Dibenz(a,h)anthracene	µg/L	ND		0.388	ND		0.388	ND		0.388	ND		0.417	ND		0.417	ND		0.388									
Fluoranthene	µg/L	ND		0.276	ND		0.276	ND		0.276	ND		0.296	ND		0.296	ND		0.276									
Fluorene	µg/L	ND		0.276	ND		0.276	ND		0.276	ND		0.296	ND		0.296	ND		0.276									
Indeno[1,2,3-cd]pyrene	µg/L	ND		0.353	ND		0.353	ND		0.353	ND		0.380	ND		0.380	ND		0.353									
Naphthalene	µg/L	ND		0.319	ND		0.319	ND		0.319	ND		0.343	ND		0.343	ND		0.319									
Phenanthrene	µg/L	ND		0.362	ND		0.362	ND		0.362	ND		0.389	ND		0.389	ND		0.362									
Pyrene	µg/L	ND		0.302	ND		0.302	ND		0.302	ND		0.324	ND		0.324	ND		0.302									
North West - Total Petroleum Hydrocarbon Diesel (NW-TPH Diesel)																												
C10-C24	µg/L	**83.7**	**J**	26.4	**216**		26.4	**151**		26.4	**532**		26.2	**371**		26.2	**392**		26.2									
C24-C40	µg/L	ND		47.2	ND		47.2	ND		47.2	**51.3**	**J**	46.7	**49.0**	**J**	46.7	ND		46.7									
Pentachlorophenol 8151A																												
Pentachlorophenol	µg/L	**0.412**	**J**	0.279	**0.755**	**J**	0.279	ND		0.300	**0.390**	**J,p**	0.279	**0.352**	**J,p**	0.279	**0.344**	**J,p**	0.279									

Notes:
µg/L = microgram per Liter
ND - Non Detect
MDL = Method Detect Limit
J = Results is less than the Reporting Limit but greater than or equal to the Method Detection Limit and the concentration is an approximate value
p = The %RPD between the primary and confirmation column/detector is >40%. The lower value has been reported

CRETE CONSULTING INC, PC
WASHINGTON WOOD PRESERVING ISS
KEMRON Project No. SH0600

TABLE 6b

EPA METHOD 1315 ANALYTICAL RESULTS - 0600-022
SVOCs, NW-TPH Diesel, and Pentachlorophenol

Parameter	Units	0600-022 (2 hour)			0600-022 (24 hour)			0600-022 (48 hour)			0600-022 (7 day)			0600-022 (14 day)			0600-022 (28 day)			0600-022 (42 day)			0600-022 (49 day)			0600-022 (63 day)		
		Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL
Polycyclic Aromatic Hydrocarbons (PAH) 8270D																												
Acenaphthene	µg/L	ND		0.276	ND		0.276	ND		0.276	ND		0.296	ND		0.296	ND		0.276									
Acenaphthylene	µg/L	ND		0.302	ND		0.302	ND		0.302	ND		0.324	ND		0.324	ND		0.302									
Anthracene	µg/L	ND		0.328	ND		0.328	ND		0.328	ND		0.352	ND		0.352	ND		0.328									
Benzo[a]anthracene	µg/L	ND		0.276	ND		0.276	ND		0.276	ND		0.296	ND		0.296	ND		0.276									
Benzo[a]pyrene	µg/L	ND		0.328	ND		0.328	ND		0.328	ND		0.352	ND		0.352	ND		0.328									
Benzo[b]fluoranthene	µg/L	ND		0.310	ND		0.310	ND		0.310	ND		0.333	ND		0.333	ND		0.310									
Benzo[g,h,i]perylene	µg/L	ND		0.534	ND		0.534	ND		0.534	ND		0.574	ND		0.574	ND		0.534									
Benzo[k]fluoranthene	µg/L	ND		0.319	ND		0.319	ND		0.319	ND		0.343	ND		0.343	ND		0.319									
Chrysene	µg/L	ND		0.284	ND		0.284	ND		0.284	ND		0.306	ND		0.306	ND		0.284									
Dibenz(a,h)anthracene	µg/L	ND		0.388	ND		0.388	ND		0.388	ND		0.417	ND		0.417	ND		0.388									
Fluoranthene	µg/L	ND		0.276	ND		0.276	ND		0.276	ND		0.296	ND		0.296	ND		0.276									
Fluorene	µg/L	ND		0.276	ND		0.276	ND		0.276	ND		0.296	ND		0.296	ND		0.276									
Indeno[1,2,3-cd]pyrene	µg/L	ND		0.353	ND		0.353	ND		0.353	ND		0.380	ND		0.380	ND		0.353									
Naphthalene	µg/L	ND		0.319	**0.334**	**J**	0.319	ND		0.319	ND		0.343	**0.353**	**J**	0.343	ND		0.319									
Phenanthrene	µg/L	ND		0.362	ND		0.362	ND		0.362	ND		0.389	ND		0.389	ND		0.362									
Pyrene	µg/L	ND		0.302	ND		0.302	ND		0.302	ND		0.324	ND		0.324	ND		0.302									
North West - Total Petroleum Hydrocarbon Diesel (NW-TPH Diesel)																												
C10-C24	µg/L	**44.7**	**J**	26.4	**182**		26.4	**89.4**	**J**	26.4	**387**		26.2	**290**		26.2	**450**		26.2									
C24-C40	µg/L	ND		47.2	ND		47.2	ND		47.2	ND		46.7	ND		46.7	ND		46.7									
Pentachlorophenol 8151A																												
Pentachlorophenol	µg/L	**0.314**	**J**	0.279	**0.640**	**J**	0.279	ND		0.279	**0.375**	**J**	0.279	**0.319**	**J,p**	0.279	**0.291**	**J,p**	0.279									

Notes:
µg/L = microgram per Liter
ND - Non Detect
MDL = Method Detect Limit
J = Results is less than the Reporting Limit but greater than or equal to the Method Detection Limit and the concentration is an approximate value
p = The %RPD between the primary and confirmation column/detector is >40%. The lower value has been reported

CRETE CONSULTING INC, PC
WASHINGTON WOOD PRESERVING ISS
KEMRON Project No. SH0600

TABLE 6c

EPA METHOD 1315 ANALYTICAL RESULTS - 0600-024
SVOCs, NW-TPH Diesel, and Pentachlorophenol

Parameter	Units	0600-024 (2 hour)			0600-024 (24 hour)			0600-024 (48 hour)			0600-024 (7 day)			0600-024 (14 day)			0600-024 (28 day)			0600-024 (42 day)			0600-024 (49 day)			0600-024 (63 day)		
		Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL
Polycyclic Aromatic Hydrocarbons (PAH) 8270D																												
Acenaphthene	µg/L	**0.522**	J	0.276	**0.786**	J	0.276	**0.889**	J	0.276	**1.24**	J	0.296	**2.23**		0.296	**1.97**		0.276									
Acenaphthylene	µg/L	ND		0.302	ND		0.302	ND		0.302	ND		0.324	ND		0.324	ND		0.302									
Anthracene	µg/L	ND		0.328	ND		0.328	ND		0.328	ND		0.352	**0.438**	J	0.352	ND		0.328									
Benzo[a]anthracene	µg/L	ND		0.276	ND		0.276	ND		0.276	ND		0.296	ND		0.296	ND		0.276									
Benzo[a]pyrene	µg/L	ND		0.328	ND		0.328	ND		0.328	ND		0.352	ND		0.352	ND		0.328									
Benzo[b]fluoranthene	µg/L	ND		0.310	ND		0.310	ND		0.310	ND		0.333	ND		0.333	ND		0.310									
Benzo[g,h,i]perylene	µg/L	ND		0.534	ND		0.534	ND		0.534	ND		0.574	ND		0.574	ND		0.534									
Benzo[k]fluoranthene	µg/L	ND		0.319	ND		0.319	ND		0.319	ND		0.343	ND		0.343	ND		0.319									
Chrysene	µg/L	ND		0.284	ND		0.284	ND		0.284	ND		0.306	ND		0.306	ND		0.284									
Dibenz(a,h)anthracene	µg/L	ND		0.388	ND		0.388	ND		0.388	ND		0.417	ND		0.417	ND		0.388									
Fluoranthene	µg/L	ND		0.276	ND		0.276	ND		0.276	ND		0.296	ND		0.296	ND		0.276									
Fluorene	µg/L	**0.477**	J	0.276	**0.781**	J	0.276	**0.794**	J	0.276	**0.928**	J	0.296	**1.80**	J	0.296	**1.56**	J	0.276									
Indeno[1,2,3-cd]pyrene	µg/L	ND		0.353	ND		0.353	ND		0.353	ND		0.380	ND		0.380	ND		0.353									
Naphthalene	µg/L	**0.678**	J	0.319	**2.10**		0.319	**2.08**		0.319	**4.13**		0.343	**8.04**		0.343	**7.37**		0.319									
Phenanthrene	µg/L	**1.22**	J	0.362	**1.40**	J	0.362	**1.33**	J	0.362	**1.04**	J	0.389	**2.22**		0.389	**1.85**		0.362									
Pyrene	µg/L	ND		0.302	ND		0.302	ND		0.302	ND		0.324	ND		0.324	ND		0.302									
North West - Total Petroleum Hydrocarbon Diesel (NW-TPH Diesel)																												
C10-C24	µg/L	**369**		26.4	**841**		26.4	**506**		26.4	**1,040**		26.2	**976**		26.2	**947**		26.2									
C24-C40	µg/L	ND		47.2	**59.4**	J	47.2	ND		47.2	**70.1**	J	46.7	**53.8**	J	46.7	**48.6**	J	46.7									
Pentachlorophenol 8151A																												
Pentachlorophenol	µg/L	**47.6**	J	14.0	**92.6**	J	14.0	**52.6**	J	14.0	**142**		14.0	**139**		14.0	**144**		14.0									

Notes:
µg/L = microgram per Liter
ND - Non Detect
MDL = Method Detect Limit
J = Results is less than the Reporting Limit but greater than or equal to the Method Detection Limit
and the concentration is an approximate value

CRETE CONSULTING INC, PC
WASHINGTON WOOD PRESERVING ISS
KEMRON Project No. SH0600

TABLE 6d

EPA METHOD 1315 ANALYTICAL RESULTS - 0600-027
SVOCs, NW-TPH Diesel, and Pentachlorophenol

Parameter	Units	0600-027 (2 hour)			0600-027 (24 hour)			0600-027 (48 hour)			0600-027 (7 day)			0600-027 (14 day)			0600-027 (28 day)			0600-027 (42 day)			0600-027 (49 day)			0600-027 (63 day)		
		Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL
Polycyclic Aromatic Hydrocarbons (PAH) 8270D																												
Acenaphthene	µg/L	ND		0.276	**0.549**	**J**	0.276	**0.591**	**J**	0.276	**1.08**	**J**	0.296	**1.63**	**J**	0.296	**1.57**	**J**	0.276									
Acenaphthylene	µg/L	ND		0.302	ND		0.302	ND		0.302	ND		0.324	ND		0.324	ND		0.302									
Anthracene	µg/L	ND		0.328	ND		0.328	ND		0.328	ND		0.352	**0.356**	**J**	0.352	ND		0.328									
Benzo[a]anthracene	µg/L	ND		0.276	ND		0.276	ND		0.276	ND		0.296	ND		0.296	ND		0.276									
Benzo[a]pyrene	µg/L	ND		0.328	ND		0.328	ND		0.328	ND		0.352	ND		0.352	ND		0.328									
Benzo[b]fluoranthene	µg/L	ND		0.310	ND		0.310	ND		0.310	ND		0.333	ND		0.333	ND		0.310									
Benzo[g,h,i]perylene	µg/L	ND		0.534	ND		0.534	ND		0.534	ND		0.574	ND		0.574	ND		0.534									
Benzo[k]fluoranthene	µg/L	ND		0.319	ND		0.319	ND		0.319	ND		0.343	ND		0.343	ND		0.319									
Chrysene	µg/L	ND		0.284	ND		0.284	ND		0.284	ND		0.306	ND		0.306	ND		0.284									
Dibenz(a,h)anthracene	µg/L	ND		0.388	ND		0.388	ND		0.388	ND		0.417	ND		0.417	ND		0.388									
Fluoranthene	µg/L	ND		0.276	ND		0.276	ND		0.276	ND		0.296	ND		0.296	ND		0.276									
Fluorene	µg/L	ND		0.276	**0.510**	**J**	0.276	**0.551**	**J**	0.276	**0.904**	**J**	0.296	**1.36**	**J**	0.296	**1.23**	**J**	0.276									
Indeno[1,2,3-cd]pyrene	µg/L	ND		0.353	ND		0.353	ND		0.353	ND		0.380	ND		0.380	ND		0.353									
Naphthalene	µg/L	ND		0.319	**1.40**	**J**	0.319	**1.32**	**J**	0.319	**3.54**		0.343	**5.03**		0.343	**4.79**		0.319									
Phenanthrene	µg/L	**0.630**	**J**	0.362	**0.881**	**J**	0.362	**1.07**	**J**	0.362	**1.17**	**J**	0.389	**1.81**	**J**	0.389	**1.53**	**J**	0.362									
Pyrene	µg/L	ND		0.302	ND		0.302	ND		0.302	ND		0.324	ND		0.324	ND		0.302									
North West - Total Petroleum Hydrocarbon Diesel (NW-TPH Diesel)																												
C10-C24	µg/L	**179**		26.4	**364**		26.4	**309**		26.4	**873**		26.2	**731**		26.2	**737**		26.2									
C24-C40	µg/L	ND		47.2	ND		47.2	ND		47.2	**62.9**	**J**	46.7	ND		46.7	ND		46.7									
Pentachlorophenol 8151A																												
Pentachlorophenol	µg/L	**27.0**	**J**	5.58	**56.5**	**J**	14.0	**27.0**	**J**	6.00	**72.9**	**J**	14.0	**78.9**	**J**	14.0	**89.1**	**J**	14.0									

Notes:
µg/L = microgram per Liter
ND - Non Detect
MDL = Method Detect Limit
J = Results is less than the Reporting Limit but greater than or equal to the Method Detection Limit

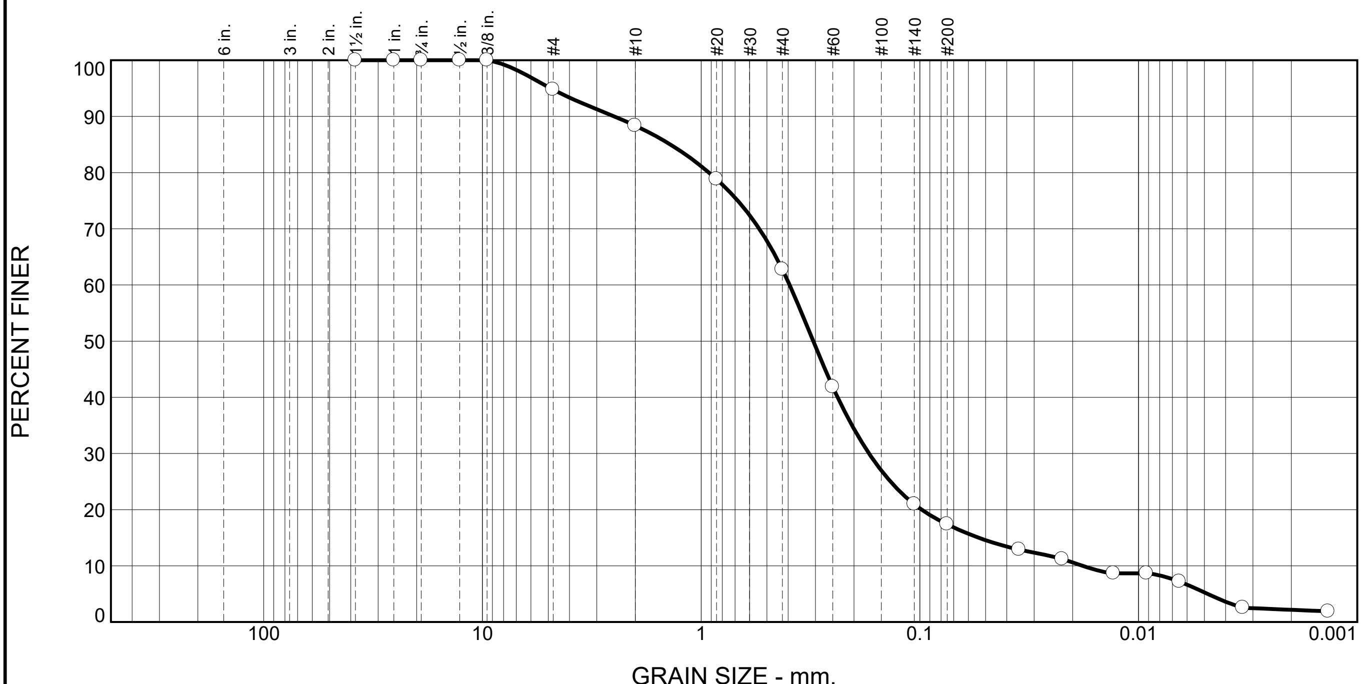
APPENDIX A

UNTREATED PHYSICAL PROPERTIES

CHARACTERIZATION

DATA SHEETS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	5.2	6.5	25.5	45.4	12.1	5.3

TEST RESULTS (ASTM D 422)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.5	100.0		
1.0	100.0		
0.75	100.0		
0.5	100.0		
0.375	100.0		
#4	94.8		
#10	88.3		
#20	78.8		
#40	62.8		
#60	41.9		
#140	21.0		
#200	17.4		
0.0351 mm.	12.9		
0.0223 mm.	11.2		
0.0130 mm.	8.7		
0.0092 mm.	8.7		
0.0065 mm.	7.2		
0.0033 mm.	2.5		
0.0014 mm.	1.9		

* (no specification provided)

Material Description

Black silty sand

Atterberg Limits (ASTM D 4318)

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

Classification

USCS (D 2487)= SM **AASHTO (M 145)=**

Coefficients

D_{90}= 2.4987 D_{85}= 1.3828 D_{60}= 0.3938
D_{50}= 0.3069 D_{30}= 0.1707 D_{15}= 0.0538
D_{10}= 0.0180 C_u= 21.91 C_c= 4.12

Remarks

Date Received: 1/8/16 **Date Tested:** 1/13/16
Tested By: LC
Checked By: TAJ
Title: Program Manager

Sample Number: ISS South Composite **Date Sampled:**

KEMRON Environmental Services Inc.
Atlanta, Georgia

Client: Crete Environmental
Project: Washington Wood Preserving ISS
Project No: SH0600 **Figure** A635_GR

LOSS ON IGNITION
(ORGANIC CONTENT)
ASTM D2974

PROJECT:	Washington Wood Preserving
PROJECT No.:	SH0600
SAMPLE No.:	ISS South Composite
TESTING DATE:	1/27/16
TESTED BY:	TNB
TRACKING CODE:	A635_LI

MOISTURE CONTENT / LOSS ON IGNITION

1. MOISTURE TIN NO.	A		B		C	
2. WT MOISTURE TIN (tare weight)	61.996	g	61.718	g	63.893	g
3. WT WET SOIL + TARE	113.200	g	111.605	g	114.084	g
4. WT DRY SOIL + TARE	92.631	g	92.827	g	94.042	g
5. WT WATER, Ww	20.569	g	18.778	g	20.042	g
6. WT DRY SOIL, Ws	30.635	g	31.108	g	30.149	g
7. WT FINAL SOIL + TARE	89.787	g	90.186	g	91.101	g
8. WT FINAL SOIL, Wf	27.791	g	28.467	g	27.208	g
9. WT ORGANICS, Wo	2.844	g	2.641	g	2.941	g
10. MOISTURE CONTENT(ASTM)	67.14	%	60.36	%	66.48	%
11. LOSS ON IGNITION	9.28	%	8.49	%	9.76	%
12. AVERAGE MOISTURE CONTENT	64.66	%				
13. AVERAGE LOSS ON IGNITION	9.18	%				

MATERIAL pH

EPA METHOD 9045
DATA SHEET

PROJECT:	Washington Wood Preserving ISS
PROJECT No.:	SH0600
TESTING DATE:	1/13/2016
TESTED BY:	TNB
TRACKING CODE:	A635_PH

KEMRON SAMPLE No.	MATERIAL pH
1. ISS South Composite (A)	6.70
2. ISS South Composite (B)	6.48
3. ISS South Composite (C)	6.14
4.	
5.	
6.	
7.	
8.	
9.	
10.	
AVERAGE:	6.44

WATER-SOLUBLE SULFATE IN SOIL
REPORT FORM
By ASTM C1580

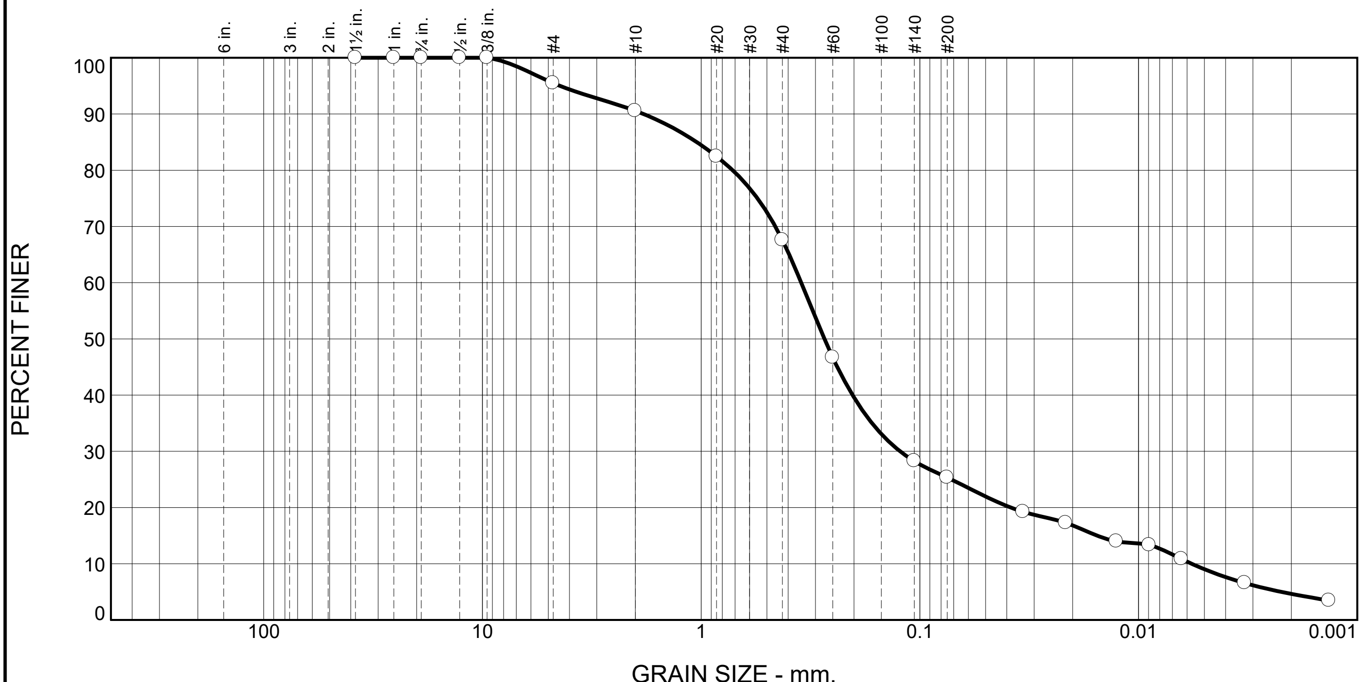
PROJECT:	Washington Wood Preserving ISS
PROJECT No.:	SH0600
SAMPLE No.:	ISS South Composite
TESTING DATE:	1/22/2016
TESTED BY:	TNB/LC
TRACKING CODE:	A635

SOLUBLE SULFATE TESTING

Test Parameters	Units	ISS South Composite				ISS South Composite Dup			
		A1	A2	B1	B2	A1	A2	B1	B2
Absorbance		0.160	0.316	0.066	0.035	0.099	0.352	0.044	0.055
SO4 concentration (calibration curve), M	mg/L	25.40	50.16	10.48	5.56	15.71	55.87	6.98	8.73
Mass of soil sample, W	g	30.0	30.0	3.0	3.0	30.0	30.0	3.0	3.0
Volume of Aliqout specimen, A/B	ml	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0
Percent of SO4 in dried soil, P	%	0.212	0.209	0.873	0.231	0.131	0.233	0.582	0.364
Average of valid results, P	%	0.381				0.327			
Souble Sulfate	g SO4/kg soil	38.13				32.74			
					Average Soluble Sulafate	**g SO4/kg soil**	**35.43**		

W:\atg\Projects\SH0600 Crete Wood Preserving ISS\Data Sheets\A635_Soluble Sulfate

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	4.5	4.9	23.0	42.3	16.3	9.0

TEST RESULTS (ASTM D 422)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.5	100.0		
1.0	100.0		
0.75	100.0		
0.5	100.0		
0.375	100.0		
#4	95.5		
#10	90.6		
#20	82.4		
#40	67.6		
#60	46.7		
#140	28.3		
#200	25.3		
0.0337 mm.	19.2		
0.0215 mm.	17.3		
0.0126 mm.	14.0		
0.0089 mm.	13.3		
0.0064 mm.	10.8		
0.0033 mm.	6.6		
0.0013 mm.	3.5		

* (no specification provided)

Material Description

Black silty sand

Atterberg Limits (ASTM D 4318)

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

Classification

USCS (D 2487)= SM **AASHTO (M 145)=**

Coefficients

D_{90}= 1.8333 D_{85}= 1.0473 D_{60}= 0.3484
D_{50}= 0.2729 D_{30}= 0.1230 D_{15}= 0.0154
D_{10}= 0.0057 C_u= 61.02 C_c= 7.61

Remarks

Date Received: 1/8/16 **Date Tested:** 1/13/16
Tested By: LC
Checked By: TAJ
Title: Program Manager

Sample Number: ISS North Composite **Date Sampled:**

KEMRON Environmental Services Inc.
Atlanta, Georgia

Client: Crete Environmental
Project: Washington Wood Preserving ISS
Project No: SH0600 **Figure** A636_GR

LOSS ON IGNITION
(ORGANIC CONTENT)
ASTM D2974

PROJECT:	Washington Wood Preserving
PROJECT No.:	SH0600
SAMPLE No.:	ISS North Composite
TESTING DATE:	1/27/16
TESTED BY:	TNB
TRACKING CODE:	A636_LI

MOISTURE CONTENT / LOSS ON IGNITION						
1. MOISTURE TIN NO.	A		B		C	
2. WT MOISTURE TIN (tare weight)	65.644	g	65.330	g	63.330	g
3. WT WET SOIL + TARE	115.776	g	118.804	g	115.284	g
4. WT DRY SOIL + TARE	101.589	g	103.838	g	100.598	g
5. WT WATER, Ww	14.187	g	14.966	g	14.686	g
6. WT DRY SOIL, Ws	35.945	g	38.508	g	37.268	g
7. WT FINAL SOIL + TARE	100.305	g	102.458	g	99.229	g
8. WT FINAL SOIL, Wf	34.661	g	37.128	g	35.899	g
9. WT ORGANICS, Wo	1.284	g	1.380	g	1.369	g
10. MOISTURE CONTENT(ASTM)	39.47	%	38.87	%	39.41	%
11. LOSS ON IGNITION	3.57	%	3.58	%	3.67	%
12. AVERAGE MOISTURE CONTENT	39.25	%				
13. AVERAGE LOSS ON IGNITION	3.61	%				

MATERIAL pH

EPA METHOD 9045
DATA SHEET

PROJECT:	Washington Wood Preserving ISS
PROJECT No.:	SH0600
TESTING DATE:	1/13/2016
TESTED BY:	TNB
TRACKING CODE:	A636_PH

KEMRON SAMPLE No.	MATERIAL pH
1. ISS North Composite (A)	5.78
2. ISS North Composite (B)	6.51
3. ISS North Composite (C)	6.48
4.	
5.	
6.	
7.	
8.	
9.	
10.	
AVERAGE:	6.26

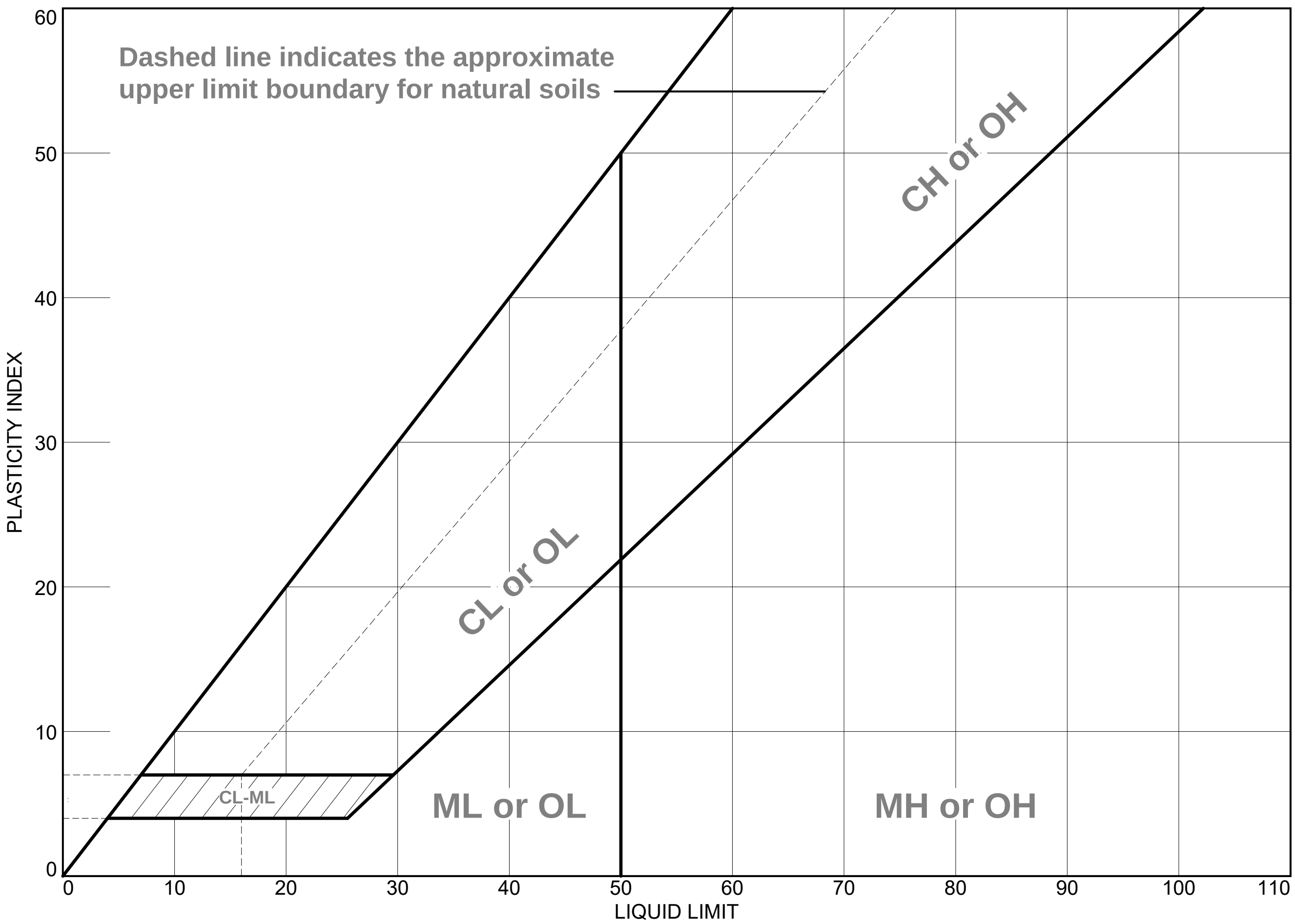
WATER-SOLUBLE SULFATE IN SOIL
REPORT FORM
By ASTM C1580

PROJECT:	Washington Wood Preserving ISS
PROJECT No.:	SH0600
SAMPLE No.:	ISS North Composite
TESTING DATE:	1/25/2016
TESTED BY:	TNB/LC
TRACKING CODE:	A636

SOLUBLE SULFATE TESTING

Test Parameters	Units	ISS North Composite				ISS North Composite Dup			
		A1	A2	B1	B2	A1	A2	B1	B2
Absorbance		0.093	0.154	0.042	0.009	0.054	0.105	0.010	0.021
SO4 concentration (calibration curve), M	mg/L	14.76	24.44	6.67	1.43	8.57	16.67	1.59	3.33
Mass of soil sample, W	g	30.0	30.0	3.0	3.0	30.0	30.0	3.0	3.0
Volume of Aliqout specimen, A/B	ml	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0
Percent of SO4 in dried soil, P	%	0.123	0.102	0.556	0.060	0.071	0.069	0.132	0.139
Average of valid results, P	%	0.210				0.103			
Souble Sulfate	g SO4/kg soil	21.00				10.30			
					Average Soluble Sulafate	**g SO4/kg soil**	**15.65**		

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Black silty sand		NP		62.8	17.4	SM
■	Black silty sand		NP		67.6	25.3	SM

Project No. SH0600 **Client:** Crete Environmental

Project: Washington Wood Preserving ISS

●**Sample Number:** ISS South Composite

■**Sample Number:** ISS North Composite

Remarks:

KEMRON Environmental Services Inc.

Atlanta, Georgia

Figure

APPENDIX B

UNTREATED ANALYTICAL CHARACTERIZATION REPORT

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Nashville
2960 Foster Creighton Drive
Nashville, TN 37204
Tel: (615)726-0177

TestAmerica Job ID: 490-95693-1
Client Project/Site: Washington Wood Preserving ISS

For:
Kemron Environmental Services, Inc.
1359A Ellsworth Industrial Blvd.
Atlanta, Georgia 30318

Attn: Mr. Tommy Jordan

Heather Baker

Authorized for release by:
1/28/2016 2:05:23 PM

Heather Baker, Project Manager I
(615)301-5043
heather.baker@testamericainc.com

The test results in this report meet all 2003 NELAC and 2009 TNI requirements for accredited parameters, exceptions are noted in this report. This report may not be reproduced except in full, and with written approval from the laboratory. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

Table of Contents

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
490-95693-1	ISS North Composite	Solid	01/13/16 12:00	01/15/16 09:06
490-95693-2	ISS South Composite	Solid	01/13/16 13:30	01/15/16 09:06

Case Narrative

Client: Kemron Environmental Services, Inc.
Project/Site: Washington Wood Preserving ISS

TestAmerica Job ID: 490-95693-1

Job ID: 490-95693-1

Laboratory: TestAmerica Nashville

Narrative

Job Narrative
490-95693-1

Comments
No additional comments.

Receipt
The samples were received on 1/15/2016 9:06 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 1.1º C.

GC/MS Semi VOA
Method 8270D: The matrix spike / matrix spike duplicate (MS/MSD) recoveries for preparation batch 490-313505 and analytical batch 490-313651 were outside control limits. Sample matrix interference and/or non-homogeneity are suspected because the associated laboratory control sample (LCS) recovery was within acceptance limits.

Method 8270D: The following sample was diluted due to the nature of the sample matrix: ISS North Composite (490-95693-1). Elevated reporting limits (RLs) are provided.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

GC Semi VOA
Method 8151A: Insufficient sample volume was available to perform a matrix spike/matrix spike duplicate (MS/MSD) associated with preparation batch 490-314611 and analytical batch 490-315175.

Method 8151A: Surrogate recovery for the following sample was outside control limits: ISS North Composite (490-95693-1). Evidence of matrix interference is present; therefore, re-extraction and/or re-analysis was not performed.

Method NWTPH-Dx: The following samples were diluted due to the nature of the sample matrix: ISS North Composite (490-95693-1), ISS South Composite (490-95693-2) and (490-95693-A-2-E DU). Elevated reporting limits (RLs) are provided.

Method NWTPH-Dx: The following sample contained a hydrocarbon pattern for analyte C24-C40 which does not match a typical Total Petroleum Hydrocarbon (TPH) pattern used by the laboratory for quantitative purposes: ISS North Composite (490-95693-1).

Method NWTPH-Dx: The following samples contained a hydrocarbon pattern that most closely resembles the Diesel Fuel #2 and Motor oil products used by the laboratory for quantitative purposes: ISS South Composite (490-95693-2) and (490-95693-A-2-E DU).

Method NWTPH-Dx: The following sample contained a hydrocarbon pattern for analyte C10-C24 that most closely resembles a Diesel product used by the laboratory for quantitative purposes: ISS North Composite (490-95693-1).

Method NWTPH-Dx: The method blank for preparation batch 490-313582 and analytical batch 490-313591 contained C10-C24 above the method detection limit. This target analyte concentration was less than half the reporting limit (RL); therefore, re-extraction and re-analysis of samples was not performed. Also, all associated sample results were greater than 10x the MB result.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Organic Prep
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Client: Kemron Environmental Services, Inc.
Project/Site: Washington Wood Preserving ISS

TestAmerica Job ID: 490-95693-1

Qualifiers

GC/MS Semi VOA

Qualifier	Qualifier Description
F1	MS and/or MSD Recovery is outside acceptance limits.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
E	Result exceeded calibration range.

GC Semi VOA

Qualifier	Qualifier Description
X	Surrogate is outside control limits
B	Compound was found in the blank and sample.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Client: Kemron Environmental Services, Inc. | TestAmerica Job ID: 490-95693-1

Project/Site: Washington Wood Preserving ISS

Client Sample ID: ISS North Composite

Lab Sample ID: 490-95693-1

Date Collected: 01/13/16 12:00 | **Matrix: Solid**

Date Received: 01/15/16 09:06 | **Percent Solids: 67.0**

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	**1.62**	**F1**	0.0669	0.00998	mg/Kg	☼	01/19/16 09:01	01/19/16 15:46	1
Acenaphthylene	ND		0.0669	0.00899	mg/Kg	☼	01/19/16 09:01	01/19/16 15:46	1
Anthracene	**0.342**	**F1**	0.0669	0.00899	mg/Kg	☼	01/19/16 09:01	01/19/16 15:46	1
Benzo[a]anthracene	**0.0878**		0.0669	0.0150	mg/Kg	☼	01/19/16 09:01	01/19/16 15:46	1
Benzo[a]pyrene	**0.0661**	**J**	0.0669	0.0120	mg/Kg	☼	01/19/16 09:01	01/19/16 15:46	1
Benzo[b]fluoranthene	**0.0693**		0.0669	0.0120	mg/Kg	☼	01/19/16 09:01	01/19/16 15:46	1
Benzo[g,h,i]perylene	**0.0390**	**J**	0.0669	0.00899	mg/Kg	☼	01/19/16 09:01	01/19/16 15:46	1
Benzo[k]fluoranthene	**0.0470**	**J**	0.0669	0.0140	mg/Kg	☼	01/19/16 09:01	01/19/16 15:46	1
Pyrene	**0.438**		0.0669	0.0120	mg/Kg	☼	01/19/16 09:01	01/19/16 15:46	1
Phenanthrene	**3.74**		0.334	0.0449	mg/Kg	☼	01/19/16 09:01	01/21/16 14:50	5
Chrysene	**0.102**		0.0669	0.00899	mg/Kg	☼	01/19/16 09:01	01/19/16 15:46	1
Dibenz(a,h)anthracene	ND		0.0669	0.00699	mg/Kg	☼	01/19/16 09:01	01/19/16 15:46	1
Fluoranthene	**0.240**		0.0669	0.00899	mg/Kg	☼	01/19/16 09:01	01/19/16 15:46	1
Fluorene	**1.32**	**F1**	0.0669	0.0120	mg/Kg	☼	01/19/16 09:01	01/19/16 15:46	1
Indeno[1,2,3-cd]pyrene	ND		0.0669	0.00998	mg/Kg	☼	01/19/16 09:01	01/19/16 15:46	1
Naphthalene	**1.09**	**F1**	0.0669	0.00899	mg/Kg	☼	01/19/16 09:01	01/19/16 15:46	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Fluorobiphenyl (Surr)	*88*		*29 - 120*	*01/19/16 09:01*	*01/19/16 15:46*	*1*
2-Fluorobiphenyl (Surr)	*107*		*29 - 120*	*01/19/16 09:01*	*01/21/16 14:50*	*5*
Terphenyl-d14 (Surr)	*103*		*13 - 120*	*01/19/16 09:01*	*01/19/16 15:46*	*1*
Terphenyl-d14 (Surr)	*118*		*13 - 120*	*01/19/16 09:01*	*01/21/16 14:50*	*5*
Nitrobenzene-d5 (Surr)	*86*		*27 - 120*	*01/19/16 09:01*	*01/19/16 15:46*	*1*
Nitrobenzene-d5 (Surr)	*102*		*27 - 120*	*01/19/16 09:01*	*01/21/16 14:50*	*5*

Method: 8151A - Herbicides (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	**2.17**		1.64	1.08	mg/Kg	☼	01/25/16 16:25	01/27/16 17:31	50

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dichloroacetic acid(Surr)	*522*	*X*	*10 - 150*	*01/25/16 16:25*	*01/27/16 16:28*	*1*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C24	**859**	**B**	39.5	13.8	mg/Kg	☼	01/19/16 11:04	01/20/16 16:55	10
C24-C40	**35.7**		3.95	1.98	mg/Kg	☼	01/19/16 11:04	01/19/16 18:00	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*306*	*X*	*50 - 150*	*01/19/16 11:04*	*01/19/16 18:00*	*1*

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	**33**		0.10	0.10	%			01/18/16 11:35	1
Percent Solids	**67**		0.10	0.10	%			01/18/16 11:35	1

Client: Kemron Environmental Services, Inc. TestAmerica Job ID: 490-95693-1
Project/Site: Washington Wood Preserving ISS

Client Sample ID: ISS South Composite
Lab Sample ID: 490-95693-2

Date Collected: 01/13/16 13:30 **Matrix: Solid**
Date Received: 01/15/16 09:06 **Percent Solids: 60.2**

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	**0.550**		0.0669	0.00998	mg/Kg	☼	01/19/16 09:01	01/19/16 16:57	1
Acenaphthylene	**0.106**		0.0669	0.00899	mg/Kg	☼	01/19/16 09:01	01/19/16 16:57	1
Anthracene	**0.124**		0.0669	0.00899	mg/Kg	☼	01/19/16 09:01	01/19/16 16:57	1
Benzo[a]anthracene	ND		0.0669	0.0150	mg/Kg	☼	01/19/16 09:01	01/19/16 16:57	1
Benzo[a]pyrene	ND		0.0669	0.0120	mg/Kg	☼	01/19/16 09:01	01/19/16 16:57	1
Benzo[b]fluoranthene	**0.0450**	**J**	0.0669	0.0120	mg/Kg	☼	01/19/16 09:01	01/19/16 16:57	1
Benzo[g,h,i]perylene	ND		0.0669	0.00899	mg/Kg	☼	01/19/16 09:01	01/19/16 16:57	1
Benzo[k]fluoranthene	ND		0.0669	0.0140	mg/Kg	☼	01/19/16 09:01	01/19/16 16:57	1
Pyrene	**0.122**		0.0669	0.0120	mg/Kg	☼	01/19/16 09:01	01/19/16 16:57	1
Phenanthrene	**0.597**		0.0669	0.00899	mg/Kg	☼	01/19/16 09:01	01/19/16 16:57	1
Chrysene	ND		0.0669	0.00899	mg/Kg	☼	01/19/16 09:01	01/19/16 16:57	1
Dibenz(a,h)anthracene	ND		0.0669	0.00699	mg/Kg	☼	01/19/16 09:01	01/19/16 16:57	1
Fluoranthene	**0.0658**	**J**	0.0669	0.00899	mg/Kg	☼	01/19/16 09:01	01/19/16 16:57	1
Fluorene	**0.317**		0.0669	0.0120	mg/Kg	☼	01/19/16 09:01	01/19/16 16:57	1
Indeno[1,2,3-cd]pyrene	ND		0.0669	0.00998	mg/Kg	☼	01/19/16 09:01	01/19/16 16:57	1
Naphthalene	**0.105**		0.0669	0.00899	mg/Kg	☼	01/19/16 09:01	01/19/16 16:57	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Fluorobiphenyl (Surr)	*72*		*29 - 120*	*01/19/16 09:01*	*01/19/16 16:57*	*1*
Terphenyl-d14 (Surr)	*82*		*13 - 120*	*01/19/16 09:01*	*01/19/16 16:57*	*1*
Nitrobenzene-d5 (Surr)	*72*		*27 - 120*	*01/19/16 09:01*	*01/19/16 16:57*	*1*

Method: 8151A - Herbicides (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	**0.0488**		0.0329	0.0217	mg/Kg	☼	01/25/16 16:25	01/27/16 16:48	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dichloroacetic acid(Surr)	*45*		*10 - 150*	*01/25/16 16:25*	*01/27/16 16:48*	*1*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C24	**452**	**B**	20.0	6.98	mg/Kg	☼	01/19/16 11:04	01/19/16 18:55	5
C24-C40	**220**		20.0	9.98	mg/Kg	☼	01/19/16 11:04	01/19/16 18:55	5

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*83*		*50 - 150*	*01/19/16 11:04*	*01/19/16 18:55*	*5*

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	**40**		0.10	0.10	%			01/18/16 11:35	1
Percent Solids	**60**		0.10	0.10	%			01/18/16 11:35	1

Client: Kemron Environmental Services, Inc. TestAmerica Job ID: 490-95693-1
Project/Site: Washington Wood Preserving ISS

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Lab Sample ID: MB 490-313505/1-A **Client Sample ID: Method Blank**
Matrix: Solid **Prep Type: Total/NA**
Analysis Batch: 313651 **Prep Batch: 313505**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	ND		0.0670	0.0100	mg/Kg		01/19/16 09:01	01/19/16 14:59	1
Acenaphthylene	ND		0.0670	0.00900	mg/Kg		01/19/16 09:01	01/19/16 14:59	1
Anthracene	ND		0.0670	0.00900	mg/Kg		01/19/16 09:01	01/19/16 14:59	1
Benzo[a]anthracene	ND		0.0670	0.0150	mg/Kg		01/19/16 09:01	01/19/16 14:59	1
Benzo[a]pyrene	ND		0.0670	0.0120	mg/Kg		01/19/16 09:01	01/19/16 14:59	1
Benzo[b]fluoranthene	ND		0.0670	0.0120	mg/Kg		01/19/16 09:01	01/19/16 14:59	1
Benzo[g,h,i]perylene	ND		0.0670	0.00900	mg/Kg		01/19/16 09:01	01/19/16 14:59	1
Benzo[k]fluoranthene	ND		0.0670	0.0140	mg/Kg		01/19/16 09:01	01/19/16 14:59	1
Pyrene	ND		0.0670	0.0120	mg/Kg		01/19/16 09:01	01/19/16 14:59	1
Phenanthrene	ND		0.0670	0.00900	mg/Kg		01/19/16 09:01	01/19/16 14:59	1
Chrysene	ND		0.0670	0.00900	mg/Kg		01/19/16 09:01	01/19/16 14:59	1
Dibenz(a,h)anthracene	ND		0.0670	0.00700	mg/Kg		01/19/16 09:01	01/19/16 14:59	1
Fluoranthene	ND		0.0670	0.00900	mg/Kg		01/19/16 09:01	01/19/16 14:59	1
Fluorene	ND		0.0670	0.0120	mg/Kg		01/19/16 09:01	01/19/16 14:59	1
Indeno[1,2,3-cd]pyrene	ND		0.0670	0.0100	mg/Kg		01/19/16 09:01	01/19/16 14:59	1
Naphthalene	ND		0.0670	0.00900	mg/Kg		01/19/16 09:01	01/19/16 14:59	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Fluorobiphenyl (Surr)	*80*		*29 - 120*	*01/19/16 09:01*	*01/19/16 14:59*	*1*
Terphenyl-d14 (Surr)	*87*		*13 - 120*	*01/19/16 09:01*	*01/19/16 14:59*	*1*
Nitrobenzene-d5 (Surr)	*78*		*27 - 120*	*01/19/16 09:01*	*01/19/16 14:59*	*1*

Lab Sample ID: LCS 490-313505/2-A **Client Sample ID: Lab Control Sample**
Matrix: Solid **Prep Type: Total/NA**
Analysis Batch: 313651 **Prep Batch: 313505**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Acenaphthene	1.67	1.298		mg/Kg		78	36 - 120
Acenaphthylene	1.67	1.284		mg/Kg		77	38 - 120
Anthracene	1.67	1.343		mg/Kg		81	46 - 124
Benzo[a]anthracene	1.67	1.333		mg/Kg		80	45 - 120
Benzo[a]pyrene	1.67	1.323		mg/Kg		79	45 - 120
Benzo[b]fluoranthene	1.67	1.336		mg/Kg		80	42 - 120
Benzo[g,h,i]perylene	1.67	1.329		mg/Kg		80	38 - 120
Benzo[k]fluoranthene	1.67	1.257		mg/Kg		75	42 - 120
Pyrene	1.67	1.257		mg/Kg		75	43 - 120
Phenanthrene	1.67	1.250		mg/Kg		75	45 - 120
Chrysene	1.67	1.263		mg/Kg		76	43 - 120
Dibenz(a,h)anthracene	1.67	1.353		mg/Kg		81	32 - 128
Fluoranthene	1.67	1.309		mg/Kg		79	46 - 120
Fluorene	1.67	1.287		mg/Kg		77	42 - 120
Indeno[1,2,3-cd]pyrene	1.67	1.330		mg/Kg		80	41 - 121
Naphthalene	1.67	1.177		mg/Kg		71	32 - 120

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
2-Fluorobiphenyl (Surr)	*77*		*29 - 120*
Terphenyl-d14 (Surr)	*81*		*13 - 120*

Method: 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: LCS 490-313505/2-A
Client Sample ID: Lab Control Sample
Matrix: Solid
Prep Type: Total/NA
Analysis Batch: 313651
Prep Batch: 313505

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
Nitrobenzene-d5 (Surr)	*83*		*27 - 120*

Lab Sample ID: 490-95693-1 MS
Client Sample ID: ISS North Composite
Matrix: Solid
Prep Type: Total/NA
Analysis Batch: 313651
Prep Batch: 313505

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Acenaphthene	1.62	F1	2.45	4.099		mg/Kg	☼	101	19 - 120
Acenaphthylene	ND		2.45	1.885		mg/Kg	☼	77	25 - 120
Anthracene	0.342	F1	2.45	0.5526	F1	mg/Kg	☼	9	28 - 125
Benzo[a]anthracene	0.0878		2.45	1.608		mg/Kg	☼	62	23 - 120
Benzo[a]pyrene	0.0661	J	2.45	1.605		mg/Kg	☼	63	15 - 128
Benzo[b]fluoranthene	0.0693		2.45	1.673		mg/Kg	☼	66	12 - 133
Benzo[g,h,i]perylene	0.0390	J	2.45	1.489		mg/Kg	☼	59	22 - 120
Benzo[k]fluoranthene	0.0470	J	2.45	1.482		mg/Kg	☼	59	28 - 120
Pyrene	0.438		2.45	2.267		mg/Kg	☼	75	20 - 123
Phenanthrene	3.38	E F1	2.45	7.352	E F1	mg/Kg	☼	162	21 - 122
Chrysene	0.102		2.45	1.562		mg/Kg	☼	60	20 - 120
Dibenz(a,h)anthracene	ND		2.45	1.439		mg/Kg	☼	59	12 - 128
Fluoranthene	0.240		2.45	1.876		mg/Kg	☼	67	10 - 143
Fluorene	1.32	F1	2.45	3.704		mg/Kg	☼	97	20 - 120
Indeno[1,2,3-cd]pyrene	ND		2.45	1.453		mg/Kg	☼	59	22 - 121
Naphthalene	1.09	F1	2.45	3.119		mg/Kg	☼	83	10 - 120

Surrogate	*MS %Recovery*	*MS Qualifier*	*Limits*
2-Fluorobiphenyl (Surr)	*53*		*29 - 120*
Terphenyl-d14 (Surr)	*60*		*13 - 120*
Nitrobenzene-d5 (Surr)	*60*		*27 - 120*

Lab Sample ID: 490-95693-1 MSD
Client Sample ID: ISS North Composite
Matrix: Solid
Prep Type: Total/NA
Analysis Batch: 313651
Prep Batch: 313505

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Acenaphthene	1.62	F1	2.43	5.369	E F1	mg/Kg	☼	155	19 - 120	27	50
Acenaphthylene	ND		2.43	2.553		mg/Kg	☼	105	25 - 120	30	50
Anthracene	0.342	F1	2.43	0.5963	F1	mg/Kg	☼	10	28 - 125	8	49
Benzo[a]anthracene	0.0878		2.43	2.193		mg/Kg	☼	87	23 - 120	31	50
Benzo[a]pyrene	0.0661	J	2.43	2.139		mg/Kg	☼	85	15 - 128	29	50
Benzo[b]fluoranthene	0.0693		2.43	2.073		mg/Kg	☼	83	12 - 133	21	50
Benzo[g,h,i]perylene	0.0390	J	2.43	2.011		mg/Kg	☼	81	22 - 120	30	50
Benzo[k]fluoranthene	0.0470	J	2.43	2.113		mg/Kg	☼	85	28 - 120	35	45
Pyrene	0.438		2.43	2.983		mg/Kg	☼	105	20 - 123	27	50
Phenanthrene	3.38	E F1	2.43	9.428	E F1	mg/Kg	☼	249	21 - 122	25	50
Chrysene	0.102		2.43	2.070		mg/Kg	☼	81	20 - 120	28	49
Dibenz(a,h)anthracene	ND		2.43	1.985		mg/Kg	☼	82	12 - 128	32	50
Fluoranthene	0.240		2.43	2.441		mg/Kg	☼	91	10 - 143	26	50
Fluorene	1.32	F1	2.43	4.892	E F1	mg/Kg	☼	147	20 - 120	28	50

Method: 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: 490-95693-1 MSD **Client Sample ID: ISS North Composite**
Matrix: Solid **Prep Type: Total/NA**
Analysis Batch: 313651 **Prep Batch: 313505**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Indeno[1,2,3-cd]pyrene	ND		2.43	1.977		mg/Kg	☼	82	22 - 121	31	50
Naphthalene	1.09	F1	2.43	4.034	F1	mg/Kg	☼	121	10 - 120	26	50

Surrogate	*MSD %Recovery*	*MSD Qualifier*	*Limits*
2-Fluorobiphenyl (Surr)	*72*		*29 - 120*
Terphenyl-d14 (Surr)	*82*		*13 - 120*
Nitrobenzene-d5 (Surr)	*80*		*27 - 120*

Method: 8151A - Herbicides (GC)

Lab Sample ID: MB 490-314611/1-A **Client Sample ID: Method Blank**
Matrix: Solid **Prep Type: Total/NA**
Analysis Batch: 315175 **Prep Batch: 314611**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	ND		0.0330	0.0217	mg/Kg		01/25/16 16:24	01/27/16 16:01	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dichloroacetic acid(Surr)	*28*		*10 - 150*	*01/25/16 16:24*	*01/27/16 16:01*	*1*

Lab Sample ID: LCS 490-314611/2-A **Client Sample ID: Lab Control Sample**
Matrix: Solid **Prep Type: Total/NA**
Analysis Batch: 315175 **Prep Batch: 314611**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Pentachlorophenol	0.0833	0.02562	J	mg/Kg		31	10 - 150

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
Dichloroacetic acid(Surr)	*29*		*10 - 150*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Lab Sample ID: MB 490-313582/1-A **Client Sample ID: Method Blank**
Matrix: Solid **Prep Type: Total/NA**
Analysis Batch: 313591 **Prep Batch: 313582**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C24	1.766	J	4.00	1.40	mg/Kg		01/19/16 11:04	01/19/16 17:44	1
C24-C40	ND		4.00	2.00	mg/Kg		01/19/16 11:04	01/19/16 17:44	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*73*		*50 - 150*	*01/19/16 11:04*	*01/19/16 17:44*	*1*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC) (Continued)

Lab Sample ID: LCS 490-313582/2-A
Matrix: Solid
Analysis Batch: 313591

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 313582

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
C10-C24	40.0	31.59		mg/Kg		79	55 - 129

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
o-Terphenyl	*69*		*50 - 150*

Lab Sample ID: 490-95693-2 DU
Matrix: Solid
Analysis Batch: 313591

Client Sample ID: ISS South Composite
Prep Type: Total/NA
Prep Batch: 313582

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
C10-C24	452	B	534.0		mg/Kg	☼	17	50
C24-C40	220		254.0		mg/Kg	☼	14	50

Surrogate	*DU %Recovery*	*DU Qualifier*	*Limits*
o-Terphenyl	*103*		*50 - 150*

Method: Moisture - Percent Moisture

Lab Sample ID: 490-95666-C-1 DU
Matrix: Solid
Analysis Batch: 313333

Client Sample ID: Duplicate
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Percent Moisture	4.2		4.0		%		4	20
Percent Solids	96		96		%		0.2	20

GC/MS Semi VOA

Prep Batch: 313505

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-95693-1	ISS North Composite	Total/NA	Solid	3550C	
490-95693-1 MS	ISS North Composite	Total/NA	Solid	3550C	
490-95693-1 MSD	ISS North Composite	Total/NA	Solid	3550C	
490-95693-2	ISS South Composite	Total/NA	Solid	3550C	
LCS 490-313505/2-A	Lab Control Sample	Total/NA	Solid	3550C	
MB 490-313505/1-A	Method Blank	Total/NA	Solid	3550C	

Analysis Batch: 313651

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-95693-1	ISS North Composite	Total/NA	Solid	8270D	313505
490-95693-1 MS	ISS North Composite	Total/NA	Solid	8270D	313505
490-95693-1 MSD	ISS North Composite	Total/NA	Solid	8270D	313505
490-95693-2	ISS South Composite	Total/NA	Solid	8270D	313505
LCS 490-313505/2-A	Lab Control Sample	Total/NA	Solid	8270D	313505
MB 490-313505/1-A	Method Blank	Total/NA	Solid	8270D	313505

Analysis Batch: 314079

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-95693-1	ISS North Composite	Total/NA	Solid	8270D	313505

GC Semi VOA

Prep Batch: 313582

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-95693-1	ISS North Composite	Total/NA	Solid	3550B	
490-95693-2	ISS South Composite	Total/NA	Solid	3550B	
490-95693-2 DU	ISS South Composite	Total/NA	Solid	3550B	
LCS 490-313582/2-A	Lab Control Sample	Total/NA	Solid	3550B	
MB 490-313582/1-A	Method Blank	Total/NA	Solid	3550B	

Analysis Batch: 313591

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-95693-1	ISS North Composite	Total/NA	Solid	NWTPH-Dx	313582
490-95693-2	ISS South Composite	Total/NA	Solid	NWTPH-Dx	313582
490-95693-2 DU	ISS South Composite	Total/NA	Solid	NWTPH-Dx	313582
LCS 490-313582/2-A	Lab Control Sample	Total/NA	Solid	NWTPH-Dx	313582
MB 490-313582/1-A	Method Blank	Total/NA	Solid	NWTPH-Dx	313582

Analysis Batch: 313858

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-95693-1	ISS North Composite	Total/NA	Solid	NWTPH-Dx	313582

Prep Batch: 314611

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-95693-1	ISS North Composite	Total/NA	Solid	8151A	
490-95693-2	ISS South Composite	Total/NA	Solid	8151A	
LCS 490-314611/2-A	Lab Control Sample	Total/NA	Solid	8151A	
MB 490-314611/1-A	Method Blank	Total/NA	Solid	8151A	

GC Semi VOA (Continued)

Analysis Batch: 315175

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-95693-1	ISS North Composite	Total/NA	Solid	8151A	314611
490-95693-1	ISS North Composite	Total/NA	Solid	8151A	314611
490-95693-2	ISS South Composite	Total/NA	Solid	8151A	314611
LCS 490-314611/2-A	Lab Control Sample	Total/NA	Solid	8151A	314611
MB 490-314611/1-A	Method Blank	Total/NA	Solid	8151A	314611

General Chemistry

Analysis Batch: 313333

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-95655-G-12 MS	Matrix Spike	Total/NA	Solid	Moisture	
490-95655-G-12 MSD	Matrix Spike Duplicate	Total/NA	Solid	Moisture	
490-95666-C-1 DU	Duplicate	Total/NA	Solid	Moisture	
490-95693-1	ISS North Composite	Total/NA	Solid	Moisture	
490-95693-2	ISS South Composite	Total/NA	Solid	Moisture	

Lab Chronicle

Client: Kemron Environmental Services, Inc.
Project/Site: Washington Wood Preserving ISS

TestAmerica Job ID: 490-95693-1

Client Sample ID: ISS North Composite

Lab Sample ID: 490-95693-1
Date Collected: 01/13/16 12:00
Matrix: Solid
Date Received: 01/15/16 09:06

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	Moisture		1			313333	01/18/16 11:35	RMS	TAL NSH

Client Sample ID: ISS North Composite

Lab Sample ID: 490-95693-1
Date Collected: 01/13/16 12:00
Matrix: Solid
Date Received: 01/15/16 09:06
Percent Solids: 67.0

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3550C			44.83 g	1 mL	313505	01/19/16 09:01	MNM	TAL NSH
Total/NA	Analysis	8270D		1	44.83 g	1 mL	313651	01/19/16 15:46	BES	TAL NSH
Total/NA	Prep	3550C			44.83 g	1 mL	313505	01/19/16 09:01	MNM	TAL NSH
Total/NA	Analysis	8270D		5	44.83 g	1 mL	314079	01/21/16 14:50	BES	TAL NSH
Total/NA	Prep	8151A			44.98 g	10 mL	314611	01/25/16 16:25	LOJ	TAL NSH
Total/NA	Analysis	8151A		1	44.98 g	10 mL	315175	01/27/16 16:28	JML	TAL NSH
Total/NA	Prep	8151A			44.98 g	10 mL	314611	01/25/16 16:25	LOJ	TAL NSH
Total/NA	Analysis	8151A		50	44.98 g	10 mL	315175	01/27/16 17:31	JML	TAL NSH
Total/NA	Prep	3550B			37.75 g	1.00 mL	313582	01/19/16 11:04	MNM	TAL NSH
Total/NA	Analysis	NWTPH-Dx		1	37.75 g	1.00 mL	313591	01/19/16 18:00	TRF	TAL NSH
Total/NA	Prep	3550B			37.75 g	1.00 mL	313582	01/19/16 11:04	MNM	TAL NSH
Total/NA	Analysis	NWTPH-Dx		10	37.75 g	1.00 mL	313858	01/20/16 16:55	TRF	TAL NSH

Client Sample ID: ISS South Composite

Lab Sample ID: 490-95693-2
Date Collected: 01/13/16 13:30
Matrix: Solid
Date Received: 01/15/16 09:06

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	Moisture		1			313333	01/18/16 11:35	RMS	TAL NSH

Client Sample ID: ISS South Composite

Lab Sample ID: 490-95693-2
Date Collected: 01/13/16 13:30
Matrix: Solid
Date Received: 01/15/16 09:06
Percent Solids: 60.2

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3550C			49.90 g	1 mL	313505	01/19/16 09:01	MNM	TAL NSH
Total/NA	Analysis	8270D		1	49.90 g	1 mL	313651	01/19/16 16:57	BES	TAL NSH
Total/NA	Prep	8151A			49.90 g	10 mL	314611	01/25/16 16:25	LOJ	TAL NSH
Total/NA	Analysis	8151A		1	49.90 g	10 mL	315175	01/27/16 16:48	JML	TAL NSH
Total/NA	Prep	3550B			41.61 g	1.00 mL	313582	01/19/16 11:04	MNM	TAL NSH
Total/NA	Analysis	NWTPH-Dx		5	41.61 g	1.00 mL	313591	01/19/16 18:55	TRF	TAL NSH

Laboratory References:

TAL NSH = TestAmerica Nashville, 2960 Foster Creighton Drive, Nashville, TN 37204, TEL (615)726-0177

Method Summary

Method	Method Description	Protocol	Laboratory
8270D	Semivolatile Organic Compounds (GC/MS)	SW846	TAL NSH
8151A	Herbicides (GC)	SW846	TAL NSH
NWTPH-Dx	Northwest - Semi-Volatile Petroleum Products (GC)	NWTPH	TAL NSH
Moisture	Percent Moisture	EPA	TAL NSH

Protocol References:

EPA = US Environmental Protection Agency

NWTPH = Northwest Total Petroleum Hydrocarbon

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL NSH = TestAmerica Nashville, 2960 Foster Creighton Drive, Nashville, TN 37204, TEL (615)726-0177

Certification Summary

Laboratory: TestAmerica Nashville

Unless otherwise noted, all analytes for this laboratory were covered under each certification below.

Authority	Program	EPA Region	Certification ID	Expiration Date
Washington	State Program	10	C789	07-19-16

The following analytes are included in this report, but certification is not offered by the governing authority:

Analysis Method	Prep Method	Matrix	Analyte
Moisture		Solid	Percent Moisture
Moisture		Solid	Percent Solids

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

Nashville, TN

COOLER RECEIPT FORM

490-95693 Chain of Custody

Cooler Received/Opened On 1/15/2016 @ 0906

Time Samples Removed From Cooler 1720 Time Samples Placed In Storage__________ (2 Hour Window)

1. Tracking # A1601628B (last 4 digits, FedEx) Courier: _HotShot_

   IR Gun ID 14740456 pH Strip Lot HC554612 Chlorine Strip Lot 072815A

2. Temperature of rep. sample or temp blank when opened: 1.1 *Degrees Celsius*
3. If Item #2 temperature is 0°C or less, was the representative sample or temp blank frozen? YES NO...NA
4. Were custody seals on outside of cooler? YES...NO...NA

   If yes, how many and where: 1 Front

5. Were the seals intact, signed, and dated correctly? YES...NO...NA
6. Were custody papers inside cooler? YES...NO...NA

I certify that I opened the cooler and answered questions 1-6 (intial) ________

7. Were custody seals on containers: YES NO and Intact YES...NO...NA

   Were these signed and dated correctly? YES...NO...NA

8. Packing mat'l used? Bubblewrap Plastic bag Peanuts Vermiculite Foam Insert Paper Other None
9. Cooling process: Ice Ice-pack Ice (direct contact) Dry ice Other None
10. Did all containers arrive in good condition (unbroken)? YES...NO...NA
11. Were all container labels complete (#, date, signed, pres., etc)? YES...NO...NA
12. Did all container labels and tags agree with custody papers? YES...NO...NA

13a. Were VOA vials received? YES...NO...NA

b. Was there any observable headspace present in any VOA vial? YES...NO...NA

14. Was there a Trip Blank in this cooler? YES...NO...NA If multiple coolers, sequence # N/A

I certify that I unloaded the cooler and answered questions 7-14 (intial) AQS

15a. On pres'd bottles, did pH test strips suggest preservation reached the correct pH level? YES..NO..NA

b. Did the bottle labels indicate that the correct preservatives were used YES...NO...NA

16. Was residual chlorine present? YES...NO...NA

I certify that I checked for chlorine and pH as per SOP and answered questions 15-16 (intial) AQS

17. Were custody papers properly filled out (ink, signed, etc)? YES...NO...NA
18. Did you sign the custody papers in the appropriate place? YES...NO...NA
19. Were correct containers used for the analysis requested? YES...NO...NA
20. Was sufficient amount of sample sent in each container? YES...NO...NA

I certify that I entered this project into LIMS and answered questions 17-20 (intial) AQS

I certify that I attached a label with the unique LIMS number to each container (intial) AQS

21. Were there Non-Conformance issues at login? YES...NO Was a NCM generated? YES...NO...# N/A

BIS = Broken in shipment

Cooler Receipt Form.doc LF-1 Revised 12/15/15

End of Form

681-Atlanta

TestAmerica Nashville
2960 Foster Creighton Drive

Nashville, TN 37204-3719
phone 615.726.0177 fax 615.726.3404

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

Client Contact	Project Manager / TAT	Site Contact	Date	COC
Kemron Environmental Services, Inc.	Project Manager: Tomecia Bradley	Site Contact:	Date: 1·14·16	COC No:
1359-A Ellsworth Ind. Blvd.	Tel/Fax: 404-601-6927	Lab Contact:	Carrier:	1 of 1 COCs
Atlanta, GA 30318	**Analysis Turnaround Time**			Sampler:
404-636-0928 Phone	☐ CALENDAR DAYS ☒ WORKING DAYS			**For Lab Use Only:**
(xxx) xxx-xxxx FAX	TAT if different from Below			Walk-in Client:
Project Name: Washington Wood Preserving ISS	☒ 2 weeks			Lab Sampling:
Site:	☐ 1 week			
PO# SH0603	☐ 2 days			Job / SDG No.:
	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	Pentachlorophenol 8151	PAH 8270	NW-TPH Diesel *	Sample Specific Notes:
ISS North Composite	1·13·16	1200	G	S	2	N		X	X	X	
ISS South Composite	↓	1330	G	S	2	N		X	X	X	Loc: 490 **95693**

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.
☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return to Client ☒ Disposal by Lab ☐ Archive for ____ Months

Special Instructions/QC Requirements & Comments: HOT Samples   Send report to: tjordan@kemron.com
* Washington Method

Custody Seals Intact: ☐ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd: | Corr'd: | Therm ID No.:

Relinquished by: Tomecia Bradley	Company: Kemron	Date/Time: 1·14·16 1245	Received by: [signature]	Company: TA	Date/Time: 1/14/16 1245
Relinquished by: [signature]	Company: TA	Date/Time: 1/14/16 1530	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by: [signature] 1.1°C	Company: TAN	Date/Time: 1/15/2016 0906

Form No. CA-C-WI-002, Rev. 4.8, dated 11/04/2015

Login Sample Receipt Checklist

Client: Kemron Environmental Services, Inc.

Job Number: 490-95693-1

Login Number: 95693
List Number: 1
Creator: Stvartak, Anthony Q

List Source: TestAmerica Nashville

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

APPENDIX C

SPIKED UNTREATED ANALYTICAL CHARACTERIZATION REPORT

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Nashville
2960 Foster Creighton Drive
Nashville, TN 37204
Tel: (615)726-0177

TestAmerica Job ID: 490-98912-1
Client Project/Site: Washington Wood Preserving ISS

For:
Kemron Environmental Services, Inc.
1359A Ellsworth Industrial Blvd.
Atlanta, Georgia 30318

Attn: Mr. Tommy Jordan

Roxanne Cisneros

Authorized for release by:
3/23/2016 5:35:27 PM

Roxanne Cisneros, Senior Project Manager
(615)301-5761
roxanne.cisneros@testamericainc.com

Designee for

Heather Baker, Project Manager I
(615)301-5043
heather.baker@testamericainc.com

The test results in this report meet all 2003 NELAC and 2009 TNI requirements for accredited parameters, exceptions are noted in this report. This report may not be reproduced except in full, and with written approval from the laboratory. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

Table of Contents

Sample Summary

Client: Kemron Environmental Services, Inc.
Project/Site: Washington Wood Preserving ISS

TestAmerica Job ID: 490-98912-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
490-98912-1	ISS North Composite	Solid	03/07/16 12:30	03/08/16 09:43
490-99129-1	ISS North Composite (Duplicate)	Solid	03/08/16 13:00	03/09/16 08:59

1 2 3 4 5 6 7 8 9 10 11 12 13

Job ID: 490-98912-1

Laboratory: TestAmerica Nashville

Narrative

Merge with 490-99129-1.

Job Narrative
490-98912-1

Comments
No additional comments.

Receipt
The sample was received on 3/8/2016 9:43 AM; the sample arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 1.7º C.

GC/MS Semi VOA
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

GC Semi VOA
Method(s) 8151A: Due to matrix interferences which required dilution of the parent sample, the matrix spike / matrix spike duplicate (MS/MSD) for preparation batch 490-323709 could not be evaluated for accuracy and precision. The associated laboratory control sample (LCS) met acceptance criteria.

Method(s) 8151A: Surrogate recovery for the following samples was outside control limits: (490-98912-B-1-B MS) and (490-98912-B-1-C MSD). Evidence of matrix interference is present; therefore, re-extraction and/or re-analysis was not performed.

Method(s) 8151A: The following sample was diluted due to the abundance of target analytes: ISS North Composite (490-98912-1). As such, surrogate recoveries are below the calibration range or are not reported, and elevated reporting limits (RLs) are provided.

Method(s) NWTPH-Dx: The following sample was diluted due to the nature of the sample matrix: ISS North Composite (490-98912-1). Elevated reporting limits (RLs) are provided.

Method(s) NWTPH-Dx: The following samples contained a hydrocarbon pattern for analyte C24-C40 which does not match a typical Total Petroleum Hydrocarbon (TPH) pattern used by the laboratory for quantitative purposes: ISS North Composite (490-98912-1).

Method(s) NWTPH-Dx: The sample duplicate (DUP) precision for preparation batch 490-323889 was outside control limits for C10-C24. Sample non-homogeneity is suspected.

Method(s) NWTPH-Dx: Surrogate recovery for the following sample was outside control limits: ISS North Composite (490-98912-1). Evidence of matrix interference is present; therefore, re-extraction and/or re-analysis was not performed.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Organic Prep
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Job ID: 490-99129-1

Laboratory: TestAmerica Nashville

Narrative

Merge with 490-98912-1.

Job Narrative
490-99129-1

Comments
No additional comments.

Job ID: 490-99129-1 (Continued)

Laboratory: TestAmerica Nashville (Continued)

Receipt
The sample was received on 3/9/2016 8:59 AM; the sample arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 1.0º C.

GC/MS Semi VOA
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

GC Semi VOA
Method(s) 8151A: Due to matrix interferences which required dilution of the parent sample, the matrix spike / matrix spike duplicate (MS/MSD) for preparation batch 490-323709 could not be evaluated for accuracy and precision. The associated laboratory control sample (LCS) met acceptance criteria.

Method(s) 8151A: Surrogate recovery for the following samples was outside control limits: (490-98912-B-1-B MS) and (490-98912-B-1-C MSD). Evidence of matrix interference is present; therefore, re-extraction and/or re-analysis was not performed.

Method(s) 8151A: The following sample was diluted due to the abundance of target analytes: ISS North Composite (Duplicate) (490-99129-1). As such, surrogate recoveries are below the calibration range or are not reported, and elevated reporting limits (RLs) are provided.

Method(s) NWTPH-Dx: The following samples were diluted due to the nature of the sample matrix: ISS North Composite (Duplicate) (490-99129-1) and (490-99129-A-1-C DU). As such, surrogate recoveries are below the calibration range, and elevated reporting limits (RLs) are provided.

Method(s) NWTPH-Dx: The following samples was diluted due to the nature of the sample matrix: ISS North Composite (Duplicate) (490-99129-1) and (490-99129-A-1-C DU). Elevated reporting limits (RLs) are provided.

Method(s) NWTPH-Dx: The following samples contained a hydrocarbon pattern that most closely resembles a Diesel Fuel #2 product used by the laboratory for quantitative purposes: ISS North Composite (Duplicate) (490-99129-1) and (490-99129-A-1-C DU).

Method(s) NWTPH-Dx: The following samples contained a hydrocarbon pattern for analyte C24-C40 which does not match a typical Total Petroleum Hydrocarbon (TPH) pattern used by the laboratory for quantitative purposes: ISS North Composite (Duplicate) (490-99129-1) and (490-99129-A-1-C DU).

Method(s) NWTPH-Dx: The sample duplicate (DUP) precision for preparation batch 490-323889 was outside control limits for C10-C24. Sample non-homogeneity is suspected.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Organic Prep
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Qualifiers

GC/MS Semi VOA

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

GC Semi VOA

Qualifier	Qualifier Description
X	Surrogate is outside control limits
4	MS, MSD: The analyte present in the original sample is greater than 4 times the matrix spike concentration; therefore, control limits are not applicable.
E	Result exceeded calibration range.
F3	Duplicate RPD exceeds the control limit
X	Surrogate is outside control limits
F3	Duplicate RPD exceeds the control limit

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Client Sample ID: ISS North Composite

Lab Sample ID: 490-98912-1

Date Collected: 03/07/16 12:30
Matrix: Solid
Date Received: 03/08/16 09:43
Percent Solids: 66.8

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	**14.4**		1.99	0.297	mg/Kg	☼	03/14/16 13:34	03/22/16 09:37	20
Acenaphthylene	**1.69**		0.0995	0.0134	mg/Kg	☼	03/14/16 13:34	03/18/16 18:55	1
Anthracene	**1.80**		0.0995	0.0134	mg/Kg	☼	03/14/16 13:34	03/18/16 18:55	1
Benzo[a]anthracene	**0.350**		0.0995	0.0223	mg/Kg	☼	03/14/16 13:34	03/18/16 18:55	1
Benzo[a]pyrene	**0.223**		0.0995	0.0178	mg/Kg	☼	03/14/16 13:34	03/18/16 18:55	1
Benzo[b]fluoranthene	**0.276**		0.0995	0.0178	mg/Kg	☼	03/14/16 13:34	03/18/16 18:55	1
Benzo[g,h,i]perylene	**0.139**		0.0995	0.0134	mg/Kg	☼	03/14/16 13:34	03/18/16 18:55	1
Benzo[k]fluoranthene	**0.125**		0.0995	0.0208	mg/Kg	☼	03/14/16 13:34	03/18/16 18:55	1
Pyrene	**3.31**		0.0995	0.0178	mg/Kg	☼	03/14/16 13:34	03/18/16 18:55	1
Phenanthrene	**33.0**		1.99	0.267	mg/Kg	☼	03/14/16 13:34	03/22/16 09:37	20
Chrysene	**0.575**		0.0995	0.0134	mg/Kg	☼	03/14/16 13:34	03/18/16 18:55	1
Dibenz(a,h)anthracene	ND		0.0995	0.0104	mg/Kg	☼	03/14/16 13:34	03/18/16 18:55	1
Fluoranthene	**1.10**		0.0995	0.0134	mg/Kg	☼	03/14/16 13:34	03/18/16 18:55	1
Fluorene	**13.3**		1.99	0.356	mg/Kg	☼	03/14/16 13:34	03/22/16 09:37	20
Indeno[1,2,3-cd]pyrene	**0.101**		0.0995	0.0149	mg/Kg	☼	03/14/16 13:34	03/18/16 18:55	1
Naphthalene	**7.73**		1.99	0.267	mg/Kg	☼	03/14/16 13:34	03/22/16 09:37	20

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Fluorobiphenyl (Surr)	*62*		*29 - 120*	*03/14/16 13:34*	*03/18/16 18:55*	*1*
Terphenyl-d14 (Surr)	*95*		*13 - 120*	*03/14/16 13:34*	*03/18/16 18:55*	*1*
Nitrobenzene-d5 (Surr)	*57*		*27 - 120*	*03/14/16 13:34*	*03/18/16 18:55*	*1*

Method: 8151A - Herbicides (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	**20.2**		4.88	3.21	mg/Kg	☼	03/13/16 14:43	03/14/16 16:24	100

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dichloroacetic acid(Surr)	*5816*	*X*	*10 - 150*	*03/13/16 14:43*	*03/14/16 16:24*	*100*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C24	**18700**		585	293	mg/Kg	☼	03/14/16 12:32	03/15/16 00:52	100
C24-C40	**599**		58.5	29.3	mg/Kg	☼	03/14/16 12:32	03/14/16 21:15	10

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*4313*	*X*	*50 - 150*	*03/14/16 12:32*	*03/14/16 21:15*	*10*

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	**33.2**		0.1	0.1	%			03/15/16 09:14	1
Percent Solids	**66.8**		0.1	0.1	%			03/15/16 09:14	1

Client: Kemron Environmental Services, Inc.
Project/Site: Washington Wood Preserving ISS

TestAmerica Job ID: 490-98912-1

Client Sample ID: ISS North Composite (Duplicate)

Date Collected: 03/08/16 13:00
Date Received: 03/09/16 08:59

Lab Sample ID: 490-99129-1
Matrix: Solid
Percent Solids: 65.3

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	9.38		2.02	0.301	mg/Kg	☼	03/14/16 13:34	03/22/16 10:01	20
Acenaphthylene	4.07		0.101	0.0136	mg/Kg	☼	03/14/16 13:34	03/18/16 19:20	1
Anthracene	1.30		0.101	0.0136	mg/Kg	☼	03/14/16 13:34	03/18/16 19:20	1
Benzo[a]anthracene	0.315		0.101	0.0226	mg/Kg	☼	03/14/16 13:34	03/18/16 19:20	1
Benzo[a]pyrene	0.191		0.101	0.0181	mg/Kg	☼	03/14/16 13:34	03/18/16 19:20	1
Benzo[b]fluoranthene	0.218		0.101	0.0181	mg/Kg	☼	03/14/16 13:34	03/18/16 19:20	1
Benzo[g,h,i]perylene	0.127		0.101	0.0136	mg/Kg	☼	03/14/16 13:34	03/18/16 19:20	1
Benzo[k]fluoranthene	0.0910	J	0.101	0.0211	mg/Kg	☼	03/14/16 13:34	03/18/16 19:20	1
Pyrene	2.64		0.101	0.0181	mg/Kg	☼	03/14/16 13:34	03/18/16 19:20	1
Phenanthrene	21.0		2.02	0.271	mg/Kg	☼	03/14/16 13:34	03/22/16 10:01	20
Chrysene	0.510		0.101	0.0136	mg/Kg	☼	03/14/16 13:34	03/18/16 19:20	1
Dibenz(a,h)anthracene	ND		0.101	0.0105	mg/Kg	☼	03/14/16 13:34	03/18/16 19:20	1
Fluoranthene	0.975		0.101	0.0136	mg/Kg	☼	03/14/16 13:34	03/18/16 19:20	1
Fluorene	8.24		2.02	0.362	mg/Kg	☼	03/14/16 13:34	03/22/16 10:01	20
Indeno[1,2,3-cd]pyrene	0.0793	J	0.101	0.0151	mg/Kg	☼	03/14/16 13:34	03/18/16 19:20	1
Naphthalene	5.16		0.101	0.0136	mg/Kg	☼	03/14/16 13:34	03/18/16 19:20	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Fluorobiphenyl (Surr)	*66*		*29 - 120*	*03/14/16 13:34*	*03/18/16 19:20*	*1*
Terphenyl-d14 (Surr)	*92*		*13 - 120*	*03/14/16 13:34*	*03/18/16 19:20*	*1*
Nitrobenzene-d5 (Surr)	*61*		*27 - 120*	*03/14/16 13:34*	*03/18/16 19:20*	*1*

Method: 8151A - Herbicides (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	20.1		9.91	6.52	mg/Kg	☼	03/13/16 14:43	03/14/16 17:09	200

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dichloroacetic acid(Surr)	*6076*	*X*	*10 - 150*	*03/13/16 14:43*	*03/14/16 17:09*	*200*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C24	9580		601	300	mg/Kg	☼	03/14/16 12:32	03/15/16 01:08	100
C24-C40	372		60.1	30.0	mg/Kg	☼	03/14/16 12:32	03/14/16 21:31	10

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*2530*	*X*	*50 - 150*	*03/14/16 12:32*	*03/14/16 21:31*	*10*

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	34.7		0.1	0.1	%			03/11/16 09:31	1
Percent Solids	65.3		0.1	0.1	%			03/11/16 09:31	1

QC Sample Results

Client: Kemron Environmental Services, Inc.
Project/Site: Washington Wood Preserving ISS

TestAmerica Job ID: 490-98912-1

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Lab Sample ID: MB 490-323909/1-A
Matrix: Solid
Analysis Batch: 325014

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 323909

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	ND		0.0670	0.0100	mg/Kg		03/14/16 13:34	03/18/16 15:40	1
Acenaphthylene	ND		0.0670	0.00900	mg/Kg		03/14/16 13:34	03/18/16 15:40	1
Anthracene	ND		0.0670	0.00900	mg/Kg		03/14/16 13:34	03/18/16 15:40	1
Benzo[a]anthracene	ND		0.0670	0.0150	mg/Kg		03/14/16 13:34	03/18/16 15:40	1
Benzo[a]pyrene	ND		0.0670	0.0120	mg/Kg		03/14/16 13:34	03/18/16 15:40	1
Benzo[b]fluoranthene	ND		0.0670	0.0120	mg/Kg		03/14/16 13:34	03/18/16 15:40	1
Benzo[g,h,i]perylene	ND		0.0670	0.00900	mg/Kg		03/14/16 13:34	03/18/16 15:40	1
Benzo[k]fluoranthene	ND		0.0670	0.0140	mg/Kg		03/14/16 13:34	03/18/16 15:40	1
Pyrene	ND		0.0670	0.0120	mg/Kg		03/14/16 13:34	03/18/16 15:40	1
Phenanthrene	ND		0.0670	0.00900	mg/Kg		03/14/16 13:34	03/18/16 15:40	1
Chrysene	ND		0.0670	0.00900	mg/Kg		03/14/16 13:34	03/18/16 15:40	1
Dibenz(a,h)anthracene	ND		0.0670	0.00700	mg/Kg		03/14/16 13:34	03/18/16 15:40	1
Fluoranthene	ND		0.0670	0.00900	mg/Kg		03/14/16 13:34	03/18/16 15:40	1
Fluorene	ND		0.0670	0.0120	mg/Kg		03/14/16 13:34	03/18/16 15:40	1
Indeno[1,2,3-cd]pyrene	ND		0.0670	0.0100	mg/Kg		03/14/16 13:34	03/18/16 15:40	1
Naphthalene	ND		0.0670	0.00900	mg/Kg		03/14/16 13:34	03/18/16 15:40	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Fluorobiphenyl (Surr)	*70*		*29 - 120*	*03/14/16 13:34*	*03/18/16 15:40*	*1*
Terphenyl-d14 (Surr)	*81*		*13 - 120*	*03/14/16 13:34*	*03/18/16 15:40*	*1*
Nitrobenzene-d5 (Surr)	*62*		*27 - 120*	*03/14/16 13:34*	*03/18/16 15:40*	*1*

Lab Sample ID: LCS 490-323909/2-A
Matrix: Solid
Analysis Batch: 325014

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 323909

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Acenaphthene	1.67	1.397		mg/Kg		84	36 - 120
Acenaphthylene	1.67	1.418		mg/Kg		85	38 - 120
Anthracene	1.67	1.468		mg/Kg		88	46 - 124
Benzo[a]anthracene	1.67	1.483		mg/Kg		89	45 - 120
Benzo[a]pyrene	1.67	1.502		mg/Kg		90	45 - 120
Benzo[b]fluoranthene	1.67	1.482		mg/Kg		89	42 - 120
Benzo[g,h,i]perylene	1.67	1.412		mg/Kg		85	38 - 120
Benzo[k]fluoranthene	1.67	1.591		mg/Kg		95	42 - 120
Pyrene	1.67	1.538		mg/Kg		92	43 - 120
Phenanthrene	1.67	1.406		mg/Kg		84	45 - 120
Chrysene	1.67	1.483		mg/Kg		89	43 - 120
Dibenz(a,h)anthracene	1.67	1.473		mg/Kg		88	32 - 128
Fluoranthene	1.67	1.473		mg/Kg		88	46 - 120
Fluorene	1.67	1.422		mg/Kg		85	42 - 120
Indeno[1,2,3-cd]pyrene	1.67	1.440		mg/Kg		86	41 - 121
Naphthalene	1.67	1.274		mg/Kg		76	32 - 120

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
2-Fluorobiphenyl (Surr)	*78*		*29 - 120*
Terphenyl-d14 (Surr)	*89*		*13 - 120*

Method: 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: LCS 490-323909/2-A | **Client Sample ID: Lab Control Sample**
Matrix: Solid | **Prep Type: Total/NA**
Analysis Batch: 325014 | **Prep Batch: 323909**

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
Nitrobenzene-d5 (Surr)	*74*		*27 - 120*

Method: 8151A - Herbicides (GC)

Lab Sample ID: MB 490-323709/1-A | **Client Sample ID: Method Blank**
Matrix: Solid | **Prep Type: Total/NA**
Analysis Batch: 323862 | **Prep Batch: 323709**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	ND		0.0330	0.0217	mg/Kg		03/13/16 14:43	03/14/16 13:52	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dichloroacetic acid(Surr)	*68*		*10 - 150*	*03/13/16 14:43*	*03/14/16 13:52*	*1*

Lab Sample ID: LCS 490-323709/2-A | **Client Sample ID: Lab Control Sample**
Matrix: Solid | **Prep Type: Total/NA**
Analysis Batch: 323862 | **Prep Batch: 323709**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Pentachlorophenol	0.0833	0.03985		mg/Kg		48	10 - 150

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
Dichloroacetic acid(Surr)	*62*		*10 - 150*

Lab Sample ID: 490-98912-1 MS | **Client Sample ID: ISS North Composite**
Matrix: Solid | **Prep Type: Total/NA**
Analysis Batch: 323862 | **Prep Batch: 323709**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Pentachlorophenol	1.16	E	0.123	1.070	E 4	mg/Kg	☼	-76	10 - 150

Surrogate	*MS %Recovery*	*MS Qualifier*	*Limits*
Dichloroacetic acid(Surr)	*2133*	*X*	*10 - 150*

Lab Sample ID: 490-98912-1 MSD | **Client Sample ID: ISS North Composite**
Matrix: Solid | **Prep Type: Total/NA**
Analysis Batch: 323862 | **Prep Batch: 323709**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Pentachlorophenol	1.16	E	0.123	1.063	E 4	mg/Kg	☼	-82	10 - 150	1	50

Surrogate	*MSD %Recovery*	*MSD Qualifier*	*Limits*
Dichloroacetic acid(Surr)	*2358*	*X*	*10 - 150*

1 2 3 4 5 6 7 8 9 10 11 12 13

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Lab Sample ID: MB 490-323889/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 323912 — **Prep Batch: 323889**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C24	ND		4.00	2.00	mg/Kg		03/14/16 12:32	03/14/16 20:41	1
C24-C40	ND		4.00	2.00	mg/Kg		03/14/16 12:32	03/14/16 20:41	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*74*		*50 - 150*	*03/14/16 12:32*	*03/14/16 20:41*	*1*

Lab Sample ID: LCS 490-323889/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 323912 — **Prep Batch: 323889**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
C10-C24	40.0	28.73		mg/Kg		72	55 - 129

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
o-Terphenyl	*71*		*50 - 150*

Lab Sample ID: 490-99129-1 DU — **Client Sample ID: ISS North Composite (Duplicate)**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 323912 — **Prep Batch: 323889**

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
C24-C40	372		540.6		mg/Kg	☼	37	50

Surrogate	*DU %Recovery*	*DU Qualifier*	*Limits*
o-Terphenyl	*3806*	*X*	*50 - 150*

Lab Sample ID: 490-99129-1 DU — **Client Sample ID: ISS North Composite (Duplicate)**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 323912 — **Prep Batch: 323889**

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
C10-C24	9580		16180	F3	mg/Kg	☼	51	50

Lab Sample ID: 490-99129-A-1-C DU — **Client Sample ID: Duplicate**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 323912 — **Prep Batch: 323889**

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
C24-C40	372		540.6		mg/Kg	☼	37	50

Surrogate	*DU %Recovery*	*DU Qualifier*	*Limits*
o-Terphenyl	*3806*	*X*	*50 - 150*

Client: Kemron Environmental Services, Inc. TestAmerica Job ID: 490-98912-1
Project/Site: Washington Wood Preserving ISS

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC) (Continued)

Lab Sample ID: 490-99129-A-1-C DU **Client Sample ID: Duplicate**
Matrix: Solid **Prep Type: Total/NA**
Analysis Batch: 323912 **Prep Batch: 323889**

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
C10-C24	9580		16180	F3	mg/Kg	☼	51	50

Method: Moisture - Percent Moisture

Lab Sample ID: 490-98912-1 DU **Client Sample ID: ISS North Composite**
Matrix: Solid **Prep Type: Total/NA**
Analysis Batch: 324058

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Percent Moisture	33.2		34.2		%		3	20
Percent Solids	66.8		65.8		%		1	20

GC/MS Semi VOA

Prep Batch: 323909

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-98912-1	ISS North Composite	Total/NA	Solid	3550C	
490-99129-1	ISS North Composite (Duplicate)	Total/NA	Solid	3550C	
LCS 490-323909/2-A	Lab Control Sample	Total/NA	Solid	3550C	
MB 490-323909/1-A	Method Blank	Total/NA	Solid	3550C	

Analysis Batch: 325014

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-98912-1	ISS North Composite	Total/NA	Solid	8270D	323909
490-99129-1	ISS North Composite (Duplicate)	Total/NA	Solid	8270D	323909
LCS 490-323909/2-A	Lab Control Sample	Total/NA	Solid	8270D	323909
MB 490-323909/1-A	Method Blank	Total/NA	Solid	8270D	323909

Analysis Batch: 325702

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-98912-1	ISS North Composite	Total/NA	Solid	8270D	323909
490-99129-1	ISS North Composite (Duplicate)	Total/NA	Solid	8270D	323909

GC Semi VOA

Prep Batch: 323709

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-98912-1	ISS North Composite	Total/NA	Solid	8151A	
490-98912-1 MS	ISS North Composite	Total/NA	Solid	8151A	
490-98912-1 MSD	ISS North Composite	Total/NA	Solid	8151A	
490-99129-1	ISS North Composite (Duplicate)	Total/NA	Solid	8151A	
LCS 490-323709/2-A	Lab Control Sample	Total/NA	Solid	8151A	
MB 490-323709/1-A	Method Blank	Total/NA	Solid	8151A	

Analysis Batch: 323862

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-98912-1	ISS North Composite	Total/NA	Solid	8151A	323709
490-98912-1 MS	ISS North Composite	Total/NA	Solid	8151A	323709
490-98912-1 MSD	ISS North Composite	Total/NA	Solid	8151A	323709
490-99129-1	ISS North Composite (Duplicate)	Total/NA	Solid	8151A	323709
LCS 490-323709/2-A	Lab Control Sample	Total/NA	Solid	8151A	323709
MB 490-323709/1-A	Method Blank	Total/NA	Solid	8151A	323709

Prep Batch: 323889

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-98912-1	ISS North Composite	Total/NA	Solid	3550B	
490-99129-A-1-C DU	Duplicate	Total/NA	Solid	3550B	
LCS 490-323889/2-A	Lab Control Sample	Total/NA	Solid	3550B	
MB 490-323889/1-A	Method Blank	Total/NA	Solid	3550B	

Analysis Batch: 323912

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-98912-1	ISS North Composite	Total/NA	Solid	NWTPH-Dx	323889
490-98912-1	ISS North Composite	Total/NA	Solid	NWTPH-Dx	323889
490-99129-A-1-C DU	Duplicate	Total/NA	Solid	NWTPH-Dx	323889
490-99129-A-1-C DU	Duplicate	Total/NA	Solid	NWTPH-Dx	323889

GC Semi VOA (Continued)

Analysis Batch: 323912 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
LCS 490-323889/2-A	Lab Control Sample	Total/NA	Solid	NWTPH-Dx	323889
MB 490-323889/1-A	Method Blank	Total/NA	Solid	NWTPH-Dx	323889

General Chemistry

Analysis Batch: 323280

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-99129-1	ISS North Composite (Duplicate)	Total/NA	Solid	Moisture	

Analysis Batch: 324058

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-98912-1	ISS North Composite	Total/NA	Solid	Moisture	
490-98912-1 DU	ISS North Composite	Total/NA	Solid	Moisture	
490-99241-A-1 MS	Matrix Spike	Total/NA	Solid	Moisture	
490-99241-A-1 MSD	Matrix Spike Duplicate	Total/NA	Solid	Moisture	

Lab Chronicle

Client: Kemron Environmental Services, Inc. TestAmerica Job ID: 490-98912-1
Project/Site: Washington Wood Preserving ISS

Client Sample ID: ISS North Composite **Lab Sample ID: 490-98912-1**
Date Collected: 03/07/16 12:30 **Matrix: Solid**
Date Received: 03/08/16 09:43

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	Moisture		1			324058	03/15/16 09:14	AAB	TAL NSH

Client Sample ID: ISS North Composite **Lab Sample ID: 490-98912-1**
Date Collected: 03/07/16 12:30 **Matrix: Solid**
Date Received: 03/08/16 09:43 **Percent Solids: 66.8**

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3550C			30.23 g	1.00 mL	323909	03/14/16 13:34	LOJ	TAL NSH
Total/NA	Analysis	8270D		1	30.23 g	1.00 mL	325014	03/18/16 18:55	LEG	TAL NSH
Total/NA	Prep	3550C			30.23 g	1.00 mL	323909	03/14/16 13:34	LOJ	TAL NSH
Total/NA	Analysis	8270D		20	30.23 g	1.00 mL	325702	03/22/16 09:37	LEG	TAL NSH
Total/NA	Prep	8151A			30.37 g	10 mL	323709	03/13/16 14:43	LOJ	TAL NSH
Total/NA	Analysis	8151A		100	30.37 g	10 mL	323862	03/14/16 16:24	JML	TAL NSH
Total/NA	Prep	3550B			25.58 g	1.00 mL	323889	03/14/16 12:32	LOJ	TAL NSH
Total/NA	Analysis	NWTPH-Dx		10	25.58 g	1.00 mL	323912	03/14/16 21:15	MDW	TAL NSH
Total/NA	Prep	3550B			25.58 g	1.00 mL	323889	03/14/16 12:32	LOJ	TAL NSH
Total/NA	Analysis	NWTPH-Dx		100	25.58 g	1.00 mL	323912	03/15/16 00:52	MDW	TAL NSH

Client Sample ID: ISS North Composite (Duplicate) **Lab Sample ID: 490-99129-1**
Date Collected: 03/08/16 13:00 **Matrix: Solid**
Date Received: 03/09/16 08:59

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	Moisture		1			323280	03/11/16 09:31	AAB	TAL NSH

Client Sample ID: ISS North Composite (Duplicate) **Lab Sample ID: 490-99129-1**
Date Collected: 03/08/16 13:00 **Matrix: Solid**
Date Received: 03/09/16 08:59 **Percent Solids: 65.3**

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3550C			30.48 g	1.00 mL	323909	03/14/16 13:34	LOJ	TAL NSH
Total/NA	Analysis	8270D		1	30.48 g	1.00 mL	325014	03/18/16 19:20	LEG	TAL NSH
Total/NA	Prep	3550C			30.48 g	1.00 mL	323909	03/14/16 13:34	LOJ	TAL NSH
Total/NA	Analysis	8270D		20	30.48 g	1.00 mL	325702	03/22/16 10:01	LEG	TAL NSH
Total/NA	Prep	8151A			30.60 g	10 mL	323709	03/13/16 14:43	LOJ	TAL NSH
Total/NA	Analysis	8151A		200	30.60 g	10 mL	323862	03/14/16 17:09	JML	TAL NSH

Laboratory References:

TAL NSH = TestAmerica Nashville, 2960 Foster Creighton Drive, Nashville, TN 37204, TEL (615)726-0177

Method	Method Description	Protocol	Laboratory
8270D	Semivolatile Organic Compounds (GC/MS)	SW846	TAL NSH
8151A	Herbicides (GC)	SW846	TAL NSH
NWTPH-Dx	Northwest - Semi-Volatile Petroleum Products (GC)	NWTPH	TAL NSH
Moisture	Percent Moisture	EPA	TAL NSH

Protocol References:

EPA = US Environmental Protection Agency

NWTPH = Northwest Total Petroleum Hydrocarbon

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL NSH = TestAmerica Nashville, 2960 Foster Creighton Drive, Nashville, TN 37204, TEL (615)726-0177

Certification Summary

Client: Kemron Environmental Services, Inc. TestAmerica Job ID: 490-98912-1
Project/Site: Washington Wood Preserving ISS

Laboratory: TestAmerica Nashville

Unless otherwise noted, all analytes for this laboratory were covered under each certification below.

Authority	Program	EPA Region	Certification ID	Expiration Date
Washington	State Program	10	C789	07-19-16

The following analytes are included in this report, but certification is not offered by the governing authority:

Analysis Method	Prep Method	Matrix	Analyte
Moisture		Solid	Percent Moisture
Moisture		Solid	Percent Solids

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

Nashville, TN

COOLER RECEIPT FORM

Atlanta

490-98912 Chain of Custody

Cooler Received/Opened On 3/8/2016 @ 0943

Time Samples Removed From Cooler __________ Time Samples Placed In Storage __________ (2 Hour Window)

1. Tracking # A6455137A (last 4 digits, FedEx) Courier: Greyhound

   IR Gun ID 18290455 pH Strip Lot HC564992 Chlorine Strip Lot 072815A

2. Temperature of rep. sample or temp blank when opened: 1.7 *Degrees Celsius*
3. If Item #2 temperature is 0°C or less, was the representative sample or temp blank frozen? YES NO...NA
4. Were custody seals on outside of cooler? YES...NO...NA

   If yes, how many and where: (1)Front

5. Were the seals intact, signed, and dated correctly? YES...NO...NA
6. Were custody papers inside cooler? YES...NO...NA

I certify that I opened the cooler and answered questions 1-6 (intial) MDM

7. Were custody seals on containers: YES NO and Intact YES...NO...NA

   Were these signed and dated correctly? YES...NO...NA

8. Packing mat'l used? Bubblewrap Plastic bag Peanuts Vermiculite Foam Insert Paper Other None
9. Cooling process: Ice Ice-pack Ice (direct contact) Dry ice Other None
10. Did all containers arrive in good condition (unbroken)? YES...NO...NA
11. Were all container labels complete (#, date, signed, pres., etc)? YES...NO...NA
12. Did all container labels and tags agree with custody papers? YES...NO...NA

13a. Were VOA vials received? YES...NO...NA

b. Was there any observable headspace present in any VOA vial? YES...NO...NA

14. Was there a Trip Blank in this cooler? YES...NO...NA If multiple coolers, sequence # NA

I certify that I unloaded the cooler and answered questions 7-14 (intial) ELA

15a. On pres'd bottles, did pH test strips suggest preservation reached the correct pH level? YES..NO..NA

b. Did the bottle labels indicate that the correct preservatives were used YES...NO...NA

16. Was residual chlorine present? YES...NO...NA

I certify that I checked for chlorine and pH as per SOP and answered questions 15-16 (intial) ELA

17. Were custody papers properly filled out (ink, signed, etc)? YES...NO...NA
18. Did you sign the custody papers in the appropriate place? YES...NO...NA
19. Were correct containers used for the analysis requested? YES...NO...NA
20. Was sufficient amount of sample sent in each container? YES...NO...NA

I certify that I entered this project into LIMS and answered questions 17-20 (intial) ELA

I certify that I attached a label with the unique LIMS number to each container (intial) ELA

21. Were there Non-Conformance issues at login? YES...NO Was a NCM generated? YES...NO...# ______

BIS = Broken in shipment
Cooler Receipt Form.doc

1 2 3 4 5 6 7 8 9 10 11 12 13

TestAmerica Nashville
2960 Foster Creighton Drive
Nashville, TN 37204-3719
phone 615.726.0177 fax 615.726.3404

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
TestAmerica Laboratories, Inc.

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

Client Contact	Project Manager: Tommy Jordan	Site Contact:	Date: 3/7/16	COC No:
KEMRON Environmental Services	Tel/Fax: 404-601-6972	Lab Contact:	Carrier:	1 of 1 COCs
1359-A Ellsworth Industrial Blvd.	Analysis Turnaround Time			Sampler:
Atlanta, GA 303018	☐ CALENDAR DAYS ☑ WORKING DAYS			For Lab Use Only:
404-636-0928 Phone	TAT if different from Below ____			Walk-in Client:
(xxx) xxx-xxxx FAX	☑ 2 weeks			Lab Sampling:
Project Name: Washington Wood Preserving ISS	☐ 1 week			
Site:	☐ 2 days			Job / SDG No.:
P O # SH0600	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	Total Pentochlorophenol 8151	Total PAHs 8270	NW-TPH Diesel	Sample Specific Notes:
ISS North Composite	3/7/2016	1230	G	S	2			x	x	x	Very HoT !! up to 30 g/kg TPH PAH
Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other								1	1	1	

Loc: 490
98912

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.
☑ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return to Client ☑ Disposal by Lab ☐ Archive for ____ Months

Special Instructions/QC Requirements & Comments: VERY HOT !! Please gently homogenize prior to pulling sample aliquot. up to 30 g/kg TPH / PAH

Custody Seals Intact: ☐ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd: ____ Corr'd: ____ | Therm ID No.: ____

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by: [signature]	Company: KEMRON	Date/Time: 3/7/16 1430	Received by: [signature]	Company: TA	Date/Time: 3-7-16 1430
Relinquished by: [signature]	Company: TA 3-7-16	Date/Time: 1542	Received by: [signature]	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by: [signature]	Company: TAN	Date/Time: 3-8-16 0943 1.7

Form No. CA-C-WI-002, Rev. 4.9, dated 2/2/2016

Login Sample Receipt Checklist

Client: Kemron Environmental Services, Inc.

Job Number: 490-98912-1

Login Number: 98912
List Number: 1
Creator: Abernathy, Eric

List Source: TestAmerica Nashville

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	N/A	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

APPENDIX D

PRELIMINARY SCREENING EVALUATIONS

DESIGN SHEETS

MIX DEVELOPMENT DATA SHEET

PROJECT:	Washington Wood Preserving ISS	MIX No.	
PROJECT No.:	SH0600		0600-001
MIXING DATE:	30-Mar-16	MIXED BY:	JDM/DMC

UNTREATED MATERIAL TYPE		**ISS South Composite**
WEIGHT OF UNTREATED MATERIAL		**800 g**
REAGENT TYPE AND LOT NUMBER	ADDITION RATE	WEIGHT
Richmond Type I PC #1047	5.25 %	42.0 g
NewCem GGBFS 100 #1049	2.25 %	18.0 g
	%	0.0 g
	%	0.0 g
	%	0.0 g
Water Addition	80 %	48.0 g

OBSERVATIONS / NOTES

Pocket Penetrometer @ 1, 3, 5 Days
UCS @ 7 Days

PENETROMETER ANALYSES

CURE TIME (Days)	1	3	5		
PENETROMETER (tons/ft^2)	2.00	3.75	4.25		

MIX DEVELOPMENT DATA SHEET

PROJECT: Washington Wood Preserving ISS

MIX No. 0600-002

PROJECT No.: SH0600

MIXING DATE: 30-Mar-16

MIXED BY: JDM/DMC

UNTREATED MATERIAL TYPE		**ISS South Composite**
WEIGHT OF UNTREATED MATERIAL		**800 g**
REAGENT TYPE AND LOT NUMBER	ADDITION RATE	WEIGHT
Richmond Type I PC #1047	7.00 %	56.0 g
NewCem GGBFS 100 #1049	3.00 %	24.0 g
	%	0.0 g
	%	0.0 g
	%	0.0 g
Water Addition	80 %	64.0 g

OBSERVATIONS / NOTES

Pocket Penetrometer @ 1, 3, 5 Days
UCS @ 7 Days

PENETROMETER ANALYSES

CURE TIME (Days)	1	3	5		
PENETROMETER (tons/ft^2)	2.25	4.5	>4.5		

MIX DEVELOPMENT DATA SHEET

PROJECT: Washington Wood Preserving ISS

MIX No. 0600-003

PROJECT No.: SH0600

MIXING DATE: 30-Mar-16

MIXED BY: JDM/DMC

UNTREATED MATERIAL TYPE	**ISS South Composite**
WEIGHT OF UNTREATED MATERIAL	**800 g**

REAGENT TYPE AND LOT NUMBER	ADDITION RATE	WEIGHT
Richmond Type I PC #1047	4.00 %	32.0 g
NewCem GGBFS 100 #1049	8.00 %	64.0 g
	%	0.0 g
	%	0.0 g
	%	0.0 g
Water Addition	80 %	76.8 g

OBSERVATIONS / NOTES

Pocket Penetrometer @ 1, 3, 5 Days
UCS @ 7 Days

PENETROMETER ANALYSES

CURE TIME (Days)	1	3	5		
PENETROMETER (tons/ft^2)	2.50	3.8	>4.5		

MIX DEVELOPMENT DATA SHEET

PROJECT: Washington Wood Preserving ISS

MIX No. 0600-004

PROJECT No.: SH0600

MIXING DATE: 30-Mar-16

MIXED BY: JDM/DMC

UNTREATED MATERIAL TYPE		**ISS South Composite**
WEIGHT OF UNTREATED MATERIAL		**800 g**
REAGENT TYPE AND LOT NUMBER	ADDITION RATE	WEIGHT
Richmond Type I PC #1047	6.00 %	48.0 g
Centralia Class F Fly Ash #1048	1.50 %	12.0 g
	%	0.0 g
	%	0.0 g
	%	0.0 g
Water Addition	80 %	48.0 g

OBSERVATIONS / NOTES

Pocket Penetrometer @ 1, 3, 5 Days
UCS @ 7 Days

PENETROMETER ANALYSES

CURE TIME (Days)	1	3	5		
PENETROMETER (tons/ft^2)	2.75	3.00	3.75		

MIX DEVELOPMENT DATA SHEET

PROJECT:	Washington Wood Preserving ISS	MIX No.	
PROJECT No.:	SH0600		0600-005
MIXING DATE:	30-Mar-16	MIXED BY:	JDM/DMC

UNTREATED MATERIAL TYPE		**ISS South Composite**
WEIGHT OF UNTREATED MATERIAL		**800 g**
REAGENT TYPE AND LOT NUMBER	ADDITION RATE	WEIGHT
Richmond Type I PC #1047	8.00 %	64.0 g
Centralia Class F Fly Ash #1048	2.00 %	16.0 g
	%	0.0 g
	%	0.0 g
	%	0.0 g
Water Addition	80 %	64.0 g

OBSERVATIONS / NOTES

Pocket Penetrometer @ 1, 3, 5 Days
UCS @ 7 Days

PENETROMETER ANALYSES

CURE TIME (Days)	1	3	5		
PENETROMETER (tons/ft^2)	2.50	>4.5	>4.5		

MIX DEVELOPMENT DATA SHEET

PROJECT: Washington Wood Preserving ISS — MIX No. 0600-006

PROJECT No.: SH0600

MIXING DATE: 30-Mar-16 — MIXED BY: JDM/DMC

UNTREATED MATERIAL TYPE		**ISS South Composite**
WEIGHT OF UNTREATED MATERIAL		**800 g**
REAGENT TYPE AND LOT NUMBER	ADDITION RATE	WEIGHT
Richmond Type I PC #1047	4.00 %	32.0 g
Centralia Class F Fly Ash #1048	10.00 %	80.0 g
	%	0.0 g
	%	0.0 g
	%	0.0 g
Water Addition	80 %	89.6 g

OBSERVATIONS / NOTES

Pocket Penetrometer @ 1, 3, 5 Days
UCS @ 7 Days

PENETROMETER ANALYSES

CURE TIME (Days)	1	3	5		
PENETROMETER (tons/ft^2)	1.00	1.75	2.00		

MIX DEVELOPMENT DATA SHEET

PROJECT: Washington Wood Preserving ISS

PROJECT No.: SH0600

MIXING DATE: 30-Mar-16

MIX No. 0600-007

MIXED BY: JDM/DMC

UNTREATED MATERIAL TYPE		**ISS South Composite**
WEIGHT OF UNTREATED MATERIAL		**800 g**
REAGENT TYPE AND LOT NUMBER	ADDITION RATE	WEIGHT
Richmond Type I PC #1047	4.00 %	32.0 g
Tacoma LKD #919	10.00 %	80.0 g
	%	0.0 g
	%	0.0 g
	%	0.0 g
Water Addition	80 %	89.6 g

OBSERVATIONS / NOTES

Pocket Penetrometer @ 1, 3, 5 Days
UCS @ 7 Days

PENETROMETER ANALYSES

CURE TIME (Days)	1	3	5		
PENETROMETER (tons/ft^2)	0.00	0.75	1.25		

MIX DEVELOPMENT DATA SHEET

PROJECT:	Washington Wood Preserving ISS	MIX No.	0600-008
PROJECT No.:	SH0600		
MIXING DATE:	30-Mar-16	MIXED BY:	JDM/DMC

UNTREATED MATERIAL TYPE		**ISS South Composite**
WEIGHT OF UNTREATED MATERIAL		**800 g**
REAGENT TYPE AND LOT NUMBER	ADDITION RATE	WEIGHT
LeHigh Type II/V PC #1042	4.00 %	32.0 g
NewCem GGBFS #1049	8.00 %	64.0 g
	%	0.0 g
	%	0.0 g
	%	0.0 g
Water Addition	80 %	76.8 g

OBSERVATIONS / NOTES

Pocket Penetrometer @ 1, 3, 5 Days
UCS @ 7 Days

PENETROMETER ANALYSES

CURE TIME (Days)	1	3	5		
PENETROMETER (tons/ft^2)	1.75	3.75	>4.5		

MIX DEVELOPMENT DATA SHEET

PROJECT:	Washington Wood Preserving ISS	MIX No.	
PROJECT No.:	SH0600		0600-009
MIXING DATE:	31-Mar-16	MIXED BY:	JDM/DMC

UNTREATED MATERIAL TYPE		**ISS South Composite**
WEIGHT OF UNTREATED MATERIAL		**800 g**
REAGENT TYPE AND LOT NUMBER	ADDITION RATE	WEIGHT
Richmond Type I PC #1047	5.25 %	42.0 g
NewCem GGBFS #1049	2.25 %	18.0 g
Wyo-Ben Hydrogel Bentonite #807	1.00 %	8.0 g
	%	0.0 g
	%	0.0 g
Water Addition	125 %	85.0 g

OBSERVATIONS / NOTES

Pocket Penetrometer @ 1, 3, 5 Days
UCS @ 7 Days

PENETROMETER ANALYSES

CURE TIME (Days)	1	3	5		
PENETROMETER (tons/ft^2)	0.50	1.50	2.00		

MIX DEVELOPMENT DATA SHEET

PROJECT:	Washington Wood Preserving ISS	MIX No.	
PROJECT No.:	SH0600		0600-010
MIXING DATE:	31-Mar-16	MIXED BY:	JDM/DMC

UNTREATED MATERIAL TYPE		**ISS North Composite**
WEIGHT OF UNTREATED MATERIAL		**800 g**

REAGENT TYPE AND LOT NUMBER	ADDITION RATE	WEIGHT
Richmond Type I PC #1047	5.25 %	42.0 g
NewCem GGBFS 100 #1049	2.25 %	18.0 g
	%	0.0 g
	%	0.0 g
	%	0.0 g
Water Addition	80 %	48.0 g

OBSERVATIONS / NOTES

Pocket Penetrometer @ 1, 3, 5 Days
UCS @ 7 Days

PENETROMETER ANALYSES

CURE TIME (Days)	1	3	5		
PENETROMETER (tons/ft^2)	1.50	3.00	4.25		

MIX DEVELOPMENT DATA SHEET

PROJECT:	Washington Wood Preserving ISS	MIX No.	0600-011
PROJECT No.:	SH0600		
MIXING DATE:	31-Mar-16	MIXED BY:	JDM/DMC

UNTREATED MATERIAL TYPE		**ISS North Composite**
WEIGHT OF UNTREATED MATERIAL		**800 g**
REAGENT TYPE AND LOT NUMBER	ADDITION RATE	WEIGHT
Richmond Type I PC #1047	7.00 %	56.0 g
NewCem GGBFS 100 #1049	3.00 %	24.0 g
	%	0.0 g
	%	0.0 g
	%	0.0 g
Water Addition	80 %	64.0 g

OBSERVATIONS / NOTES

Pocket Penetrometer @ 1, 3, 5 Days
UCS @ 7 Days

PENETROMETER ANALYSES

CURE TIME (Days)	1	3	5		
PENETROMETER (tons/ft^2)	2.00	4.50	>4.5		

MIX DEVELOPMENT DATA SHEET

PROJECT:	Washington Wood Preserving ISS	MIX No.	
PROJECT No.:	SH0600		0600-012
MIXING DATE:	31-Mar-16	MIXED BY:	JDM/DMC

UNTREATED MATERIAL TYPE		**ISS North Composite**
WEIGHT OF UNTREATED MATERIAL		**800 g**
REAGENT TYPE AND LOT NUMBER	ADDITION RATE	WEIGHT
Richmond Type I PC #1047	4.00 %	32.0 g
NewCem GGBFS 100 #1049	8.00 %	64.0 g
	%	0.0 g
	%	0.0 g
	%	0.0 g
Water Addition	80 %	76.8 g

OBSERVATIONS / NOTES

Pocket Penetrometer @ 1, 3, 5 Days
UCS @ 7 Days

PENETROMETER ANALYSES

CURE TIME (Days)	1	3	5		
PENETROMETER (tons/ft^2)	0.25	2.75	4.00		

MIX DEVELOPMENT DATA SHEET

PROJECT: Washington Wood Preserving ISS

PROJECT No.: SH0600

MIXING DATE: 31-Mar-16

MIX No. 0600-013

MIXED BY: JDM/DMC

UNTREATED MATERIAL TYPE		**ISS North Composite**
WEIGHT OF UNTREATED MATERIAL		**800 g**
REAGENT TYPE AND LOT NUMBER	ADDITION RATE	WEIGHT
Richmond Type I PC #1047	6.00 %	48.0 g
Centralia Class F Fly Ash #1048	1.50 %	12.0 g
	%	0.0 g
	%	0.0 g
	%	0.0 g
Water Addition	80 %	48.0 g

OBSERVATIONS / NOTES

Pocket Penetrometer @ 1, 3, 5 Days
UCS @ 7 Days

PENETROMETER ANALYSES

CURE TIME (Days)	1	3	5		
PENETROMETER (tons/ft^2)	1.50	2.00	3.25		

MIX DEVELOPMENT DATA SHEET

PROJECT:	Washington Wood Preserving ISS	MIX No.	
PROJECT No.:	SH0600		0600-014
MIXING DATE:	31-Mar-16	MIXED BY:	JDM/DMC

UNTREATED MATERIAL TYPE		**ISS North Composite**
WEIGHT OF UNTREATED MATERIAL		**800 g**
REAGENT TYPE AND LOT NUMBER	ADDITION RATE	WEIGHT
Richmond Type I PC #1047	8.00 %	64.0 g
Centralia Class F Fly Ash #1048	2.00 %	16.0 g
	%	0.0 g
	%	0.0 g
	%	0.0 g
Water Addition	80 %	64.0 g

OBSERVATIONS / NOTES

Pocket Penetrometer @ 1, 3, 5 Days
UCS @ 7 Days

PENETROMETER ANALYSES

CURE TIME (Days)	1	3	5		
PENETROMETER (tons/ft^2)	2.50	>4.5	>4.5		

MIX DEVELOPMENT DATA SHEET

PROJECT:	Washington Wood Preserving ISS	MIX No.	
PROJECT No.:	SH0600		0600-015
MIXING DATE:	31-Mar-16	MIXED BY:	JDM/DMC

UNTREATED MATERIAL TYPE		**ISS North Composite**
WEIGHT OF UNTREATED MATERIAL		**800 g**
REAGENT TYPE AND LOT NUMBER	ADDITION RATE	WEIGHT
Richmond Type I PC #1047	4.00 %	32.0 g
Centralia Class F Fly Ash #1048	10.00 %	80.0 g
	%	0.0 g
	%	0.0 g
	%	0.0 g
Water Addition	80 %	89.6 g

OBSERVATIONS / NOTES

Pocket Penetrometer @ 1, 3, 5 Days
UCS @ 7 Days

PENETROMETER ANALYSES

CURE TIME (Days)	1	3	5		
PENETROMETER (tons/ft^2)	0.00	0.75	1.25		

MIX DEVELOPMENT DATA SHEET

PROJECT:	Washington Wood Preserving ISS	MIX No.	
PROJECT No.:	SH0600		0600-016
MIXING DATE:	31-Mar-16	MIXED BY:	JDM/DMC

UNTREATED MATERIAL TYPE		**ISS North Composite**
WEIGHT OF UNTREATED MATERIAL		**800 g**
REAGENT TYPE AND LOT NUMBER	ADDITION RATE	WEIGHT
Richmond Type I PC #1047	4.00 %	32.0 g
Tacoma LKD #919	10.00 %	80.0 g
	%	0.0 g
	%	0.0 g
	%	0.0 g
Water Addition	80 %	89.6 g

OBSERVATIONS / NOTES

Pocket Penetrometer @ 1, 3, 5 Days
UCS @ 7 Days

PENETROMETER ANALYSES

CURE TIME (Days)	1	3	5		
PENETROMETER (tons/ft^2)	0.00	0.00	0.00		

MIX DEVELOPMENT DATA SHEET

PROJECT: Washington Wood Preserving ISS | MIX No. 0600-017
PROJECT No.: SH0600
MIXING DATE: 31-Mar-16 | MIXED BY: JDM/DMC

UNTREATED MATERIAL TYPE		**ISS North Composite**
WEIGHT OF UNTREATED MATERIAL		**800 g**
REAGENT TYPE AND LOT NUMBER	ADDITION RATE	WEIGHT
LeHigh Tpye II/V PC #1042	4.00 %	32.0 g
NewCem GGBFS #1049	8.00 %	64.0 g
	%	0.0 g
	%	0.0 g
	%	0.0 g
Water Addition	80 %	76.8 g

OBSERVATIONS / NOTES

Pocket Penetrometer @ 1, 3, 5 Days
UCS @ 7 Days

PENETROMETER ANALYSES

CURE TIME (Days)	1	3	5		
PENETROMETER (tons/ft^2)	1.00	2.75	>4.5		

MIX DEVELOPMENT DATA SHEET

PROJECT:	Washington Wood Preserving ISS	MIX No.	
PROJECT No.:	SH0600		0600-018
MIXING DATE:	31-Mar-16	MIXED BY:	JDM/DMC

UNTREATED MATERIAL TYPE		**ISS North Composite**
WEIGHT OF UNTREATED MATERIAL		**800 g**
REAGENT TYPE AND LOT NUMBER	ADDITION RATE	WEIGHT
Richmond Type I PC #1047	5.25 %	42.0 g
NewCem GGBFS #1049	2.25 %	18.0 g
Wyo-Ben Hydrogel Bentonite #807	1.00 %	8.0 g
	%	0.0 g
	%	0.0 g
Water Addition	125 %	85.0 g

OBSERVATIONS / NOTES

Pocket Penetrometer @ 1, 3, 5 Days
UCS @ 7 Days

PENETROMETER ANALYSES

CURE TIME (Days)	1	3	5		
PENETROMETER (tons/ft^2)	0.25	2.75	3.25		

APPENDIX E

PRELIMINARY SCREENING EVALUATIONS

PHYSICAL CHARACTERIZATION

DATA SHEETS

UNCONFINED COMPRESSION TEST

ASTM D 1633

PROJECT: Washington Wood Preserving ISS
PROJECT No.: SH0600
SAMPLE No.: 0600-001 (7-Day)
TESTING DATE: 6-Apr-16
TESTED BY: LC

LOADING RATE: 0.0400 in./min.
TRACKING CODE: A743_US

MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	114.42	g
3. WT WET SOIL + TARE	192.00	g
4. WT DRY SOIL + TARE	162.41	g
5. WT WATER, Ww	29.59	g
6. WT DRY SOIL, Ws	47.99	g
7. MOISTURE CONTENT, W	**61.66**	**%**

SOIL SPECIMEN DIMENSIONS				
	DIAMETER		***LENGTH***	
No. 1	2.00	in.	3.93	in.
No. 2	1.99	in.	3.93	in.
No. 3	1.99	in.	3.93	in.
Average	**1.99**	**in.**	**3.93**	**in.**

SPECIMEN CONDITIONS		
Initial Specimen WT, Wo	***312.61***	***g***
Initial Area, Ao	3.11	in²
Initial Volume, Vo	12.23	in³
Initial Bulk Unit Weight,	97.3	lb/ft³
Initial Dry Unit Weight	60.2	lb/ft³
Maximum Load (Peak)	56.00	lbs.
UCS	17.5	lb/in²

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in²)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (lb/in²)
0	0.000	0.000	3.114	0.0000	0.0
56	0.110	0.110	3.204	0.0280	17.5

UNCONFINED COMPRESSION TEST

ASTM D 1633

PROJECT:	Washington Wood Preserving ISS
PROJECT No.:	SH0600
SAMPLE No.:	0600-002 (7-Day)
TESTING DATE:	6-Apr-16
TESTED BY:	LC
LOADING RATE:	0.0400 in./min.
TRACKING CODE:	A744_US

MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	106.53	g
3. WT WET SOIL + TARE	200.04	g
4. WT DRY SOIL + TARE	163.58	g
5. WT WATER, Ww	36.46	g
6. WT DRY SOIL, Ws	57.05	g
7. MOISTURE CONTENT, W	**63.91**	**%**

SOIL SPECIMEN DIMENSIONS	*DIAMETER*		*LENGTH*	
No. 1	1.99	in.	3.93	in.
No. 2	1.99	in.	3.95	in.
No. 3	1.98	in.	3.93	in.
Average	**1.99**	**in.**	**3.93**	**in.**

SPECIMEN CONDITIONS		
Initial Specimen WT, Wo	***314.69***	***g***
Initial Area, Ao	3.10	in²
Initial Volume, Vo	12.20	in³
Initial Bulk Unit Weight,	98.3	lb/ft³
Initial Dry Unit Weight	60.0	lb/ft³
Maximum Load (Peak)	78.00	lbs.
UCS	24.6	lb/in²

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in²)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (lb/in²)
0	0.000	0.000	3.100	0.0000	0.0
78	0.085	0.085	3.168	0.0216	24.6

UNCONFINED COMPRESSION TEST

ASTM D 1633

PROJECT:	Washington Wood Preserving ISS			
PROJECT No.:	SH0600			
SAMPLE No.:	0600-003 (7-Day)			
TESTING DATE:	6-Apr-16		LOADING RATE:	0.0400 in./min.
TESTED BY:	LC		TRACKING CODE:	A745_US

MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	113.23	g
3. WT WET SOIL + TARE	213.60	g
4. WT DRY SOIL + TARE	174.13	g
5. WT WATER, Ww	39.47	g
6. WT DRY SOIL, Ws	60.90	g
7. MOISTURE CONTENT, W	**64.81**	**%**

SOIL SPECIMEN DIMENSIONS				
	DIAMETER		***LENGTH***	
No. 1	2.00	in.	3.97	in.
No. 2	1.99	in.	3.95	in.
No. 3	1.98	in.	3.97	in.
Average	**1.99**	**in.**	**3.96**	**in.**

SPECIMEN CONDITIONS		
Initial Specimen WT, Wo	***313.47***	***g***
Initial Area, Ao	3.11	in²
Initial Volume, Vo	12.34	in³
Initial Bulk Unit Weight,	96.8	lb/ft³
Initial Dry Unit Weight	58.7	lb/ft³
Maximum Load (Peak)	89.00	lbs.
UCS	28.0	lb/in²

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in²)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (lb/in²)
0	0.000	0.000	3.113	0.0000	0.0
89	0.075	0.075	3.173	0.0189	28.0

UNCONFINED COMPRESSION TEST

ASTM D 1633

PROJECT:	Washington Wood Preserving ISS
PROJECT No.:	SH0600
SAMPLE No.:	0600-004 (7-Day)
TESTING DATE:	6-Apr-16
TESTED BY:	LC
LOADING RATE:	0.0400 in./min.
TRACKING CODE:	A746_US

MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	115.98	g
3. WT WET SOIL + TARE	206.02	g
4. WT DRY SOIL + TARE	170.46	g
5. WT WATER, Ww	35.56	g
6. WT DRY SOIL, Ws	54.48	g
7. MOISTURE CONTENT, W	**65.27**	**%**

SOIL SPECIMEN DIMENSIONS				
	DIAMETER		***LENGTH***	
No. 1	2.01	in.	3.93	in.
No. 2	1.99	in.	3.93	in.
No. 3	1.98	in.	3.93	in.
Average	**1.99**	**in.**	**3.93**	**in.**

SPECIMEN CONDITIONS		
Initial Specimen WT, Wo	***312.94***	***g***
Initial Area, Ao	3.12	in²
Initial Volume, Vo	12.27	in³
Initial Bulk Unit Weight,	97.2	lb/ft³
Initial Dry Unit Weight	58.8	lb/ft³
Maximum Load (Peak)	50.00	lbs.
UCS	15.4	lb/in²

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in²)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (lb/in²)
0	0.000	0.000	3.123	0.0000	0.0
50	0.140	0.140	3.238	0.0356	15.4

UNCONFINED COMPRESSION TEST

ASTM D 1633

PROJECT: Washington Wood Preserving ISS
PROJECT No.: SH0600
SAMPLE No.: 0600-005 (7-Day)
TESTING DATE: 6-Apr-16
TESTED BY: LC

LOADING RATE: 0.0400 in./min.
TRACKING CODE: A747_US

MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	118.37	g
3. WT WET SOIL + TARE	214.63	g
4. WT DRY SOIL + TARE	176.88	g
5. WT WATER, Ww	37.75	g
6. WT DRY SOIL, Ws	58.51	g
7. MOISTURE CONTENT, W	**64.52**	**%**

SOIL SPECIMEN DIMENSIONS				
	DIAMETER		***LENGTH***	
No. 1	2.00	in.	3.93	in.
No. 2	1.99	in.	3.94	in.
No. 3	1.98	in.	3.93	in.
Average	**1.99**	**in.**	**3.93**	**in.**

SPECIMEN CONDITIONS		
Initial Specimen WT, Wo	***314.95***	***g***
Initial Area, Ao	3.11	in²
Initial Volume, Vo	12.22	in³
Initial Bulk Unit Weight,	98.2	lb/ft³
Initial Dry Unit Weight	59.7	lb/ft³
Maximum Load (Peak)	71.00	lbs.
UCS	22.2	lb/in²

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in²)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (lb/in²)
0	0.000	0.000	3.106	0.0000	0.0
71	0.110	0.110	3.195	0.0280	22.2

UNCONFINED COMPRESSION TEST

ASTM D 1633

PROJECT:	Washington Wood Preserving ISS
PROJECT No.:	SH0600
SAMPLE No.:	0600-006 (7-Day)
TESTING DATE:	6-Apr-16
TESTED BY:	LC
LOADING RATE:	0.0400 in./min.
TRACKING CODE:	A748_US

MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	111.87	g
3. WT WET SOIL + TARE	209.19	g
4. WT DRY SOIL + TARE	172.16	g
5. WT WATER, Ww	37.03	g
6. WT DRY SOIL, Ws	60.29	g
7. MOISTURE CONTENT, W	**61.42**	**%**

SOIL SPECIMEN DIMENSIONS	*DIAMETER*		*LENGTH*	
No. 1	1.97	in.	3.86	in.
No. 2	1.97	in.	3.83	in.
No. 3	1.97	in.	3.83	in.
Average	**1.97**	**in.**	**3.84**	**in.**

SPECIMEN CONDITIONS		
Initial Specimen WT, Wo	***314.38***	***g***
Initial Area, Ao	3.05	in²
Initial Volume, Vo	11.73	in³
Initial Bulk Unit Weight,	102.1	lb/ft³
Initial Dry Unit Weight	63.2	lb/ft³
Maximum Load (Peak)	29.00	lbs.
UCS	9.2	lb/in²

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in²)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (lb/in²)
0	0.000	0.000	3.052	0.0000	0.0
29	0.135	0.135	3.163	0.0351	9.2

UNCONFINED COMPRESSION TEST

ASTM D 1633

PROJECT: Washington Wood Preserving ISS
PROJECT No.: SH0600
SAMPLE No.: 0600-007 (7-Day)
TESTING DATE: 6-Apr-16
TESTED BY: LC

LOADING RATE: 0.0400 in./min.
TRACKING CODE: A749_US

MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	114.71	g
3. WT WET SOIL + TARE	191.41	g
4. WT DRY SOIL + TARE	162.97	g
5. WT WATER, Ww	28.44	g
6. WT DRY SOIL, Ws	48.26	g
7. MOISTURE CONTENT, W	**58.93**	**%**

SOIL SPECIMEN DIMENSIONS				
	DIAMETER		*LENGTH*	
No. 1	1.95	in.	3.84	in.
No. 2	1.97	in.	3.85	in.
No. 3	1.96	in.	3.83	in.
Average	**1.96**	**in.**	**3.84**	**in.**

SPECIMEN CONDITIONS		
Initial Specimen WT, Wo	***302.95***	***g***
Initial Area, Ao	3.01	in²
Initial Volume, Vo	11.54	in³
Initial Bulk Unit Weight,	100.0	lb/ft³
Initial Dry Unit Weight	62.9	lb/ft³
Maximum Load (Peak)	23.00	lbs.
UCS	7.2	lb/in²

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in²)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (lb/in²)
0	0.000	0.000	3.008	0.0000	0.0
23	0.225	0.225	3.196	0.0586	7.2

UNCONFINED COMPRESSION TEST

ASTM D 1633

PROJECT:	Washington Wood Preserving ISS		
PROJECT No.:	SH0600		
SAMPLE No.:	0600-008 (7-Day)		
TESTING DATE:	6-Apr-16	LOADING RATE:	0.0400 in./min.
TESTED BY:	LC	TRACKING CODE:	A750_US

MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	113.21	g
3. WT WET SOIL + TARE	200.98	g
4. WT DRY SOIL + TARE	167.10	g
5. WT WATER, Ww	33.88	g
6. WT DRY SOIL, Ws	53.89	g
7. MOISTURE CONTENT, W	**62.87**	**%**

SOIL SPECIMEN DIMENSIONS				
	DIAMETER		*LENGTH*	
No. 1	1.99	in.	3.93	in.
No. 2	2.00	in.	3.93	in.
No. 3	1.99	in.	3.94	in.
Average	**1.99**	**in.**	**3.93**	**in.**

SPECIMEN CONDITIONS		
Initial Specimen WT, Wo	***312.46***	***g***
Initial Area, Ao	3.11	in²
Initial Volume, Vo	12.25	in³
Initial Bulk Unit Weight,	97.2	lb/ft³
Initial Dry Unit Weight	59.7	lb/ft³
Maximum Load (Peak)	100.00	lbs.
UCS	31.5	lb/in²

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in²)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (lb/in²)
0	0.000	0.000	3.114	0.0000	0.0
100	0.080	0.080	3.179	0.0203	31.5

UNCONFINED COMPRESSION TEST

ASTM D 1633

PROJECT: Washington Wood Preserving ISS
PROJECT No.: SH0600
SAMPLE No.: 0600-009 (7-Day)
TESTING DATE: 7-Apr-16
TESTED BY: DMC

LOADING RATE: 0.0400 in./min.
TRACKING CODE: A755_US

MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	76.15	g
3. WT WET SOIL + TARE	128.49	g
4. WT DRY SOIL + TARE	105.96	g
5. WT WATER, Ww	22.53	g
6. WT DRY SOIL, Ws	29.81	g
7. MOISTURE CONTENT, W	**75.58**	**%**

SOIL SPECIMEN DIMENSIONS				
	DIAMETER		***LENGTH***	
No. 1	1.98	in.	3.92	in.
No. 2	1.99	in.	3.96	in.
No. 3	1.99	in.	3.92	in.
Average	**1.99**	**in.**	**3.93**	**in.**

SPECIMEN CONDITIONS		
Initial Specimen WT, Wo	***295.99***	***g***
Initial Area, Ao	3.10	in²
Initial Volume, Vo	12.19	in³
Initial Bulk Unit Weight,	92.5	lb/ft³
Initial Dry Unit Weight	52.7	lb/ft³
Maximum Load (Peak)	36.00	lbs.
UCS	11.2	lb/in²

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in²)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (lb/in²)
0	0.000	0.000	3.101	0.0000	0.0
36	0.145	0.145	3.220	0.0369	11.2

UNCONFINED COMPRESSION TEST

ASTM D 1633

PROJECT:	Washington Wood Preserving ISS		
PROJECT No.:	SH0600		
SAMPLE No.:	0600-010 (7-Day)		
TESTING DATE:	7-Apr-16	LOADING RATE:	0.0400 in./min.
TESTED BY:	DMC	TRACKING CODE:	A756_US

MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	76.63	g
3. WT WET SOIL + TARE	124.09	g
4. WT DRY SOIL + TARE	109.71	g
5. WT WATER, Ww	14.38	g
6. WT DRY SOIL, Ws	33.08	g
7. MOISTURE CONTENT, W	**43.47**	**%**

SOIL SPECIMEN DIMENSIONS				
	DIAMETER		LENGTH	
No. 1	2.00	in.	3.96	in.
No. 2	2.00	in.	3.96	in.
No. 3	1.99	in.	3.97	in.
Average	**2.00**	**in.**	**3.97**	**in.**

SPECIMEN CONDITIONS		
Initial Specimen WT, Wo	***349.91***	***g***
Initial Area, Ao	3.14	in²
Initial Volume, Vo	12.44	in³
Initial Bulk Unit Weight,	107.2	lb/ft³
Initial Dry Unit Weight	74.7	lb/ft³
Maximum Load (Peak)	64.00	lbs.
UCS	20.0	lb/in²

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in²)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (lb/in²)
0	0.000	0.000	3.136	0.0000	0.0
64	0.075	0.075	3.196	0.0189	20.0

UNCONFINED COMPRESSION TEST

ASTM D 1633

PROJECT:	Washington Wood Preserving ISS		
PROJECT No.:	SH0600		
SAMPLE No.:	0600-011 (7-Day)		
TESTING DATE:	7-Apr-16	LOADING RATE:	0.0400 in./min.
TESTED BY:	DMC	TRACKING CODE:	A757_US

MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	63.32	g
3. WT WET SOIL + TARE	124.41	g
4. WT DRY SOIL + TARE	105.11	g
5. WT WATER, Ww	19.30	g
6. WT DRY SOIL, Ws	41.79	g
7. MOISTURE CONTENT, W	**46.18**	**%**

SOIL SPECIMEN DIMENSIONS				
	DIAMETER		*LENGTH*	
No. 1	2.01	in.	3.96	in.
No. 2	2.00	in.	3.94	in.
No. 3	2.00	in.	3.97	in.
Average	**2.00**	**in.**	**3.95**	**in.**

SPECIMEN CONDITIONS		
Initial Specimen WT, Wo	***344.21***	***g***
Initial Area, Ao	3.15	in²
Initial Volume, Vo	12.44	in³
Initial Bulk Unit Weight,	105.4	lb/ft³
Initial Dry Unit Weight	72.1	lb/ft³
Maximum Load (Peak)	96.00	lbs.
UCS	29.8	lb/in²

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in²)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (lb/in²)
0	0.000	0.000	3.146	0.0000	0.0
96	0.090	0.090	3.219	0.0228	29.8

UNCONFINED COMPRESSION TEST

ASTM D 1633

PROJECT:	Washington Wood Preserving ISS
PROJECT No.:	SH0600
SAMPLE No.:	0600-012 (7-Day)
TESTING DATE:	7-Apr-16
TESTED BY:	DMC
LOADING RATE:	0.0400 in./min.
TRACKING CODE:	A758_US

MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	76.74	g
3. WT WET SOIL + TARE	130.53	g
4. WT DRY SOIL + TARE	113.93	g
5. WT WATER, Ww	16.60	g
6. WT DRY SOIL, Ws	37.19	g
7. MOISTURE CONTENT, W	**44.64**	**%**

SOIL SPECIMEN DIMENSIONS				
	DIAMETER		***LENGTH***	
No. 1	2.01	in.	3.95	in.
No. 2	2.00	in.	3.96	in.
No. 3	1.99	in.	3.94	in.
Average	**2.00**	**in.**	**3.95**	**in.**

SPECIMEN CONDITIONS		
Initial Specimen WT, Wo	***342.08***	***g***
Initial Area, Ao	3.14	in²
Initial Volume, Vo	12.40	in³
Initial Bulk Unit Weight,	105.1	lb/ft³
Initial Dry Unit Weight	72.7	lb/ft³
Maximum Load (Peak)	69.00	lbs.
UCS	21.4	lb/in²

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in²)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (lb/in²)
0	0.000	0.000	3.139	0.0000	0.0
69	0.110	0.110	3.229	0.0278	21.4

UNCONFINED COMPRESSION TEST

ASTM D 1633

PROJECT:	Washington Wood Preserving ISS		
PROJECT No.:	SH0600		
SAMPLE No.:	0600-013 (7-Day)		
TESTING DATE:	7-Apr-16	LOADING RATE:	0.0400 in./min.
TESTED BY:	DMC	TRACKING CODE:	A759_US

MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	76.69	g
3. WT WET SOIL + TARE	137.26	g
4. WT DRY SOIL + TARE	118.74	g
5. WT WATER, Ww	18.52	g
6. WT DRY SOIL, Ws	42.05	g
7. MOISTURE CONTENT, W	**44.04**	**%**

SOIL SPECIMEN DIMENSIONS	*DIAMETER*		*LENGTH*	
No. 1	2.00	in.	3.94	in.
No. 2	1.99	in.	3.95	in.
No. 3	2.00	in.	3.94	in.
Average	**2.00**	**in.**	**3.94**	**in.**

SPECIMEN CONDITIONS		
Initial Specimen WT, Wo	***343.97***	***g***
Initial Area, Ao	3.13	in²
Initial Volume, Vo	12.35	in³
Initial Bulk Unit Weight,	106.1	lb/ft³
Initial Dry Unit Weight	73.7	lb/ft³
Maximum Load (Peak)	62.00	lbs.
UCS	19.2	lb/in²

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in²)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (lb/in²)
0	0.000	0.000	3.134	0.0000	0.0
62	0.115	0.115	3.228	0.0292	19.2

UNCONFINED COMPRESSION TEST

ASTM D 1633

PROJECT:	Washington Wood Preserving ISS		
PROJECT No.:	SH0600		
SAMPLE No.:	0600-014 (7-Day)		
TESTING DATE:	7-Apr-16	LOADING RATE:	0.0400 in./min.
TESTED BY:	DMC	TRACKING CODE:	A760_US

MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	76.99	g
3. WT WET SOIL + TARE	126.38	g
4. WT DRY SOIL + TARE	110.98	g
5. WT WATER, Ww	15.40	g
6. WT DRY SOIL, Ws	33.99	g
7. MOISTURE CONTENT, W	**45.31**	**%**

SOIL SPECIMEN DIMENSIONS				
	DIAMETER		LENGTH	
No. 1	2.01	in.	3.90	in.
No. 2	2.00	in.	3.91	in.
No. 3	1.99	in.	3.90	in.
Average	**2.00**	**in.**	**3.90**	**in.**

SPECIMEN CONDITIONS		
Initial Specimen WT, Wo	***340.73***	***g***
Initial Area, Ao	3.14	in²
Initial Volume, Vo	12.27	in³
Initial Bulk Unit Weight,	105.8	lb/ft³
Initial Dry Unit Weight	72.8	lb/ft³
Maximum Load (Peak)	97.00	lbs.
UCS	30.2	lb/in²

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in²)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (lb/in²)
0	0.000	0.000	3.143	0.0000	0.0
97	0.090	0.090	3.217	0.0231	30.2

UNCONFINED COMPRESSION TEST

ASTM D 1633

PROJECT: Washington Wood Preserving ISS
PROJECT No.: SH0600
SAMPLE No.: 0600-015 (7-Day)
TESTING DATE: 7-Apr-16
TESTED BY: DMC

LOADING RATE: 0.0400 in./min.
TRACKING CODE: A761_US

MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	76.02	g
3. WT WET SOIL + TARE	129.24	g
4. WT DRY SOIL + TARE	112.19	g
5. WT WATER, Ww	17.05	g
6. WT DRY SOIL, Ws	36.17	g
7. MOISTURE CONTENT, W	**47.14**	**%**

SOIL SPECIMEN DIMENSIONS				
	DIAMETER		***LENGTH***	
No. 1	2.01	in.	3.78	in.
No. 2	1.99	in.	3.80	in.
No. 3	1.99	in.	3.79	in.
Average	**2.00**	**in.**	**3.79**	**in.**

SPECIMEN CONDITIONS		
Initial Specimen WT, Wo	***330.18***	***g***
Initial Area, Ao	3.13	in²
Initial Volume, Vo	11.86	in³
Initial Bulk Unit Weight,	106.1	lb/ft³
Initial Dry Unit Weight	72.1	lb/ft³
Maximum Load (Peak)	28.00	lbs.
UCS	8.7	lb/in²

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in²)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (lb/in²)
0	0.000	0.000	3.129	0.0000	0.0
28	0.115	0.115	3.227	0.0303	8.7

UNCONFINED COMPRESSION TEST

ASTM D 1633

PROJECT:	Washington Wood Preserving ISS		
PROJECT No.:	SH0600		
SAMPLE No.:	0600-016 (7-Day)		
TESTING DATE:	7-Apr-16	LOADING RATE:	0.0400 in./min.
TESTED BY:	DMC	TRACKING CODE:	A762_US

MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	77.45	g
3. WT WET SOIL + TARE	130.91	g
4. WT DRY SOIL + TARE	114.05	g
5. WT WATER, Ww	16.86	g
6. WT DRY SOIL, Ws	36.60	g
7. MOISTURE CONTENT, W	**46.07**	**%**

SOIL SPECIMEN DIMENSIONS	DIAMETER		LENGTH	
No. 1	1.96	in.	3.88	in.
No. 2	2.00	in.	3.89	in.
No. 3	1.95	in.	3.91	in.
Average	**1.97**	**in.**	**3.89**	**in.**

SPECIMEN CONDITIONS		
Initial Specimen WT, Wo	***335.45***	***g***
Initial Area, Ao	3.04	in²
Initial Volume, Vo	11.85	in³
Initial Bulk Unit Weight,	107.8	lb/ft³
Initial Dry Unit Weight	73.8	lb/ft³
Maximum Load (Peak)	13.00	lbs.
UCS	3.9	lb/in²

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in²)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (lb/in²)
0	0.000	0.000	3.043	0.0000	0.0
13	0.325	0.325	3.321	0.0835	3.9

UNCONFINED COMPRESSION TEST

ASTM D 1633

PROJECT:	Washington Wood Preserving ISS
PROJECT No.:	SH0600
SAMPLE No.:	0600-017 (7-Day)
TESTING DATE:	7-Apr-16
TESTED BY:	DMC
LOADING RATE:	0.0400 in./min.
TRACKING CODE:	A763_US

MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	76.37	g
3. WT WET SOIL + TARE	130.30	g
4. WT DRY SOIL + TARE	114.30	g
5. WT WATER, Ww	16.00	g
6. WT DRY SOIL, Ws	37.93	g
7. MOISTURE CONTENT, W	**42.18**	**%**

SOIL SPECIMEN DIMENSIONS				
	DIAMETER		***LENGTH***	
No. 1	1.99	in.	3.89	in.
No. 2	2.01	in.	3.88	in.
No. 3	2.00	in.	3.86	in.
Average	**2.00**	**in.**	**3.87**	**in.**

SPECIMEN CONDITIONS		
Initial Specimen WT, Wo	***339.02***	***g***
Initial Area, Ao	3.14	in²
Initial Volume, Vo	12.15	in³
Initial Bulk Unit Weight,	106.3	lb/ft³
Initial Dry Unit Weight	74.8	lb/ft³
Maximum Load (Peak)	86.00	lbs.
UCS	27.1	lb/in²

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in²)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (lb/in²)
0	0.000	0.000	3.135	0.0000	0.0
86	0.045	0.045	3.172	0.0116	27.1

UNCONFINED COMPRESSION TEST

ASTM D 1633

PROJECT: Washington Wood Preserving ISS
PROJECT No.: SH0600
SAMPLE No.: 0600-018 (7-Day)
TESTING DATE: 4/7/2016
TESTED BY: DMC

LOADING RATE: 0.0400 in./min.
TRACKING CODE: A764_US

MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	76.99	g
3. WT WET SOIL + TARE	129.49	g
4. WT DRY SOIL + TARE	112.19	g
5. WT WATER, Ww	17.30	g
6. WT DRY SOIL, Ws	35.20	g
7. MOISTURE CONTENT, W	**49.15**	**%**

SOIL SPECIMEN DIMENSIONS				
	DIAMETER		LENGTH	
No. 1	2.00	in.	3.99	in.
No. 2	1.99	in.	3.97	in.
No. 3	1.99	in.	3.98	in.
Average	**1.99**	**in.**	**3.98**	**in.**

SPECIMEN CONDITIONS		
Initial Specimen WT, Wo	***337.47***	***g***
Initial Area, Ao	3.13	in²
Initial Volume, Vo	12.44	in³
Initial Bulk Unit Weight,	103.3	lb/ft³
Initial Dry Unit Weight	69.3	lb/ft³
Maximum Load (Peak)	62.00	lbs.
UCS	19.1	lb/in²

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in²)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (lb/in²)
0	0.000	0.000	3.125	0.0000	0.0
62	0.140	0.140	3.239	0.0352	19.1

APPENDIX F

ADVANCED SCREENING EVALUATIONS

DESIGN SHEETS

MIX DEVELOPMENT DATA SHEET

PROJECT: Washington Wood Preserving ISS

MIX No. 0600-019

PROJECT No.: SH0600

MIXING DATE: 20-Apr-16

MIXED BY: LC

UNTREATED MATERIAL TYPE		**ISS South Composite**
WEIGHT OF UNTREATED MATERIAL		**1,800 g**
REAGENT TYPE AND LOT NUMBER	ADDITION RATE	WEIGHT
Richmond Type I PC #1047	4.00 %	72.0 g
NewCem GGBFS 100 #1049	8.00 %	144.0 g
	%	0.0 g
	%	0.0 g
	%	0.0 g
Water Addition	80 %	172.8 g

OBSERVATIONS / NOTES

Pocket Penetrometer @ 1, 3, 5, 7, 14, and 28 Days
UCS @ 7 and 28 Days
Permeability @ 28 Days
Potential LEAF Testing

PENETROMETER ANALYSES

CURE TIME (Days)	1, 3	5	7	14	28
PENETROMETER (tons/ft^2)	1.50, >4.5	>4.5	>4.5	>4.5	>4.5

MIX DEVELOPMENT DATA SHEET

PROJECT:	Washington Wood Preserving ISS	MIX No.	
PROJECT No.:	SH0600		0600-020
MIXING DATE:	20-Apr-16	MIXED BY:	LC

UNTREATED MATERIAL TYPE		**ISS South Composite**
WEIGHT OF UNTREATED MATERIAL		**1,800 g**
REAGENT TYPE AND LOT NUMBER	ADDITION RATE	WEIGHT
Richmond Type I PC #1047	5.00 %	90.0 g
NewCem GGBFS 100 #1049	10.00 %	180.0 g
Wyo-Ben Hydrogel Bentonite #807	1.00 %	18.0 g
	%	0.0 g
	%	0.0 g
Water Addition	100 %	288.0 g

OBSERVATIONS / NOTES

Pocket Penetrometer @ 1, 3, 5, 7, 14, and 28 Days
UCS @ 7 and 28 Days
Permeability @ 28 Days
Potential LEAF Testing

PENETROMETER ANALYSES

CURE TIME (Days)	1, 3	5	7	14	28
PENETROMETER (tons/ft^2)	1.00,>4.5	>4.5	>4.5	>4.5	>4.5

MIX DEVELOPMENT DATA SHEET

PROJECT:	Washington Wood Preserving ISS	MIX No.	
PROJECT No.:	SH0600		0600-021
MIXING DATE:	20-Apr-16	MIXED BY:	LC

UNTREATED MATERIAL TYPE		**ISS South Composite**
WEIGHT OF UNTREATED MATERIAL		**1,800 g**
REAGENT TYPE AND LOT NUMBER	ADDITION RATE	WEIGHT
Richmond Type I PC #1047	6.00 %	108.0 g
NewCem GGBFS 100 #1049	6.00 %	108.0 g
	%	0.0 g
	%	0.0 g
	%	0.0 g
Water Addition	80 %	172.8 g

OBSERVATIONS / NOTES

Pocket Penetrometer @ 1, 3, 5, 7, 14, and 28 Days
UCS @ 7 and 28 Days
Permeability @ 28 Days
Potential LEAF Testing

PENETROMETER ANALYSES

CURE TIME (Days)	1, 3	5	7	14	28
PENETROMETER (tons/ft^2)	2.00, 4.5	>4.5	>4.5	>4.5	>4.5

MIX DEVELOPMENT DATA SHEET

PROJECT: Washington Wood Preserving ISS

MIX No. 0600-022

PROJECT No.: SH0600

MIXING DATE: 20-Apr-16

MIXED BY: LC

UNTREATED MATERIAL TYPE		**ISS South Composite**
WEIGHT OF UNTREATED MATERIAL		**1,800 g**
REAGENT TYPE AND LOT NUMBER	ADDITION RATE	WEIGHT
Richmond Type I PC #1047	6.00 %	108.0 g
NewCem GGBFS 100 #1049	8.00 %	144.0 g
Wyo-Ben Hydrogel Bentonite #807	1.00 %	18.0 g
	%	0.0 g
	%	0.0 g
Water Addition	80 %	216.0 g

OBSERVATIONS / NOTES

Pocket Penetrometer @ 1, 3, 5, 7, 14, and 28 Days
UCS @ 7 and 28 Days
Permeability @ 28 Days
Potential LEAF Testing

PENETROMETER ANALYSES

CURE TIME (Days)	1, 3	5	7	14	28
PENETROMETER (tons/ft^2)	1.00, 3.50	>4.5	>4.5	>4.5	>4.5

MIX DEVELOPMENT DATA SHEET

PROJECT:	Washington Wood Preserving ISS	MIX No.	
PROJECT No.:	SH0600		0600-023
MIXING DATE:	20-Apr-16	MIXED BY:	LC

UNTREATED MATERIAL TYPE		**ISS South Composite**
WEIGHT OF UNTREATED MATERIAL		**1,800 g**

REAGENT TYPE AND LOT NUMBER	ADDITION RATE	WEIGHT
Richmond Type I PC #1047	8.00 %	144.0 g
NewCem GGBFS 100 #1049	4.00 %	72.0 g
Wyo-Ben Hydrogel Bentonite #807	1.00 %	18.0 g
	%	0.0 g
	%	0.0 g
Water Addition	100 %	234.0 g

OBSERVATIONS / NOTES

Pocket Penetrometer @ 1, 3, 5, 7, 14, and 28 Days
UCS @ 7 and 28 Days
Permeability @ 28 Days
Potential LEAF Testing

PENETROMETER ANALYSES

CURE TIME (Days)	1, 3	5	7	14	28
PENETROMETER (tons/ft^2)	1.75, >4.5	>4.5	>4.5	>4.5	>4.5

MIX DEVELOPMENT DATA SHEET

PROJECT: Washington Wood Preserving ISS

MIX No. 0600-024

PROJECT No.: SH0600

MIXING DATE: 20-Apr-16

MIXED BY: LC

UNTREATED MATERIAL TYPE		**ISS North Composite**
WEIGHT OF UNTREATED MATERIAL		**1,800 g**

REAGENT TYPE AND LOT NUMBER	ADDITION RATE	WEIGHT
Richmond Type I PC #1047	4.00 %	72.0 g
NewCem GGBFS 100 #1049	8.00 %	144.0 g
	%	0.0 g
	%	0.0 g
	%	0.0 g
Water Addition	80 %	172.8 g

OBSERVATIONS / NOTES

Pocket Penetrometer @ 1, 3, 5, 7, 14, and 28 Days
UCS @ 7 and 28 Days
Permeability @ 28 Days
Potential LEAF Testing

PENETROMETER ANALYSES

CURE TIME (Days)	1, 3	5	7	14	28
PENETROMETER (tons/ft^2)	0.50, 3.00	>4.5	>4.5	>4.5	>4.5

MIX DEVELOPMENT DATA SHEET

PROJECT:	Washington Wood Preserving ISS	MIX No.	
PROJECT No.:	SH0600		0600-025
MIXING DATE:	20-Apr-16	MIXED BY:	LC

UNTREATED MATERIAL TYPE		**ISS North Composite**
WEIGHT OF UNTREATED MATERIAL		**1,800 g**
REAGENT TYPE AND LOT NUMBER	ADDITION RATE	WEIGHT
Richmond Type I PC #1047	5.00 %	90.0 g
NewCem GGBFS 100 #1049	10.00 %	180.0 g
Wyo-Ben Hydrogel Bentonite #807	1.00 %	18.0 g
	%	0.0 g
	%	0.0 g
Water Addition	100 %	288.0 g

OBSERVATIONS / NOTES

Pocket Penetrometer @ 1, 3, 5, 7, 14, and 28 Days
UCS @ 7 and 28 Days
Permeability @ 28 Days
Potential LEAF Testing

PENETROMETER ANALYSES

CURE TIME (Days)	1, 3	5	7	14	28
PENETROMETER (tons/ft^2)	0.50, 3.50	>4.5	>4.5	>4.5	>4.5

MIX DEVELOPMENT DATA SHEET

PROJECT:	Washington Wood Preserving ISS	MIX No.	
PROJECT No.:	SH0600		0600-026
MIXING DATE:	20-Apr-16	MIXED BY:	LC

UNTREATED MATERIAL TYPE		**ISS North Composite**
WEIGHT OF UNTREATED MATERIAL		**1,800 g**
REAGENT TYPE AND LOT NUMBER	ADDITION RATE	WEIGHT
Richmond Type I PC #1047	6.00 %	108.0 g
NewCem GGBFS 100 #1049	6.00 %	108.0 g
	%	0.0 g
	%	0.0 g
	%	0.0 g
Water Addition	80 %	172.8 g

OBSERVATIONS / NOTES

Pocket Penetrometer @ 1, 3, 5, 7, 14, and 28 Days
UCS @ 7 and 28 Days
Permeability @ 28 Days
Potential LEAF Testing

PENETROMETER ANALYSES

CURE TIME (Days)	1, 3	5	7	14	28
PENETROMETER (tons/ft^2)	0.75, 4.25	>4.5	>4.5	>4.5	>4.5

MIX DEVELOPMENT DATA SHEET

PROJECT: Washington Wood Preserving ISS

MIX No. 0600-027

PROJECT No.: SH0600

MIXING DATE: 20-Apr-16

MIXED BY: LC

UNTREATED MATERIAL TYPE		**ISS North Composite**
WEIGHT OF UNTREATED MATERIAL		**1,800 g**
REAGENT TYPE AND LOT NUMBER	ADDITION RATE	WEIGHT
Richmond Type I PC #1047	6.00 %	108.0 g
NewCem GGBFS 100 #1049	8.00 %	144.0 g
Wyo-Ben Hydrogel Bentonite #807	1.00 %	18.0 g
	%	0.0 g
	%	0.0 g
Water Addition	100 %	270.0 g

OBSERVATIONS / NOTES

Pocket Penetrometer @ 1, 3, 5, 7, 14, and 28 Days
UCS @ 7 and 28 Days
Permeability @ 28 Days
Potential LEAF Testing

PENETROMETER ANALYSES

CURE TIME (Days)	1, 3	5	7	14	28
PENETROMETER (tons/ft^2)	0.00, 2.00	2.75	4.50	>4.5	>4.5

MIX DEVELOPMENT DATA SHEET

PROJECT: Washington Wood Preserving ISS

MIX No. 0600-028

PROJECT No.: SH0600

MIXING DATE: 20-Apr-16

MIXED BY: LC

UNTREATED MATERIAL TYPE	**ISS North Composite**
WEIGHT OF UNTREATED MATERIAL	**1,800 g**

REAGENT TYPE AND LOT NUMBER	ADDITION RATE	WEIGHT
Richmond Type I PC #1047	8.00 %	144.0 g
NewCem GGBFS 100 #1049	4.00 %	72.0 g
Wyo-Ben Hydrogel Bentonite #807	1.00 %	18.0 g
	%	0.0 g
	%	0.0 g
Water Addition	100 %	234.0 g

OBSERVATIONS / NOTES

Pocket Penetrometer @ 1, 3, 5, 7, 14, and 28 Days
UCS @ 7 and 28 Days
Permeability @ 28 Days
Potential LEAF Testing

PENETROMETER ANALYSES

CURE TIME (Days)	1, 3	5	7	14	28
PENETROMETER (tons/ft^2)	1.50, 3.25	>4.5	>4.5	>4.5	>4.5

APPENDIX G

ADVANCED SCREENING EVALUATIONS

PHYSICAL CHARATERIZATION

DATA SHEETS

UNCONFINED COMPRESSION TEST

ASTM D 2166

PROJECT: Washington Wood Preserving ISS
PROJECT No.: SH0600
SAMPLE No.: 0600-019 (7-day)
TESTING DATE: 27-Apr-16
TESTED BY: DMC
LOADING RATE: 0.0400 in./min.
TRACKING CODE: A790_US

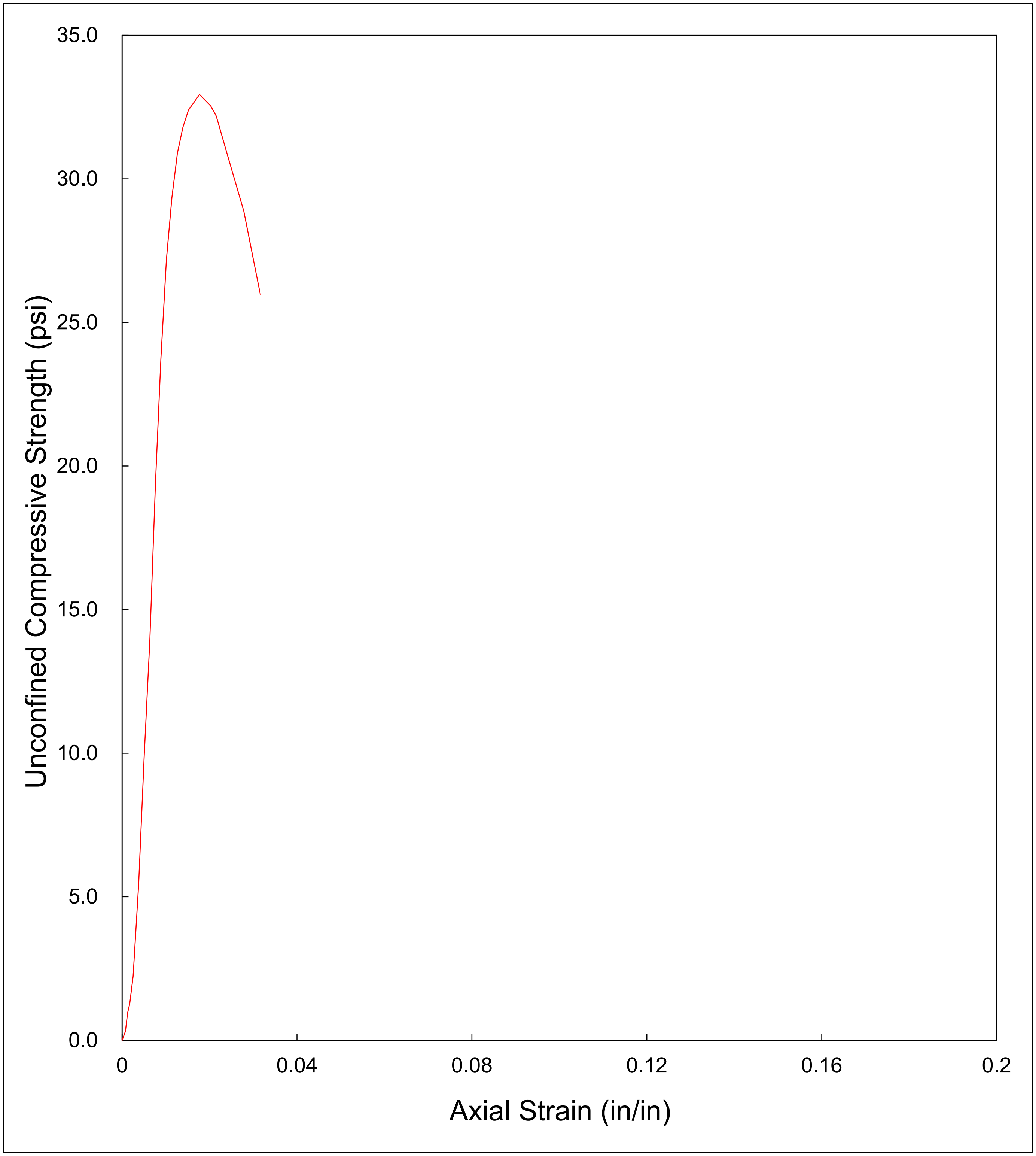
MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	113.56	g
3. WT WET SOIL + TARE	155.23	g
4. WT DRY SOIL + TARE	138.55	g
5. WT WATER, Ww	16.68	g
6. WT DRY SOIL, Ws	24.99	g
7. MOISTURE CONTENT, W	**66.75**	**%**

SOIL SPECIMEN DIMENSIONS	DIAMETER		LENGTH	
No. 1	2.00	in.	3.92	in.
No. 2	2.00	in.	4.01	in.
No. 3	1.99	in.	3.92	in.
Average	**2.00**	**in.**	**3.95**	**in.**

SPECIMEN CONDITIONS		
Initial Specimen WT, Wo	***311.33***	***g***
Initial Area, Ao	3.13	in²
Initial Volume, Vo	12.37	in³
Initial Bulk Unit Weight,	95.9	lb/ft³
Initial Dry Unit Weight	57.5	lb/ft³
15 % Strain (0.15 Lo)	0.59	in.
UCS	32.9	lb/in²

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in²)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (lb/in²)
0	0.000	0.000	3.131	0.0000	0.0
1	0.003	0.003	3.134	0.0008	0.3
3	0.005	0.005	3.135	0.0013	1.0
4	0.007	0.007	3.137	0.0018	1.3
7	0.010	0.010	3.139	0.0025	2.2
17	0.015	0.015	3.143	0.0038	5.4
31	0.020	0.020	3.147	0.0051	9.9
44	0.025	0.025	3.151	0.0063	14.0
61	0.030	0.030	3.155	0.0076	19.3
75	0.035	0.035	3.159	0.0089	23.7
86	0.040	0.040	3.163	0.0101	27.2
93	0.045	0.045	3.167	0.0114	29.4
98	0.050	0.050	3.171	0.0127	30.9
101	0.055	0.055	3.175	0.0139	31.8
103	0.060	0.060	3.179	0.0152	32.4
104	0.065	0.065	3.184	0.0165	32.7
105	0.070	0.070	3.188	0.0177	32.9
104	0.080	0.080	3.196	0.0202	32.5
103	0.085	0.085	3.200	0.0215	32.2
101	0.090	0.090	3.204	0.0228	31.5
99	0.095	0.095	3.208	0.0240	30.9
97	0.100	0.100	3.212	0.0253	30.2
95	0.105	0.105	3.217	0.0266	29.5
93	0.110	0.110	3.221	0.0278	28.9
90	0.115	0.115	3.225	0.0291	27.9
87	0.120	0.120	3.229	0.0304	26.9
84	0.125	0.125	3.233	0.0316	26.0

UNCONFINED COMPRESSION TESTING
Sample No.   0600-019 (7-day)



UNCONFINED COMPRESSION TEST

ASTM D 2166

SUMMARY OF RESULTS

PROJECT:	Washington Wood Preserving ISS		
PROJECT No.:	SH0600		
SAMPLE No.:	0600-019 (7-day)		
TESTING DATE:	4/27/2016	LOADING RATE:	0.0400 in./min.
TESTED BY:	DMC	TRACKING CODE:	A790_US

TESTING PARAMETER AND RESULTS		
MOISTURE CONTENT	66.7	**%**
BULK UNIT WEIGHT	95.9	lb/ft^3
DRY UNIT WEIGHT	57.5	lb/ft^3
UCS *	32.9	lb/in^2

* UCS - UNCONFINED COMPRESSIVE STRENGTH

UNCONFINED COMPRESSION TEST

ASTM D 2166

PROJECT:	Washington Wood Preserving ISS		
PROJECT No.:	SH0600		
SAMPLE No.:	0600-020 (7-day)		
TESTING DATE:	27-Apr-16	LOADING RATE:	0.0400 in./min.
TESTED BY:	DMC	TRACKING CODE:	A791_US

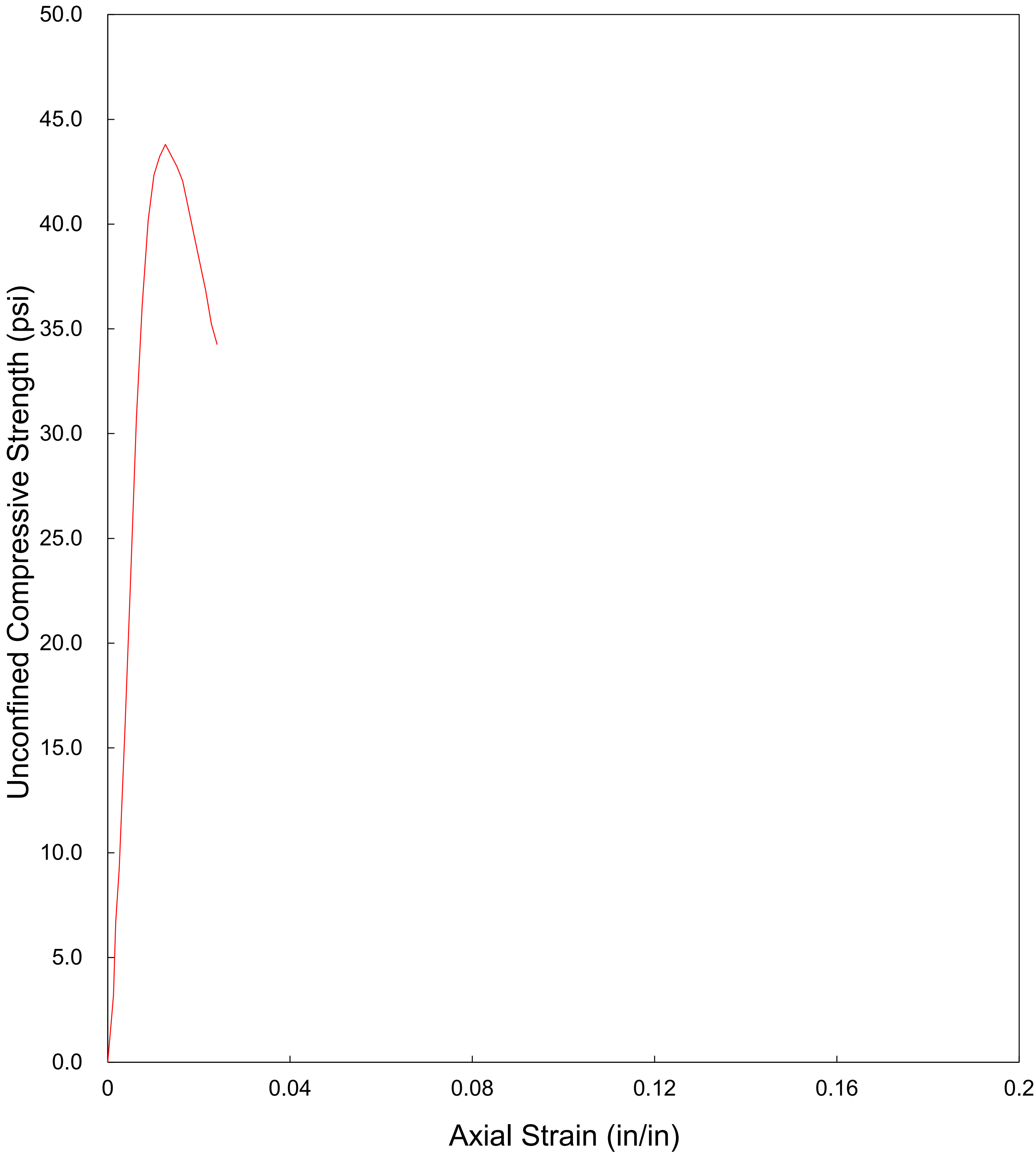
SOIL SPECIMEN DIMENSIONS				
	DIAMETER		LENGTH	
No. 1	2.01	in.	3.96	in.
No. 2	1.99	in.	3.96	in.
No. 3	1.99	in.	3.95	in.
Average	**2.00**	**in.**	**3.96**	**in.**

MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	116.06	g
3. WT WET SOIL + TARE	159.19	g
4. WT DRY SOIL + TARE	141.88	g
5. WT WATER, Ww	17.31	g
6. WT DRY SOIL, Ws	25.82	g
7. MOISTURE CONTENT, W	**67.04**	**%**

SPECIMEN CONDITIONS		
Initial Specimen WT, Wo	***307.55***	***g***
Initial Area, Ao	3.13	in²
Initial Volume, Vo	12.39	in³
Initial Bulk Unit Weight,	94.5	lb/ft³
Initial Dry Unit Weight	56.6	lb/ft³
15 % Strain (0.15 Lo)	0.59	in.
UCS	43.8	lb/in²

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in²)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (lb/in²)
0	0.000	0.000	3.133	0.0000	0.0
6	0.003	0.003	3.136	0.0008	1.9
10	0.005	0.005	3.137	0.0013	3.2
21	0.007	0.007	3.139	0.0018	6.7
29	0.010	0.010	3.141	0.0025	9.2
50	0.015	0.015	3.145	0.0038	15.9
73	0.020	0.020	3.149	0.0051	23.2
97	0.025	0.025	3.153	0.0063	30.8
114	0.030	0.030	3.157	0.0076	36.1
127	0.035	0.035	3.161	0.0088	40.2
134	0.040	0.040	3.165	0.0101	42.3
137	0.045	0.045	3.169	0.0114	43.2
139	0.050	0.050	3.173	0.0126	43.8
136	0.060	0.060	3.181	0.0152	42.7
134	0.065	0.065	3.186	0.0164	42.1
130	0.070	0.070	3.190	0.0177	40.8
126	0.075	0.075	3.194	0.0190	39.5
122	0.080	0.080	3.198	0.0202	38.2
118	0.085	0.085	3.202	0.0215	36.9
113	0.090	0.090	3.206	0.0228	35.2
110	0.095	0.095	3.210	0.0240	34.3

UNCONFINED COMPRESSION TESTING
Sample No.   0600-020 (7-day)



UNCONFINED COMPRESSION TEST

ASTM D 2166

SUMMARY OF RESULTS

PROJECT:	Washington Wood Preserving ISS		
PROJECT No.:	SH0600		
SAMPLE No.:	0600-020 (7-day)		
TESTING DATE:	4/27/2016	LOADING RATE:	0.0400 in./min.
TESTED BY:	DMC	TRACKING CODE:	A791_US

TESTING PARAMETER AND RESULTS		
MOISTURE CONTENT	67.0	**%**
BULK UNIT WEIGHT	94.5	lb/ft^3
DRY UNIT WEIGHT	56.6	lb/ft^3
UCS *	43.8	lb/in^2

* UCS - UNCONFINED COMPRESSIVE STRENGTH

UNCONFINED COMPRESSION TEST

ASTM D 2166

PROJECT:	Washington Wood Preserving ISS
PROJECT No.:	SH0600
SAMPLE No.:	0600-021 (7-day)
TESTING DATE:	27-Apr-16
TESTED BY:	DMC
LOADING RATE:	0.0400 in./min.
TRACKING CODE:	A792_US

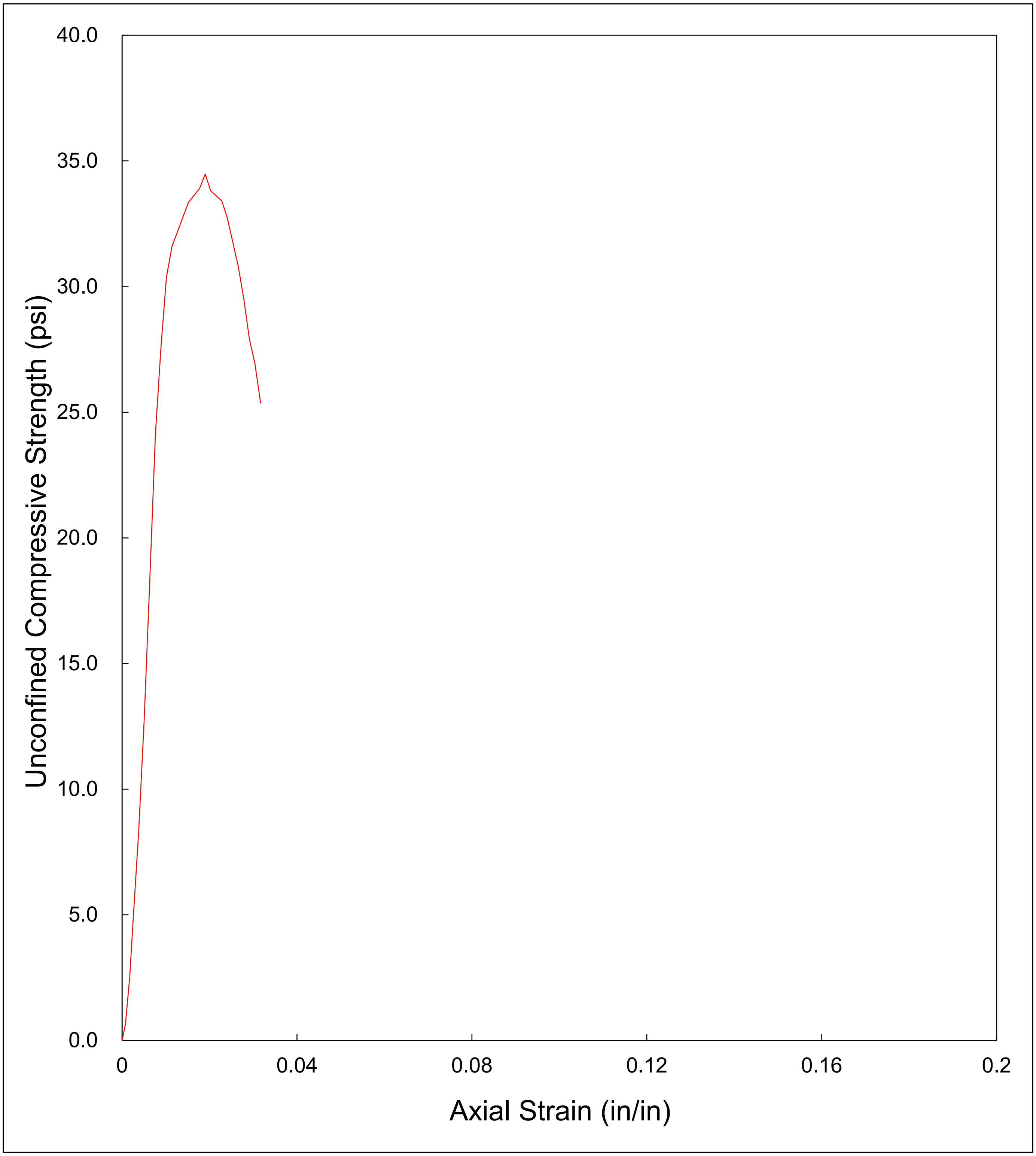
MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	116.74	g
3. WT WET SOIL + TARE	155.54	g
4. WT DRY SOIL + TARE	140.98	g
5. WT WATER, Ww	14.56	g
6. WT DRY SOIL, Ws	24.24	g
7. MOISTURE CONTENT, W	**60.07**	**%**

SOIL SPECIMEN DIMENSIONS				
	DIAMETER		LENGTH	
No. 1	2.00	in.	3.95	in.
No. 2	2.00	in.	3.95	in.
No. 3	1.99	in.	3.95	in.
Average	**2.00**	**in.**	**3.95**	**in.**

SPECIMEN CONDITIONS		
Initial Specimen WT, Wo	***312.36***	***g***
Initial Area, Ao	3.13	in²
Initial Volume, Vo	12.36	in³
Initial Bulk Unit Weight,	96.3	lb/ft³
Initial Dry Unit Weight	60.1	lb/ft³
15 % Strain (0.15 Lo)	0.59	in.
UCS	34.5	lb/in²

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in²)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (lb/in²)
0	0.000	0.000	3.130	0.0000	0.0
2	0.003	0.003	3.132	0.0008	0.6
5	0.005	0.005	3.134	0.0013	1.6
8	0.007	0.007	3.135	0.0018	2.6
15	0.010	0.010	3.138	0.0025	4.8
26	0.015	0.015	3.141	0.0038	8.3
40	0.020	0.020	3.145	0.0051	12.7
58	0.025	0.025	3.149	0.0063	18.4
76	0.030	0.030	3.154	0.0076	24.1
87	0.035	0.035	3.158	0.0089	27.6
96	0.040	0.040	3.162	0.0101	30.4
100	0.045	0.045	3.166	0.0114	31.6
102	0.050	0.050	3.170	0.0127	32.2
104	0.055	0.055	3.174	0.0139	32.8
106	0.060	0.060	3.178	0.0152	33.4
107	0.065	0.065	3.182	0.0165	33.6
108	0.070	0.070	3.186	0.0177	33.9
110	0.075	0.075	3.190	0.0190	34.5
108	0.080	0.080	3.194	0.0203	33.8
107	0.090	0.090	3.203	0.0228	33.4
105	0.095	0.095	3.207	0.0241	32.7
102	0.100	0.100	3.211	0.0253	31.8
99	0.105	0.105	3.215	0.0266	30.8
95	0.110	0.110	3.219	0.0278	29.5
90	0.115	0.115	3.223	0.0291	27.9
87	0.120	0.120	3.228	0.0304	27.0
82	0.125	0.125	3.232	0.0316	25.4

UNCONFINED COMPRESSION TESTING
Sample No. 0600-021 (7-day)



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UNCONFINED COMPRESSION TEST

ASTM D 2166
SUMMARY OF RESULTS

PROJECT:	Washington Wood Preserving ISS		
PROJECT No.:	SH0600		
SAMPLE No.:	0600-021 (7-day)		
TESTING DATE:	4/27/2016	LOADING RATE:	0.0400 in./min.
TESTED BY:	DMC	TRACKING CODE:	A792_US

TESTING PARAMETER AND RESULTS		
MOISTURE CONTENT	60.1	**%**
BULK UNIT WEIGHT	96.3	lb/ft³
DRY UNIT WEIGHT	60.1	lb/ft³
UCS *	34.5	lb/in²

* UCS - UNCONFINED COMPRESSIVE STRENGTH

UNCONFINED COMPRESSION TEST

ASTM D 2166

PROJECT:	Washington Wood Preserving ISS
PROJECT No.:	SH0600
SAMPLE No.:	0600-022 (7-day)
TESTING DATE:	27-Apr-16
TESTED BY:	DMC
LOADING RATE:	0.0400 in./min.
TRACKING CODE:	A793_US

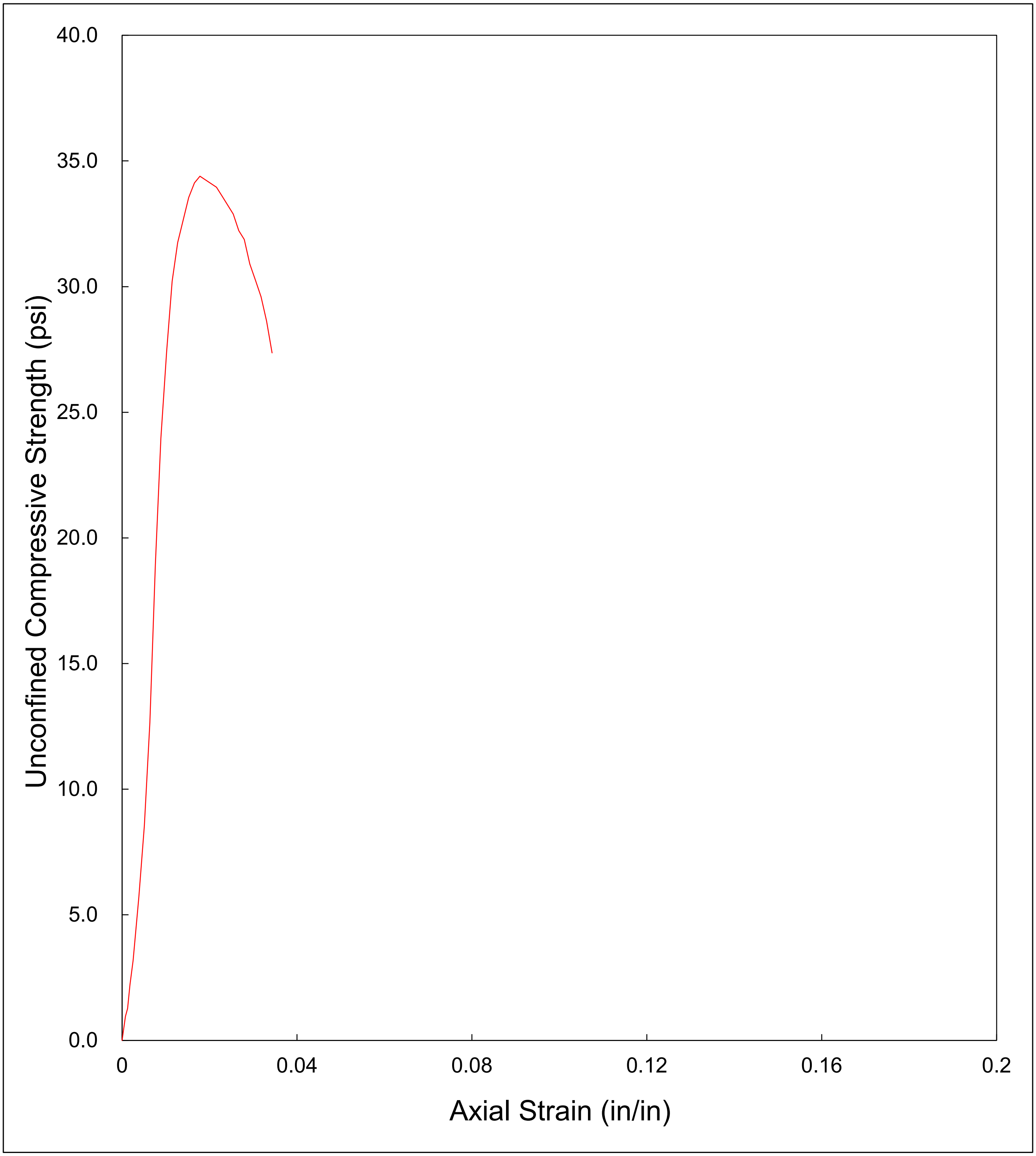
MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	107.86	g
3. WT WET SOIL + TARE	155.74	g
4. WT DRY SOIL + TARE	136.82	g
5. WT WATER, Ww	18.92	g
6. WT DRY SOIL, Ws	28.96	g
7. MOISTURE CONTENT, W	**65.33**	**%**

SOIL SPECIMEN DIMENSIONS	DIAMETER		LENGTH	
No. 1	2.01	in.	3.92	in.
No. 2	2.00	in.	3.93	in.
No. 3	1.99	in.	3.95	in.
Average	**2.00**	**in.**	**3.93**	**in.**

SPECIMEN CONDITIONS		
Initial Specimen WT, Wo	***307.63***	***g***
Initial Area, Ao	3.14	in²
Initial Volume, Vo	12.36	in³
Initial Bulk Unit Weight,	94.8	lb/ft³
Initial Dry Unit Weight	57.4	lb/ft³
15 % Strain (0.15 Lo)	0.59	in.
UCS	34.4	lb/in²

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in²)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (lb/in²)
0	0.000	0.000	3.141	0.0000	0.0
3	0.003	0.003	3.143	0.0008	1.0
4	0.005	0.005	3.145	0.0013	1.3
7	0.007	0.007	3.147	0.0018	2.2
10	0.010	0.010	3.149	0.0025	3.2
18	0.015	0.015	3.153	0.0038	5.7
27	0.020	0.020	3.157	0.0051	8.6
40	0.025	0.025	3.161	0.0064	12.7
60	0.030	0.030	3.165	0.0076	19.0
76	0.035	0.035	3.169	0.0089	24.0
87	0.040	0.040	3.173	0.0102	27.4
96	0.045	0.045	3.177	0.0114	30.2
101	0.050	0.050	3.182	0.0127	31.7
104	0.055	0.055	3.186	0.0140	32.6
107	0.060	0.060	3.190	0.0153	33.5
109	0.065	0.065	3.194	0.0165	34.1
110	0.070	0.070	3.198	0.0178	34.4
109	0.085	0.085	3.210	0.0216	34.0
108	0.090	0.090	3.215	0.0229	33.6
107	0.095	0.095	3.219	0.0241	33.2
106	0.100	0.100	3.223	0.0254	32.9
104	0.105	0.105	3.227	0.0267	32.2
103	0.110	0.110	3.231	0.0280	31.9
100	0.115	0.115	3.236	0.0292	30.9
98	0.120	0.120	3.240	0.0305	30.2
96	0.125	0.125	3.244	0.0318	29.6
93	0.130	0.130	3.248	0.0330	28.6
89	0.135	0.135	3.253	0.0343	27.4

UNCONFINED COMPRESSION TESTING
Sample No. 0600-022 (7-day)



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UNCONFINED COMPRESSION TEST

ASTM D 2166

SUMMARY OF RESULTS

PROJECT:	Washington Wood Preserving ISS		
PROJECT No.:	SH0600		
SAMPLE No.:	0600-022 (7-day)		
TESTING DATE:	4/27/2016	LOADING RATE:	0.0400 in./min.
TESTED BY:	DMC	TRACKING CODE:	A793_US

TESTING PARAMETER AND RESULTS		
MOISTURE CONTENT	65.3	**%**
BULK UNIT WEIGHT	94.8	lb/ft^3
DRY UNIT WEIGHT	57.4	lb/ft^3
UCS *	34.4	lb/in^2

* UCS - UNCONFINED COMPRESSIVE STRENGTH

UNCONFINED COMPRESSION TEST

ASTM D 2166

PROJECT: Washington Wood Preserving ISS
PROJECT No.: SH0600
SAMPLE No.: 0600-023 (7-day)
TESTING DATE: 27-Apr-16
TESTED BY: DMC

LOADING RATE: 0.0400 in./min.
TRACKING CODE: A794_US

MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	113.23	g
3. WT WET SOIL + TARE	162.53	g
4. WT DRY SOIL + TARE	142.77	g
5. WT WATER, Ww	19.76	g
6. WT DRY SOIL, Ws	29.54	g
7. MOISTURE CONTENT, W	**66.89**	**%**

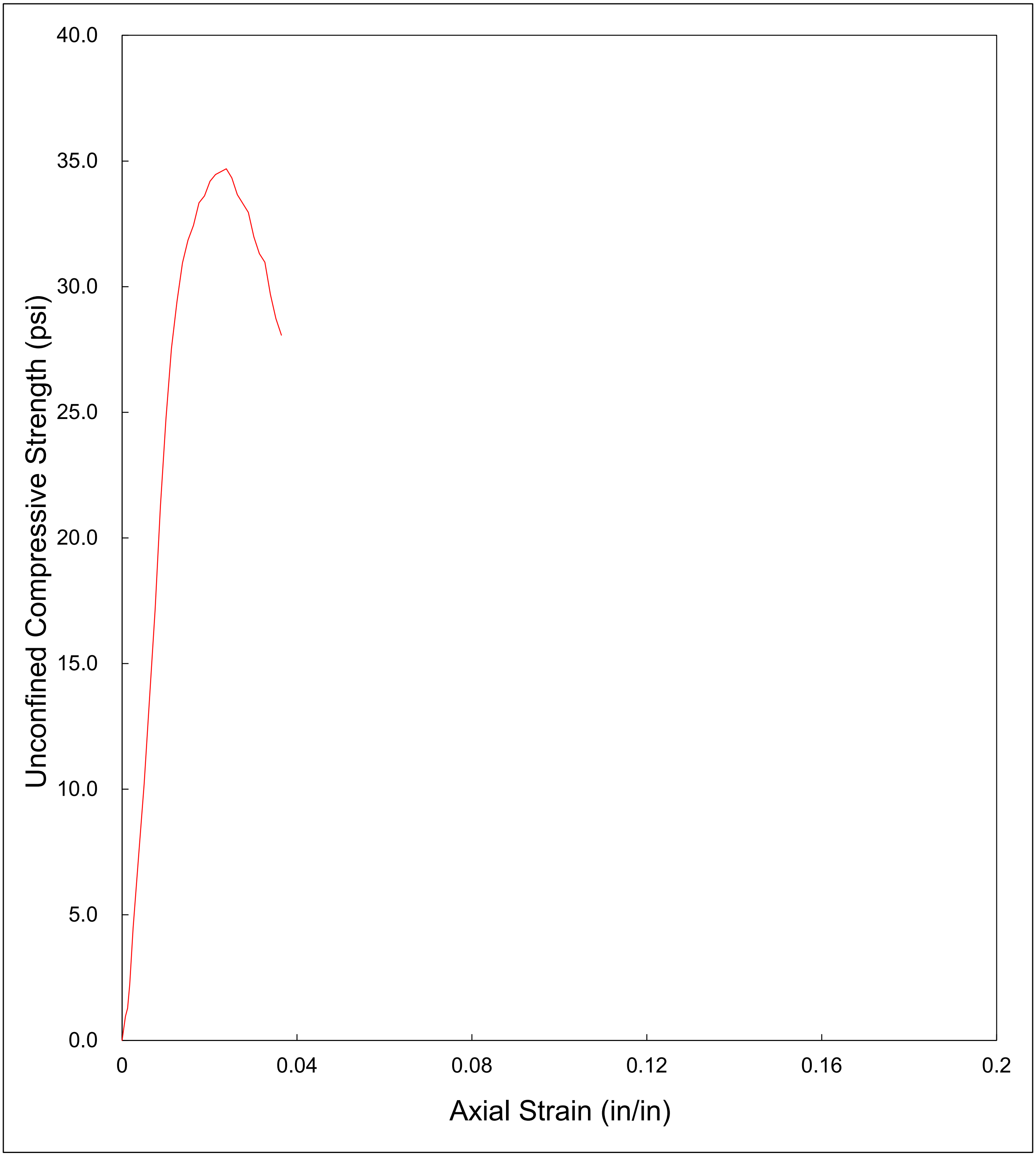
SOIL SPECIMEN DIMENSIONS	DIAMETER		LENGTH	
No. 1	2.00	in.	3.99	in.
No. 2	2.00	in.	3.98	in.
No. 3	1.99	in.	3.98	in.
Average	**1.99**	**in.**	**3.98**	**in.**

SPECIMEN CONDITIONS		
Initial Specimen WT, Wo	***312.92***	***g***
Initial Area, Ao	3.12	in²
Initial Volume, Vo	12.44	in³
Initial Bulk Unit Weight,	95.8	lb/ft³
Initial Dry Unit Weight	57.4	lb/ft³
15 % Strain (0.15 Lo)	0.60	in.
UCS	34.7	lb/in²

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in²)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (lb/in²)
0	0.000	0.000	3.124	0.0000	0.0
3	0.003	0.003	3.126	0.0008	1.0
4	0.005	0.005	3.128	0.0013	1.3
7	0.007	0.007	3.129	0.0018	2.2
14	0.010	0.010	3.132	0.0025	4.5
23	0.015	0.015	3.136	0.0038	7.3
32	0.020	0.020	3.140	0.0050	10.2
43	0.025	0.025	3.144	0.0063	13.7
54	0.030	0.030	3.148	0.0075	17.2
67	0.035	0.035	3.152	0.0088	21.3
78	0.040	0.040	3.156	0.0100	24.7
87	0.045	0.045	3.160	0.0113	27.5
93	0.050	0.050	3.164	0.0126	29.4
98	0.055	0.055	3.168	0.0138	30.9
101	0.060	0.060	3.172	0.0151	31.8
103	0.065	0.065	3.176	0.0163	32.4
106	0.070	0.070	3.180	0.0176	33.3
107	0.075	0.075	3.184	0.0188	33.6
109	0.080	0.080	3.188	0.0201	34.2
110	0.085	0.085	3.192	0.0213	34.5
111	0.095	0.095	3.200	0.0239	34.7
110	0.100	0.100	3.204	0.0251	34.3
108	0.105	0.105	3.208	0.0264	33.7
107	0.110	0.110	3.213	0.0276	33.3
106	0.115	0.115	3.217	0.0289	33.0
103	0.120	0.120	3.221	0.0301	32.0
101	0.125	0.125	3.225	0.0314	31.3
100	0.130	0.130	3.229	0.0327	31.0
96	0.135	0.135	3.233	0.0339	29.7
93	0.140	0.140	3.238	0.0352	28.7
91	0.145	0.145	3.242	0.0364	28.1

UNCONFINED COMPRESSION TESTING

Sample No. 0600-023 (7-day)



UNCONFINED COMPRESSION TEST

ASTM D 2166
SUMMARY OF RESULTS

PROJECT:	Washington Wood Preserving ISS		
PROJECT No.:	SH0600		
SAMPLE No.:	0600-023 (7-day)		
TESTING DATE:	4/27/2016	LOADING RATE:	0.0400 in./min.
TESTED BY:	DMC	TRACKING CODE:	A794_US

TESTING PARAMETER AND RESULTS		
MOISTURE CONTENT	66.9	**%**
BULK UNIT WEIGHT	95.8	lb/ft³
DRY UNIT WEIGHT	57.4	lb/ft³
UCS *	34.7	lb/in²

* UCS - UNCONFINED COMPRESSIVE STRENGTH

UNCONFINED COMPRESSION TEST

ASTM D 2166

PROJECT:	Washington Wood Preserving ISS			
PROJECT No.:	SH0600			
SAMPLE No.:	0600-024 (7-day)			
TESTING DATE:	27-Apr-16		LOADING RATE:	0.0400 in./min.
TESTED BY:	DMC		TRACKING CODE:	A795_US

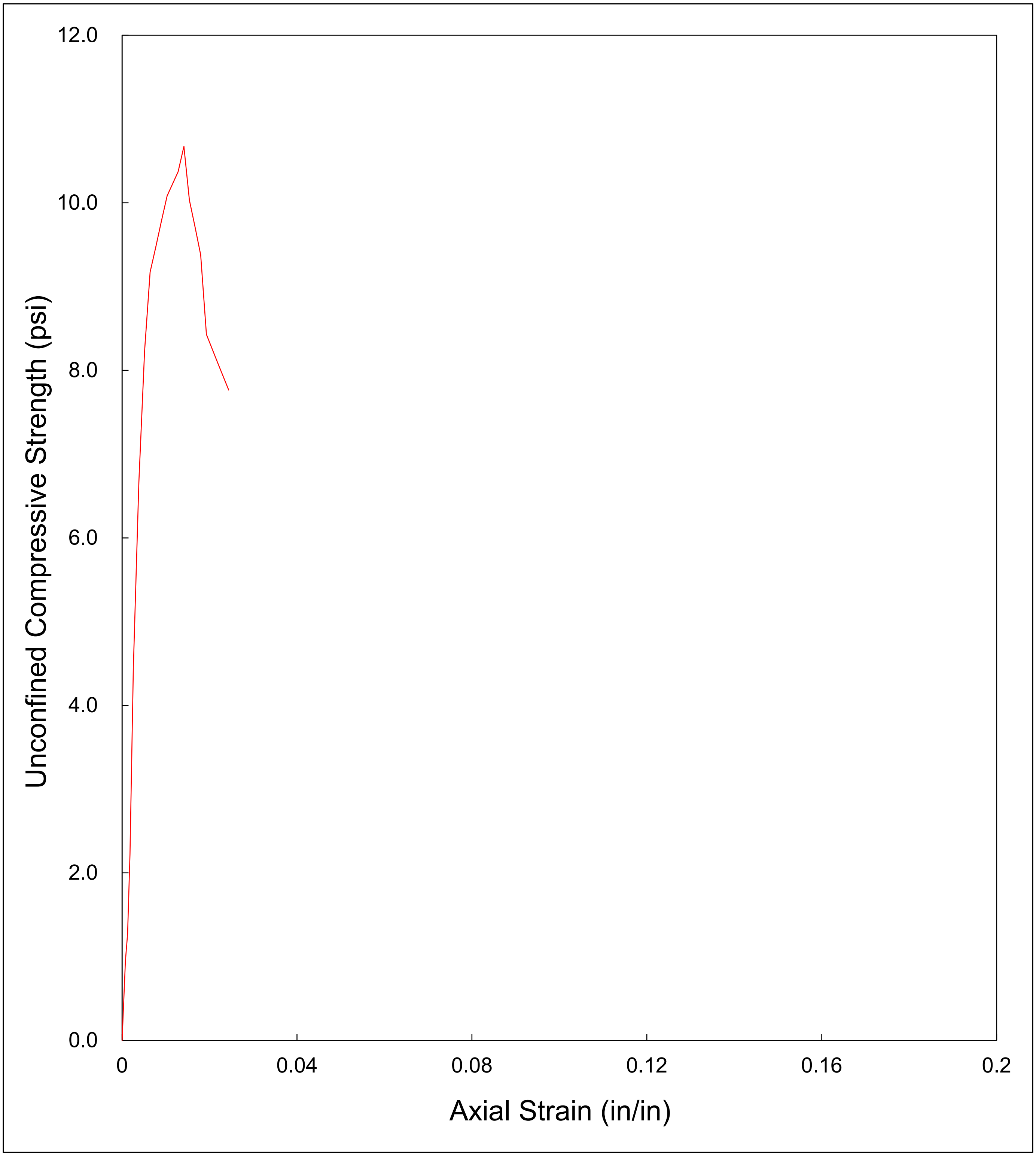
MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	115.95	g
3. WT WET SOIL + TARE	155.46	g
4. WT DRY SOIL + TARE	143.01	g
5. WT WATER, Ww	12.45	g
6. WT DRY SOIL, Ws	27.06	g
7. MOISTURE CONTENT, W	**46.01**	**%**

SOIL SPECIMEN DIMENSIONS	***DIAMETER***		***LENGTH***	
No. 1	2.01	in.	3.89	in.
No. 2	2.00	in.	3.90	in.
No. 3	1.99	in.	3.90	in.
Average	**2.00**	**in.**	**3.89**	**in.**

SPECIMEN CONDITIONS		
Initial Specimen WT, Wo	***342.89***	***g***
Initial Area, Ao	3.14	in²
Initial Volume, Vo	12.23	in³
Initial Bulk Unit Weight,	106.8	lb/ft³
Initial Dry Unit Weight	73.2	lb/ft³
15 % Strain (0.15 Lo)	0.58	in.
UCS	10.7	lb/in²

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in²)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (lb/in²)
0	0.000	0.000	3.141	0.0000	0.0
3	0.003	0.003	3.143	0.0008	1.0
4	0.005	0.005	3.145	0.0013	1.3
7	0.007	0.007	3.147	0.0018	2.2
14	0.010	0.010	3.149	0.0026	4.4
21	0.015	0.015	3.153	0.0039	6.7
26	0.020	0.020	3.157	0.0051	8.2
29	0.025	0.025	3.161	0.0064	9.2
30	0.030	0.030	3.165	0.0077	9.5
31	0.035	0.035	3.170	0.0090	9.8
32	0.040	0.040	3.174	0.0103	10.1
33	0.050	0.050	3.182	0.0128	10.4
34	0.055	0.055	3.186	0.0141	10.7
32	0.060	0.060	3.190	0.0154	10.0
31	0.065	0.065	3.194	0.0167	9.7
30	0.070	0.070	3.199	0.0180	9.4
27	0.075	0.075	3.203	0.0193	8.4
26	0.085	0.085	3.211	0.0218	8.1
25	0.095	0.095	3.220	0.0244	7.8

UNCONFINED COMPRESSION TESTING
Sample No. 0600-024 (7-day)



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UNCONFINED COMPRESSION TEST

ASTM D 2166

SUMMARY OF RESULTS

PROJECT:	Washington Wood Preserving ISS		
PROJECT No.:	SH0600		
SAMPLE No.:	0600-024 (7-day)		
TESTING DATE:	4/27/2016	LOADING RATE:	0.0400 in./min.
TESTED BY:	DMC	TRACKING CODE:	A795_US

TESTING PARAMETER AND RESULTS		
MOISTURE CONTENT	46.0	**%**
BULK UNIT WEIGHT	106.8	lb/ft^3
DRY UNIT WEIGHT	73.2	lb/ft^3
UCS *	10.7	lb/in^2

* UCS - UNCONFINED COMPRESSIVE STRENGTH

UNCONFINED COMPRESSION TEST

ASTM D 2166

PROJECT: Washington Wood Preserving ISS
PROJECT No.: SH0600
SAMPLE No.: 0600-025 (7-day)
TESTING DATE: 27-Apr-16
TESTED BY: DMC

LOADING RATE: 0.0400 in./min.
TRACKING CODE: A796_US

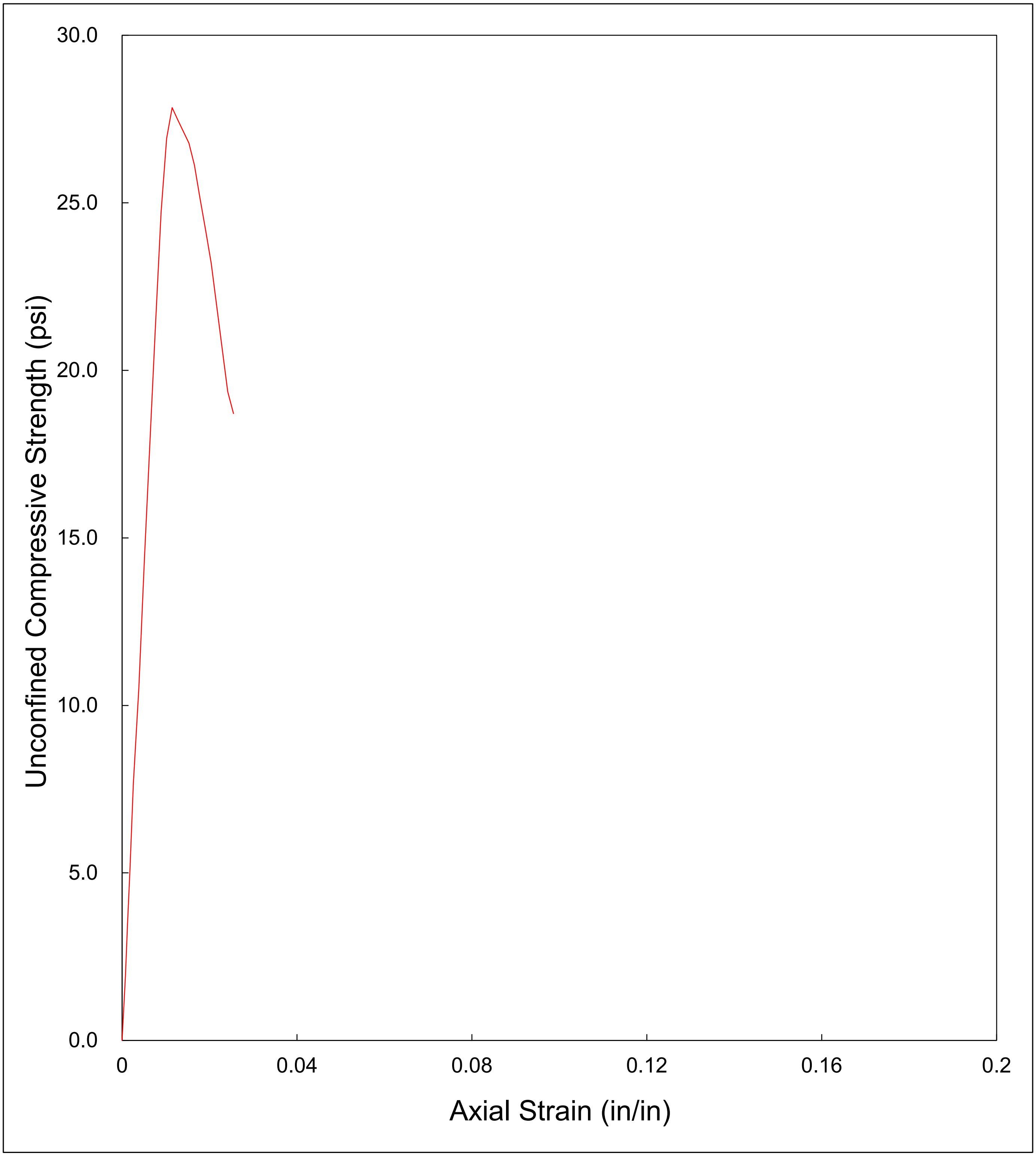
MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	114.99	g
3. WT WET SOIL + TARE	166.35	g
4. WT DRY SOIL + TARE	150.04	g
5. WT WATER, Ww	16.31	g
6. WT DRY SOIL, Ws	35.05	g
7. MOISTURE CONTENT, W	**46.53**	**%**

SOIL SPECIMEN DIMENSIONS	DIAMETER		LENGTH	
No. 1	2.01	in.	3.92	in.
No. 2	1.98	in.	3.93	in.
No. 3	1.99	in.	3.93	in.
Average	**1.99**	**in.**	**3.93**	**in.**

SPECIMEN CONDITIONS		
Initial Specimen WT, Wo	***340.11***	***g***
Initial Area, Ao	3.12	in²
Initial Volume, Vo	12.27	in³
Initial Bulk Unit Weight,	105.6	lb/ft³
Initial Dry Unit Weight	72.0	lb/ft³
15 % Strain (0.15 Lo)	0.59	in.
UCS	27.8	lb/in²

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in²)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (lb/in²)
0	0.000	0.000	3.125	0.0000	0.0
6	0.003	0.003	3.127	0.0008	1.9
11	0.005	0.005	3.129	0.0013	3.5
16	0.007	0.007	3.130	0.0018	5.1
24	0.010	0.010	3.133	0.0025	7.7
33	0.015	0.015	3.137	0.0038	10.5
45	0.020	0.020	3.141	0.0051	14.3
56	0.025	0.025	3.145	0.0064	17.8
67	0.030	0.030	3.149	0.0076	21.3
78	0.035	0.035	3.153	0.0089	24.7
85	0.040	0.040	3.157	0.0102	26.9
88	0.045	0.045	3.161	0.0115	27.8
87	0.050	0.050	3.165	0.0127	27.5
85	0.060	0.060	3.173	0.0153	26.8
83	0.065	0.065	3.177	0.0165	26.1
80	0.070	0.070	3.182	0.0178	25.1
77	0.075	0.075	3.186	0.0191	24.2
74	0.080	0.080	3.190	0.0204	23.2
70	0.085	0.085	3.194	0.0216	21.9
66	0.090	0.090	3.198	0.0229	20.6
62	0.095	0.095	3.202	0.0242	19.4
60	0.100	0.100	3.207	0.0255	18.7

UNCONFINED COMPRESSION TESTING
Sample No. 0600-025 (7-day)



UNCONFINED COMPRESSION TEST

ASTM D 2166

SUMMARY OF RESULTS

PROJECT:	Washington Wood Preserving ISS		
PROJECT No.:	SH0600		
SAMPLE No.:	0600-025 (7-day)		
TESTING DATE:	4/27/2016	LOADING RATE:	0.0400 in./min.
TESTED BY:	DMC	TRACKING CODE:	A796_US

TESTING PARAMETER AND RESULTS		
MOISTURE CONTENT	46.5	**%**
BULK UNIT WEIGHT	105.6	lb/ft^3
DRY UNIT WEIGHT	72.0	lb/ft^3
UCS *	27.8	lb/in^2

* UCS - UNCONFINED COMPRESSIVE STRENGTH

UNCONFINED COMPRESSION TEST

ASTM D 2166

PROJECT:	Washington Wood Preserving ISS		
PROJECT No.:	SH0600		
SAMPLE No.:	0600-026 (7-day)		
TESTING DATE:	27-Apr-16	LOADING RATE:	0.0400 in./min.
TESTED BY:	DMC	TRACKING CODE:	A797_US

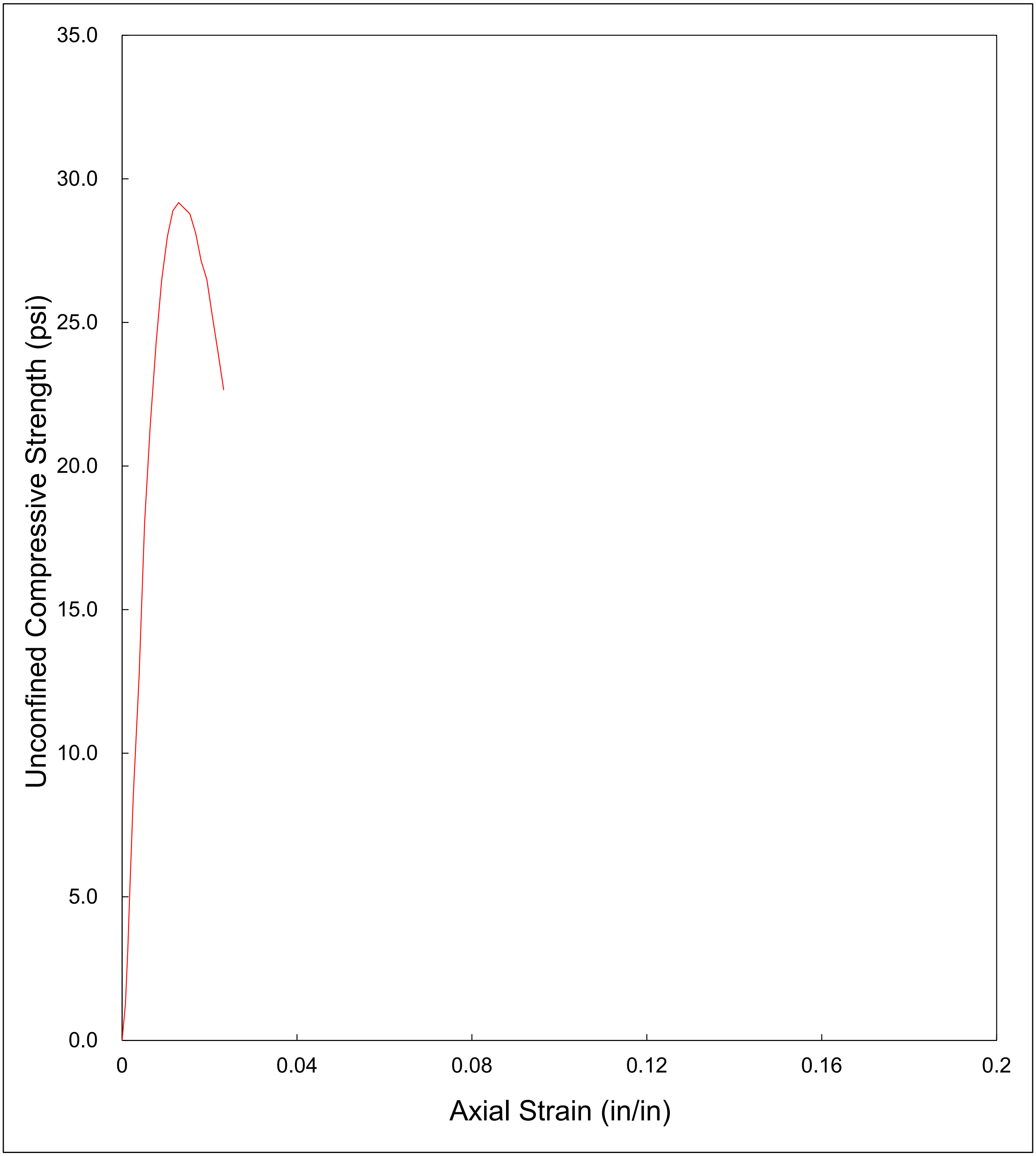
SOIL SPECIMEN DIMENSIONS				
	DIAMETER		LENGTH	
No. 1	2.01	in.	3.88	in.
No. 2	2.00	in.	3.87	in.
No. 3	2.00	in.	3.86	in.
Average	**2.00**	**in.**	**3.87**	**in.**

MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	111.52	g
3. WT WET SOIL + TARE	156.15	g
4. WT DRY SOIL + TARE	143.32	g
5. WT WATER, Ww	12.83	g
6. WT DRY SOIL, Ws	31.80	g
7. MOISTURE CONTENT, W	**40.35**	**%**

SPECIMEN CONDITIONS		
Initial Specimen WT, Wo	***343.72***	***g***
Initial Area, Ao	3.15	in²
Initial Volume, Vo	12.18	in³
Initial Bulk Unit Weight,	107.5	lb/ft³
Initial Dry Unit Weight	76.6	lb/ft³
15 % Strain (0.15 Lo)	0.58	in.
UCS	29.2	lb/in²

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in²)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (lb/in²)
0	0.000	0.000	3.147	0.0000	0.0
4	0.003	0.003	3.149	0.0008	1.3
10	0.005	0.005	3.151	0.0013	3.2
17	0.007	0.007	3.153	0.0018	5.4
27	0.010	0.010	3.155	0.0026	8.6
40	0.015	0.015	3.159	0.0039	12.7
57	0.020	0.020	3.163	0.0052	18.0
68	0.025	0.025	3.167	0.0065	21.5
77	0.030	0.030	3.171	0.0078	24.3
84	0.035	0.035	3.176	0.0090	26.5
89	0.040	0.040	3.180	0.0103	28.0
92	0.045	0.045	3.184	0.0116	28.9
93	0.050	0.050	3.188	0.0129	29.2
92	0.060	0.060	3.196	0.0155	28.8
90	0.065	0.065	3.201	0.0168	28.1
87	0.070	0.070	3.205	0.0181	27.1
85	0.075	0.075	3.209	0.0194	26.5
81	0.080	0.080	3.213	0.0207	25.2
77	0.085	0.085	3.217	0.0220	23.9
73	0.090	0.090	3.222	0.0233	22.7

UNCONFINED COMPRESSION TESTING
Sample No. 0600-026 (7-day)



UNCONFINED COMPRESSION TEST

ASTM D 2166

SUMMARY OF RESULTS

PROJECT:	Washington Wood Preserving ISS		
PROJECT No.:	SH0600		
SAMPLE No.:	0600-026 (7-day)		
TESTING DATE:	4/27/2016	LOADING RATE:	0.0400 in./min.
TESTED BY:	DMC	TRACKING CODE:	A797_US

TESTING PARAMETER AND RESULTS		
MOISTURE CONTENT	40.3	**%**
BULK UNIT WEIGHT	107.5	lb/ft^3
DRY UNIT WEIGHT	76.6	lb/ft^3
UCS *	29.2	lb/in^2

* UCS - UNCONFINED COMPRESSIVE STRENGTH

UNCONFINED COMPRESSION TEST

ASTM D 2166

PROJECT: Washington Wood Preserving ISS
PROJECT No.: SH0600
SAMPLE No.: 0600-027 (7-day)
TESTING DATE: 27-Apr-16
TESTED BY: DMC
LOADING RATE: 0.0400 in./min.
TRACKING CODE: A798_US

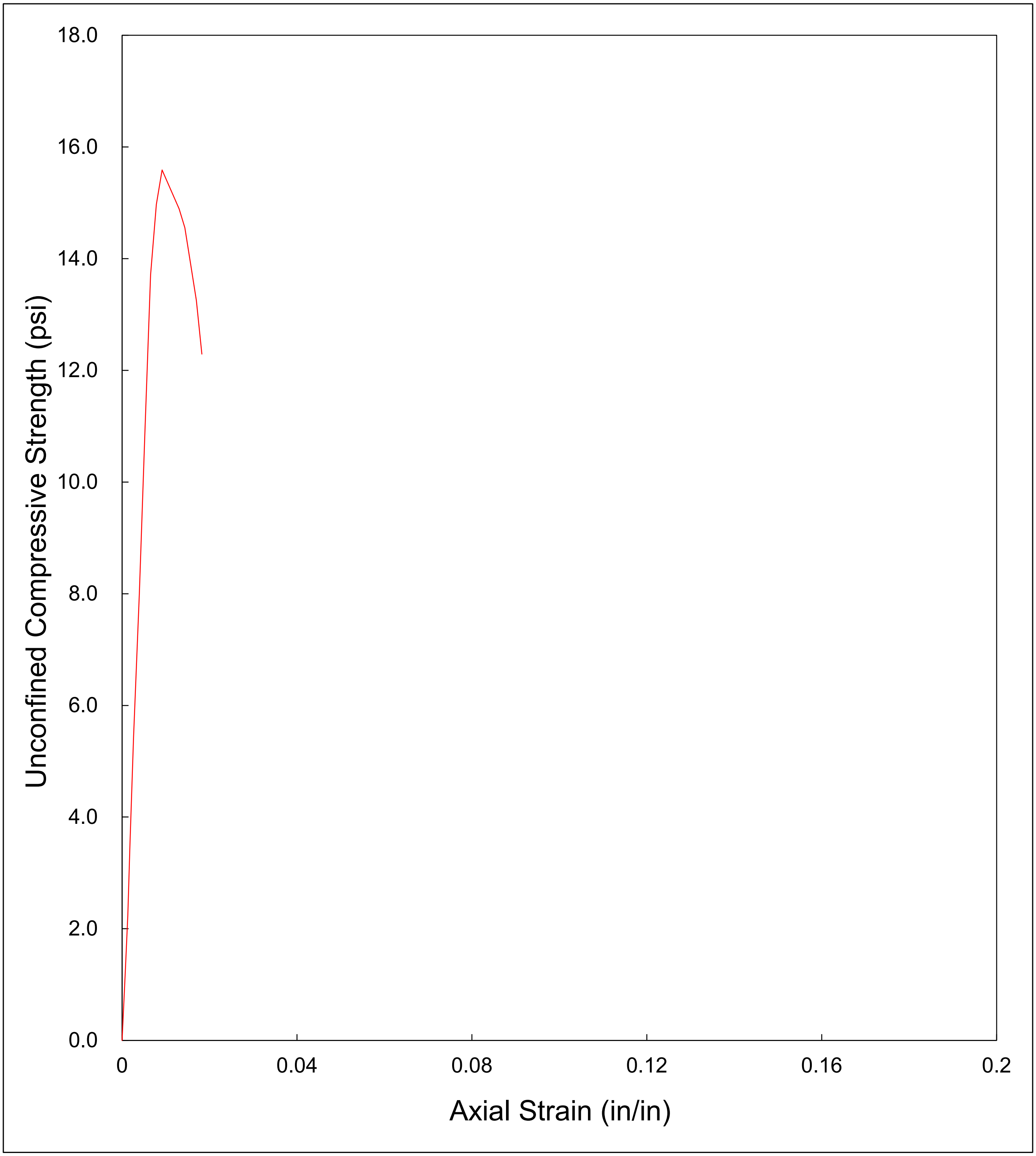
MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	106.55	g
3. WT WET SOIL + TARE	156.19	g
4. WT DRY SOIL + TARE	140.01	g
5. WT WATER, Ww	16.18	g
6. WT DRY SOIL, Ws	33.46	g
7. MOISTURE CONTENT, W	**48.36**	**%**

SOIL SPECIMEN DIMENSIONS				
	DIAMETER		LENGTH	
No. 1	1.99	in.	3.83	in.
No. 2	1.99	in.	3.83	in.
No. 3	1.99	in.	3.83	in.
Average	**1.99**	**in.**	**3.83**	**in.**

SPECIMEN CONDITIONS			
	Initial Specimen WT, Wo	***327.85***	***g***
	Initial Area, Ao	3.11	in²
	Initial Volume, Vo	11.93	in³
	Initial Bulk Unit Weight,	104.7	lb/ft³
	Initial Dry Unit Weight	70.5	lb/ft³
	15 % Strain (0.15 Lo)	0.57	in.
3	UCS	15.6	lb/in²

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in²)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (lb/in²)
0	0.000	0.000	3.115	0.0000	0.0
4	0.003	0.003	3.117	0.0008	1.3
7	0.005	0.005	3.119	0.0013	2.2
11	0.007	0.007	3.121	0.0018	3.5
17	0.010	0.010	3.123	0.0026	5.4
25	0.015	0.015	3.127	0.0039	8.0
34	0.020	0.020	3.131	0.0052	10.9
43	0.025	0.025	3.135	0.0065	13.7
47	0.030	0.030	3.140	0.0078	15.0
49	0.035	0.035	3.144	0.0091	15.6
47	0.050	0.050	3.156	0.0131	14.9
46	0.055	0.055	3.160	0.0144	14.6
44	0.060	0.060	3.165	0.0157	13.9
42	0.065	0.065	3.169	0.0170	13.3
39	0.070	0.070	3.173	0.0183	12.3

UNCONFINED COMPRESSION TESTING
Sample No. 0600-027 (7-day)



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UNCONFINED COMPRESSION TEST

ASTM D 2166

SUMMARY OF RESULTS

PROJECT:	Washington Wood Preserving ISS		
PROJECT No.:	SH0600		
SAMPLE No.:	0600-027 (7-day)		
TESTING DATE:	4/27/2016	LOADING RATE:	0.0400 in./min.
TESTED BY:	DMC	TRACKING CODE:	A798_US

TESTING PARAMETER AND RESULTS		
MOISTURE CONTENT	48.4	**%**
BULK UNIT WEIGHT	104.7	lb/ft^3
DRY UNIT WEIGHT	70.5	lb/ft^3
UCS *	15.6	lb/in^2

* UCS - UNCONFINED COMPRESSIVE STRENGTH

UNCONFINED COMPRESSION TEST

ASTM D 2166

PROJECT:	Washington Wood Preserving ISS
PROJECT No.:	SH0600
SAMPLE No.:	0600-028 (7-day)
TESTING DATE:	27-Apr-16
TESTED BY:	DMC
LOADING RATE:	0.0400 in./min.
TRACKING CODE:	A800_US

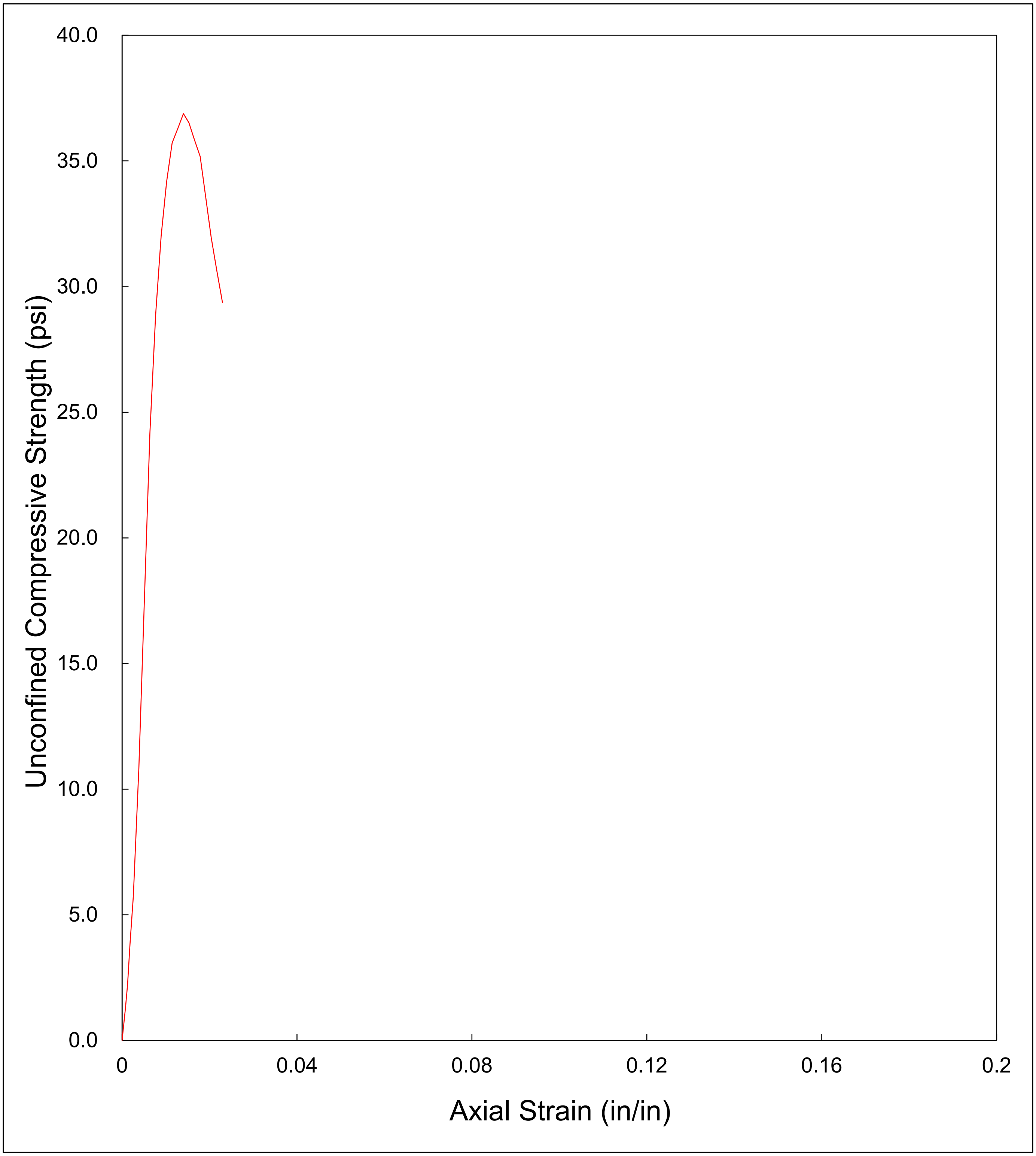
MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	114.46	g
3. WT WET SOIL + TARE	158.49	g
4. WT DRY SOIL + TARE	145.43	g
5. WT WATER, Ww	13.06	g
6. WT DRY SOIL, Ws	30.97	g
7. MOISTURE CONTENT, W	**42.17**	**%**

SOIL SPECIMEN DIMENSIONS				
	DIAMETER		***LENGTH***	
No. 1	2.00	in.	3.91	in.
No. 2	1.99	in.	3.92	in.
No. 3	1.99	in.	3.93	in.
Average	**2.00**	**in.**	**3.92**	**in.**

SPECIMEN CONDITIONS		
Initial Specimen WT, Wo	***340.17***	***g***
Initial Area, Ao	3.13	in²
Initial Volume, Vo	12.27	in³
Initial Bulk Unit Weight,	105.6	lb/ft³
Initial Dry Unit Weight	74.3	lb/ft³
15 % Strain (0.15 Lo)	0.59	in.
UCS	36.9	lb/in²

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in²)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (lb/in²)
0	0.000	0.000	3.127	0.0000	0.0
4	0.003	0.003	3.130	0.0008	1.3
7	0.005	0.005	3.131	0.0013	2.2
12	0.007	0.007	3.133	0.0018	3.8
18	0.010	0.010	3.135	0.0025	5.7
34	0.015	0.015	3.139	0.0038	10.8
55	0.020	0.020	3.143	0.0051	17.5
76	0.025	0.025	3.148	0.0064	24.1
91	0.030	0.030	3.152	0.0076	28.9
101	0.035	0.035	3.156	0.0089	32.0
108	0.040	0.040	3.160	0.0102	34.2
113	0.045	0.045	3.164	0.0115	35.7
115	0.050	0.050	3.168	0.0127	36.3
117	0.055	0.055	3.172	0.0140	36.9
116	0.060	0.060	3.176	0.0153	36.5
114	0.065	0.065	3.180	0.0166	35.8
112	0.070	0.070	3.184	0.0178	35.2
107	0.075	0.075	3.188	0.0191	33.6
102	0.080	0.080	3.193	0.0204	31.9
98	0.085	0.085	3.197	0.0217	30.7
94	0.090	0.090	3.201	0.0229	29.4

UNCONFINED COMPRESSION TESTING
Sample No. 0600-028 (7-day)



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UNCONFINED COMPRESSION TEST

ASTM D 2166

SUMMARY OF RESULTS

PROJECT:	Washington Wood Preserving ISS		
PROJECT No.:	SH0600		
SAMPLE No.:	0600-028 (7-day)		
TESTING DATE:	4/27/2016	LOADING RATE:	0.0400 in./min.
TESTED BY:	DMC	TRACKING CODE:	A800_US

TESTING PARAMETER AND RESULTS		
MOISTURE CONTENT	42.2	**%**
BULK UNIT WEIGHT	105.6	lb/ft^3
DRY UNIT WEIGHT	74.3	lb/ft^3
UCS *	36.9	lb/in^2

* UCS - UNCONFINED COMPRESSIVE STRENGTH

UNCONFINED COMPRESSION TEST

ASTM D 2166

PROJECT:	Washington Wood Preserving ISS			
PROJECT No.:	SH0600			
SAMPLE No.:	0600-019 (28-Day)			
TESTING DATE:	18-May-16		LOADING RATE:	0.0400 in./min
TESTED BY:	DMC		TRACKING CODE:	A838_US

MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	114.98	g
3. WT WET SOIL + TARE	178.47	g
4. WT DRY SOIL + TARE	154.24	g
5. WT WATER, Ww	24.23	g
6. WT DRY SOIL, Ws	39.26	g
7. MOISTURE CONTENT, W	**61.72**	**%**

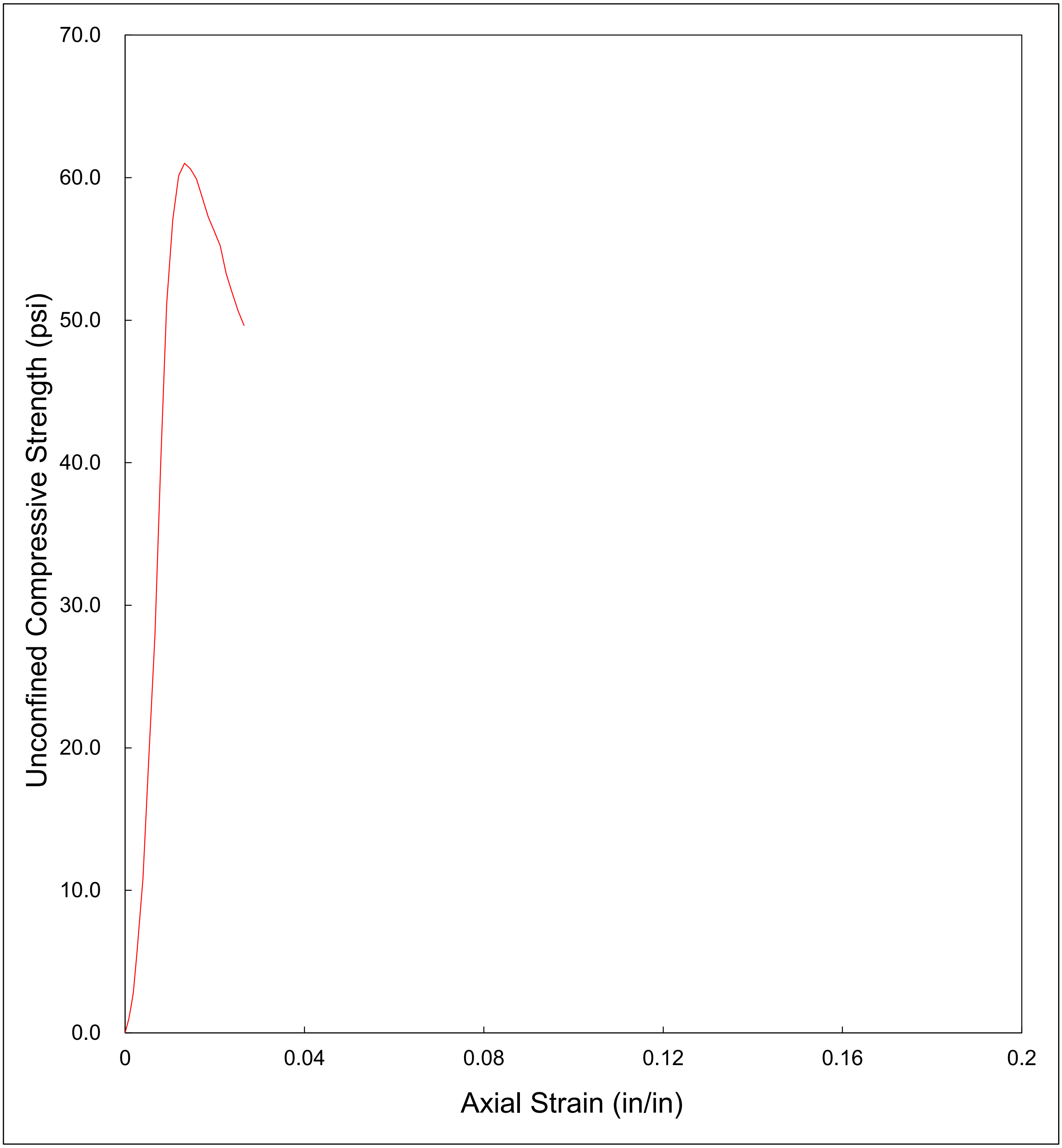
SOIL SPECIMEN DIMENSIONS				
	DIAMETER		*LENGTH*	
No. 1	2.00	in.	3.77	in.
No. 2	2.00	in.	3.78	in.
No. 3	1.99	in.	3.77	in.
Average	**2.00**	**in.**	**3.77**	**in.**

SPECIMEN CONDITIONS		
Initial Specimen WT, Wo	***300.13***	***g***
Initial Area, Ao	3.14	in²
Initial Volume, Vo	11.84	in³
Initial Bulk Unit Weight,	96.6	lb/ft³
Initial Dry Unit Weight	59.7	lb/ft³
15 % Strain (0.15 Lo)	0.57	in.
UCS	61.0	lb/in²

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in²)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (lb/in²)
0	0.000	0.000	3.138	0.0000	0.0
3	0.003	0.003	3.140	0.0008	1.0
6	0.005	0.005	3.142	0.0013	1.9
9	0.007	0.007	3.144	0.0019	2.9
18	0.010	0.010	3.146	0.0026	5.7
34	0.015	0.015	3.150	0.0040	10.8
62	0.020	0.020	3.155	0.0053	19.7
88	0.025	0.025	3.159	0.0066	27.9
127	0.030	0.030	3.163	0.0079	40.2
162	0.035	0.035	3.167	0.0093	51.1
181	0.040	0.040	3.172	0.0106	57.1
191	0.045	0.045	3.176	0.0119	60.1
194	0.050	0.050	3.180	0.0132	61.0
193	0.055	0.055	3.184	0.0146	60.6
191	0.060	0.060	3.189	0.0159	59.9
187	0.065	0.065	3.193	0.0172	58.6
183	0.070	0.070	3.197	0.0185	57.2
180	0.075	0.075	3.202	0.0199	56.2
177	0.080	0.080	3.206	0.0212	55.2
171	0.085	0.085	3.210	0.0225	53.3
167	0.090	0.090	3.215	0.0238	52.0
163	0.095	0.095	3.219	0.0252	50.6
160	0.100	0.100	3.223	0.0265	49.6

UNCONFINED COMPRESSION TESTING

Sample No. 0600-019 (28-Day)



UNCONFINED COMPRESSION TEST

ASTM D 2166

SUMMARY OF RESULTS

PROJECT:	Washington Wood Preserving ISS		
PROJECT No.:	SH0600		
SAMPLE No.:	0600-019 (28-Day)		
TESTING DATE:	5/18/2016	LOADING RATE:	0.0400 in./min
TESTED BY:	DMC	TRACKING CODE:	A838_US

TESTING PARAMETER AND RESULTS		
MOISTURE CONTENT	61.7	**%**
BULK UNIT WEIGHT	96.6	lb/ft^3
DRY UNIT WEIGHT	59.7	lb/ft^3
UCS *	61.0	lb/in^2

* UCS - UNCONFINED COMPRESSIVE STRENGTH

Client:	Kemron Environmental		
Project Name:	Washington Wood Preserving ISS		
Project Location:	---		
GTX #:	GTX-304790		
Start Date:	5/27/2016	Tested By:	jm
End Date:	6/1/2016	Checked By:	mcm
Boring	---	Test #: K1	
Sample #:	0600-019 (28-Day)		
Depth:	---		
Visual Description:	Moist, gray sandy silt		

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter by ASTM D5084 Increasing Tailwater

Sample Type: intact
Orientation: Vertical
Permeant Fluid: de-aired tap water
Cell #: P2

Sample Preparation: Specimen weighed and dimensions recorded the placed into permeameter at as-received density and moisture content.

Parameter	Initial	Final
Height, in	2.37	2.36
Diameter, in	2.99	2.99
Area, in^2	7.02	7.02
Volume, in^3	16.6	16.6
Mass, g	430	437
Bulk Density, pcf	98	100
Moisture Content, %	60.3	62.8
Dry Density, pcf	61.3	61.5
Degree of Saturation, %	---	98

B COEFFICIENT DETERMINATION

Cell Pressure, psi: 90
Sample Pressure, psi: 80
Pressure Increment, psi: 9.7
B Coefficient: 0.97

FLOW DATA

Date	Trial #	Pressure, psi Cell	Pressure, psi Sample	Head readings H_1	Head readings H_2	Head readings H_1-H_2	Elapsed Time, sec	Gradient	Permeability K, cm/sec	Temp, °C	R_t	Permeability K @ 20 °C, cm/sec
5/31	2	90	80	78.2	77.9	0.3	180	13.0	2.3E-07	21	0.976	2.2E-07
5/31	3	90	80	77.9	76.8	1.1	600	13.0	2.5E-07	21	0.976	2.5E-07
5/31	4	90	80	76.8	74.9	1.9	1020	12.8	2.6E-07	21	0.976	2.6E-07
5/31	5	90	80	74.9	72.7	2.2	1440	12.5	2.2E-07	21	0.976	2.2E-07

PERMEABILITY AT 20° C: 2.4 x 10^{-7} cm/sec (@ 10 psi effective stress)

UNCONFINED COMPRESSION TEST

ASTM D 2166

PROJECT:	Washington Wood Preserving ISS
PROJECT No.:	SH0600
SAMPLE No.:	0600-020 (28-Day)
TESTING DATE:	18-May-16
TESTED BY:	DMC
LOADING RATE:	0.0400 in./min
TRACKING CODE:	A839_US

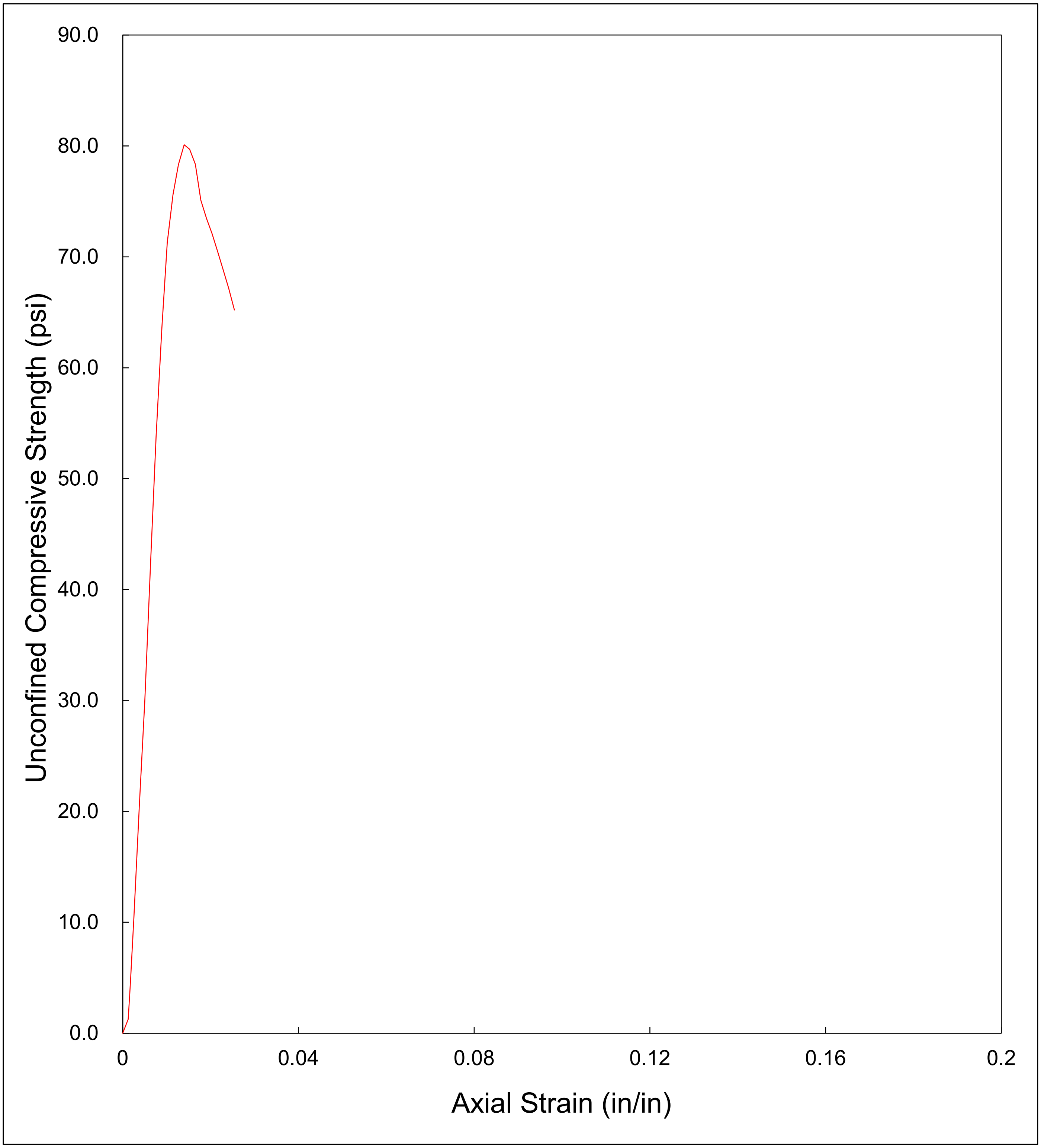
MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	114.48	g
3. WT WET SOIL + TARE	160.96	g
4. WT DRY SOIL + TARE	142.66	g
5. WT WATER, Ww	18.30	g
6. WT DRY SOIL, Ws	28.18	g
7. MOISTURE CONTENT, W	**64.94**	**%**

SOIL SPECIMEN DIMENSIONS				
	DIAMETER		LENGTH	
No. 1	2.01	in.	3.94	in.
No. 2	2.00	in.	3.93	in.
No. 3	1.99	in.	3.93	in.
Average	**2.00**	**in.**	**3.93**	**in.**

SPECIMEN CONDITIONS		
Initial Specimen WT, Wo	***309.07***	***g***
Initial Area, Ao	3.14	in²
Initial Volume, Vo	12.34	in³
Initial Bulk Unit Weight,	95.4	lb/ft³
Initial Dry Unit Weight	57.9	lb/ft³
15 % Strain (0.15 Lo)	0.59	in.
UCS	80.1	lb/in²

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in²)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (lb/in²)
0	0.000	0.000	3.138	0.0000	0.0
4	0.005	0.005	3.142	0.0013	1.3
14	0.007	0.007	3.144	0.0018	4.5
33	0.010	0.010	3.146	0.0025	10.5
65	0.015	0.015	3.150	0.0038	20.6
95	0.020	0.020	3.154	0.0051	30.1
134	0.025	0.025	3.159	0.0064	42.4
170	0.030	0.030	3.163	0.0076	53.8
201	0.035	0.035	3.167	0.0089	63.5
226	0.040	0.040	3.171	0.0102	71.3
240	0.045	0.045	3.175	0.0114	75.6
249	0.050	0.050	3.179	0.0127	78.3
255	0.055	0.055	3.183	0.0140	80.1
254	0.060	0.060	3.187	0.0153	79.7
250	0.065	0.065	3.191	0.0165	78.3
240	0.070	0.070	3.195	0.0178	75.1
235	0.075	0.075	3.199	0.0191	73.4
231	0.080	0.080	3.204	0.0203	72.1
226	0.085	0.085	3.208	0.0216	70.5
221	0.090	0.090	3.212	0.0229	68.8
216	0.095	0.095	3.216	0.0242	67.2
210	0.100	0.100	3.220	0.0254	65.2

UNCONFINED COMPRESSION TESTING
Sample No. 0600-020 (28-Day)



UNCONFINED COMPRESSION TEST

ASTM D 2166

SUMMARY OF RESULTS

PROJECT:	Washington Wood Preserving ISS		
PROJECT No.:	SH0600		
SAMPLE No.:	0600-020 (28-Day)		
TESTING DATE:	5/18/2016	LOADING RATE:	0.0400 in./min
TESTED BY:	DMC	TRACKING CODE:	A839_US

TESTING PARAMETER AND RESULTS		
MOISTURE CONTENT	64.9	**%**
BULK UNIT WEIGHT	95.4	lb/ft³
DRY UNIT WEIGHT	57.9	lb/ft³
UCS *	80.1	lb/in²

* UCS - UNCONFINED COMPRESSIVE STRENGTH

Client:	Kemron Environmental		
Project Name:	Washington Wood Preserving ISS		
Project Location:	---		
GTX #:	GTX-304790		
Start Date:	5/31/2016	Tested By:	jm
End Date:	6/3/2016	Checked By:	mcm
Boring	---	Test #: K4	
Sample #:	0600-020 (28-Day)		
Depth:	---		
Visual Description:	Moist, gray sandy silt		

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter by ASTM D5084 Increasing Tailwater

Sample Type:	intact	Permeant Fluid:	de-aired tap water
Orientation:	Vertical	Cell #:	P2

Sample Preparation: Specimen weighed and dimensions recorded the placed into permeameter at as-received density and moisture content.

Parameter	Initial	Final
Height, in	2.01	2.01
Diameter, in	2.99	2.99
Area, in^2	7.02	7.02
Volume, in^3	14.1	14.1
Mass, g	356	365
Bulk Density, pcf	96	98
Moisture Content, %	62.7	66.8
Dry Density, pcf	59.0	59.0
Degree of Saturation, %	---	97

B COEFFICIENT DETERMINATION

Cell Pressure, psi:	90	Pressure Increment, psi:	9.8
Sample Pressure, psi:	80	B Coefficient:	98

FLOW DATA

Date	Trial #	Pressure, psi Cell	Pressure, psi Sample	Head readings H_1	Head readings H_2	Head readings H_1-H_2	Elapsed Time, sec	Gradient	Permeability K, cm/sec	Temp, °C	R_t	Permeability K @ 20 °C, cm/sec
6/1	2	90	80	96.1	95.8	0.3	1920	18.8	1.5E-08	21	0.976	1.5E-08
6/1	3	90	80	95.8	95.5	0.3	1920	18.8	1.5E-08	21	0.976	1.5E-08
6/1	4	90	80	95.5	95.0	0.5	3000	18.7	1.6E-08	21	0.976	1.6E-08
6/1	5	90	80	95.0	94.3	0.7	4500	18.6	1.5E-08	21	0.976	1.5E-08

PERMEABILITY AT 20° C: 1.5 x 10^{-8} cm/sec (@ 10 psi effective stress)

UNCONFINED COMPRESSION TEST

ASTM D 2166

PROJECT:	Washington Wood Preserving ISS		
PROJECT No.:	SH0600		
SAMPLE No.:	0600-021 (28-Day)		
TESTING DATE:	18-May-16	LOADING RATE:	0.0400 in./min
TESTED BY:	DMC	TRACKING CODE:	A840_US

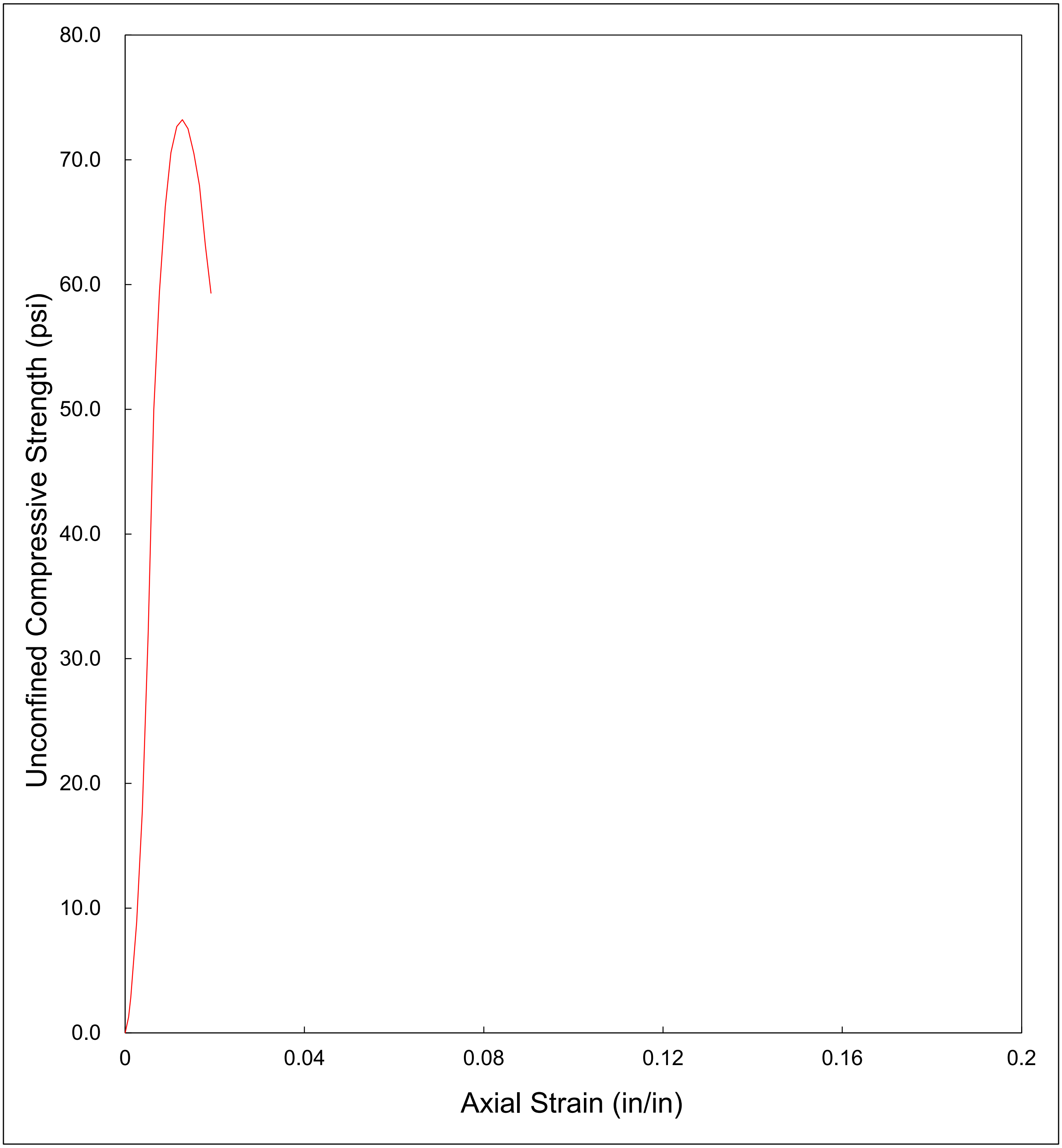
SOIL SPECIMEN DIMENSIONS				
	DIAMETER		LENGTH	
No. 1	2.01	in.	3.92	in.
No. 2	2.00	in.	3.92	in.
No. 3	1.99	in.	3.92	in.
Average	**2.00**	**in.**	**3.92**	**in.**

MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	116.76	g
3. WT WET SOIL + TARE	162.83	g
4. WT DRY SOIL + TARE	145.96	g
5. WT WATER, Ww	16.87	g
6. WT DRY SOIL, Ws	29.20	g
7. MOISTURE CONTENT, W	**57.77**	**%**

SPECIMEN CONDITIONS		
Initial Specimen WT, Wo	***315.31***	***g***
Initial Area, Ao	3.14	in²
Initial Volume, Vo	12.31	in³
Initial Bulk Unit Weight,	97.6	lb/ft³
Initial Dry Unit Weight	61.8	lb/ft³
15 % Strain (0.15 Lo)	0.59	in.
UCS	73.2	lb/in²

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in²)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (lb/in²)
0	0.000	0.000	3.142	0.0000	0.0
4	0.003	0.003	3.145	0.0008	1.3
9	0.005	0.005	3.146	0.0013	2.9
17	0.007	0.007	3.148	0.0018	5.4
28	0.010	0.010	3.150	0.0026	8.9
56	0.015	0.015	3.154	0.0038	17.8
101	0.020	0.020	3.158	0.0051	32.0
158	0.025	0.025	3.162	0.0064	50.0
188	0.030	0.030	3.166	0.0077	59.4
210	0.035	0.035	3.170	0.0089	66.2
224	0.040	0.040	3.175	0.0102	70.6
231	0.045	0.045	3.179	0.0115	72.7
233	0.050	0.050	3.183	0.0128	73.2
231	0.055	0.055	3.187	0.0140	72.5
225	0.060	0.060	3.191	0.0153	70.5
217	0.065	0.065	3.195	0.0166	67.9
202	0.070	0.070	3.199	0.0179	63.1
190	0.075	0.075	3.203	0.0191	59.3

UNCONFINED COMPRESSION TESTING
Sample No. 0600-021 (28-Day)



UNCONFINED COMPRESSION TEST

ASTM D 2166

SUMMARY OF RESULTS

PROJECT:	Washington Wood Preserving ISS		
PROJECT No.:	SH0600		
SAMPLE No.:	0600-021 (28-Day)		
TESTING DATE:	5/18/2016	LOADING RATE:	0.0400 in./min
TESTED BY:	DMC	TRACKING CODE:	A840_US

TESTING PARAMETER AND RESULTS		
MOISTURE CONTENT	57.8	**%**
BULK UNIT WEIGHT	97.6	lb/ft^3
DRY UNIT WEIGHT	61.8	lb/ft^3
UCS *	73.2	lb/in^2

* UCS - UNCONFINED COMPRESSIVE STRENGTH

UNCONFINED COMPRESSION TEST

ASTM D 2166

PROJECT:	Washington Wood Preserving ISS
PROJECT No.:	SH0600
SAMPLE No.:	0600-022 (28-Day)
TESTING DATE:	18-May-16
TESTED BY:	DMC

LOADING RATE:	0.0400 in./min
TRACKING CODE:	A841_US

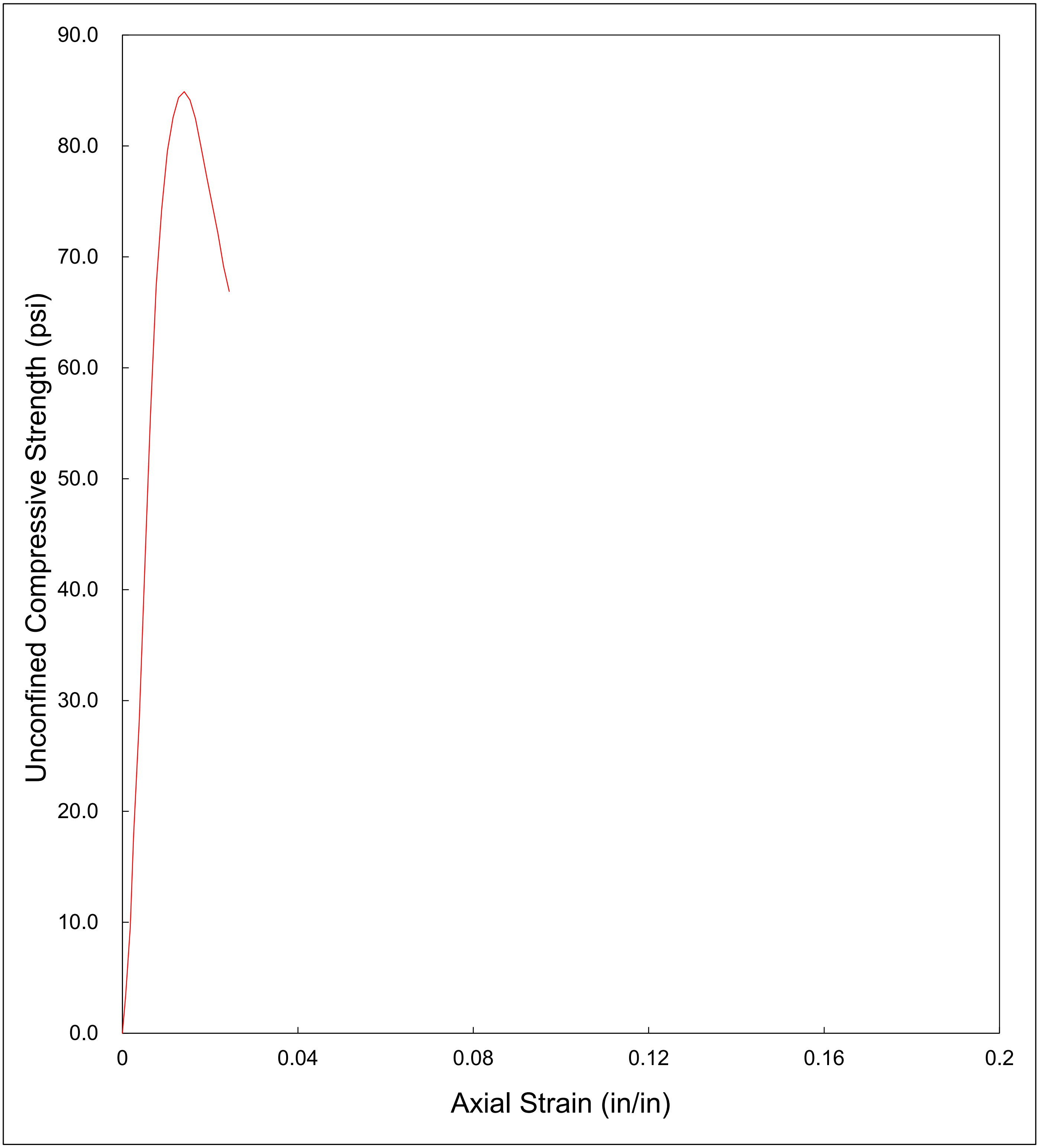
MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	113.96	g
3. WT WET SOIL + TARE	162.69	g
4. WT DRY SOIL + TARE	143.47	g
5. WT WATER, Ww	19.22	g
6. WT DRY SOIL, Ws	29.51	g
7. MOISTURE CONTENT, W	**65.13**	**%**

SOIL SPECIMEN DIMENSIONS				
	DIAMETER		***LENGTH***	
No. 1	2.00	in.	3.91	in.
No. 2	2.00	in.	3.90	in.
No. 3	2.00	in.	3.90	in.
Average	**2.00**	**in.**	**3.90**	**in.**

SPECIMEN CONDITIONS		
Initial Specimen WT, Wo	***303.70***	***g***
Initial Area, Ao	3.14	in²
Initial Volume, Vo	12.24	in³
Initial Bulk Unit Weight,	94.5	lb/ft³
Initial Dry Unit Weight	57.2	lb/ft³
15 % Strain (0.15 Lo)	0.59	in.
UCS	84.9	lb/in²

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in²)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (lb/in²)
0	0.000	0.000	3.136	0.0000	0.0
11	0.003	0.003	3.138	0.0008	3.5
21	0.005	0.005	3.140	0.0013	6.7
30	0.007	0.007	3.141	0.0018	9.5
56	0.010	0.010	3.144	0.0026	17.8
89	0.015	0.015	3.148	0.0038	28.3
134	0.020	0.020	3.152	0.0051	42.5
176	0.025	0.025	3.156	0.0064	55.8
213	0.030	0.030	3.160	0.0077	67.4
235	0.035	0.035	3.164	0.0090	74.3
252	0.040	0.040	3.168	0.0102	79.5
262	0.045	0.045	3.172	0.0115	82.6
268	0.050	0.050	3.177	0.0128	84.4
270	0.055	0.055	3.181	0.0141	84.9
268	0.060	0.060	3.185	0.0154	84.1
263	0.065	0.065	3.189	0.0167	82.5
255	0.070	0.070	3.193	0.0179	79.9
247	0.075	0.075	3.197	0.0192	77.3
239	0.080	0.080	3.201	0.0205	74.7
231	0.085	0.085	3.206	0.0218	72.1
222	0.090	0.090	3.210	0.0231	69.2
215	0.095	0.095	3.214	0.0243	66.9

UNCONFINED COMPRESSION TESTING
Sample No. 0600-022 (28-Day)



UNCONFINED COMPRESSION TEST

ASTM D 2166

SUMMARY OF RESULTS

PROJECT:	Washington Wood Preserving ISS		
PROJECT No.:	SH0600		
SAMPLE No.:	0600-022 (28-Day)		
TESTING DATE:	5/18/2016	LOADING RATE:	0.0400 in./min
TESTED BY:	DMC	TRACKING CODE:	A841_US

TESTING PARAMETER AND RESULTS		
MOISTURE CONTENT	65.1	**%**
BULK UNIT WEIGHT	94.5	lb/ft^3
DRY UNIT WEIGHT	57.2	lb/ft^3
UCS *	84.9	lb/in^2

* UCS - UNCONFINED COMPRESSIVE STRENGTH

GeoTesting EXPRESS

Client:	Kemron Environmental		
Project Name:	Washington Wood Preserving ISS		
Project Location:	---		
GTX #:	GTX-304790		
Start Date:	5/31/2016	Tested By:	jm
End Date:	6/3/2016	Checked By:	mcm
Boring	---	Test #: K5	
Sample #:	0600-22 (28-Day)		
Depth:	---		
Visual Description:	Moist, gray sandy silt		

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter by ASTM D5084 Increasing Tailwater

Sample Type:	intact	Permeant Fluid:	de-aired tap water
Orientation:	Vertical	Cell #:	P2

Sample Preparation: Specimen weighed and dimensions recorded the placed into permeameter at as-received density and moisture content.

Parameter	Initial	Final
Height, in	1.65	1.65
Diameter, in	2.99	2.99
Area, in^2	7.02	7.02
Volume, in^3	11.6	11.6
Mass, g	288	295
Bulk Density, pcf	95	97
Moisture Content, %	63.0	67.0
Dry Density, pcf	58.1	58.1
Degree of Saturation, %	---	95

B COEFFICIENT DETERMINATION

Cell Pressure, psi:	90	Pressure Increment, psi:	9.7
Sample Pressure, psi:	80	B Coefficient:	97

FLOW DATA

Date	Trial #	Pressure, psi Cell	Pressure, psi Sample	Head readings H_1	Head readings H_2	Head readings H_1-H_2	Elapsed Time, sec	Gradient	Permeability K, cm/sec	Temp, °C	R_t	Permeability K @ 20 °C, cm/sec
6/1	3	90	80	70.4	69.1	1.3	1620	16.8	8.7E-08	21	0.976	8.5E-08
6/1	4	90	80	69.1	67.7	1.4	1920	16.5	8.0E-08	21	0.976	7.8E-08
6/1	5	90	80	67.7	66.0	1.7	2340	16.1	8.2E-08	21	0.976	8.0E-08
6/1	6	90	80	66.0	63.4	2.6	3900	15.7	7.8E-08	21	0.976	7.6E-08

PERMEABILITY AT 20° C: 8.0 x 10^{-8} cm/sec (@ 10 psi effective stress)

UNCONFINED COMPRESSION TEST

ASTM D 2166

PROJECT: Washington Wood Preserving ISS
PROJECT No.: SH0600
SAMPLE No.: 0600-023 (28-Day)
TESTING DATE: 18-May-16
TESTED BY: DMC

LOADING RATE: 0.0400 in./min
TRACKING CODE: A842_US

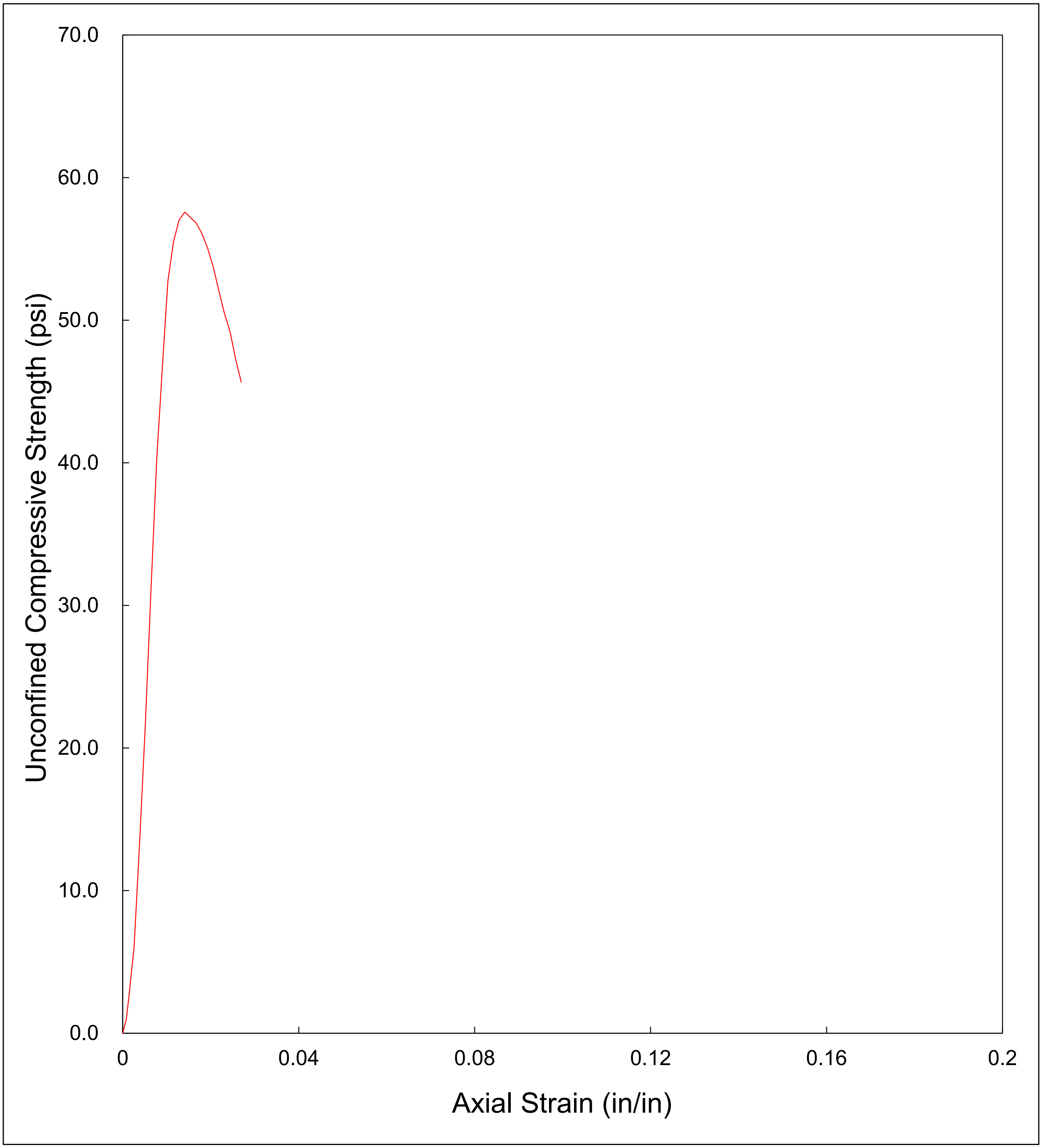
SOIL SPECIMEN DIMENSIONS	DIAMETER		LENGTH	
No. 1	2.01	in.	3.89	in.
No. 2	1.99	in.	3.90	in.
No. 3	1.99	in.	3.90	in.
Average	**2.00**	**in.**	**3.90**	**in.**

MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	111.88	g
3. WT WET SOIL + TARE	178.62	g
4. WT DRY SOIL + TARE	153.69	g
5. WT WATER, Ww	24.93	g
6. WT DRY SOIL, Ws	41.81	g
7. MOISTURE CONTENT, W	**59.63**	**%**

SPECIMEN CONDITIONS		
Initial Specimen WT, Wo	***310.90***	***g***
Initial Area, Ao	3.13	in²
Initial Volume, Vo	12.21	in³
Initial Bulk Unit Weight,	97.0	lb/ft³
Initial Dry Unit Weight	60.7	lb/ft³
15 % Strain (0.15 Lo)	0.58	in.
UCS	57.6	lb/in²

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in²)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (lb/in²)
0	0.000	0.000	3.133	0.0000	0.0
3	0.003	0.003	3.136	0.0008	1.0
7	0.005	0.005	3.137	0.0013	2.2
12	0.007	0.007	3.139	0.0018	3.8
19	0.010	0.010	3.141	0.0026	6.0
43	0.015	0.015	3.145	0.0038	13.7
68	0.020	0.020	3.149	0.0051	21.6
98	0.025	0.025	3.153	0.0064	31.1
127	0.030	0.030	3.158	0.0077	40.2
147	0.035	0.035	3.162	0.0090	46.5
167	0.040	0.040	3.166	0.0103	52.8
176	0.045	0.045	3.170	0.0115	55.5
181	0.050	0.050	3.174	0.0128	57.0
183	0.055	0.055	3.178	0.0141	57.6
181	0.065	0.065	3.186	0.0167	56.8
179	0.070	0.070	3.191	0.0180	56.1
176	0.075	0.075	3.195	0.0192	55.1
172	0.080	0.080	3.199	0.0205	53.8
167	0.085	0.085	3.203	0.0218	52.1
162	0.090	0.090	3.207	0.0231	50.5
158	0.095	0.095	3.211	0.0244	49.2
152	0.100	0.100	3.216	0.0257	47.3
147	0.105	0.105	3.220	0.0269	45.7

UNCONFINED COMPRESSION TESTING
Sample No. 0600-023 (28-Day)



UNCONFINED COMPRESSION TEST

ASTM D 2166

SUMMARY OF RESULTS

PROJECT:	Washington Wood Preserving ISS		
PROJECT No.:	SH0600		
SAMPLE No.:	0600-023 (28-Day)		
TESTING DATE:	5/18/2016	LOADING RATE:	0.0400 in./min
TESTED BY:	DMC	TRACKING CODE:	A842_US

TESTING PARAMETER AND RESULTS		
MOISTURE CONTENT	59.6	**%**
BULK UNIT WEIGHT	97.0	lb/ft^3
DRY UNIT WEIGHT	60.7	lb/ft^3
UCS *	57.6	lb/in^2

* UCS - UNCONFINED COMPRESSIVE STRENGTH

UNCONFINED COMPRESSION TEST

ASTM D 2166

PROJECT:	Washington Wood Preserving ISS
PROJECT No.:	SH0600
SAMPLE No.:	0600-024 (28-Day)
TESTING DATE:	18-May-16
TESTED BY:	DMC

LOADING RATE:	0.0400 in./min
TRACKING CODE:	A843_US

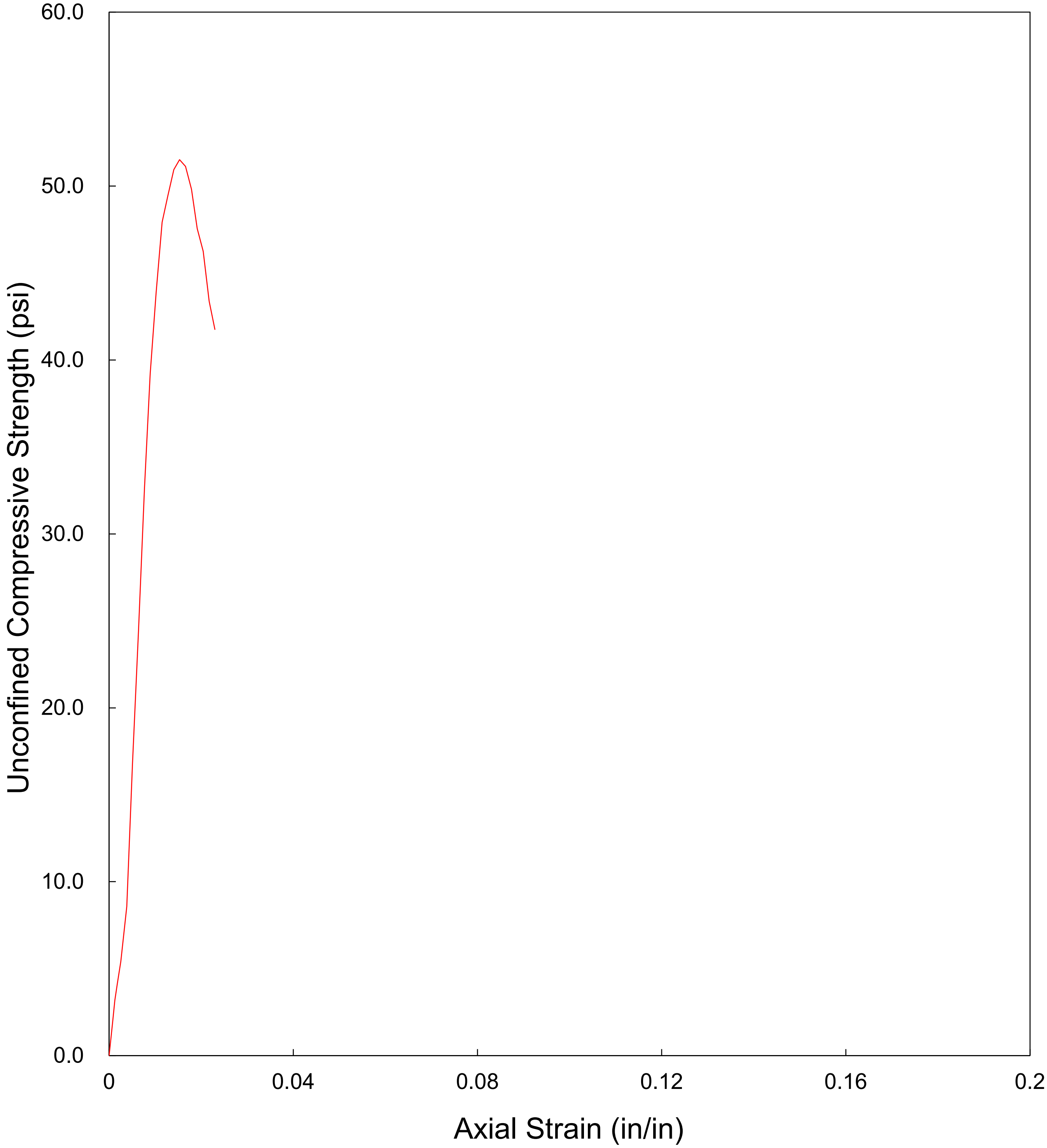
SOIL SPECIMEN DIMENSIONS				
	DIAMETER		LENGTH	
No. 1	2.00	in.	3.94	in.
No. 2	2.01	in.	3.91	in.
No. 3	1.99	in.	3.90	in.
Average	**2.00**	**in.**	**3.91**	**in.**

MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	115.96	g
3. WT WET SOIL + TARE	184.92	g
4. WT DRY SOIL + TARE	163.00	g
5. WT WATER, Ww	21.92	g
6. WT DRY SOIL, Ws	47.04	g
7. MOISTURE CONTENT, W	**46.60**	**%**

SPECIMEN CONDITIONS		
Initial Specimen WT, Wo	***339.72***	***g***
Initial Area, Ao	3.13	in²
Initial Volume, Vo	12.27	in³
Initial Bulk Unit Weight,	105.5	lb/ft³
Initial Dry Unit Weight	71.9	lb/ft³
15 % Strain (0.15 Lo)	0.59	in.
UCS	51.5	lb/in²

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in²)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (lb/in²)
0	0.000	0.000	3.135	0.0000	0.0
6	0.003	0.003	3.137	0.0008	1.9
10	0.005	0.005	3.139	0.0013	3.2
13	0.007	0.007	3.140	0.0018	4.1
17	0.010	0.010	3.143	0.0026	5.4
27	0.015	0.015	3.147	0.0038	8.6
53	0.020	0.020	3.151	0.0051	16.8
77	0.025	0.025	3.155	0.0064	24.4
103	0.030	0.030	3.159	0.0077	32.6
124	0.035	0.035	3.163	0.0089	39.2
139	0.040	0.040	3.167	0.0102	43.9
152	0.045	0.045	3.171	0.0115	47.9
157	0.050	0.050	3.175	0.0128	49.4
162	0.055	0.055	3.179	0.0140	51.0
164	0.060	0.060	3.184	0.0153	51.5
163	0.065	0.065	3.188	0.0166	51.1
159	0.070	0.070	3.192	0.0179	49.8
152	0.075	0.075	3.196	0.0192	47.6
148	0.080	0.080	3.200	0.0204	46.2
139	0.085	0.085	3.204	0.0217	43.4
134	0.090	0.090	3.209	0.0230	41.8

UNCONFINED COMPRESSION TESTING
Sample No. 0600-024 (28-Day)



UNCONFINED COMPRESSION TEST

ASTM D 2166

SUMMARY OF RESULTS

PROJECT:	Washington Wood Preserving ISS		
PROJECT No.:	SH0600		
SAMPLE No.:	0600-024 (28-Day)		
TESTING DATE:	5/18/2016	LOADING RATE:	0.0400 in./min
TESTED BY:	DMC	TRACKING CODE:	A843_US

TESTING PARAMETER AND RESULTS		
MOISTURE CONTENT	46.6	**%**
BULK UNIT WEIGHT	105.5	lb/ft^3
DRY UNIT WEIGHT	71.9	lb/ft^3
UCS *	51.5	lb/in^2

* UCS - UNCONFINED COMPRESSIVE STRENGTH

Client:	Kemron Environmental		
Project Name:	Washington Wood Preserving ISS		
Project Location:	---		
GTX #:	GTX-304790		
Start Date:	5/27/2016	Tested By:	jm
End Date:	6/1/2016	Checked By:	mcm
Boring	---	Test #: K2	
Sample #:	0600-024 (28-Day)		
Depth:	---		
Visual Description:	Moist, gray sandy silt		

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter by ASTM D5084 Increasing Tailwater

Sample Type:	intact	Permeant Fluid:	de-aired tap water
Orientation:	Vertical	Cell #:	P2

Sample Preparation: Specimen weighed and dimensions recorded the placed into permeameter at as-received density and moisture content.

Parameter	Initial	Final
Height, in	1.24	1.24
Diameter, in	2.99	2.99
Area, in^2	7.02	7.02
Volume, in^3	8.7	8.7
Mass, g	241	243
Bulk Density, pcf	105	106
Moisture Content, %	45.0	46.2
Dry Density, pcf	72.7	72.7
Degree of Saturation, %	---	95

B COEFFICIENT DETERMINATION

Cell Pressure, psi:	90	Pressure Increment, psi:	9.7
Sample Pressure, psi:	80	B Coefficient:	0.97

FLOW DATA

Date	Trial #	Pressure, psi Cell	Pressure, psi Sample	Head readings H_1	Head readings H_2	Head readings H_1-H_2	Elapsed Time, sec	Gradient	Permeability K, cm/sec	Temp, °C	R_t	Permeability K @ 20 °C, cm/sec
5/31	3	90	80	65.3	65.2	0.1	60	20.7	1.4E-07	21	0.976	1.4E-07
5/31	4	90	80	65.2	65.0	0.2	120	20.7	1.4E-07	21	0.976	1.4E-07
5/31	5	90	80	65.0	64.9	0.1	60	20.6	1.5E-07	21	0.976	1.4E-07
5/31	6	90	80	64.9	64.7	0.2	120	20.6	1.5E-07	21	0.976	1.4E-07

PERMEABILITY AT 20° C: 1.4 x 10^{-7} cm/sec (@ 10 psi effective stress)

UNCONFINED COMPRESSION TEST

ASTM D 2166

PROJECT:	Washington Wood Preserving ISS
PROJECT No.:	SH0600
SAMPLE No.:	0600-025 (28-Day)
TESTING DATE:	18-May-16
TESTED BY:	DMC
LOADING RATE:	0.0400 in./min
TRACKING CODE:	A844_US

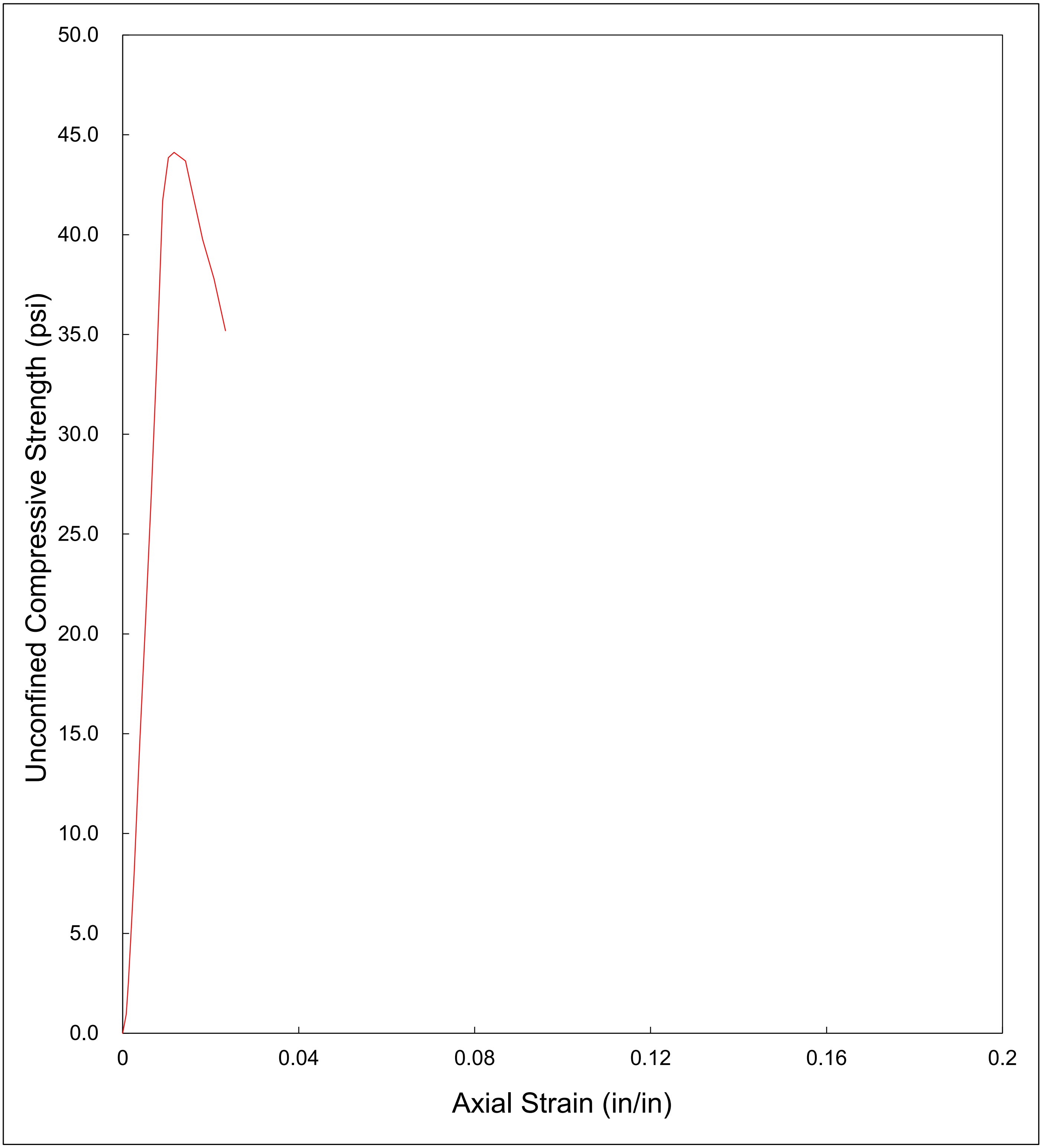
MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	113.24	g
3. WT WET SOIL + TARE	164.73	g
4. WT DRY SOIL + TARE	143.43	g
5. WT WATER, Ww	21.30	g
6. WT DRY SOIL, Ws	30.19	g
7. MOISTURE CONTENT, W	**70.55**	**%**

SOIL SPECIMEN DIMENSIONS	DIAMETER		LENGTH	
No. 1	2.00	in.	3.85	in.
No. 2	2.00	in.	3.84	in.
No. 3	1.99	in.	3.86	in.
Average	**2.00**	**in.**	**3.85**	**in.**

SPECIMEN CONDITIONS		
Initial Specimen WT, Wo	***329.72***	***g***
Initial Area, Ao	3.14	in²
Initial Volume, Vo	12.07	in³
Initial Bulk Unit Weight,	104.0	lb/ft³
Initial Dry Unit Weight	61.0	lb/ft³
15 % Strain (0.15 Lo)	0.58	in.
UCS	44.1	lb/in²

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in²)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (lb/in²)
0	0.000	0.000	3.136	0.0000	0.0
3	0.003	0.003	3.139	0.0008	1.0
8	0.005	0.005	3.140	0.0013	2.5
15	0.007	0.007	3.142	0.0018	4.8
25	0.010	0.010	3.145	0.0026	8.0
46	0.015	0.015	3.149	0.0039	14.6
65	0.020	0.020	3.153	0.0052	20.6
85	0.025	0.025	3.157	0.0065	26.9
107	0.030	0.030	3.161	0.0078	33.9
132	0.035	0.035	3.165	0.0091	41.7
139	0.040	0.040	3.169	0.0104	43.9
140	0.045	0.045	3.173	0.0117	44.1
139	0.055	0.055	3.182	0.0143	43.7
135	0.060	0.060	3.186	0.0156	42.4
131	0.065	0.065	3.190	0.0169	41.1
127	0.070	0.070	3.194	0.0182	39.8
124	0.075	0.075	3.199	0.0195	38.8
121	0.080	0.080	3.203	0.0208	37.8
117	0.085	0.085	3.207	0.0221	36.5
113	0.090	0.090	3.211	0.0234	35.2

UNCONFINED COMPRESSION TESTING
Sample No. 0600-025 (28-Day)



UNCONFINED COMPRESSION TEST

ASTM D 2166

SUMMARY OF RESULTS

PROJECT:	Washington Wood Preserving ISS		
PROJECT No.:	SH0600		
SAMPLE No.:	0600-025 (28-Day)		
TESTING DATE:	5/18/2016	LOADING RATE:	0.0400 in./min
TESTED BY:	DMC	TRACKING CODE:	A844_US

TESTING PARAMETER AND RESULTS		
MOISTURE CONTENT	70.6	**%**
BULK UNIT WEIGHT	104.0	lb/ft^3
DRY UNIT WEIGHT	61.0	lb/ft^3
UCS *	44.1	lb/in^2

* UCS - UNCONFINED COMPRESSIVE STRENGTH

UNCONFINED COMPRESSION TEST

ASTM D 2166

PROJECT:	Washington Wood Preserving ISS			
PROJECT No.:	SH0600			
SAMPLE No.:	0600-026 (28-Day)			
TESTING DATE:	18-May-16		LOADING RATE:	0.0400 in./min
TESTED BY:	DMC		TRACKING CODE:	A845_US

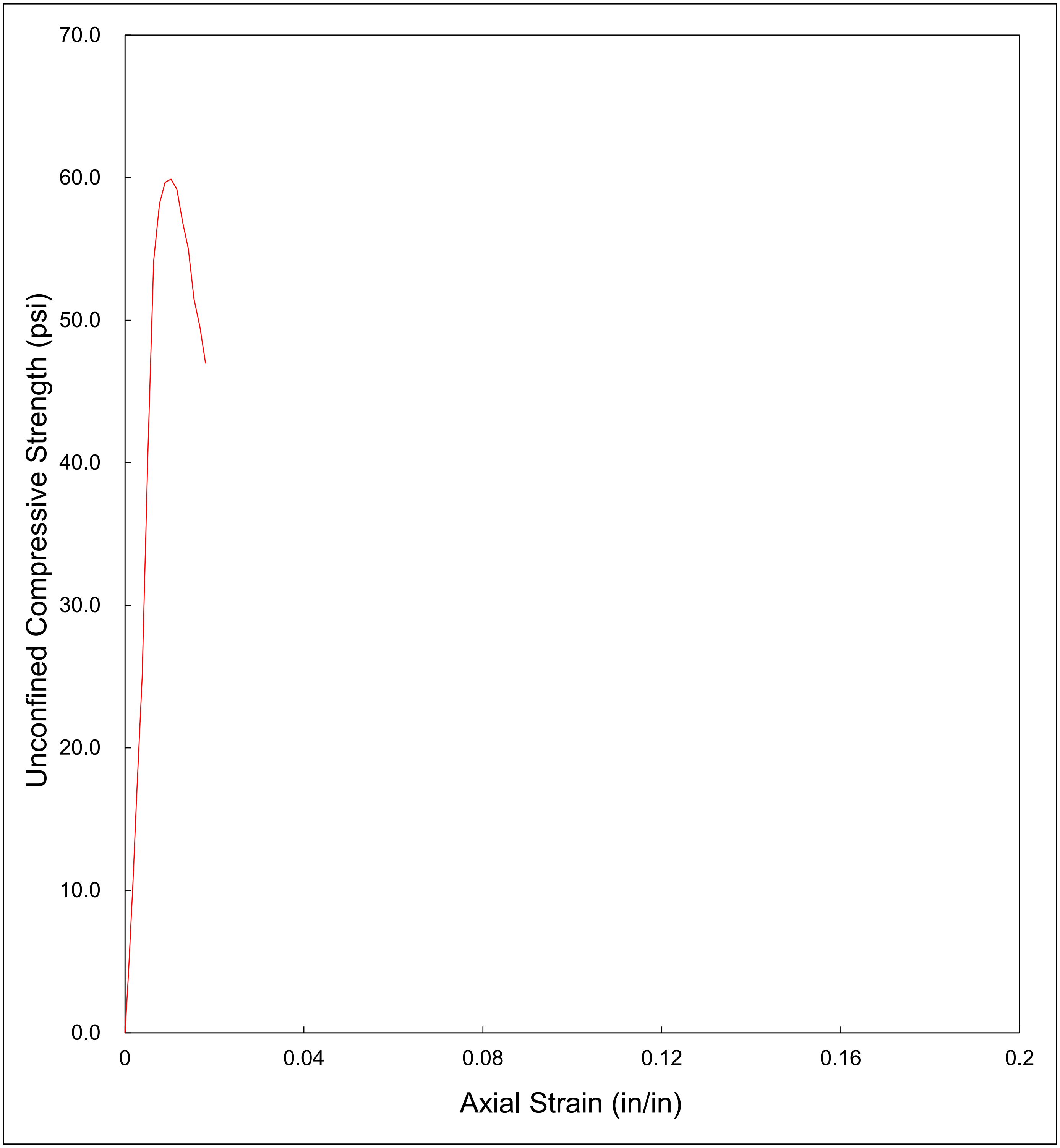
MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	114.28	g
3. WT WET SOIL + TARE	169.85	g
4. WT DRY SOIL + TARE	154.04	g
5. WT WATER, Ww	15.81	g
6. WT DRY SOIL, Ws	39.76	g
7. MOISTURE CONTENT, W	**39.76**	**%**

SOIL SPECIMEN DIMENSIONS				
	DIAMETER		***LENGTH***	
No. 1	2.01	in.	3.88	in.
No. 2	2.01	in.	3.89	in.
No. 3	1.99	in.	3.88	in.
Average	**2.00**	**in.**	**3.88**	**in.**

SPECIMEN CONDITIONS		
Initial Specimen WT, Wo	***341.88***	***g***
Initial Area, Ao	3.16	in²
Initial Volume, Vo	12.26	in³
Initial Bulk Unit Weight,	106.3	lb/ft³
Initial Dry Unit Weight	76.0	lb/ft³
15 % Strain (0.15 Lo)	0.58	in.
UCS	59.9	lb/in²

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in²)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (lb/in²)
0	0.000	0.000	3.156	0.0000	0.0
13	0.003	0.003	3.158	0.0008	4.1
23	0.005	0.005	3.160	0.0013	7.3
34	0.007	0.007	3.161	0.0018	10.8
52	0.010	0.010	3.164	0.0026	16.4
79	0.015	0.015	3.168	0.0039	24.9
130	0.020	0.020	3.172	0.0051	41.0
172	0.025	0.025	3.176	0.0064	54.2
185	0.030	0.030	3.180	0.0077	58.2
190	0.035	0.035	3.184	0.0090	59.7
191	0.040	0.040	3.189	0.0103	59.9
189	0.045	0.045	3.193	0.0116	59.2
182	0.050	0.050	3.197	0.0129	56.9
176	0.055	0.055	3.201	0.0142	55.0
165	0.060	0.060	3.205	0.0154	51.5
159	0.065	0.065	3.209	0.0167	49.5
151	0.070	0.070	3.214	0.0180	47.0

UNCONFINED COMPRESSION TESTING
Sample No. 0600-026 (28-Day)



UNCONFINED COMPRESSION TEST

ASTM D 2166
SUMMARY OF RESULTS

PROJECT:	Washington Wood Preserving ISS		
PROJECT No.:	SH0600		
SAMPLE No.:	0600-026 (28-Day)		
TESTING DATE:	5/18/2016	LOADING RATE:	0.0400 in./min
TESTED BY:	DMC	TRACKING CODE:	A845_US

TESTING PARAMETER AND RESULTS		
MOISTURE CONTENT	39.8	**%**
BULK UNIT WEIGHT	106.3	lb/ft³
DRY UNIT WEIGHT	76.0	lb/ft³
UCS *	59.9	lb/in²

* UCS - UNCONFINED COMPRESSIVE STRENGTH

UNCONFINED COMPRESSION TEST

ASTM D 2166

PROJECT: Washington Wood Preserving ISS
PROJECT No.: SH0600
SAMPLE No.: 0600-027 (28-Day)
TESTING DATE: 18-May-16
TESTED BY: DMC

LOADING RATE: 0.0400 in./min
TRACKING CODE: A846_US

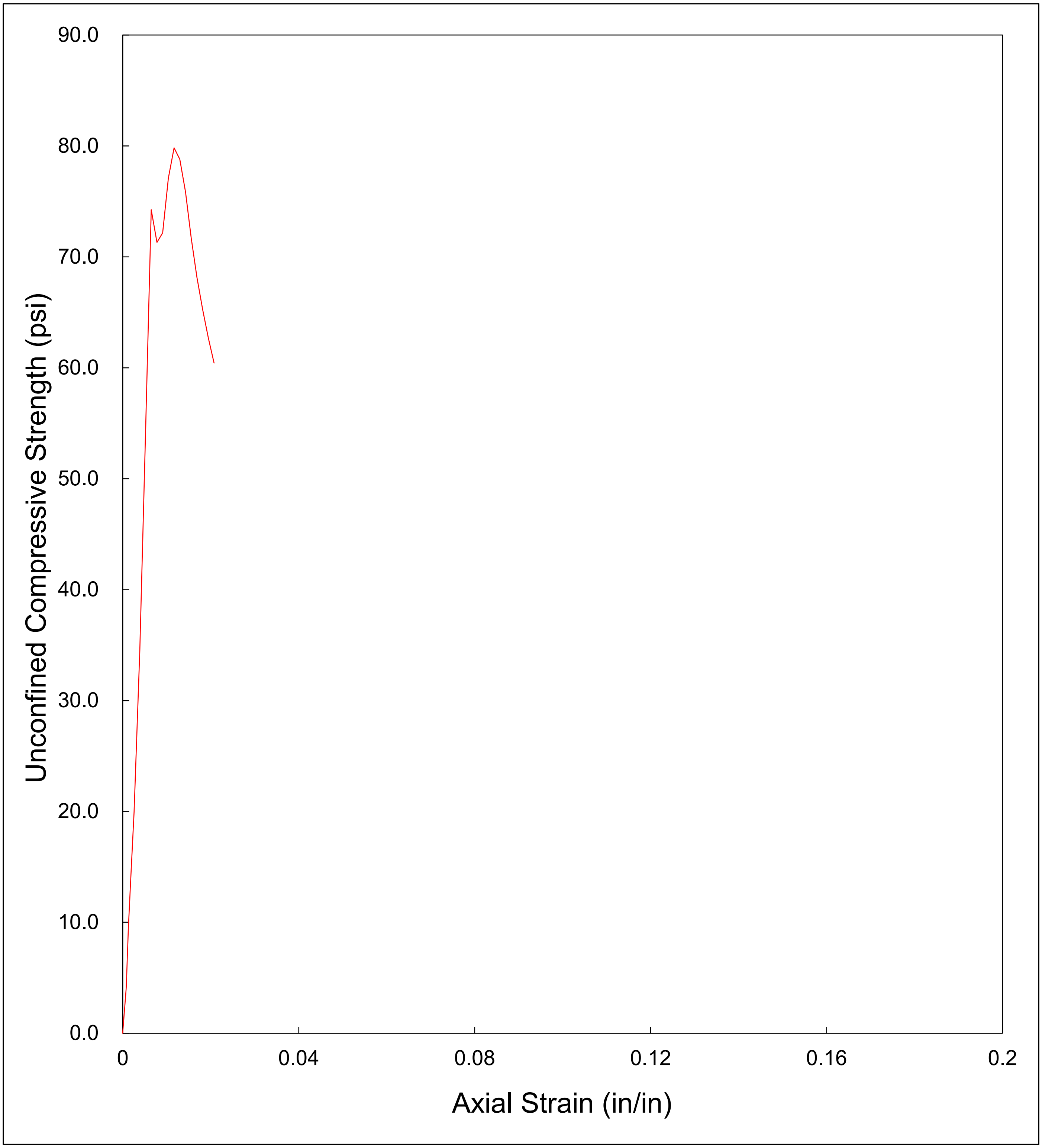
MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	111.81	g
3. WT WET SOIL + TARE	170.57	g
4. WT DRY SOIL + TARE	151.62	g
5. WT WATER, Ww	18.95	g
6. WT DRY SOIL, Ws	39.81	g
7. MOISTURE CONTENT, W	**47.60**	**%**

SOIL SPECIMEN DIMENSIONS	DIAMETER		LENGTH	
No. 1	2.01	in.	3.86	in.
No. 2	2.00	in.	3.86	in.
No. 3	2.00	in.	3.85	in.
Average	**2.00**	**in.**	**3.86**	**in.**

SPECIMEN CONDITIONS		
Initial Specimen WT, Wo	***327.93***	***g***
Initial Area, Ao	3.14	in²
Initial Volume, Vo	12.12	in³
Initial Bulk Unit Weight,	103.0	lb/ft³
Initial Dry Unit Weight	69.8	lb/ft³
15 % Strain (0.15 Lo)	0.58	in.
UCS	79.8	lb/in²

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in²)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (lb/in²)
0	0.000	0.000	3.144	0.0000	0.0
13	0.003	0.003	3.147	0.0008	4.1
30	0.005	0.005	3.148	0.0013	9.5
44	0.007	0.007	3.150	0.0018	14.0
63	0.010	0.010	3.152	0.0026	20.0
109	0.015	0.015	3.156	0.0039	34.5
171	0.020	0.020	3.161	0.0052	54.1
235	0.025	0.025	3.165	0.0065	74.3
226	0.030	0.030	3.169	0.0078	71.3
229	0.035	0.035	3.173	0.0091	72.2
245	0.040	0.040	3.177	0.0104	77.1
254	0.045	0.045	3.181	0.0117	79.8
251	0.050	0.050	3.186	0.0130	78.8
242	0.055	0.055	3.190	0.0143	75.9
229	0.060	0.060	3.194	0.0156	71.7
218	0.065	0.065	3.198	0.0169	68.2
209	0.070	0.070	3.202	0.0182	65.3
201	0.075	0.075	3.207	0.0195	62.7
194	0.080	0.080	3.211	0.0207	60.4

UNCONFINED COMPRESSION TESTING
Sample No. 0600-027 (28-Day)



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UNCONFINED COMPRESSION TEST

ASTM D 2166

SUMMARY OF RESULTS

PROJECT:	Washington Wood Preserving ISS		
PROJECT No.:	SH0600		
SAMPLE No.:	0600-027 (28-Day)		
TESTING DATE:	5/18/2016	LOADING RATE:	0.0400 in./min
TESTED BY:	DMC	TRACKING CODE:	A846_US

TESTING PARAMETER AND RESULTS		
MOISTURE CONTENT	47.6	**%**
BULK UNIT WEIGHT	103.0	lb/ft^3
DRY UNIT WEIGHT	69.8	lb/ft^3
UCS *	79.8	lb/in^2

* UCS - UNCONFINED COMPRESSIVE STRENGTH

Client:	Kemron Environmental
Project Name:	Washington Wood Preserving ISS
Project Location:	---
GTX #:	GTX-304790

Start Date:	5/31/2016	Tested By:	jm
End Date:	6/3/2016	Checked By:	mcm
Boring	---	Test #: K6	
Sample #:	0600-27 (28-Day)		
Depth:	---		
Visual Description:	Moist, gray sandy silt		

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter by ASTM D5084 Increasing Tailwater

Sample Type:	intact	Permeant Fluid:	de-aired tap water
Orientation:	Vertical	Cell #:	P2

Sample Preparation: Specimen weighed and dimensions recorded the placed into permeameter at as-received density and moisture content.

Parameter	Initial	Final
Height, in	2.36	2.36
Diameter, in	2.99	2.99
Area, in^2	7.02	7.02
Volume, in^3	16.6	16.6
Mass, g	439	445
Bulk Density, pcf	101	102
Moisture Content, %	59.5	61.6
Dry Density, pcf	63.1	63.1
Degree of Saturation, %	---	98

B COEFFICIENT DETERMINATION

Cell Pressure, psi:	90	Pressure Increment, psi:	9.7
Sample Pressure, psi:	80	B Coefficient:	97

FLOW DATA

Date	Trial #	Pressure, psi		Head readings			Elapsed Time, sec	Gradient	Permeability K, cm/sec	Temp, °C	R_t	Permeability K @ 20 °C, cm/sec
		Cell	Sample	H_1	H_2	H_1-H_2						
6/1	4	90	80	86.7	86.5	0.2	660	14.5	3.8E-08	21	0.976	3.7E-08
6/1	5	90	80	86.5	85.7	0.8	2700	14.4	3.7E-08	21	0.976	3.6E-08
6/1	6	90	80	85.7	85.0	0.7	2620	14.3	3.4E-08	21	0.976	3.3E-08
6/1	7	90	80	85.0	84.1	0.9	3240	14.2	3.5E-08	21	0.976	3.5E-08

PERMEABILITY AT 20° C: 3.5 x 10^{-8} cm/sec (@ 10 psi effective stress)

UNCONFINED COMPRESSION TEST

ASTM D 2166

PROJECT:	Washington Wood Preserving ISS			
PROJECT No.:	SH0600			
SAMPLE No.:	0600-028 (28-Day)			
TESTING DATE:	19-May-16		LOADING RATE:	0.0400 in./min
TESTED BY:	DMC		TRACKING CODE:	A847_US

MOISTURE CONTENT (Dry Basis)		
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	118.52	g
3. WT WET SOIL + TARE	172.49	g
4. WT DRY SOIL + TARE	156.10	g
5. WT WATER, Ww	16.39	g
6. WT DRY SOIL, Ws	37.58	g
7. MOISTURE CONTENT, W	**43.61**	**%**

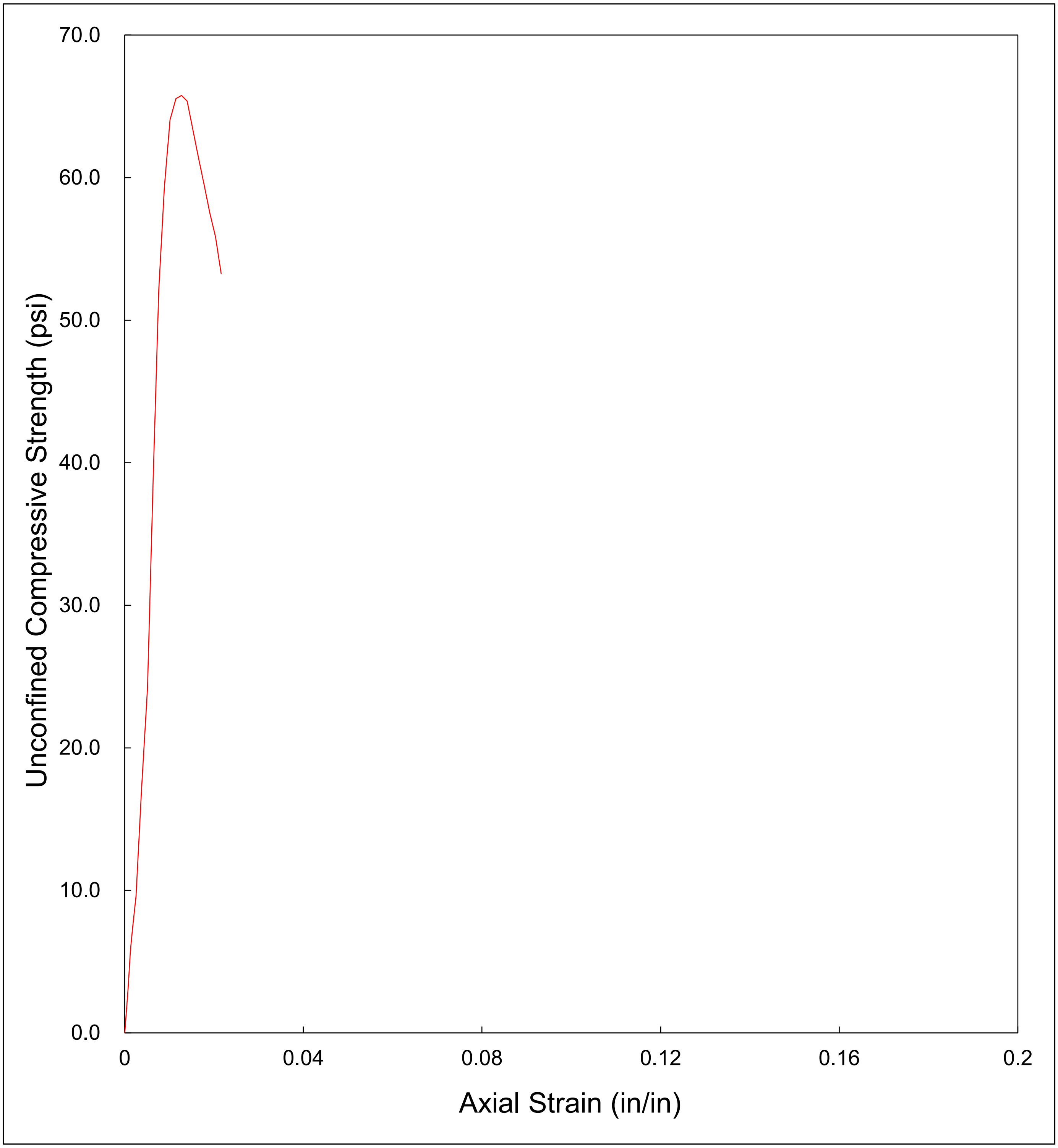
SOIL SPECIMEN DIMENSIONS				
	DIAMETER		***LENGTH***	
No. 1	2.00	in.	3.92	in.
No. 2	1.99	in.	3.95	in.
No. 3	1.99	in.	3.94	in.
Average	**1.99**	**in.**	**3.94**	**in.**

SPECIMEN CONDITIONS		
Initial Specimen WT, Wo	***339.72***	***g***
Initial Area, Ao	3.12	in²
Initial Volume, Vo	12.29	in³
Initial Bulk Unit Weight,	105.3	lb/ft³
Initial Dry Unit Weight	73.3	lb/ft³
15 % Strain (0.15 Lo)	0.59	in.
UCS	65.8	lb/in²

COMPRESSIVE LOAD (lbs.)	DIAL GAGE READING (in.)	SPECIMEN DEFORMATION (in.)	CORRECTED AREA (in²)	AXIAL STRAIN (in/in)	UNCONFINED COMPRESSIVE STRENGTH (lb/in²)
0	0.000	0.000	3.122	0.0000	0.0
10	0.003	0.003	3.125	0.0008	3.2
18	0.005	0.005	3.126	0.0013	5.8
23	0.007	0.007	3.128	0.0018	7.4
30	0.010	0.010	3.130	0.0025	9.6
54	0.015	0.015	3.134	0.0038	17.2
76	0.020	0.020	3.138	0.0051	24.2
122	0.025	0.025	3.142	0.0064	38.8
164	0.030	0.030	3.146	0.0076	52.1
187	0.035	0.035	3.150	0.0089	59.4
202	0.040	0.040	3.154	0.0102	64.0
207	0.045	0.045	3.158	0.0114	65.5
208	0.050	0.050	3.162	0.0127	65.8
207	0.055	0.055	3.167	0.0140	65.4
201	0.060	0.060	3.171	0.0152	63.4
195	0.065	0.065	3.175	0.0165	61.4
189	0.070	0.070	3.179	0.0178	59.5
183	0.075	0.075	3.183	0.0191	57.5
178	0.080	0.080	3.187	0.0203	55.9
170	0.085	0.085	3.191	0.0216	53.3

UNCONFINED COMPRESSION TESTING

Sample No. 0600-028 (28-Day)



UNCONFINED COMPRESSION TEST

ASTM D 2166

SUMMARY OF RESULTS

PROJECT:	Washington Wood Preserving ISS		
PROJECT No.:	SH0600		
SAMPLE No.:	0600-028 (28-Day)		
TESTING DATE:	5/19/2016	LOADING RATE:	0.0400 in./min
TESTED BY:	DMC	TRACKING CODE:	A847_US

TESTING PARAMETER AND RESULTS		
MOISTURE CONTENT	43.6	**%**
BULK UNIT WEIGHT	105.3	lb/ft^3
DRY UNIT WEIGHT	73.3	lb/ft^3
UCS *	65.8	lb/in^2

* UCS - UNCONFINED COMPRESSIVE STRENGTH

Client:	Kemron Environmental		
Project Name:	Washington Wood Preserving ISS		
Project Location:	---		
GTX #:	GTX-304790		
Start Date:	5/27/2016	Tested By:	jm
End Date:	6/1/2016	Checked By:	mcm
Boring	---	Test #: K3	
Sample #:	0600-028 (28-Day)		
Depth:	---		
Visual Description:	Moist, gray sandy silt		

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter by ASTM D5084 Increasing Tailwater

Sample Type:	intact	Permeant Fluid:	de-aired tap water
Orientation:	Vertical	Cell #:	P2

Sample Preparation: Specimen weighed and dimensions recorded the placed into permeameter at as-received density and moisture content.

Parameter	Initial	Final
Height, in	1.75	1.75
Diameter, in	2.99	2.99
Area, in^2	7.02	7.02
Volume, in^3	12.3	12.3
Mass, g	336	341
Bulk Density, pcf	104	106
Moisture Content, %	44.8	47.1
Dry Density, pcf	72.0	72.0
Degree of Saturation, %	---	95

B COEFFICIENT DETERMINATION

Cell Pressure, psi:	90	Pressure Increment, psi:	9.8
Sample Pressure, psi:	80	B Coefficient:	98

FLOW DATA

Date	Trial #	Pressure, psi		Head readings			Elapsed Time, sec	Gradient	Permeability K, cm/sec	Temp, °C	R_t	Permeability K @ 20 °C, cm/sec
		Cell	Sample	H_1	H_2	H_1-H_2						
5/31	4	90	80	57.8	56.7	1.1	1500	13.0	1.0E-07	21	0.976	9.9E-08
5/31	5	90	80	56.7	56.0	0.7	900	12.8	1.1E-07	21	0.976	1.1E-07
5/31	6	90	80	56.0	55.2	0.8	1200	12.6	9.5E-08	21	0.976	9.3E-08
5/31	7	90	80	55.2	53.9	1.3	1980	12.5	9.6E-08	21	0.976	9.3E-08

PERMEABILITY AT 20° C: 9.8×10^{-8} cm/sec (@ 10 psi effective stress)

APPENDIX H

LEAF METHOD 1315 DATA SHEETS

EPA 1315 LEACHABILITY

SAMPLE PREPARATION

PROJECT:	Washington Wood Preserving ISS	TESTED BY:	TNB
PROJECT No.:	SH0600	TRACKING CODE:	A838
SAMPLE No.:	0600-019		
TEST DATE:	6/7/2016		

MOISTURE CONTENT (Dry Basis)	***RESULTS***	
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	114.98	***g***
3. WT WET SOIL + TARE	178.47	***g***
4. WT DRY SOIL + TARE	154.24	***g***
5. WT WATER, Ww	24.23	g
6. WT DRY SOIL, Ws	39.26	g
7. MOISTURE CONTENT, W	61.72	%

SOIL SPECIMEN DIMENSIONS				
TRIPLICATE ANALYSES	***DIAMETER RESULTS***		***LENGTH RESULTS***	
No. 1	***2.01***	***in.***	***3.94***	***in.***
No. 2	***2.00***	***in.***	***3.99***	***in.***
No. 3	***1.99***	***in.***	***3.98***	***in.***
Average	2.00	in.	3.97	in.

SPECIMEN CONDITIONS	***INITIAL***	
Specimen WT, Wo	***308.30***	***g***
Surface Area, Ao	31.22	in^2
Volume, Vo	12.47	in^3
Bulk Unit Weight	94.2	pcf
Dry Unit Weight	58.2	pcf

EPA 1315 LEACHABILITY

TESTING DATA

Sheet 2 of 2

PROJECT:	Washington Wood Preserving ISS
PROJECT NO.:	SH0600
SAMPLE NO:	0600-019
START DATE:	6/7/2016
TRACKING CODE:	A838

LEACH INTERVAL	TESTED BY	DATE		TIME		OF SAMPLE + TARE (g)	VOLUME LEACHATE (ml)	TEMP (°C)	ORP (mV)	Conduct. (mS/cm³)	pH (s.u.)	OBSERVATIONS
		IN	OUT	IN	OUT							
Initial	TNB					309.50	1813					initial
1	TNB	6/7/2.16	06/07/16	8:56	10:56	313.44	1813	26.39	31.8	0.089	10.39	2 hr
2	TNB	06/07/16	06/08/16	10:56	8:56	314.77	1813	18.26	127.8	0.570	8.54	24 hr
3	TNB	06/08/16	06/09/16	8:56	8:56	314.73	1813	19.83	20.4	0.397	10.91	48 hr
4	TNB	06/09/16	06/14/16	8:56	8:56	315.38	1813	26.03	-6.0	0.068	11.22	7 day
5	TNB	06/14/16	06/21/16	8:56	8:56	316.37	1813	20.31	-19.0	0.647	11.86	14 day
6	TNB	06/21/16	07/05/16	8:56	8:56	316.93	1813	23.24	-14.8	0.626	11.44	28 day
7	TNB	07/05/16	07/19/16	8:56	8:56		1813					42 day
8	TNB	07/19/16	07/26/16	8:56	8:56		1813					49 day
9	TNB	07/26/16	08/09/16	8:56	8:56		1813					63 day
10												

EPA 1315 LEACHABILITY

SAMPLE PREPARATION

PROJECT:	Washington Wood Preserving ISS	TESTED BY:	TNB
PROJECT No.:	SH0600	TRACKING CODE:	A841
SAMPLE No.:	0600-022		
TEST DATE:	6/7/2016		

MOISTURE CONTENT (Dry Basis)	***RESULTS***	
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	113.96	***g***
3. WT WET SOIL + TARE	162.69	***g***
4. WT DRY SOIL + TARE	143.47	***g***
5. WT WATER, Ww	19.22	g
6. WT DRY SOIL, Ws	29.51	g
7. MOISTURE CONTENT, W	65.13	%

SOIL SPECIMEN DIMENSIONS				
TRIPLICATE ANALYSES	***DIAMETER RESULTS***		***LENGTH RESULTS***	
No. 1	***2.01***	***in.***	***3.96***	***in.***
No. 2	***2.00***	***in.***	***3.97***	***in.***
No. 3	***1.99***	***in.***	***3.97***	***in.***
Average	2.00	in.	3.97	in.

SPECIMEN CONDITIONS	***INITIAL***	
Specimen WT, Wo	***305.67***	***g***
Surface Area, Ao	31.18	in^2
Volume, Vo	12.44	in^3
Bulk Unit Weight	93.6	pcf
Dry Unit Weight	56.7	pcf

EPA 1315 LEACHABILITY

TESTING DATA

Sheet 2 of 2

PROJECT: Washington Wood Preserving ISS

PROJECT NO.: SH0600

SAMPLE NO: 0600-022

START DATE: 6/7/2016

TRACKING CODE: A841

LEACH INTERVAL	TESTED BY	DATE		TIME		OF SAMPLE + TARE (g)	VOLUME LEACHATE (ml)	TEMP (°C)	ORP (mV)	Conduct. (mS/cm³)	pH (s.u.)	OBSERVATIONS
		IN	OUT	IN	OUT							
Initial	TNB					308.32	1811					initial
1	TNB	06/07/16	06/07/16	8:57	10:57	313.29	1811	26.41	47.5	0.051	10.16	2 hr
2	TNB	06/07/16	06/08/16	10:57	8:57	314.13	1811	19.43	103.9	0.654	9.29	24 hr
3	TNB	06/08/16	06/09/16	8:57	8:57	314.32	1811	21.98	8.6	0.437	11.54	48 hr
4	TNB	06/09/16	06/04/16	8:57	8:57	314.75	1811	22.85	29.5	0.673	10.89	7 day
5	TNB	06/14/16	06/21/16	8:57	8:57	315.56	1811	20.14	2.3	0.642	11.72	14 day
6	TNB	06/21/16	07/05/16	8:57	8:57	315.75	1811	23.36	-1.9	0.533	11.46	28 day
7	TNB	07/05/16	07/19/16	8:57	8:57		1811					42 day
8	TNB	07/09/16	07/26/16	8:57	8:57		1811					49 day
9	TNB	07/26/16	08/09/16	8:57	8:57		1811					63 day
10												

EPA 1315 LEACHABILITY

SAMPLE PREPARATION

PROJECT:	Washington Wood Preserving ISS	TESTED BY:	TNB
PROJECT No.:	SH0600	TRACKING CODE:	A843
SAMPLE No.:	0600-024		
TEST DATE:	6/7/2016		

MOISTURE CONTENT (Dry Basis)	***RESULTS***	
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	115.96	***g***
3. WT WET SOIL + TARE	184.92	***g***
4. WT DRY SOIL + TARE	163.00	***g***
5. WT WATER, Ww	21.92	g
6. WT DRY SOIL, Ws	47.04	g
7. MOISTURE CONTENT, W	46.60	%

SOIL SPECIMEN DIMENSIONS				
TRIPLICATE	***DIAMETER***		***LENGTH***	
ANALYSES	***RESULTS***		***RESULTS***	
No. 1	***2.00***	***in.***	***3.96***	***in.***
No. 2	***2.01***	***in.***	***3.92***	***in.***
No. 3	***1.99***	***in.***	***3.92***	***in.***
Average	2.00	in.	3.93	in.

SPECIMEN CONDITIONS	***INITIAL***	
Specimen WT, Wo	***344.70***	***g***
Surface Area, Ao	30.97	in^2
Volume, Vo	12.34	in^3
Bulk Unit Weight	106.4	pcf
Dry Unit Weight	72.6	pcf

EPA 1315 LEACHABILITY

TESTING DATA

Sheet 2 of 2

PROJECT:	Washington Wood Preserving ISS
PROJECT NO.:	SH0600
SAMPLE NO:	0600-024
START DATE:	6/7/2016
TRACKING CODE:	A843

LEACH INTERVAL	TESTED BY	DATE		TIME		OF SAMPLE + TARE (g)	VOLUME LEACHATE (ml)	TEMP (°C)	ORP (mV)	Conduct. (mS/cm³)	pH (s.u.)	OBSERVATIONS
		IN	OUT	IN	OUT							
Initial	TNB					347.60	1799					initial
1	TNB	06/07/16	06/07/16	8:58	10:58	352.42	1799	26.48	57.3	0.039	10.00	2 hr
2	TNB	06/07/16	06/08/16	10:58	8:58	353.41	1799	19.64	29.8	0.394	10.21	24 hr
3	TNB	06/08/16	06/09/16	8:58	8:58	352.49	1799	22.37	-28.3	0.271	11.39	48 hr
4	TNB	06/09/16	06/14/16	8:58	8:58	352.22	1799	21.69	-20.3	0.384	10.93	7 day
5	TNB	06/14/16	06/21/16	8:58	8:58	353.31	1799	20.07	-24.0	0.450	11.51	14 day
6	TNB	06/21/16	07/05/16	8:58	8:58	352.81	1799	23.49	-6.2	0.340	11.15	28 day
7	TNB	07/05/16	07/19/16	8:58	8:58		1799					42 day
8	TNB	07/09/16	07/26/16	8:58	8:58		1799					49 day
9	TNB	07/26/16	08/09/16	8:58	8:58		1799					63 day
10												

EPA 1315 LEACHABILITY

SAMPLE PREPARATION

PROJECT:	Washington Wood Preserving ISS	TESTED BY:	TNB
PROJECT No.:	SH0600	TRACKING CODE:	A846
SAMPLE No.:	0600-027		
TEST DATE:	6/7/2016		

MOISTURE CONTENT (Dry Basis)	***RESULTS***	
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	111.81	***g***
3. WT WET SOIL + TARE	170.57	***g***
4. WT DRY SOIL + TARE	151.62	***g***
5. WT WATER, Ww	18.95	g
6. WT DRY SOIL, Ws	39.81	g
7. MOISTURE CONTENT, W	47.60	%

SOIL SPECIMEN DIMENSIONS				
TRIPLICATE ANALYSES	***DIAMETER RESULTS***		***LENGTH RESULTS***	
No. 1	***2.00***	***in.***	***3.96***	***in.***
No. 2	***2.00***	***in.***	***3.94***	***in.***
No. 3	***2.01***	***in.***	***3.96***	***in.***
Average	2.00	in.	3.95	in.

SPECIMEN CONDITIONS	***INITIAL***	
Specimen WT, Wo	***331.97***	***g***
Surface Area, Ao	31.18	in^2
Volume, Vo	12.46	in^3
Bulk Unit Weight	101.5	pcf
Dry Unit Weight	68.8	pcf

EPA 1315 LEACHABILITY

TESTING DATA

Sheet 2 of 2

PROJECT: Washington Wood Preserving ISS
PROJECT NO.: SH0600
SAMPLE NO: 0600-027
START DATE: 6/7/2016
TRACKING CODE: A846

LEACH INTERVAL	TESTED BY	DATE		TIME		OF SAMPLE + TARE (g)	VOLUME LEACHATE (ml)	TEMP (°C)	ORP (mV)	Conduct. (mS/cm³)	pH (s.u.)	OBSERVATIONS
		IN	OUT	IN	OUT							
Initial	TNB					333.51	1811					initial
1	TNB	06/07/16	06/07/16	8:59	10:59	336.76	1811	27.31	53.2	0.044	10.24	2 hr
2	TNB	06/07/16	06/08/16	10:59	8:59	337.85	1811	21.09	35.1	0.448	10.53	24 hr
3	TNB	06/08/16	06/09/16	8:59	8:59	338.00	1811	22.66	-12.2	0.291	11.47	48 hr
4	TNB	06/09/16	06/14/16	8:59	8:59	337.93	1811	21.44	-10.6	0.405	11.15	7 day
5	TNB	06/14/16	06/21/16	8:59	8:59	338.31	1811	20.29	-3.4	0.464	11.58	14 day
6	TNB	06/21/16	07/05/16	8:59	8:59	338.18	1811	23.38	-2.6	0.518	11.47	28 day
7	TNB	07/05/16	07/19/16	8:59	8:59		1811					42 day
8	TNB	07/09/16	07/26/16	8:59	8:59		1811					49 day
9	TNB	07/26/16	08/09/16	8:59	8:59		1811					63 day
10												

EPA 1315 LEACHABILITY

SAMPLE PREPARATION

PROJECT: Washington Wood Preserving ISS
PROJECT No.: SH0600
SAMPLE No.: 0600-019B
TEST DATE: 6/8/2016
TESTED BY: TNB
TRACKING CODE: A877

MOISTURE CONTENT (Dry Basis)	***RESULTS***	
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	114.98	***g***
3. WT WET SOIL + TARE	178.47	***g***
4. WT DRY SOIL + TARE	154.24	***g***
5. WT WATER, Ww	24.23	g
6. WT DRY SOIL, Ws	39.26	g
7. MOISTURE CONTENT, W	61.72	%

SOIL SPECIMEN DIMENSIONS				
TRIPLICATE ANALYSES	***DIAMETER RESULTS***		***LENGTH RESULTS***	
No. 1	***2.01***	***in.***	***3.91***	***in.***
No. 2	***2.00***	***in.***	***3.90***	***in.***
No. 3	***1.99***	***in.***	***3.92***	***in.***
Average	2.00	in.	3.91	in.

SPECIMEN CONDITIONS	***INITIAL***	
Specimen WT, Wo	***307.79***	***g***
Surface Area, Ao	30.82	in^2
Volume, Vo	12.26	in^3
Bulk Unit Weight	95.6	pcf
Dry Unit Weight	59.1	pcf

EPA 1315 LEACHABILITY

TESTING DATA

Sheet 2 of 2

PROJECT: Washington Wood Preserving ISS

PROJECT NO.: SH0600

SAMPLE NO: 0600-019B

START DATE: 6/8/2016

TRACKING CODE: A877

LEACH INTERVAL	TESTED BY	DATE		TIME		OF SAMPLE + TARE (g)	VOLUME LEACHATE (ml)	TEMP (°C)	ORP (mV)	Conduct. (mS/cm³)	pH (s.u.)	OBSERVATIONS
		IN	OUT	IN	OUT							
Initial	TNB					309.59	1790	25.42	161.2	0.006	8.06	initial
1	TNB	06/08/16	06/08/16	8:10	10:10	313.26	1790	21.02	82.4	0.080	9.96	2 hr
2	TNB	06/08/16	06/09/16	10:10	8:10	314.38	1790	17.84	95.6	0.525	9.83	24 hr
3	TNB	06/09/16	06/10/16	8:10	8:10	314.23	1790	21.87	86.5	0.305	9.77	48 hr
4	TNB	06/10/16	06/15/16	8:10	8:10	314.78	1790	20.33	-17.0	0.557	11.64	7 day
5	TNB	06/15/16	06/22/16	8:10	8:10	315.26	1790	20.36	-9.5	0.622	11.63	14 day
6	TNB	06/22/16	07/06/16	8:10	8:10	316.34	1790	23.63	-13.5	0.762	11.61	28 day
7	TNB	07/06/16	07/20/16	8:10	8:10		1790					42 day
8	TNB	07/20/16	07/27/16	8:10	8:10		1790					49 day
9	TNB	07/27/16	08/10/16	8:10	8:10		1790					63 day
10												

EPA 1315 LEACHABILITY

SAMPLE PREPARATION

PROJECT: Washington Wood Preserving ISS
PROJECT No.: SH0600
SAMPLE No.: 0600-022B
TEST DATE: 6/8/2016

TESTED BY: TNB
TRACKING CODE: A878

MOISTURE CONTENT (Dry Basis)	RESULTS	
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	113.99	g
3. WT WET SOIL + TARE	162.69	g
4. WT DRY SOIL + TARE	143.47	g
5. WT WATER, Ww	19.22	g
6. WT DRY SOIL, Ws	29.48	g
7. MOISTURE CONTENT, W	65.19	%

SOIL SPECIMEN DIMENSIONS				
TRIPLICATE ANALYSES	DIAMETER RESULTS		LENGTH RESULTS	
No. 1	2.01	in.	4.00	in.
No. 2	2.00	in.	3.99	in.
No. 3	1.99	in.	4.00	in.
Average	2.00	in.	4.00	in.

SPECIMEN CONDITIONS	INITIAL	
Specimen WT, Wo	312.36	g
Surface Area, Ao	31.37	in²
Volume, Vo	12.54	in³
Bulk Unit Weight	94.9	pcf
Dry Unit Weight	57.5	pcf

EPA 1315 LEACHABILITY

TESTING DATA

Sheet 2 of 2

PROJECT: Washington Wood Preserving ISS

PROJECT NO.: SH0600

SAMPLE NO: 0600-022B

START DATE: 6/8/2016

TRACKING CODE: A878

LEACH INTERVAL	TESTED BY	DATE		TIME		OF SAMPLE + TARE (g)	VOLUME LEACHATE (ml)	TEMP (°C)	ORP (mV)	Conduct. (mS/cm^3)	pH (s.u.)	OBSERVATIONS
		IN	OUT	IN	OUT							
Initial	TNB					313.96	1822	25.42	161.2	0.006	8.06	initial
1	TNB	06/08/16	06/08/16	8:11	10:11	317.44	1822	21.43	51.1	0.118	10.69	2 hr
2	TNB	06/08/16	06/09/16	10:11	8:11	318.61	1822	18.18	119.2	0.556	9.34	24 hr
3	TNB	06/09/16	06/10/16	8:11	8:11	318.65	1822	21.82	69.6	0.341	10.08	48 hr
4	TNB	06/10/16	06/15/16	8:11	8:11	318.92	1822	20.12	-11.9	0.677	11.77	7 day
5	TNB	06/15/16	06/22/16	8:11	8:11	319.64	1822	20.29	2.2	0.582	11.63	14 day
6	TNB	06/22/16	7/62016	8:11	8:11	320.64	1822	23.62	-15.9	0.928	11.75	28 day
7	TNB	07/06/16	07/20/16	8:11	8:11		1822					42 day
8	TNB	07/20/16	07/27/16	8:11	8:11		1822					49 day
9	TNB	07/28/16	08/10/16	8:11	8:11		1822					63 day
10												

EPA 1315 LEACHABILITY

SAMPLE PREPARATION

PROJECT:	Washington Wood Preserving ISS	TESTED BY:	TNB
PROJECT No.:	SH0600	TRACKING CODE:	A879
SAMPLE No.:	0600-024B		
TEST DATE:	6/8/2016		

MOISTURE CONTENT (Dry Basis)	*RESULTS*	
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	115.96	***g***
3. WT WET SOIL + TARE	184.92	***g***
4. WT DRY SOIL + TARE	163.00	***g***
5. WT WATER, Ww	21.92	g
6. WT DRY SOIL, Ws	47.04	g
7. MOISTURE CONTENT, W	46.60	%

SOIL SPECIMEN DIMENSIONS				
TRIPLICATE ANALYSES	***DIAMETER RESULTS***		***LENGTH RESULTS***	
No. 1	***2.01***	***in.***	***3.94***	***in.***
No. 2	***2.00***	***in.***	***3.95***	***in.***
No. 3	***1.99***	***in.***	***3.94***	***in.***
Average	2.00	in.	3.94	in.

SPECIMEN CONDITIONS	***INITIAL***	
Specimen WT, Wo	***344.14***	***g***
Surface Area, Ao	31.00	in^2
Volume, Vo	12.35	in^3
Bulk Unit Weight	106.1	pcf
Dry Unit Weight	72.4	pcf

EPA 1315 LEACHABILITY

TESTING DATA

Sheet 2 of 2

PROJECT:	Washington Wood Preserving ISS
PROJECT NO.:	SH0600
SAMPLE NO:	0600-024B
START DATE:	6/8/2016
TRACKING CODE:	A879

LEACH INTERVAL	TESTED BY	DATE		TIME		OF SAMPLE + TARE (g)	VOLUME LEACHATE (ml)	TEMP (°C)	ORP (mV)	Conduct. (mS/cm³)	pH (s.u.)	OBSERVATIONS
		IN	OUT	IN	OUT							
Initial	TNB					345.63	1801	25.42	161.2	0.006	8.60	initial
1	TNB	06/08/16	06/08/16	8:12	10:12	348.04	1801	21.70	52.0	0.058	10.52	2 hr
2	TNB	06/08/16	06/09/16	10:12	8:12	349.17	1801	19.95	53.7	0.350	10.08	24 hr
3	TNB	06/09/16	06/10/16	8:12	8:12	349.67	1801	23.48	-1.0	0.309	11.00	48 hr
4	TNB	06/10/16	06/15/16	8:12	8:12	350.21	1801	20.02	-35.0	0.470	11.60	7 day
5	TNB	06/15/16	06/22/16	8:12	8:12	350.61	1801	20.32	-12.9	0.371	11.38	14 day
6	TNB	06/22/16	07/06/16	8:12	8:12	351.28	1801	23.26	-24.5	0.533	11.53	28 day
7	TNB	07/06/16	07/20/16	8:12	8:12		1801					42 day
8	TNB	07/20/16	07/27/16	8:12	8:12		1801					49 day
9	TNB	07/27/16	08/10/16	8:12	8:12		1801					63 day
10												

EPA 1315 LEACHABILITY

SAMPLE PREPARATION

PROJECT: Washington Wood Preserving ISS
PROJECT No.: SH0600
SAMPLE No.: 0600-027B
TEST DATE: 6/8/2016

TESTED BY: TNB
TRACKING CODE: A880

MOISTURE CONTENT (Dry Basis)	RESULTS	
1. MOISTURE TIN NO.		
2. WT MOISTURE TIN (tare weight)	111.81	g
3. WT WET SOIL + TARE	170.57	g
4. WT DRY SOIL + TARE	151.62	g
5. WT WATER, Ww	18.95	g
6. WT DRY SOIL, Ws	39.81	g
7. MOISTURE CONTENT, W	47.60	%

SOIL SPECIMEN DIMENSIONS				
TRIPLICATE ANALYSES	DIAMETER RESULTS		LENGTH RESULTS	
No. 1	2.00	in.	3.96	in.
No. 2	2.00	in.	3.89	in.
No. 3	1.99	in.	3.96	in.
Average	2.00	in.	3.94	in.

SPECIMEN CONDITIONS	INITIAL	
Specimen WT, Wo	334.89	g
Surface Area, Ao	30.98	in^2
Volume, Vo	12.34	in^3
Bulk Unit Weight	103.4	pcf
Dry Unit Weight	70.1	pcf

EPA 1315 LEACHABILITY

TESTING DATA

Sheet 2 of 2

PROJECT:	Washington Wood Preserving ISS
PROJECT NO.:	SH0600
SAMPLE NO:	0600-027B
START DATE:	6/8/2016
TRACKING CODE:	A880

LEACH INTERVAL	TESTED BY	DATE		TIME		OF SAMPLE + TARE (g)	VOLUME LEACHATE (ml)	TEMP (°C)	ORP (mV)	Conduct. (mS/cm³)	pH (s.u.)	OBSERVATIONS
		IN	OUT	IN	OUT							
Initial	TNB					336.21	1799	25.42	161.2	0.006	8.06	initial
1	TNB	06/08/16	06/08/16	8:13	10:13	338.06	1799	21.76	52.0	0.088	10.58	2 hr
2	TNB	06/08/16	06/09/16	10:13	8:13	339.21	1799	20.03	28.1	0.350	10.69	24 hr
3	TNB	06/09/16	06/10/16	8:13	8:13	339.16	1799	23.26	4.8	0.299	10.88	48 hr
4	TNB	06/10/16	06/15/16	8:13	8:13	339.65	1799	19.83	-24.8	0.562	11.73	7 day
5	TNB	06/15/16	06/22/16	8:13	8:13	339.66	1799	20.43	-11.3	0.505	11.64	14 day
6	TNB	06/22/16	07/06/16	8:13	8:13	340.31	1799	23.13	-12.7	0.595	11.58	28 day
7	TNB	7/6/206	07/20/16	8:13	8:13		1799					42 day
8	TNB	07/20/16	07/27/16	8:13	8:13		1799					49 day
9	TNB	07/27/16	08/10/16	8:13	8:13		1799					63 day
10												

APPENDIX I

LEAF METHOD 1315 ANALYTICAL CHARACTERIZATION REPORT

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Nashville
2960 Foster Creighton Drive
Nashville, TN 37204
Tel: (615)726-0177

TestAmerica Job ID: 490-105474-1
Client Project/Site: Washington Wood Preserving ISS

For:
Kemron Environmental Services, Inc.
1359A Ellsworth Industrial Blvd.
Atlanta, Georgia 30318

Attn: Mr. Tommy Jordan

Authorized for release by:
6/21/2016 3:34:59 PM

Jannel Franklin, Project Manager I
(732)593-2551
jannel.franklin@testamericainc.com

Designee for

Heather Baker, Project Manager I
(615)301-5043
heather.baker@testamericainc.com

The test results in this report meet all 2003 NELAC and 2009 TNI requirements for accredited parameters, exceptions are noted in this report. This report may not be reproduced except in full, and with written approval from the laboratory. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

Table of Contents

Sample Summary

Client: Kemron Environmental Services, Inc.
Project/Site: Washington Wood Preserving ISS

TestAmerica Job ID: 490-105474-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
490-105474-1	0600-019 (2 hour)	Water	06/08/16 10:35	06/10/16 08:50
490-105474-2	0600-022 (2 hour)	Water	06/08/16 10:45	06/10/16 08:50
490-105474-3	0600-024 (2 hour)	Water	06/08/16 10:55	06/10/16 08:50
490-105474-4	0600-027 (2 hour)	Water	06/08/16 11:05	06/10/16 08:50
490-105474-5	0600-019 (24 hr)	Water	06/09/16 10:10	06/10/16 08:50
490-105474-6	0600-022 (24 hr)	Water	06/09/16 10:20	06/10/16 08:50
490-105474-7	0600-024 (24 hr)	Water	06/09/16 10:25	06/10/16 08:50
490-105474-8	0600-027 (24 hr)	Water	06/09/16 10:30	06/10/16 08:50

Job ID: 490-105474-1

Laboratory: TestAmerica Nashville

Narrative

Job Narrative
490-105474-1

Comments
No additional comments.

Receipt
The samples were received on 6/10/2016 8:50 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 3.6º C.

GC/MS Semi VOA
Method(s) 8270D: Insufficient sample volume was available to perform a matrix spike/matrix spike duplicate (MS/MSD) associated with preparation batch 490-347453 and analytical batch 490-347677.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

GC Semi VOA
Method(s) NWTPH-Dx: Insufficient sample volume was available to perform a matrix spike/matrix spike duplicate (MS/MSD) associated with preparation batch 490-348104 and analytical batch 490-348824.

Method(s) NWTPH-Dx: The continuing calibration verification (CCV) associated with batch 348824 recovered above the upper control limit for C24-C40. The samples associated with this CCV were non-detects or were not detected above the reporting limit (RL) for the affected analytes; therefore, the data have been reported.

Method(s) NWTPH-Dx: There was insufficient contamination present for analyte C10-C24 to perform a pattern match for the following samples: 0600-019 (2 hour) (490-105474-1), 0600-022 (2 hour) (490-105474-2), 0600-027 (2 hour) (490-105474-4), 0600-022 (24 hr) (490-105474-6), (490-105554-A-1-A) and (490-105554-B-1-B DU).

Method(s) NWTPH-Dx: The following samples contained a hydrocarbon pattern for analyte C10-C24 that most closely resembles a Diesel Fuel #2 product used by the laboratory for quantitative purposes: 0600-024 (2 hour) (490-105474-3), 0600-019 (24 hr) (490-105474-5), 0600-024 (24 hr) (490-105474-7) and 0600-027 (24 hr) (490-105474-8).

Method(s) 8151A: The %RPD between the primary and confirmation column exceeded 40% for Dichloroacetic acid(Surr) for the following samples: 0600-019 (24 hr) (490-105474-5). The lower value(s) has been reported and qualified in accordance with the laboratory's SOP.

Method(s) 8151A: Surrogate recovery for the following samples was outside control limits: 0600-024 (2 hour) (490-105474-3), 0600-027 (2 hour) (490-105474-4), 0600-024 (24 hr) (490-105474-7) and 0600-027 (24 hr) (490-105474-8). Evidence of matrix interference due to high target analytes is present; therefore, re-extraction and/or re-analysis was not performed.

Method(s) 8151A: The following samples was diluted due to the nature of the sample matrix: 0600-024 (2 hour) (490-105474-3), 0600-027 (2 hour) (490-105474-4), 0600-024 (24 hr) (490-105474-7) and 0600-027 (24 hr) (490-105474-8). Elevated reporting limits (RLs) are provided.

Method(s) 8151A: Insufficient sample volume was available to perform a matrix spike/matrix spike duplicate (MS/MSD) associated with preparation batch 490-347993 and analytical batch 490-348600.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Organic Prep
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Qualifiers

GC/MS Semi VOA

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

GC Semi VOA

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
X	Surrogate is outside control limits
p	The %RPD between the primary and confirmation column/detector is >40%. The lower value has been reported.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Client Sample ID: 0600-019 (2 hour)
Date Collected: 06/08/16 10:35
Date Received: 06/10/16 08:50

Lab Sample ID: 490-105474-1
Matrix: Water

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	ND		1.72	0.276	ug/L		06/14/16 08:19	06/14/16 20:05	1
Acenaphthylene	ND		1.72	0.302	ug/L		06/14/16 08:19	06/14/16 20:05	1
Anthracene	ND		1.72	0.328	ug/L		06/14/16 08:19	06/14/16 20:05	1
Benzo[a]anthracene	ND		1.72	0.276	ug/L		06/14/16 08:19	06/14/16 20:05	1
Benzo[a]pyrene	ND		1.72	0.328	ug/L		06/14/16 08:19	06/14/16 20:05	1
Benzo[b]fluoranthene	ND		1.72	0.310	ug/L		06/14/16 08:19	06/14/16 20:05	1
Benzo[g,h,i]perylene	ND		1.72	0.534	ug/L		06/14/16 08:19	06/14/16 20:05	1
Benzo[k]fluoranthene	ND		1.72	0.319	ug/L		06/14/16 08:19	06/14/16 20:05	1
Pyrene	ND		1.72	0.302	ug/L		06/14/16 08:19	06/14/16 20:05	1
Phenanthrene	ND		1.72	0.362	ug/L		06/14/16 08:19	06/14/16 20:05	1
Chrysene	ND		1.72	0.284	ug/L		06/14/16 08:19	06/14/16 20:05	1
Dibenz(a,h)anthracene	ND		1.72	0.388	ug/L		06/14/16 08:19	06/14/16 20:05	1
Fluoranthene	ND		1.72	0.276	ug/L		06/14/16 08:19	06/14/16 20:05	1
Fluorene	ND		1.72	0.276	ug/L		06/14/16 08:19	06/14/16 20:05	1
Indeno[1,2,3-cd]pyrene	ND		1.72	0.353	ug/L		06/14/16 08:19	06/14/16 20:05	1
Naphthalene	ND		1.72	0.319	ug/L		06/14/16 08:19	06/14/16 20:05	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Fluorobiphenyl (Surr)	*42*		*29 - 120*	*06/14/16 08:19*	*06/14/16 20:05*	*1*
Terphenyl-d14 (Surr)	*75*		*13 - 120*	*06/14/16 08:19*	*06/14/16 20:05*	*1*
Nitrobenzene-d5 (Surr)	*40*		*27 - 120*	*06/14/16 08:19*	*06/14/16 20:05*	*1*

Method: 8151A - Herbicides (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	**0.412**	**J**	1.86	0.279	ug/L		06/15/16 15:38	06/17/16 15:53	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dichloroacetic acid(Surr)	*101*		*10 - 150*	*06/15/16 15:38*	*06/17/16 15:53*	*1*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C24	**83.7**	**J**	94.3	26.4	ug/L		06/16/16 08:20	06/19/16 13:48	1
C24-C40	ND		94.3	47.2	ug/L		06/16/16 08:20	06/19/16 13:48	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*95*		*50 - 150*	*06/16/16 08:20*	*06/19/16 13:48*	*1*

Client: Kemron Environmental Services, Inc.	TestAmerica Job ID: 490-105474-1
Project/Site: Washington Wood Preserving ISS

## Client Sample ID: 0600-022 (2 hour)	Lab Sample ID: 490-105474-2

Date Collected: 06/08/16 10:45	**Matrix: Water**
Date Received: 06/10/16 08:50

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	ND		1.72	0.276	ug/L		06/14/16 08:19	06/14/16 20:30	1
Acenaphthylene	ND		1.72	0.302	ug/L		06/14/16 08:19	06/14/16 20:30	1
Anthracene	ND		1.72	0.328	ug/L		06/14/16 08:19	06/14/16 20:30	1
Benzo[a]anthracene	ND		1.72	0.276	ug/L		06/14/16 08:19	06/14/16 20:30	1
Benzo[a]pyrene	ND		1.72	0.328	ug/L		06/14/16 08:19	06/14/16 20:30	1
Benzo[b]fluoranthene	ND		1.72	0.310	ug/L		06/14/16 08:19	06/14/16 20:30	1
Benzo[g,h,i]perylene	ND		1.72	0.534	ug/L		06/14/16 08:19	06/14/16 20:30	1
Benzo[k]fluoranthene	ND		1.72	0.319	ug/L		06/14/16 08:19	06/14/16 20:30	1
Pyrene	ND		1.72	0.302	ug/L		06/14/16 08:19	06/14/16 20:30	1
Phenanthrene	ND		1.72	0.362	ug/L		06/14/16 08:19	06/14/16 20:30	1
Chrysene	ND		1.72	0.284	ug/L		06/14/16 08:19	06/14/16 20:30	1
Dibenz(a,h)anthracene	ND		1.72	0.388	ug/L		06/14/16 08:19	06/14/16 20:30	1
Fluoranthene	ND		1.72	0.276	ug/L		06/14/16 08:19	06/14/16 20:30	1
Fluorene	ND		1.72	0.276	ug/L		06/14/16 08:19	06/14/16 20:30	1
Indeno[1,2,3-cd]pyrene	ND		1.72	0.353	ug/L		06/14/16 08:19	06/14/16 20:30	1
Naphthalene	ND		1.72	0.319	ug/L		06/14/16 08:19	06/14/16 20:30	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Fluorobiphenyl (Surr)	*53*		*29 - 120*	*06/14/16 08:19*	*06/14/16 20:30*	*1*
Terphenyl-d14 (Surr)	*85*		*13 - 120*	*06/14/16 08:19*	*06/14/16 20:30*	*1*
Nitrobenzene-d5 (Surr)	*51*		*27 - 120*	*06/14/16 08:19*	*06/14/16 20:30*	*1*

Method: 8151A - Herbicides (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	**0.314**	**J**	1.86	0.279	ug/L		06/15/16 15:38	06/17/16 16:08	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dichloroacetic acid(Surr)	*108*		*10 - 150*	*06/15/16 15:38*	*06/17/16 16:08*	*1*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC) - REDL2

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C24	**44.7**	**J**	94.3	26.4	ug/L		06/16/16 08:20	06/19/16 14:05	1
C24-C40	ND		94.3	47.2	ug/L		06/16/16 08:20	06/19/16 14:05	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*86*		*50 - 150*	*06/16/16 08:20*	*06/19/16 14:05*	*1*

Client: Kemron Environmental Services, Inc.
Project/Site: Washington Wood Preserving ISS

TestAmerica Job ID: 490-105474-1

Client Sample ID: 0600-024 (2 hour)

Date Collected: 06/08/16 10:55
Date Received: 06/10/16 08:50

Lab Sample ID: 490-105474-3

Matrix: Water

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	**0.522**	**J**	1.72	0.276	ug/L		06/14/16 08:19	06/14/16 20:54	1
Acenaphthylene	ND		1.72	0.302	ug/L		06/14/16 08:19	06/14/16 20:54	1
Anthracene	ND		1.72	0.328	ug/L		06/14/16 08:19	06/14/16 20:54	1
Benzo[a]anthracene	ND		1.72	0.276	ug/L		06/14/16 08:19	06/14/16 20:54	1
Benzo[a]pyrene	ND		1.72	0.328	ug/L		06/14/16 08:19	06/14/16 20:54	1
Benzo[b]fluoranthene	ND		1.72	0.310	ug/L		06/14/16 08:19	06/14/16 20:54	1
Benzo[g,h,i]perylene	ND		1.72	0.534	ug/L		06/14/16 08:19	06/14/16 20:54	1
Benzo[k]fluoranthene	ND		1.72	0.319	ug/L		06/14/16 08:19	06/14/16 20:54	1
Pyrene	ND		1.72	0.302	ug/L		06/14/16 08:19	06/14/16 20:54	1
Phenanthrene	**1.22**	**J**	1.72	0.362	ug/L		06/14/16 08:19	06/14/16 20:54	1
Chrysene	ND		1.72	0.284	ug/L		06/14/16 08:19	06/14/16 20:54	1
Dibenz(a,h)anthracene	ND		1.72	0.388	ug/L		06/14/16 08:19	06/14/16 20:54	1
Fluoranthene	ND		1.72	0.276	ug/L		06/14/16 08:19	06/14/16 20:54	1
Fluorene	**0.477**	**J**	1.72	0.276	ug/L		06/14/16 08:19	06/14/16 20:54	1
Indeno[1,2,3-cd]pyrene	ND		1.72	0.353	ug/L		06/14/16 08:19	06/14/16 20:54	1
Naphthalene	**0.678**	**J**	1.72	0.319	ug/L		06/14/16 08:19	06/14/16 20:54	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Fluorobiphenyl (Surr)	*63*		*29 - 120*	*06/14/16 08:19*	*06/14/16 20:54*	*1*
Terphenyl-d14 (Surr)	*80*		*13 - 120*	*06/14/16 08:19*	*06/14/16 20:54*	*1*
Nitrobenzene-d5 (Surr)	*52*		*27 - 120*	*06/14/16 08:19*	*06/14/16 20:54*	*1*

Method: 8151A - Herbicides (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	**47.6**	**J**	93.0	14.0	ug/L		06/15/16 15:38	06/17/16 16:24	50

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dichloroacetic acid(Surr)	*1249*	*X*	*10 - 150*	*06/15/16 15:38*	*06/17/16 16:24*	*50*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C24	**369**		94.3	26.4	ug/L		06/16/16 08:20	06/19/16 14:22	1
C24-C40	ND		94.3	47.2	ug/L		06/16/16 08:20	06/19/16 14:22	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*84*		*50 - 150*	*06/16/16 08:20*	*06/19/16 14:22*	*1*

Client Sample ID: 0600-027 (2 hour)

Lab Sample ID: 490-105474-4

Date Collected: 06/08/16 11:05
Matrix: Water
Date Received: 06/10/16 08:50

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	ND		1.72	0.276	ug/L		06/14/16 08:19	06/14/16 21:19	1
Acenaphthylene	ND		1.72	0.302	ug/L		06/14/16 08:19	06/14/16 21:19	1
Anthracene	ND		1.72	0.328	ug/L		06/14/16 08:19	06/14/16 21:19	1
Benzo[a]anthracene	ND		1.72	0.276	ug/L		06/14/16 08:19	06/14/16 21:19	1
Benzo[a]pyrene	ND		1.72	0.328	ug/L		06/14/16 08:19	06/14/16 21:19	1
Benzo[b]fluoranthene	ND		1.72	0.310	ug/L		06/14/16 08:19	06/14/16 21:19	1
Benzo[g,h,i]perylene	ND		1.72	0.534	ug/L		06/14/16 08:19	06/14/16 21:19	1
Benzo[k]fluoranthene	ND		1.72	0.319	ug/L		06/14/16 08:19	06/14/16 21:19	1
Pyrene	ND		1.72	0.302	ug/L		06/14/16 08:19	06/14/16 21:19	1
Phenanthrene	**0.630**	**J**	1.72	0.362	ug/L		06/14/16 08:19	06/14/16 21:19	1
Chrysene	ND		1.72	0.284	ug/L		06/14/16 08:19	06/14/16 21:19	1
Dibenz(a,h)anthracene	ND		1.72	0.388	ug/L		06/14/16 08:19	06/14/16 21:19	1
Fluoranthene	ND		1.72	0.276	ug/L		06/14/16 08:19	06/14/16 21:19	1
Fluorene	ND		1.72	0.276	ug/L		06/14/16 08:19	06/14/16 21:19	1
Indeno[1,2,3-cd]pyrene	ND		1.72	0.353	ug/L		06/14/16 08:19	06/14/16 21:19	1
Naphthalene	ND		1.72	0.319	ug/L		06/14/16 08:19	06/14/16 21:19	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Fluorobiphenyl (Surr)	*48*		*29 - 120*	*06/14/16 08:19*	*06/14/16 21:19*	*1*
Terphenyl-d14 (Surr)	*75*		*13 - 120*	*06/14/16 08:19*	*06/14/16 21:19*	*1*
Nitrobenzene-d5 (Surr)	*45*		*27 - 120*	*06/14/16 08:19*	*06/14/16 21:19*	*1*

Method: 8151A - Herbicides (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	**27.0**	**J**	37.2	5.58	ug/L		06/15/16 15:38	06/17/16 16:39	20

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dichloroacetic acid(Surr)	*749*	*X*	*10 - 150*	*06/15/16 15:38*	*06/17/16 16:39*	*20*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C24	**179**		94.3	26.4	ug/L		06/16/16 08:20	06/19/16 14:40	1
C24-C40	ND		94.3	47.2	ug/L		06/16/16 08:20	06/19/16 14:40	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*95*		*50 - 150*	*06/16/16 08:20*	*06/19/16 14:40*	*1*

Client Sample ID: 0600-019 (24 hr)

Lab Sample ID: 490-105474-5

Date Collected: 06/09/16 10:10
Matrix: Water
Date Received: 06/10/16 08:50

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	ND		1.72	0.276	ug/L		06/14/16 08:19	06/14/16 21:43	1
Acenaphthylene	ND		1.72	0.302	ug/L		06/14/16 08:19	06/14/16 21:43	1
Anthracene	ND		1.72	0.328	ug/L		06/14/16 08:19	06/14/16 21:43	1
Benzo[a]anthracene	ND		1.72	0.276	ug/L		06/14/16 08:19	06/14/16 21:43	1
Benzo[a]pyrene	ND		1.72	0.328	ug/L		06/14/16 08:19	06/14/16 21:43	1
Benzo[b]fluoranthene	ND		1.72	0.310	ug/L		06/14/16 08:19	06/14/16 21:43	1
Benzo[g,h,i]perylene	ND		1.72	0.534	ug/L		06/14/16 08:19	06/14/16 21:43	1
Benzo[k]fluoranthene	ND		1.72	0.319	ug/L		06/14/16 08:19	06/14/16 21:43	1
Pyrene	ND		1.72	0.302	ug/L		06/14/16 08:19	06/14/16 21:43	1
Phenanthrene	ND		1.72	0.362	ug/L		06/14/16 08:19	06/14/16 21:43	1
Chrysene	ND		1.72	0.284	ug/L		06/14/16 08:19	06/14/16 21:43	1
Dibenz(a,h)anthracene	ND		1.72	0.388	ug/L		06/14/16 08:19	06/14/16 21:43	1
Fluoranthene	ND		1.72	0.276	ug/L		06/14/16 08:19	06/14/16 21:43	1
Fluorene	ND		1.72	0.276	ug/L		06/14/16 08:19	06/14/16 21:43	1
Indeno[1,2,3-cd]pyrene	ND		1.72	0.353	ug/L		06/14/16 08:19	06/14/16 21:43	1
Naphthalene	ND		1.72	0.319	ug/L		06/14/16 08:19	06/14/16 21:43	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Fluorobiphenyl (Surr)	*49*		*29 - 120*	*06/14/16 08:19*	*06/14/16 21:43*	*1*
Terphenyl-d14 (Surr)	*78*		*13 - 120*	*06/14/16 08:19*	*06/14/16 21:43*	*1*
Nitrobenzene-d5 (Surr)	*44*		*27 - 120*	*06/14/16 08:19*	*06/14/16 21:43*	*1*

Method: 8151A - Herbicides (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	**0.755**	**J**	1.86	0.279	ug/L		06/15/16 15:38	06/17/16 16:54	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dichloroacetic acid(Surr)	*109*	*p*	*10 - 150*	*06/15/16 15:38*	*06/17/16 16:54*	*1*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C24	**216**		94.3	26.4	ug/L		06/16/16 08:20	06/19/16 15:32	1
C24-C40	ND		94.3	47.2	ug/L		06/16/16 08:20	06/19/16 15:32	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*77*		*50 - 150*	*06/16/16 08:20*	*06/19/16 15:32*	*1*

Client: Kemron Environmental Services, Inc.
Project/Site: Washington Wood Preserving ISS

TestAmerica Job ID: 490-105474-1

Client Sample ID: 0600-022 (24 hr)

Date Collected: 06/09/16 10:20
Date Received: 06/10/16 08:50

Lab Sample ID: 490-105474-6

Matrix: Water

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	ND		1.72	0.276	ug/L		06/14/16 08:19	06/14/16 22:08	1
Acenaphthylene	ND		1.72	0.302	ug/L		06/14/16 08:19	06/14/16 22:08	1
Anthracene	ND		1.72	0.328	ug/L		06/14/16 08:19	06/14/16 22:08	1
Benzo[a]anthracene	ND		1.72	0.276	ug/L		06/14/16 08:19	06/14/16 22:08	1
Benzo[a]pyrene	ND		1.72	0.328	ug/L		06/14/16 08:19	06/14/16 22:08	1
Benzo[b]fluoranthene	ND		1.72	0.310	ug/L		06/14/16 08:19	06/14/16 22:08	1
Benzo[g,h,i]perylene	ND		1.72	0.534	ug/L		06/14/16 08:19	06/14/16 22:08	1
Benzo[k]fluoranthene	ND		1.72	0.319	ug/L		06/14/16 08:19	06/14/16 22:08	1
Pyrene	ND		1.72	0.302	ug/L		06/14/16 08:19	06/14/16 22:08	1
Phenanthrene	ND		1.72	0.362	ug/L		06/14/16 08:19	06/14/16 22:08	1
Chrysene	ND		1.72	0.284	ug/L		06/14/16 08:19	06/14/16 22:08	1
Dibenz(a,h)anthracene	ND		1.72	0.388	ug/L		06/14/16 08:19	06/14/16 22:08	1
Fluoranthene	ND		1.72	0.276	ug/L		06/14/16 08:19	06/14/16 22:08	1
Fluorene	ND		1.72	0.276	ug/L		06/14/16 08:19	06/14/16 22:08	1
Indeno[1,2,3-cd]pyrene	ND		1.72	0.353	ug/L		06/14/16 08:19	06/14/16 22:08	1
Naphthalene	**0.334**	**J**	1.72	0.319	ug/L		06/14/16 08:19	06/14/16 22:08	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Fluorobiphenyl (Surr)	*46*		*29 - 120*	*06/14/16 08:19*	*06/14/16 22:08*	*1*
Terphenyl-d14 (Surr)	*81*		*13 - 120*	*06/14/16 08:19*	*06/14/16 22:08*	*1*
Nitrobenzene-d5 (Surr)	*43*		*27 - 120*	*06/14/16 08:19*	*06/14/16 22:08*	*1*

Method: 8151A - Herbicides (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	**0.640**	**J**	1.86	0.279	ug/L		06/15/16 15:38	06/17/16 17:09	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dichloroacetic acid(Surr)	*102*		*10 - 150*	*06/15/16 15:38*	*06/17/16 17:09*	*1*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C24	**182**		94.3	26.4	ug/L		06/16/16 08:20	06/19/16 15:50	1
C24-C40	ND		94.3	47.2	ug/L		06/16/16 08:20	06/19/16 15:50	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*97*		*50 - 150*	*06/16/16 08:20*	*06/19/16 15:50*	*1*

Client Sample ID: 0600-024 (24 hr)

Date Collected: 06/09/16 10:25
Date Received: 06/10/16 08:50

Lab Sample ID: 490-105474-7

Matrix: Water

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	**0.786**	**J**	1.72	0.276	ug/L		06/14/16 08:19	06/14/16 22:32	1
Acenaphthylene	ND		1.72	0.302	ug/L		06/14/16 08:19	06/14/16 22:32	1
Anthracene	ND		1.72	0.328	ug/L		06/14/16 08:19	06/14/16 22:32	1
Benzo[a]anthracene	ND		1.72	0.276	ug/L		06/14/16 08:19	06/14/16 22:32	1
Benzo[a]pyrene	ND		1.72	0.328	ug/L		06/14/16 08:19	06/14/16 22:32	1
Benzo[b]fluoranthene	ND		1.72	0.310	ug/L		06/14/16 08:19	06/14/16 22:32	1
Benzo[g,h,i]perylene	ND		1.72	0.534	ug/L		06/14/16 08:19	06/14/16 22:32	1
Benzo[k]fluoranthene	ND		1.72	0.319	ug/L		06/14/16 08:19	06/14/16 22:32	1
Pyrene	ND		1.72	0.302	ug/L		06/14/16 08:19	06/14/16 22:32	1
Phenanthrene	**1.40**	**J**	1.72	0.362	ug/L		06/14/16 08:19	06/14/16 22:32	1
Chrysene	ND		1.72	0.284	ug/L		06/14/16 08:19	06/14/16 22:32	1
Dibenz(a,h)anthracene	ND		1.72	0.388	ug/L		06/14/16 08:19	06/14/16 22:32	1
Fluoranthene	ND		1.72	0.276	ug/L		06/14/16 08:19	06/14/16 22:32	1
Fluorene	**0.781**	**J**	1.72	0.276	ug/L		06/14/16 08:19	06/14/16 22:32	1
Indeno[1,2,3-cd]pyrene	ND		1.72	0.353	ug/L		06/14/16 08:19	06/14/16 22:32	1
Naphthalene	**2.10**		1.72	0.319	ug/L		06/14/16 08:19	06/14/16 22:32	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Fluorobiphenyl (Surr)	*42*		*29 - 120*	*06/14/16 08:19*	*06/14/16 22:32*	*1*
Terphenyl-d14 (Surr)	*83*		*13 - 120*	*06/14/16 08:19*	*06/14/16 22:32*	*1*
Nitrobenzene-d5 (Surr)	*38*		*27 - 120*	*06/14/16 08:19*	*06/14/16 22:32*	*1*

Method: 8151A - Herbicides (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	**92.6**	**J**	93.0	14.0	ug/L		06/15/16 15:38	06/17/16 17:25	50

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dichloroacetic acid(Surr)	*2185*	*X*	*10 - 150*	*06/15/16 15:38*	*06/17/16 17:25*	*50*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C24	**841**		94.3	26.4	ug/L		06/16/16 08:20	06/19/16 16:08	1
C24-C40	**59.4**	**J**	94.3	47.2	ug/L		06/16/16 08:20	06/19/16 16:08	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*109*		*50 - 150*	*06/16/16 08:20*	*06/19/16 16:08*	*1*

Client Sample ID: 0600-027 (24 hr) Lab Sample ID: 490-105474-8

Date Collected: 06/09/16 10:30 **Matrix: Water**
Date Received: 06/10/16 08:50

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	**0.549**	**J**	1.72	0.276	ug/L		06/14/16 08:19	06/14/16 22:57	1
Acenaphthylene	ND		1.72	0.302	ug/L		06/14/16 08:19	06/14/16 22:57	1
Anthracene	ND		1.72	0.328	ug/L		06/14/16 08:19	06/14/16 22:57	1
Benzo[a]anthracene	ND		1.72	0.276	ug/L		06/14/16 08:19	06/14/16 22:57	1
Benzo[a]pyrene	ND		1.72	0.328	ug/L		06/14/16 08:19	06/14/16 22:57	1
Benzo[b]fluoranthene	ND		1.72	0.310	ug/L		06/14/16 08:19	06/14/16 22:57	1
Benzo[g,h,i]perylene	ND		1.72	0.534	ug/L		06/14/16 08:19	06/14/16 22:57	1
Benzo[k]fluoranthene	ND		1.72	0.319	ug/L		06/14/16 08:19	06/14/16 22:57	1
Pyrene	ND		1.72	0.302	ug/L		06/14/16 08:19	06/14/16 22:57	1
Phenanthrene	**0.881**	**J**	1.72	0.362	ug/L		06/14/16 08:19	06/14/16 22:57	1
Chrysene	ND		1.72	0.284	ug/L		06/14/16 08:19	06/14/16 22:57	1
Dibenz(a,h)anthracene	ND		1.72	0.388	ug/L		06/14/16 08:19	06/14/16 22:57	1
Fluoranthene	ND		1.72	0.276	ug/L		06/14/16 08:19	06/14/16 22:57	1
Fluorene	**0.510**	**J**	1.72	0.276	ug/L		06/14/16 08:19	06/14/16 22:57	1
Indeno[1,2,3-cd]pyrene	ND		1.72	0.353	ug/L		06/14/16 08:19	06/14/16 22:57	1
Naphthalene	**1.40**	**J**	1.72	0.319	ug/L		06/14/16 08:19	06/14/16 22:57	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Fluorobiphenyl (Surr)	*50*		*29 - 120*	*06/14/16 08:19*	*06/14/16 22:57*	*1*
Terphenyl-d14 (Surr)	*70*		*13 - 120*	*06/14/16 08:19*	*06/14/16 22:57*	*1*
Nitrobenzene-d5 (Surr)	*47*		*27 - 120*	*06/14/16 08:19*	*06/14/16 22:57*	*1*

Method: 8151A - Herbicides (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	**56.5**	**J**	93.0	14.0	ug/L		06/15/16 15:38	06/17/16 17:40	50

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dichloroacetic acid(Surr)	*1296*	*X*	*10 - 150*	*06/15/16 15:38*	*06/17/16 17:40*	*50*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C24	**364**		94.3	26.4	ug/L		06/16/16 08:20	06/19/16 16:25	1
C24-C40	ND		94.3	47.2	ug/L		06/16/16 08:20	06/19/16 16:25	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*98*		*50 - 150*	*06/16/16 08:20*	*06/19/16 16:25*	*1*

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Lab Sample ID: MB 490-347453/1-A
Client Sample ID: Method Blank
Matrix: Water
Prep Type: Total/NA
Analysis Batch: 347677
Prep Batch: 347453

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	ND		2.00	0.320	ug/L		06/14/16 08:19	06/14/16 17:59	1
Acenaphthylene	ND		2.00	0.350	ug/L		06/14/16 08:19	06/14/16 17:59	1
Anthracene	ND		2.00	0.380	ug/L		06/14/16 08:19	06/14/16 17:59	1
Benzo[a]anthracene	ND		2.00	0.320	ug/L		06/14/16 08:19	06/14/16 17:59	1
Benzo[a]pyrene	ND		2.00	0.380	ug/L		06/14/16 08:19	06/14/16 17:59	1
Benzo[b]fluoranthene	ND		2.00	0.360	ug/L		06/14/16 08:19	06/14/16 17:59	1
Benzo[g,h,i]perylene	ND		2.00	0.620	ug/L		06/14/16 08:19	06/14/16 17:59	1
Benzo[k]fluoranthene	ND		2.00	0.370	ug/L		06/14/16 08:19	06/14/16 17:59	1
Pyrene	ND		2.00	0.350	ug/L		06/14/16 08:19	06/14/16 17:59	1
Phenanthrene	ND		2.00	0.420	ug/L		06/14/16 08:19	06/14/16 17:59	1
Chrysene	ND		2.00	0.330	ug/L		06/14/16 08:19	06/14/16 17:59	1
Dibenz(a,h)anthracene	ND		2.00	0.450	ug/L		06/14/16 08:19	06/14/16 17:59	1
Fluoranthene	ND		2.00	0.320	ug/L		06/14/16 08:19	06/14/16 17:59	1
Fluorene	ND		2.00	0.320	ug/L		06/14/16 08:19	06/14/16 17:59	1
Indeno[1,2,3-cd]pyrene	ND		2.00	0.410	ug/L		06/14/16 08:19	06/14/16 17:59	1
Naphthalene	ND		2.00	0.370	ug/L		06/14/16 08:19	06/14/16 17:59	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Fluorobiphenyl (Surr)	*58*		*29 - 120*	*06/14/16 08:19*	*06/14/16 17:59*	*1*
Terphenyl-d14 (Surr)	*74*		*13 - 120*	*06/14/16 08:19*	*06/14/16 17:59*	*1*
Nitrobenzene-d5 (Surr)	*48*		*27 - 120*	*06/14/16 08:19*	*06/14/16 17:59*	*1*

Lab Sample ID: LCS 490-347453/2-A
Client Sample ID: Lab Control Sample
Matrix: Water
Prep Type: Total/NA
Analysis Batch: 347677
Prep Batch: 347453

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Acenaphthene	40.0	27.38		ug/L		68	36 - 129
Acenaphthylene	40.0	26.37		ug/L		66	36 - 120
Anthracene	40.0	28.24		ug/L		71	42 - 130
Benzo[a]anthracene	40.0	30.11		ug/L		75	41 - 131
Benzo[a]pyrene	40.0	28.36		ug/L		71	45 - 131
Benzo[b]fluoranthene	40.0	28.11		ug/L		70	43 - 132
Benzo[g,h,i]perylene	40.0	31.84		ug/L		80	38 - 138
Benzo[k]fluoranthene	40.0	30.37		ug/L		76	44 - 129
Pyrene	40.0	27.33		ug/L		68	37 - 129
Phenanthrene	40.0	28.46		ug/L		71	39 - 126
Chrysene	40.0	29.67		ug/L		74	39 - 130
Dibenz(a,h)anthracene	40.0	30.79		ug/L		77	43 - 140
Fluoranthene	40.0	31.24		ug/L		78	31 - 132
Fluorene	40.0	28.43		ug/L		71	37 - 130
Indeno[1,2,3-cd]pyrene	40.0	30.18		ug/L		75	40 - 136
Naphthalene	40.0	22.97		ug/L		57	32 - 120

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
2-Fluorobiphenyl (Surr)	*66*		*29 - 120*
Terphenyl-d14 (Surr)	*71*		*13 - 120*

Method: 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: LCS 490-347453/2-A **Client Sample ID: Lab Control Sample**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 347677 **Prep Batch: 347453**

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
Nitrobenzene-d5 (Surr)	*60*		*27 - 120*

Method: 8151A - Herbicides (GC)

Lab Sample ID: MB 490-347993/1-A **Client Sample ID: Method Blank**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 348600 **Prep Batch: 347993**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	ND		2.00	0.300	ug/L		06/15/16 15:38	06/17/16 15:23	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dichloroacetic acid(Surr)	*75*		*10 - 150*	*06/15/16 15:38*	*06/17/16 15:23*	*1*

Lab Sample ID: LCS 490-347993/2-A **Client Sample ID: Lab Control Sample**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 348600 **Prep Batch: 347993**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Pentachlorophenol	2.50	2.324		ug/L		93	10 - 150

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
Dichloroacetic acid(Surr)	*87*		*10 - 150*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Lab Sample ID: MB 490-348104/1-A **Client Sample ID: Method Blank**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 348824 **Prep Batch: 348104**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C24	ND		100	28.0	ug/L		06/16/16 08:20	06/19/16 13:30	1
C24-C40	ND		100	50.0	ug/L		06/16/16 08:20	06/19/16 13:30	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*95*		*50 - 150*	*06/16/16 08:20*	*06/19/16 13:30*	*1*

Lab Sample ID: LCS 490-348104/2-A **Client Sample ID: Lab Control Sample**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 348824 **Prep Batch: 348104**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
C10-C24	1000	868.1		ug/L		87	51 - 132

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
o-Terphenyl	*87*		*50 - 150*

Client: Kemron Environmental Services, Inc. TestAmerica Job ID: 490-105474-1
Project/Site: Washington Wood Preserving ISS

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC) (Continued)

Lab Sample ID: 490-105554-B-1-B DU **Client Sample ID: Duplicate**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 348824 **Prep Batch: 348104**

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
C10-C24	151		152.1		ug/L		0.5	41
C24-C40	ND		ND		ug/L		NC	41

Surrogate	*DU %Recovery*	*DU Qualifier*	*Limits*
o-Terphenyl	*83*		*50 - 150*

Client: Kemron Environmental Services, Inc.
Project/Site: Washington Wood Preserving ISS

TestAmerica Job ID: 490-105474-1

GC/MS Semi VOA

Prep Batch: 347453

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-105474-1	0600-019 (2 hour)	Total/NA	Water	3510C	
490-105474-2	0600-022 (2 hour)	Total/NA	Water	3510C	
490-105474-3	0600-024 (2 hour)	Total/NA	Water	3510C	
490-105474-4	0600-027 (2 hour)	Total/NA	Water	3510C	
490-105474-5	0600-019 (24 hr)	Total/NA	Water	3510C	
490-105474-6	0600-022 (24 hr)	Total/NA	Water	3510C	
490-105474-7	0600-024 (24 hr)	Total/NA	Water	3510C	
490-105474-8	0600-027 (24 hr)	Total/NA	Water	3510C	
LCS 490-347453/2-A	Lab Control Sample	Total/NA	Water	3510C	
MB 490-347453/1-A	Method Blank	Total/NA	Water	3510C	

Analysis Batch: 347677

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-105474-1	0600-019 (2 hour)	Total/NA	Water	8270D	347453
490-105474-2	0600-022 (2 hour)	Total/NA	Water	8270D	347453
490-105474-3	0600-024 (2 hour)	Total/NA	Water	8270D	347453
490-105474-4	0600-027 (2 hour)	Total/NA	Water	8270D	347453
490-105474-5	0600-019 (24 hr)	Total/NA	Water	8270D	347453
490-105474-6	0600-022 (24 hr)	Total/NA	Water	8270D	347453
490-105474-7	0600-024 (24 hr)	Total/NA	Water	8270D	347453
490-105474-8	0600-027 (24 hr)	Total/NA	Water	8270D	347453
LCS 490-347453/2-A	Lab Control Sample	Total/NA	Water	8270D	347453
MB 490-347453/1-A	Method Blank	Total/NA	Water	8270D	347453

GC Semi VOA

Prep Batch: 347993

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-105474-1	0600-019 (2 hour)	Total/NA	Water	8151A	
490-105474-2	0600-022 (2 hour)	Total/NA	Water	8151A	
490-105474-3	0600-024 (2 hour)	Total/NA	Water	8151A	
490-105474-4	0600-027 (2 hour)	Total/NA	Water	8151A	
490-105474-5	0600-019 (24 hr)	Total/NA	Water	8151A	
490-105474-6	0600-022 (24 hr)	Total/NA	Water	8151A	
490-105474-7	0600-024 (24 hr)	Total/NA	Water	8151A	
490-105474-8	0600-027 (24 hr)	Total/NA	Water	8151A	
LCS 490-347993/2-A	Lab Control Sample	Total/NA	Water	8151A	
MB 490-347993/1-A	Method Blank	Total/NA	Water	8151A	

Prep Batch: 348104

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-105474-1	0600-019 (2 hour)	Total/NA	Water	3510C	
490-105474-2 - REDL2	0600-022 (2 hour)	Total/NA	Water	3510C	
490-105474-3	0600-024 (2 hour)	Total/NA	Water	3510C	
490-105474-4	0600-027 (2 hour)	Total/NA	Water	3510C	
490-105474-5	0600-019 (24 hr)	Total/NA	Water	3510C	
490-105474-6	0600-022 (24 hr)	Total/NA	Water	3510C	
490-105474-7	0600-024 (24 hr)	Total/NA	Water	3510C	
490-105474-8	0600-027 (24 hr)	Total/NA	Water	3510C	
490-105554-B-1-B DU	Duplicate	Total/NA	Water	3510C	

GC Semi VOA (Continued)

Prep Batch: 348104 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
LCS 490-348104/2-A	Lab Control Sample	Total/NA	Water	3510C	
MB 490-348104/1-A	Method Blank	Total/NA	Water	3510C	

Analysis Batch: 348600

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-105474-1	0600-019 (2 hour)	Total/NA	Water	8151A	347993
490-105474-2	0600-022 (2 hour)	Total/NA	Water	8151A	347993
490-105474-3	0600-024 (2 hour)	Total/NA	Water	8151A	347993
490-105474-4	0600-027 (2 hour)	Total/NA	Water	8151A	347993
490-105474-5	0600-019 (24 hr)	Total/NA	Water	8151A	347993
490-105474-6	0600-022 (24 hr)	Total/NA	Water	8151A	347993
490-105474-7	0600-024 (24 hr)	Total/NA	Water	8151A	347993
490-105474-8	0600-027 (24 hr)	Total/NA	Water	8151A	347993
LCS 490-347993/2-A	Lab Control Sample	Total/NA	Water	8151A	347993
MB 490-347993/1-A	Method Blank	Total/NA	Water	8151A	347993

Analysis Batch: 348824

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-105474-1	0600-019 (2 hour)	Total/NA	Water	NWTPH-Dx	348104
490-105474-2 - REDL2	0600-022 (2 hour)	Total/NA	Water	NWTPH-Dx	348104
490-105474-3	0600-024 (2 hour)	Total/NA	Water	NWTPH-Dx	348104
490-105474-4	0600-027 (2 hour)	Total/NA	Water	NWTPH-Dx	348104
490-105474-5	0600-019 (24 hr)	Total/NA	Water	NWTPH-Dx	348104
490-105474-6	0600-022 (24 hr)	Total/NA	Water	NWTPH-Dx	348104
490-105474-7	0600-024 (24 hr)	Total/NA	Water	NWTPH-Dx	348104
490-105474-8	0600-027 (24 hr)	Total/NA	Water	NWTPH-Dx	348104
490-105554-B-1-B DU	Duplicate	Total/NA	Water	NWTPH-Dx	348104
LCS 490-348104/2-A	Lab Control Sample	Total/NA	Water	NWTPH-Dx	348104
MB 490-348104/1-A	Method Blank	Total/NA	Water	NWTPH-Dx	348104

Client: Kemron Environmental Services, Inc.
Project/Site: Washington Wood Preserving ISS

TestAmerica Job ID: 490-105474-1

Client Sample ID: 0600-019 (2 hour)

Lab Sample ID: 490-105474-1
Date Collected: 06/08/16 10:35
Matrix: Water
Date Received: 06/10/16 08:50

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3510C			290 mL	1 mL	347453	06/14/16 08:19	KB	TAL NSH
Total/NA	Analysis	8270D		1	290 mL	1 mL	347677	06/14/16 20:05	T1C	TAL NSH
Total/NA	Prep	8151A			1075 mL	10 mL	347993	06/15/16 15:38	JKG	TAL NSH
Total/NA	Analysis	8151A		1	1075 mL	10 mL	348600	06/17/16 15:53	JML	TAL NSH
Total/NA	Prep	3510C			1060 mL	1 mL	348104	06/16/16 08:20	KB	TAL NSH
Total/NA	Analysis	NWTPH-Dx		1	1060 mL	1 mL	348824	06/19/16 13:48	A1B	TAL NSH

Client Sample ID: 0600-022 (2 hour)

Lab Sample ID: 490-105474-2
Date Collected: 06/08/16 10:45
Matrix: Water
Date Received: 06/10/16 08:50

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3510C			290 mL	1 mL	347453	06/14/16 08:19	KB	TAL NSH
Total/NA	Analysis	8270D		1	290 mL	1 mL	347677	06/14/16 20:30	T1C	TAL NSH
Total/NA	Prep	8151A			1075 mL	10 mL	347993	06/15/16 15:38	JKG	TAL NSH
Total/NA	Analysis	8151A		1	1075 mL	10 mL	348600	06/17/16 16:08	JML	TAL NSH
Total/NA	Prep	3510C	REDL2		1060 mL	1 mL	348104	06/16/16 08:20	KB	TAL NSH
Total/NA	Analysis	NWTPH-Dx	REDL2	1	1060 mL	1 mL	348824	06/19/16 14:05	A1B	TAL NSH

Client Sample ID: 0600-024 (2 hour)

Lab Sample ID: 490-105474-3
Date Collected: 06/08/16 10:55
Matrix: Water
Date Received: 06/10/16 08:50

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3510C			290 mL	1 mL	347453	06/14/16 08:19	KB	TAL NSH
Total/NA	Analysis	8270D		1	290 mL	1 mL	347677	06/14/16 20:54	T1C	TAL NSH
Total/NA	Prep	8151A			1075 mL	10 mL	347993	06/15/16 15:38	JKG	TAL NSH
Total/NA	Analysis	8151A		50	1075 mL	10 mL	348600	06/17/16 16:24	JML	TAL NSH
Total/NA	Prep	3510C			1060 mL	1 mL	348104	06/16/16 08:20	KB	TAL NSH
Total/NA	Analysis	NWTPH-Dx		1	1060 mL	1 mL	348824	06/19/16 14:22	A1B	TAL NSH

Client Sample ID: 0600-027 (2 hour)

Lab Sample ID: 490-105474-4
Date Collected: 06/08/16 11:05
Matrix: Water
Date Received: 06/10/16 08:50

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3510C			290 mL	1 mL	347453	06/14/16 08:19	KB	TAL NSH
Total/NA	Analysis	8270D		1	290 mL	1 mL	347677	06/14/16 21:19	T1C	TAL NSH
Total/NA	Prep	8151A			1075 mL	10 mL	347993	06/15/16 15:38	JKG	TAL NSH
Total/NA	Analysis	8151A		20	1075 mL	10 mL	348600	06/17/16 16:39	JML	TAL NSH
Total/NA	Prep	3510C			1060 mL	1 mL	348104	06/16/16 08:20	KB	TAL NSH
Total/NA	Analysis	NWTPH-Dx		1	1060 mL	1 mL	348824	06/19/16 14:40	A1B	TAL NSH

Client Sample ID: 0600-019 (24 hr)

Lab Sample ID: 490-105474-5

Date Collected: 06/09/16 10:10
Date Received: 06/10/16 08:50
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3510C			290 mL	1 mL	347453	06/14/16 08:19	KB	TAL NSH
Total/NA	Analysis	8270D		1	290 mL	1 mL	347677	06/14/16 21:43	T1C	TAL NSH
Total/NA	Prep	8151A			1075 mL	10 mL	347993	06/15/16 15:38	JKG	TAL NSH
Total/NA	Analysis	8151A		1	1075 mL	10 mL	348600	06/17/16 16:54	JML	TAL NSH
Total/NA	Prep	3510C			1060 mL	1 mL	348104	06/16/16 08:20	KB	TAL NSH
Total/NA	Analysis	NWTPH-Dx		1	1060 mL	1 mL	348824	06/19/16 15:32	A1B	TAL NSH

Client Sample ID: 0600-022 (24 hr)

Lab Sample ID: 490-105474-6

Date Collected: 06/09/16 10:20
Date Received: 06/10/16 08:50
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3510C			290 mL	1 mL	347453	06/14/16 08:19	KB	TAL NSH
Total/NA	Analysis	8270D		1	290 mL	1 mL	347677	06/14/16 22:08	T1C	TAL NSH
Total/NA	Prep	8151A			1075 mL	10 mL	347993	06/15/16 15:38	JKG	TAL NSH
Total/NA	Analysis	8151A		1	1075 mL	10 mL	348600	06/17/16 17:09	JML	TAL NSH
Total/NA	Prep	3510C			1060 mL	1 mL	348104	06/16/16 08:20	KB	TAL NSH
Total/NA	Analysis	NWTPH-Dx		1	1060 mL	1 mL	348824	06/19/16 15:50	A1B	TAL NSH

Client Sample ID: 0600-024 (24 hr)

Lab Sample ID: 490-105474-7

Date Collected: 06/09/16 10:25
Date Received: 06/10/16 08:50
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3510C			290 mL	1 mL	347453	06/14/16 08:19	KB	TAL NSH
Total/NA	Analysis	8270D		1	290 mL	1 mL	347677	06/14/16 22:32	T1C	TAL NSH
Total/NA	Prep	8151A			1075 mL	10 mL	347993	06/15/16 15:38	JKG	TAL NSH
Total/NA	Analysis	8151A		50	1075 mL	10 mL	348600	06/17/16 17:25	JML	TAL NSH
Total/NA	Prep	3510C			1060 mL	1 mL	348104	06/16/16 08:20	KB	TAL NSH
Total/NA	Analysis	NWTPH-Dx		1	1060 mL	1 mL	348824	06/19/16 16:08	A1B	TAL NSH

Client Sample ID: 0600-027 (24 hr)

Lab Sample ID: 490-105474-8

Date Collected: 06/09/16 10:30
Date Received: 06/10/16 08:50
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3510C			290 mL	1 mL	347453	06/14/16 08:19	KB	TAL NSH
Total/NA	Analysis	8270D		1	290 mL	1 mL	347677	06/14/16 22:57	T1C	TAL NSH
Total/NA	Prep	8151A			1075 mL	10 mL	347993	06/15/16 15:38	JKG	TAL NSH
Total/NA	Analysis	8151A		50	1075 mL	10 mL	348600	06/17/16 17:40	JML	TAL NSH
Total/NA	Prep	3510C			1060 mL	1 mL	348104	06/16/16 08:20	KB	TAL NSH
Total/NA	Analysis	NWTPH-Dx		1	1060 mL	1 mL	348824	06/19/16 16:25	A1B	TAL NSH

Laboratory References:

TAL NSH = TestAmerica Nashville, 2960 Foster Creighton Drive, Nashville, TN 37204, TEL (615)726-0177

Method	Method Description	Protocol	Laboratory
8270D	Semivolatile Organic Compounds (GC/MS)	SW846	TAL NSH
8151A	Herbicides (GC)	SW846	TAL NSH
NWTPH-Dx	Northwest - Semi-Volatile Petroleum Products (GC)	NWTPH	TAL NSH

Protocol References:

NWTPH = Northwest Total Petroleum Hydrocarbon

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL NSH = TestAmerica Nashville, 2960 Foster Creighton Drive, Nashville, TN 37204, TEL (615)726-0177

Certification Summary

Client: Kemron Environmental Services, Inc. TestAmerica Job ID: 490-105474-1
Project/Site: Washington Wood Preserving ISS

Laboratory: TestAmerica Nashville

The certifications listed below are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
Washington	State Program	10	C789	07-19-16 *

* Certification renewal pending - certification considered valid.

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

Nashville, TN

COOLER RECEIPT FORM

490-105474 Chain of Custody

Cooler Received/Opened On__6-10-16 @ 850____________________

Time Samples Removed From Cooler___________ Time Samples Placed In Storage___________ (2 Hour Window)

1. Tracking #______N/A___________(last 4 digits, FedEx) Courier: _ _bus_______ _

   IR Gun ID__97310166__ pH Strip Lot_HC564992_ Chlorine Strip Lot_1211515B_

2. Temperature of rep. sample or temp blank when opened:_3.4____*Degrees Celsius*

3. If Item #2 temperature is 0°C or less, was the representative sample or temp blank frozen? YES NO...NA

4. Were custody seals on outside of cooler? YES...NO...NA

   If yes, how many and where:_(1) Front_______________________________

5. Were the seals intact, signed, and dated correctly? YES...NO...NA

6. Were custody papers inside cooler? YES...NO...NA

I certify that I opened the cooler and answered questions 1-6 (intial) ______________ MDM

7. Were custody seals on containers: YES NO and Intact YES...NO...NA

   Were these signed and dated correctly? YES...NO...NA

8. Packing mat'l used? Bubblewrap Plastic bag Peanuts Vermiculite Foam Insert Paper Other None

9. Cooling process: Ice Ice-pack Ice (direct contact) Dry ice Other None

10. Did all containers arrive in good condition (unbroken)? YES...NO...NA

11. Were all container labels complete (#, date, signed, pres., etc)? YES...NO...NA

12. Did all container labels and tags agree with custody papers? YES...NO...NA

13a. Were VOA vials received? YES...NO...NA

   b. Was there any observable headspace present in any VOA vial? YES...NO...NA

14. Was there a Trip Blank in this cooler? YES...NO...NA If multiple coolers, sequence #_______

I certify that I unloaded the cooler and answered questions 7-14 (intial) ______________ KD

15a. On pres'd bottles, did pH test strips suggest preservation reached the correct pH level? YES..NO...NA

   b. Did the bottle labels indicate that the correct preservatives were used YES...NO...NA

16. Was residual chlorine present? YES...NO...NA

I certify that I checked for chlorine and pH as per SOP and answered questions 15-16 (intial) ______ KD

17. Were custody papers properly filled out (ink, signed, etc)? YES...NO...NA

18. Did you sign the custody papers in the appropriate place? YES...NO...NA

19. Were correct containers used for the analysis requested? YES...NO...NA

20. Was sufficient amount of sample sent in each container? YES...NO...NA

I certify that I entered this project into LIMS and answered questions 17-20 (intial) ______ KD

I certify that I attached a label with the unique LIMS number to each container (intial) ______ KD

21. Were there Non-Conformance issues at login? YES...NO Was a NCM generated? YES...NO...#_______

BIS = Broken in shipment

Cooler Receipt Form.doc LF-1 Revised 12/15/15

End of Form

1 2 3 4 5 6 7 8 9 10 11 12 13

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
Nashville, TN

COOLER RECEIPT FORM

Cooler Received/Opened On__6-10-16 @ 850____________________

Time Samples Removed From Cooler__________ Time Samples Placed In Storage__________ (2 Hour Window)

1. Tracking #______N/A__________(last 4 digits, FedEx) Courier: _ _bus_______ _

   IR Gun ID__97310166_ pH Strip Lot_HC564992_ Chlorine Strip Lot_1211515B_

2. Temperature of rep. sample or temp blank when opened:________*Degrees Celsius*

3. If Item #2 temperature is 0°C or less, was the representative sample or temp blank frozen? YES NO...NA

4. Were custody seals on outside of cooler? YES...NO...NA

   If yes, how many and where: (1) Front

5. Were the seals intact, signed, and dated correctly? YES...NO...NA

6. Were custody papers inside cooler? YES...NO...NA

I certify that I opened the cooler and answered questions 1-6 (intial) ____________

7. Were custody seals on containers: YES NO and Intact YES...NO...NA

   Were these signed and dated correctly? YES...NO...NA

8. Packing mat'l used? Bubblewrap Plastic bag Peanuts Vermiculite Foam Insert Paper Other None

9. Cooling process: Ice Ice-pack Ice (direct contact) Dry ice Other None

10. Did all containers arrive in good condition (unbroken)? YES...NO...NA

11. Were all container labels complete (#, date, signed, pres., etc)? YES...NO...NA

12. Did all container labels and tags agree with custody papers? YES...NO...NA

13a. Were VOA vials received? YES...NO...NA

b. Was there any observable headspace present in any VOA vial? YES...NO...NA

14. Was there a Trip Blank in this cooler? YES...NO...NA If multiple coolers, sequence #________

I certify that I unloaded the cooler and answered questions 7-14 (intial) KD

15a. On pres'd bottles, did pH test strips suggest preservation reached the correct pH level? YES..NO..NA

b. Did the bottle labels indicate that the correct preservatives were used YES...NO...NA

16. Was residual chlorine present? YES...NO...NA

I certify that I checked for chlorine and pH as per SOP and answered questions 15-16 (intial) KD

17. Were custody papers properly filled out (ink, signed, etc)? YES...NO...NA

18. Did you sign the custody papers in the appropriate place? YES...NO...NA

19. Were correct containers used for the analysis requested? YES...NO...NA

20. Was sufficient amount of sample sent in each container? YES...NO...NA

I certify that I entered this project into LIMS and answered questions 17-20 (intial) KD

I certify that I attached a label with the unique LIMS number to each container (intial) KD

21. Were there Non-Conformance issues at login? YES...NO Was a NCM generated? YES...NO...#________

BIS = Broken in shipment
Cooler Receipt Form.doc LF-1 Revised 12/15/15
End of Form

TestAmerica Nashville
2960 Foster Creighton Drive
Nashville, TN 37204
Phone (615) 726-0177 Fax (615) 726-3404

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

681-Atlanta

Client Information	Sampler: Tomeaia Bradley	Lab PM: Baker, Heather	Carrier Tracking No(s):	COC No: 490-54011-17498.1
Client Contact: Mr. Tommy Jordan	Phone: 404-601-6927	E-Mail: heather.baker@testamericainc.com		Page: Page 1 of 1
Company: Kemron Environmental Services, Inc.				Job #:
Address: 1359A Ellsworth Industrial Blvd.	Due Date Requested: 6.24.16			
City: Atlanta	TAT Requested (days): 10			
State, Zip: GA, 30318				
Phone: 404-516-3172(Tel)	PO #: Purchase Order Requested			
Email: tjordan@kemron.com	WO #:			
Project Name: Washington Wood ~~Treating~~ Preserving ISS	Project #: 49010102			
Site:	SSOW#:			

Analysis Requested

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	8270D - Polyaromatic Hydrocarbons	8151A - PCP	NWTPH_Dx - NWTPH	Total Number of containers	Special Instructions/Note:
				Preservation Code:			N	N	N		
0600-019 (2 hour)	6.8.16	1035	G	Water			X	X	X		
0600-022 (2 hour)	↓	1045	G	Water			X	X	X		
0600-024 (2 hour)	↓	1055	G	Water			X	X	X		
0600-027 (2 hour)	↓	1105	G	Water			X	X	X		
0600-019 (24 hr)	6.9.16	1010	G	Water			X	X	X		Loc: 490
0600-022 (24 hr)	↓	1020	G	Water			X	X	X		105474
0600-024 (24 hr)	↓	1025	G	Water			X	X	X		
0600-027 (24 hr)	↓	1030	G	Water			X	X	X		
				Water							
				Water							
				Water							

Preservation Codes:
A - HCL, B - NaOH, C - Zn Acetate, D - Nitric Acid, E - NaHSO4, F - MeOH, G - Amchlor, H - Ascorbic Acid, I - Ice, J - DI Water, K - EDTA, L - EDA
M - Hexane, N - None, O - AsNaO2, P - Na2O4S, Q - Na2SO3, R - Na2S2O3, S - H2SO4, T - TSP Dodecahydrate, U - Acetone, V - MCAA, W - ph 4-5, Z - other (specify)
Other:

Possible Hazard Identification
☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☒ Disposal By Lab ☐ Archive For ______ Months

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by: | Date: | Time: | Method of Shipment:

Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Tomeaia Bradley	6.9.16 1436	Kemron	[signature]	6-9-16 1436	TA
[signature]	6-9-16 1606	TA	Keith Jawson	06-10-2016 08:50	TAN

Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:	Cooler Temperature(s) °C and Other Remarks: 3.6

1 2 3 4 5 6 7 8

Login Sample Receipt Checklist

Client: Kemron Environmental Services, Inc.

Job Number: 490-105474-1
SDG Number:

Login Number: 105474
List Number: 1
Creator: Dawson, Keith M

List Source: TestAmerica Nashville

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

1 2 3 4 5 6 7 8 9 10 11 12 13

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Nashville
2960 Foster Creighton Drive
Nashville, TN 37204
Tel: (615)726-0177

TestAmerica Job ID: 490-105554-1
Client Project/Site: Washington Wood Treating

For:
Kemron Environmental Services, Inc.
1359A Ellsworth Industrial Blvd.
Atlanta, Georgia 30318

Attn: Mr. Tommy Jordan

Authorized for release by:
6/27/2016 1:54:19 PM
Jannel Franklin, Project Manager I
(732)593-2551
jannel.franklin@testamericainc.com

Designee for

Heather Baker, Project Manager I
(615)301-5043
heather.baker@testamericainc.com

The test results in this report meet all 2003 NELAC and 2009 TNI requirements for accredited parameters, exceptions are noted in this report. This report may not be reproduced except in full, and with written approval from the laboratory. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

Table of Contents

Sample Summary

Client: Kemron Environmental Services, Inc.
Project/Site: Washington Wood Treating

TestAmerica Job ID: 490-105554-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
490-105554-1	0600-019 (48HR)	Water	06/10/16 08:27	06/11/16 15:54
490-105554-2	0600-022 (48HR)	Water	06/10/16 08:35	06/11/16 15:54
490-105554-3	0600-024 (48HR)	Water	06/10/16 09:35	06/11/16 15:54
490-105554-4	0600-027 (48HR)	Water	06/10/16 09:40	06/11/16 15:54

Job ID: 490-105554-1

Laboratory: TestAmerica Nashville

Narrative

Job Narrative
490-105554-1

Comments
No additional comments.

Receipt
The samples were received on 6/11/2016 10:30 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 5.4º C.

Receipt Exceptions

Method(s) 8151A: Insufficient sample volume was provided for the following samples for the 8151A analysis: 0600-019 (48HR) (490-105554-1) and 0600-027 (48HR) (490-105554-4).

GC/MS Semi VOA
Method(s) 8270D: Insufficient sample volume was available to perform a matrix spike/matrix spike duplicate (MS/MSD) associated with preparation batch 490-347453 and analytical batch 490-347677.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

GC Semi VOA
Method(s) 8151A: The continuing calibration verification (CCV) associated with batch 490-348600 recovered above the upper control limit for Pentachlorophenol. The samples associated with this CCV were non-detects for the affected analytes; therefore, the data have been reported. The following sample is impacted: 0600-022 (48HR) (490-105554-2).

Method(s) 8151A: Insufficient sample volume was available to perform a matrix spike/matrix spike duplicate (MS/MSD) associated with preparation batch 490-348335 and analytical batch 490-348600.

Method(s) 8151A: Surrogate recovery for the following sample was outside control limits: 0600-024 (48HR) (490-105554-3). Evidence of matrix interference is present; therefore, re-extraction and/or re-analysis was not performed.

Method(s) 8151A: The following sample was diluted due to the nature of the sample matrix: 0600-024 (48HR) (490-105554-3). Elevated reporting limits (RLs) are provided.

Method(s) NWTPH-Dx: Insufficient sample volume was available to perform a matrix spike/matrix spike duplicate (MS/MSD) associated with preparation batch 490-348104 and analytical batch 490-348824.

Method(s) NWTPH-Dx: The continuing calibration verification (CCV) associated with batch 348824 recovered above the upper control limit for C24-C40. The samples associated with this CCV were non-detects or were not detected above the reporting limit (RL) for the affected analytes; therefore, the data have been reported.

Method(s) NWTPH-Dx: There was insufficient contamination present for analyte C10-C24 to perform a pattern match for the following samples: 0600-019 (48HR) (490-105554-1), 0600-022 (48HR) (490-105554-2) and (490-105554-B-1-B DU).

Method(s) NWTPH-Dx: The following samples contained a hydrocarbon pattern for analyte C10-C24 that most closely resembles a Diesel Fuel #2 product used by the laboratory for quantitative purposes: 0600-024 (48HR) (490-105554-3), 0600-027 (48HR) (490-105554-4) and (490-105554-B-4-B DU).

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Organic Prep
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Definitions/Glossary

Client: Kemron Environmental Services, Inc. TestAmerica Job ID: 490-105554-1
Project/Site: Washington Wood Treating

Qualifiers

GC/MS Semi VOA

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

GC Semi VOA

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
X	Surrogate is outside control limits

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Client Sample ID: 0600-019 (48HR)

Lab Sample ID: 490-105554-1

Date Collected: 06/10/16 08:27

Matrix: Water

Date Received: 06/11/16 15:54

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	ND		1.72	0.276	ug/L		06/14/16 08:19	06/14/16 23:21	1
Acenaphthylene	ND		1.72	0.302	ug/L		06/14/16 08:19	06/14/16 23:21	1
Anthracene	ND		1.72	0.328	ug/L		06/14/16 08:19	06/14/16 23:21	1
Benzo[a]anthracene	ND		1.72	0.276	ug/L		06/14/16 08:19	06/14/16 23:21	1
Benzo[a]pyrene	ND		1.72	0.328	ug/L		06/14/16 08:19	06/14/16 23:21	1
Benzo[b]fluoranthene	ND		1.72	0.310	ug/L		06/14/16 08:19	06/14/16 23:21	1
Benzo[g,h,i]perylene	ND		1.72	0.534	ug/L		06/14/16 08:19	06/14/16 23:21	1
Benzo[k]fluoranthene	ND		1.72	0.319	ug/L		06/14/16 08:19	06/14/16 23:21	1
Pyrene	ND		1.72	0.302	ug/L		06/14/16 08:19	06/14/16 23:21	1
Phenanthrene	ND		1.72	0.362	ug/L		06/14/16 08:19	06/14/16 23:21	1
Chrysene	ND		1.72	0.284	ug/L		06/14/16 08:19	06/14/16 23:21	1
Dibenz(a,h)anthracene	ND		1.72	0.388	ug/L		06/14/16 08:19	06/14/16 23:21	1
Fluoranthene	ND		1.72	0.276	ug/L		06/14/16 08:19	06/14/16 23:21	1
Fluorene	ND		1.72	0.276	ug/L		06/14/16 08:19	06/14/16 23:21	1
Indeno[1,2,3-cd]pyrene	ND		1.72	0.353	ug/L		06/14/16 08:19	06/14/16 23:21	1
Naphthalene	ND		1.72	0.319	ug/L		06/14/16 08:19	06/14/16 23:21	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Fluorobiphenyl (Surr)	*49*		*29 - 120*	*06/14/16 08:19*	*06/14/16 23:21*	*1*
Terphenyl-d14 (Surr)	*85*		*13 - 120*	*06/14/16 08:19*	*06/14/16 23:21*	*1*
Nitrobenzene-d5 (Surr)	*47*		*27 - 120*	*06/14/16 08:19*	*06/14/16 23:21*	*1*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C24	**151**		94.3	26.4	ug/L		06/16/16 08:20	06/19/16 16:43	1
C24-C40	ND		94.3	47.2	ug/L		06/16/16 08:20	06/19/16 16:43	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*88*		*50 - 150*	*06/16/16 08:20*	*06/19/16 16:43*	*1*

1 2 3 4 5 6 7 8 9 10 11 12 13

Client Sample ID: 0600-022 (48HR)
Lab Sample ID: 490-105554-2

Date Collected: 06/10/16 08:35
Matrix: Water
Date Received: 06/11/16 15:54

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	ND		1.72	0.276	ug/L		06/14/16 08:19	06/14/16 23:46	1
Acenaphthylene	ND		1.72	0.302	ug/L		06/14/16 08:19	06/14/16 23:46	1
Anthracene	ND		1.72	0.328	ug/L		06/14/16 08:19	06/14/16 23:46	1
Benzo[a]anthracene	ND		1.72	0.276	ug/L		06/14/16 08:19	06/14/16 23:46	1
Benzo[a]pyrene	ND		1.72	0.328	ug/L		06/14/16 08:19	06/14/16 23:46	1
Benzo[b]fluoranthene	ND		1.72	0.310	ug/L		06/14/16 08:19	06/14/16 23:46	1
Benzo[g,h,i]perylene	ND		1.72	0.534	ug/L		06/14/16 08:19	06/14/16 23:46	1
Benzo[k]fluoranthene	ND		1.72	0.319	ug/L		06/14/16 08:19	06/14/16 23:46	1
Pyrene	ND		1.72	0.302	ug/L		06/14/16 08:19	06/14/16 23:46	1
Phenanthrene	ND		1.72	0.362	ug/L		06/14/16 08:19	06/14/16 23:46	1
Chrysene	ND		1.72	0.284	ug/L		06/14/16 08:19	06/14/16 23:46	1
Dibenz(a,h)anthracene	ND		1.72	0.388	ug/L		06/14/16 08:19	06/14/16 23:46	1
Fluoranthene	ND		1.72	0.276	ug/L		06/14/16 08:19	06/14/16 23:46	1
Fluorene	ND		1.72	0.276	ug/L		06/14/16 08:19	06/14/16 23:46	1
Indeno[1,2,3-cd]pyrene	ND		1.72	0.353	ug/L		06/14/16 08:19	06/14/16 23:46	1
Naphthalene	ND		1.72	0.319	ug/L		06/14/16 08:19	06/14/16 23:46	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Fluorobiphenyl (Surr)	*43*		*29 - 120*	*06/14/16 08:19*	*06/14/16 23:46*	*1*
Terphenyl-d14 (Surr)	*76*		*13 - 120*	*06/14/16 08:19*	*06/14/16 23:46*	*1*
Nitrobenzene-d5 (Surr)	*42*		*27 - 120*	*06/14/16 08:19*	*06/14/16 23:46*	*1*

Method: 8151A - Herbicides (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	ND		1.86	0.279	ug/L		06/16/16 15:15	06/17/16 18:56	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dichloroacetic acid(Surr)	*72*		*10 - 150*	*06/16/16 15:15*	*06/17/16 18:56*	*1*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C24	**89.4**	**J**	94.3	26.4	ug/L		06/16/16 08:20	06/19/16 17:18	1
C24-C40	ND		94.3	47.2	ug/L		06/16/16 08:20	06/19/16 17:18	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*95*		*50 - 150*	*06/16/16 08:20*	*06/19/16 17:18*	*1*

Client Sample ID: 0600-024 (48HR)

Lab Sample ID: 490-105554-3

Date Collected: 06/10/16 09:35
Matrix: Water
Date Received: 06/11/16 15:54

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	**0.889**	**J**	1.72	0.276	ug/L		06/14/16 08:19	06/15/16 00:10	1
Acenaphthylene	ND		1.72	0.302	ug/L		06/14/16 08:19	06/15/16 00:10	1
Anthracene	ND		1.72	0.328	ug/L		06/14/16 08:19	06/15/16 00:10	1
Benzo[a]anthracene	ND		1.72	0.276	ug/L		06/14/16 08:19	06/15/16 00:10	1
Benzo[a]pyrene	ND		1.72	0.328	ug/L		06/14/16 08:19	06/15/16 00:10	1
Benzo[b]fluoranthene	ND		1.72	0.310	ug/L		06/14/16 08:19	06/15/16 00:10	1
Benzo[g,h,i]perylene	ND		1.72	0.534	ug/L		06/14/16 08:19	06/15/16 00:10	1
Benzo[k]fluoranthene	ND		1.72	0.319	ug/L		06/14/16 08:19	06/15/16 00:10	1
Pyrene	ND		1.72	0.302	ug/L		06/14/16 08:19	06/15/16 00:10	1
Phenanthrene	**1.33**	**J**	1.72	0.362	ug/L		06/14/16 08:19	06/15/16 00:10	1
Chrysene	ND		1.72	0.284	ug/L		06/14/16 08:19	06/15/16 00:10	1
Dibenz(a,h)anthracene	ND		1.72	0.388	ug/L		06/14/16 08:19	06/15/16 00:10	1
Fluoranthene	ND		1.72	0.276	ug/L		06/14/16 08:19	06/15/16 00:10	1
Fluorene	**0.794**	**J**	1.72	0.276	ug/L		06/14/16 08:19	06/15/16 00:10	1
Indeno[1,2,3-cd]pyrene	ND		1.72	0.353	ug/L		06/14/16 08:19	06/15/16 00:10	1
Naphthalene	**2.08**		1.72	0.319	ug/L		06/14/16 08:19	06/15/16 00:10	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Fluorobiphenyl (Surr)	*53*		*29 - 120*	*06/14/16 08:19*	*06/15/16 00:10*	*1*
Terphenyl-d14 (Surr)	*88*		*13 - 120*	*06/14/16 08:19*	*06/15/16 00:10*	*1*
Nitrobenzene-d5 (Surr)	*49*		*27 - 120*	*06/14/16 08:19*	*06/15/16 00:10*	*1*

Method: 8151A - Herbicides (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	**52.6**	**J**	93.0	14.0	ug/L		06/16/16 15:15	06/20/16 21:48	50

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dichloroacetic acid(Surr)	*1362*	*X*	*10 - 150*	*06/16/16 15:15*	*06/20/16 21:48*	*50*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C24	**506**		94.3	26.4	ug/L		06/16/16 08:20	06/19/16 17:36	1
C24-C40	ND		94.3	47.2	ug/L		06/16/16 08:20	06/19/16 17:36	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*95*		*50 - 150*	*06/16/16 08:20*	*06/19/16 17:36*	*1*

Client: Kemron Environmental Services, Inc. TestAmerica Job ID: 490-105554-1
Project/Site: Washington Wood Treating

Client Sample ID: 0600-027 (48HR) Lab Sample ID: 490-105554-4

Date Collected: 06/10/16 09:40 **Matrix: Water**
Date Received: 06/11/16 15:54

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	**0.591**	**J**	1.72	0.276	ug/L		06/14/16 08:19	06/15/16 00:34	1
Acenaphthylene	ND		1.72	0.302	ug/L		06/14/16 08:19	06/15/16 00:34	1
Anthracene	ND		1.72	0.328	ug/L		06/14/16 08:19	06/15/16 00:34	1
Benzo[a]anthracene	ND		1.72	0.276	ug/L		06/14/16 08:19	06/15/16 00:34	1
Benzo[a]pyrene	ND		1.72	0.328	ug/L		06/14/16 08:19	06/15/16 00:34	1
Benzo[b]fluoranthene	ND		1.72	0.310	ug/L		06/14/16 08:19	06/15/16 00:34	1
Benzo[g,h,i]perylene	ND		1.72	0.534	ug/L		06/14/16 08:19	06/15/16 00:34	1
Benzo[k]fluoranthene	ND		1.72	0.319	ug/L		06/14/16 08:19	06/15/16 00:34	1
Pyrene	ND		1.72	0.302	ug/L		06/14/16 08:19	06/15/16 00:34	1
Phenanthrene	**1.07**	**J**	1.72	0.362	ug/L		06/14/16 08:19	06/15/16 00:34	1
Chrysene	ND		1.72	0.284	ug/L		06/14/16 08:19	06/15/16 00:34	1
Dibenz(a,h)anthracene	ND		1.72	0.388	ug/L		06/14/16 08:19	06/15/16 00:34	1
Fluoranthene	ND		1.72	0.276	ug/L		06/14/16 08:19	06/15/16 00:34	1
Fluorene	**0.551**	**J**	1.72	0.276	ug/L		06/14/16 08:19	06/15/16 00:34	1
Indeno[1,2,3-cd]pyrene	ND		1.72	0.353	ug/L		06/14/16 08:19	06/15/16 00:34	1
Naphthalene	**1.32**	**J**	1.72	0.319	ug/L		06/14/16 08:19	06/15/16 00:34	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Fluorobiphenyl (Surr)	*54*		*29 - 120*	*06/14/16 08:19*	*06/15/16 00:34*	*1*
Terphenyl-d14 (Surr)	*95*		*13 - 120*	*06/14/16 08:19*	*06/15/16 00:34*	*1*
Nitrobenzene-d5 (Surr)	*50*		*27 - 120*	*06/14/16 08:19*	*06/15/16 00:34*	*1*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C24	**309**		94.3	26.4	ug/L		06/16/16 08:20	06/19/16 17:53	1
C24-C40	ND		94.3	47.2	ug/L		06/16/16 08:20	06/19/16 17:53	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*95*		*50 - 150*	*06/16/16 08:20*	*06/19/16 17:53*	*1*

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Lab Sample ID: MB 490-347453/1-A
Matrix: Water
Analysis Batch: 347677

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 347453

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	ND		2.00	0.320	ug/L		06/14/16 08:19	06/14/16 17:59	1
Acenaphthylene	ND		2.00	0.350	ug/L		06/14/16 08:19	06/14/16 17:59	1
Anthracene	ND		2.00	0.380	ug/L		06/14/16 08:19	06/14/16 17:59	1
Benzo[a]anthracene	ND		2.00	0.320	ug/L		06/14/16 08:19	06/14/16 17:59	1
Benzo[a]pyrene	ND		2.00	0.380	ug/L		06/14/16 08:19	06/14/16 17:59	1
Benzo[b]fluoranthene	ND		2.00	0.360	ug/L		06/14/16 08:19	06/14/16 17:59	1
Benzo[g,h,i]perylene	ND		2.00	0.620	ug/L		06/14/16 08:19	06/14/16 17:59	1
Benzo[k]fluoranthene	ND		2.00	0.370	ug/L		06/14/16 08:19	06/14/16 17:59	1
Pyrene	ND		2.00	0.350	ug/L		06/14/16 08:19	06/14/16 17:59	1
Phenanthrene	ND		2.00	0.420	ug/L		06/14/16 08:19	06/14/16 17:59	1
Chrysene	ND		2.00	0.330	ug/L		06/14/16 08:19	06/14/16 17:59	1
Dibenz(a,h)anthracene	ND		2.00	0.450	ug/L		06/14/16 08:19	06/14/16 17:59	1
Fluoranthene	ND		2.00	0.320	ug/L		06/14/16 08:19	06/14/16 17:59	1
Fluorene	ND		2.00	0.320	ug/L		06/14/16 08:19	06/14/16 17:59	1
Indeno[1,2,3-cd]pyrene	ND		2.00	0.410	ug/L		06/14/16 08:19	06/14/16 17:59	1
Naphthalene	ND		2.00	0.370	ug/L		06/14/16 08:19	06/14/16 17:59	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Fluorobiphenyl (Surr)	*58*		*29 - 120*	*06/14/16 08:19*	*06/14/16 17:59*	*1*
Terphenyl-d14 (Surr)	*74*		*13 - 120*	*06/14/16 08:19*	*06/14/16 17:59*	*1*
Nitrobenzene-d5 (Surr)	*48*		*27 - 120*	*06/14/16 08:19*	*06/14/16 17:59*	*1*

Lab Sample ID: LCS 490-347453/2-A
Matrix: Water
Analysis Batch: 347677

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 347453

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Acenaphthene	40.0	27.38		ug/L		68	36 - 129
Acenaphthylene	40.0	26.37		ug/L		66	36 - 120
Anthracene	40.0	28.24		ug/L		71	42 - 130
Benzo[a]anthracene	40.0	30.11		ug/L		75	41 - 131
Benzo[a]pyrene	40.0	28.36		ug/L		71	45 - 131
Benzo[b]fluoranthene	40.0	28.11		ug/L		70	43 - 132
Benzo[g,h,i]perylene	40.0	31.84		ug/L		80	38 - 138
Benzo[k]fluoranthene	40.0	30.37		ug/L		76	44 - 129
Pyrene	40.0	27.33		ug/L		68	37 - 129
Phenanthrene	40.0	28.46		ug/L		71	39 - 126
Chrysene	40.0	29.67		ug/L		74	39 - 130
Dibenz(a,h)anthracene	40.0	30.79		ug/L		77	43 - 140
Fluoranthene	40.0	31.24		ug/L		78	31 - 132
Fluorene	40.0	28.43		ug/L		71	37 - 130
Indeno[1,2,3-cd]pyrene	40.0	30.18		ug/L		75	40 - 136
Naphthalene	40.0	22.97		ug/L		57	32 - 120

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
2-Fluorobiphenyl (Surr)	*66*		*29 - 120*
Terphenyl-d14 (Surr)	*71*		*13 - 120*

Method: 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: LCS 490-347453/2-A **Client Sample ID: Lab Control Sample**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 347677 **Prep Batch: 347453**

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
Nitrobenzene-d5 (Surr)	*60*		*27 - 120*

Method: 8151A - Herbicides (GC)

Lab Sample ID: MB 490-348335/1-A **Client Sample ID: Method Blank**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 348600 **Prep Batch: 348335**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	ND		2.00	0.300	ug/L		06/16/16 15:15	06/17/16 18:26	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dichloroacetic acid(Surr)	*33*		*10 - 150*	*06/16/16 15:15*	*06/17/16 18:26*	*1*

Lab Sample ID: LCS 490-348335/2-A **Client Sample ID: Lab Control Sample**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 348600 **Prep Batch: 348335**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Pentachlorophenol	2.50	3.014		ug/L		121	10 - 150

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
Dichloroacetic acid(Surr)	*103*		*10 - 150*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Lab Sample ID: MB 490-348104/1-A **Client Sample ID: Method Blank**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 348824 **Prep Batch: 348104**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C24	ND		100	28.0	ug/L		06/16/16 08:20	06/19/16 13:30	1
C24-C40	ND		100	50.0	ug/L		06/16/16 08:20	06/19/16 13:30	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*95*		*50 - 150*	*06/16/16 08:20*	*06/19/16 13:30*	*1*

Lab Sample ID: LCS 490-348104/2-A **Client Sample ID: Lab Control Sample**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 348824 **Prep Batch: 348104**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
C10-C24	1000	868.1		ug/L		87	51 - 132

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
o-Terphenyl	*87*		*50 - 150*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC) (Continued)

Lab Sample ID: 490-105554-1 DU — **Client Sample ID: 0600-019 (48HR)**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 348824 — **Prep Batch: 348104**

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
C10-C24	151		152.1		ug/L		0.5	41
C24-C40	ND		ND		ug/L		NC	41

Surrogate	*DU %Recovery*	*DU Qualifier*	*Limits*
o-Terphenyl	*83*		*50 - 150*

Lab Sample ID: 490-105554-4 DU — **Client Sample ID: 0600-027 (48HR)**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 348824 — **Prep Batch: 348104**

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
C10-C24	309		298.5		ug/L		3	41
C24-C40	ND		ND		ug/L		NC	41

Surrogate	*DU %Recovery*	*DU Qualifier*	*Limits*
o-Terphenyl	*100*		*50 - 150*

GC/MS Semi VOA

Prep Batch: 347453

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-105554-1	0600-019 (48HR)	Total/NA	Water	3510C	
490-105554-2	0600-022 (48HR)	Total/NA	Water	3510C	
490-105554-3	0600-024 (48HR)	Total/NA	Water	3510C	
490-105554-4	0600-027 (48HR)	Total/NA	Water	3510C	
LCS 490-347453/2-A	Lab Control Sample	Total/NA	Water	3510C	
MB 490-347453/1-A	Method Blank	Total/NA	Water	3510C	

Analysis Batch: 347677

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-105554-1	0600-019 (48HR)	Total/NA	Water	8270D	347453
490-105554-2	0600-022 (48HR)	Total/NA	Water	8270D	347453
490-105554-3	0600-024 (48HR)	Total/NA	Water	8270D	347453
490-105554-4	0600-027 (48HR)	Total/NA	Water	8270D	347453
LCS 490-347453/2-A	Lab Control Sample	Total/NA	Water	8270D	347453
MB 490-347453/1-A	Method Blank	Total/NA	Water	8270D	347453

GC Semi VOA

Prep Batch: 348104

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-105554-1	0600-019 (48HR)	Total/NA	Water	3510C	
490-105554-1 DU	0600-019 (48HR)	Total/NA	Water	3510C	
490-105554-2	0600-022 (48HR)	Total/NA	Water	3510C	
490-105554-3	0600-024 (48HR)	Total/NA	Water	3510C	
490-105554-4	0600-027 (48HR)	Total/NA	Water	3510C	
490-105554-4 DU	0600-027 (48HR)	Total/NA	Water	3510C	
LCS 490-348104/2-A	Lab Control Sample	Total/NA	Water	3510C	
MB 490-348104/1-A	Method Blank	Total/NA	Water	3510C	

Prep Batch: 348335

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-105554-2	0600-022 (48HR)	Total/NA	Water	8151A	
490-105554-3	0600-024 (48HR)	Total/NA	Water	8151A	
LCS 490-348335/2-A	Lab Control Sample	Total/NA	Water	8151A	
MB 490-348335/1-A	Method Blank	Total/NA	Water	8151A	

Analysis Batch: 348600

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-105554-2	0600-022 (48HR)	Total/NA	Water	8151A	348335
LCS 490-348335/2-A	Lab Control Sample	Total/NA	Water	8151A	348335
MB 490-348335/1-A	Method Blank	Total/NA	Water	8151A	348335

Analysis Batch: 348824

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-105554-1	0600-019 (48HR)	Total/NA	Water	NWTPH-Dx	348104
490-105554-1 DU	0600-019 (48HR)	Total/NA	Water	NWTPH-Dx	348104
490-105554-2	0600-022 (48HR)	Total/NA	Water	NWTPH-Dx	348104
490-105554-3	0600-024 (48HR)	Total/NA	Water	NWTPH-Dx	348104
490-105554-4	0600-027 (48HR)	Total/NA	Water	NWTPH-Dx	348104
490-105554-4 DU	0600-027 (48HR)	Total/NA	Water	NWTPH-Dx	348104

GC Semi VOA (Continued)

Analysis Batch: 348824 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
LCS 490-348104/2-A	Lab Control Sample	Total/NA	Water	NWTPH-Dx	348104
MB 490-348104/1-A	Method Blank	Total/NA	Water	NWTPH-Dx	348104

Analysis Batch: 349110

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-105554-3	0600-024 (48HR)	Total/NA	Water	8151A	348335

Client Sample ID: 0600-019 (48HR)

Lab Sample ID: 490-105554-1

Date Collected: 06/10/16 08:27

Matrix: Water

Date Received: 06/11/16 15:54

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3510C			290 mL	1 mL	347453	06/14/16 08:19	KB	TAL NSH
Total/NA	Analysis	8270D		1	290 mL	1 mL	347677	06/14/16 23:21	T1C	TAL NSH
Total/NA	Prep	3510C			1060 mL	1 mL	348104	06/16/16 08:20	KB	TAL NSH
Total/NA	Analysis	NWTPH-Dx		1	1060 mL	1 mL	348824	06/19/16 16:43	A1B	TAL NSH

Client Sample ID: 0600-022 (48HR)

Lab Sample ID: 490-105554-2

Date Collected: 06/10/16 08:35

Matrix: Water

Date Received: 06/11/16 15:54

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3510C			290 mL	1 mL	347453	06/14/16 08:19	KB	TAL NSH
Total/NA	Analysis	8270D		1	290 mL	1 mL	347677	06/14/16 23:46	T1C	TAL NSH
Total/NA	Prep	8151A			1075 mL	10 mL	348335	06/16/16 15:15	JKG	TAL NSH
Total/NA	Analysis	8151A		1	1075 mL	10 mL	348600	06/17/16 18:56	JML	TAL NSH
Total/NA	Prep	3510C			1060 mL	1 mL	348104	06/16/16 08:20	KB	TAL NSH
Total/NA	Analysis	NWTPH-Dx		1	1060 mL	1 mL	348824	06/19/16 17:18	A1B	TAL NSH

Client Sample ID: 0600-024 (48HR)

Lab Sample ID: 490-105554-3

Date Collected: 06/10/16 09:35

Matrix: Water

Date Received: 06/11/16 15:54

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3510C			290 mL	1 mL	347453	06/14/16 08:19	KB	TAL NSH
Total/NA	Analysis	8270D		1	290 mL	1 mL	347677	06/15/16 00:10	T1C	TAL NSH
Total/NA	Prep	8151A			1075 mL	10 mL	348335	06/16/16 15:15	JKG	TAL NSH
Total/NA	Analysis	8151A		50	1075 mL	10 mL	349110	06/20/16 21:48	JML	TAL NSH
Total/NA	Prep	3510C			1060 mL	1 mL	348104	06/16/16 08:20	KB	TAL NSH
Total/NA	Analysis	NWTPH-Dx		1	1060 mL	1 mL	348824	06/19/16 17:36	A1B	TAL NSH

Client Sample ID: 0600-027 (48HR)

Lab Sample ID: 490-105554-4

Date Collected: 06/10/16 09:40

Matrix: Water

Date Received: 06/11/16 15:54

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3510C			290 mL	1 mL	347453	06/14/16 08:19	KB	TAL NSH
Total/NA	Analysis	8270D		1	290 mL	1 mL	347677	06/15/16 00:34	T1C	TAL NSH
Total/NA	Prep	3510C			1060 mL	1 mL	348104	06/16/16 08:20	KB	TAL NSH
Total/NA	Analysis	NWTPH-Dx		1	1060 mL	1 mL	348824	06/19/16 17:53	A1B	TAL NSH

Laboratory References:

TAL NSH = TestAmerica Nashville, 2960 Foster Creighton Drive, Nashville, TN 37204, TEL (615)726-0177

Method Summary

Method	Method Description	Protocol	Laboratory
8270D	Semivolatile Organic Compounds (GC/MS)	SW846	TAL NSH
8151A	Herbicides (GC)	SW846	TAL NSH
NWTPH-Dx	Northwest - Semi-Volatile Petroleum Products (GC)	NWTPH	TAL NSH

Protocol References:

NWTPH = Northwest Total Petroleum Hydrocarbon

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL NSH = TestAmerica Nashville, 2960 Foster Creighton Drive, Nashville, TN 37204, TEL (615)726-0177

Certification Summary

Laboratory: TestAmerica Nashville

The certifications listed below are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
Washington	State Program	10	C789	07-19-16 *

* Certification renewal pending - certification considered valid.

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

Nashville, TN

COOLER RECEIPT FORM

490-105554 Chain of Custody

Cooler Received/Opened On__6-11-16 @ ______1030______________

Time Samples Removed From Cooler__________ Time Samples Placed In Storage__________ (2 Hour Window)

1. Tracking # A1588857B (last 4 digits, FedEx) Courier: _ ________ _

   IR Gun ID 97310166 pH Strip Lot HC564992 Chlorine Strip Lot 1211515B

2. Temperature of rep. sample or temp blank when opened: 5.4 *Degrees Celsius*
3. If Item #2 temperature is 0°C or less, was the representative sample or temp blank frozen? YES NO...NA
4. Were custody seals on outside of cooler? YES...NO...NA

   If yes, how many and where: 1 front

5. Were the seals intact, signed, and dated correctly? YES...NO...NA
6. Were custody papers inside cooler? YES...NO...NA

I certify that I opened the cooler and answered questions 1-6 (intial) EZA

7. Were custody seals on containers: YES NO and Intact YES...NO...NA

   Were these signed and dated correctly? YES...NO...NA

8. Packing mat'l used? Bubblewrap Plastic bag Peanuts Vermiculite Foam Insert Paper Other None
9. Cooling process: Ice Ice-pack Ice (direct contact) Dry ice Other None
10. Did all containers arrive in good condition (unbroken)? YES...NO...NA
11. Were all container labels complete (#, date, signed, pres., etc)? YES...NO...NA
12. Did all container labels and tags agree with custody papers? YES...NO...NA

13a. Were VOA vials received? YES...NO...NA

b. Was there any observable headspace present in any VOA vial? YES...NO...NA

14. Was there a Trip Blank in this cooler? YES...NO...NA If multiple coolers, sequence #________

I certify that I unloaded the cooler and answered questions 7-14 (intial) ________

15a. On pres'd bottles, did pH test strips suggest preservation reached the correct pH level? YES..NO..NA

b. Did the bottle labels indicate that the correct preservatives were used YES...NO..NA

16. Was residual chlorine present? YES...NO...NA

I certify that I checked for chlorine and pH as per SOP and answered questions 15-16 (intial) ________

17. Were custody papers properly filled out (ink, signed, etc)? YES...NO...NA
18. Did you sign the custody papers in the appropriate place? YES...NO...NA
19. Were correct containers used for the analysis requested? YES...NO...NA
20. Was sufficient amount of sample sent in each container? YES...NO...NA

I certify that I entered this project into LIMS and answered questions 17-20 (intial) ________

I certify that I attached a label with the unique LIMS number to each container (intial) ________

21. Were there Non-Conformance issues at login? YES...NO Was a NCM generated? YES...NO...#________

BIS = Broken in shipment

Cooler Receipt Form.doc

LF-1

End of Form

Revised 12/15/15

681-Atlanta

TestAmerica Nashville
2960 Foster Creighton Drive
Nashville, TN 37204
Phone (615) 726-0177 Fax (615) 726-3404

Chain of Custody Record

TestAmerica — THE LEADER IN ENVIRONMENTAL TESTING

Client Information	Sampler: Tomecia Bradley	Lab PM: Baker, Heather	Carrier Tracking No(s):	COC No: 490-54011-17498.2
Client Contact: Mr. Tommy Jordan	Phone: 404-601-6927	E-Mail: heather.baker@testamericainc.com		Page: Page 2 of 4
Company: Kemron Environmental Services, Inc.		Analysis Requested		Job #:
Address: 1359A Ellsworth Industrial Blvd.	Due Date Requested: 6.27.16			
City: Atlanta	TAT Requested (days): 10			
State, Zip: GA, 30318				
Phone: 404-516-3172(Tel)	PO #: Purchase Order Requested			
Email: tjordan@kemron.com	WO #:			
Project Name: Washington Wood ~~Treating~~ Preserving	Project #: 49010102			
Site:	SSOW#:			

Preservation Codes:
A - HCL, B - NaOH, C - Zn Acetate, D - Nitric Acid, E - NaHSO4, F - MeOH, G - Amchlor, H - Ascorbic Acid, I - Ice, J - DI Water, K - EDTA, L - EDA
M - Hexane, N - None, O - AsNaO2, P - Na2O4S, Q - Na2SO3, R - Na2S2O3, S - H2SO4, T - TSP Dodecahydrate, U - Acetone, V - MCAA, W - ph 4-5, Z - other (specify)
Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	8270D - Polyaromatic Hydrocarbons	8151A - PCP	NWTPH_Dx - NWTPH	Total Number of containers	Special Instructions/Note:
				Preservation Code:			N	N	N		
0600-019 (48 hr)	6.10.16	827	G	Water			X	X	X		
0600-022 (48 hr)	↓	835	G	Water			X	X	X		
0600-024 (48 hr)	↓	935	G	Water			X	X	X		
0600-027 (48 hr)	↓	940	G	Water			X	X	X		
				Water							Loc: 490
				Water							105554
				Water							
				Water							
				Water							
				Water							
				Water							

Possible Hazard Identification
☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☒ Disposal By Lab ☐ Archive For ______ Months

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:

Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Tomecia Bradley	6.10.16	Kemron	[signature]	6/10/16 10:00	TA
[signature]	6/10/16 14:30	TA	[signature]	6/11/16 1030	TA

Custody Seals Intact: Δ Yes Δ No | Custody Seal No.: | Cooler Temperature(s) °C and Other Remarks: 5.4

Login Sample Receipt Checklist

Client: Kemron Environmental Services, Inc. Job Number: 490-105554-1

Login Number: 105554 **List Source: TestAmerica Nashville**
List Number: 1
Creator: Vest, Laura E

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	5.4
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	True	

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Nashville
2960 Foster Creighton Drive
Nashville, TN 37204
Tel: (615)726-0177

TestAmerica Job ID: 490-107227-1
Client Project/Site: Washington Wood Preserving ISS

For:
Kemron Environmental Services, Inc.
1359A Ellsworth Industrial Blvd.
Atlanta, Georgia 30318

Attn: Mr. Tommy Jordan

Authorized for release by:
7/13/2016 1:46:29 PM

Jannel Franklin, Project Manager I
(732)593-2551
jannel.franklin@testamericainc.com

Designee for

Heather Baker, Project Manager I
(615)301-5043
heather.baker@testamericainc.com

The test results in this report meet all 2003 NELAC and 2009 TNI requirements for accredited parameters, exceptions are noted in this report. This report may not be reproduced except in full, and with written approval from the laboratory. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

1 2 3 4 5 6 7 8 9 10 11 12 13

Table of Contents

Sample Summary

Client: Kemron Environmental Services, Inc.
Project/Site: Washington Wood Preserving ISS

TestAmerica Job ID: 490-107227-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
490-107227-1	0600-019 (48hr)	Water	07/06/16 10:45	07/07/16 10:00
490-107227-2	0600-027 (48hr)	Water	07/06/16 10:47	07/07/16 10:00

Case Narrative

Job ID: 490-107227-1

Laboratory: TestAmerica Nashville

Narrative

Job Narrative
490-107227-1

Comments
No additional comments.

Receipt
The samples were received on 7/7/2016 10:00 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 1.3º C.

GC Semi VOA
Method(s) 8151A: Surrogate recovery for the following sample was outside the upper control limit: 0600-019 (48hr) (490-107227-1). This sample did not contain any target analytes; therefore, re-extraction and/or re-analysis was not performed.

Method(s) 8151A: Surrogate recovery for the following sample was outside control limits: 0600-027 (48hr) (490-107227-2). Evidence of matrix interference due to high target analytes is present; therefore, re-extraction and/or re-analysis was not performed.

Method(s) 8151A: Insufficient sample volume was available to perform a matrix spike/matrix spike duplicate (MS/MSD) associated with preparation batch 490-354103 and analytical batch 490-354350.

Method(s) 8151A: The following sample was diluted due to the nature of the sample matrix: 0600-027 (48hr) (490-107227-2). Elevated reporting limits (RLs) are provided.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Organic Prep
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Definitions/Glossary

Client: Kemron Environmental Services, Inc. TestAmerica Job ID: 490-107227-1
Project/Site: Washington Wood Preserving ISS

Qualifiers

GC Semi VOA

Qualifier	Qualifier Description
X	Surrogate is outside control limits
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Client: Kemron Environmental Services, Inc.
Project/Site: Washington Wood Preserving ISS

TestAmerica Job ID: 490-107227-1

Client Sample ID: 0600-019 (48hr)

Date Collected: 07/06/16 10:45
Date Received: 07/07/16 10:00

Lab Sample ID: 490-107227-1
Matrix: Water

Method: 8151A - Herbicides (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	ND		2.00	0.300	ug/L		07/09/16 14:03	07/11/16 17:28	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dichloroacetic acid(Surr)	*157*	*X*	*10 - 150*	*07/09/16 14:03*	*07/11/16 17:28*	*1*

Client Sample ID: 0600-027 (48hr)

Lab Sample ID: 490-107227-2

Date Collected: 07/06/16 10:47
Matrix: Water
Date Received: 07/07/16 10:00

Method: 8151A - Herbicides (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	27.0	J	40.0	6.00	ug/L		07/09/16 14:03	07/12/16 12:21	20

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dichloroacetic acid(Surr)	*574*	*X*	*10 - 150*	*07/09/16 14:03*	*07/11/16 17:43*	*1*

1 2 3 4 5 6 7 8 9 10 11 12 13

Method: 8151A - Herbicides (GC)

Lab Sample ID: MB 490-354103/1-A
Matrix: Water
Analysis Batch: 354350

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 354103

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	ND		2.00	0.300	ug/L		07/09/16 14:03	07/11/16 16:57	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dichloroacetic acid(Surr)	*61*		*10 - 150*	*07/09/16 14:03*	*07/11/16 16:57*	*1*

Lab Sample ID: LCS 490-354103/2-A
Matrix: Water
Analysis Batch: 354350

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 354103

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Pentachlorophenol	2.50	1.959	J	ug/L		78	10 - 150

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
Dichloroacetic acid(Surr)	*63*		*10 - 150*

1 2 3 4 5 6 7 8 9 10 11 12 13

GC Semi VOA

Prep Batch: 354103

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-107227-1	0600-019 (48hr)	Total/NA	Water	8151A	
490-107227-2	0600-027 (48hr)	Total/NA	Water	8151A	
LCS 490-354103/2-A	Lab Control Sample	Total/NA	Water	8151A	
MB 490-354103/1-A	Method Blank	Total/NA	Water	8151A	

Analysis Batch: 354350

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-107227-1	0600-019 (48hr)	Total/NA	Water	8151A	354103
490-107227-2	0600-027 (48hr)	Total/NA	Water	8151A	354103
LCS 490-354103/2-A	Lab Control Sample	Total/NA	Water	8151A	354103
MB 490-354103/1-A	Method Blank	Total/NA	Water	8151A	354103

Analysis Batch: 354566

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-107227-2	0600-027 (48hr)	Total/NA	Water	8151A	354103

Lab Chronicle

Client: Kemron Environmental Services, Inc.
Project/Site: Washington Wood Preserving ISS

TestAmerica Job ID: 490-107227-1

Client Sample ID: 0600-019 (48hr)

Lab Sample ID: 490-107227-1

Date Collected: 07/06/16 10:45
Date Received: 07/07/16 10:00

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	8151A			1000 mL	10 mL	354103	07/09/16 14:03	JKG	TAL NSH
Total/NA	Analysis	8151A		1	1000 mL	10 mL	354350	07/11/16 17:28	JML	TAL NSH

Client Sample ID: 0600-027 (48hr)

Lab Sample ID: 490-107227-2

Date Collected: 07/06/16 10:47
Date Received: 07/07/16 10:00

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	8151A			1000 mL	10 mL	354103	07/09/16 14:03	JKG	TAL NSH
Total/NA	Analysis	8151A		1	1000 mL	10 mL	354350	07/11/16 17:43	JML	TAL NSH
Total/NA	Prep	8151A			1000 mL	10 mL	354103	07/09/16 14:03	JKG	TAL NSH
Total/NA	Analysis	8151A		20	1000 mL	10 mL	354566	07/12/16 12:21	JML	TAL NSH

Laboratory References:

TAL NSH = TestAmerica Nashville, 2960 Foster Creighton Drive, Nashville, TN 37204, TEL (615)726-0177

Method Summary

Client: Kemron Environmental Services, Inc.
Project/Site: Washington Wood Preserving ISS

TestAmerica Job ID: 490-107227-1

Method	Method Description	Protocol	Laboratory
8151A	Herbicides (GC)	SW846	TAL NSH

Protocol References:

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL NSH = TestAmerica Nashville, 2960 Foster Creighton Drive, Nashville, TN 37204, TEL (615)726-0177

Certification Summary

Laboratory: TestAmerica Nashville

The certifications listed below are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
Washington	State Program	10	C789	07-19-16 *

* Certification renewal pending - certification considered valid.

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

490-107227 Chain of Custody

Nashville, TN

COOLER RECEIPT FORM

Cooler Received/Opened On 7/7/2016 @ 1000

Time Samples Removed From Cooler________ Time Samples Placed In Storage 1615 (2 Hour Window)

1. Tracking # 6934 (last 4 digits, FedEx) Courier: _fedex_

   IR Gun ID__97310166________ pH Strip Lot HC564992 Chlorine Strip Lot 072815A

2. Temperature of rep. sample or temp blank when opened: 1.3 *Degrees Celsius*

3. If Item #2 temperature is 0°C or less, was the representative sample or temp blank frozen? YES NO...NA

4. Were custody seals on outside of cooler? YES...NO...NA

   If yes, how many and where: 1 (back)

5. Were the seals intact, signed, and dated correctly? YES...NO...NA

6. Were custody papers inside cooler? YES...NO...NA

I certify that I opened the cooler and answered questions 1-6 (intial) CG

7. Were custody seals on containers: YES NO and Intact YES...NO...NA

   Were these signed and dated correctly? YES...NO...NA

8. Packing mat'l used? Bubble wrap Plastic bag Peanuts Vermiculite Foam Insert Paper Other None

9. Cooling process: Ice Ice-pack Ice (direct contact) Dry ice Other None

10. Did all containers arrive in good condition (unbroken)? YES...NO...NA

11. Were all container labels complete (#, date, signed, pres., etc)? YES...NO...NA

12. Did all container labels and tags agree with custody papers? YES...NO...NA

13a. Were VOA vials received? YES...NO...NA

   b. Was there any observable headspace present in any VOA vial? YES...NO...NA

14. Was there a Trip Blank in this cooler? YES...NO...NA If multiple coolers, sequence # NA

I certify that I unloaded the cooler and answered questions 7-14 (intial) ACS

15a. On pres'd bottles, did pH test strips suggest preservation reached the correct pH level? YES..NO..NA

   b. Did the bottle labels indicate that the correct preservatives were used YES...NO...NA

16. Was residual chlorine present? YES...NO...NA

I certify that I checked for chlorine and pH as per SOP and answered questions 15-16 (intial) ACS

17. Were custody papers properly filled out (ink, signed, etc)? YES...NO...NA

18. Did you sign the custody papers in the appropriate place? YES...NO...NA

19. Were correct containers used for the analysis requested? YES...NO...NA

20. Was sufficient amount of sample sent in each container? YES...NO...NA

I certify that I entered this project into LIMS and answered questions 17-20 (intial) ACS

I certify that I attached a label with the unique LIMS number to each container (intial) ACS

21. Were there Non-Conformance issues at login? YES...NO Was a NCM generated? YES...NO...# NA

BIS = Broken in shipment

681-Atlanta

TestAmerica Nashville
2960 Foster Creighton Drive
Nashville, TN 37204
Phone (615) 726-0177 Fax (615) 726-3404

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Information	Sampler: Tomecia Bradley	Lab PM: Baker, Heather c/o Roxanne Cisneros	Carrier Tracking No(s):
Client Contact: Mr. Tommy Jordan	Phone: 404-601-6927	E-Mail: ~~heather.baker~~ roxanne.cisneros@testamericainc.com	COC No: 490-54011-17498.1
			Page: Page ~~1 of 1~~ 1of 1
Company: Kemron Environmental Services, Inc.			Job #:
Address: 1359A Ellsworth Industrial Blvd.	Due Date Requested: 7.14.16		
City: Atlanta	TAT Requested (days): 7		
State, Zip: GA, 30318			
Phone: 404-516-3172(Tel)	PO #: ~~Purchase Order Requested~~ SH0600		
Email: tjordan@kemron.com	WO #:		
Project Name: Washington ~~Wood Treating~~ Preserving TSS	Project #: 49010102		
Site:	SSOW#:		

Analysis Requested

Preservation Codes:
A - HCL, B - Na, C - Zn, D - Nit, E - Na, F - Me, G - An, H - As, I - Ice, J - DI, K - EDTA, L - EDA, M - Hexane, ...3, ...ecahydrate, W - pH 4-5, Z - other (specify)

Loc: 490
107227

Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	8270D - Polyaromatic Hydrocarbons	8151A - PCP	NWTPH_Dx - NWTPH	Total Number of containers	Special Instructions/Note:
				Preservation Code:			N	N	N		
0600-019 (48 hr)	7.6.16	1045	G	Water				X			
0600-027 (48 hr)	↓	1047	G	Water				X			
				Water							
				Water							
				Water							
				Water							
				Water							
				Water							
				Water							
				Water							
				Water							

Possible Hazard Identification
☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☒ Disposal By Lab ☐ Archive For ______ Months

Deliverable Requested: I, II (circled), III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:		Time:		Method of Shipment:	
Relinquished by: Tomecia Bradley	Date/Time: 7.6.16 13:10	Company: Kemron	Received by: [signature]	Date/Time: 7/6/16 13:10	Company: TA	
Relinquished by: [signature] 7/6/16	Date/Time: 14:30	Company: TA	Received by: [signature]	Date/Time: 7/7/16 1000	Company: TAN	
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time:	Company:	
Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:		Cooler Temperature(s) °C and Other Remarks:			

Login Sample Receipt Checklist

Client: Kemron Environmental Services, Inc.

Job Number: 490-107227-1

Login Number: 107227
List Number: 1
Creator: Stvartak, Anthony Q

List Source: TestAmerica Nashville

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

1 2 3 4 5 6 7 8 9 10 11 12 13

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Nashville
2960 Foster Creighton Drive
Nashville, TN 37204
Tel: (615)726-0177

TestAmerica Job ID: 490-105848-1
Client Project/Site: Washington Wood Preserving ISS

For:
Kemron Environmental Services, Inc.
1359A Ellsworth Industrial Blvd.
Atlanta, Georgia 30318

Attn: Mr. Tommy Jordan

Franklin

Authorized for release by:
6/27/2016 1:58:55 PM
Jannel Franklin, Project Manager I
(732)593-2551
jannel.franklin@testamericainc.com

Designee for

Heather Baker, Project Manager I
(615)301-5043
heather.baker@testamericainc.com

The test results in this report meet all 2003 NELAC and 2009 TNI requirements for accredited parameters, exceptions are noted in this report. This report may not be reproduced except in full, and with written approval from the laboratory. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

Table of Contents

Sample Summary

Client: Kemron Environmental Services, Inc.
Project/Site: Washington Wood Preserving ISS

TestAmerica Job ID: 490-105848-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
490-105848-1	0600-019 (7 day)	Water	06/15/16 11:00	06/16/16 09:00
490-105848-2	0600 - 022 (7 day)	Water	06/15/16 11:05	06/16/16 09:00
490-105848-3	0600 - 024 (7 day)	Water	06/15/16 11:12	06/16/16 09:00
490-105848-4	0600 - 027 (7 day)	Water	06/15/16 11:20	06/16/16 09:00

Job ID: 490-105848-1

Laboratory: TestAmerica Nashville

Narrative

Job Narrative
490-105848-1

Comments
No additional comments.

Receipt
The samples were received on 6/16/2016 9:00 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 1.9º C.

GC/MS Semi VOA
Method(s) 8270D: Insufficient sample volume was available to perform a matrix spike/matrix spike duplicate (MS/MSD) associated with preparation batch 490-348567 and analytical batch 490-349061.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

GC Semi VOA
Method(s) 8151A: The %RPD between the primary and confirmation column exceeded 40% for Dichloroacetic acid(Surr) for the following samples: 0600-019 (7 day) (490-105848-1). The lower value(s) has been reported and qualified in accordance with the laboratory's SOP.

Method(s) 8151A: Surrogate recovery for the following samples was outside control limits: 0600 - 024 (7 day) (490-105848-3) and 0600 - 027 (7 day) (490-105848-4). Evidence of matrix interference due to high target analytes is present; therefore, re-extraction and/or re-analysis was not performed.

Method(s) 8151A: The following samples was diluted due to the nature of the sample matrix: 0600 - 024 (7 day) (490-105848-3) and 0600 - 027 (7 day) (490-105848-4). Elevated reporting limits (RLs) are provided.

Method(s) 8151A: The %RPD between the primary and confirmation column exceeded 40% for Pentachlorophenol for the following samples: 0600-019 (7 day) (490-105848-1). The lower value(s) has been reported and qualified in accordance with the laboratory's SOP.

Method(s) 8151A: Insufficient sample volume was available to perform a matrix spike/matrix spike duplicate (MS/MSD) associated with preparation batch 490-349467 and analytical batch 490-349689.

Method(s) NWTPH-Dx: Insufficient sample volume was available to perform a matrix spike/matrix spike duplicate (MS/MSD) associated with preparation batch 490-348568 and analytical batch 490-348824.

Method(s) NWTPH-Dx: The continuing calibration verification (CCV) associated with batch 348824 recovered above the upper control limit for C24-C40. The samples associated with this CCV were non-detects or were not detected above the reporting limit (RL) for the affected analytes; therefore, the data have been reported.

Method(s) NWTPH-Dx: The following samples contained a hydrocarbon pattern for analyte C10-C24 that most closely resembles a Diesel Fuel #2 product used by the laboratory for quantitative purposes: 0600-019 (7 day) (490-105848-1), 0600 - 024 (7 day) (490-105848-3) and 0600 - 027 (7 day) (490-105848-4).

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Organic Prep
Method(s) 3510C: Insufficient sample volume was available to perform a sample duplicate (DUP) associated with 348568.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Definitions/Glossary

Client: Kemron Environmental Services, Inc.
Project/Site: Washington Wood Preserving ISS

TestAmerica Job ID: 490-105848-1

Qualifiers

GC/MS Semi VOA

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

GC Semi VOA

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
p	The %RPD between the primary and confirmation column/detector is >40%. The lower value has been reported.
X	Surrogate is outside control limits

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Client Sample Results

Client: Kemron Environmental Services, Inc.
Project/Site: Washington Wood Preserving ISS

TestAmerica Job ID: 490-105848-1

Client Sample ID: 0600-019 (7 day)

Lab Sample ID: 490-105848-1

Date Collected: 06/15/16 11:00
Date Received: 06/16/16 09:00

Matrix: Water

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	ND		1.85	0.296	ug/L		06/17/16 11:49	06/21/16 18:13	1
Acenaphthylene	ND		1.85	0.324	ug/L		06/17/16 11:49	06/21/16 18:13	1
Anthracene	ND		1.85	0.352	ug/L		06/17/16 11:49	06/21/16 18:13	1
Benzo[a]anthracene	ND		1.85	0.296	ug/L		06/17/16 11:49	06/21/16 18:13	1
Benzo[a]pyrene	ND		1.85	0.352	ug/L		06/17/16 11:49	06/21/16 18:13	1
Benzo[b]fluoranthene	ND		1.85	0.333	ug/L		06/17/16 11:49	06/21/16 18:13	1
Benzo[g,h,i]perylene	ND		1.85	0.574	ug/L		06/17/16 11:49	06/21/16 18:13	1
Benzo[k]fluoranthene	ND		1.85	0.343	ug/L		06/17/16 11:49	06/21/16 18:13	1
Pyrene	ND		1.85	0.324	ug/L		06/17/16 11:49	06/21/16 18:13	1
Phenanthrene	ND		1.85	0.389	ug/L		06/17/16 11:49	06/21/16 18:13	1
Chrysene	ND		1.85	0.306	ug/L		06/17/16 11:49	06/21/16 18:13	1
Dibenz(a,h)anthracene	ND		1.85	0.417	ug/L		06/17/16 11:49	06/21/16 18:13	1
Fluoranthene	ND		1.85	0.296	ug/L		06/17/16 11:49	06/21/16 18:13	1
Fluorene	ND		1.85	0.296	ug/L		06/17/16 11:49	06/21/16 18:13	1
Indeno[1,2,3-cd]pyrene	ND		1.85	0.380	ug/L		06/17/16 11:49	06/21/16 18:13	1
Naphthalene	ND		1.85	0.343	ug/L		06/17/16 11:49	06/21/16 18:13	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Fluorobiphenyl (Surr)	*52*		*29 - 120*	*06/17/16 11:49*	*06/21/16 18:13*	*1*
Terphenyl-d14 (Surr)	*60*		*13 - 120*	*06/17/16 11:49*	*06/21/16 18:13*	*1*
Nitrobenzene-d5 (Surr)	*52*		*27 - 120*	*06/17/16 11:49*	*06/21/16 18:13*	*1*

Method: 8151A - Herbicides (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	**0.390**	**J p**	1.86	0.279	ug/L		06/21/16 16:23	06/22/16 13:04	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dichloroacetic acid(Surr)	*104*	*p*	*10 - 150*	*06/21/16 16:23*	*06/22/16 13:04*	*1*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C24	**532**		93.5	26.2	ug/L		06/17/16 11:53	06/19/16 19:21	1
C24-C40	**51.3**	**J**	93.5	46.7	ug/L		06/17/16 11:53	06/19/16 19:21	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*85*		*50 - 150*	*06/17/16 11:53*	*06/19/16 19:21*	*1*

Client Sample ID: 0600 - 022 (7 day)

Lab Sample ID: 490-105848-2

Date Collected: 06/15/16 11:05
Matrix: Water
Date Received: 06/16/16 09:00

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	ND		1.85	0.296	ug/L		06/17/16 11:49	06/21/16 18:34	1
Acenaphthylene	ND		1.85	0.324	ug/L		06/17/16 11:49	06/21/16 18:34	1
Anthracene	ND		1.85	0.352	ug/L		06/17/16 11:49	06/21/16 18:34	1
Benzo[a]anthracene	ND		1.85	0.296	ug/L		06/17/16 11:49	06/21/16 18:34	1
Benzo[a]pyrene	ND		1.85	0.352	ug/L		06/17/16 11:49	06/21/16 18:34	1
Benzo[b]fluoranthene	ND		1.85	0.333	ug/L		06/17/16 11:49	06/21/16 18:34	1
Benzo[g,h,i]perylene	ND		1.85	0.574	ug/L		06/17/16 11:49	06/21/16 18:34	1
Benzo[k]fluoranthene	ND		1.85	0.343	ug/L		06/17/16 11:49	06/21/16 18:34	1
Pyrene	ND		1.85	0.324	ug/L		06/17/16 11:49	06/21/16 18:34	1
Phenanthrene	ND		1.85	0.389	ug/L		06/17/16 11:49	06/21/16 18:34	1
Chrysene	ND		1.85	0.306	ug/L		06/17/16 11:49	06/21/16 18:34	1
Dibenz(a,h)anthracene	ND		1.85	0.417	ug/L		06/17/16 11:49	06/21/16 18:34	1
Fluoranthene	ND		1.85	0.296	ug/L		06/17/16 11:49	06/21/16 18:34	1
Fluorene	ND		1.85	0.296	ug/L		06/17/16 11:49	06/21/16 18:34	1
Indeno[1,2,3-cd]pyrene	ND		1.85	0.380	ug/L		06/17/16 11:49	06/21/16 18:34	1
Naphthalene	ND		1.85	0.343	ug/L		06/17/16 11:49	06/21/16 18:34	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Fluorobiphenyl (Surr)	*51*		*29 - 120*	*06/17/16 11:49*	*06/21/16 18:34*	*1*
Terphenyl-d14 (Surr)	*63*		*13 - 120*	*06/17/16 11:49*	*06/21/16 18:34*	*1*
Nitrobenzene-d5 (Surr)	*54*		*27 - 120*	*06/17/16 11:49*	*06/21/16 18:34*	*1*

Method: 8151A - Herbicides (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	**0.375**	**J**	1.86	0.279	ug/L		06/21/16 16:23	06/22/16 13:20	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dichloroacetic acid(Surr)	*128*		*10 - 150*	*06/21/16 16:23*	*06/22/16 13:20*	*1*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C24	**387**		93.5	26.2	ug/L		06/17/16 11:53	06/19/16 20:14	1
C24-C40	ND		93.5	46.7	ug/L		06/17/16 11:53	06/19/16 20:14	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*84*		*50 - 150*	*06/17/16 11:53*	*06/19/16 20:14*	*1*

Client Sample ID: 0600 - 024 (7 day)

Lab Sample ID: 490-105848-3

Date Collected: 06/15/16 11:12
Matrix: Water
Date Received: 06/16/16 09:00

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	**1.24**	**J**	1.85	0.296	ug/L		06/17/16 11:49	06/21/16 18:56	1
Acenaphthylene	ND		1.85	0.324	ug/L		06/17/16 11:49	06/21/16 18:56	1
Anthracene	ND		1.85	0.352	ug/L		06/17/16 11:49	06/21/16 18:56	1
Benzo[a]anthracene	ND		1.85	0.296	ug/L		06/17/16 11:49	06/21/16 18:56	1
Benzo[a]pyrene	ND		1.85	0.352	ug/L		06/17/16 11:49	06/21/16 18:56	1
Benzo[b]fluoranthene	ND		1.85	0.333	ug/L		06/17/16 11:49	06/21/16 18:56	1
Benzo[g,h,i]perylene	ND		1.85	0.574	ug/L		06/17/16 11:49	06/21/16 18:56	1
Benzo[k]fluoranthene	ND		1.85	0.343	ug/L		06/17/16 11:49	06/21/16 18:56	1
Pyrene	ND		1.85	0.324	ug/L		06/17/16 11:49	06/21/16 18:56	1
Phenanthrene	**1.04**	**J**	1.85	0.389	ug/L		06/17/16 11:49	06/21/16 18:56	1
Chrysene	ND		1.85	0.306	ug/L		06/17/16 11:49	06/21/16 18:56	1
Dibenz(a,h)anthracene	ND		1.85	0.417	ug/L		06/17/16 11:49	06/21/16 18:56	1
Fluoranthene	ND		1.85	0.296	ug/L		06/17/16 11:49	06/21/16 18:56	1
Fluorene	**0.928**	**J**	1.85	0.296	ug/L		06/17/16 11:49	06/21/16 18:56	1
Indeno[1,2,3-cd]pyrene	ND		1.85	0.380	ug/L		06/17/16 11:49	06/21/16 18:56	1
Naphthalene	**4.13**		1.85	0.343	ug/L		06/17/16 11:49	06/21/16 18:56	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Fluorobiphenyl (Surr)	*36*		*29 - 120*	*06/17/16 11:49*	*06/21/16 18:56*	*1*
Terphenyl-d14 (Surr)	*43*		*13 - 120*	*06/17/16 11:49*	*06/21/16 18:56*	*1*
Nitrobenzene-d5 (Surr)	*39*		*27 - 120*	*06/17/16 11:49*	*06/21/16 18:56*	*1*

Method: 8151A - Herbicides (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	**142**		93.0	14.0	ug/L		06/21/16 16:23	06/22/16 14:05	50

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dichloroacetic acid(Surr)	*2961*	*X*	*10 - 150*	*06/21/16 16:23*	*06/22/16 13:35*	*1*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C24	**1040**		93.5	26.2	ug/L		06/17/16 11:53	06/19/16 20:32	1
C24-C40	**70.1**	**J**	93.5	46.7	ug/L		06/17/16 11:53	06/19/16 20:32	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*91*		*50 - 150*	*06/17/16 11:53*	*06/19/16 20:32*	*1*

Client Sample ID: 0600 - 027 (7 day)

Lab Sample ID: 490-105848-4

Date Collected: 06/15/16 11:20

Matrix: Water

Date Received: 06/16/16 09:00

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	**1.08**	**J**	1.85	0.296	ug/L		06/17/16 11:49	06/21/16 19:18	1
Acenaphthylene	ND		1.85	0.324	ug/L		06/17/16 11:49	06/21/16 19:18	1
Anthracene	ND		1.85	0.352	ug/L		06/17/16 11:49	06/21/16 19:18	1
Benzo[a]anthracene	ND		1.85	0.296	ug/L		06/17/16 11:49	06/21/16 19:18	1
Benzo[a]pyrene	ND		1.85	0.352	ug/L		06/17/16 11:49	06/21/16 19:18	1
Benzo[b]fluoranthene	ND		1.85	0.333	ug/L		06/17/16 11:49	06/21/16 19:18	1
Benzo[g,h,i]perylene	ND		1.85	0.574	ug/L		06/17/16 11:49	06/21/16 19:18	1
Benzo[k]fluoranthene	ND		1.85	0.343	ug/L		06/17/16 11:49	06/21/16 19:18	1
Pyrene	ND		1.85	0.324	ug/L		06/17/16 11:49	06/21/16 19:18	1
Phenanthrene	**1.17**	**J**	1.85	0.389	ug/L		06/17/16 11:49	06/21/16 19:18	1
Chrysene	ND		1.85	0.306	ug/L		06/17/16 11:49	06/21/16 19:18	1
Dibenz(a,h)anthracene	ND		1.85	0.417	ug/L		06/17/16 11:49	06/21/16 19:18	1
Fluoranthene	ND		1.85	0.296	ug/L		06/17/16 11:49	06/21/16 19:18	1
Fluorene	**0.904**	**J**	1.85	0.296	ug/L		06/17/16 11:49	06/21/16 19:18	1
Indeno[1,2,3-cd]pyrene	ND		1.85	0.380	ug/L		06/17/16 11:49	06/21/16 19:18	1
Naphthalene	**3.54**		1.85	0.343	ug/L		06/17/16 11:49	06/21/16 19:18	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Fluorobiphenyl (Surr)	*48*		*29 - 120*	*06/17/16 11:49*	*06/21/16 19:18*	*1*
Terphenyl-d14 (Surr)	*60*		*13 - 120*	*06/17/16 11:49*	*06/21/16 19:18*	*1*
Nitrobenzene-d5 (Surr)	*50*		*27 - 120*	*06/17/16 11:49*	*06/21/16 19:18*	*1*

Method: 8151A - Herbicides (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	**72.9**	**J**	93.0	14.0	ug/L		06/21/16 16:23	06/22/16 14:21	50

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dichloroacetic acid(Surr)	*1695*	*X*	*10 - 150*	*06/21/16 16:23*	*06/22/16 13:50*	*1*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C24	**873**		93.5	26.2	ug/L		06/17/16 11:53	06/19/16 20:50	1
C24-C40	**62.9**	**J**	93.5	46.7	ug/L		06/17/16 11:53	06/19/16 20:50	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*105*		*50 - 150*	*06/17/16 11:53*	*06/19/16 20:50*	*1*

Client: Kemron Environmental Services, Inc. TestAmerica Job ID: 490-105848-1
Project/Site: Washington Wood Preserving ISS

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Lab Sample ID: MB 490-348567/1-A **Client Sample ID: Method Blank**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 349061 **Prep Batch: 348567**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	ND		2.00	0.320	ug/L		06/17/16 11:49	06/21/16 14:35	1
Acenaphthylene	ND		2.00	0.350	ug/L		06/17/16 11:49	06/21/16 14:35	1
Anthracene	ND		2.00	0.380	ug/L		06/17/16 11:49	06/21/16 14:35	1
Benzo[a]anthracene	ND		2.00	0.320	ug/L		06/17/16 11:49	06/21/16 14:35	1
Benzo[a]pyrene	ND		2.00	0.380	ug/L		06/17/16 11:49	06/21/16 14:35	1
Benzo[b]fluoranthene	ND		2.00	0.360	ug/L		06/17/16 11:49	06/21/16 14:35	1
Benzo[g,h,i]perylene	ND		2.00	0.620	ug/L		06/17/16 11:49	06/21/16 14:35	1
Benzo[k]fluoranthene	ND		2.00	0.370	ug/L		06/17/16 11:49	06/21/16 14:35	1
Pyrene	ND		2.00	0.350	ug/L		06/17/16 11:49	06/21/16 14:35	1
Phenanthrene	ND		2.00	0.420	ug/L		06/17/16 11:49	06/21/16 14:35	1
Chrysene	ND		2.00	0.330	ug/L		06/17/16 11:49	06/21/16 14:35	1
Dibenz(a,h)anthracene	ND		2.00	0.450	ug/L		06/17/16 11:49	06/21/16 14:35	1
Fluoranthene	ND		2.00	0.320	ug/L		06/17/16 11:49	06/21/16 14:35	1
Fluorene	ND		2.00	0.320	ug/L		06/17/16 11:49	06/21/16 14:35	1
Indeno[1,2,3-cd]pyrene	ND		2.00	0.410	ug/L		06/17/16 11:49	06/21/16 14:35	1
Naphthalene	ND		2.00	0.370	ug/L		06/17/16 11:49	06/21/16 14:35	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Fluorobiphenyl (Surr)	*43*		*29 - 120*	*06/17/16 11:49*	*06/21/16 14:35*	*1*
Terphenyl-d14 (Surr)	*52*		*13 - 120*	*06/17/16 11:49*	*06/21/16 14:35*	*1*
Nitrobenzene-d5 (Surr)	*44*		*27 - 120*	*06/17/16 11:49*	*06/21/16 14:35*	*1*

Lab Sample ID: LCS 490-348567/2-A **Client Sample ID: Lab Control Sample**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 349061 **Prep Batch: 348567**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Acenaphthene	40.0	23.04		ug/L		58	36 - 129
Acenaphthylene	40.0	22.59		ug/L		56	36 - 120
Anthracene	40.0	22.92		ug/L		57	42 - 130
Benzo[a]anthracene	40.0	21.91		ug/L		55	41 - 131
Benzo[a]pyrene	40.0	19.74		ug/L		49	45 - 131
Benzo[b]fluoranthene	40.0	20.04		ug/L		50	43 - 132
Benzo[g,h,i]perylene	40.0	15.91		ug/L		40	38 - 138
Benzo[k]fluoranthene	40.0	19.36		ug/L		48	44 - 129
Pyrene	40.0	21.82		ug/L		55	37 - 129
Phenanthrene	40.0	22.66		ug/L		57	39 - 126
Chrysene	40.0	21.77		ug/L		54	39 - 130
Dibenz(a,h)anthracene	40.0	17.23		ug/L		43	43 - 140
Fluoranthene	40.0	23.49		ug/L		59	31 - 132
Fluorene	40.0	23.33		ug/L		58	37 - 130
Indeno[1,2,3-cd]pyrene	40.0	17.59		ug/L		44	40 - 136
Naphthalene	40.0	21.05		ug/L		53	32 - 120

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
2-Fluorobiphenyl (Surr)	*51*		*29 - 120*
Terphenyl-d14 (Surr)	*45*		*13 - 120*

Method: 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: LCS 490-348567/2-A
Matrix: Water
Analysis Batch: 349061

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 348567

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
Nitrobenzene-d5 (Surr)	*52*		*27 - 120*

Method: 8151A - Herbicides (GC)

Lab Sample ID: MB 490-349467/1-A
Matrix: Water
Analysis Batch: 349689

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 349467

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	ND		2.00	0.300	ug/L		06/21/16 16:23	06/22/16 12:34	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dichloroacetic acid(Surr)	*32*		*10 - 150*	*06/21/16 16:23*	*06/22/16 12:34*	*1*

Lab Sample ID: LCS 490-349467/2-A
Matrix: Water
Analysis Batch: 349689

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 349467

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Pentachlorophenol	2.50	1.987	J	ug/L		79	10 - 150

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
Dichloroacetic acid(Surr)	*70*		*10 - 150*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Lab Sample ID: MB 490-348568/1-A
Matrix: Water
Analysis Batch: 348824

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 348568

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C24	ND		100	28.0	ug/L		06/17/16 11:53	06/19/16 18:46	1
C24-C40	ND		100	50.0	ug/L		06/17/16 11:53	06/19/16 18:46	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*71*		*50 - 150*	*06/17/16 11:53*	*06/19/16 18:46*	*1*

Lab Sample ID: LCS 490-348568/2-A
Matrix: Water
Analysis Batch: 348824

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 348568

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
C10-C24	1000	816.7		ug/L		82	51 - 132

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
o-Terphenyl	*88*		*50 - 150*

GC/MS Semi VOA

Prep Batch: 348567

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-105848-1	0600-019 (7 day)	Total/NA	Water	3510C	
490-105848-2	0600 - 022 (7 day)	Total/NA	Water	3510C	
490-105848-3	0600 - 024 (7 day)	Total/NA	Water	3510C	
490-105848-4	0600 - 027 (7 day)	Total/NA	Water	3510C	
LCS 490-348567/2-A	Lab Control Sample	Total/NA	Water	3510C	
MB 490-348567/1-A	Method Blank	Total/NA	Water	3510C	

Analysis Batch: 349061

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-105848-1	0600-019 (7 day)	Total/NA	Water	8270D	348567
490-105848-2	0600 - 022 (7 day)	Total/NA	Water	8270D	348567
490-105848-3	0600 - 024 (7 day)	Total/NA	Water	8270D	348567
490-105848-4	0600 - 027 (7 day)	Total/NA	Water	8270D	348567
LCS 490-348567/2-A	Lab Control Sample	Total/NA	Water	8270D	348567
MB 490-348567/1-A	Method Blank	Total/NA	Water	8270D	348567

GC Semi VOA

Prep Batch: 348568

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-105848-1	0600-019 (7 day)	Total/NA	Water	3510C	
490-105848-2	0600 - 022 (7 day)	Total/NA	Water	3510C	
490-105848-3	0600 - 024 (7 day)	Total/NA	Water	3510C	
490-105848-4	0600 - 027 (7 day)	Total/NA	Water	3510C	
LCS 490-348568/2-A	Lab Control Sample	Total/NA	Water	3510C	
MB 490-348568/1-A	Method Blank	Total/NA	Water	3510C	

Analysis Batch: 348824

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-105848-1	0600-019 (7 day)	Total/NA	Water	NWTPH-Dx	348568
490-105848-2	0600 - 022 (7 day)	Total/NA	Water	NWTPH-Dx	348568
490-105848-3	0600 - 024 (7 day)	Total/NA	Water	NWTPH-Dx	348568
490-105848-4	0600 - 027 (7 day)	Total/NA	Water	NWTPH-Dx	348568
LCS 490-348568/2-A	Lab Control Sample	Total/NA	Water	NWTPH-Dx	348568
MB 490-348568/1-A	Method Blank	Total/NA	Water	NWTPH-Dx	348568

Prep Batch: 349467

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-105848-1	0600-019 (7 day)	Total/NA	Water	8151A	
490-105848-2	0600 - 022 (7 day)	Total/NA	Water	8151A	
490-105848-3	0600 - 024 (7 day)	Total/NA	Water	8151A	
490-105848-4	0600 - 027 (7 day)	Total/NA	Water	8151A	
LCS 490-349467/2-A	Lab Control Sample	Total/NA	Water	8151A	
MB 490-349467/1-A	Method Blank	Total/NA	Water	8151A	

Analysis Batch: 349689

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-105848-1	0600-019 (7 day)	Total/NA	Water	8151A	349467
490-105848-2	0600 - 022 (7 day)	Total/NA	Water	8151A	349467
490-105848-3	0600 - 024 (7 day)	Total/NA	Water	8151A	349467

GC Semi VOA (Continued)

Analysis Batch: 349689 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-105848-3	0600 - 024 (7 day)	Total/NA	Water	8151A	349467
490-105848-4	0600 - 027 (7 day)	Total/NA	Water	8151A	349467
490-105848-4	0600 - 027 (7 day)	Total/NA	Water	8151A	349467
LCS 490-349467/2-A	Lab Control Sample	Total/NA	Water	8151A	349467
MB 490-349467/1-A	Method Blank	Total/NA	Water	8151A	349467

Lab Chronicle

Client: Kemron Environmental Services, Inc.
Project/Site: Washington Wood Preserving ISS

TestAmerica Job ID: 490-105848-1

Client Sample ID: 0600-019 (7 day)

Lab Sample ID: 490-105848-1
Date Collected: 06/15/16 11:00
Matrix: Water
Date Received: 06/16/16 09:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3510C			270 mL	1.0 mL	348567	06/17/16 11:49	DHC	TAL NSH
Total/NA	Analysis	8270D		1	270 mL	1.0 mL	349061	06/21/16 18:13	RP	TAL NSH
Total/NA	Prep	8151A			1075 mL	10 mL	349467	06/21/16 16:23	JKG	TAL NSH
Total/NA	Analysis	8151A		1	1075 mL	10 mL	349689	06/22/16 13:04	JML	TAL NSH
Total/NA	Prep	3510C			1070 mL	1 mL	348568	06/17/16 11:53	MRM	TAL NSH
Total/NA	Analysis	NWTPH-Dx		1	1070 mL	1 mL	348824	06/19/16 19:21	A1B	TAL NSH

Client Sample ID: 0600 - 022 (7 day)

Lab Sample ID: 490-105848-2
Date Collected: 06/15/16 11:05
Matrix: Water
Date Received: 06/16/16 09:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3510C			270 mL	1.0 mL	348567	06/17/16 11:49	DHC	TAL NSH
Total/NA	Analysis	8270D		1	270 mL	1.0 mL	349061	06/21/16 18:34	RP	TAL NSH
Total/NA	Prep	8151A			1075 mL	10 mL	349467	06/21/16 16:23	JKG	TAL NSH
Total/NA	Analysis	8151A		1	1075 mL	10 mL	349689	06/22/16 13:20	JML	TAL NSH
Total/NA	Prep	3510C			1070 mL	1 mL	348568	06/17/16 11:53	MRM	TAL NSH
Total/NA	Analysis	NWTPH-Dx		1	1070 mL	1 mL	348824	06/19/16 20:14	A1B	TAL NSH

Client Sample ID: 0600 - 024 (7 day)

Lab Sample ID: 490-105848-3
Date Collected: 06/15/16 11:12
Matrix: Water
Date Received: 06/16/16 09:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3510C			270 mL	1.0 mL	348567	06/17/16 11:49	DHC	TAL NSH
Total/NA	Analysis	8270D		1	270 mL	1.0 mL	349061	06/21/16 18:56	RP	TAL NSH
Total/NA	Prep	8151A			1075 mL	10 mL	349467	06/21/16 16:23	JKG	TAL NSH
Total/NA	Analysis	8151A		1	1075 mL	10 mL	349689	06/22/16 13:35	JML	TAL NSH
Total/NA	Prep	8151A			1075 mL	10 mL	349467	06/21/16 16:23	JKG	TAL NSH
Total/NA	Analysis	8151A		50	1075 mL	10 mL	349689	06/22/16 14:05	JML	TAL NSH
Total/NA	Prep	3510C			1070 mL	1 mL	348568	06/17/16 11:53	MRM	TAL NSH
Total/NA	Analysis	NWTPH-Dx		1	1070 mL	1 mL	348824	06/19/16 20:32	A1B	TAL NSH

Client Sample ID: 0600 - 027 (7 day)

Lab Sample ID: 490-105848-4
Date Collected: 06/15/16 11:20
Matrix: Water
Date Received: 06/16/16 09:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3510C			270 mL	1.0 mL	348567	06/17/16 11:49	DHC	TAL NSH
Total/NA	Analysis	8270D		1	270 mL	1.0 mL	349061	06/21/16 19:18	RP	TAL NSH
Total/NA	Prep	8151A			1075 mL	10 mL	349467	06/21/16 16:23	JKG	TAL NSH
Total/NA	Analysis	8151A		1	1075 mL	10 mL	349689	06/22/16 13:50	JML	TAL NSH
Total/NA	Prep	8151A			1075 mL	10 mL	349467	06/21/16 16:23	JKG	TAL NSH

Lab Chronicle

Client: Kemron Environmental Services, Inc.
Project/Site: Washington Wood Preserving ISS

TestAmerica Job ID: 490-105848-1

Client Sample ID: 0600 - 027 (7 day)
Date Collected: 06/15/16 11:20
Date Received: 06/16/16 09:00

Lab Sample ID: 490-105848-4
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8151A		50	1075 mL	10 mL	349689	06/22/16 14:21	JML	TAL NSH
Total/NA	Prep	3510C			1070 mL	1 mL	348568	06/17/16 11:53	MRM	TAL NSH
Total/NA	Analysis	NWTPH-Dx		1	1070 mL	1 mL	348824	06/19/16 20:50	A1B	TAL NSH

Laboratory References:

TAL NSH = TestAmerica Nashville, 2960 Foster Creighton Drive, Nashville, TN 37204, TEL (615)726-0177

Method Summary

Client: Kemron Environmental Services, Inc.
Project/Site: Washington Wood Preserving ISS

TestAmerica Job ID: 490-105848-1

Method	Method Description	Protocol	Laboratory
8270D	Semivolatile Organic Compounds (GC/MS)	SW846	TAL NSH
8151A	Herbicides (GC)	SW846	TAL NSH
NWTPH-Dx	Northwest - Semi-Volatile Petroleum Products (GC)	NWTPH	TAL NSH

Protocol References:

NWTPH = Northwest Total Petroleum Hydrocarbon

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL NSH = TestAmerica Nashville, 2960 Foster Creighton Drive, Nashville, TN 37204, TEL (615)726-0177

Certification Summary

Client: Kemron Environmental Services, Inc.
Project/Site: Washington Wood Preserving ISS

TestAmerica Job ID: 490-105848-1

Laboratory: TestAmerica Nashville

The certifications listed below are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
Washington	State Program	10	C789	07-19-16 *

* Certification renewal pending - certification considered valid.

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

Nashville, TN

COOLER RECEIPT FORM

490-105848 Chain of Custody

Cooler Received/Opened On 6/16/2016 @ 900

Time Samples Removed From Cooler__________ Time Samples Placed In Storage 1628 (2 Hour Window)

1. Tracking # N/A (last 4 digits, FedEx) Courier: _bus_

   IR Gun ID 97310166 pH Strip Lot HC564992 Chlorine Strip Lot 072815A

2. Temperature of rep. sample or temp blank when opened: 1.9 *Degrees Celsius*

3. If Item #2 temperature is 0°C or less, was the representative sample or temp blank frozen? YES NO...NA

4. Were custody seals on outside of cooler? YES...NO...NA

   If yes, how many and where: 1 front

5. Were the seals intact, signed, and dated correctly? YES...NO...NA

6. Were custody papers inside cooler? YES...NO...NA

I certify that I opened the cooler and answered questions 1-6 (intial) EGA

7. Were custody seals on containers: YES NO and Intact YES...NO...NA

   Were these signed and dated correctly? YES...NO...NA

8. Packing mat'l used? Bubblewrap Plastic bag Peanuts Vermiculite Foam Insert Paper Other None

9. Cooling process: Ice Ice-pack Ice (direct contact) Dry ice Other None

10. Did all containers arrive in good condition (unbroken)? YES...NO...NA

11. Were all container labels complete (#, date, signed, pres., etc)? YES...NO...NA

12. Did all container labels and tags agree with custody papers? YES...NO...NA

13a. Were VOA vials received? YES...NO...NA

b. Was there any observable headspace present in any VOA vial? YES...NO...NA

14. Was there a Trip Blank in this cooler? YES...NO...NA If multiple coolers, sequence # N/A

I certify that I unloaded the cooler and answered questions 7-14 (intial) AOS

15a. On pres'd bottles, did pH test strips suggest preservation reached the correct pH level? YES..NO..NA

b. Did the bottle labels indicate that the correct preservatives were used YES...NO...NA

16. Was residual chlorine present? YES...NO...NA

I certify that I checked for chlorine and pH as per SOP and answered questions 15-16 (intial) AOS

17. Were custody papers properly filled out (ink, signed, etc)? YES...NO...NA

18. Did you sign the custody papers in the appropriate place? YES...NO...NA

19. Were correct containers used for the analysis requested? YES...NO...NA

20. Was sufficient amount of sample sent in each container? YES...NO...NA

I certify that I entered this project into LIMS and answered questions 17-20 (intial) AOS

I certify that I attached a label with the unique LIMS number to each container (intial) AOS

21. Were there Non-Conformance issues at login? YES..NO Was a NCM generated? YES..NO...# N/A

BIS = Broken in shipment

681-Atlanta

TestAmerica Nashville
2960 Foster Creighton Drive
Nashville, TN 37204
Phone (615) 726-0177 Fax (615) 726-3404

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Information	Sampler: Tomecia Bradley	Lab PM: Baker, Heather	Carrier Tracking No(s):
Client Contact: Mr. Tommy Jordan	Phone: 404-601-6927	E-Mail: heather.baker@testamericainc.com	COC No: 490-54011-17498.4
Company: Kemron Environmental Services, Inc.			Page: Page 4 of 4
			Job #:
Address: 1359A Ellsworth Industrial Blvd.	Due Date Requested: 6/30/16		
City: Atlanta	TAT Requested (days): 10		
State, Zip: GA, 30318			
Phone: 404-516-3172(Tel)	PO #: Purchase Order Requested		
Email: tjordan@kemron.com	WO #:		
Project Name: Washington Wood ~~Treating~~ Preserving ISS	Project #: 49010102		
Site:	SSOW#:		

Analysis Requested

Preservation Codes:
A - HCL, B - NaOH, C - Zn Acetate, D - Nitric Acid, E - NaHSO4, F - MeOH, G - Amchlor, H - Ascorbic, I - Ice, J - DI Water, K - EDTA, L - EDA, M - Hexane, N - None, O - AsNaO2, P - Na2O4S, Q - Na2SO3, R - Na2S2O3
Other:

Loc: 490
105848

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	8270D - Polyaromatic Hydrocarbons	8151A - PCP	NWTPH_Dx - NWTPH	Total Number of containers	Special Instructions/Note:
				Preservation Code:			N	N	N		
0600 - 019 (7 day)	6.15.16	1100	G	Water			X	X	X		
0600 - 022 (7 day)	↓	1105	G	Water			X	X	X		
0600 - 024 (7 day)	↓	1112	G	Water			X	X	X		
0600 - 027 (7 day)	↓	1120	G				X	X	X		

Possible Hazard Identification
☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☒ Disposal By Lab ☐ Archive For ______ Months

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by:		Date:	Time:		Method of Shipment:	
Relinquished by: Tomecia Bradley	Date/Time: 6.15.16 1313	Company: Kemron	Received by:		Date/Time: 6/15/16 13:21	Company: TA
Relinquished by:	Date/Time: 6/15/16 14:00	Company: TA	Received by:		Date/Time: 6/16/16 0935	Company: TAN
Relinquished by:	Date/Time:	Company:	Received by:		Date/Time:	Company:

Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:	Cooler Temperature(s) °C and Other Remarks: 1.9

Login Sample Receipt Checklist

Client: Kemron Environmental Services, Inc.

Job Number: 490-105848-1

Login Number: 105848
List Number: 1
Creator: Stvartak, Anthony Q

List Source: TestAmerica Nashville

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Nashville
2960 Foster Creighton Drive
Nashville, TN 37204
Tel: (615)726-0177

TestAmerica Job ID: 490-106362-1
Client Project/Site: Washington Wood Preserving

For:
Kemron Environmental Services, Inc.
1359A Ellsworth Industrial Blvd.
Atlanta, Georgia 30318

Attn: Mr. Tommy Jordan

JFranklin

Authorized for release by:
7/7/2016 9:13:05 AM
Jannel Franklin, Project Manager I
(732)593-2551
jannel.franklin@testamericainc.com

Designee for

Heather Baker, Project Manager I
(615)301-5043
heather.baker@testamericainc.com

The test results in this report meet all 2003 NELAC and 2009 TNI requirements for accredited parameters, exceptions are noted in this report. This report may not be reproduced except in full, and with written approval from the laboratory. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

Table of Contents

Sample Summary

Client: Kemron Environmental Services, Inc.
Project/Site: Washington Wood Preserving

TestAmerica Job ID: 490-106362-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
490-106362-1	0600-019 (14 day)	Water	06/22/16 11:20	06/23/16 09:30
490-106362-2	0600-022 (14 day)	Water	06/22/16 11:25	06/23/16 09:30
490-106362-3	0600-024 (14 day)	Water	06/22/16 11:30	06/23/16 09:30
490-106362-4	0600-027 (14 day)	Water	06/22/16 11:35	06/23/16 09:30

1 2 3 4 5 6 7 8 9 10 11 12 13

Job ID: 490-106362-1

Laboratory: TestAmerica Nashville

Narrative

Job Narrative
490-106362-1

Comments
No additional comments.

Receipt
The samples were received on 6/23/2016 9:30 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 1.0º C.

GC/MS Semi VOA
Method(s) 8270D: Insufficient sample volume was available to perform a matrix spike/matrix spike duplicate (MS/MSD) associated with preparation batch 490-350294 and analytical batch 490-350954.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

GC Semi VOA
Method(s) 8151A: Surrogate recovery for the following samples was outside control limits: 0600-024 (14 day) (490-106362-3) and 0600-027 (14 day) (490-106362-4). Evidence of matrix interference due to high target analytes is present; therefore, re-extraction and/or re-analysis was not performed.

Method(s) 8151A: Insufficient sample volume was available to perform a matrix spike/matrix spike duplicate (MS/MSD) associated with preparation batch 490-351426 and analytical batch 490-352839.

Method(s) NWTPH-Dx: The sample duplicate (DUP) precision for preparation batch 490-351735 was outside control limits. Sample matrix interference is suspected because the associated laboratory control sample (LCS) recovery was within acceptance limits.

Method(s) NWTPH-Dx: The following samples contained a hydrocarbon pattern which does not match a typical Total Petroleum Hydrocarbon (TPH) pattern used by the laboratory for quantitative purposes: 0600-019 (14 day) (490-106362-1), 0600-022 (14 day) (490-106362-2), 0600-024 (14 day) (490-106362-3), 0600-027 (14 day) (490-106362-4), (490-106597-C-1-A) and (490-106597-D-1-B DU).

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Organic Prep
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Qualifiers

GC/MS Semi VOA

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

GC Semi VOA

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
p	The %RPD between the primary and confirmation column/detector is >40%. The lower value has been reported.
X	Surrogate is outside control limits
F3	Duplicate RPD exceeds the control limit

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Client: Kemron Environmental Services, Inc.
Project/Site: Washington Wood Preserving

TestAmerica Job ID: 490-106362-1

Client Sample ID: 0600-019 (14 day)

Lab Sample ID: 490-106362-1

Date Collected: 06/22/16 11:20

Date Received: 06/23/16 09:30

Matrix: Water

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	ND		1.85	0.296	ug/L		06/24/16 09:29	06/27/16 16:07	1
Acenaphthylene	ND		1.85	0.324	ug/L		06/24/16 09:29	06/27/16 16:07	1
Anthracene	ND		1.85	0.352	ug/L		06/24/16 09:29	06/27/16 16:07	1
Benzo[a]anthracene	ND		1.85	0.296	ug/L		06/24/16 09:29	06/27/16 16:07	1
Benzo[a]pyrene	ND		1.85	0.352	ug/L		06/24/16 09:29	06/27/16 16:07	1
Benzo[b]fluoranthene	ND		1.85	0.333	ug/L		06/24/16 09:29	06/27/16 16:07	1
Benzo[g,h,i]perylene	ND		1.85	0.574	ug/L		06/24/16 09:29	06/27/16 16:07	1
Benzo[k]fluoranthene	ND		1.85	0.343	ug/L		06/24/16 09:29	06/27/16 16:07	1
Pyrene	ND		1.85	0.324	ug/L		06/24/16 09:29	06/27/16 16:07	1
Phenanthrene	ND		1.85	0.389	ug/L		06/24/16 09:29	06/27/16 16:07	1
Chrysene	ND		1.85	0.306	ug/L		06/24/16 09:29	06/27/16 16:07	1
Dibenz(a,h)anthracene	ND		1.85	0.417	ug/L		06/24/16 09:29	06/27/16 16:07	1
Fluoranthene	ND		1.85	0.296	ug/L		06/24/16 09:29	06/27/16 16:07	1
Fluorene	ND		1.85	0.296	ug/L		06/24/16 09:29	06/27/16 16:07	1
Indeno[1,2,3-cd]pyrene	ND		1.85	0.380	ug/L		06/24/16 09:29	06/27/16 16:07	1
Naphthalene	ND		1.85	0.343	ug/L		06/24/16 09:29	06/27/16 16:07	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Fluorobiphenyl (Surr)	*61*		*29 - 120*	*06/24/16 09:29*	*06/27/16 16:07*	*1*
Terphenyl-d14 (Surr)	*74*		*13 - 120*	*06/24/16 09:29*	*06/27/16 16:07*	*1*
Nitrobenzene-d5 (Surr)	*65*		*27 - 120*	*06/24/16 09:29*	*06/27/16 16:07*	*1*

Method: 8151A - Herbicides (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	**0.352**	**J p**	1.86	0.279	ug/L		06/28/16 16:47	07/05/16 15:22	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dichloroacetic acid(Surr)	*105*		*10 - 150*	*06/28/16 16:47*	*07/05/16 15:22*	*1*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C24	**371**		93.5	26.2	ug/L		06/29/16 14:52	06/30/16 14:48	1
C24-C40	**49.0**	**J**	93.5	46.7	ug/L		06/29/16 14:52	06/30/16 14:48	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*117*		*50 - 150*	*06/29/16 14:52*	*06/30/16 14:48*	*1*

Client Sample ID: 0600-022 (14 day)

Lab Sample ID: 490-106362-2

Date Collected: 06/22/16 11:25
Matrix: Water
Date Received: 06/23/16 09:30

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	ND		1.85	0.296	ug/L		06/24/16 09:29	06/27/16 16:28	1
Acenaphthylene	ND		1.85	0.324	ug/L		06/24/16 09:29	06/27/16 16:28	1
Anthracene	ND		1.85	0.352	ug/L		06/24/16 09:29	06/27/16 16:28	1
Benzo[a]anthracene	ND		1.85	0.296	ug/L		06/24/16 09:29	06/27/16 16:28	1
Benzo[a]pyrene	ND		1.85	0.352	ug/L		06/24/16 09:29	06/27/16 16:28	1
Benzo[b]fluoranthene	ND		1.85	0.333	ug/L		06/24/16 09:29	06/27/16 16:28	1
Benzo[g,h,i]perylene	ND		1.85	0.574	ug/L		06/24/16 09:29	06/27/16 16:28	1
Benzo[k]fluoranthene	ND		1.85	0.343	ug/L		06/24/16 09:29	06/27/16 16:28	1
Pyrene	ND		1.85	0.324	ug/L		06/24/16 09:29	06/27/16 16:28	1
Phenanthrene	ND		1.85	0.389	ug/L		06/24/16 09:29	06/27/16 16:28	1
Chrysene	ND		1.85	0.306	ug/L		06/24/16 09:29	06/27/16 16:28	1
Dibenz(a,h)anthracene	ND		1.85	0.417	ug/L		06/24/16 09:29	06/27/16 16:28	1
Fluoranthene	ND		1.85	0.296	ug/L		06/24/16 09:29	06/27/16 16:28	1
Fluorene	ND		1.85	0.296	ug/L		06/24/16 09:29	06/27/16 16:28	1
Indeno[1,2,3-cd]pyrene	ND		1.85	0.380	ug/L		06/24/16 09:29	06/27/16 16:28	1
Naphthalene	**0.353**	**J**	1.85	0.343	ug/L		06/24/16 09:29	06/27/16 16:28	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Fluorobiphenyl (Surr)	*67*		*29 - 120*	*06/24/16 09:29*	*06/27/16 16:28*	*1*
Terphenyl-d14 (Surr)	*79*		*13 - 120*	*06/24/16 09:29*	*06/27/16 16:28*	*1*
Nitrobenzene-d5 (Surr)	*68*		*27 - 120*	*06/24/16 09:29*	*06/27/16 16:28*	*1*

Method: 8151A - Herbicides (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	**0.319**	**J p**	1.86	0.279	ug/L		06/28/16 16:47	07/05/16 15:38	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dichloroacetic acid(Surr)	*105*		*10 - 150*	*06/28/16 16:47*	*07/05/16 15:38*	*1*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C24	**290**		93.5	26.2	ug/L		06/29/16 14:52	06/30/16 15:05	1
C24-C40	ND		93.5	46.7	ug/L		06/29/16 14:52	06/30/16 15:05	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*120*		*50 - 150*	*06/29/16 14:52*	*06/30/16 15:05*	*1*

Client Sample ID: 0600-024 (14 day)

Lab Sample ID: 490-106362-3

Date Collected: 06/22/16 11:30

Matrix: Water

Date Received: 06/23/16 09:30

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	**2.23**		1.85	0.296	ug/L		06/24/16 09:29	06/27/16 16:49	1
Acenaphthylene	ND		1.85	0.324	ug/L		06/24/16 09:29	06/27/16 16:49	1
Anthracene	**0.438**	**J**	1.85	0.352	ug/L		06/24/16 09:29	06/27/16 16:49	1
Benzo[a]anthracene	ND		1.85	0.296	ug/L		06/24/16 09:29	06/27/16 16:49	1
Benzo[a]pyrene	ND		1.85	0.352	ug/L		06/24/16 09:29	06/27/16 16:49	1
Benzo[b]fluoranthene	ND		1.85	0.333	ug/L		06/24/16 09:29	06/27/16 16:49	1
Benzo[g,h,i]perylene	ND		1.85	0.574	ug/L		06/24/16 09:29	06/27/16 16:49	1
Benzo[k]fluoranthene	ND		1.85	0.343	ug/L		06/24/16 09:29	06/27/16 16:49	1
Pyrene	ND		1.85	0.324	ug/L		06/24/16 09:29	06/27/16 16:49	1
Phenanthrene	**2.22**		1.85	0.389	ug/L		06/24/16 09:29	06/27/16 16:49	1
Chrysene	ND		1.85	0.306	ug/L		06/24/16 09:29	06/27/16 16:49	1
Dibenz(a,h)anthracene	ND		1.85	0.417	ug/L		06/24/16 09:29	06/27/16 16:49	1
Fluoranthene	ND		1.85	0.296	ug/L		06/24/16 09:29	06/27/16 16:49	1
Fluorene	**1.80**	**J**	1.85	0.296	ug/L		06/24/16 09:29	06/27/16 16:49	1
Indeno[1,2,3-cd]pyrene	ND		1.85	0.380	ug/L		06/24/16 09:29	06/27/16 16:49	1
Naphthalene	**8.04**		1.85	0.343	ug/L		06/24/16 09:29	06/27/16 16:49	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Fluorobiphenyl (Surr)	*66*		*29 - 120*	*06/24/16 09:29*	*06/27/16 16:49*	*1*
Terphenyl-d14 (Surr)	*77*		*13 - 120*	*06/24/16 09:29*	*06/27/16 16:49*	*1*
Nitrobenzene-d5 (Surr)	*69*		*27 - 120*	*06/24/16 09:29*	*06/27/16 16:49*	*1*

Method: 8151A - Herbicides (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	**139**		93.0	14.0	ug/L		06/28/16 16:47	07/06/16 11:03	50

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dichloroacetic acid(Surr)	*2660*	*X*	*10 - 150*	*06/28/16 16:47*	*07/05/16 15:53*	*1*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C24	**976**		93.5	26.2	ug/L		06/29/16 14:52	06/30/16 15:23	1
C24-C40	**53.8**	**J**	93.5	46.7	ug/L		06/29/16 14:52	06/30/16 15:23	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*131*		*50 - 150*	*06/29/16 14:52*	*06/30/16 15:23*	*1*

Client Sample ID: 0600-027 (14 day)

Lab Sample ID: 490-106362-4

Date Collected: 06/22/16 11:35
Matrix: Water
Date Received: 06/23/16 09:30

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	**1.63**	**J**	1.85	0.296	ug/L		06/24/16 09:29	06/27/16 17:09	1
Acenaphthylene	ND		1.85	0.324	ug/L		06/24/16 09:29	06/27/16 17:09	1
Anthracene	**0.356**	**J**	1.85	0.352	ug/L		06/24/16 09:29	06/27/16 17:09	1
Benzo[a]anthracene	ND		1.85	0.296	ug/L		06/24/16 09:29	06/27/16 17:09	1
Benzo[a]pyrene	ND		1.85	0.352	ug/L		06/24/16 09:29	06/27/16 17:09	1
Benzo[b]fluoranthene	ND		1.85	0.333	ug/L		06/24/16 09:29	06/27/16 17:09	1
Benzo[g,h,i]perylene	ND		1.85	0.574	ug/L		06/24/16 09:29	06/27/16 17:09	1
Benzo[k]fluoranthene	ND		1.85	0.343	ug/L		06/24/16 09:29	06/27/16 17:09	1
Pyrene	ND		1.85	0.324	ug/L		06/24/16 09:29	06/27/16 17:09	1
Phenanthrene	**1.81**	**J**	1.85	0.389	ug/L		06/24/16 09:29	06/27/16 17:09	1
Chrysene	ND		1.85	0.306	ug/L		06/24/16 09:29	06/27/16 17:09	1
Dibenz(a,h)anthracene	ND		1.85	0.417	ug/L		06/24/16 09:29	06/27/16 17:09	1
Fluoranthene	ND		1.85	0.296	ug/L		06/24/16 09:29	06/27/16 17:09	1
Fluorene	**1.36**	**J**	1.85	0.296	ug/L		06/24/16 09:29	06/27/16 17:09	1
Indeno[1,2,3-cd]pyrene	ND		1.85	0.380	ug/L		06/24/16 09:29	06/27/16 17:09	1
Naphthalene	**5.03**		1.85	0.343	ug/L		06/24/16 09:29	06/27/16 17:09	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Fluorobiphenyl (Surr)	*64*		*29 - 120*	*06/24/16 09:29*	*06/27/16 17:09*	*1*
Terphenyl-d14 (Surr)	*82*		*13 - 120*	*06/24/16 09:29*	*06/27/16 17:09*	*1*
Nitrobenzene-d5 (Surr)	*65*		*27 - 120*	*06/24/16 09:29*	*06/27/16 17:09*	*1*

Method: 8151A - Herbicides (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	**78.9**	**J**	93.0	14.0	ug/L		06/28/16 16:47	07/06/16 11:18	50

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dichloroacetic acid(Surr)	*1590*	*X*	*10 - 150*	*06/28/16 16:47*	*07/05/16 16:08*	*1*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C24	**731**		93.5	26.2	ug/L		06/29/16 14:52	06/30/16 15:40	1
C24-C40	ND		93.5	46.7	ug/L		06/29/16 14:52	06/30/16 15:40	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*130*		*50 - 150*	*06/29/16 14:52*	*06/30/16 15:40*	*1*

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Lab Sample ID: MB 490-350294/1-A
Matrix: Water
Analysis Batch: 350954

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 350294

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	ND		2.00	0.320	ug/L		06/24/16 09:29	06/27/16 15:04	1
Acenaphthylene	ND		2.00	0.350	ug/L		06/24/16 09:29	06/27/16 15:04	1
Anthracene	ND		2.00	0.380	ug/L		06/24/16 09:29	06/27/16 15:04	1
Benzo[a]anthracene	ND		2.00	0.320	ug/L		06/24/16 09:29	06/27/16 15:04	1
Benzo[a]pyrene	ND		2.00	0.380	ug/L		06/24/16 09:29	06/27/16 15:04	1
Benzo[b]fluoranthene	ND		2.00	0.360	ug/L		06/24/16 09:29	06/27/16 15:04	1
Benzo[g,h,i]perylene	ND		2.00	0.620	ug/L		06/24/16 09:29	06/27/16 15:04	1
Benzo[k]fluoranthene	ND		2.00	0.370	ug/L		06/24/16 09:29	06/27/16 15:04	1
Pyrene	ND		2.00	0.350	ug/L		06/24/16 09:29	06/27/16 15:04	1
Phenanthrene	ND		2.00	0.420	ug/L		06/24/16 09:29	06/27/16 15:04	1
Chrysene	ND		2.00	0.330	ug/L		06/24/16 09:29	06/27/16 15:04	1
Dibenz(a,h)anthracene	ND		2.00	0.450	ug/L		06/24/16 09:29	06/27/16 15:04	1
Fluoranthene	ND		2.00	0.320	ug/L		06/24/16 09:29	06/27/16 15:04	1
Fluorene	ND		2.00	0.320	ug/L		06/24/16 09:29	06/27/16 15:04	1
Indeno[1,2,3-cd]pyrene	ND		2.00	0.410	ug/L		06/24/16 09:29	06/27/16 15:04	1
Naphthalene	ND		2.00	0.370	ug/L		06/24/16 09:29	06/27/16 15:04	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Fluorobiphenyl (Surr)	*58*		*29 - 120*	*06/24/16 09:29*	*06/27/16 15:04*	*1*
Terphenyl-d14 (Surr)	*77*		*13 - 120*	*06/24/16 09:29*	*06/27/16 15:04*	*1*
Nitrobenzene-d5 (Surr)	*58*		*27 - 120*	*06/24/16 09:29*	*06/27/16 15:04*	*1*

Lab Sample ID: LCS 490-350294/2-A
Matrix: Water
Analysis Batch: 350954

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 350294

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Acenaphthene	40.0	30.15		ug/L		75	36 - 129
Acenaphthylene	40.0	29.76		ug/L		74	36 - 120
Anthracene	40.0	30.54		ug/L		76	42 - 130
Benzo[a]anthracene	40.0	32.81		ug/L		82	41 - 131
Benzo[a]pyrene	40.0	31.60		ug/L		79	45 - 131
Benzo[b]fluoranthene	40.0	32.04		ug/L		80	43 - 132
Benzo[g,h,i]perylene	40.0	34.26		ug/L		86	38 - 138
Benzo[k]fluoranthene	40.0	32.88		ug/L		82	44 - 129
Pyrene	40.0	28.62		ug/L		72	37 - 129
Phenanthrene	40.0	31.76		ug/L		79	39 - 126
Chrysene	40.0	32.92		ug/L		82	39 - 130
Dibenz(a,h)anthracene	40.0	34.11		ug/L		85	43 - 140
Fluoranthene	40.0	34.50		ug/L		86	31 - 132
Fluorene	40.0	31.43		ug/L		79	37 - 130
Indeno[1,2,3-cd]pyrene	40.0	33.12		ug/L		83	40 - 136
Naphthalene	40.0	27.34		ug/L		68	32 - 120

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
2-Fluorobiphenyl (Surr)	*67*		*29 - 120*
Terphenyl-d14 (Surr)	*74*		*13 - 120*

Client: Kemron Environmental Services, Inc. TestAmerica Job ID: 490-106362-1
Project/Site: Washington Wood Preserving

Method: 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: LCS 490-350294/2-A **Client Sample ID: Lab Control Sample**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 350954 **Prep Batch: 350294**

Surrogate	LCS %Recovery	LCS Qualifier	Limits
Nitrobenzene-d5 (Surr)	*68*		*27 - 120*

Lab Sample ID: LCSD 490-350294/3-A **Client Sample ID: Lab Control Sample Dup**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 350954 **Prep Batch: 350294**

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Acenaphthene	40.0	25.77		ug/L		64	36 - 129	16	50
Acenaphthylene	40.0	25.22		ug/L		63	36 - 120	17	50
Anthracene	40.0	25.17		ug/L		63	42 - 130	19	50
Benzo[a]anthracene	40.0	27.67		ug/L		69	41 - 131	17	50
Benzo[a]pyrene	40.0	26.21		ug/L		66	45 - 131	19	50
Benzo[b]fluoranthene	40.0	27.41		ug/L		69	43 - 132	16	50
Benzo[g,h,i]perylene	40.0	28.36		ug/L		71	38 - 138	19	50
Benzo[k]fluoranthene	40.0	27.18		ug/L		68	44 - 129	19	50
Pyrene	40.0	23.96		ug/L		60	37 - 129	18	50
Phenanthrene	40.0	26.00		ug/L		65	39 - 126	20	50
Chrysene	40.0	27.68		ug/L		69	39 - 130	17	50
Dibenz(a,h)anthracene	40.0	28.34		ug/L		71	43 - 140	18	50
Fluoranthene	40.0	29.15		ug/L		73	31 - 132	17	50
Fluorene	40.0	26.59		ug/L		66	37 - 130	17	50
Indeno[1,2,3-cd]pyrene	40.0	27.30		ug/L		68	40 - 136	19	50
Naphthalene	40.0	23.96		ug/L		60	32 - 120	13	50

Surrogate	LCSD %Recovery	LCSD Qualifier	Limits
2-Fluorobiphenyl (Surr)	*60*		*29 - 120*
Terphenyl-d14 (Surr)	*66*		*13 - 120*
Nitrobenzene-d5 (Surr)	*63*		*27 - 120*

Method: 8151A - Herbicides (GC)

Lab Sample ID: MB 490-351426/1-A **Client Sample ID: Method Blank**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 352839 **Prep Batch: 351426**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	ND		2.00	0.300	ug/L		06/28/16 16:47	07/05/16 14:06	1

Surrogate	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
Dichloroacetic acid(Surr)	*92*		*10 - 150*	*06/28/16 16:47*	*07/05/16 14:06*	*1*

Lab Sample ID: LCS 490-351426/2-A **Client Sample ID: Lab Control Sample**
Matrix: Water **Prep Type: Total/NA**
Analysis Batch: 352839 **Prep Batch: 351426**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Pentachlorophenol	2.50	2.588		ug/L		104	10 - 150

Method: 8151A - Herbicides (GC) (Continued)

Lab Sample ID: LCS 490-351426/2-A
Matrix: Water
Analysis Batch: 352839

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 351426

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
Dichloroacetic acid(Surr)	*98*		*10 - 150*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Lab Sample ID: MB 490-351735/1-A
Matrix: Water
Analysis Batch: 351893

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 351735

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C24	ND		100	28.0	ug/L		06/29/16 14:52	06/30/16 13:38	1
C24-C40	ND		100	50.0	ug/L		06/29/16 14:52	06/30/16 13:38	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*109*		*50 - 150*	*06/29/16 14:52*	*06/30/16 13:38*	*1*

Lab Sample ID: LCS 490-351735/2-A
Matrix: Water
Analysis Batch: 351893

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 351735

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
C10-C24	1000	814.7		ug/L		81	51 - 132

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
o-Terphenyl	*106*		*50 - 150*

Lab Sample ID: 490-106597-D-1-B DU
Matrix: Water
Analysis Batch: 351893

Client Sample ID: Duplicate
Prep Type: Total/NA
Prep Batch: 351735

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
C10-C24	1190		741.7	F3	ug/L		46	41
C24-C40	1240		754.2	F3	ug/L		49	41

Surrogate	*DU %Recovery*	*DU Qualifier*	*Limits*
o-Terphenyl	*80*		*50 - 150*

QC Association Summary

Client: Kemron Environmental Services, Inc.
Project/Site: Washington Wood Preserving

TestAmerica Job ID: 490-106362-1

GC/MS Semi VOA

Prep Batch: 350294

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-106362-1	0600-019 (14 day)	Total/NA	Water	3510C	
490-106362-2	0600-022 (14 day)	Total/NA	Water	3510C	
490-106362-3	0600-024 (14 day)	Total/NA	Water	3510C	
490-106362-4	0600-027 (14 day)	Total/NA	Water	3510C	
LCS 490-350294/2-A	Lab Control Sample	Total/NA	Water	3510C	
LCSD 490-350294/3-A	Lab Control Sample Dup	Total/NA	Water	3510C	
MB 490-350294/1-A	Method Blank	Total/NA	Water	3510C	

Analysis Batch: 350954

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-106362-1	0600-019 (14 day)	Total/NA	Water	8270D	350294
490-106362-2	0600-022 (14 day)	Total/NA	Water	8270D	350294
490-106362-3	0600-024 (14 day)	Total/NA	Water	8270D	350294
490-106362-4	0600-027 (14 day)	Total/NA	Water	8270D	350294
LCS 490-350294/2-A	Lab Control Sample	Total/NA	Water	8270D	350294
LCSD 490-350294/3-A	Lab Control Sample Dup	Total/NA	Water	8270D	350294
MB 490-350294/1-A	Method Blank	Total/NA	Water	8270D	350294

GC Semi VOA

Prep Batch: 351426

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-106362-1	0600-019 (14 day)	Total/NA	Water	8151A	
490-106362-2	0600-022 (14 day)	Total/NA	Water	8151A	
490-106362-3	0600-024 (14 day)	Total/NA	Water	8151A	
490-106362-4	0600-027 (14 day)	Total/NA	Water	8151A	
LCS 490-351426/2-A	Lab Control Sample	Total/NA	Water	8151A	
MB 490-351426/1-A	Method Blank	Total/NA	Water	8151A	

Prep Batch: 351735

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-106362-1	0600-019 (14 day)	Total/NA	Water	3510C	
490-106362-2	0600-022 (14 day)	Total/NA	Water	3510C	
490-106362-3	0600-024 (14 day)	Total/NA	Water	3510C	
490-106362-4	0600-027 (14 day)	Total/NA	Water	3510C	
490-106597-D-1-B DU	Duplicate	Total/NA	Water	3510C	
LCS 490-351735/2-A	Lab Control Sample	Total/NA	Water	3510C	
MB 490-351735/1-A	Method Blank	Total/NA	Water	3510C	

Analysis Batch: 351893

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-106362-1	0600-019 (14 day)	Total/NA	Water	NWTPH-Dx	351735
490-106362-2	0600-022 (14 day)	Total/NA	Water	NWTPH-Dx	351735
490-106362-3	0600-024 (14 day)	Total/NA	Water	NWTPH-Dx	351735
490-106362-4	0600-027 (14 day)	Total/NA	Water	NWTPH-Dx	351735
490-106597-D-1-B DU	Duplicate	Total/NA	Water	NWTPH-Dx	351735
LCS 490-351735/2-A	Lab Control Sample	Total/NA	Water	NWTPH-Dx	351735
MB 490-351735/1-A	Method Blank	Total/NA	Water	NWTPH-Dx	351735

GC Semi VOA (Continued)

Analysis Batch: 352839

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-106362-1	0600-019 (14 day)	Total/NA	Water	8151A	351426
490-106362-2	0600-022 (14 day)	Total/NA	Water	8151A	351426
490-106362-3	0600-024 (14 day)	Total/NA	Water	8151A	351426
490-106362-4	0600-027 (14 day)	Total/NA	Water	8151A	351426
LCS 490-351426/2-A	Lab Control Sample	Total/NA	Water	8151A	351426
MB 490-351426/1-A	Method Blank	Total/NA	Water	8151A	351426

Analysis Batch: 353132

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-106362-3	0600-024 (14 day)	Total/NA	Water	8151A	351426
490-106362-4	0600-027 (14 day)	Total/NA	Water	8151A	351426

Lab Chronicle

Client: Kemron Environmental Services, Inc.
Project/Site: Washington Wood Preserving

TestAmerica Job ID: 490-106362-1

Client Sample ID: 0600-019 (14 day)

Lab Sample ID: 490-106362-1
Date Collected: 06/22/16 11:20
Matrix: Water
Date Received: 06/23/16 09:30

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3510C			270 mL	1 mL	350294	06/24/16 09:29	KB	TAL NSH
Total/NA	Analysis	8270D		1	270 mL	1 mL	350954	06/27/16 16:07	T1C	TAL NSH
Total/NA	Prep	8151A			1075 mL	10 mL	351426	06/28/16 16:47	JKG	TAL NSH
Total/NA	Analysis	8151A		1	1075 mL	10 mL	352839	07/05/16 15:22	JML	TAL NSH
Total/NA	Prep	3510C			1070 mL	1 mL	351735	06/29/16 14:52	KB	TAL NSH
Total/NA	Analysis	NWTPH-Dx		1	1070 mL	1 mL	351893	06/30/16 14:48	MDW	TAL NSH

Client Sample ID: 0600-022 (14 day)

Lab Sample ID: 490-106362-2
Date Collected: 06/22/16 11:25
Matrix: Water
Date Received: 06/23/16 09:30

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3510C			270 mL	1 mL	350294	06/24/16 09:29	KB	TAL NSH
Total/NA	Analysis	8270D		1	270 mL	1 mL	350954	06/27/16 16:28	T1C	TAL NSH
Total/NA	Prep	8151A			1075 mL	10 mL	351426	06/28/16 16:47	JKG	TAL NSH
Total/NA	Analysis	8151A		1	1075 mL	10 mL	352839	07/05/16 15:38	JML	TAL NSH
Total/NA	Prep	3510C			1070 mL	1 mL	351735	06/29/16 14:52	KB	TAL NSH
Total/NA	Analysis	NWTPH-Dx		1	1070 mL	1 mL	351893	06/30/16 15:05	MDW	TAL NSH

Client Sample ID: 0600-024 (14 day)

Lab Sample ID: 490-106362-3
Date Collected: 06/22/16 11:30
Matrix: Water
Date Received: 06/23/16 09:30

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3510C			270 mL	1 mL	350294	06/24/16 09:29	KB	TAL NSH
Total/NA	Analysis	8270D		1	270 mL	1 mL	350954	06/27/16 16:49	T1C	TAL NSH
Total/NA	Prep	8151A			1075 mL	10 mL	351426	06/28/16 16:47	JKG	TAL NSH
Total/NA	Analysis	8151A		1	1075 mL	10 mL	352839	07/05/16 15:53	JML	TAL NSH
Total/NA	Prep	8151A			1075 mL	10 mL	351426	06/28/16 16:47	JKG	TAL NSH
Total/NA	Analysis	8151A		50	1075 mL	10 mL	353132	07/06/16 11:03	JML	TAL NSH
Total/NA	Prep	3510C			1070 mL	1 mL	351735	06/29/16 14:52	KB	TAL NSH
Total/NA	Analysis	NWTPH-Dx		1	1070 mL	1 mL	351893	06/30/16 15:23	MDW	TAL NSH

Client Sample ID: 0600-027 (14 day)

Lab Sample ID: 490-106362-4
Date Collected: 06/22/16 11:35
Matrix: Water
Date Received: 06/23/16 09:30

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3510C			270 mL	1 mL	350294	06/24/16 09:29	KB	TAL NSH
Total/NA	Analysis	8270D		1	270 mL	1 mL	350954	06/27/16 17:09	T1C	TAL NSH
Total/NA	Prep	8151A			1075 mL	10 mL	351426	06/28/16 16:47	JKG	TAL NSH
Total/NA	Analysis	8151A		1	1075 mL	10 mL	352839	07/05/16 16:08	JML	TAL NSH
Total/NA	Prep	8151A			1075 mL	10 mL	351426	06/28/16 16:47	JKG	TAL NSH

Client Sample ID: 0600-027 (14 day)
Date Collected: 06/22/16 11:35
Date Received: 06/23/16 09:30

Lab Sample ID: 490-106362-4
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8151A		50	1075 mL	10 mL	353132	07/06/16 11:18	JML	TAL NSH
Total/NA	Prep	3510C			1070 mL	1 mL	351735	06/29/16 14:52	KB	TAL NSH
Total/NA	Analysis	NWTPH-Dx		1	1070 mL	1 mL	351893	06/30/16 15:40	MDW	TAL NSH

Laboratory References:

TAL NSH = TestAmerica Nashville, 2960 Foster Creighton Drive, Nashville, TN 37204, TEL (615)726-0177

Method Summary

Method	Method Description	Protocol	Laboratory
8270D	Semivolatile Organic Compounds (GC/MS)	SW846	TAL NSH
8151A	Herbicides (GC)	SW846	TAL NSH
NWTPH-Dx	Northwest - Semi-Volatile Petroleum Products (GC)	NWTPH	TAL NSH

Protocol References:

NWTPH = Northwest Total Petroleum Hydrocarbon

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL NSH = TestAmerica Nashville, 2960 Foster Creighton Drive, Nashville, TN 37204, TEL (615)726-0177

Certification Summary

Client: Kemron Environmental Services, Inc.
Project/Site: Washington Wood Preserving

TestAmerica Job ID: 490-106362-1

Laboratory: TestAmerica Nashville

The certifications listed below are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
Washington	State Program	10	C789	07-19-16 *

* Certification renewal pending - certification considered valid.

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

Atlanta

490-106362 Chain of Custody

Nashville, TN

COOLER RECEIPT FORM

Cooler Received/Opened On 6/23/2016 @ 930

Time Samples Removed From Cooler 1800 Time Samples Placed In St

1. Tracking # 3379 (last 4 digits, FedEx) Courier: _fedex_ 1845

   IR Gun ID 18290455 pH Strip Lot HC564992 Chlorine Strip Lot 072815A

2. Temperature of rep. sample or temp blank when opened: 1.0 *Degrees Celsius*

3. If Item #2 temperature is 0°C or less, was the representative sample or temp blank frozen? YES NO...NA

4. Were custody seals on outside of cooler? YES...NO...NA

   If yes, how many and where: 1 front

5. Were the seals intact, signed, and dated correctly? YES...NO...NA

6. Were custody papers inside cooler? YES...NO...NA

I certify that I opened the cooler and answered questions 1-6 (intial) D

7. Were custody seals on containers: YES NO and Intact YES...NO...NA

   Were these signed and dated correctly? YES...NO...NA

8. Packing mat'l used? Bubblewrap Plastic bag Peanuts Vermiculite Foam Insert Paper Other None

9. Cooling process: Ice Ice-pack Ice (direct contact) Dry ice Other None

10. Did all containers arrive in good condition (unbroken)? YES...NO...NA

11. Were all container labels complete (#, date, signed, pres., etc)? YES...NO...NA

12. Did all container labels and tags agree with custody papers? YES...NO...NA

13a. Were VOA vials received? YES...NO...NA

b. Was there any observable headspace present in any VOA vial? YES...NO...NA

14. Was there a Trip Blank in this cooler? YES...NO...NA If multiple coolers, sequence #________

I certify that I unloaded the cooler and answered questions 7-14 (intial) MMB

15a. On pres'd bottles, did pH test strips suggest preservation reached the correct pH level? YES..NO..NA

b. Did the bottle labels indicate that the correct preservatives were used YES...NO...NA

16. Was residual chlorine present? YES...NO...NA

I certify that I checked for chlorine and pH as per SOP and answered questions 15-16 (intial) MMB

17. Were custody papers properly filled out (ink, signed, etc)? YES...NO...NA

18. Did you sign the custody papers in the appropriate place? YES...NO...NA

19. Were correct containers used for the analysis requested? YES...NO...NA

20. Was sufficient amount of sample sent in each container? YES...NO...NA

I certify that I entered this project into LIMS and answered questions 17-20 (intial) MMB

I certify that I attached a label with the unique LIMS number to each container (intial) MMB

21. Were there Non-Conformance issues at login? YES..NO Was a NCM generated? YES..NO...#_______

BIS = Broken in shipment

Cooler Receipt Form.doc

LF-1

End of Form

Revised 12/15/15

TestAmerica Nashville
2960 Foster Creighton Drive
Nashville, TN 37204
Phone (615) 726-0177 Fax (615) 726-3404

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Information			
Client Contact: Mr. Tommy Jordan	Sampler: Tomecia Bradley	Lab PM: Baker, Heather	Carrier Tracking No(s):
Company: Kemron Environmental Services, Inc.	Phone: 404-601-6927	E-Mail: heather.baker@testamericainc.com	COC No: 490-54011-17498.3
Address: 1359A Ellsworth Industrial Blvd.	Due Date Requested: ~~6-30-16~~ 7.8.16		Page: Page ~~3 of 4~~ 1 of 1
City: Atlanta	TAT Requested (days): 10		Job #: [illegible]
State, Zip: GA, 30318			
Phone: 404-516-3172(Tel)	PO #: ~~Purchase Order Requested~~ SH0600		
Email: tjordan@kemron.com	WO #:		
Project Name: Washington Wood ~~Treating~~ Preserving JS	Project #: 49010102		
Site:	SSOW#:		

Analysis Requested

Loc: 490
106362

Preservation Codes:

A - HCL	M - Hexane
B - NaOH	N - None
C - Zn Acetate	O - AsNaO2
D - Nitric Acid	P - Na2O4S
E - NaHSO4	Q - Na2SO3
F - MeOH	R - Na2S2O3
G - Amchlor	S - H2SO4
H - Ascorbic Acid	T - TSP Dodecahydrate
I - Ice	U - Acetone
J - DI Water	V - MCAA
K - EDTA	W - ph 4-5
L - EDA	Z - other (specify)

Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	8270D - Polyaromatic Hydrocarbons	8151A - PCP	NWTPH_Dx - NWTPH	Total Number of containers	Special Instructions/Note:
				Preservation Code:			N	N	N		
0600 - 019 (14 day)	6-22-16	1120	G	Water			X	X	X		
0600 - 022 (14 day)		1125	G	Water			X	X	X		
0600 - 024 (14 day)		1130	G	Water			X	X	X		
0600 - 027 (14 day)		1135	G	Water			X	X	X		
				Water							
				Water							
				Water							
				Water							
				Water							
				Water							
				Water							

Possible Hazard Identification
☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Radiological

Deliverable Requested: I, II, III, IV, Other (specify)

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☒ Disposal By Lab ☐ Archive For ________ Months

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:

Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Tomecia Bradley	6.22.16 2:20	Kemron		6/22/16 1420	TA
	6/22/16 1810	TA		6/23/16 0930	TAN

Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:	Cooler Temperature(s) °C and Other Remarks: 1.0

Login Sample Receipt Checklist

Client: Kemron Environmental Services, Inc. | Job Number: 490-106362-1

Login Number: 106362 | **List Source: TestAmerica Nashville**
List Number: 1
Creator: Ramos, Martina M

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Nashville
2960 Foster Creighton Drive
Nashville, TN 37204
Tel: (615)726-0177

TestAmerica Job ID: 490-107228-1
Client Project/Site: Washington Wood Preserving ISS

For:
Kemron Environmental Services, Inc.
1359A Ellsworth Industrial Blvd.
Atlanta, Georgia 30318

Attn: Mr. Tommy Jordan

Authorized for release by:
7/13/2016 1:48:37 PM
Jannel Franklin, Project Manager I
(732)593-2551
jannel.franklin@testamericainc.com

Designee for

Heather Baker, Project Manager I
(615)301-5043
heather.baker@testamericainc.com

1 2 3 4 5 6 7 8 9 10 11 12 13

The test results in this report meet all 2003 NELAC and 2009 TNI requirements for accredited parameters, exceptions are noted in this report. This report may not be reproduced except in full, and with written approval from the laboratory. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

Table of Contents

Sample Summary

Client: Kemron Environmental Services, Inc.
Project/Site: Washington Wood Preserving ISS

TestAmerica Job ID: 490-107228-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
490-107228-1	0600-019 (28 day)	Water	07/06/16 10:50	07/07/16 10:00
490-107228-2	0600-022 (28 day)	Water	07/06/16 10:55	07/07/16 10:00
490-107228-3	0600-024 (28 day)	Water	07/06/16 11:00	07/07/16 10:00
490-107228-4	0600-027 (28 day)	Water	07/06/16 11:02	07/07/16 10:00

1 2 3 4 5 6 7 8 9 10 11 12 13

Job ID: 490-107228-1

Laboratory: TestAmerica Nashville

Narrative

Job Narrative
490-107228-1

Comments
No additional comments.

Receipt
The samples were received on 7/7/2016 10:00 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperatures of the 2 coolers at receipt time were 1.3º C and 2.7º C.

GC/MS Semi VOA
Method(s) 8270D: Insufficient sample volume was available to perform a matrix spike/matrix spike duplicate (MS/MSD) associated with preparation batch 490-353757 and analytical batch 490-353994.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

GC Semi VOA
Method(s) 8151A: Surrogate recovery for the following samples was outside control limits: 0600-019 (28 day) (490-107228-1), 0600-022 (28 day) (490-107228-2), 0600-024 (28 day) (490-107228-3) and 0600-027 (28 day) (490-107228-4). Evidence of matrix interference due to high target analytes is present; therefore, re-extraction and/or re-analysis was not performed.

Method(s) 8151A: The %RPD between the primary and confirmation column exceeded 40% for Pentachlorophenol for the following samples: 0600-019 (28 day) (490-107228-1). The lower value(s) has been reported and qualified in accordance with the laboratory's SOP.

Method(s) 8151A: The %RPD between the primary and confirmation column exceeded 40% for Pentachlorophenol for the following samples: 0600-022 (28 day) (490-107228-2). The lower value(s) has been reported and qualified in accordance with the laboratory's SOP.

Method(s) 8151A: Insufficient sample volume was available to perform a matrix spike/matrix spike duplicate (MS/MSD) associated with preparation batch 490-354103 and analytical batch 490-354350.

Method(s) 8151A: The following samples was diluted due to the nature of the sample matrix: 0600-024 (28 day) (490-107228-3) and 0600-027 (28 day) (490-107228-4). Elevated reporting limits (RLs) are provided.

Method(s) NWTPH-Dx: The following samples contained a hydrocarbon pattern for analyte C10-C24 which does not match a typical Total Petroleum Hydrocarbon (TPH) pattern used by the laboratory for quantitative purposes: 0600-019 (28 day) (490-107228-1), 0600-022 (28 day) (490-107228-2), 0600-024 (28 day) (490-107228-3) and 0600-027 (28 day) (490-107228-4).

Method(s) NWTPH-Dx: Insufficient sample volume was available to perform a matrix spike/matrix spike duplicate/sample duplicate (MS/MSD/DUP) associated with 490-353933.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Organic Prep
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Qualifiers

GC/MS Semi VOA

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

GC Semi VOA

Qualifier	Qualifier Description
X	Surrogate is outside control limits
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
p	The %RPD between the primary and confirmation column/detector is >40%. The lower value has been reported.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

1 2 3 4 5 6 7 8 9 10 11 12 13

Client Sample ID: 0600-019 (28 day)

Lab Sample ID: 490-107228-1

Date Collected: 07/06/16 10:50

Matrix: Water

Date Received: 07/07/16 10:00

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	ND		1.72	0.276	ug/L		07/08/16 08:35	07/08/16 17:04	1
Acenaphthylene	ND		1.72	0.302	ug/L		07/08/16 08:35	07/08/16 17:04	1
Anthracene	ND		1.72	0.328	ug/L		07/08/16 08:35	07/08/16 17:04	1
Benzo[a]anthracene	ND		1.72	0.276	ug/L		07/08/16 08:35	07/08/16 17:04	1
Benzo[a]pyrene	ND		1.72	0.328	ug/L		07/08/16 08:35	07/08/16 17:04	1
Benzo[b]fluoranthene	ND		1.72	0.310	ug/L		07/08/16 08:35	07/08/16 17:04	1
Benzo[g,h,i]perylene	ND		1.72	0.534	ug/L		07/08/16 08:35	07/08/16 17:04	1
Benzo[k]fluoranthene	ND		1.72	0.319	ug/L		07/08/16 08:35	07/08/16 17:04	1
Pyrene	ND		1.72	0.302	ug/L		07/08/16 08:35	07/08/16 17:04	1
Phenanthrene	ND		1.72	0.362	ug/L		07/08/16 08:35	07/08/16 17:04	1
Chrysene	ND		1.72	0.284	ug/L		07/08/16 08:35	07/08/16 17:04	1
Dibenz(a,h)anthracene	ND		1.72	0.388	ug/L		07/08/16 08:35	07/08/16 17:04	1
Fluoranthene	ND		1.72	0.276	ug/L		07/08/16 08:35	07/08/16 17:04	1
Fluorene	ND		1.72	0.276	ug/L		07/08/16 08:35	07/08/16 17:04	1
Indeno[1,2,3-cd]pyrene	ND		1.72	0.353	ug/L		07/08/16 08:35	07/08/16 17:04	1
Naphthalene	ND		1.72	0.319	ug/L		07/08/16 08:35	07/08/16 17:04	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Fluorobiphenyl (Surr)	*41*		*29 - 120*	*07/08/16 08:35*	*07/08/16 17:04*	*1*
Terphenyl-d14 (Surr)	*70*		*13 - 120*	*07/08/16 08:35*	*07/08/16 17:04*	*1*
Nitrobenzene-d5 (Surr)	*41*		*27 - 120*	*07/08/16 08:35*	*07/08/16 17:04*	*1*

Method: 8151A - Herbicides (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	**0.344**	**J p**	1.86	0.279	ug/L		07/09/16 14:03	07/11/16 17:58	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dichloroacetic acid(Surr)	*418*	*X*	*10 - 150*	*07/09/16 14:03*	*07/11/16 17:58*	*1*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C24	**392**		93.5	26.2	ug/L		07/08/16 12:33	07/09/16 13:47	1
C24-C40	ND		93.5	46.7	ug/L		07/08/16 12:33	07/09/16 13:47	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*59*		*50 - 150*	*07/08/16 12:33*	*07/09/16 13:47*	*1*

Client Sample ID: 0600-022 (28 day)

Lab Sample ID: 490-107228-2

Date Collected: 07/06/16 10:55

Matrix: Water

Date Received: 07/07/16 10:00

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	ND		1.72	0.276	ug/L		07/08/16 08:35	07/08/16 17:25	1
Acenaphthylene	ND		1.72	0.302	ug/L		07/08/16 08:35	07/08/16 17:25	1
Anthracene	ND		1.72	0.328	ug/L		07/08/16 08:35	07/08/16 17:25	1
Benzo[a]anthracene	ND		1.72	0.276	ug/L		07/08/16 08:35	07/08/16 17:25	1
Benzo[a]pyrene	ND		1.72	0.328	ug/L		07/08/16 08:35	07/08/16 17:25	1
Benzo[b]fluoranthene	ND		1.72	0.310	ug/L		07/08/16 08:35	07/08/16 17:25	1
Benzo[g,h,i]perylene	ND		1.72	0.534	ug/L		07/08/16 08:35	07/08/16 17:25	1
Benzo[k]fluoranthene	ND		1.72	0.319	ug/L		07/08/16 08:35	07/08/16 17:25	1
Pyrene	ND		1.72	0.302	ug/L		07/08/16 08:35	07/08/16 17:25	1
Phenanthrene	ND		1.72	0.362	ug/L		07/08/16 08:35	07/08/16 17:25	1
Chrysene	ND		1.72	0.284	ug/L		07/08/16 08:35	07/08/16 17:25	1
Dibenz(a,h)anthracene	ND		1.72	0.388	ug/L		07/08/16 08:35	07/08/16 17:25	1
Fluoranthene	ND		1.72	0.276	ug/L		07/08/16 08:35	07/08/16 17:25	1
Fluorene	ND		1.72	0.276	ug/L		07/08/16 08:35	07/08/16 17:25	1
Indeno[1,2,3-cd]pyrene	ND		1.72	0.353	ug/L		07/08/16 08:35	07/08/16 17:25	1
Naphthalene	ND		1.72	0.319	ug/L		07/08/16 08:35	07/08/16 17:25	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Fluorobiphenyl (Surr)	*54*		*29 - 120*	*07/08/16 08:35*	*07/08/16 17:25*	*1*
Terphenyl-d14 (Surr)	*76*		*13 - 120*	*07/08/16 08:35*	*07/08/16 17:25*	*1*
Nitrobenzene-d5 (Surr)	*56*		*27 - 120*	*07/08/16 08:35*	*07/08/16 17:25*	*1*

Method: 8151A - Herbicides (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	**0.291**	**J p**	1.86	0.279	ug/L		07/09/16 14:03	07/11/16 18:13	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dichloroacetic acid(Surr)	*175*	*X*	*10 - 150*	*07/09/16 14:03*	*07/11/16 18:13*	*1*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C24	**450**		93.5	26.2	ug/L		07/08/16 12:33	07/09/16 14:05	1
C24-C40	ND		93.5	46.7	ug/L		07/08/16 12:33	07/09/16 14:05	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*84*		*50 - 150*	*07/08/16 12:33*	*07/09/16 14:05*	*1*

Client Sample Results

Client: Kemron Environmental Services, Inc.
Project/Site: Washington Wood Preserving ISS

TestAmerica Job ID: 490-107228-1

Client Sample ID: 0600-024 (28 day)

Lab Sample ID: 490-107228-3

Date Collected: 07/06/16 11:00
Date Received: 07/07/16 10:00

Matrix: Water

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	**1.97**		1.72	0.276	ug/L		07/08/16 08:35	07/08/16 17:46	1
Acenaphthylene	ND		1.72	0.302	ug/L		07/08/16 08:35	07/08/16 17:46	1
Anthracene	ND		1.72	0.328	ug/L		07/08/16 08:35	07/08/16 17:46	1
Benzo[a]anthracene	ND		1.72	0.276	ug/L		07/08/16 08:35	07/08/16 17:46	1
Benzo[a]pyrene	ND		1.72	0.328	ug/L		07/08/16 08:35	07/08/16 17:46	1
Benzo[b]fluoranthene	ND		1.72	0.310	ug/L		07/08/16 08:35	07/08/16 17:46	1
Benzo[g,h,i]perylene	ND		1.72	0.534	ug/L		07/08/16 08:35	07/08/16 17:46	1
Benzo[k]fluoranthene	ND		1.72	0.319	ug/L		07/08/16 08:35	07/08/16 17:46	1
Pyrene	ND		1.72	0.302	ug/L		07/08/16 08:35	07/08/16 17:46	1
Phenanthrene	**1.85**		1.72	0.362	ug/L		07/08/16 08:35	07/08/16 17:46	1
Chrysene	ND		1.72	0.284	ug/L		07/08/16 08:35	07/08/16 17:46	1
Dibenz(a,h)anthracene	ND		1.72	0.388	ug/L		07/08/16 08:35	07/08/16 17:46	1
Fluoranthene	ND		1.72	0.276	ug/L		07/08/16 08:35	07/08/16 17:46	1
Fluorene	**1.56**	**J**	1.72	0.276	ug/L		07/08/16 08:35	07/08/16 17:46	1
Indeno[1,2,3-cd]pyrene	ND		1.72	0.353	ug/L		07/08/16 08:35	07/08/16 17:46	1
Naphthalene	**7.37**		1.72	0.319	ug/L		07/08/16 08:35	07/08/16 17:46	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Fluorobiphenyl (Surr)	*57*		*29 - 120*	*07/08/16 08:35*	*07/08/16 17:46*	*1*
Terphenyl-d14 (Surr)	*77*		*13 - 120*	*07/08/16 08:35*	*07/08/16 17:46*	*1*
Nitrobenzene-d5 (Surr)	*61*		*27 - 120*	*07/08/16 08:35*	*07/08/16 17:46*	*1*

Method: 8151A - Herbicides (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	**144**		93.0	14.0	ug/L		07/09/16 14:03	07/12/16 12:36	50

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dichloroacetic acid(Surr)	*2860*	*X*	*10 - 150*	*07/09/16 14:03*	*07/11/16 18:29*	*1*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C24	**947**		93.5	26.2	ug/L		07/08/16 12:33	07/09/16 14:22	1
C24-C40	**48.6**	**J**	93.5	46.7	ug/L		07/08/16 12:33	07/09/16 14:22	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*57*		*50 - 150*	*07/08/16 12:33*	*07/09/16 14:22*	*1*

Client: Kemron Environmental Services, Inc. TestAmerica Job ID: 490-107228-1
Project/Site: Washington Wood Preserving ISS

Client Sample ID: 0600-027 (28 day) **Lab Sample ID: 490-107228-4**
Date Collected: 07/06/16 11:02 **Matrix: Water**
Date Received: 07/07/16 10:00

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	**1.57**	**J**	1.72	0.276	ug/L		07/08/16 08:35	07/08/16 18:07	1
Acenaphthylene	ND		1.72	0.302	ug/L		07/08/16 08:35	07/08/16 18:07	1
Anthracene	ND		1.72	0.328	ug/L		07/08/16 08:35	07/08/16 18:07	1
Benzo[a]anthracene	ND		1.72	0.276	ug/L		07/08/16 08:35	07/08/16 18:07	1
Benzo[a]pyrene	ND		1.72	0.328	ug/L		07/08/16 08:35	07/08/16 18:07	1
Benzo[b]fluoranthene	ND		1.72	0.310	ug/L		07/08/16 08:35	07/08/16 18:07	1
Benzo[g,h,i]perylene	ND		1.72	0.534	ug/L		07/08/16 08:35	07/08/16 18:07	1
Benzo[k]fluoranthene	ND		1.72	0.319	ug/L		07/08/16 08:35	07/08/16 18:07	1
Pyrene	ND		1.72	0.302	ug/L		07/08/16 08:35	07/08/16 18:07	1
Phenanthrene	**1.53**	**J**	1.72	0.362	ug/L		07/08/16 08:35	07/08/16 18:07	1
Chrysene	ND		1.72	0.284	ug/L		07/08/16 08:35	07/08/16 18:07	1
Dibenz(a,h)anthracene	ND		1.72	0.388	ug/L		07/08/16 08:35	07/08/16 18:07	1
Fluoranthene	ND		1.72	0.276	ug/L		07/08/16 08:35	07/08/16 18:07	1
Fluorene	**1.23**	**J**	1.72	0.276	ug/L		07/08/16 08:35	07/08/16 18:07	1
Indeno[1,2,3-cd]pyrene	ND		1.72	0.353	ug/L		07/08/16 08:35	07/08/16 18:07	1
Naphthalene	**4.79**		1.72	0.319	ug/L		07/08/16 08:35	07/08/16 18:07	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Fluorobiphenyl (Surr)	*56*		*29 - 120*	*07/08/16 08:35*	*07/08/16 18:07*	*1*
Terphenyl-d14 (Surr)	*77*		*13 - 120*	*07/08/16 08:35*	*07/08/16 18:07*	*1*
Nitrobenzene-d5 (Surr)	*57*		*27 - 120*	*07/08/16 08:35*	*07/08/16 18:07*	*1*

Method: 8151A - Herbicides (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	**89.1**	**J**	93.0	14.0	ug/L		07/09/16 14:03	07/12/16 12:52	50

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Dichloroacetic acid(Surr)	*1773*	*X*	*10 - 150*	*07/09/16 14:03*	*07/11/16 18:44*	*1*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C24	**737**		93.5	26.2	ug/L		07/08/16 12:33	07/09/16 14:39	1
C24-C40	ND		93.5	46.7	ug/L		07/08/16 12:33	07/09/16 14:39	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*61*		*50 - 150*	*07/08/16 12:33*	*07/09/16 14:39*	*1*

Client: Kemron Environmental Services, Inc.
Project/Site: Washington Wood Preserving ISS

TestAmerica Job ID: 490-107228-1

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Lab Sample ID: MB 490-353757/1-A
Matrix: Water
Analysis Batch: 353994

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 353757

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	ND		2.00	0.320	ug/L		07/08/16 08:35	07/08/16 16:22	1
Acenaphthylene	ND		2.00	0.350	ug/L		07/08/16 08:35	07/08/16 16:22	1
Anthracene	ND		2.00	0.380	ug/L		07/08/16 08:35	07/08/16 16:22	1
Benzo[a]anthracene	ND		2.00	0.320	ug/L		07/08/16 08:35	07/08/16 16:22	1
Benzo[a]pyrene	ND		2.00	0.380	ug/L		07/08/16 08:35	07/08/16 16:22	1
Benzo[b]fluoranthene	ND		2.00	0.360	ug/L		07/08/16 08:35	07/08/16 16:22	1
Benzo[g,h,i]perylene	ND		2.00	0.620	ug/L		07/08/16 08:35	07/08/16 16:22	1
Benzo[k]fluoranthene	ND		2.00	0.370	ug/L		07/08/16 08:35	07/08/16 16:22	1
Pyrene	ND		2.00	0.350	ug/L		07/08/16 08:35	07/08/16 16:22	1
Phenanthrene	ND		2.00	0.420	ug/L		07/08/16 08:35	07/08/16 16:22	1
Chrysene	ND		2.00	0.330	ug/L		07/08/16 08:35	07/08/16 16:22	1
Dibenz(a,h)anthracene	ND		2.00	0.450	ug/L		07/08/16 08:35	07/08/16 16:22	1
Fluoranthene	ND		2.00	0.320	ug/L		07/08/16 08:35	07/08/16 16:22	1
Fluorene	ND		2.00	0.320	ug/L		07/08/16 08:35	07/08/16 16:22	1
Indeno[1,2,3-cd]pyrene	ND		2.00	0.410	ug/L		07/08/16 08:35	07/08/16 16:22	1
Naphthalene	ND		2.00	0.370	ug/L		07/08/16 08:35	07/08/16 16:22	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Fluorobiphenyl (Surr)	*50*		*29 - 120*	*07/08/16 08:35*	*07/08/16 16:22*	*1*
Terphenyl-d14 (Surr)	*75*		*13 - 120*	*07/08/16 08:35*	*07/08/16 16:22*	*1*
Nitrobenzene-d5 (Surr)	*53*		*27 - 120*	*07/08/16 08:35*	*07/08/16 16:22*	*1*

Lab Sample ID: LCS 490-353757/2-A
Matrix: Water
Analysis Batch: 353994

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 353757

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Acenaphthene	40.0	23.47		ug/L		59	36 - 129
Acenaphthylene	40.0	23.71		ug/L		59	36 - 120
Anthracene	40.0	29.62		ug/L		74	42 - 130
Benzo[a]anthracene	40.0	30.75		ug/L		77	41 - 131
Benzo[a]pyrene	40.0	27.44		ug/L		69	45 - 131
Benzo[b]fluoranthene	40.0	29.47		ug/L		74	43 - 132
Benzo[g,h,i]perylene	40.0	28.32		ug/L		71	38 - 138
Benzo[k]fluoranthene	40.0	27.85		ug/L		70	44 - 129
Pyrene	40.0	27.65		ug/L		69	37 - 129
Phenanthrene	40.0	27.90		ug/L		70	39 - 126
Chrysene	40.0	30.35		ug/L		76	39 - 130
Dibenz(a,h)anthracene	40.0	28.27		ug/L		71	43 - 140
Fluoranthene	40.0	36.72		ug/L		92	31 - 132
Fluorene	40.0	26.28		ug/L		66	37 - 130
Indeno[1,2,3-cd]pyrene	40.0	27.35		ug/L		68	40 - 136
Naphthalene	40.0	22.39		ug/L		56	32 - 120

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
2-Fluorobiphenyl (Surr)	*55*		*29 - 120*
Terphenyl-d14 (Surr)	*71*		*13 - 120*

Client: Kemron Environmental Services, Inc.
Project/Site: Washington Wood Preserving ISS

TestAmerica Job ID: 490-107228-1

Method: 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: LCS 490-353757/2-A
Matrix: Water
Analysis Batch: 353994

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 353757

Surrogate	LCS %Recovery	LCS Qualifier	Limits
Nitrobenzene-d5 (Surr)	60		27 - 120

Method: 8151A - Herbicides (GC)

Lab Sample ID: MB 490-354103/1-A
Matrix: Water
Analysis Batch: 354350

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 354103

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	ND		2.00	0.300	ug/L		07/09/16 14:03	07/11/16 16:57	1

Surrogate	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
Dichloroacetic acid(Surr)	61		10 - 150	07/09/16 14:03	07/11/16 16:57	1

Lab Sample ID: LCS 490-354103/2-A
Matrix: Water
Analysis Batch: 354350

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 354103

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Pentachlorophenol	2.50	1.959	J	ug/L		78	10 - 150

Surrogate	LCS %Recovery	LCS Qualifier	Limits
Dichloroacetic acid(Surr)	63		10 - 150

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Lab Sample ID: MB 490-353933/1-A
Matrix: Water
Analysis Batch: 354059

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 353933

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C24	ND		100	28.0	ug/L		07/08/16 12:33	07/09/16 13:13	1
C24-C40	ND		100	50.0	ug/L		07/08/16 12:33	07/09/16 13:13	1

Surrogate	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
o-Terphenyl	61		50 - 150	07/08/16 12:33	07/09/16 13:13	1

Lab Sample ID: LCS 490-353933/2-A
Matrix: Water
Analysis Batch: 354059

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 353933

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
C10-C24	1000	861.3		ug/L		86	51 - 132

Surrogate	LCS %Recovery	LCS Qualifier	Limits
o-Terphenyl	68		50 - 150

GC/MS Semi VOA

Prep Batch: 353757

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-107228-1	0600-019 (28 day)	Total/NA	Water	3510C	
490-107228-2	0600-022 (28 day)	Total/NA	Water	3510C	
490-107228-3	0600-024 (28 day)	Total/NA	Water	3510C	
490-107228-4	0600-027 (28 day)	Total/NA	Water	3510C	
LCS 490-353757/2-A	Lab Control Sample	Total/NA	Water	3510C	
MB 490-353757/1-A	Method Blank	Total/NA	Water	3510C	

Analysis Batch: 353994

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-107228-1	0600-019 (28 day)	Total/NA	Water	8270D	353757
490-107228-2	0600-022 (28 day)	Total/NA	Water	8270D	353757
490-107228-3	0600-024 (28 day)	Total/NA	Water	8270D	353757
490-107228-4	0600-027 (28 day)	Total/NA	Water	8270D	353757
LCS 490-353757/2-A	Lab Control Sample	Total/NA	Water	8270D	353757
MB 490-353757/1-A	Method Blank	Total/NA	Water	8270D	353757

GC Semi VOA

Prep Batch: 353933

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-107228-1	0600-019 (28 day)	Total/NA	Water	3510C	
490-107228-2	0600-022 (28 day)	Total/NA	Water	3510C	
490-107228-3	0600-024 (28 day)	Total/NA	Water	3510C	
490-107228-4	0600-027 (28 day)	Total/NA	Water	3510C	
LCS 490-353933/2-A	Lab Control Sample	Total/NA	Water	3510C	
MB 490-353933/1-A	Method Blank	Total/NA	Water	3510C	

Analysis Batch: 354059

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-107228-1	0600-019 (28 day)	Total/NA	Water	NWTPH-Dx	353933
490-107228-2	0600-022 (28 day)	Total/NA	Water	NWTPH-Dx	353933
490-107228-3	0600-024 (28 day)	Total/NA	Water	NWTPH-Dx	353933
490-107228-4	0600-027 (28 day)	Total/NA	Water	NWTPH-Dx	353933
LCS 490-353933/2-A	Lab Control Sample	Total/NA	Water	NWTPH-Dx	353933
MB 490-353933/1-A	Method Blank	Total/NA	Water	NWTPH-Dx	353933

Prep Batch: 354103

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-107228-1	0600-019 (28 day)	Total/NA	Water	8151A	
490-107228-2	0600-022 (28 day)	Total/NA	Water	8151A	
490-107228-3	0600-024 (28 day)	Total/NA	Water	8151A	
490-107228-4	0600-027 (28 day)	Total/NA	Water	8151A	
LCS 490-354103/2-A	Lab Control Sample	Total/NA	Water	8151A	
MB 490-354103/1-A	Method Blank	Total/NA	Water	8151A	

Analysis Batch: 354350

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-107228-1	0600-019 (28 day)	Total/NA	Water	8151A	354103
490-107228-2	0600-022 (28 day)	Total/NA	Water	8151A	354103
490-107228-3	0600-024 (28 day)	Total/NA	Water	8151A	354103

GC Semi VOA (Continued)

Analysis Batch: 354350 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-107228-4	0600-027 (28 day)	Total/NA	Water	8151A	354103
LCS 490-354103/2-A	Lab Control Sample	Total/NA	Water	8151A	354103
MB 490-354103/1-A	Method Blank	Total/NA	Water	8151A	354103

Analysis Batch: 354566

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-107228-3	0600-024 (28 day)	Total/NA	Water	8151A	354103
490-107228-4	0600-027 (28 day)	Total/NA	Water	8151A	354103

Client Sample ID: 0600-019 (28 day)

Lab Sample ID: 490-107228-1

Date Collected: 07/06/16 10:50
Date Received: 07/07/16 10:00

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3510C			290 mL	1 mL	353757	07/08/16 08:35	MRM	TAL NSH
Total/NA	Analysis	8270D		1	290 mL	1 mL	353994	07/08/16 17:04	RP	TAL NSH
Total/NA	Prep	8151A			1075 mL	10 mL	354103	07/09/16 14:03	JKG	TAL NSH
Total/NA	Analysis	8151A		1	1075 mL	10 mL	354350	07/11/16 17:58	JML	TAL NSH
Total/NA	Prep	3510C			1070 mL	1 mL	353933	07/08/16 12:33	KB	TAL NSH
Total/NA	Analysis	NWTPH-Dx		1	1070 mL	1 mL	354059	07/09/16 13:47	GMH	TAL NSH

Client Sample ID: 0600-022 (28 day)

Lab Sample ID: 490-107228-2

Date Collected: 07/06/16 10:55
Date Received: 07/07/16 10:00

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3510C			290 mL	1 mL	353757	07/08/16 08:35	MRM	TAL NSH
Total/NA	Analysis	8270D		1	290 mL	1 mL	353994	07/08/16 17:25	RP	TAL NSH
Total/NA	Prep	8151A			1075 mL	10 mL	354103	07/09/16 14:03	JKG	TAL NSH
Total/NA	Analysis	8151A		1	1075 mL	10 mL	354350	07/11/16 18:13	JML	TAL NSH
Total/NA	Prep	3510C			1070 mL	1 mL	353933	07/08/16 12:33	KB	TAL NSH
Total/NA	Analysis	NWTPH-Dx		1	1070 mL	1 mL	354059	07/09/16 14:05	GMH	TAL NSH

Client Sample ID: 0600-024 (28 day)

Lab Sample ID: 490-107228-3

Date Collected: 07/06/16 11:00
Date Received: 07/07/16 10:00

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3510C			290 mL	1 mL	353757	07/08/16 08:35	MRM	TAL NSH
Total/NA	Analysis	8270D		1	290 mL	1 mL	353994	07/08/16 17:46	RP	TAL NSH
Total/NA	Prep	8151A			1075 mL	10 mL	354103	07/09/16 14:03	JKG	TAL NSH
Total/NA	Analysis	8151A		1	1075 mL	10 mL	354350	07/11/16 18:29	JML	TAL NSH
Total/NA	Prep	8151A			1075 mL	10 mL	354103	07/09/16 14:03	JKG	TAL NSH
Total/NA	Analysis	8151A		50	1075 mL	10 mL	354566	07/12/16 12:36	JML	TAL NSH
Total/NA	Prep	3510C			1070 mL	1 mL	353933	07/08/16 12:33	KB	TAL NSH
Total/NA	Analysis	NWTPH-Dx		1	1070 mL	1 mL	354059	07/09/16 14:22	GMH	TAL NSH

Client Sample ID: 0600-027 (28 day)

Lab Sample ID: 490-107228-4

Date Collected: 07/06/16 11:02
Date Received: 07/07/16 10:00

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3510C			290 mL	1 mL	353757	07/08/16 08:35	MRM	TAL NSH
Total/NA	Analysis	8270D		1	290 mL	1 mL	353994	07/08/16 18:07	RP	TAL NSH
Total/NA	Prep	8151A			1075 mL	10 mL	354103	07/09/16 14:03	JKG	TAL NSH
Total/NA	Analysis	8151A		1	1075 mL	10 mL	354350	07/11/16 18:44	JML	TAL NSH
Total/NA	Prep	8151A			1075 mL	10 mL	354103	07/09/16 14:03	JKG	TAL NSH

Lab Chronicle

Client: Kemron Environmental Services, Inc.
Project/Site: Washington Wood Preserving ISS

TestAmerica Job ID: 490-107228-1

Client Sample ID: 0600-027 (28 day)
Date Collected: 07/06/16 11:02
Date Received: 07/07/16 10:00

Lab Sample ID: 490-107228-4
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8151A		50	1075 mL	10 mL	354566	07/12/16 12:52	JML	TAL NSH
Total/NA	Prep	3510C			1070 mL	1 mL	353933	07/08/16 12:33	KB	TAL NSH
Total/NA	Analysis	NWTPH-Dx		1	1070 mL	1 mL	354059	07/09/16 14:39	GMH	TAL NSH

Laboratory References:

TAL NSH = TestAmerica Nashville, 2960 Foster Creighton Drive, Nashville, TN 37204, TEL (615)726-0177

Method Summary

Method	Method Description	Protocol	Laboratory
8270D	Semivolatile Organic Compounds (GC/MS)	SW846	TAL NSH
8151A	Herbicides (GC)	SW846	TAL NSH
NWTPH-Dx	Northwest - Semi-Volatile Petroleum Products (GC)	NWTPH	TAL NSH

Protocol References:

NWTPH = Northwest Total Petroleum Hydrocarbon

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL NSH = TestAmerica Nashville, 2960 Foster Creighton Drive, Nashville, TN 37204, TEL (615)726-0177

Certification Summary

Client: Kemron Environmental Services, Inc.
Project/Site: Washington Wood Preserving ISS

TestAmerica Job ID: 490-107228-1

Laboratory: TestAmerica Nashville

The certifications listed below are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
Washington	State Program	10	C789	07-19-16 *

* Certification renewal pending - certification considered valid.

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

Nashville, TN

COOLER RECEIPT FORM

490-107228 Chain of Custody

Cooler Received/Opened On 7/7/2016 @ 1000

Time Samples Removed From Cooler 1430 Time Samples Placed In Storage 1626 (2 Hour Window)

1. Tracking # 6934 (last 4 digits, FedEx) Courier: _fedex_

   IR Gun ID 97310166 pH Strip Lot HC564992 Chlorine Strip Lot 072815A

2. Temperature of rep. sample or temp blank when opened: 1.3 *Degrees Celsius*
3. If Item #2 temperature is 0°C or less, was the representative sample or temp blank frozen? YES NO...NA
4. Were custody seals on outside of cooler? YES...NO...NA

   If yes, how many and where: 1 (back)

5. Were the seals intact, signed, and dated correctly? YES...NO...NA
6. Were custody papers inside cooler? YES...NO...NA

I certify that I opened the cooler and answered questions 1-6 (intial) Cq

7. Were custody seals on containers: YES NO and Intact YES...NO...NA

   Were these signed and dated correctly? YES...NO...NA

8. Packing mat'l used? Bubblewrap Plastic bag Peanuts Vermiculite Foam Insert Paper Other None
9. Cooling process: Ice Ice-pack Ice (direct contact) Dry ice Other None
10. Did all containers arrive in good condition (unbroken)? YES...NO...NA
11. Were all container labels complete (#, date, signed, pres., etc)? YES...NO...NA
12. Did all container labels and tags agree with custody papers? YES...NO...NA

13a. Were VOA vials received? YES...NO...NA

b. Was there any observable headspace present in any VOA vial? YES...NO...NA

14. Was there a Trip Blank in this cooler? YES...NO...NA If multiple coolers, sequence # 1

I certify that I unloaded the cooler and answered questions 7-14 (intial) AO9

15a. On pres'd bottles, did pH test strips suggest preservation reached the correct pH level? YES..NO..NA

b. Did the bottle labels indicate that the correct preservatives were used YES...NO...NA

16. Was residual chlorine present? YES...NO...NA

I certify that I checked for chlorine and pH as per SOP and answered questions 15-16 (intial) AO8

17. Were custody papers properly filled out (ink, signed, etc)? YES...NO...NA
18. Did you sign the custody papers in the appropriate place? YES...NO...NA
19. Were correct containers used for the analysis requested? YES...NO...NA
20. Was sufficient amount of sample sent in each container? YES...NO...NA

I certify that I entered this project into LIMS and answered questions 17-20 (intial) AO8

I certify that I attached a label with the unique LIMS number to each container (intial) AO8

21. Were there Non-Conformance issues at login? YES...NO Was a NCM generated? YES...NO...# NA

BIS = Broken in shipment

Cooler Receipt Form.doc

LF-1

End of Form

Revised 12/15/15

Loc: 490
107228

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
Nashville, TN

COOLER RECEIPT FORM

Cooler Received/Opened On 7/7/2016 @ 1000

Time Samples Removed From Cooler 1430 Time Samples Placed In Storage 1626 (2 Hour Window)

1. Tracking # 6945 (last 4 digits, FedEx) Courier: _fedex_

   IR Gun ID 18290455 pH Strip Lot HC564992 Chlorine Strip Lot 072815A

2. Temperature of rep. sample or temp blank when opened: 2.7 *Degrees Celsius*
3. If Item #2 temperature is 0°C or less, was the representative sample or temp blank frozen? YES NO..NA
4. Were custody seals on outside of cooler? YES...NO...NA

   If yes, how many and where: 1 on the front

5. Were the seals intact, signed, and dated correctly? YES...NO...NA not Signed
6. Were custody papers inside cooler? YES...NO...NA

I certify that I opened the cooler and answered questions 1-6 (intial) PG

7. Were custody seals on containers: YES NO and Intact YES...NO...NA

   Were these signed and dated correctly? YES...NO...NA

8. Packing mat'l used? Bubblewrap Plastic bag Peanuts Vermiculite Foam Insert Paper Other None
9. Cooling process: Ice Ice-pack Ice (direct contact) Dry ice Other None
10. Did all containers arrive in good condition (unbroken)? YES...NO...NA
11. Were all container labels complete (#, date, signed, pres., etc)? YES...NO...NA
12. Did all container labels and tags agree with custody papers? YES...NO...NA

13a. Were VOA vials received? YES...NO...NA

   b. Was there any observable headspace present in any VOA vial? YES...NO...NA

14. Was there a Trip Blank in this cooler? YES...NO...NA If multiple coolers, sequence # 2

I certify that I unloaded the cooler and answered questions 7-14 (intial) ADS

15a. On pres'd bottles, did pH test strips suggest preservation reached the correct pH level? YES..NO..NA

   b. Did the bottle labels indicate that the correct preservatives were used YES...NO...NA

16. Was residual chlorine present? YES...NO...NA

I certify that I checked for chlorine and pH as per SOP and answered questions 15-16 (intial) ACOS

17. Were custody papers properly filled out (ink, signed, etc)? YES...NO...NA
18. Did you sign the custody papers in the appropriate place? YES...NO...NA
19. Were correct containers used for the analysis requested? YES...NO...NA
20. Was sufficient amount of sample sent in each container? YES...NO...NA

I certify that I entered this project into LIMS and answered questions 17-20 (intial) ACOS

I certify that I attached a label with the unique LIMS number to each container (intial) ACOS

21. Were there Non-Conformance issues at login? YES...NO Was a NCM generated? YES...NO...# N/A

BIS = Broken in shipment

TestAmerica Nashville
2960 Foster Creighton Drive
Nashville, TN 37204
Phone (615) 726-0177 Fax (615) 726-3404

Chain of Custody Record

TestAmerica

681-Atlanta

Client Information	Sampler: Tomecia Bradley	Lab PM: Baker, Heather c/o Roxanne Cisneros	Carrier Tracking No(s):	COC No: 490-54011-17498.4
Client Contact: Mr. Tommy Jordan	Phone: 404-601-6927	E-Mail: ~~heather.baker~~@testamericainc.com roxanne.cisneros		Page: Page ~~4~~ 1 of 1
Company: Kemron Environmental Services, Inc.				Job #:

Address: 1359A Ellsworth Industrial Blvd.	Due Date Requested: 7·20·16	
City: Atlanta	TAT Requested (days): 10	
State, Zip: GA, 30318		
Phone: 404-516-3172(Tel)	PO #: ~~Purchase Order Requested~~ SH0600	
Email: tjordan@kemron.com	WO #:	
Project Name: Washington Wood ~~Treating~~ Preserving ISS	Project #: 49010102	
Site:	SSOW#:	

Analysis Requested

Preservation Codes:
A - HCL, B - NaOH, C - Zn Acetate, D - Nitric Acid, E - NaHSO4, F - MeOH, G - Amchlor, H - Ascorbic Acid, I - Ice, J - DI Water, K - EDTA, L - EDA
M - Hexane, N - None, O - AsNaO2, P - Na2O4S
Other:

Loc: 490
107228

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	8270D - Polyaromatic Hydrocarbons	8151A - PCP	NWTPH_Dx - NWTPH *	Total Number of containers	Special Instructions/Note:
			Preservation Code:				N	N	N		
~~0600-019 (48 hr)~~	~~7-6-16~~	~~1045~~	~~G~~	~~Water~~				~~X~~			* Limited Quantity
~~0600-027 (48 hr)~~	~~↓~~	~~1017~~	~~G~~	~~Water~~				~~X~~			DO NOT perform NWTPH
0600-019 (28 day)	7·6·16	1050	G	Water			X	X	X		method duplicates from
0600-022 (28 day)		1055	G	Water			X	X	X		this job *
0600-024 (28 day)		1100	G	Water			X	X	X		
0600-027 (28 day)	↓	1102	G	Water			X	X	X		

Possible Hazard Identification
☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☒ Disposal By Lab ☐ Archive For ______ Months

Deliverable Requested: I, (II), III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:

Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Tomecia Bradley	7·6·16 13:10	Kemron	[signature]	7/6/16 13:10	TA
[signature] 7/6/16	14:30	TA	[signature]	7/7/16 1000	TAN

Custody Seals Intact: △ Yes △ No	Custody Seal No.:	Cooler Temperature(s) °C and Other Remarks:

Login Sample Receipt Checklist

Client: Kemron Environmental Services, Inc.

Job Number: 490-107228-1

Login Number: 107228
List Number: 1
Creator: Stvartak, Anthony Q

List Source: TestAmerica Nashville

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Appendix D
Intertidal Sediment Conditioning Laboratory Reports

Materials Testing & Consulting, Inc.

Geotechnical Engineering • Special Inspection • Materials Testing • Environmental Consulting

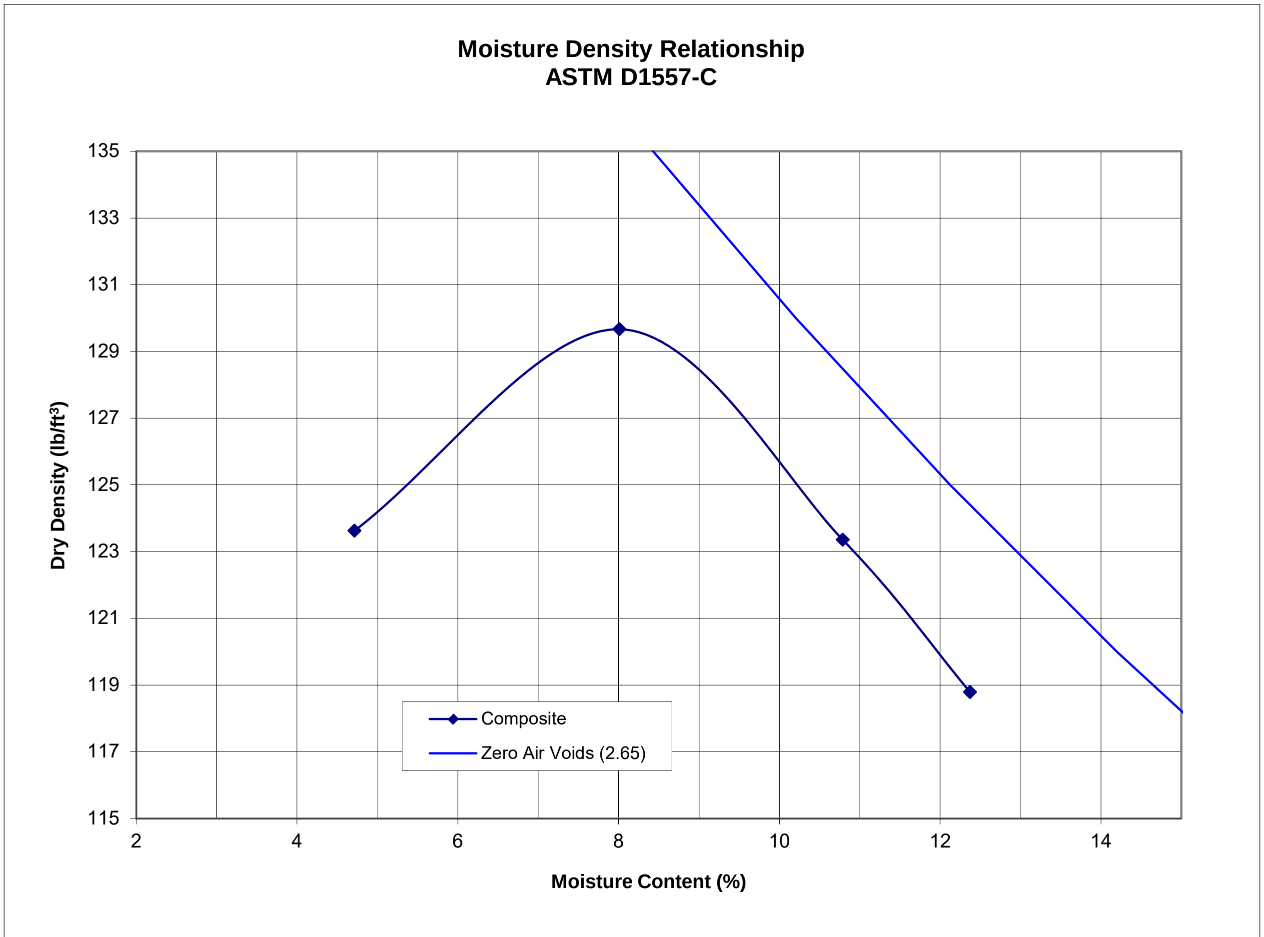
Moisture Density Relationship

Client:	Crete Consulting	Date:	May 24, 2016
Project:	Intertidal Soil Testing		
Project No.:	16T009		
Sample ID:	Composite		

	Standard		Corrected	
Optimum Moisture Content	8.0	%	7.4	%
Maximum Density	129.7	lb/ft^3	132.2	lb/ft^3

Percent retained on the 3/4 inch sieve	8.1	Rock correction required?	Yes

Note: The plot shows as-tested data (material greater than 3/4" removed).



If required, the Rock Correction is performed according to ASTM D4718

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Visit our website: www.mtc-inc.net

Project:	Intertidal Soil Testing	**Date Received:**	March 28, 2016
Project #:	16T009	**Sampled By:**	Client
Client :	CRETE Consulting	**Date Tested:**	April 8, 2016
Source:	IT-TTWP-N	**Tested By:**	AU / KO
MTC Sample#:	T16-0492		

CASE NARRATIVE

1. One sample was submitted for Testing on March 28, 2016.
2. The sample was submitted for grain size distribution according to ASTM D422. The sample was prepared according to ASTM D421.
3. An assumed specific gravity of 2.65 was used in the hydrometer calculations.
4. A standard milkshake mixer type device was used to disperse the fine fraction sample for one minute.
5. The data is provided in summary tables and plots.
6. There were no noted anomalies in this project.

Reviewed by: H Berry

Materials Testing & Consulting, Inc.

Geotechnical Engineering • Special Inspection • Materials Testing • Environmental Consulting

Project: Intertidal Soil Testing
Project #: 16T009
Date Received: March 28, 2016
Date Tested: April 8, 2016

Client: CRETE Consulting
Sampled by: Client
Tested by: AU / KO

Percent Finer (Passing) Than the Indicated Size

Sieve Size (microns)	3"	2"	1 1/2"	1"	3/4"	1/2"	3/8"	#4 (4750)	#10 (2000)	#20 (850)	#40 (425)	#60 (250)	#100 (150)	#200 (75)	32	22	13	9	7	3.2	1.3
IT-TTWP-N	100.0	100.0	100.0	100.0	91.9	91.9	91.3	86.8	81.4	72.6	59.1	45.7	37.7	31.8	20.6	16.8	13.1	11.2	10.3	6.5	4.7

Testing performed according to ASTM D421/D422
Organics were not removed prior to analysis. The grain size distribution reported is the "apparent grain size distribution".

Reviewed by: H Berg

Materials Testing & Consulting, Inc.

Geotechnical Engineering • Special Inspection • Materials Testing • Environmental Consulting

Project: Intertidal Soil Testing
Project #: 16T009
Date Received: March 28, 2016
Date Tested: April 8, 2016

Client: CRETE Consulting
Sampled by: Client
Tested by: AU / KO

Percent Retained in Each Size Fraction

Description	% Coarse Gravel				% Gravel			% Coarse Sand	% Medium Sand		% Fine Sand			% Very Coarse Silt	% Coarse Silt	% Medium Silt	% Fine Silt	% Fine Silt	% Very Fine Silt	% Clay	
Particle Size (microns)	3-2"	2-1 1/2"	1 1/2"-1"	1-3/4"	3/4-1/2"	1/2-3/8"	3/8"-4750	4750-2000	2000-850	850-425	425-250	250-150	150-75	75-32	32-22	22-13	13-9	9-7	7-3.2	3.2-1.3	<1.3
IT-TTWP-N	0.0	0.0	0.0	8.1	0.0	0.7	4.5	5.4	8.8	13.5	13.4	8.0	5.9	11.2	3.7	3.7	1.9	0.9	3.7	1.9	4.7

Testing performed according to ASTM D421/D422
Organics were not removed prior to analysis. The grain size distribution reported is the "apparent grain size distribution".

Reviewed by: H Berry

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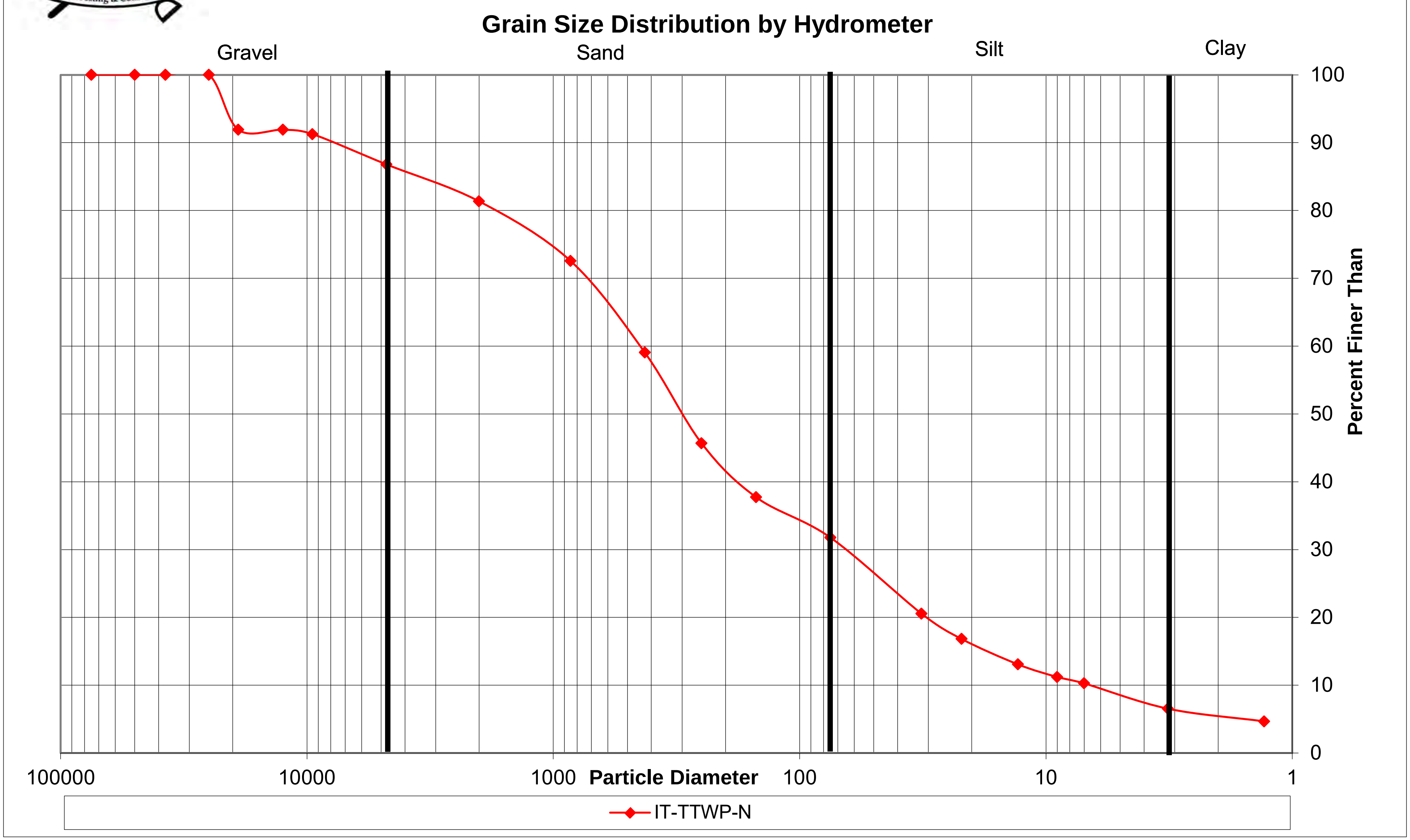

Grain Size Distribution by Hydrometer
Gravel
Sand
Silt
Clay
100
90
80
70
60
50
40
30
20
10
0
Percent Finer Than
100000
10000
1000
Particle Diameter
100
10
1
IT-TTWP-N

Materials Testing & Consulting, Inc.

Geotechnical Engineering • Special Inspection • Materials Testing • Environmental Consulting

Client:	Crete Consulting	**Date:**	May 15, 2015
Address:	Seattle, WA	**Project:**	Intertidal Soil Testing
		Project #:	16T009
Attn:	Grant Hainsworth	**Sample #:**	T16-0493

As requested MTC, Inc. has performed the following test(s) on the sample referenced above. The testing was performed in accordance with current applicable AASHTO or ASTM standards as indicated below. The results obtained in our laboratory were as follows below or on the attached pages:

	Test(s) Performed:	Test Results		Test(s) Performed:	Test Results
	Sieve Analysis			Sulfate Soundness	
	Proctor			Bulk Density & Voids	
	Sand Equivalent			WSDOT Degradation	
	Fracture Count				
	Moisture Content				
x	TVS	see attached			
	Minimum Resistivity				
	Organic Content				
	Atterberg Limits				
	Asphalt Extraction/Gradation				
	Rice Density				

If you have any questions concerning the test results, the procedures used, or if we can be of any further assistance please call on us at the number below.

Respectfully Submitted,

H Benny

Harold Benny
WABO Supervising Laboratory Technician

Materials Testing & Consulting, Inc.

Geotechnical Engineering • Special Inspection • Materials Testing • Environmental Consulting

Project: Intertidal Soil Testing
Client: Crete Consulting
Project #: 16T009
Date Received: March 28, 2016
Sampled by: Others
Date Tested: April 13, 2016
Tested by: HB

Moisture Content - ASTM C-566, ASTM D-2216 & AASHTO T-265

Sample #	Location	Tare	Wet + Tare	Dry + Tare	Wgt. Of Moisture	Wgt. Of Soil	% Moisture
T16-0493	IT-TTWP-N	257.9	1486.0	1240.0	246.0	982.1	25.0%

Organic Content - ASTM D-2974, AASHTO T-267

Sample #	Location	Tare	Soil + Tare, Pre-Ignition	Soil + Tare, Post Ignition	% Organics
T16-0493	IT-TTWP-N	257.9	1240.0	1219.8	2.1%

Reviewed by: H Berry

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Sieve Report

Project: Intertidal Soil Testing
Project #: 16T009
Client: Crete Consulting
Source: IT-TTWP-S
Sample#: T16-0492

Date Received: 28-Mar-16
Sampled By: Client
Date Tested: 13-Apr-16
Tested By: HB

ASTM D-2487 Unified Soils Classification System
SP, Poorly graded Sand with Gravel
Sample Color:
Redish Brown

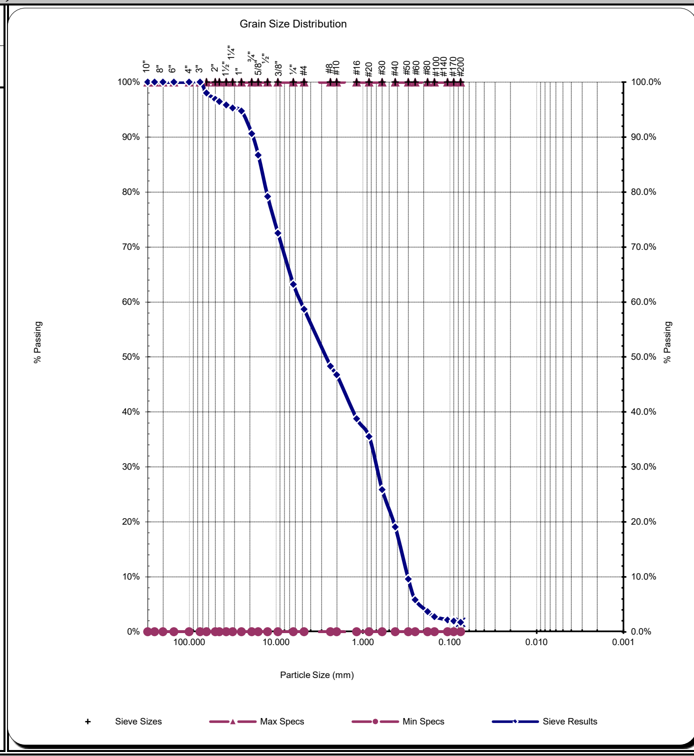
ASTM D-2216, ASTM D-2419, ASTM D-4318, ASTM D-5821

Specifications
No Specs
Sample Meets Specs ? N/A

$D_{(5)}$ = 0.223 mm	% Gravel = 41.3%	Coeff. of Curvature, C_C = 0.31
$D_{(10)}$ = 0.305 mm	% Sand = 56.9%	Coeff. of Uniformity, C_U = 17.06
$D_{(15)}$ = 0.371 mm	% Silt & Clay = 1.7%	Fineness Modulus = 4.56
$D_{(30)}$ = 0.707 mm	Liquid Limit = n/a	Plastic Limit = n/a
$D_{(50)}$ = 2.747 mm	Plasticity Index = n/a	Moisture %, as sampled = 2.4%
$D_{(60)}$ = 5.204 mm	Sand Equivalent = n/a	Req'd Sand Equivalent =
$D_{(90)}$ = 18.520 mm	Fracture %, 1 Face = n/a	Req'd Fracture %, 1 Face =
Dust Ratio = 1/11	Fracture %, 2+ Faces = n/a	Req'd Fracture %, 2+ Faces =

ASTM C-136, ASTM D-6913

Sieve Size US	Sieve Size Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
12.00"	300.00		100%	100.0%	0.0%
10.00"	250.00		100%	100.0%	0.0%
8.00"	200.00		100%	100.0%	0.0%
6.00"	150.00		100%	100.0%	0.0%
4.00"	100.00		100%	100.0%	0.0%
3.00"	75.00		100%	100.0%	0.0%
2.50"	63.00	98%	98%	100.0%	0.0%
2.00"	50.00		97%	100.0%	0.0%
1.75"	45.00		96%	100.0%	0.0%
1.50"	37.50		96%	100.0%	0.0%
1.25"	31.50		95%	100.0%	0.0%
1.00"	25.00	95%	95%	100.0%	0.0%
3/4"	19.00	91%	91%	100.0%	0.0%
5/8"	16.00	87%	87%	100.0%	0.0%
1/2"	12.50	79%	79%	100.0%	0.0%
3/8"	9.50	73%	73%	100.0%	0.0%
1/4"	6.30		63%	100.0%	0.0%
#4	4.75	59%	59%	100.0%	0.0%
#8	2.36		48%	100.0%	0.0%
#10	2.00	47%	47%	100.0%	0.0%
#16	1.18		39%	100.0%	0.0%
#20	0.850	36%	36%	100.0%	0.0%
#30	0.600		26%	100.0%	0.0%
#40	0.425	19%	19%	100.0%	0.0%
#50	0.300		10%	100.0%	0.0%
#60	0.250	6%	6%	100.0%	0.0%
#80	0.180		4%	100.0%	0.0%
#100	0.150	3%	3%	100.0%	0.0%
#140	0.106		2%	100.0%	0.0%
#170	0.090		2%	100.0%	0.0%
#200	0.075	1.7%	1.7%	100.0%	0.0%



Comments: The sample contained large amounts of glass fragments which may have broked down during testing.

Reviewed by: H Bon

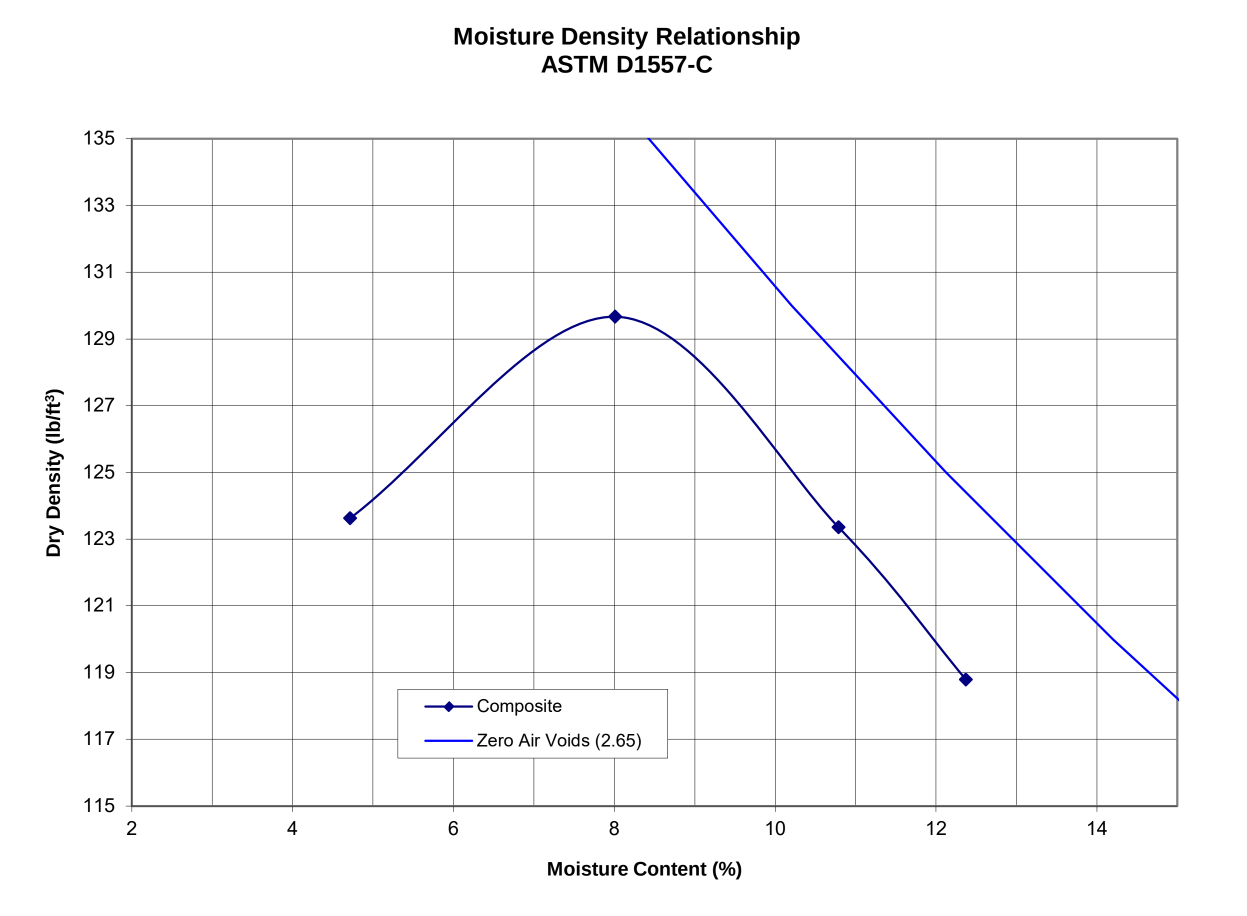
Moisture Density Relationship

Client:	Crete Consulting	Date:	May 24, 2016
Project:	Intertidal Soil Testing		
Project No.:	16T009		
Sample ID:	Composite		

	Standard		Corrected	
Optimum Moisture Content	8.0	%	7.4	%
Maximum Density	129.7	lb/ft^3	132.2	lb/ft^3

Percent retained on the 3/4 inch sieve	8.1	Rock correction required?	Yes

Note: The plot shows as-tested data (material greater than 3/4" removed).



If required, the Rock Correction is performed according to ASTM D4718

Materials Testing & Consulting, Inc.

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3% Portland Cement - 28 cure results

Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter, ASTM D5084

Project: Intertidal Soils
Project #: 16T009
Client: Crete Consultants

Date Received: June 15, 2016
Sampled By: client
Date Tested: July 24, 2016
Tested By: H Benny

Test Results for Flexible Wall Hydraulic Conductivity Testing

Sample Identification	Depth (ft)	As Received Sample Parameters: Wet Density (lbs/ft^3)	Total Porosity	Saturation	Moisture Content (%)	After Test Sample Parameters: Wet Density (lbs/ft^3)	Total Porosity	Saturation	Moisture Content (%)	Gradient (h/l)	Hydraulic Conductivity (cm/s)
T16-1191	NA	115.0	0.38	0.55	13.0	125.4	0.39	0.99	23.5	1.38	1.84E-04

Notes:
1. The samples were tested in general accordance with ASTM D-5084.
2. The tests were performed using tap water for the permeant.
3. The porosity and the saturation were calculated using assumed specific gravity values.
4. The soil was mixed with 3% Portland Cement and allowed to cure for 28 days.

Sample Description and Dimensions

Sample ID	Depth (ft)	Visual Description	Confining Pressure (psi)	Initial Average Length (cm)	Initial Average Diameter (cm)	Final Average Length (cm)	Final Average Diameter (cm)
T16-1191	NA	Gray silty sand with 3% Portland Cement addition	3.0	13.23	7.29	13.25	7.29

Comments:

Reviewed By: HBenny

Client:	Crete Consultants	**Date:**	July 26, 2016
Address:	Seattle, WA	**Project:**	Intertidal Soils Testing
		Project #:	16T009
Attn:	Grant Hainsworth, PE	**Sample #:**	T16-1191

Testing Narrative

1. A three point Consolidated, Undrained triaxial shear test was performed in general accordance with ASTM D4767. The client specified consolidation stresses of 10, 20, and 25 psi.
2. The specimens were prepared from soil that had been amended with 3% Portland Cement on a dry weight basis and allowed to cure for 28 days.
3. Because the diameter of the specimens was 2.40 inches, all material greater than 3/8-inch was removed. (No particle is to be more than 1/6th the diameter of a specimen).
4. The specimens were prepared by compacting the soil into a mold in 4 lifts of approximately 1.3 inches in height. The surface of each lift was scarified prior to compacting the next lift.
5. Each specimen was mounted in a triaxial cell; the cell was connected to the test panel, and saturation was initiated. The "B" value was measured. Once the "B" value had reached 0.95 or higher, the specimen was consolidated, in steps, to the specified consolidation pressure.
6. Once consolidation was complete, the test cell was positioned on the load frame the shear test was performed. All specimens had a shear failure, along a well defined shear plane. The strain rate used was calculated from the consolidation data, and all three tests were run at a speed of 0.007 inches per minute.
7. Each test was run to at least 12% strain.
8. Once the shear test was complete, the sample was taken down and a final moisture content was run on the test remains.

If you have any questions concerning the test results, the procedures used, or if we can be of any further assistance please call on us at the number below.

Respectfully Submitted,

H Benny

Harold Benny
WABO Supervising Laboratory Technician

3% Portland Cement - 28 cure results
Traix 1

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Consolidated Undrained Triaxial Compression Test, ASTM D4767

Project Number	16T009	LVDT	Load Cell	Strain Ratio	Corrected Area	Deviator Stress	Corrected Stress	Pore Pressure	Δ U	Induced Pore Pressure	σ'3	σ'1	σ'1/σ'3	(σ1−σ3)/2	(σ'1+σ'3)/2
Units		.001"	lbs		ft^2	psf	psf	psi	psi	psf	psf	psf			
Sample #	1	0	0	0	0.0287	0	0	28.0	0.0	0	1440	1440	1	0	1440
Depth	NA	5	28	0.001	0.0287	975	974	28.4	0.4	58	1382	2357	1.70	487	1869
Cell pressure	38	10	67	0.002	0.0288	2330	2329	28.9	0.9	130	1310	3639	2.78	1165	2475
Back Pressure	28	15	94	0.003	0.0288	3266	3264	29.3	1.3	187	1253	4517	3.61	1633	2885
Strain Rate	0.007	20	115	0.004	0.0288	3992	3989	29.5	1.5	216	1224	5213	4.26	1996	3219
Initial Platten Height	0	25	132	0.005	0.0288	4578	4574	29.6	1.6	230	1210	5784	4.78	2289	3497
Initial Load Cell Reading	0	54	216	0.011	0.0290	7448	7440	27.8	-0.2	-29	1469	8909	6.07	3724	5189
Initial Length	5.073	75	250	0.015	0.0291	8584	8574	25.8	-2.2	-317	1757	10331	5.88	4292	6044
Initial Area	0.0287	100	263	0.020	0.0293	8985	8972	24.2	-3.8	-547	1987	10959	5.51	4492	6473
Height after Saturation	5.070	125	268	0.025	0.0294	9110	9094	23.3	-4.7	-677	2117	11210	5.30	4555	6664
Height after Consolidation	5.070	150	272	0.030	0.0296	9199	9180	22.6	-5.4	-778	2218	11397	5.14	4599	6807
		175	271	0.035	0.0297	9118	9096	22.2	-5.8	-835	2275	11371	5.00	4559	6823
		200	271	0.039	0.0299	9072	9047	22.0	-6.0	-864	2304	11351	4.93	4536	6827
		225	272	0.044	0.0300	9059	9030	21.8	-6.2	-893	2333	11363	4.87	4529	6848
		250	274	0.049	0.0302	9078	9047	21.7	-6.3	-907	2347	11394	4.85	4539	6871
		275	275	0.054	0.0303	9064	9030	21.7	-6.3	-907	2347	11377	4.85	4532	6862
		300	277	0.059	0.0305	9082	9045	21.6	-6.4	-922	2362	11407	4.83	4541	6884
		325	279	0.064	0.0307	9100	9060	21.5	-6.5	-936	2376	11436	4.81	4550	6906
		350	281	0.069	0.0308	9117	9074	21.5	-6.5	-936	2376	11450	4.82	4558	6913
		375	284	0.074	0.0310	9165	9120	21.5	-6.5	-936	2376	11496	4.84	4583	6936
		415	290	0.082	0.0313	9279	9229	21.5	-6.5	-936	2376	11605	4.88	4640	6991
		425	291	0.084	0.0313	9291	9240	21.4	-6.6	-950	2390	11630	4.87	4646	7010
		450	294	0.089	0.0315	9337	9282	21.4	-6.6	-950	2390	11673	4.88	4668	7032
		515	303	0.102	0.0319	9487	9426	21.2	-6.8	-979	2419	11845	4.90	4744	7132
		550	306	0.108	0.0322	9507	9443	21.0	-7.0	-1008	2448	11891	4.86	4754	7169
		610	305	0.120	0.0326	9350	9280	20.7	-7.3	-1051	2491	11771	4.72	4675	7131
		650	306	0.128	0.0329	9297	9222	20.6	-7.4	-1066	2506	11728	4.68	4649	7117

Reviewed By: ____________________

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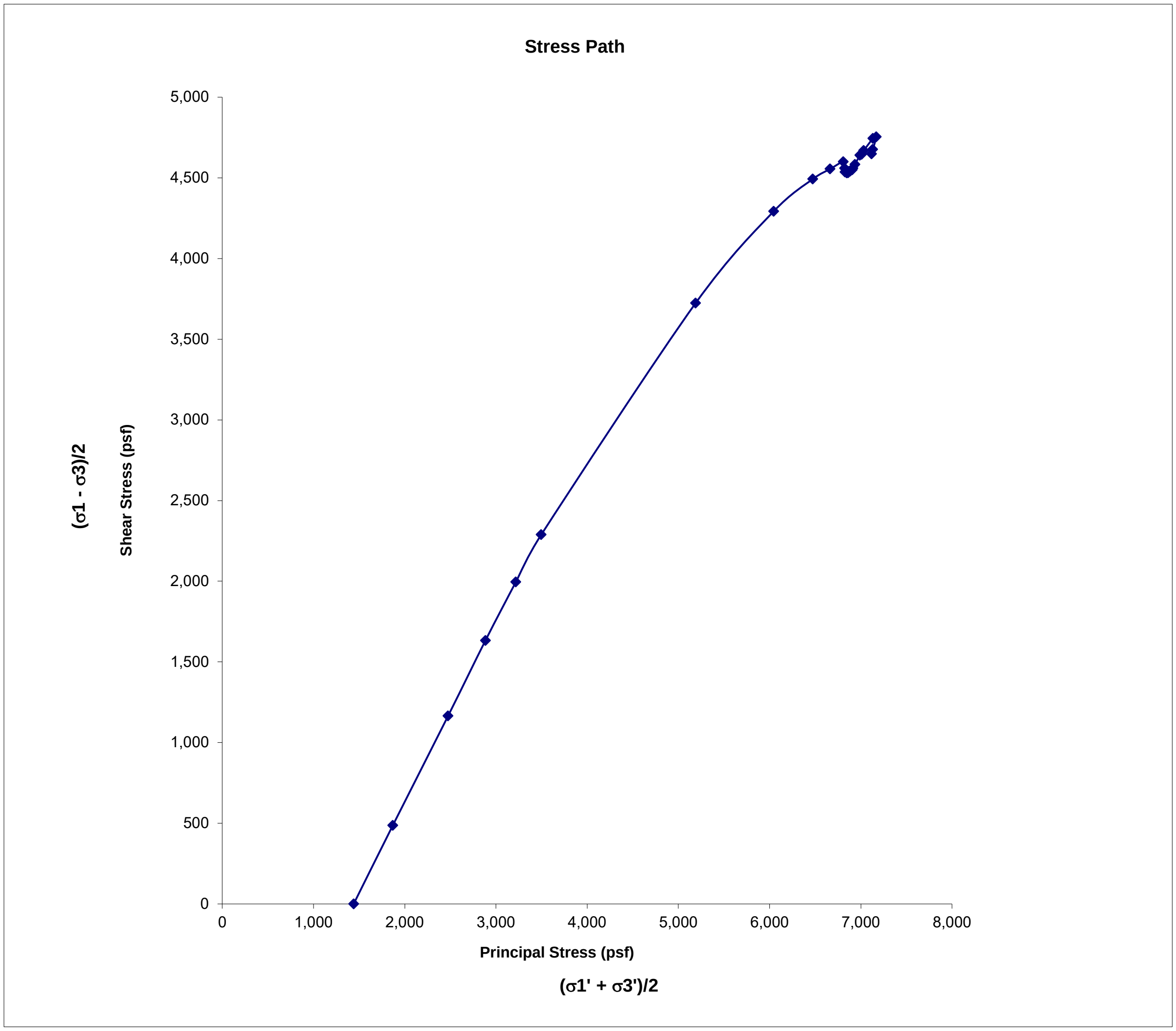
3% Portland Cement - 28 cure results
Date should be July 26, 2016, Traix 1

Materials Testing & Consulting, Inc.

Geotechnical Engineering • Special Inspection • Materials Testing • Environmental Consulting

Project:	Intertidal Soils Testing	Date Sampled:	June 15, 2016
Project #:	16T009	Sampled By:	Client
Client:	Crete Consultants	Date Tested:	June 26, 2016
Source:	Site Stockpile	Tested by:	H Benny
Sample #:	T16-1191		



Reviewed By: H Benny

3% Portland Cement - 28 cure results
Date should be July 26, 2016, Traix 1

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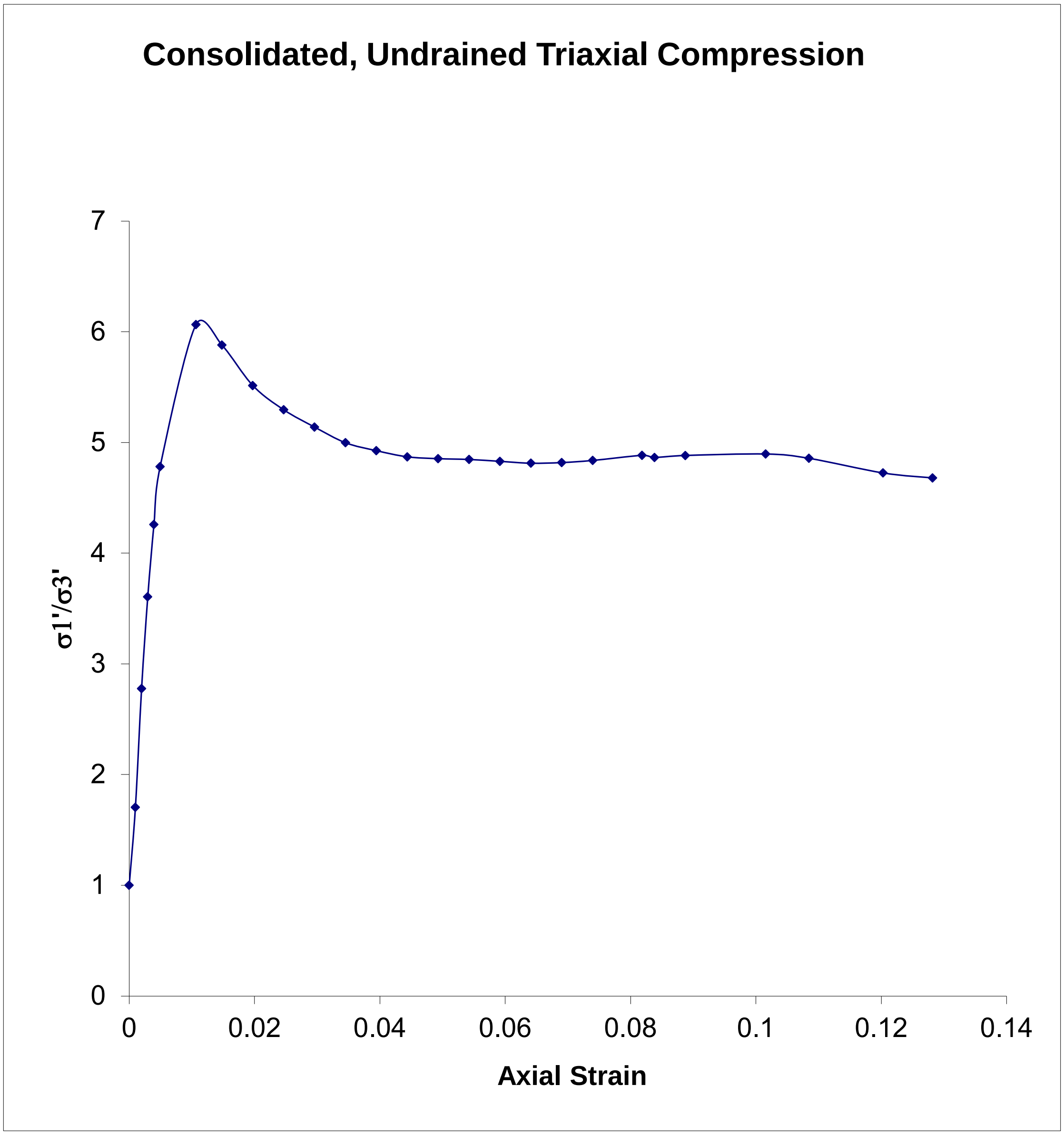
Project:	Intertidal Soils Testing	Date Sampled:	June 15, 2016
Project #:	16T009	Sampled By:	Client
Client:	Crete Consultants	Date Tested:	June 26, 2016
Source:	Site Stockpile	Tested by:	H Benny
Sample #:	T16-1191		



Sample	Depth	Water Content		Void Ratio		Saturation		Unit Weight		Pressure		
Number	Feet	Initial	Final	Initial	Final	Initial	Final	Initial Wet	Initial Dry	Consol	Cell	Back
1.0	NA	7.3	18.5	0.491	0.361	0.399	1.111	121.3	106.6	10.0	38.0	28.0

Reviewed By: H Benny

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3% Portland Cement - 28 cure results
Date should be July 26, 2016, Traix 1

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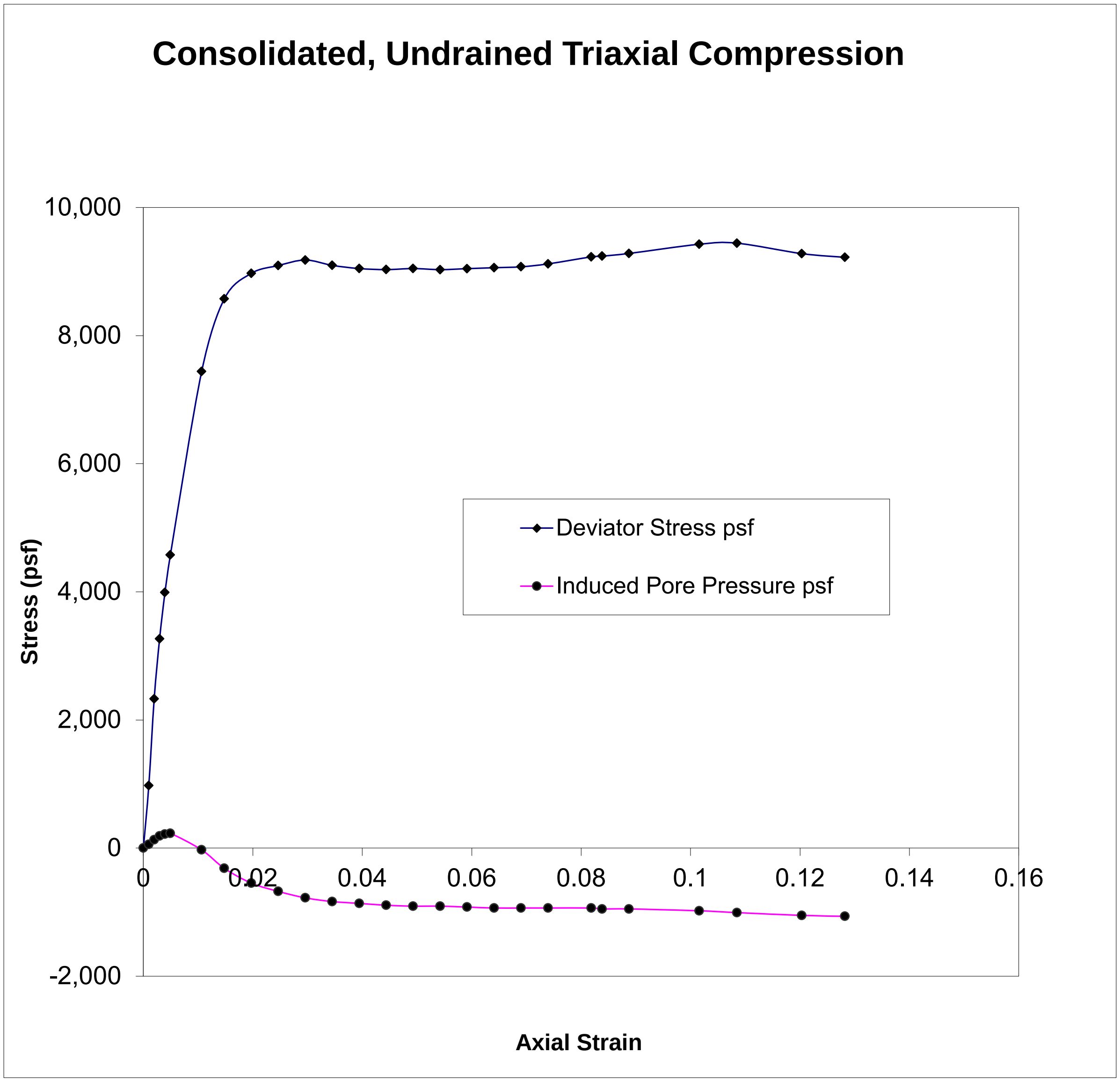
Project:	Intertidal Soils Testing	Date Sampled:	June 15, 2016
Project #:	16T009	Sampled By:	Client
Client:	Crete Consultants	Date Tested:	June 26, 2016
Source:	Site Stockpile	Tested by:	H Benny
Sample #:	T16-1191		



Sample	Depth	Water Content		Void Ratio		Saturation		Unit Weight		Pressure		(psi)
Number	feet	Initial	Final	Initial	Final	Initial	Final	Initial Wet	Initial Dry	Consol	Cell	Back
1	NA	7.3	18.5	0.491	0.361	0.399	1.111	121.3	106.6	10	38	28

Reviewed By: H Benny

3% Portland Cement - 28 cure results
Traix 2

Materials Testing & Consulting, Inc.
Geotechnical Engineering • Special Inspection • Materials Testing • Environmental Consulting

Consolidated Undrained Triaxial Compression Test, ASTM D4767

Project Number	16T009	LVDT	Load Cell	Strain Ratio	Corrected Area	Deviator Stress	Corrected Stress	Pore Pressure	Δ U	Induced Pore Pressure	σ'3	σ'1	σ'1/σ'3	(σ1−σ3)/2	(σ'1+σ'3)/2
Units		.001"	lbs		ft^2	psf	psf	psi	psi	psf	psf	psf			
Sample #	1	0	0	0	0.0301	0	0	28.0	0.0	0	2880	2880	1	0	2880
Depth	NA	5	19	0.001	0.0302	630	630	28.4	0.4	58	2822	3452	1.22	315	3137
Cell pressure	48	10	37	0.002	0.0302	1226	1225	29.3	1.3	187	2693	3918	1.45	613	3305
Back Pressure	28	15	55	0.003	0.0302	1821	1819	30.9	2.9	418	2462	4281	1.74	910	3372
Strain Rate	0.007	20	70	0.004	0.0302	2315	2313	32.4	4.4	634	2246	4559	2.03	1158	3403
Initial Platten Height	0	25	85	0.005	0.0303	2809	2806	33.9	5.9	850	2030	4836	2.38	1404	3433
Initial Load Cell Reading	0	50	150	0.009	0.0304	4933	4927	37.4	9.4	1354	1526	6453	4.23	2466	3990
Initial Length	5.333	75	222	0.014	0.0306	7266	7257	37.1	9.1	1310	1570	8827	5.62	3633	5198
Initial Area	0.0301	100	286	0.019	0.0307	9316	9305	34.7	6.7	965	1915	11220	5.86	4658	6568
Height after Saturation	5.327	125	313	0.023	0.0308	10147	10133	30.7	2.7	389	2491	12624	5.07	5074	7558
Height after Consolidation	5.334	150	321	0.028	0.0310	10357	10339	30.5	2.5	360	2520	12859	5.10	5178	7690
		175	323	0.033	0.0311	10371	10351	29.5	1.5	216	2664	13015	4.89	5185	7839
		200	322	0.037	0.0313	10289	10266	29.1	1.1	158	2722	12987	4.77	5144	7854
		225	322	0.042	0.0314	10239	10213	28.8	0.8	115	2765	12978	4.69	5119	7871
		250	321	0.047	0.0316	10157	10128	28.6	0.6	86	2794	12922	4.63	5078	7858
		275	320	0.052	0.0318	10075	10044	28.5	0.5	72	2808	12852	4.58	5038	7830
		300	321	0.056	0.0319	10057	10023	28.4	0.4	58	2822	12846	4.55	5028	7834
		325	321	0.061	0.0321	10007	9971	28.3	0.3	43	2837	12807	4.51	5004	7822
		350	321	0.066	0.0322	9957	9918	28.2	0.2	29	2851	12769	4.48	4979	7810
		375	321	0.070	0.0324	9907	9865	28.2	0.2	29	2851	12717	4.46	4954	7784
		400	320	0.075	0.0326	9826	9782	28.2	0.2	29	2851	12633	4.43	4913	7742
		425	322	0.080	0.0327	9838	9791	28.2	0.2	29	2851	12642	4.43	4919	7747
		450	321	0.084	0.0329	9757	9708	28.2	0.2	29	2851	12559	4.40	4879	7705
		500	323	0.094	0.0332	9718	9663	28.2	0.2	29	2851	12515	4.39	4859	7683
		550	327	0.103	0.0336	9736	9677	28.4	0.4	58	2822	12500	4.43	4868	7661
		610	330	0.114	0.0340	9702	9638	28.5	0.5	72	2808	12446	4.43	4851	7627
		650	334	0.122	0.0343	9737	9668	28.5	0.5	72	2808	12476	4.44	4868	7642

Reviewed By: H Berry

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3% Portland Cement - 28 cure results
Date should be July 26, 2016, Triax 2

Materials Testing & Consulting, Inc.

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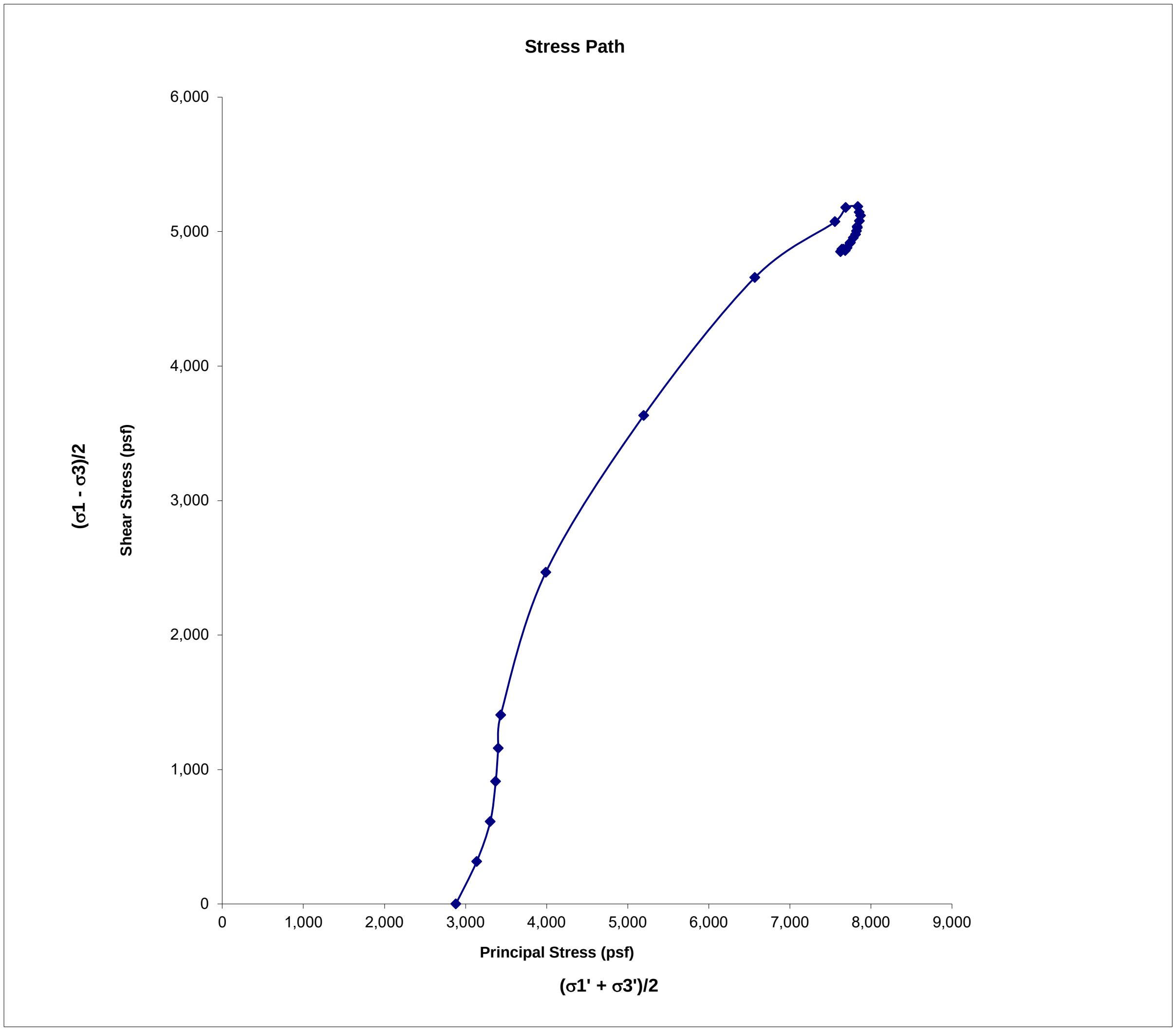
Project:	Intertidal Soils Testing	Date Sampled:	June 15, 2016
Project #:	16T009	Sampled By:	Client
Client:	Crete Consultants	Date Tested:	June 26, 2016
Source:	Site Stockpile	Tested by:	H Benny
Sample #:	T16-1191		



Reviewed By: H Benny

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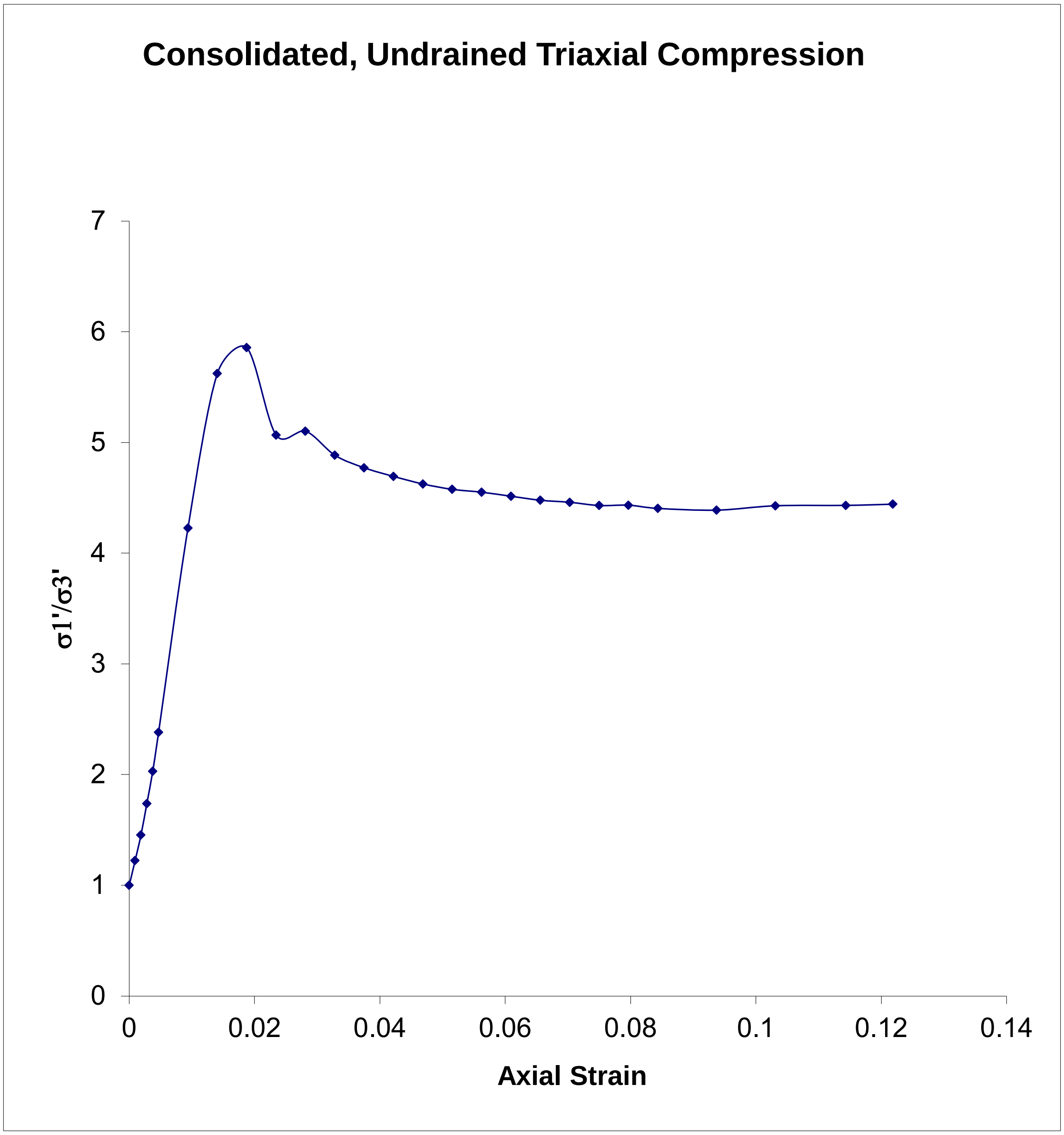
Project:	Intertidal Soils Testing	Date Sampled:	June 15, 2016
Project #:	16T009	Sampled By:	Client
Client:	Crete Consultants	Date Tested:	June 26, 2016
Source:	Site Stockpile	Tested by:	H Benny
Sample #:	T16-1191		



Sample	Depth	Water Content		Void Ratio		Saturation		Unit Weight		Pressure		
Number	Feet	Initial	Final	Initial	Final	Initial	Final	Initial Wet	Initial Dry	Consol	Cell	Back
1.0	NA	14.6	20.4	0.584	0.520	0.675	1.057	121.9	107.0	20.0	48.0	28.0

Reviewed By: H Benny

3% Portland Cement - 28 cure results
Date should be July 26, 2016, Triax 2

Materials Testing & Consulting, Inc.

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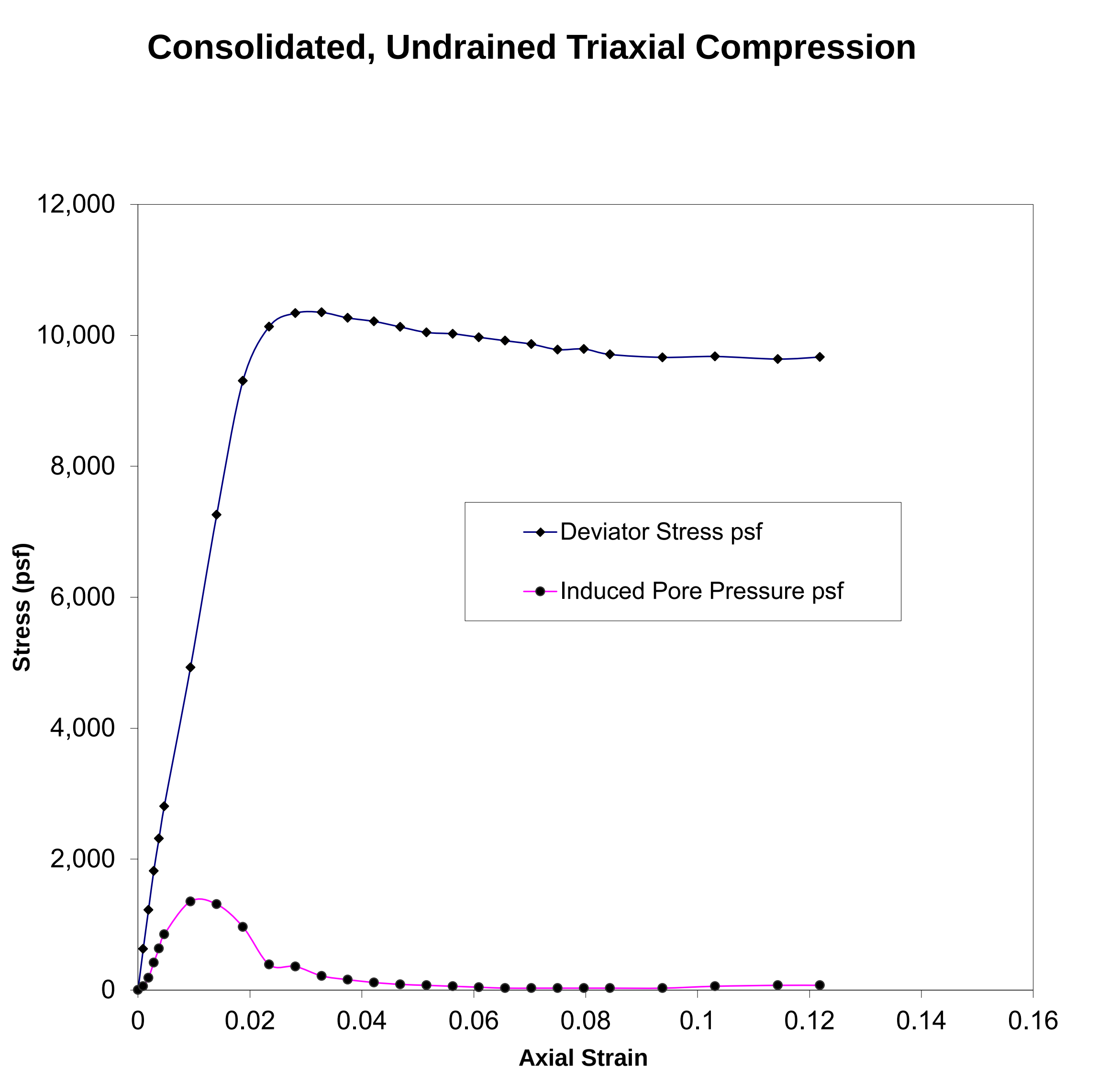
Project:	Intertidal Soils Testing	Date Sampled:	June 15, 2016
Project #:	16T009	Sampled By:	Client
Client:	Crete Consultants	Date Tested:	June 26, 2016
Source:	Site Stockpile	Tested by:	H Benny
Sample #:	T16-1191		



Sample	Depth	Water Content		Void Ratio		Saturation		Unit Weight		Pressure		(psi)
Number	feet	Initial	Final	Initial	Final	Initial	Final	Initial Wet	Initial Dry	Consol	Cell	Back
1	NA	14.6	20.4	0.584	0.520	0.675	1.057	121.9	107.0	20	48	28

Reviewed By: H Benny

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3% Portland Cement - 28 cure results
Triax 3

Materials Testing & Consulting, Inc.

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Consolidated Undrained Triaxial Compression Test, ASTM D4767

Project Number	16T009	LVDT	Load Cell	Strain Ratio	Corrected Area	Deviator Stress	Corrected Stress	Pore Pressure	Δ U	Induced Pore Pressure	σ'3	σ'1	σ'1/σ'3	(σ1−σ3)/2	(σ'1+σ'3)/2
Units		.001"	lbs		ft^2	psf	psf	psi	psi	psf	psf	psf			
Sample #	1	0	0	0	0.0300	0	0	28.0	0.0	0	3600	3600	1	0	3600
Depth	NA	5	72	0.001	0.0300	2399	2399	29.8	1.8	259	3341	5739	1.72	1200	4540
Cell pressure	53	10	97	0.002	0.0300	3229	3228	30.8	2.8	403	3197	6425	2.01	1615	4811
Back Pressure	28	15	120	0.003	0.0301	3991	3989	32.1	4.1	590	3010	6999	2.33	1996	5004
Strain Rate	0.007	20	141	0.004	0.0301	4685	4683	33.0	5.0	720	2880	7563	2.63	2343	5221
Initial Platten Height	0	25	161	0.005	0.0301	5345	5342	33.9	5.9	850	2750	8092	2.94	2672	5421
Initial Load Cell Reading	0	50	267	0.009	0.0303	8823	8817	35.7	7.7	1109	2491	11308	4.54	4411	6900
Initial Length	5.395	75	338	0.014	0.0304	11116	11107	34.2	6.2	893	2707	13815	5.10	5558	8261
Initial Area	0.0300	100	364	0.019	0.0306	11915	11903	32.4	4.4	634	2966	14869	5.01	5957	8918
Height after Saturation	5.391	125	371	0.023	0.0307	12086	12072	31.5	3.5	504	3096	15168	4.90	6043	9132
Height after Consolidation	5.373	150	375	0.028	0.0308	12158	12141	30.7	2.7	389	3211	15352	4.78	6079	9282
		175	378	0.033	0.0310	12197	12177	30.2	2.2	317	3283	15460	4.71	6099	9372
		200	380	0.037	0.0311	12203	12180	29.9	1.9	274	3326	15506	4.66	6101	9416
		225	381	0.042	0.0313	12176	12150	29.7	1.7	245	3355	15505	4.62	6088	9430
		250	382	0.047	0.0314	12148	12120	29.5	1.5	216	3384	15504	4.58	6074	9444
		275	382	0.051	0.0316	12089	12058	29.4	1.4	202	3398	15456	4.55	6044	9427
		300	382	0.056	0.0318	12030	11996	29.4	1.4	202	3398	15394	4.53	6015	9396
		325	380	0.060	0.0319	11908	11871	29.5	1.5	216	3384	15255	4.51	5954	9320
		350	379	0.065	0.0321	11818	11779	29.6	1.6	230	3370	15148	4.50	5909	9259
		375	380	0.070	0.0322	11790	11748	29.7	1.7	245	3355	15103	4.50	5895	9229
		400	382	0.074	0.0324	11793	11748	29.8	1.8	259	3341	15089	4.52	5896	9215
		425	386	0.079	0.0326	11856	11809	29.9	1.9	274	3326	15136	4.55	5928	9231
		450	388	0.084	0.0327	11857	11808	29.8	1.8	259	3341	15149	4.53	5929	9245
		500	392	0.093	0.0331	11858	11804	29.8	1.8	259	3341	15145	4.53	5929	9243
		550	397	0.102	0.0334	11886	11827	29.8	1.8	259	3341	15168	4.54	5943	9254
		610	401	0.114	0.0338	11856	11792	29.7	1.7	245	3355	15147	4.51	5928	9251
		650	406	0.121	0.0341	11903	11835	29.6	1.6	230	3370	15205	4.51	5952	9287
		700	410	0.130	0.0345	11893	11821	29.5	1.5	216	3384	15205	4.49	5947	9294

Reviewed By: ____________________

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3% Portland Cement - 28 cure results
Date should be July 26, 2016, Triax 3

Materials Testing & Consulting, Inc.

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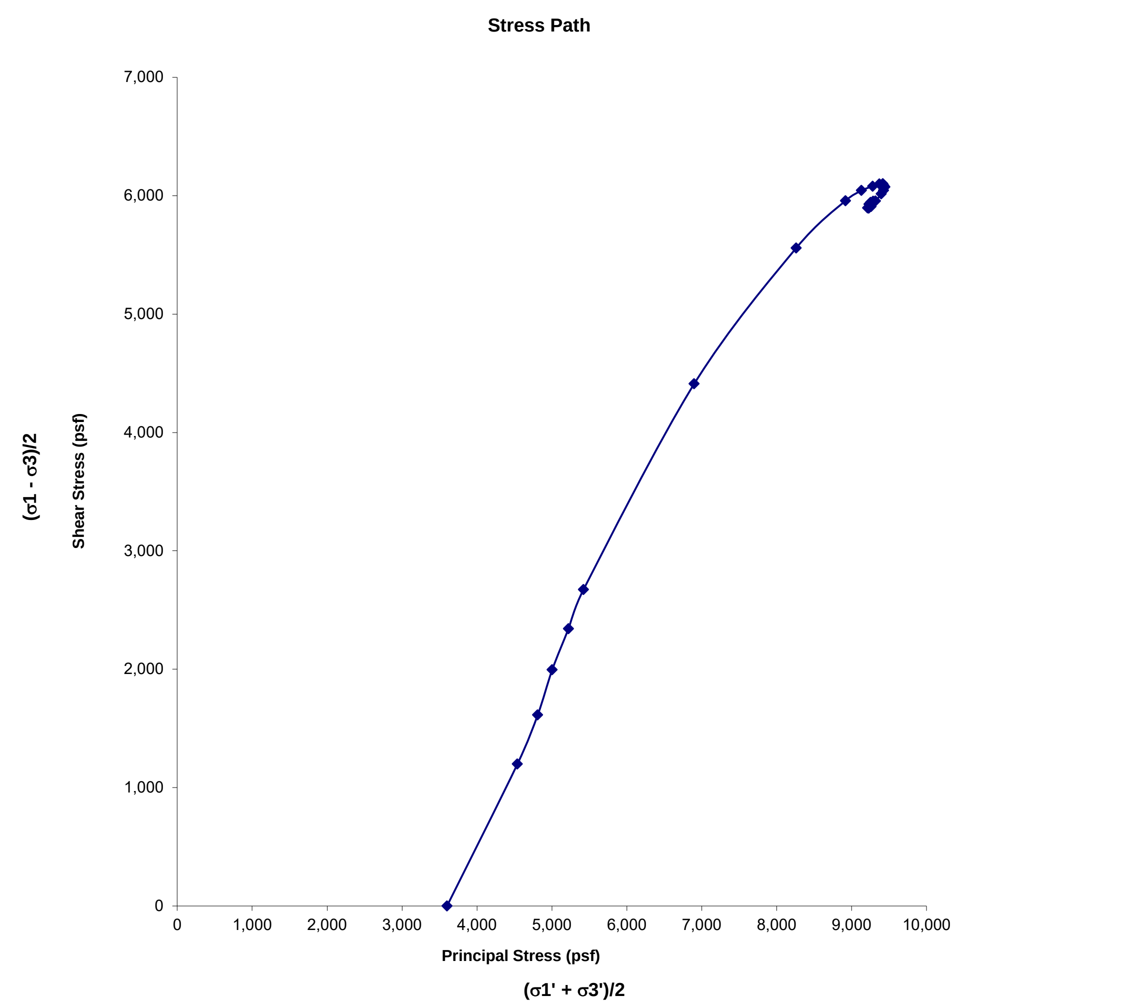
Project:	Intertidal Soils Testing	Date Sampled:	June 15, 2016
Project #:	16T009	Sampled By:	Client
Client:	Crete Consultants	Date Tested:	June 26, 2016
Source:	Site Stockpile	Tested by:	H Benny
Sample #:	T16-1191		



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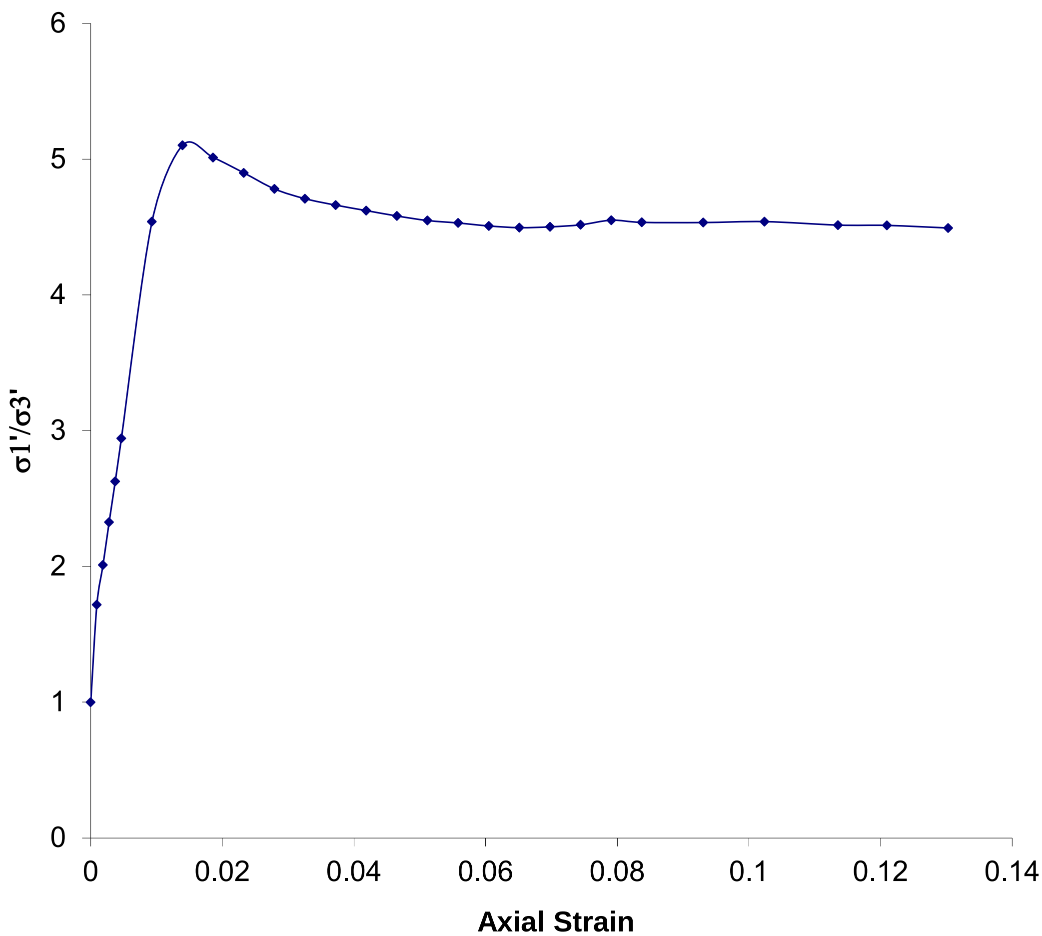
Project:	Intertidal Soils Testing	Date Sampled:	June 15, 2016
Project #:	16T009	Sampled By:	Client
Client:	Crete Consultants	Date Tested:	June 26, 2016
Source:	Site Stockpile	Tested by:	H Benny
Sample #:	T16-1191		

Consolidated, Undrained Triaxial Compression



Sample	Depth	Water Content		Void Ratio		Saturation		Unit Weight		Pressure		
Number	Feet	Initial	Final	Initial	Final	Initial	Final	Initial Wet	Initial Dry	Consol	Cell	Back
1.0	NA	14.9	20.0	0.569	0.492	0.707	1.099	123.4	102.8	25.0	53.0	28.0

Reviewed By: H Benny

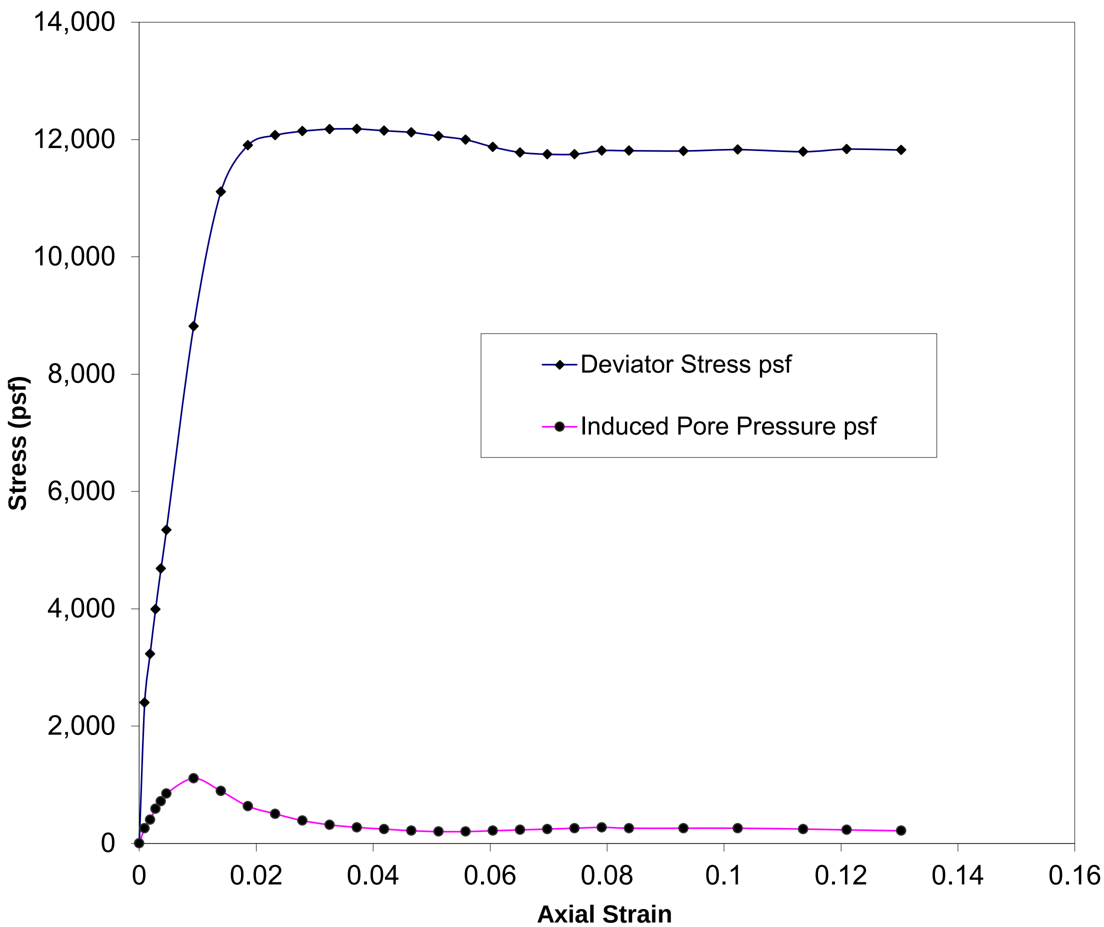
3% Portland Cement - 28 cure results
Date should be July 26, 2016, Triax 3

Materials Testing & Consulting, Inc.

Geotechnical Engineering • Special Inspection • Materials Testing • Environmental Consulting

Project:	Intertidal Soils Testing	Date Sampled:	June 15, 2016
Project #:	16T009	Sampled By:	Client
Client:	Crete Consultants	Date Tested:	June 26, 2016
Source:	Site Stockpile	Tested by:	H Benny
Sample #:	T16-1191		

Consolidated, Undrained Triaxial Compression



Sample	Depth	Water Content		Void Ratio		Saturation		Unit Weight		Pressure		(psi)
Number	feet	Initial	Final	Initial	Final	Initial	Final	Initial Wet	Initial Dry	Consol	Cell	Back
1	NA	14.9	20.0	0.569	0.492	0.707	1.099	123.4	102.8	25	53	28

Reviewed By: H Benny

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3% Portland Cement - 28 cure results
Date should be July 26, 2016

Client:	Crete Consultants	**Date:**	May 15, 2015
Address:	Seattle Wa	**Project:**	Intertidal Soil Testing
		Project #:	16T009
Attn:	Grant Hainsworth, PE	**Sample #:**	T16-1191

As requested MTC, Inc. has performed the following test(s) on the sample referenced above. The testing was performed in accordance with current applicable AASHTO or ASTM standards as indicated below. The results obtained in our laboratory were as follows below or on the attached pages:

	Test(s) Performed:	Test Results		Test(s) Performed:	Test Results
x	Sieve-Hydrometer Analysis	See Attached		Sulfate Soundness	
x	Proctor	124.1 pcf at 10.6%		Bulk Density & Voids	
	Sand Equivalent			WSDOT Degradation	
	Fracture Count				
	Moisture Content				
	pH				
	Minimum Resistivity				
	Organic Content				
x	Atterberg Limits	Non-Plastic			
	Asphalt Extraction/Gradation				
	Rice Density				

If you have any questions concerning the test results, the procedures used, or if we can be of any further assistance please call on us at the number below.

Respectfully Submitted,

Harold Benny
WABO Supervising Laboratory Technician

Materials Testing & Consulting, Inc.

Geotechnical Engineering • Special Inspection • Materials Testing • Environmental Consulting

3% Portland Cement - 28 cure results
Date should be July 26, 2016

Proctor Report

Project: Intertidal Soil Testing
Project #: 16T009
Client: Crete Consultants
Source: Site Stockpile
Sample#: T16-1191

Date Received: 10-Jun-16
Sampled By: Client
Date Tested: 15-Jun-16
Tested By: H Benny

Unified Soils Classification System, ASTM D-2487
SW, Well-graded Sand
Sample Color
Gray

Sample Prepared: Moist: X Dry: Manual: Mechanical: X

Test Standard: ASTM D698: X ASTM D 1557: AASHTO T 99: AASHTO T 180: Method C

Assumed Sp. Gr. 2.65

Point Number	Percent Moisture	Dry Density
1	8.3 %	116.6
2	10.6 %	121.5
3	12.8 %	120.0
4	14.9 %	114.7

Uncorrected Proctor Value

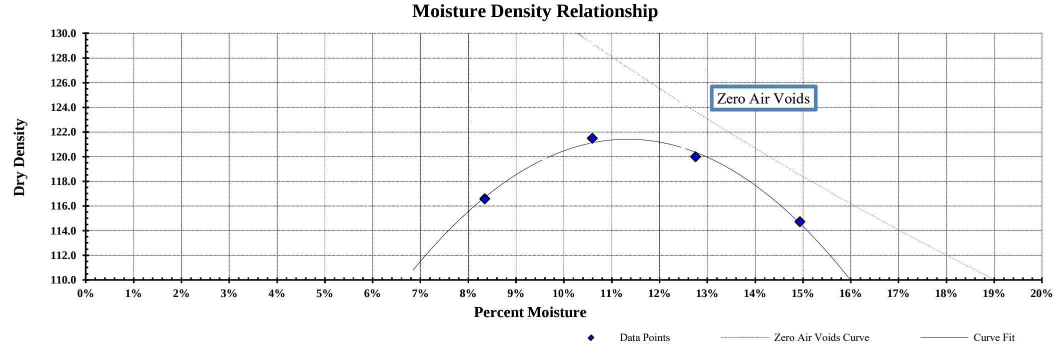
Max. Dry Density		Optimum Moist
121.4	**lbs/ft³**	**11.3 %**

Value w/ Oversize Correction Applied

Max. Dry Density		Optimum Moist
124.1	**lbs/ft³**	**10.5%**

ACCREDITED
Certificate #: 1366.01, 1366.02 & 1366.04

Moisture Density Relationship



ASTM C-136

Sieve US	Size mm	Percent Passing	Specifications Max	Specifications Min
12.00"	300.00		100.0 %	0.0 %
10.00"	250.00		100.0 %	0.0 %
8.00"	200.00		100.0 %	0.0 %
6.00"	150.00		100.0 %	0.0 %
4.00"	100.00		100.0 %	0.0 %
3.00"	75.00		100.0 %	0.0 %
2.50"	63.00		100.0 %	0.0 %
2.00"	50.00		100.0 %	0.0 %
1.75"	45.00		100.0 %	0.0 %
1.50"	37.50		100.0 %	0.0 %
1.25"	31.50		100.0 %	0.0 %
1.00"	25.00	100 %	100.0 %	0.0 %
3/4"	19.00	92 %	100.0 %	0.0 %
5/8"	16.00		100.0 %	0.0 %
1/2"	12.50		100.0 %	0.0 %
3/8"	9.50	91 %	100.0 %	0.0 %
1/4"	6.30		100.0 %	0.0 %
#4	4.75	87 %	100.0 %	0.0 %
#8	2.36		100.0 %	0.0 %
#10	2.00		100.0 %	0.0 %
#16	1.18		100.0 %	0.0 %
#20	0.850		100.0 %	0.0 %
#30	0.600		100.0 %	0.0 %
#40	0.425		100.0 %	0.0 %
#50	0.300		100.0 %	0.0 %
#60	0.250		100.0 %	0.0 %
#80	0.180		100.0 %	0.0 %
#100	0.150		100.0 %	0.0 %
#140	0.106		100.0 %	0.0 %
#170	0.090		100.0 %	0.0 %
#200	0.075		100.0 %	0.0 %

ASTM D-4718, Misc. Oversize Correction Values

% Oversize Mat'l: 8%

% Oversize Retained	Corrected Density	Optimum Moisture
5%	123.0	10.8%
10%	124.7	10.3%
15%	126.5	9.7%
20%	128.2	9.2%
25%	130.1	8.6%
30%	131.9	8.1%

Specs: No Specs
Meets Specs? **N/A**

% Gravel: 13.2%	C_C: 1.50	$D_{(10)}$: 0.547
% Sand: 85.4%	C_U: 6.00	$D_{(30)}$: 1.642
% Silt&Clay: 1.4%	FM: 4.46	$D_{(60)}$: 3.283
LL: n/a	PL: n/a	PI: n/a
Sand Equivalent: n/a	Req'd Sand Equivalent:	
Fracture %, 1 Face: n/a	Req'd Fracture %, 1 Face:	
Fracture %, 2+ Faces: n/a	Req'd Fracture %, 2+ Faces:	

Comments: The sample contained shell fragments wich broke up during testing.

Reviewed by: H Benny

Materials Testing & Consulting, Inc.

Geotechnical Engineering • Special Inspection • Materials Testing • Environmental Consulting

Project: Intertidal Soils
Project #: T16-009
Date Received: June 15, 2016
Date Tested: July 25, 2016

Client: Crete Consultants
Sampled by: Client
Tested by: H Benny, J Benny

Percent Finer (Passing) Than the Indicated Size

Sieve Size (microns)	3"	2"	1 1/2"	1"	3/4"	1/2"	3/8"	#4 (4750)	#10 (2000)	#20 (850)	#40 (425)	#60 (250)	#100 (150)	#200 (75)	32	22	13	9	7	3.2	1.3
Cement Amended Soil	100.0	100.0	100.0	100.0	100.0	97.6	96.3	92.0	86.6	76.3	60.0	42.8	33.0	25.8	20.1	17.5	13.1	9.6	7.9	5.3	2.6

Testing performed according to ASTM D421/D422
Organics were not removed prior to analysis. The grain size distribution reported is the "apparent grain size distribution".

Reviewed by: ______________________

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Materials Testing & Consulting, Inc.

Geotechnical Engineering • Special Inspection • Materials Testing • Environmental Consulting

Project: Intertidal Soils
Project #: T16-009
Date Received: June 15, 2016
Date Tested: July 25, 2016

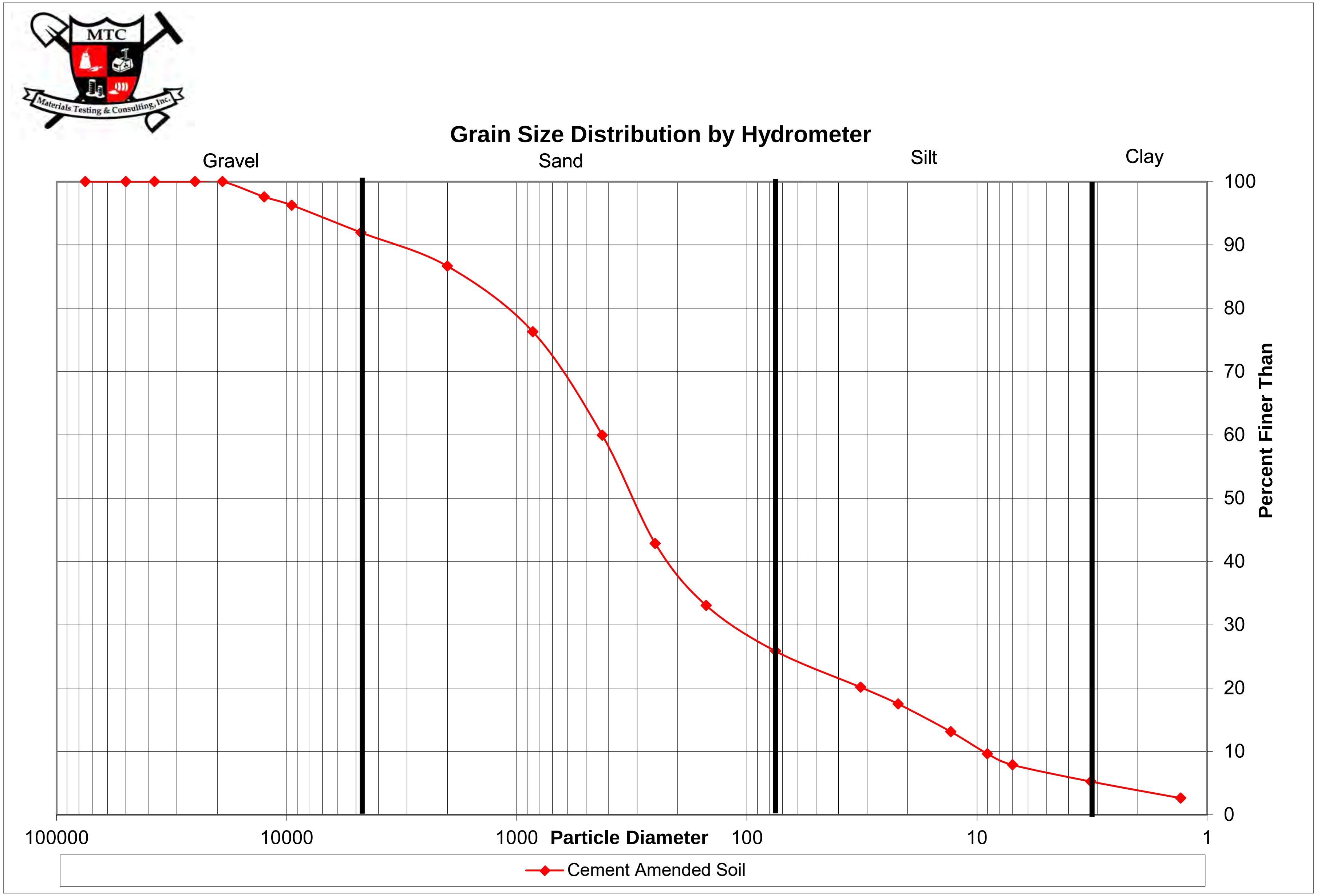
Client: Crete Consultants
Sampled by: Client
Tested by: H Benny, J Benny

Percent Retained in Each Size Fraction

Description	% Coarse Gravel				% Gravel			% Coarse Sand	% Medium Sand		% Fine Sand			% Very Coarse Silt	% Coarse Silt	% Medium Silt	% Fine Silt	% Fine Silt	% Very Fine Silt	% Clay	
Particle Size (microns)	3-2"	2-1 1/2"	1 1/2"-1"	1-3/4"	3/4-1/2"	1/2-3/8"	3/8"-4750	4750-2000	2000-850	850-425	425-250	250-150	150-75	75-32	32-22	22-13	13-9	9-7	7-3.2	3.2-1.3	<1.3
Cement Amended Soil	0.0	0.0	0.0	0.0	2.4	1.3	4.3	5.3	10.4	16.3	17.1	9.8	7.2	5.7	2.6	4.4	3.5	1.8	2.6	2.6	2.6

Testing performed according to ASTM D421/D422
Organics were not removed prior to analysis. The grain size distribution reported is the "apparent grain size distribution".

Reviewed by:



Materials Testing & Consulting, Inc.
MTC
Grain Size Distribution by Hydrometer
Gravel
Sand
Silt
Clay
100
90
80
70
60
50
40
30
20
10
0
Percent Finer Than
100000
10000
1000
Particle Diameter
100
10
1
Cement Amended Soil

APPENDIX C
Sediment Cap and Groundwater Flow

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LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS AND ABBREVIATIONS

2-MN	2-methylnaphthalene
AC	activated carbon
CAP	Cleanup Action Plan
cm/yr	centimeters per year
D/F	dioxins and furans
EDR	Engineering Design Report
EPA	U.S. Environmental Protection Agency
foc	fraction organic carbon
IHS	indicator hazardous substances
ISS	in-situ solidification
LNAPL	light non-aqueous phase liquid
µg/L	micrograms per liter
MLLW	mean lower low water
MNR	Monitored Natural Recovery
NAPL	non-aqueous phase liquid
OC	organoclay
PCP	pentachlorophenol
RI/FS	Remedial Investigation/Feasibility Study
Site	R.G. Haley Site
SSI	Supplemental Sediment Investigation
TLC	thin-layer cap
TPH	total petroleum hydrocarbons
USACE	U.S. Army Corps of Engineers

1.0 INTRODUCTION

This appendix summarizes sediment cap performance modeling for chemical isolation and containment completed as part of the sediment cap design for the Marine Unit of the R.G. Haley Site (Site). As shown on Figure C-1, planned sediment cleanup actions for the Marine Unit include:

- Removing nearshore intertidal sediment that has been most heavily impacted by historic releases of non-aqueous phase liquid (NAPL) from the adjacent upland unit;
- Placing an amended sand cap in areas within and outside of the sediment removal area where needed to enhance chemical containment;
- Placing a non-amended thin-layer containment cap (TLC) of gravelly sand seaward of the amended caps; and
- Monitoring expected natural recovery in the Monitored Natural Recovery (MNR) area seaward of the capping areas.

The sediment cap modeling described in this appendix was completed to support design of the nearshore amended sand caps. This modeling builds upon previous cap modeling done as part of the Haley Site Remedial Investigation/Feasibility Study (RI/FS; GeoEngineers 2016). The FS identified sediment cap alternatives that meet the cleanup action objectives for the Marine Unit, as further described in the Cleanup Action Plan (CAP; Washington State Department of Ecology 2018) and in Section 1.1 of the Engineering Design Report (EDR).

2.0 CAP PERFORMANCE MODELING OBJECTIVES

The objective of cap performance modeling is to identify sediment cap profiles that are capable of containing contaminants present in underlying sediment and associated porewater to the degree necessary to meet cleanup levels at the applicable points of compliance.

During the FS, indicator hazardous substances (IHS) were evaluated to identify those contaminants requiring the most robust cap design to achieve cleanup standards. Based on this analysis, pentachlorophenol (PCP) and 2-methylnaphthalene (2-MN) were selected for cap modeling, in part because of their higher dissolved-phase mobility in groundwater relative to other Site contaminants. The FS cap modeling also included total petroleum hydrocarbons (TPH) for nearshore locations where sediment contains residual light non-aqueous phase liquid (LNAPL). These same contaminants (2-MN, PCP and TPH) were the focus of evaluations discussed in this EDR. In addition, a sensitivity analysis was conducted to confirm that the cap design(s) developed based on PCP, 2-MN and TPH concentrations will also be protective of dioxins and furans (D/F). This analysis was conducted because of the exceptionally low cleanup level for D/F, even though this IHS group is significantly less mobile than the other modeled contaminants.

Since the FS-level cap modeling was completed, the groundwater cleanup level for PCP decreased from 3 micrograms per liter (μg/L) to 0.04 μg/L. This change triggered more rigorous cap modeling efforts to design an effective cap; however, much of the basis for cap modeling and design remains unchanged from that described in the FS report. The footprint of sediment capping at the Haley Site also expanded since the FS was completed in response to post-FS sediment sampling (GeoEngineers 2018). Sediment capping needs in this expanded area were also evaluated during the modeling described in this appendix. The general cap modeling approach utilized to support this EDR is similar to that described in the FS report, except for the greater level of detail needed to support remedial design.

Cap modeling was completed to verify that the key IHSs driving cap design, PCP, 2-MN and TPH, are physically and chemically isolated, thereby achieving sediment and surface water cleanup levels during a 100-year design life for the remedy. The ability of the cap profiles to meet these cleanup levels over this time period was the guiding performance criterion for cap modeling. The sediment point of compliance for the cleanup action is discussed in Section 2.3 of the EDR text.

3.0 MODELING EVALUATION

3.1. Approach

A one-dimensional transient model was used to evaluate contaminant transport within cap material under selected cap design scenarios. Analyses were performed using the transient numerical modeling program CAPSIM© (Version 3.6) developed by Dr. Danny Reible and associates (Reible 2018). The CAPSIM program is a well-accepted model that is commonly used to evaluate the contaminant isolation capability of sediment caps. Application of the CAPSIM model also addresses cap design considerations for chemical containment described in the U.S. Environmental Protection Agency (EPA) and U.S. Army Corps of Engineers (USACE) guidance for contaminated sediment capping (Palermo et al. 1998).

The modeling was completed to support design of the cap over an area of approximately six acres in the Haley Marine Unit with varying contaminant concentrations, predicted groundwater flux rates at the mudline, and sediment organic carbon fractions. As noted above, PCP and 2-MN were considered to require the most robust cap design because of their prevalence and relative mobility in the aqueous phase. These contaminants are also closely associated with TPH and residual LNAPL at the Site. Iterative modeling runs supported development of several cap profiles (thickness and amendments) in different portions of the Marine Unit. Amendments are included in the cap designs where necessary to isolate contaminants and achieve compliance with sediment and porewater cleanup levels. The amendments include different dosing of organoclay (OC) and/or activated carbon (AC) in the chemical isolation layer. The modeling output estimates the proposed cap designs will contain 2-MN, PCP, TPH and D/F beyond the 100-year design life of the remedy. The resulting design is anticipated to also be protective of other Haley contaminants that are less mobile.

3.2. Groundwater Flux Zones

The most sensitive parameter affecting contaminant transport and modeling results is the rate of groundwater flow (flux) through underlying sediment and the resulting rate of upwelling at the sediment mudline. Groundwater flow modeling (using MODFLOW) was performed to estimate the distribution of groundwater flux in the Haley Marine Unit. Based on this modeling output, three main zones of groundwater flux were estimated to exist in the Marine Unit (Figure C-1). Cap design in each of these zones was evaluated separately using CAPSIM. These three groundwater flux zones are described below.

3.2.1. (Zones 1a and 1b – High Groundwater Flux) Nearshore Area

This zone generally encompasses the area shoreward of mean lower low water (MLLW) where the predicted groundwater and associated contaminant mass flux rates at the mudline are comparatively high. Within a portion of this high flux zone (Zone 1a), excavation is planned to depths ranging from about 2 to 4 feet below the existing mudline to remove sediment where residual LNAPL is most likely to be present along with associated elevated concentrations of TPH, PCP, 2-MN and other IHSs. The excavation will then be capped to address any residual LNAPL potentially remaining in sediment below the excavation depth.

This high flux zone also includes areas north and south of the excavation area where IHSs are present but residual LNAPL is less likely to occur (Zone 1b). The cap will be placed directly on contaminated sediment (no excavation) in this area, after debris removal and minor sediment grading as necessary for cap placement.

3.2.2. (Zone 2 – Moderate to Low Groundwater Flux) Lower-Intertidal/Shallow Subtidal Areas

This zone encompasses offshore areas where moderate to high concentrations of IHSs are present in sediment, but groundwater flux values are estimated to be approximately one-half of those in Zone 1. The cap will be directly placed on contaminated sediment, following removal of debris. This zone is located seaward of Zone 1. The inner margin of this zone is generally located near MLLW; the seaward margin varies in bathymetry based on the groundwater modeling estimates of flux.

3.2.3. (Zone 3 – Minimal Groundwater Flux) Offshore Diffusion-Dominant Areas

This zone encompasses areas farther offshore where advective transport is minimal because there is little or no groundwater flux at the mudline. In this area, contaminants migrate primarily by diffusion which is driven by concentration gradients between contaminated sediment and overlying clean cap materials.

4.0 MODEL INPUTS

4.1. Porewater Concentrations

The CAPSIM cap model relies on user-input values for dissolved-phase contaminant concentrations entering the cap. Several sources of data were considered for conservative input concentrations to the model, including the following:

- Measured groundwater concentrations in groundwater samples collected from upland and intertidal zone monitoring wells. This data set excluded samples collected from the future in-situ solidification (ISS) footprint and samples from intertidal wells located within the future sediment excavation area. Groundwater samples collected from wells with trace LNAPL at the time of sampling were also excluded, as were samples from wells in the Upland Unit more than approximately 100 feet upgradient from the shoreline.
- Calculated equilibrium porewater concentrations based on maximum sediment concentrations presented in the RI and the Supplemental Sediment Investigation (SSI; GeoEngineers 2018). This data set applied a conservative estimate of the sediment fraction organic carbon (foc). Sediment samples within the future excavation footprint, and samples greater than 4 feet below the existing mudline were excluded from evaluation.
- Maximum leachate concentrations from the ISS treatability study (see EDR Appendix B).

Conservative concentrations from the above data sets were used as input values in CAPSIM (Table C-1). Concentrations used in the model for PCP, 2-MN and TPH in all groundwater flux zones are based on the calculated equilibrium porewater concentrations except for 2-MN in Zone 1. These calculated porewater concentrations are higher, and therefore more conservative than concentrations derived from the other data sources described above. The input concentrations for 2-MN and TPH in Zone 1 are based on leachate concentrations from the ISS treatability study (EDR Appendix B). These values were used because they are higher than the highest porewater concentrations calculated for 2-MN and TPH using sediment data. The 2-MN and TPH concentrations used from the leachate test are very conservative values because the sample was manually spiked with LNAPL and is expected to overestimate the leachability of contaminants from ISS-treated soil. In addition, the leachate test results do not reflect the attenuation that will occur as a result of advective transport in groundwater outside of the ISS body, which itself has a low hydraulic conductivity.

The primary drivers of cap design are PCP and 2-MN because of their mobility, and TPH because it competes for the amendment sorption material in the cap. For modeling purposes, concentrations of constituents in porewater entering the cap from below were conservatively assumed to remain fixed over the 100-year design life that was modeled. This assumption simulates an infinite source of contamination to the overlying sediment cap. The following ranges of porewater concentrations were used for modeling:

- PCP: 136 µg/L to 7.8 µg/L
- 2-MN: 74.8 µg/L to 2.7 µg/L
- TPH: 1,321 µg/L to 17.9 µg/L

The higher concentrations for each constituent reflect conditions in Zone 1 and the lower concentrations reflect conditions in Zone 3. Refer to Table C-1 for the complete list of sediment and porewater model inputs.

4.2. Groundwater Velocity Distribution

Groundwater modeling was completed as part of the RI/FS. As part of this work, a three-dimensional MODFLOW model was created to evaluate groundwater flux rates to the Haley Marine Unit, as described in Section 4.2.2 and Appendix H of the RI. The model was then used to evaluate selected cleanup action elements for FS alternatives such as ISS and low permeability capping in the Upland Unit, and sediment excavation and capping in the Marine Unit.

The groundwater flow model was further refined during the EDR to develop groundwater velocity inputs for cap performance modeling of the cleanup action. The groundwater model was modified to consider the effects of the upland ISS, as well as the low-permeability upland cap on groundwater flow to capping areas in the Marine Unit. Groundwater flux at the mudline was contoured, leading to identification of the three zones described in Section 2.0 and shown on Figure C-1. Modeling results also provided associated porewater velocity inputs to the cap model to assess the influence of flux on contaminant mobility.

4.3. Input Parameter Summary

Table C-1 summarizes the input parameters used for the CAPSIM model and the basis for the input values. Input parameters are presented for each groundwater flux zone including chemical inputs and capping materials with amendments and other properties for containing contaminants over the 100-year design life. Additional model inputs included parameters for advection, diffusion, dispersion, bioturbation, settlement, deposition, chemical retardation, porewater/sediment interaction, dissolved organic matter (organic carbon), and local equilibria. Input parameters were derived from previous site sampling and testing data, literature review, and communication with subject-matter experts, including Dr. Danny Reible, the CAPSIM model developer.

5.0 MODEL RESULTS

Sediment cap modeling using CAPSIM was completed for each of the three groundwater flux zones within the Marine Unit. CAPSIM model output includes porewater and solid concentration data along a one-dimensional (vertical) profile through the sediment cap for the selected design period. Selected cap profiles and model results for Zones 1 through 3 are explained below and presented in Tables C-2 and C-3.

Figures C-2 through C-17 present CAPSIM model output graphs of PCP concentrations in solids (sediment cap material) and porewater versus depth within the cap profile. Output graphs of 2-MN and TPH in solids are also shown. Porewater graphs for 2-MN and TPH are not presented because their associated cleanup levels are applicable to sediment (as opposed to surface water). The output graphs illustrate the respective contaminant concentrations within the different cap profiles at 20-year increments over the modeled 100-year design lifespan. The key input parameters and modeling-derived cap profiles that achieve cleanup levels in each groundwater flux zone are summarized below.

In all cases the modeling results indicate that cleanup levels for PCP, 2-MN, and TPH are expected to be achieved over a 100-year period at depths within the caps well below their respective points of compliance.

5.1. Zone 1a (High Groundwater Flux Within Nearshore Sediment Excavation)

- Groundwater flux was estimated to be greatest in nearshore Zone 1a (and Zone 1b) at 537 centimeters per year (cm/yr).
- The input porewater concentration for of 136 µg/L for PCP was calculated based on the highest PCP concentration remaining in sediment immediately below the bottom of the excavation (4,000 µg/kg, sample COB-SC-01).
- The input porewater concentrations of 74.8 µg/L for 2-MN and 1,321 µg/L for TPH were based on the maximum leachate concentration from the ISS treatability study (sample 0600-024). The TPH concentration was used to conservatively model the influence of high TPH concentrations on competitive adsorption in cap material.
- Cap modeling results indicated that amendments would be needed to meet cleanup levels in Zone 1a. Modeling showed that AC effectively attenuates 2-MN, while OC is needed to attenuate PCP over a 100-year design life modeled. TPH is also attenuated with these amendments. Contaminant containment can be achieved by capping the excavation area using a 2-foot chemical containment horizon. The bottom 1-foot would be amended with 1 percent (by weight) OC and the top 1-foot would be amended with 1 percent (by weight) AC.
- There is some uncertainty regarding the vertical profile of residual LNAPL in the excavation area because it is located adjacent to the nearshore oil plume in the Upland Unit. The CAPSIM model does not account for petroleum in the form of LNAPL, therefore a more robust cap design is proposed for this area. Based on discussions with vendors that have experience with similar conditions, a 10 percent (by weight) OC amendment is proposed for the full 2-foot profile of the chemical containment horizon.

OC is the preferred amendment for this application because of its capacity to sorb residual LNAPL, if present beneath the excavation. Cap modeling shows that with this amount of OC amendment, AC is not needed to sequester 2-MN. Modeling output indicates this cap design is estimated to achieve sediment and porewater cleanup levels at the depths within the cap shown on Figures C-2 through C-5. The footprint of this sediment cap is shown in Figure C-1.

- As discussed in Section 6.2.4 of this EDR, cap design for Zone 1a will be refined, if needed, based on the results of additional porewater and solids sampling in the nearshore organoclay cap constructed during the 2013 interim action and other Zone 1a locations to be determined.

5.2. Zone 1b (High Groundwater Flux Area, Outside Sediment Excavation Limits)

- The same elevated nearshore groundwater flux of 537 cm/yr described above for Zone 1a was estimated to be present in the Zone 1b area outside the limits of the excavation.
- To be conservative, input porewater concentrations were estimated to be the same as within the excavation limits as described above; 136 µg/L for PCP, 74.8 µg/L for 2-MN, and 1,321 µg/L for TPH.
- In Zone 1b, 2-MN was determined to be most effectively attenuated by AC, while OC is needed to address PCP. Contaminant containment can be achieved using a 1-foot thick sand layer with 1 percent (by weight) AC over another 1-foot thick sand layer with 1 percent OC. This cap profile applies to areas where residual LNAPL is unlikely to be present.
- Modeling results indicate this cap design will achieve sediment and porewater cleanup levels at the depths within the cap shown on Figures C-6 through C-9.

5.3. Zone 2 (Moderate to Low Groundwater Flux Area)

- Modeled conditions for this zone include moderate to low groundwater fluxes representative of conditions in the lower-intertidal to shallow subtidal areas. The highest estimated groundwater flux of 280 cm/yr at the mudline was used for this zone.
- Input porewater concentrations in Zone 2 are estimated to be generally one order of magnitude less than Zones 1a and 1b: 7.8 µg/L for PCP, 2.7 µg/L for 2-MN and 24.8 µg/L for TPH.
- Modeling results indicate that an OC-amended sand cap is required in this area to sequester PCP. Contaminant containment can be achieved using a 2-foot-thick horizon composed of sand with 1 percent OC. This profile applies to capping areas seaward of Zone 1 between approximately MLLW and -10 feet MLLW (Figure C-1).
- Modeling results indicate this cap design will achieve sediment and porewater cleanup levels at the depths within the cap shown in Figures C-10 through C-13.

5.4. Zone 3 (Minimal Groundwater Flux Area, Diffusion-Dominated)

- Modeled conditions for this zone include minimal groundwater flux seaward of Zone 2.
- Input porewater concentrations of PCP, 2-MN, and TPH are typically one to two orders of magnitude lower than those in Zone 1 based on available sediment data: 34 µg/L for PCP, 8.9 µg/L for 2-MN and 17.9 µg/L for TPH.
- Modeling results indicate that a sand cap containing a minimal amount of organic carbon is required for chemical containment in this zone. Considering the negligible groundwater flux at the mudline and

relatively low concentrations of PCP, contaminant containment can be achieved using a 1-foot-thick sand cap with 0.1 percent AC. Naturally occurring carbon sources may also be suitable for the purpose of achieving this organic carbon content.

- Modeling results indicate this cap design is estimated to achieve sediment and porewater cleanup levels at the depths within the cap shown on Figures C-14 through C-17.

6.0 SENSITIVITY ANALYSIS FOR DIOXINS/FURANS

As previously described, the key contaminants used to evaluate cap performance were PCP and 2-MN because of their mobility, and TPH because it competes for sorption sites in the cap. However, a sensitivity analysis was performed to confirm that the proposed cap profiles will also be protective of D/F.

The CAPSIM model was run using conservative input D/F concentrations, the highest groundwater flux conditions, and a conservative cap amendment condition (Zone 1a 2-foot sand cap with 1-foot of sand amended with 1 percent OC overlain by 1-foot of sand amended with 1 percent AC). Input parameters used for sediment and porewater conditions are as described in Table C-1 for Zone 1 (mass transport properties and cap material/placement properties) and for cap materials are as presented in Table C-2 for Zone 1b. The model input parameters and results specific to D/F are presented in Table C-4.

The model run used the highest D/F concentration observed in shallow sediment within the nearshore zone affected by groundwater flux as a conservative estimate of D/F mobility. As presented in Table C-4, the results of the conservative model run for D/F indicates that D/F attenuates very quickly within the 1-percent OC amended sand cap and after 100 years, the concentrations of D/F exceeding cleanup levels would migrate only 8 cm into the cap material. Based on this result for the most conservative D/F mobility scenario, further cap modeling for D/F was not conducted.

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TABLE C-1. INPUT PARAMETER SUMMARY FOR THE SEDIMENT CAP MODEL

Model Input Parameters		Unit	Zone 1	Zone 2	Zone 3	Data Source/Rationale
			Value			
Mass Transport Properties						
Groundwater Darcy velocity		cm/yr	537	280	0	Groundwater model (MODFLOW) output.
Depositional velocity		cm/yr	0	0	0	Conservative assumption of no net sedimentation.
Boundary layer mass transfer coefficient		cm/hr	2.37	2.37	2.37	Conservative assumption consistent with CapSIM Manual guidance.
Biodiffusion coefficients		cm^2/yr	1 (particle), 100 (porewater)			Typical values used for cap design (Reible 2012).
Chemical Properties						
Octonal-Water Partition Coefficient (Kow)	PCP	L/kg	3.86			Literature (Montgomery 2000).
	2-MN	L/kg	5.09			
	TPH	L/kg	7.23			
Organic Carbon-Water Partition Coefficient (Koc)	PCP	L/kg	590			
	2-MN	L/kg	2,478			
	TPH	L/kg	2,700,800			
Sediment Cleanup Level (cap material)	PCP	µg/kg (dw)	100			Cleanup Action Plan. As measured at bottom of biologically active zone.
	2-MN	µg/kg (dw)	670			
	TPH	µg/kg (dw)	260,000			
Surface Water Cleanup Level	PCP	µg/L	0.04			Cleanup Action Plan. As measured at bottom of biologically active zone.
	2-MN	µg/L	NA			
	TPH	µg/L	250			

Model Input Parameters		Unit	Zone 1	Zone 2	Zone 3	Data Source/Rationale
			Value			
Source Properties						
Sediment fraction organic carbon (f_{oc})		--	0.05	0.05	0.05	Conservative assumption based on sediment data collected during the RI and SSI.
Underlying sediment concentrations used to derive equilibrium porewater concentrations	PCP	µg/kg	4,000[1]	230	210	[1] Sediment data collected during the RI and SSI, assumes constant source. [2] Sediment data not used, see note below for Zone 1 2-MN and TPH.
	2-MN	µg/kg	NA[2]	335	121	
	TPH	µg/kg	NA[2]	3,360	2,430	
Underlying porewater concentration	PCP	µg/L	136[3]	7.8	34	[3] Equilibrium concentration calculated based on underlying sediment concentrations listed above. [4] Maximum leachate concentration of ISS treatability test sample 0600-024.
	2-MN	µg/L	74.8[4]	2.7	8.9	
	TPH	µg/L	1,321[4]	24.8	17.9	
Cap Material/Placement Properties						
Maximum consolidation depth		cm	55.88			Value derived from geotechnical analysis completed using SETTLE3D.
Time to 90% consolidation		yr	3.8			
Cap thickness excluding erosion protection layer		ft	2	2	1	Cap thickness based on physical/chemical containment properties, constructability, and bathymetry considerations.
Bioturbation zone thickness		cm	12			Cited value for Bellingham Bay (Anchor 2015).
Depositional velocity		cm/yr	0	0	0	Conservative assumption of no net sedimentation.
Porosity		--	0.4 (sand), 0.5 (OC), 0.64 (AC)			Literature and material vendor provided values.
f_{OC} of sand before amending		--	0.01			
Bulk density		g/cm³	1.6 (sand), 0.8 (OC), 0.49 (AC)			
Chemical Isolation Sorption Isotherm		--	Linear Kd specified (sand + OC)		Freundlich (AC)	Standard practice.
Organoclay Partition Coefficients	K_d	L/kg	14,621 (2-MN), 437,522 (PCP), 161,800,000 (TPH)			CETCO (organoclay vendor).

Model Input Parameters		Unit	Zone 1	Zone 2	Zone 3	Data Source/Rationale
			Value			
Activated Carbon Isotherm	K_F (Freundlich)	µg/kg/ (µg/L)^N	7.25 x 10^6 (2-MN and PCP)			Communication with Dr. Reible and professional judgement.
	N (Freundlich)	--	0.42 (2-MN and PCP)			Communication with Dr. Reible and professional judgement.

Notes:

2-MN = 2-methylnaphthalene
PCP = pentachlorophenol
TPH = total petroleum hydrocarbons
µg/L = micrograms per liter
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
AC = activated carbon
cm = centimeters
CAP = cleanup action plan
CUL = cleanup level
ft= feet
f_{oc} = fraction organic carbon
FS = feasibility study
g/cm^3 = grams per cubic centimeter
L/kg = liters per kilogram
Kf = Freundlich equation constant
K_d = solid-water distribution coefficient
K_{oc} = dissolved organic carbon partitioning coefficient
K_{ow} = octanol-water partitioning coefficient
N=1/n= Freundlich equation constant
OC = organic carbon
NA = not applicable
RI = remedial investigation
yr = year

TABLE C-2. MODELED CAP PROFILES

Groundwater Flux Zone	Modeled Cap Profile[1]	
	Chemical Containment Layer(s)	**Erosion Protection Layer(s)**
Zone 1a High Groundwater Flux Within Nearshore Sediment Excavation	2 ft (60.96 cm) Sand Amended with 10% OC	2 ft (30.48 cm) Armor Rock over 0.5 ft (15.24 cm) Gravel[2]
Zone 1b High Groundwater Flux Area, Outside Sediment Excavation Limits	1 ft (30.48 cm) Sand Amended with 1% AC over 1ft (30.48 cm) Sand Amended with 1% OC	
Zone 2 Moderate to Low Groundwater Flux Area	2 ft (60.96 cm) Sand Amended with 1% OC	
Zone 3 Minimal Groundwater Flux Area, Diffusion Dominated	1 ft (30.48 cm) Sand Amended with 0.1% AC	1 ft (30.48 cm) Gravelly Sand[3]

Notes:

[1] Amendment percentages by weight. Cap armor layers were selected based on the results of coastal engineering modeling (Appendix E).

[2] Plus small area of 1.5 ft Gravel Cobble erosion protection.

[3] Modeled as representative case, noting 1.5 ft Gravel Cobble erosion protection also present.

AC = activated carbon

OC = organoclay

TABLE C-3. CAPSIM MODEL RESULTS

Modeled IHS	Cleanup Level		Depth Below Which IHS Concentrations are < Cleanup Levels in 100 Years[1]			
	Concentration	Medium	Zone 1a	Zone 1b	Zone 2	Zone 3
PCP	0.04 µg/L	Porewater	0-113 cm	0-104 cm	0-109 cm	0-54 cm
	100 µg /kg dw	Sediment	0-107 cm	0-97 cm	0-109 cm	0-53 cm
2-MN	NA	Porewater	--	--	--	--
	670 µg /kg dw	Sediment	0-76 cm	0-91 cm	0-77 cm	0-55 cm
TPH	NA	Porewater	--	--	--	--
	260 mg/kg dw	Sediment	0-119 cm	0-125 cm	0-125 cm	0-49 cm

Notes:

[1] 0 centimeters (cm) represents top of cap profile including erosion protection.

µg/L = micrograms per liter

µg/kg = micrograms per kilogram

mg/kg = milligrams per kilogram

dw = dry weight

IHS = indicator hazardous substance

2-MN = 2-methylnaphthalene

NA = not applicable

PCP = pentachlorophenol

TPH = total petroleum hydrocarbons

TABLE C-4. DIOXIN/FURAN MODEL RESULTS

D/F TEQ[1] Sediment Concentration (ng/kg)	D/F Koc[2] (L/kg)	Calculated D/F Porewater Concentration[3] (pg/L)	First (deepest) Cap Layer	D/F - Organoclay Kd (L/kg)	Distance into first cap layer above mudline where sediment CUL[5] is exceeded after 100 years (cm)
550	4,786,301	2.30 [4]	1ft (30.48 cm) Sand Amended with 1% OC	23,442	8

Notes:

[1] 2,3,7,8-TCDD used as a surrogate value for D/F TEQ.

[2] Whatcom Waterway EDR (Anchor 2015).

[3] Porewater concentration calculated using the sediment concentration, K_{oc} value, and an f_{oc} of 0.05 for sediment.

[4] Calculated Porewater concentration is lower than Cleanup Level of 32 pg/L

[5] Sediment Cleanup Level for D/F TEQ = 15 ng/kg

cm = centimeters

D/F = dioxins and furans

f_{oc} = fraction organic carbon

K_d = solid-water distribution coefficient

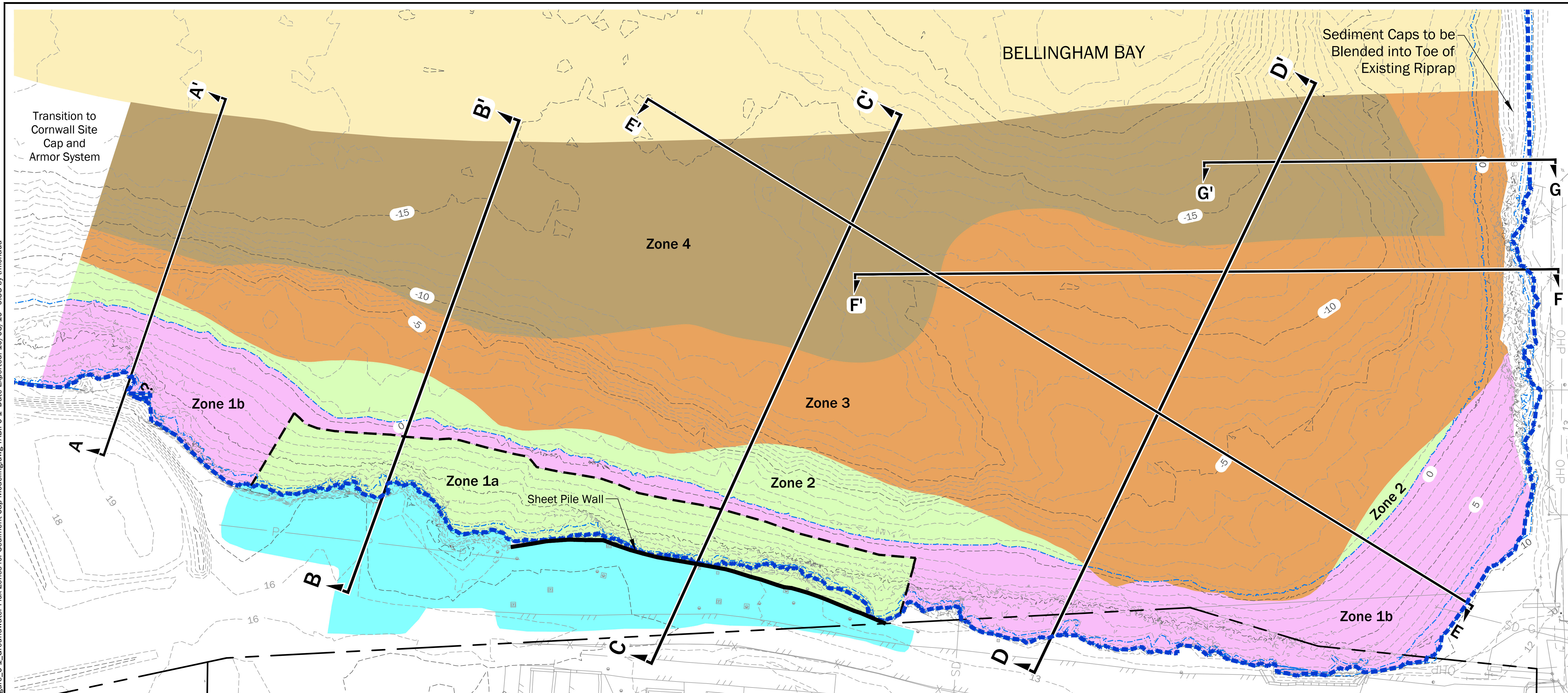
K_{oc} = dissolved organic carbon partitioning coefficient

L/kg = liters per kilogram

ng/kg = nanograms per kilogram

OC = organoclay

pg/L = picograms per liter



Legend

A — A'	Cross Section Location
	Haley Marine Unit Boundary (OHWM)
	Extent of Sediment Removal
--10--	Existing Elevation Contour in Feet (NAVD88)
Zone 1a	High Flux Area Within Sediment Excavation Area Extent
Zone 1b	High Flux Area Outside Sediment Excavation Area Extent
Zone 2	Moderate Flux Area
Zone 3	Minimal Flux Area

- Organoclay and Activated Carbon Amended Sand Cap (Zone 1b)
- Organoclay Amended Sand Cap (Zones 1a & 2)
- Activated Carbon Amended Sand Cap (Zone 3)
- Combined Gravelly Sand Thin-Layer Containment Cap and Seafloor Erosion Protection
- Monitored Natural Recovery
- Approximate Maximum Potential Extent of Upland ISS

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Base survey by Wilson Engineering & Surveying 10/28/15.

Projection: WA State Plane, N Zone, NAD83, US Foot
Vertical Datum: NAVD88

W S N E True North Project North

80 0 80
Feet

Groundwater Flux Zones for Sediment Cap Modeling

R.G. Haley Site
Bellingham, Washington

GeoEngineers

Figure C-1

CAPSIM v3.6: Porewater Concentration Output Figures C-2 through C-17

Notes:

AC	Activated carbon
OC	Organoclay
2-MN	2-methylnaphthalene
PCP	Pentachlorophenol
TPH	Total Petroleum Hydrocarbons

Zone 1a (High Groundwater Flux Within Nearshore Sediment Excavation)

Chemical Containment Horizon: 2 ft Sand with 10% Organoclay

Erosion Protection: 2 ft Armor Rock over 0.5 ft Gravel

Figure C-2

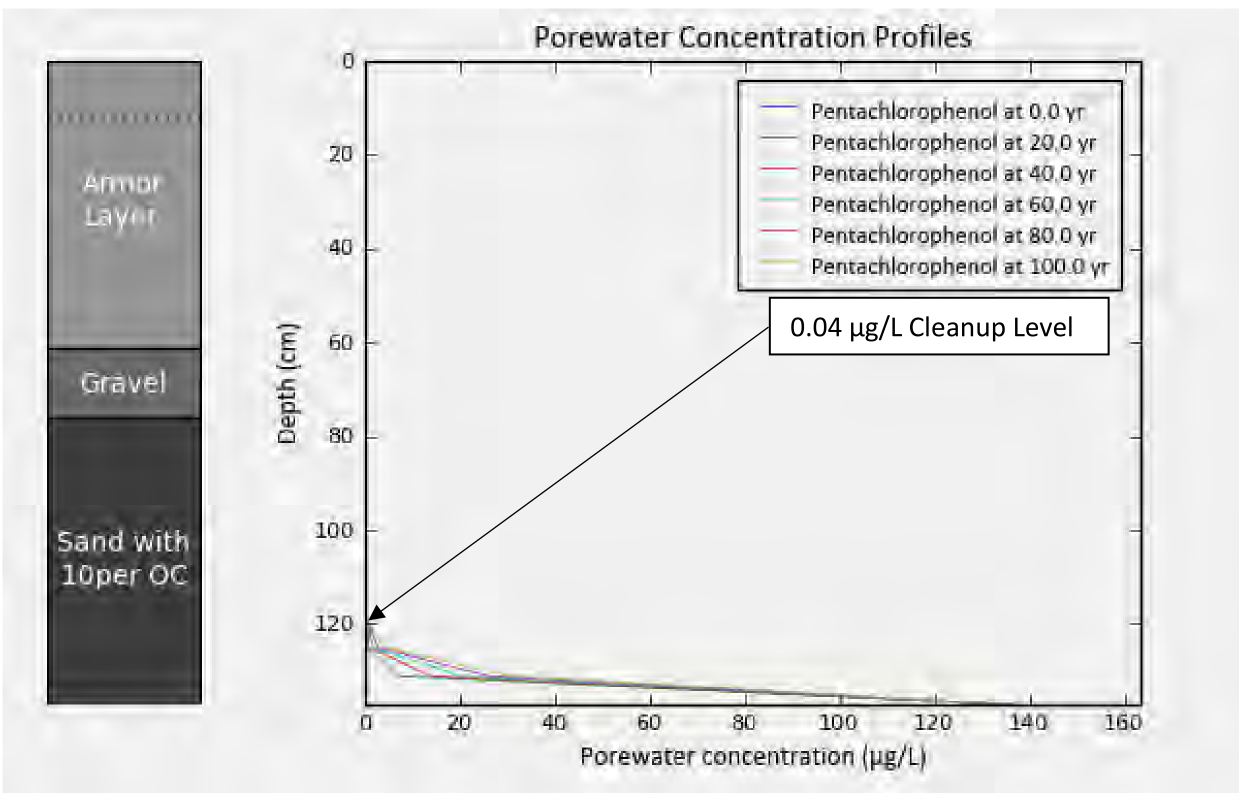


Figure C-3

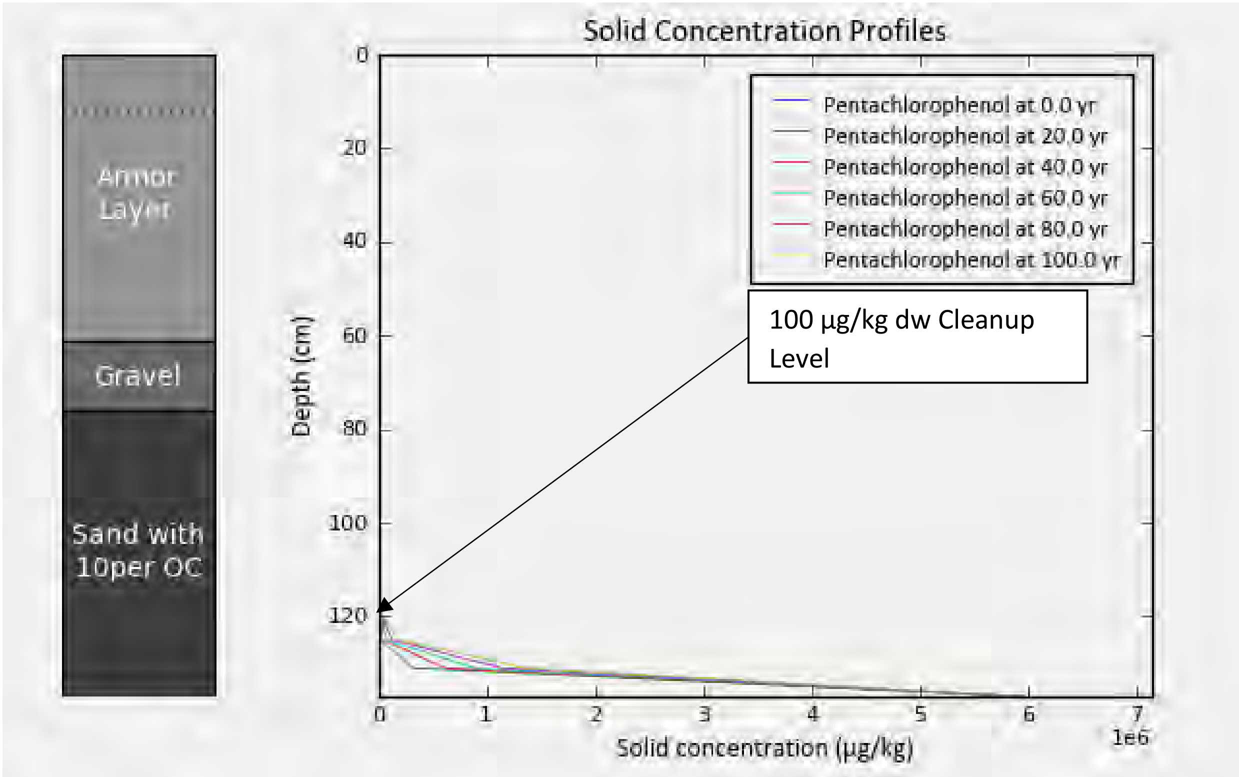
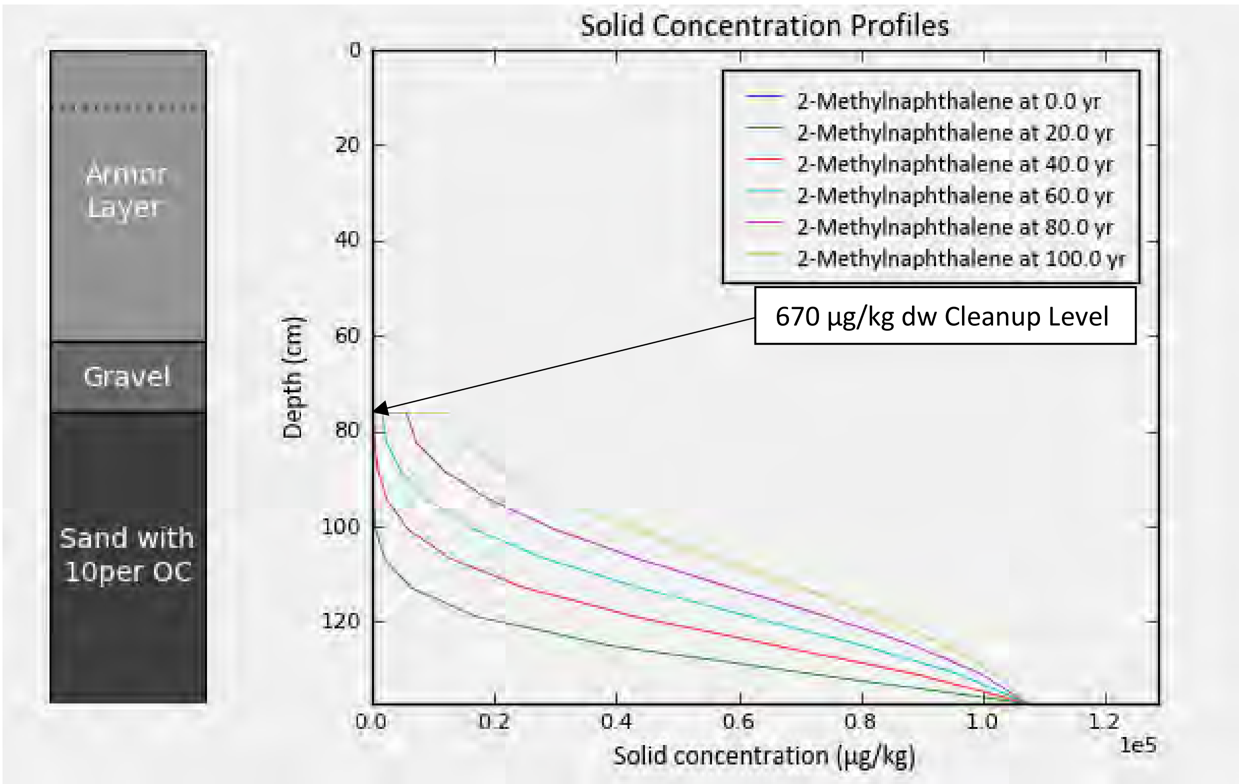
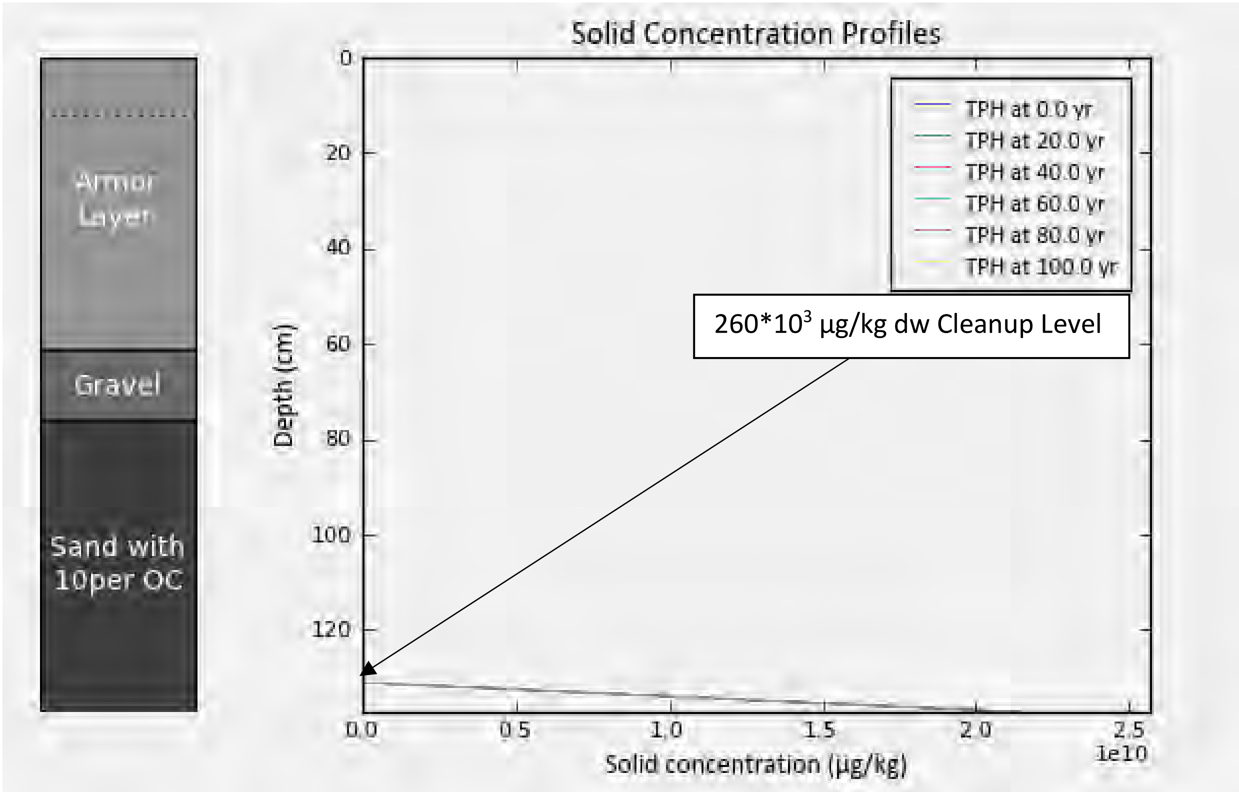

Solid Concentration Profiles
Armor Layer
Gravel
Sand with 10per OC
Depth (cm)
0
20
40
60
80
100
120
Pentachlorophenol at 0.0 yr
Pentachlorophenol at 20.0 yr
Pentachlorophenol at 40.0 yr
Pentachlorophenol at 60.0 yr
Pentachlorophenol at 80.0 yr
Pentachlorophenol at 100.0 yr
100 µg/kg dw Cleanup Level
0
1
2
3
4
5
6
7
1e6
Solid concentration (µg/kg)

Figure C-4



Solid Concentration Profiles
Armor Layer
Gravel
Sand with 10per OC
2-Methylnaphthalene at 0.0 yr
2-Methylnaphthalene at 20.0 yr
2-Methylnaphthalene at 40.0 yr
2-Methylnaphthalene at 60.0 yr
2-Methylnaphthalene at 80.0 yr
2-Methylnaphthalene at 100.0 yr
670 µg/kg dw Cleanup Level
Depth (cm)
0
20
40
60
80
100
120
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1e5
Solid concentration (µg/kg)

Figure C-5



Solid Concentration Profiles
Armor Layer
Gravel
Sand with 10per OC
TPH at 0.0 yr
TPH at 20.0 yr
TPH at 40.0 yr
TPH at 60.0 yr
TPH at 80.0 yr
TPH at 100.0 yr
260*10³ µg/kg dw Cleanup Level
Depth (cm)
0
20
40
60
80
100
120
0.0
0.5
1.0
1.5
2.0
2.5
1e10
Solid concentration (µg/kg)

Zone 1b (High Groundwater Flux Area, Outside Sediment Excavation Limits)

Chemical Containment Horizon: 1 ft Sand with 1% Activated Carbon over 1 ft Sand with 1% Organoclay

Erosion Protection: 2 ft Armor Rock over 0.5 ft Gravel

Figure C-6

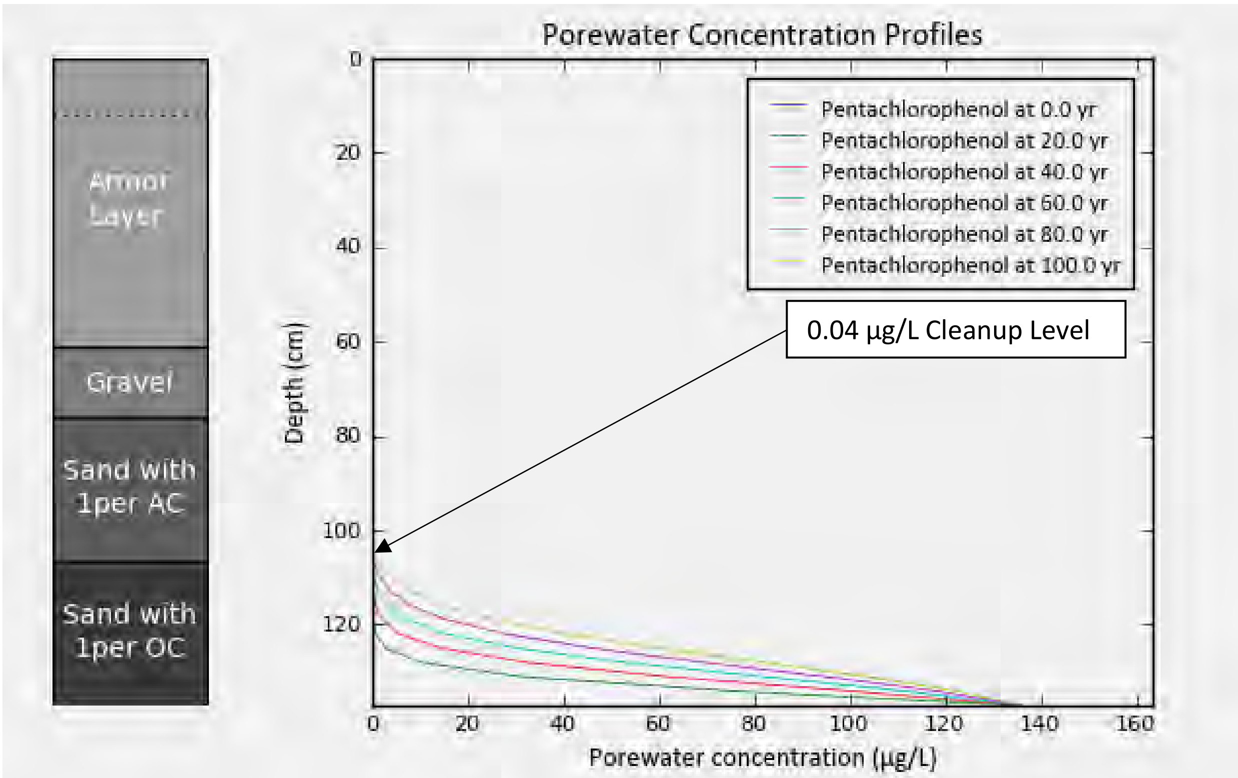
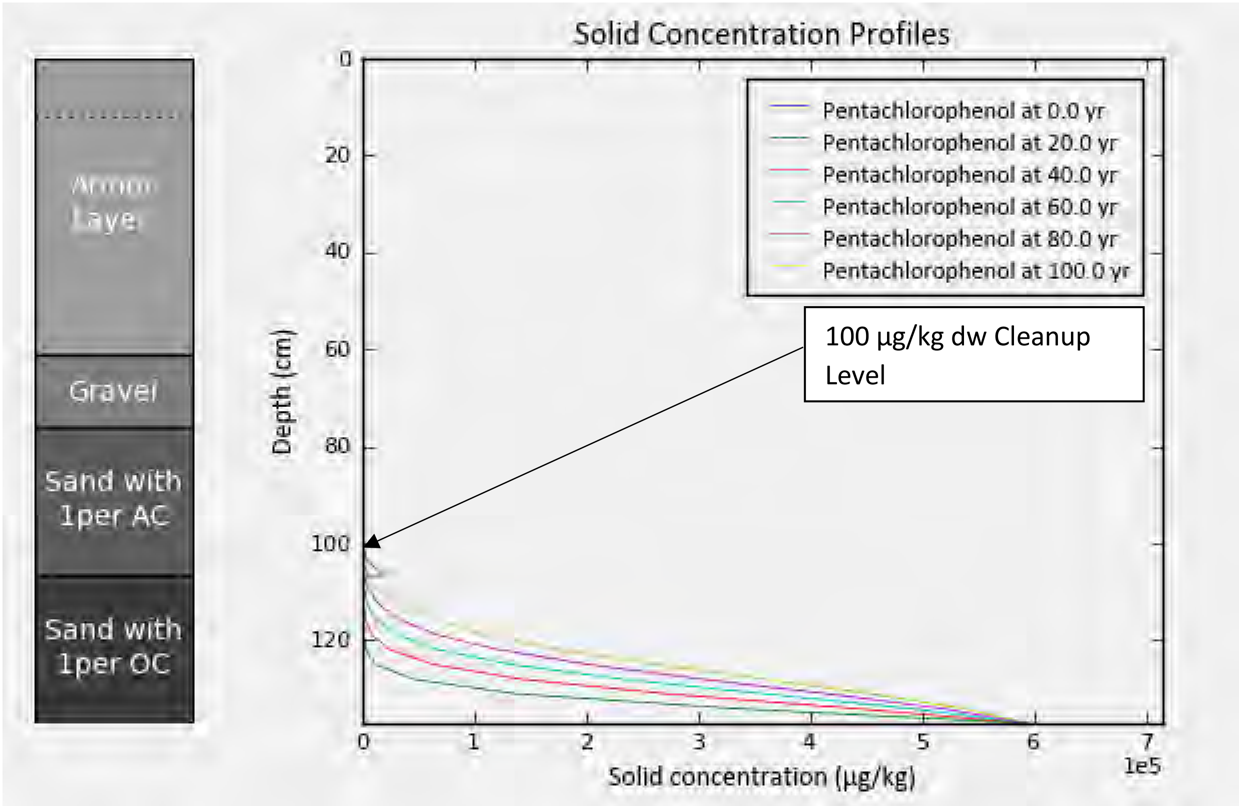


Figure C-7



Solid Concentration Profiles
Armor Layer
Gravel
Sand with 1per AC
Sand with 1per OC
Depth (cm)
0
20
40
60
80
100
120
Pentachlorophenol at 0.0 yr
Pentachlorophenol at 20.0 yr
Pentachlorophenol at 40.0 yr
Pentachlorophenol at 60.0 yr
Pentachlorophenol at 80.0 yr
Pentachlorophenol at 100.0 yr
100 µg/kg dw Cleanup Level
0
1
2
3
4
5
6
7
1e5
Solid concentration (µg/kg)

Figure C-8

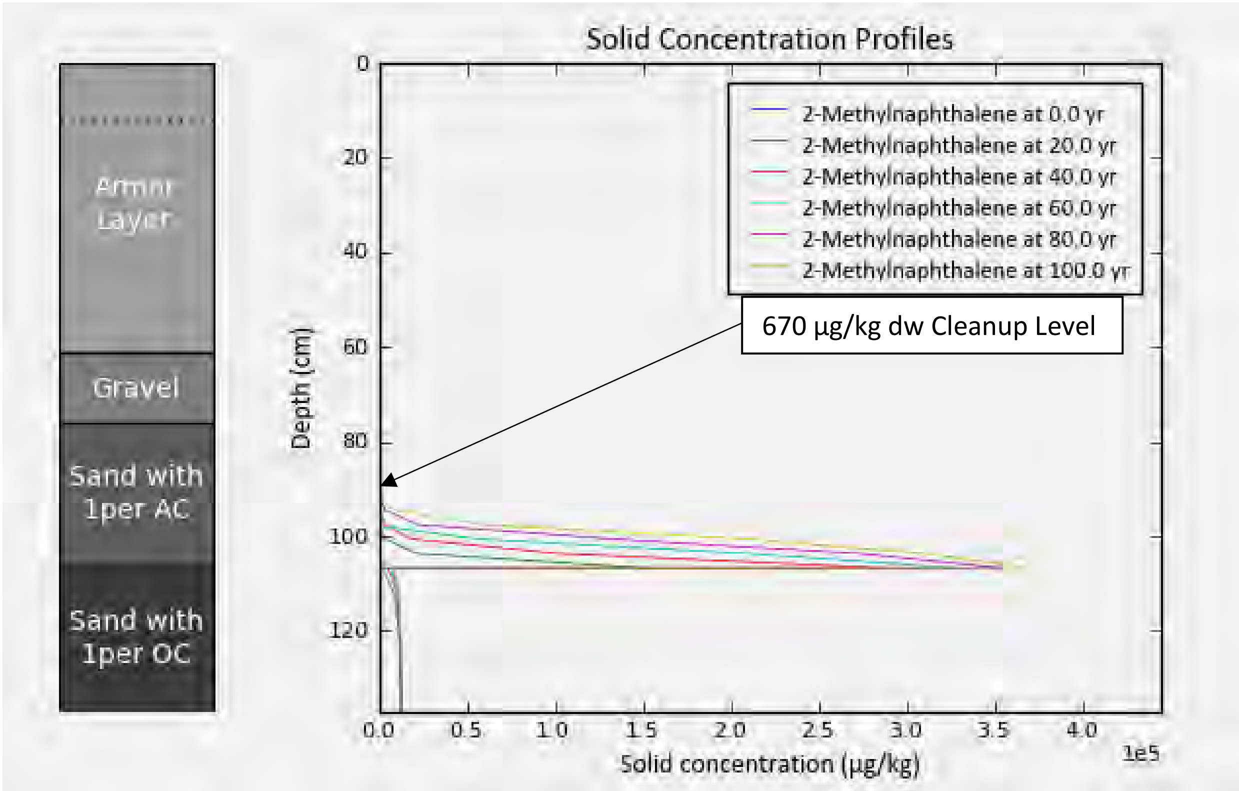
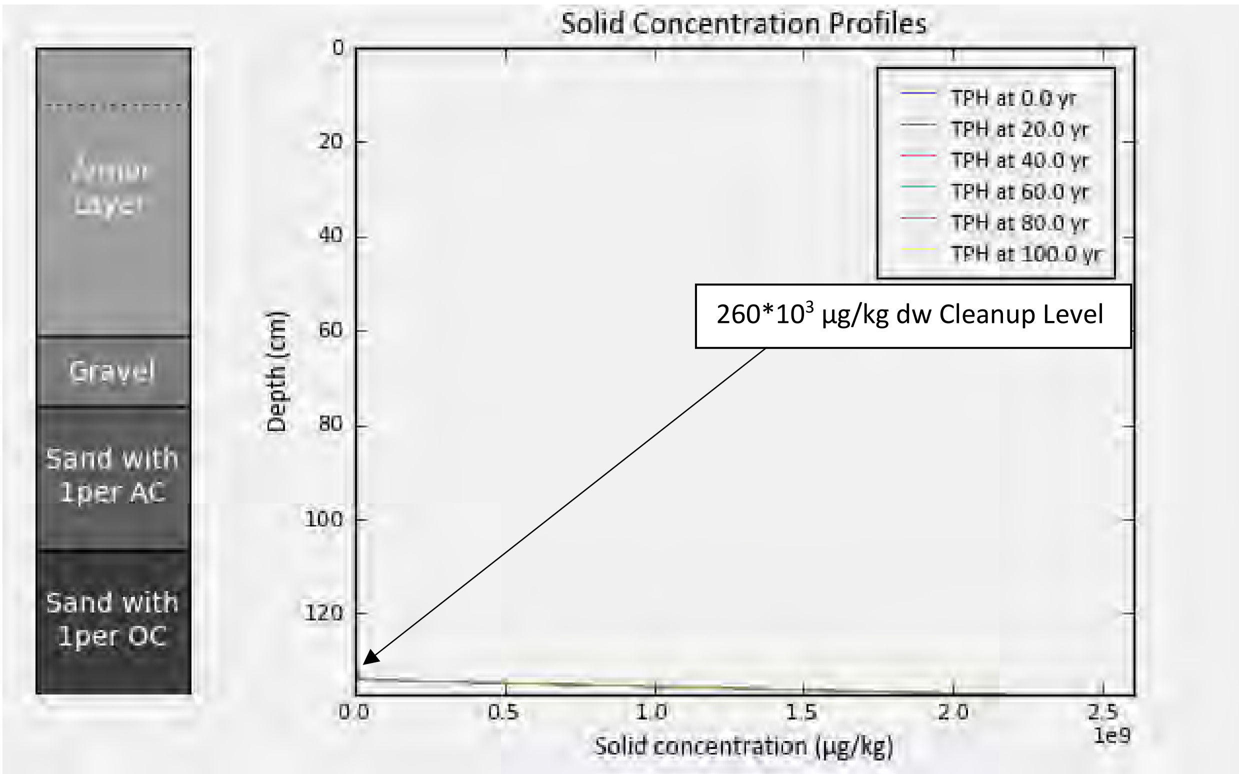

Solid Concentration Profiles
Armor Layer
Gravel
Sand with 1per AC
Sand with 1per OC
Depth (cm)
Solid concentration (µg/kg)
1e5
2-Methylnaphthalene at 0.0 yr
2-Methylnaphthalene at 20.0 yr
2-Methylnaphthalene at 40.0 yr
2-Methylnaphthalene at 60.0 yr
2-Methylnaphthalene at 80.0 yr
2-Methylnaphthalene at 100.0 yr
670 µg/kg dw Cleanup Level

Figure C-9



Solid Concentration Profiles
Gravel
Sand with 1per AC
Sand with 1per OC
Depth (cm)
0
20
40
60
80
100
120
TPH at 0.0 yr
TPH at 20.0 yr
TPH at 40.0 yr
TPH at 60.0 yr
TPH at 80.0 yr
TPH at 100.0 yr
260*10^3 µg/kg dw Cleanup Level
0.0
0.5
1.0
1.5
2.0
2.5
1e9
Solid concentration (µg/kg)

Zone 2 Moderate to Low Groundwater Flux Area

Chemical Containment Horizon: 2 ft Sand with 1% Organoclay

Erosion Protection: 2 ft Armor Rock over 0.5 ft Gravel*

*plus small area of 1.5 ft Gravel Cobble erosion protection

Figure C-10

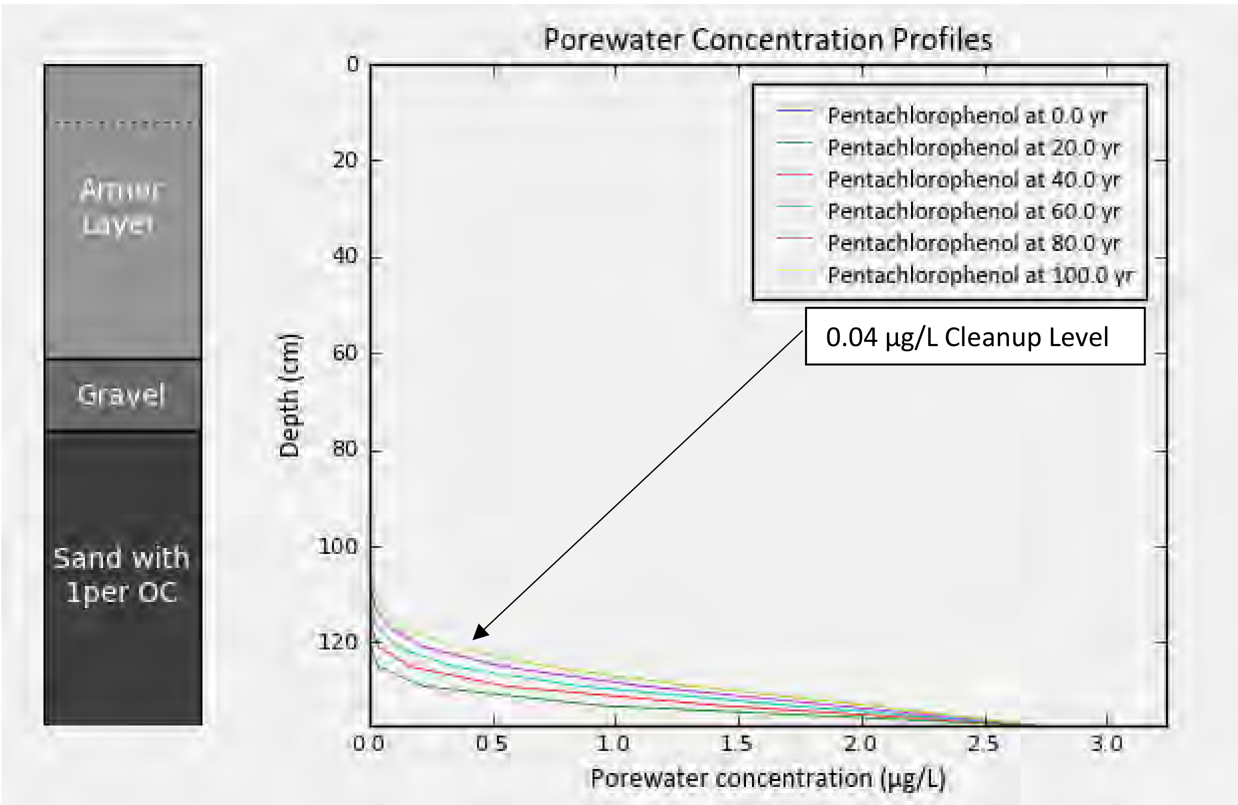
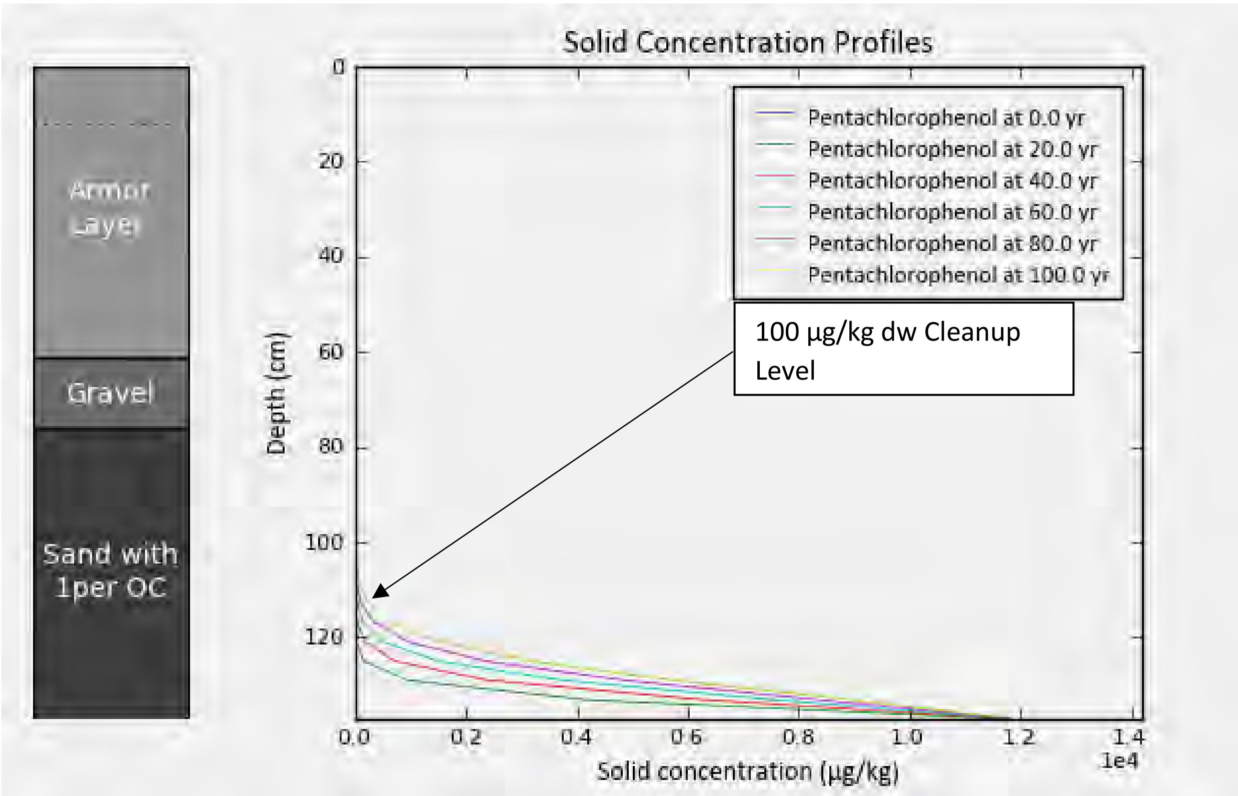
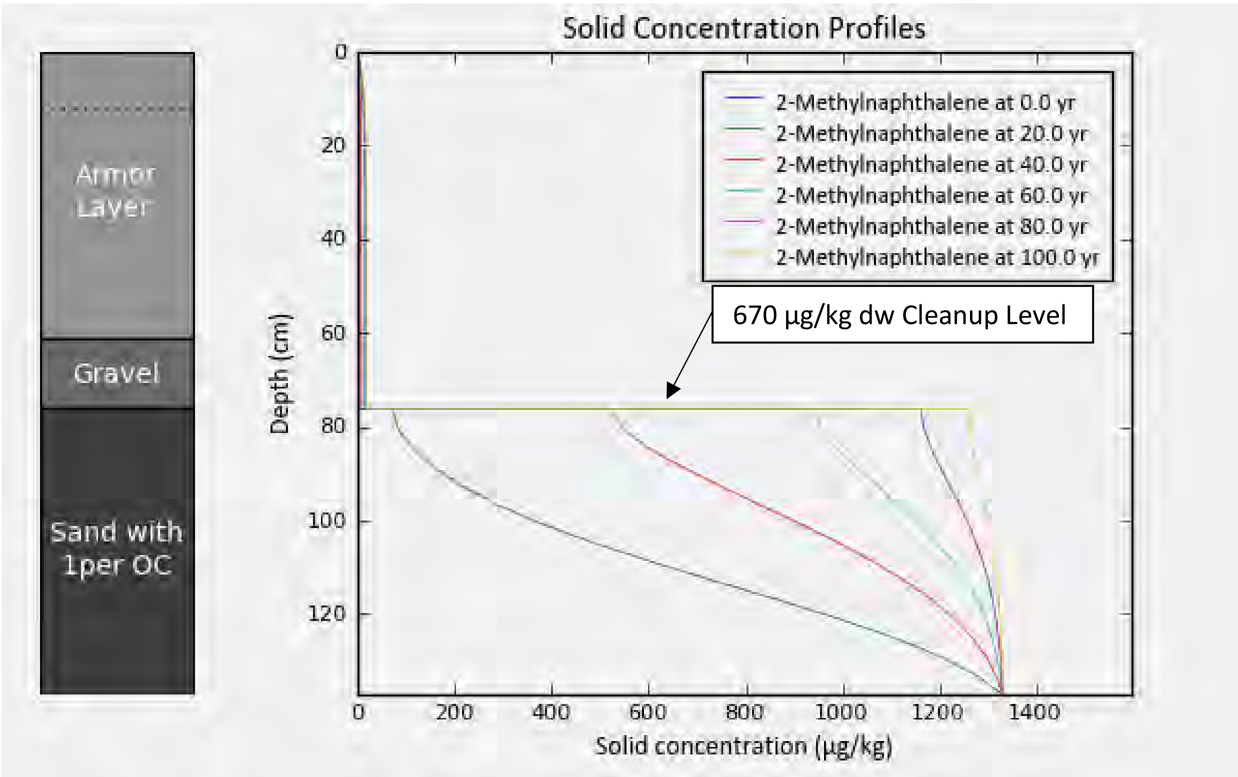


Figure C-11



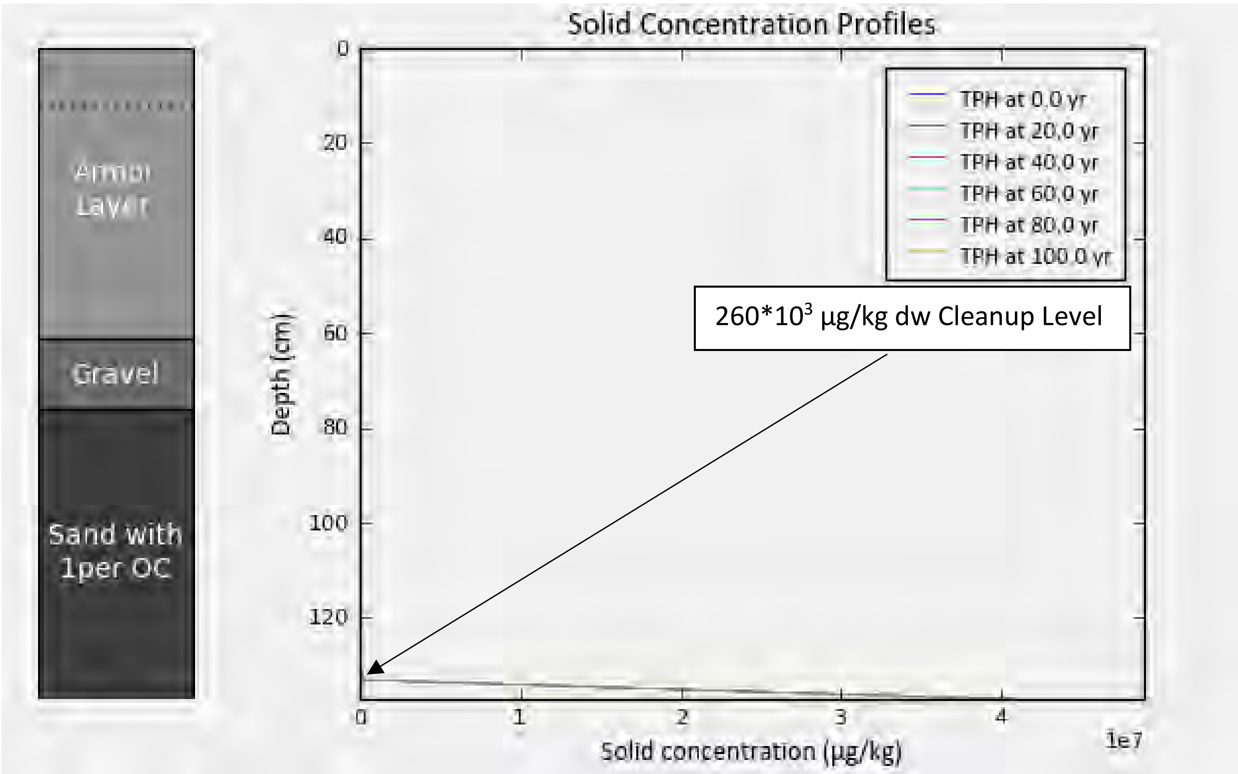
Solid Concentration Profiles
Armor Layer
Gravel
Sand with 1per OC
Pentachlorophenol at 0.0 yr
Pentachlorophenol at 20.0 yr
Pentachlorophenol at 40.0 yr
Pentachlorophenol at 60.0 yr
Pentachlorophenol at 80.0 yr
Pentachlorophenol at 100.0 yr
100 µg/kg dw Cleanup Level
Depth (cm)
0
20
40
60
80
100
120
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1e4
Solid concentration (µg/kg)

Figure C-12



Armor Layer
Gravel
Sand with 1per OC
Solid Concentration Profiles
2-Methylnaphthalene at 0.0 yr
2-Methylnaphthalene at 20.0 yr
2-Methylnaphthalene at 40.0 yr
2-Methylnaphthalene at 60.0 yr
2-Methylnaphthalene at 80.0 yr
2-Methylnaphthalene at 100.0 yr
670 µg/kg dw Cleanup Level
Depth (cm)
0
20
40
60
80
100
120
0
200
400
600
800
1000
1200
1400
Solid concentration (µg/kg)

Figure C-13



Solid Concentration Profiles
Armor Layer
Gravel
Sand with 1per OC
Depth (cm)
0
20
40
60
80
100
120
TPH at 0.0 yr
TPH at 20.0 yr
TPH at 40.0 yr
TPH at 60.0 yr
TPH at 80.0 yr
TPH at 100.0 yr
260*10^3 µg/kg dw Cleanup Level
0
1
2
3
4
1e7
Solid concentration (µg/kg)

Zone 3 Minimal Groundwater Flux Area, Diffusion Dominated

Chemical Containment Horizon: 1 ft Sand with 0.1% Activated Carbon

Erosion Protection: 1 ft Gravelly Sand*

*Modeled as representative case, noting 1.5 ft Gravel Cobble erosion protection also present

Figure C-14

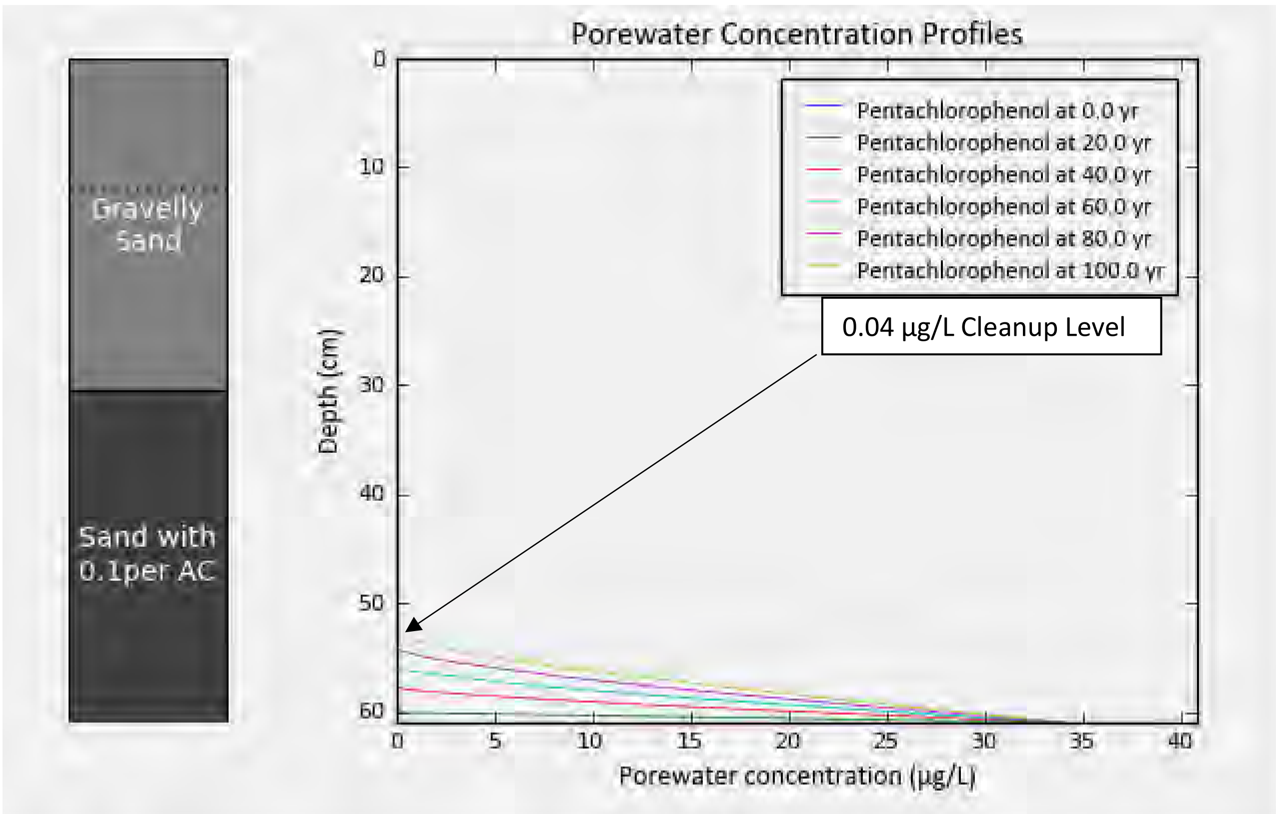
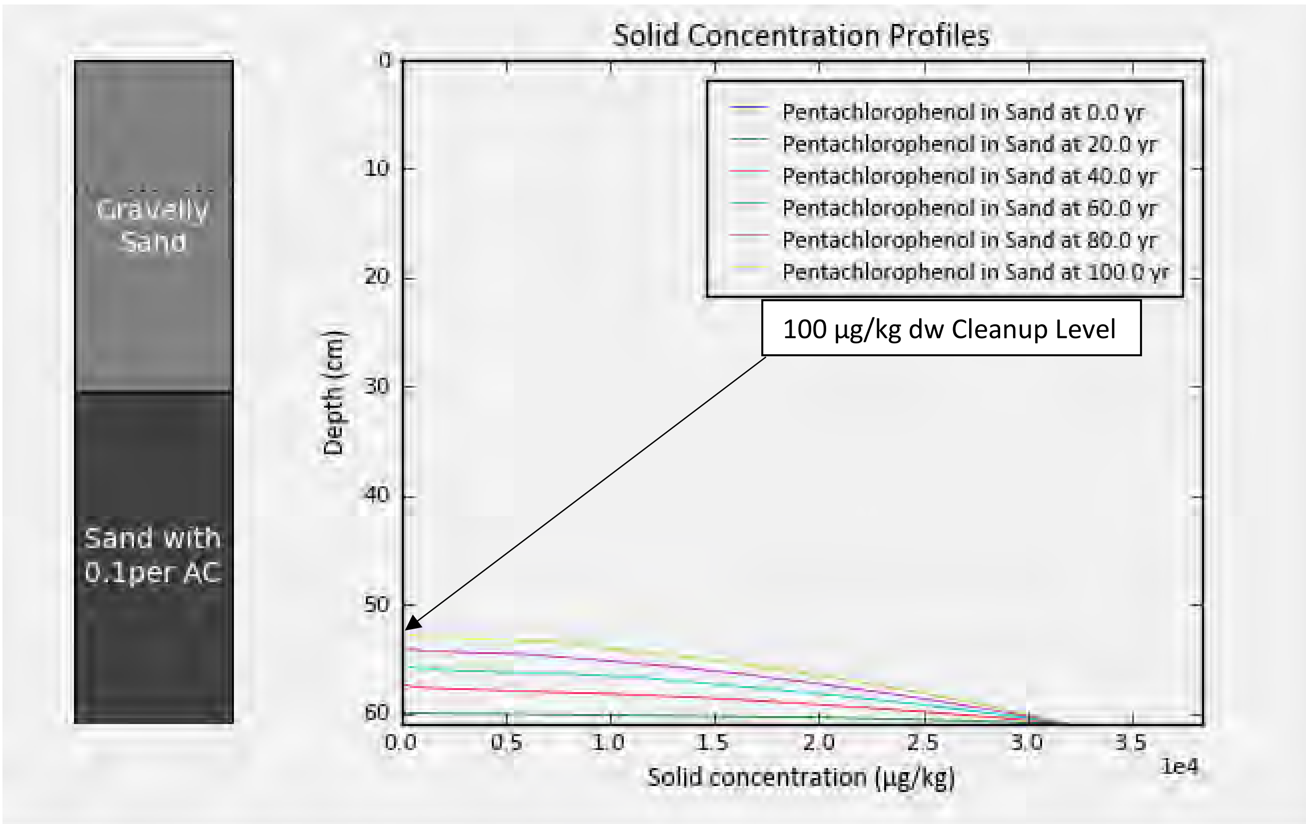
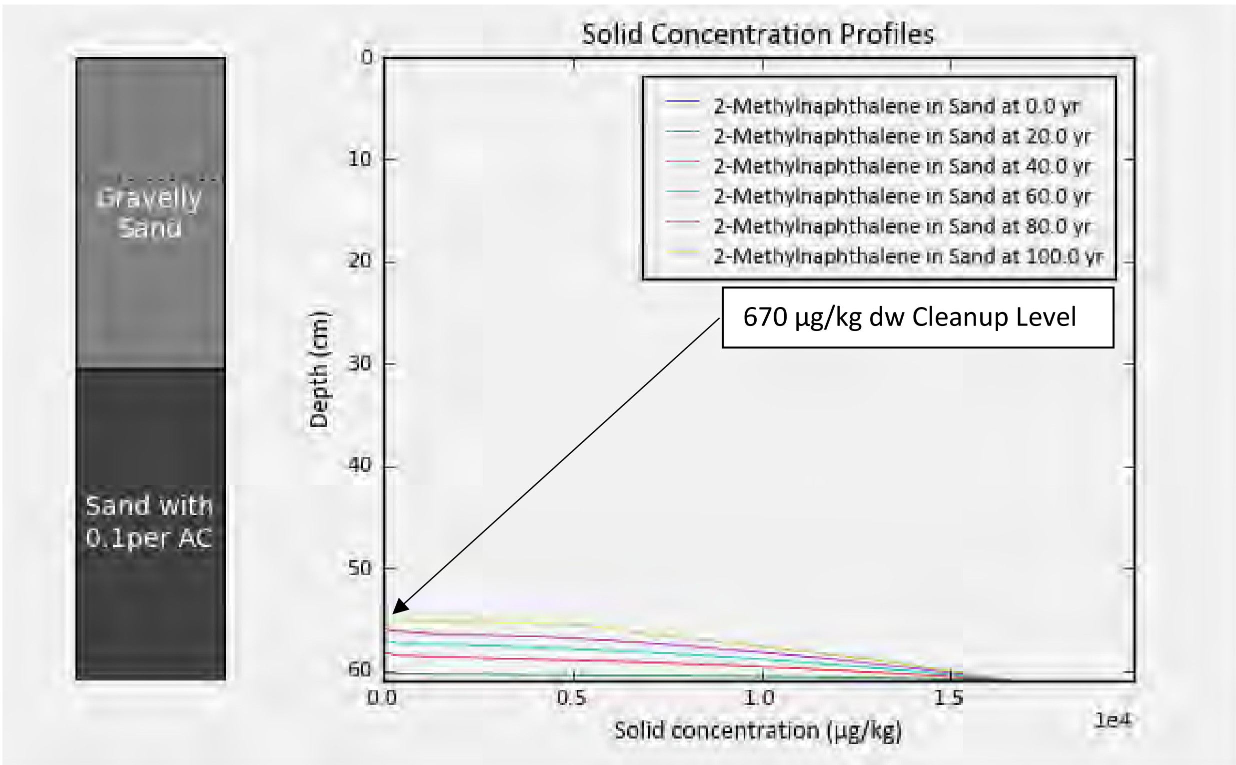


Figure C-15



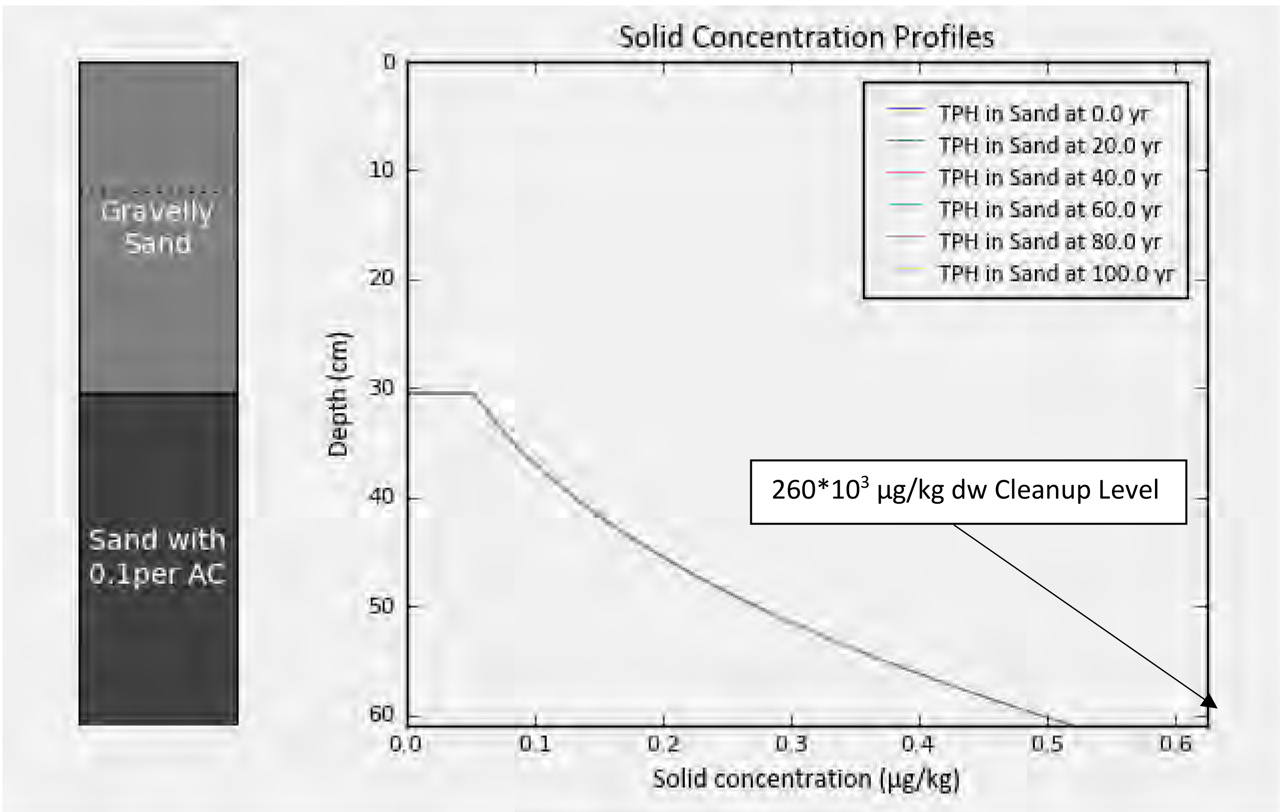
Gravelly Sand
Sand with 0.1per AC
Solid Concentration Profiles
Pentachlorophenol in Sand at 0.0 yr
Pentachlorophenol in Sand at 20.0 yr
Pentachlorophenol in Sand at 40.0 yr
Pentachlorophenol in Sand at 60.0 yr
Pentachlorophenol in Sand at 80.0 yr
Pentachlorophenol in Sand at 100.0 yr
100 µg/kg dw Cleanup Level
Depth (cm)
0
10
20
30
40
50
60
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1e4
Solid concentration (µg/kg)

Figure C-16



Gravelly Sand
Sand with 0.1per AC
Solid Concentration Profiles
2-Methylnaphthalene in Sand at 0.0 yr
2-Methylnaphthalene in Sand at 20.0 yr
2-Methylnaphthalene in Sand at 40.0 yr
2-Methylnaphthalene in Sand at 60.0 yr
2-Methylnaphthalene in Sand at 80.0 yr
2-Methylnaphthalene in Sand at 100.0 yr
670 µg/kg dw Cleanup Level
Depth (cm)
0
10
20
30
40
50
60
0.0
0.5
1.0
1.5
1e4
Solid concentration (µg/kg)

Figure C-17


Gravelly Sand
Sand with 0.1per AC
Solid Concentration Profiles
TPH in Sand at 0.0 yr
TPH in Sand at 20.0 yr
TPH in Sand at 40.0 yr
TPH in Sand at 60.0 yr
TPH in Sand at 80.0 yr
TPH in Sand at 100.0 yr
260*10^3 µg/kg dw Cleanup Level
Depth (cm)
0
10
20
30
40
50
60
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Solid concentration (µg/kg)

APPENDIX D
Landfill Gas Evaluation

APPENDIX D

LANDFILL GAS CONTROL SYSTEM DESIGN

TABLE OF CONTENTS

ATTACHMENTS

LANDFILL GAS CONTROL SYSTEM DESIGN

This appendix provides design-basis information in support of developing the landfill gas (LFG) collection and control system for the Engineering Design Report (EDR). The LFG collection and control system is a component of an engineered containment cap to be constructed throughout the main portion of the Haley Upland Unit to isolate contaminated soil, as described in the body of the EDR. LFG will be collected beneath a low-permeable liner placed over contaminated soil, and then discharged to the atmosphere through vents extending through the sealed cap liner, drainage layer, and cap cover material to above the ground surface.

The R.G. Haley Cleanup site (Site) encompasses an area containing wood waste, and also includes a portion of the Cornwall Landfill that contains or is adjacent to municipal solid waste (MSW) – both of which are expected to continue generating gas during decomposition into the foreseeable future. The R.G. Haley Cleanup Site also contains other subsurface soil contaminants and non-aqueous in the free-phase liquid (NAPL) petroleum product form that could potentially release volatile organic compounds (VOCs) that impact soil vapor quality and must be considered in developing plans for controlled release. The low-permeability upland cap is designed to restrict the fugitive, non-point release of LFG and other VOCs from the subsurface, which is currently occurring naturally, through the soil cover.

Although only the southwestern portion of the Haley Site is includes the Cornwall landfill, the term 'LFG' is used in a general context to describe all potential emissions of subsurface gas and soil vapor from MSW, wood waste, and contaminant VOCs. This context is also consistent with terminology used for the LFG evaluation in the Cornwall site EDR. In the current condition, LFG is generated as waste breaks down and slowly ventilates through the existing permeable soil cover. LFG can be explosive at higher concentrations when allowed to accumulate in confined spaces, and can pose a threat to human health if it contains VOCs at concentrations exceeding applicable regulatory criteria. After constructing a low-permeability cap, the LFG and other VOCs contained in the soil vapors must be provided with a ventilation pathway, or increasing pressures and concentrations could potentially lead to unsafe levels or cause lateral migration. LFG must also be vented in a manner that does not pose an unacceptable risk to human health.

The design goals of the LFG control system, as part of the overall Site remedy, are the following:

- Prevent accumulation of LFG under the upland landfill cap by providing an LFG capture layer beneath the low-permeability cap that is connected to the atmosphere.
- Provide internal pressure relief to reduce the potential for cover system uplift and lateral migration.
- Provide controlled release of LFG through engineered vents to prevent fugitive emissions where exposure is uncontrolled, and vent LFG in a manner that is adequately protective of human health.
- Integrated the LFG control system with the adjacent Cornwall site system.

As part of this evaluation, Landau Associates relied on data developed for the adjacent Cornwall Avenue cleanup site (Cornwall site). This Cornwall site subsurface soil vapor data and LFG generation modeling was augmented by including the results of the soil vapor investigation conducted for the R.G. Haley Site, and by updating the LFG generation models to include the contribution of waste degradation occurring in the R.G. Haley footprint. This appendix further details the data evaluation in order to establish the engineering basis of design for controlling LFG and soil vapor emissions at the R.G. Haley Site, which will be controlled in conjunction with the LFG system for the adjacent Cornwall site.

Data from both cleanup sites include field investigation data, development of a model of the LFG generation rate, and an estimation of ambient air impacts through air dispersion modeling of the anticipated emissions through passive vents to be installed at the Site. These data were used to develop the conceptual design elements of the LFG control system included in the EDR. The design provided in the EDR is considered conservatively protective by using worst-case input parameters for potential hazards and weather conditions that might affect human exposure.

Some of the elements included in the design are viewed as exceeding the level of LFG control and environmental protection needed based on current property usage, since access to, and use of the Site are restricted. However, because future property usage is planned as a public park, the LFG control system design will include several considerations intended to provide adequate protection for park visitors and service and maintenance providers following completion of cleanup action construction.

The following sections describe the development of Site conditions relating to LFG production, gas quality, potential exposures, and design considerations.

Landfill Gas Generation Modeling

This section summarizes the LFG production rate evaluation for the Site. The LFG production rate was estimated using the US Environmental Protection Agency's (EPA) LandGEM spreadsheet model – the industry standard approach for estimating LFG emissions for regulatory compliance, and a tool for LFG control system design. The estimate is based on the quantity of buried waste, waste age, type, and physical factors related to the subsurface environment.

According to the EDR for the Cornwall site (Landau Associates 2017), and cross-sections presented in the EDR from the Site Remedial Investigation and Feasibility Study Report for the R.G. Haley cleanup Site (RI/FS; GeoEngineers 2016), the LFG generation modeling assumes the following volumes of MSW and wood waste were placed:

- Approximately 84,000 tons of wood waste deposited at the R.G. Haley and Cornwall sites from 1888 to 1946.
- Approximately 100,000 tons of refuse (MSW) was buried at the Cornwall site from 1953 to 1965.

- Non-aqueous phase liquid (NAPL) contamination that appears to be the source of subsurface VOCs.

The estimate of gas production will include contributions from both sites since the source of gas generation (buried waste) is present and continuous across the site boundaries and overlapping area between these cleanup sites.

Modeling Approach

LandGEM is a spreadsheet-based model prepared by EPA that estimates the overall flow rate of LFG from a MSW landfill based on user input regarding the amount of waste buried, the year of burial, and other parameters developed by EPA based on landfills across the US. Emissions factors used in the model are from the Compilation of Air Pollutant Emission Factors (AP-42; EPA 1998). The model allows variation of parameters affecting the overall LFG production capacity of the waste (given infinite time), and the rate at which the LFG is released – each constrained to typically observed ranges.

The total mass of buried waste that will produce LFG during its decomposition was is estimated for the purposes of modeling based on the thickness and lateral extent of waste observed during RI investigations at both the R.G. Haley and Cornwall cleanup sites. The gas-generation modeling for this design assumes that the following wastes are present in the subsurface: roughly 83,000 tons of wood waste deposited between 1888 and 1946, and 101,000 tons of MSW deposited between 1953 through 1965 based on information presented in the Cornwall EDR (LAI 2016). The modeling develops potential gas generation rates from wood waste observed at the R.G. Haley cleanup site, as well as wood waste and MSW buried at the adjacent Cornwall cleanup site. Modeling the combined gas generation from both cleanup sites provides for a conservatively high estimate for design purposes, which, due to the contiguity of the sites and the planned integration of cover systems is reasonable and warranted.

The moisture content (saturated) of the solid waste buried under water was accounted for by adjusting the rate constant (k) to match that of a landfill with more than 40 annual inches of precipitation [$k = 0.12$ year^{-1}, as referenced in EPA's Waste Reduction Model (WARM Version 13)], maximizing this variable parameter within the allowable range. Three individual modeling runs were executed so the parameters could be varied for three unique conditions: wood waste (both R.G. Haley and Cornwall cleanup sites), MSW in the overlapping marine portion of the sites, and MSW in the upland portion of the Site. It is assumed for the purposes of modeling a worst-case scenario that LFG generated by decomposition of MSW in the marine portion of the sites would migrate laterally toward the uplands and require capture and control at that location. The modeling output for the portions of the models updated for the R.G. Haley Site are provided in Attachment D.1. The results of this output, in combination with the modeling conducted for the Cornwall site, are discussed below. Note that, although LandGem can be used to estimate VOCs present in LFG emissions, site-specific data were developed through field investigations. The site-specific VOC data derived during field testing is discussed in a later section (Landfill Gas Monitoring: Volatile Organic Compounds).

LFG Production Rate Modeling Results

The modeling results indicate an approximate total LFG generation rate of 3.6 cubic feet per minute (cfm) for year 2020, which includes the combined contributions of LFG generated from the degradation of all wastes at both sites. Figure D.1 in Attachment D.1 presents the generation curve developed by combining the output from the three modeling scenarios discussed above. Based on this low estimated rate of LFG production, a safety factor greater than 2 will be applied to the production rate for design, and the capture and control system will be designed for a LFG flow rate of 10 cfm.

Landfill Gas Monitoring

Eight temporary soil vapor monitoring probes were installed at the R.G. Haley Site in 2005 near previous explorations where elevated concentrations of diesel-range petroleum hydrocarbons and VOCs including naphthalene and 2-methylnaphthalene had been identified in soil and groundwater samples within the petroleum smear zone (Figure D.2). Soil vapor samples were obtained at each probe location at a depth of approximately 5 feet below ground surface, corresponding to the lower portion of the vadose zone and the upper portion of the smear zone. The samples were analyzed by an accredited laboratory for petroleum hydrocarbon fractions, vinyl chloride, methyl tert-butyl ether, BTEX, naphthalene, and 2-methylnaphthalene. Tabulated analytical results are provided in Table D-2 in Attachment D.2.

Thirteen LFG probes were installed at the adjacent Cornwall site in 2015, where the greatest mass of the MSW is located. These probe locations were selected to characterize LFG in the areas where the greatest thickness of MSW was anticipated to be, and monitored for the field parameters listed below. These data are combined with the RG Haley data to provide a more comprehensive and environmentally conservative approach to gas control at the RG Haley Site, as discussed further in later sections of this report. The field-collected data corroborated the results of the LFG generation modeling effort, and supported the conclusion that, although present gas generation rates are low, installation of a surface cover necessitated proper LFG ventilation to prevent build-up of gases to unsafe or unhealthy levels (Cornwall Site EDR, Landau Associates 2016). The following parameters were monitored:

- Methane (CH_4)
- Oxygen (O_2)
- Carbon dioxide (CO_2)
- Carbon monoxide (CO)
- Hydrogen sulfide (H_2S)
- Hydrogen gas
- Static pressure
- Total VOCs by field-measurement with photoionization detector.

Volatile Organic Compounds

In addition to the field-analyzed parameters summarized above, gas samples were collected from both sites and analyzed by an accredited laboratory. The tabulated VOC results for both sites are provided in Table D-2 in Attachment D.2.

Discussion of Gas Monitoring Results

The landfilled material continues to generate at least small quantities of LFG, as evidenced by elevated levels of methane and carbon dioxide, and depressed concentrations of oxygen. The majority of the gas generated at the Site is likely due to natural decomposition of organics; however, some gas is generated from the volatilization of hydrocarbon contamination. The results of VOC testing indicate there are detectable concentrations of VOCs associated with LFG throughout most of the Cornwall site, and the slightly greater prevalence of VOCs associated with hydrocarbons within the R.G. Haley Site is likely due to volatilization of NAPL observed in the subsurface. The results of VOC testing are used further (as discussed in the evaluation below) to determine if LFG emissions will require an air permit, and to determine if control technology is required for the protection of human health and the environment prior to discharge.

Air Permitting Considerations

Construction of the containment system will include installation of new gas vents so that LFG and VOCs can discharge from the subsurface in a controlled manner, and not be trapped beneath the low-permeability cover. Although the emissions have been occurring for decades in an uncontrolled manner, installation of the vents requires an evaluation of these emissions as a new source.

Federal Standards

Activities and equipment associated with R.G. Haley are not found to be subject to New Source Performance Standards (NSPS) or National Emission Standards for Hazardous Air Pollutants (NESHAP). NSPS and NESHAP dictate reporting requirements and additional emission standards for sources found to be subject to its rulings. Potentially applicable NSPS and NESHAP were identified and applicability was evaluated.

- **40 Code of Federal Regulations (CFR) 60 Subpart WWW: Municipal Solid Waste Landfills.** The Haley Site was not found to be subject to this NSPS because the Cornwall Landfill stopped accepting waste in 1965. Affected sources are limited to landfills that commenced construction or modification after May 30, 1991. Although the Haley Site includes locations where MSW was placed, it was not operated as a landfill per se.

- **40 CFR Subpart AAAA: Municipal Solid Waste Landfills**. The Site was not found to be subject to this NESHAP because R.G. Haley and Cornwall Landfill stopped accepting waste in 1965. Affected sources are limited to landfills that have accepted waste since 1987.
- **40 CFR 63 Subpart GGGGG: Site Remediation**. The Site was not found to be subject to this NESHAP because it is not considered to be a major source of HAPs and is not co-located with any other stationary source of HAPs.

Northwest Clean Air Agency

The Site is subject to New Source Review pursuant to Northwest Clean Air Agency (NWCAA) Regulation 300. Emissions from the Site have been calculated and compared to *de minimis* values and small quantity emission rates (SQERs) (WAC 173-460) in consideration of a NWCAA permit. Our evaluation has shown that a NWCAA Notice of Construction (NOC) permit application should be submitted prior to construction of the landfill gas collection and venting system.

Emission Estimates

LFG emissions were calculated from sample results and LandGEM estimates. From monitoring efforts, the highest observed concentration of each constituent from any sample was used to calculate emissions. When reported concentrations were below the reporting limit, the reporting limit was used. Maximum observed concentrations were applied to the total estimated flow of LFG of 10 cfm. The safety factor applied to the LFG generation estimate discussed in the previous section was applied to these calculations. The estimated emissions of VOCs are presented in Table D-3 and compared to the SQERs and *de minimis* emission values (WAC Chapter 173-460). Source emissions are compared to SQERs and *de minimis* values to determine whether further permitting considerations or implementing treatment technology prior to discharge is necessary.

De minimis levels are considered to be "trivial levels of emissions that do not pose a threat to human health or the environment." Most constituents were found to be below *de minimis*. However, naphthalene was found to be above *de minimis* thresholds.

Carbon adsorption was considered as a control method for VOCs, including naphthalene. The design of carbon absorption will be further detailed later in this Appendix under "*landfill gas control system – treatment.*" Based on the estimated emissions, a removal efficiency of 44 percent would be required to reduce naphthalene emissions below the SQER. Naphthalene has a relatively high molecular weight (128 grams per mole), and thus a strong adsorption rate to activated carbon. Due to the low flow rate of LFG and high adsorption capacity (a typical vendor assumption for carbon adsorption capacity is 20 percent for naphthalene), we assume the carbon canisters can be sized for a design removal efficiency of 90 percent. As such, a VOC control factor of 90 percent for carbon adsorption was applied for the SQER evaluation, and naphthalene emissions were found to be below the SQER. Since all constituents were found to be below the SQER or *de minimis* thresholds, no further air dispersion modeling was conducted for air permitting purposes. Additional air dispersion modeling was conducted for this project to evaluate the VOC concentrations in comparison to Model Toxics Control Act (MTCA) cleanup levels for ambient air, as discussed in the following section.

Air Dispersion Modeling

Air dispersion modeling was conducted to estimate the ambient air impacts in the breathing zone expected from the proposed LFG vents. The dispersion model determines the reduction in contaminant concentration between the point of release, at the vent effluent, to the potential point of exposure, where, in the future, park visitors or park workers could be exposed to vent emissions. An EPA-recommended air screening model, AERSCREEN (version 16216), was used to estimate maximum exposure concentrations using worst-case emissions; the model estimates worst-case concentrations at 1-hour, 24-hour, and annual averaging periods at the highest of the modeled receptors throughout the Site (not surprisingly, those are the nodes nearest the vents). All emissions were modeled to discharge from one LFG vent, assumed to be 12 feet tall and to have a diameter of 4 inches Meteorological data was created using the model's internal MAKEMET code (version 16216). MAKEMET inputs were based on Western Regional Climate Center meteorological data between 1988 and 2018 for Bellingham, Washington. Terrain data was not included in this model because the terrain was considered to be flat and because the maximum emissions scenarios used estimated that the highest concentrations of contaminants were relatively close (within 30 feet) to the modeled source. The land use was considered to be "grassland" to reflect the flattened and unoccupied characteristics of the site. The maximum modeled concentrations were compared to MTCA Method B Cleanup Standards, which are discussed below.

MTCA Method B Cleanup Standards

MTCA Method B criteria for air emissions from a cleanup project were evaluated for both cancer and non-cancer risks for all VOCs with toxicology data available on the Washington State Department of Ecology's (Ecology's) CLARC database (Ecology website 2019). The permissible concentrations protective of both cancer and non-cancer risks are presented in Table D-3 in Attachment D.3, along with the estimated ambient air concentration estimated at the breathing zone. Even with the conservatively high estimates of potential emissions and exposures, all compounds, except naphthalene, are below cleanup levels with the assumed vent height of 12 feet above ground surface. Modeled naphthalene concentrations are slightly greater than the MTCA Method B Cleanup Standards and will be treated prior to discharge. Post-construction emissions will be monitored to determine the need for continued treatment, in coordination with Ecology.

Landfill Gas Control System – Treatment

Based on the results of these evaluations, LFG emissions from the Site LFG will be treated with granular activated carbon (GAC) prior to release. However, based on the conservative nature of the models and the selection of conservative input at each opportunity when developing these estimates, it is considered likely that the actual emissions measured after construction would not pose an unacceptable risk to human health, or exceed air quality standards. Compliance monitoring will be conducted at the gas vents to confirm the discharge conditions and evaluate whether air quality emissions requirements are met, and also whether emissions meet the cleanup levels or will be below the cleanup levels in the breathing zone, in accordance with Ecology's guidance document for establishing and evaluating air cleanup standards under MTCA (Ecology 2005). If testing of actual conditions after construction indicate carbon filtration is not required to meet air quality standards or MTCA Method B Cleanup Levels in ambient air, the local air quality agency and Ecology will be consulted to determine if the carbon treatment can cease.

Landfill Gas Control System – Design Elements

Based on the analyses presented above, typical solid-waste design practices for passive collection of LFG will be used to control and mitigate LFG, as a component of the Site cleanup. Based on the low quantity of LFG being generated, an active LFG control system using blowers to extract LFG is not required. The design will include the following elements to meet the goals stated in the introduction to this appendix. The proposed design is presented in the EDR and includes the design elements summarized below.

Prevent accumulation of LFG under the landfill cap by providing a LFG capture layer beneath the low-permeability liner that is connected to the atmosphere

This will be accomplished by including an LFG capture layer of geocomposite material below the low-permeability liner. Several design alternatives were considered including the use of a gravel/sand layer, the use of crushed concrete (which could be manufactured from concrete debris during Site grading), or the use of a combination of geocomposite materials and conveyance piping. The use of geocomposite material provided the most economical alternative based on significant savings in installation costs during construction by eliminating most earthwork associated with alternative LFG collection systems (trenching and pipe installation). This approach is also consistent with what is proposed for the neighboring Cornwall site, providing for ease of construction and simplifying long-term operations and maintenance.

The required transmissivity of this LFG capture layer was calculated for the Cornwall site, based on equations developed by Thiel (Thiel 2005). Because LFG generation is lower at the R.G. Haley Site, it is assumed that the similar required transmissivity within this layer of 1.2 x 10^{-5} square meters per second (m^2/s) is more than adequate.

The geocomposite material evaluated for this application was Draintube™, by AFITEX-Texel, which combines standard perforated pipes and geosynthetic products into one roll-out material. The product incorporates an integrated conveyance tubing that exceeds the transmissivity requirement with a lower cost than the other alternatives considered. The integrated perforated piping has a large ventilation capacity and is the primary source of vapor transport to the headers and, ultimately, the vents. Landau Associates has reviewed reference applications and confirmed this product has been used at over 1,000 projects world-wide including LFG capture and control at several dozen similar landfill projects, some here in the Pacific Northwest. A limited amount of additional earthwork and piping is required to connect the collection layer to the vents. The materials of construction are consistent with the anticipated emissions at the R.G. Haley Site.

Additionally, if stabilized sediment is placed at the Site in layers greater than 5-feet in thickness, strip-drain geocomposites will be placed beneath these layers with a spacing not to exceed 20 feet. The strip-drain geocomposites will provide lateral migration pathways for gases that rise up and are released from the stabilized sediment, which is anticipated to have a relatively low permeability, and could impede upward migration of gases. The strip-drain geocomposites will be connected to the header system and, ultimately, to the vents for treatment and controlled release.

Provide internal pressure relief to reduce the potential for lateral migration

Internal pressure relief will be provided by the installation of two passive ventilation wells extending vertically into the wood waste. In addition to the LFG collection layer discussed previously (which captures LFG that has migrated upwards), these vertical passive wells provide a ventilation pathway for LFG within the waste mass to minimize buildup of gas pressures that could cause lateral migration. Both of the passive wells will be located in areas where the potential for gas generation is thought to be the highest (in a representatively thick section of wood waste, where the waste thickness is greatest) to the east and just inland of the in-situ stabilization solidification area.

The passive wells will be connected through subsurface LFG lateral headers to the ventilation system and will include isolation valves and monitoring ports located in secure subsurface vaults.

Provide controlled release of LFG through engineered vents, to prevent fugitive emissions where exposure is uncontrolled

Gases collected from the passive wells and from the LFG capture layer in the cover system will be routed through subsurface LFG header piping to two passive vents. During development of the conceptual design, the number of vents and the need for potential ventilation assistance through the use of solar-powered fans and wind turbines were evaluated. Additional vents to a passive ventilation system are useful to keep the collection system clear of LFG, but they are not powerful enough to provide active extraction of LFG from the subsurface. The inclusion of ventilation assistance was determined to be advantageous in minimizing the number of passive vents, although it should be noted that dispersion modeling and the exposure assessment was conducted without the additional convection or dispersion assistance from a solar-powered blower or wind turbine.

Based on lower capital cost and maintenance, the wind turbine was preferable to the solar-assisted ventilation system evaluated. Wind turbines can provide a similar level of ventilation improvement at a small fraction of the cost and, as a result, each of the 2 vents will be outfitted with a wind turbine at the head, which will rotate in the wind to enhance ventilation.

Each vent will also include a subsurface vault that will be outfitted with GAC filtration canisters to treat the emissions prior to discharge. As noted previously, it may be determined through testing after construction, that carbon filtration would no longer be required to meet MTCA cleanup standard. However, based on the design basis calculations, the GAC filtration will be included as a necessary element of construction, and only removed later, if possible, in coordination with Ecology. It should also be noted that carbon filtration may provide effective treatment for odors, so may be advantageous to keep in place, even if emissions do not require carbon filtration to meet MTCA Method B Air Cleanup Levels.

The subsurface vaults will also contain flame arrestors, a safety device that prevents a flame from traveling through the LFG control system due to the anticipated presence of methane gas. This will be included based on the potential for methane to occasionally be present above the explosive limit, and the possibility of lightening striking the vents.

The vents will be constructed of stainless steel 4-inch-diameter pipe with a round concrete base, and an effluent point 12 feet above ground surface, so that the release of LFG is at a controlled location where exposures are not anticipated and ambient air will not be effected. The vent pipe will be metal to provide a long service life, and stainless steel will be used to provide corrosion protection from external elements and the moisture condensing from the LFG. The subsurface vault will be secured in concrete and will have a secure, spring-assisted metal access lid. The vent pipes could be integrated into light poles or other structures for aesthetic purposes during future Site use, if desired. The vent pipe height may need to be extended to accommodate potential increases in ground surface elevations from planned future park development.

References

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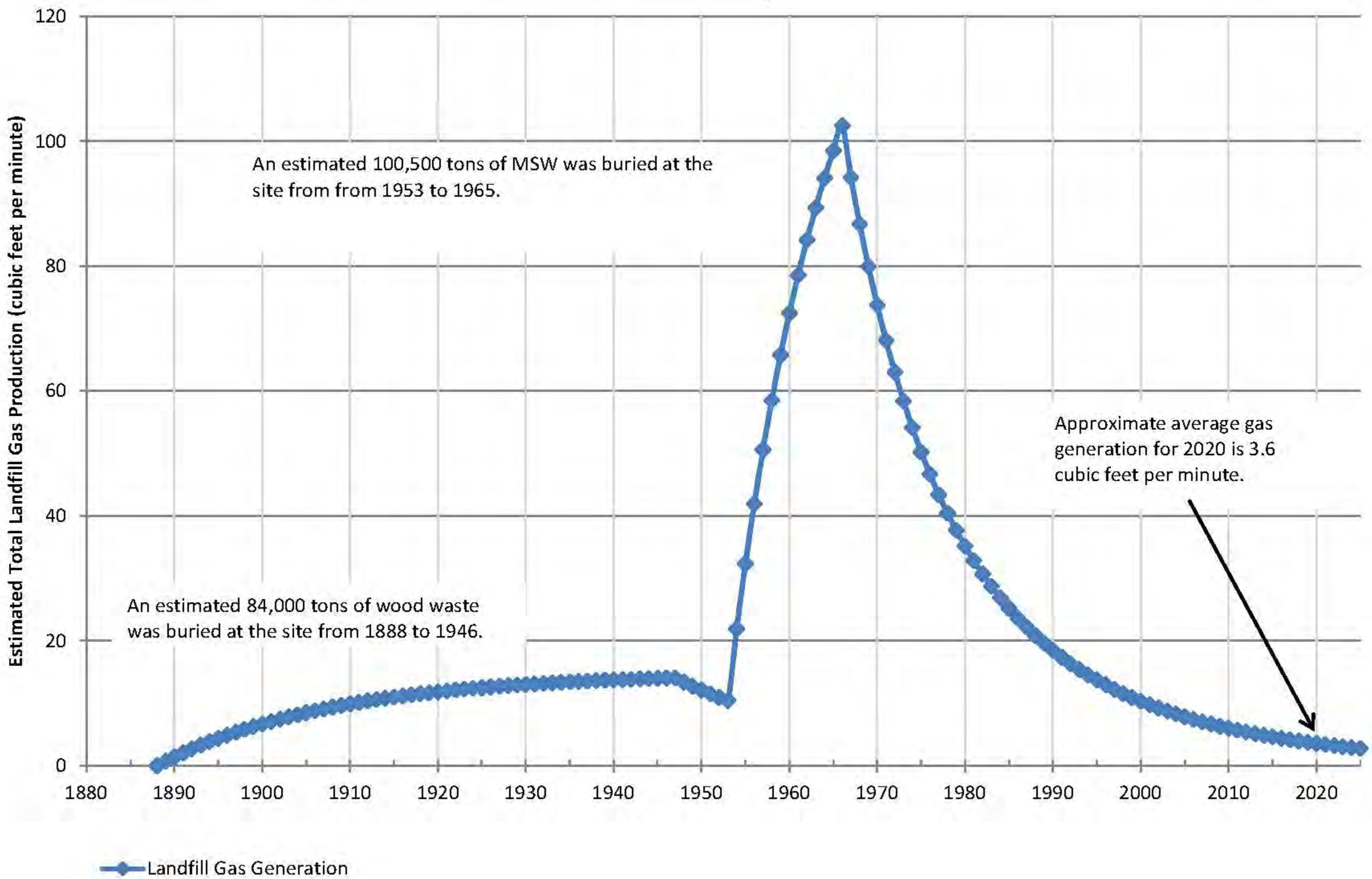
ATTACHMENT D.1

Landfill Gas Generation Modeling Report



LANDAU ASSOCIATES

R.G.Haley Site Remedial Design Bellingham, Washington	**Landfill Gas Generation Estimation**	Figure D.1

Summary Report

Landfill Name or Identifier: RG Haley +CALF - Wood Waste

Date: Monday, January 14, 2019

Description/Comments:

About LandGEM:

First-Order Decomposition Rate Equation:

$$Q_{CH_4} = \sum_{i=1}^{n} \sum_{j=0.1}^{1} kL_o \left(\frac{M_i}{10} \right) e^{-kt_{ij}}$$

Where,

Q_{CH4} = annual methane generation in the year of the calculation *(m^3/year)*
i = 1-year time increment
n = (year of the calculation) - (initial year of waste acceptance)
j = 0.1-year time increment
k = methane generation rate *($year^{-1}$)*
L_o = potential methane generation capacity *(m^3/Mg)*

M_i = mass of waste accepted in the i^{th} year (*Mg*)
t_{ij} = age of the j^{th} section of waste mass M_i accepted in the i^{th} year (*decimal years*, e.g., 3.2 years)

LandGEM is based on a first-order decomposition rate equation for quantifying emissions from the decomposition of landfilled waste in municipal solid waste (MSW) landfills. The software provides a relatively simple approach to estimating landfill gas emissions. Model defaults are based on empirical data from U.S. landfills. Field test data can also be used in place of model defaults when available. Further guidance on EPA test methods, Clean Air Act (CAA) regulations, and other guidance regarding landfill gas emissions and control technology requirements can be found at http://www.epa.gov/ttnatw01/landfill/landflpg.html.

LandGEM is considered a screening tool — the better the input data, the better the estimates. Often, there are limitations with the available data regarding waste quantity and composition, variation in design and operating practices over time, and changes occurring over time that impact the emissions potential. Changes to landfill operation, such as operating under wet conditions through leachate recirculation or other liquid additions, will result in generating more gas at a faster rate. Defaults for estimating emissions for this type of operation are being developed to include in LandGEM along with defaults for convential landfills (no leachate or liquid additions) for developing emission inventories and determining CAA applicability. Refer to the Web site identified above for future updates.

Input Review

LANDFILL CHARACTERISTICS

Landfill Open Year	**1888**	
Landfill Closure Year (with 80-year limit)	**1946**	
Actual Closure Year (without limit)	***1946***	
Have Model Calculate Closure Year?	**No**	
Waste Design Capacity		*megagrams*

MODEL PARAMETERS

Methane Generation Rate, k	**0.050**	*year^{-1}*
Potential Methane Generation Capacity, L_o	**170**	*m^3/Mg*
NMOC Concentration	**4,000**	*ppmv as hexane*
Methane Content	**50**	*% by volume*

GASES / POLLUTANTS SELECTED

Gas / Pollutant #1:	**Total landfill gas**
Gas / Pollutant #2:	**Methane**
Gas / Pollutant #3:	**Carbon dioxide**
Gas / Pollutant #4:	**NMOC**

WASTE ACCEPTANCE RATES

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
1888	1,295	1,424	0	0
1889	1,295	1,424	1,295	1,424
1890	1,295	1,424	2,589	2,848
1891	1,295	1,424	3,884	4,272
1892	1,295	1,424	5,178	5,696
1893	1,295	1,424	6,473	7,120
1894	1,295	1,424	7,767	8,544
1895	1,295	1,424	9,062	9,968
1896	1,295	1,424	10,356	11,392
1897	1,295	1,424	11,651	12,816
1898	1,295	1,424	12,945	14,240
1899	1,295	1,424	14,240	15,664
1900	1,295	1,424	15,535	17,088
1901	1,295	1,424	16,829	18,512
1902	1,295	1,424	18,124	19,936
1903	1,295	1,424	19,418	21,360
1904	1,295	1,424	20,713	22,784
1905	1,295	1,424	22,007	24,208
1906	1,295	1,424	23,302	25,632
1907	1,295	1,424	24,596	27,056
1908	1,295	1,424	25,891	28,480
1909	1,295	1,424	27,185	29,904
1910	1,295	1,424	28,480	31,328
1911	1,295	1,424	29,775	32,752
1912	1,295	1,424	31,069	34,176
1913	1,295	1,424	32,364	35,600
1914	1,295	1,424	33,658	37,024
1915	1,295	1,424	34,953	38,448
1916	1,295	1,424	36,247	39,872
1917	1,295	1,424	37,542	41,296
1918	1,295	1,424	38,836	42,720
1919	1,295	1,424	40,131	44,144
1920	1,295	1,424	41,425	45,568
1921	1,295	1,424	42,720	46,992
1922	1,295	1,424	44,015	48,416
1923	1,295	1,424	45,309	49,840
1924	1,295	1,424	46,604	51,264
1925	1,295	1,424	47,898	52,688
1926	1,295	1,424	49,193	54,112
1927	1,295	1,424	50,487	55,536

WASTE ACCEPTANCE RATES (Continued)

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	(short tons/year)	(Mg)	(short tons)
1928	1,295	1,424	51,782	56,960
1929	1,295	1,424	53,076	58,384
1930	1,295	1,424	54,371	59,808
1931	1,295	1,424	55,665	61,232
1932	1,295	1,424	56,960	62,656
1933	1,295	1,424	58,255	64,080
1934	1,295	1,424	59,549	65,504
1935	1,295	1,424	60,844	66,928
1936	1,295	1,424	62,138	68,352
1937	1,295	1,424	63,433	69,776
1938	1,295	1,424	64,727	71,200
1939	1,295	1,424	66,022	72,624
1940	1,295	1,424	67,316	74,048
1941	1,295	1,424	68,611	75,472
1942	1,295	1,424	69,905	76,896
1943	1,295	1,424	71,200	78,320
1944	1,295	1,424	72,495	79,744
1945	1,295	1,424	73,789	81,168
1946	1,295	1,424	75,084	82,592
1947	0	0	76,378	84,016
1948	0	0	76,378	84,016
1949	0	0	76,378	84,016
1950	0	0	76,378	84,016
1951	0	0	76,378	84,016
1952	0	0	76,378	84,016
1953	0	0	76,378	84,016
1954	0	0	76,378	84,016
1955	0	0	76,378	84,016
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1958	0	0	76,378	84,016
1959	0	0	76,378	84,016
1960	0	0	76,378	84,016
1961	0	0	76,378	84,016
1962	0	0	76,378	84,016
1963	0	0	76,378	84,016
1964	0	0	76,378	84,016
1965	0	0	76,378	84,016
1966	0	0	76,378	84,016
1967	0	0	76,378	84,016

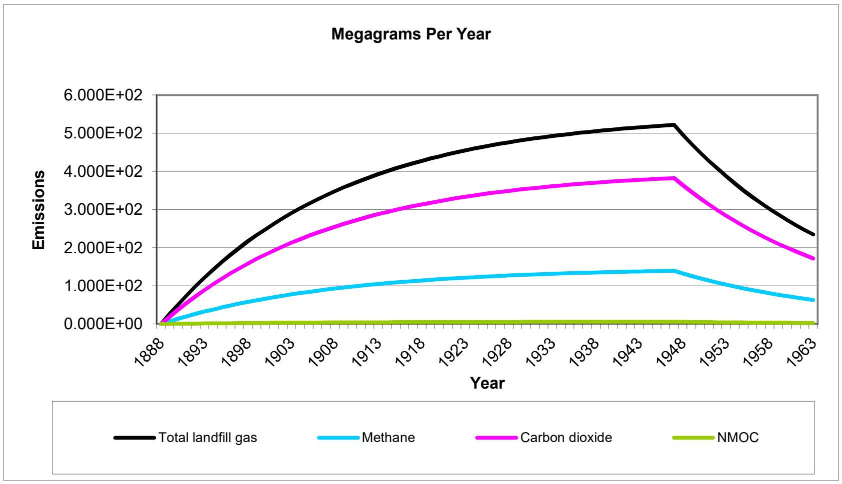
Pollutant Parameters

	Compound	Gas / Pollutant Default Parameters: Concentration (*ppmv*)	Molecular Weight	User-specified Pollutant Parameters: Concentration (*ppmv*)	Molecular Weight
Gases	Total landfill gas		0.00		
	Methane		16.04		
	Carbon dioxide		44.01		
	NMOC	4,000	86.18		
Pollutants	1,1,1-Trichloroethane (methyl chloroform) - HAP	0.48	133.41		
	1,1,2,2-Tetrachloroethane - HAP/VOC	1.1	167.85		
	1,1-Dichloroethane (ethylidene dichloride) - HAP/VOC	2.4	98.97		
	1,1-Dichloroethene (vinylidene chloride) - HAP/VOC	0.20	96.94		
	1,2-Dichloroethane (ethylene dichloride) - HAP/VOC	0.41	98.96		
	1,2-Dichloropropane (propylene dichloride) - HAP/VOC	0.18	112.99		
	2-Propanol (isopropyl alcohol) - VOC	50	60.11		
	Acetone	7.0	58.08		
	Acrylonitrile - HAP/VOC	6.3	53.06		
	Benzene - No or Unknown Co-disposal - HAP/VOC	1.9	78.11		
	Benzene - Co-disposal - HAP/VOC	11	78.11		
	Bromodichloromethane - VOC	3.1	163.83		
	Butane - VOC	5.0	58.12		
	Carbon disulfide - HAP/VOC	0.58	76.13		
	Carbon monoxide	140	28.01		
	Carbon tetrachloride - HAP/VOC	4.0E-03	153.84		
	Carbonyl sulfide - HAP/VOC	0.49	60.07		
	Chlorobenzene - HAP/VOC	0.25	112.56		
	Chlorodifluoromethane	1.3	86.47		
	Chloroethane (ethyl chloride) - HAP/VOC	1.3	64.52		
	Chloroform - HAP/VOC	0.03	119.39		
	Chloromethane - VOC	1.2	50.49		
	Dichlorobenzene - (HAP for para isomer/VOC)	0.21	147		
	Dichlorodifluoromethane	16	120.91		
	Dichlorofluoromethane - VOC	2.6	102.92		
	Dichloromethane (methylene chloride) - HAP	14	84.94		
	Dimethyl sulfide (methyl sulfide) - VOC	7.8	62.13		
	Ethane	890	30.07		
	Ethanol - VOC	27	46.08		

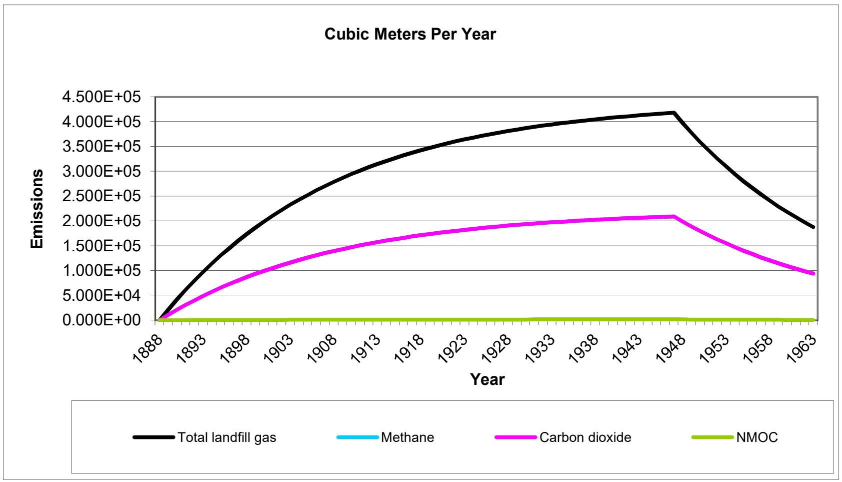
Pollutant Parameters (Continued)

	Gas / Pollutant Default Parameters:			User-specified Pollutant Parameters:	
	Compound	Concentration (*ppmv*)	Molecular Weight	Concentration (*ppmv*)	Molecular Weight
Pollutants	Ethyl mercaptan (ethanethiol) - VOC	2.3	62.13		
	Ethylbenzene - HAP/VOC	4.6	106.16		
	Ethylene dibromide - HAP/VOC	1.0E-03	187.88		
	Fluorotrichloromethane - VOC	0.76	137.38		
	Hexane - HAP/VOC	6.6	86.18		
	Hydrogen sulfide	36	34.08		
	Mercury (total) - HAP	2.9E-04	200.61		
	Methyl ethyl ketone - HAP/VOC	7.1	72.11		
	Methyl isobutyl ketone - HAP/VOC	1.9	100.16		
	Methyl mercaptan - VOC	2.5	48.11		
	Pentane - VOC	3.3	72.15		
	Perchloroethylene (tetrachloroethylene) - HAP	3.7	165.83		
	Propane - VOC	11	44.09		
	t-1,2-Dichloroethene - VOC	2.8	96.94		
	Toluene - No or Unknown Co-disposal - HAP/VOC	39	92.13		
	Toluene - Co-disposal - HAP/VOC	170	92.13		
	Trichloroethylene (trichloroethene) - HAP/VOC	2.8	131.40		
	Vinyl chloride - HAP/VOC	7.3	62.50		
	Xylenes - HAP/VOC	12	106.16		

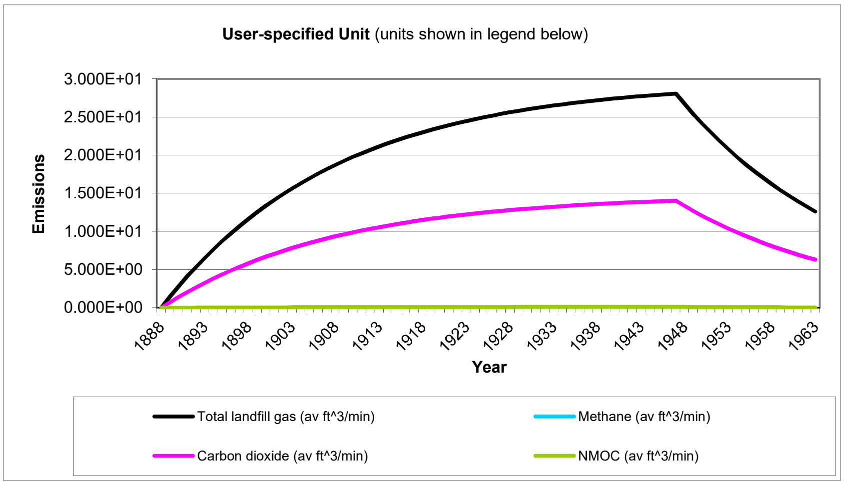
Graphs



Megagrams Per Year
6.000E+02
5.000E+02
4.000E+02
3.000E+02
2.000E+02
1.000E+02
0.000E+00
Emissions
1888
1893
1898
1903
1908
1913
1918
1923
1928
1933
1938
1943
1948
1953
1958
1963
Year
Total landfill gas
Methane
Carbon dioxide
NMOC



Cubic Meters Per Year
4.500E+05
4.000E+05
3.500E+05
3.000E+05
2.500E+05
2.000E+05
1.500E+05
1.000E+05
5.000E+04
0.000E+00
Emissions
1888
1893
1898
1903
1908
1913
1918
1923
1928
1933
1938
1943
1948
1953
1958
1963
Year
Total landfill gas
Methane
Carbon dioxide
NMOC



User-specified Unit (units shown in legend below)
3.000E+01
2.500E+01
2.000E+01
1.500E+01
1.000E+01
5.000E+00
0.000E+00
Emissions
1888
1893
1898
1903
1908
1913
1918
1923
1928
1933
1938
1943
1948
1953
1958
1963
Year
Total landfill gas (av ft^3/min)
Methane (av ft^3/min)
Carbon dioxide (av ft^3/min)
NMOC (av ft^3/min)

Results

Year	Total landfill gas			Methane		
	(Mg/year)	(m^3/year)	(av ft^3/min)	(Mg/year)	(m^3/year)	(av ft^3/min)
1888	0	0	0	0	0	0
1889	2.687E+01	2.152E+04	1.446E+00	7.178E+00	1.076E+04	7.230E-01
1890	5.244E+01	4.199E+04	2.821E+00	1.401E+01	2.100E+04	1.411E+00
1891	7.676E+01	6.146E+04	4.130E+00	2.050E+01	3.073E+04	2.065E+00
1892	9.989E+01	7.998E+04	5.374E+00	2.668E+01	3.999E+04	2.687E+00
1893	1.219E+02	9.760E+04	6.558E+00	3.256E+01	4.880E+04	3.279E+00
1894	1.428E+02	1.144E+05	7.684E+00	3.815E+01	5.718E+04	3.842E+00
1895	1.627E+02	1.303E+05	8.755E+00	4.347E+01	6.515E+04	4.378E+00
1896	1.817E+02	1.455E+05	9.774E+00	4.853E+01	7.274E+04	4.887E+00
1897	1.997E+02	1.599E+05	1.074E+01	5.334E+01	7.995E+04	5.372E+00
1898	2.168E+02	1.736E+05	1.167E+01	5.791E+01	8.681E+04	5.833E+00
1899	2.331E+02	1.867E+05	1.254E+01	6.227E+01	9.333E+04	6.271E+00
1900	2.486E+02	1.991E+05	1.338E+01	6.641E+01	9.954E+04	6.688E+00
1901	2.634E+02	2.109E+05	1.417E+01	7.035E+01	1.054E+05	7.085E+00
1902	2.774E+02	2.221E+05	1.492E+01	7.410E+01	1.111E+05	7.462E+00
1903	2.907E+02	2.328E+05	1.564E+01	7.766E+01	1.164E+05	7.821E+00
1904	3.034E+02	2.430E+05	1.633E+01	8.105E+01	1.215E+05	8.163E+00
1905	3.155E+02	2.527E+05	1.698E+01	8.428E+01	1.263E+05	8.488E+00
1906	3.270E+02	2.618E+05	1.759E+01	8.735E+01	1.309E+05	8.797E+00
1907	3.379E+02	2.706E+05	1.818E+01	9.026E+01	1.353E+05	9.091E+00
1908	3.483E+02	2.789E+05	1.874E+01	9.304E+01	1.395E+05	9.370E+00
1909	3.582E+02	2.868E+05	1.927E+01	9.568E+01	1.434E+05	9.636E+00
1910	3.676E+02	2.944E+05	1.978E+01	9.819E+01	1.472E+05	9.889E+00
1911	3.766E+02	3.015E+05	2.026E+01	1.006E+02	1.508E+05	1.013E+01
1912	3.851E+02	3.083E+05	2.072E+01	1.029E+02	1.542E+05	1.036E+01
1913	3.932E+02	3.148E+05	2.115E+01	1.050E+02	1.574E+05	1.058E+01
1914	4.009E+02	3.210E+05	2.157E+01	1.071E+02	1.605E+05	1.078E+01
1915	4.082E+02	3.269E+05	2.196E+01	1.090E+02	1.634E+05	1.098E+01
1916	4.152E+02	3.324E+05	2.234E+01	1.109E+02	1.662E+05	1.117E+01
1917	4.218E+02	3.377E+05	2.269E+01	1.127E+02	1.689E+05	1.135E+01
1918	4.281E+02	3.428E+05	2.303E+01	1.143E+02	1.714E+05	1.152E+01
1919	4.341E+02	3.476E+05	2.335E+01	1.159E+02	1.738E+05	1.168E+01
1920	4.398E+02	3.522E+05	2.366E+01	1.175E+02	1.761E+05	1.183E+01
1921	4.452E+02	3.565E+05	2.395E+01	1.189E+02	1.783E+05	1.198E+01
1922	4.504E+02	3.606E+05	2.423E+01	1.203E+02	1.803E+05	1.212E+01
1923	4.553E+02	3.646E+05	2.450E+01	1.216E+02	1.823E+05	1.225E+01
1924	4.600E+02	3.683E+05	2.475E+01	1.229E+02	1.842E+05	1.237E+01
1925	4.644E+02	3.719E+05	2.499E+01	1.240E+02	1.859E+05	1.249E+01
1926	4.686E+02	3.753E+05	2.521E+01	1.252E+02	1.876E+05	1.261E+01
1927	4.726E+02	3.785E+05	2.543E+01	1.262E+02	1.892E+05	1.271E+01
1928	4.765E+02	3.815E+05	2.563E+01	1.273E+02	1.908E+05	1.282E+01
1929	4.801E+02	3.844E+05	2.583E+01	1.282E+02	1.922E+05	1.292E+01
1930	4.836E+02	3.872E+05	2.602E+01	1.292E+02	1.936E+05	1.301E+01
1931	4.869E+02	3.898E+05	2.619E+01	1.300E+02	1.949E+05	1.310E+01
1932	4.900E+02	3.924E+05	2.636E+01	1.309E+02	1.962E+05	1.318E+01
1933	4.930E+02	3.947E+05	2.652E+01	1.317E+02	1.974E+05	1.326E+01
1934	4.958E+02	3.970E+05	2.667E+01	1.324E+02	1.985E+05	1.334E+01
1935	4.985E+02	3.992E+05	2.682E+01	1.332E+02	1.996E+05	1.341E+01
1936	5.011E+02	4.012E+05	2.696E+01	1.338E+02	2.006E+05	1.348E+01
1937	5.035E+02	4.032E+05	2.709E+01	1.345E+02	2.016E+05	1.354E+01

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	(m^3/year)	(av ft^3/min)	(Mg/year)	(m^3/year)	(av ft^3/min)
1938	5.058E+02	4.050E+05	2.721E+01	1.351E+02	2.025E+05	1.361E+01
1939	5.080E+02	4.068E+05	2.733E+01	1.357E+02	2.034E+05	1.367E+01
1940	5.101E+02	4.085E+05	2.745E+01	1.363E+02	2.042E+05	1.372E+01
1941	5.121E+02	4.101E+05	2.755E+01	1.368E+02	2.050E+05	1.378E+01
1942	5.140E+02	4.116E+05	2.765E+01	1.373E+02	2.058E+05	1.383E+01
1943	5.158E+02	4.130E+05	2.775E+01	1.378E+02	2.065E+05	1.388E+01
1944	5.175E+02	4.144E+05	2.784E+01	1.382E+02	2.072E+05	1.392E+01
1945	5.192E+02	4.157E+05	2.793E+01	1.387E+02	2.079E+05	1.397E+01
1946	5.207E+02	4.170E+05	2.802E+01	1.391E+02	2.085E+05	1.401E+01
1947	5.222E+02	4.182E+05	2.810E+01	1.395E+02	2.091E+05	1.405E+01
1948	4.967E+02	3.978E+05	2.673E+01	1.327E+02	1.989E+05	1.336E+01
1949	4.725E+02	3.784E+05	2.542E+01	1.262E+02	1.892E+05	1.271E+01
1950	4.495E+02	3.599E+05	2.418E+01	1.201E+02	1.800E+05	1.209E+01
1951	4.275E+02	3.424E+05	2.300E+01	1.142E+02	1.712E+05	1.150E+01
1952	4.067E+02	3.257E+05	2.188E+01	1.086E+02	1.628E+05	1.094E+01
1953	3.869E+02	3.098E+05	2.081E+01	1.033E+02	1.549E+05	1.041E+01
1954	3.680E+02	2.947E+05	1.980E+01	9.829E+01	1.473E+05	9.899E+00
1955	3.500E+02	2.803E+05	1.883E+01	9.350E+01	1.401E+05	9.417E+00
1956	3.330E+02	2.666E+05	1.791E+01	8.894E+01	1.333E+05	8.957E+00
1957	3.167E+02	2.536E+05	1.704E+01	8.460E+01	1.268E+05	8.520E+00
1958	3.013E+02	2.413E+05	1.621E+01	8.048E+01	1.206E+05	8.105E+00
1959	2.866E+02	2.295E+05	1.542E+01	7.655E+01	1.147E+05	7.710E+00
1960	2.726E+02	2.183E+05	1.467E+01	7.282E+01	1.091E+05	7.334E+00
1961	2.593E+02	2.076E+05	1.395E+01	6.927E+01	1.038E+05	6.976E+00
1962	2.467E+02	1.975E+05	1.327E+01	6.589E+01	9.876E+04	6.636E+00
1963	2.346E+02	1.879E+05	1.262E+01	6.267E+01	9.394E+04	6.312E+00
1964	2.232E+02	1.787E+05	1.201E+01	5.962E+01	8.936E+04	6.004E+00
1965	2.123E+02	1.700E+05	1.142E+01	5.671E+01	8.500E+04	5.711E+00
1966	2.020E+02	1.617E+05	1.087E+01	5.394E+01	8.086E+04	5.433E+00
1967	1.921E+02	1.538E+05	1.034E+01	5.131E+01	7.691E+04	5.168E+00
1968	1.827E+02	1.463E+05	9.832E+00	4.881E+01	7.316E+04	4.916E+00
1969	1.738E+02	1.392E+05	9.352E+00	4.643E+01	6.960E+04	4.676E+00
1970	1.653E+02	1.324E+05	8.896E+00	4.417E+01	6.620E+04	4.448E+00
1971	1.573E+02	1.259E+05	8.462E+00	4.201E+01	6.297E+04	4.231E+00
1972	1.496E+02	1.198E+05	8.050E+00	3.996E+01	5.990E+04	4.025E+00
1973	1.423E+02	1.140E+05	7.657E+00	3.801E+01	5.698E+04	3.828E+00
1974	1.354E+02	1.084E+05	7.284E+00	3.616E+01	5.420E+04	3.642E+00
1975	1.288E+02	1.031E+05	6.928E+00	3.440E+01	5.156E+04	3.464E+00
1976	1.225E+02	9.809E+04	6.590E+00	3.272E+01	4.904E+04	3.295E+00
1977	1.165E+02	9.330E+04	6.269E+00	3.112E+01	4.665E+04	3.134E+00
1978	1.108E+02	8.875E+04	5.963E+00	2.961E+01	4.438E+04	2.982E+00
1979	1.054E+02	8.442E+04	5.672E+00	2.816E+01	4.221E+04	2.836E+00
1980	1.003E+02	8.031E+04	5.396E+00	2.679E+01	4.015E+04	2.698E+00
1981	9.540E+01	7.639E+04	5.133E+00	2.548E+01	3.819E+04	2.566E+00
1982	9.074E+01	7.266E+04	4.882E+00	2.424E+01	3.633E+04	2.441E+00
1983	8.632E+01	6.912E+04	4.644E+00	2.306E+01	3.456E+04	2.322E+00
1984	8.211E+01	6.575E+04	4.418E+00	2.193E+01	3.287E+04	2.209E+00
1985	7.810E+01	6.254E+04	4.202E+00	2.086E+01	3.127E+04	2.101E+00
1986	7.430E+01	5.949E+04	3.997E+00	1.985E+01	2.975E+04	1.999E+00
1987	7.067E+01	5.659E+04	3.802E+00	1.888E+01	2.830E+04	1.901E+00
1988	6.723E+01	5.383E+04	3.617E+00	1.796E+01	2.692E+04	1.808E+00

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
1989	6.395E+01	5.121E+04	3.440E+00	1.708E+01	2.560E+04	1.720E+00
1990	6.083E+01	4.871E+04	3.273E+00	1.625E+01	2.435E+04	1.636E+00
1991	5.786E+01	4.633E+04	3.113E+00	1.546E+01	2.317E+04	1.557E+00
1992	5.504E+01	4.407E+04	2.961E+00	1.470E+01	2.204E+04	1.481E+00
1993	5.235E+01	4.192E+04	2.817E+00	1.398E+01	2.096E+04	1.408E+00
1994	4.980E+01	3.988E+04	2.679E+00	1.330E+01	1.994E+04	1.340E+00
1995	4.737E+01	3.793E+04	2.549E+00	1.265E+01	1.897E+04	1.274E+00
1996	4.506E+01	3.608E+04	2.424E+00	1.204E+01	1.804E+04	1.212E+00
1997	4.286E+01	3.432E+04	2.306E+00	1.145E+01	1.716E+04	1.153E+00
1998	4.077E+01	3.265E+04	2.194E+00	1.089E+01	1.633E+04	1.097E+00
1999	3.879E+01	3.106E+04	2.087E+00	1.036E+01	1.553E+04	1.043E+00
2000	3.689E+01	2.954E+04	1.985E+00	9.855E+00	1.477E+04	9.925E-01
2001	3.509E+01	2.810E+04	1.888E+00	9.374E+00	1.405E+04	9.441E-01
2002	3.338E+01	2.673E+04	1.796E+00	8.917E+00	1.337E+04	8.980E-01
2003	3.175E+01	2.543E+04	1.708E+00	8.482E+00	1.271E+04	8.542E-01
2004	3.021E+01	2.419E+04	1.625E+00	8.068E+00	1.209E+04	8.126E-01
2005	2.873E+01	2.301E+04	1.546E+00	7.675E+00	1.150E+04	7.730E-01
2006	2.733E+01	2.189E+04	1.471E+00	7.301E+00	1.094E+04	7.353E-01
2007	2.600E+01	2.082E+04	1.399E+00	6.945E+00	1.041E+04	6.994E-01
2008	2.473E+01	1.980E+04	1.331E+00	6.606E+00	9.902E+03	6.653E-01
2009	2.352E+01	1.884E+04	1.266E+00	6.284E+00	9.419E+03	6.328E-01
2010	2.238E+01	1.792E+04	1.204E+00	5.977E+00	8.959E+03	6.020E-01
2011	2.129E+01	1.704E+04	1.145E+00	5.686E+00	8.522E+03	5.726E-01
2012	2.025E+01	1.621E+04	1.089E+00	5.408E+00	8.107E+03	5.447E-01
2013	1.926E+01	1.542E+04	1.036E+00	5.145E+00	7.711E+03	5.181E-01
2014	1.832E+01	1.467E+04	9.857E-01	4.894E+00	7.335E+03	4.929E-01
2015	1.743E+01	1.396E+04	9.376E-01	4.655E+00	6.978E+03	4.688E-01
2016	1.658E+01	1.327E+04	8.919E-01	4.428E+00	6.637E+03	4.460E-01
2017	1.577E+01	1.263E+04	8.484E-01	4.212E+00	6.314E+03	4.242E-01
2018	1.500E+01	1.201E+04	8.070E-01	4.007E+00	6.006E+03	4.035E-01
2019	1.427E+01	1.143E+04	7.677E-01	3.811E+00	5.713E+03	3.838E-01
2020	1.357E+01	1.087E+04	7.302E-01	3.625E+00	5.434E+03	3.651E-01
2021	1.291E+01	1.034E+04	6.946E-01	3.449E+00	5.169E+03	3.473E-01
2022	1.228E+01	9.834E+03	6.607E-01	3.280E+00	4.917E+03	3.304E-01
2023	1.168E+01	9.354E+03	6.285E-01	3.120E+00	4.677E+03	3.143E-01
2024	1.111E+01	8.898E+03	5.979E-01	2.968E+00	4.449E+03	2.989E-01
2025	1.057E+01	8.464E+03	5.687E-01	2.823E+00	4.232E+03	2.844E-01
2026	1.005E+01	8.051E+03	5.410E-01	2.686E+00	4.026E+03	2.705E-01
2027	9.564E+00	7.659E+03	5.146E-01	2.555E+00	3.829E+03	2.573E-01
2028	9.098E+00	7.285E+03	4.895E-01	2.430E+00	3.643E+03	2.447E-01

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
1888	0	0	0	0	0	0
1889	1.970E+01	1.076E+04	7.230E-01	3.085E-01	8.608E+01	5.784E-03
1890	3.843E+01	2.100E+04	1.411E+00	6.020E-01	1.680E+02	1.129E-02
1891	5.625E+01	3.073E+04	2.065E+00	8.812E-01	2.458E+02	1.652E-02
1892	7.321E+01	3.999E+04	2.687E+00	1.147E+00	3.199E+02	2.150E-02
1893	8.933E+01	4.880E+04	3.279E+00	1.399E+00	3.904E+02	2.623E-02
1894	1.047E+02	5.718E+04	3.842E+00	1.640E+00	4.575E+02	3.074E-02
1895	1.193E+02	6.515E+04	4.378E+00	1.868E+00	5.212E+02	3.502E-02
1896	1.331E+02	7.274E+04	4.887E+00	2.086E+00	5.819E+02	3.910E-02
1897	1.463E+02	7.995E+04	5.372E+00	2.293E+00	6.396E+02	4.297E-02
1898	1.589E+02	8.681E+04	5.833E+00	2.489E+00	6.945E+02	4.666E-02
1899	1.708E+02	9.333E+04	6.271E+00	2.676E+00	7.467E+02	5.017E-02
1900	1.822E+02	9.954E+04	6.688E+00	2.854E+00	7.963E+02	5.351E-02
1901	1.930E+02	1.054E+05	7.085E+00	3.024E+00	8.436E+02	5.668E-02
1902	2.033E+02	1.111E+05	7.462E+00	3.185E+00	8.885E+02	5.970E-02
1903	2.131E+02	1.164E+05	7.821E+00	3.338E+00	9.313E+02	6.257E-02
1904	2.224E+02	1.215E+05	8.163E+00	3.484E+00	9.719E+02	6.530E-02
1905	2.312E+02	1.263E+05	8.488E+00	3.622E+00	1.011E+03	6.790E-02
1906	2.397E+02	1.309E+05	8.797E+00	3.754E+00	1.047E+03	7.037E-02
1907	2.477E+02	1.353E+05	9.091E+00	3.880E+00	1.082E+03	7.273E-02
1908	2.553E+02	1.395E+05	9.370E+00	3.999E+00	1.116E+03	7.496E-02
1909	2.625E+02	1.434E+05	9.636E+00	4.113E+00	1.147E+03	7.709E-02
1910	2.694E+02	1.472E+05	9.889E+00	4.221E+00	1.177E+03	7.911E-02
1911	2.760E+02	1.508E+05	1.013E+01	4.323E+00	1.206E+03	8.104E-02
1912	2.822E+02	1.542E+05	1.036E+01	4.421E+00	1.233E+03	8.287E-02
1913	2.881E+02	1.574E+05	1.058E+01	4.514E+00	1.259E+03	8.461E-02
1914	2.938E+02	1.605E+05	1.078E+01	4.602E+00	1.284E+03	8.627E-02
1915	2.992E+02	1.634E+05	1.098E+01	4.686E+00	1.307E+03	8.785E-02
1916	3.043E+02	1.662E+05	1.117E+01	4.766E+00	1.330E+03	8.935E-02
1917	3.091E+02	1.689E+05	1.135E+01	4.843E+00	1.351E+03	9.077E-02
1918	3.137E+02	1.714E+05	1.152E+01	4.915E+00	1.371E+03	9.213E-02
1919	3.181E+02	1.738E+05	1.168E+01	4.984E+00	1.390E+03	9.342E-02
1920	3.223E+02	1.761E+05	1.183E+01	5.049E+00	1.409E+03	9.465E-02
1921	3.263E+02	1.783E+05	1.198E+01	5.112E+00	1.426E+03	9.581E-02
1922	3.301E+02	1.803E+05	1.212E+01	5.171E+00	1.443E+03	9.692E-02
1923	3.337E+02	1.823E+05	1.225E+01	5.227E+00	1.458E+03	9.798E-02
1924	3.371E+02	1.842E+05	1.237E+01	5.281E+00	1.473E+03	9.899E-02
1925	3.404E+02	1.859E+05	1.249E+01	5.332E+00	1.487E+03	9.994E-02
1926	3.434E+02	1.876E+05	1.261E+01	5.380E+00	1.501E+03	1.009E-01
1927	3.464E+02	1.892E+05	1.271E+01	5.426E+00	1.514E+03	1.017E-01
1928	3.492E+02	1.908E+05	1.282E+01	5.470E+00	1.526E+03	1.025E-01
1929	3.519E+02	1.922E+05	1.292E+01	5.512E+00	1.538E+03	1.033E-01
1930	3.544E+02	1.936E+05	1.301E+01	5.552E+00	1.549E+03	1.041E-01
1931	3.568E+02	1.949E+05	1.310E+01	5.590E+00	1.559E+03	1.048E-01
1932	3.591E+02	1.962E+05	1.318E+01	5.626E+00	1.569E+03	1.054E-01
1933	3.613E+02	1.974E+05	1.326E+01	5.660E+00	1.579E+03	1.061E-01
1934	3.634E+02	1.985E+05	1.334E+01	5.692E+00	1.588E+03	1.067E-01
1935	3.653E+02	1.996E+05	1.341E+01	5.723E+00	1.597E+03	1.073E-01
1936	3.672E+02	2.006E+05	1.348E+01	5.753E+00	1.605E+03	1.078E-01
1937	3.690E+02	2.016E+05	1.354E+01	5.781E+00	1.613E+03	1.084E-01

Results (Continued)

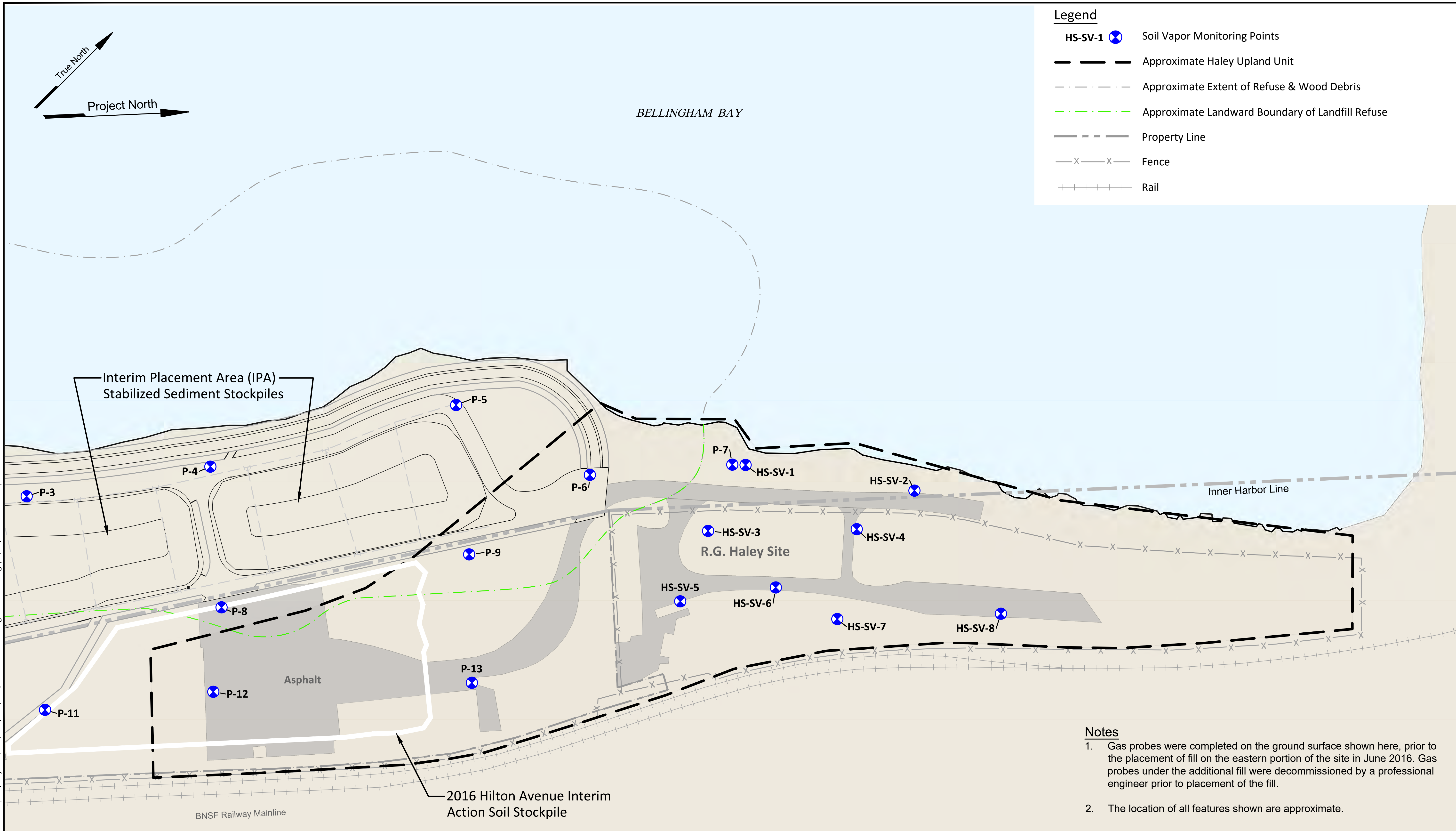
Year	Carbon dioxide			NMOC		
	(Mg/year)	(m^3/year)	(av ft^3/min)	(Mg/year)	(m^3/year)	(av ft^3/min)
1938	3.707E+02	2.025E+05	1.361E+01	5.807E+00	1.620E+03	1.089E-01
1939	3.723E+02	2.034E+05	1.367E+01	5.833E+00	1.627E+03	1.093E-01
1940	3.739E+02	2.042E+05	1.372E+01	5.857E+00	1.634E+03	1.098E-01
1941	3.753E+02	2.050E+05	1.378E+01	5.880E+00	1.640E+03	1.102E-01
1942	3.767E+02	2.058E+05	1.383E+01	5.901E+00	1.646E+03	1.106E-01
1943	3.780E+02	2.065E+05	1.388E+01	5.922E+00	1.652E+03	1.110E-01
1944	3.793E+02	2.072E+05	1.392E+01	5.942E+00	1.658E+03	1.114E-01
1945	3.805E+02	2.079E+05	1.397E+01	5.961E+00	1.663E+03	1.117E-01
1946	3.816E+02	2.085E+05	1.401E+01	5.978E+00	1.668E+03	1.121E-01
1947	3.827E+02	2.091E+05	1.405E+01	5.995E+00	1.673E+03	1.124E-01
1948	3.640E+02	1.989E+05	1.336E+01	5.703E+00	1.591E+03	1.069E-01
1949	3.463E+02	1.892E+05	1.271E+01	5.425E+00	1.513E+03	1.017E-01
1950	3.294E+02	1.800E+05	1.209E+01	5.160E+00	1.440E+03	9.673E-02
1951	3.133E+02	1.712E+05	1.150E+01	4.909E+00	1.369E+03	9.201E-02
1952	2.981E+02	1.628E+05	1.094E+01	4.669E+00	1.303E+03	8.752E-02
1953	2.835E+02	1.549E+05	1.041E+01	4.442E+00	1.239E+03	8.325E-02
1954	2.697E+02	1.473E+05	9.899E+00	4.225E+00	1.179E+03	7.919E-02
1955	2.565E+02	1.401E+05	9.417E+00	4.019E+00	1.121E+03	7.533E-02
1956	2.440E+02	1.333E+05	8.957E+00	3.823E+00	1.067E+03	7.166E-02
1957	2.321E+02	1.268E+05	8.520E+00	3.636E+00	1.014E+03	6.816E-02
1958	2.208E+02	1.206E+05	8.105E+00	3.459E+00	9.650E+02	6.484E-02
1959	2.100E+02	1.147E+05	7.710E+00	3.290E+00	9.179E+02	6.168E-02
1960	1.998E+02	1.091E+05	7.334E+00	3.130E+00	8.732E+02	5.867E-02
1961	1.900E+02	1.038E+05	6.976E+00	2.977E+00	8.306E+02	5.581E-02
1962	1.808E+02	9.876E+04	6.636E+00	2.832E+00	7.901E+02	5.309E-02
1963	1.720E+02	9.394E+04	6.312E+00	2.694E+00	7.516E+02	5.050E-02
1964	1.636E+02	8.936E+04	6.004E+00	2.563E+00	7.149E+02	4.803E-02
1965	1.556E+02	8.500E+04	5.711E+00	2.438E+00	6.800E+02	4.569E-02
1966	1.480E+02	8.086E+04	5.433E+00	2.319E+00	6.469E+02	4.346E-02
1967	1.408E+02	7.691E+04	5.168E+00	2.206E+00	6.153E+02	4.134E-02
1968	1.339E+02	7.316E+04	4.916E+00	2.098E+00	5.853E+02	3.933E-02
1969	1.274E+02	6.960E+04	4.676E+00	1.996E+00	5.568E+02	3.741E-02
1970	1.212E+02	6.620E+04	4.448E+00	1.898E+00	5.296E+02	3.558E-02
1971	1.153E+02	6.297E+04	4.231E+00	1.806E+00	5.038E+02	3.385E-02
1972	1.096E+02	5.990E+04	4.025E+00	1.718E+00	4.792E+02	3.220E-02
1973	1.043E+02	5.698E+04	3.828E+00	1.634E+00	4.558E+02	3.063E-02
1974	9.921E+01	5.420E+04	3.642E+00	1.554E+00	4.336E+02	2.913E-02
1975	9.438E+01	5.156E+04	3.464E+00	1.478E+00	4.125E+02	2.771E-02
1976	8.977E+01	4.904E+04	3.295E+00	1.406E+00	3.923E+02	2.636E-02
1977	8.539E+01	4.665E+04	3.134E+00	1.338E+00	3.732E+02	2.508E-02
1978	8.123E+01	4.438E+04	2.982E+00	1.273E+00	3.550E+02	2.385E-02
1979	7.727E+01	4.221E+04	2.836E+00	1.210E+00	3.377E+02	2.269E-02
1980	7.350E+01	4.015E+04	2.698E+00	1.151E+00	3.212E+02	2.158E-02
1981	6.992E+01	3.819E+04	2.566E+00	1.095E+00	3.056E+02	2.053E-02
1982	6.651E+01	3.633E+04	2.441E+00	1.042E+00	2.907E+02	1.953E-02
1983	6.326E+01	3.456E+04	2.322E+00	9.910E-01	2.765E+02	1.858E-02
1984	6.018E+01	3.287E+04	2.209E+00	9.427E-01	2.630E+02	1.767E-02
1985	5.724E+01	3.127E+04	2.101E+00	8.967E-01	2.502E+02	1.681E-02
1986	5.445E+01	2.975E+04	1.999E+00	8.530E-01	2.380E+02	1.599E-02
1987	5.179E+01	2.830E+04	1.901E+00	8.114E-01	2.264E+02	1.521E-02
1988	4.927E+01	2.692E+04	1.808E+00	7.718E-01	2.153E+02	1.447E-02

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	(m^3/year)	(av ft^3/min)	(Mg/year)	(m^3/year)	(av ft^3/min)
1989	4.687E+01	2.560E+04	1.720E+00	7.342E-01	2.048E+02	1.376E-02
1990	4.458E+01	2.435E+04	1.636E+00	6.984E-01	1.948E+02	1.309E-02
1991	4.241E+01	2.317E+04	1.557E+00	6.643E-01	1.853E+02	1.245E-02
1992	4.034E+01	2.204E+04	1.481E+00	6.319E-01	1.763E+02	1.185E-02
1993	3.837E+01	2.096E+04	1.408E+00	6.011E-01	1.677E+02	1.127E-02
1994	3.650E+01	1.994E+04	1.340E+00	5.718E-01	1.595E+02	1.072E-02
1995	3.472E+01	1.897E+04	1.274E+00	5.439E-01	1.517E+02	1.020E-02
1996	3.303E+01	1.804E+04	1.212E+00	5.174E-01	1.443E+02	9.698E-03
1997	3.142E+01	1.716E+04	1.153E+00	4.921E-01	1.373E+02	9.225E-03
1998	2.988E+01	1.633E+04	1.097E+00	4.681E-01	1.306E+02	8.775E-03
1999	2.843E+01	1.553E+04	1.043E+00	4.453E-01	1.242E+02	8.347E-03
2000	2.704E+01	1.477E+04	9.925E-01	4.236E-01	1.182E+02	7.940E-03
2001	2.572E+01	1.405E+04	9.441E-01	4.029E-01	1.124E+02	7.553E-03
2002	2.447E+01	1.337E+04	8.980E-01	3.833E-01	1.069E+02	7.184E-03
2003	2.327E+01	1.271E+04	8.542E-01	3.646E-01	1.017E+02	6.834E-03
2004	2.214E+01	1.209E+04	8.126E-01	3.468E-01	9.675E+01	6.501E-03
2005	2.106E+01	1.150E+04	7.730E-01	3.299E-01	9.203E+01	6.184E-03
2006	2.003E+01	1.094E+04	7.353E-01	3.138E-01	8.754E+01	5.882E-03
2007	1.905E+01	1.041E+04	6.994E-01	2.985E-01	8.327E+01	5.595E-03
2008	1.812E+01	9.902E+03	6.653E-01	2.839E-01	7.921E+01	5.322E-03
2009	1.724E+01	9.419E+03	6.328E-01	2.701E-01	7.535E+01	5.063E-03
2010	1.640E+01	8.959E+03	6.020E-01	2.569E-01	7.167E+01	4.816E-03
2011	1.560E+01	8.522E+03	5.726E-01	2.444E-01	6.818E+01	4.581E-03
2012	1.484E+01	8.107E+03	5.447E-01	2.325E-01	6.485E+01	4.358E-03
2013	1.412E+01	7.711E+03	5.181E-01	2.211E-01	6.169E+01	4.145E-03
2014	1.343E+01	7.335E+03	4.929E-01	2.103E-01	5.868E+01	3.943E-03
2015	1.277E+01	6.978E+03	4.688E-01	2.001E-01	5.582E+01	3.751E-03
2016	1.215E+01	6.637E+03	4.460E-01	1.903E-01	5.310E+01	3.568E-03
2017	1.156E+01	6.314E+03	4.242E-01	1.810E-01	5.051E+01	3.394E-03
2018	1.099E+01	6.006E+03	4.035E-01	1.722E-01	4.805E+01	3.228E-03
2019	1.046E+01	5.713E+03	3.838E-01	1.638E-01	4.570E+01	3.071E-03
2020	9.947E+00	5.434E+03	3.651E-01	1.558E-01	4.347E+01	2.921E-03
2021	9.462E+00	5.169E+03	3.473E-01	1.482E-01	4.135E+01	2.778E-03
2022	9.001E+00	4.917E+03	3.304E-01	1.410E-01	3.934E+01	2.643E-03
2023	8.562E+00	4.677E+03	3.143E-01	1.341E-01	3.742E+01	2.514E-03
2024	8.144E+00	4.449E+03	2.989E-01	1.276E-01	3.559E+01	2.391E-03
2025	7.747E+00	4.232E+03	2.844E-01	1.214E-01	3.386E+01	2.275E-03
2026	7.369E+00	4.026E+03	2.705E-01	1.154E-01	3.221E+01	2.164E-03
2027	7.010E+00	3.829E+03	2.573E-01	1.098E-01	3.063E+01	2.058E-03
2028	6.668E+00	3.643E+03	2.447E-01	1.045E-01	2.914E+01	1.958E-03

ATTACHMENT D.2

Soil Vapor Monitoring Data



Landau Associates | G:\Projects\611\002\010\020\F03 GasMonitoringLocations.dwg | 8/12/2019 3:13 PM | JVALLUZZI

Sources: Port of Bellingham 1996, Anchor Environmental 2008, Wilson Engineering 2015, and Pacific Surveying and Engineering 2016

0 120 240
Scale in Feet

LANDAU ASSOCIATES

Engineering Design Report
R.G. Haley Site
Bellingham, Washington

LFG Monitoring Locations

Figure
D.2

Table D-2
Landfill Gas Monitoring Data - TO-15 Analytical Results
Cornwall Avenue Landfill and RG Haley
Bellingham, Washington

Analyte	MTCA Method B Cleanup Level	Cornwall Site - Sample ID, Laboratory ID, Sample Date, and Results										R.G. Haley Site - Sample ID, Laboratory ID, Sample Date, and Results							
		CL-LFG-BACKGROUND P1502473-001 6/15/2015	CL-LFG-MW-102 P1502473-006 6/15/2015	CL-LFG-P-2 P1503343-03 8/7/2015	CL-LFG-P-3 P1502473-003 6/15/2015	CL-LFG-P-3 P1503343-04 8/7/2015	CL-LFG-P-6 P1503343-01 8/7/2015	CL-LFG-P-12 P1502473-004 6/15/2015	CL-LFG-P-12 P1503343-02 8/7/2015	CL-LFG-VENT-3 P1502473-005 6/15/2015	CL-LFG-VENT-4 P1502473-002 6/15/2015	HS-SV-1	HS-SV-2	HS-SV-3	HS-SV-4	HS-SV-5	HS-SV-6	HS-SV-7	HS-SV-8
Volatiles (µg/m³) **EPA Method TO-15**																			
Propene	No Criteria	0.21 U	6.9 U	**1300**	**190**	**120**	**540**	**84**	**26** J1	**6.5**	0.21 U	--	--	--	--	--	--	--	--
Dichlorodifluoromethane (CFC 12)	45.71	**2.3**	8.4 U	**45** J1	1.3 U	2.6 U	**54**	8.0 U	10 U	**1.9**	**1.0**	--	--	--	--	--	--	--	--
Chloromethane	41.14	0.22 U	7.4 U	15 U	1.2 U	2.3 U	14 U	7.1 U	9.2 U	**0.33** J1	**0.49** J1	--	--	--	--	--	--	--	--
1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	No Criteria	0.28 U	9.4 U	**440**	**14**	2.9 U	**200**	8.9 U	12 U	0.28 U	**0.39** J1	--	--	--	--	--	--	--	--
Vinyl chloride	0.28	--	--	**170**	--	--	**150**	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Butadiene	0.08	0.33 U	11 U	22 U	1.7 U	3.3 U	20 U	10 U	14 U	0.33 U	0.33 U	20 U	50 U	20 U	20 U	20 U	20 U	20 U	20 U
Bromomethane	2.29	0.28 U	9.4 U	19 U	1.5 U	2.9 U	18 U	8.9 U	12 U	0.28 U	0.28 U	--	--	--	--	--	--	--	--
Chloroethane	4571	0.25 U	8.4 U	17 U	1.3 U	2.6 U	16 U	8.0 U	10 U	0.25 U	0.25 U	--	--	--	--	--	--	--	--
Ethanol	No Criteria	**6.3** J1	**270**	79 U	**79**	12 U	74 U	**860**	49 U	**100**	**60**	--	--	--	--	--	--	--	--
Acetonitrile	27.43	0.27 U	8.9 U	18 U	1.4 U	2.7 U	17 U	8.5 U	11 U	**1.6**	0.27 U	--	--	--	--	--	--	--	--
Acrolein	0.01	0.25 U	8.4 U	17 U	1.3 U	2.6 U	16 U	8.0 U	10 U	**3.2**	0.25 U	--	--	--	--	--	--	--	--
Acetone	14171	**7.5**	38 U	76 U	**97**	12 U	71 U	**200** J1	47 U	**180**	**40**	--	--	--	--	--	--	--	--
Trichlorofluoromethane	320	**1.3** J	8.4 U	17 U	1.3 U	2.6 U	16 U	8.0 U	10 U	**1.4** J	**0.66** J, J1	--	--	--	--	--	--	--	--
2-Propanol (Isopropyl Alcohol)	No Criteria	0.63 U	21 U	42 U	**5.4** J1	6.3 U	39 U	**56** J1	26 U	**6.7** J1	**5.8** J1	--	--	--	--	--	--	--	--
Acrylonitrile	0.04	0.25 U	8.4 U	17 U	1.3 U	2.6 U	16 U	8.0 U	10 U	0.25 U	0.25 U	--	--	--	--	--	--	--	--
1,1-Dichloroethene	91.43	0.25 U	8.4 U	17 U	1.3 U	2.6 U	16 U	8.0 U	10 U	0.25 U	0.25 U	--	--	--	--	--	--	--	--
Methylene Chloride	250	**0.41** J1	8.4 U	17 U	1.3 U	2.6 U	16 U	8.0 U	10 U	**0.48** J1	**0.39** J1	--	--	--	--	--	--	--	--
3-Chloro-1-propene (Allyl Chloride)	0.42	0.24 U	7.9 U	16 U	1.2 U	2.4 U	15 U	7.5 U	9.9 U	0.24 U	0.24 U	--	--	--	--	--	--	--	--
Trichlorotrifluoroethane	No Criteria	**0.52** J1	8.4 U	17 U	1.3 U	2.6 U	16 U	8.0 U	10 U	**0.53** J1	0.25 U	--	--	--	--	--	--	--	--
Carbon Disulfide	320	0.22 U	**8.6** J1	15 U	**29** J1	**45** J1	**20** J1	**45** J1	9.2 U	**4.9** J1	**2.4** J1	--	--	--	--	--	--	--	--
trans-1,2-Dichloroethene	No Criteria	0.28 U	9.4 U	19 U	1.5 U	2.9 U	18 U	8.9 U	12 U	0.28 U	0.28 U	--	--	--	--	--	--	--	--
1,1-Dichloroethane	1.56	0.24 U	7.9 U	16 U	1.2 U	2.4 U	15 U	7.5 U	9.9 U	0.24 U	0.24 U	--	--	--	--	--	--	--	--
Methyl tert-Butyl Ether	9.62	0.25 U	8.4 U	17 U	1.3 U	2.6 U	16 U	8.0 U	10 U	0.25 U	0.25 U	20 U	50 U	20 U	20 U	20 U	20 U	20 U	20 U
Vinyl Acetate	91.43	0.97 U	32 U	65 U	5.0 U	9.8 U	60 U	31 U	40 U	**2.7** J1	0.96 U	--	--	--	--	--	--	--	--
2-Butanone (MEK)	2286	**0.65** J1	10 U	21 U	**4.4** J1	**3.4** J1	19 U	9.9 U	13 U	**42**	**14**	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	No Criteria	0.24 U	7.9 U	**24** J1	**7.0**	**3.2** J1	**25** J1	7.5 U	9.9 U	0.24 U	0.24 U	--	--	--	--	--	--	--	--
Ethyl Acetate	32	**1.4** J1	17 U	35 U	2.7 U	5.3 U	**61** J1	16 U	22 U	**4.8**	**3.0**	--	--	--	--	--	--	--	--
n-Hexane	320	**0.79**	**86**	**5500**	**450**	**170**	**1000**	**84**	**110**	**1.4**	**25**	--	--	--	--	--	--	--	--
Chloroform	0.11	0.25 U	8.4 U	17 U	1.3 U	2.6 U	16 U	8.0 U	10 U	**0.32** J1	**10**	--	--	--	--	--	--	--	--
Tetrahydrofuran (THF)	No Criteria	0.30 U	9.9 U	20 U	**4.3**	3.0 U	19 U	9.4 U	12 U	**280**	**100**	--	--	--	--	--	--	--	--
1,2-Dichloroethane	0.10	0.24 U	7.9 U	16 U	1.2 U	2.4 U	15 U	7.5 U	9.9 U	0.24 U	0.24 U	--	--	--	--	--	--	--	--
1,1,1-Trichloroethane	2286	0.25 U	8.4 U	17 U	1.3 U	2.6 U	16 U	8.0 U	10 U	0.25 U	0.25 U	--	--	--	--	--	--	--	--
Benzene	0.32	**0.61** J1	**12** J1	**60**	**120**	**16**	**100**	7.5 U	9.9 U	**2.8**	**3.2**	**3.1**	**22**	**97**	**3**	**210**	**65**	**130**	**49**
Carbon Tetrachloride	0.42	**0.53** J, J1	7.4 U	15 U	1.2 U	2.3 U	14 U	7.1 U	9.2 U	**0.55** J, J1	0.22 U	--	--	--	--	--	--	--	--
Cyclohexane	2743	0.43 U	**51**	**570**	**180**	**65**	**850**	**120**	**130**	**4.5**	**8.7**	--	--	--	--	--	--	--	--
1,2-Dichloropropane	0.25	0.24 U	7.9 U	16 U	1.2 U	2.4 U	15 U	7.5 U	9.9 U	0.24 U	0.24 U	--	--	--	--	--	--	--	--
Bromodichloromethane	0.07	0.22 U	7.4 U	15 U	1.2 U	2.3 U	14 U	7.1 U	9.2 U	0.22 U	0.22 U	--	--	--	--	--	--	--	--
Trichloroethene	0.37	0.21 U	6.9 U	14 U	**1.9** J1	2.1 U	13 U	6.6 U	8.6 U	0.21 U	0.21 U	--	--	--	--	--	--	--	--
1,4-Dioxane	0.50	0.24 U	7.9 U	16 U	1.2 U	2.4 U	15 U	7.5 U	9.9 U	0.24 U	0.24 U	--	--	--	--	--	--	--	--
Methyl Methacrylate	320	0.46 U	15 U	31 U	2.4 U	4.7 U	29 U	15 U	19 U	0.46 U	0.46 U	--	--	--	--	--	--	--	--
n-Heptane	No Criteria	**1.0**	**210**	**2000**	**240**	**74**	**730**	**26**	**32**	**2.6**	**5.5**	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	0.63	0.21 U	6.9 U	14 U	1.1 U	2.1 U	13 U	6.6 U	8.6 U	0.21 U	0.21 U	--	--	--	--	--	--	--	--
4-Methyl-2-pentanone	1371	0.24 U	7.9 U	16 U	**2.0** J1	2.4 U	15 U	7.5 U	9.9 U	**1.8**	**0.82**	--	--	--	--	--	--	--	--
trans-1,3-Dichloropropene	No Criteria	0.24 U	7.9 U	16 U	1.2 U	2.4 U	15 U	7.5 U	9.9 U	0.24 U	0.24 U	--	--	--	--	--	--	--	--
1,1,2-Trichloroethane	0.09	0.24 U	7.9 U	16 U	1.2 U	2.4 U	15 U	7.5 U	9.9 U	0.24 U	0.24 U	--	--	--	--	--	--	--	--
Toluene	2286	**5.6**	**98**	**36** J1	**270**	**3.4** J1	**30** J1	**190**	10 U	**330**	**280**	**37**	**85**	**110**	**34**	**140**	**110**	**230**	**52**
2-Hexanone	No Criteria	0.24 U	7.9 U	16 U	1.2 U	2.4 U	15 U	7.5 U	9.9 U	0.24 U	0.24 U	--	--	--	--	--	--	--	--
Dibromochloromethane	0.09	0.24 U	7.9 U	16 U	1.2 U	2.4 U	15 U	7.5 U	9.9 U	0.24 U	0.24 U	--	--	--	--	--	--	--	--
1,2-Dibromoethane	0.0042	0.24 U	7.9 U	16 U	1.2 U	2.4 U	15 U	7.5 U	9.9 U	0.24 U	0.24 U	--	--	--	--	--	--	--	--
n-Butyl Acetate	No Criteria	0.24 U	7.9 U	16 U	1.2 U	2.4 U	15 U	7.5 U	9.9 U	**7.7**	**6.4**	--	--	--	--	--	--	--	--
n-Octane	No Criteria	**0.57** J1	8.9 U	**220**	**130**	**29**	**220**	8.5 U	11 U	**4.3**	**3.5**	--	--	--	--	--	--	--	--
Tetrachloroethene	9.62	0.21 U	6.9 U	14 U	1.1 U	2.1 U	13 U	6.6 U	8.6 U	0.21 U	0.21 U	--	--	--	--	--	--	--	--
Chlorobenzene	22.86	0.24 U	7.9 U	16 U	1.2 U	2.4 U	15 U	7.5 U	9.9 U	0.24 U	0.24 U	--	--	--	--	--	--	--	--
Ethylbenzene	457.14	**1.1**	**36**	**16** J1	**55**	**2.5** J1	15 U	**27**	9.9 U	**32**	**28**	**3.3**	**93**	**8,200** J	**8.3**	**1,700**	**1,200**	**630**	**76**
m,p-Xylenes	45.71	**3.9**	**110**	**34** J1	**77**	**9.2** J1	**34** J1	**55**	18 U	**49**	**43**	**12**	**510**	**350**	**18**	**4,100**	**980**	**9,500** J	**140**
Bromoform	2.27	0.22 U	7.4 U	15 U	1.2 U	2.3 U	14 U	7.1 U	9.2 U	0.22 U	0.22 U	--	--	--	--	--	--	--	--
Styrene	457.14	0.22 U	7.4 U	15 U	**2.6** J1	2.3 U	14 U	7.1 U	9.2 U	**2.7**	**4.2**	--	--	--	--	--	--	--	--
o-Xylene	45.71	**1.4**	**33**	**40** J1	**51**	2.3 U	**28** J1	**24**	**21** J1	**17**	**16**	**4.4**	**140**	**190**	**6.9**	**3,300** J	**270**	**5,400** J	**83**
n-Nonane	No Criteria	0.22 U	7.4 U	15 U	**61**	**11**	**160**	7.1 U	9.2 U	**2.0**	**1.9**	--	--	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	0.04	0.22 U	7.4 U	15 U	1.2 U	2.3 U	14 U	7.1 U	9.2 U	0.22 U	0.22 U	--	--	--	--	--	--	--	--

Table D-2
Landfill Gas Monitoring Data - TO-15 Analytical Results
Cornwall Avenue Landfill and RG Haley
Bellingham, Washington

Analyte	MTCA Method B Cleanup Level	Cornwall Site - Sample ID, Laboratory ID, Sample Date, and Results										R.G. Haley Site - Sample ID, Laboratory ID, Sample Date, and Results							
		CL-LFG-BACKGROUND P1502473-001 6/15/2015	CL-LFG-MW-102 P1502473-006 6/15/2015	CL-LFG-P-2 P1503343-03 8/7/2015	CL-LFG-P-3 P1502473-003 6/15/2015	CL-LFG-P-3 P1503343-04 8/7/2015	CL-LFG-P-6 P1503343-01 8/7/2015	CL-LFG-P-12 P1502473-004 6/15/2015	CL-LFG-P-12 P1503343-02 8/7/2015	CL-LFG-VENT-3 P1502473-005 6/15/2015	CL-LFG-VENT-4 P1502473-002 6/15/2015	HS-SV-1	HS-SV-2	HS-SV-3	HS-SV-4	HS-SV-5	HS-SV-6	HS-SV-7	HS-SV-8
Cumene	182.86	0.22 U	**220**	**58**	**9.9**	2.3 U	**64**	**230**	**62**	**0.79**	**1.6**	--	--	--	--	--	--	--	--
alpha-Pinene	No Criteria	0.21 U	6.9 U	14 U	**50**	**18**	**250**	**2,000**	**250**	**1.3**	**1.3**	--	--	--	--	--	--	--	--
n-Propylbenzene	457.14	0.24 U	**270**	16 U	**5.2**	2.4 U	15 U	**140**	9.9 U	**2.4**	**2.6**	--	--	--	--	--	--	--	--
4-Ethyltoluene	No Criteria	**0.30** J1	7.9 U	16 U	1.2 U	2.4 U	15 U	7.5 U	9.9 U	**3.6**	**3.7**	--	--	--	--	--	--	--	--
1,3,5-Trimethylbenzene	No Criteria	**0.30** J1	**11** J1	**17** J1	**16**	**3.1** J1	**19** J1	7.5 U	9.9 U	**3.3**	**3.6**	--	--	--	--	--	--	--	--
1,2,4-Trimethylbenzene	3.2	**0.98**	**25** J1	**28** J1	**29**	**5.6** J1	**39** J1	**17** J1	9.2 U	**11**	**13**	--	--	--	--	--	--	--	--
Benzyl Chloride	0.05	0.16 U	5.4 U	11 U	0.85 U	1.7 U	10 U	5.2 U	6.8 U	0.16 U	0.16 U	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene	No Criteria	0.22 U	7.4 U	15 U	**1.4** J1	2.3 U	14 U	7.1 U	9.2 U	**1.3**	**0.90**	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	0.23	0.21 U	6.9 U	**32** J1	1.1 U	2.1 U	13 U	6.6 U	8.6 U	0.21 U	0.21 U	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	91.43	0.22 U	7.4 U	15 U	1.2 U	2.3 U	14 U	7.1 U	9.2 U	0.22 U	0.22 U	--	--	--	--	--	--	--	--
d-Limonene	No Criteria	0.21 U	6.9 U	14 U	**18**	2.1 U	13 U	**150**	8.6 U	**10**	**11**	--	--	--	--	--	--	--	--
1,2-Dibromo-3-chloropropane	0.0004	0.15 U	4.9 U	9.8 U	0.77 U	1.5 U	9.2 U	4.7 U	6.1 U	0.15 U	0.15 U	--	--	--	--	--	--	--	--
1,2,4-Trichlorobenzene	0.91	0.24 U	7.9 U	16 U	1.2 U	2.4 U	15 U	7.5 U	9.9 U	0.24 U	0.24 U	--	--	--	--	--	--	--	--
Naphthalene	0.07	0.27 U	8.9 U	18 U	**2.7** J1	2.7 U	17 U	8.5 U	11 U	**0.49** J1	**2.2**	**10**	100 U	**1,700**	**14**	**11,000 J**	**26,000 J**	**850**	**410**
2-Methylnaphthalene		--	--	--	--	--	--	--	--	--	--	**15**	100 U	250 U	10 U	**1,600 J**	**1,500** J	**120**	100 U
Hexachlorobutadiene	0.11	0.21 U	6.9 U	14 U	1.1 U	2.1 U	13 U	6.6 U	8.6 U	0.21 U	0.21 U	--	--	--	--	--	--	--	--
Volatiles (µg/m³) **EPA Method TO-15 SIM**																			
Vinyl Chloride	0.28	0.011 U	0.37 U	--	**0.68**	**0.67** J	--	0.36 U	1.5 U	**0.061**	**0.039**	--	--	--	--	--	--	--	--
Hydrocarbons																			
C5 to C8 Aliphatic Hydrocarbons												**1,000**	780,000	1,600,000	**230**	920,000	450,000	1,100,000	210,000
C9 to C12 Aliphatic Hydrocarbons												**1,100**	260,000	760,000	**230**	620,000	980,000	470,000	55,000
C9 to C10 Aromatic Hydrocarbons												**150**	**11,000**	**130,000**	40 U	**110,000**	**180,000**	**53,000**	**1,600**
Total Petroleum Hydrocarbons	**140**	**13**	**298**	**204**	**576**	**36**	**224**	**312**	**80**	**431**	**372**	**2,320**	**1,051,950**	**2,500,647**	**584**	**1,670,450**	**1,638,625**	**1,639,740**	**267,410**

Notes:

Nondetected compound show the method detection limit (MDL) as the reporting limit.
J = Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
J1 = The result is an estimated concentration that is less than the MRL but greater than or equal to the MDL.
U = Indicates the compound was not detected at the reported concentration.
Bold = Detected compound.
Blue Shading = Laboratory reporting limit is above cleanup level for ambient air.
Green Shading = Detected above cleanup level for ambient air.

Abbreviations and Acronyms:

EPA = U.S. Environmental Protection Agency
ID = identification
µg/m³ = micrograms per cubic meter
MTCA = Model Toxics Control Act
-- = Not analyzed.
SIM = selected ion monitoring
VOC = volatile organic compound

ATTACHMENT D.3

Soil Vapor Emissions and MTCA Evaluation

Table D.3
Soil Vapor Emissions
Cornwall Avenue Landfill and RG Haley
Bellingham, Washington

Pollutant	CAS #	Averaging Period[1]	De Minimis[1] (lb/averaging period)	SQER[1] (lb/averaging period)	Maximum Emission Rate[2] (lb/averaging period)	De Minimis Evaluation	SQER Evaluation	MTCA Method B Cleanup Level[3] (µg/m³)	Maximum Modeled Concentration[4] (µg/m³)	MTCA Cleanup Level Evaluation
Sampled Constituents - EPA Method TO-15										
Propene	115-07-1	24-hr	19.7	394	1.17E-03	Below		No Criteria	4.59E-02	
Dichlorodifluoromethane (CFC 12)	75-71-8				2.02E-06			45.71	1.91E-03	Below
Chloromethane	74-87-3	24-hr	0.591	11.8	1.35E-05	Below		41.14	5.30E-04	Below
Vinyl Chloride	75-01-4	year	0.123	2.46	5.58E-02	Below		0.28	6.01E-03	Below
1,3-Butadiene	106-99-0	year	0.0564	1.13	1.64E-02	Below		0.08	1.77E-03	Below
Bromomethane	74-83-9	24-hr	0.0629	0.657	1.71E-05	Below		2.29	6.71E-04	Below
Chloroethane	75-00-3	24-hr	197	3940	1.53E-05	Below		4571	6.01E-04	Below
Acetonitrile	75-05-8	year	576	11500	5.91E-03	Below		27.43	6.36E-04	Below
Acrolein	107-02-8	24-hr	0.000394	0.00789	1.53E-05	Below		0.01	6.01E-04	Below
Acetone	67-64-1				7.49E-06			14171	7.07E-03	Below
Trichlorofluoromethane	75-69-4				6.37E-07			320	6.01E-04	Below
2-Propanol (Isopropyl Alcohol)	67-63-0	1-hr	0.35	7.01	2.10E-06	Below		No Criteria	1.98E-03	
Acrylonitrile	107-13-1	year	0.0331	0.662	5.58E-03	Below		0.04	6.01E-04	Below
1,1-Dichloroethene	75-35-4	24-hr	1.31	26.3	1.53E-05	Below		91.43	6.01E-04	Below
Methylene Chloride	75-09-2	year	9.59	192	5.58E-03	Below		250	6.01E-04	Below
3-Chloro-1-propene (Allyl Chloride)	107-05-1	year	1.6	32	5.25E-03	Below		0.42	5.65E-04	Below
Carbon Disulfide	75-15-0	24-hr	5.26	105	4.05E-05	Below		320	1.59E-03	Below
1,1-Dichloroethane	75-34-3	year	6	120	5.25E-03	Below		1.56	5.65E-04	Below
Methyl tert-Butyl Ether	1634-04-4	year	36.9	739	1.64E-02	Below		9.62	1.77E-03	Below
Vinyl Acetate	108-05-4	24-hr	1.31	26.3	5.84E-05	Below		91.43	2.30E-03	Below
2-Butanone (MEK)	78-93-3	24-hr	32.9	657	3.78E-05	Below		2286	1.48E-03	Below
Ethyl Acetate	141-78-6				2.28E-06			32	2.16E-03	Below
n-Hexane	110-54-3	24-hr	4.6	92	4.94E-03	Below		320	1.94E-01	Below
Chloroform	67-66-3	year	0.417	8.35	5.58E-03	Below		0.11	6.01E-04	Below
1,2-Dichloroethane	107-06-2	year	0.369	7.39	5.25E-03	Below		0.10	5.65E-04	Below
1,1,1-Trichloroethane	71-55-6	24-hr	6.57	131	1.53E-05	Below		2286	6.01E-04	Below
Benzene	71-43-2	year	0.331	6.62	6.89E-02	Below		0.32	7.42E-03	Below
Carbon Tetrachloride	56-23-5	year	0.228	4.57	4.92E-03	Below		0.42	5.30E-04	Below
Cyclohexane	110-82-7	24-hr	39.4	789	7.64E-04	Below		2743	3.00E-02	Below
1,2-Dichloropropane	78-87-5	year	0.959	19.2	5.25E-03	Below		0.25	5.65E-04	Below
Bromodichloromethane	75-27-4	year	0.259	5.18	4.92E-03	Below		0.07	5.30E-04	Below
Trichloroethene	79-01-6	year	4.8	95.9	4.59E-03	Below		0.37	4.95E-04	Below
1,4-Dioxane	123-91-1	year	1.25	24.9	5.25E-03	Below		0.50	5.65E-04	Below
Methyl Methacrylate	80-62-6	24-hr	4.6	92	2.79E-05	Below		320	1.10E-03	Below
cis-1,3-Dichloropropene	542-75-6	year	0.6	12	4.59E-03	Below		0.63	4.95E-04	Below
4-Methyl-2-pentanone	108-10-1	24-hr	19.7	394	1.44E-05	Below		1371	5.65E-04	Below
1,1,2-Trichloroethane	79-00-5	year	0.6	12	5.25E-03	Below		0.09	5.65E-04	Below
Toluene	108-88-3	24-hr	32.9	657	2.97E-04	Below		2286	1.17E-02	Below
Dibromochloromethane	124-48-1	year	0.355	7.1	5.25E-03	Below		0.09	5.65E-04	Below
1,2-Dibromoethane	106-93-4	year	0.135	2.71	5.25E-03	Below		0.00	5.65E-04	Below
Tetrachloroethene	127-18-4	year	1.62	32.4	4.59E-03	Below		9.62	4.95E-04	Below
Chlorobenzene	108-90-7	24-hr	6.57	131	1.44E-05	Below		22.86	5.65E-04	Below
Ethylbenzene	100-41-4	year	3.84	76.8	2.69	Below		457	2.90E-01	Below
m,p-Xylenes	1330-20-7				3.56E-04			45.71	3.36E-01	Below
Bromoform	75-25-2	year	8.72	174	4.92E-03	Below		2.27	5.30E-04	Below
Styrene	100-42-5	24-hr	5.91	118	1.35E-05	Below		457.14	5.30E-04	Below
o-Xylene	95-47-6	24-hr	1.45	29	4.85E-03	Below		45.71	1.91E-01	Below
1,1,2,2-Tetrachloroethane	79-34-5	year	0.165	3.3	4.92E-03	Below		0.04	5.30E-04	Below
Cumene	98-82-8	24-hr	2.63	52.6	2.07E-04	Below		182.86	8.13E-03	Below
n-Propylbenzene	103-65-1				1.01E-05			457.14	9.54E-03	Below
1,2,4-Trimethylbenzene	95-63-6				1.46E-06			3.20	1.38E-03	Below
Benzyl Chloride	100-44-7	year	0.196	3.91	3.61E-03	Below		0.05	3.89E-04	Below
1,4-Dichlorobenzene	106-46-7	year	0.872	17.4	1.05E-02	Below		0.23	1.13E-03	Below
1,2-Dichlorobenzene	95-50-1				5.62E-07			91.43	5.30E-04	Below
1,2-Dibromo-3-chloropropane	96-12-8	year	0.00505	0.101	3.22E-03	Below		0.00042	3.46E-04	Below
1,2,4-Trichlorobenzene	120-82-1				5.99E-07			0.91	5.65E-04	Below
Naphthalene[5]	91-20-3	year	0.282	5.64	0.85	Above	Below	0.07	9.19E-02	Above
Hexachlorobutadiene	87-68-3	year	0.437	8.73	4.59E-03	Below		0.11	4.95E-04	Below
Vinyl Chloride	75-01-4	year	0.123	2.46	4.92E-04	Below		0.28	5.30E-05	Below
Hydrocarbons										
C5 to C8 Aliphatic Hydrocarbons					5.99E-02			No Criteria	5.65E+01	
C9 to C12 Aliphatic Hydrocarbons					3.67E-02			No Criteria	3.46E+01	
C9 to C10 Aromatic Hydrocarbons					6.74E-03			No Criteria	6.36E+00	
***Total Petroleum Hydrocarbons**					4.40E-04			140	9.75E+01	Below

Abbreviations and Acronyms
lb = pound
µg/m³ = micrograms per cubic meter
1-hr = 1-hour averaging period
24-hr = 24-hour averaging period
SQER - small quantity emission rate
MTCA = Model Toxics Control Act

Notes
(1) Values are based on Washington Administrative Code (WAC) Chapter 173-460-150
(2) Maximum emission rates for sampled pollutants are based on analytical data collected in from field collected samples. When no averaging period is provided, an averaging period of 1-hr is shown.
(3) MTCA Method B Cleanup Levels are based on WAC 173-340.
(4) Maximum modeled concentrations are based on a 24-hour averaging period and are based on AERSCREEN modeled estimates.
(5) A control factor of 90% was applied to naphthalene based on estimated control efficiency of a carbon adsorption system.

* Total Petroleum Hydrocarbons represents the summation of the C5 to C8 and C9 to C12 aliphatic hydrocarbons, the C9 to C10 aromatic hydrocarbons, benzene, toluene, ethylbenzene, xylenes, and naphthalene. The MTCA Method B Cleanup Level shown is for exposure to TPH in indoor air.

ATTACHMENT D.4

Landfill Gas Monitoring Data

Table A-1
Landfill Gas Monitoring Data - June 15, 2015
Cornwall Avenue Landfill
Bellingham, Washington

Location	Date	CH_4 (%)	CO_2 (%)	O_2 (%)	Balance (%)	H_2 (ppm)	CO (ppm)	H_2S (ppm)	Static Pressure (inches WC)	TO-15 (Y/N)	VOCs (ppm)
Groundwater Monitoring Wells											
AF-MW-1	6/15/2015	11.8	12.5	00.1	75.5	low	0	9	0.24	N	0
CL-MW-101	6/15/2015	9.3	10.3	00.4	80.0	low	0	2	0.20	N	0
CL-MW-102	6/15/2015	1.1	12.2	00.4	86.3	low	0	1	0.21	**Y**	8.7
CL-MW-103	6/15/2015	6.5	14.1	00.3	79.1	low	0	4	0.16	N	2.3
MW-1	6/15/2015	0	13.3	1.4	85.2	low	0	0	0.21	N	0
MW-11S	6/15/2015	0	4.3	14.6	81.0	low	0	0	0.25	N	0
MW-12S	6/15/2015	35.0	6.2	11.0	48.9	low	0	1	0.34	N	0.9
MW-13S	6/15/2015	52.2	11.3	5.7	30.3	low	0	0	0.35	N	0
MW-14S	6/15/2015	32.0	18.2	4.5	45.1	low	0	1	0.24	N	0
MW-15S	6/15/2015	58.2	16.9	0	24.1	low	0	6	0.24	N	2.0
MW-16S	6/15/2015	1.9	10.1	6.3	81.8	low	17[a]	0	1.55	N	0.8
MW-6	6/15/2015	13.1	6.9	00.5	79.6	low	0	4	0.16	N	0.9
MW-9	6/15/2015	0	8.1	11.3	80.6	low	0	0	0.59	N	0
Landfill Gas Vents											
VENT 1	6/15/2015	1.7	00.1	19.8	78.3	low	0	0	0.24	N	0
VENT 2	6/15/2015	0	0	20.4	79.4	low	0	0	0.25	N	0
VENT 3	6/15/2015	7.1	1.2	16.5	75.2	low	0	42	0.21	**Y**	0
VENT 4	6/15/2015	6.2	7.0	9.0	77.8	low	0	0	0.25	**Y**	0

Table A-1
Landfill Gas Monitoring Data - June 15, 2015
Cornwall Avenue Landfill
Bellingham, Washington

Location	Date	CH_4 (%)	CO_2 (%)	O_2 (%)	Balance (%)	H_2 (ppm)	CO (ppm)	H_2S (ppm)	Static Pressure (inches WC)	TO-15 (Y/N)	VOCs (ppm)
Temporary Landfill Gas Probes											
P-1	6/15/2015	1.6	1.4	19.4	77.5	low	0	1	0.25	N	0
P-2	6/15/2015	87.5	12.3	00.1	00.2	low	0	1	0.25	N	0
P-3	6/15/2015	51.9	35.7	1.6	10.8	low	0	1	4.79	**Y**	0
P-4	6/15/2015	12.2	15.2	13.6	59.4	low	0	0	0.31	N	0
P-5	6/15/2015	28.2	3.6	15.3	52.8	low	29	2	0.75	N	0
P-6	6/15/2015	35.2	19.3	0	45.4	low	0	0	0.25	N	0.4
P-7	6/15/2015	0	11.8	4.2	83.7	low	0	0	0.24	N	0
P-8	6/15/2015	73.0	10.2	00.3	16.6	low	0	0	0.26	N	0
P-9	6/15/2015	58.7	12.9	0	28.3	low	0	0	0.18	N	0.9
P-10	6/15/2015	0	12.2	7.8	80.0	low	0[b]	0	0.24	N	0
P-11	6/15/2015	0	9.7	6.7	83.5	low	0	0	0.24	N	0
P-12	6/15/2015	8.7	8.2	00.2	82.9	low	0	0	8.77	**Y**	1.8
P-13	6/15/2015	0	12.0	3.0	85.1	low	0	0	0.16	N	1.5

[a] Peaked at 180 ppm.

[b] Peaked at 210 ppm.

CH_4 = methane
CO_2 = carbon dioxide
H_2 = hydrogen
H_2S = hydrogen sulfide
N/A = not applicable.
O_2 = oxygen
ppm = parts per million
WC = water column
Y/N = yes/no

Barometric Pressure Data: Sample Event Number 1 - Monday, June 15, 2015

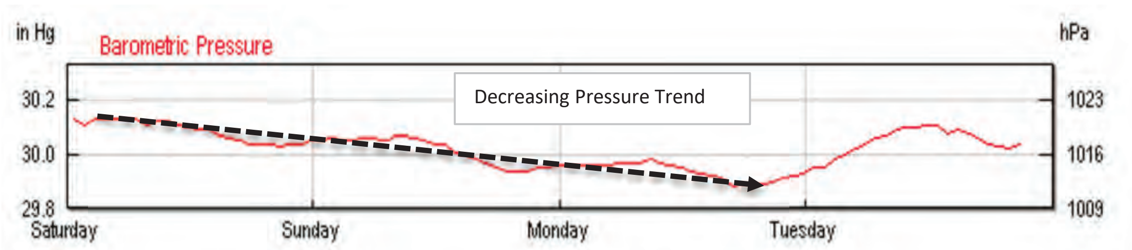
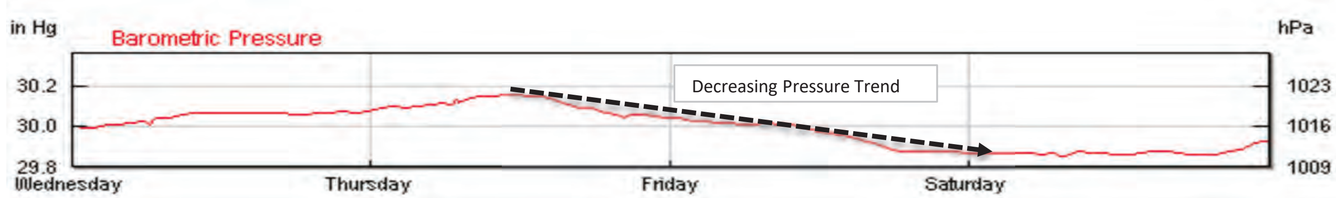


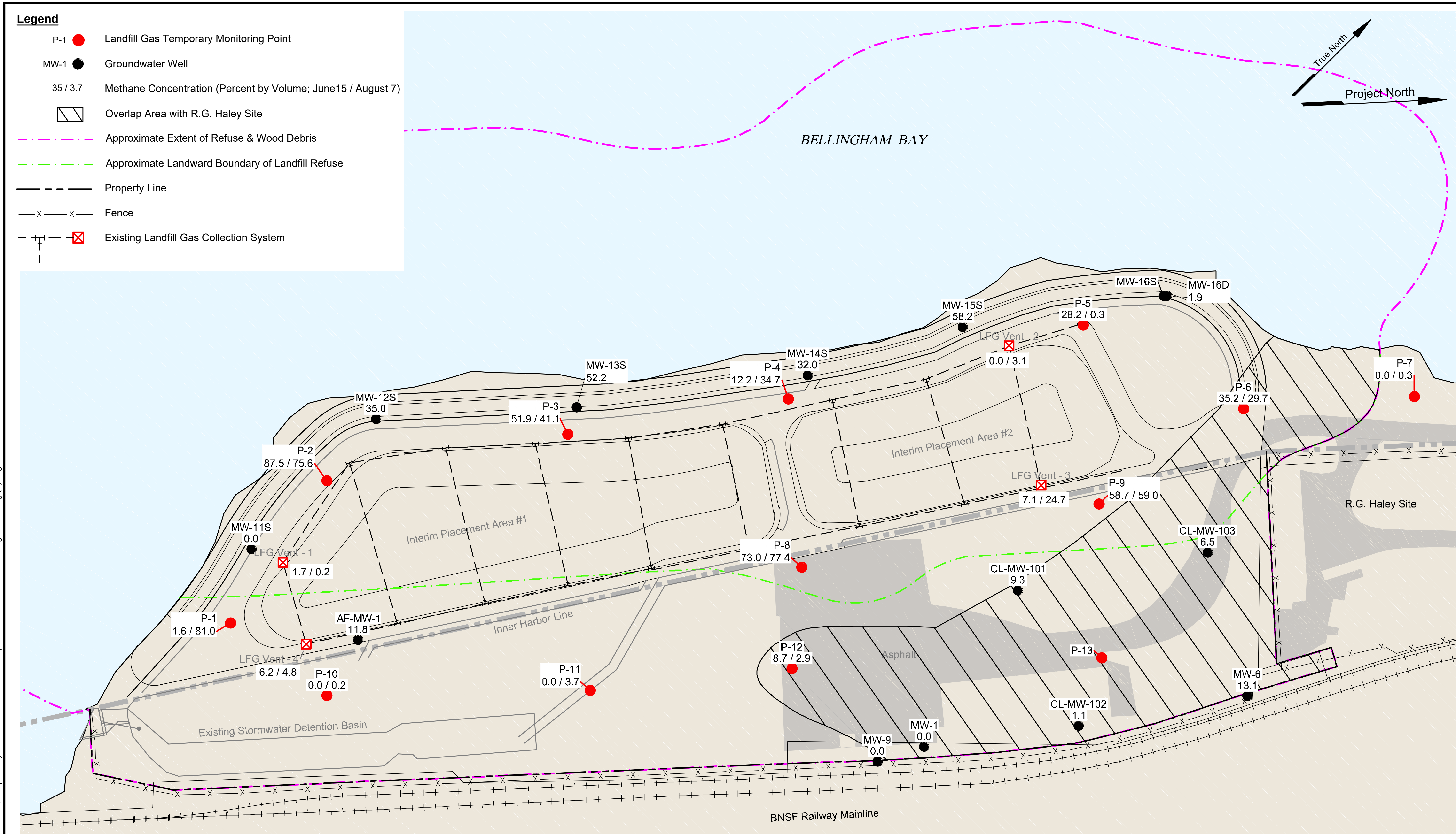
Table A-2
Landfill Gas Monitoring Data - August 7, 2015
Cornwall Avenue Landfill
Bellingham, Washington

Location	Date	Time (in seconds)	Purge Volume	CH_4 (%)	CO_2 (%)	O_2 (%)	Balance (%)	H_2 (ppm)	CO (ppm)	H_2S (ppm)	Static Pressure (inches WC)	TO-15 (Y/N)	VOCs (ppm)
Landfill Gas Vents													
VENT 1	8/7/2015	53	~0.5817	0.2	0.4	20.3	79.1	low	0	0.0	0.01	N	4.3
VENT 2	8/7/2015	50	0.5817	3.1	0.5	20.1	76.3	low	0	0.0	0.03	N	3.0
VENT 3	8/7/2015	50	0.5817	24.7	8.3	9.1	57.9	low	0	0.0	0.01	N	0.0
VENT 4	8/7/2015	81	0.6103	4.8	10.7	7.8	76.7	low	0	0.0	0.03	N	2.0
Temporary Landfill Gas Probes													
P-1	8/7/2015	80	N/A	81.0	10.7	1.5	6.8	low	0	0.0	-1.01	N	0.0
P-2	8/7/2015	111	N/A	75.6	7.9	5.2	11.3	low	5	2.8	0.13	**Y**	0.0
P-3	8/7/2015	67	N/A	41.1	39.8	4.4	14.6	low	0	0.0	-0.04	**Y**	0.7
P-4	8/7/2015	108	N/A	34.7	24.4	8.9	32.0	low	0	0.0	0.08	N	0.1
P-5	8/7/2015	53	N/A	0.3	0.1	20.7	79.0	low	0	0.0	0.07	N	0.1
P-6	8/7/2015	60	N/A	29.7	19.8	0.3	50.3	low	0	0.0	0.02	**Y**	0.0
P-7	8/7/2015	53	N/A	0.3	12.0	8.8	78.9	low	0	0.0	-0.02	N	5.7
P-8	8/7/2015	93	N/A	77.4	14.0	0.1	8.5	low	0	0.0	-0.02	N	0.2
P-9	8/7/2015	160	N/A	59.0	17.3	0.1	23.7	low	0	4.5	-0.01	N	0.8
P-10	8/7/2015	55	N/A	0.2	12.1	9.2	78.5	low	0	0.0	0.02	N	10.0
P-11	8/7/2015	63	N/A	3.7	6.5	0.1	89.8	low	0	0.0	-0.01	N	0.0
P-12	8/7/2015	45	N/A	2.9	14.6	0.2	82.3	low	0	3.8	-0.01	**Y**	6.4
P-13	8/7/2015	80	N/A	0.00	9.6	8.1	82.3	low	0	0.0	-0.04	N	0.0

CH_4 = methane
CO_2 = carbon dioxide
H_2 = hydrogen
H_2S = hydrogen sulfide
N/A = not applicable.
O_2 = oxygen
ppm = parts per million
WC = water column
Y/N = yes/no

Barometric Pressure Data: Sample Event Number 2 - Friday, August 7, 2015





Basemap source: Port of Bellingham 1996, Anchor Environmental 2008, Wilson Engineering LLC 2015

0 100 200
Scale in Feet

LANDAU ASSOCIATES

Engineering Design Report
Cornwall Avenue Landfill
Bellingham, Washington

Landfill Gas Monitoring Results
Methane Concentration

Figure
A-2

APPENDIX E
Draft Basis of Design Report, Coast & Harbor Engineering

Basis of Design Report
R.G. Haley Shoreline and Bottom Slope Protection

COAST & HARBOR ENGINEERING
A Division of Mott MacDonald

Basis of Design Report

R.G. Haley Shoreline and Bottom Slope Protection

1. Introduction

This technical report summarizes the engineering basis of design that was used by Coast & Harbor Engineering, a Division of Mott MacDonald (MM) to assist GeoEngineers with preliminary (30%) level design of the shoreline and bottom slope erosion protection for the R.G. Haley Project. Prior to preliminary design, MM developed and coordinated with the Project Team, the City of Bellingham, and GeoEngineers to determine the input data and design criteria for the preliminary design. Using the input data and design criteria, the shoreline erosion and bottom slope protection were designed by MM considering the remediated surfaces provided by GeoEngineers. The following remediated surfaces with caps to contain sediment contamination were provided by GeoEngineers: Organoclay Amended Sand Cap (OASC)[1]; Activated Carbon Amended Sand Cap (ACASC); and Combined Gravelly Sand Thin-Layer Containment Cap and Seafloor Erosion Protection (GSTLC). The locations of the remediated surfaces within the project site can be found in Figure 1. As part of the design, MM determined the type, dimensions, and thickness of the material to be placed on top of the remediated surfaces (updated version transmitted by GeoEngineers on 07/01/2020) that will protect said remediated sediment cap surfaces from erosion during storm conditions, as defined by the design criteria.

[1] Also includes organoclay and activated carbon-amended cap shown in Figure 1.

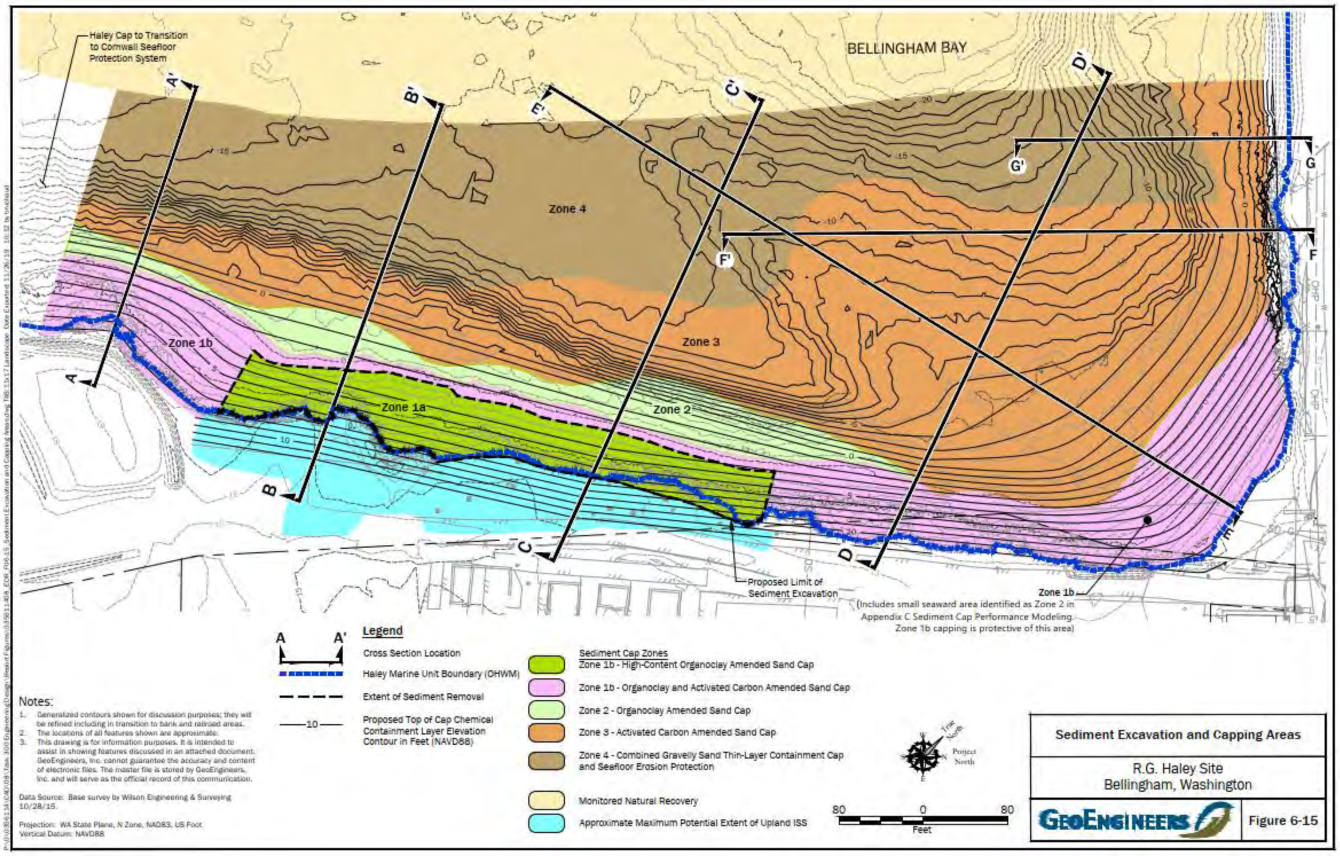


Figure 1. Preliminary project design showing remediated sediment cap surfaces provided by GeoEngineers (preconstruction bathymetry)

This technical report focuses on the preliminary (30%) design of the shoreline and bottom slope erosion protection for the remediated surfaces of the R.G. Haley project. Shoreline and bottom slope erosion protection begins at the upper edge of the remediated bank along the shoreline crest and extends out to the waterward limit of the GSTLC. No protection is planned over the monitored natural recovery (MNR) surface based on continued net deposition conditions and relatively low concentrations of contaminants, as described in the Engineering Design Report.

2. Input Data and Major Design Criteria

The shoreline and bottom slope protection were designed considering the input data and design criteria, developed and coordinated with the Project Team through the previous and current phases of engineering and design. More details on input data and design criteria affecting the analysis can be found in the 2018 Mott MacDonald technical memorandum on Input Data and Analysis Criteria. The design data and criteria includes:

- Bathymetry: 2008 NOAA bathymetry, 2015 bathymetry provided by GeoEngineers, and 2016 Whatcom Waterway Project Bathymetry provided by the Port of Bellingham.
- Design Storm: 100-year return period storm event and corresponding waves. The 100-year storm winds were determined for a spectrum of directions by performing extreme value analysis on the Bellingham Airport wind data (1948 – 2014) and fitting the extreme wind events to a Weibull distribution. These winds were then used to force a wave model to estimate the 100-year wave conditions at the project site.
- Maximum Design Water Surface Elevation and Sea Level Rise (SLR): Mean Higher High Water (MHHW) was identified as the maximum design water surface elevation and 50 inches was identified as extent of SLR. MHHW combined with SLR (50 inches), surge, and wave runup may occur during the design storm.
- Propeller Wash: Propeller wash was not considered in the design.

Additional design criteria for water levels, SLR, and current velocities are discussed below in Sections 2.1, 2.2, and 2.3 respectively.

2.1 Water Levels

A review of extreme waves from previous projects in Bellingham Bay has shown that wave heights are maximized when the water surface elevation (WSE) in the bay is at or above Mean Sea Level (MSL). To optimize the design, the shoreline and bottom slope protection was designed using revetment design rock sizing methods above the MSL wave breaking limit, and shoreline and bottom slope protection was designed for stability under wave bottom velocities below the MSL wave breaking limit.

2.2 Sea Level Rise

Multiple criterion for SLR were assessed to minimize the risk of erosion of the shoreline protection layer. The upper (higher) level of SLR criteria, 50 inches, was used for design of erosion protection and wave runup/overtopping at the upper part of the slope and shoreline, while a lower (smaller) level of SLR, 2.4 feet, was used for design of scour protection for the lower part of the slope and shoreline.

The higher level of SLR was obtained from the substantive requirements of the Bellingham Municipal Code (BMC) Chapter 16.30 Planned Actions and is an estimated SLR projection of 50 inches by 2120.

The lower level of SLR criteria, 2.4 feet, was selected based on a review of the available regional SLR estimates provided by the Washington Coastal Resilience Project (Miller et al. 2018, updated July 2019). An estimate of 1.8 feet to 2.4 feet of SLR represents the 50% exceedance SLR magnitudes reported for the two carbon emission scenarios included in the report. This approach follows similar guidance for coastal structure design (50% chance of exceedance) within the United States Army Corps of Engineers Coastal Engineering Manual (CEM, 2002). The 2.4 feet of projected SLR was used to provide a more conservative design water surface elevation for scour protection for the lower part of the slope and shoreline.

2.3 Currents

Stability analysis of the sand cap containment layers under tidal current velocities was conducted based on results of previous three-dimensional (3-D) hydrodynamic modeling of flow circulation in Bellingham Bay. Figure 2 shows snapshots of depth-averaged maximum velocities in the modeling domain during normal tide conditions and extreme flow in Whatcom Creek.

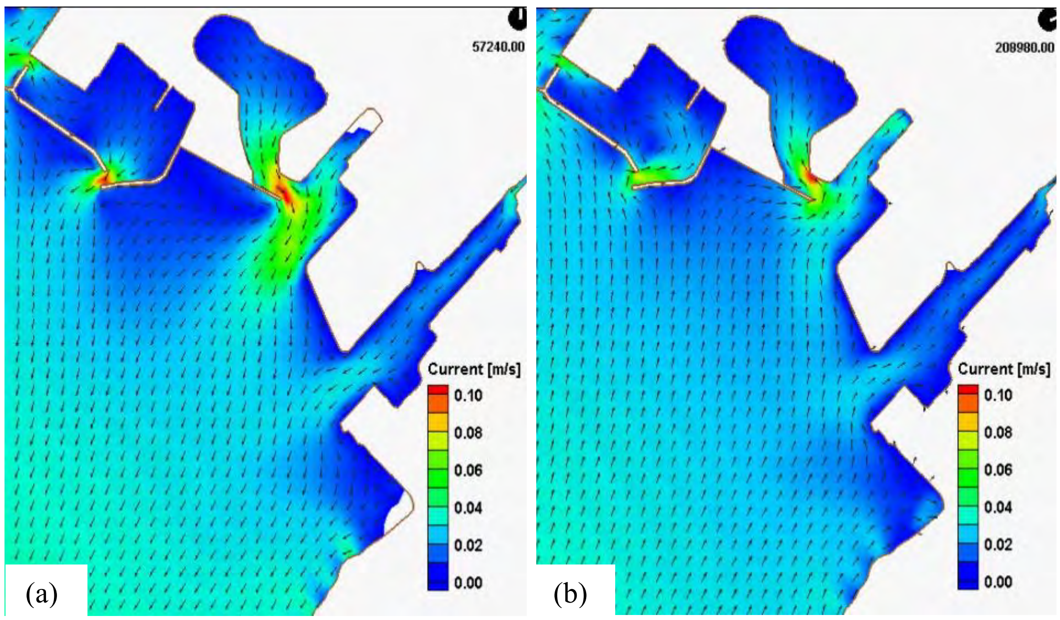


Figure 2. Snapshot of depth-averaged maximum velocities in modeling domain during extreme flow in Whatcom Creek for (a) ebb; and (b) flood.

Figure 2 shows that the maximum velocities at the area adjacent to the R.G. Haley Project do not exceed 0.06 m/s or 0.2 ft/sec. Comparison of tidal flow velocities to wave orbital velocities over the project area indicate that wave orbital velocities at the seabed significantly exceed tidal current velocities that may occur in the sand cap containment layer in the project area. Therefore, for design of the cap erosion protection material, wave orbital velocity were considered the governing velocity design criteria.

Detailed wave analysis and numerical modeling was performed to establish the wave conditions prior to the project (existing conditions) and determine the stable material size for shoreline and bottom slope protection. It was assumed that any reduction in depth by the addition of the cap and protection layers has a negligible effect on waves at theproject.

3. Wave Analysis

3.1. Methodology

Wave conditions at the project site were developed based on numerical modeling of wind-wave generation for the design (100-year) wind speeds from the south to west directions (180° through 330° TN), which correspond to the limiting wave fetches for the project location in Bellingham Bay. Wave modeling was conducted using the two-dimensional (2-D) Simulating Waves Nearshore Model (SWAN 40.72, Delft Technical University, 2008) in steady state mode. SWAN simulates the growth of waves due to wind forcing and accounts for wave shoaling, refraction, and bottom friction of waves as they approach the shoreline. To account for the large-scale wind-wave growth within Puget Sound (large-scale dynamics) and accurately represent wave propagation to the project site (small-scale dynamics), the SWAN numerical model utilized a large regional grid as well as a local nested grid to simulate wind-wave growth and propagation for the 100-year design winds. Figure 3 shows the model bathymetry for the large regional grid and the local nested grid. The SWAN wave modeling numerical grid was built using bathymetry data from various public sources (e.g., NOAA), provided project topography/bathymetry data, and bathymetry from an internal MM database.

The SWAN modeling results for the critical wind direction cases were extracted near the project site and applied as a boundary input condition for determining the stable materials to be used in shoreline and bottom slope protection design.

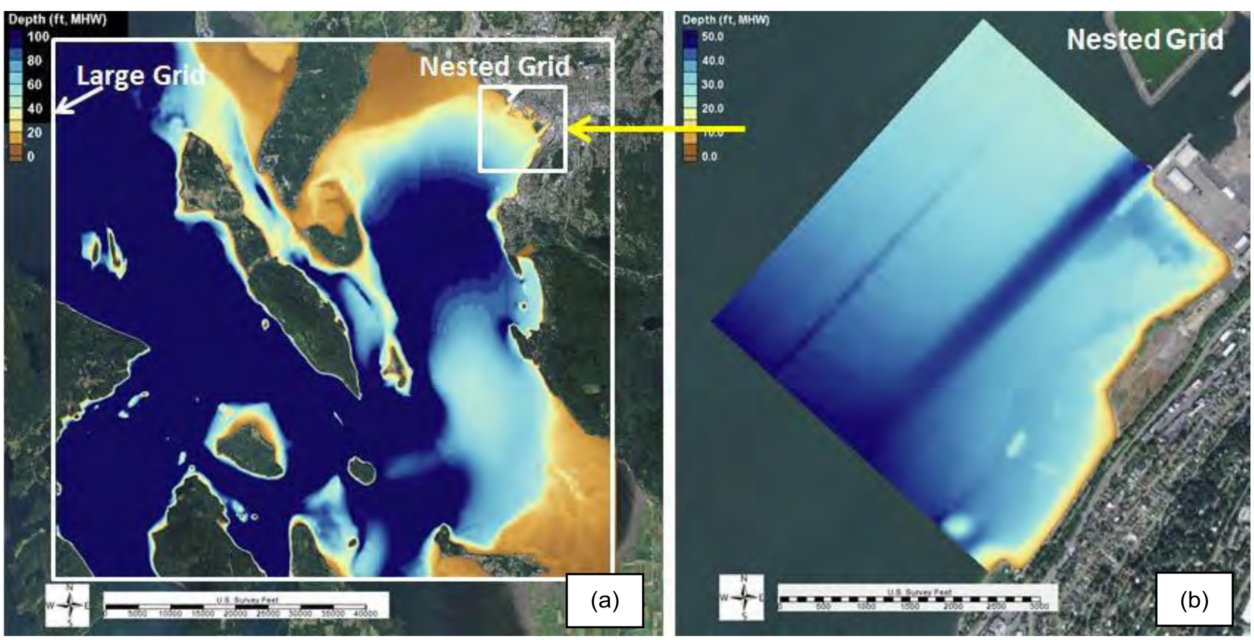


Figure 3. SWAN Wave modeling bathymetry grids: (a) large and (b) nested

3.2. Results

Modeling was conducted for the design storm event (100-year storm) using winds from the directions 180° through 330° TN and for water levels ranging from MLLW to MHHW plus 50 inches. Example SWAN modeling wave results for Bellingham Bay as well as a zoomed-in view at the project site, both under existing conditions, are shown in Figure 4 and Figure 5, respectively. Figure 4 shows a distribution (field) of significant wave heights during the 100-year design storm for various wind directions over the nested modeling domain in color format. Figure 5 shows significant wave heights at the project site during the 100-year design storm with winds from 230 degrees and a water surface elevation equal to MHHW plus 50 inches (governing case for overtopping). The wave field modeling outputs in terms of significant wave heights were extracted from the modeling results at points of interest throughout the project area and were used as the basis for analysis and optimization of the various components of the shoreline and bottom slope erosion protection, which are described in Section 4.

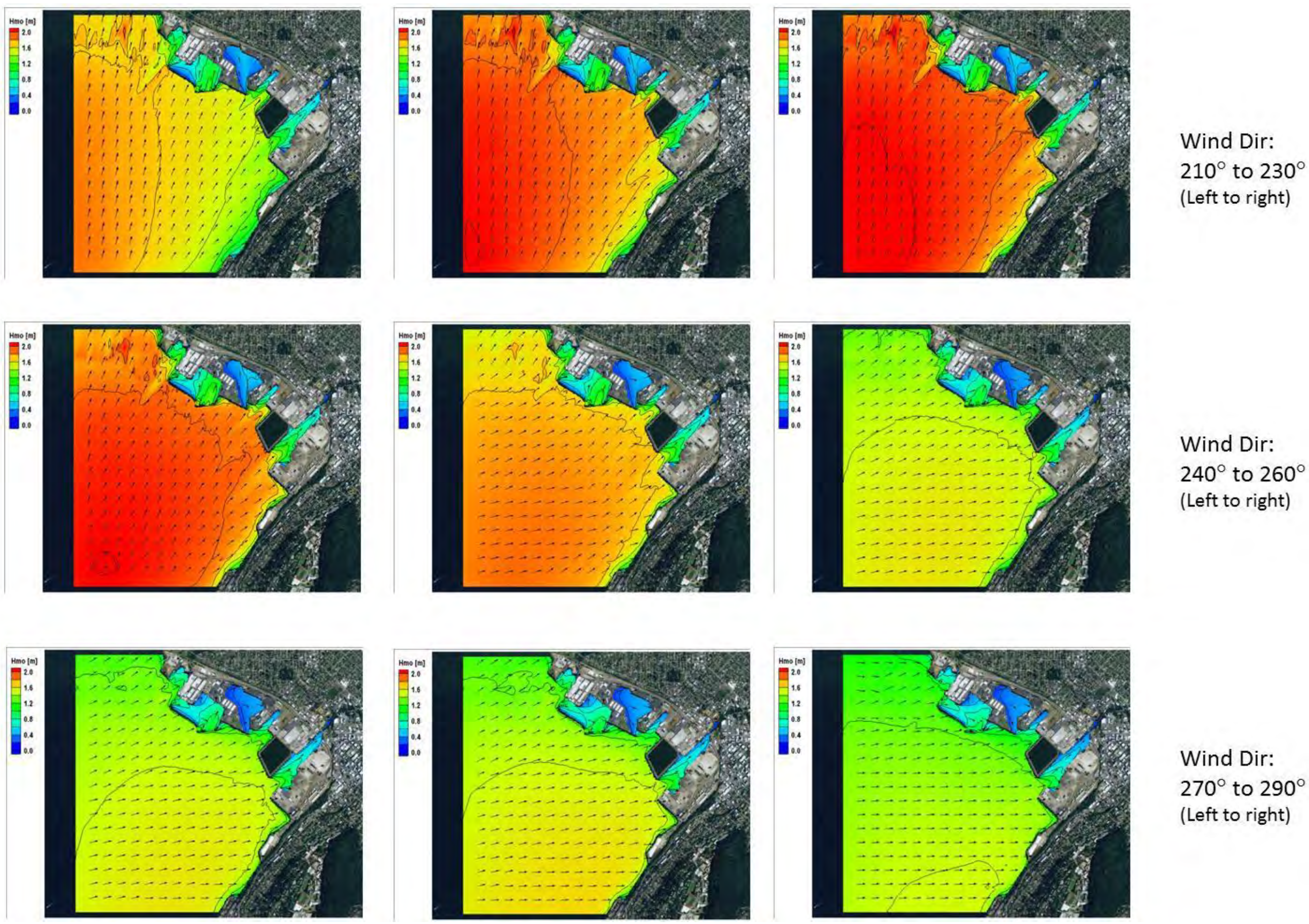


Figure 4. Example wave modeling outputs in Bellingham Bay; wave heights over modeling domain during design storms from different directions

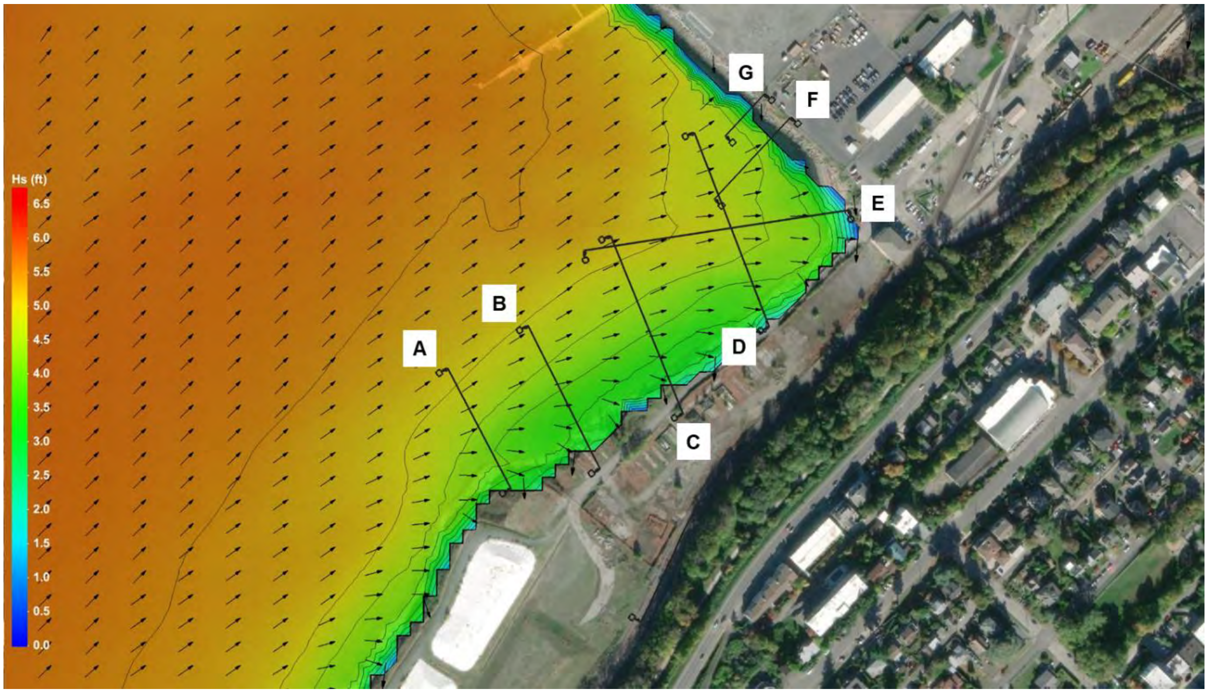


Figure 5. Significant wave heights at the project site during the 100-yr design storm with winds from 230 degrees and a water surface elevation MHHW plus 50 inches. Locations of the provided sections (from GeoEngineers) are also shown in black for reference.

4. Material Sizing

4.1. Methodology

Based on the results of the wave analysis and numerical wave modeling, the shoreline and bottom slope erosion protection material were designed using two methods that account for the specific wave hydrodynamics in the nearshore and breaking areas. The first method considers the stability of armor material under the impact of breaking waves. This method was applied to the project area located at elevations of 0.0 feet NAVD88 or higher. The elevation of 0.0 feet NAVD88 corresponds approximately to the wave breaking elevation of the design wave storm at MSL. As previously mentioned, wave heights are maximized when the WSE is at or above MSL. To account for SLR, the wave breaking elevation when the WSE is at MSL plus 50 inches was determined. This approximate elevation is 3.5 feet NAVD88 relative to the existing ground surface. The method for stability analysis under breaking wave conditions (Method 1) is based on recommendations from the Coastal Engineering Manual and integrates well known and industry accepted methods such as van der Meer deep- and shallow-water (1988), Melby (2005), and van Gent (2004).

The second method for calculation of stable material considers stability of material under the impact of wave orbital velocities. This method was applied for the project area that is located below elevation 0.0 feet NAVD88. The method for stability analysis under wave orbital velocity (Method 2) is also based on recommendations from the Coastal Engineering Manual and integrates well known methods of Grant & Madsen (1979) and Maynord (1998).

It should be noted that the approach discussed above, in which different material sizing methods are used at differing elevations and regions of the shoreline, has been successfully applied to design the stable material under wave impact for various clean up and shoreline erosion protection projects both worldwide and in Puget Sound. Example projects that were designed using this methodology include: Port of Anacortes Former Scott Mill Cleanup Project; Wyman Property Habitat Restoration Project; Former Custom Plywood Site Cleanup Project; Whatcom Waterway Cleanup Project; and others.

4.2. Results

The results of the stable material size analysis calculations are shown in Table 1.

Table 1. Results of material stability analysis.

Range of Surface Elevation (NAVD88)	Range of Bottom Slope (Approx.)	Size of Material, D50
Max Upper Elev. Limit = Upland Crest **Min Lower Elev. Limit =** 0.0 ft	7H:1V to 20H:1V	0.8 feet
Max Upper Elev. Limit = 0.0 ft **Min Lower Elev. Limit =** -2 ft to -9.0 ft	7H:1V to 13H:1V	1.5 inches
Max Upper Elev. Limit = -2 ft to -9.0 ft **Min Lower Elev. Limit =** Seaward limit of site	3H:1V to 15H:1V	0.4 inches

Figure 6 shows the recommended design for the shoreline and bottom slope erosion protection materials in plan-view and their location within the project site.

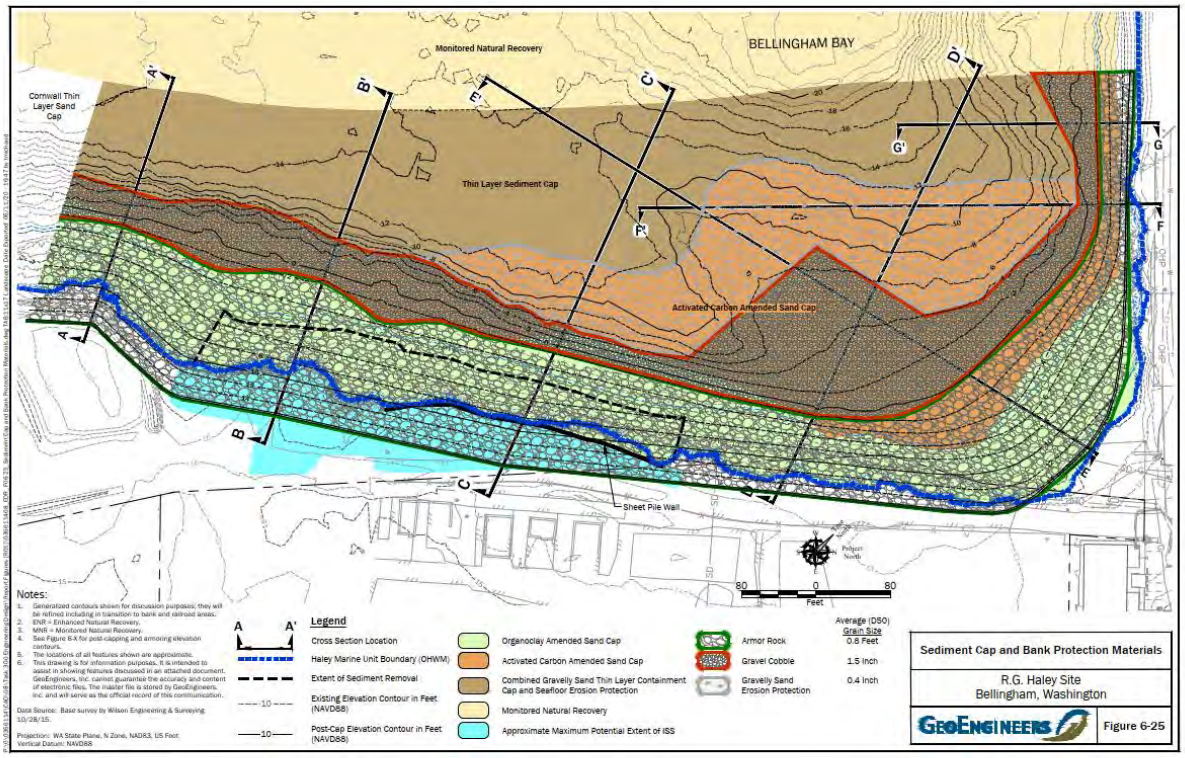


Figure 6. Plan view of recommended design shoreline and bottom slope erosion protection materials

In addition to the plan view for the recommended design, results of the material sizing analysis were translated to cross-sections provided to MM by GeoEngineers and verified for accuracy by MM. A total of seven cross-sections, A-A’ through G-G’, were provided to MM by GeoEngineers and reviewed for accuracy by MM. MM found no issue with the provided cross sections from GeoEngineers, which incorporate the stability analysis results presented in this document.

5. Recommendations for the Design

5.1. General

As presented above, the recommended design to protect the slopes from erosion consists of three material types placed at varying elevations: armor rock, a cobble/gravel mix, and a gravel/sand mix. A description of each material type, their extents, and their function is provided in the sections below.

5.2. Armor Rock

The armor rock will be placed on the upper part of the existing shoreline from elevation 0.0 feet NAVD88 up to the approximate elevations provided in Table 2.

Table 2. Armor Rock Crest Recommendations

Section	Recommended Minimum Armor Rock Crest Elevation (NAVD88)	Design Criteria
A, B, C, D	15.5 ft.	Minimizes risk of overtopping and upland erosion
E	14 ft.	Allows potential overtopping; minimizes risk of upland erosion[2]
F, G	Elevation of crest of existing riprap revetment	Allows potential overtopping; minimizes risk of upland erosion[2]

A smooth rock crest transition will be necessary between the different minimum crest elevations provided in Table 2. The existing riprap along the northern shoreline of the project will need to be assessed to determine the required up-slope extents of the proposed armor rock (during the next phase of design). At the southernmost part of the project, the armor rock revetment will be transitioned into the proposed design surface of the Cornwall Cleanup Project south of R.G. Haley. The transition between the R.G. Haley site and Cornwall site will be designed upon completion of the Cornwall Cleanup Project design.

The revetment was designed to be placed on top of the final grade of the remediated OASC and a portion of the ACASC cap surfaces. Some grading of the existing shoreline is expected in order to allow for the installation of the armor rock up to the crest elevations provided in Table 2 and will be coordinated and refined by the project team in the next phase of design. The armor rock should be placed to a minimum thickness of 2.0 feet below approximate elevation 3.5 feet NAVD88 and a minimum thickness of 2.5 feet above approximate elevation 3.5 feet NAVD88 relative to the existing shoreline surface. A gravel bedding layer of 6 inches (minimum thickness) should be placed between the remediated surfaces and the armor rock to prevent piping of the remediated surface materials through the armor rock.

[2] Precludes erosion for paved and reinforced surfaces.

5.3. Cobble/Gravel Mix

The cobble/gravel mix will be placed on the existing shoreline from elevation 0.0 feet NAVD88 to lower elevations ranging from -2.0 feet NAVD88 to -9.0 feet NAVD88 and will provide the bottom slope protection from wave induced bottom velocities. At the northernmost part of the project, the cobble/gravel mix will be graded into the existing shoreline bottom slopes by employing a transition berm to help mitigate potential scour (Figure 7). At the southernmost part of the project, the cobble/gravel mix will be graded to ensure a smooth transition into the proposed design surface of the Cornwall Cleanup Project adjacent to the R.G. Haley Project (transition to be determined after the completion of the Cornwall Cleanup Project design).

The cobble/gravel mix was designed to be placed directly on top of the final grade of the ACASC and a portion of the OASC remediated cap surfaces. The cobble/gravel mix should be placed to a minimum thickness of 1.5 ft. No cut and fill of the existing bottom slopes are expected to allow for the installation of the cobble/gravel mix. No additional separation layer or bedding material is expected to be needed between the cobble/gravel mix and ACASC, OASC, and the seafloor to prevent piping.

5.4. Gravel/Sand Mix

The gravel/sand mix will be placed on the existing bottom slopes starting at elevations ranging from -2.0 feet NAVD88 to -9.0 feet NAVD88 and seaward to the offshore limit of the Thin-Layer Cap protecting the bottom slopes from wave induced bottom velocities. At the northernmost part of the project, the gravel/sand mix will grade to transition into the existing shoreline bottom slopes by employing a transition berm to help mitigate potential future scour. At the southernmost part of the project, the gravel/sand mix will be graded to ensure a smooth transition into the proposed design surface of the Cornwall Cleanup project adjacent to the R.G. Haley Project (transition to be determined after the completion of the Cornwall Cleanup Project design).

The gravel/sand mix was designed to be placed directly on top of the final grade of the AC Amended Sand Cap where it will perform as a single purpose layer (erosion protection only), and to be placed directly on top the existing sediment surface seaward of the AC Amended Sand Cap where it will perform as a dual purpose layer (capping and erosion protection). The gravel/sand mix should be placed to a minimum thickness of 1.0 ft. No cut and fill of the existing sediment surface are expected to allow for the installation of the gravel/sand mix.

5.5 Transition Berms

Transition berms will be placed at the transitions separating the Armor Rock and Cobble/Gravel Mix interface, as well as the Cobble/Gravel Mix and Gravel/Sand Mix interface. Transition berms are designed to prevent scour and allow natural adjustment at the interface between two different types of material on the bottom slope. The transition berms are designed to initially be 2.0 feet thick with a crest width of 4.0 feet. The transition berm side slopes for a given material at a given location during initial placement as part of construction will be the angle of repose to support the design thickness (2.0 feet) and crest width (4.0 feet). It is expected that the transition berm material will migrate and adjust to the bottom slope after placement. The design grades of the transition berm may not be achievable and are shown herein to estimate the volume of construction material and to define the specific placement of that material on the bottom slope.

5.6 North and South Transition Zones

The transitions at the north and south end of the R.G. Haley project site were designed to ensure a smooth and stable connection to the existing bathymetry (north transition) or adjacent Cornwall Cleanup project (south transition). Figure 7a and 7b show the recommended transition to the existing elevations at the north end of the R.G. Haley project. A transition berm is needed between the erosion protection layer (1.5-foot thick gravel/cobble and 1-foot gravel/sand layer) and uncapped seafloor. A transition berm is most likely not necessary between the armor rock and existing rock revetment. At the south end transition, the erosion protection layer will be graded to ensure a smooth transition into the proposed design surface of the Cornwall Cleanup Project adjacent to the R.G. Haley Project (transition to be determined after the completion of the Cornwall Cleanup Project design).

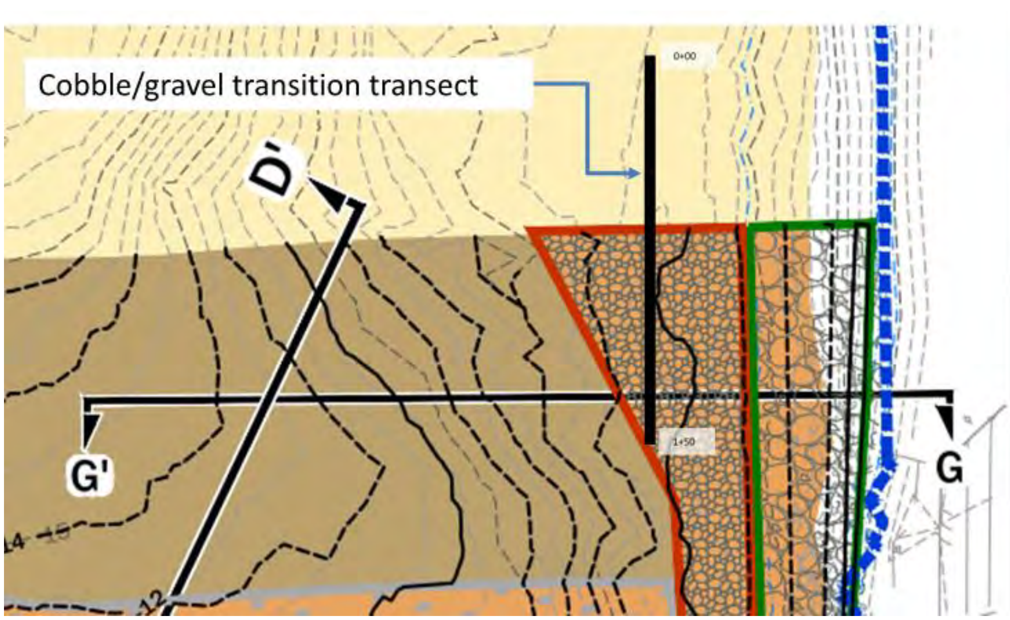


Figure 7a. Plan view showing transect location used to describe north transition of protection layers to existing bathymetry for R.G. Haley project

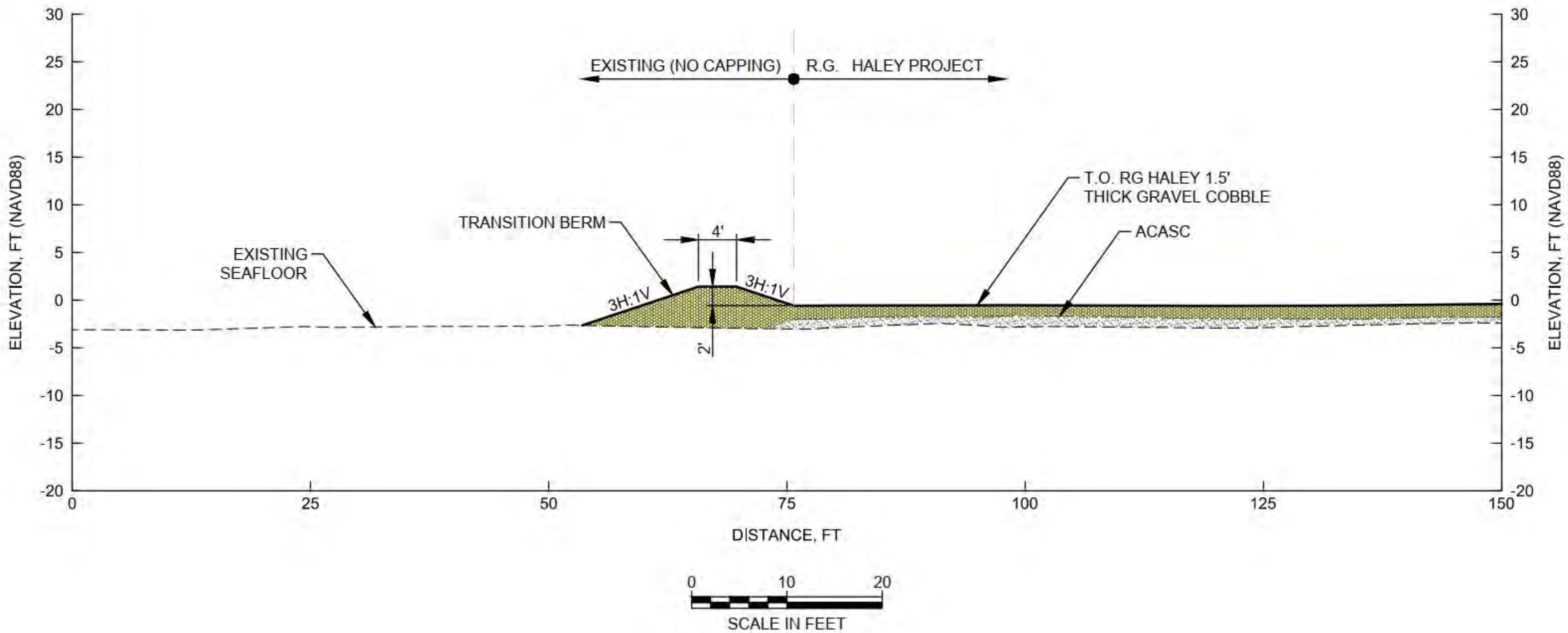


Figure 7b. Transition transect - North transition of protection layers to existing bathymetry

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APPENDIX F
Geotechnical Modeling and Analysis

Appendix F-1
Geotechnical Modeling and Analysis

APPENDIX F-1
GEOTECHNICAL MODELING AND ANALYSIS

1.0 INTRODUCTION

The appendix summarizes geotechnical analyses completed as part of the capping and in-situ solidification (ISS) design for the Upland and Marine Units of the R.G. Haley Site (Site). The long-term slope stability and potential settlement of the capping areas were evaluated for the geotechnical analysis.

2.0 SLOPE STABILITY

2.1. Design Criteria

Washington State Department of Transportation (WSDOT) Geotechnical Design Manual (GDM) Section 7.4, establishes the minimum required factors of safety (FS) for slope stability analysis of permanent cuts and fills as 1.25 and 1.05 for static and pseudo-static cases, respectively. In engineering practice these FSs are also commonly considered for comparative purposes for slopes that do not support structures or would not impact a structure during failure. The GDM FSs were used as general guidance in the Site geotechnical stability analysis and are presented for reference to evaluate the long-term performance of the upland and sediment caps and ISS mass.

2.2. Approach and Assumptions

2.2.1. Soil Properties

A Site Plan is presented on Figure F-1 presenting cross sections C-C' and D-D' used for the slope stability analyses. These cross sections align with upland and off-shore/bank cross sections presented in the body of the Engineering Design Report (EDR) with the same letter designations. The modeled slope stability analyses for these cross sections are shown on Figures F-2 through F-6 for C-C' and on F-7 through F-8 for D-D'.

Field observations and geotechnical laboratory test results from 13 explorations were reviewed to define the subsurface conditions in the analyses. The exploration locations are shown on Figure F-1 and include HD-MW-17, HS-MW-19, HS-MW8, HW-SB-18, RW-4, RW-5, RW-6, TL-MW-1, TL-MW-2, TL-MW-13, TL-MW-14, TL-MW15, and TL-MW16. Table F-1 below presents the soil and rock properties selected for the geotechnical analysis based on the field and laboratory testing information reviewed. Soil friction angles are based on correlations between $N1_{60}$ and friction angle per Table 5-1 in the WSDOT GDM, and GeoEngineers' engineering experience with similar soils in the vicinity. The cohesive strength for the ISS mass is based on laboratory testing information presented in Appendix F-2.

TABLE F-1. SOIL AND ROCK PROPERTIES FOR DESIGN

Material	Total Unit Weight, γ (pcf)	Strength	
		Φ (deg)	C (psf)
Gravel-Cobble Armor Rock	135	40	–
Amended Sand Cap	120	32	–
ISS (Treated Soil)	125	–	7,200
Existing Fill (Sand and Silt)	125	32	–

Material	Total Unit Weight, γ (pcf)	Strength	
		Φ (deg)	C (psf)
Wood Debris and Sawdust	75	30	–
Native Marine Deposits	130	37	–
Sandstone Bedrock (Chuckanut Formation)	130	45	–

Notes:

ϕ = static friction angle
c = static cohesion
deg = degrees
pcf = pounds per cubic foot
psf = pounds per square foot

2.2.2. Seismic Parameters

The Haley Site seismic design evaluation follows the 2015 International Building Code (IBC) which is based on a seismic event with a 2 percent probability of exceedance in a 50-year period. This event is equivalent to the approximate 2,475-year return period. The 2015 IBC criteria were used as general guidance to develop seismic design parameters and are presented for reference to evaluate the long-term performance of the Haley upland and sediment caps under pseudo-static conditions. For comparison, the Cornwall site EDR (Landau 2018) provided seismic design parameters based on the 2012 IBC for the 2,475-year return period event.

The IBC references the 2008 United States Geological Survey (USGS) National Seismic Hazards Mapping Project for determining a peak ground (soft rock) acceleration (PGA) coefficient for design. The calculated PGA for a seismic event with this return period at the Site is:

- PGA = 0.40 gravitational acceleration (g)

The soft rock PGA values are then modified for the site class, which accounts for the subsurface conditions within 100 feet of the ground surface. Site class was evaluated from a sampling of borings across the Haley Site using the measured blow count and the procedures outlined in the American Association of State Highway Transportation Officials (AASHTO) Load and Resistance Factor Design (LRFD) Bridge Design Specifications (2017). Both Site Class D and E soils were at the Site. Site Class D was selected as representative for calculating the Site Class adjusted PGA, which is referred to as the PGA_M.

- Site amplification factor for Site Class D = 1.101
- PGA adjusted for Site Class amplification (PGA_M) = 0.439 g

For pseudo-static slope stability analyses, a seismic horizontal coefficient, kh, of 0.22 g was used, which is equal to one half of the PGA_M in accordance with the standard of practice.

2.2.3. Groundwater

Nearshore groundwater conditions were assumed to closely match the anticipated relative tidal fluctuations. For modeling purposes, the groundwater and sea level were modeled with a level piezometric line and were set at elevation 8.04 feet North American Vertical Datum of 1988 (NAVD88) corresponding to the mean higher high water (MHHW) in accordance with the standard of practice.

2.3. Analysis Runs

Slope stability was modeled using the commercial software Slope/W version 8.16.1.13452 produced by GeoStudio. The stability of the proposed critical sections was evaluated for temporary conditions during construction (i.e., sediment excavation seaward of ISS), and post-construction static and pseudo-static conditions. Section C-C' considers failure surfaces near the ISS as well as offshore where the sea floor becomes steeper.

2.3.1. Slope Stability Results

Slope stability results for modeled sections C-C' and D-D' are presented on Figures F-2 through F-6 and F-7 through F-8, respectively. A summary of the global stability results is presented in Table F-2, below.

TABLE F-2. SLOPE STABILITY ANALYSIS RESULTS

Cross Section	Analysis Name	Minimum Required Factor of Safety	Calculated Factor of Safety
Temporary			
C-C'	Sediment Excavation (Post-ISS)	1.25	2.6
Post-Capping			
C-C'	Static – Near ISS	1.25	3.8
C-C'	Static – Offshore	1.25	1.5
C-C'	Pseudo-Static – Near ISS	*	1.1
C-C	Pseudo-Static –Offshore	*	0.6
D-D'	Static – Upland/Offshore Slope Transition	1.25	3.0
D-D'	Pseudo-Static – Upland/Offshore Slope Transition	*	0.9

*Submerged portions of capped offshore slopes could potentially move in a seismic event.

3.0 SETTLEMENT

3.1. Approach/Assumptions

3.1.1. Soil Properties

The Existing Fill and Native Marine Deposits were modeled as cohesionless soil layers using elastic settlement properties with an elastic modulus recommend by AASHTO Table C10.4.6.3-1. The Wood Debris and Sawdust were modeled as cohesive and organic soil layers were modeled using consolidation settlement properties. The debris size in the Wood Debris and Sawdust soil unit varies from relatively large wood pieces to decomposing fibers considered to be similar to peat for modeling purposes. The compressibility of the wood debris soil unit was evaluated based on recommendations for peat/organic soils in accordance with recommendations set forth in the WDSOT GDM Section 5.13.2.

Settlement analyses were completed using the selected soil properties presented in Table F-3, below.

TABLE F-3. HALEY CONSOLIDATION PROPERTIES

Soil Unit	Total Unit Weight, γ (pcf)	Consolidation				Elastic Settlement
		C_{Ce}	C_{re}	C_V (ft²/day)	$C_{\alpha e}$	E_s (ksf)
Wood Debris and Sawdust	75	0.4	0.04	0.2	0.024	--
Existing Fill (Sand and Silt)	125	--	--	--	--	600
Native Marine Deposits	130	--	--	--	--	800

Notes:

C_{Ce} = compression index
C_{re} = recompression index
C_v = coefficient of consolidation
$C_{\alpha e}$ = secondary compression index
e_0 = initial void ratio
E_s = Young's Modulus
ft^2 = square feet
pcf = pounds per cubic foot

The ISS-treated soil and Chuckanut formation were considered incompressible. The ISS treated soil will be solidified by the cement mixed into the soil and the Chuckanut Formation is composed of sandstone bedrock.

3.1.2. Groundwater

Nearshore groundwater conditions were assumed to closely match the tidal fluctuations anticipated at the site. The groundwater and sea level were modeled at elevation 8 feet NAVD88 corresponding to the MHHW in accordance with the standard of practice.

3.2. Analysis Runs

Potential settlement was evaluated using the commercial software Settle3D Version 4.018 produced by Rocscience, Inc. The Terzaghi 1D consolidation theory was used to evaluate potential post-construction total and differential settlement of the upland cap and of the sediment cap by modeling the maximum fill loads in either area using two profiles were selected for estimating the potential range of settlements across the filled area.

The soil boring material profiles used to evaluate settlements for upland and sediment capping cases included:

- Upland Cap: HS-SB-18 (more compressible) and TL-MW-1 (less compressible). Estimated upland cap settlement were based on the sum of cap loads and future upland park fill and parking lot pavement loads.

  Cap Load = 3 feet of upland cap fill (or 375psf) estimated from the thickest anticipated upland fill section.

  Future Park Fill and Pavement Loads = 3 feet of structural fill below parking lot, and 0.5 feet concrete asphalt (or 450 psf) based on cross section illustrations presented in the Cornwall Beach Park Master Plan Report (Anchor QEA 2014).

- Sediment Cap: COB-SC-02 (more compressible) and COB-SC-09 (less compressible).

  Load = 0.5-foot gravel base and 2-foot armor rock layer (645 psf total load) over 2-foot sand cap.

3.3. Settlement Results

The settlement analysis results are summarized in Table F-4, below.

TABLE F-4. SETTLEMENT ANALYSIS RESULTS

Representative Site Location	Representative Boring Profile	Estimated Settlement (inch)	Potential Differential Settlement (inch)*
Upland Cap	HS-SB-18	25	24
	TL-MW-1	About 1	
Sediment Cap	COB-SC-02	26	26
	COB-SC-09	Less than 1	

* Differential settlement will vary based on existing soil conditions and other factors.

For the sediment caps the time to reach 90 percent of the total estimated settlement is about 3.8 years.

4.0 REFERENCES

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Attachments:

Figure F-1. Site Plan

Figure F-2. Section C-C' Temporary - Excavation (Post ISS Install)

Figure F-3. Section C-C' Static - Post Construction - Near ISS

Figure F-4. Section C-C' Static - Post Construction - Off Shore

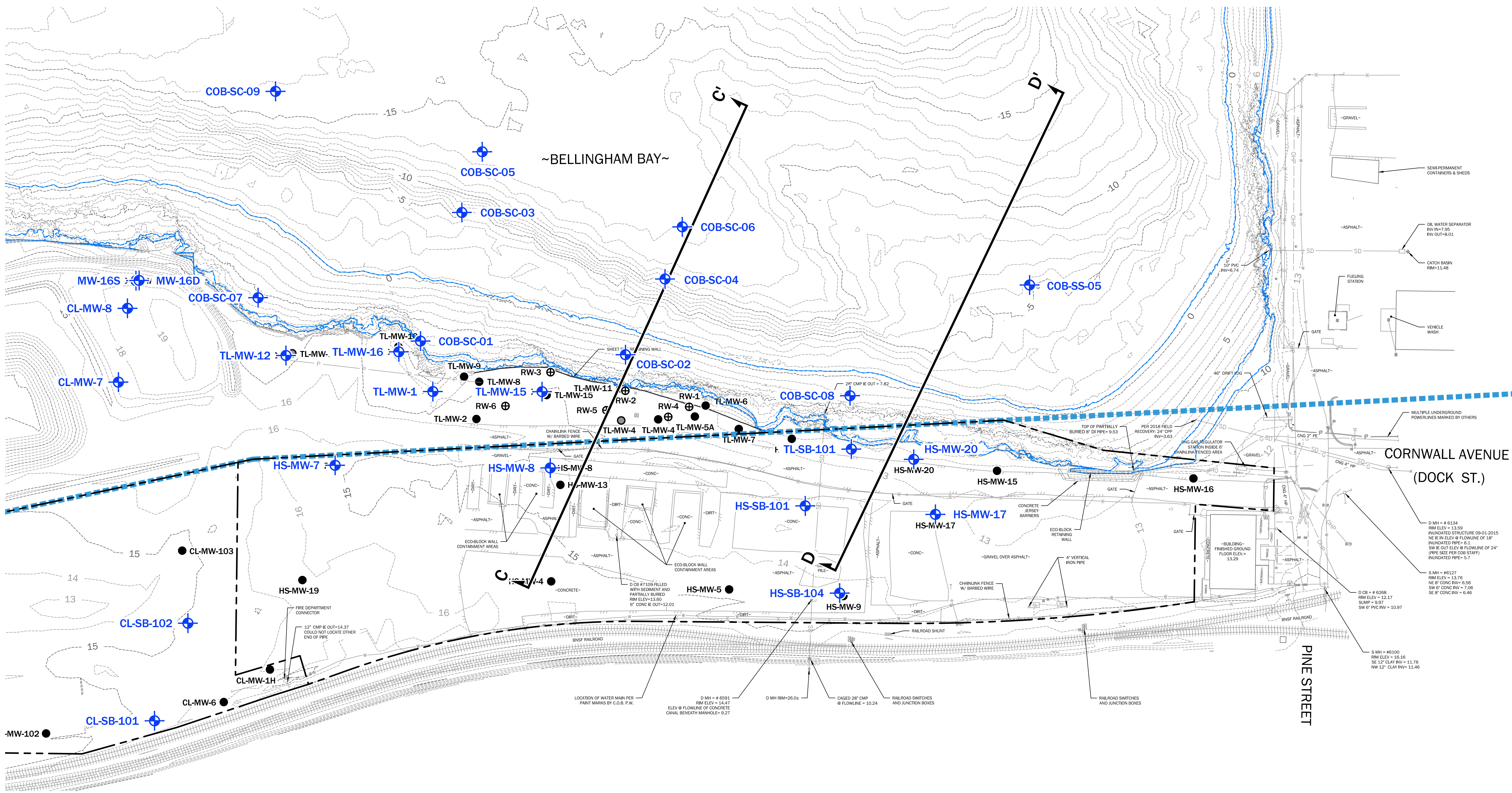
Figure F-5. Section C-C' Pseudo-Static - Post Construction - Near ISS

Figure F-6. Section C-C' Pseudo-Static - Post Construction - Off Shore

Figure F-7. Section D-D' Static - Post Construction

Figure F-8. Section D-D' Pseudo-Static - Post Construction

Figures F-9 through F-12. Log of Explorations



Notes:

1. The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.
2. This figure is for informational purposes only. It is intended to assist in the identification of features discussed in a related document. Data were compiled from sources as listed in this figure. The data sources do not guarantee these data are accurate or complete. There may have been updates to the data since the publication of this figure. This figure is a copy of a master document. The hard copy is stored by GeoEngineers, Inc. and will serve as the official document of record.
3. Surface topography and bathymetry based on October 28, 2015 Wilson Engineering survey drawings (Project No. 2015-088) prepared for the City of Bellingham (R.G. Haley Site Cleanup Project Topo - EC-0018)

Vertical Datum: NAVD 88.

A A'

Legend

Cross-Section Location

100 0 100

Feet

Site Plan

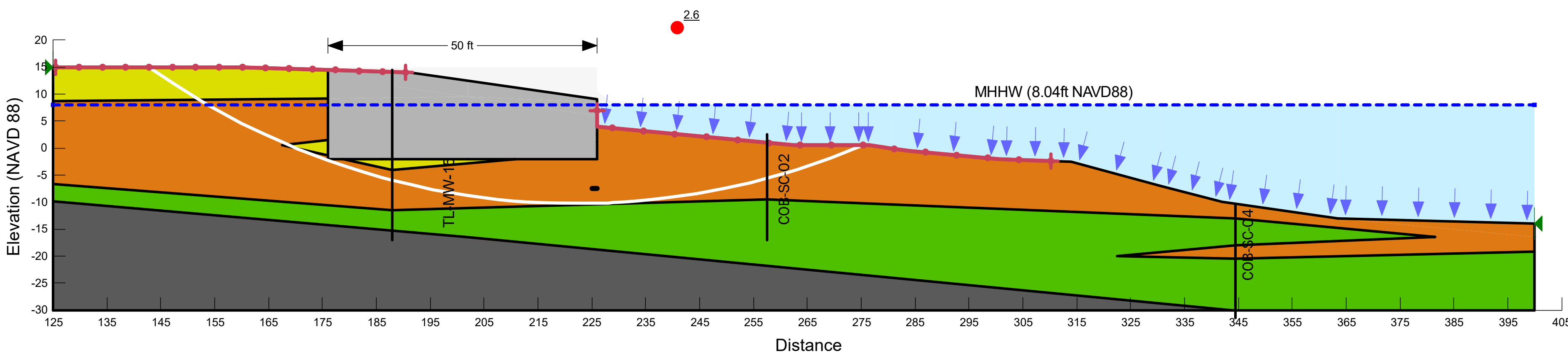
R.G. Haley Site
Bellingham, Washington

GeoEngineers

Figure F-1

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Wood Debris and Sawdust	75	0	30
	Native Marine Sediments	130	0	37
	Chuckanut Formation (SSTN)	130	0	45
	ISS soil treatment	125	7,200	0
	Existing Fill soil (Sand and Silt)	125	0	32

Factor of Safety: 2.6



Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document.
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Section C-C'
Temporary - Excavation (Post ISS Install)

R.G. Haley Site
Bellingham, Washington

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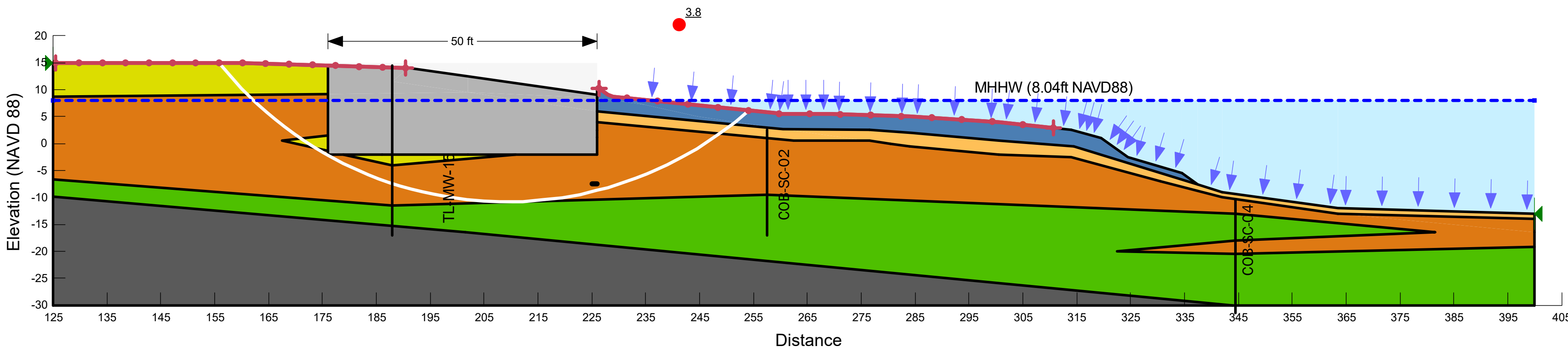
Figure F-2

00180-356-02 Date Exported: 10/16/18

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Gravel-Cobble Armor	135	0	40
	Amended Sand Cap	120	0	32
	Wood Debris and Sawdust	75	0	30
	Native Marine Sediments	130	0	37
	Chuckanut Formation (SSTN)	130	0	45
	ISS soil treatment	125	7,200	0
	Existing Fill soil (Sand and Silt)	125	0	32

Factor of Safety: 3.8



Notes:

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Section C-C'
Static - Post Construction - Near ISS

R.G. Haley Site
Bellingham, Washington

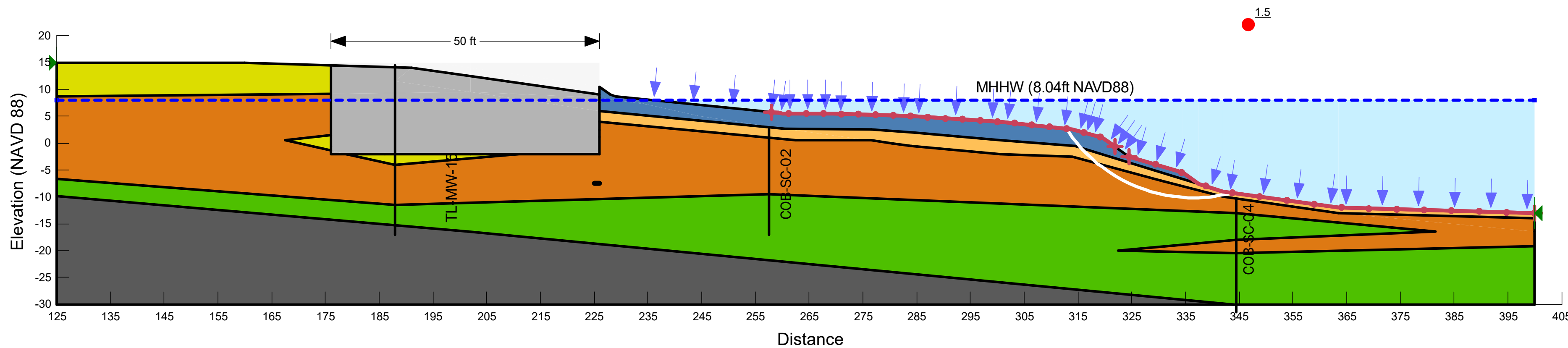
GeoEngineers

Figure F-3

00180-356-02 Date Exported: 10/16/18

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Gravel-Cobble Armor	135	0	40
	Amended Sand Cap	120	0	32
	Wood Debris and Sawdust	75	0	30
	Native Marine Sediments	130	0	37
	Chuckanut Formation (SSTN)	130	0	45
	ISS soil treatment	125	7,200	0
	Existing Fill soil (Sand and Silt)	125	0	32

Factor of Safety: 1.5



Notes:

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Section C-C'
Static - Post Construction - Off Shore

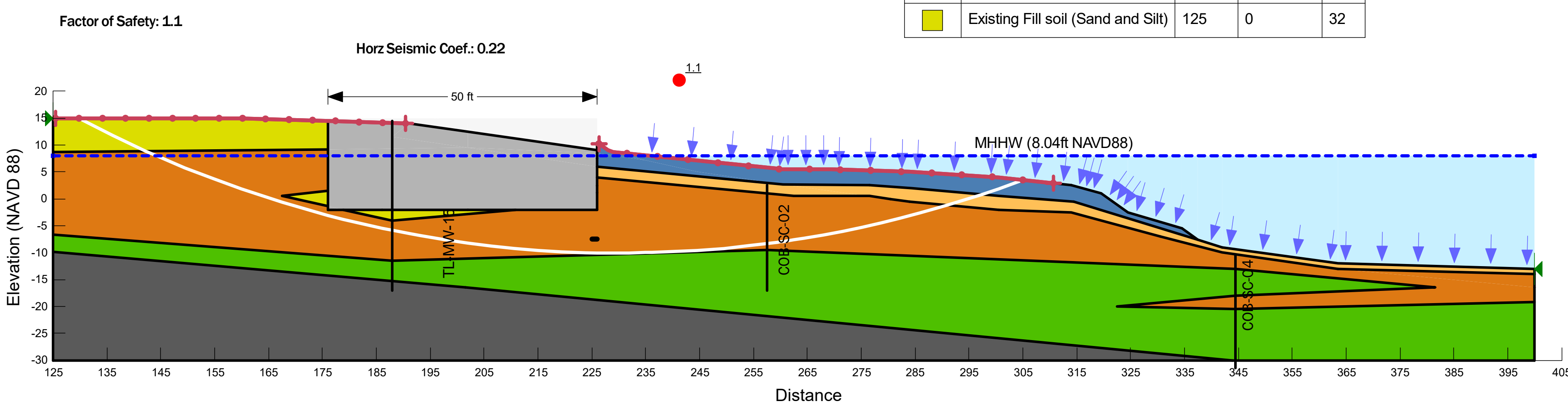
R.G. Haley Site
Bellingham, Washington

GeoEngineers

Figure F-4

00180-356-02 Date Exported: 10/16/18

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Gravel-Cobble Armor	135	0	40
	Amended Sand Cap	120	0	32
	Wood Debris and Sawdust	75	0	30
	Native Marine Sediments	130	0	37
	Chuckanut Formation (SSTN)	130	0	45
	ISS soil treatment	125	7,200	0
	Existing Fill soil (Sand and Silt)	125	0	32



Notes:

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Section C-C'
Pseudo-Static - Post Construction - Near ISS

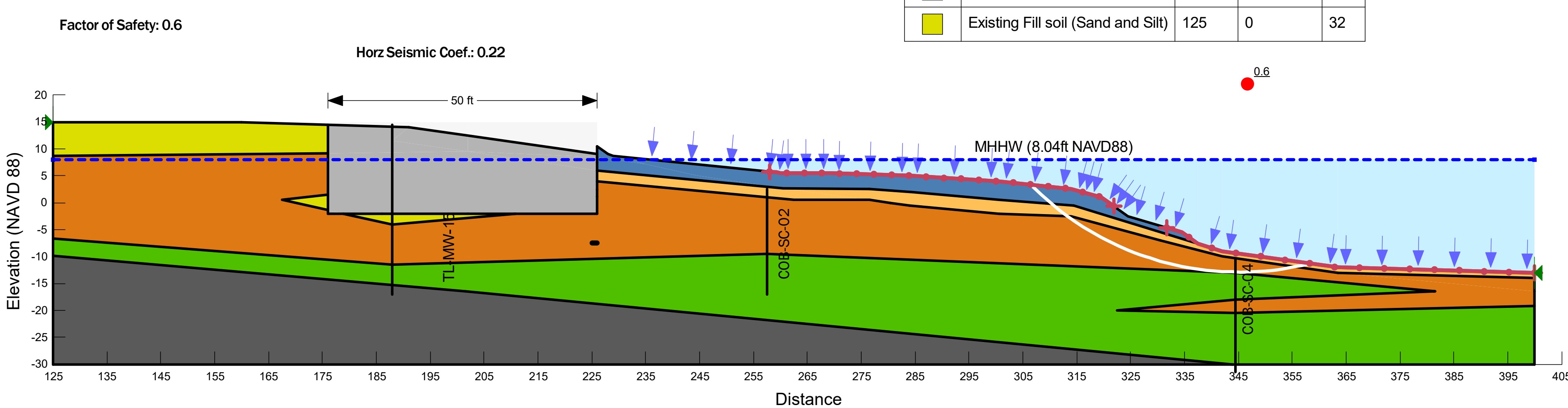
R.G. Haley Site
Bellingham, Washington

GeoEngineers

Figure F-5

00180-356-02 Date Exported: 10/16/18

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Gravel-Cobble Armor	135	0	40
	Amended Sand Cap	120	0	32
	Wood Debris and Sawdust	75	0	30
	Native Marine Sediments	130	0	37
	Chuckanut Formation (SSTN)	130	0	45
	ISS soil treatment	125	7,200	0
	Existing Fill soil (Sand and Silt)	125	0	32



Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document.
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Section C-C'
Pseudo-Static - Post Construction - Off Shore

R.G. Haley Site
Bellingham, Washington

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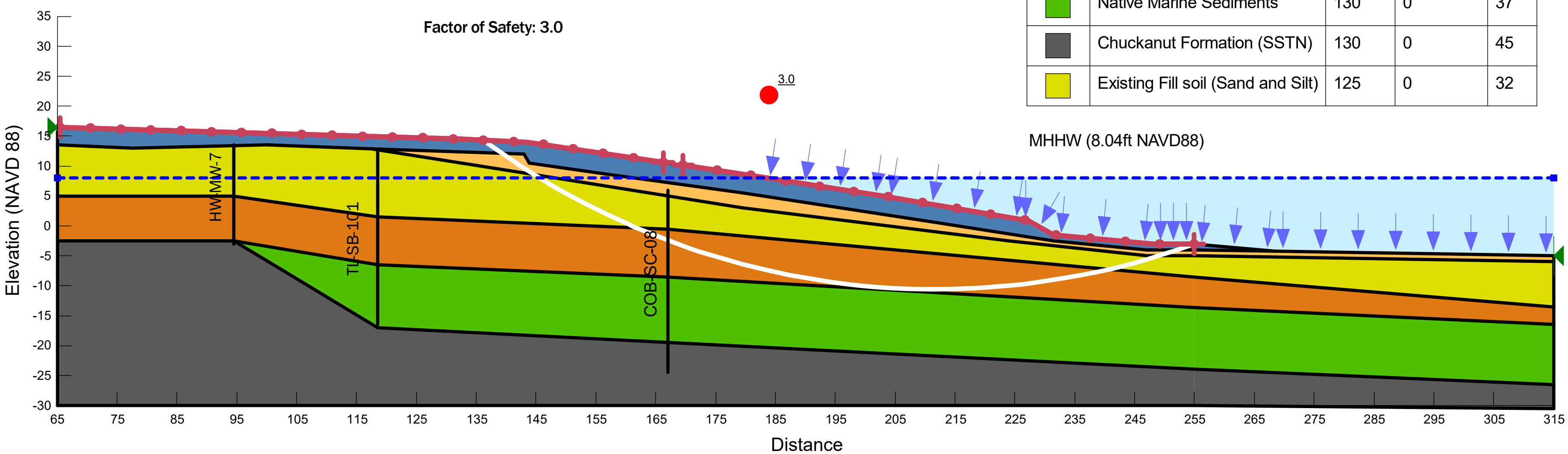
Figure F-6

00180-356-02 Date Exported: 10/16/18



Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Gravel-Cobble Armor	135	0	40
	Amended Sand Cap	120	0	32
	Wood Debris and Sawdust	75	0	30
	Native Marine Sediments	130	0	37
	Chuckanut Formation (SSTN)	130	0	45
	Existing Fill soil (Sand and Silt)	125	0	32

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document.
3. GeoEngineers, Inc. cannot guarantee the accuracy and context of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Section D-D'
Static - Post Construction

R.G. Haley Site
Bellingham, Washington

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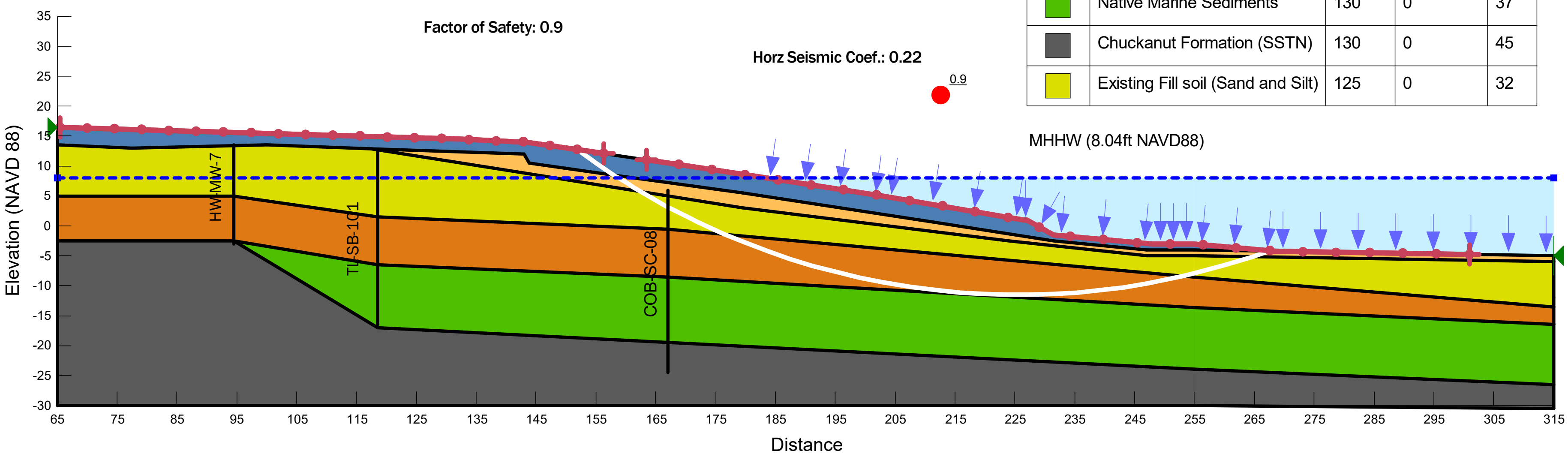
Figure F-7

00180-356-02 Date Exported: 10/16/18

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Gravel-Cobble Armor	135	0	40
	Amended Sand Cap	120	0	32
	Wood Debris and Sawdust	75	0	30
	Native Marine Sediments	130	0	37
	Chuckanut Formation (SSTN)	130	0	45
	Existing Fill soil (Sand and Silt)	125	0	32



Notes:

1. The locations of all features shown are approximate.
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Section D-D'
Pseudo-Static - Post Construction

R.G. Haley Site
Bellingham, Washington

GeoEngineers

Figure F-8

00180-356-02 Date Exported: 10/16/18

Drilled	Start 7/11/2012	End 7/11/2012	Total Depth (ft) 20	Logged By CTB / Checked By CEB	Driller Boart Longyear	Drilling Method Hollow-stem Auger
Surface Elevation (ft) 13.16	Vertical Datum NAVD88		Hammer Data 300 (lbs) / 30 (in) Drop		Drilling Equipment Truck-mounted CME 75	
Easting (X) 639592.47	Northing (Y) 1240420.1		System Datum NAD83/98		Groundwater: Date Measured / Depth to Water (ft) / Elevation (ft)	

Notes: HS-MW-18 well was not constructed. Auger Data: 4¼-inch I.D.; 8½-inch O.D.

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0								GP	Coarse gravel (logged based on cuttings)			
10													
	5		18	2						No recovery			
5			6	6		HS-MW-18-7.5-9 CA			Wood	Cored with 30% silty sand, petroleum-like odor, moist	SS	<1	
	10		6	7		HS-MW-18-10-11.5 CA			Wood	Wood fragments with 5% silty sand, fine to coarse sand, dark gray, moist to wet	MS	<1	
0													
	15		6	5		HS-MW-18-15-16.5 CA			Wood	Wood fragments and shavings with 5% organic silt, black, wet	SS	<1	
-5													
	20									Refusal at 20 feet on bedrock			

Note: Please see Figure A-1 for explanation of symbols

Log of Boring HS-SB-18

GEOENGINEERS

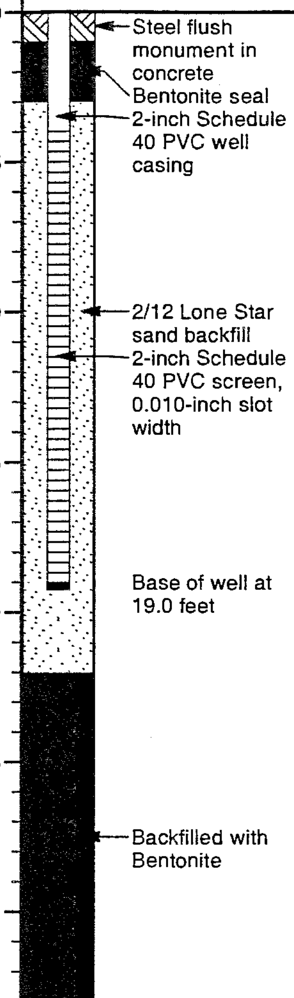
Project: R.G. Haley Site
Project Location: Bellingham, Washington
Project Number: 0356-114-06

Figure F-9

Project	Job Number	Location
Douglas Management	0275-002-00	DNR Property

Date Drilled	04/03/00	Logged By	JJO/SLM	Contractor	Cascade
Drill Method	4.25" ID HSA	Equipment	Truck Mounted CME 75	Drill Bit	
Sample Method	2" SPT/Split Spoon	Hammer Data	140 lb hammer/30" drop	X-coordinate: / Y-coordinate:	Not Determined / Not Determined
Total Depth (ft)	33	Elevation (ft)	15.57	Datum: / System:	City / Not Determined
Total Well Depth (ft)	19	Monument Elevation Stickup (ft)	Flush mounted	Casing Elevation Stickup (ft)	15.05

WELL SCHEMATIC



DEPTH IN FEET	Sample No.	Blows per foot	USCS Group Symbol	Material Description	Headspace Vapor (ppm)	Sheen	Other Tests And Notes
0			SM	Brown silty sand with gravel (loose, moist) (fill)			
			SP-SM	Brown fine to medium sand with silt and occasional gravel (loose, moist) (fill)			
	1	7			0	SS	
5							
	2	9			0	SS	
7				▽			
			SP-SM	Dark gray fine to medium sand with silt and a trace of shells (very loose, wet)			
	3	2			0	MS	
10			SP	Dark gray fine sand with occasional large woody debris and shells (very loose, wet)			
	4	3			0	SS	
	5	5			0	SS	
15			SP	Dark gray fine to medium sand with occasional shells (medium dense, wet)			
	6	18			0	SS	
			SP	Dark gray fine to medium sand with medium woody debris and occasional shells (loose, wet)			
	7	6			0	SS	
20							
	8	7			0	NS	
			SP	Dark gray fine to medium sand with occasional medium woody debris, shells and gravel (medium dense, wet)			
	9	16			0	NS	
25			GP-GM	Dark gray sandy fine to coarse gravel with occasional shells and a trace of silt (medium dense, wet)			
	10	12	SM	Dark gray silty fine to medium sand with gravel and a trace of medium to large woody debris (medium dense to dense, wet)	0	NS	
	11	28			0	NS	
30			ML	Dark gray silt with gravel and occasional shells (medium dense, wet)			
	12	20					
	13	50/5"	ML	Dark gray silt with occasional gravel and shells (hard, moist to wet)	0	NS	
35				Boring completed at a depth of 33.0 feet on 04/03/00. Ground water encountered at a depth of 7.0 feet during drilling.			
40							

GeoEngineers

LOG OF MONITORING WELL TL-MW-1

FIGURE B-21

GEI WELL LOG 027502TL.GPJ GEI_CORP.GDT 5/30/00 0275-002-00

Figure F-10

Drilled	Start 8/27/2012	End 8/27/2012	Total Depth (ft) 20
Logged By GRL	Checked By SBS	Driller Cascade Drilling, L.P.	Drilling Method Sonic

Surface Elevation (ft) / Vertical Datum	4 / NAVD88	Hammer Data	N/A - Sonic Drilling
Drilling Equipment	GeoProbe 8140 LS		
Easting (X) / Northing (Y)	639563.3014 / 1240177.913	System Datum	NAD83/98

Groundwater: Date Measured | Depth to Water (ft) | Elevation (ft)

Notes: 5 foot core barrel, 3-inch liner

FIELD DATA

Elevation (feet)	Depth (feet)	Recovered (in)	Blows/foot	Collected Sample / Sample Name Testing	Water Level	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0	46.8		COB-SC-02-00-02		SM	Brown silty fine to coarse sand with gravel and occasional debris (debris = glass and brick fragments) (debris <5% by volume)	NS	<1	No odor
				COB-SC-02-02-04		Wood	Wood (wood >90% by volume; sawdust up to 2 inches long)	SS	1.9	Petroleum odor
0								NS	12.5	
				COB-SC-02-04-06			(wood content decreases to ~50% by volume, becomes dark brown)	MS	12.9	No odor
	5	45.6						NS	8.5	
							(wood content increases to >90% by volume, becomes light brown)	NS	3.5	
								NS		
-5				COB-SC-02-08-10			Wood becomes dark brown	NS	3.2	
	10	44.4						NS	1.8	
							Trace glass and brick fragments	NS	1.8	
				COB-SC-02-12.5-14.5		SM	Gray silty fine sand with abundant clam shell fragments (native)			
-10								NS	3.1	
	15	58.8					Grades to with gravel	NS	0.8	
								NS	1.3	
				COB-SC-02-17-19		GM	Gray silty fine to coarse gravel with sand			
-15								NS	3.3	
	20							NS	1.0	

Note: Please see Figure A-1 for explanation of symbols

Seattle: Date:6/25/13 Path:P:\0\0356114\06\GINT\035611406 HALEY.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_STANDARD

Log of Boring COB-SC-02

GEOENGINEERS

Project: R.G. Haley Site
Project Location: Bellingham, Washington
Project Number: 0356-114-06

Sheet 1 of 1

Figure F-11

Drilled	Start 8/1/2012	End 8/1/2012	Total Depth (ft) 10	Logged By GRL / Checked By SBS	Driller Cascade Drilling, L.P.	Drilling Method Sonic

Surface Elevation (ft) / Vertical Datum	Undetermined	Hammer Data	N/A - Sonic Drilling
Drilling Equipment	GeoProbe 8140 LS		
Easting (X)	639489.7267	System	
Northing (Y)	1239751.825	Datum	

Groundwater: Date Measured | Depth to Water (ft) | Elevation (ft)

Notes: 5 foot core barrel, 3-inch liner

Elevation (feet)	Depth (feet)	Recovered (in)	Blows/foot	Sample Name / Testing	Water Level	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0	60		COB-SC-09-00-02		ML	Gray silt with trace wood (<5% by volume) (wood = splinters)	NS	1.3	Moderate hydrogen sulfide odor from 0 to 5 feet bgs
								NS	1.9	
				COB-SC-09-02-04		ML	One piece of clamshell at 1.7 feet bgs Gray silt (native)	NS	1.3	
				COB-SC-09-04-06			Trace organic material at 3.6 feet bgs	NS	1.0	
	5	60						NS	1.8	Slight hydrogen sulfide odor from 5 to 10 feet bgs
							1 clam shell at 6 feet bgs Trace clam shell pieces to 10 feet bgs	NS	<1	
								NS	<1	
				COB-SC-09-08-10				NS	<1	
	10							NS	<1	

Note: Please see Figure A-1 for explanation of symbols

Log of Boring COB-SC-09

GEOENGINEERS

Project: R.G. Haley Site
Project Location: Bellingham, Washington
Project Number: 0356-114-06

Figure F-12

Appendix F-2
Crete Memorandum - Detailed Calculation for Stability During Construction

TO: Rick Moore – GeoEngineers, Inc.

FROM: Mike Byers, PE – CRETE Consulting Inc., PC

PROJECT: R.G. Haley

SUBJECT: ISS Slope Stability Study

DATE: April 17, 2019

ATTACHMENT: Detailed Calculation for Stability during Construction

---

This memorandum provides a summary of the geotechnical evaluation of the stability of the Insitu Solidification (ISS) mass during remediation construction on the R.G. Haley site in Bellingham, Washington. Please refer to the attached calculation for specific details. The stability study was performed to evaluate the ability of the ISS mass to provide lateral support to upland portions of the site while shoreline and offshore excavations were completed as part of the overall site remediation. The ISS process results in an overall lower permeability of the processed soil which reduces the mobility of chemicals within the soil. It also results in an increase in the internal strength of the soil which has a significant effect on the ability of the ISS soil to resist surface loading and to perform as a stabilizing measure in an open excavation.

The attached calculations evaluate the slope stability of the ISS mass during remediation construction after the ISS has cured and when temporary remediation excavations are completed adjacent to the mass. The ISS contains a relatively small amount of cement or hardening agent when compared to a structural concrete mass, so it is modeled as a very stiff soil with a relatively high internal strength as opposed to a mass of concrete. The calculation used excavations adjacent to the ISS mass that are being planned to complete remediation of the bank and sediment areas. They also include a surface construction load near the edge of the ISS mass.

Recommendations that are based on the calculations include:

- The slope of the ISS in an excavation should be no steeper than ½ Horizontal to 1 Vertical (1/2H:1V).
- For excavations no deeper than elevation +5 (design depth), equipment should come no closer than 5 ft from the top of the ISS slope. The slope should be inspected during excavation activities to determine if additional setback distance is necessary.
- The equipment setback should be increased an addition foot for each foot of excavation depth below the design depth, and the excavation slope should be decreased to 1H:1V
- No excavation next to the ISS should be completed until the ISS has had at least 28 days to cure to gain strength, and achieved the required strength.

Attachment: Detailed calculations

PURPOSE

To evaluate the slope stability of the ISS mass at the shoreline during construction of the project which involves impacted soil removal water-ward of the ISS Mass. Evaluate the stability of the mass during construction that includes an excavator on the slope.

REFERENCES

1. Boring logs from GeoEngineers & Exploration Location Site Plan (Figure 3-2A) - Attachment 1 (Site Plan) Attachment 2 (Logs)

2. Preferred Cleanup Action Alternative Cross Sections D-D - Figure X GeoEngineers - Attachment 3

3. Slide Version 6.0, Rocscience, Inc, Toronto, CA. Slide is a 2-D limit equalibrium slope stability program

4. Tabular results from Bench scale Testing - RG Haley site - CRETE (Attachment 4)

5. NAVFAC Soil Mechanics - 7.01. Figure 7, 7.1-149 (Attachment 5)

6. CAT 340 long reach excavator Spec

ATTACHMENTS

1. Exploration Site Plan
2. Boring logs.
3. Preferred Cleanup Action Alt. X-section
4. Tables from draft Treatability Study Results - CRETE 2018.
5. Fig 7, Ref 4.
6. CAT 340 Long Reach Excavator specification
7. Analyses Figures

BY MB DATE 10/9/18 Sheet No 1 of 9

CHECKED BY ____ DATE ____ PROJECT NUMBER ____

PROJECT RG Haley - ISS bank stability

CRETE CONSULTING, INC.

Soil Properties:

The pertinent soil units for the stability analyses are taken from the cross section (ATT 3) and boring logs in Att 1. They include

A) ISS Mixture - The ISS Mixture is Marine Fill and upland fill soil that is mixed with a stabilizing agent to result in a treated soil layer that has very different properties when compared to the parent soils.

B) Marine Fill - several feet of the Marine Fill will be present below the ISS treatment layer

C) Native Marine Sediment - located below the Marine Fill soil

BY MB DATE 10/9/18

CHECKED BY ______ DATE ______

PROJECT RGH - ISS Stability

Sheet No 2 of 9

PROJECT NUMBER ______

CRETE CONSULTING, INC.

ISS Soil Properties

Attachement 4, Table 4 includes data from a number of samples from the project ISS area that were mixed with different stabilizing agents and tested for preliminary screening purposes.

Density and m/c of the ISS mass will be determined for the stability study by taking an average of the results from Table 4 Attachment 4.

Bulk density ISS = $\bar{\gamma}_b = 102 \frac{lbs}{ft^3}$

dry density $\bar{\gamma}_d = 66 \frac{lbs}{ft^3}$

Moisture Content $\overline{MC} = 54\%$

ISS strength is based on results from Att 4 which show a range of strengths. A target of 25 psi will be used.

Cohesion = ½ qu = ½ UCS lab test result.

BY MB DATE 10/9/18 Sheet No 3 of 9

CHECKED BY ____ DATE ____ PROJECT NUMBER ____

PROJECT RGH ISS Bank Stability

CRETE CONSULTING, INC.

BORING Log Blow count analyses

The boring logs were completed using a variety of different samplers and hammers. In order to provide a rough direct comparison, the energy input into the ground from the different combinations needs to be standardized to 100% @ correction factors to compare to Standard SPT blow counts.

Typical samplers used for the work include

Sampler	Sampler ID (in)	Sampler OD (in)
SPT	1.375"	2"
D&M	2.4"	3.25"
Modified CAL	2.5	3

To convert the two other samplers and the hammer sizes to equivalent SPT values, use a ratio of the energy delivered.

SPT sampler with 140 lb hammer, 30" drop energy.

$$E_{SPT} = \frac{ft\text{-}lbs}{in^2} = 140\ lbs \left[\frac{30''}{12''/ft}\right] \frac{1}{\frac{\pi}{4}\left(2^2 - 1.375^2\right)}$$

$$E_{SPT} = 211.26\ \frac{ft\text{-}lbs}{in^2}$$

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CHECKED BY / DATE

PROJECT RGH ISS Stability

Sheet No 4 of 9

PROJECT NUMBER

CRETE CONSULTING, INC.

$E_{D \dot{\imath} M}$ using a 300 lb hammer, 30" drop

$$E_{DM} = 300 \left(\frac{30}{12}\right) \frac{1}{\frac{\pi}{4}\left(3.25^2 - 2.4^2\right)}$$

$$E_{DM} = 198.8 \ \frac{ft\text{-}lbs}{in^2}.$$

E_{CAL} using a 140# hammer, 30" drop:

$$E_{CAL} = 140 \left[\frac{30}{12}\right] \frac{1}{\frac{\pi}{4}\left(3^2 - 2.5^2\right)}$$

$$E_{CAL} = 162.05 \ \frac{ft\text{-}lbs}{in^2}$$

$\Rightarrow$

FROM	TO	Multiply blows by
SPT	SPT	1
D$\dot{\imath}$M (300#)	SPT	$\frac{198.80}{211.26} = 0.94$
CAL (140#)	SPT	$\frac{162.05}{211.26} = 0.77$

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CHECKED BY ______ DATE ______ PROJECT NUMBER ______

PROJECT RGH ISS Stability

CRETE CONSULTING, INC.

Apply the SPT correction factor to the boring logs depending on what was used to gather blow counts for the borings.

Average Soil Properties.

Marine Fill – typically described as a SP-SM fine to medium sand with varying amounts of silt. There were occasional silt layers within the SP-SM,

SPT $\bar{N} \hat{=} 8$ – loose – Medium Dense $R_d \hat{=} 25-50\%$

Ref 4, Fig 7 page 7.1 - 149 (Attachment 5)

for SP-SM, Rd 25-50%

γ_d from 95 - 109 pcf use $\gamma_d = 100$ pcf

ϕ from 29° to 32° use $\phi = 30°$

$c = 0$ $\gamma_m = 100 \times 1.2 = 120$ (x 20% MC)

Native Marine – Typically described as silty poorly graded Sand to Sandy Silt - SP-SM-ML.

SPT $\bar{N}$ = 20 med dense.

Attachment 5

γ_d from 95 to 110 pcf - use $\gamma_d = 100$ pcf

ϕ from 32 to 36° use $\phi = 34°$

$C = 0$ $\gamma_m = 120$ pcf

BY M. Byers DATE 10/9/18 Sheet No 6 of 9

CHECKED BY ______ DATE ______ PROJECT NUMBER ______

PROJECT RG H ISS STABILITY

CRETE CONSULTING, INC.

Calculation:

The excavation configuration only extends to elev +5 immediately adjacent to the ISS Mass. Also the top of the ISS Mass is set at +12 which includes the top of the ISS @ elev +9 and 3 feet of fluff that is anticipated to be developed as the Mass is mixed. The configuration is shown on Attachment 3.

A long reach excavator will be used to remove sediment from the shore. This excavator could sit atop the ISS mass at the edge of the mass.

Evaluate the surface load imposed by an excavator by looking at the weight of a suitable excavator and the footprint area of the excavator.

Attachment 6 shows a max gross vehicle weight of 96,700 lbs for a fully loaded CAT 340 with a long reach boom. The tracks are 10 feet wide and 8 feet long, so the pressure of a uniform load is:

$$\frac{96,700}{10 \times 8} = \boxed{1208 \text{ psf}}$$

BY MB DATE 4-4-2019 Sheet No 7 of 9

CHECKED BY DATE PROJECT NUMBER

PROJECT

CRETE CONSULTING, INC.

This load will be included in the stability evaluation as a distributed load with an intensity equal to

$1208 \times 1.5 = 1813$ psf. The 1.5 factor is added to account for higher loading while digging and for vibrations. It will be added to a 10 ft long section at the edge of the ISS mass. If this results in an unstable situation, the load will be moved away from the edge.

ISS Strength - the project specifications are targeting a UCS of 30psi for a minimum 28 day strength. See Att 4. Assume that there will be some inconsistencies in mixing, so the stability analyses will assume a UCS of 25psi

$$25 \frac{lbs}{in^2} \times \frac{144 in^2}{ft^2} \times \frac{1}{2} = 1,800 \text{ psf}$$ for soil cohesion for the ISS mass.

BY MB DATE 4-4-19 Sheet No 8 of 9

CHECKED BY DATE PROJECT NUMBER

PROJECT RGH ISS Stability - Revision

CRETE CONSULTING, INC.

RESULTS

Excavator load up to edge of ISS   Min FS = 1.665

5 ft set back for excavator   Min FS = 2.9

Min FS for no excavator load   FS = 7

Conclusions

A) Without any surface loading, the vertical face of the ISS that extends from elev 5 to elev 12 is predicted to stand nearly vertical. Recommend 1/2 H : 1 V as a maximum slope.

B) A 5 ft minimum setback is recommended from the edge of the ISS mass. The setback is recommended to account for digging vibrations that could result in local instability.

Results of the stability runs are attached as Attachment 7.

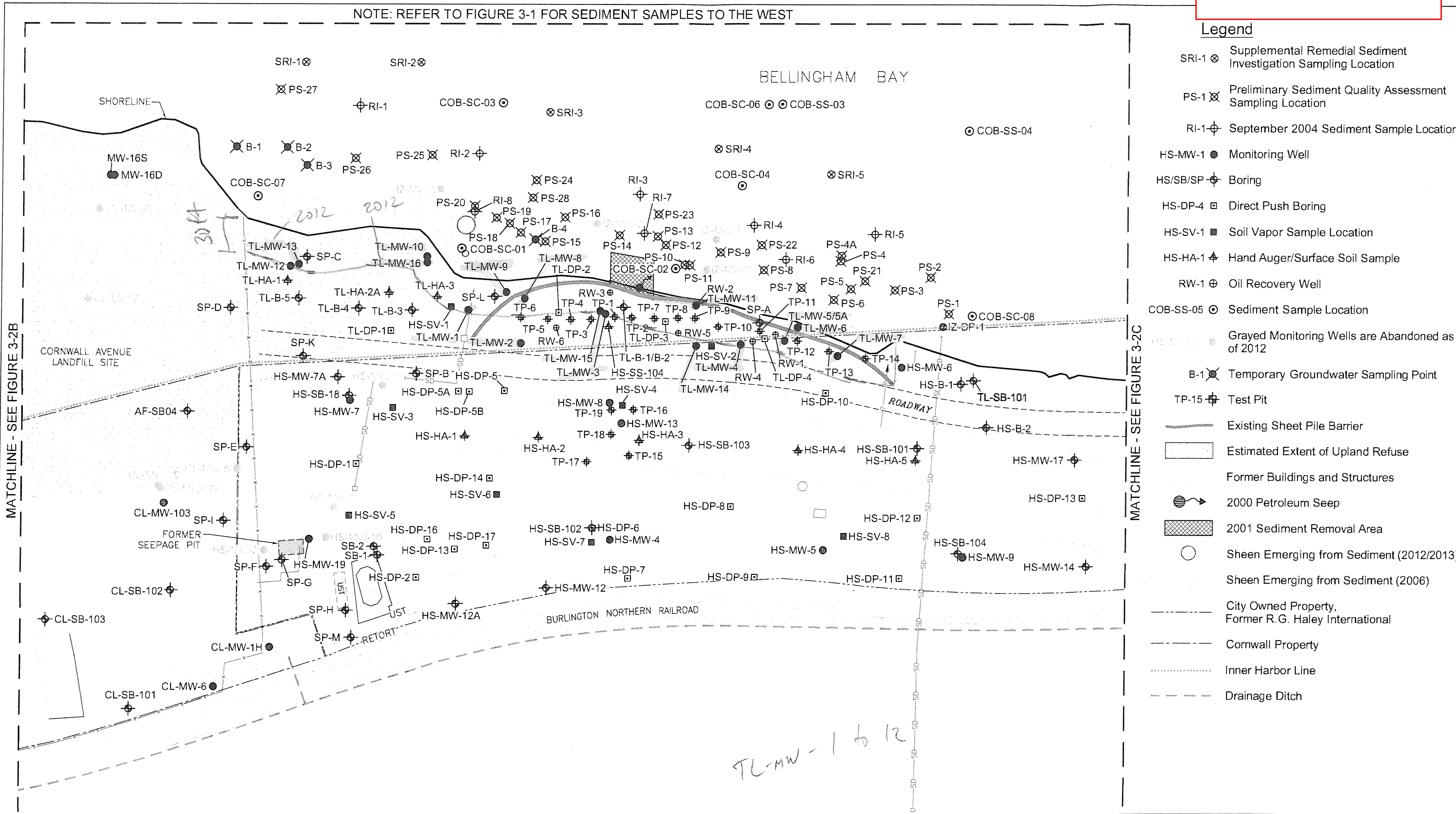
BY MB   DATE 4-4-19   Sheet No 9 of 9

CHECKED BY ______ DATE ______   PROJECT NUMBER ______

PROJECT RGH - ISS Stability - Revision

CRETE CONSULTING, INC.

ATTACHMENT 1



Notes

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Reference: CAD files RGHALEY_SVx_base20x.dwg" dated 7-17-2012, "R2000geoeng_haleybase50x" revised 07/28/04 by Pacific Survey & Engineering Inc., file "Fig3-8" dated August 2002 by Landau Associates, and files "027500201T1LM" and "027500201T1A" dated 03/29/04 by GeoEngineers.

All Previous and Supplemental RI Exploration Locations

R.G. Haley Site
Bellingham, Washington

GEOENGINEERS

Figure 3-2A

P:\0\0356114\06\CAD\RI_FS Figures\Figure 3-2A to 2C All Exploration Locations.dwg\TAB 3-2A Upland Central modified on Jan 28, 2015 - 3:11pm

SEAT:JL:TJM

ATTACHMENT 2

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% RETAINED ON NO. 200 SIEVE	SAND AND SANDY SOILS	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS
				SP	POORLY-GRADED SANDS, GRAVELLY SAND
	MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS, ROCK FLOUR, CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% PASSING NO. 200 SIEVE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS AND SILTS OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: Multiple symbols are used to indicate borderline or dual soil classifications

AD

SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
	AC	Asphalt Concrete
	CC	Cement Concrete
	CR	Crushed Rock/ Quarry Spalls
	TS	Topsoil/ Forest Duff/Sod

Groundwater Contact

Measured groundwater level in exploration, well, or piezometer

Groundwater observed at time of exploration

Perched water observed at time of exploration

Measured free product in well or piezometer

Graphic Log Contact

Distinct contact between soil strata or geologic units

Approximate location of soil strata change within a geologic soil unit

Material Description Contact

Distinct contact between soil strata or geologic units

Approximate location of soil strata change within a geologic soil unit

Sampler Symbol Descriptions

2.4-inch I.D. split barrel

Standard Penetration Test (SPT)

Shelby tube

Piston

Direct-Push

Bulk or grab

Blowcount is recorded for driven samplers as the number of blows required to advance sampler 12 inches (or distance noted). See exploration log for hammer weight and drop.

A "P" indicates sampler pushed using the weight of the drill rig.

Laboratory / Field Tests

%F	Percent fines
AL	Atterberg limits
CA	Chemical analysis
CP	Laboratory compaction test
CS	Consolidation test
DS	Direct shear
HA	Hydrometer analysis
MC	Moisture content
MD	Moisture content and dry density
OC	Organic content
PM	Permeability or hydraulic conductivity
PI	Plasticity index
PP	Pocket penetrometer
PPM	Parts per million
SA	Sieve analysis
TX	Triaxial compression
UC	Unconfined compression
VS	Vane shear

Sheen Classification

NS	No Visible Sheen
SS	Slight Sheen
MS	Moderate Sheen
HS	Heavy Sheen
NT	Not Tested

NOTE: The reader must refer to the discussion in the report text and the logs of explorations for a proper understanding of subsurface conditions. Descriptions on the logs apply only at the specific exploration locations and at the time the explorations were made; they are not warranted to be representative of subsurface conditions at other locations or times.

KEY TO EXPLORATION LOGS

GEOENGINEERS

FIGURE A-1

2" / 140# SPT

Project	Job Number	Location
Douglas Management	0275-002-00	DNR Property

Date Drilled	04/03/00	Logged By	JJO/SLM	Contractor	Cascade
Drill Method	4.25" ID HSA	Equipment	Truck Mounted CME 75	Drill Bit	
Sample Method	2" SPT/Split Spoon	Hammer Data	140 lb hammer/30" drop	X-coordinate: / Y-coordinate:	Not Determined / Not Determined
Total Depth (ft)	33	Elevation (ft)	15.57	Datum: / System:	City / Not Determined
Total Well Depth (ft)	19	Monument Elevation Stickup (ft)	Flush mounted	Casing Elevation Stickup (ft)	15.05

Well schematic notes: Steel flush monument in concrete; Bentonite seal; 2-inch Schedule 40 PVC well casing; 2/12 Lone Star sand backfill; 2-inch Schedule 40 PVC screen, 0.010-inch slot width; Base of well at 19.0 feet; Backfilled with Bentonite

Handwritten: TEST (at ~14.5 ft); MF ↑ (at ~21 ft); Native M. (at ~23 ft)

DEPTH IN FEET	Sample No.	Blows per foot	USCS Group Symbol	Material Description	Headspace Vapor (ppm)	Sheen
0			SM	Brown silty sand with gravel (loose, moist) (fill)		
			SP-SM	Brown fine to medium sand with silt and occasional gravel (loose, moist) (fill)		
	1	7			0	SS
5	2	9			0	SS
	3	2	SP-SM	Dark gray fine to medium sand with silt and a trace of shells (very loose, wet)	0	MS
10	4	3	SP	Dark gray fine sand with occasional large woody debris and shells (very loose, wet)	0	SS
	5	5			0	SS
15	6	18	SP	Dark gray fine to medium sand with occasional shells (medium dense, wet)	0	SS
	7	6	SP	Dark gray fine to medium sand with medium woody debris and occasional shells (loose, wet)	0	SS
20	8	7			0	NS
	9	16	SP	Dark gray fine to medium sand with occasional medium woody debris, shells and gravel (medium dense, wet)	0	NS
25	10	12	GP-GM	Dark gray sandy fine to coarse gravel with occasional shells and a trace of silt (medium dense, wet)	0	NS
	11	28	SM	Dark gray silty fine to medium sand with gravel and a trace of medium to large woody debris (medium dense to dense, wet)	0	NS
30	12	20	ML	Dark gray silt with gravel and occasional shells (medium dense, wet)		
	13	50/5"	ML	Dark gray silt with occasional gravel and shells (hard, moist to wet)	0	NS
35				Boring completed at a depth of 33.0 feet on 04/03/00. Ground water encountered at a depth of 7.0 feet during drilling.		
40						

MF $\bar{N}$ = 10.3
Native $\bar{N}$ = 19

GEI WELL LOG 027502TL.GPJ GEI_CORP.GDT 5/30/00 0275-002-00

GeoEngineers

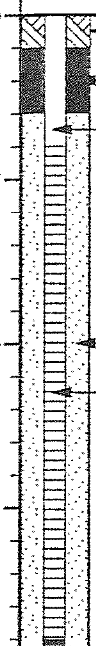
LOG OF MONITORING WELL TL-MW-1

FIGURE B-21

2.4" / 300#

Project	Job Number	Location
Douglas Management	0275-002-00	DNR Property

Date Drilled	04/04/00	Logged By	JJO/SLM	Contractor	Cascade
Drill Method	4.25" ID HSA	Equipment	Truck Mounted CME 75	Drill Bit	
Sample Method	2.4" ID Split Barrel	Hammer Data	300 lb Hammer/30" drop	X-coordinate: / Y-coordinate:	Not Determined / Not Determined
Total Depth (ft)	19	Elevation (ft)	17.07	Datum: / System:	City / Not Determined
Total Well Depth (ft)	19	Monument Elevation Stickup (ft)	Flush mounted	Casing Elevation Stickup (ft)	16.77



DEPTH IN FEET	Sample No.	Blows per foot	USCS Group Symbol	Material Description	Headspace Vapor (ppm)	Sheen	Other Tests And Notes
0			SP-SM	Brown fine to medium sand with silt, occasional gravel, brick and concrete (loose to medium dense, moist) (fill)			
5			ML	Bluish gray sandy silt with large woody debris (medium stiff, moist)			
				▽			
	1	15	SP	Dark brownish black fine to medium sand with occasional large woody debris and a trace of silt (medium dense, wet)	109	HS	
10			SP	Dark brownish black fine to medium sand with occasional medium to large woody debris and shells (medium dense, wet)			
	2	27			64	HS	
	3	16	MF		4	SS	
15			SP	Dark gray fine to medium sand with occasional shells, large woody debris and a trace of silt (very dense, wet)			
	4	50/4"			0	NS	
20				Boring completed at a depth of 19.0 feet on 04/04/00. Ground water encountered at a depth of 7.5 feet during drilling.			
25							
30							
35							

MF $\bar{N}$ = 18

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LOG OF MONITORING WELL TL-MW-2

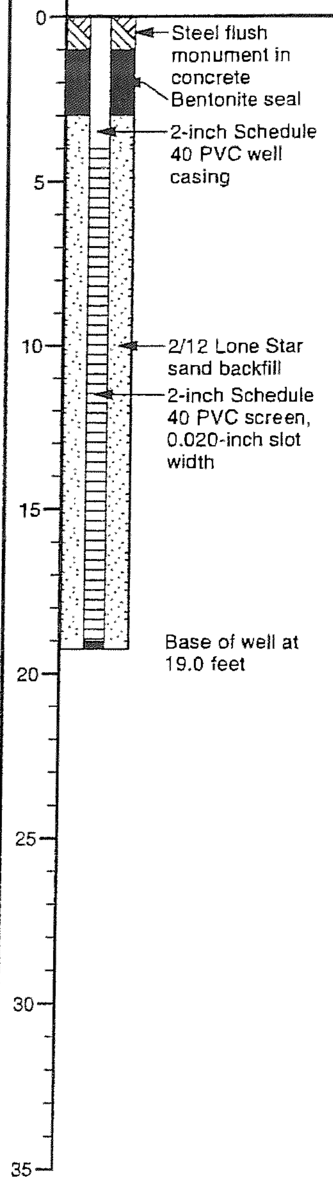
FIGURE B-22

No samples

Project	Job Number	Location
Douglas Management	0275-002-00	DNR Property

Date Drilled	04/04/00	Logged By	JJO/SLM	Contractor	Cascade
Drill Method	4.25" ID HSA	Equipment	Truck Mounted CME 75	Drill Bit	
Sample Method	N/A	Hammer Data	N/A	X-coordinate: / Y-coordinate:	Not Determined / Not Determined
Total Depth (ft)	19	Elevation (ft)	15.64	Datum: / System:	City / Not Determined
Total Well Depth (ft)	19	Monument Elevation Stickup (ft)	Flush mounted	Casing Elevation Stickup (ft)	15.29

DEPTH IN FEET	WELL SCHEMATIC	Sample No.	Blows per foot	Sample	Graphic Log	USCS Group Symbol	Material Description	Headspace Vapor (ppm)	Sheen	Other Tests And Notes	DEPTH IN FEET
0							Blind drill to 19.0 feet See Log of Boring B-1/B-2 for details				0
20							Boring completed at a depth of 19.0 feet on 04/04/00. Ground water encountered at a depth of 7.5 feet during drilling.				20



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LOG OF MONITORING WELL TL-MW-3

FIGURE B-23

GEI WELL LOG 02750271.GPJ GEI_CORP.GDT 5/30/00 0275-002-00

2.4"/300#

Project	Job Number	Location
Douglas Management	0275-002-00	DNR Property

Date Drilled	04/03/00	Logged By	JJO/SLM	Contractor	Cascade
Drill Method	4.25" ID HSA	Equipment	Truck Mounted CME 75	Drill Bit	
Sample Method	2.4" ID Split Barrel	Hammer Data	300 lb Hammer/30" drop	X-coordinate: / Y-coordinate:	Not Determined / Not Determined
Total Depth (ft)	19	Elevation (ft)	14.87	Datum: / System:	City / Not Determined
Total Well Depth (ft)	19	Monument Elevation Stickup (ft)	Flush mounted	Casing Elevation Stickup (ft)	14.62

DEPTH IN FEET	WELL SCHEMATIC	Sample No.	Blows per foot	USCS Group Symbol	Material Description	Headspace Vapor (ppm)	Sheen	Other Tests And Notes
0	Steel flush monument in concrete; Bentonite seal; 2-inch Schedule 40 PVC well casing; SPT N			SP-SM	Brown fine to medium sand with silt, occasional gravel, bricks and wood (medium dense, moist) (fill)			
5				SP	Dark gray fine to medium sand with occasional shells (loose, wet)			
	4	1	4			35	HS	
10	2/12 Lone Star sand backfill; 2-inch Schedule 40 PVC screen, 0.020-inch slot width			ML	Dark gray silt with shells and large woody debris (medium stiff, wet)			
		2	~~50/4"~~			0	NS	
	19	3	20	SP-SM	Dark gray fine to medium sand with silt and occasional shells (medium dense, wet)	0	SS	
15	ME							
				SP-SM	Dark gray fine to medium sand with silt, occasional shells and medium woody debris (very dense, wet)			
	Base of well at 19.0 feet	4	~~65/6"~~			0	NS	
20					Boring completed at a depth of 19.0 feet on 04/03/00. Ground water encountered at a depth of 7.0 feet during drilling.			
25								
30								
35	MF $\bar{N}$ = 11							

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LOG OF MONITORING WELL TL-MW-4

FIGURE B-24

GEI WELL LOG 0275027L.GPJ GEI_CORP.GDT 5/30/00 0275-002-00

(2.4"/300#)

Project	Job Number	Location
Douglas Management	0275-002-00	DNR Property

Date Drilled	04/03/00	Logged By	JJO/SLM	Contractor	Cascade
Drill Method	4.25" ID HSA	Equipment	Truck Mounted CME 75	Drill Bit	
Sample Method	2.4" ID Split Barrel	Hammer Data	300 lb Hammer/30" drop	X-coordinate: / Y-coordinate:	Not Determined / Not Determined
Total Depth (ft)	19	Elevation (ft)	14.07	Datum: / System:	City / Not Determined
Total Well Depth (ft)	19	Monument Elevation / Stickup (ft)	Flush mounted	Casing Elevation / Stickup (ft)	13.47

DEPTH IN FEET	WELL SCHEMATIC	Sample No.	Blows per foot	USCS Group Symbol	Material Description	Headspace Vapor (ppm)	Sheen	Other Tests And Notes
0	Steel flush monument in concrete; Bentonite seal; 2-inch Schedule 40 PVC well casing SPT			SP-SM	Brown fine to medium sand with silt and occasional gravel (loose to medium dense, moist) (fill)			
~7				SP-SM	Dark gray fine to medium sand with silt and occasional shells (loose, wet) ∇			
~9	4	1	4			62	HS	
10	2/12 Lone Star sand backfill 4							
~11	2-inch Schedule 40 PVC screen, 0.020-inch slot width	2	4	ML	Dark gray silt with fine sand, shells and medium woody debris (stiff, wet)	7	MS/HS	
~13.5	MF 19	3	20			0	MS	
~16	Matrix			SP-SM	Dark gray fine to medium sand with silt, occasional gravel and shells, and large woody debris (dense, wet)			
~18.5	34	4	36			0	SS	
19	Base of well at 19.0 feet				Boring completed at a depth of 19.0 feet on 04/03/00. Ground water encountered at a depth of 7.0 feet during drilling.			

MF $\bar{N}$ = 9

Matrix $\bar{N}$ = 34

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LOG OF MONITORING WELL TL-MW-5

FIGURE B-25

2.5'/ 140±

Project	Job Number	Location
Douglas Management	0275-002-00	Bellingham, WA

Date Drilled	03/07/01	Logged By	RMB	Contractor	Cascade
Drill Method	Hollow-Stem Auger	Equipment	Truck Mounted CME 55	Drill Bit	
Sample Method	2.5-inch ID Split Spoon	Hammer Data	140 lb. Hammer/30-inch Drop	Location	
Total Depth (ft)	20	Elevation (ft)	Not Measured	Datum: System:	
Total Well Depth (ft)	19	Monument Elevation (ft) Stickup (ft)	Flush mounted	Casing Elevation (ft) Stickup (ft)	13.50

DEPTH IN FEET	WELL SCHEMATIC	Sample No.	Blows per foot	Sample	Graphic Log	USCS Group Symbol	Material Description	Headspace Vapor (ppm)	Sheen	Other Tests And Notes	DEPTH IN FEET
0	Concrete surface seal; Bentonite seal; 2-inch Schedule 40 PVC well casing					ML	Gray and black silt with sand, occasional gravel (medium stiff, moist) (fill)				0
5	SPT N: 8	1	10	☒				∇ <100	MS		5
	2-inch Schedule 40 PVC screen, .010-inch slot width										
10	6	2	8	☒		ML	Gray silt, occasional shells (medium stiff, moist)	<100	NS		10
	MF										
15	2/12 Lonestar sand backfill						Refusal on wood				15
	5	3	6	☒			No recovery				
20							Boring completed at a depth of 20.0 feet on 03/07/01. Ground water encountered at a depth of 6.0 feet during drilling.				20
25											25
30											30
35											35

MF $\bar{N}$ = 6.9

Note: See Figure B-2 for explanation of symbols

GEI WELL LOG 027502TL.GPJ GEI_CORP.GDT 4/29/02 0275-002-00

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LOG OF MONITORING WELL TL-MW-5A

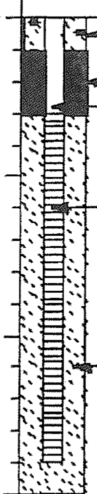
FIGURE B-3

2.5"/140#

Project	Job Number	Location
Douglas Management	0275-002-00	Bellingham, WA

Date Drilled	03/12/01	Logged By	RMB	Contractor	Cascade
Drill Method	Hollow-Stem Auger	Equipment	Truck Mounted CME 75	Drill Bit	
Sample Method	2.5-inch ID Split Spoon	Hammer Data	140 lb. Hammer/30-inch Drop	Location	
Total Depth (ft)	15	Elevation (ft)	Not Measured	Datum: System:	
Total Well Depth (ft)	14	Monument Elevation (ft) Stickup (ft)	Flush mounted	Casing Elevation (ft) Stickup (ft)	13.04

WELL SCHEMATIC



SPT N 18, 8, 8, 15

ME

DEPTH IN FEET	Sample No.	Blows per foot	Sample	USCS Group Symbol	Material Description	Headspace Vapor (ppm)	Sheen	Other Tests And Notes
0				SM	Brown silty fine to medium sand, occasional wood (loose, moist) (fill)			
	1	24	⊠			<100	NS	
	2	11	⊠	SM	Gray and green silty fine to medium sand (loose, moist) (fill)	<100	HS	
	3	10	⊠	WD	Brown sawdust (loose, moist) (fill)	<100	HS	
				WD	Brown sawdust with sand (loose, wet) (fill)			
	4	20	⊠		Free product appeared to be present in the sample matrix	<100	HS	
15					Boring completed at a depth of 15.0 feet on 03/12/01. Ground water encountered at a depth of 13.5 feet during drilling.			

Depth scale: 0, 5, 10, 15, 20, 25, 30, 35

MF $\bar{N}$ = 12

Note: See Figure B-2 for explanation of symbols

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LOG OF MONITORING WELL TL-MW-6

FIGURE B-4

GEI WELL LOG 027502TL.GPJ GEI_CORP.GDT 4/29/02 0275-002-00

2.5"/ 140#

Project	Job Number	Location
Douglas Management	0275-002-00	Bellingham, WA

Date Drilled	03/07/01	Logged By	RMB	Contractor	Cascade
Drill Method	Hollow-Stem Auger	Equipment	Truck Mounted CME 55	Drill Bit	
Sample Method	2.5-inch ID Split Spoon	Hammer Data	140 lb. Hammer/30-inch Drop	Location	
Total Depth (ft)	20	Elevation (ft)	Not Measured	Datum: System:	
Total Well Depth (ft)	19	Monument Elevation (ft) Stickup (ft)	Flush mounted	Casing Elevation (ft) Stickup (ft)	13.47

DEPTH IN FEET	WELL SCHEMATIC	Sample No.	Blows per foot	Sample	Graphic Log	USCS Group Symbol	Material Description	Headspace Vapor (ppm)	Sheen	Other Tests And Notes	DEPTH IN FEET
0	Concrete surface seal; Bentonite seal; 2-inch Schedule 40 PVC well casing					SM	Gray silty sand, occasional gravel (medium dense, moist) (fill)				0
		1		⊠				<100	NS		
						RK	Brown sandstone fragments, sawdust (very dense, dry) (fill)				
5		2	~~50/6"~~	⊠				<100	SS		5
	2-inch Schedule 40 PVC screen, .010-inch slot width					SP-SM	Wood in bit Gray fine to medium sand with silt, occasional wood (medium dense, wet)	∇			
10	9	3	12	⊠				<100	SS		10
						ML	Brown silt with sand, occasional wood (stiff, wet) (fill)				
15	2/12 Lonestar sand backfill						Wood encountered during drilling at 15.0 feet.				15
	11	4	14	⊠				<100	MS		
20							Boring completed at a depth of 20.0 feet on 03/07/01. Ground water encountered at a depth of 7.0 feet during drilling.				20
25											25
30	MF $\bar{N}$ = 10										30
35											35

Note: See Figure B-2 for explanation of symbols

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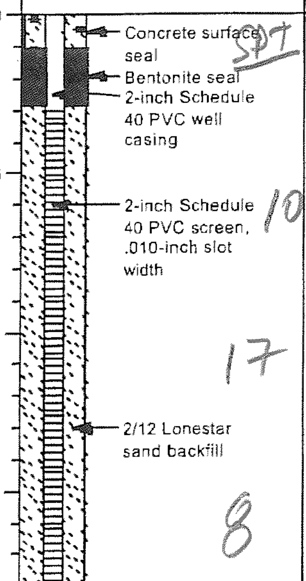
LOG OF MONITORING WELL TL-MW-7

FIGURE B-5

2.5'/140#

Project	Job Number	Location
Douglas Management	0275-002-00	Bellingham, WA

Date Drilled	03/07/01	Logged By	RMB	Contractor	Cascade
Drill Method	Hollow-Stem Auger	Equipment	Truck Mounted CME 55	Drill Bit	
Sample Method	2.5-inch ID Split Spoon	Hammer Data	140 lb. Hammer/30-inch Drop	Location	
Total Depth (ft)	18	Elevation (ft)	Not Measured	Datum: System:	
Total Well Depth (ft)	18	Monument Elevation (ft) Stickup (ft)	Flush mounted	Casing Elevation (ft) Stickup (ft)	15.92



Depth in Feet	Sample No.	Blows per foot	USCS Group Symbol	Material Description	Headspace Vapor (ppm)	Sheen	Other Tests And Notes
0			SM	Brown silty sand, occasional gravel (medium dense, moist) (fill)			
	1		SP-SM	Gray fine to medium sand with silt (loose, moist)	<100	SS	
5	2	13			<100	SS	
10	3	22			<100	MS	
			SM	Gray silty fine to medium sand, occasional shells (loose, wet)			
15	4	11			<100	NS	

Boring completed at a depth of 18.0 feet on 03/07/01.
Ground water encountered at a depth of 7.5 feet during drilling.

MF $\bar{N}$ = 12

Note: See Figure B-2 for explanation of symbols

GEI WELL LOG 027502TL.GPJ GEI CORP.GDT 4/29/02 0275-002-00

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LOG OF MONITORING WELL TL-MW-8

FIGURE B-6

2.5"/140#

Project	Job Number	Location
Douglas Management	0275-002-00	Bellingham, WA

Date Drilled	03/12/01	Logged By	RMB	Contractor	Cascade
Drill Method	Hollow-Stem Auger	Equipment	Truck Mounted CME 75	Drill Bit	
Sample Method	2.5-inch ID Split Spoon	Hammer Data	140 lb. Hammer/30-inch Drop	Location	
Total Depth (ft)	15	Elevation (ft)	Not Measured	Datum: System:	
Total Well Depth (ft)	14	Monument Elevation (ft) Stickup (ft)	Flush mounted	Casing Elevation (ft) Stickup (ft)	15.01

DEPTH IN FEET	WELL SCHEMATIC	Sample No.	Blows per foot	Sample	Graphic Log	USCS Group Symbol	Material Description	Headspace Vapor (ppm)	Sheen	Other Tests And Notes	DEPTH IN FEET
0	Concrete surface seal; Bentonite seal; 2-inch Schedule 40 PVC well casing					SM	Brown silty fine to medium sand, occasional gravel (very dense, moist) (fill)				0
		1	50/6"	☒			Note: Blows per foot overstated because of sampler obstruction	<100	NS		
5	2-inch Schedule 40 PVC screen, .020-inch slot width 12										5
		2	14	☒				<100	NS		
10	2/12 Lonestar sand backfill 28										10
		3	36	☒		SM	Gray silty fine to medium sand with occasional shells (medium dense, wet)	<100	NS		
		4	90	☒		SM-SP	Gray fine to medium sand with silt (dense, wet)	<100	SS		
15							Boring completed at a depth of 15.0 feet on 03/12/01. Ground water encountered at a depth of 10.0 feet during drilling.				15
20											20
25											25
30	MF $\bar{N}$ = 12										30
35	Native $\bar{N}$ = 28										35

Note: See Figure B-2 for explanation of symbols

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LOG OF MONITORING WELL TL-MW-9

FIGURE B-7

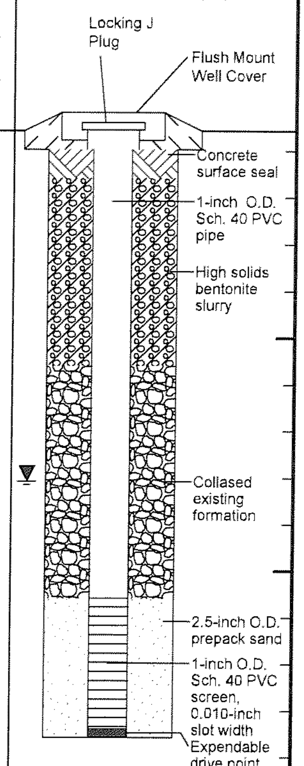
GEI WELL LOG 027502TL.GPJ GEI_CORP.GDT 4/29/02 0275-002-00

Direct Push

Date(s) Drilled	06/16/2004 - 06/16/2004	Logged By	RMB	Checked By	BES
Drilling Contractor	Cascade Drilling	Drilling Method	Direct Push	Sampling Methods	1.4" plastic sleve
Auger Data	3.25"	Hammer Data	N/A	Drilling Equipment	4' MicroCore
Total Depth (ft)	24	Ground Surface Elevation (ft)	14.42	Groundwater Elevation (ft. bgs)	6.92
Vertical Datum	City	Datum/ System	N/A N/A	Easting(x): Northing(y):	

Depth feet	SAMPLES: Recovered (in)	Blows/foot	Sub-Sample Sample Number	Testing	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID (ppm)
0	36	P			TS	Topsoil		
			0'-2'		SM	Dark brown silty fine to medium sand with occasional gravel and coal fragments (moist) (fill)	NS	--
			2'-4'		SP	Brown fine to medium sand with silt (moist) (fill)	NS	--
					AC	Concrete		
	24	P			SM	Brown silty fine sand (moist) (fill)		
5			4'-5.5'				NS	--
					WD	Wood fragments		
			5.5'-8'	CA	ML	Brown silt with sand and occasional gravel and brick fragments (moist) (fill)	SS	--
	18	P			SP	Gray fine to medium sand with occasional brick fragments (wet) (fill)		
10			8'-12'	CA	WD	Black saw dust with sand and occasional wood fragments (wet) (fill) (free product in sleeve)	MS	--
	24	P	12'-13'	CA			HS	--
15			13'-16'		SM	Gray silty fine to medium sand with occasional shells (wet) (fill)	MS	--
	36	P	16'-18'	CA			SS	--
			18'-20'		ML	Gray silt with sand and occasional shells (wet) (fill)	NS	--
20	24	P	20'-22'	CA	WD	Brown saw dust (wet) (fill)	NS	--
25						Boring completed at 24 feet below ground surface		

WELL CONSTRUCTION



All sample numbers are prefixed with TL-MW-10-(sample number)

V6_ENVWELL P:\0\0275002\GINT\027500201.GPJ GEIV6_1.GDT 3/14/06

LOG OF MONITORING WELL TL-MW-10

GEOENGINEERS

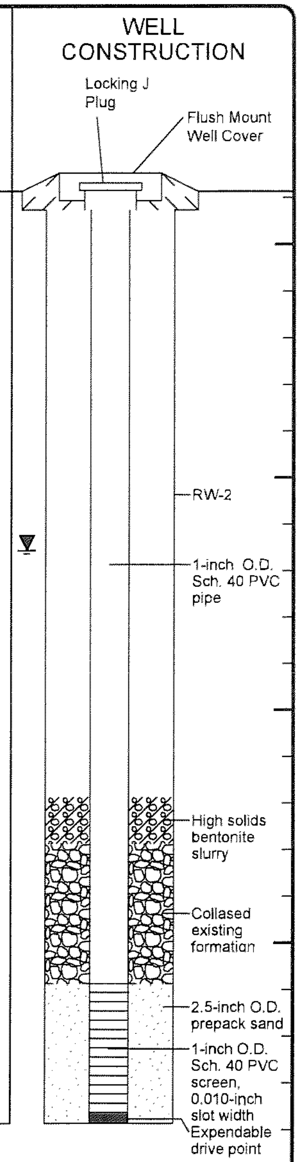
Project: R.G. Haley
Project Location: Bellingham
Project Number: 0275-002-01

FIGURE A-80
Sheet 1 of 1

DP

Date(s) Drilled	06/18/2004 - 06/18/2004	Logged By	RMB	Checked By	BES
Drilling Contractor	Cascade Drilling	Drilling Method	Direct Push	Sampling Methods	1.4" plastic sleve
Auger Data	3.25"	Hammer Data	N/A	Drilling Equipment	4' MicroCore
Total Depth (ft)	20	Ground Surface Elevation (ft)	16.13	Groundwater Elevation (ft. bgs)	8.43
Vertical Datum	City	Datum/ System	N/A N/A	Easting(x): Northing(y):	

Depth feet	SAMPLES Interval	Recovered (in)	Blows/foot	Sub-Sample Sample Number	Testing	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID (ppm)
0							C	RW- 2 Well Casing		
14		36	P				ML	Gray silt with occasional shell fragments (wet) (fill)		
15				14'-17'					SS	--
17				17'-18'			WD	Brown coarse saw dust with occasional wood fragments (wet) (fill)	SS	--
18		5	P							
19				18'-20'				Grades to with gray sand	SS	--
20								Refusal on wood at 20 feet below ground surface		



All sample numbers are prefixed with TL-MW-11-(sample number)
Boring and well were completed inside RW-2

LOG OF MONITORING WELL TL-MW-11

GEOENGINEERS

Project: R.G. Haley
Project Location: Bellingham
Project Number: 0275-002-01

FIGURE A-81
Sheet 1 of 1

V6_ENVWELL P:\0\0275002\GINT\027500201.GPJ GEIV6_1.GDT 3/14/06

2.4-inch ID Split barrel / 300#

Drilled	Start 7/3/2012	End 7/3/2012	Total Depth (ft) 46.3	Logged By RNM / Checked By CEB	Driller Cascade Drilling, L.P.	Drilling Method Hollow-stem Auger

Hammer Data	300 (lbs) / 30 (in) Drop	Drilling Equipment	Truck-mounted CME 75
Surface Elevation (ft)	15.06	Top of Casing Elevation (ft)	14.60
Vertical Datum	NAVD88		
Easting (X)	639332.11	Horizontal Datum	NAD83/98
Northing (Y)	1239940.56		

DOE Well I.D.: BHE 984
A 2 (in) well was installed on 7/3/2012 to a depth of 46.1 (ft).

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
7/3/2012	10.0	5.1

Notes: Auger Data: 4¼-inch I.D.

FIELD DATA

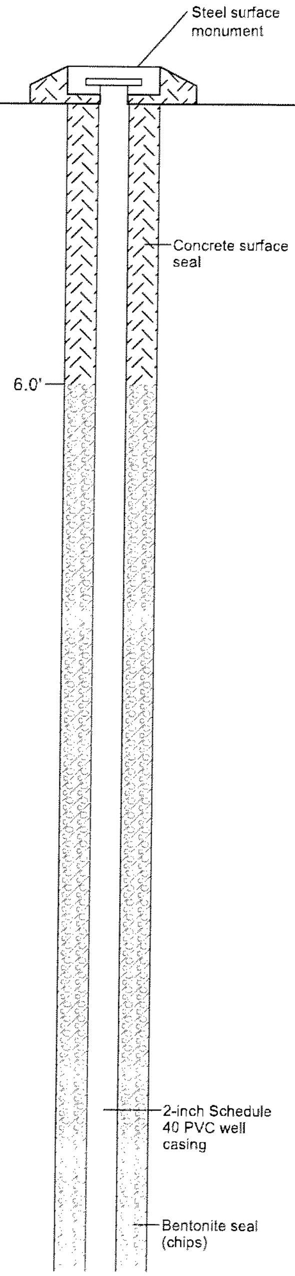
Elevation (feet)	Depth (feet)	Recovered (in)	Blows/foot	Collected Sample	Sample Name	Water Level	Group Classification	Sheen	Headspace Vapor (ppm)
	0			SPT N			SM		
		12	8	7				NS	<1
		16	10	9			ML / SM	NS	<1
10	5	18	10	9			ML	NS	<1
		8	50/6"	—			SM / Wood	NS	<1
		0	5	5					
5	10	6	5	5	TL-MW-13-11-12 CA	▽	SM	HS	74
		16	10	9			SP-SM	HS	58
		18	17	16			SM	MS	23
0	15	6	4	4			SP-SM	NS	2
		2	4	4				SS	<1
		10	10	9	TL-MW-13-18-19 CA			NS	<1
-5	20	6	12	11				NS	<1
		10	14		TL-MW-13-23-24 CA		Wood	NS	25
	25								

↑ ISS

MATERIAL DESCRIPTION

- SM: Silty sand with gravel (50/30/20), fine to medium sand, fine to coarse gravel, dark brown, moist, loose
- ML: Sandy silt with gravel (50/30/20), fine to medium sand, fine to coarse gravel, glass fragments, dark brown with orange mottling, moist, medium stiff
- SM: Silty sand with gravel (50/30/20), fine to medium sand, fine to coarse gravel, brown occasional wood fragments and black glassy gravel, moist, loose
- ML: Sandy silt (60/40), fine sand, green-gray with orange mottling, white shell fragments, moist, medium stiff
- SM: Silty sand (60/40), fine to medium sand, trace fine gravel, gray with orange mottling, occasional fresh brown wood fragments, moist, dense
- Wood: Fresh brown wood fragments
- SM: Silty sand (70/20/10 gravel), fine to medium sand, fine gravel, dark brown to black, occasional wood fragments and shavings, wet, loose, brown NAPL on sampler, staining and petroleum-like odor
- SP-SM: Poorly graded sand with silt (90/10), fine to medium sand, gray, occasional brown wood fragments, wet, medium dense, petroleum-like odor
- SM: Silty sand with gravel (45/35/20), fine to medium sand, fine to coarse gravel, dark brown to black, occasional brown to black wood fragments and shavings, wet, medium dense
- SP-SM: Poorly graded sand with gravel and silt (70/20/10), fine to medium sand, fine to coarse gravel, dark gray, occasional wood, shell and brick fragments, wet, loose
- Wood: Wood fragments and shavings, tan, orange-brown and dark brown

WELL LOG



Note: Please see Figure A-1 for explanation of symbols

Log of Monitoring Well TL-MW-13

GEOENGINEERS

Project: R.G. Haley Site
Project Location: Bellingham, Washington
Project Number: 0356-114-06

Elevation (feet)	Depth (feet)	Recovered (in)	Blows/foot	Collected Sample	Sample Name	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	25	6	7	7				SS	1
		2	7	7				NS	<1
-15	30	18	2	2		SM	Silty sand (65/35), fine sand, gray, occasional brown fresh wood fragments, wet, very loose	SS	2
						Wood	Wood fragments and shavings, 35% silt, dark brown, occasional white shell fragments, moist	NS	<1
						SM			
		18	13	12	TL-MW-13-33-34 CA	SP-SM	Silty sand (65/30/5 shells), fine to medium sand, white shell fragments, gray, wet, very loose	NS	<1
							Poorly graded sand with silt (90/10), fine to medium sand, gray, occasional brown wood fragments and white shell fragments, wet, medium dense		
-20	35	18	10	9				NS	<1
		17	15	14		SM	Silty sand (80/20), fine to medium sand, gray, occasional white shell fragments, wet, medium dense	NS	<1
-25	40	6	15	14		SP-SM	Poorly graded sand with gravel (55-75 sand/15-35 gravel/10 silt), fine to medium sand, fine to coarse gravel, gray, occasional brown wood fragments and white shell fragments, wet, medium dense	NS	3
		6	21	20				NS	1
-30	45	6	50/6"		TL-MW-13-45-46 CA			NS	<1
		2	50/3"			GM	Silty gravel with sand (50/30/20), fine to coarse gravel, fine to medium sand, gray to brown, moist, very dense	NS	<1
						Siltstone	Gray to brown siltstone		

MF

Native

WELL LOG

42.0'

43.1' — 2/12 sand backfill

2-inch Schedule 40 PVC screen, 0.01-inch slot width

46.1' — 2-inch Schedule 40 PVC slip cap (screwed on)

46.3'

MF $\bar{N}$ = 6

Native $\bar{N}$ = 14

Note: Please see Figure A-1 for explanation of symbols

Seattle: Date:2/4/13 Path:C:\USERS\CVOSS\DESKTOP\035611406 HALEY.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

Log of Monitoring Well TL-MW-13 (continued)

GEOENGINEERS

Project: R.G. Haley Site

Project Location: Bellingham, Washington

Project Number: 0356-114-06

2.4" ID split barrel/300#

Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	7/2/2012	7/2/2012	32.3	RNM	CEB	Cascade Drilling, L.P.	Hollow-stem Auger

Hammer Data	300 (lbs) / 30 (in) Drop	Drilling Equipment	Truck-mounted CME 75
Surface Elevation (ft)	14.41	Top of Casing Elevation (ft)	
Vertical Datum	NAVD88		
Easting (X)	639521.3	Horizontal Datum	NAD83/98
Northing (Y)	1240226.18		

DOE Well I.D.: BHE 980
A 2 (in) well was installed on 7/2/2012 to a depth of 30.3 (ft).

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
7/2/2012	8.0	6.4

Notes: Auger Data: 4¼-inch I.D.

FIELD DATA

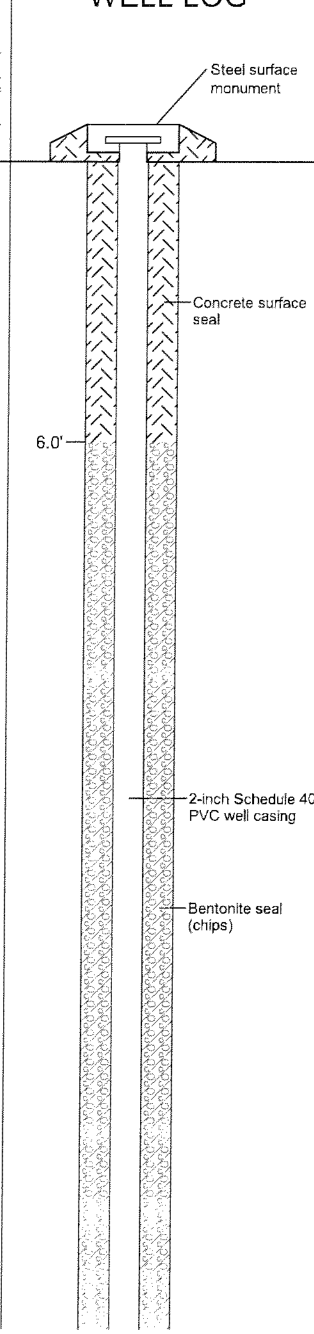
Recovered (in)	Blows/foot	Collected Sample	Sample Name	Sheen	Headspace Vapor (ppm)
12	11	16		SS	<1
0	11	10		SS	<1
2	9	9		SS	<1
1	13	12		MS	5
4	6	6		HS	100
16	10	9	TL-MW-14-11-12 CA	HS	85
18	5	5		HS	11
17	9	9		HS	70
14	12	11	TL-MW-14-15-16 CA	MS	43
8	7	7		MS	16
6	50/3"	—		SS	1
3	50/3"	—		NS	<1
12	50/3"	—		NS	3
0	4	4			
16	4	4	TL-MW-14-23-24 CA	NS	2
12	10	9		NS	<1

MATERIAL DESCRIPTION

Group Classification	Material Description
SP-SM	Brown poorly graded sand with silt and gravel (70/20/10), fine to medium sand, fine to coarse gravel, dark brown, occasional wood fragments, moist, medium dense
ML	Sandy silt (65/30/5 gravel), fine to coarse gravel, fine sand, brown, moist, medium stiff
GP	Poorly graded gravel with sand and silt (70/25/5), fine gravel, fine to medium sand, dark brown, moist, loose
GP-GM	Poorly graded gravel with sand and silt (50/40/10), fine gravel, fine to medium sand, dark brown, moist to wet, medium dense, staining and petroleum-like odor
SM	Silty sand with gravel (60/25/15), fine to medium sand, fine to coarse gravel, dark brown to black, occasional wood fragments, wet, loose, staining and petroleum-like odor
SP-SM	Poorly graded sand with gravel and silt (70/20/10), fine to medium sand, fine to coarse gravel, dark gray, occasional brown fresh wood fragments and white shell fragments, wet, medium dense, staining and petroleum-like odor
SM	Silty sand (80/20), fine to medium sand, dark gray, occasional brown to black wood fragments and white shell fragments, wet, loose, staining and petroleum-like odor
SP-SM	Poorly graded sand with silt (90/10), fine to medium sand, dark gray, occasional wood fragments and shavings and shell fragments, wet, medium dense, petroleum-like odor
SM	Silty sand (80/20), fine to medium sand, gray, occasional wood and shell fragments, wet, loose, petroleum-like odor
Wood	Wood fragments and shavings, orange-brown, tan and black fresh to decomposed, wet, occasional white shell fragments
SM	Silty sand (75 - 85% sand; 15 - 25% silt), fine to medium sand, gray, occasional brown fresh wood fragments and white shell fragments, wet, loose

T
ISS
ME

WELL LOG



Note: Please see Figure A-1 for explanation of symbols

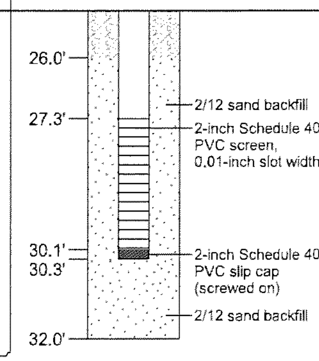
Log of Monitoring Well TL-MW-14

GEOENGINEERS

Project: R.G. Haley Site
Project Location: Bellingham, Washington
Project Number: 0356-114-06

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	25		8	10	9						NS	<1
MF			10	15	14	TL-MW-14-28-29					NS	<1
-15 Matri	30		10	34	32				ML	Sandy silt (60/30/10 gravel), fine sand, fine to medium gravel, gray, occasional brown fresh wood fragments and white shell fragments, moist, very stiff	NS	<1
			3	65/3"	-				Siltstone	Gray siltstone	NS	<1

WELL LOG



MF $\bar{N}$ = 8

Matri $\bar{M}$ = 32

Note: Please see Figure A-1 for explanation of symbols

Log of Monitoring Well TL-MW-14 (continued)

GEOENGINEERS

Project: R.G. Haley Site
Project Location: Bellingham, Washington
Project Number: 0356-114-06

2.4" ID split barrel/300#

Drilled	Start 6/27/2012	End 6/27/2012	Total Depth (ft) 32.3	Logged By RNM Checked By CEB	Driller Cascade Drilling, L.P.
Drilling Method	Hollow-stem Auger				
Hammer Data	300 (lbs) / 30 (in) Drop	Drilling Equipment	Truck-mounted CME 75		
Surface Elevation (ft)	15.4	Top of Casing Elevation (ft)	14.85		
Vertical Datum	NAVD88				
Easting (X)	639484.496	Horizontal Datum	NAD83/98		
Northing (Y)	1240148.15				

DOE Well I.D.: BHE 981
A 2 (in) well was installed on 6/27/2012 to a depth of 30.3 (ft).

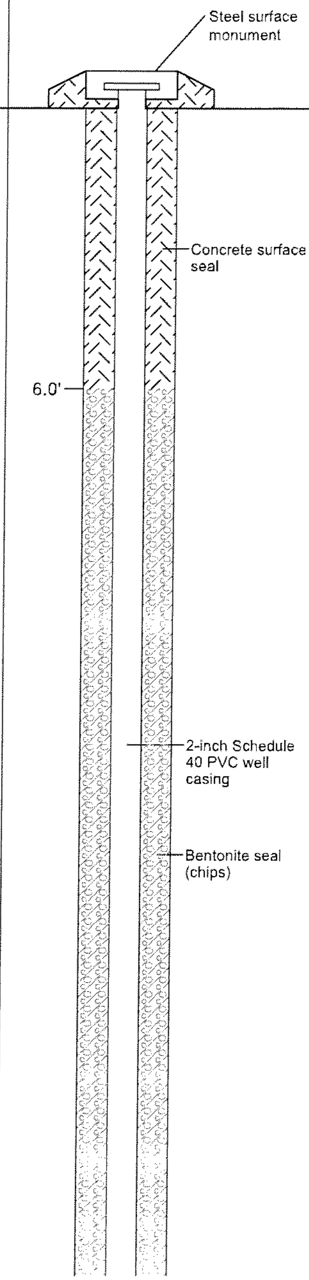
Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
6/28/2012	6.0	9.4

Notes: Auger Data: 4¼-inch I.D.

Elevation (feet)	Depth (feet)	Recovered (in)	Blows/foot	Collected Sample (SPT B)	Sample Name	Water Level	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
15	0	16	10	9			SP-SM	Poorly graded sand with gravel and silt (50/40/10), fine to medium sand, fine to coarse gravel, dark brown, loose, moist	SS	<1
		9	10	9					SS	<1
		12	12	11			SM	Silty sand with gravel (50/30/20), dark brown with orange mottling, dark brown, moist, medium dense, occasional orange-red brick fragments	SS	<1
		15	22	21					SS	<1
10	5									
		18	27	25		▽	SP-SM / Wood	Poorly graded sand with silt (80/10/10), fine to medium sand, fine gravel, brown to black with orange mottling, moist, medium dense, occasional brown wood fragments	NS	<1
		2	12	11				Wood fragments, stained and petroleum-like odor	HS	7
		3	9	8	TL-MW-15-10-11 CA		SM / Wood	Silty sand (50/35/10 gravel/5 wood), fine to medium sand, fine gravel, dark brown, moist to wet, medium dense, staining and petroleum-like odor	MS	<1
5	10								HS	2
		13	9	8				Wood fragments, dark brown, wet, stained and petroleum-like odor	HS	8
							SP-SM	Poorly graded sand with silt (90/10), medium sand, wet, loose, occasional white shell fragments and brown wood fragments, staining and petroleum-like odor		
		18	17	16	TL-MW-15-14-15 CA		SP		SS	1
		12	8	8				Poorly graded sand (95/5% silt), medium sand, wet, medium dense, occasional white shell and brown wood fragments	SS	<1
0	15									
		14	44	—					NS	1
		13	6	6					NS	<1
-5	20						Wood	Tan to orange-brown fresh wood shavings, moist to wet, loose		
		6	6	6	TL-MW-15-22-23 CA				NS	<1
		0	6	6						
	25									

JSS.

WELL LOG



Note: Please see Figure A-1 for explanation of symbols

Log of Monitoring Well TL-MW-15

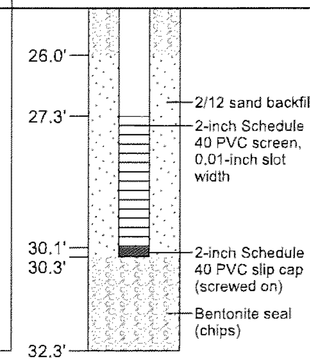
GEOENGINEERS

Project: R.G. Haley Site
Project Location: Bellingham, Washington
Project Number: 0356-114-06

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
-10	25											
			18	6	6						NS	<1
									SP-SM	Poorly graded sand with gravel and silt (75/15/10), medium sand, fine to coarse gravel, gray, wet, loose, occasional white shell fragments and brown to tan fresh wood fragments		
			12	17	16	TL-MW-15-29-30			SM	Silty sand with gravel (60/20/20), fine to medium sand, fine to coarse gravel, wet, medium dense, occasional shell fragments	NS	<1
									ML	Silt with sand (80/20), fine sand, trace fine gravel, gray, moist, stiff		
-15	30											
			15	52/9"	—				SM	Silty sand (55/25/20 gravel), fine to coarse sand, fine to coarse gravel, gray, moist to wet, medium dense, occasional white shell fragments	NS	<1
									ML	Silt (80/10 sand/10 gravel), fine sand, fine gravel, gray, moist, stiff		
									Siltstone	Siltstone		

MF
T
Native

WELL LOG



MF $\bar{N}$ = 6

Native $\bar{N}$ = 16.

Note: Please see Figure A-1 for explanation of symbols

Log of Monitoring Well TL-MW-15 (continued)

GEOENGINEERS

Project: R.G. Haley Site
Project Location: Bellingham, Washington
Project Number: 0356-114-06

2.4" ID Split barrel /300#

Drilled	Start	End	Total Depth (ft)	33.3	Logged By	RNM	Driller	Cascade Drilling, L.P.	Drilling Method	Hollow-stem Auger
	6/28/2012	6/28/2012			Checked By	CEB				

Hammer Data	300 (lbs) / 30 (in) Drop	Drilling Equipment	Truck-mounted CME 75	DOE Well I.D.: BHE 979 A 2 (in) well was installed on 6/28/2012 to a depth of 32.7 (ft).	
Surface Elevation (ft)	13.53	Top of Casing Elevation (ft)	12.99		
Vertical Datum	NAVD88				
Easting (X)	639409.89	Horizontal Datum	NAD83/98	Groundwater Date Measured: 6/28/2012	Depth to Water (ft): 6.0 / Elevation (ft): 7.5
Northing (Y)	1240016.04				

Notes: Auger Data: 4¼-inch I.D.

FIELD DATA

Depth (feet)	Recovered (in)	Blows/foot	Sample Name	Sheen	Headspace Vapor (ppm)
0	15	10		SS	<1
				SS	<1
	4	5		NS	<1
	6	8		NS	<1
5	6	9		NS	<1
				NS	<1
	2	4		MS	<1
	6	4	TL-MW-16-8-9 CA	MS	1
	1	6		MS	1
10	4	2		MS	1
	12	8		MS	7
	16	5	5 TL-MW-16-14-15 CA	MS	<1
15	18	8	7	SS	<1
	17	3	3	NS	<1
	18	5	5 TL-MW-16-20-21 CA	SS	<1
20	<1	5	5		
	0	4	4		
25	15	3	3	NS	<1

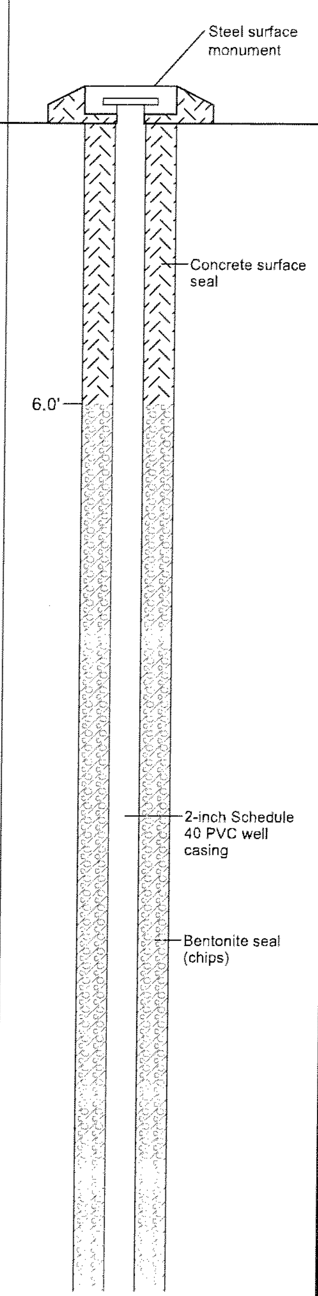
Elevation (feet): 10, 5, 0, -5, -10

↑ TSS

MATERIAL DESCRIPTION

Group Classification	Material Description
SM	Silty sand with gravel (50/25/25), fine to medium sand, fine gravel, black to dark brown, trace brown fresh and black decomposed wood fragments and shavings, moist, loose, staining
ML	Sandy silt (70/30), fine sand, trace fine gravel, brown with orange mottling, moist, medium stiff
SM	Silty sand (60/40), fine to medium sand, trace fine gravel, tan to brown with orange mottling, moist, loose
Wood	Wood, orange-brown fresh fragments and black to dark brown fragments and shavings in fine to medium sand (~10%) and silt (~10%), trace fine gravel, staining and petroleum-like odor throughout
SM	Silty sand (60/30/10 gravel), fine to medium sand, fine gravel, dark gray, wet, loose, occasional wood fragments and white shell fragments, staining and petroleum-like odor
SP-SM	Poorly graded sand with silt (90/10), fine to medium sand, dark gray, wet, loose, occasional white shell fragments (15-17 feet), petroleum-like odor (14-15 feet)
SM	Silty sand (70/30), fine to medium sand, gray, wet, very loose, occasional white shell fragments
ML	Sandy silt (70/30), fine sand, gray, wet, soft, occasional white shell fragments, sulfur-like odor
SP-SM	Poorly graded sand with silt (90/10), fine to medium sand, gray, wet, loose, occasional white shell fragments
Wood	Wood fragments and shavings, tan to brown, wet, with 10% fine to medium sand and 5% silt from 24.5-25 feet

WELL LOG



Note: Please see Figure A-1 for explanation of symbols

Log of Monitoring Well TL-MW-16

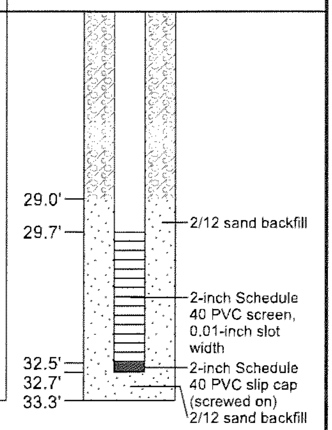
GEOENGINEERS

Project: R.G. Haley Site
Project Location: Bellingham, Washington
Project Number: 0356-114-06

Seattle: Date:2/4/13 Path:C:\USERS\CVOSS\DESKTOP\0356114\06 HALEY.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	25								SM	Silty sand (70/30), fine to medium sand, gray, wet, very loose, occasional white shell fragments and wood fragments		
MF / Native			18	22	20				SM	-with 10% fine to coarse gravel (70/20/10), at 27.5 feet; medium dense, no wood fragments		
15			18	37	35				SP	Poorly graded sand with gravel (75/20/5 silt), fine to medium sand, fine to coarse gravel, gray, wet, dense, occasional white shell fragments	NS	<1
	30											
			18	36	34	TL-MW-16-30-31 CA			SP-SM	Poorly graded sand with gravel and silt (70/20/10), gray, wet, dense, occasional white shell fragments	NS	<1
			9	65/9"		TL-MW-16-31-32 CA			SP	Poorly graded sand (85/10 gravel/5 silt), medium sand, fine gravel, gray, wet, dense	NS	<1
									Siltstone	Siltstone		

WELL LOG



MF $\bar{N}$ = 5

Native $\bar{N}$ = 30

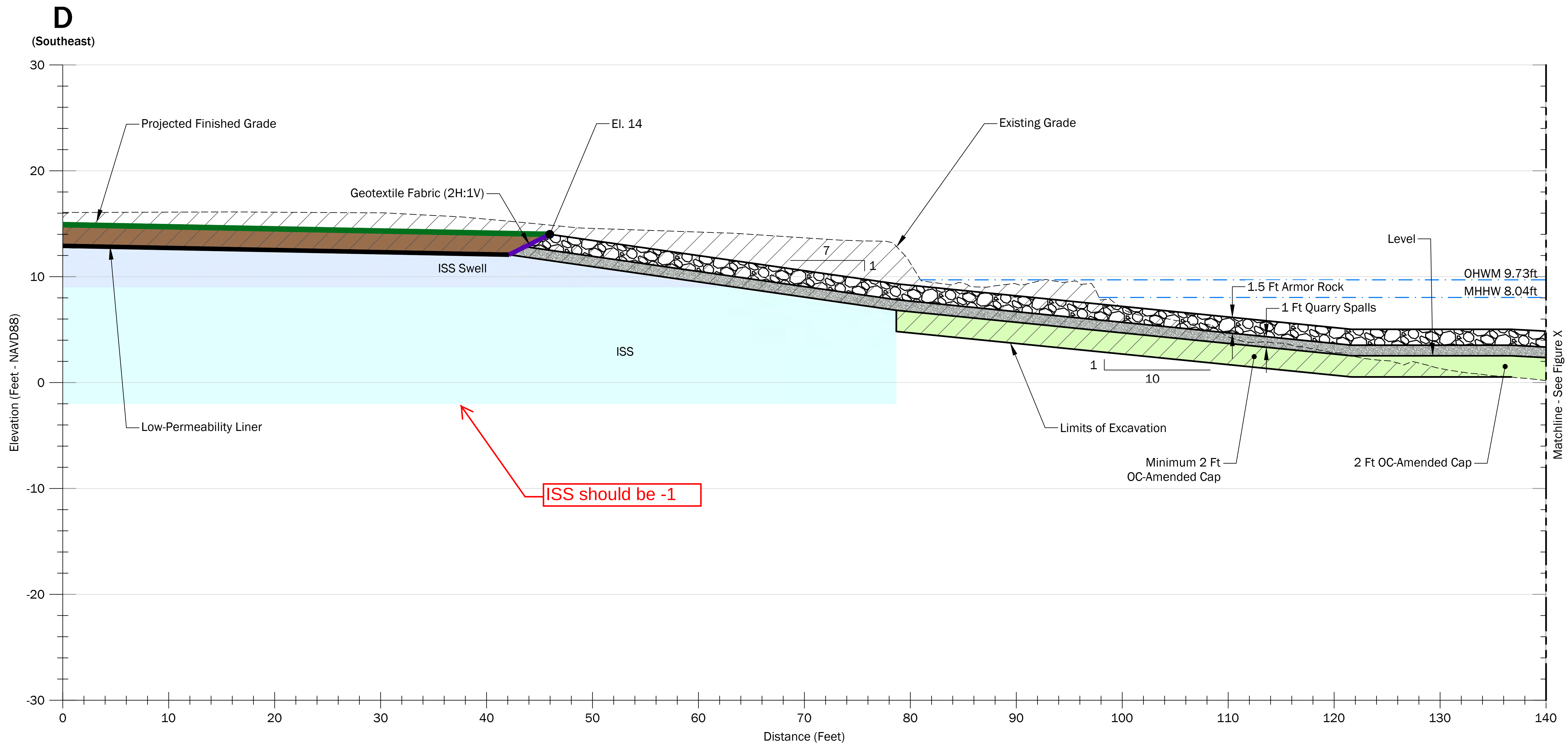
Note: Please see Figure A-1 for explanation of symbols

Log of Monitoring Well TL-MW-16 (continued)

GEOENGINEERS

Project: R.G. Haley Site
Project Location: Bellingham, Washington
Project Number: 0356-114-06

ATTACHMENT 3



Legend

	Approximate Extent of ISS
	Estimated ISS Swell
	Upland Low-Permeability Vegetated Capping System
	Organophilic Clay (OC) Amended Sand Cap
	Excavation

	Average (D50) Grain Size
Armor Rock	0.7 Feet
Quarry Spalls	4 Inch

March 8, 2019
In-Process Draft,
Subject to Revision

10 0 10
Horizontal Scale in Feet
10 0 10
Vertical Scale in Feet
Vertical Exaggeration: 1X

Cross-Section D-D'
(1 of 3)

R.G. Haley Site
Bellingham, Washington

GEOENGINEERS

Figure X

P:\0\0356114\CAD\08\Task 300 Engineering Design\Grading [Upland and Marine]\035611408_F0X_Cross-Sections.dwg TAB:DD - 1 Date Exported: 03/08/19 - 13:34 by tmichaud

CRETE DRAFT BENCH SCALE REPORT

ATTACHMENT 4

Tables

Table 2 Untreated Physical Properties Characterization

Testing Parameter (1)	Test Method	Unit	Untreated Material	
			ISS South	ISS North
Particle Size Distribution	ASTM D422			
Gravel		%	5.2	4.5
Sand		%	77.4	70.2
Silt		%	12.1	16.3
Clay		%	5.3	9.0
Sample Description	USCS ASTM D2487		Black Silty Sand	Black Silty Sand
Sample Classification	USCS ASTM D2487		SM	SM
Loss on Ignition	ASTM D2974			
Average ASTM Moisture Content		%	64.66	39.25
Average Loss on Ignition @ 440°C		%	9.18	3.61
Material pH	EPA Method 9045	S.U.	6.44	6.26
Atterberg Limits	ASTM D4318 Method B			
Plastic Limit			NP	NP
Liquid Limit			N/A	N/A
Plasticity Index			N/A	N/A
Soluble Sulfate	ASTM C1580-15	g SO_4/ kg soil	35.43	15.65

Notes:
Sample color determined by the Munsell Soil Color Charts
%= Percent
S.U. = Standard Units
g SO_4/kg soil = grams of Sulfate per kilogram pf soil
(1) = Testing was performed on homogenized material screen through a 0.5 inch sieve
NP = Nonplastic
N/A = Not Applicable
USCS = Unified Soil Clasification System

Table 3 Untreated Analytical Results

Parameter	Units	ISS South			ISS North			ISS North Spiked			ISS North Spiked (Duplicate)		
		Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL	Results	Qual.	MDL
Polycyclic Aromatic Hydrocarbons (PAH) 8270D													
1-Methylnaphthalene	mg/Kg	**4.47**	E	0.0140	**24.8**	E	0.0699	**226**	E	0.416	**141**	E	0.422
2-Methylnaphthalene	mg/Kg	**1.88**		0.0160	**34.8**	E	0.0799	**359**	E	0.475	**218**	E	0.482
Acenaphthene	mg/Kg	**0.550**		0.00998	**1.62**	F1	0.00998	**14.4**		0.297	**9.38**		0.301
Acenaphthylene	mg/Kg	**0.106**		0.00899	ND		0.00899	**1.69**		0.0134	**4.07**		0.0136
Anthracene	mg/Kg	**0.124**		0.00899	**0.342**	F1	0.00899	**1.80**		0.0134	**1.30**		0.0136
Benzo[a]anthracene	mg/Kg	ND		0.0150	**0.0878**		0.0150	**0.350**		0.0223	**0.315**		0.0226
Benzo[a]pyrene	mg/Kg	ND		0.0120	**0.0661**	J	0.0120	**0.223**		0.0178	**0.191**		0.0181
Benzo[b]fluoranthene	mg/Kg	**0.0450**	J	0.0120	**0.0693**		0.0120	**0.276**		0.0178	**0.218**		0.0181
Benzo[g,h,i]perylene	mg/Kg	ND		0.00899	**0.0390**	J	0.00899	**0.139**		0.0134	**0.127**		0.0136
Benzo[k]fluoranthene	mg/Kg	ND		0.0140	**0.0470**	J	0.0140	**0.125**		0.0208	**0.0910**	J	0.0211
Chrysene	mg/Kg	ND		0.00899	**0.102**		0.00899	**0.575**		0.0134	**0.510**		0.0136
Dibenz(a,h)anthracene	mg/Kg	ND		0.00699	ND		0.00699	ND		0.0104	ND		0.0105
Fluoranthene	mg/Kg	**0.0658**	J	0.00899	**0.240**		0.00899	**1.10**		0.0134	**0.975**		0.0136
Fluorene	mg/Kg	**0.317**		0.0120	**1.32**	F1	0.0120	**13.3**		0.356	**8.24**		0.362
Indeno[1,2,3-cd]pyrene	mg/Kg	ND		0.00998	ND		0.00998	**0.101**		0.0149	**0.0793**	J	0.0151
Naphthalene	mg/Kg	**0.105**		0.00899	**1.09**	F1	0.00899	**7.73**		0.267	**5.16**		0.0136
Phenanthrene	mg/Kg	**0.597**		0.00899	**3.74**		0.0449	**33.0**		0.267	**21.0**		0.271
Pyrene	mg/Kg	**0.122**		0.0120	**0.438**		0.0120	**3.31**		0.0178	**2.64**		0.0181
North West - Total Petroleum Hydrocarbon Diesel (NW-TPH Diesel)													
C10-C24	mg/Kg	**452**	B	6.98	**859**	B	13.8	**18,700**		293	**9,580**		300
C24-C40	mg/Kg	**220**		9.98	**35.7**		1.98	**599**		29.3	**372**		30.0
Pentachlorophenol 8151A													
Pentachlorophenol	mg/Kg	**0.0488**		0.0217	**2.17**		1.08	**20.2**		3.21	**20.1**		6.52

Notes:
mg/Kg = milligram per kilogram
MDL = Method Detect Limit
E = Result exceeded calibration range
J = Results is less than the Reporting Limit but greater than or equal to the Method Detection Limit and the concentration is an approximate value
B = Compound was found in the blank and sample
F1 = Matrix Spike (MS) and/or Matrix Spike Duplicate (MSD) Recovery is outside acceptance limits

Table 4 Preliminary Screening Evaluation Results

KEMRON Sample Number	Untreated Material Type	Reagent Type and Identification Number(s)	Reagent Addition % by Wet Soil wt.	Water Addition % by Reagent wt.	Pocket Penetrometer (TSF)			Cure Day	Unconfined Compressive Strength ASTM D2166				Predicted Strength		Axial Strain
					1 Day	3 Day	5 Day		Moisture Content (%)	Bulk Density (lb/ft³)	Dry Density (lb/ft³)	UCS (lb/in²)	28-Day UCS (lb/in²)	Final UCS (lb/in²)	(%)
0600-001	ISS South	Richmond Type I PC #1047/NewCem GGBFS 100 #1049	5.25/2.25	80.0	2.00	3.75	4.25	7	61.66	97.3	60.2	17.5	23.3	26.8	2.8%
0600-002	ISS South	Richmond Type I PC #1047/NewCem GGBFS 100 #1049	7.00/3.00	80.0	2.25	4.50	>4.50	7	63.91	98.3	60.0	24.6	32.8	**37.7**	2.2%
0600-003	ISS South	Richmond Type I PC #1047/NewCem GGBFS 100 #1049	4.00/8.00	80.0	2.50	3.75	>4.50	7	64.81	96.8	58.7	28.0	37.3	**42.9**	1.9%
0600-004	ISS South	Richmond Type I PC #1047/Centralia Class F Fly Ash #1048	6.00/1.50	80.0	2.75	3.00	3.75	7	65.27	97.2	58.8	15.4	20.5	23.6	3.6%
0600-005	ISS South	Richmond Type I PC #1047/Centralia Class F Fly Ash #1048	8.00/2.00	80.0	2.50	>4.50	>4.50	7	64.52	98.2	59.7	22.2	29.6	**34.0**	2.8%
0600-006	ISS South	Richmond Type I PC #1047/Centralia Class F Fly Ash #1048	4.00/10.00	80.0	1.00	1.75	2.00	7	61.42	102.1	63.2	9.2	12.3	14.1	3.5%
0600-007	ISS South	Richmond Type I PC #1047/Tacoma LKD #919	4.00/10.00	80.0	0.00	0.75	1.25	7	58.93	100.0	62.9	7.2	9.6	11.0	5.9%
0600-008	ISS South	LeHigh Type II/V PC #1042/NewCem GGBFS #1049	4.00/8.00	80.0	1.75	3.75	>4.50	7	62.87	97.2	59.7	31.5	42.0	**48.3**	2.0%
0600-009	ISS South	Richmond Type I PC #1047/NewCem GGBFS 100 #1049/Wyo-Ben Hydrogel Bentonite #807	5.25/2.25/1.00	125.0	0.50	1.50	2.00	7	75.58	92.5	52.7	11.2	14.9	17.2	3.7%
0600-010	ISS North Spiked	Richmond Type I PC #1047/NewCem GGBFS 100 #1049	5.25/2.25	80.0	1.50	3.00	4.25	7	43.47	107.2	74.7	20.0	26.7	**30.7**	1.9%
0600-011	ISS North Spiked	Richmond Type I PC #1047/NewCem GGBFS 100 #1049	7.00/3.00	80.0	2.00	4.50	>4.50	7	46.18	105.4	72.1	29.8	39.7	**45.7**	2.3%
0600-012	ISS North Spiked	Richmond Type I PC #1047/NewCem GGBFS 100 #1049	4.00/8.00	80.0	0.25	2.75	4.00	7	44.64	105.1	72.7	21.4	28.5	**32.8**	2.8%
0600-013	ISS North Spiked	Richmond Type I PC #1047/Centralia Class F Fly Ash #1048	6.00/1.50	80.0	1.50	2.00	3.25	7	44.04	106.1	73.7	19.2	25.6	29.4	2.9%
0600-014	ISS North Spiked	Richmond Type I PC #1047/Centralia Class F Fly Ash #1048	8.00/2.00	80.0	2.50	>4.5	>4.50	7	45.31	105.8	72.8	30.2	40.3	**46.3**	2.3%
0600-015	ISS North Spiked	Richmond Type I PC #1047/Centralia Class F Fly Ash #1048	4.00/10.00	80.0	0.00	0.75	1.25	7	47.14	106.1	72.1	8.7	11.6	13.3	3.0%
0600-016	ISS North Spiked	Richmond Type I PC #1047/Tacoma LKD #919	4.00/10.00	80.0	0.00	0.00	0.00	7	46.07	107.8	73.8	3.9	5.2	6.0	8.4%
0600-017	ISS North Spiked	LeHigh Type II/V PC #1042/NewCem GGBFS #1049	4.00/8.00	80.0	1.00	2.75	>4.50	7	42.18	106.3	74.8	27.1	36.1	**41.6**	1.2%
0600-018	ISS North Spiked	Richmond Type I PC #1047/NewCem GGBFS 100 #1049/Wyo-Ben Hydrogel Bentonite #807	5.25/2.25/1.00	125.0	0.25	2.75	3.25	7	49.15	103.3	69.3	19.1	25.5	29.3	3.5%

Notes:
% = Percent
lb/ft³ = pounds per cubic foot
lb/in² = pounds per square inch
UCS = Unconfined Compressive Strength
TSF = Tons per square foot
Wt= Weight
GGBFS = Grangulated Ground Blast Furnace Slag
PC = Portland Cement
LKD = Lime Kiln Dust

Density of ISS treated samples – 18 total.

$\bar{\gamma}_b = 102$ pcf.

$\bar{\gamma}_d = 66$ pcf

$\bar{mc} = 54\%$

Table 5 Summary of Advanced Screening

		ISS South				ISS North Spiked			
Reagent Type and Identification Number(s)	Reagent Addition % by Wet Soil wt.	KEMRON Sample ID	Axial Strain (%) 28 day	UCS (lb/in^2) 28 day	Hydraulic Conductivity (cm/sec) 28 day	KEMRON Sample ID	Axial Strain (%) 28 day	UCS (lb/in^2) 28 day	Hydraulic Conductivity (cm/sec) 28 day
	Performance Critiera			**> 30 psi**	**< 1.0E-5**			**> 30 psi**	**< 1.0E-5**
Richmond Type I PC #1047/NewCem GGBFS 100 #1049	4.00/8.00	0600-019	1.32	61.0	2.4E-07	0600-024	1.53	51.5	1.4E-07
Richmond Type I PC #1047/NewCem GGBFS 100 #1049/Wyo-Ben Hydrogel Bentonite #807	6.00/8.00/1.00	0600-022	1.42	84.9	8.0E-08	0600-027	1.17	79.8	3.5E-08
The following mixtures were not carried forward for leachability testing									
Richmond Type I PC #1047/NewCem GGBFS 100 #1049/Wyo-Ben Hydrogel Bentonite #807	5.00/10.00/1.00	0600-020	1.40	80.1	1.5E-08	0600-025	1.17	44.1	Not Tested
Richmond Type I PC #1047/NewCem GGBFS 100 #1049/Wyo-Ben Hydrogel Bentonite #807	8.00/4.00/1.00	0600-023	1.41	57.6	Not Tested	0600-028	1.27	65.8	9.8E-08
Richmond Type I PC #1047/NewCem GGBFS 100 #1049	6.00/6.00	0600-021	1.28	73.2	Not Tested	0600-026	1.03	59.9	Not Tested

Notes:
% = Percent
K = hydraulic conductivity cm/sec - Performace Critieria of 1x10-5 cm/sec
lb/in^2 = pounds per square inch
UCS = Unconfined Compressive Strength - Performace Critiera of 30 lb/in2, based on site data of SPT logs of 10 to 24 psi.
TSF = Tons per square foot
GGBFS = Grangulated Ground Blast Furnace Slag
PC = Portland Cement

Attachment 5

NAVFAC 7.01

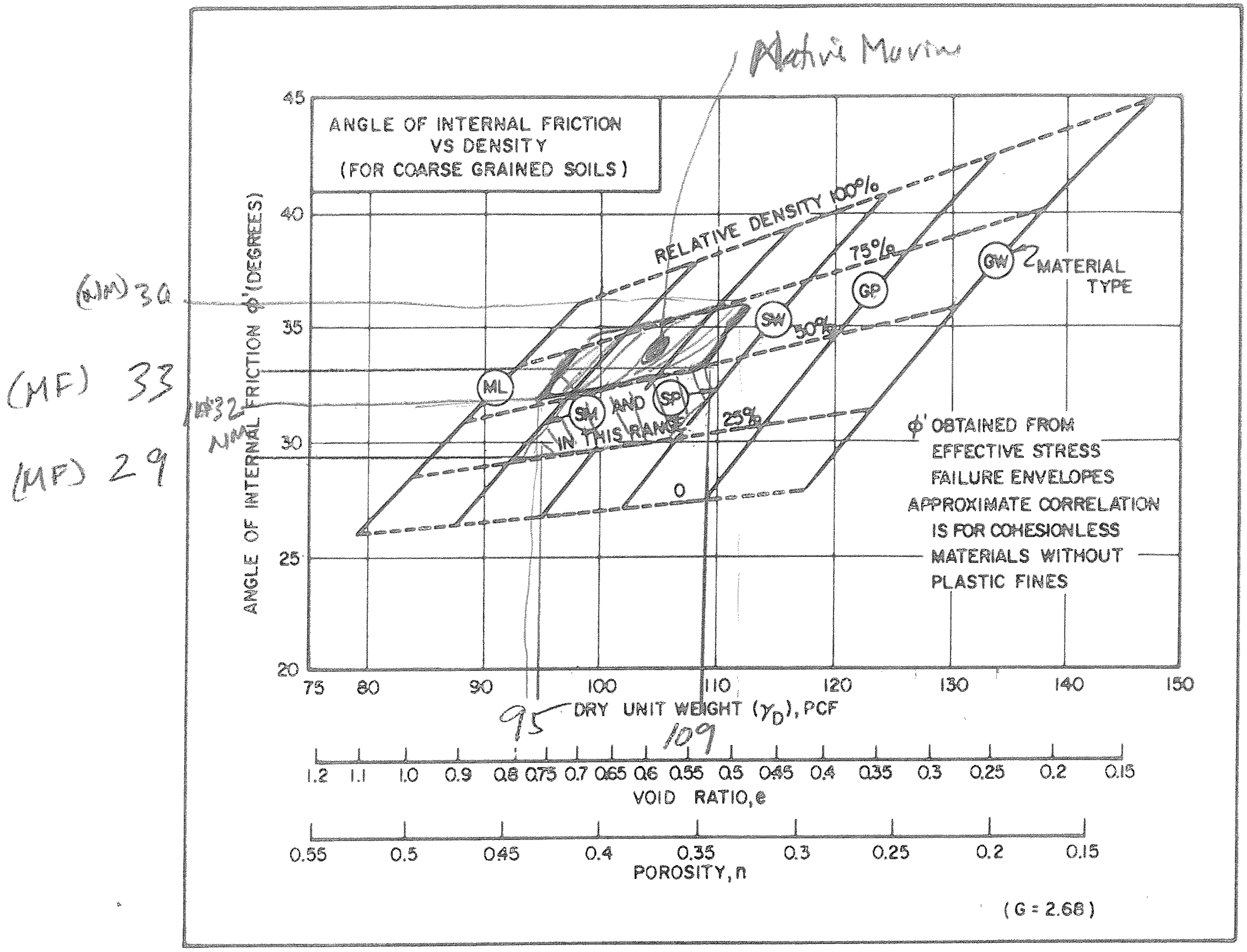


FIGURE 7
Correlations of Strength Characteristics for Granular Soils

$\gamma_M = (1 + mc)\,\gamma_d$

Native Marine

γ_d from 95 to 110

use $\gamma_d = 100$

ϕ from 32 to 36

use $\phi = 34°$

MF Soil

γ_d from 95 to 109

use 100

ϕ from 29 to 33

use 30°

ATTACHMENT 6

340

Hydraulic Excavator

Not all configurations shown available in all regions. Consult your Cat® dealer for details.

Technical Specifications

Engine

Engine Model	C9.3B	
Net Power – ISO 9249	232 kW	311 hp
Net Power – SAE J1349	232 kW	311 hp
Gross Power – ISO 14396	234 kW	314 hp
Bore	115 mm	5 in
Stroke	149 mm	6 in
Displacement	9.3 L	568 in^3

- Meets U.S. EPA Tier 4 Final, EU Stage V, and Japan 2014 emission standards.
- Recommended for use up to 3300 m (10,830 ft) altitude with engine power derate above 2300 m (7,550 ft).
- Net power advertised is the power available at the flywheel when the engine is equipped with fan, air cleaner, muffler, and alternator.
- Rating at 1,800 rpm.

Engine rpm

Operation	1,550 rpm
Travel	1,800 rpm

Swing Mechanism

Swing Speed	8.75 rpm	
Maximum Swing Torque	144 kN·m	106,228 lbf-ft

Weights

Operating Weight	39 700 kg	87,600 lb

- HD High Wide undercarriage, Reach boom, R3.2DB (10'6") stick, GD 2.27 m^3 (2.97 yd^3) bucket, 600 mm (24") HD triple grouser shoes, and 7.56 mt (16,700 lb) counterweight.

Operating Weight	40 000 kg	88,200 lb

- Long undercarriage, Straight boom, R3.2DB (10'6") stick, GD 2.27 m^3 (2.97 yd^3) bucket, 600 mm (24") HD triple grouser shoes, and 9.0 mt (19,800 lb) counterweight.

Operating Weight	41 300 kg	91,100 lb

- HD High Wide undercarriage, Mass boom, M2.55TB (8'4") stick, SD 2.41 m^3 (3.15 yd^3) bucket, 600 mm (24") DG shoes, and 7.56 (16,700 lb) counterweight.

Operating Weight	43 900 kg	96,700 lb

- HD High Wide undercarriage, LRE boom, LRE7.1B1 (23'4") stick, GD 0.93 m^3 (1.22 yd^3) bucket, 850 mm (33") triple grouser shoes, and 10.35 mt (22,800 lb) counterweight.

Track

Standard Track Shoes Width	600 mm	24 in
Optional Track Shoes Width	700 mm	28 in
Optional Track Shoes Width	850 mm	33 in
Number of Shoes (each side)	49	
Number of Track Rollers (each side)	8	
Number of Carrier Rollers (each side)	2	

CAT®

340 Hydraulic Excavator Specifications

Drive

Maximum Gradeability	35°/70%	
Maximum Travel Speed	4.7 km/h	2.9 mph
Maximum Drawbar Pull	295 kN	66,206 lbf

Hydraulic System

Main System – Maximum Flow – Implement	558 L/min (279 × 2 pumps)	147 gal/min (74 × 2 pumps)
Maximum Pressure – Equipment – Implement	35 000 kPa	5,076 psi
Maximum Pressure – Equipment – Lift Mode	38 000 kPa	5,511 psi
Maximum Pressure – Travel	35 000 kPa	5,076 psi
Maximum Pressure – Swing	29 400 kPa	4,264 psi
Boom Cylinder – Bore	150 mm	6 in
Boom Cylinder – Stroke	1440 mm	57 in
Stick Cylinder – Bore	170 mm	7 in
Stick Cylinder – Stroke	1738 mm	68 in
DB Bucket Cylinder – Bore	150 mm	6 in
DB Bucket Cylinder – Stroke	1151 mm	45 in
TB Bucket Cylinder – Bore	160 mm	6 in
TB Bucket Cylinder – Stroke	1356 mm	53 in

Service Refill Capacities

Fuel Tank Capacity	600 L	158.5 gal
Cooling System	40 L	10.5 gal
Engine Oil (with filter)	32 L	8.5 gal
Swing Drive	18 L	4.8 gal
Final Drive (each)	8 L	2.1 gal
Hydraulic System (including tank)	373 L	98.5 gal
Hydraulic Tank (including suction pipe)	161 L	42.5 gal
DEF Tank	80 L	21.1 gal

Standards

Brakes	ISO 10265:2008
Cab/FOGS	ISO 10262:1998
Cab/ROPS	ISO 12117-2:2008

Sound Performance

ISO 6395:2008 (external)	105 dB(A)
ISO 6396:2008 (inside cab)	73 dB(A)

- Hearing protection may be needed when operating with an open operator station and cab (when not properly maintained or doors/windows open) for extended periods or in a noisy environment.

Air Conditioning System

The air conditioning system on this machine contains the fluorinated greenhouse gas refrigerant R134a (Global Warming Potential = 1430). The system contains 1.00 kg of refrigerant, which has a CO_2 equivalent of 1.430 metric tonnes.

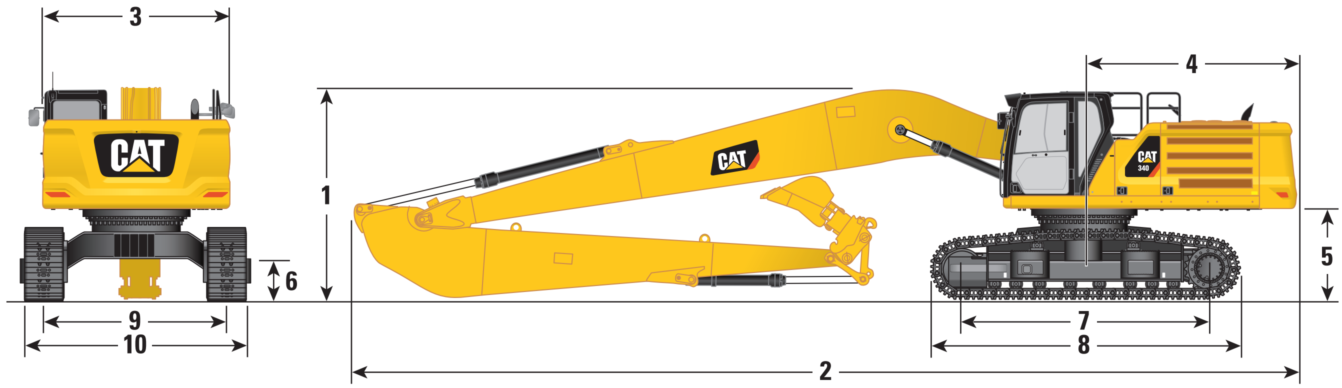
Operating Weights and Ground Pressures

	600 mm (24") Double Grouser Shoes		600 mm (24") HD Triple Grouser Shoes		700 mm (28") Triple Grouser Shoes		850 mm (33") Triple Grouser Shoes	
	Weight	Ground Pressure	Weight	Ground Pressure	Weight	Ground Pressure	Weight	Ground Pressure
	kg (lb)	kPa (psi)	kg (lb)	kPa (psi)	kg (lb)	kPa (psi)	kg (lb)	kPa (psi)
9.0 mt (19,800 lb) Counterweight + Long Undercarriage Base Machine								
Straight Boom + R3.9 m DB (12'10") Stick + 2.27 m³ (2.97 yd³) GD Bucket			40 200 (88,500)	74.8 (10.9)	39 900 (87,900)	74.2 (10.8)	40 700 (89,800)	65.0 (9.4)
Straight Boom + R3.2 m DB (10'6") Stick + 2.27 m³ (2.97 yd³) GD Bucket			40 000 (88,200)	74.5 (10.8)	39 700 (87,500)	73.9 (10.7)	40 600 (89,400)	64.7 (9.4)
9.0 mt (19,800 lb) Counterweight + Long Narrow Undercarriage Base Machine								
Straight Boom + R3.9 m DB (12'10") Stick + 2.27 m³ (2.97 yd³) GD Bucket			40 000 (88,300)	74.6 (10.8)	39 700 (87,600)	74.0 (10.7)		
Straight Boom + R3.2 m DB (10'6") Stick + 2.27 m³ (2.97 yd³) GD Bucket			39 900 (87,900)	74.3 (10.8)	39 600 (87,200)	73.7 (10.7)		
7.56 mt (16,700 lb) Counterweight + HD High Wide Undercarriage Base Machine								
Reach Boom + R3.2 m DB (10'6") Stick + 2.27 m³ (2.97 yd³) GD Bucket	39 800 (87,800)	74.2 (10.8)	39 700 (87,600)	74.0 (10.7)	39 400 (86,900)	73.4 (10.6)	40 300 (88,800)	64.3 (9.3)
Reach Boom + R2.8 m DB (9'2") Stick + 2.27 m³ (2.97 yd³) GD Bucket	39 700 (87,600)	74.0 (10.7)	39 600 (87,300)	73.8 (10.7)	39 300 (86,700)	73.2 (10.6)	40 200 (88,600)	64.1 (9.3)
Mass Boom + M2.55 m TB (8'4") Stick + 2.41 m³ (3.15 yd³) SD Bucket	41 300 (91,100)	77.0 (11.2)	41 200 (90,900)	76.8 (11.1)	40 900 (90,200)	76.2 (11.1)	41 800 (92,100)	66.7 (9.7)
10.35 mt (22,800 lb) Counterweight + HD High Wide Undercarriage Base Machine								
Long Reach Boom + LRE7.1 m B1 (23'4") Stick + 0.93 m³ (1.22 yd³) GD Bucket			43 300 (95,000)	80.7 (11.7)	43 000 (94,800)	80.1 (11.6)	43 900 (96,700)	70.0 (10.2)

All operating weights include a 90% fuel tank with 75 kg (165 lb) operator.

Dimensions

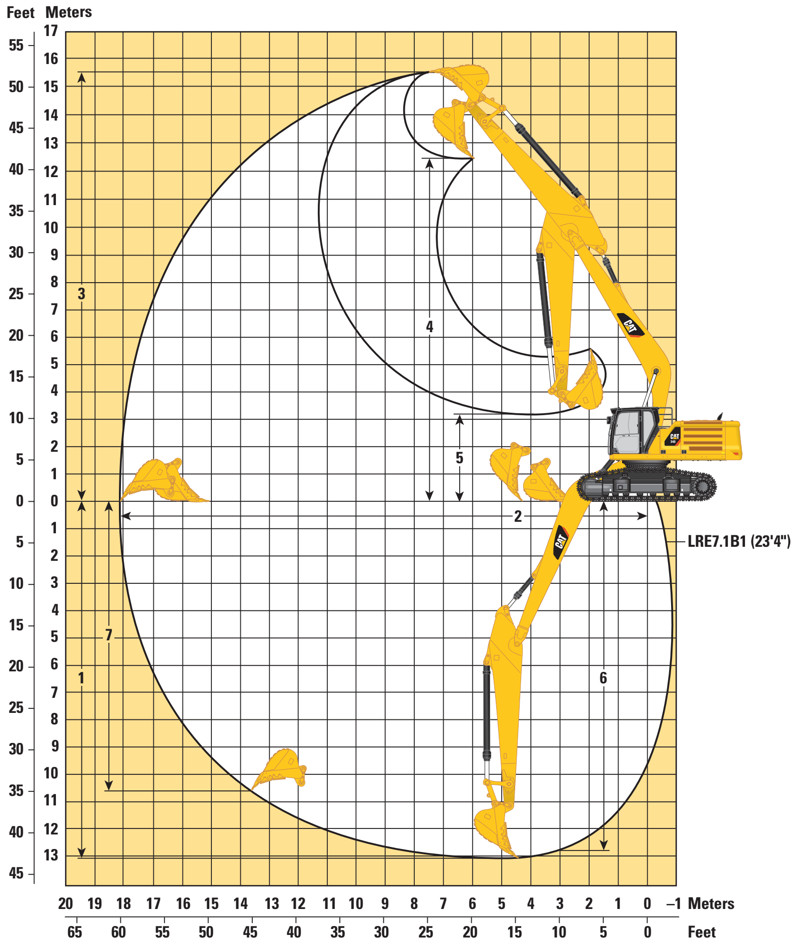
All dimensions are approximate and may vary depending on bucket selection.



Boom Option	**LRE Boom 10.6 m (34'9")**	
Stick Option	**LRE Stick LRE7.1B1 (23'4")**	
1 Machine Height:		
Cab Height	3400 mm	11.2 ft
FOGS Height	3540 mm	11.6 ft
Handrails Height	3390 mm	11.1 ft
With Boom/Stick/Bucket Installed (with auxiliary lines)	3670 mm	12 ft
With Boom/Stick Installed (with auxiliary lines)	3670 mm	12 ft
With Boom Installed (with auxiliary lines)	3340 mm	11 ft
2 Machine Length:		
With Boom/Stick/Bucket Installed (with auxiliary lines)	15 310 mm	50.2 ft
With Boom/Stick Installed (with auxiliary lines)	15 310 mm	50.2 ft
With Boom Installed (with auxiliary lines)	14 180 mm	46.5 ft
3 Upperframe Width without Walkways	3030 mm	9.9 ft
4 Tail Swing Radius	3530 mm	11.6 ft
5 Counterweight Clearance	1470 mm	4.8 ft
6 Ground Clearance	720 mm	2.4 ft
7 Length to Center of Rollers	4040 mm	13.3 ft
8 Track Length	5030 mm	16.5 ft
9 Track Gauge – Extended (long undercarriage)	2930 mm	9.6 ft
10 Track Width:		
600 mm (24") Shoes (long undercarriage)	3530 mm	11.6 ft
700 mm (28") Shoes (long undercarriage)	3630 mm	11.9 ft
850 mm (33") Shoes (long undercarriage)	3780 mm	12.4 ft
Undercarriage Width (with steps/without steps):		
600 mm (24") Shoes (long undercarriage)	3670 mm	12.0 ft
700 mm (28") Shoes (long undercarriage)	3670 mm	12.0 ft
850 mm (33") Shoes (long undercarriage)	3780 mm	12.4 ft
Bucket Type	GD	
Bucket Capacity	0.93 m^3	1.22 yd^3
Bucket Tip Radius	1580 mm	5.2 ft

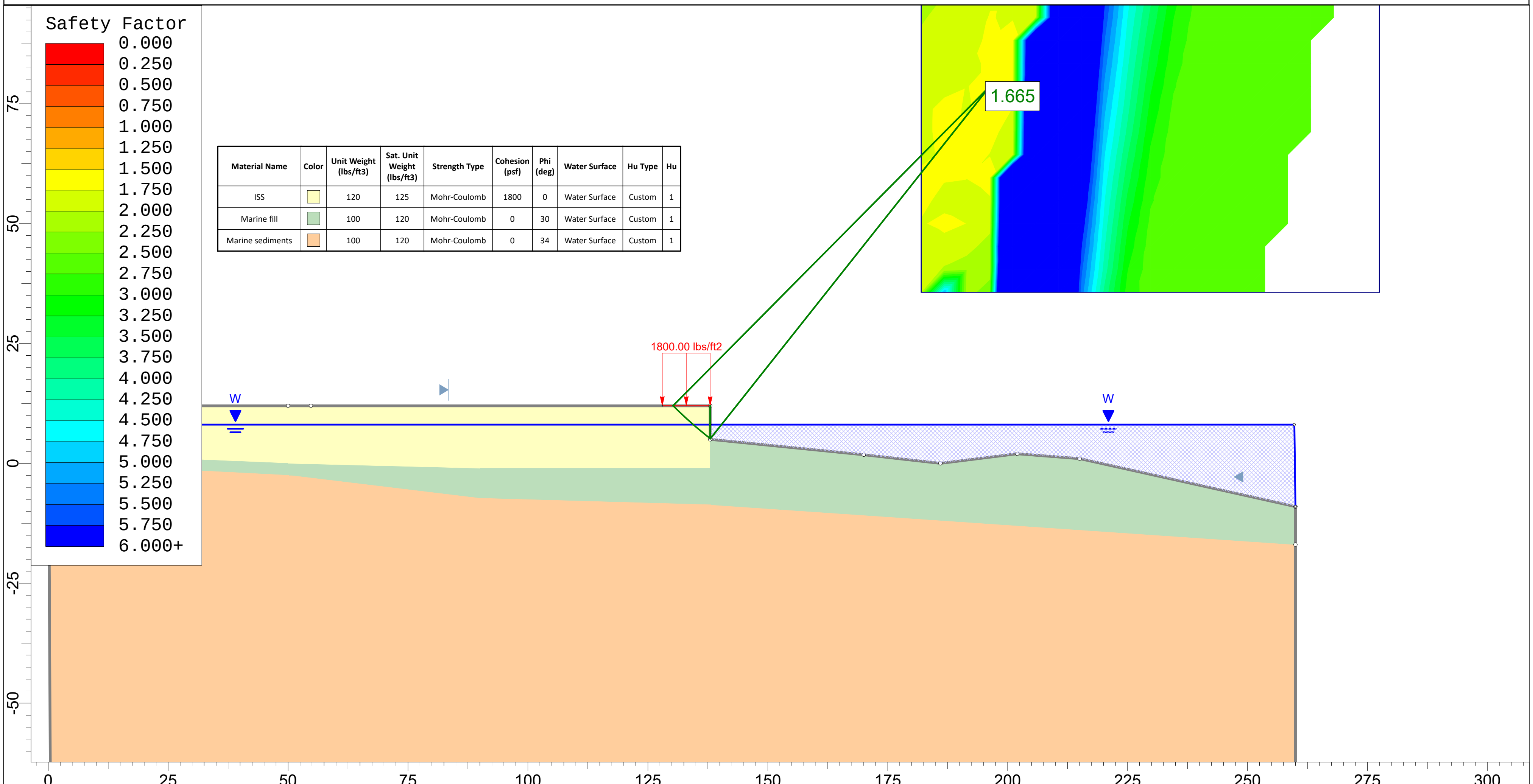
Working Ranges and Forces

All dimensions are approximate and may vary depending on bucket selection.



Boom Option	LRE Boom 10.6 m (34'9")	
Stick Option	**LRE Stick LRE7.1B1 (23'4")**	
1 Maximum Digging Depth	13 050 mm	42.8 ft
2 Maximum Reach at Ground Line	18 080 mm	59.3 ft
3 Maximum Cutting Height	15 620 mm	51.2 ft
4 Maximum Loading Height	12 770 mm	41.9 ft
5 Minimum Loading Height	3210 mm	10.5 ft
6 Maximum Depth Cut for 2440 mm (8 ft) Level Bottom	12 960 mm	42.5 ft
7 Maximum Vertical Wall Digging Depth	10 660 mm	35.0 ft
Bucket Digging Force (SAE)	125 kN	28,020 lbf
Bucket Digging Force (ISO)	141 kN	31,590 lbf
Stick Digging Force (SAE)	91 kN	20,470 lbf
Stick Digging Force (ISO)	92 kN	20,750 lbf
Bucket Type	GD	
Bucket Capacity	0.93 m³	1.22 yd³
Bucket Tip Radius	1580 mm	5.2 ft

ATTACHMENT 7
RESULTS - 25PSI LOAD AT EDGE

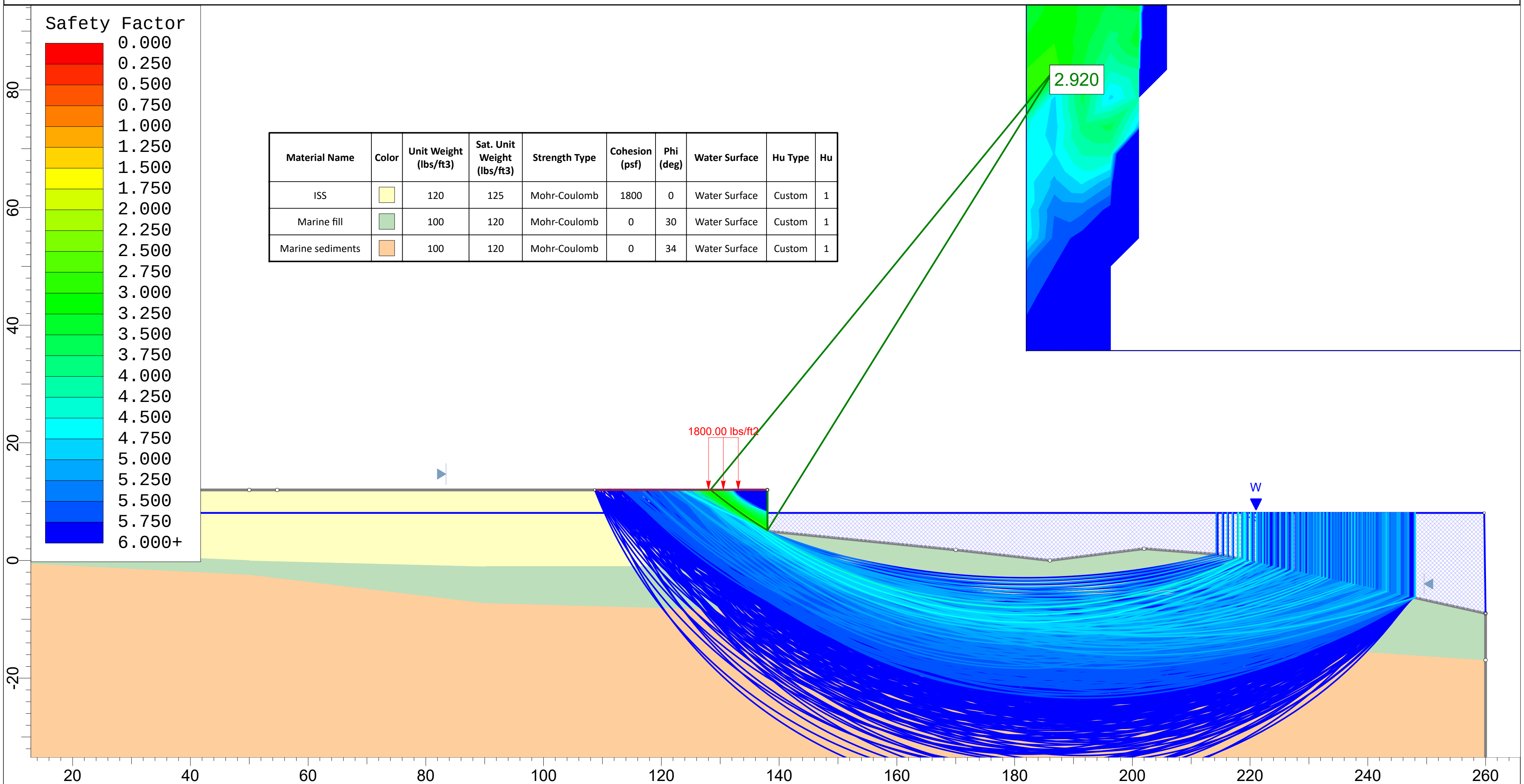


Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
ISS		120	125	Mohr-Coulomb	1800	0	Water Surface	Custom	1
Marine fill		100	120	Mohr-Coulomb	0	30	Water Surface	Custom	1
Marine sediments		100	120	Mohr-Coulomb	0	34	Water Surface	Custom	1

SLIDEINTERPRET 6.039

Project	SLIDE - An Interactive Slope Stability Program
Analysis Description	ISS Stability During Construction
Drawn By	MB
Scale	1:364
Company	CRETE Consulting Inc
Date	4/4/2019
File Name	Section B-B 25psi R.slim

RESULTS - 25PSI 5 FT SETBACK

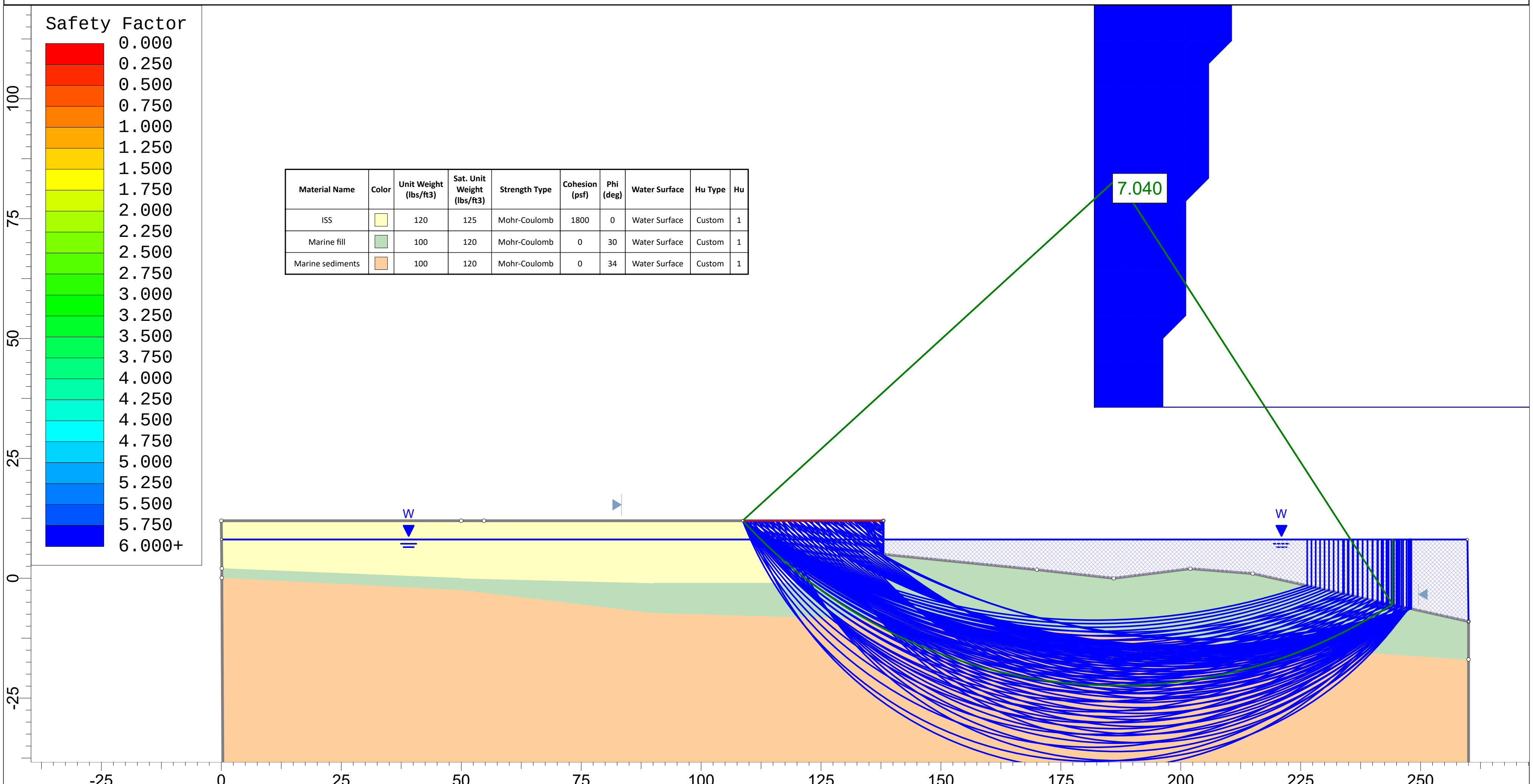


Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
ISS		120	125	Mohr-Coulomb	1800	0	Water Surface	Custom	1
Marine fill		100	120	Mohr-Coulomb	0	30	Water Surface	Custom	1
Marine sediments		100	120	Mohr-Coulomb	0	34	Water Surface	Custom	1

Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description	ISS Stability During Construction		
Drawn By: MB	Scale: 1:295	Company	CRETE Consulting Inc
Date: 4/4/2019		File Name	Section B-B 25psi R setback.slim

SLIDEINTERPRET 6.039

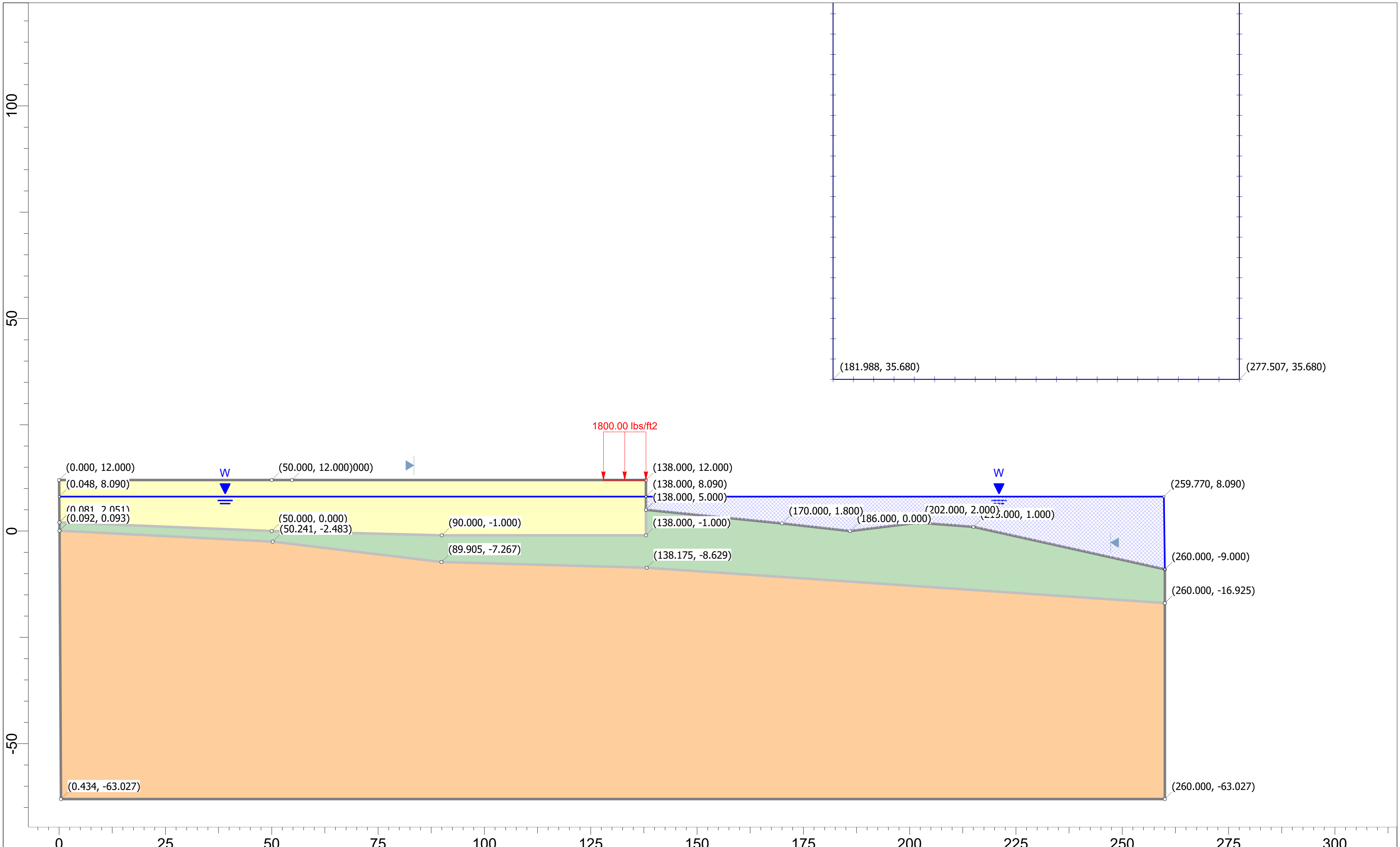
RESULTS - NO SURFACE LOAD



Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
ISS		120	125	Mohr-Coulomb	1800	0	Water Surface	Custom	1
Marine fill		100	120	Mohr-Coulomb	0	30	Water Surface	Custom	1
Marine sediments		100	120	Mohr-Coulomb	0	34	Water Surface	Custom	1

Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description	ISS Stability During Construction		
Drawn By MB	*Scale* 1:364	*Company*	CRETE Consulting Inc
Date	4/4/2019	*File Name*	Section B-B 25psi R no load.slim

SLIDEINTERPRET 6.039



Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description	ISS Stability During Construction		
Drawn By MB	*Scale* 1:375	*Company*	CRETE Consulting Inc
Date	10/10/2018, 1:54:12 PM	*File Name*	25psi no setback.slim

SLIDE 6.039

APPENDIX G
WWHM and HELP Modeling

Haley Site Upland Capping Design - WWHM Modeling Summary

Drainage Areas and Model Assumptions

- Predeveloped Condition: Drainage were delineated based on the survey map prepared by Wilson Engineering & Surveying 10/28/15. See attached figure.
- Post-Development Condition: Drainage areas delineated based on GeoEngineers 30% capping design. See attached figure.

	On-site Area (acres)		Off-site Areas (acres)			Total Areas (acres)		
Predeveloped	Impervious	Vegetated	Impervious - BNSF RR	Impervious - Cornwall	Vegetated - Cornwall	Total Impervious	Total Vegetated	Total Drainage Area
DB-E	1.30	0	0.32	0	0	1.62	0	1.62
DB-W	3.02	0.83	0	0	0	3.02	0.83	3.85
Total	4.32	0.83	0.32	0	0	4.64	0.83	5.47

Note: Impervious areas include asphalt, concrete and gravel areas.

	On-site Area (acres)		Off-site Areas (acres)			Total Areas (acres)		
Post-development	Impervious	Vegetated	Impervious - BNSF RR	Impervious - Cornwall	Vegetated - Cornwall	Total Impervious	Total Vegetated	Total Drainage Area
DB-E	0	1.17	0	0	0.14	0	1.31	1.31
DB-W	0	3.85	0	0	0.44	0	4.29	4.29
Total	0	5.02	0	0	0.58	0	5.60	5.60

Note: Impervious areas include asphalt, concrete and compact gravel surfaces.

WWHM Modeling Results

1. Upland Cap Surface Runoff Flow Rate:

WWHM report name: Upland Capping

	Surface Runoff Flow per Flow Frequency (cfs)			
Drainage Basin	DB-E		DB-W	
Return Period	Predeveloped	Post-Development	Predeveloped	Post-Development
2-Yr	0.68	0.00	1.28	0.04
5-Yr	0.91	0.02	1.73	0.18
10-Yr	1.06	0.05	2.02	0.39
25-Yr	1.26	0.14	2.40	0.87

2. Drainage Channel in Drainage Basin DB-E model inputs:

Channel Dimensions:

- Length = 1,000 feet
- Bottom width = 5 feet
- Channel side slope = 2H:1V
- Channel bottom slope = 1%

Post-Development Peak Flow and Stage in East Channel:

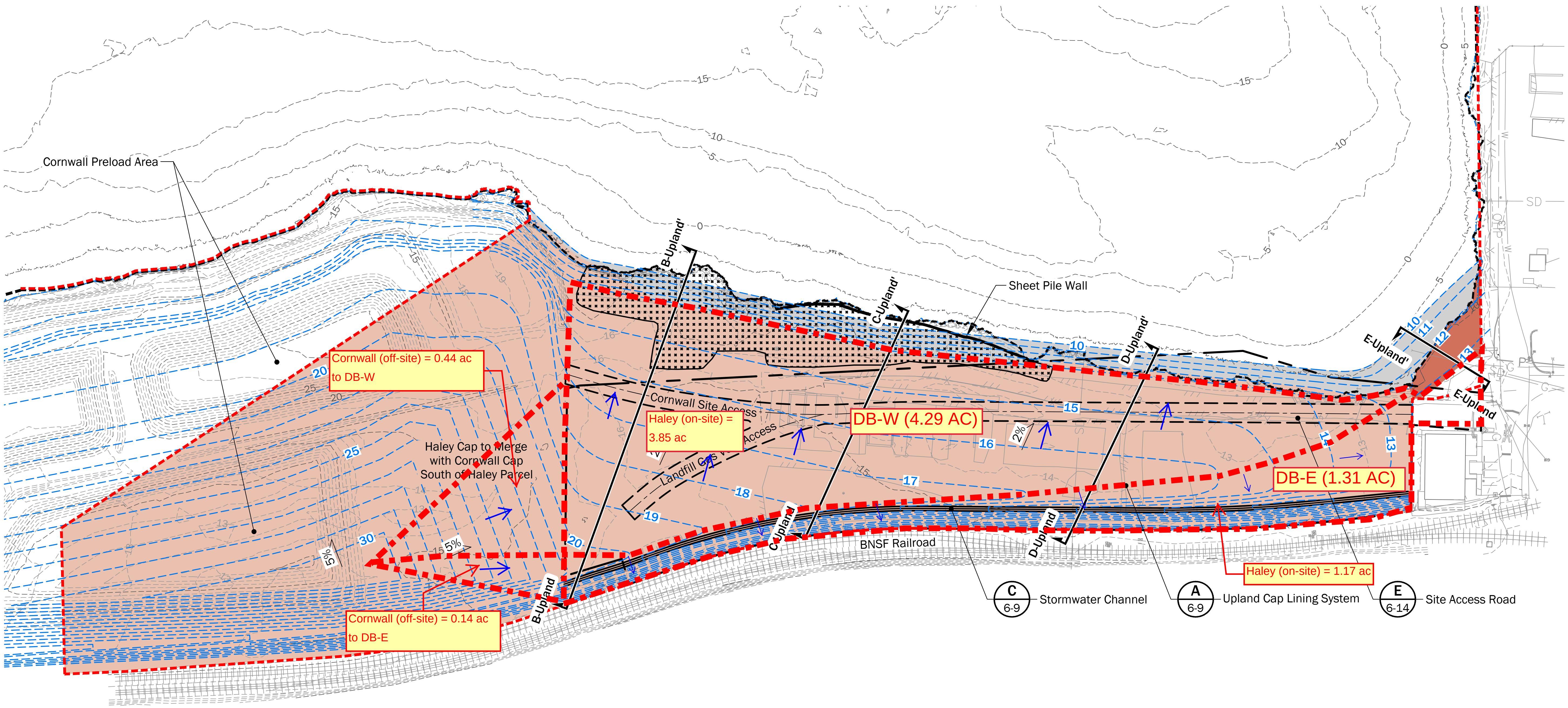
- Peak stage (ft) = 0.063
- Peak flow (cfs) = 0.25

R.G. Haley Stormwater Pre-Development Stormwater Basins

Bellingham, Washington

GeoEngineers

XXXXX-XXX-XX Date Exported: 04/09/15



Notes:

1. Generalized contours shown for discussion purposes; they will be refined including in transition to bank and railroad areas.
2. The locations of all features shown are approximate.
3. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
4. 2016 Hilton Avenue Stockpile topography provided from April 30, 2018 Cornwall Site EDR.

Data Source: Base survey by Wilson Engineering & Surveying 10/28/15.

Projection: WA State Plane, N Zone, NAD83, US Foot
Vertical Datum: NAVD88

Legend

B-Upland B-Upland' — Cross Section Location (See Figures 6-6 through 6-8)

Existing Marine Unit Boundary (OHWM - Elevation 9.73 Feet NAVD88)

20 — Existing Elevation Contour in Feet (NAVD88)

20 — Post-Construction Surface Elevation Contours

Haley Cleanup Area Boundary

City-Owned Parcel (Former Haley Property)

Low-Permeability Upland Cap

Upland Soil Cap

Approximate Extent of ISS

Shoreline Bank Transition between Upland and Marine Units

Access Road

Surface Slope

True North
Project North

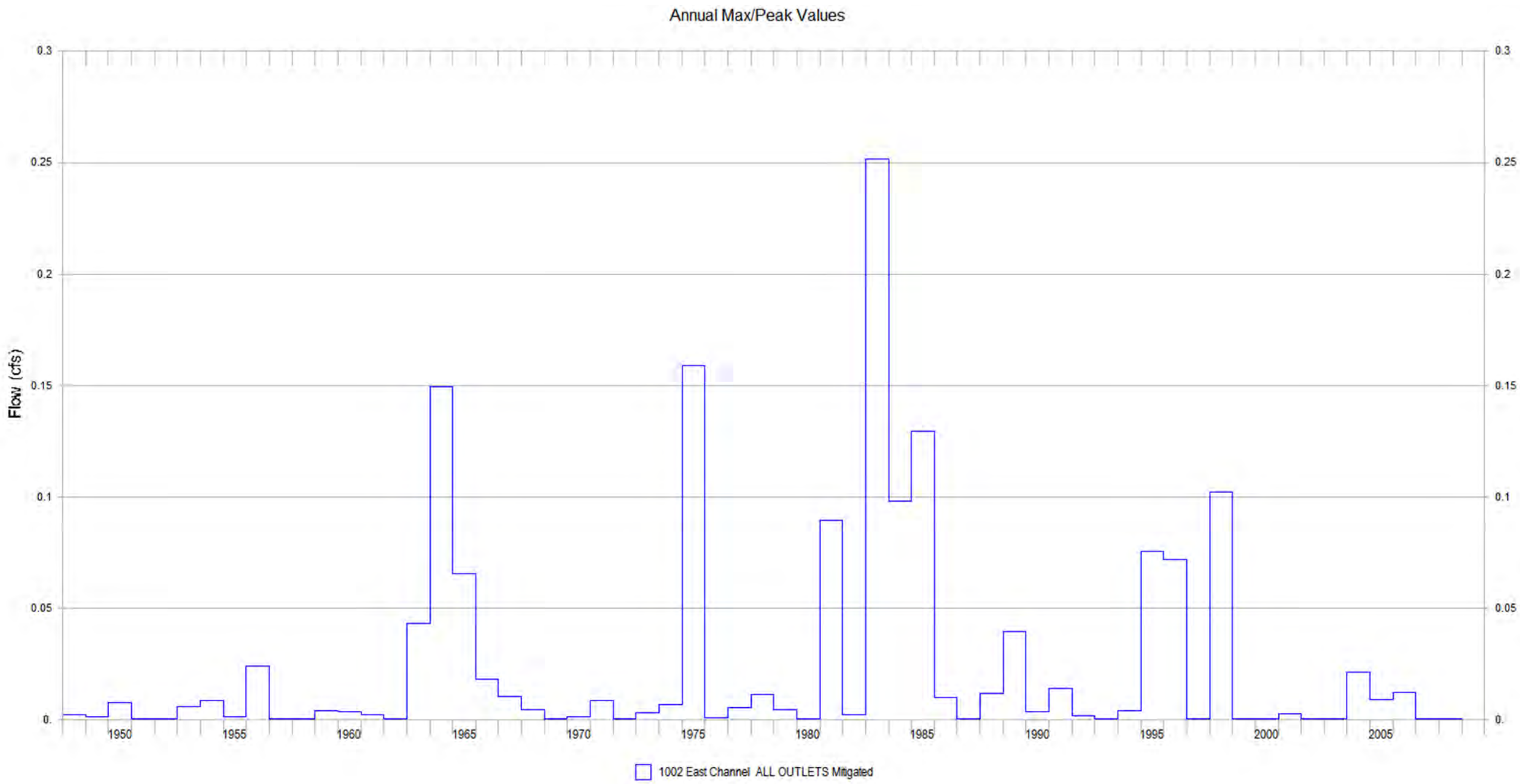
120 0 120
Feet

Post-Development Drainage Basin Map

R.G. Haley Site
Bellingham, Washington

GeoEngineers

P:\0\0356114\CAD\08\Task 300 Engineering Design\Report Figures\0356114\08_EDR_F06-05_Upland Grading Plan.dwg TAB:11x17 Landscape Date Exported: 11/07/19 - 14:01 by tmichaud



Legend

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source:

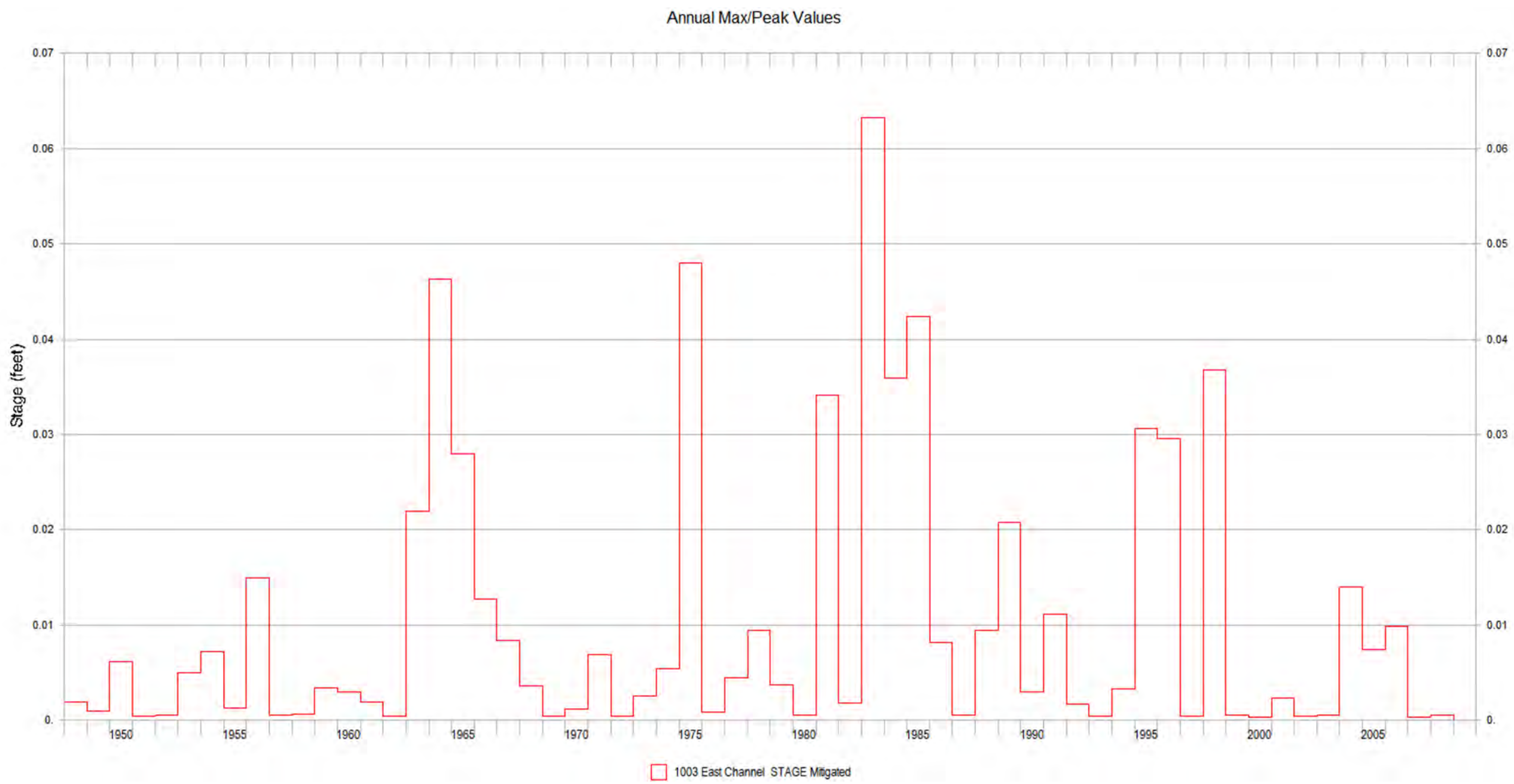
RC Haley Stormwater Chanel Peak Flow WWHM Model Results

RC Haley
Bellingham, Washington

GEOENGINEERS

Figure X

XXXXX-XXX-XX Date Exported: 04/09/15



Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source:

RC Haley Stormwater Chanel Peak Flow WWHM Model Results

RC Haley
Bellingham, Washington

GeoEngineers

Figure X

XXXXX-XXX-XX Date Exported: 04/09/15

WWHM2012

PROJECT REPORT

General Model Information

Project Name:	Upland Capping
Site Name:	R.G. Haley Site
Site Address:	
City:	Bellingham
Report Date:	4/23/2019
Gage:	Blaine
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2018/10/10
Version:	4.2.16

POC Thresholds

Low Flow Threshold for POC1:	50 Percent of the 2 Year
High Flow Threshold for POC1:	50 Year
Low Flow Threshold for POC2:	50 Percent of the 2 Year
High Flow Threshold for POC2:	50 Year

Landuse Basin Data
Predeveloped Land Use

DB-E

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROADS FLAT	1.62
Impervious Total	1.62
Basin Total	1.62

Element Flows To:

Surface	Interflow	Groundwater

DB-W

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Flat	0.83
Pervious Total	0.83
Impervious Land Use	acre
ROADS FLAT	3.02
Impervious Total	3.02
Basin Total	3.85

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

DB-E

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Flat	1.31
Pervious Total	1.31
Impervious Land Use	acre
Impervious Total	0
Basin Total	1.31

Element Flows To:

Surface	Interflow	Groundwater
East Channel	East Channel	

DB-W

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Flat	4.29
Pervious Total	4.29
Impervious Land Use	acre
Impervious Total	0
Basin Total	4.29

Element Flows To:

Surface	Interflow	Groundwater

Routing Elements
Predeveloped Routing

Mitigated Routing

East Channel

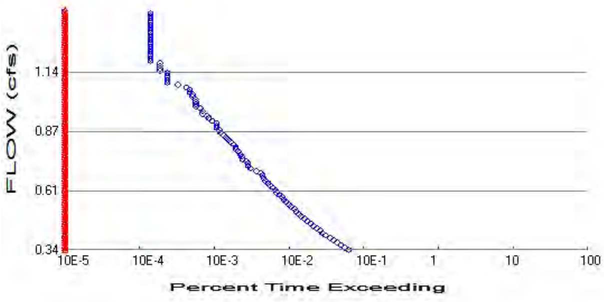
Bottom Length:	1000.00 ft.
Bottom Width:	5.00 ft.
Manning's n:	0.03
Channel bottom slope 1:	0.01 To 1
Channel Left side slope 0:	2 To 1
Channel right side slope 2:	2 To 1
Discharge Structure	
Riser Height:	0 ft.
Riser Diameter:	0 in.
Element Flows To:	
Outlet 1	Outlet 2

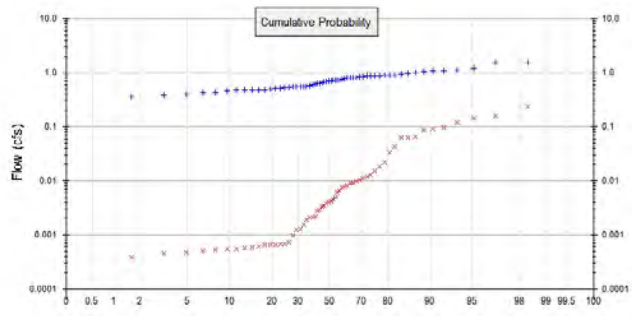
Channel Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.114	0.000	0.000	0.000
0.0111	0.115	0.001	0.013	0.000
0.0222	0.116	0.002	0.043	0.000
0.0333	0.117	0.003	0.086	0.000
0.0444	0.118	0.005	0.139	0.000
0.0556	0.119	0.006	0.201	0.000
0.0667	0.120	0.007	0.273	0.000
0.0778	0.121	0.009	0.354	0.000
0.0889	0.122	0.010	0.442	0.000
0.1000	0.124	0.011	0.539	0.000
0.1111	0.125	0.013	0.643	0.000
0.1222	0.126	0.014	0.755	0.000
0.1333	0.127	0.016	0.874	0.000
0.1444	0.128	0.017	1.000	0.000
0.1556	0.129	0.019	1.132	0.000
0.1667	0.130	0.020	1.272	0.000
0.1778	0.131	0.021	1.418	0.000
0.1889	0.132	0.023	1.571	0.000
0.2000	0.133	0.024	1.730	0.000
0.2111	0.134	0.026	1.895	0.000
0.2222	0.135	0.027	2.067	0.000
0.2333	0.136	0.029	2.245	0.000
0.2444	0.137	0.030	2.430	0.000
0.2556	0.138	0.032	2.620	0.000
0.2667	0.139	0.033	2.816	0.000
0.2778	0.140	0.035	3.019	0.000
0.2889	0.141	0.037	3.227	0.000
0.3000	0.142	0.038	3.441	0.000
0.3111	0.143	0.040	3.661	0.000
0.3222	0.144	0.041	3.888	0.000
0.3333	0.145	0.043	4.119	0.000
0.3444	0.146	0.045	4.357	0.000
0.3556	0.147	0.046	4.601	0.000
0.3667	0.148	0.048	4.850	0.000
0.3778	0.149	0.049	5.105	0.000
0.3889	0.150	0.051	5.365	0.000
0.4000	0.151	0.053	5.632	0.000
0.4111	0.152	0.054	5.904	0.000

0.4222	0.153	0.056	6.182	0.000
0.4333	0.154	0.058	6.465	0.000
0.4444	0.155	0.060	6.754	0.000
0.4556	0.156	0.061	7.049	0.000
0.4667	0.157	0.063	7.349	0.000
0.4778	0.158	0.065	7.655	0.000
0.4889	0.159	0.067	7.967	0.000
0.5000	0.160	0.068	8.284	0.000
0.5111	0.161	0.070	8.607	0.000
0.5222	0.162	0.072	8.935	0.000
0.5333	0.163	0.074	9.269	0.000
0.5444	0.164	0.076	9.609	0.000
0.5556	0.165	0.077	9.954	0.000
0.5667	0.166	0.079	10.30	0.000
0.5778	0.167	0.081	10.66	0.000
0.5889	0.168	0.083	11.02	0.000
0.6000	0.169	0.085	11.39	0.000
0.6111	0.170	0.087	11.76	0.000
0.6222	0.171	0.089	12.14	0.000
0.6333	0.172	0.091	12.52	0.000
0.6444	0.174	0.093	12.91	0.000
0.6556	0.175	0.095	13.31	0.000
0.6667	0.176	0.096	13.71	0.000
0.6778	0.177	0.098	14.12	0.000
0.6889	0.178	0.100	14.53	0.000
0.7000	0.179	0.102	14.95	0.000
0.7111	0.180	0.104	15.37	0.000
0.7222	0.181	0.106	15.80	0.000
0.7333	0.182	0.108	16.24	0.000
0.7444	0.183	0.110	16.68	0.000
0.7556	0.184	0.112	17.13	0.000
0.7667	0.185	0.115	17.58	0.000
0.7778	0.186	0.117	18.04	0.000
0.7889	0.187	0.119	18.50	0.000
0.8000	0.188	0.121	18.97	0.000
0.8111	0.189	0.123	19.45	0.000
0.8222	0.190	0.125	19.93	0.000
0.8333	0.191	0.127	20.41	0.000
0.8444	0.192	0.129	20.91	0.000
0.8556	0.193	0.131	21.41	0.000
0.8667	0.194	0.134	21.91	0.000
0.8778	0.195	0.136	22.42	0.000
0.8889	0.196	0.138	22.94	0.000
0.9000	0.197	0.140	23.46	0.000
0.9111	0.198	0.142	23.98	0.000
0.9222	0.199	0.144	24.52	0.000
0.9333	0.200	0.147	25.06	0.000
0.9444	0.201	0.149	25.60	0.000
0.9556	0.202	0.151	26.15	0.000
0.9667	0.203	0.153	26.71	0.000
0.9778	0.204	0.156	27.27	0.000
0.9889	0.205	0.158	27.84	0.000
1.0000	0.206	0.160	28.41	0.000
1.0111	0.207	0.163	28.99	0.000

Analysis Results
POC 1





+ Predeveloped   x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0
Total Impervious Area: 1.62

Mitigated Landuse Totals for POC #1
Total Pervious Area: 1.31
Total Impervious Area: 0

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.679872
5 year	0.909046
10 year	1.061542
25 year	1.25553
50 year	1.401206
100 year	1.548043

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.004269
5 year	0.021517
10 year	0.05287
25 year	0.143706
50 year	0.280531
100 year	0.52004

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1949	0.511	0.002
1950	1.182	0.001
1951	0.475	0.008
1952	0.465	0.001
1953	0.543	0.001
1954	0.963	0.006
1955	0.643	0.008
1956	0.860	0.002
1957	0.873	0.022
1958	0.817	0.001

1959	0.500	0.001
1960	0.864	0.004
1961	0.383	0.003
1962	1.046	0.002
1963	0.908	0.001
1964	0.949	0.042
1965	1.136	0.145
1966	0.918	0.064
1967	0.616	0.015
1968	0.638	0.010
1969	0.571	0.004
1970	0.474	0.001
1971	0.434	0.001
1972	0.805	0.008
1973	0.434	0.000
1974	0.511	0.003
1975	0.598	0.006
1976	0.813	0.156
1977	1.514	0.001
1978	0.835	0.005
1979	0.825	0.011
1980	0.733	0.005
1981	1.015	0.001
1982	0.697	0.087
1983	0.484	0.002
1984	1.088	0.238
1985	0.683	0.091
1986	1.074	0.120
1987	0.850	0.009
1988	0.652	0.001
1989	1.557	0.011
1990	0.703	0.034
1991	0.536	0.003
1992	0.549	0.013
1993	0.525	0.002
1994	0.400	0.001
1995	0.482	0.004
1996	0.780	0.066
1997	0.738	0.064
1998	0.354	0.000
1999	0.744	0.097
2000	0.560	0.001
2001	0.881	0.000
2002	0.555	0.003
2003	0.542	0.001
2004	0.915	0.001
2005	0.683	0.018
2006	0.738	0.009
2007	0.731	0.012
2008	0.362	0.000
2009	0.478	0.001

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	1.5573	0.2377
2	1.5142	0.1563
3	1.1816	0.1453

4	1.1365	0.1196
5	1.0884	0.0975
6	1.0737	0.0911
7	1.0463	0.0874
8	1.0152	0.0664
9	0.9632	0.0639
10	0.9485	0.0638
11	0.9175	0.0424
12	0.9152	0.0338
13	0.9084	0.0220
14	0.8810	0.0184
15	0.8732	0.0155
16	0.8639	0.0127
17	0.8602	0.0118
18	0.8497	0.0109
19	0.8354	0.0105
20	0.8249	0.0097
21	0.8171	0.0091
22	0.8132	0.0090
23	0.8051	0.0081
24	0.7801	0.0078
25	0.7439	0.0076
26	0.7381	0.0064
27	0.7376	0.0061
28	0.7328	0.0050
29	0.7310	0.0045
30	0.7032	0.0041
31	0.6965	0.0039
32	0.6834	0.0038
33	0.6830	0.0035
34	0.6516	0.0034
35	0.6430	0.0028
36	0.6380	0.0028
37	0.6157	0.0021
38	0.5979	0.0021
39	0.5707	0.0021
40	0.5598	0.0019
41	0.5554	0.0015
42	0.5490	0.0013
43	0.5429	0.0012
44	0.5425	0.0010
45	0.5357	0.0007
46	0.5252	0.0007
47	0.5108	0.0007
48	0.5107	0.0007
49	0.4995	0.0007
50	0.4838	0.0007
51	0.4815	0.0006
52	0.4780	0.0006
53	0.4749	0.0006
54	0.4741	0.0006
55	0.4649	0.0005
56	0.4343	0.0005
57	0.4337	0.0005
58	0.3995	0.0005
59	0.3832	0.0005
60	0.3622	0.0004
61	0.3542	0.0004

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.3399	1349	0	0	Pass
0.3507	1194	0	0	Pass
0.3614	1063	0	0	Pass
0.3721	937	0	0	Pass
0.3828	845	0	0	Pass
0.3935	755	0	0	Pass
0.4043	669	0	0	Pass
0.4150	603	0	0	Pass
0.4257	553	0	0	Pass
0.4364	509	0	0	Pass
0.4471	450	0	0	Pass
0.4579	415	0	0	Pass
0.4686	374	0	0	Pass
0.4793	344	0	0	Pass
0.4900	310	0	0	Pass
0.5007	291	0	0	Pass
0.5115	265	0	0	Pass
0.5222	251	0	0	Pass
0.5329	230	0	0	Pass
0.5436	214	0	0	Pass
0.5543	194	0	0	Pass
0.5651	183	0	0	Pass
0.5758	173	0	0	Pass
0.5865	159	0	0	Pass
0.5972	145	0	0	Pass
0.6079	139	0	0	Pass
0.6187	130	0	0	Pass
0.6294	119	0	0	Pass
0.6401	112	0	0	Pass
0.6508	104	0	0	Pass
0.6615	98	0	0	Pass
0.6723	94	0	0	Pass
0.6830	89	0	0	Pass
0.6937	78	0	0	Pass
0.7044	65	0	0	Pass
0.7151	61	0	0	Pass
0.7259	60	0	0	Pass
0.7366	57	0	0	Pass
0.7473	51	0	0	Pass
0.7580	50	0	0	Pass
0.7687	48	0	0	Pass
0.7795	45	0	0	Pass
0.7902	42	0	0	Pass
0.8009	41	0	0	Pass
0.8116	39	0	0	Pass
0.8223	35	0	0	Pass
0.8331	33	0	0	Pass
0.8438	31	0	0	Pass
0.8545	29	0	0	Pass
0.8652	26	0	0	Pass
0.8759	25	0	0	Pass
0.8867	23	0	0	Pass
0.8974	23	0	0	Pass

0.9081	23	0	0	Pass
0.9188	20	0	0	Pass
0.9295	18	0	0	Pass
0.9403	17	0	0	Pass
0.9510	15	0	0	Pass
0.9617	15	0	0	Pass
0.9724	14	0	0	Pass
0.9831	12	0	0	Pass
0.9938	12	0	0	Pass
1.0046	12	0	0	Pass
1.0153	12	0	0	Pass
1.0260	11	0	0	Pass
1.0367	11	0	0	Pass
1.0474	10	0	0	Pass
1.0582	10	0	0	Pass
1.0689	9	0	0	Pass
1.0796	7	0	0	Pass
1.0903	5	0	0	Pass
1.1010	5	0	0	Pass
1.1118	5	0	0	Pass
1.1225	5	0	0	Pass
1.1332	5	0	0	Pass
1.1439	4	0	0	Pass
1.1546	4	0	0	Pass
1.1654	4	0	0	Pass
1.1761	4	0	0	Pass
1.1868	3	0	0	Pass
1.1975	3	0	0	Pass
1.2082	3	0	0	Pass
1.2190	3	0	0	Pass
1.2297	3	0	0	Pass
1.2404	3	0	0	Pass
1.2511	3	0	0	Pass
1.2618	3	0	0	Pass
1.2726	3	0	0	Pass
1.2833	3	0	0	Pass
1.2940	3	0	0	Pass
1.3047	3	0	0	Pass
1.3154	3	0	0	Pass
1.3262	3	0	0	Pass
1.3369	3	0	0	Pass
1.3476	3	0	0	Pass
1.3583	3	0	0	Pass
1.3690	3	0	0	Pass
1.3798	3	0	0	Pass
1.3905	3	0	0	Pass
1.4012	3	0	0	Pass

Water Quality

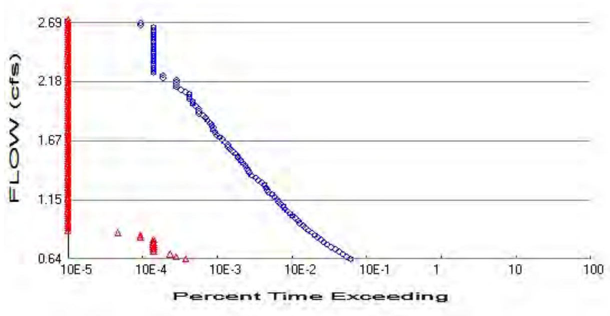
Water Quality BMP Flow and Volume for POC #1

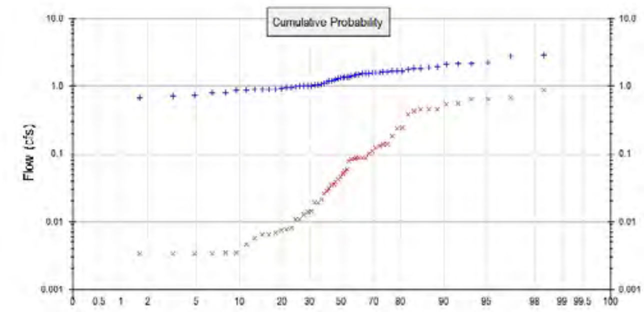
On-line facility volume:	0 acre-feet
On-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.
Off-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.

LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
East Channel POC	☐	0.63			☐	0.00			
Total Volume Infiltrated		0.63	0.00	0.00		0.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Passed

POC 2





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #2
Total Pervious Area: 0.83
Total Impervious Area: 3.02

Mitigated Landuse Totals for POC #2
Total Pervious Area: 4.29
Total Impervious Area: 0

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #2

Return Period	Flow(cfs)
2 year	1.281966
5 year	1.72628
10 year	2.023507
25 year	2.403101
50 year	2.689116
100 year	2.978144

Flow Frequency Return Periods for Mitigated. POC #2

Return Period	Flow(cfs)
2 year	0.044144
5 year	0.184662
10 year	0.390164
25 year	0.86634
50 year	1.450395
100 year	2.305635

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #2

Year	Predeveloped	Mitigated
1949	0.953	0.019
1950	2.203	0.014
1951	0.891	0.078
1952	0.867	0.003
1953	1.012	0.006
1954	1.796	0.082
1955	1.219	0.103
1956	1.604	0.019
1957	1.661	0.244
1958	1.523	0.008
1959	0.932	0.008

1960	1.611	0.039
1961	0.714	0.060
1962	1.951	0.021
1963	1.694	0.005
1964	1.858	0.462
1965	2.240	0.646
1966	1.819	0.559
1967	1.153	0.185
1968	1.189	0.111
1969	1.064	0.046
1970	0.884	0.003
1971	0.808	0.013
1972	1.502	0.085
1973	0.810	0.007
1974	0.954	0.051
1975	1.115	0.088
1976	1.646	0.670
1977	2.823	0.015
1978	1.558	0.057
1979	1.555	0.087
1980	1.366	0.042
1981	1.893	0.011
1982	1.299	0.548
1983	0.902	0.031
1984	2.196	0.870
1985	1.348	0.383
1986	2.125	0.648
1987	1.584	0.088
1988	1.215	0.006
1989	2.903	0.124
1990	1.348	0.238
1991	0.999	0.035
1992	1.024	0.140
1993	0.985	0.028
1994	0.745	0.003
1995	0.898	0.026
1996	1.531	0.453
1997	1.435	0.453
1998	0.661	0.003
1999	1.470	0.431
2000	1.044	0.011
2001	1.643	0.003
2002	1.039	0.035
2003	1.011	0.003
2004	1.706	0.007
2005	1.273	0.139
2006	1.381	0.089
2007	1.363	0.130
2008	0.675	0.003
2009	0.891	0.006

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #2

Rank	Predeveloped	Mitigated
1	2.9034	0.8700
2	2.8230	0.6703
3	2.2401	0.6479
4	2.2028	0.6460

5	2.1964	0.5593
6	2.1252	0.5480
7	1.9506	0.4620
8	1.8932	0.4535
9	1.8577	0.4534
10	1.8187	0.4307
11	1.7956	0.3833
12	1.7064	0.2442
13	1.6937	0.2377
14	1.6610	0.1854
15	1.6456	0.1405
16	1.6427	0.1394
17	1.6105	0.1298
18	1.6038	0.1235
19	1.5840	0.1107
20	1.5575	0.1026
21	1.5547	0.0889
22	1.5313	0.0884
23	1.5234	0.0883
24	1.5025	0.0873
25	1.4701	0.0851
26	1.4349	0.0825
27	1.3806	0.0775
28	1.3661	0.0596
29	1.3628	0.0567
30	1.3482	0.0512
31	1.3481	0.0460
32	1.2992	0.0419
33	1.2732	0.0388
34	1.2185	0.0352
35	1.2151	0.0350
36	1.1893	0.0310
37	1.1531	0.0282
38	1.1146	0.0261
39	1.0640	0.0215
40	1.0436	0.0192
41	1.0386	0.0188
42	1.0235	0.0145
43	1.0121	0.0140
44	1.0113	0.0127
45	0.9993	0.0108
46	0.9846	0.0107
47	0.9540	0.0081
48	0.9534	0.0077
49	0.9319	0.0075
50	0.9020	0.0068
51	0.8977	0.0065
52	0.8913	0.0064
53	0.8911	0.0056
54	0.8838	0.0046
55	0.8666	0.0035
56	0.8097	0.0034
57	0.8085	0.0034
58	0.7448	0.0034
59	0.7143	0.0034
60	0.6753	0.0034
61	0.6607	0.0033

Duration Flows
The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.6410	1300	8	0	Pass
0.6617	1146	6	0	Pass
0.6824	1018	5	0	Pass
0.7030	899	3	0	Pass
0.7237	811	3	0	Pass
0.7444	714	3	0	Pass
0.7651	631	3	0	Pass
0.7858	571	3	0	Pass
0.8065	527	3	0	Pass
0.8272	476	2	0	Pass
0.8479	430	2	0	Pass
0.8686	392	1	0	Pass
0.8892	359	0	0	Pass
0.9099	323	0	0	Pass
0.9306	299	0	0	Pass
0.9513	272	0	0	Pass
0.9720	260	0	0	Pass
0.9927	237	0	0	Pass
1.0134	217	0	0	Pass
1.0341	201	0	0	Pass
1.0547	184	0	0	Pass
1.0754	173	0	0	Pass
1.0961	164	0	0	Pass
1.1168	150	0	0	Pass
1.1375	140	0	0	Pass
1.1582	135	0	0	Pass
1.1789	124	0	0	Pass
1.1996	116	0	0	Pass
1.2203	104	0	0	Pass
1.2409	100	0	0	Pass
1.2616	96	0	0	Pass
1.2823	91	0	0	Pass
1.3030	83	0	0	Pass
1.3237	76	0	0	Pass
1.3444	70	0	0	Pass
1.3651	62	0	0	Pass
1.3858	57	0	0	Pass
1.4064	55	0	0	Pass
1.4271	54	0	0	Pass
1.4478	51	0	0	Pass
1.4685	48	0	0	Pass
1.4892	44	0	0	Pass
1.5099	42	0	0	Pass
1.5306	40	0	0	Pass
1.5513	38	0	0	Pass
1.5720	34	0	0	Pass
1.5926	32	0	0	Pass
1.6133	30	0	0	Pass
1.6340	30	0	0	Pass
1.6547	27	0	0	Pass
1.6754	25	0	0	Pass
1.6961	23	0	0	Pass
1.7168	21	0	0	Pass

1.7375	20	0	0	Pass
1.7581	19	0	0	Pass
1.7788	19	0	0	Pass
1.7995	18	0	0	Pass
1.8202	17	0	0	Pass
1.8409	16	0	0	Pass
1.8616	15	0	0	Pass
1.8823	14	0	0	Pass
1.9030	12	0	0	Pass
1.9237	12	0	0	Pass
1.9443	12	0	0	Pass
1.9650	11	0	0	Pass
1.9857	10	0	0	Pass
2.0064	10	0	0	Pass
2.0271	9	0	0	Pass
2.0478	9	0	0	Pass
2.0685	9	0	0	Pass
2.0892	8	0	0	Pass
2.1098	7	0	0	Pass
2.1305	6	0	0	Pass
2.1512	6	0	0	Pass
2.1719	6	0	0	Pass
2.1926	6	0	0	Pass
2.2133	4	0	0	Pass
2.2340	4	0	0	Pass
2.2547	3	0	0	Pass
2.2754	3	0	0	Pass
2.2960	3	0	0	Pass
2.3167	3	0	0	Pass
2.3374	3	0	0	Pass
2.3581	3	0	0	Pass
2.3788	3	0	0	Pass
2.3995	3	0	0	Pass
2.4202	3	0	0	Pass
2.4409	3	0	0	Pass
2.4615	3	0	0	Pass
2.4822	3	0	0	Pass
2.5029	3	0	0	Pass
2.5236	3	0	0	Pass
2.5443	3	0	0	Pass
2.5650	3	0	0	Pass
2.5857	3	0	0	Pass
2.6064	3	0	0	Pass
2.6271	3	0	0	Pass
2.6477	3	0	0	Pass
2.6684	2	0	0	Pass
2.6891	2	0	0	Pass

Water Quality

Water Quality BMP Flow and Volume for POC #2

On-line facility volume:	0 acre-feet
On-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.
Off-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.

LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
Total Volume Infiltrated		0.00	0.00	0.00		0.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Passed

Model Default Modifications

Total of 0 changes have been made.

PERLND Changes

No PERLND changes have been made.

IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic

Mitigated Schematic

Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01        END    2009 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                   UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                             ***
WDM        26   Upland Capping.wdm
MESSU      25   PreUpland Capping.MES
           27   PreUpland Capping.L61
           28   PreUpland Capping.L62
           30   POCUpland Capping1.dat
           31   POCUpland Capping2.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      IMPLND       1
      PERLND       7
      COPY       501
      COPY       502
      DISPLY       1
      DISPLY       2
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1       DB-E                        MAX                     1    2   30    9
    2       DB-W                        MAX                     1    2   31    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1        1    1
  501        1    1
  502        1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                          in  out           ***
    7     A/B, Lawn, Flat         1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
    7         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY
```

```
  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
    7         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
    7         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
    7            0         5       0.8       400      0.05       0.3     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
    7            0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                               ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
    7            0.1       0.5      0.25         0       0.7      0.25
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
              ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
    7            0         0         0         0         3         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                      in  out           ***
    1      ROADS/FLAT            1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    1         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    1         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    1         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    1          400      0.01       0.1       0.1
  END IWAT-PARM2
```

```
  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    1             0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    1             0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
DB-E***
IMPLND   1                        1.62     COPY   501     15
DB-W***
PERLND   7                        0.83     COPY   502     12
PERLND   7                        0.83     COPY   502     13
IMPLND   1                        3.02     COPY   502     15

******Routing******
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1
COPY   502 OUTPUT MEAN   1 1   48.4        DISPLY   2     INPUT  TIMSER 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                 ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG            ***
                                           in  out                           ***
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ****************** PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                      ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *         ***
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
  END HYDR-PARM2
  HYDR-INIT
```

```
    RCHRES  Initial conditions for each HYDR section                         ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1              PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1              IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    501 FLOW     ENGL      REPL
COPY   502 OUTPUT MEAN   1 1     48.4      WDM    502 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   13

  MASS-LINK       15
IMPLND     IWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   15


END MASS-LINK

END RUN
```

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01        END    2009 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                   UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM        26   Upland Capping.wdm
MESSU      25   MitUpland Capping.MES
           27   MitUpland Capping.L61
           28   MitUpland Capping.L62
           31   POCUpland Capping2.dat
           30   POCUpland Capping1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND       7
      RCHRES       1
      COPY       502
      COPY         1
      COPY       501
      DISPLY       2
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    2        DB-W                        MAX                    1    2   31    9
    1        East Channel                MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1        1    1
  502        1    1
  501        1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                         User  t-series Engl Metr ***
                                         in  out           ***
    7     A/B, Lawn, Flat         1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
    7         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY
```

```
  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
    7         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
    7         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
    7              0         5       0.8       400      0.05       0.3     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
    7              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                               ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
    7            0.1       0.5      0.25         0       0.7      0.25
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
              ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
    7              0         0         0         0         3         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                     in  out            ***
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
```

```
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                    <--Area-->     <-Target->   MBLK   ***
<Name>   #                    <-factor->     <Name>   #   Tbl#   ***
DB-E***
PERLND   7                          1.31     RCHRES   1      2
PERLND   7                          1.31     RCHRES   1      3
DB-W***
PERLND   7                          4.29     COPY   502     12
PERLND   7                          4.29     COPY   502     13

******Routing******
PERLND   7                          1.31     COPY     1     12
PERLND   7                          1.31     COPY     1     13
RCHRES   1                             1     COPY   501     16
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   502 OUTPUT MEAN   1 1   48.4        DISPLY   2     INPUT  TIMSER 1
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1


<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                 ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG            ***
                                         in  out                             ***
    1     East Channel            1    1    1    1   28    0    1
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
    1         1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ******************* PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
    1         4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                      ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *         ***
    1        0  1  0  0    4  0  0  0  0       0  0  0  0  0       2  2  2  2  2
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
    1             1      0.19       0.0       0.0       0.5       0.0
```

```
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                            ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit       for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
    1          0          4.0  0.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
  FTABLE      1
   91    4
     Depth      Area    Volume  Outflow1 Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.114784  0.000000  0.000000
  0.011111  0.115805  0.001281  0.013750
  0.022222  0.116825  0.002573  0.043691
  0.033333  0.117845  0.003877  0.085950
  0.044444  0.118866  0.005192  0.138952
  0.055556  0.119886  0.006519  0.201735
  0.066667  0.120906  0.007856  0.273630
  0.077778  0.121927  0.009205  0.354132
  0.088889  0.122947  0.010566  0.442847
  0.100000  0.123967  0.011938  0.539454
  0.111111  0.124988  0.013321  0.643686
  0.122222  0.126008  0.014715  0.755319
  0.133333  0.127028  0.016121  0.874157
  0.144444  0.128049  0.017538  1.000033
  0.155556  0.129069  0.018966  1.132801
  0.166667  0.130089  0.020406  1.272329
  0.177778  0.131110  0.021857  1.418503
  0.188889  0.132130  0.023320  1.571221
  0.200000  0.133150  0.024793  1.730388
  0.211111  0.134171  0.026279  1.895923
  0.222222  0.135191  0.027775  2.067751
  0.233333  0.136211  0.029283  2.245803
  0.244444  0.137232  0.030802  2.430019
  0.255556  0.138252  0.032332  2.620341
  0.266667  0.139272  0.033874  2.816720
  0.277778  0.140293  0.035427  3.019109
  0.288889  0.141313  0.036992  3.227465
  0.300000  0.142333  0.038568  3.441751
  0.311111  0.143354  0.040155  3.661930
  0.322222  0.144374  0.041753  3.887971
  0.333333  0.145394  0.043363  4.119844
  0.344444  0.146415  0.044984  4.357524
  0.355556  0.147435  0.046617  4.600985
  0.366667  0.148455  0.048261  4.850205
  0.377778  0.149476  0.049916  5.105165
  0.388889  0.150496  0.051582  5.365847
  0.400000  0.151516  0.053260  5.632234
  0.411111  0.152537  0.054949  5.904311
  0.422222  0.153557  0.056650  6.182065
  0.433333  0.154577  0.058362  6.465485
  0.444444  0.155598  0.060085  6.754560
  0.455556  0.156618  0.061819  7.049281
  0.466667  0.157638  0.063565  7.349640
  0.477778  0.158659  0.065322  7.655630
  0.488889  0.159679  0.067091  7.967246
  0.500000  0.160699  0.068871  8.284482
  0.511111  0.161720  0.070662  8.607334
  0.522222  0.162740  0.072465  8.935800
  0.533333  0.163761  0.074279  9.269877
  0.544444  0.164781  0.076104  9.609564
  0.555556  0.165801  0.077940  9.954860
  0.566667  0.166822  0.079788  10.30577
  0.577778  0.167842  0.081647  10.66228
```

```
  0.588889  0.168862  0.083518  11.02440
  0.600000  0.169883  0.085400  11.39214
  0.611111  0.170903  0.087293  11.76550
  0.622222  0.171923  0.089198  12.14447
  0.633333  0.172944  0.091114  12.52906
  0.644444  0.173964  0.093041  12.91928
  0.655556  0.174984  0.094980  13.31512
  0.666667  0.176005  0.096930  13.71660
  0.677778  0.177025  0.098891  14.12372
  0.688889  0.178046  0.100863  14.53649
  0.700000  0.179066  0.102847  14.95491
  0.711111  0.180086  0.104843  15.37898
  0.722222  0.181107  0.106849  15.80872
  0.733333  0.182127  0.108867  16.24413
  0.744444  0.183147  0.110897  16.68522
  0.755556  0.184168  0.112937  17.13199
  0.766667  0.185188  0.114989  17.58446
  0.777778  0.186208  0.117053  18.04263
  0.788889  0.187229  0.119127  18.50652
  0.800000  0.188249  0.121213  18.97612
  0.811111  0.189269  0.123310  19.45145
  0.822222  0.190290  0.125419  19.93252
  0.833333  0.191310  0.127539  20.41933
  0.844444  0.192331  0.129670  20.91190
  0.855556  0.193351  0.131813  21.41024
  0.866667  0.194371  0.133967  21.91435
  0.877778  0.195392  0.136133  22.42426
  0.888889  0.196412  0.138309  22.93996
  0.900000  0.197432  0.140497  23.46146
  0.911111  0.198453  0.142697  23.98879
  0.922222  0.199473  0.144907  24.52194
  0.933333  0.200493  0.147129  25.06094
  0.944444  0.201514  0.149363  25.60578
  0.955556  0.202534  0.151607  26.15649
  0.966667  0.203555  0.153863  26.71308
  0.977778  0.204575  0.156131  27.27555
  0.988889  0.205595  0.158410  27.84392
  1.000000  0.206616  0.160700  28.41819
  END FTABLE  1
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1              PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1              IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
RCHRES   1 HYDR   RO     1 1        1      WDM   1002 FLOW     ENGL      REPL
RCHRES   1 HYDR   STAGE  1 1        1      WDM   1003 STAG     ENGL      REPL
COPY     1 OUTPUT MEAN   1 1     48.4      WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    801 FLOW     ENGL      REPL
COPY     2 OUTPUT MEAN   1 1     48.4      WDM    702 FLOW     ENGL      REPL
COPY   502 OUTPUT MEAN   1 1     48.4      WDM    802 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK        2
PERLND     PWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    2

  MASS-LINK        3
```

```
PERLND     PWATER IFWO       0.083333      RCHRES          INFLOW IVOL
  END MASS-LINK    3

  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY            INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY            INPUT  MEAN
  END MASS-LINK   13

  MASS-LINK       16
RCHRES     ROFLOW                          COPY            INPUT  MEAN
  END MASS-LINK   16

END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

Disclaimer

Legal Notice

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Local (360)943-0304

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Haley Upland Cover System - HELP Model
Output File: HALEYCAP.OUT

Model Input Data:

Upland Top Cover Layers	HELP Layer	Layer Thickness (inches)	Layer Type	HELP Classification	USCS Classification	Hydraulic Conductivity, k (cm/sec)
Surface Layer (Top Soil)	1	6	Vertical Percolation	7	SM	0.00052
Protection Layer	2	18	Lateral Drainage	5	SM	0.001
Drainage Layer	3	0.2	Lateral Drainage	20	Geocomposite*	4.7
Geomembrane	4	0.06	GM Material	36	LDPE Liner	4.00E-13
Gas Collection Layer	5	0.2	Lateral Drainage**	20	Geocomposite*	4.7
Foundation Layer	6	6	Barrier Soil	23	ML	9.00E-06

* Geocomposite consists of double-sided geotextile and Geonet Core. The k value estimated based on GSE FabriNet 250 mil Geocomposite.
** The geocomposite in Layer 5 is intended for use as a gas collection layer.
- Landfill Area = 5 acres
- Curve Number = 69 (user specified)
- Average Annual Precipitation = 35.16 inches

Results:
- Drainage Length to Sink = 100 feet
- Maximum Head on Top of Geomembrane (Layer 4) = 11.06 inches
Refer to the HELP output report for additional input data and results.

```
******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                    USAE WATERWAYS EXPERIMENT STATION                     **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
******************************************************************************
******************************************************************************


PRECIPITATION DATA FILE:    C:\HELP3\haley\DATA4.D4
TEMPERATURE DATA FILE:      C:\HELP3\haley\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\HELP3\haley\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\HELP3\haley\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\HELP3\haley\DATA10.D10
OUTPUT DATA FILE:           C:\HELP3\haley\HALEYCAP.OUT


TIME:  15:45     DATE:   5/ 8/2019


******************************************************************************

     TITLE:  Haley Upland Cap

******************************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
              COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.


                                  LAYER  1
                                  --------

                      TYPE 1 - VERTICAL PERCOLATION LAYER
                          MATERIAL TEXTURE NUMBER   7
           THICKNESS                  =      6.00   INCHES
           POROSITY                   =      0.4730 VOL/VOL
           FIELD CAPACITY             =      0.2220 VOL/VOL
           WILTING POINT              =      0.1040 VOL/VOL
           INITIAL SOIL WATER CONTENT  =      0.2412 VOL/VOL
           EFFECTIVE SAT. HYD. COND.   =  0.520000001000E-03 CM/SEC
         NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
                  FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.
```

LAYER 2

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 5

```
THICKNESS                    =     18.00   INCHES
POROSITY                     =      0.4570 VOL/VOL
FIELD CAPACITY               =      0.1310 VOL/VOL
WILTING POINT                =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.2490 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC
```

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

```
THICKNESS                    =      0.25   INCHES
POROSITY                     =      0.8500 VOL/VOL
FIELD CAPACITY               =      0.0100 VOL/VOL
WILTING POINT                =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.0866 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =   4.69999981000     CM/SEC
SLOPE                        =      2.00   PERCENT
DRAINAGE LENGTH              =    100.0    FEET
```

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 36

```
THICKNESS                    =      0.06   INCHES
POROSITY                     =      0.0000 VOL/VOL
FIELD CAPACITY               =      0.0000 VOL/VOL
WILTING POINT                =      0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.399999993000E-12 CM/SEC
FML PINHOLE DENSITY          =      1.00   HOLES/ACRE
FML INSTALLATION DEFECTS     =      2.00   HOLES/ACRE
FML PLACEMENT QUALITY        =  3 - GOOD
```

LAYER 5

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

```
THICKNESS                    =      0.25   INCHES
```

```
POROSITY                     =      0.8500 VOL/VOL
FIELD CAPACITY               =      0.0100 VOL/VOL
WILTING POINT                =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =   4.69999981000     CM/SEC
SLOPE                        =      2.00   PERCENT
DRAINAGE LENGTH              =    100.0    FEET


                         LAYER  6
                         --------

               TYPE 3 - BARRIER SOIL LINER
               MATERIAL TEXTURE NUMBER  23
THICKNESS                    =      6.00   INCHES
POROSITY                     =      0.4610 VOL/VOL
FIELD CAPACITY               =      0.3600 VOL/VOL
WILTING POINT                =      0.2030 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.4610 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.900000032000E-05 CM/SEC


          GENERAL DESIGN AND EVAPORATIVE ZONE DATA
          ----------------------------------------

 NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM A USER-
          SPECIFIED CURVE NUMBER OF 69.0, A SURFACE SLOPE
          OF  2.% AND A SLOPE LENGTH OF  100. FEET.

SCS RUNOFF CURVE NUMBER              =     71.30
FRACTION OF AREA ALLOWING RUNOFF     =    100.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE   =      5.000  ACRES
EVAPORATIVE ZONE DEPTH               =     12.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE    =      2.879  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE   =      5.580  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE   =      0.972  INCHES
INITIAL SNOW WATER                   =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS     =      8.720  INCHES
TOTAL INITIAL WATER                  =      8.720  INCHES
TOTAL SUBSURFACE INFLOW              =      0.00   INCHES/YEAR


           EVAPOTRANSPIRATION AND WEATHER DATA
           -----------------------------------

 NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
          BELLINGHAM           WASHINGTON

  STATION LATITUDE                         =  47.50 DEGREES
  MAXIMUM LEAF AREA INDEX                  =   2.00
  START OF GROWING SEASON (JULIAN DATE)    =    126
```

```
END OF GROWING SEASON (JULIAN DATE)    =    287
EVAPORATIVE ZONE DEPTH                 =  12.0  INCHES
AVERAGE ANNUAL WIND SPEED              =   9.10 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY  =  75.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY  =  69.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY  =  70.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY  =  79.00 %
```

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR OLYMPIA WASHINGTON

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
4.67	3.02	3.22	2.69	2.48	1.86
1.18	1.23	1.78	3.68	5.80	4.22

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR SEATTLE WASHINGTON

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
39.20	40.80	44.20	48.40	53.80	58.50
62.30	62.50	57.20	49.80	43.20	38.10

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR SEATTLE WASHINGTON AND STATION LATITUDE = 47.50 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	4.52	3.19	3.16	3.09	2.52	1.64
	1.07	0.97	1.65	3.62	5.51	4.23
STD. DEVIATIONS	1.37	1.03	1.09	0.91	1.34	0.81
	0.93	0.60	0.92	1.41	2.15	1.15

RUNOFF

TOTALS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.024	0.000
STD. DEVIATIONS	0.001	0.002	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.001	0.091	0.001

EVAPOTRANSPIRATION

TOTALS	0.902	1.159	2.213	3.151	2.451	1.833
	1.095	0.899	1.088	1.337	0.931	0.797
STD. DEVIATIONS	0.144	0.144	0.227	0.711	0.954	0.913
	0.953	0.500	0.755	0.339	0.093	0.105

LATERAL DRAINAGE COLLECTED FROM LAYER 3

TOTALS	3.3298	2.2916	1.3881	0.6784	0.2284	0.2101
	0.0865	0.0506	0.0485	0.5561	3.6463	3.0741
STD. DEVIATIONS	1.1152	0.9310	0.8038	0.4827	0.1409	0.3506
	0.0337	0.0114	0.0922	0.7872	2.1469	0.9666

PERCOLATION/LEAKAGE THROUGH LAYER 4

TOTALS	0.2820	0.2203	0.1766	0.1201	0.0723	0.0590
	0.0473	0.0369	0.0297	0.0663	0.2934	0.2680
STD. DEVIATIONS	0.0532	0.0538	0.0526	0.0424	0.0213	0.0352
	0.0100	0.0045	0.0139	0.0582	0.1665	0.0468

LATERAL DRAINAGE COLLECTED FROM LAYER 5

TOTALS	0.0164	0.0108	0.0064	0.0032	0.0011	0.0009
	0.0004	0.0002	0.0002	0.0025	0.0314	0.0144
STD. DEVIATIONS	0.0072	0.0049	0.0036	0.0022	0.0007	0.0016
	0.0002	0.0001	0.0004	0.0035	0.0547	0.0060

PERCOLATION/LEAKAGE THROUGH LAYER 6

TOTALS	0.2656	0.2095	0.1702	0.1170	0.0713	0.0580
	0.0469	0.0366	0.0295	0.0638	0.2620	0.2536
STD. DEVIATIONS	0.0468	0.0492	0.0491	0.0402	0.0206	0.0336
	0.0098	0.0045	0.0135	0.0549	0.1188	0.0416

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	0.0265	0.0171	0.0084	0.0042	0.0014	0.0013
	0.0005	0.0003	0.0003	0.0034	0.0670	0.0213

STD. DEVIATIONS	0.0180	0.0110	0.0049	0.0030	0.0009	0.0022
	0.0002	0.0001	0.0006	0.0048	0.1391	0.0139

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	0.0014	0.0012	0.0008	0.0006	0.0003	0.0003
	0.0002	0.0002	0.0001	0.0003	0.0015	0.0013
STD. DEVIATIONS	0.0003	0.0003	0.0003	0.0002	0.0001	0.0002
	0.0000	0.0000	0.0001	0.0003	0.0008	0.0002

****

****

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 30

	INCHES	CU. FEET	PERCENT
PRECIPITATION	35.16 (4.518)	638129.9	100.00
RUNOFF	0.025 (0.0912)	455.29	0.071
EVAPOTRANSPIRATION	17.856 (2.0070)	324082.22	50.786
LATERAL DRAINAGE COLLECTED FROM LAYER 3	15.58856 (3.46509)	282932.406	44.33774
PERCOLATION/LEAKAGE THROUGH LAYER 4	1.67192 (0.24460)	30345.312	4.75535
AVERAGE HEAD ON TOP OF LAYER 4	0.013 (0.012)		
LATERAL DRAINAGE COLLECTED FROM LAYER 5	0.08784 (0.05733)	1594.302	0.24984
PERCOLATION/LEAKAGE THROUGH LAYER 6	1.58408 (0.20135)	28751.008	4.50551
AVERAGE HEAD ON TOP OF LAYER 6	0.001 (0.000)		
CHANGE IN WATER STORAGE	0.017 (0.7175)	314.54	0.049

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	2.36	42834.000
RUNOFF	0.365	6619.6719
DRAINAGE COLLECTED FROM LAYER 3	1.41995	25772.02150
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.240347	4362.29150
AVERAGE HEAD ON TOP OF LAYER 4	9.019	
MAXIMUM HEAD ON TOP OF LAYER 4	11.059	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	42.0 FEET	
DRAINAGE COLLECTED FROM LAYER 5	0.13257	2406.12427
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.107778	1956.16711
AVERAGE HEAD ON TOP OF LAYER 6	0.036	
MAXIMUM HEAD ON TOP OF LAYER 6	0.049	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	1.0 FEET	
SNOW WATER	2.65	48108.9375

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3645
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0810

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	1.5111	0.2518
2	4.9139	0.2730
3	0.0459	0.1838
4	0.0000	0.0000
5	0.0025	0.0100
6	2.7660	0.4610
SNOW WATER	0.000	

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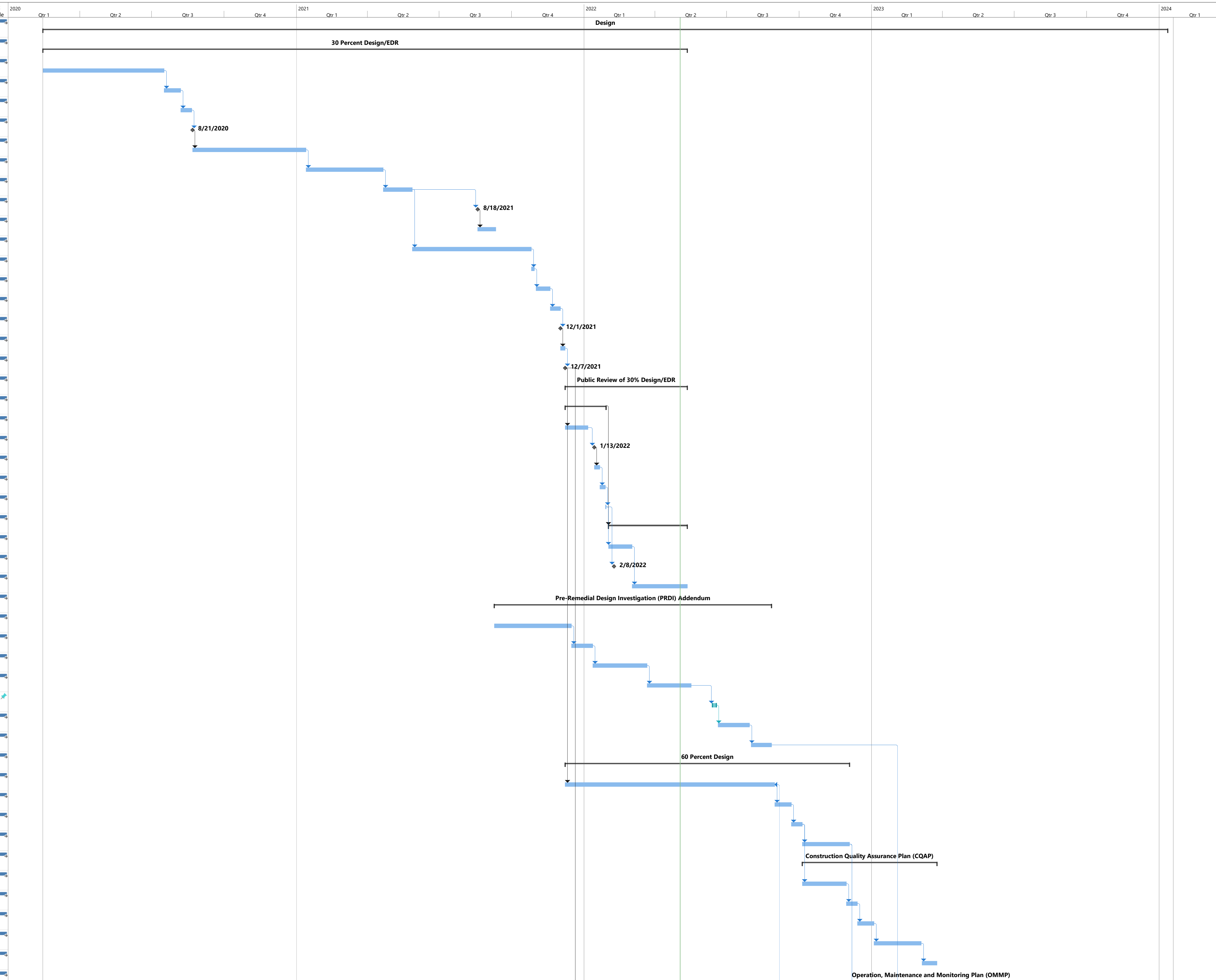
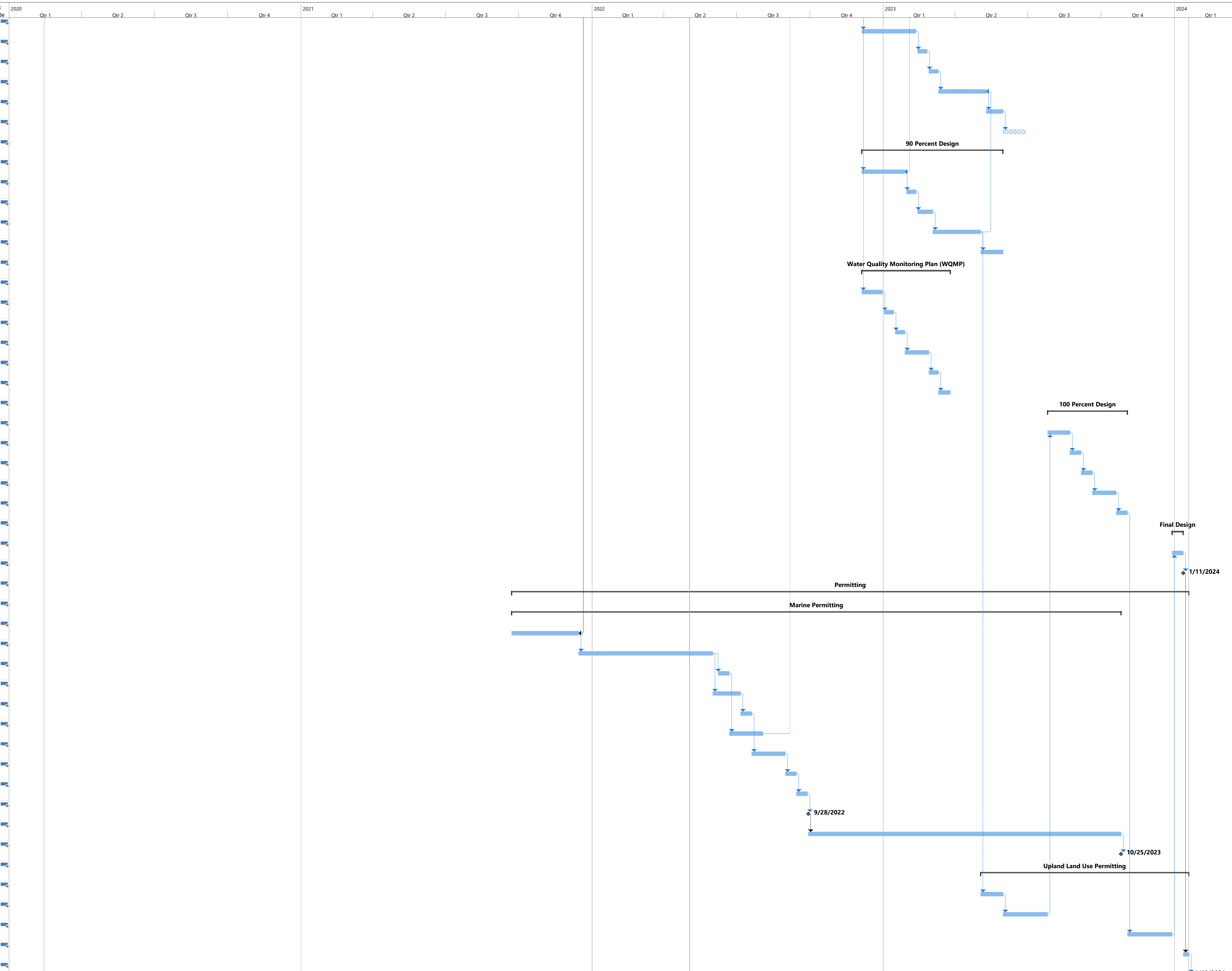
APPENDIX H
Design and Construction Schedule

Cleanup Action Engineering Design Report (EDR) Schedule
R.G. Haley Site, Bellingham, Washington

ID	Task Name	Duration	Start	Finish	Predecessors	Task Mode
1	**Design**	**1020 days**	**Fri 2/14/20**	**Thu 1/11/24**		
2	**30 Percent Design/EDR**	**584 days**	**Fri 2/14/20**	**Wed 5/11/22**		
3	Prepare Draft 30% Design/EDR	22 wks	Fri 2/14/20	Thu 7/16/20		
4	City Review of Draft 30% Design/EDR	3 wks	Fri 7/17/20	Thu 8/6/20	3	
5	Prepare Ecology Review Draft 30% Design/EDR	2 wks	Fri 8/7/20	Thu 8/20/20	4	
6	Submit Draft 30% Design/EDR to Ecology	1 day	Fri 8/21/20	Fri 8/21/20	5	
7	Ecology Review of 30% Design/EDR and Issues Comments	144 edays	Fri 8/21/20	Tue 1/12/21	6	
8	Revise and Submit Draft Final 30% Design/EDR to Ecology	14 wks	Wed 1/13/21	Tue 4/20/21	7	
9	Ecology Review of Draft Final 30% Design/EDR and Issues Comments	5.4 wks	Wed 4/21/21	Thu 5/27/21	8	
10	Ecology Meeting to Discuss Response to Comments and Dioxin/Furan Cleanup Level	1 day	Wed 8/18/21	Wed 8/18/21	9FS+58 days	
11	Coordination with Whatcom Waterway/Development of Updated Dioxin/Furan Cleanup Level	17 days	Thu 8/19/21	Fri 9/10/21	10	
12	Revise and Re-Submit Final Ecology Review Draft 30% Design/EDR for Ecology Review	107 days	Fri 5/28/21	Mon 10/25/21	9	
13	Ecology Review of Final Ecology Review Draft 30% Design/EDR	4 days	Tue 10/26/21	Fri 10/29/21	12	
14	Revise and Re-Submit Final Ecology Review Draft 30% Design/EDR for Ecology Review	14 days	Mon 11/1/21	Thu 11/18/21	13	
15	Ecology Review of Final Ecology Review Draft 30% Design/EDR	9 days	Fri 11/19/21	Wed 12/1/21	14	
16	Ecology Approval of Ecology Review Draft 30% Design/EDR	0 days	Wed 12/1/21	Wed 12/1/21	15	
17	Prepare and Submit Public Review Draft EDR to Ecology	4 days	Thu 12/2/21	Tue 12/7/21	16	
18	Ecology Review and Approval of Public Review Draft 30% Design/EDR	0 days	Tue 12/7/21	Tue 12/7/21	17	
19	**Public Review of 30% Design/EDR**	**111 days**	**Wed 12/8/21**	**Wed 5/11/22**		
20	**Prepare For Public Review**	**38 days**	**Wed 12/8/21**	**Fri 1/28/22**		
21	Ecology Develops Final Fact Sheet	21 days	Wed 12/8/21	Wed 1/5/22	18	
22	Outreach Schedule Check-In	0 days	Thu 1/13/22	Thu 1/13/22	21FS+6 days	
23	Print and Publications Placed and Public Review Documents Completed	5 days	Fri 1/14/22	Thu 1/20/22	22	
24	Webpage Updated	1 wk	Fri 1/21/22	Thu 1/27/22	23	
25	Fact Sheet in Mail, Newspaper Ad Runs	1 day	Fri 1/28/22	Fri 1/28/22	24	
26	**Public Comment Period**	**72 days**	**Mon 1/31/22**	**Wed 5/11/22**	**20**	
27	Comment Period	30 edays	Mon 1/31/22	Wed 3/2/22	25FS+1 day	
28	Public Event	0 days	Tue 2/8/22	Tue 2/8/22	25FS+6 days	
29	Final EDR and Responsiveness Summary	10 wks	Thu 3/3/22	Wed 5/11/22	27	
30	**Pre-Remedial Design Investigation (PRDI) Addendum**	**252 days**	**Thu 9/9/21**	**Fri 8/26/22**		
31	Prepare Draft PRDI Work Plan Addendum	14 wks	Thu 9/9/21	Wed 12/15/21		
32	Ecology Review of Draft PRDI Work Plan Addendum	19 days	Thu 12/16/21	Tue 1/11/22	31	
33	Revise and Finalize Work Plan Addendum	49 days	Wed 1/12/22	Mon 3/21/22	32	
34	Permitting for PRDI Sampling in Marine Unit	8 wks	Tue 3/22/22	Mon 5/16/22	33	
35	PRDI Addendum Field Activities (Within Low Tide Window)	1 wk	Mon 6/13/22	Fri 6/17/22	34	
36	Sample Analysis and Data Validation	6 wks	Mon 6/20/22	Fri 7/29/22	35	
37	PRDI Addendum Data Report	4 wks	Mon 8/1/22	Fri 8/26/22	36	
38	**60 Percent Design**	**258 days**	**Wed 12/8/21**	**Sat 12/3/22**		
39	Prepare Draft 60% Design	38 wks	Wed 12/8/21	Tue 8/30/22	18,85FF+20 days	
40	City Review of Draft 60% Design	3 wks	Wed 8/31/22	Tue 9/20/22	39	
41	Prepare Ecology Review Draft 60% Design	2 wks	Wed 9/21/22	Tue 10/4/22	40	
42	Ecology Review of 60% Design and Issues Comments	60 edays	Tue 10/4/22	Sat 12/3/22	41	
43	**Construction Quality Assurance Plan (CQAP)**	**123 days**	**Wed 10/5/22**	**Fri 3/24/23**		
44	Prepare Draft CQAP	8 wks	Wed 10/5/22	Tue 11/29/22	41	
45	City Review of Draft CQAP	2 wks	Wed 11/30/22	Tue 12/13/22	44	
46	Prepare Ecology Review Draft CQAP	3 wks	Wed 12/14/22	Tue 1/3/23	45	
47	Ecology Review of Draft CQAP and Issues Comments	60 edays	Tue 1/3/23	Sat 3/4/23	46	
48	Prepare Final Draft CQAP and Submit to Ecology	3 wks	Mon 3/6/23	Fri 3/24/23	47	
49	**Operation, Maintenance and Monitoring Plan (OMMP)**	**147 days**	**Mon 12/5/22**	**Tue 6/27/23**		



ID	Task Name	Duration	Start	Finish	Predecessors	Task Mode
50	Prepare Draft OMMP	10 wks	Mon 12/5/22	Fri 2/10/23	42	
51	City Review of Draft OMMP	2 wks	Mon 2/13/23	Fri 2/24/23	50	
52	Prepare Ecology Review Draft OMMP	2 wks	Mon 2/27/23	Fri 3/10/23	51	
53	Ecology Review of Draft OMMP and Issues Comments	60 edays	Fri 3/10/23	Tue 5/9/23	52,60FF	
54	Prepare Final Draft OMMP and Submit to Ecology	3 wks	Wed 5/10/23	Tue 5/30/23	53	
55	Final OMMP Prepared After Cleanup Construction	4 wks	Wed 5/31/23	Tue 6/27/23	54	
56	**90 Percent Design**	**127 days**	**Mon 12/5/22**	**Tue 5/30/23**		
57	Prepare Draft 90% Design	8 wks	Mon 12/5/22	Fri 1/27/23	42,37FF	
58	City Review of Draft 90% Design	2 wks	Mon 1/30/23	Fri 2/10/23	57	
59	Prepare Ecology Review Draft 90% Design	3 wks	Mon 2/13/23	Fri 3/3/23	58	
60	Ecology Review of 90% Design and Issues Comments	60 edays	Fri 3/3/23	Tue 5/2/23	59	
61	Prepare Permitting Agency Review Draft 90% Design	4 wks	Wed 5/3/23	Tue 5/30/23	60	
62	**Water Quality Monitoring Plan (WQMP)**	**80 days**	**Mon 12/5/22**	**Sat 3/25/23**		
63	Prepare Draft WQMP	4 wks	Mon 12/5/22	Fri 12/30/22	42	
64	City Review of Draft WQMP	2 wks	Mon 1/2/23	Fri 1/13/23	63	
65	Prepare Ecology Review Draft WQMP	2 wks	Mon 1/16/23	Fri 1/27/23	64	
66	Ecology Review of Draft WQMP and Issues Comments	30 edays	Fri 1/27/23	Sun 2/26/23	65	
67	Prepare Final WQMP and Submit to Ecology	2 wks	Mon 2/27/23	Fri 3/10/23	66	
68	Ecology Reviews Final WQMP	15 edays	Fri 3/10/23	Sat 3/25/23	67	
69	**100 Percent Design**	**72 days**	**Wed 7/26/23**	**Thu 11/2/23**		
70	Prepare Draft 100% Design	4 wks	Wed 7/26/23	Tue 8/22/23	94	
71	City Review of 100% Design	2 wks	Wed 8/23/23	Tue 9/5/23	70	
72	Prepare Ecology Review Draft 100% Design	2 wks	Wed 9/6/23	Tue 9/19/23	71	
73	Ecology Review of 100% Design and Issues Comments	30 edays	Tue 9/19/23	Thu 10/19/23	72	
74	Prepare Permitting Agency Review Draft 100% Design	2 wks	Fri 10/20/23	Thu 11/2/23	73	
75	**Final Design**	**10 days**	**Fri 12/29/23**	**Thu 1/11/24**		
76	Prepare Final (For Bid) Design	2 wks	Fri 12/29/23	Thu 1/11/24	95	
77	Submit Final (For Bid) Design to City, Ecology and Permitting Agency	0 days	Thu 1/11/24	Thu 1/11/24	76	
78	**Permitting**	**607 days**	**Wed 9/22/21**	**Thu 1/18/24**		
79	**Marine Permitting**	**546 days**	**Wed 9/22/21**	**Wed 10/25/23**		
80	Mitigation Approach Development	12 wks	Wed 9/22/21	Tue 12/14/21	18FF+5 days	
81	Conceptual Mitigation Plan Development	24 wks	Wed 12/15/21	Tue 5/31/22	80	
82	Pre-Application Meetings With Tribes and US Army Corps of Engineers/Resource Agencies	2 wks	Wed 6/8/22	Tue 6/21/22	81FS+5 days	
83	Complete Mitigation Plan and Biological Evaluation (BE)	5 wks	Wed 6/1/22	Tue 7/5/22	81	
84	City Review of Mitigation Plan and BE	2 wks	Wed 7/6/22	Tue 7/19/22	83	
85	Followup Coordination with Tribes and US Army Corps of Engineers/Resource Agencies	6 wks	Wed 6/22/22	Tue 8/2/22	82	
86	Prepare JARPA, Shoreline Exemption and Substantive Requirements Submittals	6 wks	Wed 7/20/22	Tue 8/30/22	84	
87	City Review of JARPA, Shoreline Exemption and Substantive Requirements Submittals	2 wks	Wed 8/31/22	Tue 9/13/22	86	
88	Ecology Review of JARPA, Shoreline Exemption and Substantive Requirements Submittals	2 wks	Wed 9/14/22	Tue 9/27/22	87	
89	Submit JARPA, BE, Mitigation Plan, Shoreline Exemption and Substantive Requirements Submittals to Federal and State	1 day	Wed 9/28/22	Wed 9/28/22	88	
90	Agency Review	14 mons	Thu 9/29/22	Wed 10/25/23	89	
91	Marine Permit Approval	0 wks	Wed 10/25/23	Wed 10/25/23	90	
92	**Upland Land Use Permitting**	**187 days**	**Wed 5/3/23**	**Thu 1/18/24**		
93	Prepare Permit Application Documents	4 wks	Wed 5/3/23	Tue 5/30/23	60	
94	Agency Review of Permit Documents and 90% Design	8 wks	Wed 5/31/23	Tue 7/25/23	93	
95	Agency Review of Permit Documents and 100% Design	8 wks	Fri 11/3/23	Thu 12/28/23	74	
96	Permits are drafted by Permitting Agency	1 wk	Fri 1/12/24	Thu 1/18/24	77	
97	Upland Land Use Permit Issued	0 days	Thu 1/18/24	Thu 1/18/24	96	



APPENDIX I
Marine Unit Recontamination Evaluation and Updated Cleanup Level for Dioxins and Furans

APPENDIX I
R.G. HALEY MARINE UNIT RECONTAMINATION EVALUATION AND UPDATED CLEANUP LEVEL FOR DIOXINS AND FURANS

Introduction

The R.G. Haley Site (Haley Site or Site) is located on the northeastern shore of Bellingham Bay, Bellingham, WA (Figure 1). The Haley Site is comprised of an Upland Unit and a Marine Unit, and is currently undergoing cleanup planning and design according to the Model Toxic Control Act (MTCA; Chapter 173-340 WAC) and the Sediment Management Standards (SMS; Chapter 173-204 WAC) for contaminated upland soil, groundwater, air and sediment. Following completion of a remedial investigation and feasibility study, a cleanup action plan (CAP) was published by the Washington State Department of Ecology in April 2018. The CAP specified the cleanup standards (both the cleanup levels and points of compliance) for each medium along with areas requiring cleanup, what the cleanup action will be and how the cleanup will be implemented.

For dioxins and furans, the CAP set the sediment cleanup level (SCL) for the Marine Unit at the regional background-based Cleanup Screening Level (CSL) of 15 nanograms per kilogram (ng/kg), expressed as the toxic equivalent of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TEQ), without a recontamination evaluation to provide the rationale for adjusting the SCL up from the PQL-based Sediment Cleanup Objective (SCO) of 5 ng/kg TEQ. As part of Ecology's review of the Engineering Design Report (EDR), they requested a recontamination evaluation for dioxins and furans to attain consistency with the SMS.

This appendix presents the recontamination evaluation and an updated SCL for dioxins and furans based on the results of the evaluation. The following sections describe the regulatory framework for adjusting the SCL, how Ecology established regional background in Bellingham Bay and the lines of evidence that indicate post-construction recontamination of the Marine Unit. Additionally, the following sections describe the basis for adjusting the dioxin and furan SCL up from the SCO and the updated dioxin and furan SCL.

Regulatory Framework

According to SMS, the SCO is the sediment quality goal, but the SCL may be adjusted up to, but not higher than, the CSL based on an evaluation of technical possibility and net adverse environmental impact (WAC 173-204-560[2][a][ii]). SCUM (Chapter 7, Section 7.2.3.2) states that "technically possible" includes being implemented in a reliable and effective manner that is dependent on site-specific factors such as the ability to maintain the SCO after construction. SCUM (Chapter 7, Section 7.2.3.2) also states that, recontamination from diffuse sources not under the authority or responsibility of the PLP should be considered to determine if the SCO can be maintained.

Bellingham Bay Regional Background

Ecology established regional background concentrations for dioxins and furans (15 ng/kg TEQ) and several other contaminants in Bellingham Bay in 2015 in support of the Bellingham Bay Demonstration Pilot, a program addressing the comprehensive cleanup of the bay and involving eight sediment cleanup sites. Surface sediment samples were collected in the regional background Area of Interest (AOI) determined to be outside of the direct influence of known sources including cleanup sites, active or historical sources or dredge material disposal sites (Figure 2). Intertidal areas or those areas representative of natural background concentrations were also excluded from the AOI. The resulting data underwent data quality evaluations and statistical analysis prior to calculating a background value according to Ecology procedures. Details of the derivation of regional background for Bellingham Bay are provided in Ecology's report (2015).

Lines of Evidence

There are multiple lines of evidence that establish the potential for recontamination at the Marine Unit including the potential for sediment erosion or resuspension from the regional background AOI outside of the Marine Unit boundary and transport to the Marine Unit by currents within Bellingham Bay. In addition, there is recent empirical evidence of recontamination in the vicinity of the Marine Unit.

Sediment Erosion, Resuspension and Transport

There are several natural forces that can erode or resuspend and transport sediment to the Marine Unit. Storm-generated waves are responsible for eroding shorelines and sediment in Bellingham Bay and causing transport of eroded materials. Both breaking waves and the orbital velocities from storm waves have sufficient energy to resuspend and move sediment. Both deep and shallow currents transport sediment either as suspended particles or bed load. Fine-grained sediment is frequently transported as suspended particles in currents where coarse-grained sediments are often moved by those same currents along the bottom.

Bottom currents in Bellingham Bay are relatively consistent throughout the year and velocities within the bay range from 4 to 18 centimeters per second (cm/sec) with a maximum velocity of 40 cm/sec (Colyer 1998 [In] RETEC 2006). A velocity of 20 to 30 cm/sec is generally required to erode fine-grained (i.e., clay, silts and fine sands) sediment particles (Downing 1983). Based on the regional background study, sediment in the AOI is predominantly in the clay and silt range[1] and susceptible to erosion and transport. Therefore, sediment present in the regional background AOI can be resuspended by bottom currents. See the Resuspension and Sedimentation section below for further discussion of resuspension.

Once fine-grained sediment particles are suspended, the particles can be transported by weaker currents. Transport distances are a function of the size of the particles and the strength and direction of the current.

Typical shallow surface currents in the inner bay are much slower ranging from 2 cm/sec to 10 cm/sec with a maximum of 16 cm/sec (Colyer 1998 [In] RETEC 2006). The typical, slower shallow surface currents within the inner bay allow deposition and accumulation of fine-grained sediment in this portion of the bay including the Marine Unit. The results from hydrodynamic modeling conducted by Coast & Harbors Engineers Division of Mott/McDonald (CHE) (EDR Appendix E) suggest that tidal currents in the Marine Unit do not exceed 6 cm/sec.

The forces created by storm-generated waves are primarily responsible for shoreline and nearshore erosion in Bellingham Bay. Winds from the prevailing storms typically originate from the south/southwest, creating waves up to three meters in height near the shore. Shoreline erosion from storm waves is evidenced by the

[1] Thirty out of 34 surface sediment samples were characterized by greater than 90 percent fines.

historical migration of shorelines in Bellingham Bay and the need for shoreline armoring throughout the inner bay.

CHE conducted wave analysis and numerical modeling to support cap design for the Marine Unit (EDR Appendix E). The results of the modeling show that erosion and transport of sediment from storm-generated waves could occur up to the depths evaluated (approximately -20 feet NAVD88). CHE also evaluated changes in sea floor bathymetry at the Cornwall Landfill and Haley sediment units to support remedial design (CHE 2019). The results of the evaluation provide evidence of sediment transport along the bottom to depths greater than -20 feet NAVD88 (Figure 3). Elongated wave-like forms both parallel and perpendicular to the shoreline are evident in Figure 3 and are likely from bottom currents and storm-generated waves periodically moving sediment along the bottom. The evaluation also identified areas of accretion and erosion over an 8-year period between 2007 and 2015. Sediment appears to be accumulating over much of the area evaluated with limited areas of erosion.

The information pertaining to currents in Bellingham Bay and from wave modeling and sediment accretion in the vicinity of the Cornwall and Haley sediment units identifies that sediment erosion and transport are occurring. The regional background AOI is adjacent to the Marine Unit and extends into the inner bay. Because the AOI adjacent to the Marine Unit experiences similar hydrodynamic conditions and exposure to storms, sediment erosion and transport from the AOI to the Marine Unit is highly likely.

Resuspension and Sedimentation

There is additional evidence of sediment erosion, resuspension and transport based on the sedimentation and resuspension evaluation conducted as part of the 2000 RI/FS for Whatcom Waterway (Anchor and Hart Crowser 2000). Several sediment traps (HC-ST-100 and HC-ST-101) were deployed in the inner bay within the regional background AOI (Figure 4) for three, four-month periods to evaluate gross sedimentation rates under various conditions. Gross sedimentation ranged from 7.85 centimeters per year (cm/yr) to 21.8 cm/yr and averaged 13.8 cm/yr[2].

Two cores (HC-NR-100 and HC-NR-101), which were co-located with the sediment traps, were used to measure net sedimentation. Rates of sediment accumulation over time were based on decay rates of two radioisotopes (lead-210 and cesium-137). Mercury depth profiles and depth to native sediment in historical dredging prisms were two other lines of evidence evaluated to determine rates of accumulation. Results among the first three methods (two radioisotope dating methods and chemical profiling) to measure net sedimentation had reasonable agreement so results were averaged. Net sedimentation estimates ranged from 1.1 cm/yr to 3.4 cm/yr; the overall average was 1.6 cm/yr.

Resuspension rates (as a percent) were calculated using both gross sedimentation rates and net sediment accumulation over time measured at the co-located traps and cores (gross – net/gross = percent resuspension). Resuspension rates ranged from 81 to 93 percent with an average of 88 percent. These results confirm that bottom sediments in the regional background AOI are highly likely to be resuspended and transported to other locations including the Marine Unit.

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[2] Based on five data points.

Current Patterns and Transport

The current direction in Bellingham Bay, both shallow and deep, is variable. Tidal exchanges[3]; wind direction, duration, magnitude and fetch; riverine discharges, water depth and shoreline configuration all influence the complex circulation of water in Bellingham Bay. Deep flow generally oscillates from inbound to outbound based on tide and nearshore currents flow in both clockwise and counterclockwise directions following shorelines depending on winds and river flows.

The dominant current direction has been reported to be an oscillating north-south longshore flow (USACE 1997) but has also been reported to be a dominant clockwise flow (Colyer 1998). Eddies have been reported to form, particularly in the inner bay, depending on wind speed and direction, freshwater input, and strength of the tidal exchange (Colyer 1998).

Modeling by CHE indicates current reversals with ebb and flood tides in the vicinity of the Marine Unit (Figure 2 of EDR Appendix E). The modeling by CHE indicates that a component of the current in and adjacent to the Marine Unit oscillates in a north-south longshore flow as a result of tides. Winds from the south and southwest entrain water at and near the surface, pushing it to the north/northeast towards the inner bay causing return flows that typically flow counterclockwise. Winds from the west and northwest cause surface currents to flow clockwise along the eastern shoreline (Shea et al 1981 [In] RETEC 2006). As a result of the oscillating current directions observed in Bellingham Bay, sediment transported to the Marine Unit is highly likely to originate from regional background AOI.

Sediment Conditions in Bellingham Bay

Dioxins and furans have been evaluated as part of various sediment investigations in Bellingham Bay over the last 20 years. More recently, Ecology conducted a sediment investigation in 2014 to establish regional background levels of dioxins and furans along with several other chemicals of concern in Bellingham Bay. Surface sediment samples were collected and analyzed for dioxins and furans from 23 locations (BB-08 through BB-30) that were outside the influence of known dioxin and furan sources as part of the investigation (Figure 4). Dioxin and furan concentrations ranged from 2.2 nanogram/kilogram (ng/kg) to 14.4 (average dioxin TEQ at BB-24) ng/kg TEQ. The data were evaluated to determine the representativeness of regional conditions and ultimately a value of 15 ng/kg TEQ was statistically derived (90/90 upper tolerance limit or UTL) from the data to represent regional background in Bellingham Bay (Ecology 2015).

Since that time, other samples have been collected as part of the long-term monitoring for the Whatcom Waterway cleanup (Anchor QEA 2019 and 2020). Five locations (MNR-03 through MNR-05, MNR-07 and MNR-09) in and adjacent to the regional background AOI that were designated monitored natural recovery (MNR) stations (Figure 4) have been sampled twice (2017 and 2019). Dioxin and furan concentrations at these locations were similar for both sampling years and to the regional background data set, ranging from 5.1 ng/kg TEQ to 14.5 ng/kg TEQ as summarized in the following table. The recent MNR data suggest some stability in prevailing conditions in Bellingham Bay in the regional background area.

[3] The tidal range (the difference in elevation between the highest high tide and lowest low tide) in Bellingham Bay is approximately 12 feet.

WHATCOM WATERWAY DIOXIN TEQ DATA AT MNR LOCATIONS FOR YEARS 1 AND 3

Location	Year 1	Year 3
MNR-03	6.1	6.6 [a] (8.1, 5.1)
MNR-04	5.1 [a] (6.9, 3.3)	9.3
MNR-05	10.2	10.6
MNR-07	14.5	12.1
MNR-09	11.6	13.6

Note:

a. Value is an average of two field replicates

Sediment Conditions in the AOI Adjacent to the Marine Unit

Based on the lines of evidence discussed above, the regional background AOI[4] adjacent to the Marine Unit represents the most likely source of resuspended sediment that may recontaminate surface sediment following remediation. The adjacent AOI area identified as the Recontamination Evaluation Area on Figure 5, was evaluated to determine the level of recontamination that may occur within the Marine Unit from the AOI. The area selected as the source of recontamination accounts for proximity of the Marine Unit to the AOI, current and storm wave resuspension in the shallower portion of the AOI adjacent to the Marine Unit, and transport vectors (i.e., from the southwest to the northeast) from the AOI to the Marine Unit based on current oscillation within the Bay adjacent to the Marine Unit.

A dioxin and furan surface-area weighted average concentration (SWAC) was calculated for the Recontamination Evaluation Area. The SWAC was prepared using GIS interpolation[5] of dioxin and furan TEQ concentrations in Bellingham Bay. The data used are shown on Figure 4, and were compiled from Ecology's Environmental Information Management (EIM) database and published reports. The data consist of the most recent surface sediment (0 to 12 cm) data for each of the areas shown in Figure 4. The data set and study area boundaries are consistent with the data used for evaluation of dioxin and furans for the Whatcom Waterway Site. The entire data set underwent GIS interpolation which resulted in a dioxin and furan TEQ concentration being assigned to each square foot of area encompassed by the data set. Then the concentration values for each square foot comprising the Recontamination Evaluation Area shown in Figure 5 were "clipped" from the larger interpolation and used to calculate the SWAC for the Recontamination Evaluation Area. The resulting dioxin SWAC is 13.1 ng/kg TEQ and represents the most likely level to which surface sediment within the Marine Unit will be recontaminated by sediment from the Recontamination Evaluation Area.

Empirical Evidence of Recontamination

There is empirical evidence of recent recontamination based on the monitoring of a dredged and capped area in the Whatcom Waterway Site (Anchor QEA 2018, 2019 and 2020). Site Unit 1C near the mouth of the waterway and adjacent to the regional background AOI (Figure 5) was dredged to remove

[4] The regional background AOI overlaps with the outermost portion of the Marine Unit. The overlap area was not included in the recontamination evaluation area.

[5] Interpolation was conducted using an inverse-distance weighted geospatial model, with a power of 5, maximum number of neighbors of 4, minimum number of neighbors of 2, four sectors rotated 45 degrees and a 500-foot diameter search area (reach).

contamination. As with all dredging, a thin layer of contaminated dredge residuals settled on top of the clean dredged surface upon completion of dredging. The dioxin and furan concentrations in the dredged residuals ranged from 2.1 ng/kg to 26.2 ng/kg TEQ so a cap was placed over the dredged area to cover the residuals. Confirmation samples collected from the cap placed over the dredge residuals showed that the new surface was below natural background (5 ng/kg TEQ) at five of the six sampling locations with one location being slightly above regional background (16.3 ng/kg TEQ versus 15 ng/kg TEQ). Monitoring in the first (2017) and third (2019) years following dredging and placement of the residual cap measured concentrations of 13.2 ng/kg TEQ and 13.8 ng/kg TEQ at monitoring location P1CM-02 located near the center of the previously dredged area at the mouth of the waterway (Figure 5). Concentrations measured in Site Unit 1C are very similar to the upper values reported in the regional background data set and suggest that recontamination is occurring to levels similar to the regional background concentration at Site Unit 1C located adjacent to the regional background area.

Regional and Local Sources of Dioxins and Furans

The persistence and relative stability of dioxin and furan concentrations in surface sediment in the Bellingham Bay regional background area is likely due to the presence of uncontrolled or unknown sources within the surrounding area. The eastern and northern portions of the bay are within urban and industrial areas of the City. As with other urban and industrial areas, there are current and historical sources of dioxin and furans.

In Bellingham, current and/or historical sources include burning of wood (residential heating, hog fuel, forest fires), vehicle emissions, incineration of waste, pulp manufacturing, wood-treating operations, cement kilns, and other sources. Except for identified cleanup sites where dioxins and furans are a contaminant of concern, other current point sources are unknown. The existence of ubiquitous sources remains challenging for control of dioxins and furans in Bellingham Bay and throughout the Puget Sound region.

As a result of current and historical releases, dioxins and furans are a ubiquitous contaminant in soil in urban environments. A study of residential soil in Bellingham as part of the Oeser Site cleanup (START 2002) reported concentrations ranging from 2.7 ng/kg to 34.8 ng/kg TEQ in areas considered background. These concentrations fall within the range (7.5 ng/kg to 36 ng/kg) of dioxin and furan TEQs reported in residential soil from Seattle neighborhoods (Ecology 2011).

A historical investigation of the Little Squalicum Creek watershed that had been impacted by the Oeser Site suggests that riparian and wetland soils as well as stream sediment in the urban areas are a potential source of contamination to the bay. Background samples in the Little Squalicum stream corridor had dioxin and furan TEQ concentrations of 12.6 ng/kg and 14.0 ng/kg (data from EIM; accessed 4/29/21).

Numerous sources of dioxins and furans exist that are not under the control of the City including air emissions, surface water, non-municipal stormwater runoff and erosion of soil. Dioxin and furan emissions and transport from non-City sources likely represents a long-term source to the bay and contribution to dioxin and furan concentrations in regional background.

Updated Dioxin and Furan Cleanup Level for the Marine Unit

The evaluation of recontamination identifies that waves and currents within Bellingham Bay are sufficient to cause resuspension and transport of sediment to the Marine Unit from the Recontamination Evaluation

Area. The dioxin and furan concentrations in the regional background AOI adjacent to the Marine Unit range between approximately 6 ng/kg TEQ and 15 ng/kg TEQ based on recent data. Data from sediment samples collected in 2017 and 2019 suggest there is some temporal stability in the sediment quality conditions in the AOI when compared to the 2014 regional background study conducted by Ecology. Evaluation of the recontamination lines of evidence suggests that the regional background value established by Ecology continues to be reasonable upper bound concentration representing surface sediment conditions in the bay.

The resuspension and transport of sediment from the Recontamination Evaluation Area is sufficient to recontaminate sediment at the Marine Unit following remediation. The more detailed evaluation of the Recontamination Evaluation Area, which would contribute to recontamination of the Haley site, concludes that a value of 13 ng/kg TEQ represents a likely recontamination level from this portion of the AOI. Based on the results of the recontamination evaluation, the dioxin and furan PQL-based SCO of 5 ng/kg TEQ cannot be maintained following construction. Therefore, in accordance with the SMS and SCUM, the SCL for the Marine Unit is adjusted up to 13 ng/kg TEQ, slightly lower than the regional background-based SCL of 15 ng/kg TEQ previously identified in the CAP. There is uncertainty in any estimate of future concentrations in surface sediment at the Haley Site. The timing and duration of remediation of other sites in the bay will affect what can be maintained over time. Long-term monitoring will document compliance of the remedy with the cleanup level and will allow assessment of the rate of recovery and achievement of the long-term goal for Bellingham Bay. The SCO remains the long-term goal to be attained through pollution prevention and toxics reduction initiatives over a longer timeframe than is applied to the cleanup of the Haley Site.

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Attachments:

Figure 1. Vicinity Map

Figure 2. Regional Background Area of Interest

Figure 3. Sediment Accretion 2007 to 2015

Figure 4. Recent Dioxin/Furan Data Used in Recontamination Evaluation

Figure 5. Recontamination Evaluation Area

W
True North
S
N
Project North
E

0 1,000 2,000
Feet

Reference: Whatcom County GIS, City of Bellingham GIS,
Aerial from Esri, 2017.

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. can not guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
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Projection: NAD 1983 UTM Zone 10N

Vicinity Map

R.G. Haley Site
Bellingham, Washington

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Figure 1

Path: P:\0\0356114\GIS\MXDs\035611408_F01_VicinityMap.mxd Map Revised: 24 September 2021 glohrmeyer

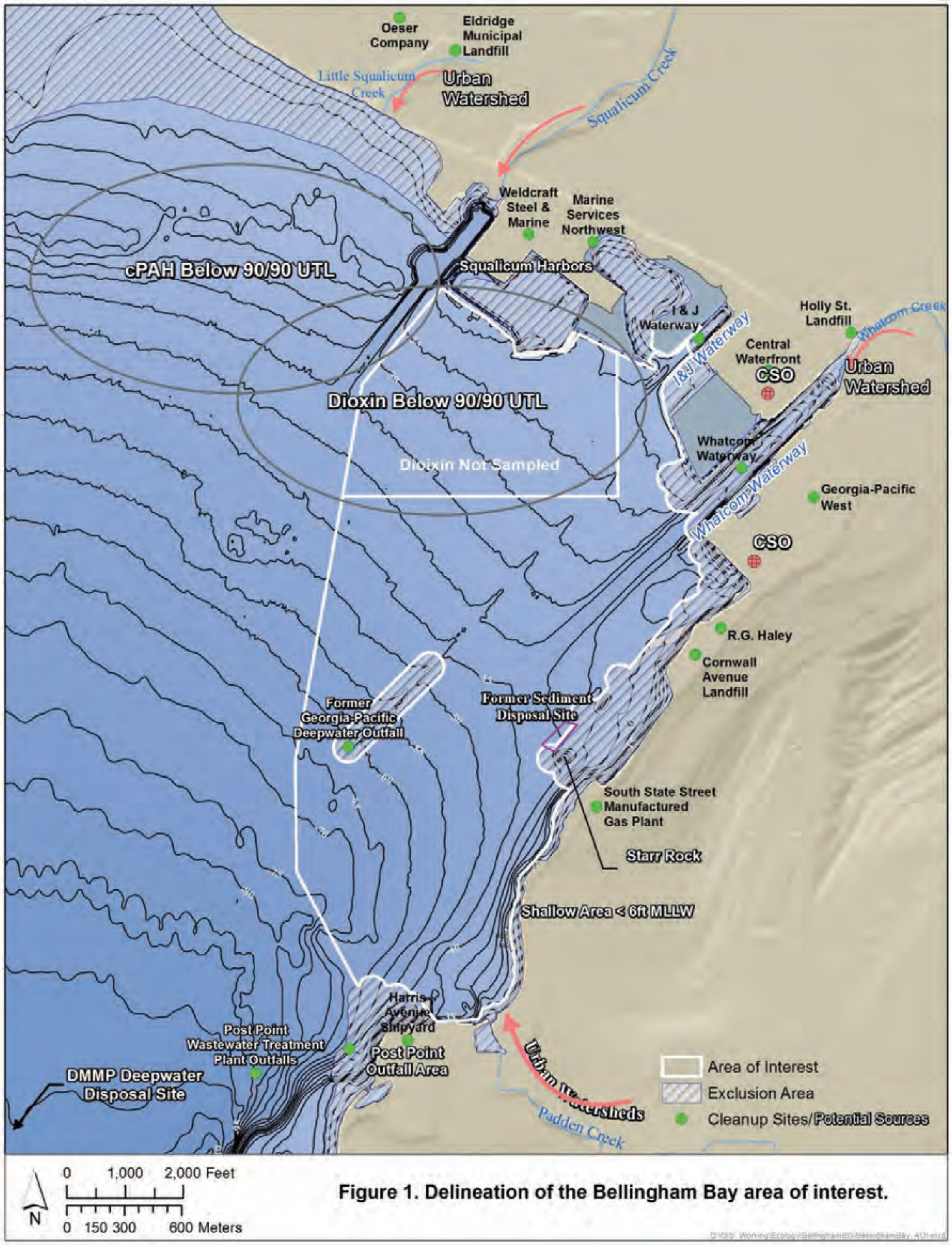

Figure 1. Delineation of the Bellingham Bay area of interest.

Notes:

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2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electr ored by GeoEngineers, Inc. and will serv d of this communication.

Data Source: Ecology 2015. Bellingham Bay Regional Background Sediment Characterization, Bellingham WA. Final Data Evaluation and Summary Report. Publication No. 15-09-044. February 27, 2015.

Regional Background Area of Interest

R.G. Haley Site
Bellingham, Washington

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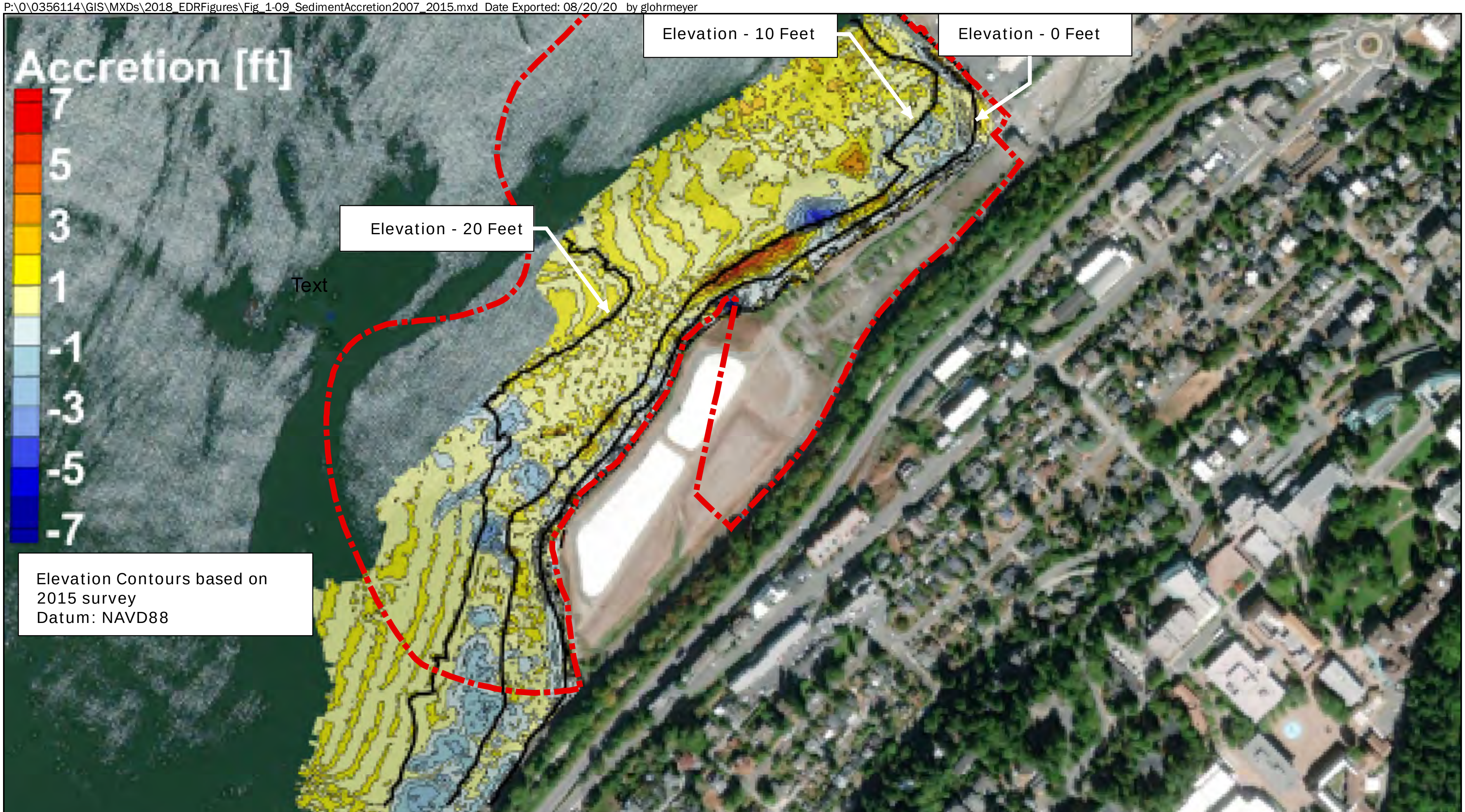
Figure 2

P:\0\0356114\GIS\MXDs\2018_EDRFigures\Fig_1-09_SedimentAccretion2007_2015.mxd Date Exported: 08/20/20 by glohrmeyer



Notes:
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3. Modified from Mott MacDonald figure presented during April 10, 2019 coordination meeting with the City and the Port.
Accretion determined by Mott MacDonald by subtracting 2007 depths to seafloor from 2015 depths.
Haley Cleanup Area Boundary added for reference.

Projection: NAD 1983 StatePlane Oregon North FIPS 3601 Feet

Legend

Haley Cleanup Area Boundary

500 0 500
Feet

N W E S

Sediment Accretion 2007 to 2015

R.G. Haley Site
Bellingham, Washington

GeoEngineers

Figure 3

Notes:
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Data Source: Aerial from Bing.

Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Legend

- BB-25 11.9 — Sample Designation and Dioxin/Furan TEQ (ng/kg)
- Cap Area
- RG Haley Site Marine Unit
- Whatcom Waterway Site
- South State Street Site Marine Unit
- Regional Background Area of Interest (AOI)
- Dioxin/Furan Exclusion Areas

Sample Year

- 1996
- 2004
- 2008
- 2012
- 2013
- 2014
- 2015
- 2019
- 2020

1,050 0 1,050

Feet

Recent Dioxin/Furan Data Used in Recontamination Evaluation

R.G. Haley Site
Bellingham Washington

GeoEngineers

Figure 4

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Data Source: Aerial from Bing.

Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Legend

- BB-25 11.9 — Sample Designation and Dioxin/Furan TEQ (ng/kg)
- Recontamination Evaluation Area
- Cap Area
- RG Haley Site Marine Unit
- Whatcom Waterway Site
- South State Street Site Marine Unit
- Regional Background Area of Interest (AOI)
- Dioxin/Furan Exclusion Areas
- Site Unit 1C Dredge and Cap Area

Sample Year

- 1996
- 2004
- 2008
- 2012
- 2013
- 2014
- 2015
- 2019
- 2020

500 0 500
Feet

Recontamination Evaluation Area

R.G. Haley Site
Bellingham Washington

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Figure 5