Technical Memorandum
Engineering Geologic Evaluation of Proposed Improvements at Saltwater State Park
Des Moines, Washington

November 5, 2015

SHANNON & WILSON, INC.

GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

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21-1-22077-001

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November 5, 2015

Mr. Scott White
Confluence Environmental Company
146 N. Canal Street, Suite 111
Seattle, WA 98103

RE: TECHNICAL MEMORANDUM: ENGINEERING GEOLOGIC EVALUATION OF PROPOSED IMPROVEMENTS AT SALTWATER STATE PARK, DES MOINES, WASHINGTON

Dear Mr. White:

This technical memorandum presents the results of our evaluation of the engineering geologic aspects of proposed improvements to Saltwater State Park in Des Moines, Washington. Environmental testing was also performed at the site. The two main purposes of the improvements are to (1) create better fish habitat along McSorley Creek by removing the armoring along the channel and moving the channel southward, closer to its original alignment and (2) increase sediment and woody debris recruitment from the park bluff to the beach by removing or relocating the seawall and fill bench on the north end of the park.

To this end, we have performed the following scope of services:

1. Reviewed historic park drawings provided by Confluence Environmental Company (Confluence).
2. Reviewed on-line photographs and media articles, geologic literature, and photographs from the Washington State Department of Natural Resources.
3. Performed a field reconnaissance of the park bluff and entrance road.
4. Excavated and logged eight test pits.
5. Performed grain size analyses on representative samples from the eight test pits.
6. Performed two soil compaction tests on representative soil samples from the test pits.
7. Performed environmental testing on samples from the test pits.
8. Prepared this technical memorandum.

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Shannon & Wilson, Inc.'s work on this project was authorized by Mr. Scott White of Confluence on May 14, 2015. The project owner is King County Department of Natural Resources.

SITE DESCRIPTION

Saltwater State Park is located in the southwestern corner of Des Moines, Washington, along the Puget Sound shoreline, as show in the Vicinity Map, Figure 1. The park extends eastward from the shoreline for about ½ mile along McSorley Creek, but the focus of this evaluation is at and near the shoreline. The upper part of the north end of the park is an upland at about elevation 200 feet (Figures 2 and 3). This upland area contains two permanent park buildings at the north end and walking trails throughout. It is wooded, except where there are buildings, parking lots, and access roads. The two buildings are located relatively close to the top of the steep bluff that fronts Puget Sound. The interpretive center is set back about 70 feet from the edge of the bluff at its closest point. The classroom and maintenance shop is 20 to 30 feet from the edge of the bluff.

The park entrance road is about 20 feet wide and paved, with a paved drainage ditch on the inboard side and a sidewalk, guard rail, and concrete rubble retaining wall on the outboard side. On the inboard side, the cut slope is steep at about 50 degrees, and is well vegetated with conifers and ivy.

The lower, non-beach part of the park contains an asphalt-paved parking lot and open grass fields. A concession stand and restroom are located in this relatively level area.

Just south of and continuing to the north of the mouth of McSorley Creek, the park was enhanced by filling behind a 10-foot-high rock seawall, as shown in Figure 4, Photo 1. The fill is relatively level, but is slightly graded down from east to west, starting at the toe of the steep bluff and ending at the edge of the seawall. This part of the park contains a fire ring, a restroom, and several picnic areas. The steep slope to the east of this bench is heavily wooded, except where landslides appear to have removed the trees. The undergrowth is dense. We understand that thick undergrowth was planted on this slope to discourage access by the public.

GEOLOGIC CONDITIONS

The soils exposed in the bluffs to the north of the park are assumed to be representative of those in the bluff at the park. These glacially derived strata were deposited prior to and during the last

glacial episode to reach the central Puget Lowland. The geologic units discussed herein are documented on the geologic map of the quadrangle (Booth and others, 2004).[1] Except for the beach sediments and artificial fill at the park, all of the sediments have been overridden by about 3,000 feet of ice at least once.

The lowest and oldest geologic unit is pre-Olympia coarse grain deposits (Qpogc), comprised of interbedded layers of sand and gravel, but containing scattered fine-grain lenses. This unit makes up the lower part of the sea bluff, standing near vertically along the shoreline north of the park. Water is typically perched on top of this layer in Puget Lowland bluffs, but none was observed during our reconnaissance in the park or on the exposed bluffs to the north of the park.

The geologic map indicates Vashon Advance Outwash (Qva) overlies Qpogc on the park bluff. This is corroborated by the presence of madrone trees that have an affinity to free-draining glacial soils, and the nature of the soil in the landslide deposit on the beach to the north of the park. The Qva unit is comprised of relatively clean sand and gravel.

The upper geologic unit at the site is Vashon Till (Qvt), as shown in the geologic map. This is confirmed by the large blocks of till on the beach at the toe of the recent landslide on private property to the north of the park. Till is a mixture of sand and silt, with varying amounts of gravel. It is very dense and, where unweathered, has a relatively low permeability.

A steep (near-vertical) bluff forms the coastal slope from Zenith Bluff, about 1½ miles to the north, southward to Saltwater State Park, as shown in Figure 4, Photo 2. In this zone, the lower 30 to 50 feet of the bluff is bare, owing to continual wave attack from the southwest. Because the soils in the bluff are very dense, the bluff stays near-vertical, and regresses slowly. The bare lower bluff continues southward to the northern edge of the state park. On the slope within the park, the inclination is about 45 to 50 degrees, without the lower vertical bluff that is typical to the north. The City of Des Moines has classified this slope, including the park and private properties to the north, as a geologically hazardous area for landslides and erosion. The Washington State Coastal Zone Atlas categorizes the bluff as unstable.

[1] Booth, D.B., Waldron, H.H. and Troost, K.G., 2004, Geologic map of the Poverty Bay 7.5' Quadrangle, King and Pierce Counties, Washington, U.S. Geological Survey, Scientific Investigation Map 2854.

The bluff in the park shows signs of past shallow instability, based on the accumulation of landslide debris at the toe of the slope in three places, as noted on Figure 3. One is shown in Figure 4, Photo 3. Additionally, the natural tree cover on the slope is locally missing or monoculturally deciduous in an otherwise coniferous forest. No signs of active instability were observed on the bluff in the park.

To the north of the park, instability has occurred on the private properties (Figure 3 and Figure 4, Photo 4). A review of Google Earth photographs indicates that a landslide occurred on the upper part of the bluff between the summers of 2010 and 2011 on the property adjoining the northern park line (Figure 4, Photo 5). More recently, a landslide occurred on the same property and extended northward on March 27, 2015. The total width of the recent landslide is about 280 feet. All of the mobile soil was from the upper bluff. The lower bluff stayed intact, and the moving upper bluff soil and debris cascaded over it and onto the beach.

Photographs of the 2015 landslide show broken irrigation lines, and it is reported that neighbors had complained about the watering of the slope and vegetation cutting on this property on which the recent landslide occurred. A 2010 photograph shows fresh vegetation cutting at the site of the 2010/2011 landslide (Figure 4, Photo 6).

POTENTIAL SCENARIOS FOR THE PARK SLOPE

We have considered three potential scenarios for the rock seawall: (1) leave the seawall and park fill in place (no action), (2) remove the park fill and move the seawall to the toe of the bluff, and (3) remove the seawall and the park fill. The following is our professional opinion on the potential ensuing changes, if any, in the bluff and potential effects on surrounding features due to the three scenarios.

Leave Seawall and Park Fill In Place (No Action)

In this case, it is likely that the slope will continue to incur shallow instability on the very steep lower part of the slope due to above-normal winter precipitation exacerbated by intense storms. The soil and woody debris will be deposited on the flats of the park and could potentially damage or destroy some of the facilities there. It is unlikely that the interpretive center and maintenance building at the top of the slope will be negatively impacted over the next several decades if the past several decades are an indication of the future and the seawall stays in-place.

However, continued stability of the upper slope near the park buildings is not guaranteed if an intense precipitation event were to strike this area; the slope is potentially unstable. We recommend that the slope markers to the west of the interpretive center be left in place in the event that instability should occur on the slope. We also recommend that the park continue to leave vegetation undisturbed and wisely manage water in the proximity of the slope. It is important to keep the slope dry, not introducing outside water to it and not concentrating runoff near it.

Remove Park Fill and Move Seawall to the Toe of the Bluff

In this case, undermining of the toe of the slope would be prevented, but shallow landslides would still occur at a rate similar to the present. When landslides occur, sediment and woody debris would be delivered directly to the beach and then redistributed by subsequent storm waves. The effects on structures at the top of the slope would be the same as the no action scenario.

Remove Rock Bulkhead and Park Fill

In this case, waves would attack the toe directly, and eventually, the slope would revert to a slope similar to that to the north of the park; that is, a near-vertical lower 30- to 50-foot bluff and a flatter upper bluff. There would likely be a sharp increase in wood and sediment delivery to the beach over the next several decades due to discrete 10- to 30-foot-wide slope failures from colluvial soils that cover the hard/very dense soils on the lower slope (see Figure 5). Such a process could deliver desired materials to the beach, but also be a danger to the public.

Following the removal of colluvium that now covers the in-place glacial soils on the lower slope, it is then likely that the upper bluff colluvial and in situ soils (Figure 5) could be undermined, leading to instability on the upper bluff. This would increase the risk of damage to the park buildings at the top of the slope; however, it is our opinion that this is unlikely to occur for several or more decades. However, the duration of stability is impossible to predict. It has been our experience at Seahurst Park and Eagle Landing Park that landslides at unprotected beach slopes can destabilize in as little as ten years in a narrow colluvial event, but more likely will maintain stability for five or more decades if left undisturbed.

PARK ENTRANCE ROAD

In general, the park entrance road is in good condition, with the exception of the area discussed below. The pavement is in good condition except near the top where arcuate cracks in the pavement and sidewalk indicate that the slope below is or has been moving (Figure 3). It is apparent that the cracks have been sealed one or more times in the past, so this may be an on-going maintenance issue.

The concrete rubble retaining wall on the outboard side of the road appeared to be in good condition, as shown in Figure 4, Photo 7. No bulging or failure was observed; however, all of the wall except for about 20 feet near the north end was covered with ivy.

On the uphill side of the entrance road, no areas of recent instability were observed. One area, indicated in Figure 3, had the appearance of a slope failure, but the slope has since revegetated.

The road has the appearance of being cut/fill construction; that is, the uphill slope was excavated and the soil placed on the downhill side of the road, retained by the concrete rubble wall. This wall is not likely constructed according to modern standards, but except for the area noted above, has not suffered damage or degradation. We recommend that the road be tested with a falling weight deflectometer to confirm the subgrade condition along the length of the road.

At the site of the current road distress, we recommend that a boring be drilled and sampled to evaluate the subsurface conditions. The boring should be installed prior to the winter so a vibrating wire piezometer can record water levels throughout the wet season. Engineering studies can then be performed to formulate the design parameters and choose the type of repair for this section of the road.

FIELD AND LABORATORY SOILS TESTING

Eight test pits (TP-1 through TP-8) were excavated to 6 to 10 feet deep for engineering and environmental purposes at the approximate locations shown in Figure 2. The results of the environmental/ hazardous materials testing are discussed below and are presented in Appendix C. The test pit logs are presented in Appendix A. For engineering purposes, grain size analyses were performed on a sample from each test pit, and then two soil compaction tests were run. One compaction test was performed on soil from TP-1 and another on a combined sample of TP-4 and TP-5. The laboratory test results are presented in Appendix B.

As shown in the laboratory test results, the grain size samples range from relatively clean sand and gravel (TP-8) to very dirty, silty sand (TP-4). Three of the samples (TP-1, TP-4, and TP-6) contained some degree of plastic fines.

The soil compaction tests indicate that the tested soils were significantly to slightly higher than the optimum moisture, necessitating that the soils would need to be dried or mixed with drier soils in order to obtain suitable compaction if reused as structural fill elsewhere on the site.

HAZARDOUS MATERIALS TESTING AND RESULTS

One composite soil sample was collected from each of the eight test pit explorations and analyzed for hazardous materials as an initial environmental screening effort. Based on the scope of work, soil samples were analyzed for Northwest Total Petroleum Hydrocarbons Identification (NWTPH-HCID), Model Toxics Control Act (MTCA) metals (arsenic, cadmium, chromium, lead, and mercury), and polyaromatic hydrocarbons (PAHs). Samples were collected using disposable sampling equipment and by donning a new pair of disposable nitrile gloves for each soil sampling. At least one, laboratory-supplied 8-ounce jar was filled using disposable stainless steel spoons, and two clean, laboratory-supplied 40-millimeter vials in accordance with U.S. Environmental Protection Agency Method 5035. The sample container labels were completed using indelible ink. The samples were sealed in plastic bags, and then placed into a cooler and maintained at 4 degrees Celsius (°C) ($\pm$ 2°C) with “blue ice.” Coolers were transported to Fremont Analytical of Seattle, Washington, under standard chain-of-custody procedures.

Petroleum hydrocarbons were not detected above method detection limits in the eight soil samples analyzed for NWTPH-HCID. Further gasoline and/or diesel- and lube oil-range hydrocarbons analyses, as outlined in the scope of work, were not warranted since the initial hydrocarbon identification analysis did not yield any detections. PAHs were also not detected above method detection limits in the eight soil samples analyzed. MTCA-5 metals arsenic, chromium, and lead were detected in the eight soil samples analyzed below the MTCA Method A cleanup criteria. A summary of the analytical soil sample results and laboratory analytical report is presented in Appendix C.

Soil samples were collected for initial screening purposes only and do not reflect a site wide characterization of conditions. Areas of contamination may be encountered that were not identified during this effort. As the environmental investigation is limited and due to the presence of undocumented fill, we recommend soil screening be conducted during future project excavation activities. Additional soil sampling may be required for disposal characterization of excavated material to be disposed of off-site. The amount of samples for disposal purposes is determined by the accepting disposal facility. A contingency should be set aside to provide for this effort. Soil screening requirements should be included in project plans and specifications.

To evaluate the suitability of site soils for use in intertidal zones, a broader suite of metals analyses including priority pollutant metals by EPA method 200.7, 6010B, 6010C would likely be required. Final determination as to the suite of analytical testing for placement in intertidal zones will be based on the requirements of the project permits.

LIMITATIONS

The conclusions and recommendations in this technical memorandum are based on a visual examination of the surface conditions as they existed during the time of our field reconnaissance. Subsurface explorations were performed for this study only to evaluate the soils that may be reworked on the lower parts of the park. This work has been performed using practices consistent with geologic and geotechnical industry standards in the region for slope stability; however, prediction of slope movement with absolute certainty is not possible with currently available scientific knowledge. As with any steep slope, there are always risks of instability that present and future owners must accept. Such risks include poor drainage maintenance, excavating at the toe of a slope, placement of fill at the top of a slope, extreme or unusual storm events, and fire, among others. If conditions described in this letter report change, we should be advised immediately so that we can review those conditions and reconsider our conclusions and recommendations.

Shannon & Wilson, Inc. has included the enclosed Appendix D, “Important Information About Your Geotechnical/Environmental Report” to assist you and others in understanding the use and limitations of our reports.

We appreciate the opportunity to be of service. If you have any questions or comments, please contact me.

Sincerely,

SHANNON & WILSON, INC.

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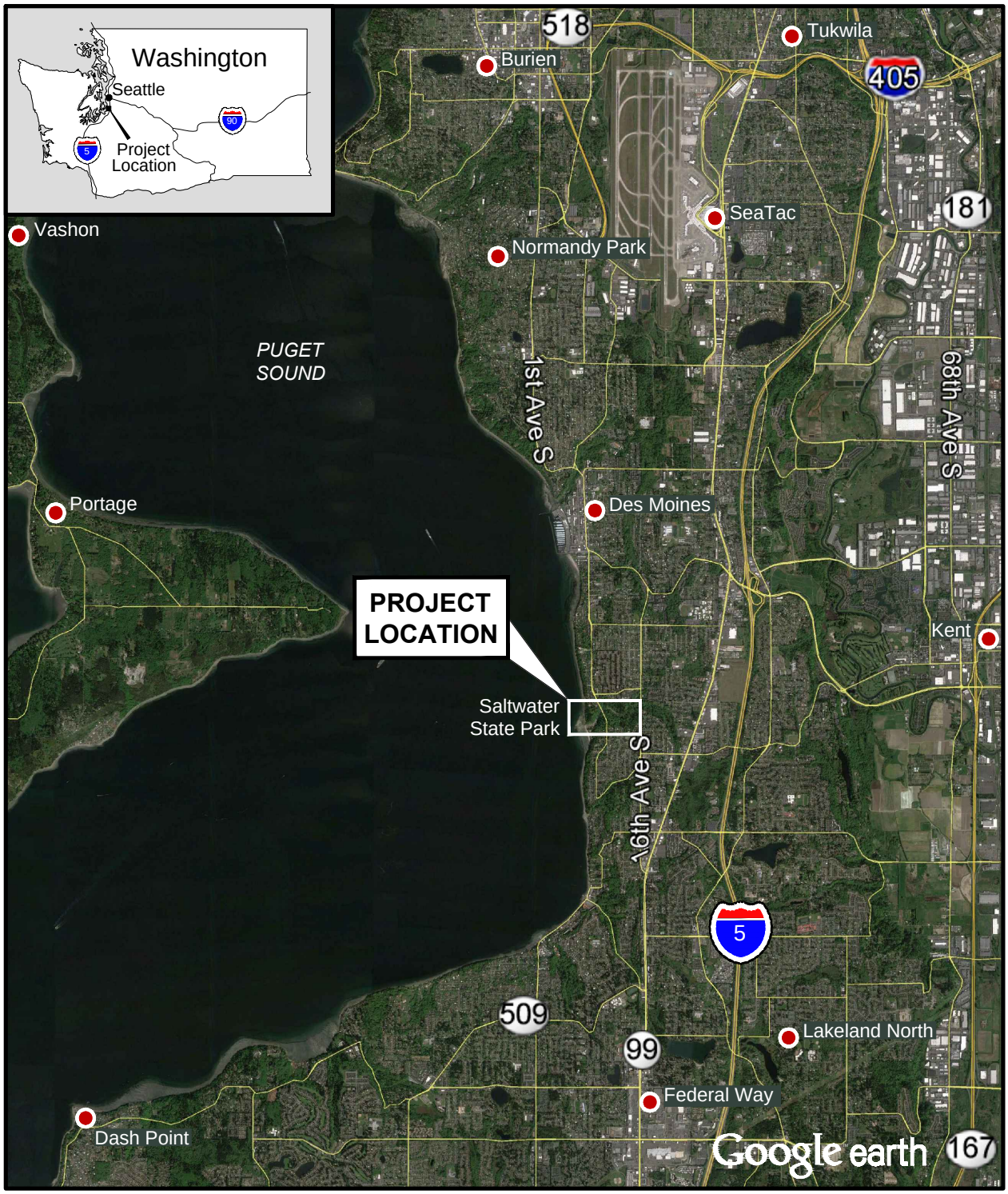
WTL:SWG/wtl

The engineering geologic portion of this report was prepared by Mr. William T. Laprade, L.E.G.
The environmental hazardous materials section of the report was prepared under the supervision Mr. Scott W. Gaulke, P.E., L.H.G.

Enc: Figure 1 – Vicinity Map
Figure 2 – Site Plan
Figure 3 – Reconnaissance Map
Figure 4 – Photographs (7 photos)
Figure 5 – Hypothetical Slope Profile
Appendix A – Test Pit Logs
Appendix B – Laboratory Test Results
Appendix C – Environmental Testing Results
Appendix D – Important Information About Your Geotechnical/Environmental Report



0 8000 16,000

Approximate Scale in Feet

NOTE

Map adapted from aerial imagery provided by Google Earth Pro, reproduced by permission granted by Google Earth ™ Mapping Service.

Saltwater State Park
Des Moines, Washington

VICINITY MAP

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FIG. 1

Filename: J:\211\22077-001\21-1-22077-001 Vicinity Map.dwg Date: 11-05-2015 Login: sac

LEGEND

TP-7 Test Pit
Location & Designation

N
W E
S

0 150
Feet

Saltwater State Park
Des Moines, WA

SITE PLAN

November 2015 21-1-22077-001

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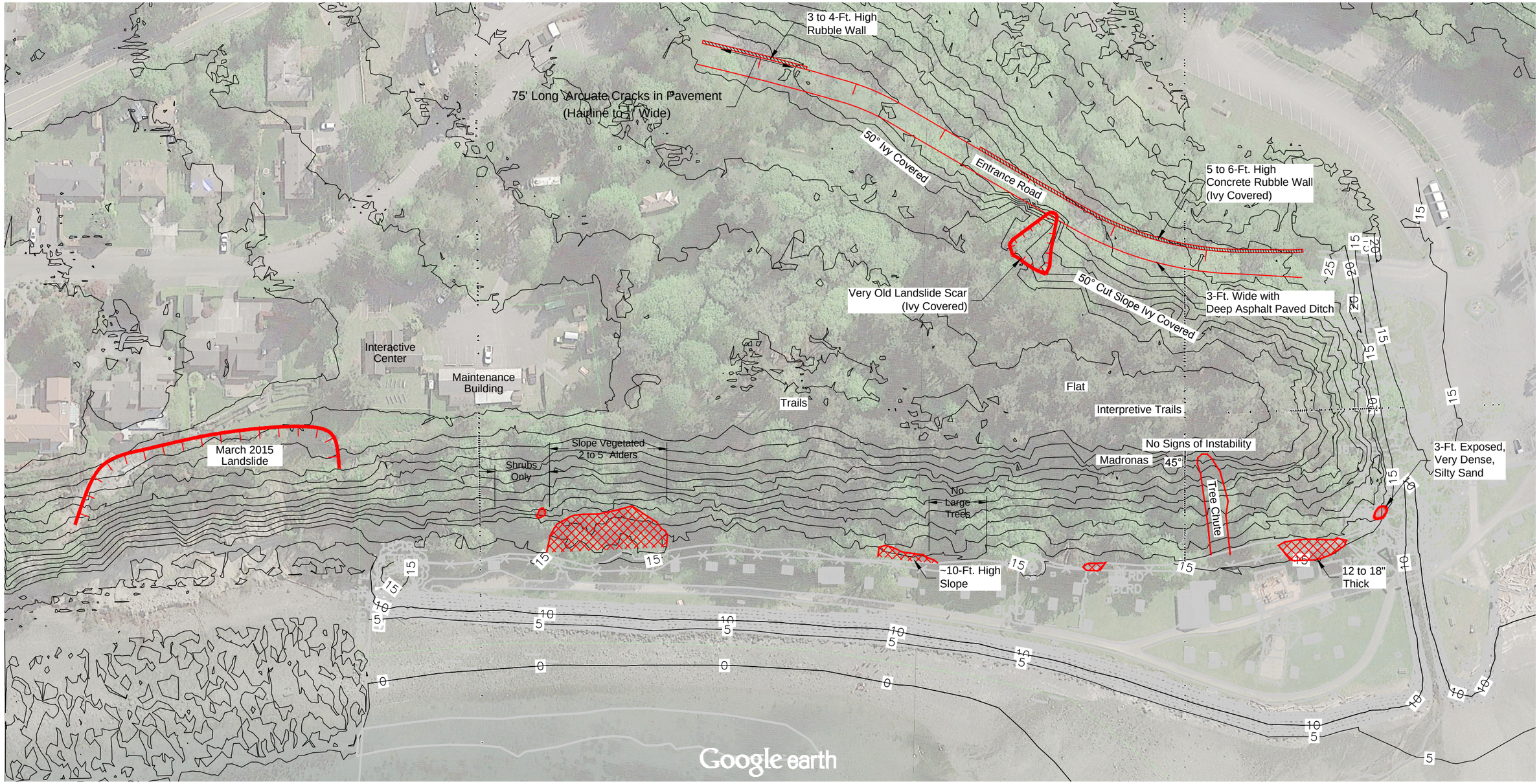
FIG. 2

Filename: T:\21-1\22077_Saltwater\AV_mxd\22077_S&E.mxd Date: 10/7/2015 brl



0 100 200

Scale in Feet
Contour Interval = 10 Feet

N

NOTE

This figure is adapted from client file, *N430196_X-TOPO_McSorley Creek Salt Water State Park-edited rev9.dwg*, received 9-3-2015. Aerial imagery provided by Google Earth Pro, reproduced by permission granted by Google Earth ™ Mapping Service.

LEGEND

Colluvium Deposit

Sand Exposure

Saltwater State Park
Des Moines, Washington

RECONNAISSANCE MAP

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FIG. 3

Filename: J:\211\22077-001\21-1-22077-001 Fig 3 - Reconnaissance Map.dwg Layout: 10-Ft Contours Date: 11-05-2015 Login: sac

Photo 1.
Northern end of Saltwater State Park with seawall to the left; steep slope to the right.

Photo 2.
Near vertical bluff to north of Saltwater State Park.

File: J:\211\22077-001\21-1-22077-001 Fig 4 - Site Photos.dwg Date: 11-05-2015 Author: sac

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21-1-22077-001

SITE PHOTOGRAPHS

FIG. 4
Sheet 1 of 5

Photo 3.
Debris at toe of steep slope. Immature alder on slope above.

Photo 4.
February 2015 Landslide north of Saltwater State Park. Lower bluff undisturbed landslide debris on beach from upper bluff.

File: J:\211\22077-001\21-1-22077-001 Fig 4 - Site Photos.dwg Date: 11-05-2015 Author: sac

November 2015
21-1-22077-001

SITE PHOTOGRAPHS

FIG. 4
Sheet 2 of 5

Photo 5.
2010/2011 landslide north of park. Photo taken in 2012.

File: J:\211\22077-001\21-1-22077-001 Fig 4 - Site Photos.dwg Date: 11-05-2015 Author: sac

Photo 6.
Fresh vegetation cutting in 2010 at site of 2010/2011 landslide.

File: J:\21\22077-001\21-1-22077-001 Fig 4 - Site Photos.dwg Date: 11-05-2015 Author: sac

Photo 7.
Concrete rubble wall on entrance road.

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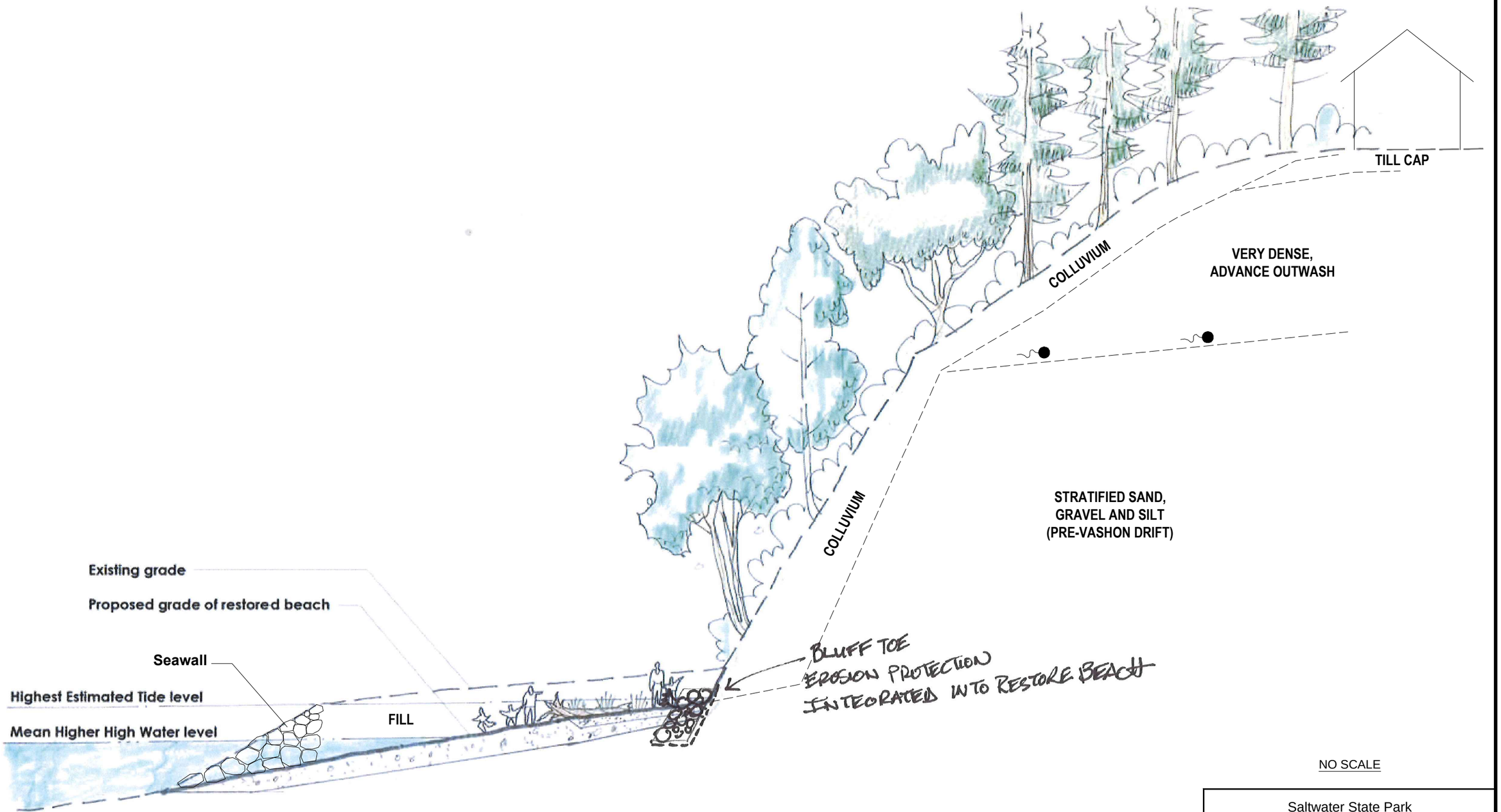
FIG. 4
Sheet 5 of 5



NOTE

Base plan sketch adapted from Green Vision Plan Concept Report, dated 2007.

NO SCALE

Saltwater State Park
Des Moines, Washington

HYPOTHETICAL SLOPE PROFILE

November 2015 21-1-22077-001

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FIG. 5

Filename: J:\211\22077-001\21-1-22077-001 Fig 5 - Slope Profile.dwg Date: 11-05-2015 Login: sac

APPENDIX A

TEST PIT LOGS

APPENDIX A

TEST PIT LOGS

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FIGURES

A-1 Soil Description and Log Key (3 sheets)
A-2 Log of Test Pit TP-1
A-3 Log of Test Pit TP-2
A-4 Log of Test Pit TP-3
A-5 Log of Test Pit TP-4
A-6 Log of Test Pit TP-5
A-7 Log of Test Pit TP-6
A-8 Log of Test Pit TP-7
A-9 Log of Test Pit TP-8

Shannon & Wilson, Inc. (S&W), uses a soil identification system modified from the Unified Soil Classification System (USCS). Elements of the USCS and other definitions are provided on this and the following pages. Soil descriptions are based on visual-manual procedures (ASTM D2488) and laboratory testing procedures (ASTM D2487), if performed.

S&W INORGANIC SOIL CONSTITUENT DEFINITIONS

CONSTITUENT[2]	FINE-GRAINED SOILS (50% or more fines)[1]	COARSE-GRAINED SOILS (less than 50% fines)[1]
Major	***Silt, Lean Clay, Elastic Silt,*** or ***Fat Clay***[3]	***Sand*** or ***Gravel***[4]
Modifying (Secondary) Precedes major constituent	30% or more coarse-grained: ***Sandy*** or ***Gravelly***[4]	More than 12% fine-grained: ***Silty*** or ***Clayey***[3]
Minor Follows major constituent	15% to 30% coarse-grained: ***with Sand*** or ***with Gravel***[4]	5% to 12% fine-grained: ***with Silt*** or ***with Clay***[3]
	30% or more total coarse-grained *and* lesser coarse-grained constituent is 15% or more: ***with Sand*** or ***with Gravel***[5]	15% or more of a second coarse-grained constituent: ***with Sand*** or ***with Gravel***[5]

[1]All percentages are by weight of total specimen passing a 3-inch sieve.
[2]The order of terms is: *Modifying Major with Minor*.
[3]Determined based on behavior.
[4]Determined based on which constituent comprises a larger percentage.
[5]Whichever is the lesser constituent.

MOISTURE CONTENT TERMS

Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, from below water table

STANDARD PENETRATION TEST (SPT) SPECIFICATIONS

Hammer:	140 pounds with a 30-inch free fall. Rope on 6- to 10-inch-diam. cathead 2-1/4 rope turns, > 100 rpm NOTE: If automatic hammers are used, blow counts shown on boring logs should be adjusted to account for efficiency of hammer.
Sampler:	10 to 30 inches long Shoe I.D. = 1.375 inches Barrel I.D. = 1.5 inches Barrel O.D. = 2 inches
N-Value:	Sum blow counts for second and third 6-inch increments. Refusal: 50 blows for 6 inches or less; 10 blows for 0 inches.

NOTE: Penetration resistances (N-values) shown on boring logs are as recorded in the field and have not been corrected for hammer efficiency, overburden, or other factors.

PARTICLE SIZE DEFINITIONS

DESCRIPTION	SIEVE NUMBER AND/OR APPROXIMATE SIZE
FINES	< #200 (0.075 mm = 0.003 in.)
SAND Fine Medium Coarse	 #200 to #40 (0.075 to 0.4 mm; 0.003 to 0.02 in.) #40 to #10 (0.4 to 2 mm; 0.02 to 0.08 in.) #10 to #4 (2 to 4.75 mm; 0.08 to 0.187 in.)
GRAVEL Fine Coarse	 #4 to 3/4 in. (4.75 to 19 mm; 0.187 to 0.75 in.) 3/4 to 3 in. (19 to 76 mm)
COBBLES	3 to 12 in. (76 to 305 mm)
BOULDERS	> 12 in. (305 mm)

RELATIVE DENSITY / CONSISTENCY

COHESIONLESS SOILS		COHESIVE SOILS	
N, SPT, BLOWS/FT.	RELATIVE DENSITY	N, SPT, BLOWS/FT.	RELATIVE CONSISTENCY
< 4	Very loose	< 2	Very soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium dense	4 - 8	Medium stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very dense	15 - 30	Very stiff
		> 30	Hard

WELL AND BACKFILL SYMBOLS

Bentonite Cement Grout	Surface Cement Seal
Bentonite Grout	Asphalt or Cap
Bentonite Chips	Slough
Silica Sand	Inclinometer or Non-perforated Casing
Perforated or Screened Casing	Vibrating Wire Piezometer

PERCENTAGES TERMS [1, 2]

Trace	< 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

[1]Gravel, sand, and fines estimated by mass. Other constituents, such as organics, cobbles, and boulders, estimated by volume.

[2]Reprinted, with permission, from ASTM D2488 - 09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428. A copy of the complete standard may be obtained from ASTM International, www.astm.org.

Saltwater State Park
Des Moines, Washington

SOIL DESCRIPTION AND LOG KEY

October 2015 | 21-1-22077-001

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Geotechnical and Environmental Consultants

FIG. A-1
Sheet 1 of 3

SOIL_CLASS_KEY_PG1 21-22077.GPJ SHAN_WIL.GDT 10/12/15

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)
(Modified From USACE Tech Memo 3-357, ASTM D2487, and ASTM D2488)

MAJOR DIVISIONS			GROUP/GRAPHIC SYMBOL		TYPICAL IDENTIFICATIONS
COARSE-GRAINED SOILS *(more than 50% retained on No. 200 sieve)*	Gravels *(more than 50% of coarse fraction retained on No. 4 sieve)*	Gravel *(less than 5% fines)*	GW		Well-Graded Gravel; Well-Graded Gravel with Sand
			GP		Poorly Graded Gravel; Poorly Graded Gravel with Sand
		Silty or Clayey Gravel *(more than 12% fines)*	GM		Silty Gravel; Silty Gravel with Sand
			GC		Clayey Gravel; Clayey Gravel with Sand
	Sands *(50% or more of coarse fraction passes the No. 4 sieve)*	Sand *(less than 5% fines)*	SW		Well-Graded Sand; Well-Graded Sand with Gravel
			SP		Poorly Graded Sand; Poorly Graded Sand with Gravel
		Silty or Clayey Sand *(more than 12% fines)*	SM		Silty Sand; Silty Sand with Gravel
			SC		Clayey Sand; Clayey Sand with Gravel
FINE-GRAINED SOILS *(50% or more passes the No. 200 sieve)*	Silts and Clays *(liquid limit less than 50)*	Inorganic	ML		Silt; Silt with Sand or Gravel; Sandy or Gravelly Silt
			CL		Lean Clay; Lean Clay with Sand or Gravel; Sandy or Gravelly Lean Clay
		Organic	OL		Organic Silt or Clay; Organic Silt or Clay with Sand or Gravel; Sandy or Gravelly Organic Silt or Clay
	Silts and Clays *(liquid limit 50 or more)*	Inorganic	MH		Elastic Silt; Elastic Silt with Sand or Gravel; Sandy or Gravelly Elastic Silt
			CH		Fat Clay; Fat Clay with Sand or Gravel; Sandy or Gravelly Fat Clay
		Organic	OH		Organic Silt or Clay; Organic Silt or Clay with Sand or Gravel; Sandy or Gravelly Organic Silt or Clay
HIGHLY-ORGANIC SOILS	Primarily organic matter, dark in color, and organic odor		PT		Peat or other highly organic soils (see ASTM D4427)

NOTE: No. 4 size = 4.75 mm = 0.187 in.; No. 200 size = 0.075 mm = 0.003 in.

NOTES

1. Dual symbols *(symbols separated by a hyphen, i.e., SP-SM, Sand with Silt)* are used for soils with between 5% and 12% fines or when the liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart. Graphics shown on the logs for these soil types are a combination of the two graphic symbols (e.g., SP and SM).

2. Borderline symbols *(symbols separated by a slash, i.e., CL/ML, Lean Clay to Silt; SP-SM/SM, Sand with Silt to Silty Sand)* indicate that the soil properties are close to the defining boundary between two groups.

Saltwater State Park
Des Moines, Washington

SOIL DESCRIPTION AND LOG KEY

October 2015 | 21-1-22077-001

SHANNON & WILSON, INC.
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FIG. A-1
Sheet 2 of 3

SOIL_CLASS_KEY_PG2 21-22077.GPJ SHAN_WIL.GDT 10/12/15

GRADATION TERMS

Poorly Graded	Narrow range of grain sizes present or, within the range of grain sizes present, one or more sizes are missing (Gap Graded). Meets criteria in ASTM D2487, if tested.
Well-Graded	Full range and even distribution of grain sizes present. Meets criteria in ASTM D2487, if tested.

CEMENTATION TERMS[1]

Weak	Crumbles or breaks with handling or slight finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

PLASTICITY[2]

DESCRIPTION	VISUAL-MANUAL CRITERIA	APPROX. PLASITICITY INDEX RANGE
Nonplastic	A 1/8-in. thread cannot be rolled at any water content.	< 4
Low	A thread can barely be rolled and a lump cannot be formed when drier than the plastic limit.	4 to 10
Medium	A thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. A lump crumbles when drier than the plastic limit.	10 to 20
High	It takes considerable time rolling and kneading to reach the plastic limit. A thread can be rerolled several times after reaching the plastic limit. A lump can be formed without crumbling when drier than the plastic limit.	> 20

ADDITIONAL TERMS

Mottled	Irregular patches of different colors.
Bioturbated	Soil disturbance or mixing by plants or animals.
Diamict	Nonsorted sediment; sand and gravel in silt and/or clay matrix.
Cuttings	Material brought to surface by drilling.
Slough	Material that caved from sides of borehole.
Sheared	Disturbed texture, mix of strengths.

PARTICLE ANGULARITY AND SHAPE TERMS[1]

Angular	Sharp edges and unpolished planar surfaces.
Subangular	Similar to angular, but with rounded edges.
Subrounded	Nearly planar sides with well-rounded edges.
Rounded	Smoothly curved sides with no edges.
Flat	Width/thickness ratio > 3.
Elongated	Length/width ratio > 3.

[1]Reprinted, with permission, from ASTM D2488 - 09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428. A copy of the complete standard may be obtained from ASTM International, www.astm.org.

[2]Adapted, with permission, from ASTM D2488 - 09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428. A copy of the complete standard may be obtained from ASTM International, www.astm.org.

ACRONYMS AND ABBREVIATIONS

ATD	At Time of Drilling
Diam.	Diameter
Elev.	Elevation
ft.	Feet
FeO	Iron Oxide
gal.	Gallons
Horiz.	Horizontal
HSA	Hollow Stem Auger
I.D.	Inside Diameter
in.	Inches
lbs.	Pounds
MgO	Magnesium Oxide
mm	Millimeter
MnO	Manganese Oxide
NA	Not Applicable or Not Available
NP	Nonplastic
O.D.	Outside Diameter
OW	Observation Well
pcf	Pounds per Cubic Foot
PID	Photo-Ionization Detector
PMT	Pressuremeter Test
ppm	Parts per Million
psi	Pounds per Square Inch
PVC	Polyvinyl Chloride
rpm	Rotations per Minute
SPT	Standard Penetration Test
USCS	Unified Soil Classification System
q_u	Unconfined Compressive Strength
VWP	Vibrating Wire Piezometer
Vert.	Vertical
WOH	Weight of Hammer
WOR	Weight of Rods
Wt.	Weight

STRUCTURE TERMS[1]

Interbedded	Alternating layers of varying material or color with layers at least 1/4-inch thick; singular: bed.
Laminated	Alternating layers of varying material or color with layers less than 1/4-inch thick; singular: lamination.
Fissured	Breaks along definite planes or fractures with little resistance.
Slickensided	Fracture planes appear polished or glossy; sometimes striated.
Blocky	Cohesive soil that can be broken down into small angular lumps that resist further breakdown.
Lensed	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay.
Homogeneous	Same color and appearance throughout.

Saltwater State Park
Des Moines, Washington

SOIL DESCRIPTION AND LOG KEY

October 2015 21-1-22077-001

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FIG. A-1
Sheet 3 of 3

SOIL_CLASS_KEY_PG3 21-22077.GPJ SHAN_WIL.GDT 10/12/15

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LOG OF TEST PIT TP-1

JOB NO: 21-1-22077-001 DATE: 10-7-15 LOCATION: See Site and Exploration Plan

PROJECT: Saltwater State Park, Des Moines, WA

SOIL DESCRIPTION	Ground Water	% Water Content	Samples	Depth, Ft.
(1) Brown, *Silty Sand with Gravel (ML)*; moist; scattered organics; round to subround gravel; iron-oxide staining. Fill (Hf)				0
(2) Dark brown, *Poorly Graded Gravel with Sand (GP)*; wet; fine to medium sand; round to subround gravel.	▽		S-1	2
(3) Blue gray, *Silty Sand (SM)*; wet.				4
- Collapse/caving at 3 feet - Two 1-ft. diameter logs, ends exposed, parallel to test pit long axis on south wall - One 1-ft. diameter log at bottom of test pit - TP-1:ES composite environmental sample collected at 9:30 9-15-15			S-2	6
				8
				10
				12

Sketch of East Pit Side

Surface Elevation: Approx. _____ Ft.

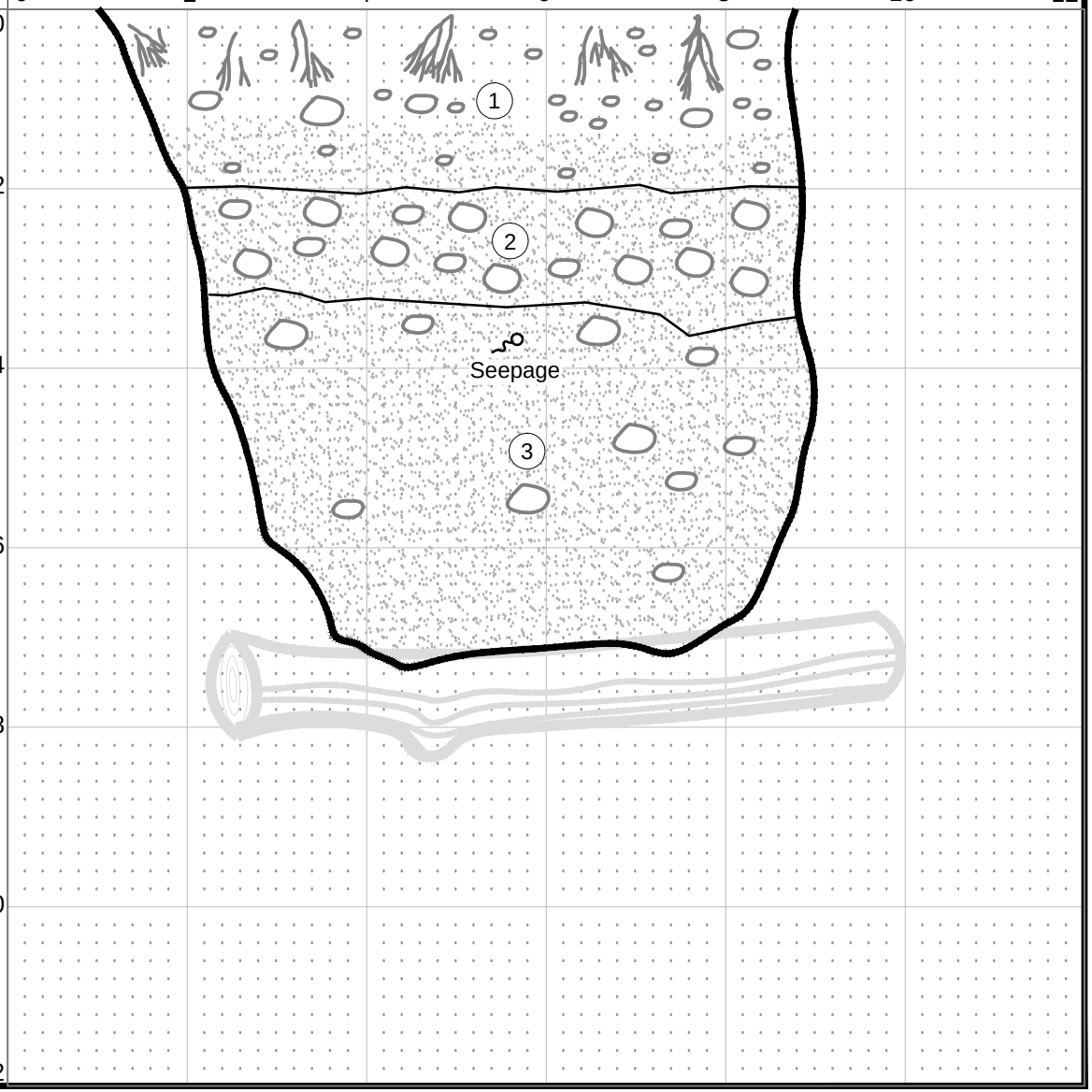

FIG. A-2

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

LOG OF TEST PIT TP-2

JOB NO: 21-1-22077-001 DATE: 10-7-15 LOCATION: See Site and Exploration Plan

PROJECT: Saltwater State Park, Des Moines, WA

SOIL DESCRIPTION	Ground Water	% Water Content	Samples	Depth, Ft.
(1) Sod/grass.				0
(2) Brown, *Poorly Graded Gravel with Sand (GP)*; moist. Fill (Hf)			S-1	2
(3) Brown and red brown, *Silty Sand (SM);* moist; interbedded with *Sandy Silt (ML)*; moist; iron-oxide staining throughout. Fill (Hf)				4
- Caving at 7.3 feet. - Composite environmental sample TP-2:ES collected at 9:00 9-16-15.	▽		S-2	6
				8
				10
				12

Sketch of _____ Pit Side

Surface Elevation: Approx. _____ Ft.

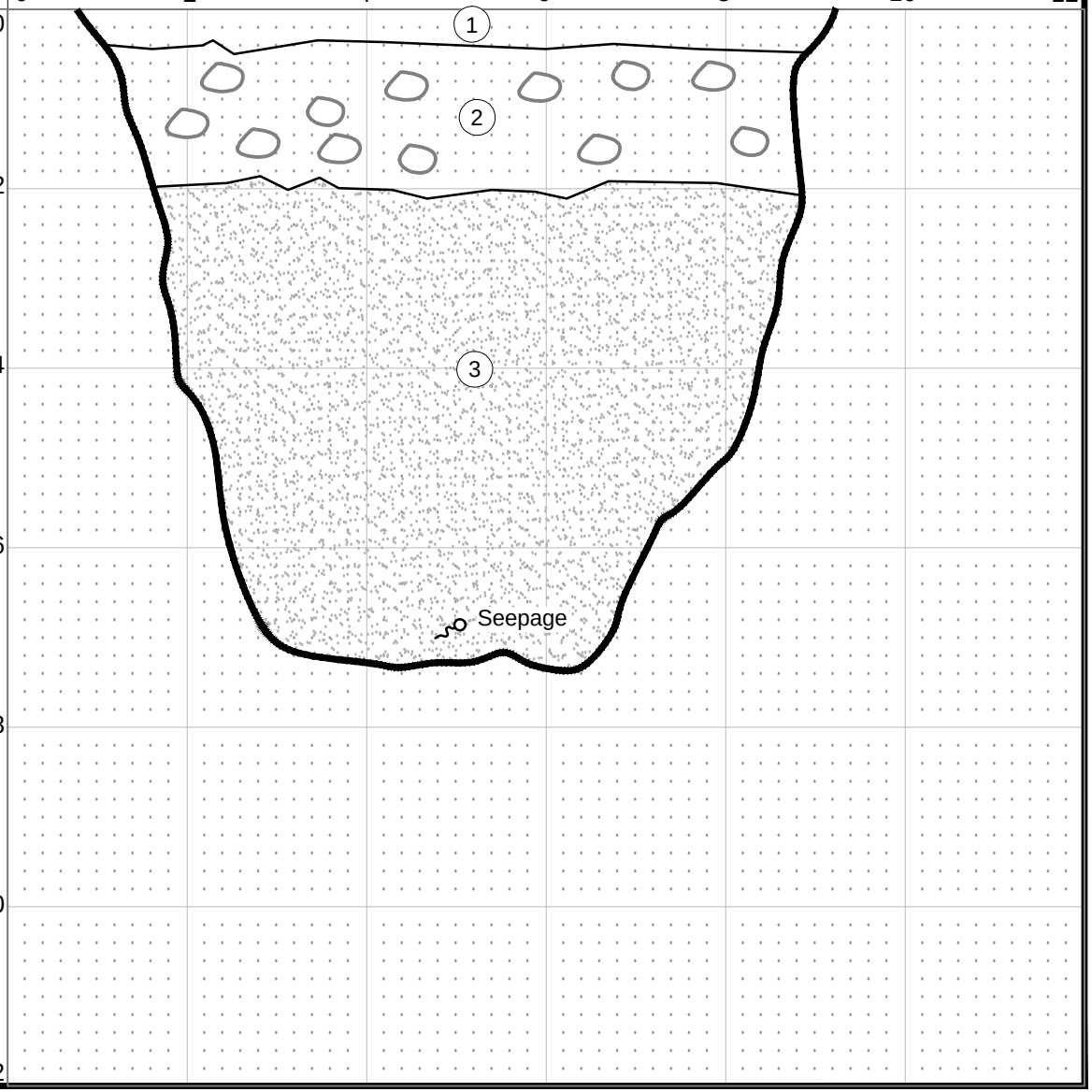

FIG. A-3

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

LOG OF TEST PIT TP-3

JOB NO: 21-1-22077-001 DATE: 10-7-15 LOCATION: See Site and Exploration Plan

PROJECT: Saltwater State Park, Des Moines, WA

SOIL DESCRIPTION	Ground Water	% Water Content	Samples	Depth, Ft.
(1) Sod/grass.				0
(2) Brown, *Sandy Silt with Gravel (ML)*; moist; round to subround gravel. Fill (Hf)				
(3) Brown, *Well Graded Sand with Silt and Gravel and Cobbles (SW-SM)*; moist; organics from 2.5 to 3.5 feet; sand coarsening with depth; rusted piece of pipe at 3.6 feet. Fill (Hf)			S-1	2
(4) Brown and gray, *Poorly Graded Sand with Gravel (SP)*; moist; round to subround gravel; scattered shell fragments. Beach Deposits			S-2	4
- Corroded, woven finch steel cable and wood encountered from 4 to 6 feet - Caving at 4 feet - Composite environmental sample TP-3:ES collected at 13:20 9-15-15	▽			6
				8
				10
				12

Sketch of Northwest Pit Side

Surface Elevation: Approx. _____ Ft.

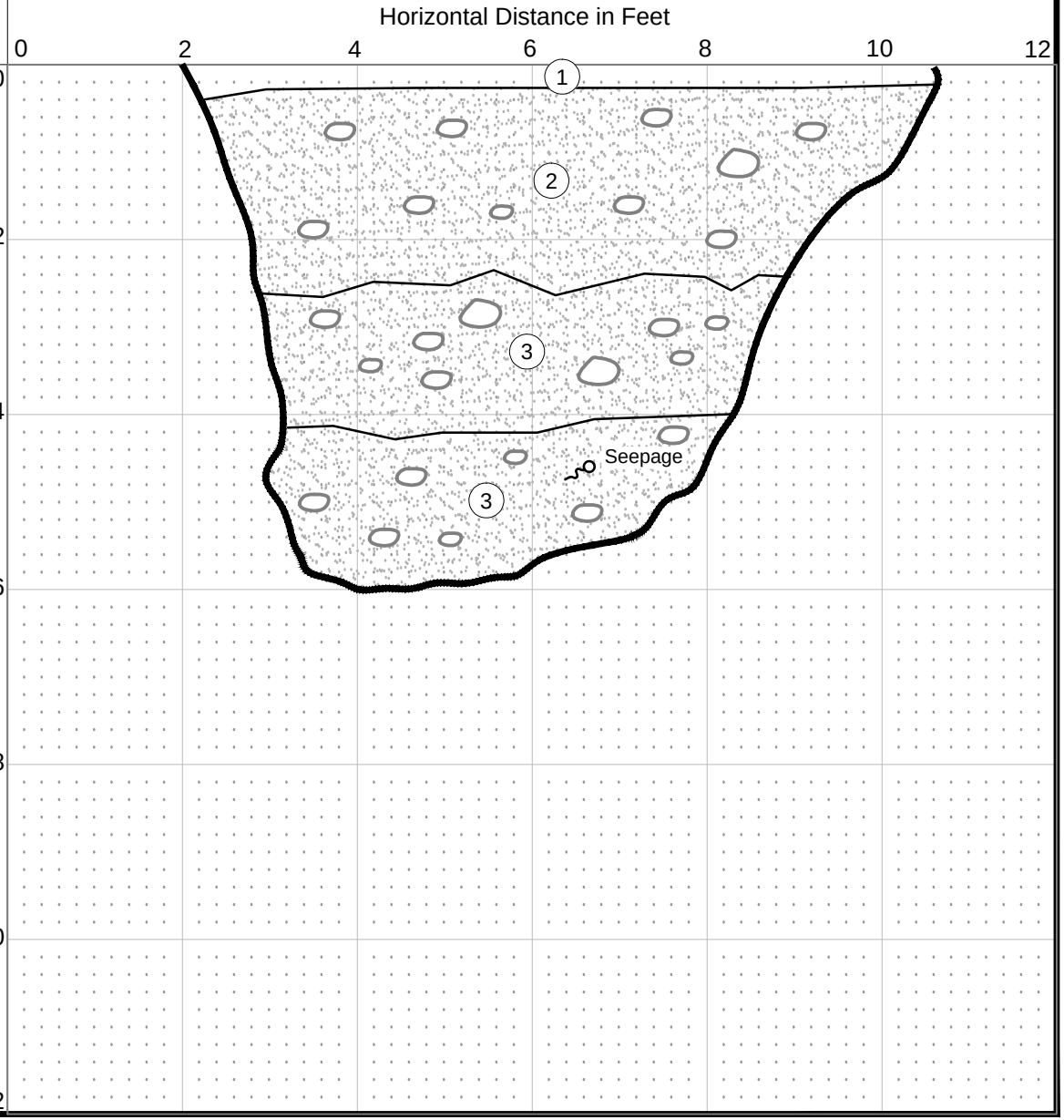

FIG. A-4

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

LOG OF TEST PIT TP-4

JOB NO: 21-1-22077-001 DATE: 10-7-15 LOCATION: See Site and Exploration Plan

PROJECT: Saltwater State Park, Des Moines, WA

SOIL DESCRIPTION	Ground Water	% Water Content	Samples	Depth, Ft.
(1) Sod/grass.				0
(2) Brown, *Silty Sand with Gravel (SM)*; moist; gray, silty sand to sandy silt interbeds at 2.5 feet. Fill (Hf)			S-1	2
(3) Gray, *Well Graded Sand with Gravel (SW)*; wet; scattered shell fragments; round to subround gravel. Beach Deposits				4
- Caving at 5.5 feet - Composite environmental sample TP-4:ES collected at 12:30 9-16-15				6
	▽		S-2	8
				10
				12

Sketch of West Pit Side

Surface Elevation: Approx. _____ Ft.

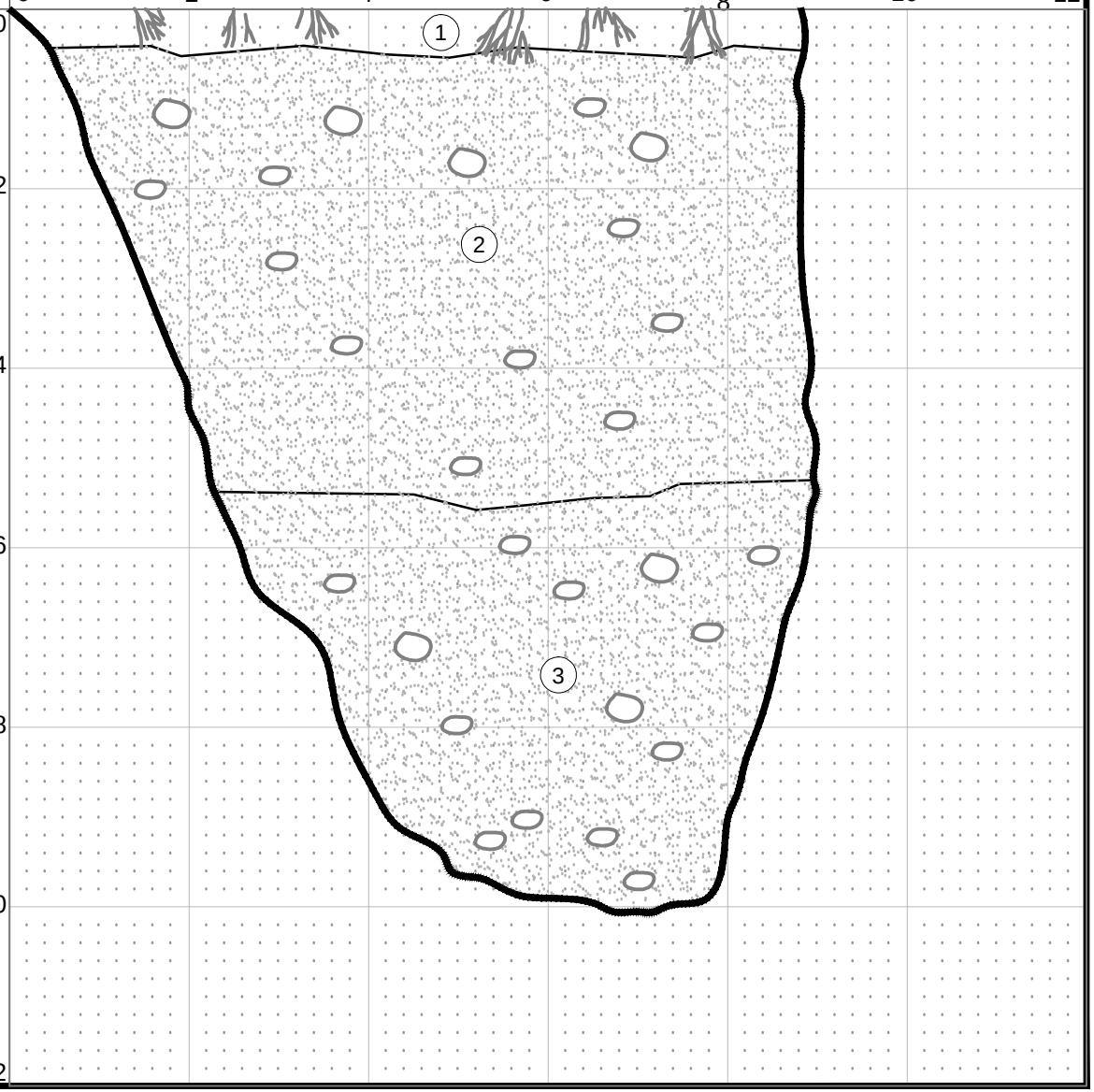

FIG. A-5

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

LOG OF TEST PIT TP-5

JOB NO: 21-1-22077-001 DATE: 10-7-15 LOCATION: See Site and Exploration Plan

PROJECT: Saltwater State Park, Des Moines, WA

SOIL DESCRIPTION	Ground Water	% Water Content	Samples	Depth, Ft.
(1) Sod/grass.				0
(2) Brown, *Silty Sand with Gravel (SM)*; moist; round to subround gravel; scattered organics in upper 3 feet; light gray silt interbed from 4.5 to 4.8 feet.			S-1	2
(3) Gray, *Well Graded Sand with Gravel (SW)*; wet; scattered shell fragments. Beach Deposits - Caving at 7 feet - Composite environmental sample TP-5:ES collected at 11:05 9-16-15	▽		S-2	4, 6, 8, 10, 12

Sketch of North Pit Side

Surface Elevation: Approx. _____ Ft.

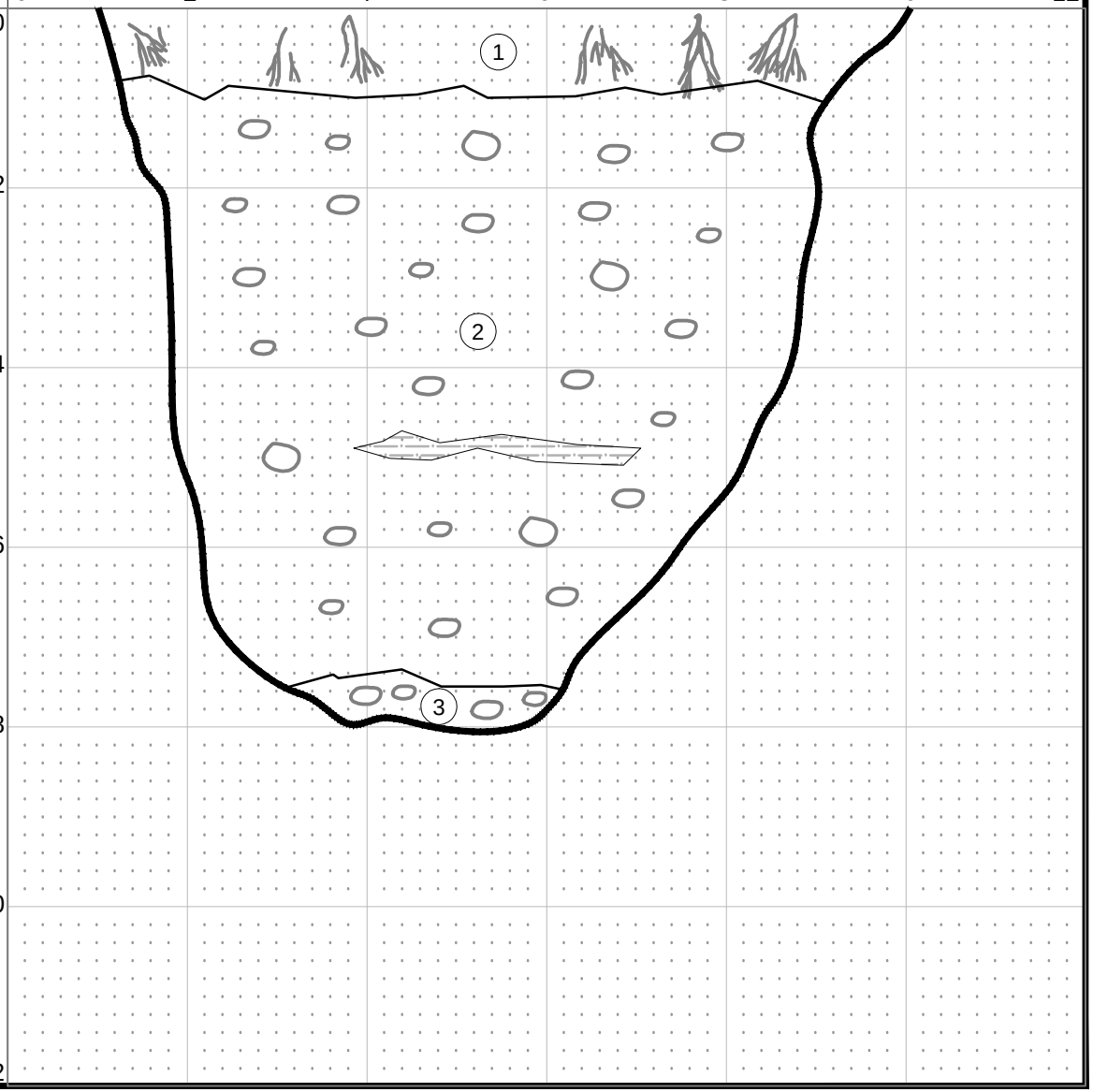

FIG. A-6

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

LOG OF TEST PIT TP-6

JOB NO: 21-1-22077-001 DATE: 10-7-15 LOCATION: See Site and Exploration Plan

PROJECT: Saltwater State Park, Des Moines, WA

SOIL DESCRIPTION	Ground Water	% Water Content	Samples	Depth, Ft.
(1) Sod/grass.				0
(2) Brown, *Silty Sand with Gravel (SM)*; moist; 2-inch cobbles at 4.0 feet. Fill (Hf)			S-1	2
(3) Blue gray, *Well Graded Sand with Gravel (SW)*; wet; medium to coarse sand; round to subround gravel; small boulders at 7.2 feet. Beach Deposits				4
- 12-inch boulder on the southwest corner of the test pit - Composite environmental sample TP-6:ES collected at 10:15 9-16-15	▽		S-2	6
				8
				10
				12

Sketch of North Pit Side

Surface Elevation: Approx. _____ Ft.

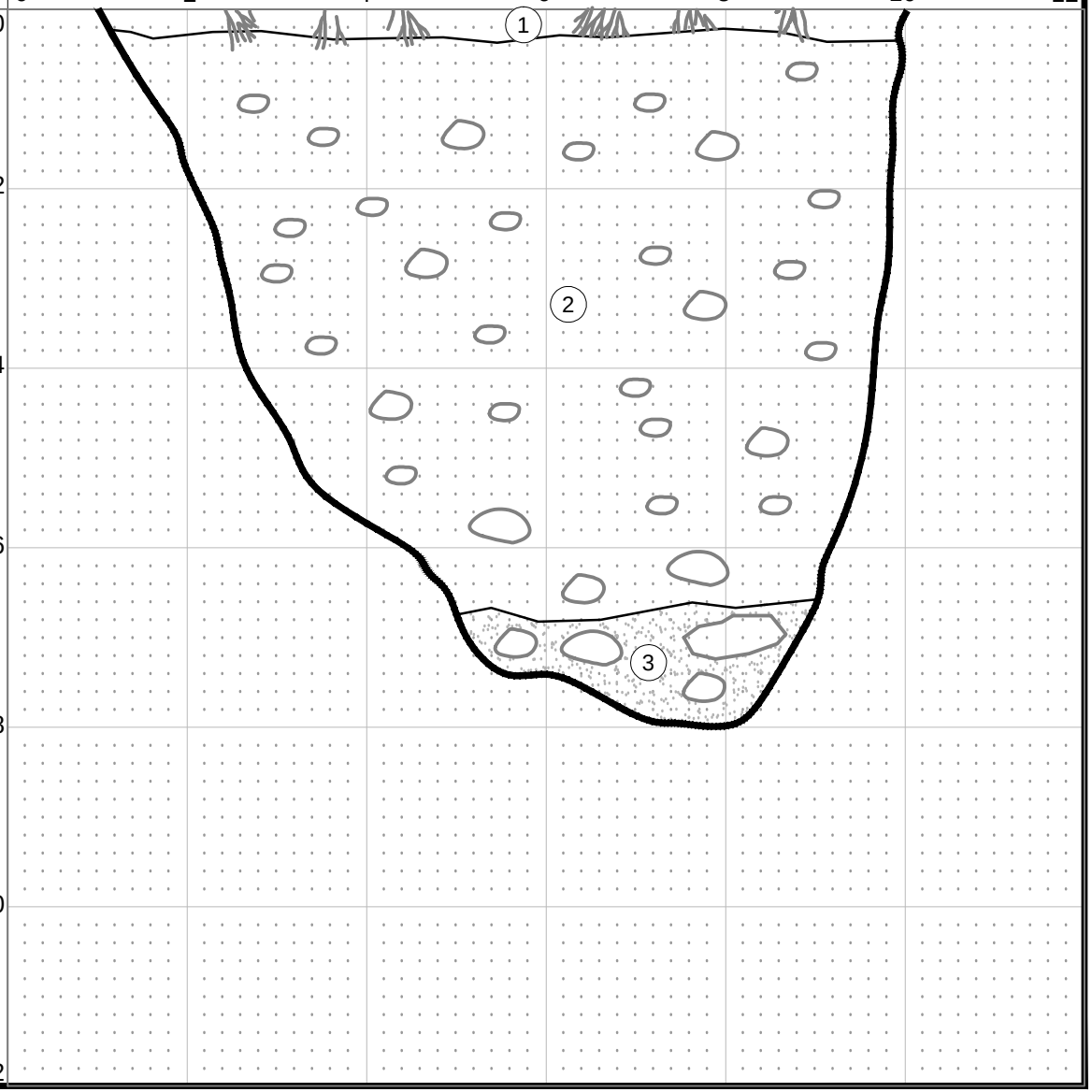

FIG. A-7

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

LOG OF TEST PIT TP-7

JOB NO: 21-1-22077-001 DATE: 10-7-15 LOCATION: See Site and Exploration Plan

PROJECT: Saltwater State Park, Des Moines, WA

SOIL DESCRIPTION	Ground Water	% Water Content	Samples	Depth, Ft.
(1) Sod/grass.				0
(2) Brown, *Well Graded Sand with Silt and Gravel (SW-SM)*; moist; round to subround gravel; cobbles. Fill (Hf)				2
(3) Blue gray, *Silty Sand with Gravel (SM)*; moist. Fill (Hf)			S-1	
(4) Brown, *Poorly Graded Sand with Gravel and Silt (SP-SM)*; moist; fine to coarse and; round to subround gravel. Fill (Hf)				4
(5) Brown and gray, *Well Graded Sand with Gravel (SW)*; wet; scattered shell fragments; round to subround gravel with cobbles. Beach Deposits				
- Caving from 8.5 to 9 feet - Composite environmental sample TP-7:ES collected at10:50 9-15-15			S-2	6
	▽			8
				10
				12

Sketch of North Pit Side

Surface Elevation: Approx. _____ Ft.

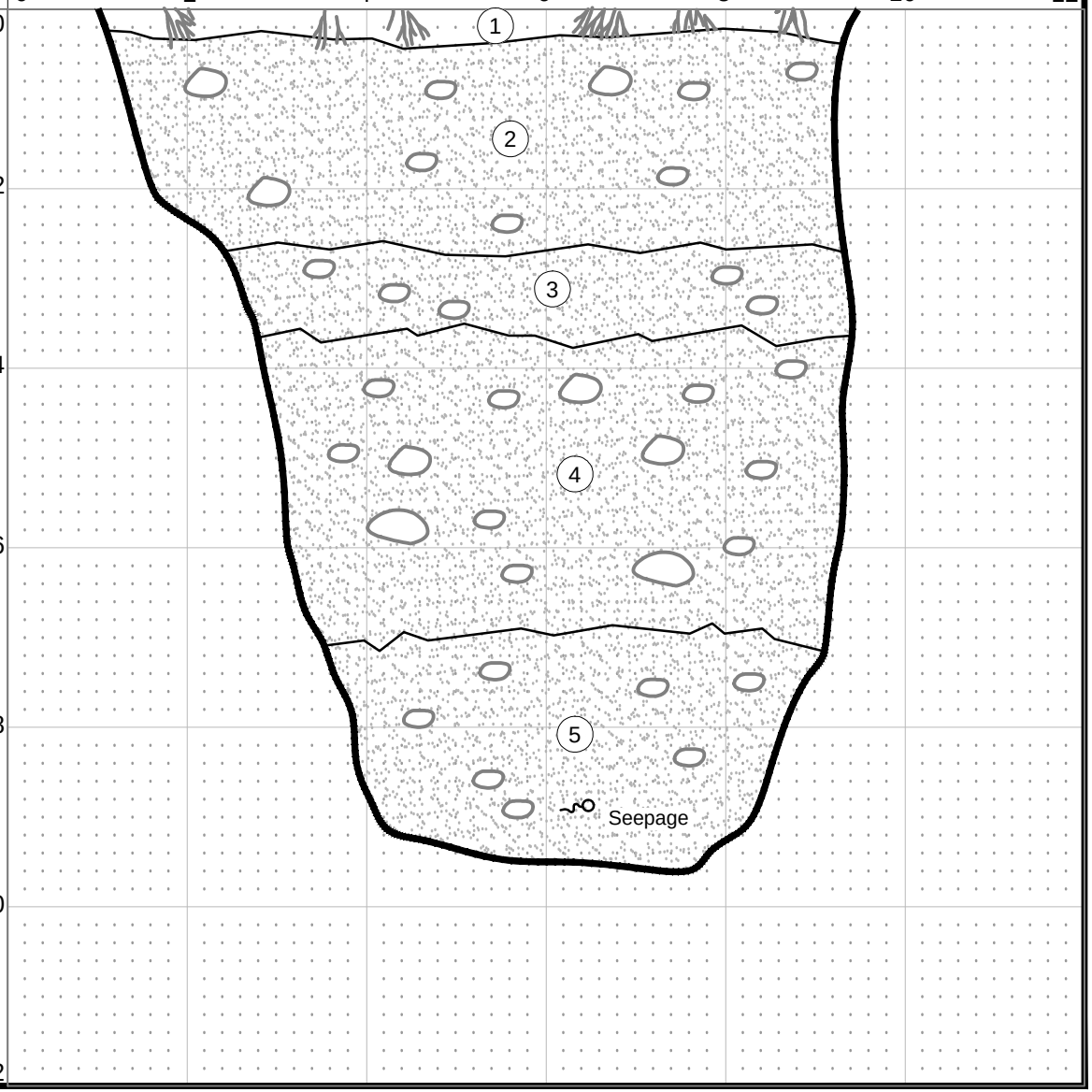

FIG. A-8

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

LOG OF TEST PIT TP-8

JOB NO: 21-1-22077-001 DATE: 10-7-15 LOCATION: See Site and Exploration Plan

PROJECT: Saltwater State Park, Des Moines, WA

SOIL DESCRIPTION	Ground Water	% Water Content	Samples	Depth, Ft.
(1) Sod/grass.				0
(2) Brown, *Poorly Graded Sand with Silt and Gravel (SP-SM)*; moist; scattered organics; interbeds of gray silt; iron-oxide staining throughout; shell fragments at 3.6 feet. Fill(Hf)			S-1	2
(3) Brown, *Poorly Graded Gravel with Sand (GP)*; moist; round to subround gravel.				4
(4) Brown and gray, *Poorly Graded Sand with Gravel (SP)*; moist; iron-oxide staining from 5 to 6 feet; scattered shell fragments.				6
(5) Brown, *Well Graded Sand with Gravel (SW)*; wet; scattered shell fragments. Beach Deposits - Caving at 4 feet - Composite environmental sample TP-8:ES collected at 12:05 9-15-15	▽		S-2	8
				10
				12

Sketch of East Pit Side

Surface Elevation: Approx. _____ Ft.

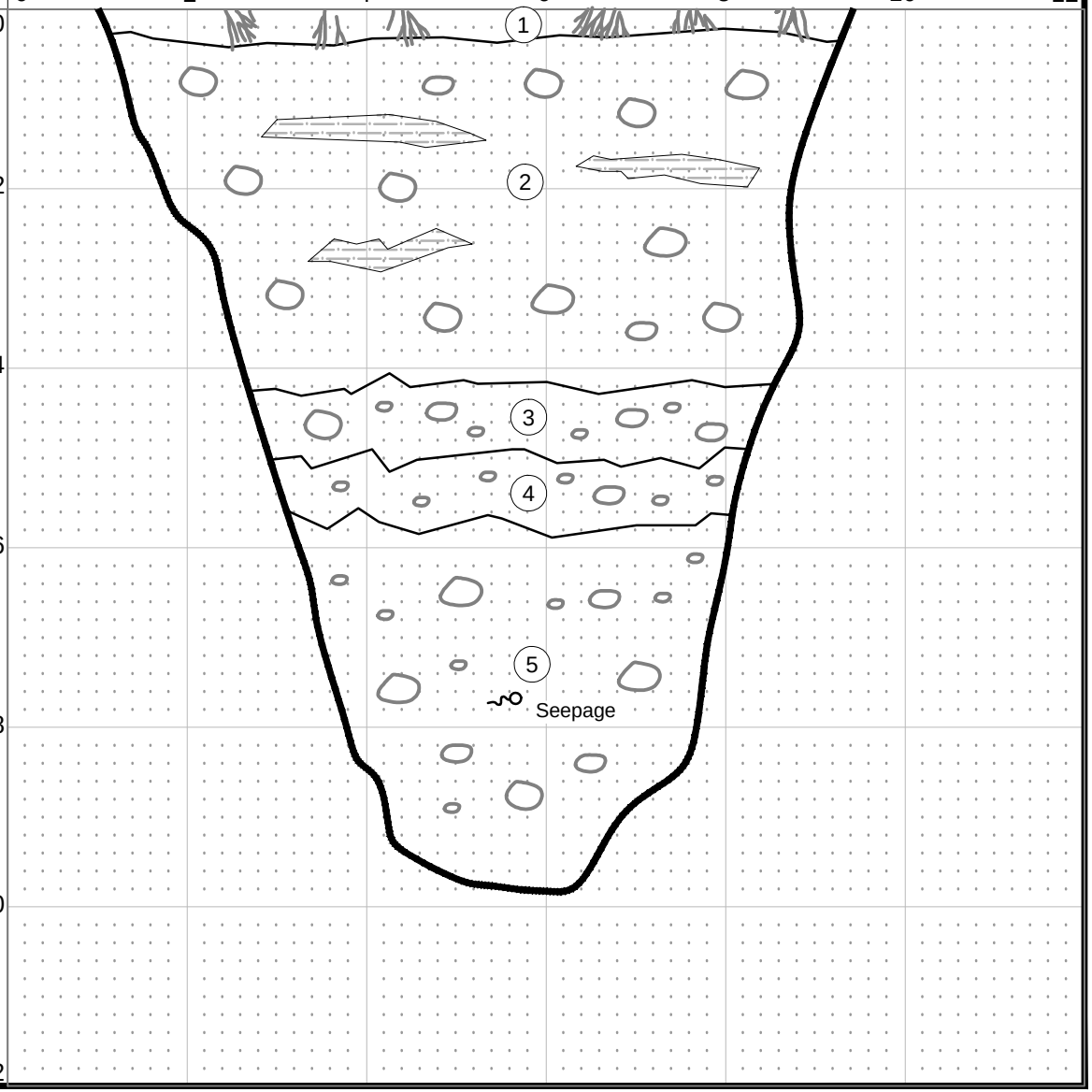

FIG. A-9

APPENDIX B

LABORATORY TEST RESULTS

APPENDIX B

LABORATORY TEST RESULTS

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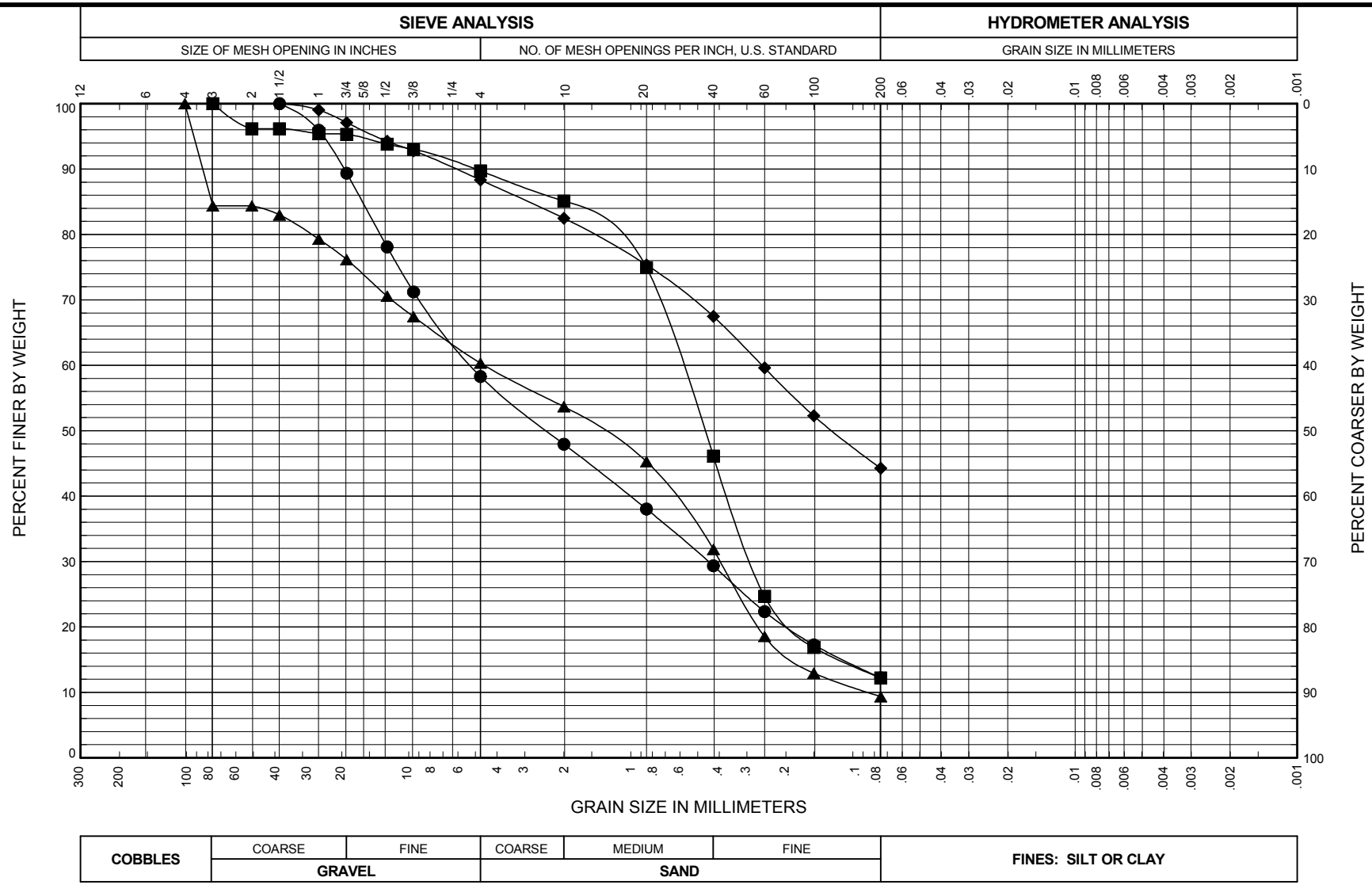
FIGURES

B-1 Grain Size Distribution (2 sheets)
B-2 Moisture-Density Test (2 sheets)



BORING AND SAMPLE NO.	DEPTH (feet)	U.S.C.S. SYMBOL	SOIL CLASSIFICATION	COBBLE %	GRAVEL %	SAND %	FINES %	NAT. W.C. %	TEST BY	REVIEW BY	ASTM STD
● TP-1, S-1	1.0	SM	Silty Sand with Gravel		42	46	12.2	15.9	AKV	AKV	C136
■ TP-2, S-1*	1.0	SM	Silty Sand		10	77	12.2	18.5	AKV	AKV	C136
▲ TP-3, S-1*	1.0	SW-SM	Well-Graded Sand with Silt and Gravel and Cobbles	16	24	51	9.4	10.7	AKV	AKV	C136
◆ TP-4, S-1	1.0	SM	Silty Sand		12	44	44.3	15.3	AKV	AKV	C136

Saltwater State Park
Des Moines, Washington

GRAIN SIZE DISTRIBUTION

October 2015 21-1-22077-001

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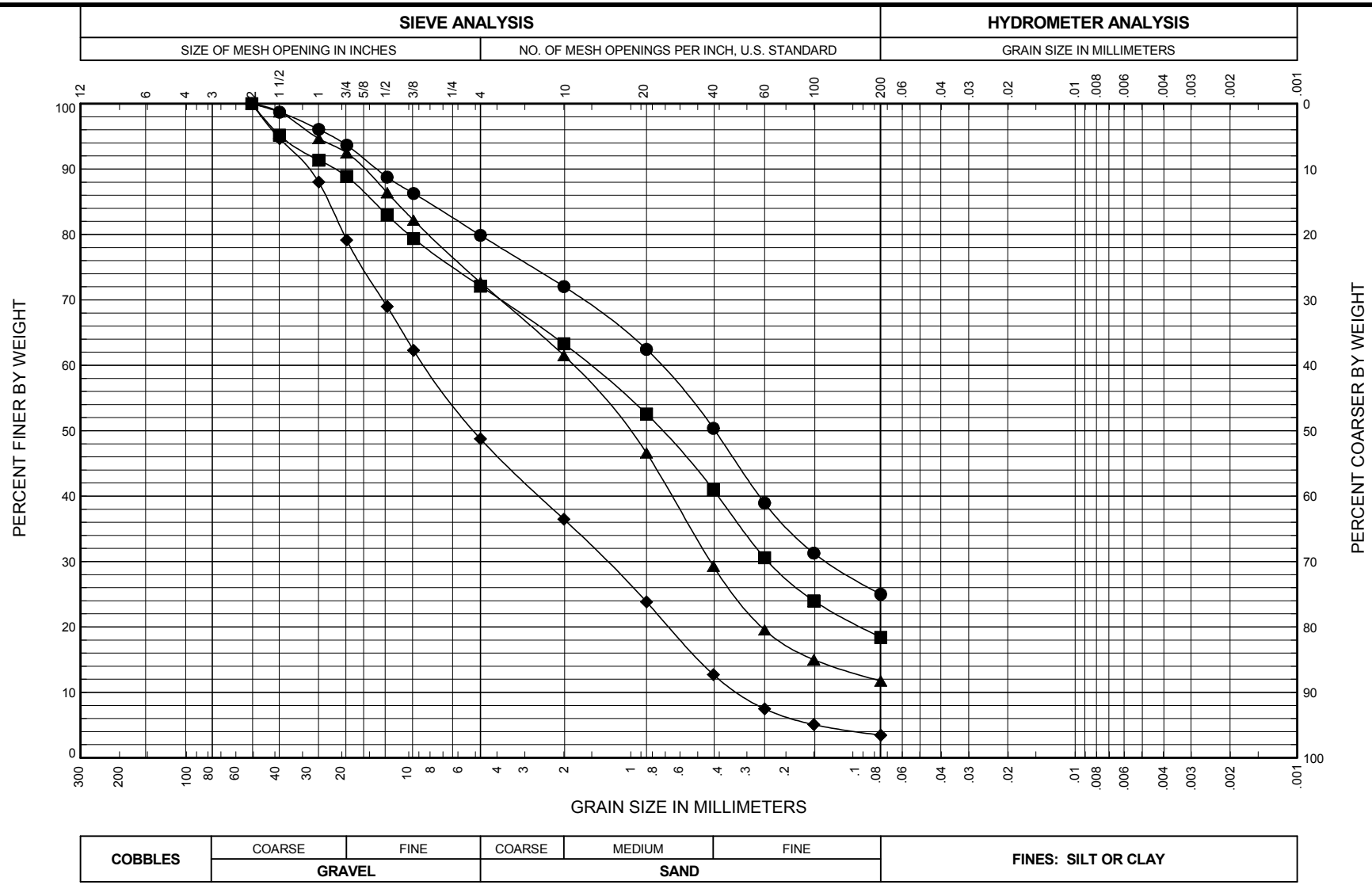
FIG. B-1
Sheet 1 of 2

** Sample specimen weight did not meet required minimum mass for ASTM test method.*

FIG. B-1

AASHTO GSA MAIN 21-22077.GPJ SHAN WIL.GDT 10/7/15



BORING AND SAMPLE NO.	DEPTH (feet)	U.S.C.S. SYMBOL	SOIL CLASSIFICATION	COBBLE %	GRAVEL %	SAND %	FINES %	NAT. W.C. %	TEST BY	REVIEW BY	ASTM STD
● TP-5, S-1*	1.0	SM	Silty Sand with Gravel		20	55	25.0	11.6	AKV	AKV	C136
■ TP-6, S-1*	1.0	SM	Silty Sand with Gravel		28	54	18.4	11.7	AKV	AKV	C136
▲ TP-7, S-1*	1.0	SW-SM	Well-Graded Sand with Silt and Gravel		27	61	11.7	10.1	AKV	AKV	C136
◆ TP-8, S-1*	1.0	GP	Poorly Graded Gravel with Sand		51	45	3.5	8.0	AKV	AKV	C136

Saltwater State Park
Des Moines, Washington

GRAIN SIZE DISTRIBUTION

October 2015 21-1-22077-001

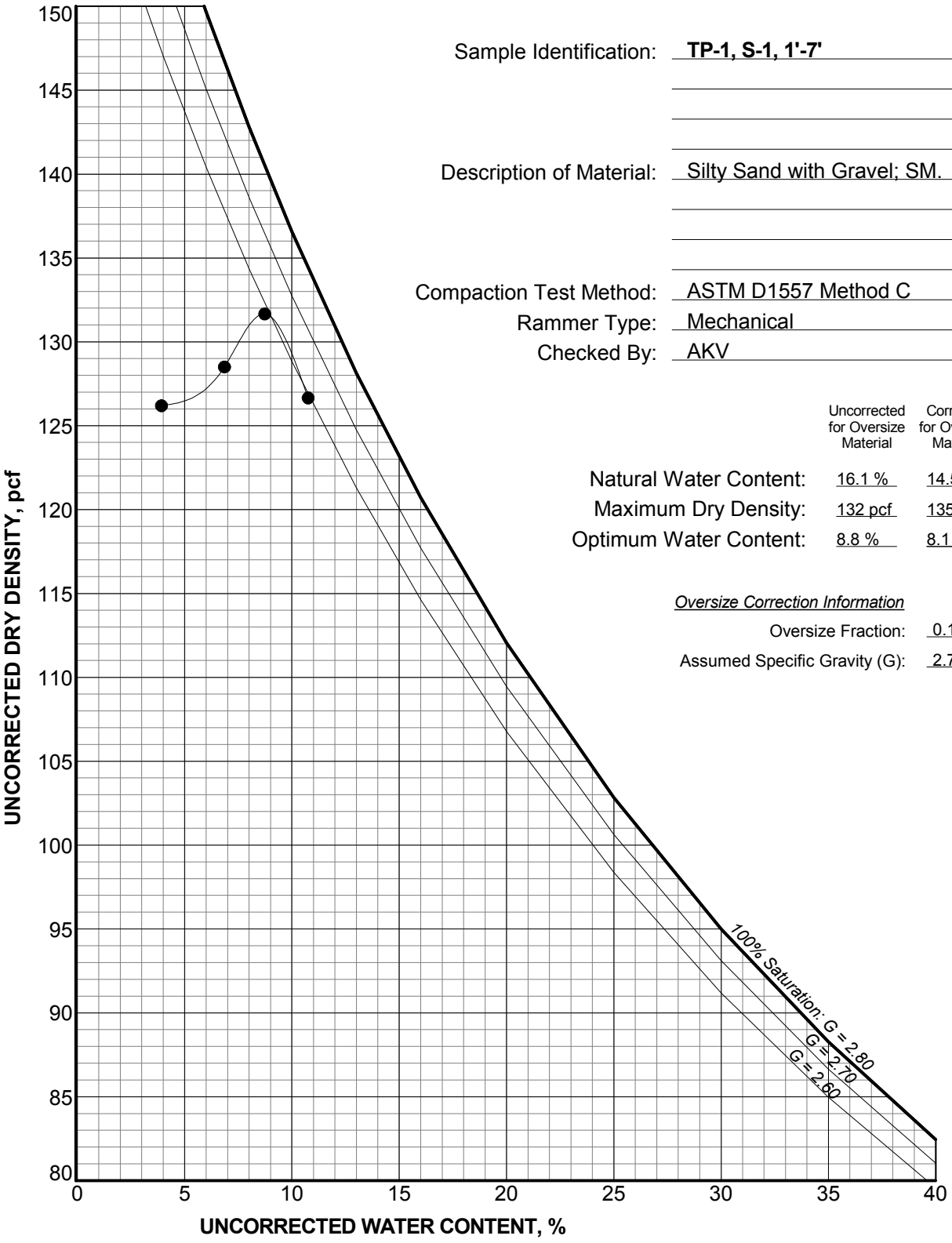
SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B-1
Sheet 2 of 2

** Sample specimen weight did not meet required minimum mass for ASTM test method.*

FIG. B-1

AASHTO GSA MAIN 21-22077.GPJ SHAN WIL.GDT 10/7/15



Sample Identification: **TP-1, S-1, 1'-7'**

Description of Material: Silty Sand with Gravel; SM.

Compaction Test Method: ASTM D1557 Method C

Rammer Type: Mechanical

Checked By: AKV

	Uncorrected for Oversize Material	Corrected for Oversize Material
Natural Water Content:	16.1 %	14.5 %
Maximum Dry Density:	132 pcf	135 pcf
Optimum Water Content:	8.8 %	8.1 %

Oversize Correction Information

Oversize Fraction: 0.13

Assumed Specific Gravity (G): 2.7

Saltwater State Park
Des Moines, Washington

MOISTURE-DENSITY TEST

October 2015 21-1-22077-001

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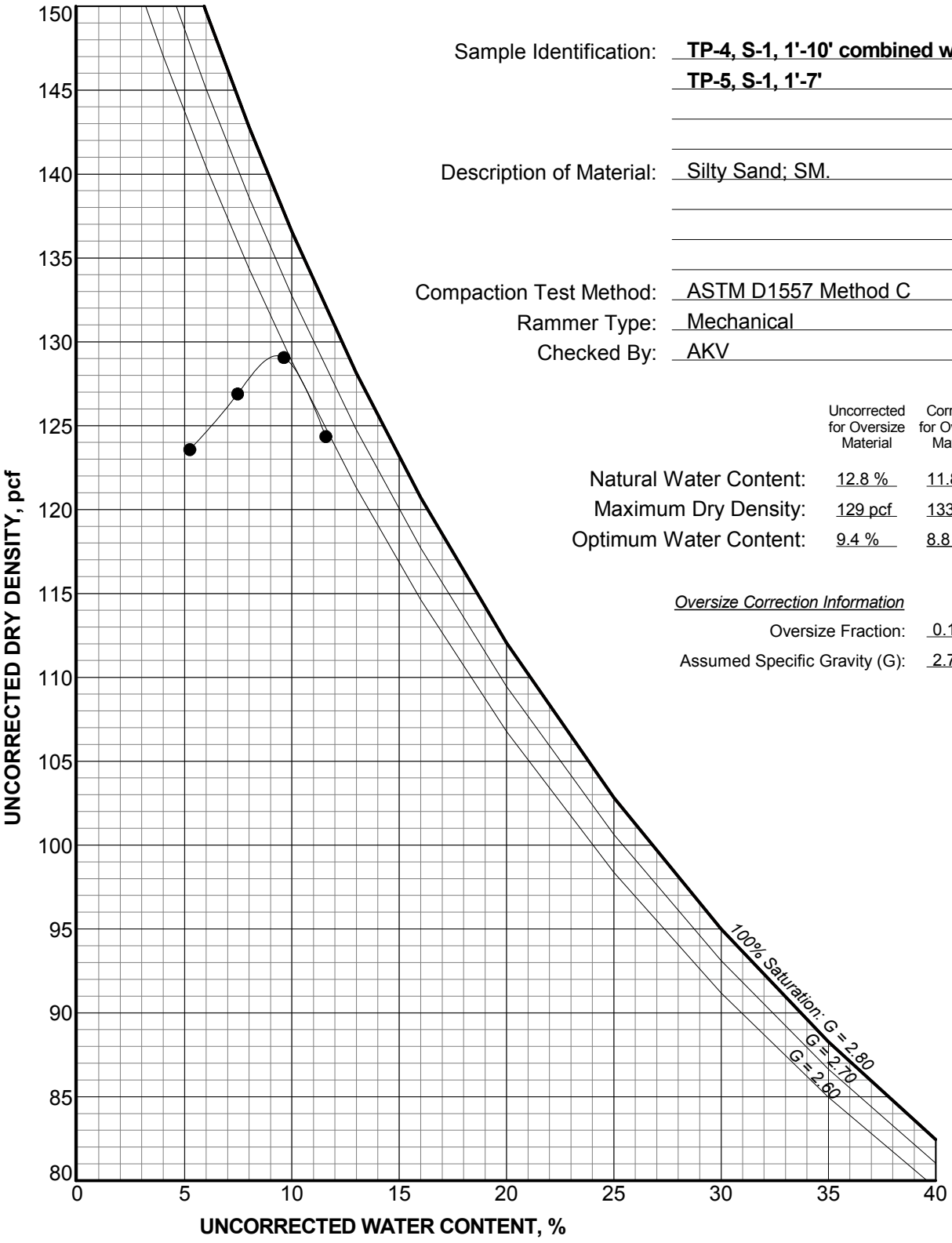
FIG. B-2
Sheet 1 of 2



Sample Identification: **TP-4, S-1, 1'-10' combined with TP-5, S-1, 1'-7'**

Description of Material: Silty Sand; SM.

Compaction Test Method: ASTM D1557 Method C

Rammer Type: Mechanical

Checked By: AKV

	Uncorrected for Oversize Material	Corrected for Oversize Material
Natural Water Content:	12.8 %	11.8 %
Maximum Dry Density:	129 pcf	133 pcf
Optimum Water Content:	9.4 %	8.8 %

Oversize Correction Information

Oversize Fraction: 0.12

Assumed Specific Gravity (G): 2.7

Saltwater State Park
Des Moines, Washington

MOISTURE-DENSITY TEST

October 2015 21-1-22077-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B-2
Sheet 2 of 2

APPENDIX C

ENVIRONMENTAL TESTING RESULTS

APPENDIX C

ENVIRONMENTAL TESTING RESULTS

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FIGURES

Table 1 – Summary of Analytical Soil Sample Results
Fremont Analytical Inc. Laboratory Report

Summary of Analytical Soil Sample Results

Test Pit Soil Sample Name	TP-1:ES	TP-2:ES	TP-3:ES	TP-4:ES	TP-5:ES	TP-6:ES	TP-7:ES	TP-8:ES	***MTCA Method A Cleanup Levels (mg/kg)***
Date Sampled	9/15/2015	9/16/2015	9/15/2015	9/16/2015	9/16/2015	9/16/2015	9/15/2015	9/15/2015	
Analytical Laboratory Report No.	1509211	1509211	1509211	1509211	1509211	1509211	1509211	1509211	
ANALYTE									
Petroleum Hydrocarbons (mg/kg)									
Diesel	55 U	55 U	54 U	56 U	54 U	50 U	48 U	55 U	2,000
Gasoline	22.1 U	22 U	21 U	22 U	22 U	20 U	19 U	22 U	2,000
Lube Oil	110 U	110 U	107 U	111 U	109 U	101 U	96.6 U	109 U	2,000
Polyaromatic Hydrocarbons (PAHs)									
1-Methylnaphthalene	0.059 U	0.060 U	0.058 U	0.058 U	0.056 U	0.058 U	0.055 U	0.055 U	*
2-Methylnaphthalene	0.059 U	0.060 U	0.058 U	0.058 U	0.056 U	0.058 U	0.055 U	0.055 U	*
Acenaphthene	0.059 U	0.060 U	0.058 U	0.058 U	0.056 U	0.058 U	0.055 U	0.055 U	*
Acenaphthylene	0.059 U	0.060 U	0.058 U	0.058 U	0.056 U	0.058 U	0.055 U	0.055 U	*
Anthracene	0.059 U	0.060 U	0.058 U	0.058 U	0.056 U	0.058 U	0.055 U	0.055 U	*
Benz[a]anthracene	0.059 U	0.060 U	0.058 U	0.058 U	0.056 U	0.058 U	0.055 U	0.055 U	*
Benzo(a)pyrene	0.059 U	0.060 U	0.058 U	0.058 U	0.056 U	0.058 U	0.055 U	0.055 U	0.1
Benzo(b)fluoranthene	0.059 U	0.060 U	0.058 U	0.058 U	0.056 U	0.058 U	0.055 U	0.055 U	*
Benzo(ghi)perylene	0.059 U	0.060 U	0.058 U	0.058 U	0.056 U	0.058 U	0.055 U	0.055 U	*
Benzo(k)fluoranthene	0.059 U	0.060 U	0.058 U	0.058 U	0.056 U	0.058 U	0.055 U	0.055 U	*
Chrysene	0.059 U	0.060 U	0.058 U	0.058 U	0.056 U	0.058 U	0.055 U	0.055 U	*
Dibenzo(a,h)anthracene	0.059 U	0.060 U	0.058 U	0.058 U	0.056 U	0.058 U	0.055 U	0.055 U	*
Fluoranthene	0.059 U	0.060 U	0.058 U	0.058 U	0.056 U	0.058 U	0.055 U	0.055 U	*
Fluorene	0.059 U	0.060 U	0.058 U	0.058 U	0.056 U	0.058 U	0.055 U	0.055 U	*
Indeno(1,2,3-cd)pyrene	0.059 U	0.060 U	0.058 U	0.058 U	0.056 U	0.058 U	0.055 U	0.055 U	*
Naphthalene	0.059 U	0.060 U	0.058 U	0.058 U	0.056 U	0.058 U	0.055 U	0.055 U	5
Phenanthrene	0.059 U	0.060 U	0.058 U	0.058 U	0.056 U	0.058 U	0.055 U	0.055 U	*
Pyrene	0.059 U	0.060 U	0.058 U	0.058 U	0.056 U	0.058 U	0.055 U	0.055 U	*
MTCA 5 metals (mg/kg)									
Arsenic	**3.8**	**3.4**	**4.2**	**3.8**	**2.5**	**2.4**	**3.6**	**3.4**	20
Cadmium	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	2
Chromium	**22**	**14**	**18**	**28**	**28**	**24**	**13**	**15**	2,000
Lead	**4.0**	**2.7**	**7.1**	**3.5**	**3.0**	**3.0**	**3.3**	**2.9**	250
Mercury	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	2

Notes:
All units are in milligrams per kilogram (mg/kg)
* = no Model Toxics Control Act Method A values have been established for this analyte.
Bold values indicate a detection.
MTCA = Model Toxics Control Act
Polyaromatic Hydrocarbons (PAHs) were not detected in the eight test pit samples analyzed.
U = the analyte was not detected above the laboratory reporting limit

3600 Fremont Ave. N.
Seattle, WA 98103
T: (206) 352-3790
F: (206) 352-7178
info@fremontanalytical.com

Shannon & Wilson
Ed Ptak
400 N. 34th Street, Suite 100
Seattle, WA 98103

RE: Saltwater State Park
Lab ID: 1509211

September 23, 2015

Attention Ed Ptak:

Fremont Analytical, Inc. received 9 sample(s) on 9/16/2015 for the analyses presented in the following report.

Hydrocarbon Identification by NWTPH-HCID
Mercury by EPA Method 7471
Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)
Sample Moisture (Percent Moisture)
Total Metals by EPA Method 6020

This report consists of the following:

- Case Narrative
- Analytical Results
- Applicable Quality Control Summary Reports
- Chain of Custody

All analyses were performed consistent with the Quality Assurance program of Fremont Analytical, Inc. Please contact the laboratory if you should have any questions about the results.

Thank you for using Fremont Analytical.

Sincerely,

Mike Ridgeway
President

Date: *09/23/2015*

CLIENT: Shannon & Wilson
Project: Saltwater State Park
Lab Order: 1509211

Work Order Sample Summary

Lab Sample ID	Client Sample ID	Date/Time Collected	Date/Time Received
1509211-001	TP-1:ES	09/15/2015 9:30 AM	09/16/2015 2:00 PM
1509211-002	TP-2:ES	09/16/2015 9:00 AM	09/16/2015 2:00 PM
1509211-003	TP-3:ES	09/15/2015 1:20 PM	09/16/2015 2:00 PM
1509211-004	TP-4:ES	09/16/2015 12:30 PM	09/16/2015 2:00 PM
1509211-005	TP-5:ES	09/16/2015 11:25 AM	09/16/2015 2:00 PM
1509211-006	TP-6:ES	09/16/2015 10:15 AM	09/16/2015 2:00 PM
1509211-007	TP-7:ES	09/15/2015 10:50 AM	09/16/2015 2:00 PM
1509211-008	TP-8:ES	09/15/2015 12:05 PM	09/16/2015 2:00 PM
1509211-009	Trip Blank	09/09/2015 8:45 AM	09/16/2015 2:00 PM

Note: If no "Time Collected" is supplied, a default of 12:00AM is assigned

Case Narrative

WO#: **1509211**

Date: **9/23/2015**

CLIENT: Shannon & Wilson

Project: Saltwater State Park

I. SAMPLE RECEIPT:
Samples receipt information is recorded on the attached Sample Receipt Checklist.

II. GENERAL REPORTING COMMENTS:
Results are reported on a wet weight basis unless dry-weight correction is denoted in the units field on the analytical report ("mg/kg-dry" or "ug/kg-dry").

Matrix Spike (MS) and MS Duplicate (MSD) samples are tested from an analytical batch of "like" matrix to check for possible matrix effect. The MS and MSD will provide site specific matrix data only for those samples which are spiked by the laboratory. The sample chosen for spike purposes may or may not have been a sample submitted in this sample delivery group. The validity of the analytical procedures for which data is reported in this analytical report is determined by the Laboratory Control Sample (LCS) and the Method Blank (MB). The LCS and the MB are processed with the samples and the MS/MSD to ensure method criteria are achieved throughout the entire analytical process.

III. ANALYSES AND EXCEPTIONS:
Exceptions associated with this report will be footnoted in the analytical results page(s) or the quality control summary page(s) and/or noted below.

Qualifiers:

* - Flagged value is not within established control limits
B - Analyte detected in the associated Method Blank
D - Dilution was required
E - Value above quantitation range
H - Holding times for preparation or analysis exceeded
I - Analyte with an internal standard that does not meet established acceptance criteria
J - Analyte detected below LOQ
N - Tentatively Identified Compound (TIC)
Q - Analyte with an initial or continuing calibration that does not meet established acceptance criteria (<20%RSD, <20% Drift or minimum RRF)
S - Spike recovery outside accepted recovery limits
ND - Not detected at the Reporting Limit

Acronyms:

%Rec - Percent Recovery
CCB - Continued Calibration Blank
CCV - Continued Calibration Verification
DF - Dilution Factor
HEM - Hexane Extractable Material
ICV - Initial Calibration Verification
LCS/LCSD - Laboratory Control Sample / Laboratory Control Sample Duplicate
MB or MBLANK - Method Blank
MDL - Method Detection Limit
MS/MSD - Matrix Spike / Matrix Spike Duplicate
PDS - Post Digestion Spike
Ref Val - Reference Value
RL - Reporting Limit
RPD - Relative Percent Difference
SD - Serial Dilution
SGT - Silica Gel Treatment
SPK - Spike
Surr - Surrogate

Analytical Report

WO#: **1509211**
Date Reported: **9/23/2015**

Client: Shannon & Wilson
Collection Date: 9/15/2015 9:30:00 AM
Project: Saltwater State Park
Lab ID: 1509211-001
Matrix: Soil
Client Sample ID: TP-1:ES

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Hydrocarbon Identification by NWTPH-HCID				Batch ID: 11853		Analyst: EC
Gasoline	ND	22.1		mg/Kg-dry	1	9/17/2015 2:16:00 PM
Mineral Spirits	ND	33.1		mg/Kg-dry	1	9/17/2015 2:16:00 PM
Kerosene	ND	55.2		mg/Kg-dry	1	9/17/2015 2:16:00 PM
Diesel (Fuel Oil)	ND	55.2		mg/Kg-dry	1	9/17/2015 2:16:00 PM
Heavy Oil	ND	110		mg/Kg-dry	1	9/17/2015 2:16:00 PM
Mineral Oil	ND	110		mg/Kg-dry	1	9/17/2015 2:16:00 PM
Surr: 2-Fluorobiphenyl	86.2	50-150		%REC	1	9/17/2015 2:16:00 PM
Surr: o-Terphenyl	80.2	50-150		%REC	1	9/17/2015 2:16:00 PM
Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)				Batch ID: 11876		Analyst: NG
Naphthalene	ND	58.5		µg/Kg-dry	1	9/18/2015 10:25:00 PM
2-Methylnaphthalene	ND	58.5		µg/Kg-dry	1	9/18/2015 10:25:00 PM
1-Methylnaphthalene	ND	58.5		µg/Kg-dry	1	9/18/2015 10:25:00 PM
Acenaphthylene	ND	58.5		µg/Kg-dry	1	9/18/2015 10:25:00 PM
Acenaphthene	ND	58.5		µg/Kg-dry	1	9/18/2015 10:25:00 PM
Fluorene	ND	58.5		µg/Kg-dry	1	9/18/2015 10:25:00 PM
Phenanthrene	ND	58.5		µg/Kg-dry	1	9/18/2015 10:25:00 PM
Anthracene	ND	58.5		µg/Kg-dry	1	9/18/2015 10:25:00 PM
Fluoranthene	ND	58.5		µg/Kg-dry	1	9/18/2015 10:25:00 PM
Pyrene	ND	58.5		µg/Kg-dry	1	9/18/2015 10:25:00 PM
Benz(a)anthracene	ND	58.5		µg/Kg-dry	1	9/18/2015 10:25:00 PM
Chrysene	ND	58.5		µg/Kg-dry	1	9/18/2015 10:25:00 PM
Benzo(b)fluoranthene	ND	58.5		µg/Kg-dry	1	9/18/2015 10:25:00 PM
Benzo(k)fluoranthene	ND	58.5		µg/Kg-dry	1	9/18/2015 10:25:00 PM
Benzo(a)pyrene	ND	58.5		µg/Kg-dry	1	9/18/2015 10:25:00 PM
Indeno(1,2,3-cd)pyrene	ND	58.5		µg/Kg-dry	1	9/18/2015 10:25:00 PM
Dibenz(a,h)anthracene	ND	58.5		µg/Kg-dry	1	9/18/2015 10:25:00 PM
Benzo(g,h,i)perylene	ND	58.5		µg/Kg-dry	1	9/18/2015 10:25:00 PM
Surr: 2-Fluorobiphenyl	88.8	30.6-166		%REC	1	9/18/2015 10:25:00 PM
Surr: Terphenyl-d14 (surr)	125	48.8-157		%REC	1	9/18/2015 10:25:00 PM
Mercury by EPA Method 7471				Batch ID: 11874		Analyst: TN
Mercury	ND	0.288		mg/Kg-dry	1	9/18/2015 3:20:53 PM
Total Metals by EPA Method 6020				Batch ID: 11873		Analyst: TN
Arsenic	3.80	0.0983		mg/Kg-dry	1	9/18/2015 2:17:31 PM

Analytical Report

WO#: **1509211**

Date Reported: **9/23/2015**

Client: Shannon & Wilson

Collection Date: 9/15/2015 9:30:00 AM

Project: Saltwater State Park

Lab ID: 1509211-001

Matrix: Soil

Client Sample ID: TP-1:ES

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Metals by EPA Method 6020				Batch ID: 11873		Analyst: TN
Cadmium	ND	0.197		mg/Kg-dry	1	9/18/2015 2:17:31 PM
Chromium	22.2	0.0983		mg/Kg-dry	1	9/18/2015 2:17:31 PM
Lead	3.99	0.197		mg/Kg-dry	1	9/18/2015 2:17:31 PM
Sample Moisture (Percent Moisture)				Batch ID: R24961		Analyst: SL
Percent Moisture	16.6			wt%	1	9/18/2015 2:56:45 PM

Analytical Report

WO#: **1509211**
Date Reported: **9/23/2015**

Client: Shannon & Wilson
Collection Date: 9/16/2015 9:00:00 AM
Project: Saltwater State Park
Lab ID: 1509211-002
Matrix: Soil
Client Sample ID: TP-2:ES

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Hydrocarbon Identification by NWTPH-HCID				Batch ID: 11853		Analyst: EC
Gasoline	ND	22.0		mg/Kg-dry	1	9/17/2015 2:48:00 PM
Mineral Spirits	ND	33.1		mg/Kg-dry	1	9/17/2015 2:48:00 PM
Kerosene	ND	55.1		mg/Kg-dry	1	9/17/2015 2:48:00 PM
Diesel (Fuel Oil)	ND	55.1		mg/Kg-dry	1	9/17/2015 2:48:00 PM
Heavy Oil	ND	110		mg/Kg-dry	1	9/17/2015 2:48:00 PM
Mineral Oil	ND	110		mg/Kg-dry	1	9/17/2015 2:48:00 PM
Surr: 2-Fluorobiphenyl	87.9	50-150		%REC	1	9/17/2015 2:48:00 PM
Surr: o-Terphenyl	86.0	50-150		%REC	1	9/17/2015 2:48:00 PM
Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)				Batch ID: 11876		Analyst: NG
Naphthalene	ND	59.7		µg/Kg-dry	1	9/18/2015 10:51:00 PM
2-Methylnaphthalene	ND	59.7		µg/Kg-dry	1	9/18/2015 10:51:00 PM
1-Methylnaphthalene	ND	59.7		µg/Kg-dry	1	9/18/2015 10:51:00 PM
Acenaphthylene	ND	59.7		µg/Kg-dry	1	9/18/2015 10:51:00 PM
Acenaphthene	ND	59.7		µg/Kg-dry	1	9/18/2015 10:51:00 PM
Fluorene	ND	59.7		µg/Kg-dry	1	9/18/2015 10:51:00 PM
Phenanthrene	ND	59.7		µg/Kg-dry	1	9/18/2015 10:51:00 PM
Anthracene	ND	59.7		µg/Kg-dry	1	9/18/2015 10:51:00 PM
Fluoranthene	ND	59.7		µg/Kg-dry	1	9/18/2015 10:51:00 PM
Pyrene	ND	59.7		µg/Kg-dry	1	9/18/2015 10:51:00 PM
Benz(a)anthracene	ND	59.7		µg/Kg-dry	1	9/18/2015 10:51:00 PM
Chrysene	ND	59.7		µg/Kg-dry	1	9/18/2015 10:51:00 PM
Benzo(b)fluoranthene	ND	59.7		µg/Kg-dry	1	9/18/2015 10:51:00 PM
Benzo(k)fluoranthene	ND	59.7		µg/Kg-dry	1	9/18/2015 10:51:00 PM
Benzo(a)pyrene	ND	59.7		µg/Kg-dry	1	9/18/2015 10:51:00 PM
Indeno(1,2,3-cd)pyrene	ND	59.7		µg/Kg-dry	1	9/18/2015 10:51:00 PM
Dibenz(a,h)anthracene	ND	59.7		µg/Kg-dry	1	9/18/2015 10:51:00 PM
Benzo(g,h,i)perylene	ND	59.7		µg/Kg-dry	1	9/18/2015 10:51:00 PM
Surr: 2-Fluorobiphenyl	93.7	30.6-166		%REC	1	9/18/2015 10:51:00 PM
Surr: Terphenyl-d14 (surr)	130	48.8-157		%REC	1	9/18/2015 10:51:00 PM
Mercury by EPA Method 7471				Batch ID: 11874		Analyst: TN
Mercury	ND	0.272		mg/Kg-dry	1	9/18/2015 3:27:23 PM
Total Metals by EPA Method 6020				Batch ID: 11873		Analyst: TN
Arsenic	3.44	0.0971		mg/Kg-dry	1	9/18/2015 2:21:02 PM

Analytical Report

WO#: **1509211**

Date Reported: **9/23/2015**

Client: Shannon & Wilson

Collection Date: 9/16/2015 9:00:00 AM

Project: Saltwater State Park

Lab ID: 1509211-002

Matrix: Soil

Client Sample ID: TP-2:ES

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Metals by EPA Method 6020				Batch ID: 11873		Analyst: TN
Cadmium	ND	0.194		mg/Kg-dry	1	9/18/2015 2:21:02 PM
Chromium	13.5	0.0971		mg/Kg-dry	1	9/18/2015 2:21:02 PM
Lead	2.70	0.194		mg/Kg-dry	1	9/18/2015 2:21:02 PM
Sample Moisture (Percent Moisture)				Batch ID: R24961		Analyst: SL
Percent Moisture	16.3			wt%	1	9/18/2015 2:56:45 PM

Analytical Report

WO#: **1509211**
Date Reported: **9/23/2015**

Client: Shannon & Wilson
Collection Date: 9/15/2015 1:20:00 PM
Project: Saltwater State Park
Lab ID: 1509211-003
Matrix: Soil
Client Sample ID: TP-3:ES

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Hydrocarbon Identification by NWTPH-HCID				Batch ID: 11853		Analyst: EC
Gasoline	ND	21.4		mg/Kg-dry	1	9/17/2015 3:19:00 PM
Mineral Spirits	ND	32.1		mg/Kg-dry	1	9/17/2015 3:19:00 PM
Kerosene	ND	53.5		mg/Kg-dry	1	9/17/2015 3:19:00 PM
Diesel (Fuel Oil)	ND	53.5		mg/Kg-dry	1	9/17/2015 3:19:00 PM
Heavy Oil	ND	107		mg/Kg-dry	1	9/17/2015 3:19:00 PM
Mineral Oil	ND	107		mg/Kg-dry	1	9/17/2015 3:19:00 PM
Surr: 2-Fluorobiphenyl	72.7	50-150		%REC	1	9/17/2015 3:19:00 PM
Surr: o-Terphenyl	73.7	50-150		%REC	1	9/17/2015 3:19:00 PM
Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)				Batch ID: 11876		Analyst: NG
Naphthalene	ND	58.1		µg/Kg-dry	1	9/18/2015 11:17:00 PM
2-Methylnaphthalene	ND	58.1		µg/Kg-dry	1	9/18/2015 11:17:00 PM
1-Methylnaphthalene	ND	58.1		µg/Kg-dry	1	9/18/2015 11:17:00 PM
Acenaphthylene	ND	58.1		µg/Kg-dry	1	9/18/2015 11:17:00 PM
Acenaphthene	ND	58.1		µg/Kg-dry	1	9/18/2015 11:17:00 PM
Fluorene	ND	58.1		µg/Kg-dry	1	9/18/2015 11:17:00 PM
Phenanthrene	ND	58.1		µg/Kg-dry	1	9/18/2015 11:17:00 PM
Anthracene	ND	58.1		µg/Kg-dry	1	9/18/2015 11:17:00 PM
Fluoranthene	ND	58.1		µg/Kg-dry	1	9/18/2015 11:17:00 PM
Pyrene	ND	58.1		µg/Kg-dry	1	9/18/2015 11:17:00 PM
Benz(a)anthracene	ND	58.1		µg/Kg-dry	1	9/18/2015 11:17:00 PM
Chrysene	ND	58.1		µg/Kg-dry	1	9/18/2015 11:17:00 PM
Benzo(b)fluoranthene	ND	58.1		µg/Kg-dry	1	9/18/2015 11:17:00 PM
Benzo(k)fluoranthene	ND	58.1		µg/Kg-dry	1	9/18/2015 11:17:00 PM
Benzo(a)pyrene	ND	58.1		µg/Kg-dry	1	9/18/2015 11:17:00 PM
Indeno(1,2,3-cd)pyrene	ND	58.1		µg/Kg-dry	1	9/18/2015 11:17:00 PM
Dibenz(a,h)anthracene	ND	58.1		µg/Kg-dry	1	9/18/2015 11:17:00 PM
Benzo(g,h,i)perylene	ND	58.1		µg/Kg-dry	1	9/18/2015 11:17:00 PM
Surr: 2-Fluorobiphenyl	87.2	30.6-166		%REC	1	9/18/2015 11:17:00 PM
Surr: Terphenyl-d14 (surr)	132	48.8-157		%REC	1	9/18/2015 11:17:00 PM
Mercury by EPA Method 7471				Batch ID: 11874		Analyst: TN
Mercury	ND	0.293		mg/Kg-dry	1	9/18/2015 3:29:04 PM
Total Metals by EPA Method 6020				Batch ID: 11873		Analyst: TN
Arsenic	4.22	0.0921		mg/Kg-dry	1	9/18/2015 2:24:34 PM

Analytical Report

WO#: **1509211**

Date Reported: **9/23/2015**

Client: Shannon & Wilson

Collection Date: 9/15/2015 1:20:00 PM

Project: Saltwater State Park

Lab ID: 1509211-003

Matrix: Soil

Client Sample ID: TP-3:ES

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Metals by EPA Method 6020				Batch ID: 11873		Analyst: TN
Cadmium	ND	0.184		mg/Kg-dry	1	9/18/2015 2:24:34 PM
Chromium	18.4	0.0921		mg/Kg-dry	1	9/18/2015 2:24:34 PM
Lead	7.06	0.184		mg/Kg-dry	1	9/18/2015 2:24:34 PM
Sample Moisture (Percent Moisture)				Batch ID: R24961		Analyst: SL
Percent Moisture	16.5			wt%	1	9/18/2015 2:56:45 PM

Analytical Report

WO#: **1509211**
Date Reported: **9/23/2015**

Client: Shannon & Wilson
Collection Date: 9/16/2015 12:30:00 PM
Project: Saltwater State Park
Lab ID: 1509211-004
Matrix: Soil
Client Sample ID: TP-4:ES

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Hydrocarbon Identification by NWTPH-HCID				Batch ID: 11853		Analyst: EC
Gasoline	ND	22.3		mg/Kg-dry	1	9/17/2015 3:50:00 PM
Mineral Spirits	ND	33.4		mg/Kg-dry	1	9/17/2015 3:50:00 PM
Kerosene	ND	55.6		mg/Kg-dry	1	9/17/2015 3:50:00 PM
Diesel (Fuel Oil)	ND	55.6		mg/Kg-dry	1	9/17/2015 3:50:00 PM
Heavy Oil	ND	111		mg/Kg-dry	1	9/17/2015 3:50:00 PM
Mineral Oil	ND	111		mg/Kg-dry	1	9/17/2015 3:50:00 PM
Surr: 2-Fluorobiphenyl	85.0	50-150		%REC	1	9/17/2015 3:50:00 PM
Surr: o-Terphenyl	80.7	50-150		%REC	1	9/17/2015 3:50:00 PM
Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)				Batch ID: 11876		Analyst: NG
Naphthalene	ND	58.4		µg/Kg-dry	1	9/18/2015 11:43:00 PM
2-Methylnaphthalene	ND	58.4		µg/Kg-dry	1	9/18/2015 11:43:00 PM
1-Methylnaphthalene	ND	58.4		µg/Kg-dry	1	9/18/2015 11:43:00 PM
Acenaphthylene	ND	58.4		µg/Kg-dry	1	9/18/2015 11:43:00 PM
Acenaphthene	ND	58.4		µg/Kg-dry	1	9/18/2015 11:43:00 PM
Fluorene	ND	58.4		µg/Kg-dry	1	9/18/2015 11:43:00 PM
Phenanthrene	ND	58.4		µg/Kg-dry	1	9/18/2015 11:43:00 PM
Anthracene	ND	58.4		µg/Kg-dry	1	9/18/2015 11:43:00 PM
Fluoranthene	ND	58.4		µg/Kg-dry	1	9/18/2015 11:43:00 PM
Pyrene	ND	58.4		µg/Kg-dry	1	9/18/2015 11:43:00 PM
Benz(a)anthracene	ND	58.4		µg/Kg-dry	1	9/18/2015 11:43:00 PM
Chrysene	ND	58.4		µg/Kg-dry	1	9/18/2015 11:43:00 PM
Benzo(b)fluoranthene	ND	58.4		µg/Kg-dry	1	9/18/2015 11:43:00 PM
Benzo(k)fluoranthene	ND	58.4		µg/Kg-dry	1	9/18/2015 11:43:00 PM
Benzo(a)pyrene	ND	58.4		µg/Kg-dry	1	9/18/2015 11:43:00 PM
Indeno(1,2,3-cd)pyrene	ND	58.4		µg/Kg-dry	1	9/18/2015 11:43:00 PM
Dibenz(a,h)anthracene	ND	58.4		µg/Kg-dry	1	9/18/2015 11:43:00 PM
Benzo(g,h,i)perylene	ND	58.4		µg/Kg-dry	1	9/18/2015 11:43:00 PM
Surr: 2-Fluorobiphenyl	87.8	30.6-166		%REC	1	9/18/2015 11:43:00 PM
Surr: Terphenyl-d14 (surr)	130	48.8-157		%REC	1	9/18/2015 11:43:00 PM
Mercury by EPA Method 7471				Batch ID: 11874		Analyst: TN
Mercury	ND	0.261		mg/Kg-dry	1	9/18/2015 3:30:40 PM
Total Metals by EPA Method 6020				Batch ID: 11873		Analyst: TN
Arsenic	3.77	0.0945		mg/Kg-dry	1	9/18/2015 2:28:05 PM

Analytical Report

WO#: **1509211**

Date Reported: **9/23/2015**

Client: Shannon & Wilson

Collection Date: 9/16/2015 12:30:00 PM

Project: Saltwater State Park

Lab ID: 1509211-004

Matrix: Soil

Client Sample ID: TP-4:ES

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Metals by EPA Method 6020				Batch ID: 11873		Analyst: TN
Cadmium	ND	0.189		mg/Kg-dry	1	9/18/2015 2:28:05 PM
Chromium	28.4	0.0945		mg/Kg-dry	1	9/18/2015 2:28:05 PM
Lead	3.46	0.189		mg/Kg-dry	1	9/18/2015 2:28:05 PM
Sample Moisture (Percent Moisture)				Batch ID: R24961		Analyst: SL
Percent Moisture	16.0			wt%	1	9/18/2015 2:56:45 PM

Analytical Report

WO#: **1509211**
Date Reported: **9/23/2015**

Client: Shannon & Wilson
Collection Date: 9/16/2015 11:25:00 AM
Project: Saltwater State Park
Lab ID: 1509211-005
Matrix: Soil
Client Sample ID: TP-5:ES

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Hydrocarbon Identification by NWTPH-HCID				Batch ID: 11853		Analyst: EC
Gasoline	ND	21.8		mg/Kg-dry	1	9/17/2015 4:22:00 PM
Mineral Spirits	ND	32.6		mg/Kg-dry	1	9/17/2015 4:22:00 PM
Kerosene	ND	54.4		mg/Kg-dry	1	9/17/2015 4:22:00 PM
Diesel (Fuel Oil)	ND	54.4		mg/Kg-dry	1	9/17/2015 4:22:00 PM
Heavy Oil	ND	109		mg/Kg-dry	1	9/17/2015 4:22:00 PM
Mineral Oil	ND	109		mg/Kg-dry	1	9/17/2015 4:22:00 PM
Surr: 2-Fluorobiphenyl	86.3	50-150		%REC	1	9/17/2015 4:22:00 PM
Surr: o-Terphenyl	83.0	50-150		%REC	1	9/17/2015 4:22:00 PM
Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)				Batch ID: 11876		Analyst: NG
Naphthalene	ND	55.7		µg/Kg-dry	1	9/19/2015 12:09:00 AM
2-Methylnaphthalene	ND	55.7		µg/Kg-dry	1	9/19/2015 12:09:00 AM
1-Methylnaphthalene	ND	55.7		µg/Kg-dry	1	9/19/2015 12:09:00 AM
Acenaphthylene	ND	55.7		µg/Kg-dry	1	9/19/2015 12:09:00 AM
Acenaphthene	ND	55.7		µg/Kg-dry	1	9/19/2015 12:09:00 AM
Fluorene	ND	55.7		µg/Kg-dry	1	9/19/2015 12:09:00 AM
Phenanthrene	ND	55.7		µg/Kg-dry	1	9/19/2015 12:09:00 AM
Anthracene	ND	55.7		µg/Kg-dry	1	9/19/2015 12:09:00 AM
Fluoranthene	ND	55.7		µg/Kg-dry	1	9/19/2015 12:09:00 AM
Pyrene	ND	55.7		µg/Kg-dry	1	9/19/2015 12:09:00 AM
Benz(a)anthracene	ND	55.7		µg/Kg-dry	1	9/19/2015 12:09:00 AM
Chrysene	ND	55.7		µg/Kg-dry	1	9/19/2015 12:09:00 AM
Benzo(b)fluoranthene	ND	55.7		µg/Kg-dry	1	9/19/2015 12:09:00 AM
Benzo(k)fluoranthene	ND	55.7		µg/Kg-dry	1	9/19/2015 12:09:00 AM
Benzo(a)pyrene	ND	55.7		µg/Kg-dry	1	9/19/2015 12:09:00 AM
Indeno(1,2,3-cd)pyrene	ND	55.7		µg/Kg-dry	1	9/19/2015 12:09:00 AM
Dibenz(a,h)anthracene	ND	55.7		µg/Kg-dry	1	9/19/2015 12:09:00 AM
Benzo(g,h,i)perylene	ND	55.7		µg/Kg-dry	1	9/19/2015 12:09:00 AM
Surr: 2-Fluorobiphenyl	87.8	30.6-166		%REC	1	9/19/2015 12:09:00 AM
Surr: Terphenyl-d14 (surr)	128	48.8-157		%REC	1	9/19/2015 12:09:00 AM
Mercury by EPA Method 7471				Batch ID: 11874		Analyst: TN
Mercury	ND	0.251		mg/Kg-dry	1	9/18/2015 3:32:16 PM
Total Metals by EPA Method 6020				Batch ID: 11873		Analyst: TN
Arsenic	2.48	0.0962		mg/Kg-dry	1	9/18/2015 2:31:36 PM

Analytical Report

WO#: **1509211**

Date Reported: **9/23/2015**

Client: Shannon & Wilson

Collection Date: 9/16/2015 11:25:00 AM

Project: Saltwater State Park

Lab ID: 1509211-005

Matrix: Soil

Client Sample ID: TP-5:ES

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Metals by EPA Method 6020				Batch ID: 11873		Analyst: TN
Cadmium	ND	0.192		mg/Kg-dry	1	9/18/2015 2:31:36 PM
Chromium	27.5	0.0962		mg/Kg-dry	1	9/18/2015 2:31:36 PM
Lead	3.04	0.192		mg/Kg-dry	1	9/18/2015 2:31:36 PM
Sample Moisture (Percent Moisture)				Batch ID: R24961		Analyst: SL
Percent Moisture	14.1			wt%	1	9/18/2015 2:56:45 PM

Analytical Report

WO#: **1509211**
Date Reported: **9/23/2015**

Client: Shannon & Wilson
Collection Date: 9/16/2015 10:15:00 AM
Project: Saltwater State Park
Lab ID: 1509211-006
Matrix: Soil
Client Sample ID: TP-6:ES

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Hydrocarbon Identification by NWTPH-HCID				Batch ID: 11853		Analyst: EC
Gasoline	ND	20.1		mg/Kg-dry	1	9/17/2015 4:53:00 PM
Mineral Spirits	ND	30.2		mg/Kg-dry	1	9/17/2015 4:53:00 PM
Kerosene	ND	50.4		mg/Kg-dry	1	9/17/2015 4:53:00 PM
Diesel (Fuel Oil)	ND	50.4		mg/Kg-dry	1	9/17/2015 4:53:00 PM
Heavy Oil	ND	101		mg/Kg-dry	1	9/17/2015 4:53:00 PM
Mineral Oil	ND	101		mg/Kg-dry	1	9/17/2015 4:53:00 PM
Surr: 2-Fluorobiphenyl	97.6	50-150		%REC	1	9/17/2015 4:53:00 PM
Surr: o-Terphenyl	94.5	50-150		%REC	1	9/17/2015 4:53:00 PM
Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)				Batch ID: 11876		Analyst: NG
Naphthalene	ND	57.8		µg/Kg-dry	1	9/19/2015 12:35:00 AM
2-Methylnaphthalene	ND	57.8		µg/Kg-dry	1	9/19/2015 12:35:00 AM
1-Methylnaphthalene	ND	57.8		µg/Kg-dry	1	9/19/2015 12:35:00 AM
Acenaphthylene	ND	57.8		µg/Kg-dry	1	9/19/2015 12:35:00 AM
Acenaphthene	ND	57.8		µg/Kg-dry	1	9/19/2015 12:35:00 AM
Fluorene	ND	57.8		µg/Kg-dry	1	9/19/2015 12:35:00 AM
Phenanthrene	ND	57.8		µg/Kg-dry	1	9/19/2015 12:35:00 AM
Anthracene	ND	57.8		µg/Kg-dry	1	9/19/2015 12:35:00 AM
Fluoranthene	ND	57.8		µg/Kg-dry	1	9/19/2015 12:35:00 AM
Pyrene	ND	57.8		µg/Kg-dry	1	9/19/2015 12:35:00 AM
Benz(a)anthracene	ND	57.8		µg/Kg-dry	1	9/19/2015 12:35:00 AM
Chrysene	ND	57.8		µg/Kg-dry	1	9/19/2015 12:35:00 AM
Benzo(b)fluoranthene	ND	57.8		µg/Kg-dry	1	9/19/2015 12:35:00 AM
Benzo(k)fluoranthene	ND	57.8		µg/Kg-dry	1	9/19/2015 12:35:00 AM
Benzo(a)pyrene	ND	57.8		µg/Kg-dry	1	9/19/2015 12:35:00 AM
Indeno(1,2,3-cd)pyrene	ND	57.8		µg/Kg-dry	1	9/19/2015 12:35:00 AM
Dibenz(a,h)anthracene	ND	57.8		µg/Kg-dry	1	9/19/2015 12:35:00 AM
Benzo(g,h,i)perylene	ND	57.8		µg/Kg-dry	1	9/19/2015 12:35:00 AM
Surr: 2-Fluorobiphenyl	82.9	30.6-166		%REC	1	9/19/2015 12:35:00 AM
Surr: Terphenyl-d14 (surr)	127	48.8-157		%REC	1	9/19/2015 12:35:00 AM
Mercury by EPA Method 7471				Batch ID: 11874		Analyst: TN
Mercury	ND	0.275		mg/Kg-dry	1	9/18/2015 3:37:08 PM
Total Metals by EPA Method 6020				Batch ID: 11873		Analyst: TN
Arsenic	2.40	0.0903		mg/Kg-dry	1	9/18/2015 2:35:08 PM

Analytical Report

WO#: **1509211**

Date Reported: **9/23/2015**

Client: Shannon & Wilson

Collection Date: 9/16/2015 10:15:00 AM

Project: Saltwater State Park

Lab ID: 1509211-006

Matrix: Soil

Client Sample ID: TP-6:ES

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Metals by EPA Method 6020				Batch ID: 11873		Analyst: TN
Cadmium	ND	0.181		mg/Kg-dry	1	9/18/2015 2:35:08 PM
Chromium	23.9	0.0903		mg/Kg-dry	1	9/18/2015 2:35:08 PM
Lead	2.99	0.181		mg/Kg-dry	1	9/18/2015 2:35:08 PM
Sample Moisture (Percent Moisture)				Batch ID: R24961		Analyst: SL
Percent Moisture	14.1			wt%	1	9/18/2015 2:56:45 PM

Analytical Report

WO#: **1509211**
Date Reported: **9/23/2015**

Client: Shannon & Wilson
Collection Date: 9/15/2015 10:50:00 AM
Project: Saltwater State Park
Lab ID: 1509211-007
Matrix: Soil
Client Sample ID: TP-7:ES

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Hydrocarbon Identification by NWTPH-HCID				Batch ID: 11853		Analyst: EC
Gasoline	ND	19.3		mg/Kg-dry	1	9/17/2015 5:24:00 PM
Mineral Spirits	ND	29.0		mg/Kg-dry	1	9/17/2015 5:24:00 PM
Kerosene	ND	48.3		mg/Kg-dry	1	9/17/2015 5:24:00 PM
Diesel (Fuel Oil)	ND	48.3		mg/Kg-dry	1	9/17/2015 5:24:00 PM
Heavy Oil	ND	96.6		mg/Kg-dry	1	9/17/2015 5:24:00 PM
Mineral Oil	ND	96.6		mg/Kg-dry	1	9/17/2015 5:24:00 PM
Surr: 2-Fluorobiphenyl	94.4	50-150		%REC	1	9/17/2015 5:24:00 PM
Surr: o-Terphenyl	86.5	50-150		%REC	1	9/17/2015 5:24:00 PM
Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)				Batch ID: 11876		Analyst: NG
Naphthalene	ND	55.1		µg/Kg-dry	1	9/19/2015 1:01:00 AM
2-Methylnaphthalene	ND	55.1		µg/Kg-dry	1	9/19/2015 1:01:00 AM
1-Methylnaphthalene	ND	55.1		µg/Kg-dry	1	9/19/2015 1:01:00 AM
Acenaphthylene	ND	55.1		µg/Kg-dry	1	9/19/2015 1:01:00 AM
Acenaphthene	ND	55.1		µg/Kg-dry	1	9/19/2015 1:01:00 AM
Fluorene	ND	55.1		µg/Kg-dry	1	9/19/2015 1:01:00 AM
Phenanthrene	ND	55.1		µg/Kg-dry	1	9/19/2015 1:01:00 AM
Anthracene	ND	55.1		µg/Kg-dry	1	9/19/2015 1:01:00 AM
Fluoranthene	ND	55.1		µg/Kg-dry	1	9/19/2015 1:01:00 AM
Pyrene	ND	55.1		µg/Kg-dry	1	9/19/2015 1:01:00 AM
Benz(a)anthracene	ND	55.1		µg/Kg-dry	1	9/19/2015 1:01:00 AM
Chrysene	ND	55.1		µg/Kg-dry	1	9/19/2015 1:01:00 AM
Benzo(b)fluoranthene	ND	55.1		µg/Kg-dry	1	9/19/2015 1:01:00 AM
Benzo(k)fluoranthene	ND	55.1		µg/Kg-dry	1	9/19/2015 1:01:00 AM
Benzo(a)pyrene	ND	55.1		µg/Kg-dry	1	9/19/2015 1:01:00 AM
Indeno(1,2,3-cd)pyrene	ND	55.1		µg/Kg-dry	1	9/19/2015 1:01:00 AM
Dibenz(a,h)anthracene	ND	55.1		µg/Kg-dry	1	9/19/2015 1:01:00 AM
Benzo(g,h,i)perylene	ND	55.1		µg/Kg-dry	1	9/19/2015 1:01:00 AM
Surr: 2-Fluorobiphenyl	88.4	30.6-166		%REC	1	9/19/2015 1:01:00 AM
Surr: Terphenyl-d14 (surr)	121	48.8-157		%REC	1	9/19/2015 1:01:00 AM
Mercury by EPA Method 7471				Batch ID: 11874		Analyst: TN
Mercury	ND	0.276		mg/Kg-dry	1	9/18/2015 3:38:45 PM
Total Metals by EPA Method 6020				Batch ID: 11873		Analyst: TN
Arsenic	3.63	0.0856		mg/Kg-dry	1	9/18/2015 2:38:39 PM

Analytical Report

WO#: **1509211**

Date Reported: **9/23/2015**

Client: Shannon & Wilson

Collection Date: 9/15/2015 10:50:00 AM

Project: Saltwater State Park

Lab ID: 1509211-007

Matrix: Soil

Client Sample ID: TP-7:ES

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Metals by EPA Method 6020				Batch ID: 11873		Analyst: TN
Cadmium	ND	0.171		mg/Kg-dry	1	9/18/2015 2:38:39 PM
Chromium	13.4	0.0856		mg/Kg-dry	1	9/18/2015 2:38:39 PM
Lead	3.34	0.171		mg/Kg-dry	1	9/18/2015 2:38:39 PM
Sample Moisture (Percent Moisture)				Batch ID: R24961		Analyst: SL
Percent Moisture	12.8			wt%	1	9/18/2015 2:56:45 PM

Analytical Report

WO#: **1509211**
Date Reported: **9/23/2015**

Client: Shannon & Wilson
Collection Date: 9/15/2015 12:05:00 PM
Project: Saltwater State Park
Lab ID: 1509211-008
Matrix: Soil
Client Sample ID: TP-8:ES

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Hydrocarbon Identification by NWTPH-HCID				Batch ID: 11853		Analyst: EC
Gasoline	ND	21.8		mg/Kg-dry	1	9/17/2015 5:56:00 PM
Mineral Spirits	ND	32.7		mg/Kg-dry	1	9/17/2015 5:56:00 PM
Kerosene	ND	54.5		mg/Kg-dry	1	9/17/2015 5:56:00 PM
Diesel (Fuel Oil)	ND	54.5		mg/Kg-dry	1	9/17/2015 5:56:00 PM
Heavy Oil	ND	109		mg/Kg-dry	1	9/17/2015 5:56:00 PM
Mineral Oil	ND	109		mg/Kg-dry	1	9/17/2015 5:56:00 PM
Surr: 2-Fluorobiphenyl	89.4	50-150		%REC	1	9/17/2015 5:56:00 PM
Surr: o-Terphenyl	87.0	50-150		%REC	1	9/17/2015 5:56:00 PM
Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)				Batch ID: 11876		Analyst: NG
Naphthalene	ND	54.8		µg/Kg-dry	1	9/19/2015 1:27:00 AM
2-Methylnaphthalene	ND	54.8		µg/Kg-dry	1	9/19/2015 1:27:00 AM
1-Methylnaphthalene	ND	54.8		µg/Kg-dry	1	9/19/2015 1:27:00 AM
Acenaphthylene	ND	54.8		µg/Kg-dry	1	9/19/2015 1:27:00 AM
Acenaphthene	ND	54.8		µg/Kg-dry	1	9/19/2015 1:27:00 AM
Fluorene	ND	54.8		µg/Kg-dry	1	9/19/2015 1:27:00 AM
Phenanthrene	ND	54.8		µg/Kg-dry	1	9/19/2015 1:27:00 AM
Anthracene	ND	54.8		µg/Kg-dry	1	9/19/2015 1:27:00 AM
Fluoranthene	ND	54.8		µg/Kg-dry	1	9/19/2015 1:27:00 AM
Pyrene	ND	54.8		µg/Kg-dry	1	9/19/2015 1:27:00 AM
Benz(a)anthracene	ND	54.8		µg/Kg-dry	1	9/19/2015 1:27:00 AM
Chrysene	ND	54.8		µg/Kg-dry	1	9/19/2015 1:27:00 AM
Benzo(b)fluoranthene	ND	54.8		µg/Kg-dry	1	9/19/2015 1:27:00 AM
Benzo(k)fluoranthene	ND	54.8		µg/Kg-dry	1	9/19/2015 1:27:00 AM
Benzo(a)pyrene	ND	54.8		µg/Kg-dry	1	9/19/2015 1:27:00 AM
Indeno(1,2,3-cd)pyrene	ND	54.8		µg/Kg-dry	1	9/19/2015 1:27:00 AM
Dibenz(a,h)anthracene	ND	54.8		µg/Kg-dry	1	9/19/2015 1:27:00 AM
Benzo(g,h,i)perylene	ND	54.8		µg/Kg-dry	1	9/19/2015 1:27:00 AM
Surr: 2-Fluorobiphenyl	80.1	30.6-166		%REC	1	9/19/2015 1:27:00 AM
Surr: Terphenyl-d14 (surr)	117	48.8-157		%REC	1	9/19/2015 1:27:00 AM
Mercury by EPA Method 7471				Batch ID: 11874		Analyst: TN
Mercury	ND	0.264		mg/Kg-dry	1	9/18/2015 3:40:23 PM
Total Metals by EPA Method 6020				Batch ID: 11873		Analyst: TN
Arsenic	3.38	0.0819		mg/Kg-dry	1	9/18/2015 2:49:16 PM

Analytical Report

WO#: **1509211**

Date Reported: **9/23/2015**

Client: Shannon & Wilson

Collection Date: 9/15/2015 12:05:00 PM

Project: Saltwater State Park

Lab ID: 1509211-008

Matrix: Soil

Client Sample ID: TP-8:ES

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Metals by EPA Method 6020				Batch ID: 11873		Analyst: TN
Cadmium	ND	0.164		mg/Kg-dry	1	9/18/2015 2:49:16 PM
Chromium	15.2	0.0819		mg/Kg-dry	1	9/18/2015 2:49:16 PM
Lead	2.88	0.164		mg/Kg-dry	1	9/18/2015 2:49:16 PM
Sample Moisture (Percent Moisture)				Batch ID: R24961		Analyst: SL
Percent Moisture	8.89			wt%	1	9/18/2015 2:56:45 PM

Date: *9/23/2015*

Work Order: 1509211
CLIENT: Shannon & Wilson
Project: Saltwater State Park

QC SUMMARY REPORT

Total Metals by EPA Method 6020

Sample ID **MB-11873** SampType: **MBLK** Units: **mg/Kg** Prep Date: **9/17/2015** RunNo: **24962**
Client ID: **MBLKS** Batch ID: **11873** Analysis Date: **9/18/2015** SeqNo: **470279**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Arsenic	ND	0.100									
Cadmium	ND	0.200									
Chromium	ND	0.100									
Lead	ND	0.200									

Sample ID **LCS-11873** SampType: **LCS** Units: **mg/Kg** Prep Date: **9/17/2015** RunNo: **24962**
Client ID: **LCSS** Batch ID: **11873** Analysis Date: **9/18/2015** SeqNo: **470280**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Arsenic	48.8	0.100	50.00	0	97.6	80	120				
Cadmium	2.53	0.200	2.500	0	101	80	120				
Chromium	53.1	0.100	50.00	0	106	80	120				
Lead	23.7	0.200	25.00	0	94.9	80	120				

Sample ID **1509240-001ADUP** SampType: **DUP** Units: **mg/Kg-dry** Prep Date: **9/18/2015** RunNo: **24962**
Client ID: **BATCH** Batch ID: **11873** Analysis Date: **9/18/2015** SeqNo: **470282**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Arsenic	9.95	0.669						10.05	1.02	20	
Cadmium	ND	1.34						0		20	
Chromium	12.8	0.669						14.36	11.3	20	
Lead	ND	1.34						0		20	

Sample ID **1509240-001AMS** SampType: **MS** Units: **mg/Kg-dry** Prep Date: **9/18/2015** RunNo: **24962**
Client ID: **BATCH** Batch ID: **11873** Analysis Date: **9/18/2015** SeqNo: **470286**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Arsenic	335	0.674	336.9	10.05	96.3	75	125				
Cadmium	17.2	1.35	16.85	0.09507	102	75	125				
Chromium	372	0.674	336.9	14.36	106	75	125				

Date: *9/23/2015*

Work Order: 1509211
CLIENT: Shannon & Wilson
Project: Saltwater State Park

QC SUMMARY REPORT

Total Metals by EPA Method 6020

Sample ID **1509240-001AMS** SampType: **MS** Units: **mg/Kg-dry** Prep Date: **9/18/2015** RunNo: **24962**
Client ID: **BATCH** Batch ID: **11873** Analysis Date: **9/18/2015** SeqNo: **470286**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	159	1.35	168.5	0.9578	94.0	75	125				

Sample ID **1509240-001AMSD** SampType: **MSD** Units: **mg/Kg-dry** Prep Date: **9/18/2015** RunNo: **24962**
Client ID: **BATCH** Batch ID: **11873** Analysis Date: **9/18/2015** SeqNo: **470287**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Arsenic	330	0.679	339.5	10.05	94.1	75	125	334.6	1.54	20	
Cadmium	17.0	1.36	16.98	0.09507	99.5	75	125	17.24	1.45	20	
Chromium	359	0.679	339.5	14.36	102	75	125	371.9	3.47	20	
Lead	161	1.36	169.8	0.9578	94.3	75	125	159.3	1.14	20	

Date: *9/23/2015*

Work Order: 1509211
CLIENT: Shannon & Wilson
Project: Saltwater State Park

QC SUMMARY REPORT

Mercury by EPA Method 7471

Sample ID **MB-11874** SampType: **MBLK** Units: **mg/Kg** Prep Date: **9/17/2015** RunNo: **24964**
Client ID: **MBLKS** Batch ID: **11874** Analysis Date: **9/18/2015** SeqNo: **470324**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	ND	0.250									

Sample ID **LCS-11874** SampType: **LCS** Units: **mg/Kg** Prep Date: **9/17/2015** RunNo: **24964**
Client ID: **LCSS** Batch ID: **11874** Analysis Date: **9/18/2015** SeqNo: **470325**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.577	0.250	0.5000	0	115	80	120				

Sample ID **1509211-001ADUP** SampType: **DUP** Units: **mg/Kg-dry** Prep Date: **9/18/2015** RunNo: **24964**
Client ID: **TP-1:ES** Batch ID: **11874** Analysis Date: **9/18/2015** SeqNo: **470327**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	ND	0.288						0		20	

Sample ID **1509211-001AMS** SampType: **MS** Units: **mg/Kg-dry** Prep Date: **9/18/2015** RunNo: **24964**
Client ID: **TP-1:ES** Batch ID: **11874** Analysis Date: **9/18/2015** SeqNo: **470328**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.623	0.288	0.5765	0.01544	105	70	130				

Sample ID **1509211-001AMSD** SampType: **MSD** Units: **mg/Kg-dry** Prep Date: **9/18/2015** RunNo: **24964**
Client ID: **TP-1:ES** Batch ID: **11874** Analysis Date: **9/18/2015** SeqNo: **470329**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.612	0.288	0.5765	0.01544	104	70	130	0.6229	1.73	20	

Date: *9/23/2015*

Work Order: 1509211
CLIENT: Shannon & Wilson
Project: Saltwater State Park

QC SUMMARY REPORT

Hydrocarbon Identification by NWTPH-HCID

Sample ID **MB-11853** SampType: **MBLK** Units: **mg/Kg** Prep Date: **9/16/2015** RunNo: **24906**
Client ID: **MBLKS** Batch ID: **11853** Analysis Date: **9/16/2015** SeqNo: **469427**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Gasoline	ND	20.0									
Mineral Spirits	ND	30.0									
Kerosene	ND	50.0									
Diesel (Fuel Oil)	ND	50.0									
Heavy Oil	ND	100									
Mineral Oil	ND	100									
Surr: 2-Fluorobiphenyl	17.3		20.00		86.3	50	150				
Surr: o-Terphenyl	17.2		20.00		86.0	50	150				

Sample ID **LCS-11853** SampType: **LCS** Units: **mg/Kg** Prep Date: **9/16/2015** RunNo: **24906**
Client ID: **LCSS** Batch ID: **11853** Analysis Date: **9/16/2015** SeqNo: **469426**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel (Fuel Oil)	473	50.0	500.0	0	94.7	65	135				
Surr: 2-Fluorobiphenyl	21.0		20.00		105	50	150				
Surr: o-Terphenyl	18.6		20.00		93.0	50	150				

Date: *9/23/2015*

Work Order: 1509211
CLIENT: Shannon & Wilson
Project: Saltwater State Park

QC SUMMARY REPORT

Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)

Sample ID **MB-11876** SampType: **MBLK** Units: **µg/Kg** Prep Date: **9/18/2015** RunNo: **24982**
Client ID: **MBLKS** Batch ID: **11876** Analysis Date: **9/18/2015** SeqNo: **470692**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Naphthalene	ND	50.0									
2-Methylnaphthalene	ND	50.0									
1-Methylnaphthalene	ND	50.0									
Acenaphthylene	ND	50.0									
Acenaphthene	ND	50.0									
Fluorene	ND	50.0									
Phenanthrene	ND	50.0									
Anthracene	ND	50.0									
Fluoranthene	ND	50.0									
Pyrene	ND	50.0									
Benz(a)anthracene	ND	50.0									
Chrysene	ND	50.0									
Benzo(b)fluoranthene	ND	50.0									
Benzo(k)fluoranthene	ND	50.0									
Benzo(a)pyrene	ND	50.0									
Indeno(1,2,3-cd)pyrene	ND	50.0									
Dibenz(a,h)anthracene	ND	50.0									
Benzo(g,h,i)perylene	ND	50.0									
Surr: 2-Fluorobiphenyl	443		500.0		88.7	30.6	166				
Surr: Terphenyl-d14 (surr)	627		500.0		125	48.8	157				

Sample ID **LCS-11876** SampType: **LCS** Units: **µg/Kg** Prep Date: **9/18/2015** RunNo: **24982**
Client ID: **LCSS** Batch ID: **11876** Analysis Date: **9/18/2015** SeqNo: **470693**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Naphthalene	984	50.0	1,000	0	98.4	61.6	125				
2-Methylnaphthalene	954	50.0	1,000	0	95.4	58.2	129				
1-Methylnaphthalene	920	50.0	1,000	0	92.0	56.4	132				
Acenaphthylene	1,150	50.0	1,000	0	115	52.2	133				
Acenaphthene	937	50.0	1,000	0	93.7	53.6	115				
Fluorene	948	50.0	1,000	0	94.8	53.4	131				

Date: *9/23/2015*

Work Order: 1509211
CLIENT: Shannon & Wilson
Project: Saltwater State Park

QC SUMMARY REPORT

Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)

Sample ID **LCS-11876** SampType: **LCS** Units: **µg/Kg** Prep Date: **9/18/2015** RunNo: **24982**
Client ID: **LCSS** Batch ID: **11876** Analysis Date: **9/18/2015** SeqNo: **470693**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Phenanthrene	943	50.0	1,000	0	94.3	47.2	124				
Anthracene	962	50.0	1,000	0	96.2	51	132				
Fluoranthene	938	50.0	1,000	0	93.8	48.4	134				
Pyrene	1,010	50.0	1,000	0	101	48.6	135				
Benz(a)anthracene	874	50.0	1,000	0	87.4	41.9	136				
Chrysene	1,080	50.0	1,000	0	108	49.4	134				
Benzo(b)fluoranthene	795	50.0	1,000	0	79.5	35.9	148				
Benzo(k)fluoranthene	1,030	50.0	1,000	0	103	45.7	138				
Benzo(a)pyrene	754	50.0	1,000	0	75.4	39.5	138				
Indeno(1,2,3-cd)pyrene	749	50.0	1,000	0	74.9	41	140				
Dibenz(a,h)anthracene	870	50.0	1,000	0	87.0	37.6	140				
Benzo(g,h,i)perylene	561	50.0	1,000	0	56.1	45	134				
Surr: 2-Fluorobiphenyl	455		500.0		90.9	30.6	166				
Surr: Terphenyl-d14 (surr)	593		500.0		119	48.8	157				

Sample ID **1509195-001ADUP** SampType: **DUP** Units: **µg/Kg-dry** Prep Date: **9/18/2015** RunNo: **24982**
Client ID: **BATCH** Batch ID: **11876** Analysis Date: **9/18/2015** SeqNo: **470674**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Naphthalene	ND	53.6						0		30	
2-Methylnaphthalene	ND	53.6						0		30	
1-Methylnaphthalene	ND	53.6						0		30	
Acenaphthylene	ND	53.6						0		30	
Acenaphthene	ND	53.6						0		30	
Fluorene	ND	53.6						0		30	
Phenanthrene	ND	53.6						0		30	
Anthracene	ND	53.6						0		30	
Fluoranthene	ND	53.6						0		30	
Pyrene	ND	53.6						0		30	
Benz(a)anthracene	ND	53.6						0		30	
Chrysene	ND	53.6						0		30	

Date: *9/23/2015*

Work Order: 1509211
CLIENT: Shannon & Wilson
Project: Saltwater State Park

QC SUMMARY REPORT

Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)

Sample ID **1509195-001ADUP** SampType: **DUP** Units: **µg/Kg-dry** Prep Date: **9/18/2015** RunNo: **24982**
Client ID: **BATCH** Batch ID: **11876** Analysis Date: **9/18/2015** SeqNo: **470674**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzo(b)fluoranthene	ND	53.6						0		30	
Benzo(k)fluoranthene	ND	53.6						0		30	
Benzo(a)pyrene	ND	53.6						0		30	
Indeno(1,2,3-cd)pyrene	ND	53.6						0		30	
Dibenz(a,h)anthracene	ND	53.6						0		30	
Benzo(g,h,i)perylene	ND	53.6						0		30	
Surr: 2-Fluorobiphenyl	405		535.6		75.7	30.6	166		0		
Surr: Terphenyl-d14 (surr)	1,080		535.6		202	48.8	157		0		S

NOTES:
S - Outlying surrogate recovery observed (high bias). A duplicate analysis was performed and recovered within range.

Sample ID **1509195-002AMS** SampType: **MS** Units: **µg/Kg-dry** Prep Date: **9/18/2015** RunNo: **24982**
Client ID: **BATCH** Batch ID: **11876** Analysis Date: **9/18/2015** SeqNo: **470676**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Naphthalene	956	54.5	1,090	0	87.7	42.9	138				
2-Methylnaphthalene	891	54.5	1,090	0	81.7	42.8	151				
1-Methylnaphthalene	927	54.5	1,090	0	85.0	41.6	148				
Acenaphthylene	1,210	54.5	1,090	0	111	32.6	160				
Acenaphthene	960	54.5	1,090	0	88.1	46.3	142				
Fluorene	1,000	54.5	1,090	0	91.9	43.4	153				
Phenanthrene	1,020	54.5	1,090	0	93.6	45.5	140				
Anthracene	1,060	54.5	1,090	0	96.9	32.6	160				
Fluoranthene	1,020	54.5	1,090	0	93.6	44.6	161				
Pyrene	1,060	54.5	1,090	0	97.1	48.3	158				
Benz(a)anthracene	999	54.5	1,090	0	91.7	57.5	169				
Chrysene	1,110	54.5	1,090	0	102	45.2	146				
Benzo(b)fluoranthene	933	54.5	1,090	0	85.6	42.2	168				
Benzo(k)fluoranthene	1,100	54.5	1,090	0	101	48	161				
Benzo(a)pyrene	878	54.5	1,090	0	80.5	34.4	179				
Indeno(1,2,3-cd)pyrene	932	54.5	1,090	0	85.5	41.1	165				
Dibenz(a,h)anthracene	1,140	54.5	1,090	0	105	38.1	166				

Date: *9/23/2015*

Work Order: 1509211
CLIENT: Shannon & Wilson
Project: Saltwater State Park

QC SUMMARY REPORT

Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)

Sample ID **1509195-002AMS** SampType: **MS** Units: **µg/Kg-dry** Prep Date: **9/18/2015** RunNo: **24982**
Client ID: **BATCH** Batch ID: **11876** Analysis Date: **9/18/2015** SeqNo: **470676**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzo(g,h,i)perylene	682	54.5	1,090	0	62.6	45.6	157				
Surr: 2-Fluorobiphenyl	462		545.1		84.7	30.6	166				
Surr: Terphenyl-d14 (surr)	700		545.1		128	48.8	157				

Date: *9/23/2015*

Work Order: 1509211
CLIENT: Shannon & Wilson
Project: Saltwater State Park

QC SUMMARY REPORT

Sample Moisture (Percent Moisture)

Sample ID	1509211-001ADUP	SampType:	DUP	Units:	wt%	Prep Date:	9/18/2015	RunNo:	24961
Client ID:	TP-1:ES	Batch ID:	R24961			Analysis Date:	9/18/2015	SeqNo:	470229

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Percent Moisture	16.1	0.500						16.60	3.08	20	

Sample ID	1509211-002ADUP	SampType:	DUP	Units:	wt%	Prep Date:	9/18/2015	RunNo:	24961
Client ID:	TP-2:ES	Batch ID:	R24961			Analysis Date:	9/18/2015	SeqNo:	470231

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Percent Moisture	16.1	0.500						16.30	1.47	20	

Sample Log-In Check List

Client Name:	**SW**	Work Order Number:	**1509211**
Logged by:	**Clare Griggs**	Date Received:	**9/16/2015 2:00:00 PM**

Chain of Custody

1.	Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
2.	How was the sample delivered?	Client		

Log In

3.	Coolers are present?	Yes ☑	No ☐	NA ☐
4.	Shipping container/cooler in good condition?	Yes ☑	No ☐	
5.	Custody Seals present on shipping container/cooler? (Refer to comments for Custody Seals not intact)	Yes ☐	No ☐	Not Required ☑
6.	Was an attempt made to cool the samples?	Yes ☑	No ☐	NA ☐
7.	Were all items received at a temperature of >0°C to 10.0°C *	Yes ☑	No ☐	NA ☐
8.	Sample(s) in proper container(s)?	Yes ☑	No ☐	
9.	Sufficient sample volume for indicated test(s)?	Yes ☑	No ☐	
10.	Are samples properly preserved?	Yes ☑	No ☐	
11.	Was preservative added to bottles?	Yes ☐	No ☑	NA ☐
12.	Is there headspace in the VOA vials?	Yes ☐	No ☐	NA ☑
13.	Did all samples containers arrive in good condition(unbroken)?	Yes ☑	No ☐	
14.	Does paperwork match bottle labels?	Yes ☑	No ☐	
15.	Are matrices correctly identified on Chain of Custody?	Yes ☑	No ☐	
16.	Is it clear what analyses were requested?	Yes ☑	No ☐	
17.	Were all holding times able to be met?	Yes ☑	No ☐	

Special Handling (if applicable)

18.	Was client notified of all discrepancies with this order?	Yes ☐	No ☐	NA ☑

Person Notified: _____ Date _____

By Whom: _____ Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person

Regarding: _____

Client Instructions: _____

19. Additional remarks:

Item Information

Item #	Temp ºC
Cooler	5.7
Sample	8.2

* Note: DoD/ELAP and TNI require items to be received at 4°C +/- 2°C

Fremont Analytical

Chain of Custody Record

3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790
Fax: 206-352-7178

Laboratory Project No (internal): 1509211

Date: 9/16/15 Page: 1 of: 1

Client: Shannon & Wilson Inc.
Address: 400 N 34th St. Suite 100
City, State, Zip: Seattle, WA
Telephone: 206-632-8020 Fax: 206-695-6777

Project Name: Saltwater State Park
Project No: 21-1-22077-001 Collected by: EVP
Location: Saltwater State Park
Report To (PM): Edwin Ptak
PM Email: evp@shanwil.com

*Matrix Codes: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	VOCs (EPA 8260 / 624)	GX/BTEX	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8)	Total (T) | Dissolved (D)	Anions (IC)***	EDB (8011)	Comments
1	TP-1:ES	9/15/15	0930	S				X			X		X	T				
2	TP-2:ES	9/16/15	0900					X			X		X	T				
3	TP-3:ES	9/15/15	1320					X			X		X	T				
4	TP-4:ES	9/16/15	1230					X			X		X	T				
5	TP-5:ES	9/16/15	1125					X			X		X	T				
6	TP-6:ES	9/16/15	1015					X			X		X	T				
7	TP-7:ES	9/15/15	1050					X			X		X	T				
8	TP-8:ES	9/15/15	1205					X			X		X	T				
9																		
10																		

**Metals Analysis (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL Individual: Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl U V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

Turn-around times for samples received after 4:00pm will begin on the following business day.

Special Remarks:

Sample Disposal: ☐ Return to Client ☑ Disposal by Lab (A fee may be assessed if samples are retained after 30 days.)

Relinquished	Date/Time	Received	Date/Time
x	9/16/15 1400	x	09/16/15 14:00
Relinquished	Date/Time	Received	Date/Time
x		x	

TAT → SameDay^ NextDay^ 2 Day 3 Day STD

^Please coordinate with the lab in advance

Distribution: White - Lab, Yellow - File, Pink - Originator

APPENDIX D

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL/ENVIRONMENTAL REPORT

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL/ENVIRONMENTAL REPORT

CONSULTING SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND FOR SPECIFIC CLIENTS.

Consultants prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your consultant prepared your report expressly for you and expressly for the purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the consultant. No party should apply this report for any purpose other than that originally contemplated without first conferring with the consultant.

THE CONSULTANT'S REPORT IS BASED ON PROJECT-SPECIFIC FACTORS.

A geotechnical/environmental report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. Depending on the project, these may include: the general nature of the structure and property involved; its size and configuration; its historical use and practice; the location of the structure on the site and its orientation; other improvements such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask the consultant to evaluate how any factors that change subsequent to the date of the report may affect the recommendations. Unless your consultant indicates otherwise, your report should not be used: (1) when the nature of the proposed project is changed (for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one, or chemicals are discovered on or near the site); (2) when the size, elevation, or configuration of the proposed project is altered; (3) when the location or orientation of the proposed project is modified; (4) when there is a change of ownership; or (5) for application to an adjacent site. Consultants cannot accept responsibility for problems that may occur if they are not consulted after factors which were considered in the development of the report have changed.

SUBSURFACE CONDITIONS CAN CHANGE.

Subsurface conditions may be affected as a result of natural processes or human activity. Because a geotechnical/environmental report is based on conditions that existed at the time of subsurface exploration, construction decisions should not be based on a report whose adequacy may have been affected by time. Ask the consultant to advise if additional tests are desirable before construction starts; for example, groundwater conditions commonly vary seasonally.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes, or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical/environmental report. The consultant should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

MOST RECOMMENDATIONS ARE PROFESSIONAL JUDGMENTS.

Site exploration and testing identifies actual surface and subsurface conditions only at those points where samples are taken. The data were extrapolated by your consultant, who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your consultant can work together to help reduce their impacts. Retaining your consultant to observe subsurface construction operations can be particularly beneficial in this respect.

A REPORT'S CONCLUSIONS ARE PRELIMINARY.

The conclusions contained in your consultant's report are preliminary because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Actual subsurface conditions can be discerned only during earthwork; therefore, you should retain your consultant to observe actual conditions and to provide conclusions. Only the consultant who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations based on those conclusions are valid and whether or not the contractor is abiding by applicable recommendations. The consultant who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

THE CONSULTANT'S REPORT IS SUBJECT TO MISINTERPRETATION.

Costly problems can occur when other design professionals develop their plans based on misinterpretation of a geotechnical/environmental report. To help avoid these problems, the consultant should be retained to work with other project design professionals to explain relevant geotechnical, geological, hydrogeological, and environmental findings, and to review the adequacy of their plans and specifications relative to these issues.

BORING LOGS AND/OR MONITORING WELL DATA SHOULD NOT BE SEPARATED FROM THE REPORT.

Final boring logs developed by the consultant are based upon interpretation of field logs (assembled by site personnel), field test results, and laboratory and/or office evaluation of field samples and data. Only final boring logs and data are customarily included in geotechnical/environmental reports. These final logs should not, under any circumstances, be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process.

To reduce the likelihood of boring log or monitoring well misinterpretation, contractors should be given ready access to the complete geotechnical engineering/environmental report prepared or authorized for their use. If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared, and that developing construction cost estimates was not one of the specific purposes for which it was prepared. While a contractor may gain important knowledge from a report prepared for another party, the contractor should discuss the report with your consultant and perform the additional or alternative work believed necessary to obtain the data specifically appropriate for construction cost estimating purposes. Some clients hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes that aggravate them to a disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY.

Because geotechnical/environmental engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, consultants have developed a number of clauses for use in their contracts, reports and other documents. These responsibility clauses are not exculpatory clauses designed to transfer the consultant's liabilities to other parties; rather, they are definitive clauses that identify where the consultant's responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.

The preceding paragraphs are based on information provided by the
ASFE/Association of Engineering Firms Practicing in the Geosciences, Silver Spring, Maryland