APPENDIX D

Stormwater Engineering Plan

Discharge Permits

Stormwater Pollution Prevention Plan

STORMWATER ENGINEERING REPORT

Stormwater Treatment System for Samson Tug and Barge / Duwamish Metal Fabrication

6361 First Avenue South
Seattle, WA 98108

EXPIRES: 11/27/2017

July 31, 2013
REVISED: March 7, 2016

Prepared by:

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4500 15th Street East
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1. CERTIFICATION

The following Engineering Report has been prepared in conformance to sound engineering principles and standards, and with the requirements of Chapter 173-240-130 WAC. The Engineering Report contained herein has been prepared by or under the direct supervision of the undersigned Professional Engineer Licensed in the State of Washington.

Michael McCutcheon Johnson, PE
License Number 34993
March 2016 – Tacoma, WA

EXPIRES: 11/27/2017

2. EXECUTIVE SUMMARY

SAMSON TUG AND BARGE (SAMSON) is a marine container and bulk material shipping facility located on the Duwamish River at 6361 1st Avenue South in Seattle, Washington. DUWAMISH METAL FABRICATION (DMF) occupies the contiguous site to the south and shares common ownership and overlapping stormwater management systems. The site has been used for marine transportation under various management structures at the 1st Avenue location since the 1940s. Industrial activities at the site include loading and unloading of barges, unloading of trucks, containerizing and freight consolidation. (Figure 1).

The facility's primary stormwater management system collects stormwater from approximately 3.0 acres of mostly unpaved surface on the Samson site into seven catch basins for discharge via private storm sewer westbound into the Duwamish Waterway. DMF has an additional 3 catch basins that collect flow from mostly paved surfaces and from the roof of the fabrication building. The DMF site covers 1.7 acres. The total area of the site is 4.7 acres, most of which drains to the Duwamish via the existing 10" outfall located approximately 100 feet north of the fabrication building (Outfall 1). The wastewater from a wheel-wash at northeast corner of the site is collected and transported off-site by vacuum truck. There were previously three outfalls at the site, but two have been permanently closed and their flows diverted to Outfall 1 or sanitary sewer. Portions of the site are leased from the City of Seattle and the Port of Seattle, and are included in the total area for which treatment will be provided.

The facility is industrial in nature and discharges stormwater under Department of Ecology's NPDES Stormwater Industrial General Permit. Pursuant to permit condition SA.1. The facility must use adaptive management with the objective of discharge at or below benchmark values. The facility has not consistently met benchmark values for turbidity, total copper and total zinc.

For the purposes of this report, the Samson and DMF sites are considered together and will be referred to as the "facility" or the "site".

The facility is currently undergoing a remedial investigation and feasibility study for site cleanup relevant to legacy issues at the site and involving a number of review agencies. Final cleanup is expected to include excavation and removal of contaminated soils and possibly capping or paving the site. Areas outside of current industrial activity are outside the scope of this report.

The intent of this engineering report is to address stormwater treatment in the current site conditions and at the current stage of remedial investigation, prior to significant remedial activity. It is expected that the site characteristics will change as a result of remediation. An updated engineering report will be submitted for any substantive changes would impact the character of the influent or tributary areas. In the interim, the stormwater treatment system will be required to treat stormwater generated under existing site conditions, and any flows that will be generated during cleanup operations.

An interim Engineering Report was submitted in February of 2014 for the construction of a temporary stormwater treatment system. This report addresses the upgrades to the system to include increasing the size and efficiency of treatment units, documentation of performance characteristics, and future upgrades relevant to the operation of the system under changing site conditions.

The stormwater treatment system consists of the following elements:

1. Installation of pumps in an existing collection sump upstream from Outfall 1.
2. Installation of an overflow riser to bypass overflows greater than the design storm directly to Outfall 1.
3. Electrocoagulation of the stormwater at the 98% treatment level (per WHMM 2012)
4. Gravity sedimentation of the coagulated total flow.
5. Polishing through sand filtration, with recirculation through the filters as allowed by flow conditions to the 98% level.
6. Discharge via Outfall 1.

Based on data from laboratory and field tests it is expected that the proposed system will consistently produce treated stormwater below benchmark goals. Additional structural BMPs associated with site cleanup upstream are expected to enhance the performance of the system and improve performance.

3. INTRODUCTION AND BACKGROUND

Samson Tug and Barge (Samson) and Duwamish Metal Fabrication (DMF) occupy contiguous sites and share common ownership and co-mingled stormwater management systems. The following engineering report is intended to provide sufficient information to allow for the design, construction and operation of a stormwater treatment system from the combined stormwater flow to pretreat water discharged to the Duwamish Waterway via a private stormwater conveyance. The proposed treatment system will be an interim measure, to function until the site cleanup has been completed and the site has been repaved. At that time a permanent treatment system will be designed, reviewed, and installed.

This report also fulfills the requirement under Level III corrective action as required by Washington state Industrial Stormwater General Permit (ISWGP) requirements for construction of stormwater treatment systems for systems with three or more benchmark exceedances for a given parameter in a single year. The site has been identified for clean-up for several contaminants of concern, including heavy metals, under the Model Toxics Control Act. An agreed order is presently being administered by Ecology and sampling plans submitted for approval. (See APPENDIX A – FACT SHEET)

4. ENGINEERING REPORT REQUIREMENTS

SECTION I - Facility Description (WAC 173-240-130(2)(a-b))

SAMSON TUG AND BARGE (SAMSON) is a marine container and bulk material shipping facility located on the Duwamish River at 6361 1st Avenue South in Seattle, Washington. The facility has been under the current operators control since 2001. Industrial activities at the site include loading and unloading of barges, unloading of trucks, containerizing cargo and freight consolidation (Figure 1). Samson is contiguous to Duwamish Metal Fabrication (DMF) located on the south end of the subject property.

The buildings at the Samson, or north, part of the facility are used for offices and administrative duties. On the DMF side to the south, the buildings are used for metal fabrication, welding and assembly. Smaller buildings at the south end of the facility are used for storage and offices.

The combined facility's primary stormwater management system collects stormwater from approximately 3.6 acres of unpaved surface and one acre of roofs into 11 catch basins for discharge via private storm sewer westbound into the Duwamish Waterway. The facility discharges stormwater under Department of Ecology's NPDES Stormwater Industrial General Permit. Pursuant to permit condition S1.A the facility must use adaptive management with the objective of discharge at or below benchmark values. The facility has not consistently met benchmark values for turbidity, total copper and total zinc.

The latitude and longitude of the present facility outfall is approximately 47° 32' 38.29" N by 122 ° 20' 09.00"W (Google maps) The site map is shown as Figure 2, represents the stormwater handling layout and location of the catch basins and collection system.

The site is 750 feet long (north to south) and 300 feet wide (east to west) at its largest dimension. The northern section (Samson) is trapezoidal approximately 300' by 350'. The southern portion (DMF and Samson) is approximately right-triangular in shape with the legs 300 feet and 450 feet in length. The sections are approximately 3.0 acres and 1.7 acres, respectively.

The facility is operating under an Agreed Order DE 9844 (4/23/2013).

Per Ecology Fact Sheet, *Duwamish Marine Center leases portions of the property to other companies. Samson tug and Barge operates in the northern portion of the Duwamish Marine Center and Duwamish Metal Fabricators operates on the southern portion of the property. Historically, the site operated as a marine shipyard, rail yard, junk dealer, various construction service companies, and a barge shipping terminal. A marine railway operated next to the southwestern shoreline from 1940 to the mid-1970s.*

Several environmental investigations have been conducted at the Duwamish Marine Center. Soil and groundwater investigations performed at the property in 2000 and 2002 showed petroleum hydrocarbons, metals, polychlorinated biphenyls (PCBs), and polynuclear aromatic

hydrocarbons (PAHs) above cleanup levels in soil and groundwater. The groundwater also contained solvents. Sediments adjacent to the site contain PCBs and PAHs.

Approximately 50 cubic yards of lead contaminated soil that classified as hazardous waste were excavated and removed from the central area of the site. Samples collected after the soil removal from the bottom and sidewalls of the removal area confirmed that this lead contaminated soil was removed from the property.

Groundwater was sampled at one of the wells at the Duwamish Marine Center in November 2003 and February, May, and August 2004. Total mercury and petroleum hydrocarbons were detected in groundwater above levels of concern.

The Agreed Order is a legal agreement between Ecology and the potentially liable persons (PLPs). It describes the work that the PLPs agrees to perform on the site. It ensures timely cleanup that protects human health and the environment according to Washington State's cleanup law—the Model Toxics Control Act, and the Sediment Management Standards. Work to be performed includes a ***Remedial Investigation and Feasibility Study (RI/FS).*** *The RI includes sampling to define the nature and extent of contamination in soil, groundwater, surface water, and sediments. The FS presents the results of the RI and evaluates cleanup alternatives. Ecology also requires the PLP to complete a draft Cleanup Action Plan* ***(draft CAP).*** *The draft CAP uses the RI/FS to identify a preferred cleanup action and a schedule to cleanup the contamination.*

The Duwamish Marine Center site is located within the larger Lower Duwamish Waterway (LDW) cleanup site. The LDW site is both a state and federal cleanup covering about 5.5 miles of the Duwamish River south of Harbor Island. The LDW sediments are contaminated with several hazardous substances, including PCBs, arsenic, dioxins/furans, and PAHs. The Duwamish Marine Center site is one of several areas near the LDW that is being addressed. It will be cleaned up as necessary to reduce the threat to human health and the environment from pollution. This work will also assist in preventing recontamination of the sediments after the LDW site cleanup is complete. Ecology is working with the U.S. Environmental Protection Agency (EPA) and other local agencies and businesses to clean up the Lower Duwamish.

Existing Stormwater Handling Facilities

The Samson facility currently has eight catch basins covering the northern portion of the subject property. There are no detention facilities. Four of the catch basins are located along the waterfront portion of the subject property and gravity flow to the south, with three catch basins set along the 1st Avenue South (eastern) portion of the property. DMF stormwater primary drainage consists of three catch basins that gravity flow to Outfall 1. The Samson collection and conveyance system serves approximately 2.9 impervious acres (Figure 2) which drain to Outfall 1. The DMF facility is approximately 1.7 acres. A small slab is located between the DMF facility and storage building, the parking lot to the south of the DMF facility, and the roofs of the metal

fabrication facility, the Samson Facility and a small dispatch office trailer comprise the fixed portion of the impervious surface.

A segregated section of approximately 0.5 acre on the northern portion of the site is hydraulically connected to a closed and locked outfall at the northern edge of the shoreline. This collection system includes the tributary area in and around CB09, and is pumped from a collection sump and catch basin (CB09) to the treatment system via CB07.

A roof area of about 2500 square feet on the south side of the DMF building drains to the south by sheet flow, into a City right-of-way. This flow will be intercepted with a roof gutter and conveyed by pipe to the stormwater treatment system.

At least 90% of the site is defined to be impervious per Ecology specifications.

Existing Water Quality Facilities

A temporary stormwater treatment facility is located at Outfall 1, collecting much of the water from both Samson site and DMF. Samson and DMF have no other functional stormwater or industrial wastewater facilities. Both sites are served by City of Seattle sewer discharging to King County Industrial Waste facilities at West Point. Neither site has an industrial waste water permit or industrial discharge authorization.

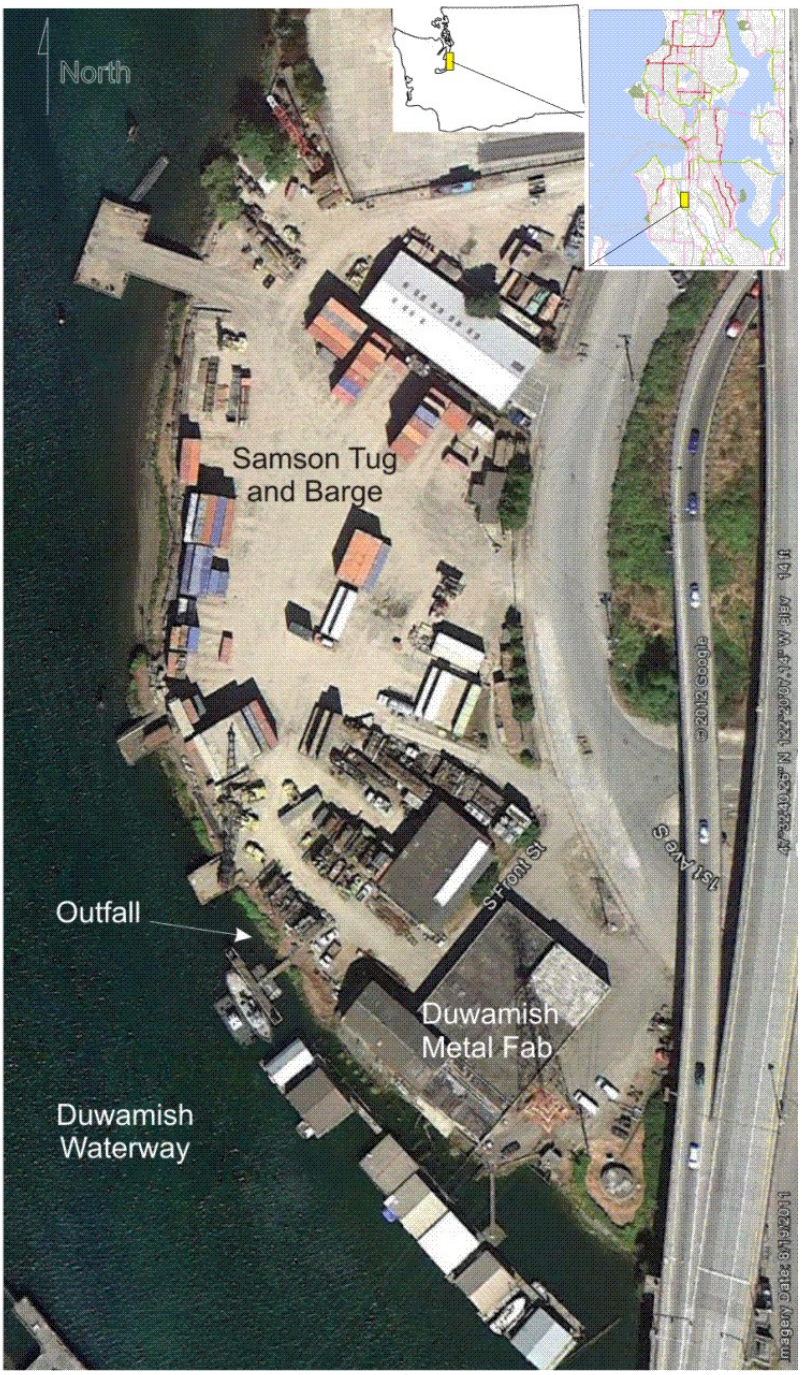

FIGURE 1
Vicinity Map and Aerial Photo of Site
© Google Earth, 8/2011

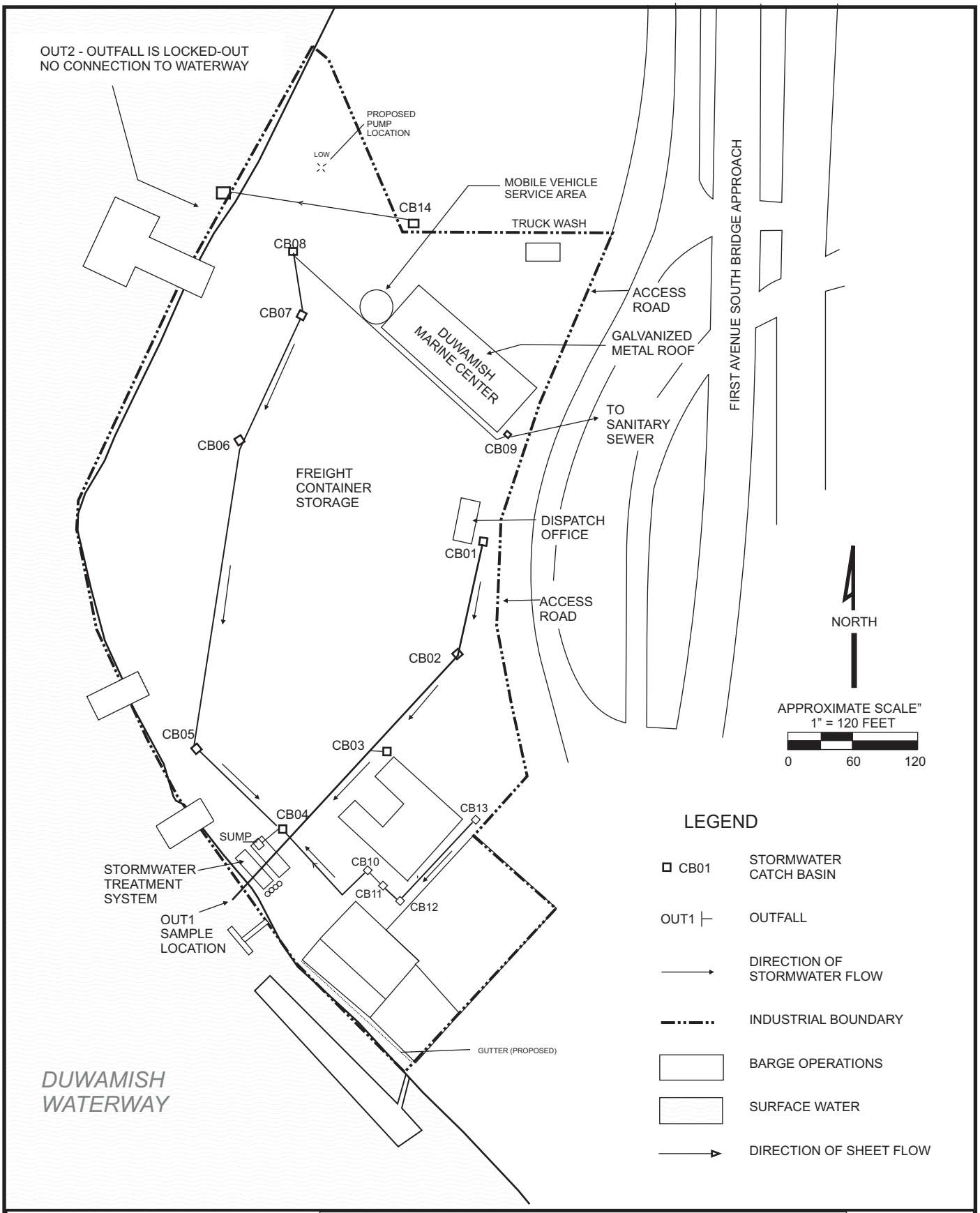

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FIGURE 2 - SAMSON / DMF SITE PLAN STORMWATER COLLECTION SYSTEM

SAMPSON TUG AND BARGE / DUWAMISH METAL FABRICATION
6361 FIRST AVENUE SOUTH, SEATTLE WA 98109

DRAWN BY:
M. JOHNSON

DATE:
MAY 14, 2013
REVISED:
MAR 5, 2016

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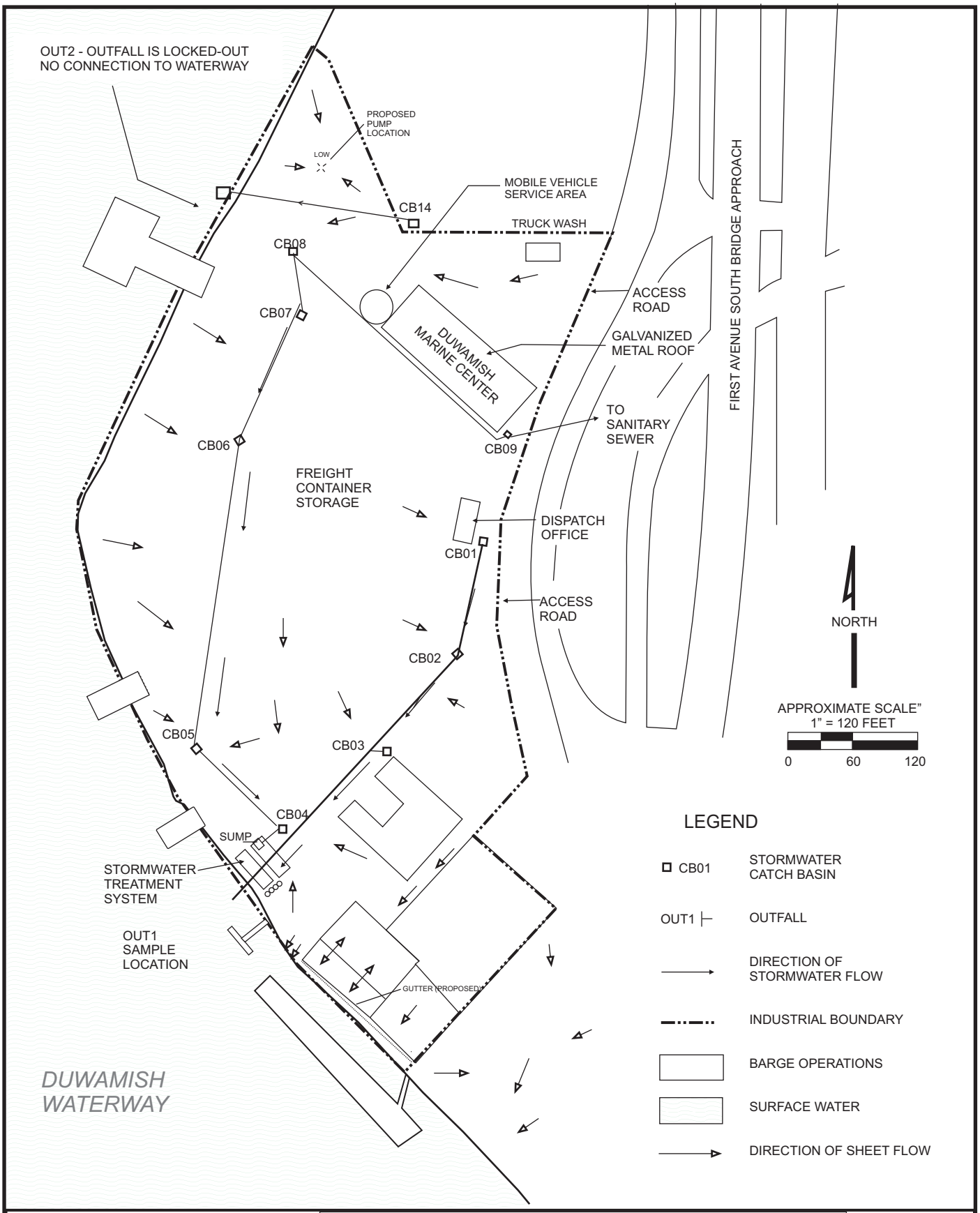

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FIGURE 3 - DUWAMISH MARINE SITE PLAN AND SHEET FLOW DIAGRAM

SAMPSON TUG AND BARGE / DUWAMISH METAL FABRICATION
6361 FIRST AVENUE SOUTH, SEATTLE WA 98109

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SECTION II - Stormwater Characterization (WAC 173-240-130(c)(i-iv))

The stormwater generated at the Samson / DMF site exhibits common industrial pollutants such as high turbidity, copper and zinc. The current sampling location for SAMSON is OUTFALL1 (Figure 2). DMF began regular sampling in 2011. Discharge Monitoring Report (DMR) data was evaluated from October 2010 to December 2015 and is tabulated below in TABLE A.

Location	Sampling QUARTER	Turbidity (NTU)	Copper, Total (mg/L)	Zinc, Total (mg/L)	pH (su)	Sheen?
OUTFALL1	4Q.2010	>2000	1640	4330	8	N
OUTFALL1	1Q.2011	923	122	362	8	N
OUTFALL1	2Q.2011	763	180	676	7.5	N
OUTFALL1	3Q.2011	1312	204	713	6.5	N
OUTFALL1	4Q.2011	NS 67	NS	NS	NS	NS
OUTFALL1	1Q.2012	0	120	315	6.7	N
OUTFALL1	2Q.2012	>3000	365	1060	8.6	N
OUTFALL1	3Q.2012	NS	NS	NS	NS	NS
OUTFALL1	4Q.2012	>3000	146	616	8.7	N
OUTFALL1	1Q.2013	12	5.12	23.8	8.2	N
OUTFALL1	2Q.2013	954	399	1680	8.4	N
OUTFALL1	3Q.2013					
OUTFALL1	4Q.2013	226 2	172	817	8.1	N
OUTFALL1	1Q.2014	94	136	520	6.6	N
OUTFALL1	2Q.2014	188	54.9	168	7.9	N
OUTFALL1	3Q.2014	388	229	1280	8.6	N
OUTFALL1	4Q.2014	226	172	817	8.1	N
OUTFALL1	4Q.2014	8	3.5	11.9	7.4	N
OUTFALL1	1Q.2015	>3000	1060	5490	8.5	N
OUTFALL1	2Q.2015					
OUTFALL1	3Q.2015	4	6.71	12.9	6.7	N
OUTFALL1	4Q.2015	5	3.6	5.04	6.4	N

TABLE A
Stormwater Monitoring – Summary of Results

Additional parameters sampled for 2Q.2102 at DMF include NWTPH 6.3 mg/l and lead (Pb) at 373 μg/l.

Water Quality Design Storm

According to the SWMMWW, Volume V, Chapter 4.1.1, the design flow for the stormwater system must meet the 24-hour storm with a six month return frequency for the location. The DOE's approved stormwater calculation program, WWHM 2012, does not compute the actual full value of the 6-month storm, but rather flows that correspond to percentages of the total

annual runoff that must be treated. The standard value for the treatment level is 91% of annual runoff, but other values may be used. Table B below shows the volume and flows calculated for a range of annual treatment levels at the site.

Treatment Level	24-hr Volume (acre-feet)	On-line Flow (CFS)	Off-line Flow (CFS)	Off-line Flow (GPM)
91%	0.5842	0.7116	0.4360	196
93%	0.6324	0.8565	0.4941	222
95%	0.6911	0.9650	0.5753	258
97%	0.9200	1.1543	0.7075	318
98%	**1.1238**	**1.3158**	**0.8195**	**368**
99%	1.2029	1.6320	1.0289	462

TABLE B
Volume and Flows Calculated for a Range of Annual Treatment Levels

The calculations above are based on 4.7 acres of completely impervious surface, using the SeaTac gauge and a 1.00 precipitation scale factor, computed with WWHM 2012. Beyond the 99% treatment level, WWHM 2012 does not generate useful numbers. If the 100% level is input to the model, for example, WWHM calculates flows that are greater than the 100-year storm.

The treatment system for the site is designed to treat 98% of the annual flow. The reason for selecting this high treatment level is that the high levels of turbidity of bypassed runoff can significantly increase the turbidity of the combined treated and untreated flow. At the 98% level, assuming a linear relationship and that the turbidity of the treated flow is 0 NTU, the remaining 2% of flow can have a turbidity no higher than 1250 NTU or the 25 NTU benchmark for combined flows will be exceeded. To achieve that level of turbidity reduction in the bypass flow, erosion control BMPs like catch basin inserts and straw bales will be strategically placed upstream to reduce influent TSS loading.

98% of the stormwater will undergo treatment via sedimentation, electrocoagulation and sand filtration. The floc formed through the portion undergoing electrocoagulation will contribute to accelerated formation of colloidal particles throughout the treatment train, and will affect sedimentation and filtration for the full 98% design flow. The portion not undergoing EC will overflow from the primary mixing zone into Sedimentation Zone 1 and be co-mingled through Sedimentation Zone 2 and Sedimentation Zone 3 prior to sand filtration. (See FIGURE 4).

In addition to the WQ Design Storm, TABLE C lists relevant significant storm events and flow rates of interest by return frequency:

Return Frequency	Cubic Feet / Second
2-year	1.81
5-year	2.29
10-year	2.61
25-year	3.03
50-year	3.35
100-year	3.68

TABLE C
Flow Rates by Return Frequency

While WWHM 2012 does not calculate the full value of the six-month storm, its value may be approximated by taking it as 72% of the 2-year storm. In this case, 72% of 1.81 CFS is 1.30 CFS, which falls between the values listed in the Treatment Level table above for on-line and off-line flows at the 99% treatment level. The 1.30 CFS flow will be used here as the full value of the 6-month storm:

6-month storm 1.30 CFS

Quantity of Domestic and Non-Contact Wastewater WAC 173-240-130(c)(ii-iii))
Domestic Wastewater is not disposed via surface conveyance or stormwater systems. There is no non-contact cooling water in use at the site.

Quantity of Water Lost to Evaporation WAC 173-240-130(c)(iv)
There will be considerable evaporative losses through the rainy and dry seasons, but are not considered as part of the flow calculations or sizing of the stormwater system.

Petroleum Hydrocarbons
Fats, oil and grease (FOG) is expected to be a parameter of concern for SAMSON / DMF stormwater discharges, based on results of visual monitoring. The heavy equipment used throughout the Samson site is a potential source for petroleum hydrocarbons. Oil sheens are not visible in the stormwater, but it likely the oil present is bound to soil particles carried in the stormwater (see TSS/Turbidity below). Given the high sediment load in the stormwater, oil/water separators would be expected to plug up with sediment quickly. Oil will be more effectively removed by removing the soil particles with which it is bound.

TSS / Turbidity
Turbidity and suspended solids at the Samson / DMF facility are significant issues for the management of stormwater at the site. The turbidity is created by heavy forklifts transporting 40’ shipping containers across unpaved surfaces – which leads to muddy site conditions, high turbidity and suspended solids during storm events. Turbidity is occasionally in excess of the 3,000 NTU operating range of field instrumentation. TSS was measured in a single sample at 2,810 mg/L. That sample was analyzed for particle size distribution, with the following results:

Particle Size (microns)	Volume (or mass) Percentage
1-5	0.9
5-15	5.0
15-30	11.8
30-50	16.1
50-100	66.3

TABLE D
Particle Size Distribution

The administrative requirements of the Agreed Order make structural BMPs such as paving and capping impractical in the timeframe required for implementation of Level 3 treatment. As a result, significant measures must be undertaken to reduce turbidity in the treatment process.

Acidity / Alkalinity and pH

The pH of stormwater has significant impact on the ability of treatment technology to be effective in removal of heavy metals. The facility DMR data shows a relatively stable pH ranging from 6.5 – 8.5. pH is controlled as a feature of the metals absorption process. Additional controls of pH will not be necessary

Heavy Metals, Copper and Zinc

Metals are commonly associated with runoff from industrial, commercial and residential land use. Historical land uses at Samson /DMF include a shipping terminal for rail-based transportation, junk yard, construction services yard, etc. dating prior to the Second World War. Significant and potentially contaminated fill from the Duwamish waterway may have been used at the site dating from the inception of industrial activity. Heavy forklifts are used throughout the site, and may contribute metals from tires, brakes, fluids and from the transport of other materials. Based on the current and historical uses of the site, copper and zinc are expected to be routinely present in site stormwater. Comparing Table A concentrations to stormwater data tabulated for Washington facilities in the manufacturing industrial category, SAMSON / DMF zinc concentrations are above the benchmark of 117 µg/L. Copper concentrations are above the benchmark level of 14 µg/L. Given historical site use and current industrial activity, and the likelihood of a protracted process in obtaining required Ecology TCP approval for structural BMPs, metals are expected to continue to occur at concentrations in excess of benchmarks in the influent stormwater.

Receiving Water: Duwamish Waterway

The SAMSON/DMF site is located on the Duwamish River just downstream of the first Avenue South Bridge, which is along the Duwamish Waterway approximately 3.0 miles south of the mouth to Elliot Bay, approximately River Mile (RM) 3. The stormwater management system at SAMSON / DMF discharges directly to the Duwamish Waterway via private stormwater collection and conveyance).

The Duwamish Waterway is subject to significant tidal fluctuations, and is estuarine, stratified, with the upper layer of freshwater flowing to Puget Sound and a marine water underflow that is tidally driven upstream (south) several miles.

A regional storm sewer outfall is located immediately upstream of the site, under the First Avenue South Bridge. The outfall has been abandoned by the City of Seattle but the actual extent of any remaining flow or overflow is unknown.

Duwamish Waterway use-designations vary depending on location. Specific use designation to River Mile 11 are: aquatic life use for salmonid rearing and migration, only; secondary-contact recreational uses; water supply uses for industrial, agricultural and stock water; and miscellaneous uses (wildlife habitat, fish harvesting, commerce/ navigation, boating and aesthetics) (WAC 173-201A-602). Water quality standards for the waterway are specified in Washington State's surface water quality standards (chapter 173-201A WAC).

The Duwamish Waterway has been the site of industrial activity for over a century. The Lower Duwamish Waterway (LDW) was added to EPA's National Priorities (Superfund) List in 2001. In addition to extensive investigatory and cleanup actions in and along the waterway, source control efforts have been implemented to reduce the conveyance of stormwater pollutants to the waterway. Seattle Public Utilities (SPU) reports there are approximately 230 piped outfalls, ditches, and streams discharging to the LDW; over 200 of the piped outfalls are public and private storm drains.

Six records are reported for Category 5/303(d) listings for water in the Duwamish Waterway (per Ecology's Water Quality Assessment for Washington Simple Query Tool) for fecal coliform and dissolved oxygen. Two Category 4A listings for ammonia nitrogen are also noted. Duwamish Waterway is covered by a state water cleanup plan (also known as TMDL) for ammonia-N (Water Quality Improvement Projects for King County). PCB and PAH tissue listings are also noted downstream in the LDW.

ISWGP Compliance and Stormwater Pollution Prevention Plan

Samson has been subject to the Industrial Stormwater General Permit for several years, and has recently updated its Stormwater Pollution Prevention Plan. Stormwater best management practices described in the facility's Stormwater Pollution Prevention Plan (SWPPP) have been updated and submitted to the Department of Ecology. (Samson, Blue Environmental, 2016).

There are three classes of best management practices (BMPs): operational, structural, and treatment. Operational BMPs are management practices that prevent or reduce pollutants from entering stormwater. Examples include housekeeping practices, inspections and corrective actions, source reduction, covering potential sources with tarps or inside of building structures, preventive maintenance procedures, spill prevention and cleanup, employee training, and performance incentives. Structural BMPs are physical and often permanent changes in a facility

that prevent stormwater from contacting pollutants, or keep pollutants from entering stormwater. Treatment BMPs are systems, operations, devices or facilities that are designed to remove pollutants after they have been introduced to stormwater. These BMPs are briefly summarized below.

Operational BMPs and Structural BMPs

Based on a review of the original 2010 SWPPP, operational and structural controls have been upgraded to be consistent with those typical of this facility type and operations. The use of unpaved surfaces by heavy (shipping container) fork trucks creates significant issues with turbidity and associated metals content of the system. See the discussion portion below for the implications of other regulatory action regarding the structural BMPs.

Treatment BMPs

A temporary treatment BMPs currently in-use at Samson or DMF. Additional discussion of treatment BMPs occurs in Section IV. The addition of significant structural BMPs are not feasible in light of the on-going RI/FS to assure a timely implementation of Treatment BMPs. Development and approval of sampling plans, and especially the potential for conflict in the RI/FS process renders the paving or structural improvement of the site impractical at this time.

Additional structural controls are required at the site to assure all industrial stormwater at the site is collected and the discharge of contaminants to any treatment system is minimized. Specifically:

Additional Structural Controls

1. Install gutters, collection systems and/or roof drains on the DMF storage building located at the west end of its complex.
2. Inspect the existing berm along the west side of the site and fill any gaps to prevent potential discharge of sheet flow directly to the Duwamish Waterway. At a minimum, berms, ecology blocks or silt fencing along the waterfront portion should be maintained.
3. Maintain wheel washing station to be consistent with site conditions.

While most of these improvements are not within the scope of the treatment system design, it is believed that their eventual implementation will render the treatment system described herein more effective and assist in consistent attainment of stormwater benchmarks as established in the ISWGP.

Alternatives Analysis for Treatment Technology

Operational and structural BMPs currently are employed by Samson / DMF. BMP effectiveness is monitored visually and stormwater has been sampled during the quarterly permit sampling requirement. Laboratory data from sampling results indicate that Samson and DMF require additional treatment for the control of metals and turbidity in stormwater runoff discharged from the site. The following narrative section describes the technical assessment, which includes treatment technologies identified by Ecology, and Samson / DMF evaluation of options for

treatment technologies. The regulatory requirements (Benchmarks) for all technologies are as follows:

Turbidity	< 25 NTU
Copper	< 14 ug/l
Zinc	< 117 ug/l
Lead (Pb)	< 87 ug/l
TPH	<10 mg/l
pH	5.0 – 9.0 SU

TABLE E
Stormwater Benchmark Limits

The benchmarks must be met for a combination of treated and bypassed flows. The relative volumes of treated and bypassed flows are indicated by the water quality treatment level, which is customarily 91%. At this site, with its high level of TSS and turbidity, a design treatment level of\ 98% will be used.

With the exception of pH and probably TPH, all the benchmarks are exceeded at this site under present conditions.

Regulatory requirements

Ecology primarily regulates stormwater runoff from industrial facilities through the Industrial Stormwater General Permit (ISWGP). This NPDES permit requires stormwater dischargers to implement operational, structural and treatment BMPs to control stormwater pollutants. BMPs are specified in permits, guidance documents, and the Stormwater Management Manual for Western Washington (SWMMWW). Ecology does not mandate specific treatment BMPs for removal of metals from industrial stormwater, except that the ISWGP requires the use of treatment BMPs that are consistent with the SWMMWW.

Additional Requirements in Support of Remedial Investigation

In addition to the benchmarks for constituents required under the ISWGP, The Department of Ecology has indicated that certain contaminants that may be present in the soils at the site may present in the stormwater. Additional sampling parameters may be added to the quarterly ISGP list on request. Analyses and treatment of these parameters is beyond the scope of this document.

SECTION III: Stormwater Treatment System

All descriptions reference FIGURE 4 on page 24. Based on the data in Table A and the evaluation of benchmarks in the ISWGP, the facility requires, at a minimum, enhanced treatment for metals (Zinc and Copper) and turbidity. The proposed treatment train will include flow equalization, pre-treatment coagulation, gravity pre-settling, electrocoagulation, dissolved air (gas) flotation (DAF), settling, clarification, and pressure sand filtration. Backwash from the sand filters will be returned to the head of the system.

The treatment system is design to treat 98% of the annual runoff volume, which corresponds to an off-line flow rate of 368 GPM. A maximum of 189 GPM will be added back to the head of the system during sand filter backwash cycles. Flows greater than 368 GPM (0.82CFS) will be bypassed to discharge from the inlet sump without treatment.

NOTE: While design flows will provide reasonable accuracy of the required capacity, the model is based on an entirely impervious surface with no infiltration, detention or evaporation on the property. The property in its current condition is largely unpaved, but must be considered impervious because of the industrial activity on the site. Based on visual observation during peak storm events, the actual maximum flow rate appears to be in the range of 100-150 GPM (conservative) – and as a result the system as-designed will have significantly higher hydraulic capacity than will be initially required. The system will function adequately as site conditions change in the event of capping, paving or other physical changes are affected during the remedial activity.

Transfer to EC Treatment Zone

Turbidity is expected to be a major contributor to many of the issues at Samson / DMF. Turbidity is typically caused by suspended particles in stormwater. These particles can be made of finely divided clays or silt, due to electronegativity of terminal oxygen in the particles, tend to have negative external charge, therefore repel each other and resist forming larger colloidal particles. FIGURE 5 shows the bench top results of single pass coagulation reactor.

FIGURE 5
Single-Pass Coagulation Reactor Jar Test (Time in minutes, marks in inches)

The stormwater to be treated is pumped via two submersible pumps into a treatment the EC treatment mixing zone in the primary reactor tank (Tank 1), but is not initially transferred through reactors. The untreated water is mixed with recirculated water from the sand filters that has passed through the EC reactors, which provides activated ionic sites for coagulation to be initiated. Mixing the untreated water in this way allows the coagulation reaction to begin, without risking contamination or fouling of the reactors. Maximum back wash flow rate is 189 GPM. Due to high influent suspended solids, the pretreatment tank will require periodic cleaning. Solids will be managed per Department of Ecology regulations (WAC 173-303).

The overflow from the mixing zone will flow into a stilling zone in the primary reactor tank. The combined volume of mixing zone and stilling zone is 21,000 Gallons. Stormwater will flow over a weir into sedimentation from the mixing zone to the stilling zone in the reactor tank, and then flow by gravity through an 8" pipe into coagulation/sedimentation Tank 2. The volume of the coagulation/sedimentation tanks is 7500 gallons each. Following further coagulation and sedimentation, the stormwater then overflows through a box weir into final coagulation sedimentation Tank 3. A float switch in the final tank will actuate the main sand filter pump, and a second float switch in Tank 3 will actuate the high flow control valve (V2). Following the sand filter, the majority of the flow (nominally 50% - 85%) will be diverted through a flow control valve through the electrocoagulation reactors while a smaller fraction (nominally 15-50%) will be discharged through the outfall riser and to the Duwamish River.

Flow Control

The EC process is initiated by water flowing from the sand filter through the EC reactors at the headworks of the treatment train, where it is mixed with incoming stormwater water. The recirculation rate is fixed by the pump velocity, while the discharge will be controlled by discharge control valves that regulate the flow of water to the Duwamish River. A low-flow valve will allow a predetermined rate (50-100 GPM) to discharge during all flow conditions. When tank levels reach a high level float switch (Figure 4) a second air actuated valve opens allowing discharge of the full WQ design flow. The balance of the flows is pumped to the electrocoagulation (EC) units. In all flow scenarios, the proportion of stormwater recirculated to the EC treatment section is expected to provide adequate treatment to achieve benchmarks over several passes (two or more) under all flow conditions.

Electrocoagulation

With the exception of the sand filter, coagulation occurs throughout the treatment train. The first chamber in the primary treatment reactor Tank 1 is referred to as the mixing zone, in which incoming stormwater is mixed with recirculated water passing through one of sixteen electrocoagulation reactors. During the electrocoagulation process, small amount of gases are formed, promoting the flotation (dissolved air flotation, or DAF) of oils and low density solids. The turbulence within this section will not allow appreciable settling, but coarser particles will settle in the mixing zone of Tank 1 while smaller particles will begin to coagulate as they pass through subsequent zones. The EC reactors provide chemical reduction of dissolved pollutants at the anode surface and an activated charge to which suspended anionic particles (e.g. silicates) are attracted and form larger particles that can be filtered or settle.

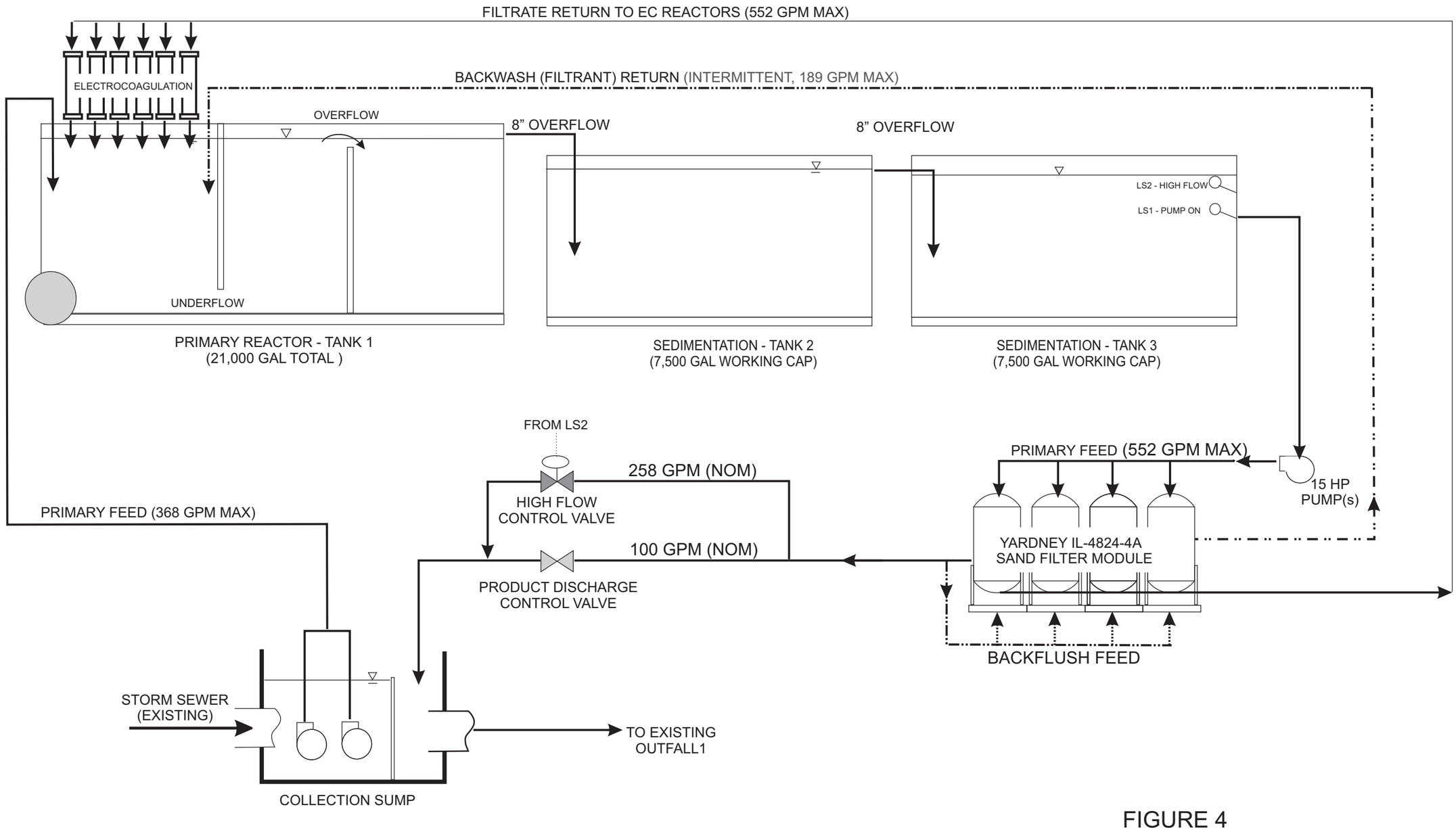


FIGURE 4

SAMSON TUG AND BARGE / DUWAMISH METAL FABRICATION STORMWATER TREATMENT SYSTEM SCHEMATIC		
COMBINED TREATMENT SYSTEM 6361 FIRST AVENUE SOUTH, SEATTLE WA	DRAWN: MMcJ REVISED: MAR 6, 2016	DATE: JUNE 27, 2012 PAGE 1 OF 1

Lean Environment
4500A 15TH STREET EAST
TACOMA, WA 98424

Traditional EC has been in use since the 1920's, which is a class of electrochemical processes that uses an electrochemical reaction to form colloidal particles by placing a voltage across electrodes immersed in a flowing system. Electrical charge destabilizes ionic particles and generates an ionic coagulant by oxidation of anodes and metal reduction at cathodes. It is effective for formation of large colloidal particles that are otherwise predisposed to mutual repulsion due to weak ionic forces. Such conditions are common among silicate based clays. Several processes work concurrently to remove solids. The primary pollutant removal mechanisms are as follows:

Coagulation is initiated by the use of direct current (DC) to disrupt the stability of charged suspended particles, and promote the chemical oxidation of anode at a fixed rate into the effluent to be treated. Both divalent (+2) and trivalent (+3) ions are temporarily formed in the oxidation of the anode, with high charge density that attract weakly ionic suspended particles and begin accumulation of larger colloidal particles. This charge is distributed over the entire colloidal particle, thereby increasing the size of the particles over time. The process of colloid formation accelerates as charge is preserved for most species, until the density and size of the particle cause precipitation.

The pH of the water is changed only slightly by the electrocoagulation process. Formation of hydrogen ions on the cathode will generally outpace the formation of oxygen on the anode, leaving a slight net increase in residual hydroxide formation, thereby raising pH slightly. Reactor residence time will not be adequate to affect bulk pH significantly.

Other mechanisms include chemical reduction of metals such as zinc, which can precipitate as primary metals or be plated onto the cathode. Gas bubbles form during the reduction of hydrogen ions to H_2 gas, while oxygen gas forms on the anode. Bubbles affect surface tension and facilitate large colloidal particles to form in the same manner as dissolved air flotation (DAF). The particles that are lower in bulk density can be bound to the bubbles by surface tension and float to the surface for collection by a skimmer.

The four EC test-units used in the field tests were eight inches in diameter and thirty-six inches long. Electrode surface areas, electrode materials, operational voltages and amperage are considered proprietary. Based on the results of field testing, it is determined that sixteen reactors are needed to meet the 98% flow criteria. EC performance *may* be enhanced by the addition of sodium chloride up to 1 mS conductivity, or up a mass fraction of 0.03% NaCl. For reference, the Duwamish is brackish, and the TDS of sea water is 3.3%. Addition of salt will be controlled by a conductivity controller and LDI metering pump, but will be avoided if possible.

Settling and Sedimentation – Tank 1

From the mixing zone next to the EC reactors, water will overflow to the next chamber for settling of solids. The primary treatment tank (Tank 1) is eight feet wide, forty feet long, and carrying depth up to ten feet deep, with a volume of 21,000 gallons and a surface area in the sedimentation zone of 160 SF. Maximum flow through the mixing zone at any time will be the

treatment flow rate (368 GPM) plus the minimum recirculation rate (184 GPM), for a total flow of 552 GPM. With an ideal overflow rate of 3.45 GPM/SF and a usable rate of about 80% of that, or 4.31 GPM/SF, the settling zone of Tank 1 should be able to remove soil particles down to the size of smaller than 65 microns. According to the particle size distribution table (Table D), 66% of the TSS consists or particles greater than 50 microns. Smaller particles will continue on to the next sedimentation zone (Tank 2 and 3) and then on to filtration. To minimize turbulence, an adjustable box weir will be used at the exit of Tank 2 and entrance to Tank 3 a smooth collection riser will be used at the outlet.

Clarification – Sedimentation in Tanks 2 and 3

Following Tank 1 the flow will be carried by gravity to the downstream sedimentation tanks (Tank 2 and 3), where heavy coagulated particles (floc) will settle out and supernatant and any remaining light particles will rise to the surface. The total volume of each of these chambers is eight feet wide, twenty feet long, and seven feet deep. The two tanks are arranged in series, each twenty feet long and each with a volume of 8360 gallons and a surface area of 160 SF. The ideal available overflow rate is 3.45 GPM/SF in each chamber at design flow, with a usable rate of about 80% of that, or 4.31 GPM/SF.

When the final settling (overflow) and rise rates of the floc are determined through field testing at start-up, it will be possible to estimate the extent of TSS removal in the clarification step.

The goal of clarification is to reduce the load on the sand filters as much as practical, not to achieve complete removal of TSS and the associated pollutants that are bound to it. Complete removal by gravity would require much more area than is available at the site. The clarification step allows an appreciable amount of sediment to accumulate in a place where it can easily be removed and to reduce the loading on the sand filters, which will in turn extend run time between backwashes and allow for greater recirculation through the filters at flows less than the design flow.

Pressure Sand Filtration

After clarification, the design flow will be pumped to the sand filters. The filters are made by Yardney Filtration Systems (Model IL-4824-4A) and consist of four interconnected 48” diameter sand filters with a sand media designed to filter down to 20 microns at a flow rate of 504 to 756 GPM with all four filters operating, or 378 to 567 GPM with one filter down for backwash. Maximum operating pressure is 80 psi, but these units will be design to operate at a maximum of 50 psi. The peak filtration rate is 15 GPM/SF, the maximum allowed for gravity sand filters under Volume 5, Chapter 8 of the WWSWMM. Total surface area of the Yardney Model IL-4824-4A is 50.24 square feet, and therefore has a nominal capacity of 753 GPM per the Ecology criteria. The design filtration rate can be achieved by a pressure filter using a much finer sand gradation than a gravity system, which allows a pressure filter to trap correspondingly smaller particles at the same filtration rate. The recommended sand gradation shown in the WWSWMM is for gravity filters and is not applicable in the case of pressure filters.

The design rate for the treatment system is 552 GPM, including backwash flow. With one filter down for backwash the remaining three filters can handle up to 564 GPM so the performance of the system will be within design flow requirements even when one filter is backwashing.

The filter controller will begin the backwash based on manual settings on an adjustable timer. Only one filter at a time will be backwashed, to assure that three filters are available at any time. The backwash flow rate is expected to be a maximum of 189 GPM for a duration of three to five minutes, as recommended by Yardney's engineer. In operation it may be necessary to adjust flow and duration somewhat to meet actual conditions. Backwash water will be pumped back to the pretreatment tank at the head of the treatment system.

When all four filters are operating, they will have a total flow capacity of 756 GPM, which provides 388 GPM of excess capacity available for treating flows that exceed the 98% treatment level flow of 368 GPM, a factor of 1.1 times the design treatment flow. When one filter is down for backwash and its 189 GPM backwash flow is added to the 368 GPM, creating a total flow 546 GPM, there is 21 GPM excess capacity available below the three-filter capacity of 567 GPM.

Field experience has shown that recirculation of treated effluent improves clarity with each cycle. To take advantage of the excess capacity available during four- filter operation and to further clean the stormwater, 552 GPM will be recirculated through the sand filters while four filters are operating regardless of the rate of discharge. This will provide a recirculation factor of about 5:1 under low flow conditions and 1.5:1 at peak flow. When one filter is down for backwash, the recirculation system will be turned off by the same controller that turns the backwash cycle on, and the remaining three filters will operate within their capacity. As supernatant from the backflush is introduced into the headworks, there is no net change in the rate of flow through the system, only the proportion of the recirculation that is introduced to the EC reactors during backflush. The pumped flow rate does not change appreciably during backflush.

The backwash duration will be one to five minutes out of a total expected cycle time of 60 minutes for each filter, allowing up to 50% of the design flow to be completely recirculated once during peak flow conditions. At flows below the design flow, or most of the time, the recirculation rate will be much higher.

There are several options for managing recirculation and enhancing the single-pass performance of the sand filters. All of the recirculation methods have advantages and disadvantages (e.g. finer sand versus increased backflush frequency); the final determination that will be made during the start-up and optimization phase after the single pass efficiency is determined.

Improvements included in this engineering report include provision of additional storage and sedimentation capacity, additional EC capacity, high solids EC reactors, and automated flow

controls. The backflush is also introduced directly into the mixing zone to accelerate coagulation.

Treatment Description Summary

The proposed treatment system consists of a series of collection sump, pre-sedimentation and flow equalization, electrocoagulation, sedimentation and clarification, recirculated sand filtration with automatic backwash and treatment of back wash flow, as described above.

Capacity and Sizing (WAC 173-303-130(d))

The treatment system is designed to ultimately treat 98% of the annual treatment volume, at a flow rate of 368 GPM. Excess flows will be bypassed. Stormwater is collected through the existing conveyance system to the first catch basin upstream from the outfall, where it is pumped to a pre-sedimentation/equalization zone in Tank 1, which also receives backwash flow from the sand filters. From there, stormwater overflows by gravity to a sedimentation zone in the primary treatment tank. After settling, then flows into a series of two settling tanks (Tank 2 and 3). Float switches actuate a pump which sends the stormwater is pumped through the sand filters to an array of 8 or more electrocoagulation (EC) units. After coagulation, the recirculated flow repeats the pattern through a clarification chamber for partial removal of the flocculated sediment particles. Prior to discharge, polishing is accomplished through pressure sand filtration with recirculation. The treated stormwater flows through discharge control valves (CV1 and CV2) to existing OUTFALL1. Since the system bypass is located at the catch basin, the system is offline. The Water Quality design flow rate is 368 GPM, which will treat 98% of the annual flow. Calculations are provided in Appendix C.

The lift pumps are of adequate size to transfer stormwater to the pre-sedimentation / equalization tank and provide a minimum flow rate of 368 GPM. Two 1.5 HP lift pumps (or equivalent) are controlled by level switches and transfer the stormwater to the first stage in the treatment system. The collection sump will provide a minimum detention volume of 90 gallons. Stormwater collection system piping will contribute an unknown volume of detention.

Clarification tanks (Sedimentation Zones 2 and 3) with a total working volume of 8400 gallons will precede the sand media filters. Floc particles that are not removed in the clarifier are pumped to the pressure sand filters. The four filters are sized such that backwash flow can be recirculated to the influent stage and the remaining three filters can still treat the design flow.

Sand filters are comprised of a skid with four four-foot diameter Yardney (Model IL-4824-4A) sand filters. Each filter will be capable of treating approximately 189 GPM each. The media will be operated at a maximum hydraulic loading rate of 15 GPM/SF. The backwash rate will be determined in the field, but according the manufacturer it is typically 189 GPM with a duration of three to five minutes. Total volume should be no more than 1000 gallons per cycle.

Amount and Kind of Chemicals Used – WAC 173-240-130(d)

No chemicals will be used. NaCl brine may be used at a future date to control conductivity to 1,000 uS controlled by a conductivity controller and LMI metering pump.

Provisions for Bypass (WAC 173-303-130(i))
The sump pumps are comprised of two centrifugal pumps with a minimum capacity of 368 GPM (0.81 CFS) with 10 feet of head. Should these pumps not be adequate to handle instantaneous storm flows, the excess water will overflow a riser within the sump and bypass to the main discharge pipe and Outfall 1. The bypass structure will be designed to handle the 100-year storm (3.57 CFS) in bypass mode.

Physical Provision for Oil and Hazardous Material Spill Control (WAC 173-303-130(j))
The tanks function as emergency reservoirs to collect and capture any accidental releases that may find their way to the stormwater. Residual and/or spilled oils will be retained in DAF Zone and Sedimentation Zone 1 with underflow and a storage capacity in excess of 300 gallons.

Results to be Expected from the Treatment Process (WAC 173-303-130(k))
Bench-scale studies have shown that the proposed treatment process will provide adequate treatment to meet benchmarks in the ISWGP as shown in Table E.

Additional contaminants of concern are expected to meet surface water quality criteria concurrently with the treatment of suspended solids, metals and oils. Additional treatment elements may be added in the future (e.g. carbon adsorption, anthracite filtration, etc.) as they are determined to be technically feasible and in the event that the proposed system in not effective in meeting Ecology requirements.

PARAMETER	INITIAL Concentration (ug/l)	SETTLED Concentration (ug/l)	TREATED Concentration (ug/l)	% Removal	Fraction of Benchmark
COPPER	148.7	59.6	1.7	98.8%	0.121
LEAD (Pb)	189.1	44.6	0.3	99.8%	0.003
ZINC	598.6	320.9	15.4	97.4	0.131

TABLE H
EC Field Trial Results

Results from the electrocoagulation field trials (using EC and settling without filtration) are tabulated in TABLE H.

Description of Receiving Water, Location of the Point of Discharge (WAC 173-303-130(k))
The SAMSON/DMF site is located on the Duwamish River just downstream of the first Avenue South Bridge, which is along the Duwamish Waterway approximately 3.0 miles south of the mouth to Elliot Bay, approximately River Mile (RM) 3. The stormwater management system at

SAMSON / DMF discharges directly to the Duwamish Waterway via private stormwater collection and conveyance on 1st Ave S (Figure 2).

The Duwamish Waterway is subject to significant tidal fluctuations, and is estuarine, stratified, with the upper layer of freshwater flowing to Puget Sound and a marine water underflow that is tidally driven upstream (south) several miles.

A regional storm sewer outfall is located immediately upstream of the site, under the First Avenue South Bridge. Stormwater from throughout the Georgetown area has historically collected and discharged untreated via the Michigan Street conveyance to the Duwamish Waterway. It is not clear the extent to which large upstream flows have been diverted, but the impacts of concentrated upstream urban and industrial discharge are highly variable and have significant impact on receiving water quality.

Duwamish Waterway use-designations vary depending on location. Specific use designation to River Mill 11 are: aquatic life use for salmonid rearing and migration, only; secondary-contact recreational uses; water supply uses for industrial, agricultural and stock water; and miscellaneous uses (wildlife habitat, fish harvesting, commerce/ navigation, boating and aesthetics) (WAC 173-201A-602). Water quality standards for the waterway are specified in Washington State's surface water quality standards (chapter 173-201A WAC).

The Duwamish Waterway has been the site of industrial activity for over a century. The Lower Duwamish Waterway (LDW) was added to EPA's National Priorities (Superfund) List in 2001. In addition to extensive investigatory and cleanup actions in and along the waterway, source control efforts have been implemented to reduce the conveyance of stormwater pollutants to the waterway. Seattle Public Utilities (SPU) reports there are approximately 230 piped outfalls, ditches, and streams discharging to the LDW; over 200 of the piped outfalls are public and private storm drains.

Six records are reported for Category 5/303(d) listings for water in the Duwamish Waterway (per Ecology's Water Quality Assessment for Washington Simple Query Tool) including fecal coliform and dissolved oxygen. Two Category 4A listings for ammonia nitrogen are also noted. Duwamish Waterway is covered by a state water cleanup plan (also known as TMDL) for ammonia-N (Water Quality Improvement Projects for King County. PCB and PAH tissue listings are also noted.

Detailed Outfall Analysis (WAC 173-303-130(m))

The outfall for the Samson / DMF site is at a single 10" pipe located approximately 3 feet above mean high tide. The current at the location is influenced by both tide and river levels, and is also may be influenced by the Michigan Street stormwater outfall located approximately 200 feet upstream of the STB / DMF outfall.

The receiving water is estuarine with adequate surface flows to immediately mix and diffuse the stormwater outfall with the receiving waters. USGS Stream flow data indicate long-term median flows in the Duwamish Basin exceed 765 CFS. This flow rate rises significantly during storm events, but may be cut in half during the dry summer months. Maximum flows from the site are not expected to approach one-part-per thousand of the receiving waters under any conceivable scenario.

The Lower Duwamish Waterway (LDW) is located south of Elliott Bay in Seattle, Washington (FIGURE 1). The LDW Site consists of 5.5 miles of the Duwamish Waterway as measured from the southern tip of Harbor Island to just south of the Norfolk Combined Sewer Overflow (CSO) (Figure 1). The LDW has been identified as a Superfund site by the U.S. Environmental Protection Agency (EPA) and a Model Toxics Control Act (MTCA) site by the Washington State Department of Ecology (Ecology).

The proposed location of the treatment system is adjacent to the existing CB04. This location is proximal to the shoreline of the Duwamish River and maybe subject to approval from the Port of Seattle, who owns the land and leases the adjacent property to Samson/DMF. Other permits may be required by the City of Seattle and a State Environmental Policy Act (SEPA) checklist may be prepared and submitted to the City with the application. If no local permits are required for system installation, the SEPA checklist may be submitted to Ecology.

SAMSON/DMF is not aware of a state or local water quality management plan relevant to discharge other than those indicated in the discussion on receiving water bodies.

Justification that the System Will Meet ISWGP Benchmarks (WAC 173-303-130(q))
The treatment system described herein is primarily mechanical in nature. Bench-level testing and filed data confirm that a sound engineering basis and justification that the system will meet the required benchmarks from the Stormwater General Permit.

Method of Final Sludge Disposal (WAC 173-303-130(r))
The sludge generated from the treatment process will be subject to both Dangerous Waste regulations and as clean-up solids under the Model Toxics Control Act. The solids will be profiled and analyzed for contaminants of concern and disposed in accordance with all applicable regulations. (Disposal in a hazardous waste landfill or other appropriate means is a likely result.)

Ownership, Operation and Maintenance of the Treatment System (WAC 173-303-130(s))
The property owner, represented by Jim Gilmur, will own the treatment system. Filtration Systems will operate and maintain the treatment system on behalf of the property owner.

Conformance with Water Quality Management Plans ((WAC 173-303-130(t))
Samson / DMF outfalls are part of a facility engaged in a number of regulatory actions relating to the historical practices in the Lower Duwamish Waterway and the DMC site Agreed Order. (WAC 173-303-130(u))

Other Requirements (Chapter 173-240-130 (2)(r-y))
The facility will be located adjacent to CB04 as shown in FIGURE 2. The potential for remedial activity throughout the site suggests that the system must be flexible and capable of being moved in the event that remedial activity is required. The selected modular system should be moved relatively easily in the event that Ecology TCP / RI/FS and/or remedial activity is required. For emergency or extreme flows, an overflow (flow splitter) will allow stormwater to be conveyed under conditions similar to existing.

The system will be wholly owned and operated by the property owner, represented by Mr. Jim Gilmur. System maintenance requirements will be outlined in detail after detail design is complete and indicated in the System Operations and Maintenance Manual.

Sludge will be removed from the pre-settling tanks, settling tank, and the clarification tanks using a commercial vacuum truck. It will be managed and disposed of as solid waste after sampling, analysis and designation following the procedures of WAC 173-303.

The sand filter media will be removed using a commercial vacuum truck. It will be managed and disposed of as solid waste after sampling, analysis and designation following the procedures of Chapter 173-303 WAC.

Provisions for any Committed Future Plans ((WAC 173-303-130(t))
There are no committed future plans aside from those stated above. Requirements for clean-up activity and mobility are assumed, given the possibility for sampling and/or remedial activity at the site. Future improvements may include expansion of storage and sedimentation capacity, expansion of EC capacity (residence time) and/or additional treatment elements to ensure conformance to surface water quality criteria. Addition of carbon adsorption or anthracite filtration may be indicated if higher than anticipated levels of organics or petroleum hydrocarbons are encountered.

Stormwater discharges must not cause or contribute to a violation of the surface water quality standards of chapter 173-201A WAC. Based on performance data from the bench testing and field testing of the EC / sand filter / sedimentation combination, stormwater from the facility is expected to meet benchmarks and surface water quality criteria in the receiving waters.

A discussion of the various alternatives evaluated, if any, and reasons they are unacceptable ((WAC 173-303-130(2)(v))
A good deal of effort was invested in evaluating all treatment options for the DMC site in light of the challenges of RI/FS and the high levels of suspended solids and other contaminants. It is clear that extensive sedimentation / settling will be necessary to remove the bulk of he suspended solids. There is no space available for detention facilities in-ground, and the flexibility mandated by the on-going remedial investigation is precludes surface impoundments or other structural BMPs. As a result, pressure filters were considered a necessary element for successful management of the suspended solids.

Other technologies, oil / water separators, adsorption systems, Enpurion® Metals Treatment, StormwateRx Purus and Aquip systems were considered for the other pollutants expected to be present in the system. None could have singularly achieved the results anticipated with the combination of EC / sedimentation and sand filtration. Future analysis for TPHDx and TPHGx will determine the extent to which the EC will contribute to DAF for oils and insoluble liquids.

Implementation Schedule ((WAC 173-303-130(2)(w))

A proposed schedule for implementation is provided in Table 11. Implementation dates are target dates, set to allow SAMSON to have an operating system at the start of the Fall 2012 wet weather season. Longer Ecology approval periods will shift the schedule accordingly.

(Partial implementation is acceptable per R Wright – provided no environmental risk is incurred. Use of settling tanks and sand filters can be completed prior to final certification.)

Submit Engineering Report – March 2016
Receive Approval of Engineering Report – June 2016
Testing Sand Filtration and Sedimentation Steps – March 2016
Conduct final Field Studies for Flow and Polishing – March 2016
Complete testing of Pretreatment / Advanced Pretreatment – March 2016
EC Installation, Pre-Treatment Tank and Final Construction – March 2016
Preliminary start-up and define operation parameters – March 2016
Update SWPPP – March 2016
Ecology Approval of SWPPP and O&M – June 2016
Completion and Final Start-up – March 2016

Compliance with SEPA and NEPA Where Applicable ((WAC 173-303-130(2)(x))
Discussion with City of Seattle (per Mr. Plowman) has indicated the site is eligible for exemption from Shoreline permit process and an exemption application is being prepared for submission to the City of Seattle. The City will not be a lead agency for SEPA. A SEPA Checklist has been prepared and will be forwarded to the Department of Ecology as the lead agency upon completion.

APPENDIX A
ECOLOGY FACT SHEET

DEPARTMENT OF ECOLOGY
State of Washington

Duwamish Marine Center

Toxics Cleanup Program **August 2011**

Agreed Order For a Remedial Investigation and Feasibility Study Available for Public Review and Comment

Public Comment Invited

The Washington Department of Ecology (Ecology) invites comments on an Agreed Order (legal agreement) with the James D. and Jacqueline H. Gilmur Living Trust, owners of the Duwamish Marine Center site. The Agreed Order requires a Remedial Investigation (RI), Feasibility Study (FS) and the preparation of a draft Cleanup Action Plan (CAP).

You are invited to:

- **Review** the Agreed Order, including the Scope of Work, Schedule and Public Participation Plan.
- **Send** your comments to Ecology for consideration. Comments will be accepted from August 1 - 30, 2011.

See the box at the right for details about where to review documents and submit comments.

Site Location

The site is located at 6365 First Avenue South in Seattle, Washington, on the east side of the Lower Duwamish Waterway (LDW) (see page 3). The site is bordered on the north by the Lone Star Investors property, on the east by First Avenue S, on the south and west by the LDW, and on the northwest by Slip 2. Final site boundaries will be defined by the extent of contamination determined during the RI.

Site Background

Duwamish Marine Center leases portions of the property to other companies. Samson Tug and Barge operates in the northern portion of the Duwamish Marine Center and Duwamish Metal Fabricators operates on the southern portion of the property. Historically, the site operated as a marine shipyard, rail yard, junk dealer, various construction service companies, and a barge shipping terminal. A marine railway operated next to the southwestern shoreline from 1940 to the mid-1970s.

COMMENTS ACCEPTED

August 1 - 30, 2011

Submit Comments and Technical Questions to:

Victoria Sutton, Site Manager
WA Department of Ecology
Toxics Cleanup Program
Northwest Regional Office
3190 160th Ave SE
Bellevue, WA 98008
Phone: (425) 649-7219
E-mail: Victoria.Sutton@ecy.wa.gov

Public Involvement
Meg Bommarito
Phone: (425) 649-7256
Email: Meg.Bommarito@ecy.wa.gov

Document Review Locations:

South Park Branch
Seattle Public Library
8604 Eighth Ave S.
Seattle, WA 98108
Phone: (206) 615-1688
Hours: Mon. and Tues. 1 - 8 p.m.
Wed. and Thurs. 11 a.m. - 6 p.m.
Saturday 11 a.m.- 6 p.m.
Friday and Sunday Closed.

WA Department of Ecology
Northwest Regional Office
3190 160th Ave SE
Bellevue, WA 98008
Call for an appointment:
(425) 649-7190

Ecology's Toxics Cleanup Web site
https://fortress.wa.gov/ecy/gsp/Sitepage.aspx?csid=4146

Facility Site ID #: 21945598

Publication Number: 11-09-212

Previous Investigations and Cleanup Work

Several environmental investigations have been conducted at the Duwamish Marine Center. Soil and groundwater investigations performed at the property in 2000 and 2002 showed petroleum hydrocarbons, metals, polychlorinated biphenyls (PCBs), and polynuclear aromatic hydrocarbons (PAHs) above cleanup levels in soil and groundwater. The groundwater also contained solvents. Sediments adjacent to the site contain PCBs and PAHs.

Approximately 50 cubic yards of lead-contaminated soil that classified as hazardous waste were excavated and removed from the central area of the site. Samples collected after the soil removal from the bottom and sidewalls of the removal area confirmed that this lead contaminated soil was removed from the property.

Groundwater was sampled at one of the wells at the Duwamish Marine Center in November 2003 and February, May, and August 2004. Total mercury and petroleum hydrocarbons were detected in groundwater above levels of concern.

Overview of the Agreed Order

The Agreed Order is a legal agreement between Ecology and the potentially liable persons (PLPs). It describes the work that the PLPs agrees to perform on the site. It ensures timely cleanup that protects human health and the environment according to Washington State's cleanup law—the Model Toxics Control Act, and the Sediment Management Standards.

Work to be performed includes a **Remedial Investigation and Feasibility Study (RI/FS).** The RI includes sampling to define the nature and extent of contamination in soil, groundwater, surface water, and sediments. The FS presents the results of the RI and evaluates cleanup alternatives. Ecology also requires the PLP to complete a draft Cleanup Action Plan **(draft CAP).** The draft CAP uses the RI/FS to identify a preferred cleanup action and a schedule to cleanup the contamination.

Contaminants of Concern

Contamination at this site is from historical operations. Soil, groundwater and sediment contaminants include:

- Metals
- Polychlorinated biphenyls (PCBs)
- Polynuclear aromatic hydrocarbons (PAHs)
- Petroleum hydrocarbons
- Solvents

More information about these contaminants is available at the Agency for Toxic Substances & Disease Registry's Web page:

http://www.atsdr.cdc.gov/toxfaqs/index.asp

Public Participation Plan

Ecology and the PLPs are committed to providing the public with timely information and meaningful opportunities to participate in the cleanup process. Ecology worked with the PLPs and stakeholders to draft a Public Participation Plan. This plan describes how citizens and interested parties can learn about and provide input on the cleanup.

What Happens Next?

- Once the public comment period ends, Ecology will review and consider all comments received.
- The Agreed Order and Public Participation Plan may be modified based upon your comments.
- As other documents on the site are developed, the public will be notified of future public comment periods.

Lower Duwamish Waterway Cleanup

The Duwamish Marine Center site is located within the larger Lower Duwamish Waterway (LDW) cleanup site. The LDW site is both a state and federal cleanup covering about 5.5 miles of the Duwamish River south of Harbor Island. The LDW sediments are contaminated with several hazardous substances, including PCBs, arsenic, dioxins/furans, and PAHs.

The Duwamish Marine Center site is one of several areas near the LDW that is being addressed. It will be cleaned up as necessary to reduce the threat to human health and the environment from pollution. This work will also assist in preventing recontamination of the sediments after the LDW site cleanup is complete.

Ecology is working with the U.S. Environmental Protection Agency (EPA) and other local agencies and businesses to clean up the Lower Duwamish. For more information see Ecology's Web site: http://www.ecy.wa.gov/programs/tcp/sites_brochure/lower_duwamish/lower_duwamish_hp.html and EPA's Web Site: http://yosemite.epa.gov/r10/cleanup.nsf/sites/LDuwamish

DEPARTMENT OF ECOLOGY
State of Washington
3190 160th Ave SE
Bellevue, WA 98008

Duwamish Marine Center
King County, WA

Public Comment Period on an Agreed Order for Investigation and Cleanup

Public Comment Period:
August 1 to August 30, 2011

Facility Site ID #: 21945598

If you need this publication in an alternative format, call reception at (425) 649-7070. Persons with hearing loss, call 711 for Washington Relay Service. Persons with speech disability call 877-833-6341.

El periodo de comentario público para la Orden Acordada y el Plan de Participación del Público para el Sitio del Centro Marino Duwamish comienza el 1 de agosto y termina el 30 de agosto de 2011. Para obtener más información, por favor comuníquese con Gustavo Ordóñez al (360) 407-6619 o por correo electrónico a gord461@ecy.wa.gov.

Thời gian thu nhận sự đóng góp ý kiến liên hệ đến tài liệu Sắc lệnh Đồng thuận và Kế hoạch Hợp tác Công cộng tại Duwamish Marine Center bắt đầu từ ngày 1 tháng 8 đến hết ngày 30 tháng 8 năm 2011. Để biết thêm chi tiết xin liên lạc với ông Lê Teddy, số điện thoại 360 -407-6948 hoặc gửi đến teddy.le@ecy.wa.gov.

在此時間,華盛頓州生態部征詢公眾對Duwamish海洋中心的調查清理的工作同意命令 (AgreedOrder)和公眾參与計划(PublicParticipationPlan)的建議。欲了解更多信息，請聯系林昊(425) 649-7187。電子信箱: hlin461@ecy.wa.gov。

Want to get more involved with efforts to clean up the Duwamish River?
Contact the Duwamish River Cleanup Coalition at james@duwamishcleanup.org, (206) 954-0218 or visit http://www.duwamishcleanup.org/index.html

APPENDIX B
WAC 173-240-130 Engineering Report Requirements

(1) The engineering report for an industrial wastewater facility must be sufficiently complete so that plans and specifications can be developed from it without substantial changes. Two copies of the report must be submitted to the department for approval.

(2) The engineering report shall include the following information together with any other relevant data as requested by the department:

(a) Type of industry or business;

(b) The kind and quantity of finished product;

(c) The quantity and quality of water used by the industry and a description of how it is consumed or disposed of, including:

(i) The quantity and quality of all process wastewater and method of disposal;

(ii) The quantity of domestic wastewater and how it is disposed of;

(iii) The quantity and quality of noncontact cooling water (including air conditioning) and how it is disposed of; and

(iv) The quantity of water consumed or lost to evaporation.

(d) The amount and kind of chemicals used in the treatment process, if any;

(e) The basic design data and sizing calculations of the treatment units;

(f) A discussion of the suitability of the proposed site for the facility;

(g) A description of the treatment process and operation, including a flow diagram;

(h) All necessary maps and layout sketches;

(i) Provisions for bypass, if any;

(j) Physical provision for oil and hazardous material spill control or accidental discharge prevention or both;

(k) Results to be expected from the treatment process including the predicted wastewater characteristics, as shown in the waste discharge permit, where applicable;

(l) A description of the receiving water, location of the point of discharge, applicable water quality standards, and how water quality standards will be met outside of any applicable dilution zone;

(m) Detailed outfall analysis;

(n) The relationship to existing treatment facilities, if any;

(o) Where discharge is to a municipal sewerage system, a discussion of that system's ability to transport and treat the proposed industrial waste discharge without exceeding the municipality's allocated industrial capacity. Also, a discussion on the effects of the proposed industrial discharge on the use or disposal of municipal sludge;

(p) Where discharge is through land application, including seepage lagoons, irrigation, and subsurface disposal, a geohydrologic evaluation of factors such as:

(i) Depth to groundwater and groundwater movement during different times of the year;

(ii) Water balance analysis of the proposed discharge area;

(iii) Overall effects of the proposed facility upon the groundwater in conjunction with any other land application facilities that may be present;

(q) A statement expressing sound engineering justification through the use of pilot plant data, results from other similar installations, or scientific evidence from the literature, or both, that the effluent from the proposed facility will meet applicable permit effluent limitations or pretreatment standards or both;

(r) A discussion of the method of final sludge disposal selected and any alternatives considered with reasons for rejection;

(s) A statement regarding who will own, operate, and maintain the system after construction;

(t) A statement regarding compliance with any state or local water quality management plan or any plan adopted under the Federal Water Pollution Control Act as amended;

(u) Provisions for any committed future plans;

(v) A discussion of the various alternatives evaluated, if any, and reasons they are unacceptable;

(w) A timetable for final design and construction;

(x) A statement regarding compliance with the State Environmental Policy Act (SEPA) and the National Environmental Policy Act (NEPA), if applicable;

(y) Additional items to be included in an engineering report for a solid waste leachate treatment system are:

(i) A vicinity map and also a site map that shows topography, location of utilities, and location of the leachate collection network, treatment systems, and disposal;

(ii) Discussion of the solid waste site, working areas, soil profile, rainfall data, and groundwater movement and usage;

(iii) A statement of the capital costs and the annual operation and maintenance costs;

(iv) A description of all sources of water supply within two thousand feet of the proposed disposal site. Particular attention should be given to showing impact on usable or potentially usable aquifers.

APPENDIX C
WWHM2012
PROJECT REPORT

Project Name: Alt. Duwamish
Site Name: Alt. Duwamish
Site Address:
City :
Report Date: 3/4/2016
Gage : Seatac
Data Start : 1948/10/01 00:00
Data End : 2009/09/30 00:00
Precip Scale: 1.00
Version : 2013/04/29

Low Flow Threshold for POC 1 : 50 Percent of the 2 Year

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	Acres
Pervious Total	0

Impervious Land Use	Acres
PARKING FLAT	4.75
Impervious Total	4.75
Basin Total	4.75

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	Acres

Pervious Total	0

Impervious Land Use	Acres
PARKING FLAT	4.75
Impervious Total	4.75
Basin Total	4.75

Element Flows To:
Surface Interflow Groundwater

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:0
Total Impervious Area:4.75

Mitigated Landuse Totals for POC #1
Total Pervious Area:0
Total Impervious Area:4.75

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	1.811002
5 year	2.287511
10 year	2.611268
25 year	3.031227
50 year	3.352653
100 year	3.681885

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	1.811002
5 year	2.287511
10 year	2.611268
25 year	3.031227
50 year	3.352653
100 year	3.681885

Stream Protection Duration

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1949	2.346	2.346
1950	2.535	2.535
1951	1.465	1.465
1952	1.303	1.303
1953	1.407	1.407
1954	1.473	1.473
1955	1.670	1.670
1956	1.643	1.643
1957	1.864	1.864
1958	1.504	1.504
1959	1.534	1.534
1960	1.505	1.505
1961	1.592	1.592
1962	1.387	1.387
1963	1.541	1.541
1964	1.511	1.511
1965	1.920	1.920
1966	1.284	1.284
1967	2.212	2.212
1968	2.515	2.515
1969	1.749	1.749
1970	1.687	1.687
1971	2.012	2.012
1972	2.077	2.077
1973	1.258	1.258
1974	1.836	1.836
1975	2.115	2.115
1976	1.422	1.422
1977	1.540	1.540
1978	1.884	1.884
1979	2.579	2.579
1980	2.314	2.314
1981	1.893	1.893
1982	2.669	2.669
1983	2.172	2.172
1984	1.370	1.370
1985	1.888	1.888
1986	1.637	1.637
1987	2.525	2.525
1988	1.532	1.532
1989	1.916	1.916
1990	3.227	3.227
1991	2.578	2.578
1992	1.357	1.357
1993	1.175	1.175
1994	1.278	1.278
1995	1.678	1.678
1996	1.786	1.786
1997	1.734	1.734
1998	1.758	1.758
1999	3.596	3.596
2000	1.790	1.790
2001	1.967	1.967
2002	2.294	2.294
2003	1.783	1.783

2004	3.365	3.365
2005	1.538	1.538
2006	1.358	1.358
2007	3.145	3.145
2008	2.533	2.533
2009	2.341	2.341

Stream Protection Duration
Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	3.5962	3.5962
2	3.3647	3.3647
3	3.2272	3.2272
4	3.1449	3.1449
5	2.6686	2.6686
6	2.5788	2.5788
7	2.5781	2.5781
8	2.5346	2.5346
9	2.5331	2.5331
10	2.5251	2.5251
11	2.5154	2.5154
12	2.3456	2.3456
13	2.3408	2.3408
14	2.3135	2.3135
15	2.2944	2.2944
16	2.2123	2.2123
17	2.1721	2.1721
18	2.1147	2.1147
19	2.0773	2.0773
20	2.0122	2.0122
21	1.9668	1.9668
22	1.9200	1.9200
23	1.9158	1.9158
24	1.8925	1.8925
25	1.8882	1.8882
26	1.8838	1.8838
27	1.8639	1.8639
28	1.8356	1.8356
29	1.7900	1.7900
30	1.7858	1.7858
31	1.7826	1.7826
32	1.7578	1.7578
33	1.7486	1.7486
34	1.7342	1.7342
35	1.6870	1.6870
36	1.6782	1.6782
37	1.6699	1.6699
38	1.6430	1.6430
39	1.6366	1.6366
40	1.5923	1.5923
41	1.5413	1.5413
42	1.5400	1.5400
43	1.5376	1.5376
44	1.5341	1.5341
45	1.5319	1.5319
46	1.5114	1.5114

47	1.5054	1.5054
48	1.5041	1.5041
49	1.4727	1.4727
50	1.4652	1.4652
51	1.4220	1.4220
52	1.4074	1.4074
53	1.3874	1.3874
54	1.3701	1.3701
55	1.3580	1.3580
56	1.3569	1.3569
57	1.3034	1.3034
58	1.2838	1.2838
59	1.2785	1.2785
60	1.2579	1.2579
61	1.1752	1.1752

Stream Protection Duration
POC #1
The Facility PASSED

The Facility PASSED.

Flow(cfs)	**Predev**	**Mit**	**Percentage**	**Pass/Fail**
0.9055	1805	1805	100	Pass
0.9302	1637	1637	100	Pass
0.9549	1476	1476	100	Pass
0.9797	1346	1346	100	Pass
1.0044	1228	1228	100	Pass
1.0291	1102	1102	100	Pass
1.0538	1005	1005	100	Pass
1.0785	922	922	100	Pass
1.1033	853	853	100	Pass
1.1280	794	794	100	Pass
1.1527	726	726	100	Pass
1.1774	665	665	100	Pass
1.2021	610	610	100	Pass
1.2268	572	572	100	Pass
1.2516	533	533	100	Pass
1.2763	488	488	100	Pass
1.3010	450	450	100	Pass
1.3257	420	420	100	Pass
1.3504	389	389	100	Pass
1.3752	364	364	100	Pass
1.3999	339	339	100	Pass
1.4246	316	316	100	Pass
1.4493	296	296	100	Pass
1.4740	271	271	100	Pass
1.4987	256	256	100	Pass
1.5235	238	238	100	Pass
1.5482	221	221	100	Pass
1.5729	208	208	100	Pass
1.5976	196	196	100	Pass
1.6223	181	181	100	Pass
1.6471	171	171	100	Pass
1.6718	161	161	100	Pass
1.6965	148	148	100	Pass

1.7212	139	139	100	Pass
1.7459	135	135	100	Pass
1.7707	122	122	100	Pass
1.7954	113	113	100	Pass
1.8201	107	107	100	Pass
1.8448	105	105	100	Pass
1.8695	100	100	100	Pass
1.8942	92	92	100	Pass
1.9190	87	87	100	Pass
1.9437	84	84	100	Pass
1.9684	73	73	100	Pass
1.9931	71	71	100	Pass
2.0178	66	66	100	Pass
2.0426	63	63	100	Pass
2.0673	62	62	100	Pass
2.0920	58	58	100	Pass
2.1167	54	54	100	Pass
2.1414	54	54	100	Pass
2.1662	52	52	100	Pass
2.1909	50	50	100	Pass
2.2156	46	46	100	Pass
2.2403	45	45	100	Pass
2.2650	40	40	100	Pass
2.2897	39	39	100	Pass
2.3145	33	33	100	Pass
2.3392	32	32	100	Pass
2.3639	29	29	100	Pass
2.3886	28	28	100	Pass
2.4133	25	25	100	Pass
2.4381	22	22	100	Pass
2.4628	21	21	100	Pass
2.4875	20	20	100	Pass
2.5122	17	17	100	Pass
2.5369	13	13	100	Pass
2.5617	12	12	100	Pass
2.5864	9	9	100	Pass
2.6111	9	9	100	Pass
2.6358	9	9	100	Pass
2.6605	9	9	100	Pass
2.6852	8	8	100	Pass
2.7100	8	8	100	Pass
2.7347	8	8	100	Pass
2.7594	8	8	100	Pass
2.7841	8	8	100	Pass
2.8088	8	8	100	Pass
2.8336	8	8	100	Pass
2.8583	7	7	100	Pass
2.8830	7	7	100	Pass
2.9077	7	7	100	Pass
2.9324	7	7	100	Pass
2.9572	7	7	100	Pass
2.9819	7	7	100	Pass
3.0066	6	6	100	Pass
3.0313	6	6	100	Pass
3.0560	6	6	100	Pass
3.0807	6	6	100	Pass
3.1055	6	6	100	Pass

3.1302	6	6	100	Pass
3.1549	5	5	100	Pass
3.1796	5	5	100	Pass
3.2043	4	4	100	Pass
3.2291	3	3	100	Pass
3.2538	3	3	100	Pass
3.2785	2	2	100	Pass
3.3032	2	2	100	Pass
3.3279	2	2	100	Pass
3.3527	2	2	100	Pass

Water Quality BMP Flow and Volume for POC #1
On-line facility volume: 1.1238 **acre-feet**
On-line facility target flow: 1.3158 **cfs.**
Adjusted for 15 min: 1.3158 **cfs.**
Off-line facility target flow: 0.8195 **cfs.**
Adjusted for 15 min: 0.8195 **cfs.**

Wetlands Fluctuation for POC 1
Average Annual Volume (acft)

Month	Predevel	Mitigated	Percent	Pass/Fail
Jan	99.2889	99.2889	100.0	Pass
Feb	65.4492	65.4492	100.0	Pass
Mar	54.6347	54.6347	100.0	Pass
Apr	32.6702	32.6702	100.0	Pass
May	18.3911	18.3911	100.0	Pass
Jun	15.7518	15.7518	100.0	Pass
Jul	7.2548	7.2548	100.0	Pass
Aug	13.2479	13.2479	100.0	Pass
Sep	21.9609	21.9609	100.0	Pass
Oct	53.5964	53.5964	100.0	Pass
Nov	106.3644	106.3644	100.0	Pass
Dec	103.5156	103.5156	100.0	Pass

Day	Predevel	Mitigated	Percent	Pass/Fail
Jan1	4.4780	4.4780	100.0	Pass
2	2.5266	2.5266	100.0	Pass
3	3.3312	3.3312	100.0	Pass
4	4.0251	4.0251	100.0	Pass
5	3.2818	3.2818	100.0	Pass
6	4.1269	4.1269	100.0	Pass
7	2.8772	2.8772	100.0	Pass
8	3.2664	3.2664	100.0	Pass
9	2.7977	2.7977	100.0	Pass
10	2.5398	2.5398	100.0	Pass
11	2.8291	2.8291	100.0	Pass
12	3.7160	3.7160	100.0	Pass
13	4.4387	4.4387	100.0	Pass
14	3.1992	3.1992	100.0	Pass
15	2.9780	2.9780	100.0	Pass
16	3.0955	3.0955	100.0	Pass
17	3.4340	3.4340	100.0	Pass
18	3.4186	3.4186	100.0	Pass

19	3.0981	3.0981	100.0	Pass
20	2.8031	2.8031	100.0	Pass
21	2.7746	2.7746	100.0	Pass
22	3.9892	3.9892	100.0	Pass
23	3.7642	3.7642	100.0	Pass
24	2.4419	2.4419	100.0	Pass
25	2.3817	2.3817	100.0	Pass
26	2.4771	2.4771	100.0	Pass
27	2.5581	2.5581	100.0	Pass
28	3.2526	3.2526	100.0	Pass
29	3.0559	3.0559	100.0	Pass
30	3.5243	3.5243	100.0	Pass
31	2.4839	2.4839	100.0	Pass
Feb1	2.3797	2.3797	100.0	Pass
2	1.8461	1.8461	100.0	Pass
3	1.9840	1.9840	100.0	Pass
4	1.5646	1.5646	100.0	Pass
5	2.5774	2.5774	100.0	Pass
6	2.3362	2.3362	100.0	Pass
7	3.3346	3.3346	100.0	Pass
8	2.2877	2.2877	100.0	Pass
9	1.9281	1.9281	100.0	Pass
10	1.8426	1.8426	100.0	Pass
11	2.8523	2.8523	100.0	Pass
12	2.2244	2.2244	100.0	Pass
13	2.0777	2.0777	100.0	Pass
14	2.6817	2.6817	100.0	Pass
15	3.1104	3.1104	100.0	Pass
16	2.6116	2.6116	100.0	Pass
17	2.9964	2.9964	100.0	Pass
18	3.2459	3.2459	100.0	Pass
19	1.7345	1.7345	100.0	Pass
20	2.1334	2.1334	100.0	Pass
21	1.8674	1.8674	100.0	Pass
22	2.0744	2.0744	100.0	Pass
23	2.4206	2.4206	100.0	Pass
24	2.2036	2.2036	100.0	Pass
25	1.7648	1.7648	100.0	Pass
26	2.1858	2.1858	100.0	Pass
27	2.2532	2.2532	100.0	Pass
28	1.7350	1.7350	100.0	Pass
29	1.9656	1.9656	100.0	Pass
Mar1	1.8674	1.8674	100.0	Pass
2	2.8208	2.8208	100.0	Pass
3	1.9768	1.9768	100.0	Pass
4	2.4396	2.4396	100.0	Pass
5	1.1026	1.1026	100.0	Pass
6	1.4074	1.4074	100.0	Pass
7	2.0721	2.0721	100.0	Pass
8	2.4649	2.4649	100.0	Pass
9	2.0826	2.0826	100.0	Pass
10	2.3600	2.3600	100.0	Pass
11	2.6941	2.6941	100.0	Pass
12	1.5490	1.5490	100.0	Pass
13	1.7340	1.7340	100.0	Pass
14	2.0154	2.0154	100.0	Pass
15	1.6409	1.6409	100.0	Pass

16	1.5035	1.5035	100.0	Pass
17	1.9686	1.9686	100.0	Pass
18	1.2215	1.2215	100.0	Pass
19	1.2491	1.2491	100.0	Pass
20	0.9020	0.9020	100.0	Pass
21	2.1614	2.1614	100.0	Pass
22	2.1459	2.1459	100.0	Pass
23	1.8967	1.8967	100.0	Pass
24	1.3346	1.3346	100.0	Pass
25	1.3658	1.3658	100.0	Pass
26	1.3112	1.3112	100.0	Pass
27	1.3346	1.3346	100.0	Pass
28	1.6179	1.6179	100.0	Pass
29	1.3820	1.3820	100.0	Pass
30	1.0567	1.0567	100.0	Pass
31	1.1831	1.1831	100.0	Pass
Apr1	1.1879	1.1879	100.0	Pass
2	1.2534	1.2534	100.0	Pass
3	1.8777	1.8777	100.0	Pass
4	1.3598	1.3598	100.0	Pass
5	1.2159	1.2159	100.0	Pass
6	0.7474	0.7474	100.0	Pass
7	1.3729	1.3729	100.0	Pass
8	1.4986	1.4986	100.0	Pass
9	0.8964	0.8964	100.0	Pass
10	1.2019	1.2019	100.0	Pass
11	1.1178	1.1178	100.0	Pass
12	1.4948	1.4948	100.0	Pass
13	1.0965	1.0965	100.0	Pass
14	0.9844	0.9844	100.0	Pass
15	1.5216	1.5216	100.0	Pass
16	1.0258	1.0258	100.0	Pass
17	0.4949	0.4949	100.0	Pass
18	2.0740	2.0740	100.0	Pass
19	0.6897	0.6897	100.0	Pass
20	0.4159	0.4159	100.0	Pass
21	1.0607	1.0607	100.0	Pass
22	1.2841	1.2841	100.0	Pass
23	0.7706	0.7706	100.0	Pass
24	0.5526	0.5526	100.0	Pass
25	0.4070	0.4070	100.0	Pass
26	1.1676	1.1676	100.0	Pass
27	0.6253	0.6253	100.0	Pass
28	1.0950	1.0950	100.0	Pass
29	1.0004	1.0004	100.0	Pass
30	0.9134	0.9134	100.0	Pass
May1	0.5965	0.5965	100.0	Pass
2	0.4744	0.4744	100.0	Pass
3	0.6538	0.6538	100.0	Pass
4	0.6684	0.6684	100.0	Pass
5	0.7589	0.7589	100.0	Pass
6	0.4770	0.4770	100.0	Pass
7	0.3847	0.3847	100.0	Pass
8	0.4069	0.4069	100.0	Pass
9	0.4677	0.4677	100.0	Pass
10	0.7585	0.7585	100.0	Pass
11	0.3898	0.3898	100.0	Pass

12	0.4492	0.4492	100.0	Pass
13	0.7595	0.7595	100.0	Pass
14	0.5665	0.5665	100.0	Pass
15	0.4528	0.4528	100.0	Pass
16	0.4511	0.4511	100.0	Pass
17	0.6076	0.6076	100.0	Pass
18	0.7821	0.7821	100.0	Pass
19	0.4300	0.4300	100.0	Pass
20	0.3316	0.3316	100.0	Pass
21	0.3130	0.3130	100.0	Pass
22	0.5755	0.5755	100.0	Pass
23	0.6064	0.6064	100.0	Pass
24	0.3102	0.3102	100.0	Pass
25	0.8599	0.8599	100.0	Pass
26	0.6287	0.6287	100.0	Pass
27	0.5962	0.5962	100.0	Pass
28	0.9570	0.9570	100.0	Pass
29	0.8809	0.8809	100.0	Pass
30	0.8841	0.8841	100.0	Pass
31	0.7391	0.7391	100.0	Pass
Jun1	0.4955	0.4955	100.0	Pass
2	0.8374	0.8374	100.0	Pass
3	0.8618	0.8618	100.0	Pass
4	0.4283	0.4283	100.0	Pass
5	0.8890	0.8890	100.0	Pass
6	0.7167	0.7167	100.0	Pass
7	0.5829	0.5829	100.0	Pass
8	0.6718	0.6718	100.0	Pass
9	0.6753	0.6753	100.0	Pass
10	0.7237	0.7237	100.0	Pass
11	0.6287	0.6287	100.0	Pass
12	0.1992	0.1992	100.0	Pass
13	0.1805	0.1805	100.0	Pass
14	0.3532	0.3532	100.0	Pass
15	0.3907	0.3907	100.0	Pass
16	0.6933	0.6933	100.0	Pass
17	0.2285	0.2285	100.0	Pass
18	0.2513	0.2513	100.0	Pass
19	0.5074	0.5074	100.0	Pass
20	0.5052	0.5052	100.0	Pass
21	0.2771	0.2771	100.0	Pass
22	0.3803	0.3803	100.0	Pass
23	1.3586	1.3586	100.0	Pass
24	0.3609	0.3609	100.0	Pass
25	0.2437	0.2437	100.0	Pass
26	0.2841	0.2841	100.0	Pass
27	0.4353	0.4353	100.0	Pass
28	0.3944	0.3944	100.0	Pass
29	0.4579	0.4579	100.0	Pass
30	0.5036	0.5036	100.0	Pass
Jul1	0.3088	0.3088	100.0	Pass
2	0.2927	0.2927	100.0	Pass
3	0.1881	0.1881	100.0	Pass
4	0.3650	0.3650	100.0	Pass
5	0.1454	0.1454	100.0	Pass
6	0.3016	0.3016	100.0	Pass
7	0.3911	0.3911	100.0	Pass

8	0.4854	0.4854	100.0	Pass
9	0.2781	0.2781	100.0	Pass
10	0.1010	0.1010	100.0	Pass
11	0.4923	0.4923	100.0	Pass
12	0.3484	0.3484	100.0	Pass
13	0.3225	0.3225	100.0	Pass
14	0.0296	0.0296	100.0	Pass
15	0.6973	0.6973	100.0	Pass
16	0.1790	0.1790	100.0	Pass
17	0.0798	0.0798	100.0	Pass
18	0.2044	0.2044	100.0	Pass
19	0.1464	0.1464	100.0	Pass
20	0.0824	0.0824	100.0	Pass
21	0.2012	0.2012	100.0	Pass
22	0.1252	0.1252	100.0	Pass
23	0.0625	0.0625	100.0	Pass
24	0.0917	0.0917	100.0	Pass
25	0.4990	0.4990	100.0	Pass
26	0.1146	0.1146	100.0	Pass
27	0.0958	0.0958	100.0	Pass
28	0.0206	0.0206	100.0	Pass
29	0.0584	0.0584	100.0	Pass
30	0.0428	0.0428	100.0	Pass
31	0.2204	0.2204	100.0	Pass
Aug1	0.3037	0.3037	100.0	Pass
2	0.3848	0.3848	100.0	Pass
3	0.1890	0.1890	100.0	Pass
4	0.0435	0.0435	100.0	Pass
5	0.4349	0.4349	100.0	Pass
6	0.4978	0.4978	100.0	Pass
7	0.0613	0.0613	100.0	Pass
8	0.4026	0.4026	100.0	Pass
9	0.0846	0.0846	100.0	Pass
10	0.1714	0.1714	100.0	Pass
11	0.1625	0.1625	100.0	Pass
12	0.0981	0.0981	100.0	Pass
13	0.6035	0.6035	100.0	Pass
14	0.6900	0.6900	100.0	Pass
15	0.2018	0.2018	100.0	Pass
16	0.3524	0.3524	100.0	Pass
17	0.6549	0.6549	100.0	Pass
18	0.5743	0.5743	100.0	Pass
19	0.2659	0.2659	100.0	Pass
20	0.5354	0.5354	100.0	Pass
21	0.7877	0.7877	100.0	Pass
22	1.2060	1.2060	100.0	Pass
23	0.7542	0.7542	100.0	Pass
24	0.5271	0.5271	100.0	Pass
25	0.6555	0.6555	100.0	Pass
26	0.6313	0.6313	100.0	Pass
27	0.4491	0.4491	100.0	Pass
28	0.6392	0.6392	100.0	Pass
29	0.3057	0.3057	100.0	Pass
30	0.3595	0.3595	100.0	Pass
31	0.5247	0.5247	100.0	Pass
Sep1	0.6284	0.6284	100.0	Pass
2	0.3999	0.3999	100.0	Pass

3	0.7244	0.7244	100.0	Pass
4	0.3139	0.3139	100.0	Pass
5	0.6725	0.6725	100.0	Pass
6	0.1196	0.1196	100.0	Pass
7	0.6324	0.6324	100.0	Pass
8	0.3731	0.3731	100.0	Pass
9	0.8233	0.8233	100.0	Pass
10	0.5177	0.5177	100.0	Pass
11	0.2125	0.2125	100.0	Pass
12	0.3287	0.3287	100.0	Pass
13	0.8620	0.8620	100.0	Pass
14	0.4932	0.4932	100.0	Pass
15	0.6258	0.6258	100.0	Pass
16	1.8991	1.8991	100.0	Pass
17	0.7496	0.7496	100.0	Pass
18	0.9704	0.9704	100.0	Pass
19	0.8329	0.8329	100.0	Pass
20	0.6732	0.6732	100.0	Pass
21	1.4969	1.4969	100.0	Pass
22	0.8728	0.8728	100.0	Pass
23	0.8228	0.8228	100.0	Pass
24	0.7740	0.7740	100.0	Pass
25	0.8392	0.8392	100.0	Pass
26	0.8752	0.8752	100.0	Pass
27	0.9661	0.9661	100.0	Pass
28	0.6096	0.6096	100.0	Pass
29	1.3287	1.3287	100.0	Pass
30	0.7175	0.7175	100.0	Pass
Oct1	0.7646	0.7646	100.0	Pass
2	1.1286	1.1286	100.0	Pass
3	1.5776	1.5776	100.0	Pass
4	1.0652	1.0652	100.0	Pass
5	2.1167	2.1167	100.0	Pass
6	0.9887	0.9887	100.0	Pass
7	2.3762	2.3762	100.0	Pass
8	2.1350	2.1350	100.0	Pass
9	1.8320	1.8320	100.0	Pass
10	0.8033	0.8033	100.0	Pass
11	1.0062	1.0062	100.0	Pass
12	1.1429	1.1429	100.0	Pass
13	1.2450	1.2450	100.0	Pass
14	1.0546	1.0546	100.0	Pass
15	1.2294	1.2294	100.0	Pass
16	1.9554	1.9554	100.0	Pass
17	1.6107	1.6107	100.0	Pass
18	2.1659	2.1659	100.0	Pass
19	3.7622	3.7622	100.0	Pass
20	2.2140	2.2140	100.0	Pass
21	1.9338	1.9338	100.0	Pass
22	1.6222	1.6222	100.0	Pass
23	1.7698	1.7698	100.0	Pass
24	1.9538	1.9538	100.0	Pass
25	2.2960	2.2960	100.0	Pass
26	2.7061	2.7061	100.0	Pass
27	2.3016	2.3016	100.0	Pass
28	2.0022	2.0022	100.0	Pass
29	1.5052	1.5052	100.0	Pass

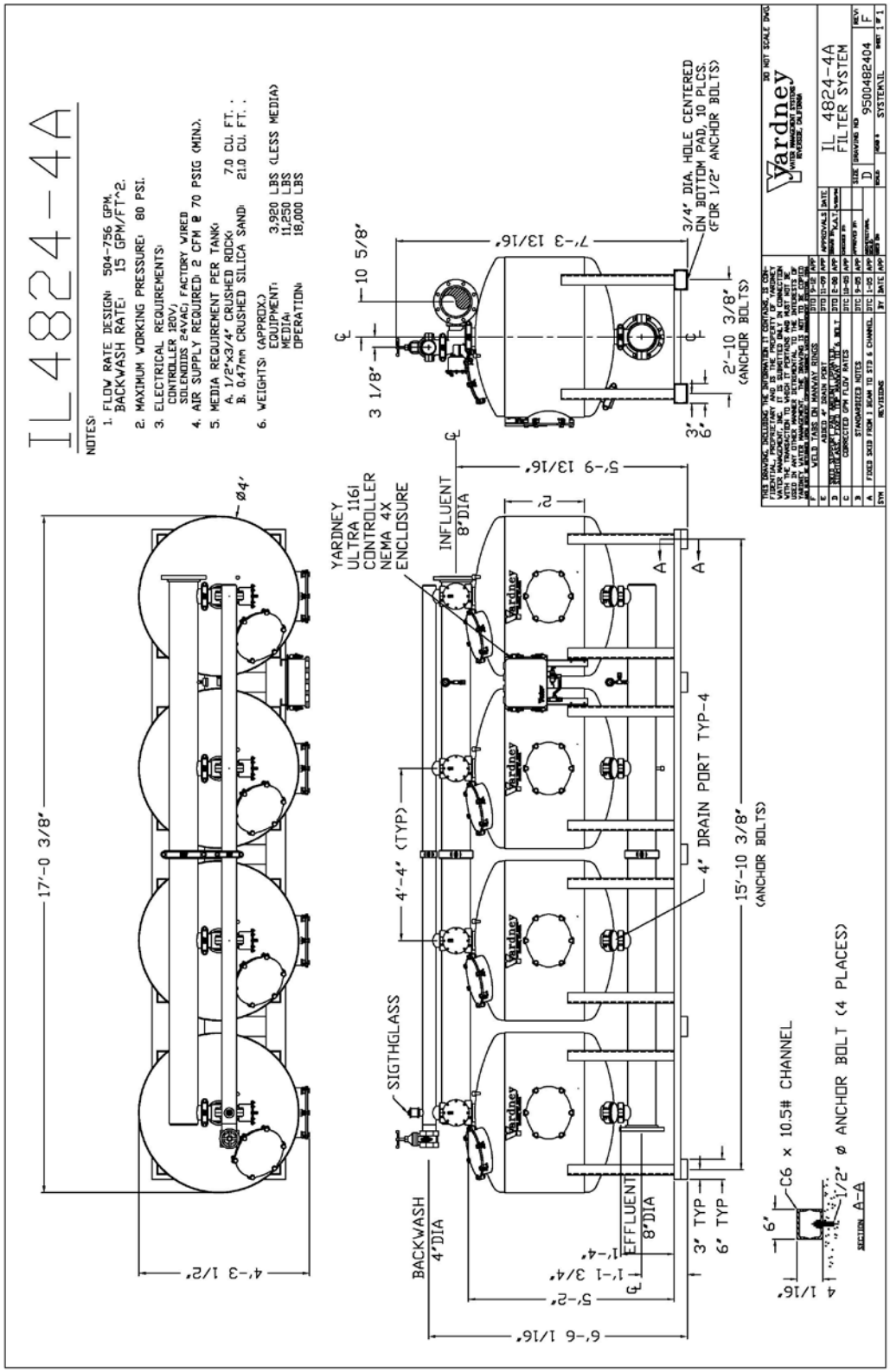
30	2.6233	2.6233	100.0	Pass
31	2.2749	2.2749	100.0	Pass
Nov1	2.9461	2.9461	100.0	Pass
2	3.9294	3.9294	100.0	Pass
3	3.7539	3.7539	100.0	Pass
4	2.0958	2.0958	100.0	Pass
5	3.5256	3.5256	100.0	Pass
6	2.6031	2.6031	100.0	Pass
7	2.4574	2.4574	100.0	Pass
8	3.6930	3.6930	100.0	Pass
9	3.7911	3.7911	100.0	Pass
10	4.7183	4.7183	100.0	Pass
11	4.0633	4.0633	100.0	Pass
12	4.0766	4.0766	100.0	Pass
13	3.2383	3.2383	100.0	Pass
14	2.5405	2.5405	100.0	Pass
15	3.5734	3.5734	100.0	Pass
16	3.4589	3.4589	100.0	Pass
17	2.9321	2.9321	100.0	Pass
18	4.9792	4.9792	100.0	Pass
19	4.4600	4.4600	100.0	Pass
20	3.0785	3.0785	100.0	Pass
21	2.9679	2.9679	100.0	Pass
22	4.8355	4.8355	100.0	Pass
23	4.9964	4.9964	100.0	Pass
24	4.9812	4.9812	100.0	Pass
25	3.4292	3.4292	100.0	Pass
26	2.9742	2.9742	100.0	Pass
27	2.7029	2.7029	100.0	Pass
28	3.2258	3.2258	100.0	Pass
29	4.0833	4.0833	100.0	Pass
30	3.6613	3.6613	100.0	Pass
Dec1	3.8754	3.8754	100.0	Pass
2	4.9434	4.9434	100.0	Pass
3	2.5690	2.5690	100.0	Pass
4	3.7864	3.7864	100.0	Pass
5	2.9753	2.9753	100.0	Pass
6	2.5987	2.5987	100.0	Pass
7	2.8827	2.8827	100.0	Pass
8	3.5133	3.5133	100.0	Pass
9	4.0727	4.0727	100.0	Pass
10	3.7355	3.7355	100.0	Pass
11	3.8035	3.8035	100.0	Pass
12	3.8206	3.8206	100.0	Pass
13	3.8372	3.8372	100.0	Pass
14	4.3619	4.3619	100.0	Pass
15	3.3097	3.3097	100.0	Pass
16	2.5848	2.5848	100.0	Pass
17	2.6209	2.6209	100.0	Pass
18	2.8731	2.8731	100.0	Pass
19	3.9123	3.9123	100.0	Pass
20	3.3022	3.3022	100.0	Pass
21	2.8344	2.8344	100.0	Pass
22	3.0659	3.0659	100.0	Pass
23	2.5252	2.5252	100.0	Pass
24	2.9643	2.9643	100.0	Pass
25	3.9186	3.9186	100.0	Pass

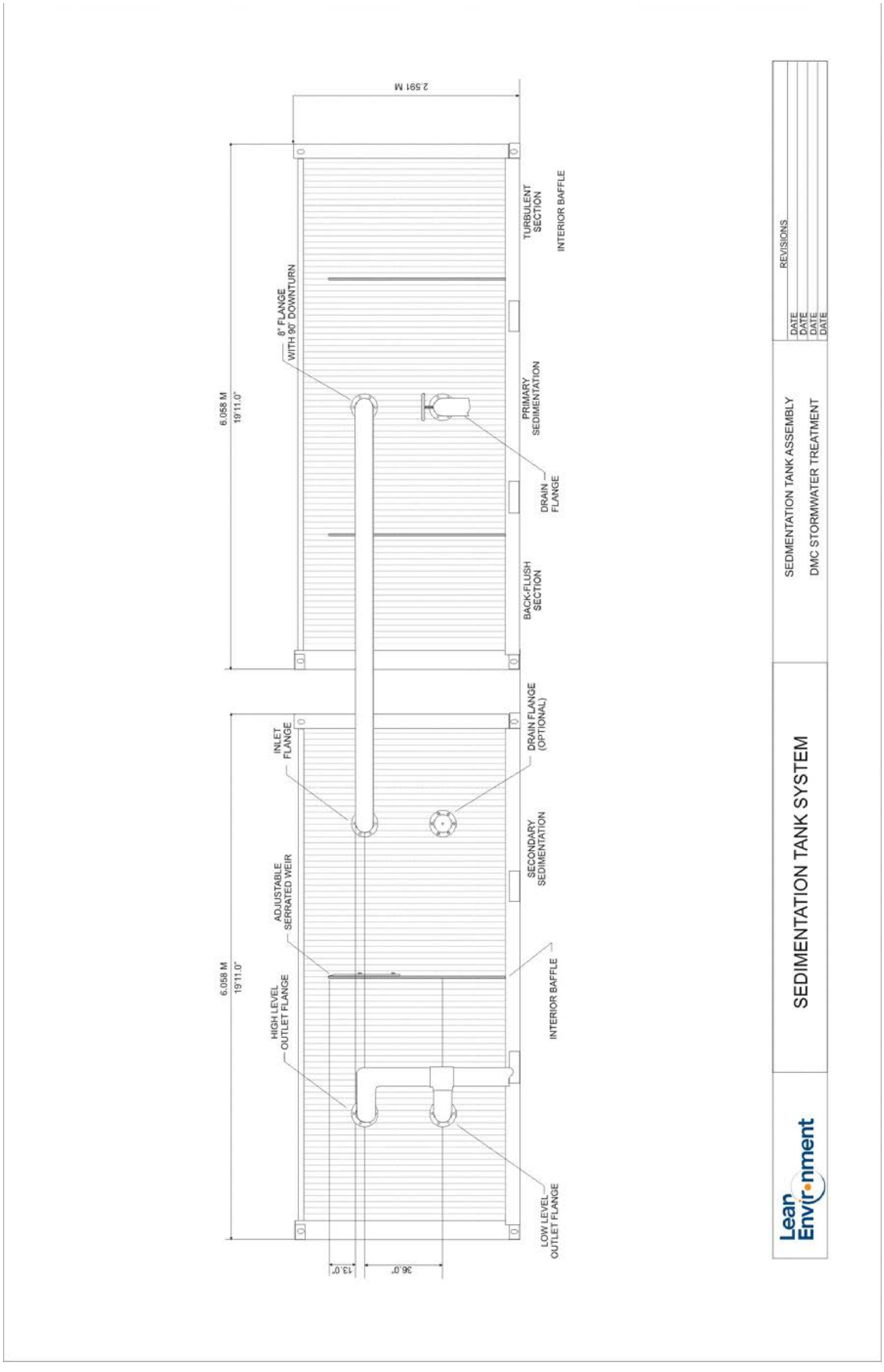
26	3.5553	3.5553	100.0	Pass
27	1.9323	1.9323	100.0	Pass
28	3.8777	3.8777	100.0	Pass
29	3.6102	3.6102	100.0	Pass
30	2.2162	2.2162	100.0	Pass
31	2.8267	2.8267	100.0	Pass

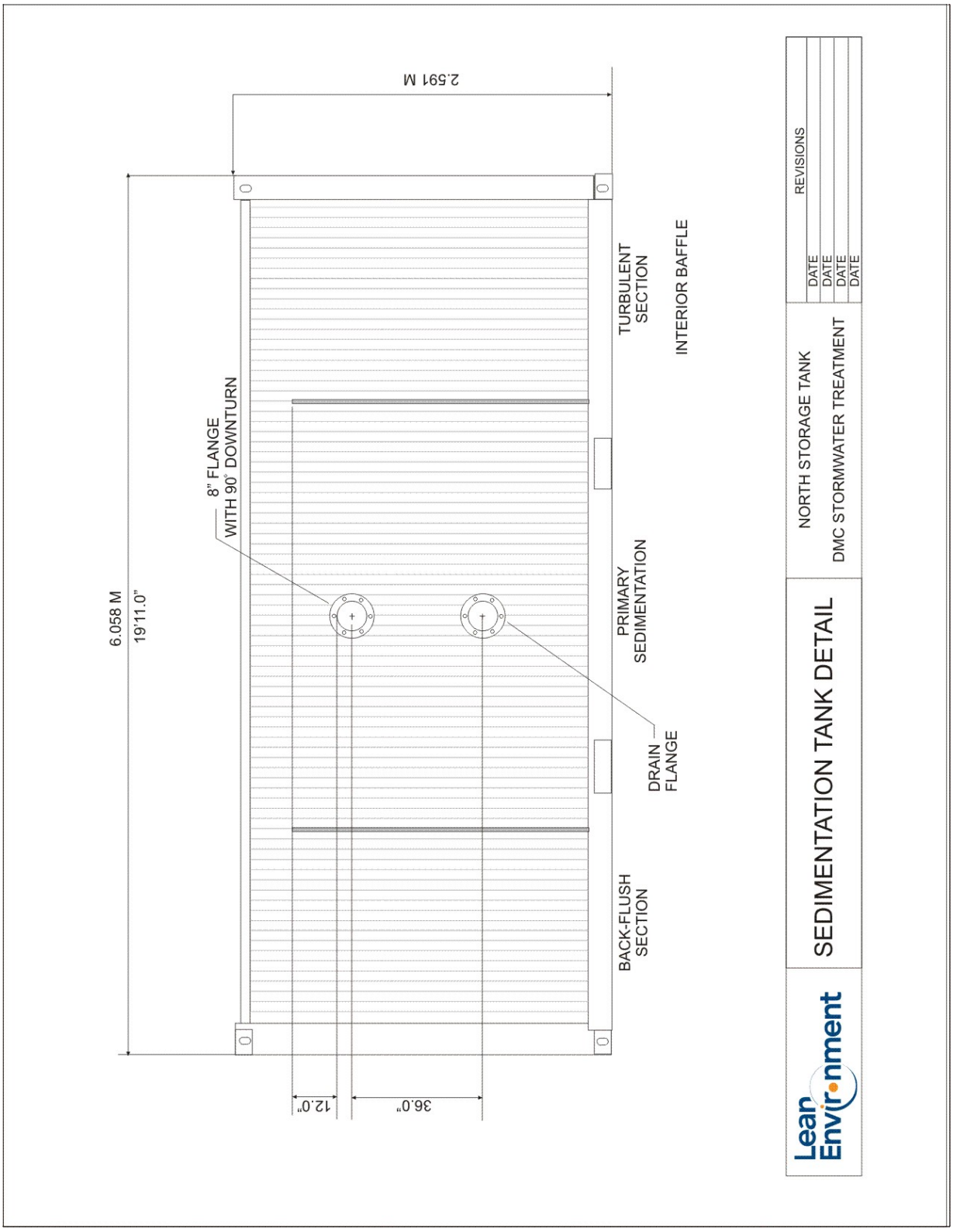
Perlnd and Implnd Changes

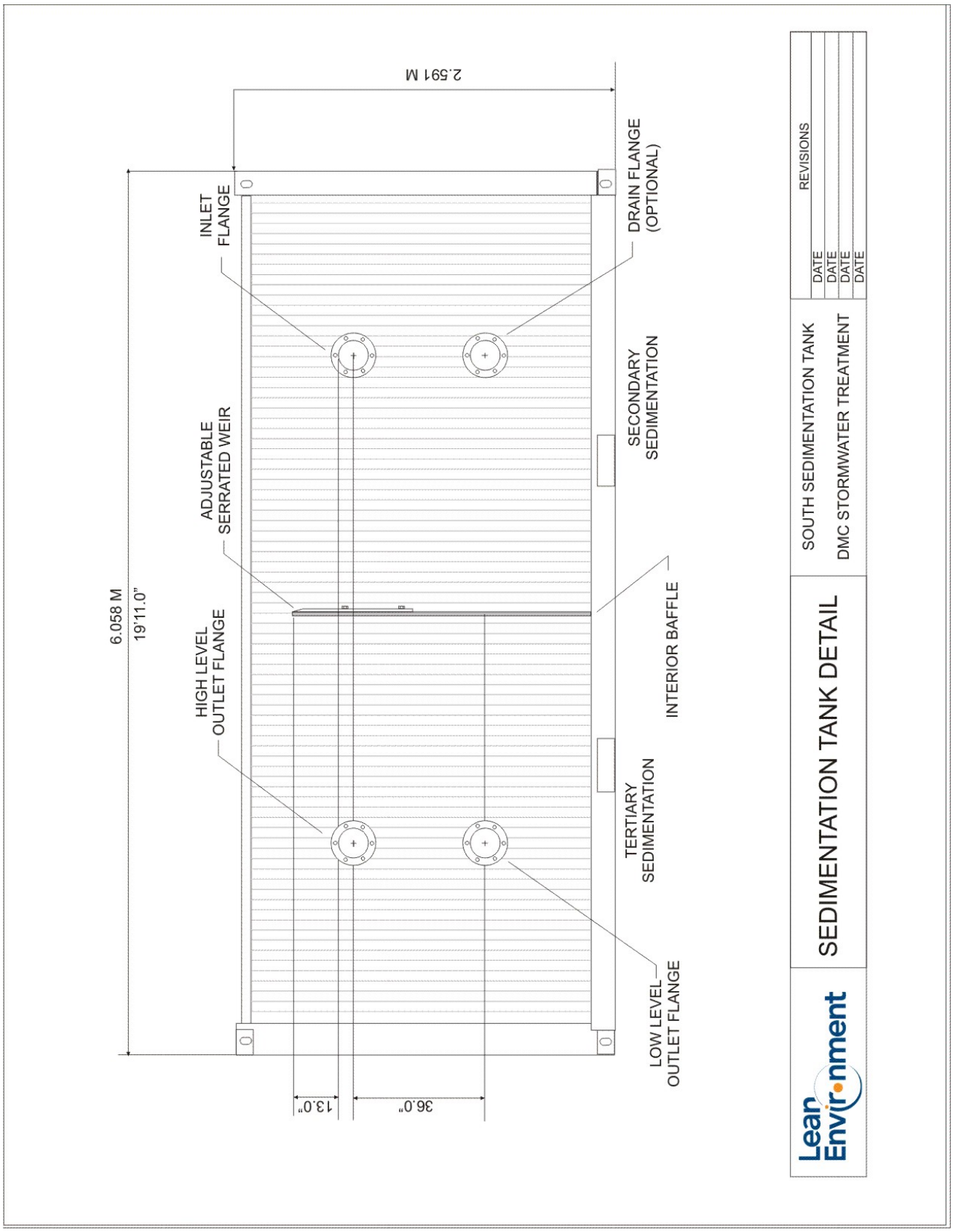
No changes have been made.

APPENDIX D – COMPONENT DRAWINGS




2.591 M
TURBULENT SECTION
INTERIOR BAFFLE
8" FLANGE WITH 90° DOWNTURN
6.058 M 19'11.0"
PRIMARY SEDIMENTATION
DRAIN FLANGE
BACK-FLUSH SECTION
DRAIN FLANGE (OPTIONAL)
INLET FLANGE
SECONDARY SEDIMENTATION
ADJUSTABLE SERRATED WEIR
6.058 M 19'11.0"
HIGH LEVEL OUTLET FLANGE
INTERIOR BAFFLE
LOW LEVEL OUTLET FLANGE
13.0"
36.0"
REVISIONS
DATE
DATE
DATE
DATE
DATE
SEDIMENTATION TANK ASSEMBLY
DMC STORMWATER TREATMENT
SEDIMENTATION TANK SYSTEM
Lean Environment


2.591 M
6.058 M
19'11.0"
8" FLANGE
WITH 90° DOWNTURN
TURBULENT
SECTION
INTERIOR BAFFLE
PRIMARY
SEDIMENTATION
DRAIN
FLANGE
BACK-FLUSH
SECTION
12.0"
36.0"
REVISIONS
DATE
DATE
DATE
DATE
NORTH STORAGE TANK
DMC STORMWATER TREATMENT
SEDIMENTATION TANK DETAIL
Lean Environment


2.591 M
INLET FLANGE
DRAIN FLANGE (OPTIONAL)
ADJUSTABLE SERRATED WEIR
SECONDARY SEDIMENTATION
6.058 M
19'11.0"
HIGH LEVEL OUTLET FLANGE
INTERIOR BAFFLE
TERTIARY SEDIMENTATION
LOW LEVEL OUTLET FLANGE
13.0"
36.0"
REVISIONS
DATE
DATE
DATE
DATE
SOUTH SEDIMENTATION TANK
DMC STORMWATER TREATMENT
SEDIMENTATION TANK DETAIL
Lean Environment

APPENDIX F
Particle Distribution Study

SPECTRA Laboratories

2221 Ross Way • Tacoma, WA 98421 • (253) 272-4850 • Fax (253) 572-9838 • www.spectra-lab.com

04/01/2013

Lean Environmental
4500 15th St E
Fife, WA 98424
Attn: Dan Rich

Project:	Duwamish Marine
Client ID:	1
Sample Matrix:	Water
Date Sampled:	03/20/2013
Date Received:	03/20/2013
Spectra Project:	2013030467
Spectra Number:	1

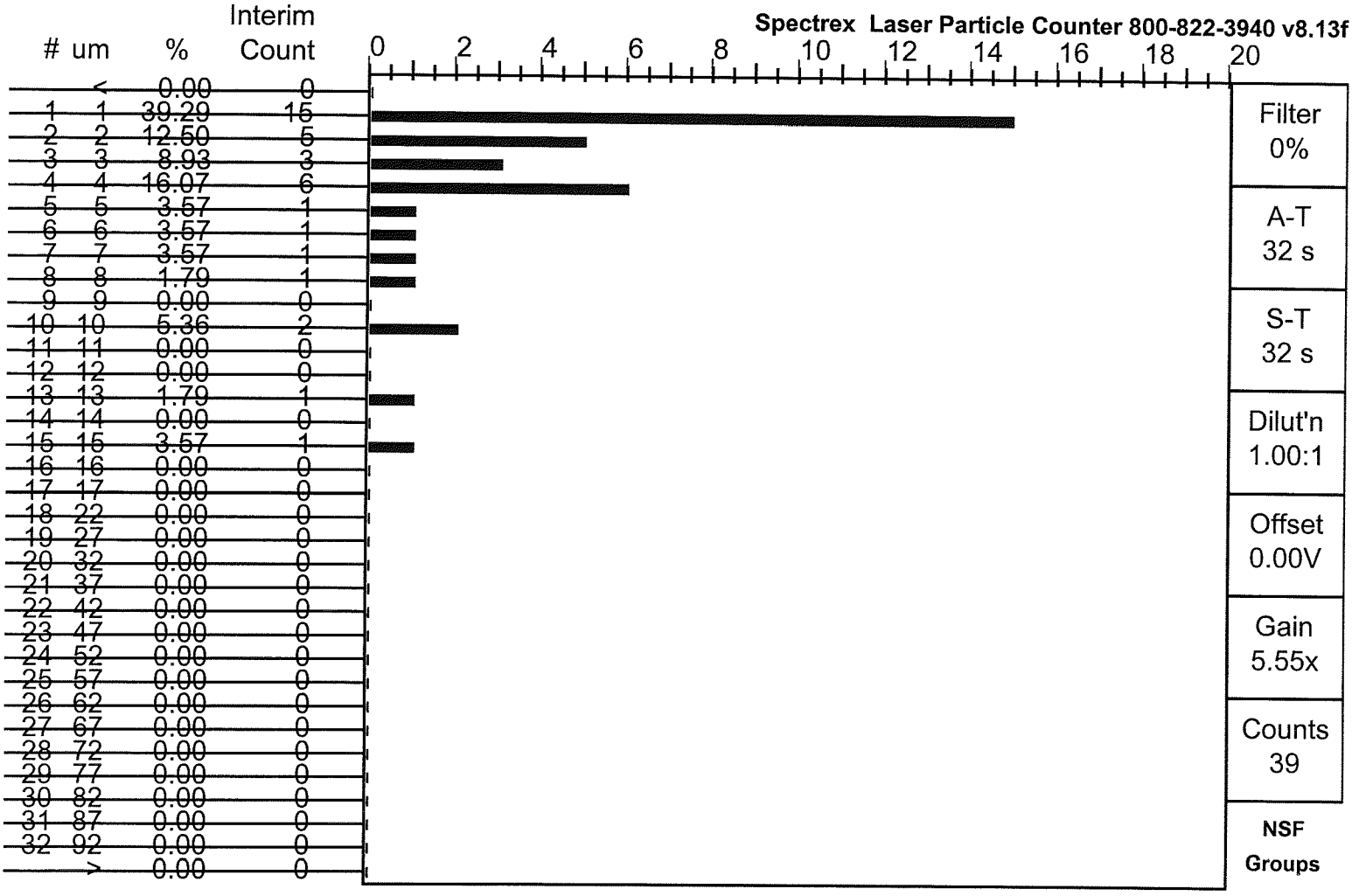
Analyte	Result	Units	Method
Particle Count	757,875,000 *	#/cc	NSF
Total Suspended Solids	2810	mg/L	SM 2540-D

* Please see attached scans.

SPECTRA LABORATORIES

Steve Hibbs, Laboratory Manager
a6/mh

04-01-2013
BLANK



NSF Class	Size	Total counts /cc	Counts percent	Surface area percent	Volume percent
#1	< 1	0.00	0.00%	0.00%	0.00%
#2	1-5	29.61	76.79%	16.57%	7.22%
#3	5-15	7.57	19.64%	52.22%	50.03%
#4	15-30	1.38	3.57%	31.21%	42.75%
#5	30-50	0.00	0.00%	0.00%	0.00%
#6	50-100	0.00	0.00%	0.00%	0.00%

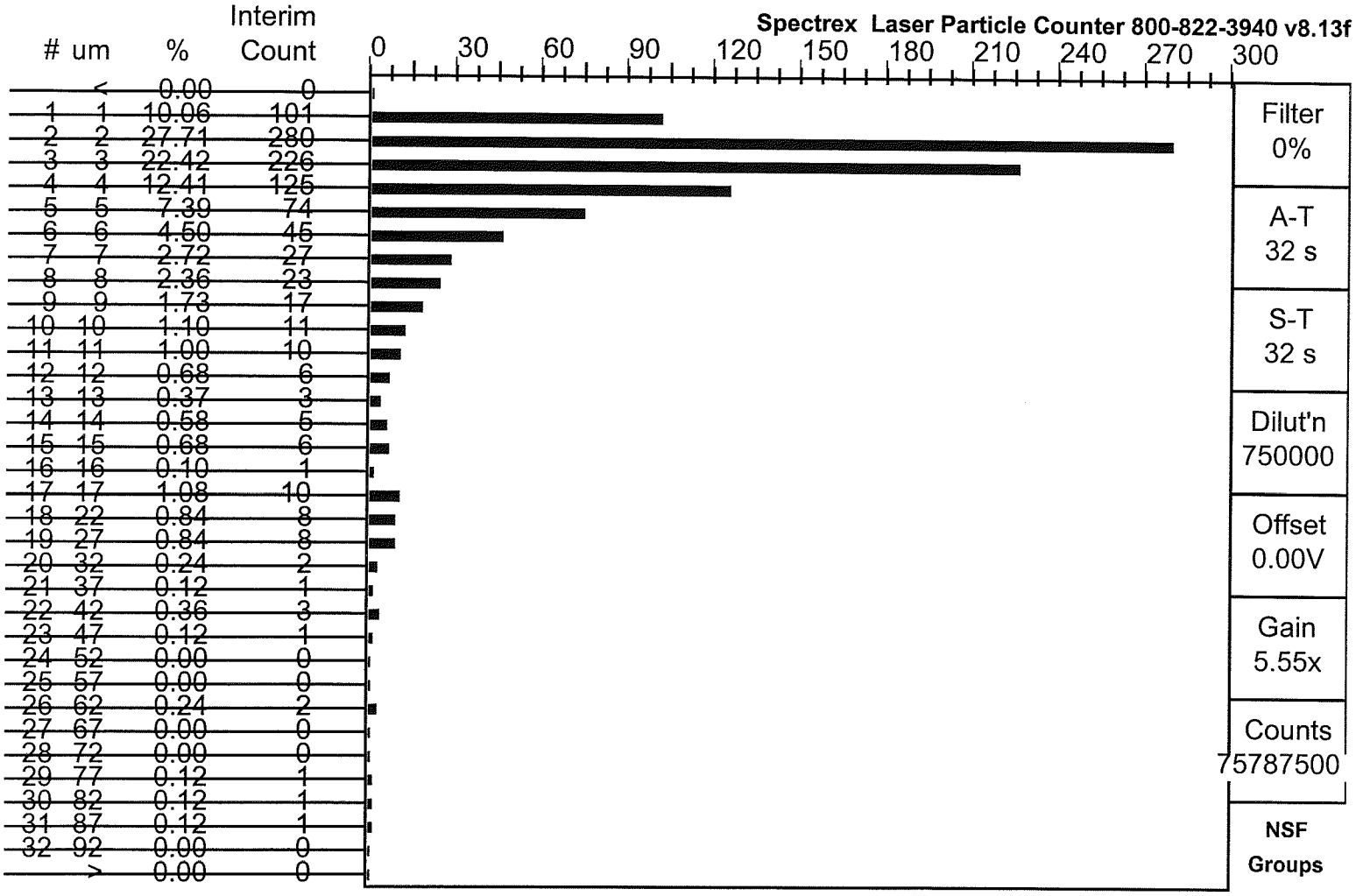
Total counts: 38.56/cc
Mean size: 3.64um
Standard dev: 3.53um

Sample taken on April 1, 2013 at 11:42

NSF Bin	Size	Total counts /cc	Counts percent	Surface area percent	Volume percent
	<	0.00	0.00%	0.00%	0.00%
1	1um	15.15	39.29%	1.53%	0.27%
2	2um	4.82	12.50%	1.94%	0.59%
3	3um	3.44	8.93%	3.12%	1.28%
4	4um	6.20	16.07%	9.99%	5.08%
5	5um	1.38	3.57%	3.47%	2.08%
6	6um	1.38	3.57%	4.99%	3.44%
7	7um	1.38	3.57%	6.80%	5.26%
8	8um	0.69	1.79%	4.44%	3.79%
9	9um	0.00	0.00%	0.00%	0.00%
10	10um	2.07	5.36%	20.80%	21.03%
11	11um	0.00	0.00%	0.00%	0.00%
12	12um	0.00	0.00%	0.00%	0.00%
13	13um	0.69	1.79%	11.72%	14.42%
14	14um	0.00	0.00%	0.00%	0.00%
15	15um	1.38	3.57%	31.21%	42.75%
16	16um	0.00	0.00%	0.00%	0.00%
17	17um	0.00	0.00%	0.00%	0.00%
18	22um	0.00	0.00%	0.00%	0.00%
19	27um	0.00	0.00%	0.00%	0.00%
20	32um	0.00	0.00%	0.00%	0.00%
21	37um	0.00	0.00%	0.00%	0.00%
22	42um	0.00	0.00%	0.00%	0.00%
23	47um	0.00	0.00%	0.00%	0.00%
24	52um	0.00	0.00%	0.00%	0.00%
25	57um	0.00	0.00%	0.00%	0.00%
26	62um	0.00	0.00%	0.00%	0.00%
27	67um	0.00	0.00%	0.00%	0.00%
28	72um	0.00	0.00%	0.00%	0.00%
29	77um	0.00	0.00%	0.00%	0.00%
30	82um	0.00	0.00%	0.00%	0.00%
31	87um	0.00	0.00%	0.00%	0.00%
32	92um	0.00	0.00%	0.00%	0.00%
	>	0.00	0.00%	0.00%	0.00%
	TOTALS	38.56	100.00%	100.00%	100.00%

Sample taken on April 1, 2013 at 11:42

04-01-2013
Lean Environment
Spectra # 2013030467-1
Client ID: 1



NSF Class	Size	Total counts /cc	Counts percent	Surface area percent	Volume percent
#1	< 1	0.00	0.00%	0.00%	0.00%
#2	1-5	550,243,452.07	72.60%	6.55%	0.93%
#3	5-15	169,916,448.40	22.42%	16.03%	4.96%
#4	15-30	26,825,928.06	3.54%	18.96%	11.76%
#5	30-50	6,352,016.80	0.84%	16.44%	16.05%
#6	50-100	4,537,154.86	0.60%	42.02%	66.29%

Total counts: 757,875,000.19/cc
Dilution factor: 750000.00:1
Mean size: 4.91um
Standard dev: 7.44um

Sample taken on April 1, 2013 at 14:10

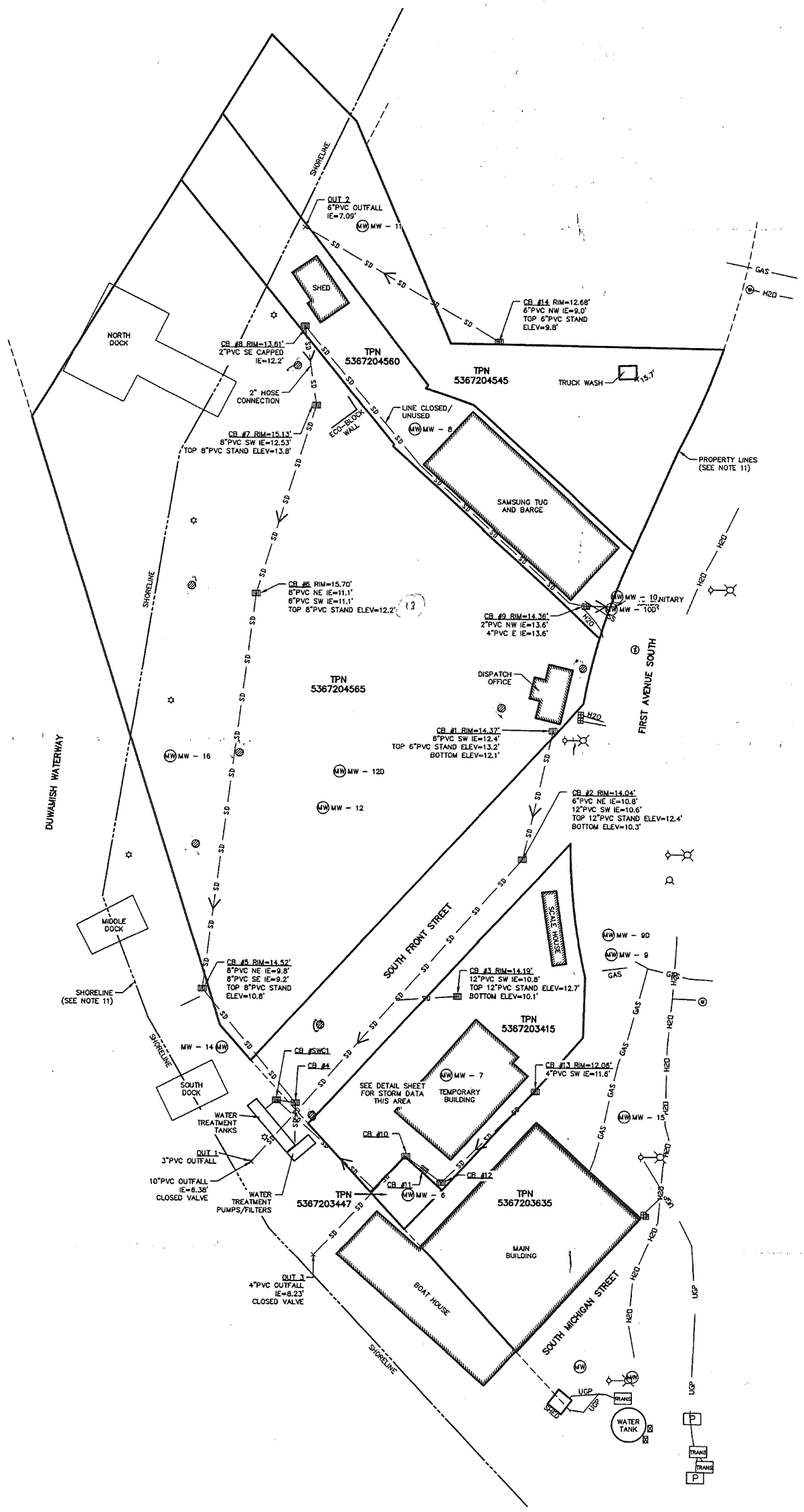
04-01-2013
Lean Environment
Spectra # 2013030467-1
Client ID: 1

NSF Bin	Size	Total counts /cc	Counts percent	Surface area percent	Volume percent
	<	0.00	0.00%	0.00%	0.00%
1	1um	76,224,201.15	10.06%	0.13%	0.01%
2	2um	210,013,554.22	27.71%	1.39%	0.14%
3	3um	169,916,448.40	22.42%	2.54%	0.35%
4	4um	94,089,248.30	12.41%	2.50%	0.43%
5	5um	55,977,147.72	7.39%	2.32%	0.47%
6	6um	34,142,090.10	4.50%	2.04%	0.48%
7	7um	20,644,054.48	2.72%	1.68%	0.44%
8	8um	17,865,047.15	2.36%	1.90%	0.55%
9	9um	13,101,034.57	1.73%	1.76%	0.56%
10	10um	8,337,022.00	1.10%	1.38%	0.47%
11	11um	7,543,019.91	1.00%	1.51%	0.56%
12	12um	5,161,013.62	0.68%	1.23%	0.48%
13	13um	2,779,007.33	0.37%	0.78%	0.32%
14	14um	4,367,011.52	0.58%	1.42%	0.63%
15	15um	5,161,013.62	0.68%	1.93%	0.89%
16	16um	794,002.10	0.10%	0.34%	0.16%
17	17um	8,166,878.74	1.08%	3.92%	2.00%
18	22um	6,352,016.80	0.84%	5.10%	3.16%
19	27um	6,352,016.80	0.84%	7.68%	5.54%
20	32um	1,814,861.94	0.24%	3.08%	2.53%
21	37um	907,430.97	0.12%	2.06%	1.88%
22	42um	2,722,292.91	0.36%	7.97%	8.01%
23	47um	907,430.97	0.12%	3.33%	3.64%
24	52um	0.00	0.00%	0.00%	0.00%
25	57um	0.00	0.00%	0.00%	0.00%
26	62um	1,814,861.94	0.24%	11.57%	15.58%
27	67um	0.00	0.00%	0.00%	0.00%
28	72um	0.00	0.00%	0.00%	0.00%
29	77um	907,430.97	0.12%	8.93%	14.13%
30	82um	907,430.97	0.12%	10.12%	16.80%
31	87um	907,430.97	0.12%	11.40%	19.77%
32	92um	0.00	0.00%	0.00%	0.00%
	>	0.00	0.00%	0.00%	0.00%
	TOTALS	757,875,000.19	100.00%	100.00%	100.00%

Sample taken on April 1, 2013 at 14:10

SITE MAP

NE 1/4 NE 1/4 SEC. 30
TOWNSHIP 24 NORTH, RANGE 4 EAST W.M.
KING COUNTY, WASHINGTON



LEGEND:

TPN	TAX PARCEL NUMBER
	HAND HOLE
	LUMINAIRE
	UTILITY POLE WITH LIGHT
TRANS	PAD MOUNTED TRANSFORMER
P	POWER VAULT
UGP	UNDERGROUND POWER PAINT MARKS
GAS	GAS PAINT MARKS
	FIRE HYDRANT
W	WATER MAN HOLE
	WATER METER
H2O	WATER PAINT MARKS
S	SANITARY SEWER MANHOLE
SS	SANITARY SEWER PAINT MARKS
	CATCH BASIN (CB)
SD	STORM CONNECTION
	DIRECTION OF FLOW PER CLIENT
IE	INVERT ELEVATION
PVC	PLASTIC PIPE
MW	MONITORING WELL - FOUND IN FIELD
	MONITORING WELL LOCATION - GIS COORDINATES PROVIDED BY CLIENT NOT FOUND DURING FIELD SURVEY.
×15.7'	SPOT ELEVATION

NOTES AND COMMENTS:

1.) PURPOSE OF SURVEY: THE PURPOSE OF THIS SURVEY WAS TO DEVELOP A PLANNING AND DESIGN BASE FOR USE BY OTHERS.

2.) HORIZONTAL DATUM: THE OVERALL HORIZONTAL DATUM FOR THIS PROJECT IS NAD 83/91, WASHINGTON COORDINATE SYSTEM, NORTH ZONE, BASED ON GPS MEASUREMENTS USING THE WASHINGTON STATE REFERENCE NETWORK.

3.) VERTICAL DATUM: THE VERTICAL DATUM FOR THIS SURVEY IS NAVD 88, BASED ON GPS MEASUREMENTS USING THE WASHINGTON STATE REFERENCE NETWORK.

4.) FIELD SURVEY METHODOLOGY: ACCESSIBLE SURVEY MONUMENTS AND MARKERS WERE FIELD MEASURED USING A TOPCON GLOBAL POSITIONING SYSTEM (GPS). MONUMENT POSITIONS THAT WERE NOT DIRECTLY OBSERVED USING GPS WERE TIED TO THOSE POINTS USING A TRIMBLE 5-SECOND OR BETTER ELECTRONIC TOTAL STATION IN CONFORMANCE WITH ACCEPTED SURVEY PROCEDURES WHICH MEET OR EXCEED STATE STANDARDS SPECIFIED BY WAC 332-130 WITH REGARD TO LINEAR AND ANGULAR CLOSURES.

5.) INSTRUMENT CALIBRATION: ALL MEASURING INSTRUMENTS EMPLOYED IN THIS SURVEY HAVE BEEN MAINTAINED IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS.

6.) THIS MAP GRAPHICALLY REPRESENTS CONDITIONS AND FEATURES EXISTING AT THE TIME OF THIS SURVEY ONLY, WHICH WAS PERFORMED DURING JULY OF 2015.

7.) THIS SURVEY WAS PREPARED FOR THE EXCLUSIVE USE OF THE CLIENT NAMED HEREON. ITS' USE DOES NOT EXTEND TO ANY UNNAMED PERSON OR PERSONS WITHOUT THE EXPRESS RECERTIFICATION BY THIS SURVEYOR NAMING SUCH PARTY.

8.) FOR YOUR INFORMATION: 0.0833 FEET = 1 INCH ON THE GROUND

9.) KING COUNTY TAX PARCEL NUMBERS:
5367203635, 5367203447, 5367203412, 5367204565, 5367204560, AND 5367204545

10.) THE UNDERGROUND UTILITIES SHOWN HEREON HAVE BEEN LOCATED FROM A COMBINATION OF: 1.) THE FIELD SURVEYED LOCATION OF VISIBLE SURFACE UTILITY STRUCTURES SUCH AS MANHOLE LIDS, GRATES, GAS AND WATER VALVE LIDS, ETC... 2.) AS-BUILT RECORDS AND MAPS OBTAINED FROM CLIENT, AND 3.) THE FIELD SURVEYED LOCATION OF PAINT OR OTHER MARKS OR MARKERS PLACED BY AN UNDERGROUND UTILITY LOCATOR SERVICE. WE MAKE NO GUARANTEE THAT THE UNDERGROUND UTILITIES SHOWN COMPRISE ALL SUCH UTILITIES IN THE AREA, EITHER IN SERVICE OR ABANDONED, NOR THAT ARE IN THE EXACT LOCATION SHOWN. AN UNDERGROUND UTILITY LOCATING SERVICE WAS NOT HIRED BY PLS, INC. NOR OTHERS TO SURFACE MARK UTILITY LINES FOR THIS PROJECT.

UTILITY INVERT ELEVATIONS AND PIPE / FLOW LINE DIAMETERS SHOWN HEREON ARE BASED ON OBSERVATIONS FROM THE TOP OF THE UTILITY STRUCTURE AND ARE APPROXIMATE ONLY. FOR SAFETY REASONS NO PHYSICAL ENTRY INTO THE UTILITY STRUCTURE WAS PERFORMED DURING THE COURSE OF THIS SURVEY.

11.) THE PROPERTY AND RIGHT-OF-WAYS LINES DISPLAYED ON THIS MAP WERE EXTRACTED FROM THE KING COUNTY ONLINE I-MAP WEBSITE AT THE TIME OF THIS SURVEY. THE COORDINATES OF THE CORNERS OF THE PARCELS AS DETERMINED FROM THE WEBSITE WERE USED TO POSITION THE PARCELS ON THIS MAP. THE DIMENSIONS AND LOCATION OF THE PARCEL LINES ARE APPROXIMATE ONLY.

12.) THE GRAPHIC LOCATION AND SIZE OF SOME PHYSICAL FEATURES SUCH AS FENCES AND UTILITY STRUCTURES MAY BE SLIGHTLY EXAGGERATED FOR CLARITY PURPOSES.

SHEET 1 OF 2

DRAWING NAME: 15082 TOPO.DWG
JOB NO: 15082
SCALE: 1"= 40'
DATE: AUG 18, 2015
DRAWN BY: BPM
CHECKED BY: KAP

SHEET TITLE: SITE MAP

CLIENT: FILTER ENGINEERING

NO.	DATE	REVISIONS	BY
1	8/22/15	STORM REVISIONS PER CLIENT	BPM
2	8/31/15	REVISIONS PER CLIENT	BPM
3	9/2/15	REVISIONS PER CLIENT	BPM
4	10/21/15	MAPPED ADDITIONAL UTILITIES, SITE FEATURES AND UTILITY PAINT MARKS BY OTHERS - SHEET 1 OF 2	BPM
5	12/21/15	MAPPED ADDITIONAL MONITOR WELLS	BPM

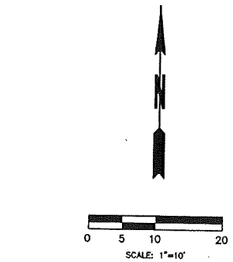
1/8/2016
KURT A. PARCHER
STATE OF WASHINGTON
49288
REGISTERED
PROFESSIONAL LAND SURVEYOR

FILTER ENGINEERING
16 S. MICHIGAN STREET
SEATTLE, WA 98108

PLS, Inc.
Professional Land Surveyors
1595 NW Gilman Boulevard, #15
Issaquah, Washington 98027
(425) 313-9378 (fax) 313-9379

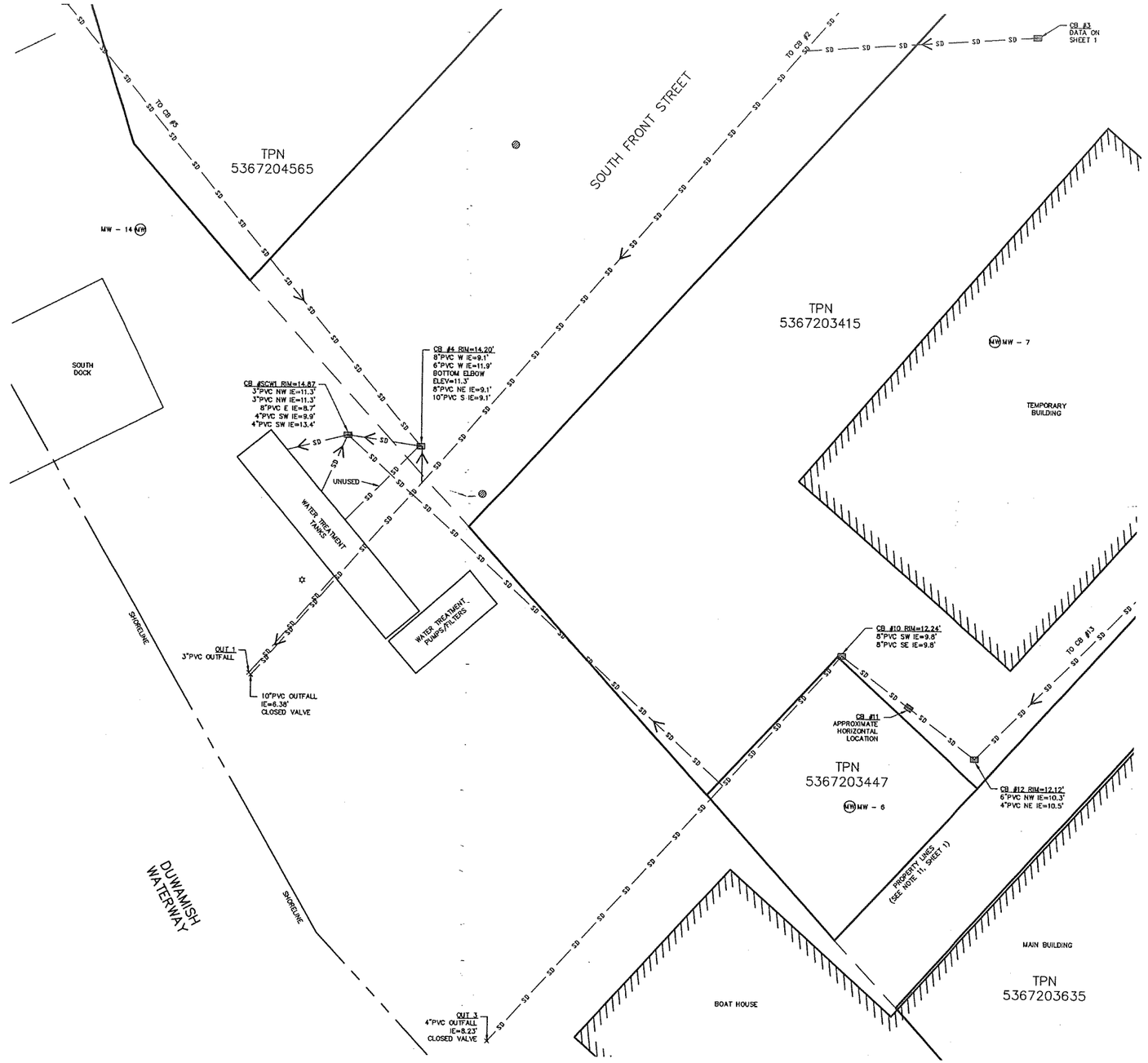
SITE MAP

NE 1/4 NE 1/4 SEC. 30
TOWNSHIP 24 NORTH, RANGE 4 EAST W.M.
KING COUNTY, WASHINGTON



LEGEND:

TPN	TAX PARCEL NUMBER
☼	LUMINAIRE
⊕	UTILITY POLE WITH LIGHT
CB	CATCH BASIN (CB)
—SD—	STORM CONNECTION
<	DIRECTION OF FLOW-PER CLIENT
IE	INVERT ELEVATION
PVC	PLASTIC PIPE
MW	MONITORING WELL – FOUND IN FIELD
⊘	MONITORING WELL LOCATION – GIS COORDINATES PROVIDED BY CLIENT NOT FOUND DURING FIELD SURVEY.
×15.7'	SPOT ELEVATION



DETAIL SHEET

PLS, Inc.
Professional Land Surveyors
1595 NW Gilman Boulevard, #16
Issaquah, Washington 98027
(425) 313-9378 (fax) 313-9379

FILTER ENGINEERING
16 S. MICHIGAN STREET
SEATTLE, WA 98108

1/6/2016
A. PARKER KLEIN
STATE OF WASHINGTON
PROFESSIONAL LAND SURVEYOR

REVISIONS

NO.	DATE	DESCRIPTION	BY
1	8/22/15	STORM REVISIONS PER CLIENT	BPM
2	8/31/15	REVISIONS PER CLIENT	BPM
3	9/2/15	REVISIONS PER CLIENT	BPM
4	10/21/15	MAPPED ADDITIONAL UTILITIES, SITE FEATURES AND UTILITY PAINT MARKS BY OTHERS – SHEET 1 OF 2	BPM
5	12/21/15	MAPPED ADDITIONAL MONITOR WELLS	BPM

SHEET TITLE: SITE MAP
CLIENT: FILTER ENGINEERING

DRAWN BY: BPM	CHECKED BY: KAP
SCALE: 1"= 10'	DATE: AUG 18, 2015
JOB NO: 15082	
DRAWING NAME: 15082 TOPO.DWG	
SHEET 2 OF 2	

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DUWAMISH METAL FAB

STORMWATER POLLUTION PREVENTION PLAN

Prepared for

DUWAMISH METAL FAB
SEATTLE, WA

Prepared by
Blue Environmental
800 5th Ave #101-251
Seattle, WA 98104

August 2016

STORMWATER POLLUTION PREVENTION PLAN
DUWAMISH METAL FAB
SEATTLE, WA

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

ACRONYMS AND ABBREVIATIONS

BMPs - Best Management Practices
DMR - Discharge Monitoring Report
Ecology - Washington State Department of Ecology
EPA - Environmental Protection Agency
General Permit - The Industrial Stormwater General Permit effective date October 1st, 2010
ug/L - Micrograms per liter
mg/L - Milligrams per liter
MSDS - Material Safety Data Sheet
NOI - Notice of Intent
NPDES - National Pollutant Discharge Elimination System
PMI - Preventive Maintenance Inspection
SPCC - Spill Prevention, Control and Countermeasures
SWPPP - Stormwater Pollution Prevention Plan

STORMWATER POLLUTION PREVENTION PLAN
DUWAMISH METAL FAB
SEATTLE, WA

1.0 STORMWATER POLLUTION PREVENTION PLAN PURPOSE AND OBJECTIVES

The Washington State Department of Ecology's (Ecology) Industrial Stormwater General Permit (General Permit) requires the development and implementation of a Stormwater Pollution Prevention Plan (SWPPP) emphasizing stormwater Best Management Practices (BMPs). The purpose of the General Permit is to establish controls that can address sources of stormwater pollutants at a broad range of facilities. BMPs are the physical, structural, operational or administrative means of providing the appropriate controls.

The major objectives of the SWPPP are:

1. To eliminate the discharges of process wastewater, domestic wastewater and non-contact cooling water to stormwater drainage systems;

2. To implement BMPs that will identify the sources of stormwater pollution and reduce or eliminate stormwater pollutants.

3. To prevent violations of surface water quality, ground water quality and sediment management standards.

This SWPPP is intended to comply with the requirements for SWPPPs as specified in the General Permit effective on January 2, 2015.

1.1 SWPPP LOCATION AND PUBLIC ACCESS

The facility is located at 16 S. Michigan Street, Seattle, WA. A copy of the SWPPP will be located on site and shall be made available if requested by Ecology, and if a written request is received from the general public.

1.2 SWPPP REVIEW AND REVISIONS

Ecology may notify the Facility if the SWPPP does not meet the minimum requirements for stormwater pollution prevention plans established in the General Permit. Following such notification, a plan for modification of the SWPPP and a schedule for implementing any modifications must be submitted to Ecology within 30 days of receipt of the notice.

The Facility will modify the SWPPP whenever there is a change in design, construction, operation or maintenance that causes the SWPPP to be less effective in controlling pollutants. The SWPPP may also be modified whenever a self-inspection reveals that the description of potential pollutant sources or established pollution

prevention measures and controls are inadequate. Appropriate modifications must be made within two weeks of the self-inspection and implementation of modifications must occur in a timely manner.

1.3 RECORDKEEPING

Reports will be kept of all significant events, such as spills or releases, which result in stormwater pollution, as well as in-house inspection reports, follow-up responses to any deficiencies noted during inspections, documentation describing any significant changes in on-site activities. Copies of discharge monitoring reports submitted to Ecology will also be kept with the SWPPP (Appendix B). These reports will be maintained on site with the SWPPP for at least five years.

2.0 FACILITY DESCRIPTION

The Facility is located at 16 S Michigan Street, Seattle, Washington (Figure 1). A general site information summary is included in Appendix A.

2.1 SITE DESCRIPTION

The majority of the site is paved with asphalt with the exception of a truck scale, shipping dock and two concrete pads. The upland portion of the site is used by Filter Engineering for the storage of a variety of construction and marine related equipment and materials, including: ship/boat parts, vehicles, electric generators, empty above ground storage tanks (AST's), pallets, metal pieces and other heavy equipment.

2.2 FACILITY OPERATION

Duwamish Metal Fab's permitted process is steel fabrication that includes grinding, cutting, welding, bending, drilling and generally crafting various steel components described in the detail drawing.

The process begins with coordinating the first steel to be fabricated with the steel stock. Material handling laborers ensure that the fitters have the exact steel inventory at different fitting stations when the steel is required. In tandem, template makers create disposable cardboard-like templates used for cutting steel. These templates take the guesswork out of the shop workers hands. They fabricate the steel to match the template and an accurate steel detail piece is produced.

There are two most common welding processes – arc welding and gas welding. Gas welding is a process in which heat is generated with an electric arc formed between a metal electrode and the metal being welded. An inert gas, typically helium or argon protects the arc from contamination. General gas techniques are TIG (tungsten-inert-gas) and MIG (metal-inert-gas) welding.

Carbon arc welding is a puddling process in which the heat from an electric arc generates a small pool of molten metal that can be added to using metal from a filler rod. This is commonly referred to as stick welding. Welding techniques for field erection of steel or shop fabrication are similar.

After the fabricated assembly is transported to the site, the only work remaining is unloading, sorting, storage and erection.

Other permitted activity at the site includes bulk loading and unloading of marine cargo at the dock at the south end of the property. Operations include private barges that use the Duwamish Metal Fab dock and crane to load and unload cargo. All bulk material is contained in shipping containers. Items too large for shipping

containers such as fabricated steel structures or marine pilings are transloaded directly.

2.3 FACILITY STORMWATER DRAINAGE SYSTEM

The stormwater drainage system consists of three catch basins located adjacent to the indoor metal fabrication area. All three catch basins connect to a stormwater treatment system shared with Samson Tug and Barge. After all stormwater is treated it discharges to the Lower Duwamish Waterway.

2.3.1 Non-Stormwater Discharges

Federal law and the General Permit prohibit most non-stormwater discharges unless specifically permitted under an individual NPDES permit. Typical non-stormwater discharges not authorized by the General Permit include the following: (May not exist at this site)

- Vehicle and equipment wash water;
- Floor drains connected to the storm drainage system;
- Steam cleaning discharges; and
- Vactor truck (catch basin or sump cleaning) liquids.

Non-stormwater discharges authorized by the General Permit include:

- Discharges from fire-fighting activities;
- Fire hydrant flushing;
- Potable water sources including water line flushing;
- Irrigation drainage;
- Lawn watering;
- Uncontaminated groundwater;
- Foundation or footing drains where flows are not contaminated with process materials and;
- Discharges from spring;

As discussed in Section 4.1.6, monthly inspections will be conducted to ensure compliance with the Industrial Stormwater General Permit and the Stormwater Pollution Prevention Plan. This inspection will be performed on a monthly basis beginning in January 2010.

Routine observations may at any time result in identification of unauthorized discharges. All Facility staff will be trained to recognize such discharges and to report it to the Facility Manager for follow-up action.

2.3.2 Significant Spills or Leaks of Toxic or Hazardous Pollutants to Stormwater

The facility is currently under an agreed order with the Department of Ecology regarding soil/groundwater contamination.

3.0 NARRATIVE DESCRIPTION

The General Permit requires the following elements be included in a SWPPP:

- An assessment and description of existing and potential pollutant sources, and;

- A description of the BMPs that are needed to reduce the potential for discharge of significant amounts of pollutants, including operational, source control and treatment BMPs.

Operational BMPs may consist of administrative policies, operating procedures, the prohibition of undesirable practices, maintenance procedures, training, good housekeeping, and other managerial practices to prevent or reduce pollution of waters of the state. Source control BMPs are physical, structural or mechanical devices or structures that are intended to prevent pollutants from entering stormwater. Treatment BMPs are structures or devices designed to remove pollutants from stormwater.

3.1 AREAS ASSOCIATED WITH INDUSTRIAL ACTIVITIES

The SWPPP must address all areas which are associated with industrial activities and which have been or may potentially be sources of stormwater pollutants. The following paragraphs briefly describe the areas at the Facility that are associated with industrial activity, and identify the materials that may be stored or used in those areas.

3.1.1 Equipment Maintenance

Routine maintenance/service is performed on site under cover whenever possible. When large equipment like the crane cannot be serviced under cover proper secondary containment is used. Fueling is delivered on site via wet-hosing. The shop floor is flat, unbroken concrete.

3.1.2 Equipment Washing

As specified in the Permit no vehicle or equipment washing is done on site.

3.1.3 Outdoor Storage Areas

Various metal parts, are stored near the metal fabrication shop. Vehicles are stored near the weigh scales. Other miscellaneous materials are stored at the north end of the site.

3.1.4 Oil Storage

Oil storage and handling practices are described in the SPCC Plan, referenced into this document.

3.2 POTENTIAL STORMWATER POLLUTANTS

Table 3-1 lists categories of significant materials that have a reasonable potential to be present in the stormwater discharges from the Facility.

Table 3-1
Potential Stormwater Pollutants

Location	**Pollutants**
Outdoor storage area	Heavy metals and sediments
Material loading and unloading	Heavy metals, oil and grease
Parking area	Oil and grease
Transloading Dock	Oil or Fuel from the Crane

4.0 STORMWATER BEST MANAGEMENT PRACTICES

This section describes the stormwater BMP's appropriate for the Facility.

4.1 Operational BMP's

The Facility implements six operational BMPs, described in this section:

1. SWPPP Team
2. Good Housekeeping
3. Preventive Maintenance
4. Spill Prevention and Emergency Response
5. Employee Training
6. Inspections

4.1.1 Stormwater Pollution Prevention Team

A Stormwater Pollution Prevention Team has been formed by the Facility. The individuals on the team are responsible for developing the SWPPP and assisting the Facility Manager in implementing, maintaining and modifying the plan. The team members are the Facility Manager, service workers, and an inspection and sampling subcontractor, Blue Environmental. The SWPPP responsibilities of these team members are listed below:

<u>Site Manager</u>

- Overall compliance with stormwater regulations and stormwater discharge permit;
- Spill notification;
- Initiation of corrective actions;
- Retention of records;

<u>Service workers</u>

- Implementation of good housekeeping practices; and
- Implementation of routine preventive maintenance practices.

<u>Blue Environmental</u>

- Training of employees on SWPPP responsibilities including updates;

- Implementation of stormwater monitoring plans;
- SWPPP amendments;
- Stormwater monitoring and reporting;
- Facility Inspections and SWPPP evaluations.

4.1.2 Good Housekeeping

Good housekeeping involves maintaining a clean and orderly work environment. A clean and orderly environment reduces the possibility of accidental spills caused by mishandling of equipment, and should also reduce safety hazards to personnel. Examples of good housekeeping practices that may be employed by the Facility include:

- Neat and orderly storage of chemicals, with proper labeling;
- Prompt cleanup and removal of spillage;
- Regular pickup and disposal of garbage and rubbish;
- Regular cleaning of floors using brooms;
- Provisions for proper storage of material containers;
- Prevention of accumulations of liquid or solid chemicals on the ground or the floor;
- Water tight lids on solid waste receptacles; and
- Quarterly Sweep outdoor paved surfaces to remove accumulated sediments.

4.1.3 Preventive Maintenance

Preventive maintenance involves the inspection of equipment and systems to reveal conditions that might result in discharges of pollutants to the storm drain system, and subsequent correction of those conditions by adjustment, repair or replacement of worn parts before the equipment or systems fail. The preventive maintenance program involves:

- Identifying equipment and systems, which, could fail and release liquid materials if not properly maintained;
- Adjusting, repairing and replacing parts and equipment when necessary;

- Maintaining complete records of deficiencies and corrective actions;

The Facility may perform inspections to detect potential problems before they occur. All inspections and resulting corrective action taken are documented.

4.1.4 Spill Prevention and Emergency Cleanup

The General Permit requires the implementation of spill prevention and emergency cleanup procedures. Spill prevention and response procedures are described in the facility's SPCC plan, which is incorporated into this SWPPP.

4.1.5 Employee Training

The Facility trains employees in understanding and implementing the SWPPP. Employee training is essential to the effective implementation of the SWPPP. The purpose of the training program is to inform personnel at all levels of responsibility of the components and goals of the SWPPP. The training addresses each component of the SWPPP, including operational and source control BMPs, spill prevention and response, good housekeeping and material management practices and stormwater monitoring. Employee training in good housekeeping incorporates the following topics:

- The importance of good housekeeping;
- The prompt cleanup of spilled materials to prevent stormwater contamination;
- The locations where brooms, vacuums, sorbents, and other good housekeeping and spill response equipment are stored;
- Securing drums and containers and checking for leaks and spills; and
- Maintaining a regular schedule for housekeeping.

Tools used in the training sessions may include employee handbooks, films and slide presentations, handouts, or drills. Spill control and response training is described in the SPCC Plan.

The Service Manager will document employee training and maintain the training records.

4.1.6 Inspections

At a minimum, Blue Environmental will conduct twelve (12) monthly inspections. The inspections will be visual inspections (visual monitoring) performed in conjunction with the quarterly stormwater sampling, as outlined in Section 5. Visual observations during quarterly inspections will include: (1) description of potential pollutant sources, suspended solids, oil and grease, discolorations, turbidity and odor in the vicinity of stormwater outfalls; (2) evaluation of the adequacy of BMPs being used; and (3) determination of whether the SWPPP is up-to-date.

Blue Environmental will perform all SWPPP inspections. Appendix B contains inspection report forms for the various SWPPP inspections described in this section. All records of these inspections will be retained with this SWPPP for at least five (5) years after the date of the inspection.

4.2 SOURCE CONTROL AND TREATMENT RMPS

The Facility employs source control BMPs for all of its industrial activities. These BMPs were identified based upon guidance in Ecology's Manual. These BMPs are discussed in the following paragraphs.

4.2.1 Equipment Maintenance

In accordance with the Manual, the following BMPs are implemented to address equipment maintenance performed on site:

- Maintenance/service activities are conducted on site under cover; when this is not possible proper secondary containment is used
- Activities conducted outdoors employ spill prevention measures and have spill kits readily accessible;
- Incoming equipment is inspected for leaks; and
- Drip pans or absorbent materials are used to collect drips or leaks during dismantling of oil-containing parts or removal of fluids, or when a leaking piece of equipment is identified.

4.2.2 Equipment Washing

No equipment washing is done on site in accordance with the guidelines of the General Permit.

4.2.3 Oil Storage

The following BMPs for oil storage have been or will be implemented by the Facility:

- Implementing procedures in SPCC Plan;

- Secondary containment (concrete pads or containment pallets, with capacity of 110% of capacity of largest container) will be provided for lube oils and other oils stored outdoors or with the potential to be spilled to the outdoors; and;

- Spill response kits are maintained at convenient locations (shown on Figure 2).

4.2.4 Outdoor Storage

The following BMPs are being implemented at the Facility to prevent stormwater pollution from outdoor storage activities:

- Weekly inspections of parked equipment in gravel parking areas for evidence of leaks;

- Drip pans or absorbent materials may be used to collect drips or leaks during dismantling of oil-containing parts or removal of fluids, or when a leaking piece of equipment is identified;

- Store oily equipment/parts indoors or on covered (with tarps) pallets to prevent contact with rain and runoff;

4.2.5 Erosion and Sediment Control

The unpaved areas of the site are a potential source of sediment discharge to the storm drain system. The Facility is implementing the following BMPs to control sediment discharge from the site:

- Sweep paved surfaces in high-traffic areas as necessary;

- Catch basin inspected on a monthly basis;

- Install and maintain perimeter controls in areas not draining to storm drain system.

4.2.6 Treatment System

The treatment system consists of pumps that move the water to the sedimentation tanks, electrocoagulation cells to flock the water, pressurized sand filtration and a polishing unit at the end of the treatment train. The treatment system is designed to treat flows from Samson Tug (3 acres) and Duwamish Metal Fab (1.7 acres). All stormwater from the site is discharged through outfall 1. A detailed engineering report with flow calculations, treatment system layout and technology details are referenced in the appendix.

5.0 MONITORING PLAN

This section describes the stormwater monitoring program that will be implemented at the Facility in compliance with the General Permit. Monitoring will consist of both visual observations of discharge water quality and sample collection and analysis. Laboratory analyses will be performed by a contracted laboratory accredited under the provisions of the Accreditation of Environmental Laboratories (Chapter 173-50 WAC).

5.1 MONITORING LOCATIONS

Stormwater sample collection takes place at one location, Outfall 01. The outfall reflects the impact of the industrial activity on the site prior to discharge in to the Duwamish Waterway.

5.2 MONITORING FREQUENCY

Sample collection and analysis will be performed quarterly. The quarters are defined as:

- 1st Quarter: January-March;
- 2nd Quarter: April-June;
- 3rd Quarter: July-September; and
- 4th Quarter: October-December.

To the extent practicable, samples will be collected during rainfall events with the following characteristics:

- The rainfall event should be sampled within the first 12 hours of discharge. If a sample cannot be taken within the first 12 hours an explanation will be included with the sampling records; and
- A first fall storm event will be taken after October 1st of each year that precipitation occurs and results in a stormwater discharge from the facility.

Stormwater sampling personnel will monitor weather forecasts and local precipitation records to identify potential qualifying sampling events, and mobilize to sample when conditions are likely to produce a qualifying rainfall

event. Samples will be collected during normal business hours and during daylight hours only.

5.3 MONITORING PARAMETERS

Stormwater samples will be analyzed for parameters listed in Table 5-1.

Table 5-l
Stormwater Monitoring Parameters

Parameter	**Units**	**Analytical Method**	**Benchmark Value**
pH	Standard Units	Meter	5-9 SU
Turbidity	NTU	Meter	25 NTU
Oil Sheen	Yes/No	Visual	N/A
Zinc	ug/L	EPA 200.8	117 ug/L
Copper	ug/L	EPA 200.8	14 ug/L
Lead	ug/L	EPA 200.8	81.6 ug/L
TPH	mg/L	NWTPH-Dx	10 mg/L
TSS	mg/L	SM 2540 D	30mg/L per day

5.4 MONITORING METHODS

Samples will be single grab samples collected within the first 12 hours after discharge from the sampling points. This will require observing the sampling locations during a candidate rainfall event to determine at what time discharge begins. Due to the impervious nature of the site, the time at which discharge begins may be reasonably soon after the start of rainfall.

Sampling personnel will be responsible for maintaining the integrity of samples from the time of collection to the time of delivery to a contracted analytical laboratory.

5.4.1 Sample Containers

Sample bottles, extra bottles for breakage, bottle labels may be kept on site for the water samples.

5.4.2 Sample Preservation

Cooling after sample collection is the only preservation required for all of the analytes. Cooling should reduce the sample temperature to 4 degrees Celsius within

30 to 60 minutes of collection. Some parameters will require chemical preservation, as identified in Table 5-3. The laboratory will supply preservatives.

5.4.3 Sample Storage and Delivery

Samples will be delivered to the laboratory each sampling day, or at the latest the following morning. Samples may also be express-mailed following appropriate chain-of-custody procedures.

5.4.4 Holding Times

Holding times are the allowable elapsed time between sample collection and extraction, preparation, or analysis of the sample. If a sample is not analyzed within the designated holding time, the analytical results may be compromised. Thus, it is important that the laboratory meet all specified holding times and make every effort to prepare and analyze the samples immediately after they are received. Prompt analysis also allows the laboratory time to review the data, and if inconsistencies are found, to re-process the affected samples.

5.4.5 Packaging

The sample cooler(s) will be filled with packing material and bottles and left with enough room for ice. Chain of custody seals (provided by the laboratory) will be affixed to the cooler. ·

If samples are delivered the day after the sampling event, a sufficient amount of ice will be maintained in the cooler during overnight storage.

Table 5-3 presents a summary of sample containers, required sample volumes, holding times and preservation methods for the parameters to be monitored at the Facility.

5.5 REPORTING AND RECORDKEEPING

Monitoring reports must be submitted to the Department of Ecology quarterly, corresponding to each sampling event. The monitoring data must be summarized, reported and submitted electronically using the Secure Access Washington Database

If approval is received a paper Discharge Monitoring Report (DMR) form may be mailed to:

Industrial Stormwater Permit Manager
Department of Ecology
Water Quality Program
PO Box 47696

Olympia, WA 98504-7696

The DMRs must be submitted no later than 45 days following the end of the last calendar day of each monitoring period. Copies of laboratory reports will be maintained on-site along with copies of DMRs and records of visual observations. All of these records must be maintained for at least five years.

APPENDICIES

APPENDIX A

General Information Summary

STORMWATER POLLUTION PREVENTION PLAN
for
DUWAMISH METAL FAB
SEATTLE, WASHINGTON

GENERAL INFORMATION

Mailing Address: 16 S. Michigan Street
Seattle, WA 98108

Facility Owner: Duwamish Metal Fab

Facility Phone Number: (206) 762-8799

Stormwater Pollution Prevention Team:

Clint Harris – Owners Representative

SIC Code: 3449

Correspondence regarding this plan should be directed to:

Clint Harris
Owners Representative

If the spill causes discharge of harmful quantities of oil into or upon the navigable waters of the United States, then the SPCC plan coordinator will immediately notify:

CEMS 888-450-0907

National Response Center 800/424-8802

or

U.S. EPA 800/564-7577 or 206-553-1200

Local and state agencies will be notified as needed and determined by the plan coordinator.

Department of Ecology (24 hr) 425-649-7000

If, at any time, there is a question of whether to report a release to the environment, REPORT THE RELEASE. Failure to report is subject to a maximum of $10,000 fine and/or one year imprisonment.

The following information is required in reporting:

Name of the reporter
Name of the Company involved
Name and address of the plant or facility
Telephone number
The sources, causes, quantities, locations, and duration of the release
Nature of any inquiries or property damage, if any
Other relevant information, such as weather conditions
Corrective actions being taken

APPENDIX B

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Stormwater Pollution Prevention Plan
(SWPPP)

Samson Tug & Barge Company and Duwamish Marine Center
6361 1st Avenue South, Seattle, Washington

Updated

November 2015

Table of Contents

1.0 Introduction

Federal regulations, administered by the Washington State Department of Ecology (Ecology), require the Samson Tug and Barge Facility at 6361 1st Avenue South, Seattle, Washington to have a General Industrial Stormwater Permit (hereafter referred to as the "Permit"). The purpose of the regulation is to protect water quality by reduction the amount of pollutants in stormwater. The permit covers the Facility as shown in Figure 1. A copy of the Permit is at the back of this Stormwater Prevention Plan (SWPPP).

1.1 Purpose of the SWPPP

This SWPPP provides for identification of the potential sources of pollution that could affect the quality of stormwater discharged from the facility. It also describes the Best Management Practices (BMPs) used to reduce pollutants in stormwater discharges associated with the facility.

2.0 Facility Assessment

The Samson Tug and Barge Facility is approximately 5 acres in size and is located at 6361 1st Avenue South, Seattle, Washington (Figure 1). The facility is owned by the Gilmur/Hale Family Trust. Operators on the site include Samson Tug and Barge Company and the Duwamish Marine Center.

2.1 General Nature of Facility Activity

The Facility's primary object is the loading and unloading of cargo containers from seagoing ships. Samson operates on the northern end of the facility and provides bi-weekly barge service to Alaska from Seattle. Various types of cargo are shipped via 20 or 40 ft shipping containers. The primary cargo shipped consists of fish, fish products, construction equipment, and vehicles. The loading equipment (forklifts, cranes, etc.) are maintained on site. Maintenance includes engine maintenance, lubrication and pressure washing. Samson's busy season is from spring through fall. The yard is often full of cargo during this time.

Duwamish Marine Center operates on the southern portion of the site primarily as a transfer facility for sediments being shipping to Waste Management in Seattle, Washington. Duwamish Marine Center is a certified waste recipient for transfer of dredged sediment. Dredged sediment is placed in lined containers and transferred to trucks at the facility. The trucks then transport the sediment to Waste Management in Seattle, Washington. Duwamish Marine Center's busy season is in winter.
The site is general level and primarily unpaved. The average elevation of the site is approximately + 18 ft MLLW.

Three buildings are present on the site. Roofing materials for the building are as follows:
1) The Duwamish Marine Center has a galvanized metal roof,
2) The Dispatch Office has a composite tile roof, and
3) The Storage Building has a canvas (or fabric) roof.

2.2 Maps of Site

Maps of the site are shown in Figure 1 through 3. Figure 1 shows site features such as buildings, catch basins and stormwater drainage structures. Figure 2 shows an outline of the stormwater drainage areas for each stormwater discharge point, surface water locations, area where stormwater discharges to ground, and areas of potential soil erosion. Figure 3 shows locations of industrial activity at the facility and materials exposed to stormwater.

2.3 Description of Storm Drainage and Outfalls

Nine catch basins and two outfalls are present on the facility (Fig. 2). Seven catch basins drain the southern 4 acres and discharge to Outfall 1. Two catch basins drain the northern 1 acre and are directed toward Outfall 2, which is locked and sealed. Stormwater from the northern drainage area is pumped to the stormwater treatment system.

Stormwater infiltrates into the ground and flows through catch basins toward the outfalls. According to site personnel, stormwater has never been observed going over the top of the bank of the property.

Stormwater from the site discharges to the Lower Duwamish Waterway.

2.4 Industrial Activity

Industrial activities at the facility include the following:

- Loading and loading of Containerized and Bulk Cargo
- Access Roads for Shipping and Receiving
- Temporary Storage of Raw Materials
- Barge Operations
- Vehicle and equipment maintenance and fueling
- Vehicle wash area

Areas of industrial activities are shown on Figure 3.

2.5 Inventory of Materials

Materials handled or stored at the site that can be exposed to stormwater include scrap metal, metal cargo, automobiles, tires, diesels, dredged sediments, steel drums, forklifts and cranes.

2.6 Potential Pollutants

The locations of various activities that could be sources of pollution are shown on Figure 3 and are described below.

Mobile Vehicle Service Area

With the exception of the cranes located on the dock apron, maintenance of vehicles and equipment occurs in front of the Duwamish Marine Center building. Servicing involves replacement of coolant and lubricants, and fueling. Potential pollutants from this activity include oil, grease, diesel and antifreeze. Stormwater from this rea drains to Catch Basin 8 and is pumped to the stormwater treatment system.

Vehicle Washing Area
Vehicles are steam cleaned in the area shown on Figure 3. Wastewater from steam cleaning is contained and pumped to the stormwater treatment system. No wash waster is discharged to the Duwamish Waterway. Solids from vehicle washing are contained and appropriately disposed of.

Barge Operations
Large cranes are situated near docks on the northern and southern end of the site to load and unload cargo (Figure 3). Cranes are serviced at the dock side. Maintenance is limited to various lubricants and oils. Leaks could occur from hydraulic hoses. Potential pollutants from this activity include oil and grease. Stormwater from this area drains to Outfall 1 which discharges to the Lower Duwamish Waterway.

Container Yard
The container handling equipment (top picks and forklifts) have hydraulic oil lines that can break, spilling oil. Additional, significant truck traffic I present within the unpaved container yard. Potential pollutants from the container yard include oil, grease, lead and zinc. Stormwater form this area primarily drains to Outfall 1 which discharges to the Lower Duwamish Waterway.

Temporary Storage of Materials
Materials such as metals are stored temporarily at locations show in Figure 3. Potential pollutants from the temporary storage of these materials include oil, grease, lead and zinc. Stormwater form this area primarily drains to Outfall 1 which discharges to the Lower Duwamish Waterway.

Access Roads for Shipping and Receiving
Access roads for the facility are shown on Figure 3. Since the site is unpaved, track out of dirt can occur onto public roadways. A potential pollutant from this activity is elevated turbidity in stormwater.

Voluntary MTCA Cleanup
The site is currently undergoing a Voluntary Cleanup in accordance with the Model Toxics Control Act (MTCA) due to historic release of contaminants at the site. The cleanup is currently in the investigative phase. The approximate boundaries of impacted soils are shown in Figure 3. Potential pollutants in near surface soils primarily consist of metals, hydrocarbons, and PCBs. Stormwater from this area primarily drains to Outfall 1 which discharges to the Duwamish Waterway.

3.0 Stormwater Controls

Stormwater will be managed by implementing appropriate Best Management Practices (BMPs) at the facility. This section describes the BMPs that will be used. BMPs were selected from the Storm Water Management Manual for Wester Washington using the presumptive method.

3.1 Pollution Prevention Team

A stormwater pollution prevention team shall be responsible for developing, implementing, maintain, and updating this SWPPP. The members of the team will be familiar with all aspects of management and

operations of the facility. The members of the team and their primary responsibilities include the following: implementing, maintaining, record keeping, reporting, and, inspecting, training, and testing. The current team members are listed in Table 1.

Table 1

Stormwater Pollution Prevention Team		
Name	***Title***	***Responsibility***
Wally Stilson	Port Captain for Samson Tug & Barge (Permittee)	Corporate signatory authority; review and implementation of the SWPPP and permit renewal
James D. Gilmur	Property Owner/ Operator of the Duwamish Marine Center (Co-Permittee)	Co- signatory authority; review and implementation of the SWPPP.
Richard Seslar	Seattle Facilities and Safety Operations Manager/ SWPPP Coordinator	Onsite coordination of all components of the SWPPP; oversees good housekeeping practices and BMPs. Responsible for monthly site inspections, record-keeping, and reporting.
Site Staff		Implementation of operational source control BMPs (e.g. good housekeeping, fueling procedures, preventive maintenance, etc.), promptly identify conditions not meeting SWPPP, perform SWPPP tasks as directed.
Blue Environmental	Contracted Environmental Consultant	Responsible for stormwater sampling and water quality reporting, as well as annual training. Responsible for analysis of monitoring data. Recommends new BMPs, if required.

3.2 Good Housekeeping

Good housekeeping is an ongoing approach to improve and maintain a clean and orderly work environment. BMPs for good housekeeping at this facility will consist of the following:

- Promptly contain and clean up solid and liquid pollutant leaks and spills including oils and fuels, and dust from operations on any area expose to stormwater.
- Do not hose down pollutants from any areas to the ground, storm drains, or receiving water unless necessary for dust control purposes to meet air quality regulations and unless the pollutants are convey to a treatment system approved by the local jurisdiction.

- Clean oils, debris, sludge, etc. from all BMP systems regularly, including catch basins, boomed areas, and conveyance systems, to prevent contamination of stormwater.
- Promptly repair or replace all leaking connections, pipes, hoses, valves, etc., which can contaminate stormwater.
- Use solid absorbents, e.g. clay and peat absorbents and rags for cleanup of liquid spills/leaks, where practicable.

3.3 Preventive Maintenance

A preventive maintenance program shall be employed at this facility, which includes inspection and maintenance of stormwater management devices and drainage systems and routing inspections of industrial facility operations including vehicle maintenance. Equipment such as containers (drums), and outside piping, pumps and process equipment shall be checked regularly for signs of deterioration.

Catch basins on the site shall be inspected quarterly for buildup of sediments. Catch basins shall be cleaned out when accumulated material comes within 18 inches of the bottom of the lowest pipe exiting the catch basin. Sediments in the catch basins shall be removed and disposed of by a contractor to perform such work. Records of catch basins inspection and cleanout will be maintained with compliance records.

3.4 Spill Prevention, Reporting and Emergency Cleanup

The facility maintains a spill plan which is provided in Attachment A. Employees of the facility shall be made aware of response procedures, including material handling and storage requirements. Spill kits and cleanup equipment shall be stored in locations close to areas of potential spills.

3.5 Training

Onsite training of key personnel responsible for compliance with the SWPPP shall be provided annually. All operators on the site shall be familiarized with the major elements of the plan. Training shall include identifying pollutant sources, understanding pollutant control measures, spill prevention and response, good housekeeping, and environmental acceptable material handling/management practices. The training will focus on how employees make a difference in complying with the SWPPP and preventing contamination of stormwater. Temporary workers and others at the site will be given appropriate training information at the conclusion of the site safety meeting or on an as-needed basis.

3.6 Illicit Discharge Detection and Elimination

Illicit discharges are any discharges that are not composed entirely of stormwater with limited exceptions (e.g., firefighting) listed in the Permit. Illicit discharges are prohibited at the Facility. A dry season inspection will be performed to determine if illicit discharges are occurring. Any discharges identified during the inspection, or at any other time, will be eliminated as soon as practicable.

3.7 Maintenance and Repair of Vehicles and Equipment

Leaks and spills of fluids that occur during the repair of vehicles and equipment shall use good housekeeping and cover and containment BMPs. Employees shall:

- Inspect for leaks all incoming vehicles and equipment stored temporarily outside.

- Use drip pans or containers under parts or vehicles that drip or are likely to drip liquids, such as during dismantling of liquid containing parts or removal or transfer of liquids.
- Retain and maintain an appropriate oil spill cleanup kit on-site for rapid cleanup of material spills.
- Remove batteries and liquids from vehicles and equipment in designated areas designed to prevent stormwater contamination. Store cracked batteries in a covered non-leaking secondary containment systems.
- Empty oil and fuel filters before disposal. Provide for proper disposal of waste oil and fuel.

Samson employees currently keep maintenance records and check lists for vehicles and equipment. A copy of the current check list is provided in Attachment B.

3.8 Mobile Fueling

The following BMPs will be implemented for mobile fueling on the site.

- Ensure that all mobile operations are approved by the local fire department and comply with local and Washington State fire codes.
- Ensure the presence and the constant observation/monitoring of the driver/operator at the fuel transfer location at all times during fuel transfer and ensure that the following procedures are implemented at the fuel transfer locations:
    - Locating the point of fueling at least 25 feet from the nearest storm drain or inside an impervious containment with a volumetric holding capacity equal to or greater than 110 percent of the fueling tank volume, or covering the storm drain to ensure no inflow of spilled or leaked fuel. Storm drains that convey the inflow to a spill control separator approved by the local jurisdiction and the fire department need not be covered. Potential spill/leak conveyance surfaces must be impervious and in good repair.
    - Placement of a drip pan, or an absorbent pad under each fueling location prior to and during all dispensing operations. The pan (must be liquid tight) and the absorbent pad must have a capacity of 5 gallons. Spills retained in the drip pan or the pad need not be reported.
- The handling and operation of fuel transfer hoses and nozzle, drip pan(s), and absorbent pads as needed to prevent spills/leaks of fuel from reaching the ground, storm drains, and receiving waters.
- Not extending the fueling hoses across a traffic lane without fluorescent traffic cones, or equivalent devices conspicuously placed so that all traffic is blocked from cross the fuel hose.
- Removing the fill nozzle and cessation of filing when automatic shut-off valve engages. Do not allow automatic shutoff fueling nozzles to be locked in the open position.
- Not “topping off” the fuel receiving equipment.
- Provide the driver/operator of the fueling vehicle with adequate flashlights or other mobile lighting to view fill openings with poor accessibility. Consult with local fire department for additional lighting requirements.

3.9 Erosion and Sediment Control

Erosion and sediment control BMPs are needed at this site to minimize track out of dirt onto public roadways. The following BMPs will be implemented at this site during operating hours.

Grated Exits

Grates will be installed in areas where truck exit the site to help minimize track out of dirt onto public roadways. Truckers will be instructed to drive over the grates prior to exiting the facility, so that excess dirt can be contained on the facility. Grates will be inspected at least twice/year and will be cleaned out on an as needed basis.

Vacuum Sweeper

During times of significant trucking activity, it's possible that track out of dirt may still occur even with grate exits. If this occurs, a vacuum sweeper will be employed on an as needed basis to minimize dirt track out onto road ways.

Catch Basin Inlet Protection

Where catch basins are located outside of vehicle traffic or storage areas, inlet protections (such as silt fence, hay bales, or wattles) will be installed to reduce the volume of sediment entering the conveyance system.

4.0 Monitoring

In accordance with the permit, stormwater monitoring and sampling shall be performed quarterly at location OUT1 (Figure 2).

First Quarter: January, February, March
Second Quarter: April, May, June
Third Quarter: July, August, September
Fourth Quarter: October, November, December

Stormwater quality conditions at the site will be monitored by a contracted consultant or qualified technician. Stormwater will be collected in general accordance with Ecology's Guidance Document, "How to Do Storm Water Sampling. A Guide for Industrial Facilities." (December 2002). Samples will be tested for pH, Turbidity, Oil, and Grease, and, Zinc in accordance with the methods identified in Table2. Visual observations of sheen, odor, discoloration, turbidity, and odor will be noted on field forms.

Samples will be taken to Fremont Analytical in Seattle, Washington.

Table 2.

Stormwater Sampling Parameters					
Parameter	**Units**	**Benchmark Value**	**Analytical Method**	**Laboratory Quantitation Level**	**Minimum Sampling**
Turbidity	NTU	25 NTU	EPA 180.1 Meter	0.5	Quarterly
pH	Standard Units	5.0-9.0 pH	Meter/ Paper	±0.5	Quarterly
Oil Sheen	Yes/No	No visible oil sheen	N/A	N/A	Quarterly
Zinc, Total	µg/L	117 ug/L	EPA 200.8	2.0	Quarterly
Copper, Total	µg/L	14 µg/L	EPA 200.8	2.5	Quarterly
Industry-Specific Benchmarks and Sampling Requirement					
Petroleum Hydrocarbons	mg/L	10 mg/L	ECY NWTPH Dx	0.1	Quarterly
Sampling and Effluent Limit Applicable to Discharges to 303(d)-listed Waters/Puget Sound Sediment Cleanup					
Total Suspended Solids(TSS)	mg/L	30 mg/L(Maximum Daily Effluent Limit)	SM 2540 D	5	Quarterly

For each measurement or sample taken, the following information shall be recorded: (1) the date, exact place, method, and time of sampling or measurement; (2) the individual who performed the sampling or measurement; (3) the dates are analyses were performed; (4) the laboratory that performed the analyses; (5) the analytical techniques or methods used; and (6) the result of all analyses. Also, visual observations of the presence of floating materials including oil and grease, visible sheen, discoloration, turbidity, and odor shall be noted on the sampling forms (Attachment C). Sampling and laboratory chain-of-custody forms shall be signed by the individual conducting the sampling. Copies of sampling forms will be retained with SWPPP compliance records.

Analytical and testing result will be compared against benchmark values stated in the permit and identified in Table 2.

At this facility, the sampling point, OUT1, is exposed during mid to low tides, therefore stormwater sampling will occur as soon as the tide has dropped low enough to expose the sampling point.

Discharge Monitoring Reports (DMRs) will be submitted quarterly to Ecology. If there is no discharge during the entire quarter, a report will be submitted stating that no discharge occurred. DMRs must be submitted to Ecology within 45 days following the end of the reporting period:

First Quarter	Not later than May 15
Second Quarter	Not later than August 15
Third Quarter	Not later than November 15
Fourth Quarter	Not later than February 15

DMRs and SMRs shall also be submitted electronically using Department of Ecology's Water Quality Permitting Portal.

If a sample is taken but one or more of the criteria listed above are not met, the report will include an explanation identifying what criteria were not met and why.

Annual Reports shall be submitted no later than May 15th of each year. The annual report shall include the following information:

4.1 Discharging to Puget Sound Sediment Cleanup Site

In accordance with the 2015-2019 ISGP update, Total Suspended Solid (TSS) was added as one of the stormwater sampling parameter as a requirement of discharging to a Puget Sound Sediment Cleanup Site. The sample shall be taken at least once per quarter. Benchmarks and sampling requirement can be found in Table 2.

In addition, accumulated solids from storm drain lines (including inlets, catch basins, sumps, conveyance lines, and oil/water separators) shall be removed at least once prior to October 1, 2016. Line shall also be cleaned (e.g., jetting, vacuuming, removal, loading, storage and/or transport) using BMPs to prevent discharges of storm drain solids to surface waters of the state.

Storm drains solids must also be sampled and analyzed at least once prior to October 1, 2016. Sampling parameters and analytic methods are listed in Table 3.

Table 3

Analyte	**Method in Sediment**	**Quantitation Level[a]**
Conventional Parameters		
Percent total solids	SM 2540G, or ASTM Method D 2216	NA
Total organic carbon	Puget Sound Estuary Protocols (PSEP 1997), or EPA 9060	0.1%
Grain size	Ecology Method Sieve and Pipette (ASTM 1997), ASTMD422, or PSEP 1986/2003	NA
Metals		
Antimony, Total	EPA Method 200.8 (ICP/MS) , EPA Method 6010 or EPA Method 6020	0.2 mg/kg dw[b]
Arsenic, Total	EPA Method 200.8 (ICP/MS) , EPA Method 6010 or EPA Method 6020	0.1 mg/kg dw
Beryllium, Total	EPA Method 200.8 (ICP/MS) , EPA Method 6010 or EPA Method 6020	0.2 mg/kg dw
Cadmium, Total	EPA Method 200.8 (ICP/MS) , EPA Method 6010 or EPA Method 6020	0.2 mg/kg dw

Chromium, Total	EPA Method 200.8 (ICP/MS) , EPA Method 6010 or EPA Method 6020	0.5 mg/kg dw
Copper, Total	EPA Method 200.8 (ICP/MS) , EPA Method 6010 or EPA Method 6020	0.2 mg/kg dw
Lead, Total	EPA Method 200.8 (ICP/MS) , EPA Method 6010 or EPA Method 6020	0.2 mg/kg dw
Mercury, Total	EPA Method 1631E, or EPA Method 7471B	0.005 mg/kg dw
Nickel, Total	EPA Method 200.8 (ICP/MS) , EPA Method 6010 or EPA Method 6020	0.1 mg/kg dw
Selenium, Total	EPA Method 200.8 (ICP/MS) , EPA Method 6010 or EPA Method 6020	0.5 mg/kg dw
Silver, Total	EPA Method 200.8 (ICP/MS) , EPA Method 6010 or EPA Method 6020	0.1 mg/kg dw
Thallium, Total	EPA Method 200.8 (ICP/MS) , EPA Method 6010 or EPA Method 6020	0.2 mg/kg dw
Zinc, Total	EPA Method 200.8 (ICP/MS) , EPA Method 6010 or EPA Method 6020	5.0 mg/kg dw
Organics		
PAH compounds[c]	EPA Method 8270 D	70 µg/kg dw
PCBs (aroclors), Total[d]	EPA Method 8082	10 µg/kg dw
Petroleum Hydrocarbons		
NWTPH-Dx	NWTPH-Dx	25.0-100.0 mg/kg dw

5.0 Administrative Requirements

This SWPPP shall be retained on-site or within reasonable access of the site and be immediately available, upon request, to Ecology.

5.1 Reporting and Record Keeping

Records of all monitoring information, inspections and visual observations, corrective actions and follow-up activities, and copies of all reports, shall be maintained for a minimum of five (5) years.

Reports that are completed throughout the year will be kept onsite and made available for regulatory inspections. These reports include:

- Catch basin inspection forms (quarterly)
- Catch Basin Cleanout Records
- Preventive Maintenance Forms

- Employee Training (annually)
- Stormwater Sampling Forms (quarterly)
- Discharge Monitoring Reports (quarterly)
- Annual Reports (annually)

5.2 Certification of the SWPPP

The permittee and co-permittee shall ensure implementation of this SWPPP

"I certify under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Base on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

//signed//
By: Richard Seslar
PERMITTEE

Seattle Facilities and Safety Operations Manager
TITLE

//Signed//
BY: Jerry Morgan
CO-PERMITTEE

Director of Sales
TITLE

6.0 References

Department of Ecology, December 2002. "How to do Storm Water Sampling. A Guide for Industrial Facilities."

STORM WATER SAMPLING FIELD LOG

Samson Facility 6361 1st Avenue South, Seattle, WA

Sample Station	Time Rainfall Began	Date	Time	Sampling Method	Name of Sampler	Number of bottles	pH	Turbidity	Visual Observations

LIFT TRUCK OPERATOR'S DAILY/WEEKLY INSPECTION REPORT
INTERNAL COMBUSTION LIFT TRUCKS

OPERATOR'S NAME _____ HOUR METER READING (START OF WEEK) _____
UNIT NO. _____ MODEL _____ SERIAL NUMBER _____
SHIFT 1___ 2___ 3___ SPECIAL ATTACHMENTS _____

IMPORTANT!

This check must be made by the truck operator daily at the start of the shift.

Daily Inspection Check List for Week Beginning _____, 19___	Sunday		Monday		Tuesday		Wednesday		Thursday		Friday		Saturday	
	OK	Needs Attn.	OK	Needs Attn.	OK	Needs Attn.	OK	Needs Attn.	OK	Needs Attn.	OK	Needs Attn.	OK	Needs Attn.
1. Engine Oil— Check level. (When oil must be added, show number of quarts in "needs attn." column.)														
2. Fuel System— Check for leaks. (Report any leaks immediately.)														
3. Radiator— Check coolant level. (Caution.)														
4. Tires— Check for foreign particles, gouges and cuts; check pneumatic tire pressure.														
5. Mast, Carriage, Fork or Attachment— Check for loose or missing bolts and damage; check chain; check adjustment and operation.														
6. Oil and Water— Check for leaks.														
7. Truck Damage— Explain in remarks section.														
8. Operator's Compartment— Inspect for cleanliness.														
9. Engine Oil Gauge— Check pressure. (Report any abnormal pressure reading.)														
10. Fuel— Check level.														
11. Ammeter— Check charging rate (Report unusual readings.)														
12. Safety Equipment (Rotating lights, back-up alarms, etc.)— Check operation.														
13. Steering— Check operation.														
14. Brakes— Check brake pedal travel and parking brake adjustment.														
15. Truck Operation— Report any unusual operation or noises.														

REMARKS: _____

_____

_____ _____
(Operators' Signature) (Date)

WEEKLY CHECK

	OK	Needs Attn.		OK	Needs Attn.
1. Clean Air Cleaner*			5. Oil Lines for Leaks		
2. Hydraulic Oil Level			6. Battery Compartment and Electrolyte Level		
3. Oil Clutch Level			7. Power Steering Oil Level		
4. Transmission Oil Level			8. Lift Chain Adjustment		

*Where operating conditions require in accordance with agreement.

REMARKS: _____

_____

_____
(Operator's Signature) (Date)

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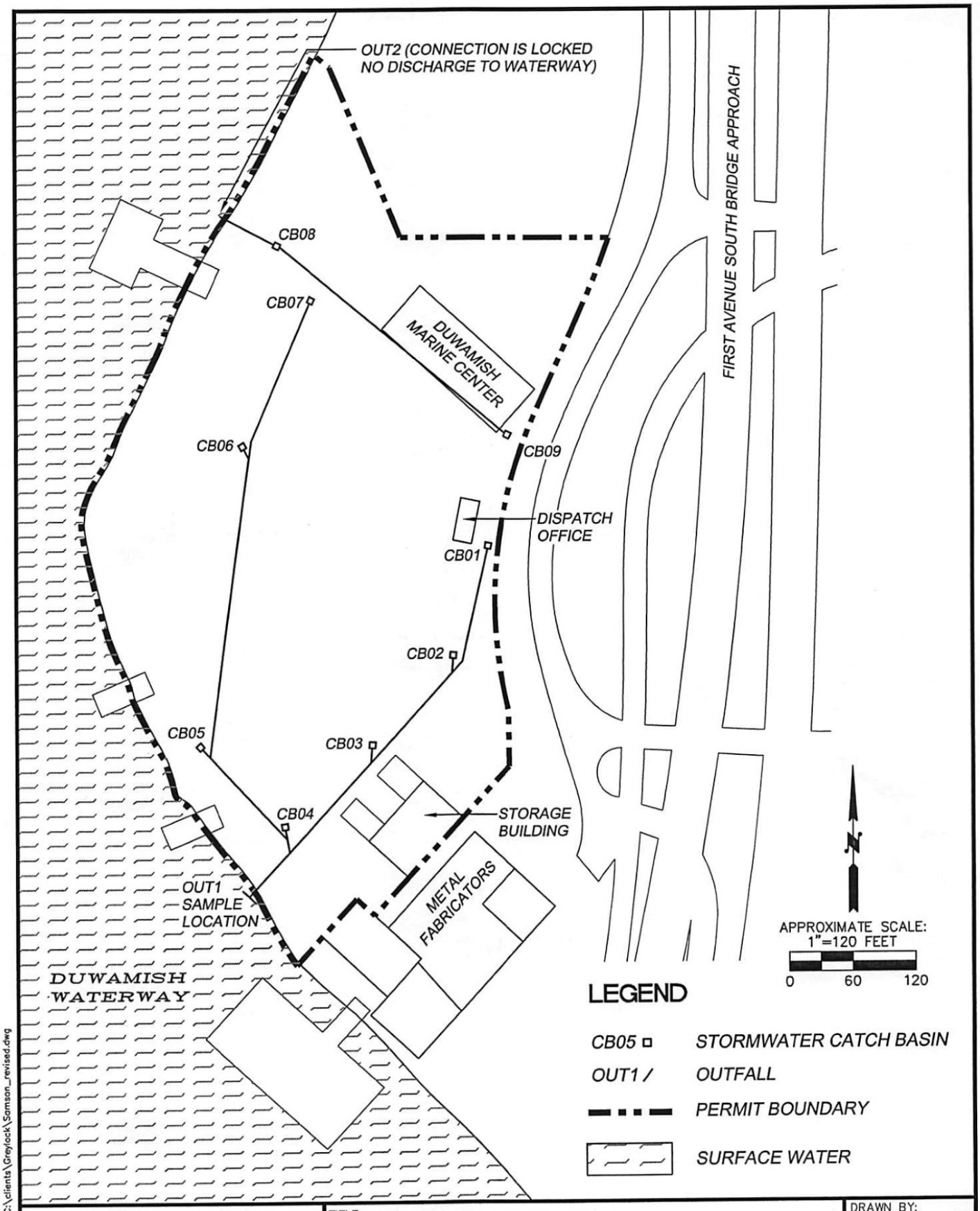


P.O. Box 23254
Federal Way, WA 98093
Office: (253) 941-0654
greylockllc@comcast.net

GREYLOCK CONSULTING LLC
Water Resources & Environmental Services

TITLE: FIGURE 1 - SITE PLAN

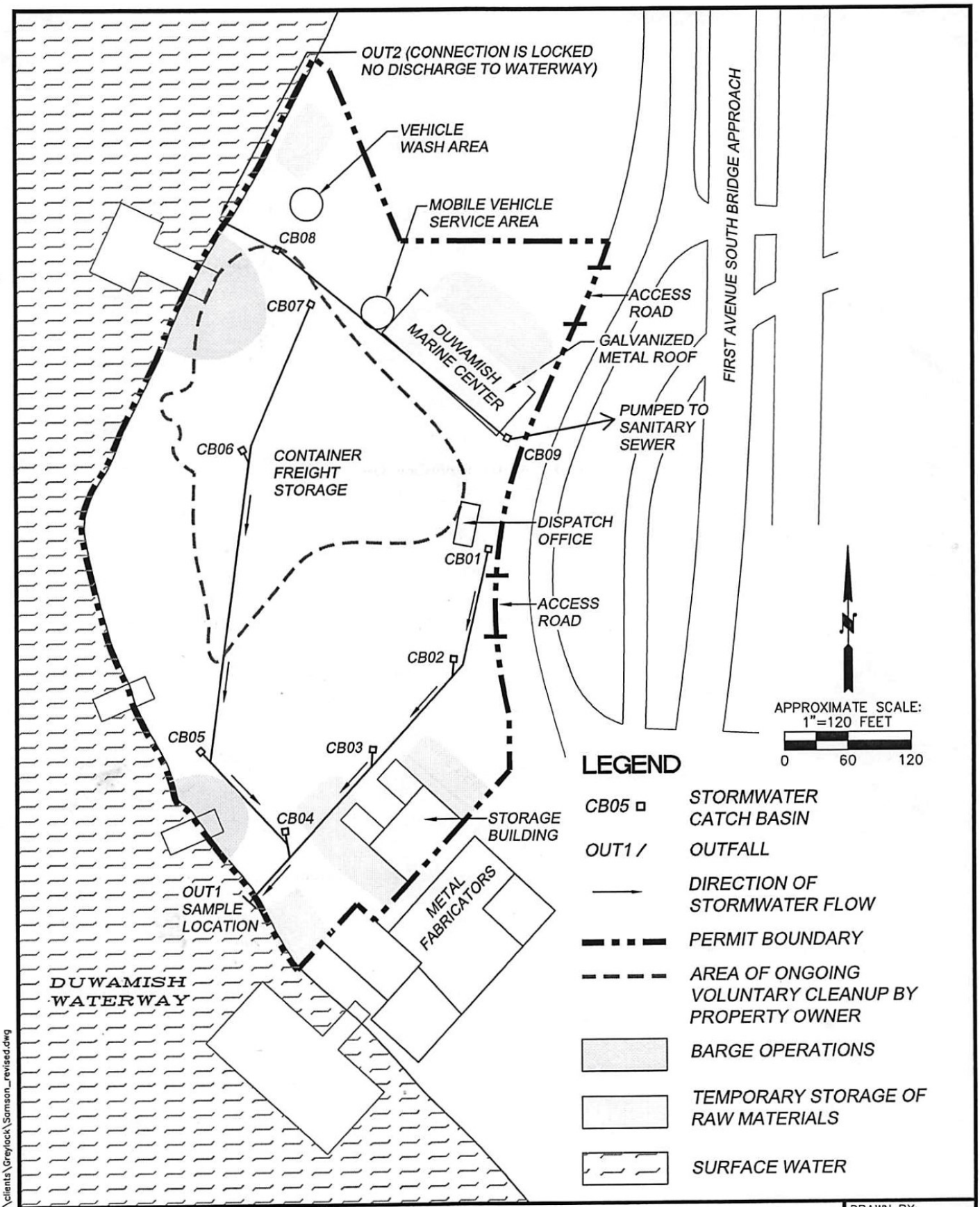
DRAWN BY: CPS

DATE: 02/20/09

SAMPSON TUG AND BARGE FACILITY
6361 1st AVE. S., SEATTLE, WA

SHEET NO: 1

CPS February 20, 2009 - C:\clients\Greylock\Samson_revised.dwg



P.O. Box 23254
Federal Way, WA 98093
Office: (253) 941-0654
greylockllc@comcast.net

GREYLOCK CONSULTING LLC
Water Resources & Environmental Services

TITLE: FIGURE 3 - INDUSTRIAL ACTIVITIES

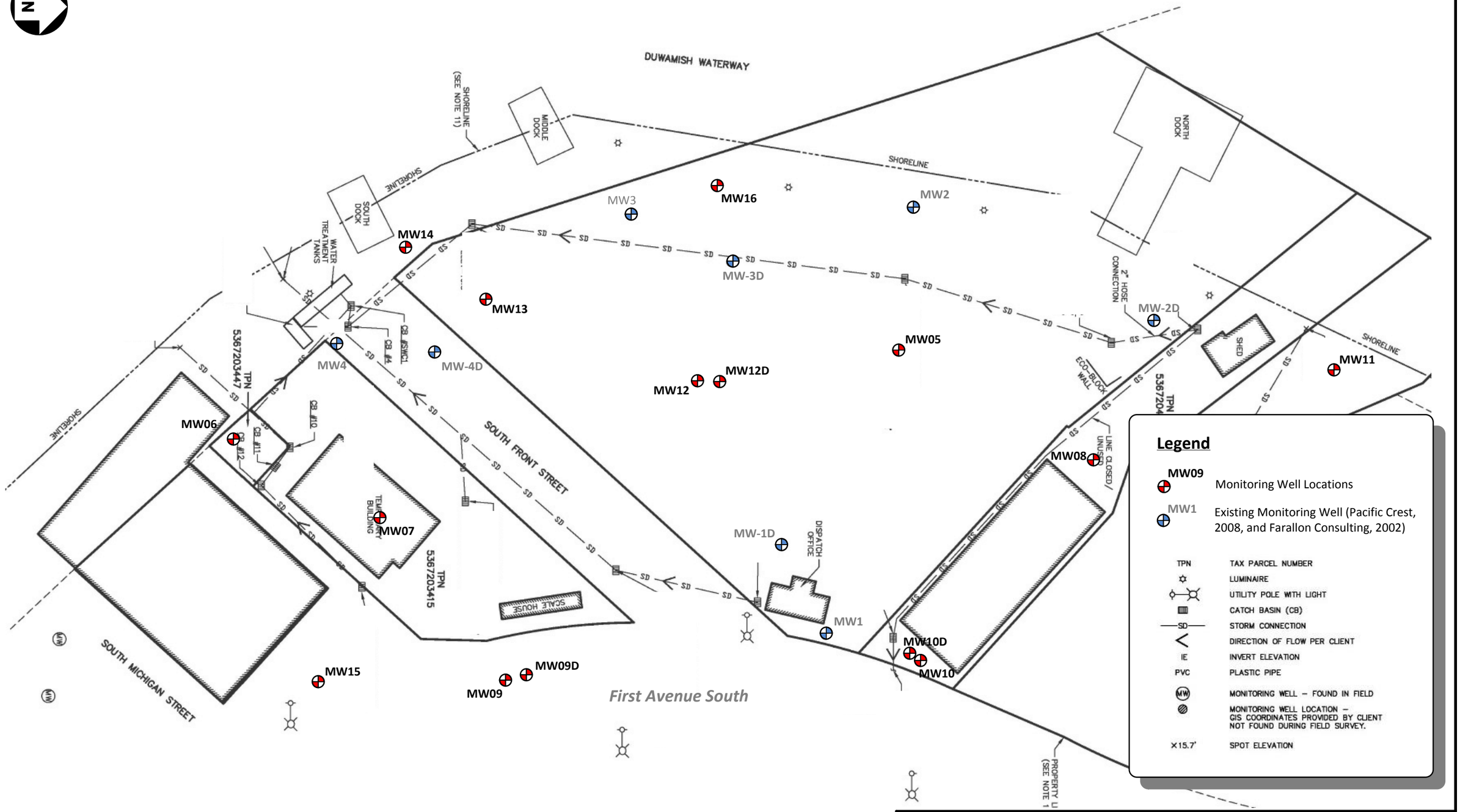
DRAWN BY: CPS

DATE: 02/20/09

SAMPSON TUG AND BARGE FACILITY
6361 1st AVE. S., SEATTLE, WA

SHEET NO: 3

CPS February 20, 2009 – C:\clients\Greylock\Samson_revised.dwg



Legend

MW09 Monitoring Well Locations

MW1 Existing Monitoring Well (Pacific Crest, 2008, and Farallon Consulting, 2002)

TPN	TAX PARCEL NUMBER
☼	LUMINAIRE
	UTILITY POLE WITH LIGHT
	CATCH BASIN (CB)
—SD—	STORM CONNECTION
	DIRECTION OF FLOW PER CLIENT
IE	INVERT ELEVATION
PVC	PLASTIC PIPE
(MW)	MONITORING WELL – FOUND IN FIELD
	MONITORING WELL LOCATION – GIS COORDINATES PROVIDED BY CLIENT NOT FOUND DURING FIELD SURVEY.
×15.7'	SPOT ELEVATION

g-logics

Note: This figure contains information in color. Black & white photocopies may not be suitable for review.

Approximate Drawing Scale: 1" = 60'

0 ft. 36 ft. 60 ft. 120 ft.

Monitoring Well Locations
Duwamish River Marine Center Property
6365 First Avenue South
Seattle, WA

Figure 2

Project File: 01-0979-C-RT-F2.vsd

Mapping Reference: PLS, Inc. Survey Dated 9/2/2015

*Precautions the employees may take to lessen the possibility of exposure by usage of appropriate protective measures.

Anyone having questions about this plan please contact the terminal manager, tug captain or port captain. We will use this plan as a guideline to protect our employees from the dangers of any chemical product we may use in our operation. This plan should be available for all crews to read and should be available for any inquiries by OSHA.

X. Hazardous Material Spill Notification

An oil or hazardous material spill in a terminal yard or into the water from a terminal or a vessel will be reported as directed in the following instructions:

1. Oil/Haz Spill T/B Annahootz - SOPEP
2. Oil/Haz Spill Deck Cargo Barges - Shipboard Oil Pollution Emergency Plan
3. Oil/Haz Spill Terminals or Unattached Tugs - Take the following action:

A. Action Steps:

- Shut off ignition sources
- Warn people in area
- Contain the spill
- Notify company and agencies
- Stop the product flow
- Use personal protection equipment
- Obtain any assistance needed
- Complete the spill report

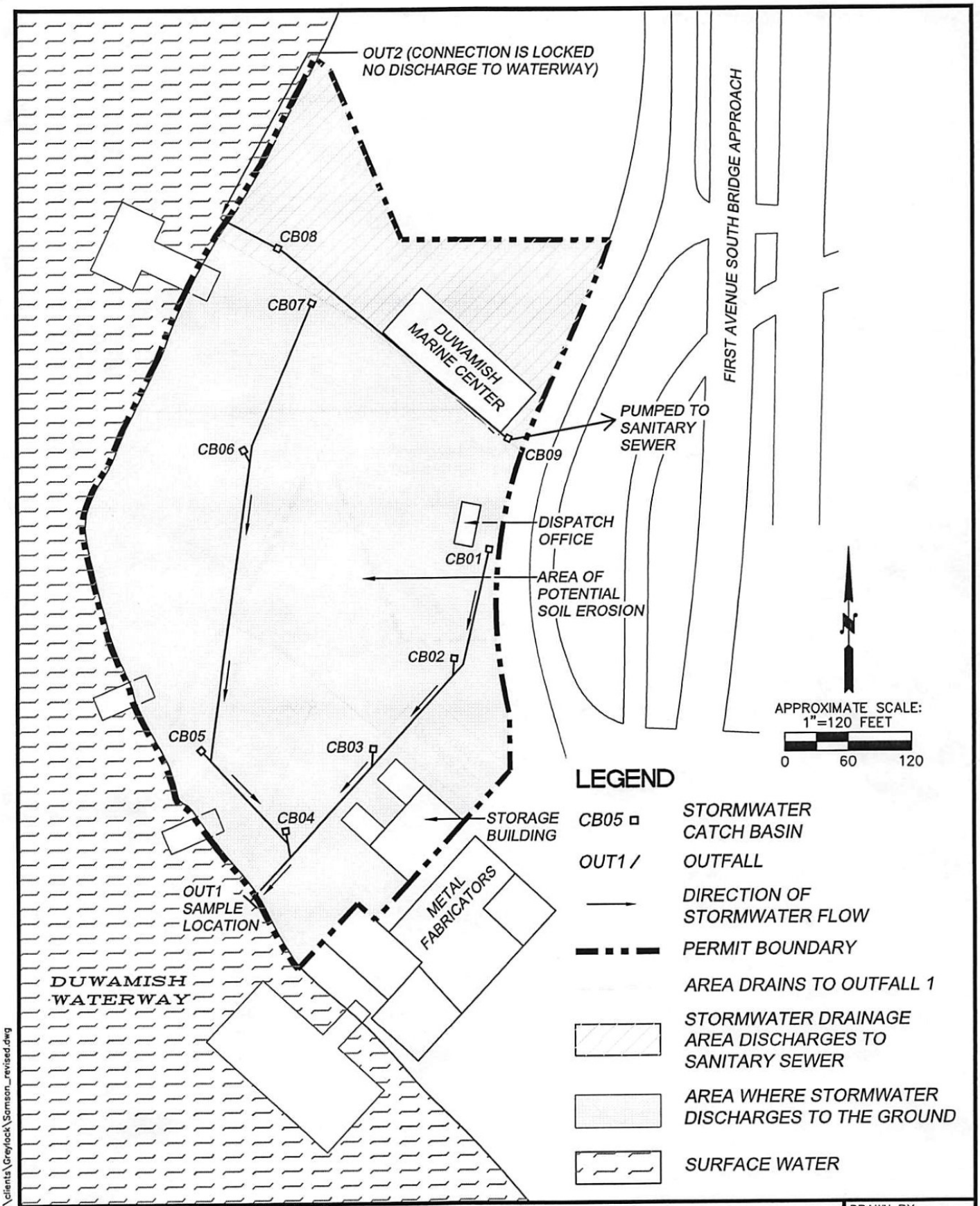
B. Notification - notify appropriate personnel and agencies as soon as possible and commence response action.

Sitka office:	Phone 907-747-8559 Fax 907-747-5370
Port Captain Wally Stilson:	907-747-5048 (h) 907-738-3380 (c)
USCG National Response:	1-800-424-8802
Alaska Dept. Of Environmental Conservation:	1-800-478-9300
Washington Dept. Emergency Services:	1-800-258-5990
Washington Maritime:	206-448-7557; Channel 20 VHF Radio
USCG MSO Seattle:	206-217-6232
USCG MSO Juneau:	907-463-2450
USCG MSO Anchorage:	907-271-6700
USCG MSO Valdez:	907-835-4793
USCG MSO Kodiak:	907-487-5750

ADEC Juneau:	907-465-5340
Anchorage:	907-349-7755
Kodiak:	907-486-6760 Fax 907-486-6749

C. Record and provide the information from the Time Line Sheet to the Port Captain when making notification. Continue to use the Time Line Sheet throughout the incident. This will become part of the official record of a spill.

D. Post Spill Action - Provide written report to Port Captain on incident including copy of Time Line Sheet, response taken, amount of oil recovered, amount of time and equipment expended. Include copies of state or federal documents.



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greylockllc@comcast.net

GREYLOCK CONSULTING LLC
Water Resources & Environmental Services

TITLE: FIGURE 2 - STORM WATER DRAINAGE

DRAWN BY: CPS

DATE: 02/20/09

SAMPSON TUG AND BARGE FACILITY
6361 1st AVE. S., SEATTLE, WA

SHEET NO: 2

CPS February 20, 2009 - C:\clients\Greylock\Samson_revised.dwg

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STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
PO Box 47600 • Olympia, WA 98504-7600 • 360-407-6000
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December 3, 2014

Kirk Miles
Terminal Manager
Samson Tug And Barge Company Inc
6361 1st Ave S
Seattle, WA 98108-3228

Facility Name: SAMSON TUG & BARGE SEATTLE FAC
Location: 6361 1ST AVE S
Seattle, WA 98108-3282
Permit No: WAR011484
County: King

RE: Reissuance of Coverage under the Industrial Stormwater General Permit

Dear Kirk Miles:

The Washington Department of Ecology (Ecology) has reissued the Industrial Stormwater General Permit (permit). A copy of your new permit is enclosed. **Retain this letter with your permit and Stormwater Pollution Prevention Plan. It is the official record of permit coverage for your facility.** Ecology issued the final permit December 3, 2014 and it becomes effective January 2, 2015.

Permit Overview
The new permit has a number of changes. The most significant changes are summarized in the enclosed "Summary of Changes" table. You can find more information on Ecology's website at: http://www.ecy.wa.gov/programs/wq/stormwater/industrial/index.html. Please contact Ecology if you have any questions.

New Reporting Requirements
Beginning in 2015, you must submit Discharge Monitoring Reports and Annual Reports electronically, using Ecology's Water Quality Permitting Portal– Permit Submittals application, unless a waiver from electronic reporting has been granted. You can find more information regarding Ecology's Water Quality Permitting Portal on our website at: http://www.ecy.wa.gov/programs/wq/permits/paris/webdmr.html.

If you have technical questions regarding Ecology's Water Quality Permitting Portal, please contact the portal staff at (800) 633-6193/option 3 or email WQWebPortal@ecy.wa.gov.

Site Specific Monitoring Requirements
Enclosed is a summary of the monitoring requirements for your facility. This summary is based on the best information available to Ecology about your facility. If you believe there is a discrepancy between what the permit requires and the enclosed summary, please contact Ecology immediately. In the case of a difference between the permit as applied to your facility and the summary, the permit requirements take precedence.

Your Right to Appeal the Permit
You have a right to appeal the terms and conditions of this general permit to the Pollution Control Hearing Board (PCHB) within 30 days of the date of receipt of this permit issuance notice. The appeal process is governed by Chapter 43.21B RCW and Chapter 371-08 WAC. "Date of receipt" is defined in RCW 43.21B.001(2).

To appeal you must do the following within 30 days of the date of receipt of this notice:

- File your appeal and a copy of this notice with the PCHB (see addresses below). Filing means actual receipt by the PCHB during regular business hours.
- Serve a copy of your appeal and this notice on Ecology in paper form - by mail or in person. (See addresses below.) E-mail is not accepted.

Address and Location Information

Street Addresses	**Mailing Addresses**
Department of Ecology Attn: Appeals Processing Desk 300 Desmond Drive SE Lacey, WA 98503	**Department of Ecology** Attn: Appeals Processing Desk PO Box 47608 Olympia, WA 98504-7608
Pollution Control Hearings Board 1111 Israel Road SW, Suite 301 Tumwater, WA 98501	**Pollution Control Hearings Board** PO Box 40903 Olympia, WA 98504-0903

For Additional Information or Assistance
Ecology is committed to providing assistance to you. Please review our web page at http://www.ecy.wa.gov/programs/wq/stormwater/industrial/index.html. For questions about transfers, terminations, and other administrative issues, please contact Josh Klimek at jokl461@ecy.wa.gov or (360) 407-7451.

If you have questions regarding stormwater management issues at your site, please contact Greg Stegman at GSTE461@ecy.wa.gov or (425) 649-7019.

Questions
If you have questions regarding the permit, please contact Jeff Killelea at jeff.killelea@ecy.wa.gov or (360) 407-6127.

Sincerely,

Bill Moore, P.E., Manager
Program Development Services Section
Water Quality Program

Enclosures

Permit No: WAR011484
Facility Name: SAMSON TUG & BARGE SEATTLE FAC
Location: 6361 1ST AVE S
Seattle, WA 98108-3282
SIC Codes: 4491

Summary of Your Facility's ISGP Monitoring Requirements

This summary is based on the best information available to Ecology about your facility. If you believe there is a discrepancy between what the permit requires and the enclosed summary, please contact Ecology immediately. In the case of a difference between the permit as applied to your facility and the summary, the permit requirements take precedence.

Benchmarks and Sampling Requirements Applicable to All Facilities (Condition S5, Table 2)

Parameter	Units	Benchmark Value	Analytical Method	Laboratory Quantitation Level[1]
Turbidity	NTU	25	EPA 180.1 Meter	0.5
pH	SU	Between 5.0 - 9.0	Meter/Paper[2]	±0.5
Oil Sheen	Yes/No	No visible oil sheen	N/A	N/A
Copper, Total	µg/L	Western WA: 14 Eastern WA: 32	EPA 200.8	2.0
Zinc, Total	µg/L	117	EPA 200.8	2.5

[1]The Permittee shall ensure laboratory results comply with the quantitation level (QL) specified in the table. However, if an alternate method from 40 CFR Part 136 is sufficient to produce measurable results in the sample, the Permittee may use that method for analysis. If the Permittee uses an alternative method it must report the test method and QL on the discharge monitoring report.
[2]Permittees shall use either a calibrated pH meter or narrow-range pH indicator paper with a resolution not greater than ± 0.5 Standard Units.

Industry-Specific Benchmarks and Sampling Requirements (Condition S5, Table 3)

Parameter	Units	Benchmark Value	Analytical Method	Laboratory Quantitation Level[1]
Petroleum Hydrocarbons	mg/L	10	ECY NWTPH Dx	0.1

[1]The Permittee shall ensure laboratory results comply with the quantitation level (QL) specified in the table. However, if an alternate method from 40 CFR Part 136 is sufficient to produce measurable results in the sample, the Permittee may use that method for analysis. If the Permittee uses an alternative method it must report the test method and QL on the discharge monitoring report.

Sampling and Effluent Limits Applicable to Discharges to 303(d)-listed Waters (Condition S6, Table 6)

Parameter	Units	Maximum Daily[1]	Analytical Method[2]	Laboratory Quantitation Level[3]	Impairment Type
Total Suspended Solids (TSS)	mg/L	30	SM 2540 D	5	303(d)/Puget Sound Sediment Cleanup

[1]Maximum daily effluent limit means the highest allowable daily discharge. The daily discharge means the discharge of a pollutant measured during a calendar day. The daily discharge is the average measurement of the pollutant over the day; this does not apply to pH.
[2]Or other equivalent method with the same reporting level.
[3]The Permittee shall ensure laboratory results comply with the quantitation level (QL) specified in the table. However, if an alternate method from 40 CFR Part 136 is sufficient to produce measurable results in the sample, the Permittee may use that method for analysis. If the Permittee uses an alternative method it must report the test method and QL on the discharge monitoring report.

Additional Sampling

Ecology may have established site-specific sampling requirements in addition to those contained in the ISGP (Administrative Order, permit modification, etc.). These additional requirements are not addressed in this summary.

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STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
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December 3, 2014

James Gilmur
President
Duwamish Metal Fabrication
16 S Michigan St
Seattle, WA 98108-3256

Facility Name: Duwamish Metal Fabrication
Location: 16 S MICHIGAN ST
Seattle, WA 98108
Permit No: WAR125423
County: King

RE: Reissuance of Coverage under the Industrial Stormwater General Permit

Dear James Gilmur:

The Washington Department of Ecology (Ecology) has reissued the Industrial Stormwater General Permit (permit). A copy of your new permit is enclosed. **Retain this letter with your permit and Stormwater Pollution Prevention Plan. It is the official record of permit coverage for your facility.** Ecology issued the final permit December 3, 2014 and it becomes effective January 2, 2015.

Permit Overview
The new permit has a number of changes. The most significant changes are summarized in the enclosed "Summary of Changes" table. You can find more information on Ecology's website at: http://www.ecy.wa.gov/programs/wq/stormwater/industrial/index.html. Please contact Ecology if you have any questions.

New Reporting Requirements
Beginning in 2015, you must submit Discharge Monitoring Reports and Annual Reports electronically, using Ecology's Water Quality Permitting Portal– Permit Submittals application, unless a waiver from electronic reporting has been granted. You can find more information regarding Ecology's Water Quality Permitting Portal on our website at: http://www.ecy.wa.gov/programs/wq/permits/paris/webdmr.html.

If you have technical questions regarding Ecology's Water Quality Permitting Portal, please contact the portal staff at (800) 633-6193/option 3 or email WQWebPortal@ecy.wa.gov.

Site Specific Monitoring Requirements
Enclosed is a summary of the monitoring requirements for your facility. This summary is based on the best information available to Ecology about your facility. If you believe there is a discrepancy between what the permit requires and the enclosed summary, please contact Ecology immediately. In the case of a difference between the permit as applied to your facility and the summary, the permit requirements take precedence.

Your Right to Appeal the Permit
You have a right to appeal the terms and conditions of this general permit to the Pollution Control Hearing Board (PCHB) within 30 days of the date of receipt of this permit issuance notice. The appeal process is governed by Chapter 43.21B RCW and Chapter 371-08 WAC. "Date of receipt" is defined in RCW 43.21B.001(2).

To appeal you must do the following within 30 days of the date of receipt of this notice:

- File your appeal and a copy of this notice with the PCHB (see addresses below). Filing means actual receipt by the PCHB during regular business hours.
- Serve a copy of your appeal and this notice on Ecology in paper form - by mail or in person. (See addresses below.) E-mail is not accepted.

Address and Location Information

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Pollution Control Hearings Board 1111 Israel Road SW, Suite 301 Tumwater, WA 98501	**Pollution Control Hearings Board** PO Box 40903 Olympia, WA 98504-0903

For Additional Information or Assistance
Ecology is committed to providing assistance to you. Please review our web page at http://www.ecy.wa.gov/programs/wq/stormwater/industrial/index.html. For questions about transfers, terminations, and other administrative issues, please contact Josh Klimek at jokl461@ecy.wa.gov or (360) 407-7451.

If you have questions regarding stormwater management issues at your site, please contact Greg Stegman at GSTE461@ecy.wa.gov or (425) 649-7019.

Questions
If you have questions regarding the permit, please contact Jeff Killelea at jeff.killelea@ecy.wa.gov or (360) 407-6127.

Sincerely,

Bill Moore, P.E., Manager
Program Development Services Section
Water Quality Program

Enclosures

Permit No: WAR125423
Facility Name: Duwamish Metal Fabrication
Location: 16 S MICHIGAN ST
Seattle, WA 98108
SIC Codes: 3449

Summary of Your Facility's ISGP Monitoring Requirements

This summary is based on the best information available to Ecology about your facility. If you believe there is a discrepancy between what the permit requires and the enclosed summary, please contact Ecology immediately. In the case of a difference between the permit as applied to your facility and the summary, the permit requirements take precedence.

Benchmarks and Sampling Requirements Applicable to All Facilities (Condition S5, Table 2)

Parameter	Units	Benchmark Value	Analytical Method	Laboratory Quantitation Level[1]
Turbidity	NTU	25	EPA 180.1 Meter	0.5
pH	SU	Between 5.0 - 9.0	Meter/Paper[2]	±0.5
Oil Sheen	Yes/No	No visible oil sheen	N/A	N/A
Copper, Total	µg/L	Western WA: 14 Eastern WA: 32	EPA 200.8	2.0
Zinc, Total	µg/L	117	EPA 200.8	2.5

[1]The Permittee shall ensure laboratory results comply with the quantitation level (QL) specified in the table. However, if an alternate method from 40 CFR Part 136 is sufficient to produce measurable results in the sample, the Permittee may use that method for analysis. If the Permittee uses an alternative method it must report the test method and QL on the discharge monitoring report.
[2]Permittees shall use either a calibrated pH meter or narrow-range pH indicator paper with a resolution not greater than ± 0.5 Standard Units.

Industry-Specific Benchmarks and Sampling Requirements (Condition S5, Table 3)

Parameter	Units	Benchmark Value	Analytical Method	Laboratory Quantitation Level[1]
Lead, Total	µg/L	81.6	EPA 200.8	0.5
Petroleum Hydrocarbons	mg/L	10	ECY NWTPH Dx	0.1

[1]The Permittee shall ensure laboratory results comply with the quantitation level (QL) specified in the table. However, if an alternate method from 40 CFR Part 136 is sufficient to produce measurable results in the sample, the Permittee may use that method for analysis. If the Permittee uses an alternative method it must report the test method and QL on the discharge monitoring report.

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Total Suspended Solids (TSS)	mg/L	30	SM 2540 D	5	303(d)/Puget Sound Sediment Cleanup

[1]Maximum daily effluent limit means the highest allowable daily discharge. The daily discharge means the discharge of a pollutant measured during a calendar day. The daily discharge is the average measurement of the pollutant over the day; this does not apply to pH.
[2]Or other equivalent method with the same reporting level.
[3]The Permittee shall ensure laboratory results comply with the quantitation level (QL) specified in the table. However, if an alternate method from 40 CFR Part 136 is sufficient to produce measurable results in the sample, the Permittee may use that method for analysis. If the Permittee uses an alternative method it must report the test method and QL on the discharge monitoring report.

Additional Sampling

Ecology may have established site-specific sampling requirements in addition to those contained in the ISGP (Administrative Order, permit modification, etc.). These additional requirements are not addressed in this summary.

APPENDIX E

Boring/Well Logs

The Riley Group, Inc.

Geotechnical Engineering • Environmental • Wetland Services

PRELIMINARY PHASE II SUBSURFACE INVESTIGATION

DUWAMISH MARINE CENTER PROPERTY
6365 FIRST AVENUE SOUTH
SEATTLE, WASHINGTON 98108

September 13, 2000

PREPARED BY:

The Riley Group, Inc.
10728 Lake City Way NE
Seattle, WA 98125

PREPARED FOR:

Mr. Jim Gilmur
% Duwamish Marine Center
16 South Michigan Street
Seattle, Washington 98108

Riley Project No. 2000-122

Test Pit TP-1

Logged by D. Holmes on July 17, 2000

Excavated using a Case 580 rubber-tired backhoe operated by Mr. Joe Koivu of Duwamish Marine Center.

Depth (feet)	Sample ID/ Interval	Moisture Content (%)	PID (ppm)	USCS	Soil Description
0				F (GP)	Sparse grass over brownish gray sandy gravel FILL to 4 inches.
1				F (SP)	Gravelly sand FILL to 1.0 feet, grayish brown, fine grained, pebble to cobble gravel, abundant debris including concrete, brick, wood, damp.
2	1.5'	11	8.0	F (GP)	**TP-1-1.5' (9:10)** Sandy gravel FILL to 2.3 feet, brownish gray, sand medium-grained, pebble to cobble gravel including basalt fragments, damp.
3	2.5'	15	0.0	F (SP)	**TP-1-2.5' (9:20)** Sand FILL to 3.2 feet with sparse gravel and wire debris, very dark gray, medium-grained, odor of decay, faint odor of hydrocarbons, damp (possible disturbed native soil).
4				F (SM)	Silty sand FILL with very sparse debris (brick fragments) to at least 5 feet, dark gray, medium- to fine-grained, damp (possible slightly disturbed native soil).
5	4.5'		5.0		**TP-1-4.5' (9:30)**
6					

Total depth of excavation: 5.0 feet. Unit breaks are based upon visual observations of soil color, texture, and amount of debris present.

The Riley Group, Inc.
10728 LAKE CITY WAY NE
SEATTLE, WASHINGTON 98125

Duwamish Marine Center Property

Riley Project # 2000-122	*Log of Test Pit TP-1*	*Figure A-1*
Logged by: D. Holmes	*Date Logged: 7/17/2000*	
Site Address: 6365 First Avenue South, Seattle, Washington 98108		

Test Pit TP-2

Logged by D. Holmes on July 17, 2000

Excavated using a Case 580 rubber-tired backhoe operated by Mr. Joe Koivu of Duwamish Marine Center.

Depth (feet)	Sample ID/ Interval	Moisture Content (%)	PID (ppm)	USCS	Soil Description
1				F (GP)	Sandy gravel/gravelly sand FILL to 1 foot, light brownish gray, medium grained, pebble gravel, minor metal debris, dry.
2	2'		0.0	F (SP)	Sand FILL to 3.25 feet, brown, medium- to fine-grained, minor pebble gravel, minor debris including cardboard, concrete fragments, brick fragments, damp. **TP-2-2' (10:00)**
3					
4	3.5'	12	2.1	F (GP)	**TP-2-3.5' (10:05)** Sandy Gravel FILL to 4.2 feet, dark gray, cobble gravel, sand medium-grained, very dark gray, abundant debris including concrete, pipe fragments, wood, glass, brick, wire, etc., some dense silty lenses, damp.
5	4.5'	18	4.1	F (SP)	**TP-2-4.5' (10:10)** Sand FILL to 5.0 feet, grayish brown, medium-grained, minor debris as above, damp.
6	5.5'	22	4.0	F (SP)	Sand FILL to at least 7.0 feet, very dark gray, medium-grained, slightly moist (possible native soil). **TP-2-5.5' (10:15)**
7					

Total depth of excavation: 7.0 feet. Unit breaks are based upon visual observations of soil color, texture and amount of debris present.

The Riley Group, Inc.
10728 LAKE CITY WAY NE
SEATTLE, WASHINGTON 98125

Duwamish Marine Center Property

Riley Project # 2000-122	*Log of Test Pit TP-2*	*Figure A-2*
Logged by: D. Holmes	*Date Logged: 7/17/2000*	
Site Address: 6365 First Avenue South, Seattle, Washington 98108		

Test Pit TP-3

Logged by D. Holmes on July 17, 2000

Excavated using a Case 580 rubber-tired backhoe operated by Mr. Joe Koivu of Duwamish Marine Center.

Depth (feet)	Sample ID/ Interval	Moisture Content (%)	PID (ppm)	USCS	Soil Description
1				F (GP)	Sandy gravel FILL to 1 foot, light brown, medium grained, pebble gravel, minor metal debris, dry.
2				F (GP)	Sandy gravel FILL to at least 6.5 feet bgs, very dark gray, medium-grained, pebble gravel, decreasing gravel to 2.5 feet bgs, slightly moist, increasing moisture with depth to moist at 6.5 feet.
3					
4				F (SP)	
5					
6	5.5'	15	6.3		**TP-3-5.5' (10:15)** Sand FILL as above, debris includes rubber, cans, metal cuttings, wood, concrete fragments. @ 6.5' - encountered large concrete clast and backfilled excavation.
7					

Total depth of excavation: 6.5 feet. Unit breaks are based upon visual observations of soil color, texture and amount of debris present.

The Riley Group, Inc.
10728 LAKE CITY WAY NE
SEATTLE, WASHINGTON 98125

Duwamish Marine Center Property

Riley Project # 2000-122	*Log of Test Pit TP-3*	*Figure A-3*
Logged by: D. Holmes	*Date Logged: 7/17/2000*	
Site Address: 6365 First Avenue South, Seattle, Washington 98108		

Test Pit TP-4

Logged by D. Holmes on July 17, 2000

Excavated using a Case 580 rubber-tired backhoe operated by Mr. Joe Koivu of Duwamish Marine Center.

Depth (feet)	Sample ID/ Interval	Moisture Content (%)	PID (ppm)	USCS	Soil Description
1				F (GP)	Sandy gravel FILL to 1 foot, light brown, medium grained, pebble gravel, minor metal debris, dry.
2	2'	19	27.0	F (SP)	Silty sand with gravel FILL to at least 3.5 feet bgs, black, medium-grained, very dark gray, medium-grained, pebble gravel, slightly moist, increasing moisture with depth. **TP-4-2' (11:30)** Black silty sand FILL as above, abundant metal cuttings/debris.
3					
4					@ 3.5' - encountered large concrete clast or a concrete slab and backfilled excavation.
5					
6					
7					

Total depth of excavation: 3.5 feet. Unit breaks are based upon visual observations of soil color, texture and amount of debris present.

The Riley Group, Inc.
10728 LAKE CITY WAY NE
SEATTLE, WASHINGTON 98125

Duwamish Marine Center Property

Riley Project # 2000-122	*Log of Test Pit TP-4*	*Figure A-4*
Logged by: D. Holmes	*Date Logged: 7/17/2000*	
Site Address: 6365 First Avenue South, Seattle, Washington 98108		

Boring B-1

Logged by D. Holmes on August 3, 2000
Driller: R & R Drilling

Drilled using Mobile B-61, 4.5" ID HSA with 140 lb. hammer.

Depth (feet)	Sample ID/ Interval	(N) Blows/ft	Moisture Content (%)/ Water Table	PID (ppm)	USCS	Soil Description
						Dust over brownish gray sandy gravel gravel (FILL), gravel pea to pebble sized, sand medium-grained, dry.
	1	50/4"		na		1 - No recovery, probable sandy gravel fill, very dense. (8:35)
5	2	77/10"		0.3	F (GP)	2 - Sandy gravel FILL, gray, gravel pea-sized to pebble, sand fine-grained, dry, very dense. (8:45)
	3	28		0.3		3 - Sandy pebble gravel FILL, dark gray, sand fine- to medium grained, minor silt and clay, sheet metal noted in sample, damp, medium dense. (9:00)
10	4	17	▼	0.0		4 - Clayey sandy pebble gravel FILL, dark grayish brown, sand medium- to fine-grained, wet, medium dense. (9:10)
	5	68/10"		na	F (SM)	5 - Silty sand/sandy silt FILL, very dark gray, sand fine-grained, pebble in sample shoe, very little recovery, wet, very dense. (9:15)
	6	50/4"		12.6	F (GP)	@ 14' - refusal (drilling through wire rope). 6 - Sandy pea gravel FILL, black, abundant wood and wire rope fragments, sand medium- to coarse-grained, sheen present, pizza-like odor noted, very dense. (9:30)
15						
20						

Boring terminated at 14.3 feet. Groundwater encountered at 10.5 feet bgs. A groundwater sample was not retreivable. Groundwater exhibited a very faint sheen. Boring located 8 feet east of the south edge of the north dock.

The Riley Group, Inc.
10728 LAKE CITY WAY NE
SEATTLE, WASHINGTON 98125

Duwamish Marine Center Property

Riley Project # 2000-122	*Log of Boring B-1*	*Figure A-5*
Logged by: D. Holmes	*Date Logged: 8/3/2000*	
Site Address: 6365 First Avenue South, Seattle, Washington 98108		

Boring B-2

Logged by D. Holmes on August 3, 2000.
Driller: R & R Drilling

Drilled using Mobile B-61, 4.5" ID HSA with 140 lb. hammer.

Depth (feet)	Sample ID/ Interval	(N) Blows/ft	Moisture Content (%)/ Water Table	PID (ppm)	USCS	Soil Description
						Tan-colored sandy pebble gravel FILL, sand fine- to medium-grained, machine shop-type metal cuttings present in drill cuttings at a depth of 8 inches. Extremely hard drilling to 3.0 feet.
	1	36	7.0	132	F (GP & SP)	1 - Gravelly sand FILL with wood fragments and metal cuttings, black, sand medium-grained, pebble gravel, dense, damp. (10:40)
5						@ 6' - very hard drilling with abundant metal cuttings in drill cuttings.
	2	26		53.2	SP	2 - Upper 6": Wood and rubber tire fragments in a sand matrix (FILL). Lower 12": SAND, very dark gray to black, medium-fine-grained, damp, medium dense. (10:50)
10			▼			
	3	12		1.5	ML	3 - SILT with very fine-grained sand, brownish gray, moderate to high plasticity, very moist, stiff. (10:55)
15						
	4	35		0.0	SP	4 - SAND, very dark gray to black, medium- to medium-coarse-grained, 1.5-inch thick silt bed and 1.5" peat bed present in center of sample (both light brown), wet, dense. (11:05)
20						

Boring terminated at 19.0 feet. Groundwater encountered at 10.8 feet bgs. Groundwater sample B-2-W obtained at 11:15. Boring located 84 feet south of the adjacent Burgess Enterprises building.

The Riley Group, Inc.
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SEATTLE, WASHINGTON 98125

Duwamish Marine Center Property

Riley Project # 2000-122	*Log of Boring B-2*	*Figure A-6*
Logged by: D. Holmes	*Date Logged: 8/3/2000*	
Site Address: 6365 First Avenue South, Seattle, Washington 98108		

Boring B-3

Logged by D. Holmes on August 3, 2000
Driller: R & R Drilling

Drilled using Mobile B-61, 4.5" ID HSA with 140 lb. hammer.

Depth (feet)	Sample ID/ Interval	(N) Blows/ft	Moisture Content (%)/ Water Table	PID (ppm)	USCS	Soil Description
						Brush and 5/8" crushed rock over gray sandy pebble gravel fill, sand medium grained, very hard drilling to 7.0'.
	1	50/5"		na		1 - No recovery, probable sandy gravel fill, very dense. (12:35)
5						@ 5' to 5.5' - white rock fragments (quartzite) in cuttings along with T-shirt and rag fragments. Very difficult drilling.
						@ 7' - cuttings become fine-grained sand.
	2	11		0.0		2 - Gravelly sand with silt (FILL), grayish brown, medium- to fine-grained, pebble gravel, glass fragments present, damp, medium dense. (13:05)
10			▼		F (GP & SP)	@ 10' - encountered black sand fill with pizza-like odor.
	3	30		0.0		3 - Gravel with silt and sand (FILL), black, sand medium- to coarse-grained, pebble gravel, glass fragments present, faint pizza-like odor noted, wet, medium dense. (13:15)
15						
	4	30		0.0		4 - Silty sand (FILL), black, medium to fine-grained, minor pebble gravel present, "greasy" appearance, glass and wood fragments present, pizza-like odor noted, wet, medium dense. (13:20)
20						
						@ 21' - cuttings become silty sand, probable fill/native soil interface.
	5	23		0.0	SP	5 - SAND, black, medium- to coarse grained, slight "greasy" appearance, wet, very faint pizza-like odor noted, wet, medium dense. (13:35)

Boring terminated at 24.0 feet. Groundwater encountered at 12.0 feet bgs. Groundwater sample B-3-W obtained at 13:45. Noticeable sheen on groundwater. Boring located 180 feet west-northwest of boring B-2 and 100 feet south-southwest of boring B-1.

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SEATTLE, WASHINGTON 98125

Duwamish Marine Center Property

Riley Project # 2000-122	*Log of Boring B-3*	*Figure A-7*
Logged by: D. Holmes	*Date Logged: 8/3/2000*	
Site Address: 6365 First Avenue South, Seattle, Washington 98108		

Boring B-4

Logged by D. Holmes on August 3, 2000
Driller: R & R Drilling

Drilled using Mobile B-61, 4.5" ID HSA with 140 lb. hammer.

Depth (feet)	Sample ID/ Interval	(N) Blows/ft	Moisture Content (%)/ Water Table	PID (ppm)	USCS	Soil Description
						Dust over brownish gray sandy gravel gravel (FILL), gravel pea to pebble sized, sand medium-grained, dry.
	1	50/6"		na	F	1 - No recovery, sample was one large fragment of basalt (FILL), very dense. (14:35)
5						
	2	34	▼	na		2 - No recovery, sample was large basalt fragment with approximately 1-ounce of brown, medium-grained sand (FILL), dense. (14:45)
10	3	8		0.0	OL	3 - Organic silty CLAY, brown, moderately plastic, damp, medium soft, damp. (15:15)
						@ 12' - cuttings are medium-grained black sand to 14.5 feet.
					SP	
15	4	9		0.0	OH	4 - As sample 3 above, highly plastic, wood fibers present, wet, stiff. (15:20)
20						

Boring terminated at 16.5 feet. Groundwater encountered at 9.25 feet bgs. Groundwater was not sampled. Boring located 68 feet northeast of the south edge of the middle dock.

The Riley Group, Inc.
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SEATTLE, WASHINGTON 98125

Duwamish Marine Center Property

Riley Project # 2000-122	*Log of Boring B-4*	*Figure A-8*
Logged by: D. Holmes	*Date Logged: 8/3/2000*	
Site Address: 6365 First Avenue South, Seattle, Washington 98108		

FARALLON CONSULTING
Quality Service for Environmental Solutions

320 3rd Ave. NE, Suite 200
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SITE CLOSURE REPORT

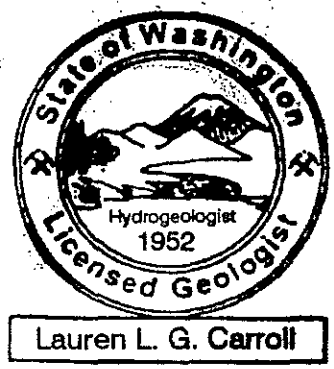
GILMUR/HALE FAMILY TRUST SITE
6365 FIRST AVENUE SOUTH
SEATTLE, WASHINGTON

Submitted by:
Farallon Consulting, L.L.C.
320 3rd Avenue NE, Suite 200
Issaquah, Washington 98027

Farallon PN: 781-001

For:
Mr. Jim Gilmur
16 South Michigan Street
Seattle, Washington 98108

September 25, 2002



Prepared by:

Lauren Carroll
Senior Hydrogeologist

Reviewed by:

Peter Jewett
Principal

FARALLON CONSULTING
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Issaquah, WA 98027

LOG OF BORING B-1

Gilmur/Hale Family Trust
6365 1st Avenue South
Seattle, Washington

Farallon PN: 781-001

Logged By: Jim Pender

Date/Time Started : 3-13-02/1030
Date/Time Completed : 3-13-02/1050
Drilling Company : Cascade Drilling
Drilling Forman : Casey Goble
Drilling Method : Geoprobe with autohammer

Sampler Type : 1.5" splitspoon
Depth Of Water ATD - : 7.5'
Total Depth : 9'

Depth in Feet	Sample Interval	Time	% Recovery	Sample ID	Sample Analyzed	PID (units)	USCS	GRAPHIC	DESCRIPTION	Water Level
0		1035	70	B1-0-3	Y	0	GM		Gravelly SILT with sand, medium brown-gray, slightly moist, plastic debris (Fill)	
							SW		SAND, poorly sorted medium sand, gray (Fill)	
		1040	10	B1-3-6		0			Woody debis, some plastic, creosote-like odor (Fill)	
5							SM		SILT/SAND with debris, blackish-brown (Fill)	
			75			0	SW		SAND with silt, very fine, wet, gray, no odor (Fill)	▼
10										
15										

ABBREVIATIONS

LOG OF BORING B-1

(Page 1 of 1)

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LOG OF BORING B-2

Gilmur/Hale Family Trust
6365 1st Avenue South
Seattle, Washington

Farallon PN: 781-001

Logged By: Jim Pender

Date/Time Started	: 3-13-02/1000	Sampler Type	: 1.5" splitspoon
Date/Time Completed	: 3-13-02/1025	Depth Of Water ATD	: 7.0'-7.5'
Drilling Company	: Cascade Drilling	Total Depth	: 12'
Drilling Forman	: Casey Goble		
Drilling Method	: Geoprobe with autohammer		

Depth in Feet	Sample Interval	Time	% Rec-overy	Sample ID	Sample Analyzed	PID (units)	USCS	GRAPHIC	DESCRIPTION	Depth in Feet	Water Level
0							GM		Silty sandy GRAVEL, fine sand, dark brown, gray, light brown in color (Fill)	0	
		1005	80	B2-0-3	Y	0	SW		SAND, fine, orangish brown to dark brown, moist (Fill)		
							SM		Silty SAND, gray, trace gravel (angular), moist (Fill)		
							SM		Sand and silt, gray, moist (Fill)		
		1010	60	B2-3-6		0			Whitish, solid substance (fractured).		
5									Wood and glass debris, black, with sandy SILT, minor	5	
							GM		Sandy, silty GRAVEL (fractured), fine to coarse, fine sand, sub-round to angular (Fill)		
		1015	50	B2-6-9		0			Glass and plastic debris, wet (Fill)		
									Wet, more glass and plastic observed, minimal recovery, no sand (Fill)		
10			25			0				10	
15										15	
20										20	

ABBREVIATIONS

LOG OF BORING B-2

(Page 1 of 1)

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LOG OF BORING B-3

Gilmur/Hale Family Trust
6365 1st Avenue South
Seattle, Washington

Farallon PN: 781-001

Logged By: Jim Pender

Date/Time Started : 3-13-02/0900
Date/Time Completed : 3-13-02/0920
Drilling Company : Cascade Drilling
Drilling Forman : Casey Goble
Drilling Method : Geoprobe with autohammer

Sampler Type : 1.5" splitspoon
Depth Of Water ATD : ~7.5'
Total Depth : 9'

Depth in Feet	Sample Interval	Time	% Rec-overy	Sample ID	Sample Analyzed	PID (units)	USCS	GRAPHIC	DESCRIPTION
0							SW		SAND, wet
							GW		GRAVEL, gray, slightly moist, angular and fractured (Fill)
		0905	100	B3-0-3	Y	2.0	SW		Silty, gravelly SAND, fine, fine to coarse gravel, dark brown to black, moist, metal and glass debris (Fill)
									Brick and metal debris (Fill)
5		0910	100	B3-3-6		0			SAND, dark brown to black, moist, fine to medium grained, well-graded (Fill)
		0915	90	B3-6-9		0	SW		
10									
15									
20									

Depth in Feet: 0, 5, 10, 15, 20

Water Level

ABBREVIATIONS

LOG OF BORING B-3

(Page 1 of 1)

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LOG OF BORING B-4

Gilmur/Hale Family Trust
6365 1st Avenue South
Seattle, Washington

Farallon PN: 781-001

Logged By: Jim Pender

Date/Time Started : 3-13-02/0930
Date/Time Completed : 3-13-02/0950
Drilling Company : Cascade Drilling
Drilling Forman : Casey Goble
Drilling Method : Geoprobe with autohammer

Sampler Type : 1.5" splitspoon
Depth Of Water ATD : ~8.0'
Total Depth : 9'

Depth in Feet	Sample Interval	Time	% Recovery	Sample ID	Sample Analyzed	PID (units)	USCS	GRAPHIC	DESCRIPTION	Depth in Feet	Water Level
0							GM		Sandy GRAVEL with silt, fine to coarse gravel, fine sand, light to dark brown, moist, subround to fractured angular (Fill)	0	
		0940	100	B4-0-3	Y	5.0	SM		Silty SAND, dark brown to black, moist, light petroleum-like odor (Fill)		
							SP		SAND, fine to medium, well sorted, black-gray, very moist, no odor (Fill)		
5		0945	100	B4-3-6		0	SW		SAND with a trace amount of coarse rounded gravel (Fill)	5	
							SW		SAND, blackish gray (Fill)		
		0950	90	B4-6-9		0	SW		Silty SAND, dark brown (sharp contact) (Fill)		
							SW		SAND, fine to medium, well sorted, black-gray, very moist, no odor, visible contact (Fill)		
							SW		SILT with trace organics, wet, gray, no odor, (Fill)		
10										10	
15										15	
20										20	

ABBREVIATIONS

LOG OF BORING B-4

(Page 1 of 1)

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LOG OF BORING B-5

Gilmur/Hale Family Trust
6365 1st Avenue South
Seattle, Washington

Farallon PN: 781-001

Logged By: Jim Pender

Date/Time Started	: 3-13-02/1100	Sampler Type	: 1.5" splitspoon
Date/Time Completed	: 3-13-02/1130	Depth Of Water ATD	: 8.5'
Drilling Company	: Cascade Drilling	Total Depth	: 9'
Drilling Forman	: Casey Goble		
Drilling Method	: Geoprobe with autohammer		

Depth in Feet	Sample Interval	Time	% Rec-overy	Sample ID	Sample Analyzed	PID (units)	USCS	GRAPHIC	DESCRIPTION
0							SW		SAND, medium brown (Fill)
			80			0	SM		Silty SAND with gravel, debris (plastic, rubber, metal, glass), brown to black, medium grained, well sorted, moist (Fill)
							Fill		Plastic, rubble, glass, and wood debris.
5		1110	60	B5-3-4	Y	150	SM		Silty SAND, fine to medium grained, black, with plastic and wood debris (Fill)
		1120	25	B5-6-9	Y	0	SM		Silty SAND, fine to medium grained, well graded, moist, with glass, wood, and plastic debris (Fill)
									No recovery from the bottom
10									
15									
20									

Depth in Feet: 0, 5, 10, 15, 20

Water Level: ▼ at 5

ABBREVIATIONS

LOG OF BORING B-5

(Page 1 of 1)

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LOG OF BORING B-6

Gilmur/Hale Family Trust
6365 1st Avenue South
Seattle, Washington

Farallon PN: 781-001

Logged By: Jim Pender

Date/Time Started	: 3-13-02/0815	Sampler Type	: 1.5" splitspoon
Date/Time Completed	: 3-13-02/0850	Depth Of Water ATD	: 7'-7.5'
Drilling Company	: Cascade Drilling	Total Depth	: 9'
Drilling Forman	: Casey Goble		
Drilling Method	: Geoprobe with autohammer		

Depth in Feet	Sample Interval	Time	% Rec-overy	Sample ID	Sample Analyzed	PID (units)	USCS	GRAPHIC	DESCRIPTION	Depth in Feet	Water Level
0							GM		Silty, Sandy GRAVEL, fine to coarse gravel, fine to coarse sand, subrounded to angular fractured, medium to dark brown, moist, no odor (Fill)	0	
		0835	75	B6-0-3	Y	0	SP		SAND, fine to medium grained well sorted, silt lens one inch thick at about two feet, brown to black, very moist, no odor (Fill)		
5		0840	80	B6-3-4		0	SP		SAND, fine to medium, well sorted, very moist, brown, with glass shards (Fill)	5	
		0845	80	B6-6-9		0	SP		Black, no odor (Fill)		
							ML		SILT, gray, wet (Fill)		
10										10	
15										15	
20										20	

ABBREVIATIONS

LOG OF BORING B-6

(Page 1 of 1)

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LOG OF BORING B-7

Gilmur/Hale Family Trust
6365 1st Avenue South
Seattle, Washington

Farallon PN: 781-001

Logged By: Jim Pender

Date/Time Started	: 3-13-02/1135	Sampler Type	: 1.5" splitspoon
Date/Time Completed	: 3-13-02/1200	Depth Of Water ATD	: ~10'
Drilling Company	: Cascade Drilling	Total Depth	: 11'(refusal)
Drilling Forman	: Casey Goble		
Drilling Method	: Geoprobe with autohammer		

Depth in Feet	Sample Interval	Time	% Rec-overy	Sample ID	Sample Analyzed	PID (units)	USCS	GRAPHIC	DESCRIPTION
0		1140	100	B7-2-4	Y	0	GM		Sandy GRAVEL with silt, fine to coarse grained, subround to subangular, light brown to light gray, slightly moist (Fill)
							SW		SAND, black , sharp contact with color change, debris with metal shavings (Fill)
5			100			0	ML		SILT, gray, stiff, slightly moist (Fill)
							FILL		Plastic, metal and woody debris.
		1150	100	B6-6-7.5	Y	0	SP		SAND, fine to medium, well sorted, black, moist (Fill)
							ML		Gravelly SAND, fine to medium well sorted black with woody debris and possibly some concrete (Fill)
10			50				SP		SAND, black wet, with no odor (Fill) Refusal at 11' bgs.
15									
20									

Depth in Feet: 0, 5, 10, 15, 20

Water Level: ▼ at 10

ABBREVIATIONS

LOG OF BORING B-7

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LOG OF BORING B-8

Gilmur/Hale Family Trust
6365 1st Avenue South
Seattle, Washington

Farallon PN: 781-001

Logged By: Jim Pender

Date/Time Started	: 3-13-02/1300	Sampler Type	: 1.5" splitspoon
Date/Time Completed	: 3-13-02/1325	Depth Of Water ATD	: NA
Drilling Company	: Cascade Drilling	Total Depth	: 9'
Drilling Forman	: Casey Goble		
Drilling Method	: Geoprobe with autohammer		

Depth in Feet	Sample Interval	Time	% Rec-overy	Sample ID	Sample Analyzed	PID (units)	USCS	GRAPHIC	DESCRIPTION
0							GW		Sandy GRAVEL, fine to coarse grained sand, subround to angular, medium brown to blue gray in color, wet (Fill)
		1300	60	B8-2-3	Y	0	SM		Sandy SILT/silty SAND, moist, dark brown in color, gray SILT at bottom two inches (Fill)
							ML		SILT, gray, moist (Fill)
							SW		SAND, coarse gravelly, light tan (Fill)
			20			0	Fill		Woody plywood debris
5							GW		Sandy GRAVEL, fine to coarse grained wet (possibly from puddle at ground surface) (Fill)
		1315		B8-7.5-9		0	Fill		Woody debris
							SP		SAND, fine to medium, well sorted, brown to black, moist (Fill)
10									
15									
20									

Depth in Feet | Water Level

ABBREVIATIONS

LOG OF BORING B-8

(Page 1 of 1)

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LOG OF BORING B-9

Gilmur/Hale Family Trust
6365 1st Avenue South
Seattle, Washington

Farallon PN: 781-001

Logged By: Jim Pender

Date/Time Started	: 3-13-02/1340	Sampler Type	: 1.5" splitspoon
Date/Time Completed	: 3-13-02/1350	Depth Of Water ATD	: NA
Drilling Company	: Cascade Drilling	Total Depth	: 5'(refusal)
Drilling Forman	: Casey Goble		
Drilling Method	: Geoprobe with autohammer		

Depth in Feet	Sample Interval	Time	% Rec-overy	Sample ID	Sample Analyzed	PID (units)	USCS	GRAPHIC	DESCRIPTION	Depth in Feet	Water Level
0							SW		Gravelly SAND, brown, fine to medium grained (Fill)	0	
							GM		GRAVEL with silt and sand, fine to coarse grained, moist (Fill)		
			100	B9-1.5-2	Y	0	SP		SAND, fine to medium grained, well sorted, light brown to black, moist (Fill)		
				B9-3-4.5		0	SM		SILT, interbedded with fine to medium grained, well sorted, dark brown to black, moist (Fill)		
5							ML		SILT with gravel and wood debris.	5	
10										10	
15										15	
20										20	

ABBREVIATIONS

LOG OF BORING B-9

(Page 1 of 1)

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LOG OF BORING B-10

Gilmur/Hale Family Trust
6365 1st Avenue South
Seattle, Washington

Farallon PN: 781-001

Logged By: Jim Pender

Date/Time Started : 3-13-02/1430
Date/Time Completed : 3-13-02/1450
Drilling Company : Cascade Drilling
Drilling Forman : Casey Goble
Drilling Method : Geoprobe with autohammer

Sampler Type : 1.5" splitspoon
Depth Of Water ATD : 8'
Total Depth : 9'

Depth in Feet	Sample Interval	Time	% Recovery	Sample ID	Sample Analyzed	PID (units)	USCS	GRAPHIC	DESCRIPTION
0							GW		Sandy GRAVEL, fine to course grained, light brown to blue gray to tan in color, subangular (Fill)
		1440	90	B10-1-3	Y	0	SP		SAND, fine to medium grained, well sorted, medium brown in color, moist (Fill)
5			40				SM		Silty SAND with minor amount of brick debris. Only 6" recovered (Fill)
			60				SP		SAND, fine to medium grained, well sorted, medium brown, wet below 7.5' (Fill)
10									
15									
20									

Depth in Feet | Water Level

ABBREVIATIONS

LOG OF BORING B-10

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08-14-2002 W:\Projects\781001 Duwamish Marine\Drawings_Plots\b-10.bor

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Issaquah, WA 98027

LOG OF BORING B-11

Gilmur/Hale Family Trust
6365 1st Avenue South
Seattle, Washington

Farallon PN: 781-001

Logged By: Jim Pender

Date/Time Started	: 3-14-02/1000	Sampler Type	: 1.5" splitspoon
Date/Time Completed	: 3-14-02/1025	Depth Of Water ATD	: 7.5'
Drilling Company	: Cascade Drilling	Total Depth	: 9'
Drilling Forman	: Casey Goble		
Drilling Method	: Geoprobe with autohammer		

Depth in Feet	Sample Interval	Time	% Recovery	Sample ID	Sample Analyzed	PID (units)	USCS	GRAPHIC	DESCRIPTION	Depth in Feet	Water Level
0										0	
		1005	100	B11-0-3	Y	0	SP		SAND, medium to coarse grained, well sorted, medium brown, moist (Fill)		
		1010	100	B11-3-6		0	SM		Gravelly Silty SAND with plastic, rubber, and glass debris (Fill)		
5		1015	75			0	SP		SAND, fine to medium grained, well sorted, color grades from medium gray to dark gray, grades from moist to wet (Fill)	5	▼
10										10	
15										15	
20										20	

ABBREVIATIONS

LOG OF BORING B-11

(Page 1 of 1)

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Issaquah, WA 98027

LOG OF BORING B-12

Gilmur/Hale Family Trust
6365 1st Avenue South
Seattle, Washington

Farallon PN: 781-001

Logged By: Jim Pender

Date/Time Started : 3-14-02/1040
Date/Time Completed : 3-14-02/1100
Drilling Company : Cascade Drilling
Drilling Forman : Casey Goble
Drilling Method : Geoprobe with autohammer

Sampler Type : 1.5" splitspoon
Depth Of Water ATD : 6.0'
Total Depth : 9.0'

Depth in Feet	Sample Interval	Time	% Rec-overy	Sample ID	Sample Analyzed	PID (units)	USCS	GRAPHIC	DESCRIPTION	Depth in Feet	Water Level
0		1045	60	B12-0-1	Y	0	SP		SAND, medium to course grained, well sorted, light tan, moist (Fill)	0	
		1046	60	B12-1-3		0	SM		Silty, Gravelly SAND, fine gravel, fine to coarse grained sand, blue-gray (Fill)		
		1050	50	B12-3-6		0	SP		SAND, medium to fine grained, well sorted, blue-gray		
5		1055	75	B12-6-9		0	SP		SAND, fine to medium grained well sorted, dark gray, grades from very moist to wet	5	▼
							ML		SILT, stiff, gray, wet.		
10										10	
15										15	
20										20	

ABBREVIATIONS

LOG OF BORING B-12

(Page 1 of 1)

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Issaquah, WA 98027

LOG OF BORING B-13

Gilmur/Hale Family Trust
6365 1st Avenue South
Seattle, Washington

Farallon PN: 781-001

Logged By: Jim Pender

Date/Time Started	: 3-13-02/1515	Sampler Type	: 1.5" splitspoon
Date/Time Completed	: 3-13-02/1535	Depth Of Water ATD	: 7.0'
Drilling Company	: Cascade Drilling	Total Depth	: 9.0'
Drilling Forman	: Casey Goble		
Drilling Method	: Geoprobe with autohammer		

Depth in Feet	Sample Interval	Time	% Rec-overy	Sample ID	Sample Analyzed	PID (units)	USCS	GRAPHIC	DESCRIPTION
0		1520	75	B13-0-3	Y	0	GM		Silty GRAVEL with sand, fine to coarse grained gravel, fine to coarse grained sand, brown, moist, minor amount of metal shard debris (Fill)
							GW		Sandy GRAVEL, fine to coarse grained, gray, moist (Fill)
5		1525	40	B13-3-6		0	SM		Silty SAND with gravel, gray, slightly moist (Fill)
		1530	5				SM		Silty SAND with gravel, black, wet
10									
15									
20									

Depth in Feet: 0, 5, 10, 15, 20

Water Level: ▼ at approximately 5 feet

ABBREVIATIONS

LOG OF BORING B-13

(Page 1 of 1)

08-14-2002 W:\Projects\781001 Duwamish Marine\Drawings_Plots\b-13.bor

FARALLON CONSULTING
320 3rd Ave. NE, Suite 200
Issaquah, WA 98027

LOG OF BORING B-15

Gilmur/Hale Family Trust
6365 1st Avenue South
Seattle, Washington

Farallon PN: 781-001

Logged By: Jim Pender

Date/Time Started	: 3-14-02/0940	Sampler Type	: 1.5" splitspoon
Date/Time Completed	: 3-14-02/1000	Depth Of Water ATD	: 7.5'
Drilling Company	: Cascade Drilling	Total Depth	: 9.0'
Drilling Forman	: Casey Goble		
Drilling Method	: Geoprobe with autohammer		

Depth in Feet	Sample Interval	Time	% Rec-overy	Sample ID	Sample Analyzed	PID (units)	USCS	GRAPHIC	DESCRIPTION	Depth in Feet	Water Level
0							GM		Sandy GRAVEL with silt, medium brown in color, moist (Fill)	0	
		0945	90	B15-0-3	Y	0	SM		Silty, gravelly SAND, fine to coarse grained, gray, moist (Fill)		
		0950	80	B15-3-6		0	ML		Sandy SILT with gravel, dark brown in color, moist (Fill)		
5							SP		SAND medium to fine grained, well sorted, moist to wet (Fill)	5	▼
			60								
10										10	
15										15	
20										20	

ABBREVIATIONS

LOG OF BORING B-15

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08-14-2002 W:\Projects\781001 Duwamish Marine\Drawings_Plots\b-15.bor

FARALLON CONSULTING
320 3rd Ave. NE, Suite 200
Issaquah, WA 98027

LOG OF BORING B-14

Gilmur/Hale Family Trust
6365 1st Avenue South
Seattle, Washington

Farallon PN: 781-001

Logged By: Jim Pender

Date/Time Started	: 3-13-02/1455	Sampler Type	: 1.5" splitspoon
Date/Time Completed	: 3-13-02/1510	Depth Of Water ATD	: 4.0'
Drilling Company	: Cascade Drilling	Total Depth	: 4.5'(refusal)
Drilling Forman	: Casey Goble		
Drilling Method	: Geoprobe with autohammer		

Depth in Feet	Sample Interval	Time	% Rec-overy	Sample ID	Sample Analyzed	PID (units)	USCS	GRAPHIC	DESCRIPTION	Depth in Feet	Water Level
0							GW		Sandy GRAVEL	0	
							SP		SAND, medium to fine grained, well sorted, medium brown, grades from moist to very moist (Fill)		
		1500	90	B14-2-3	Y	0					
		1505	25				SW		SAND with gravel, medium to fine grained, well sorted, medium brown, wet (Fill)		▼
5									Refusal at 4.5'	5	
10										10	
15										15	
20										20	

ABBREVIATIONS

LOG OF BORING B-14

(Page 1 of 1)

FARALLON CONSULTING
320 3rd Ave. NE, Suite 200
Issaquah, WA 98027

LOG OF BORING B-16

Gilmur/Hale Family Trust
6365 1st Avenue South
Seattle, Washington

Farallon PN: 781-001

Logged By: Jim Pender

Date/Time Started	: 3-14-02/0905	Sampler Type	: 1.5" splitspoon
Date/Time Completed	: 3-14-02/0935	Depth Of Water ATD	: 6.0'-6.5'
Drilling Company	: Cascade Drilling	Total Depth	: 9.0'
Drilling Forman	: Casey Goble		
Drilling Method	: Geoprobe with autohammer		

Depth in Feet	Sample Interval	Time	% Rec-overy	Sample ID	Sample Analyzed	PID (units)	USCS	GRAPHIC	DESCRIPTION
0		0915	80	B16-0-1.5	Y	0	SM		Silty SAND with gravel, gray in color, moist (Fill)
		0916	80	B16-1.5-3			SP		SAND, medium to fine grained, well sorted, dark gray to black, grades from moist to wet (Fill)
5		0930		B16-3-6		0			
							ML		Sandy SILT, medium gray, wet (Fill)
10									
15									
20									

Depth in Feet | Water Level

ABBREVIATIONS

LOG OF BORING B-16

(Page 1 of 1)

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FARALLON CONSULTING
320 3rd Ave. NE, Suite 200
Issaquah, WA 98027

LOG OF BORING B-17

Gilmur/Hale Family Trust
6365 1st Avenue South
Seattle, Washington

Farallon PN: 781-001

Logged By: Jim Pender

Date/Time Started	: 3-14-02/0815	Sampler Type	: 1.5" splitspoon
Date/Time Completed	: 3-14-02/0840	Depth Of Water ATD	: 6.0'
Drilling Company	: Cascade Drilling	Total Depth	: 7.5'
Drilling Forman	: Casey Goble		
Drilling Method	: Geoprobe with autohammer		

Depth in Feet	Sample Interval	Time	% Rec-overy	Sample ID	Sample Analyzed	PID (units)	USCS	GRAPHIC	DESCRIPTION	Depth in Feet	Water Level
0										0	
		0820	100	B17-0-3	Y	0	SM		Silty SAND with gravel, light brown to gray, fine to coarse grained, fine to course grained subrounded to angular gravel (Fill)		
		0825	70	B17-4-5		0	SM		SILT/silty SAND/sandy, fine to medium grained sand, black, wet (Fill)		
5		0830	100	B17-6-7.5			Fill		Debris mixed with silty, sandy gravel (Fill)	5	▼
10										10	
15										15	
20										20	

ABBREVIATIONS

LOG OF BORING B-17

(Page 1 of 1)

FARALLON CONSULTING
320 3rd Ave. NE, Suite 200
Issaquah, WA 98027

LOG OF BORING B-18

Gilmur/Hale Family Trust
6365 1st Avenue South
Seattle, Washington

Farallon PN: 781-001

Logged By: Jim Pender

Date/Time Started	: 3-14-02/0845	Sampler Type	: 1.5" splitspoon
Date/Time Completed	: 3-14-02/0905	Depth Of Water ATD	: 7.0'
Drilling Company	: Cascade Drilling	Total Depth	: 9.0'
Drilling Forman	: Casey Goble		
Drilling Method	: Geoprobe with autohammer		

Depth in Feet	Sample Interval	Time	% Recovery	Sample ID	Sample Analyzed	PID (units)	USCS	GRAPHIC	DESCRIPTION	Depth in Feet	Water Level
0							SP		SAND, fine to medium grained, well sorted	0	
		0850	60	B18-0-3	Y	0	SW		Gravelly SAND with silt, fine to coarse grained sand and gravel, dark brown, moist, angular to subrounded gravel (Fill)		
5		0855	70	B18-4-6		0	SP		SAND, fine to medium grained, well sorted, medium brown-gray to grayish black, grades from moist to wet (Fill)	5	▼
			60								
10										10	
15										15	
20										20	

ABBREVIATIONS

LOG OF BORING B-18

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FARALLON CONSULTING
320 3rd Ave. NE, Suite 200
Issaquah, WA 98027

LOG OF BORING B-19

Gilmur/Hale Family Trust
6365 1st Avenue South
Seattle, Washington

Farallon PN: 781-001

Logged By: Jim Pender

Date/Time Started : 3-13-02/1400
Date/Time Completed : 3-13-02/1420
Drilling Company : Cascade Drilling
Drilling Forman : Casey Goble
Drilling Method : Geoprobe with autohammer

Sampler Type : 1.5" splitspoon
Depth Of Water ATD : 8.5"
Total Depth : 9.0'

Depth in Feet	Sample Interval	Time	% Recovery	Sample ID	Sample Analyzed	PID (units)	USCS	GRAPHIC	DESCRIPTION
0							SW		SAND with gravel (Fill)
							GM		Sandy, silty GRAVEL, fine to course grained, rounded to angular, light brown, fine grained sand, moist (Fill)
		1405	100	B19-1.5-3	Y	0	SM		Silty SAND, fine to medium grained, dark brown in color, some wood debris with black coating, light petroleum odor, moist (Fill)
5		1410	90	B19-3-6		0	SP		SAND fine to medium grained, well sorted, minor amounts of interbedded SILT/silty SAND. Moderately stiff silt, moist, no odor (Fill)
							GM		Silty, Sandy GRAVEL, fine grained, gray, grades from moist to wet, some woody debris (Fill)
10									
15									
20									

Depth in Feet | Water Level

ABBREVIATIONS

LOG OF BORING B-19

(Page 1 of 1)

FARALLON CONSULTING
320 3rd Ave. NE, Suite 200
Issaquah, WA 98027

LOG OF WELL MW-1

(Page 1 of 1)

Gilmur/Hale Family Trust
6365 1st Avenue South
Seattle, Washington

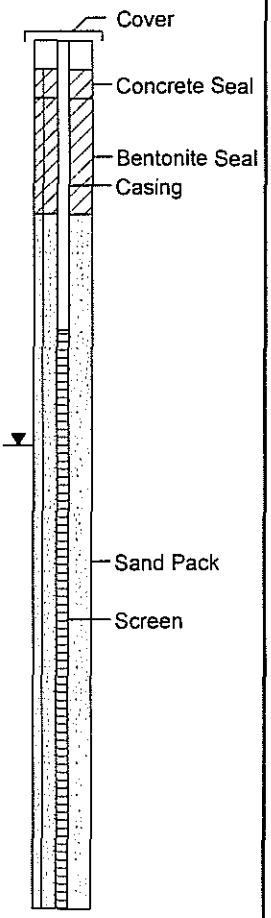
Farallon PN: 781-001

Logged By: Jim Pender

Date/Time Started	: 3/18/02; 0815	Drilling Method	: Hollow Stem Auger
Date/Time Completed	: 3/18/02; 0910	Sampler Type	: D&M with 140 lb. hammer
Equipment	: CME 175	Depth Of Water ATD	: 7-7.5 feet bgs
Drilling Company	: Cascade Drilling	Total Depth	: 15 feet bgs
Drilling Forman	: James Goble		

Depth in Feet	Sample Interval	Blow Counts 6/6/6	% Recovery	Sample ID	Samples Analyzed	PID (units)	USCS	GRAPHIC	DESCRIPTION
0							SM		Silty SAND, fine, with fine to coarse gravel, dark brown, dense, moist, contains some organic material (Fill)
	X	15/16/27	100	MW1-3-4.5		0	SM		Silty SAND, fine, with fine to coarse gravel, dark brown to light grey, dense, contains debris - plastic, rubber (Fill)
5	X	16/20/20	100	MW1-5-6.5		0	SP		SAND, brown, dense, very moist, no odor (Fill)
	X	4/3/3	100	MW1-7.5-9		0	SP		Sandy SILT, fine sand, loose, grey, wet (Fill)
10	X	3/3/3	0	No Sample		-	SM		SILT, with fine sand, brown to dark grey, loose, contains organic material (Fill)
	X	3/5/5	0	No Sample		-	SP		SAND (Fill)
15									
20									

Well: MW-1
Elev.: Unknown



WELL INFORMATION

Cover: 8" steel	Grout: Bentonite Chips
Casing: 2" PVC	Seal: Concrete
Screen: 2", 0.010-slot	Sand Pack: 2/12

LOG OF WELL MW-1

(Page 1 of 1)

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FARALLON CONSULTING
320 3rd Ave. NE, Suite 200
Issaquah, WA 98027

LOG OF WELL MW-2

Gilmur/Hale Family Trust
6365 1st Avenue South
Seattle, Washington

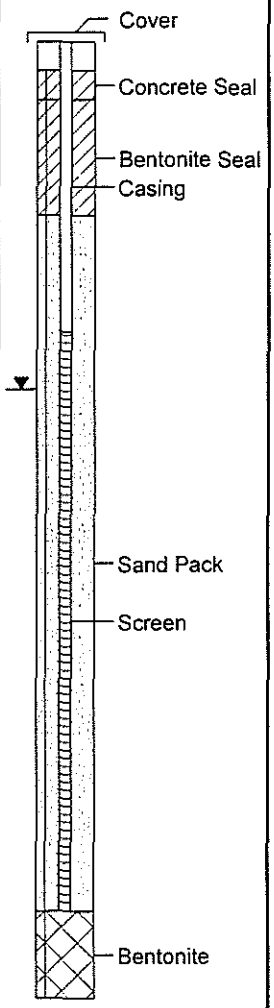
Farallon PN: 781-001

Logged By: Jim Pender

Date/Time Started	: 3/18/02; 0920	Drilling Method	: Hollow Stem Auger
Date/Time Completed	: 3/18/02; 1000	Sampler Type	: D&M, 140 lb. hammer
Equipment	: CME 175	Depth Of Water ATD	: 6 feet bgs
Drilling Company	: Cascade Drilling	Total Depth	: 16.5 feet bgs
Drilling Forman	: James Goble		

Depth in Feet	Sample Interval	Blow Counts 6/6/6	% Recovery	Sample ID	Samples Analyzed	PID (units)	USCS	GRAPHIC	DESCRIPTION
0		Hand	dug	MW2-2-4			SM		Sandy SILT, fine to coarse sand, with fine to coarse gravel, some cobbles, grey, very moist (Fill)
5		50 for 6"	0	No Sample			SP		Rock in sampler, no recovery, wet (Fill)
10		14/11/10	5	No Sample			SM		Sandy GRAVEL, fine, with silt, fine to coarse sand, medium grey, medium dense, wet (Fill)
15		6/7/9		No Sample					
20									

Well: MW-2
Elev.: Unknown



WELL INFORMATION

Cover: 8" steel
Casing: 2" PVC
Screen: 2", 0.010-slot
Grout: Bentonite Chips
Seal: Concrete
Sand Pack: 2/12

LOG OF WELL MW-2

(Page 1 of 1)

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FARALLON CONSULTING
320 3rd Ave. NE, Suite 200
Issaquah, WA 98027

LOG OF WELL MW-3

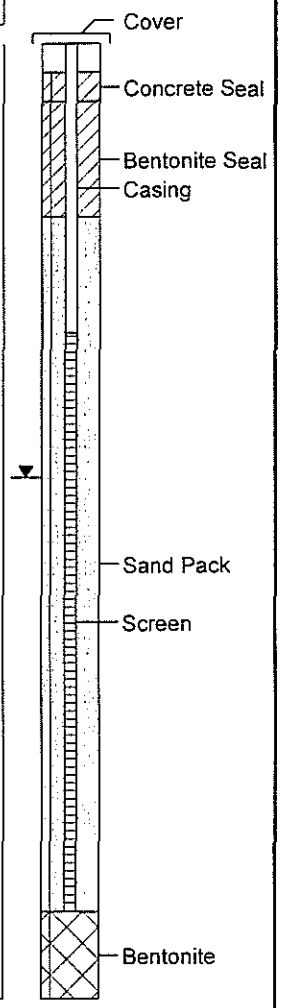
Gilmur/Hale Family Trust
6365 1st Avenue South
Seattle, Washington

Farallon PN: 781-001

Logged By: Jim Pender

Date/Time Started	: 3/18/02; 1015	Drilling Method	: Hollow Stem Auger
Date/Time Completed	: 3/18/02; 1130	Sampler Type	: D&M, 140 lb. hammer
Equipment	: CME 175	Depth Of Water ATD	: 7.5 feet bgs
Drilling Company	: Cascade Drilling	Total Depth	: 16.5 feet bgs
Drilling Forman	: James Goble		

Depth in Feet	Sample Interval	Blow Counts 6/6/6	% Recovery	Sample ID	Samples Analyzed	PID (units)	USCS	GRAPHIC	DESCRIPTION
0									
		50 for 6"	100	MW3-2.5-4			GM		Silty, sandy GRAVEL, fine to coarse, subrounded to angular, fine to coarse sand, light brown to dark brown, very dense, moist (Fill)
5									
10		3/3/6					SM		Sandy SILT, fine sand, grey, medium stiff, wet, contains some organic material as woody debris (Fill)
15		5/11/22					SW		SAND, fine, well-graded
20									



WELL INFORMATION

Cover: 8" steel
Casing: 2" PVC
Screen: 2", 0.010-slot
Grout: Bentonite Chips
Seal: Concrete
Sand Pack: 2/12

LOG OF WELL MW-3

(Page 1 of 1)

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FARALLON CONSULTING
320 3rd Ave. NE, Suite 200
Issaquah, WA 98027

LOG OF WELL MW-4

(Page 1 of 1)

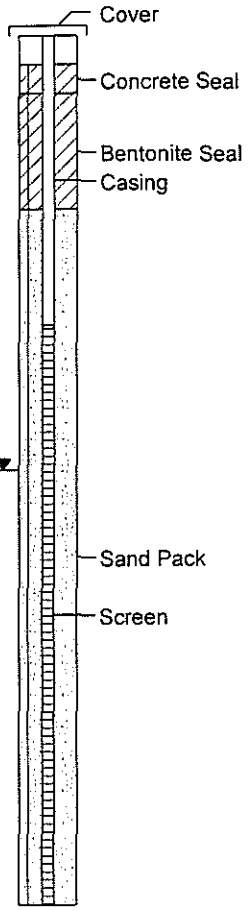
Gilmur/Hale Family Trust
6365 1st Avenue South
Seattle, Washington

Farallon PN: 781-001

Logged By: Jim Pender

Date/Time Started	: 3/18/02; 1240	Drilling Method	: Hollow Stem Auger
Date/Time Completed	: 3/18/02; 1315	Sampler Type	: D&M, 140 lb. hammer
Equipment	: CME 175	Depth Of Water ATD	: 7.5 feet bgs
Drilling Company	: Cascade Drilling	Total Depth	: 15 feet bgs
Drilling Forman	: James Goble		

Depth in Feet	Sample Interval	Blow Counts 6/6/6	% Recovery	Sample ID	Samples Analyzed	PID (units)	USCS	GRAPHIC	DESCRIPTION
0							SM		Silty SAND, fine to coarse, with gravel, light brown to grey, subrounded to angular (Fill)
				From B-17 (0-7.5 feet)			SM		Sandy SILT, fine to medium sand, black, wet (Fill)
5									Fill, debris mixed with silty, sandy gravel
10		7/7/10	100	No Sample			SP		GRAVEL, SILT and SAND interbeds, fine sand, trace organics, grey to black, medium dense, wet (Fill)
			100	No Sample			SP		SAND, fine, minor silt, grey to black
15									
20									



WELL INFORMATION

Cover: 8" steel
Casing: 2" PVC
Screen: 2", 0.010-slot
Grout: Bentonite Chips
Seal: Concrete
Sand Pack: 2/12

LOG OF WELL MW-4

(Page 1 of 1)

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PACIFIC CREST ENVIRONMENTAL
1531 BENDIGO BOULEVARD NORTH PO BOX 952 NORTH BEND, WA 98045
T 425.888.4990 F 425.888.4994

REMEDIAL INVESTIGATION REPORT

GILMUR/HALE FAMILY TRUST
6365 FIRST AVENUE SOUTH
SEATTLE, WASHINGTON

Submitted by:

Pacific Crest Environmental, LLC

1531 Bendigo Boulevard North
North Bend, Washington 98045

Pacific Crest PN: 107-001

For:
Mr. Jim Gilmur
16 South Michigan Street
Seattle, Washington 98108

May 11, 2009

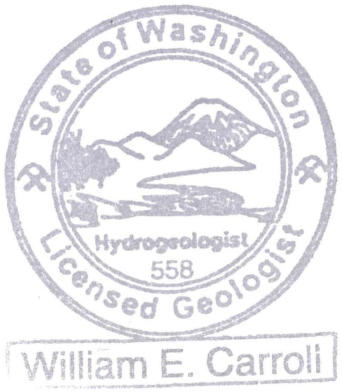
Prepared by:

Annica Nord
Staff Geologist

William Carroll, L.H.G.
Principal Geologist

Reviewed by:

Lauren G. Carroll, L.H.G.
Principal Hydrogeologist



LOG OF WELL MW-1d

(Page 1 of 2)

Site Name: Gilmur/Hale Property

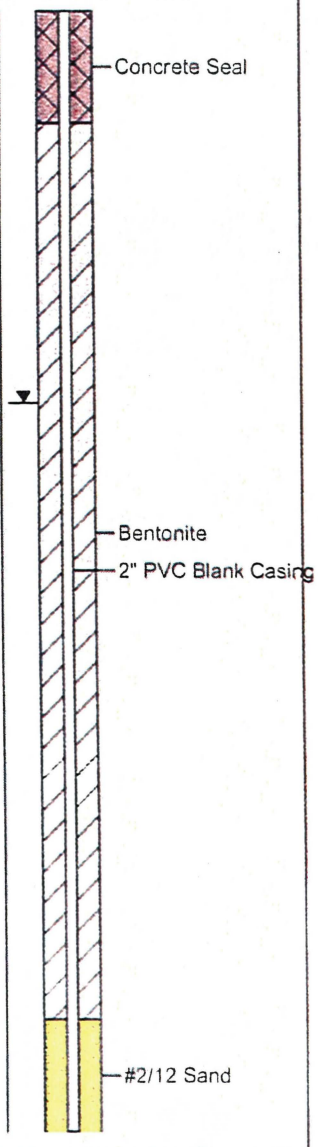
Client: Mr. Jim Gilmur

Project #: 107-001

Date/Time Started	: 6-02-2008 / 1100
Date/Time Completed	: 6-02-2008 / 1310
Total Boring Depth	: 31.5ft
Total Well Depth	: 30.0 ft
DTW ATD	: 6 ft
Elevation (ft)	: NA
Drilling Method	: Hollow Stem Auger
Sampler Type	: D+M 18" split spoon
Drive Hammer (lbs)	: 140

Depth In Feet	Samples	Description	USCS	Graphic	% Recovery	Blow Count	PID (ppm)	Sample ID
0		2.5 - 4.0 Sandy SILT minor gravel (55% silt, 35% fine sand, 10% fine gravel), black, dry, (fill).	ML		60	11-15/6"	35.0	-
5		5.0 - 6.0 SAND, minor gravel, trace silt (80% fine to medium sand, 15% fine gravel, 5% silt), black, dry, (fill).	SP		90	12/15/18	4.2	MW1d-5.0-6.5
		6.0 - 6.5 SAND (100% fine to medium sand), black, dry, (fill).	SP					
		7.5 - 8.5 SAND, trace silt (95% fine to medium sand, 5% silt), black, wet, (fill).	SP		100	2/2/2	0.6	-
		8.5 - 9.0 SILT with sand (80% silt, 20% fine to medium sand), black, wet, (fill).	ML					
10		10.0 - 10.5 SILT, trace sand (95% silt, 5% fine to medium sand), medium-dark brown, wet, (fill)	ML		100	2/2/2	0.9	-
		10.5 - 11.5 SILT (100% silt), medium-dark brown, wet, wood fragments, (fill).	ML					
		12.5 - 13.5 Sandy SILT (60% silt, 40% fine-medium sand), black, wet, (fill).	ML		100	4/4/4	0.4	-
		13.5 - 14.0 SAND, trace silt (95% fine to medium sand, 5% silt), black, wet.	SP					
15		15.0 - 16.5 SAND, trace silt (95% fine to medium sand, 5% silt), black, wet.	SP		95	4/10/12	0.4	-
		17.5 - 19.0 SAND (100% medium to coarse sand), black, wet.	SP		100	4/4/4	0.4	-
20								

Well: MW-1d



Drilling Company	: Cascade Drilling Inc.
Drilling Foreman	: Scott
Equipment	: CME 75 HSA
Pacific Crest Rep.	: Monty Busbee

LOG OF WELL MW-1d

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LOG OF WELL MW-2d

(Page 1 of 2)

Site Name: Gilmur/Hale Property

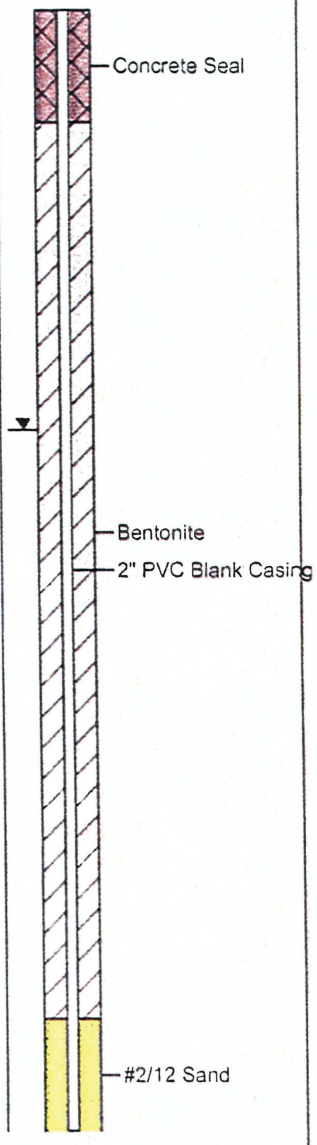
Client: Mr. Jim Gilmur

Project #: 107-001

Date/Time Started	: 06-02-2008/0751
Date/Time Completed	: 06-02-2008/0930
Total Boring Depth	: 31.5'
Total Well Depth	: 30'
DTW ATD	: 7.5
Elevation (ft)	: NA
Drilling Method	: Hollow Stem Auger
Sampler Type	: D+M 18" split spoon
Drive Hammer (lbs)	: 140

Depth In Feet	Samples	Description	USCS	Graphic	% Recovery	Blow Count	PID (ppm)	Sample ID
0								
		2.5 - 3.5 Sandy SILT minor gravel (50% silt, 35% fine to medium sand, 15% gravel), dark gray, moist, wood fragments, (fill).	ML		70	7/6/4	8.5	-
		3.5 - 4.0 SAND, trace silt (95% fine to medium sand, 5% silt), med brown, moist, (fill).	SP					
5		5.0 - 6.5 Silty SAND, trace gravel (60% fine to medium sand, 35% silt, 5% gravel), medium to dark brown, moist, wood fragments, (fill).	SP-SM		70	3/4/5	7.2	MW2d-6-6.5
		7.5 - 9.0 Gravelly SAND with silt (50% fine to medium sand, 30% gravel, 20% silt), medium to dark brown, wet, wood fragments, (fill).	SP-SM		35	2/4/10	68.0	-
10		10.0 - 11.5 Gravelly SAND with silt (50% fine to medium sand, 30% gravel, 20% silt), black, wet, sheen, (fill).	SP-SM		60	8/12/20	6.5	-
		12.5 - 13.5 SAND with silt, minor gravel (70% fine to medium sand, 20% silt, 10% fine gravel), black, wet, (fill).	SP-SM		100	5/8/10	10.5	-
		13.5 - 14.0 SILT, trace sand (98% silt, 5% fine sand), black, wet, (fill).	ML					
15		15.0 - 16.5 Gravelly SAND, trace silt (65% fine to medium sand, 30% fine gravel, 5% silt), black, wet, (fill).	SP		90	8/10/10	6.1	-
		17.5 - 19.0 Silty SAND, trace gravel (60% fine to med sand, 35% silt, 5% fine gravel), black, wet.	SP-SM		75	8/10/10	11.8	-
20								

Well: MW-2d



Drilling Company	: Cascade Drilling, Inc.
Drilling Foreman	: Scott
Equipment	: CME 75 HSA
Pacific Crest Rep.	: Monty Busbee

LOG OF WELL MW-2d

(Page 1 of 2)

12-11-2008 \\Pacific-8e185a\public\Project Files\107 Gilmur - Hale\Boring logs\MW-2d.bor

LOG OF WELL MW-1d

(Page 2 of 2)

Site Name: Gilmur/Hale Property

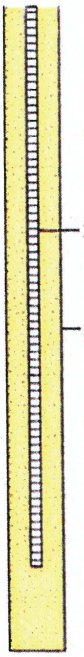
Client: Mr. Jim Gilmur

Project #: 107-001

Date/Time Started	: 6-02-2008 / 1100
Date/Time Completed	: 6-02-2008 / 1310
Total Boring Depth	: 31.5ft
Total Well Depth	: 30.0 ft
DTW ATD	: 6 ft
Elevation (ft)	: NA
Drilling Method	: Hollow Stem Auger
Sampler Type	: D+M 18" split spoon
Drive Hammer (lbs)	: 140

Depth In Feet	Samples	Description	USCS	Graphic	% Recovery	Blow Count	PID (ppm)	Sample ID
20		20.0 - 21.5 SAND (100% medium to coarse sand), black, wet.	SP		85	10/12/12	1.1	-
		22.5 - 24.0 SAND (100% medium to coarse sand), black, wet.	SP		80	10/12/15	1.5	-
25		25.0 - 26.5 SAND (100% medium to coarse sand), black, wet.	SP		100	10/10/16	1.7	-
		27.5 - 29.0 SAND, trace silt (95% fine to medium sand, 5% silt), black, wet.	SP		70	10/15/16	1.7	-
30		30.0 - 31.0 SAND, trace silt (95% fine to medium sand, 5% silt), black, wet.	SP		80	10/15/16	1.2	-
		31.0 - 31.5 SAND, minor silt (90% fine to medium sand, 10% silt), black, wet.	SP					
35								
40								

Well: MW-1d



Drilling Company	: Cascade Drilling Inc.
Drilling Foreman	: Scott
Equipment	: CME 75 HSA
Pacific Crest Rep.	: Monty Busbee

LOG OF WELL MW-1d

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LOG OF WELL MW-2d

(Page 2 of 2)

Site Name: Gilmur/Hale Property

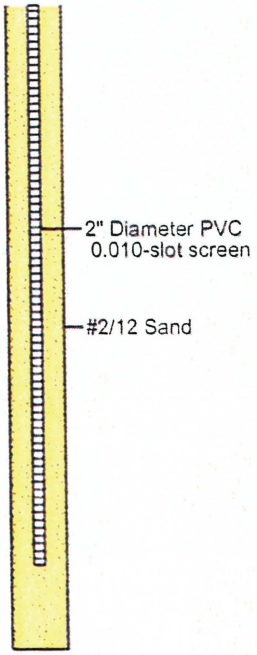
Client: Mr. Jim Gilmur

Project #: 107-001

Date/Time Started	: 06-02-2008/0751
Date/Time Completed	: 06-02-2008/0930
Total Boring Depth	: 31.5'
Total Well Depth	: 30'
DTW ATD	: 7.5
Elevation (ft)	: NA
Drilling Method	: Hollow Stem Auger
Sampler Type	: D+M 18" split spoon
Drive Hammer (lbs)	: 140

Depth In Feet	Samples	Description	USCS	Graphic	% Recovery	Blow Count	PID (ppm)	Sample ID
20		20.0 - 20.5 SAND, minor silt (90% fine to medium sand, 10% silt), black, wet.	SP					
		20.5 - 21.5 SAND (100% fine to medium sand), black, wet.	SP		100	10/10/10	4.6	-
		22.5 -24.0 SAND, trace silt (95% fine to medium sand, 5% silt), black, wet.	SP		100	8/10/12	5.5	-
25		25.0 -26.5 SAND, trace silt (95% fine sand, 5% silt), black, wet.	SW		75	10/10/10	3.4	-
		27.5 - 29.0 SAND, trace silt (95% fine sand, 5% silt), black, wet.	SW		30	10/12/12	2.0	-
30		30.0 - 31.5 SAND, trace silt (95% fine sand, 5% silt), black, wet.	SW		85	9/12/15	5.7	-
35								
40								

Well: MW-2d



Drilling Company	: Cascade Drilling, Inc.
Drilling Foreman	: Scott
Equipment	: CME 75 HSA
Pacific Crest Rep.	: Monty Busbee

LOG OF WELL MW-2d

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LOG OF WELL MW-3d

(Page 1 of 2)

Site Name: Gilmur/Hale Property

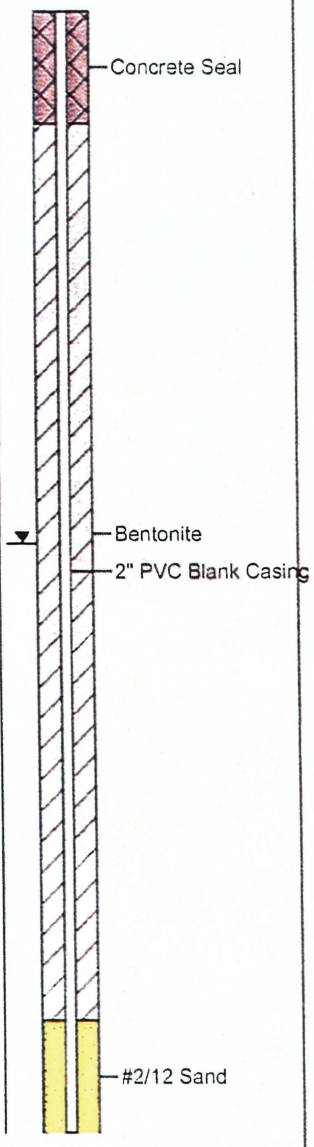
Client: Mr. Jim Gilmur

Project #: 107-001

Date/Time Started	: 05-30-2008/0855
Date/Time Completed	: 05-30-2008/1110
Total Boring Depth	: 31.5'
Total Well Depth	: 30'
DTW ATD	: 9'
Elevation (ft)	: NA
Drilling Method	: Hollow Stem Auger
Sampler Type	: D+M 18" split spoon
Drive Hammer (lbs)	: 140

Depth In Feet	Samples	Description	USCS	Graphic	% Recovery	Blow Count	PID (ppm)	Sample ID
0								
		2.5 - 4.0 SAND, minor gravel, trace silt (85% fine to medium sand, 10% gravel, 5% silt), dark brown, moist, (fill).	SP		75	15/16/14	12.3	-
5		5.0 - 6.5 SAND, minor gravel, trace silt (85% fine to medium sand, 10% gravel, 5% silt), dark brown, moist, wood fragments, (fill).	SP		75	12/12/14	7.7	-
		7.5 - 9.0 SILT, trace sand (95% silt, 5% medium sand), olive mottled with gray, moist, .(fill)	ML		95	4/4/8	7.1	MW3d-8
		10.0 - 10.75 SILT, trace sand (95% silt, 5% medium sand) medium to dark brown, wet, (fill).	ML					
10		10.75 - 11.5 SAND, minor gravel (90% fine to medium sand, 10% fine to coarse gravel), gray, wet, sheen on outside of sampler, (fill).	SP		55	4/5/6	12.7	-
		12.5 - 13.25 SAND, trace silt, trace gravel (90% fine to coarse sand, 5% silt, 5% fine gravel), dark gray to black, wet, sheen, (fill).	SP		80	4/9/18	67.2	-
		13.25 - 14.0 Silty SAND with gravel (50% fine to medium sand, 30% silt, 20% fine to coarse gravel), black, wet, sheen, wood fragments and organic material, (fill).	SP-SM					
15		15.0 - 16.5 SILT with sand (75% silt, 25% very fine sand), black ,wet, (fill).	ML		100	4/8/10	869	-
		17.5 - 18.0 Silty SAND (60% fine sand, 40% silt), black, wet, (fill).	SW-SM					
		18.0 - 19.0 SAND (100% fine sand), black, wet, (fill).	SW		85	9/12/15	20 8	-
20								

Well: MW-3d



Drilling Company	: Cascade Drilling, Inc.
Drilling Foreman	: Dave
Equipment	: CME 75 HSA
Pacific Crest Rep.	: Monty Busbee

LOG OF WELL MW-3d

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LOG OF WELL MW-3d

(Page 2 of 2)

Site Name: Gilmur/Hale Property

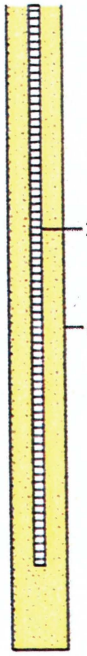
Client: Mr. Jim Gilmur

Project #: 107-001

Date/Time Started	: 05-30-2008/0855
Date/Time Completed	: 05-30-2008/1110
Total Boring Depth	: 31.5'
Total Well Depth	: 30'
DTW ATD	: 9'
Elevation (ft)	: NA
Drilling Method	: Hollow Stem Auger
Sampler Type	: D+M 18" split spoon
Drive Hammer (lbs)	: 140

Depth In Feet	Samples	Description	USCS	Graphic	% Recovery	Blow Count	PID (ppm)	Sample ID
20		20.0 - 21.5 SAND, minor silt (90% fine sand, 10% silt nodules) black, wet.	SW		100	7/11/13	56.4	-
		22.5 -24.0 SAND (100% fine to medium sand), black, wet.	SP		90	16/20/23	39.4	-
25		25.0 -26.5 SAND (100% fine to medium sand), black, wet.	SP		100	12-50/6"	15.4	-
		27.5 - 29.0 SAND (100% fine to medium sand), black, wet, sheen.	SP		100	18-50/6"	51.5	-
30		30.0 - 31.0 SAND (100% fine to medium sand), black, wet, sheen.	SP		85	17/18/15	58.1	-
		31.0 - 31.5 SAND, minor silt (90% fine to medium sand, 10% silt), black, wet.	SP					
35								
40								

Well: MW-3d



Drilling Company	: Cascade Drilling, Inc.
Drilling Foreman	: Dave
Equipment	: CME 75 HSA
Pacific Crest Rep.	: Monty Busbee

LOG OF WELL MW-3d

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LOG OF WELL MW-4d

(Page 1 of 2)

Site Name: Gilmur/Hale Property

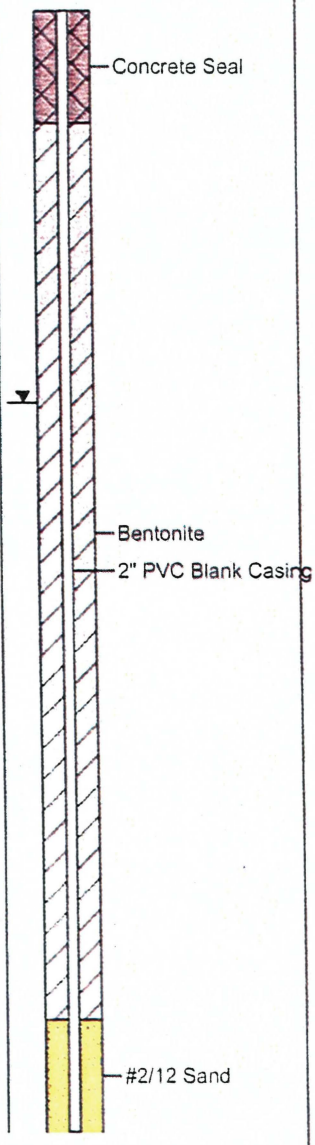
Client: Mr. Jim Gilmur

Project #: 107-001

Date/Time Started	: 05-30-2008/1209
Date/Time Completed	: 05-30-2008/1400
Total Boring Depth	: 31.5'
Total Well Depth	: 30'
DTW ATD	: 7'
Elevation (ft)	: NA
Drilling Method	: Hollow Stem Auger
Sampler Type	: D+M 18" split spoon
Drive Hammer (lbs)	: 140

Depth In Feet	Samples	Description	USCS	Graphic	% Recovery	Blow Count	PID (ppm)	Sample ID
0								
		2.5 - 4.0 SAND, with gravel, minor silt (65% fine to medium sand, 20% gravel, 15% silt), dark brown to black, moist, (fill).	SP		20	16-50/6"	300	-
5		5.0 - 5.5 SAND, with gravel, minor silt (65% fine to medium sand, 20% gravel, 15% silt), dark brown to black, moist, (fill).	SP					
		5.5 - 6.5 SAND (100% fine to medium sand), black, moist, (fill).	SP		90	16/18/20	256	MW4d-6.5
		7.5 - 9.0 SAND (100% fine to medium sand), black, wet, (fill).	SP		70	6/7/10	129	-
10		10.0 - 11.0 SILT (100% silt), black, wet, (fill).	ML		100	4/5/6	55.5	-
		11.0 - 11.5 SAND, trace silt (95% fine to medium sand, 5% silt), gray, wet, (fill).	SP					
		12.5 - 14.0 Sandy SILT (70% silt, 30% fine to medium sand) black, wet, wood fragments, (fill).	ML		90	4/4/4	30.3	-
15		15.0 - 16.5 SAND, trace silt (95% fine to medium sand, 5% silt), black, wet, silt nodules.	SP		90	1/4/7	39.2	-
		17.5 - 19.0 SAND, trace silt (95% fine to medium sand, 5% silt), black, wet, very thin silt lenses.	SP		90	7/8/8	31.1	-
20								

Well: MW-4d



Drilling Company	: Cascade Drilling, Inc.
Drilling Foreman	: Dave
Equipment	: CME 75 HSA
Pacific Crest Rep.	: Monty Busbee

LOG OF WELL MW-4d

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LOG OF WELL MW-4d

(Page 2 of 2)

Site Name: Gilmur/Hale Property

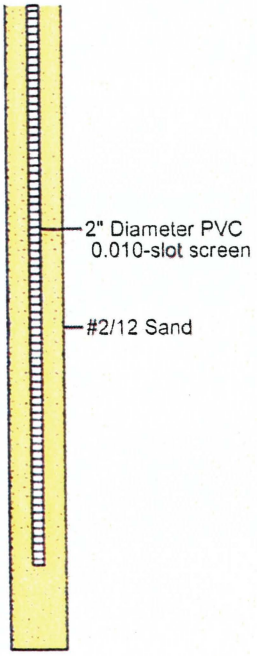
Client: Mr. Jim Gilmur

Project #: 107-001

Date/Time Started	: 05-30-2008/1209
Date/Time Completed	: 05-30-2008/1400
Total Boring Depth	: 31.5'
Total Well Depth	: 30'
DTW ATD	: 7'
Elevation (ft)	: NA
Drilling Method	: Hollow Stem Auger
Sampler Type	: D+M 18" split spoon
Drive Hammer (lbs)	: 140

Depth In Feet	Samples	Description	USCS	Graphic	% Recovery	Blow Count	PID (ppm)	Sample ID
20		20.0 - 21.5 SAND, minor silt (85% fine to medium sand, 15% silt), black, wet.	SP		90	7/8/10	174.1	-
		22.5 -24.0 SAND (100% fine to medium sand), black, wet.	SP		90	10/12/14	380.5	-
25		25.0 -26.0 SAND trace silt (95% fine to medium sand, 5% silt), black, wet.	SP		100	5/7/8	212.3	-
		26.0 - 26.5 SAND (100% fine to medium sand), black, wet.	SP					
		27.5 - 28.5 SAND, trace silt (95% fine to medium sand, 5% silt), black, wet.	SP		90	5/8/11	98.4	-
		28.5 - 29.0 SILT, trace sand (95% silt, 5% fine to medium sand), black , wet.	ML					
30		30.0 - 31.5 Silty SAND (65% fine to medium sand, 35% silt), black, wet.	SP-SM		100	4/7/8	87.7	-
35								
40								

Well: MW-4d



Drilling Company	: Cascade Drilling, Inc.
Drilling Foreman	: Dave
Equipment	: CME 75 HSA
Pacific Crest Rep.	: Monty Busbee

LOG OF WELL MW-4d

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LIMITED PHASE II SUBSURFACE INVESTIGATION REPORT

GILMUR SOUTH PARCEL
16 SOUTH MICHIGAN STREET
SEATTLE, WASHINGTON

Submitted by:
Farallon Consulting, L.L.C.
320 3rd Avenue NE
Issaquah, Washington 98027

Farallon PN: 781-003

For:
Mr. Jim Gilmur
16 South Michigan Street
Seattle, Washington 98108

April 5, 2004

Prepared by:

Deborah Gardner, L.H.G.
Associate Geologist

Reviewed by:

Lauren Carroll, L.H.G.
Senior Hydrogeologist

FARALLON CONSULTING
320 3rd Avenue NE
Issaquah, WA 98027

Log of Boring: SB-1

Client: Mr. Jim Gilmur
Project: Gilmur South Property
Location: Seattle, Washington
Farallon PN: 781-003
Logged By: John Schmitt

Date/Time Started: 01/09/04 1610
Date/Time Completed: 01/09/04 1700
Equipment: Geoprobe
Drilling Company: Cascade
Drilling Foreman: Kasey Gobel
Drilling Method: Direct Push

Sampler Type: 2 inch by 4 foot
Disposable sleeves: Yes
Depth of Water ATD : 4.5 feet bgs
Total Boring Depth: 12 feet bgs.

Depth (feet bgs.)	USCS	Graphic	Lithologic Description	Sample Interval	% Recovery	Sample ID	PID (ppm)	Sample Analyzed	Water Level	Temporary well	Depth (feet bgs.)
0			0-2' CONCRETE.								0
	GP		2-6' Sandy GRAVEL, brown, moist, no odor. Sample includes whitish sandy substance similar to concrete washout.		10	SB1-2-6	5.6		▼		
5											5
	ML		6-10' SILT?, wet. Sample not observed. Soil type based on driller's description of sample residue.		0						
10	ML		10-12' SILT?, wet. Sample not observed. Soil type based on Soil type based on driller's description of sample residue.		0						10
15											15
20											20

Boring Details

Boring Abandonment: Bentonite backfill.
Notes:

Reconnaissance Groundwater Sample Collection Details

Screen interval from: 4 to: 7 ft. **Screen Slot Size (inches):** 0.010
Purging method: Peristaltic **Sampling method:** Peristaltic
Time begin purging: 1625 **Time sample collection complete:** 1640
Groundwater Sample Identification: SB1-GW

FARALLON CONSULTING
320 3rd Avenue NE
Issaquah, WA 98027

Log of Boring: SB-2

Client: Mr. Jim Gilmur
Project: Gilmur South Property
Location: Seattle, Washington
Farallon PN: 781-003
Logged By: John Schmitt

Date/Time Started: 01/09/04 1415
Date/Time Completed: 01/09/04 1535
Equipment: Geoprobe
Drilling Company: Cascade
Drilling Foreman: Kasey Gobel
Drilling Method: Direct Push

Sampler Type: 2 inch by 4 foot
Disposable sleeves: Y
Depth of Water ATD : N/A feet bgs
Total Boring Depth: 2.5 feet bgs.

Depth (feet bgs.)	USCS	Graphic	Lithologic Description	Sample Interval	% Recovery	Sample ID	PID (ppm)	Sample Analyzed	Water Level	Temporary well	Depth (feet bgs.)
0			0-2' CONCRETE.								0
			2-2.5' Pieces of cement and asphalt (6"). Refusal at 2.5' due to large concrete pieces obstructing sample tube under concrete slab.								
5											5
10											10
15											15
20											20

Boring Details

Boring Abandonment: Bentonite backfill.
Notes:

Reconnaissance Groundwater Sample Collection Details

Screen interval from: N/A to: **ft.** **Screen Slot Size (inches):**
Purging method: N/A **Sampling method:** N/A
Time begin purging: **Time sample collection complete:**
Groundwater Sample Identification:

FARALLON CONSULTING
320 3rd Avenue NE
Issaquah, WA 98027

Log of Boring: SB-3

Client: Mr. Jim Gilmur
Project: Gilmur South Property
Location: Seattle, Washington
Farallon PN: 781-003
Logged By: John Schmitt

Date/Time Started: 01/09/04 0850
Date/Time Completed: 01/09/04 1200
Equipment: Geoprobe
Drilling Company: Cascade
Drilling Foreman: Kasey Gobel
Drilling Method: Direct Push

Sampler Type: 2 inch by 4 foot
Disposable sleeves: Y
Depth of Water ATD : 6 feet bgs
Total Boring Depth: 10 feet bgs.

Depth (feet bgs.)	USCS	Graphic	Lithologic Description	Sample Interval	% Recovery	Sample ID	PID (ppm)	Sample Analyzed	Water Level	Temporary well	Depth (feet bgs.)
0			0-2' CONCRETE, consecutive slabs of 4", 8" and 8"								0
	SP		2-8' SAND, fine to medium, trace rounded gravel, trace silt, moist, no odor, no sheen. 2-2.5' Very light brown coloration. 2.5' Becomes brown coloration.		50	SB3-2-6	6.6				
5			6' Becomes wet, dark greyish brown coloration, no odor, no sheen.			SB3-6-8	6.8	Y	▼		5
	ML		8-10' SILT, trace fine sand, organic present (highly decayed wood), olive grey, soft, wet, organic odor, no sheen. 8.5' Becomes brown with light orange mottling.		100	SB3-8-10	7.4				
10											10
15											15
20											20

Boring Details

Boring Abandonment: Bentonite backfill.
Notes:

Reconnaissance Groundwater Sample Collection Details

Screen interval from: 7 **to:** 10ft. **Screen Slot Size (inches):** 0.010
Purging method: Peristaltic **Sampling method:** Peristaltic
Time begin purging: 1130 **Time sample collection complete:** 1147
Groundwater Sample Identification: SB3-GW

FARALLON CONSULTING
320 3rd Avenue NE
Issaquah, WA 98027

Log of Boring: SB-4

Client: Mr. Jim Gilmur
Project: Gilmur South Property
Location: Seattle, Washington
Farallon PN: 781-003
Logged By: John Schmitt

Date/Time Started: 01/09/04 1200
Date/Time Completed: 01/09/04 1410
Equipment: Geoprobe
Drilling Company: Cascade
Drilling Foreman: Kasey Gobel
Drilling Method: Direct Push

Sampler Type: 2 inch by 4 foot
Disposable sleeves: Yes
Depth of Water ATD : 6.5 feet bgs
Total Boring Depth: 8 feet bgs.

Depth (feet bgs.)	USCS	Graphic	Lithologic Description	Sample Interval	% Recovery	Sample ID	PID (ppm)	Sample Analyzed	Water Level	Temporary well	Depth (feet bgs.)
0			0-10" CONCRETE.								0
	SP		10"-6' SAND, trace silt, fine to medium, brown, moist, loose, no odor, no sheen.		70	SB4-1-4	5.2				
5					60	SB4-4-6	5.6				5
	SP-SM		6-7' Silty SAND, fine, brown, wet, no odor, no sheen.		60	SB4-6-8	6.1	Y	▼		
	ML		7-8' SILT, trace fine to medium sand, greyish brown, wet, soft, no odor, no sheen.								
10											10
15											15
20											20

Boring Details

Boring Abandonment: Bentonite backfill.
Notes:

Reconnaissance Groundwater Sample Collection Details

Screen interval from: 5 to: 8 ft. **Screen Slot Size (inches):** 0.010
Purging method: Peristaltic **Sampling method:** Peristaltic
Time begin purging: 1340 **Time sample collection complete:** 1400
Groundwater Sample Identification: SB4-GW

FARALLON CONSULTING
320 3rd Avenue NE
Issaquah, WA 98027

Log of Boring: SB-5

Client: Mr. Jim Gilmur
Project: Gilmur South Property
Location: Seattle, Washington

Farallon PN: 781-003

Logged By: John Schmitt

Date/Time Started: 01/09/04
Date/Time Completed: 01/09/04
Equipment: Geoprobe
Drilling Company: Cascade
Drilling Foreman: Kasey Gobel
Drilling Method: Direct Push

Sampler Type: 2 inch by 4 foot
Disposable sleeves: Y
Depth of Water ATD : 5 feet bgs
Total Boring Depth: 12 feet bgs.

Depth (feet bgs.)	USCS	Graphic	Lithologic Description	Sample Interval	% Recovery	Sample ID	PID (ppm)	Sample Analyzed	Water Level	Temporary well	Depth (feet bgs.)
0	SP-SM		0-3" ASPHALT.								0
			3"-1' SAND with silt and fine gravel, sand fine to medium, dark brown, moist, no odor, no sheen.								
	SP		1-6' SAND, fine to medium, trace fine rounded gravel, trace silt, brown, moist, no odor, no sheen.			SB5-1-4	4.4				
5						SB5-4-6	3.2		▼		5
	ML		5' Becomes wet.								
			6-8' SILT, trace fine sand, organics (highly decayed wood), olive brown, wet, no odor, no sheen.			SB5-6-8	4.4				
			8-12' SILT, trace fine sand, brown, wet, no odor, no sheen.								
10	ML										10
15											15
20											20

Boring Details

Boring Abandonment: Bentonite backfill.
Notes:

Reconnaissance Groundwater Sample Collection Details

Screen interval from: 7 to: 10ft. **Screen Slot Size (inches):** 0.010
Purging method: Peristaltic **Sampling method:** Peristaltic
Time begin purging: 0800 **Time sample collection complete:** 0820
Groundwater Sample Identification: SB5-GW

LIMITED PHASE II SUBSURFACE INVESTIGATION REPORT

GILMUR NORTH PARCEL
6357 FIRST AVENUE SOUTH
SEATTLE, WASHINGTON

Submitted by:
Farallon Consulting, L.L.C.
320 3rd Avenue NE
Issaquah, Washington 98027

Farallon PN: 781-002

For:
Mr. Jim Gilmur
16 South Michigan Street
Seattle, Washington 98108

April 6, 2004

Prepared by:

DRAFT

Jeff Keller
Staff Chemist

Reviewed by:

DRAFT

Lauren Carroll, L.H.G.
Senior Hydrogeologist

FARALLON CONSULTING
320 3rd Avenue NE
Issaquah, WA 98027

Log of Boring: SB-1

Client: Mr. Jim Gilmur
Project: Gilmur North Property
Location: Seattle, Washington
Farallon PN: 781-002
Logged By: John Schmitt

Date/Time Started: 01/08/04 1500
Date/Time Completed: 01/08/04 1600
Equipment: Geoprobe
Drilling Company: Cascade
Drilling Foreman: Kasey Gobel
Drilling Method: Direct Push

Sampler Type: 2 inch by 4 foot
Disposable sleeves: Yes
Depth of Water ATD : 7.5 feet bgs
Total Boring Depth: 12 feet bgs.

Depth (feet bgs.)	USCS	Graphic	Lithologic Description	Sample Interval	% Recovery	Sample ID	PID (ppm)	Sample Analyzed	Water Level	Temporary well	Depth (feet bgs.)
0	GP-GM		0-1' Sandy GRAVEL with silt, gravel mostly fine, angular, brown to brownish grey, dense, no odor, no sheen.								0
	GP		1-5' Sandy GRAVEL mostly fine, angular, trace silt, brown to brownish grey, dense, no odor, no sheen. 3.5-5' slight orange/grey mottling.		90	SB1-0-4	5.3				
5	SP		5-9' SAND fine to medium, trace coarse, trace fine gravel, trace silt, greyish brown, moist, no odor. 7.5' Becomes wet.		100	SB1-5-8	5.4	Y	⧗		5
	SM		9-10' Silty SAND, fine to medium, greyish brown, wet.								
10	ML		10-12' SILT, trace fine sand, trace organics, brown, soft, moist to wet, no odor, no sheen.		75	SB1-10-12	5.4				10
15											15
											20

Boring Details

Boring Abandonment: Bentonite backfill.
Notes:

Reconnaissance Groundwater Sample Collection Details

Screen interval from: 9 to: 12ft. Screen Slot Size (inches): 0.010
Purging method: Peristaltic Sampling method: Peristaltic
Time begin purging: 1200 Time sample collection complete: 1200
Groundwater Sample Identification: SB1-GW

FARALLON CONSULTING
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Issaquah, WA 98027

Log of Boring: SB-1A

Client: Mr. Jim Gilmur
Project: Gilmur North Property
Location: Seattle, Washington

Farallon PN: 781-002

Logged By: John Schmitt

Date/Time Started:	01/08/04 1425	Sampler Type:	2 inch by 4 foot
Date/Time Completed:	01/08/04 1445	Disposable sleeves:	Y
Equipment:	Geoprobe	Depth of Water ATD :	N/A feet bgs
Drilling Company:	Cascade	Total Boring Depth:	2 feet bgs.
Drilling Foreman:	Kasey Gobel		
Drilling Method:	Direct Push		

Depth (feet bgs.)	USCS	Graphic	Lithologic Description	Sample Interval	% Recovery	Sample ID	PID (ppm)	Sample Analyzed	Water Level	Temporary well	Depth (feet bgs.)
0	GP		0-2' Sandy GRAVEL, brown, moist, very dense. 2' Refusal due to very dense gravel.		20	SB1A-0-2	-				0
5											5
10											10
15											15
											20

Boring Details

Boring Abandonment: Bentonite backfill.
Notes:

Reconnaissance Groundwater Sample Collection Details

Screen interval from: to: ft. Screen Slot Size (inches):
Purging method: Sampling method:
Time begin purging: Time sample collection complete:
Groundwater Sample Identification:

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Issaquah, WA 98027

Log of Boring: SB-1B

Client:	Mr. Jim Gilmur
Project:	Gilmur North Property
Location:	Seattle, Washington
Farallon PN:	781-002
Logged By:	John Schmitt

Date/Time Started:	01/08/04 1425	Sampler Type:	2 inch by 4 foot
Date/Time Completed:	01/08/04 1500	Disposable sleeves:	Y
Equipment:	Geoprobe	Depth of Water ATD :	N/A feet bgs
Drilling Company:	Cascade	Total Boring Depth:	5 feet bgs.
Drilling Foreman:	Kasey Gobel		
Drilling Method:	Direct Push		

Depth (feet bgs.)	USCS	Graphic	Lithologic Description	Sample Interval	% Recovery	Sample ID	PID (ppm)	Sample Analyzed	Water Level	Temporary well	Depth (feet bgs.)
0	GP		0-3' Sandy GRAVEL, brown, moist, dense.		20	SB1B-0-4	5.3				0
	SP		3-5' SAND, fine to medium, with gravel, dark brown, moist, dense, organic odor, no sheen.								
5			4-5' sample not retained. 5' Refusal.		20	SB1B-4-5	-				5
10											10
15											15
											20

Boring Details

Boring Abandonment: Bentonite backfill.

Notes:

Reconnaissance Groundwater Sample Collection Details

Screen interval from: to: ft. Screen Slot Size (inches):

Purging method: Sampling method:

Time begin purging: Time sample collection complete:

Groundwater Sample Identification:

FARALLON CONSULTING
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Log of Boring: SB-2

Client:	Mr. Jim Gilmur
Project:	Gilmur North Property
Location:	Seattle, Washington
Farallon PN:	781-002
Logged By:	John Schmitt

Date/Time Started:	01/08/04 1310	Sampler Type:	2 inch by 4 foot
Date/Time Completed:	01/08/04 1425	Disposable sleeves:	Y
Equipment:	Geoprobe	Depth of Water ATD :	8 feet bgs
Drilling Company:	Cascade	Total Boring Depth:	12 feet bgs.
Drilling Foreman:	Kasey Gobel		
Drilling Method:	Direct Push		

Depth (feet bgs.)	USCS	Graphic	Lithologic Description	Sample Interval	% Recovery	Sample ID	PID (ppm)	Sample Analyzed	Water Level	Temporary well	Depth (feet bgs.)
0	SP		0-8' SAND with gravel, trace silt, sand fine to medium, gravel fine to coarse, subrounded, brown, moist, no odor.		70	SB2-0-4	6.0				0
5			7.5' Becomes very moist		60	SB2-4-8	6.1				5
	SP		8' Refusal due to wood. Move boring 5 feet south and resume sampling at 8 feet.								
10			8-10' Same as above, wet.								10
	ML		10-11' Sandy SILT (organic), sand mostly fine to medium, highly decayed wood present, black, organic odor, no sheen.		75	SB2-8-12	6.4				
	SM		11-12' Silty SAND, fine, dark grey, wet, no odor.								
15											15
											20

Boring Details

Boring Abandonment: Bentonite backfill.

Notes:

Reconnaissance Groundwater Sample Collection Details

Screen interval from: to: 12ft. Screen Slot Size (inches): 0.010

Purging method: Peristaltic Sampling method: Peristaltic

Time begin purging: 1200 Time sample collection complete: 1200

Groundwater Sample Identification: SB2-GW

FARALLON CONSULTING
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Log of Boring: SB-3

Client:	Mr. Jim Gilmur	**Date/Time Started:**	01/08/04 1050	**Sampler Type:**	2 inch by 4 foot
Project:	Gilmur North Property	**Date/Time Completed:**	01/08/04 1310	**Disposable sleeves:**	Yes
Location:	Seattle, Washington	**Equipment:**	Geoprobe	**Depth of Water ATD :**	8 feet bgs
Farallon PN:	781-002	**Drilling Company:**	Cascade	**Total Boring Depth:**	12 feet bgs.
Logged By:	John Schmitt	**Drilling Foreman:**	Kasey Gobel		
		Drilling Method:	Direct Push		

Depth (feet bgs.)	USCS	Graphic	Lithologic Description	Sample Interval	% Recovery	Sample ID	PID (ppm)	Sample Analyzed	Water Level	Temporary well	Depth (feet bgs.)
0			0-3" CEMENT								0
	SP		4"-3' Gravelly SAND, fine, angular (fill), trace silt, brown, moist, no odor.		75	SB3-0-3	6.5				
	ML		3-5' SILT, minor fine sand, trace gravel, grey, moist, slight organic odor								
5	SM		5-5.5' Silty SAND, fine to coarse, degraded asphalt present, moist, no odor.								5
	ML		5.5-8' SILT, minor fine sand, trace gravel, grey, moist, no odor.		60	SB3-4-8	6.0				
			8' Trends to gravelly SILT, wet, grey, no odor.								
10	ML				70	SB3-8-12	6.0	Y			10
15											15
											20

Boring Details

Boring Abandonment: Bentonite backfill.

Notes: Temporary well repeatedly went dry during sampling.

Reconnaissance Groundwater Sample Collection Details

Screen interval from: 9 to: 12ft. **Screen Slot Size (inches):** 0.010

Purging method: Peristaltic **Sampling method:** Peristaltic

Time begin purging: 1140 **Time sample collection complete:** 1310

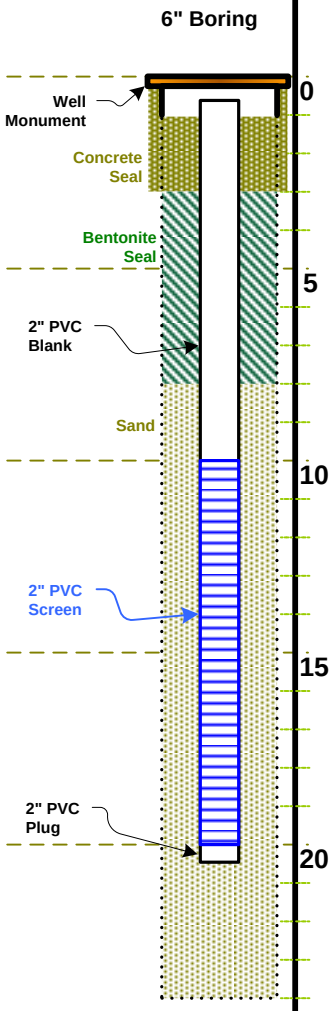
Groundwater Sample Identification: SB3-GW

01-0979-c-ab-mw05.vsd

Depth	BLOWS/6 inches	INTERVAL	SAMPLE NUMBER	SOIL DESCRIPTION	Recovery %	USCS	PID (ppmv in headspace)
0				Surface: 6" Gravel/Quarry Spalls			
				Metal debris in cuttings			
	28 8 19		MW05-03	2.5-5': Dark gray, slightly moist, sandy SILT, some gravel. Wood debris at 3'.	50	ML	0
5	8 16 19		MW05-06	5-16': Dark gray, moist, silty, gravelly SAND, fine grain, well graded. Wood debris at 7.5'. Petroleum odor and possible staining at 11'.	80	SM	0
	2 1 2				5		0
10	3 3 5		MW05-10	Turns wet at 12.5'. Organics (grasses) present at 12.5-14'. Thin silt lenses throughout.	25	SM	0
	4 4 4		MW05-13		50		0
15	2 4 6			16-24': Dark gray, wet, slightly silty SAND, poorly graded.	60	SM/ SP	0
20	3 2 3		MW05-20	Increasing silt content at 22.5'.	50		0
				EOB at 24.0'			
25							
30							

Depth in feet

WELL CONSTRUCTION



Drilling Method:	Hollow-stem auger	**Date:**	10/19/2015
Drilling Company:	Holocene Drilling	**Weather:**	Cloudy, Mild
Boring Diameter:	Six Inches	**Page**	1 of 1
Logged By:	Stuart Hyde		

Other Information:

Well Tag No.: BJX-750

PID was not functioning correctly.

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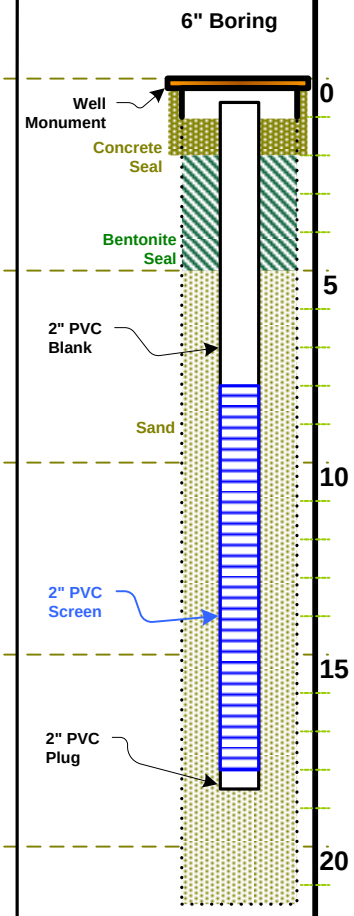
MW05

01-0979-c-ab-mw06.vsd

Depth	BLOWS/6 inches	INTERVAL	SAMPLE NUMBER	SOIL DESCRIPTION	Recovery %	USCS	PID (ppmv in headspace)
				Surface: 6" Gravel/Quarry Spalls			
0	3 2 3		MW06-03	2.5-8': Brown and gray, moist, slightly silty SAND, well graded.	100	SW	0
5	2 3 2		MW06-05	Slight asphalt odor at 5'.	100		0
	3 1 2			8-10.5': Gray, moist, SILT with organics, slight organic odor.	100	ML/ OL	0
10	2 1 2		MW06-11	10.5-12.5': Gray, moist to very moist, silty SAND, fine grain, some organics.	60	SM	0
	1 1 1		MW06-14	12.5-21.5': Dark gray, wet, SAND, fine to medium grain, poorly sorted. Varying silt content throughout unit.	100	SP	0
15	2 6 5				50		0
	13 7 6				75	SP	0
20	8 8 6		MW06-20	EOB at 21.5'	60		0
25							
30	Depth in feet						



Drilling Method:	Hollow-stem auger	**Date:** 10/21/2015	**Other Information:**
Drilling Company:	Holocene Drilling	**Weather:** Cloudy, Mild	Well Tag No.: BJX-755
Boring Diameter:	Six Inches	**Page** 1 **of** 1	PID was not functioning correctly.
Logged By:	Stuart Hyde		

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Duwamish Marine Center
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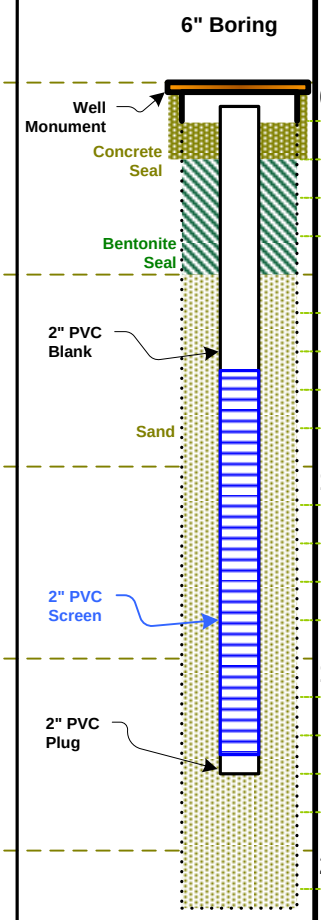
MW06

01-0979-c-ab-mw07.vsd

Depth	BLOWS/6 inches	INTERVAL	SAMPLE NUMBER	SOIL DESCRIPTION	Recovery %	USCS	PID (ppmv in headspace)
0				Surface: 6" Concrete			
	3 5 3		MW07-04	2.5-10.5': Dark gray, moist, silty, gravelly SAND, some organics.	75	SM	0
5	3 6 11			Becomes very moist/wet with slight asphalt odor at 8'.	60		0
	4 6 7		MW07-08		80		0
10	2 1 2			10.5-12': Gray-brown, moist, SILT, trace organics.	100	ML	0
	4 3 2		MW07-13	12.5-21.5': Dark gray/black, wet, silty SAND, medium to coarse grain, trace organics, well graded.	75	SM	0
15	3 3 2			Thin silt lenses throughout unit.	100		0
	5 7 7		MW07-18		60	SM	0
20	9 9 10			EOB at 21.5'	70		0
25							
30							

Depth in feet



Drilling Method:	Hollow-stem auger	**Date:** 10/20/2015	**Other Information:**
Drilling Company:	Holocene Drilling	**Weather:** Sunny, Mild	Well Tag No.: BJX-754
Boring Diameter:	Six Inches	**Page** 1 **of** 1	PID was not functioning correctly.
Logged By:	Stuart Hyde		

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Seattle, WA 98018

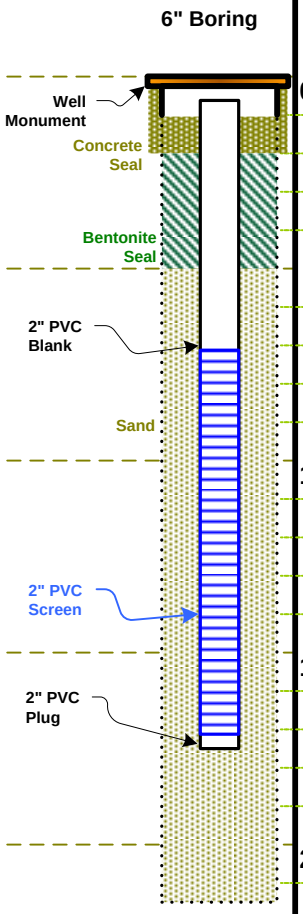
MW07

01-0979-c-ab-mw08.vsd

Depth	BLOWS/6 inches	INTERVAL	SAMPLE NUMBER	SOIL DESCRIPTION	Recovery %	USCS	PID (ppmv in headspace)
0				Surface: 4" Concrete			
	24 13 18			2.5-10': Brown-yellow, dry, slightly silty SAND, coarse grain, some gravel.	75	SP	0
5	5 8 7		MW08-06	Fill debris (brick pieces and asphalt) at 8'.	60		0
	6 6 3		MW08-08	Wet at 9'.	50		0
10	2 2 2		MW08-11	10-21.5': Brown, wet, silty SAND, fine grain, well graded. Varying silt content.	40		0
	3 2 2			Lenses containing organics present at 12', 15', and 18'.	75	SM	0
15	3 4 3		MW08-15	Brick debris encountered at 20.5'.	90		0
	5 6 7				40	SM	0
20	3 2 4		MW08-21	EOB at 21.5'	50		0
25							
30							

Depth in feet

WELL CONSTRUCTION



Drilling Method:	Hollow-stem auger	**Date:** 10/20/2015	**Other Information:**
Drilling Company:	Holocene Drilling	**Weather:** Sunny, Mild	Well Tag No.: BJX-752
Boring Diameter:	Six Inches	**Page** 1 **of** 1	PID was not functioning correctly.
Logged By:	Stuart Hyde		

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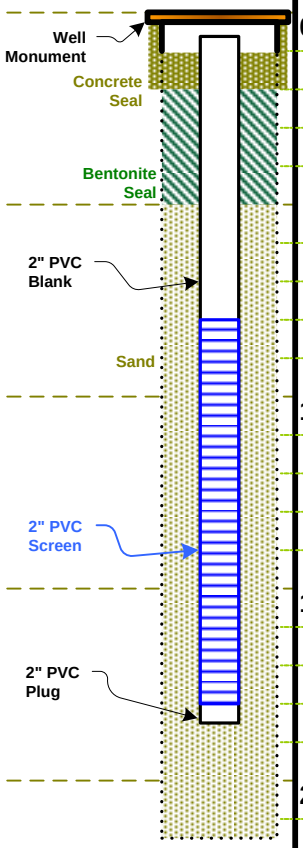
MW08

01-0979-c-ab-mw09.vsd

BLOWS/6 inches	INTERVAL	SAMPLE NUMBER	SOIL DESCRIPTION	Recovery %	USCS	PID (ppmv in headspace)	WELL CONSTRUCTION
			Surface: Gravel				6" Boring
7 11 12			2.5-5.5': Brown, moist, silty, gravelly SAND, well graded.	50	SM	0	
6 9 11		MW09-05	5.5-8.5': Brown, moist, slightly silty SAND, little gravel, poorly graded. Wet lens at 8-8.5'.	60	SP	0	
3 3 2		MW09-08	8.5-13': Brown, moist, SILT with organics, varying fine sand content.	80		0	
1 1 1				100	ML	0.4	
2 3 1		MW09-13	13-21.5': Dark gray, wet, silty SAND, fine to medium grain, well graded. Thin silt lenses throughout.	75		0	
2 5 4		MW09-16		40	SM	0.4	
4 3 4				20		0	
5 3 2		MW09-20	EOB at 21.5'	30		0.2	



Depth in feet

Drilling Method: Hollow-stem auger	**Date:** 10/22/2015	**Other Information:**	
Drilling Company: Holocene Drilling	**Weather:** Sunny, Mild	Well Tag No.: BJX-759	
Boring Diameter: Six Inches	**Page** 1 **of** 1		
Logged By: Stuart Hyde			

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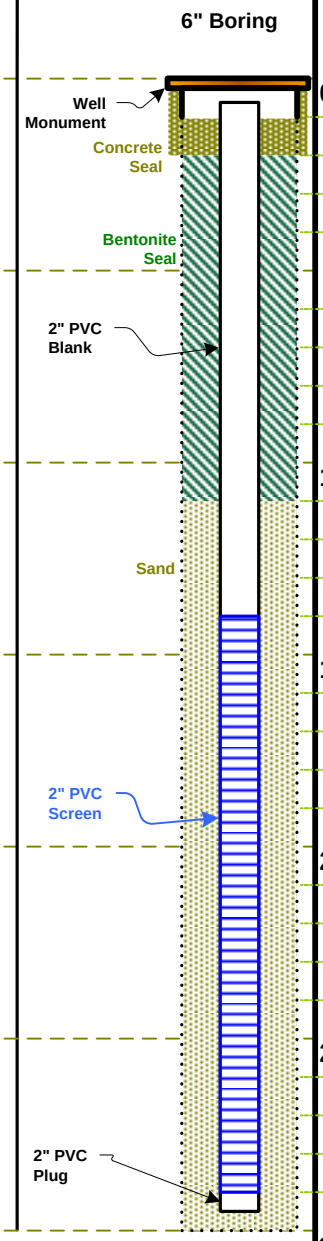
MW09

01-0979-c-ab-mw09d.vsd

BLOWS/6 inches	INTERVAL	SAMPLE NUMBER	SOIL DESCRIPTION	Recovery %	USCS	PID (ppmv in headspace)
			Surface: Gravel			
19 11 13			2.5-4': Brown, dry, silty, gravelly SAND, fine grain (road base). Turns blue/gray at 3.5-4'.	90	SM	0.1
10 9 9		MW09D-05	4-6.5': Dark gray and black, dry, slightly silty SAND, fine grain.	50		0.1
5 4 2			7.5-9': Gray-brown, moist, interbedded sandy SILT and silty SAND, some organics, fine grain.	75	ML/ SM	0
2 1 1		MW09D-10	10-14': Gray-brown, moist, SILT, some gravel and organics.	40	ML	0.4
2 3 6		MW09D-14	14-31.5': Brown and dark gray, wet, silty SAND, fine grain, well graded.	100		0.6
6 4 8				100		0.0
1 2 4		MW09D-18		80	SM	0.5
4 5 4				100		0.5
7 9 11		MW09D-23		100		0
5 7 8		MW09D-26	Varying lenses of organics.	30	SM	0.3

Depth in feet



Drilling Method: Hollow-stem auger	**Date:** 10/22/2015	**Other Information:**	
Drilling Company: Holocene Drilling	**Weather:** Sunny, Mild	Well Tag No.: BJX-760	
Boring Diameter: Six Inches	**Page** 1 **of** 2		
Logged By: Stuart Hyde			

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Boring/Well Log
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MW09D

01-0979-c-ab-mw09dpg2.vsd

BLOWS/6 inches	INTERVAL	SAMPLE NUMBER	SOIL DESCRIPTION	Recovery %	USCS	PID (ppmv in headspace)	WELL CONSTRUCTION
							6" Boring
3 5 2			Same	50	SM	0.1	Sand; 2" PVC Screen
5 2 3		MW09D-31	EOB at 31.5'	60		0.6	2" PVC Plug

25 30 35 40 45 50 55

Depth in feet

Drilling Method: Hollow-stem auger	**Date:** 10/22/2015	**Other Information:**	
Drilling Company: Holocene Drilling	**Weather:** Sunny, Mild	Well Tag No.: BJX-760	
Boring Diameter: Six Inches	**Page** 2 **of** 2		
Logged By: Stuart Hyde			

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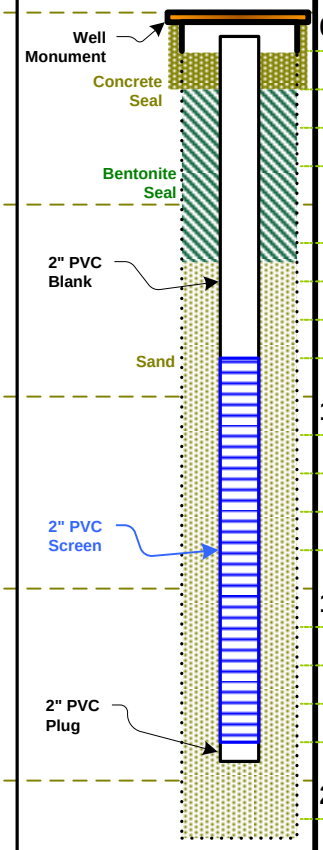
6365 First Avenue South
Seattle, WA 98018

MW09D

01-0979-c-ab-mw10.vsd

Depth	BLOWS/6 inches	INTERVAL	SAMPLE NUMBER	SOIL DESCRIPTION	Recovery %	USCS	PID (ppmv in headspace)
0				Surface: 4" Pavement			
	6 6 8				0		
				5-6': Blue-gray, moist, silty, gravelly SAND, well			
5	7 15 16		MW10-06	graded. Brick debris present in sampler. 6-8': Black and gray, dry, slightly silty SAND, poorly	60	SM SP	0.3
	2 1 1			graded.	50		0.5
				8-16': Brown and gray, moist, SILT, some organics.			
10	1 1 1		MW10-10	Interbedded fine SANDS throughout unit. Possible perched groundwater at 10.5'.	100	ML	0.2
	4 5 8				100		0.4
15	2 1 2		MW10-16		50	SM	0.4
	1 3 6		MW10-18	16-19': Black/gray, wet, silty SAND with organics.	40		0.4
20	2 6 7			EOB at 21.5'	0		
25							
30	Depth in feet						



Drilling Method:	Hollow-stem auger	**Date:** 10/22/2015	**Other Information:**
Drilling Company:	Holocene Drilling	**Weather:** Sunny, Mild	Well Tag No.: BJX-762
Boring Diameter:	Six Inches	**Page** 1 **of** 1	
Logged By:	Stuart Hyde		

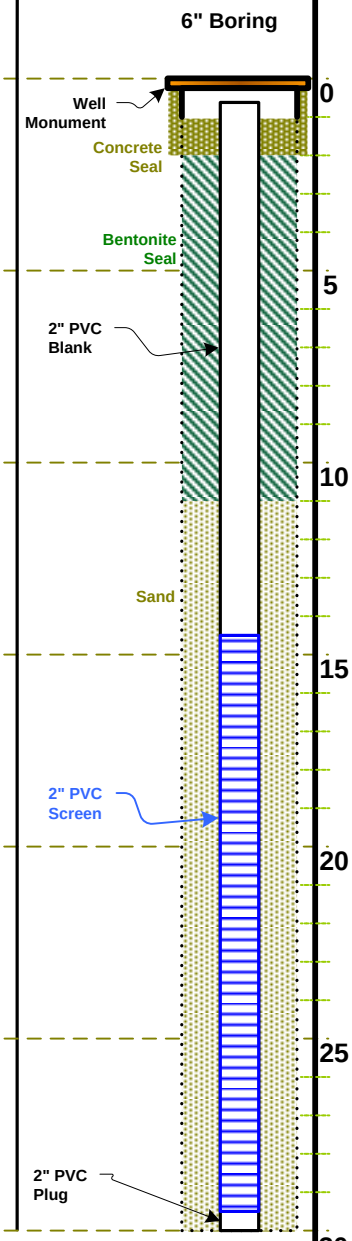
g-logics

Boring/Well Log
Duwamish Marine Center
6365 First Avenue South
Seattle, WA 98018

MW10

01-0979-c-ab-mw10d.vsd

Depth	BLOWS/6 inches	INTERVAL	SAMPLE NUMBER	SOIL DESCRIPTION	Recovery %	USCS	PID (ppmv in headspace)
0				Surface: 4" Pavement			
	6 6 5		MW10D-04	2.5-5.5': Brown, slightly moist, silty, gravelly SAND, well graded. Brick debris in sampler. Turns to blue/ green at 3.5'.	50	SM	0.3
5	5 9 11		MW10D-06	5.5-6.5': Black/brown, dry, slightly silty SAND.	75	SP	0
	3 2 3			Little to no recovery at 7.5' and 10'.	0	?	
10	4 3 2			10-31.5': Brown, very moist, silty SAND with gravel, well graded.	5		
	2 2 2		MW10D-13	Turns gray and wet at 13'.	50	SM	0
15	1 2 6			Thin SILT lenses throughout unit.	50		0.2
	4 8 7		MW10D-18		60		0.1
20	5 5 5				25		0.4
	6 8 9		MW10D-24		25	SM	0.2
25	4 4 7			Same	30		0.2
30	Depth in feet						



Drilling Method:	Hollow-stem auger	**Date:** 10/22/2015	**Other Information:**
Drilling Company:	Holocene Drilling	**Weather:** Sunny, Mild	Well Tag No.: BJX-761
Boring Diameter:	Six Inches	**Page** 1 of 2	
Logged By:	Stuart Hyde		

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Boring/Well Log
Duwamish Marine Center
6365 First Avenue South
Seattle, WA 98018

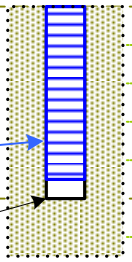
MW10D

01-0979-c-ab-mw10dpg2.vsd

BLOWS/6 inches	INTERVAL	SAMPLE NUMBER	SOIL DESCRIPTION	Recovery %	USCS	PID (ppmv in headspace)	WELL CONSTRUCTION
							6" Boring
			Increasing silt content.				
5 10 9		MW10D-28		40	SM	0.2	
6 4 2		MW10D-31	EOB at 31.5'	90		0.4	

25 30 35 40 45 50 55

Depth in feet



Drilling Method:	Hollow-stem auger	**Date:** 10/22/2015	**Other Information:**
Drilling Company:	Holocene Drilling	**Weather:** Sunny, Mild	Well Tag No.: BJX-761
Boring Diameter:	Six Inches	**Page** 2 **of** 2	
Logged By:	Stuart Hyde		

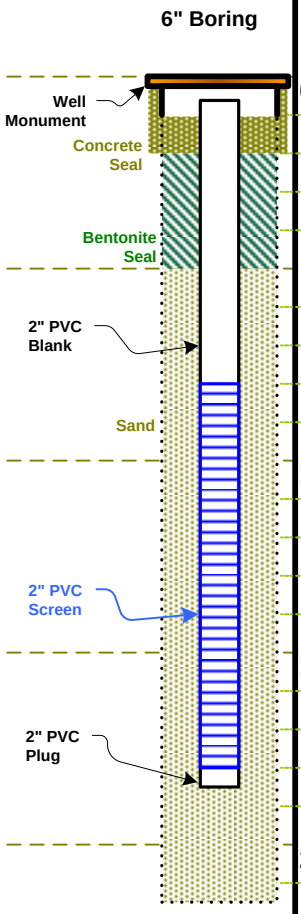
g-logics

Boring/Well Log
Duwamish Marine Center
6365 First Avenue South
Seattle, WA 98018

MW10D

01-0979-c-ab-mw11.vsd

Depth	BLOWS/6 inches	INTERVAL	SAMPLE NUMBER	SOIL DESCRIPTION	Recovery %	USCS	PID (ppmv in headspace)
0				Surface: 6" Concrete			
	7 8 6			2.5-5.5': Gray-brown, moist, slightly silty SAND. Increasing gravel at 5'.	10	SM	0
5	15 14 3		MW11-06	5.5-6.5': Gray, moist, clayey SILT, some organics.	75	ML	0
	14 28 50/6			Braided cable found in auger. Appears to have been encountered beginning at 2.5'.	0	?	0
10	2 6 2		MW11-11	10-12': Gray/brown, wet, very silty SAND, fine to coarse grain, well graded.	75	SM	0
	1 1 1			Turns black from 11-11.5'. 12.5-14': Light brown, slightly moist, SILT and SAND, fine grain, some organics.	100	SM/ ML	0
15	2 2 5		MW11-16	15-17': Brown, wet, silty SAND, some organics and wood debris.	75	SM	0
	3 2 4			17-21.5': Gray, slightly silty SAND, medium grain, poorly graded.	60	SP	0
20	3 2 3		MW11-20	EOB at 21.5'	75		0
25							
30	Depth in feet						



Drilling Method:	Hollow-stem auger	**Date:** 10/20/2015	**Other Information:**
Drilling Company:	Holocene Drilling	**Weather:** Sunny, Mild	Well Tag No.: BJX-753
Boring Diameter:	Six Inches	**Page** 1 **of** 1	PID was not functioning correctly.
Logged By:	Stuart Hyde		

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Boring/Well Log
Duwamish Marine Center
6365 First Avenue South
Seattle, WA 98018

MW11

01-0979-c-ab-mw12.vsd

BLOWS/6 inches	INTERVAL	SAMPLE NUMBER	SOIL DESCRIPTION	Recovery %	USCS	PID (ppmv in headspace)	WELL CONSTRUCTION
			Surface: 6" Gravel/Quarry Spalls				6" Boring
17 9 11		MW12-04	2.5-5.5': Brown, dry, slightly silty SAND, medium grain, poorly graded. Silt lens at 3.5-4'.	90	SP	0	
9 11 17		MW12-06	5.5-8': Dark gray, silty, gravelly SAND, some organics, slight odor.	75	SM	0	
7 9 10			8-11': Dark gray, moist, SAND, medium grain, poorly graded. Wet at 10.5' (perched water). Slight petroleum/tar odor and possible staining at 10.5-11'.	60		0	
7 3 3		MW12-11	11.5-12': Light gray, slightly moist, SILT.	60	ML	0	
3 2 6				75	SM/ ML	0	
3 3 3		MW12-16	12-19': Gray, wet, silt SAND, medium grain, well graded. Silt lenses throughout unit.	75	SM	0	
5 6 7			EOB at 19'	5	SP	0	
						0	

Depth in feet

Well Monument
Concrete Seal
Bentonite Seal
2" PVC Blank
Sand
2" PVC Screen
2" PVC Plug

Drilling Method:	Hollow-stem auger	**Date:** 10/20/2015	**Other Information:**
Drilling Company:	Holocene Drilling	**Weather:** Cold	Well Tag No.: BJX-751
Boring Diameter:	Six Inches	**Page** 1 **of** 1	PID was not functioning correctly.
Logged By:	Stuart Hyde		

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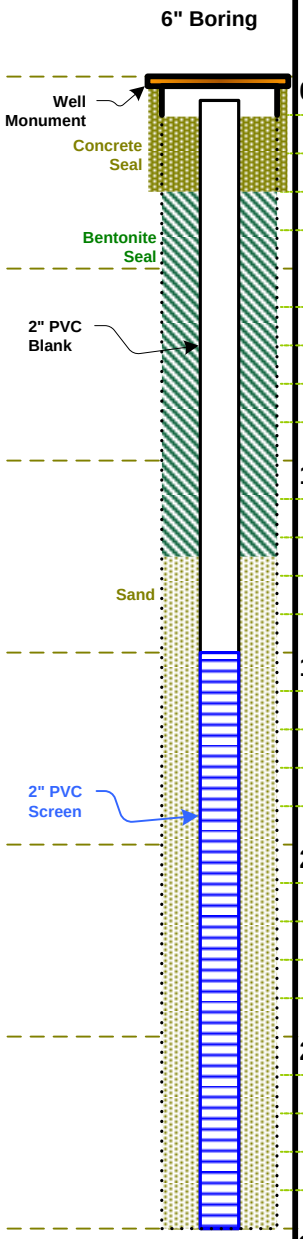
Boring/Well Log
Duwamish Marine Center
6365 First Avenue South
Seattle, WA 98018

MW12

01-0979-c-ab-mw12d.vsd

BLOWS/6 inches	INTERVAL	SAMPLE NUMBER	SOIL DESCRIPTION	Recovery %	USCS	PID (ppmv in headspace)
			Surface: 6" Gravel/Quarry Spalls			
7 14 8		MW12D-04	2.5-11': Brown, moist, slightly silty SAND, medium grain, poorly graded. Turns gray with increasing gravel at 5'.	60	SP	0
28 7 8				30		0
3 6 8		MW12D-08	Turns moist with little gravel at 7.5' Wet at 9-10' (perched groundwater).	90		0
4 2 1		MW12D-10 MW12D-11	11-13': Gray, moist, SILT, some organics.	75	ML	0
1 3 4		MW12D-14	13-31': Gray, wet, silty SAND, medium grain, well graded.	100		0
1 2 4		MW12D-16	Silt lenses throughout unit.	90	SM	0
4 4 4				60		0
1 1 2				5		0
2 2 4		MW12D-23	Increased organics at 23' (grass/reeds).	60		0
2 3 4				100	SM	0

WELL CONSTRUCTION



Depth in feet

Drilling Method:	Hollow-stem auger	**Date:** 10/19/2015	**Other Information:**
Drilling Company:	Holocene Drilling	**Weather:** Cloudy, Mild	Well Tag No.: BJX-749
Boring Diameter:	Six Inches	**Page** 1 **of** 2	PID was not functioning correctly.
Logged By:	Stuart Hyde		

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Seattle, WA 98018

MW12D

01-0979-c-ab-mw12dpg2.vsd

BLOWS/6 inches	INTERVAL	SAMPLE NUMBER	SOIL DESCRIPTION	Recovery %	USCS	PID (ppmv in headspace)	WELL CONSTRUCTION
							6" Boring
			Same		SM		Sand; 2" PVC Screen
6 10 13		MW12D-31	EOB at 31.5'	75		0	2" PVC Plug

25 30 35 40 45 50 55

Depth in feet

Drilling Method:	Hollow-stem auger	**Date:**	10/19/2015
Drilling Company:	Holocene Drilling	**Weather:**	Cloudy, Mild
Boring Diameter:	Six Inches	**Page**	2 of 2
Logged By:	Stuart Hyde		

Other Information:

Well Tag No.: BJX-749

PID was not functioning correctly.

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Boring/Well Log
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Seattle, WA 98018

MW12D

01-0979-c-ab-mw13.vsd

BLOWS/6 inches	INTERVAL	SAMPLE NUMBER	SOIL DESCRIPTION	Recovery %	USCS	PID (ppmv in headspace)	WELL CONSTRUCTION
			Surface: Gravel				6" Boring
16 20 21		MW13-04	2.5-6.5': Blue-gray, slightly moist, silty, gravelly SAND, well graded. Organics present at 6.5'.	50	SM	0	
10 16 21				100		0	
10 9 9				0	?		
1 2 3		MW13-10	10-13': Gray and brown, moist, SILT, organic content increasing with depth.	75	ML	0	
4 6 7		MW13-13	13-21.5': Gray, wet, slightly silty SAND, medium grain. Varying silt content.	60		0	
2 4 5				75	SM	0	
4 4 5		MW13-18	Same	50		0	
2 5 4		MW13-21	EOB at 21.5'	50		0	

Depth in feet

Well Monument
Concrete Seal
Bentonite Seal
2" PVC Blank
Sand
2" PVC Screen
2" PVC Plug

Drilling Method:	Hollow-stem auger	**Date:** 10/21/2015	**Other Information:**
Drilling Company:	Holocene Drilling	**Weather:** Cloudy, Mild	Well Tag No.: BJX-757
Boring Diameter:	Six Inches	**Page** 1 **of** 1	PID was not functioning properly.
Logged By:	Stuart Hyde		

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Boring/Well Log
Duwamish Marine Center
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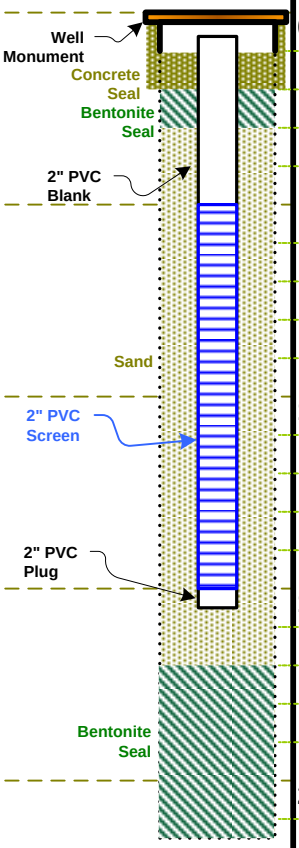
Seattle, WA 98018

MW13

01-0979-c-ab-mw14.vsd

Depth	BLOWS/6 inches	INTERVAL	SAMPLE NUMBER	SOIL DESCRIPTION	Recovery %	USCS	PID (ppmv in headspace)
0				Surface: Gravel			
	8 18 13		MW14-03	2.5-4': Brown/gray, moist, silty, gravelly, SAND. Wood and brick debris present at 3.5' (fill).	100	SM	1.0
5	6 8 9		MW14-06	5-12.5': Blue-gray, slightly moist, sandy SILT, some gravel. Little to no recovery.	75 0	ML	1.6
	13 12 6						
10	0 1 1		MW14-11		2		
	2 1 2			12.5-18': Black (stained), very moist, SILT and SAND, fine grain, some organics. Wet at 15'.	70	ML/ SM	3.8
15	1 1 1		MW14-16	Strong oily odor and staining, decreasing at 16.5'.	70		0.6
	6 11 9			18-21.5': Dark gray, wet, slightly silty SAND, no odor or staining.	70	SP	0.2
20	6 7 8		MW14-20	EOB at 21.5'	60		0.5
25							
30	Depth in feet						



Drilling Method:	Hollow-stem auger	**Date:** 10/21/2015	**Other Information:**
Drilling Company:	Holocene Drilling	**Weather:** Sunny, Mild	Well Tag No.: BJX-758
Boring Diameter:	Six Inches	**Page** 1 **of** 1	
Logged By:	Stuart Hyde		

g-logics

Boring/Well Log
Duwamish Marine Center
6365 First Avenue South
Seattle, WA 98018

MW14

01-0979-c-ab-mw15.vsd

BLOWS/6 inches	INTERVAL	SAMPLE NUMBER	SOIL DESCRIPTION	Recovery %	USCS	PID (ppmv in headspace)	WELL CONSTRUCTION
			Surface: 4" Asphalt				6" Boring
7 9 12			2.5-3.5': Brown, moist, silty SAND, metal/trash debris (fill).	75	SM	0	
4 9 7		MW15-06	3.5-8': Brown, slightly moist, slightly silty SAND, some gravel.	100	SP	0	
2 0 1				100		0	
			8-11': Gray/brown, moist, SILT with organics, organic odor.		ML		
1 1 2		MW15-11	Turns to very silty SAND with organics at 11-13'	100	SM	0	
2 2 3				75		0	
2 3 5		MW15-15	13-21.5': Dark gray, wet, slightly silty SAND, medium grain, poorly graded.	100		0	
3 4 5				75	SP	0	
12 11 10		MW15-20	EOB at 21.5'	100		0	

Depth in feet

Well Monument
Concrete Seal
Bentonite Seal
2" PVC Blank
Sand
2" PVC Screen
2" PVC Plug

Drilling Method:	Hollow-stem auger	**Date:** 10/21/2015	**Other Information:**
Drilling Company:	Holocene Drilling	**Weather:** Cloudy, Cool	Well Tag No.: BJX-756
Boring Diameter:	Six Inches	**Page** 1 **of** 1	PID was not functioning properly.
Logged By:	Stuart Hyde		

g-logics

Boring/Well Log
Duwamish Marine Center
6365 First Avenue South
Seattle, WA 98018

MW15

01-0979-c-ab-mw16.vsd

BLOWS/6 inches	INTERVAL	SAMPLE NUMBER	SOIL DESCRIPTION	Recovery %	USCS	PID (ppmv in headspace)	WELL CONSTRUCTION
			Surface: Gravel				6" Boring
16 17 17		MW16-03	2.5-11': Brown, very moist, silty, gravelly SAND, some organics, well graded. Metal/trash debris at 2'.	50	SM	0	
3 4 5		MW16-06	Turns dark gray at 5.5'.	60		0	
5 12 17			Brick/fill debris encountered at 7.5-10'. Turns black (stained?) at 10-11'	60	SM	0	
3 4 6		MW16-10	11-12': Gray/black, moist, SAND, trace silt, medium grain, poorly graded.	75	SP	0	
3 6 4		MW16-13	12-17.5': Dark gray, very moist, silty SAND, some gravel and organics.	60	SM	0	
50/6		MW16-15	Strong oily odor and possible staining at 15-16'. Wet at 15'.	75		0	
2 3 5		MW16-18	17.5-21.5': Gray, wet, slightly silty SAND, some organic/wood debris. Silt lens at 21'.	90	SP	0	
1 3 5		MW16-20	EOB at 21.5'	80		0	

Well Monument
Concrete Seal
Bentonite Seal
2" PVC Blank
Sand
2" PVC Screen
2" PVC Plug

Depth in feet

Drilling Method:	Hollow-stem auger	**Date:**	10/19/2015
Drilling Company:	Holocene Drilling	**Weather:**	Cloudy, Cool
Boring Diameter:	Six Inches	**Page**	1 of 1
Logged By:	Stuart Hyde		

Other Information:
Well Tag No.: BJX-748
PID was not functioning properly.

g-logics

Boring/Well Log
Duwamish Marine Center
6365 First Avenue South
Seattle, WA 98018

MW16

glb01.vsd

BLOWS/6 inches	INTERVAL	SAMPLE NUMBER	SOIL DESCRIPTION	Recovery %	USCS	PID (ppmv in headspace)	WELL CONSTRUCTION
			Surface: 6" Gravel				
			0.5-3': Brown, very moist, silty SAND, some trash debris, no odor or obvious staining.		SM		Temporary Boring. Backfilled with Bentonite
			3-8': Gray, moist, gravelly, clayey, SAND/SILT, slight petroleum oil odor, possible staining.	70		0.0	
			Wood debris at 5'		SC/ ML		
		GLB01-07	Foreign objects at 7 to 7.5'. Strong creosote odor, possible piling debris.	60		3.5	
			8-14': Brown (8-12') to dark gray (12-14'), wet, silty SAND, slight odor and possible staining at 12-14'. Perched groundwater at 9'.	50	SM	0.0	
		GLB01-12					
		GLB01-14				0.0	
			14-16': Brown/gray, moist SILT, no odor or staining.		ML		
			16-20': Black/dark gray, wet, SAND, medium grain, trace silt, slight odor and potential staining.	75	SP	0.0	
		GLB01-20		100		0.0	
			EOB at 20.0'				

0 5 10 15 20 25 30

Depth in feet

Drilling Method: Direct Push	**Date:** 3/29/2016	**Other Information:**
Drilling Company: Holocene	**Weather:** Cloudy	
Boring Diameter: Two inches	**Page** 1 **of** 1	
Logged By: Stuart Hyde		

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Boring Log
Duwamish Marine Center
6365 First Avenue South
Seattle, WA

GLB01

glb02.vsd

BLOWS/6 inches	INTERVAL	SAMPLE NUMBER	SOIL DESCRIPTION	Recovery %	USCS	PID (ppmv in headspace)	WELL CONSTRUCTION
			Surface: 6" Gravel				
		GLB02-03	0.5-3.5': Gray/brown, dry, silty, gravelly SAND, some brick/trash debris, sweet odor and possible staining at 2-3'.	75	SM	0.1 1.4	Temporary Boring. Backfilled with Bentonite
		GLB02-08	3.5-16': Dark gray, moist, silty SAND, some organics and wood debris, burned oil odor and possible staining throughout.	20		3.4	
			Water at 12'.	10	SM		
		GLB02-14	Oily slick appearance at 12-16'.				
		GLB02-17	16-20': Black, wet, SAND, medium grain, trace silt, oily appearance, burned oil odor and possible staining.	15	SP	2.5	
		GLB02-20	EOB at 20.0'	75		1.9	

0 5 10 15 20 25 30

Depth in feet

Drilling Method: Direct Push	**Date:** 3/28/2016	**Other Information:**
Drilling Company: Holocene	**Weather:** Cloudy	
Boring Diameter: Two inches	**Page** 1 **of** 1	
Logged By: Stuart Hyde		

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Boring Log
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6365 First Avenue South
Seattle, WA

GLB02

glb03.vsd

BLOWS/6 inches	INTERVAL	SAMPLE NUMBER	SOIL DESCRIPTION	Recovery %	USCS	PID (ppmv in headspace)	WELL CONSTRUCTION
			Surface: 6" Gravel				
			0.5-3': Brown/gray, moist, silty, gravelly SAND, crushed rock/trash/brick debris throughout, no obvious odor or staining.			0.0	Temporary Boring. Backfilled with Bentonite
		GLB03-04	3-8': Dark gray, moist, silty SAND, some organics, trace gravel, scattered trash and wood debris, creosote odor.	100	SM	1.2	
		GLB03-08	8-15': Dark gray, very moist to wet at 12', silty SAND, creosote odor, possible staining.	75	SM	1.5	
			11-11.5': Lens of dark gray, wet GRAVEL, pea size.	75	GP	0.1	
					SM	0.5	
		GLB03-17	15-17': Dark Gray, moist, SILT and SAND, very fine grained, marine odor.	100	SM/ ML	0.2	
		GLB03-20	17-20': Dark gray, wet, silty SAND, possible staining at 17', slight odor.	100	SM	0.1	
			EOB at 20.0'				

0 5 10 15 20 25 30

Depth in feet

Drilling Method: Direct Push	**Date:** 3/28/2016	**Other Information:**
Drilling Company: Holocene	**Weather:** Cloudy	
Boring Diameter: Two inches	**Page** 1 **of** 1	
Logged By: Stuart Hyde		

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Duwamish Marine Center
6365 First Avenue South
Seattle, WA

GLB03

glb04.vsd

BLOWS/6 inches	INTERVAL	SAMPLE NUMBER	SOIL DESCRIPTION	Recovery %	USCS	PID (ppmv in headspace)	WELL CONSTRUCTION
			Surface: 6" Gravel				
0			0.5-2': Red/brown, moist, silty, gravelly SAND, some trash debris, no odor or staining.			0.0	Temporary Boring. Backfilled with Bentonite
		GLB04-04		100	SM	1.2	
5			2-12': Gray, moist, silty, gravelly SAND, some organics, slight odor throughout. Trash debris from				
		GLB04-07	0.5-4'. Lenses of white/light gray, crushed rock at 2.5', 4', and 8', possible fill material.	75	SM	1.5	
10						0.1	
		GLB04-12		75			
			12-15': Gray, very moist to wet at 14', very fine SAND and SILT, odor and staining at 12-13', diminishing with depth.		SM/ ML	0.5	
15		GLB04-16		100		0.2	
			15-20': Gray, wet, slightly silty SAND, fine to coarse grained, no obvious odor or staining.		SM		
		GLB04-20		100		0.1	
20			EOB at 20.0'				
25							
30							

Depth in feet

Drilling Method: Direct Push	**Date:** 3/28/2016	**Other Information:**
Drilling Company: Holocene	**Weather:** Cloudy	
Boring Diameter: Two inches	**Page** 1 **of** 1	
Logged By: Stuart Hyde		

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6365 First Avenue South
Seattle, WA

GLB04

glb05.vsd

BLOWS/6 inches	INTERVAL	SAMPLE NUMBER	SOIL DESCRIPTION	Recovery %	USCS	PID (ppmv in headspace)	WELL CONSTRUCTION
			Surface: 6" Gravel				
		GLB05-04	0.5-9': Brown, to dark gray at 1.5', slightly moist, silty, gravelly SAND, some trash debris at 1.5 to 4', slight odor and possible staining at 1.5 to 4'.	90	SM	8.8	Temporary Boring. Backfilled with Bentonite
		GLB05-08	8-9': Dark gray, very moist, SAND, medium grain, poorly graded, faint odor and possible staining.	0	SP	0.1	
		GLB05-12	9-12': Brown/gray, moist, SILT, varying sand content throughout, no odor or staining.	100	ML	0.2	
			12-14': Brown/gray, moist, very silty SAND with organics/wood debris.			0.2	
		GLB05-16		100	SM	0.2	
			14-20': Brown/gray, wet, slightly silty SAND, some organics, no obvious odor or staining.				
		GLB05-20		75		0.1	
			EOB at 20.0'				

0 5 10 15 20 25 30

Depth in feet

Drilling Method: Direct Push	**Date:** 3/28/2016	**Other Information:**
Drilling Company: Holocene	**Weather:** Cloudy	
Boring Diameter: Two inches	**Page** 1 **of** 1	
Logged By: Stuart Hyde		

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Seattle, WA

GLB05

glb06.vsd

BLOWS/6 inches	INTERVAL	SAMPLE NUMBER	SOIL DESCRIPTION	Recovery %	USCS	PID (ppmv in headspace)	WELL CONSTRUCTION
			Surface: 6" Gravel				
			0.5-5': Gray to dark gray at 2', moist silty SAND with gravel, some trash/brick debris, petroleum odor and staining from 2-5'.		SM	0.1	Temporary Boring. Backfilled with Bentonite
		GLB06-04		80		1.1	
			5-5.5': Gray, moist, GRAVEL, pea size, no odor or staining.		ML/ CL		
		GLB06-07	5.5-7': Blue-gray, moist, SILT and CLAY, some brick debris, no odor.	70		0.0	
			7-10': Gray, wet (perched groundwater), silty, gravelly SAND, some clay and organics, trash/ crushed rock debris.		SM		
		GLB06-09				0.0	
			10-13.5': Dark gray, very moist, SILT and CLAY, no obvious odor or staining.	20	ML/ CL		
		GLB06-14	13.5-15': Dark gray, wet, silty SAND, decreasing silt content with depth, no obvious odor or staining.		SM	0.0	
				100		0.0	
			15-20': Dark gray, wet, SAND, medium grained, trace silt, no odor or staining.		SP		
		GLB06-20		100		0.0	
			EOB at 20.0'				

0 5 10 15 20 25 30

Depth in feet

Drilling Method: Direct Push	**Date:** 3/29/2016	**Other Information:** Refusal at 10' in original boring. Driller moved forward 1' and redrilled.
Drilling Company: Holocene	**Weather:** Cloudy	
Boring Diameter: Two inches	**Page** 1 **of** 1	
Logged By: Stuart Hyde		

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GLB06

glb07.vsd

BLOWS/6 inches	INTERVAL	SAMPLE NUMBER	SOIL DESCRIPTION	Recovery %	USCS	PID (ppmv in headspace)	WELL CONSTRUCTION
			Surface: 6" Gravel				
		GLB07-04	0.5-8': Brown, moist, silty SAND, some gravel, no odor or staining.	50	SM	1.8	Temporary Boring. Backfilled with Bentonite
		GLB07-08	Little recovery from 4' to 8'. Oily burnt odor and staining at end of sample tube.	10		4.6	
			8-14': Dark gray to brown at 10', wet at 12', SAND and GRAVEL, possible staining at 8' to 10'.	30	SP/ GP	0.0	
		GLB07-15	14-15': Dark gray/black, very moist, very fine SAND and SILT, slight marine odor.	60	SM/ ML	0.0	
			15-18': Dark gray/black, wet, SAND, medium grained, trace silt, no odor or staining.		SP		
		GLB07-19	18-20': Gray, very moist, very fine SAND and SILT, no odor or staining.	50	SM/ ML	0.0	
			EOB at 20.0'				

0 5 10 15 20 25 30

Depth in feet

Drilling Method: Direct Push	**Date:** 3/28/2016	**Other Information:**
Drilling Company: Holocene	**Weather:** Cloudy	
Boring Diameter: Two inches	**Page** 1 **of** 1	
Logged By: Stuart Hyde		

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Duwamish Marine Center
6365 First Avenue South
Seattle, WA

GLB07

glb08.vsd

BLOWS/6 inches	INTERVAL	SAMPLE NUMBER	SOIL DESCRIPTION	Recovery %	USCS	PID (ppmv in headspace)	WELL CONSTRUCTION
			Surface: 6" Gravel				
			0.5-4': Brown, slightly moist, silty, gravelly SAND, no odor or staining.	50	SM	0.0 0.3	Temporary Boring. Backfilled with Bentonite
			No recovery from 4' to 8'.				
		GLB08-08	8-10': Dark gray, wet, silty SAND, some organics, no odor or staining, perched groundwater at 8'	0		0.0	
		GLB08-12	10-13': Brown, slightly moist to wet at 12', very fine SAND and SILT, some organic and wood debris, slight marine odor.	100	SM/ ML	0.1 0.0	
		GLB08-16	13-20': Dark gray, wet, SAND, medium grained, trace silt, no odor or staining.	75	SP	0.0	
		GLB08-20	EOB at 20.0'	50		0.0	

0 5 10 15 20 25 30

Depth in feet

Drilling Method:	Direct Push	**Date:**	3/28/2016
Drilling Company:	Holocene	**Weather:**	Cloudy
Boring Diameter:	Two inches	**Page**	1 of 1
Logged By:	Stuart Hyde		

Other Information:

g-logics

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Duwamish Marine Center
6365 First Avenue South
Seattle, WA

GLB08

glb09.vsd

BLOWS/6 inches	INTERVAL	SAMPLE NUMBER	SOIL DESCRIPTION	Recovery %	USCS	PID (ppmv in headspace)	WELL CONSTRUCTION
			Surface: 6" Gravel				
		GLB09-03	0.5-6': Gray and brown, moist, silty SAND with gravel, some organics at 3.5', no odor or staining. Thin gravel lenses at 5' and 6'.	75	SM	0.0	Temporary Boring. Backfilled with Bentonite
		GLB09-08	6-9.5': Dark gray, moist, SAND, medium grained, little silt, no odor or staining.	75	SP	0.0 0.0	
			9.5-14', Gray/brown, moist to wet at 12', SILT with organics, increasing sand content with depth, organic odor, no obvious staining.	100	ML	0.0	
		GLB09-14	14-20': Brown/gray, wet very silty SAND, trace organics, decreasing silt content at 18', no odor or staining.	100	SM	0.0	
		GLB09-20	EOB at 20.0'	100		0.0	

0 5 10 15 20 25 30

Depth in feet

Drilling Method: Direct Push	**Date:** 3/29/2016	**Other Information:**
Drilling Company: Holocene	**Weather:** Cloudy	
Boring Diameter: Two inches	**Page** 1 **of** 1	
Logged By: Stuart Hyde		

g-logics

Boring Log
Duwamish Marine Center
6365 First Avenue South
Seattle, WA

GLB09

glb10.vsd

BLOWS/6 inches	INTERVAL	SAMPLE NUMBER	SOIL DESCRIPTION	Recovery %	USCS	PID (ppmv in headspace)	WELL CONSTRUCTION
			Surface: 6" Gravel				
			0.5-3': Brown, moist, silty, gravelly SAND, some trash/brick/crushed rock debris, no odor or staining.			0.0	Temporary Boring. Backfilled with Bentonite
		GLB10-04	3-8': Dark gray, silty SAND, some clay, some brick/ glass/trash debris, petroleum oil odor and possible staining.	60	SM	4.4	
						0.1	
		GLB10-08		50	SP		
			No recovery from 8' to 10'.	0			
			EOB at 10.0', Refusal				

0 5 10 15 20 25 30

Depth in feet

Drilling Method: Direct Push	**Date:** 3/29/2016	**Other Information:** Refusal at 10'. Moved forward one foot and tried again. Refusal again at 10'.
Drilling Company: Holocene	**Weather:** Cloudy	
Boring Diameter: Two inches	**Page** 1 **of** 1	
Logged By: Stuart Hyde		

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Boring Log
Duwamish Marine Center
6365 First Avenue South
Seattle, WA

GLB10

glb11.vsd

BLOWS/6 inches	INTERVAL	SAMPLE NUMBER	SOIL DESCRIPTION	Recovery %	USCS	PID (ppmv in headspace)	WELL CONSTRUCTION
			Surface: 6" Gravel				
			0.5-3': Gray, slightly moist, silty, gravelly SAND, some brick/crushed rock/ trash debris, no obvious odor or staining.	100		0.1	Temporary Boring. Backfilled with Bentonite
			3-5.5': Reddish brown, moist, silty SAND, no odor or staining.		SM		
		GLB11-06				0.3	
			5.5-9.5': Brown/gray, moist, silty SAND with gravel, staining and creosote odor at 5.5; and 7.5'.	100			
			9.5-13.5': Brown/gray, moist very fine SAND and SILT, increasing sand content with depth.	60	SM/ ML	0.2	
			13.5-15': Brown/gray, wet, slightly silty SAND,		SM		
		GLB11-15	decreasing silt content at 14.5'.			0.2	
			15-20': Dark gray, wet, SAND, medium grained, some organics, slight organic odor, no staining.	100	SP	0.4	
		GLB11-20		100		0.2	
			EOB at 20.0'				

0 5 10 15 20 25 30

Depth in feet

Drilling Method: Direct Push	**Date:** 3/28/2016	**Other Information:**
Drilling Company: Holocene	**Weather:** Cloudy	
Boring Diameter: Two inches	**Page** 1 **of** 1	
Logged By: Stuart Hyde		

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Boring Log
Duwamish Marine Center
6365 First Avenue South
Seattle, WA

GLB11

glb12.vsd

BLOWS/6 inches	INTERVAL	SAMPLE NUMBER	SOIL DESCRIPTION	Recovery %	USCS	PID (ppmv in headspace)	WELL CONSTRUCTION
			Surface: 6" Gravel				
		GLB12-04	0.5-4.5': Brown, very moist, silty SAND, some gravel, no odor or staining.	90	SM	0.0 0.0	Temporary Boring. Backfilled with Bentonite
		GLB12-06	4.5-10': Dark gray, very moist, SAND, medium grained, trace silt, no odor, possible staining at 6'.	75	SP	0.2 0.0	
		GLB12-10	10-13.5': Brown, slightly moist SILT with organics, increasing sand content at 13', no odor or staining.	100	ML	0.0	
		GLB12-14		100		0.1	
			13.5-20': Brown/gray, wet, SAND, medium grained, little silt, no odor or staining.		SP		
		GLB12-20		100		0.1	
			EOB at 20.0'				

0 5 10 15 20 25 30

Depth in feet

Drilling Method: Direct Push	**Date:** 3/29/2016	**Other Information:**
Drilling Company: Holocene	**Weather:** Cloudy	
Boring Diameter: Two inches	**Page** 1 **of** 1	
Logged By: Stuart Hyde		

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Boring Log
Duwamish Marine Center
6365 First Avenue South
Seattle, WA

GLB12

glb13.vsd

BLOWS/6 inches	INTERVAL	SAMPLE NUMBER	SOIL DESCRIPTION	Recovery %	USCS	PID (ppmv in headspace)	WELL CONSTRUCTION
			Surface: 6" Gravel				
		GLB13-01	0.5-4': Brown/gray, dry, silty, gravelly SAND, some organics and wood debris at 1', no odor or staining.	40	SM	0.2	Temporary Boring. Backfilled with Bentonite
		GLB13-04	Rock in shoe, no recovery	0	?		
			8-12': Gray, wet, slightly silty SAND, no obvious odor or staining.	10	SP		
		GLB13-12	No recovery.	0	?		
			EOB at 20.0'	0			

0 5 10 15 20 25 30

Depth in feet

Drilling Method: Direct Push	**Date:** 3/28/2016	**Other Information:**
Drilling Company: Holocene	**Weather:** Cloudy	
Boring Diameter: Two inches	**Page** 1 **of** 1	
Logged By: Stuart Hyde		

g-logics

Boring Log
Duwamish Marine Center
6365 First Avenue South
Seattle, WA

GLB13

glb14.vsd

BLOWS/6 inches	INTERVAL	SAMPLE NUMBER	SOIL DESCRIPTION	Recovery %	USCS	PID (ppmv in headspace)	WELL CONSTRUCTION
			Surface: 18" Concrete				
		GLB14-02	1.5-2.5': Brown, wet, silty SAND, no odor or staining.	50	SM	0.0	Temporary Boring. Backfilled with Bentonite
		GLB14-06	2.5-8': Gray, dry to wet at 4', SAND and GRAVEL (crushed rock fill), no odor or staining.	60	GW	0.0	
			8-13': Dark gray, dry to wet at 10', silty SAND,		SM		
		GLB14-12	possible staining, no odor.	5		0.0	
		GLB14-15				0.0	
				100			
			13-20': Dark gray, wet, slightly silty SAND, some gravel, no odor or staining.		SM		
		GLB14-15		100		0.0	
			EOB at 20.0'				

0 5 10 15 20 25 30

Depth in feet

Drilling Method: Direct Push	**Date:** 3/29/2016	**Other Information:**
Drilling Company: Holocene	**Weather:** Cloudy	
Boring Diameter: Two inches	**Page** 1 **of** 1	
Logged By: Stuart Hyde		

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Boring Log
Duwamish Marine Center
6365 First Avenue South
Seattle, WA

GLB14

APPENDIX F

G-Logics *Tidal Influence Study*

Appendix F
Tidal-Influence Study
Duwamish Marine Center Property
6365 First Avenue South
Seattle, WA 98018

Prepared for: Mr. Clint Harris
Duwamish Marine Center
16 South Michigan St.
Seattle, WA 98108

Prepared by: G-Logics, Inc.
40 2nd Avenue SE
Issaquah, WA 98027

Telephone: (425) 391-6874
Facsimile: (425) 313-3074

February 18, 2020

G-Logics Project 01-0979-F

g-logics

February 18, 2020
G-Logics Project 01-0979-G

Mr. Clint Harris
Duwamish Marine Center
16 South Michigan St.
Seattle, WA 98108

Subject: Appendix F
Tidal-Influence Study
Duwamish Marine Center Property
6365 First Avenue South
Seattle, WA 98018

Dear Mr. Harris:

Presented in this document are the results of G-Logics Tidal-Influence Study, performed at the above-referenced property (the "Property"). This report documents the purpose, approach, and results of this study. We trust the information presented in this report meets your needs at this time. Should you require additional information or have any questions, please contact us at your convenience.

Sincerely,
G-Logics, Inc.

Rory L. Galloway, LG, LHG
Principal

Stuart Hyde, LG
Project Geologist

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40 2nd Avenue SE
Issaquah, WA 98027
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TABLE OF CONTENTS

1.0 INTRODUCTION

G-Logics has completed a Tidal-Influence Study for the subject Property (Duwamish Marine Center Property), located at 6365 First Avenue South, in Seattle, WA (Figure 1). Water levels were measured throughout the Property to assess the Duwamish River's tidal influence relative to groundwater elevations. Work was conducted in August 2016 and was performed in accordance with G-Logics workplan dated June 7, 2016. Results of the tidal-influence study are presented in this report and are subject to the presented limitations.

2.0 TIDAL-INFLUENCE STUDY BACKGROUND

Tidal fluctuations in the adjacent Lower Duwamish Waterway (LDW) can influence near-shore groundwater elevations, which in turn may affect the movement of groundwater and contaminants on the Property. Continuous groundwater-elevation data was collected in wells throughout the Property in order to calculate mean groundwater elevations and hydraulic gradients (vertical and lateral). With this information, measured groundwater elevations were used to assess the net groundwater-flow direction, as well as groundwater flow directions during low and high-tide events.

Results of the tidal influence study also provides information on groundwater-elevation fluctuations due to tidal inundation and tidal-lag times across the Property. Because it was suspected that individual wells are affected at different times with respect to the rising and falling tides, this study also provides information for when groundwater sampling should be scheduled in respect to tidal events in the LDW.

3.0 DATA COLLECTION

The tidal-influence study was conducted by placing in-situ pressure transducers/data loggers in twelve monitoring wells situated across the Site. The pressure transducers recorded measurements of water levels, water pressures, and temperatures for five days. The approach for collecting data for this study is described below.

3.1 Tidal-Influence Study Approach

The tidal-influence study was started on August 25, 2016. In order to continuously collect data across the Site, a transducer was submerged into the following wells.

- Shallow-Zone Wells: MW05, MW06, MW07, MW08, MW10, MW11, MW12, MW13, MW16
- Deep-Zone Wells: MW-9D, MW-10D, MW-12D.
- Temporary Stilling Well: SW-01

The wells listed above were selected to provide an array of locations across the Property at varying depths and distances from the shoreline. Although MW09 was identified in our workplan as part of our tidal study, the well was omitted. We do not know why it was excluded. Use of transducers followed procedures outlined in Ecology's *Standard Operating Procedure for the use of Submersible Pressure Transducers During Groundwater Studies*, dated February 25, 2015. A temporary well, placed into the Duwamish River, was constructed for this study. This "stilling well" was installed along the Middle Dock to measure tide levels in the Duwamish River. Additionally, a barometric sensor was placed in a secure location on the site to measure and record barometric fluctuations during the study period. All data loggers were programmed to record pressure readings (water levels) at 15-minute intervals during the study period.

Water levels were manually measured in the wells at the beginning and end of the study in order to convert the pressure-transducer readings to groundwater elevations and to confirm that each transducer remained at a fixed depth in the well.

3.2 Data-Collection Methods

Data loggers (In-Situ, Inc. Level TROLL 700) were deployed and securely placed in all wells. Barometric pressure was recorded using a BaroTROLL 500 instrument. Water levels were measured and logged every 15-minutes for five days. Vented pressure transducers were used to compensate for atmospheric pressure changes so barometric corrections to water-level data were not required. A barometric pressure transducer was deployed to record barometric pressure fluctuations over the test period in the event that barometric corrections were required (e.g., if a transducer vent line became obstructed).

4.0 TIDAL-INFLUENCE STUDY RESULTS

The findings of this tidal-influence study are presented below. In general, tidal fluctuations occur twice a day with two high tides and two low tides. During the study period, the high tide-peak elevations for the LDW and all wells varied by approximately one foot or less. In contrast, low-tide elevations within a single day varied by as much as approximately six feet in the LDW and wells closest to the shoreline. Because of this, reference to the "low-low" tide refers to the lower-elevation low-tide event for each day during the study.

Hydrographs for the shallow-zone wells and deep-zone wells are presented in Graphs 1 and 2, respectively. Additionally, the hydrographs for well pairs MW10/10D and MW12/12D are presented on Graphs 3-1 and 3-2, respectively.

4.1 Groundwater-Elevation Fluctuations and Tidal Lag Times

Groundwater-elevation fluctuations were calculated in the shallow-zone wells to assess the magnitude of groundwater response to the tidal fluctuations. Fluctuations in each shallow-zone well were calculated between the high and low-low tide each day between August 26 and August 29, 2016. The daily fluctuations then were averaged for each well, with results ranging from 3.89 and 7.33 feet across the Property. Greatest groundwater fluctuations were measured in the vicinity of well MW08 and generally in wells nearest to the LDW shoreline fluctuations also were observed to decrease with distance from the shoreline. In general, an inverse-linear correlation is present between well distance from the shoreline and groundwater fluctuations. Calculated groundwater-elevation fluctuations are presented in Table 1 and are plotted against well distance from the shoreline in Graph 4. An isocontour map is shown on Figure 2 to present the magnitude of groundwater fluctuations across the Property.

The time delay between a tidally-influenced change in a surface-water body and corresponding change in groundwater is referred to as tidal-lag time. For this project, the time lag was calculated as the difference in time between low tides at the stilling well and corresponding troughs in each monitoring well between August 26 and August 29, 2019. In general, the lag time of water-level changes is shortest near the LDW and increases with distance inland. Average low-tide lag times were calculated for each well, with results ranging from 18 minutes to 117 minutes. Average lag times over the 5-day period also are presented in Table 1.

4.2 Well Distance vs Chloride Concentrations

In addition to groundwater data collected during this study, chloride concentrations measured in wells during groundwater sampling events were plotted against well distance from the shoreline. This process was completed to assess the tidal intrusion of surface water (saltwater) into upland groundwater on the Property. Chloride concentrations (analogous to salinity concentrations) measured in groundwater on the Property ranged from 1.11 to 4,870 mg/L (see Table 2). Chloride concentrations across the Property also are presented on the isocontour map in Figure 3. Graph 5 plots average chloride concentrations in each well against well distance from the shoreline. The trend line for the data yield an inverse-power correlation and demonstrates that chloride concentrations rapidly diminish with distance from the shoreline.

The LDW is considered marine water under Washington State water-quality standards due to salinity concentrations greater than 1 part per thousand (1,000 mg/L). In contrast, a study conducted by the United States Geological Survey (USGS) analyzed chloride concentrations in five freshwater streams in Washington State, with the average concentration of 9.14 mg/L (USGS, 2009). In addition, the study found that groundwater from shallow monitoring wells in urban areas across the United States contained a median chloride concentration of 46 mg/L.

Based on the USGS study and the chloride concentrations measured in upgradient wells on the Property (7.46 to 20.8 mg/L), groundwater with chloride concentrations greater than 50 mg/L is considered to be impacted by tidal intrusion of LDW surface water. Chloride concentrations measured on the Property indicate that tidal intrusion affects upland groundwater quality between approximately 120 feet (northern portions of the Property) and 200 feet (central and southern portions of the Property) inland from the LDW shoreline.

4.3 Mean Groundwater Elevations and Groundwater-Flow Direction

The Serfes method (Serfes, 1991) was used to calculate the mean groundwater elevations in each observed well over a 72-hour period (August 26, 2016 at 12:00 a.m. to August 28, 2016 at 11:45 p.m.). The Serfes method uses moving averages over a 72-hour period to filter the tidal-influenced elevations and produce a mean groundwater elevation. Hydrographs for each observed well are presented in Graphs 6-1 through 6-11 and include the results of the filtering process, as well as the mean groundwater elevation calculated using the Serfes method. The results of these calculations also are presented in Table 1.

Figure 4a presents the mean groundwater elevations, interpreted groundwater-elevation isocontours, and groundwater-flow directions of the shallow-zone wells based on the results. Mean groundwater elevations ranged between 5.34 and 6.14 feet (above the North American Vertical Datum of 1988, NAVD 88). Groundwater flow is generally to the south, southwest, and west towards the LDW shoreline.

4.4 Mean Vertical and Lateral-Hydraulic Gradients

Mean vertical-hydraulic gradients were calculated for the shallow and deep-zone well pairs MW10/10D and MW12/12D To calculate the vertical-hydraulic gradient, the difference in mean-groundwater elevations for each well pair (deep well minus shallow well) were divided by the elevation difference in well-screen midpoints (also deep minus shallow). For the shallow-zone wells screened across the water table, well-screen midpoints were calculated for the saturated portion of the well screen. Positive values indicate an upward hydraulic gradient, with negative values indicating downward gradients. A downward gradient was present in well pair MW10/10D at -0.021 ft/ft. Conversely, an upward gradient was present in well pair MW12/12D at 0.032 ft/ft. Table 3a presents the vertical hydraulic gradients calculated for each well pair. In addition, Graphs 3-1 and 3-2 present the mean groundwater elevations of each well pair for visual comparison.

Lateral-hydraulic gradients were calculated for three shallow-zone well sets: wells MW06, 07, and 13; wells MW12, 13, and 16; and wells MW10, 11, 16. These well sets were chosen based on well distribution across the Property and the general flow characteristics indicated on Figure 4a (groundwater-flow directions and relative gradient based on isocontours). Lateral-hydraulic gradients were calculated using the standard “three-point problem” for groundwater flow. Hydraulic gradients across the Property ranged from 0.0016 to 0.0049 ft/ft, with flow directions to the south, southwest, and west. Table 3b and Figure 4b present the gradients and lateral-flow directions for each well set.

4.5 Low and High Tide Groundwater Elevations and Flow Direction

Average elevations for the high and low-low tides over the study period are presented in Table 1. These averages were calculated using elevation information collected between August 26 and August 29, 2016. Interpreted isocontours for average low-low and high-tide groundwater elevations in shallow-zone wells are presented on Figure 5 and Figure 6, respectively. These figures also present an interpretation of flow directions during the low-low and high-tide events. In general, groundwater flows toward the river during low-low

tides. However, high tides in the LDW cause temporary and lesser groundwater flow and gradient reversals inland across the entire Property.

5.0 CONCLUSIONS

Based on the results of the tidal-influence study, the following conclusions regarding mean-groundwater elevations, tidal fluctuations, hydraulic gradients, and tidal influence of the LDW on the Property are presented below.

- Mean groundwater elevations were calculated using the Serfes Method over a 72-hour period. Mean groundwater elevations on the Property ranged from 5.34 to 6.14 feet. Mean groundwater-flow directions in shallow-zone wells were to the south, southwest, and west.
- All monitoring wells at the Site are tidally influenced, with elevation fluctuations ranging from 3.89 to 7.33 feet. The magnitude of elevation changes is greatest near the shoreline and decreases with distance inland.
- The lag time of water-level changes is shortest near the LDW and increases with distance inland. Water-level elevations closely follow tide stages. Average lag times range from 18 minutes to 117 minutes.
- Mean vertical-hydraulic gradients were calculated for two well pairs: a mean downward gradient of 0.021 ft/ft in MW10/10D and a mean upward gradient of 0.032 ft/ft in MW12/12D.Although, as shown on Graph 3-1, wells MW10/10D appear to shift from a downward gradient at low tide towards no vertical gradient at high tide. In contrast, the vertical-hydraulic gradient in wells MW12/12D appears to maintain an upward vertical gradient, regardless of tide conditions (Graph 3-2).
- Lateral-hydraulic gradients were calculated across the Property for three well sets. Lateral gradients ranged from 0.0016 to 0.0049 ft/ft, generally in the direction of the LDW (south, southwest, and west).
- Chloride concentrations measured in groundwater on the Property ranged from 1.11 to 4,870 mg/L. Chloride concentrations indicate that tidal intrusion of surface water occurs on the Property and affects upland groundwater quality to distances between 120 and 200 feet inland of the LDW shoreline.

6.0 OPINIONS

Although groundwater elevations in wells distant from the LDW shoreline show a response to tidal fluctuations, the groundwater-elevation fluctuations in distant wells likely are due to

mounding of groundwater as it encounters saltwater from the LDW. This mounding causes temporary groundwater-flow reversals in the "upgradient" direction. However, mean groundwater elevations indicate that net flow is to the west towards the LDW.

Based on groundwater-elevation fluctuations, hydraulic gradients, tidal-lag times, and chloride concentrations, all areas on the Property within approximately 120 feet of the LDW shoreline appear to be strongly hydraulically connected to the LDW surface water. The affected areas of the shallow aquifer likely are more transmissive with greater surface-water infiltration inland. These areas also coincide with locations that have been filled with dredged and/or imported material. Additionally, based on the data, the central and southern portion of the Property (south of well MW12) appear to be impacted by surface-water infiltration further inland than the northern portion of the Property, to distances of approximately 200 feet.

Lastly, to collect a representative and conservative groundwater sample (i.e., a water that contains the most amount of groundwater as opposed to surface water), efforts should be made to collect samples within 3 hours (either side) of low-tide. Samples collected during this time period would be most representative of groundwater which flows in the direction of the LDW.

7.0 LIMITATIONS

The scope of work on this project was presented in our identified workplan and subsequently approved by the Duwamish Marine Center. Please be aware our scope of work was limited to those items specifically identified in the workplan. Other activities not specifically included in the presented scope of work (in a workplan, correspondence, or this report) are excluded and are therefore not part of our services.

Land use, site conditions (both on-site and off-site), and other factors will change over time. Since site activities and regulations beyond our control could change at any time after the completion of this report, our observations, findings, and opinions can be considered valid only as of the date of the site visit.

This report is prepared for the sole use of our client. The scope of services performed during this assessment may not be appropriate for the needs of other users. Re-use of this document or the findings, conclusions, or recommendations presented herein, are at the sole risk of said user(s). Our client and regulatory agencies also may make additional copies of

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No warranty, either express or implied, is made.

8.0 REFERENCES

Serfes, Michael E. (August 1991). *Determining the Mean Hydraulic Gradient of Ground Water Affected by Tidal Fluctuations.* Ground Water Journal, Volume 29, Number 4, July-August 1991.

United States Geological Survey. (2009). *Chloride in Groundwater and Surface Water in Areas Underlain by the Glacial Aquifer System, Northern United States.* Scientific Investigations Report 2009-5086.

FIGURES

g-logics

Approximate Drawing Scale: 1" = 80'

0 ft. 48 ft. 80 ft. 160 ft.

Tidal-Study Well Locations

Duwamish Marine Center Property
6365 First Avenue South
Seattle, Washington

Figure 1

Project File: 01-0979-G-AF-F1.vsd

Mapping Reference: King County iMap, PLS Inc. Survey (2015-2017), G-Logics Site Measurements

N

Slip 2

Current Shoreline

Property Boundary

Lower Duwamish Waterway

Legend

- MW09 — G-Logics Monitoring Well Location and ID Not Used in Tidal Study
- MW08 — Tidal Study Well Location and ID
- SW1 — Temporary Stilling Well Location and ID
- Isocontour of Groundwater-Elevation Fluctuations for Shallow-Zone Wells (feet)

Groundwater fluctuations were calculated using the high and low-low tide elevation data collected between 8/26/2016 and 8/29/2016.

MW11 *6.74'*

7.0'

6.0'

MW08 *7.33'*

5.0'

4.0'

MW10 *3.89'*

MW10D

MW05

MW16 *6.59'*

MW12D

MW12 *6.09'*

SW01 *10.74'*

MW09D

MW09

MW13 *4.96'*

5.0'

MW14

MW07 *5.09'*

MW15

6.0'

MW06 *6.29'*

Note: This figure contains information in color. Black & white photocopies may not be suitable for review.

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Approximate Drawing Scale: 1" = 80'

0 ft. 48 ft. 80 ft. 160 ft.

Average Groundwater Fluctuations

Duwamish Marine Center Property

6365 First Avenue South

Seattle, Washington

Figure 2

Project File: 01-0979-G-AF-F2.vsd

Mapping Reference: King County iMap, PLS Inc. Survey (2015-2017), G-Logics Site Measurements

N

Slip 2

Current Shoreline

Property Boundary

Lower Duwamish Waterway

Legend

MW09	G-Logics Monitoring Well Location and ID
MW08	Tidal Study Well Location and ID
SW1	Temporary Stilling Well Location and ID
4,870	Chloride Concentrations (mg/L)
	Isocontour of Average Chloride Concentrations (mg/L)

Chloride concentrations are averages based on G-Logics groundwater-sampling events.

MW11 *4,870*

4,000

3,000

2,000

1,000

500

250

100

MW08 *6.93*

MW10 *7.46*

MW10D *16.7*

MW05 *86.6*

MW16 *4,133*

MW12D *43.9*

MW12 *106.7*

SW01

MW13 *219.67*

MW09D *20.8*

MW09 *18.9*

MW14 *1,523*

MW07 *161*

MW15 *10.85*

MW06 *844*

Note: This figure contains information in color. Black & white photocopies may not be suitable for review.

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Approximate Drawing Scale: 1" = 80'

0 ft. 48 ft. 80 ft. 160 ft.

Average Chloride Isocontours
Duwamish Marine Center Property
6365 First Avenue South
Seattle, Washington

Figure 3

Project File: 01-0979-G-AF-F3.vsd

Mapping Reference: King County iMap, PLS Inc. Survey (2015-2017), G-Logics Site Measurements

N

Slip 2

Current Shoreline

Property Boundary

Lower Duwamish Waterway

Legend

- MW09 — G-Logics Monitoring Well Location and ID
- MW08 — Tidal Study Well Location and ID
- SW1 — Temporary Stilling Well Location and ID
- Isocontour of Groundwater Elevations (feet) in Shallow-Zone Wells and Groundwater-Flow Direction

Mean groundwater elevations were calculated using the Serfes Method (1991) and data collected between 8/26/2016 and 8/28/2016.

MW11 *5.80'*

MW08 *5.56'*

MW10 *5.87'*

MW10D *5.70'*

MW05

MW16 *5.34'*

MW12D *6.14'*

MW12 *5.88'*

SW01 *4.90'*

MW13 *5.72'*

MW09D *5.57'*

MW09

MW14

MW07 *5.51'*

MW15

MW06 *5.34'*

5.8' 5.7' 5.6' 5.5' 5.4' 5.8' 5.7' 5.6' 5.5' 5.4' 5.3'

Note: This figure contains information in color. Black & white photocopies may not be suitable for review.

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Approximate Drawing Scale: 1" = 80'

0 ft. 48 ft. 80 ft. 160 ft.

Mean Groundwater Isocontours

Duwamish Marine Center Property
6365 First Avenue South
Seattle, Washington

Figure 4a

Project File: 01-0979-G-AF-F4a.vsd

Mapping Reference: King County iMap, PLS Inc. Survey (2015-2017), G-Logics Site Measurements

N

Slip 2

Current Shoreline

Property Boundary

Lower Duwamish Waterway

Legend

- MW09 — G-Logics Monitoring Well Location and ID
- MW08 — Tidal Study Well Location and ID
- SW1 — Temporary Stilling Well Location and ID
- Groundwater Elevation Contours for Shallow-Zone Wells (in feet)
- 0.00161 ft/ft, 243 Degrees — Lateral-Hydraulic Gradient and Groundwater-Flow Direction for Triangulated Well Sets

Lateral hydraulic gradients calculated using standard "three-point problem" for groundwater flow. Flow directions are in degrees, clockwise from north.

MW11 5.80'
MW08 5.56'
MW10 5.87'
MW10D 5.70'
MW05
MW12D 6.14'
MW16 5.34'
MW12 5.88'
SW01
MW13 5.72'
MW09D 5.57'
MW09
MW14
MW07 5.51'
MW15
MW06 5.34'

5.8' 5.7' 5.6' 5.5' 5.4' 5.3'

0.0016 ft/ft, 243 Degrees
0.0049 ft/ft, 274 Degrees
0.0021 ft/ft, 172 Degrees

Note: This figure contains information in color. Black & white photocopies may not be suitable for review.

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Approximate Drawing Scale: 1" = 80'
0 ft. 48 ft. 80 ft. 160 ft.

Lateral Hydraulic Gradients
Duwamish Marine Center Property
6365 First Avenue South
Seattle, Washington

Figure 4b

Project File: 01-0979-G-AF-F4b.vsd

Mapping Reference: King County iMap, PLS Inc. Survey (2015-2017), G-Logics Site Measurements

g-logics

Approximate Drawing Scale: 1" = 80'

0 ft. 48 ft. 80 ft. 160 ft.

Low Tide Groundwater Isocontours
Duwamish Marine Center Property
6365 First Avenue South
Seattle, Washington

Figure 5

Project File: 01-0979-G-AF-F5.vsd

Mapping Reference: King County iMap, PLS Inc. Survey (2015-2017), G-Logics Site Measurements

g-logics

Approximate Drawing Scale: 1" = 80'

0 ft. 48 ft. 80 ft. 160 ft.

High Tide Groundwater Isocontours

Duwamish Marine Center Property
6365 First Avenue South
Seattle, Washington

Figure 6

Project File: 01-0979-G-AF-F6.vsd

Mapping Reference: King County iMap, PLS Inc. Survey (2015-2017), G-Logics Site Measurements

TABLES

TABLE 1
Well Information, Groundwater Elevations, and Tidal Lag Times
Duwamish Marine Center
6365 First Avenue South
Seattle, Washington

Location Designation	Approximate Distance to Shoreline (ft)	Elevation Top of PVC Casing (ft)	Depth to Top of Screen (ft)	Depth to Bottom of Screen (ft)	Well Diameter (in.)	High Tide, Average Depth to Water (ft) (1)	Low-Low Tide, Average Depth to Water (ft) (1)	High Tide, Average Groundwater Elevation (ft)	Low Tide, Average Groundwater Elevation (ft)	Mean GW Elevation (ft) (2)	Groundwater Elevation Fluctuations (ft) (1)	Average Tidal Lag Time (hr:min:sec)
SW01	---	17.33	10	20	2	8.66	19.40	8.67	-2.07	4.902	10.74	---
MW05 (3)	116	16.48	10	20	2	9.61	---	6.87	---	5.94	---	0:18:45
MW06	86	12.73	8	18	2	5.05	11.34	7.68	1.39	5.34	6.29	0:41:15
MW07	160	14.93	7	17	2	7.66	12.75	7.27	2.18	5.51	5.09	1:00:00
MW08	136	14.41	8	18	2	6.33	13.66	8.08	0.75	5.56	7.33	0:37:30
MW09D	307	14.97	14	29	2	7.66	12.26	7.31	2.71	5.57	4.60	1:26:15
MW10	322	15.07	9	19	2	7.78	11.67	7.29	3.40	5.87	3.89	1:56:15
MW10D	322	15.03	14.5	29.5	2	7.64	12.10	7.39	2.93	5.70	4.46	1:22:30
MW11	40	14.25	8	18	2	6.13	12.87	8.12	1.38	5.80	6.74	0:18:45
MW12	137	16.70	7.5	17.5	2	8.55	14.63	8.15	2.07	5.88	6.09	0:48:45
MW12D	147	16.80	15	30	2	8.37	14.48	8.43	2.32	6.14	6.11	0:45:00
MW13	93	15.23	8	18	2	7.68	12.64	7.55	2.59	5.72	4.96	0:37:30
MW16	30	17.42	9	19	2	9.80	16.39	7.62	1.03	5.34	6.59	0:37:30

Notes:

(1) High and low-low tide average based on groundwater elevations collected over four days, 8/26/2016 to 8/29/2016. Groundwater fluctuations were calculated using these averages.

(2) Mean groundwater elevations calculated using the Serfes Method (1991) with data collected over a 72-hour period, 8/26/2016 at 12:00 a.m. to 8/28/2016 at 11:45 p.m.

(3) Data from well MW05 not used for groundwater-elevation measurements due to the transducer being out of water during low-tide events.

TABLE 2
Groundwater Geochemical Parameters
Duwamish Marine Center
6365 First Avenue South
Seattle, Washington

Exploration Location	Observation Date	Approximate Distance to Shoreline (ft)	Chloride (mg/L)(2)	Conductivity (mS/cm)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	pH	Oxidation-Reduction Potential (mV)
MW05	Average (3)	155	86.6	0.923	3.8	---	6.97	-65.4
MW06	Average (3)	86	844	3.450	36.6	2.34	6.39	15.1
MW07	Average (3)	160	161	1.200	25.5	2.52	6.52	-131.4
MW08	Average (3)	136	6.93	0.408	15.0	1.57	7.18	-78.3
MW09	Average (3)	305	18.9	1.040	20.6	4.18	6.38	88.2
MW09D	Average (3)	307	20.8	0.417	21.6	2.22	6.58	-69.5
MW10	Average (3)	322	7.46	0.329	33.3	3.50	6.52	54.3
MW10D	Average (3)	322	16.1	0.299	21.7	2.19	6.51	-51.0
MW11	Average (3)	40	4,870	16.664	9.0	0.82	7.33	-43.9
MW12	Average (3)	137	107	1.183	17.4	2.56	6.60	-126.2
MW12D	Average (3)	147	43.9	0.625	15.2	1.43	6.54	-90.1
MW13	Average (3)	93	220	1.589	12.0	1.27	6.67	-136.1
MW14	Average (3)	36	1,523	5.015	31.1	2.81	6.85	-119.1
MW15	Average (3)	235	11	0.234	41.0	4.93	6.33	50.3
MW16	Average (3)	30	4,133	10.885	13.3	1.35	7.15	-140.7
SW01	Average (3)	0	---	---	---	---	---	---

Notes: Refer to site diagram(s) for well locations.

(1) Fluctuation of groundwater elevations in each well were calculated between low-low and high-high tide for each day and averaged.

(2) Brackish water in tidal estuaries contain chloride levels between 500 and 5,000 mg/L. Drinking water standards for chloride are 500 mg/L.

(3) Geochemical-parameter values are averages based on the groundwater-sampling events outlined in Table 2-8 of the RI report.

TABLE 3a
Vertical Hydraulic Gradient for Paired Wells
Duwamish Marine Center
6365 First Avenue South
Seattle, Washington

Well Pair Identification	Elevation Top of PVC Casing (ft)	Depth to Top of Screen (ft)	Depth to Bottom of Screen (ft)	Elevation of Top of Screen (ft)	Elevation of Bottom of Screen (ft)	Well Screen Midpoint Elevation (ft)	Mean GW Elevation (ft)	Mean Vertical Gradient (ft/ft)
MW10	15.07	9.00	19.00	6.07	-3.93	0.97	5.87	-0.021
MW10D	15.03	14.50	29.50	0.53	-14.47	-6.97	5.70	
MW12	16.70	7.50	17.50	9.20	-0.80	2.54	5.88	0.032
MW12D	16.80	15.00	30.00	1.80	-13.20	-5.70	6.14	

Notes:

Mean groundwater elevations calculated using the Serfes Method (1991) with data collected over a 72-hour period, 8/26/2016 at 12:00 a.m. to 8/28/2016 at 11:45 p.m.

Mean vertical-hydraulic gradient calculated by dividing the difference between deep and shallow wells by the elevation difference between the well-screen midpoints.

Only saturated/submerged portions of the well screen were used to calculate vertical gradient.

Positive value indicates an upward vertical gradient. Negative values indicate a downward vertical gradient.

TABLE 3b

Lateral Hydraulic Gradient for Shallow-Zone Well Sets

Duwamish Marine Center

6365 First Avenue South

Seattle, Washington

Well Identification	Mean GW Elevation (ft)	Average Lateral Gradient (ft/ft)	Groundwater Flow Direction (degrees)
MW06	5.336		
MW07	5.508	0.0021	172
MW13	5.720		
MW12	5.878		
MW13	5.720	0.0049	274
MW16	5.337		
MW10	5.871		
MW11	5.800	0.0016	243
MW16	5.337		

Notes:

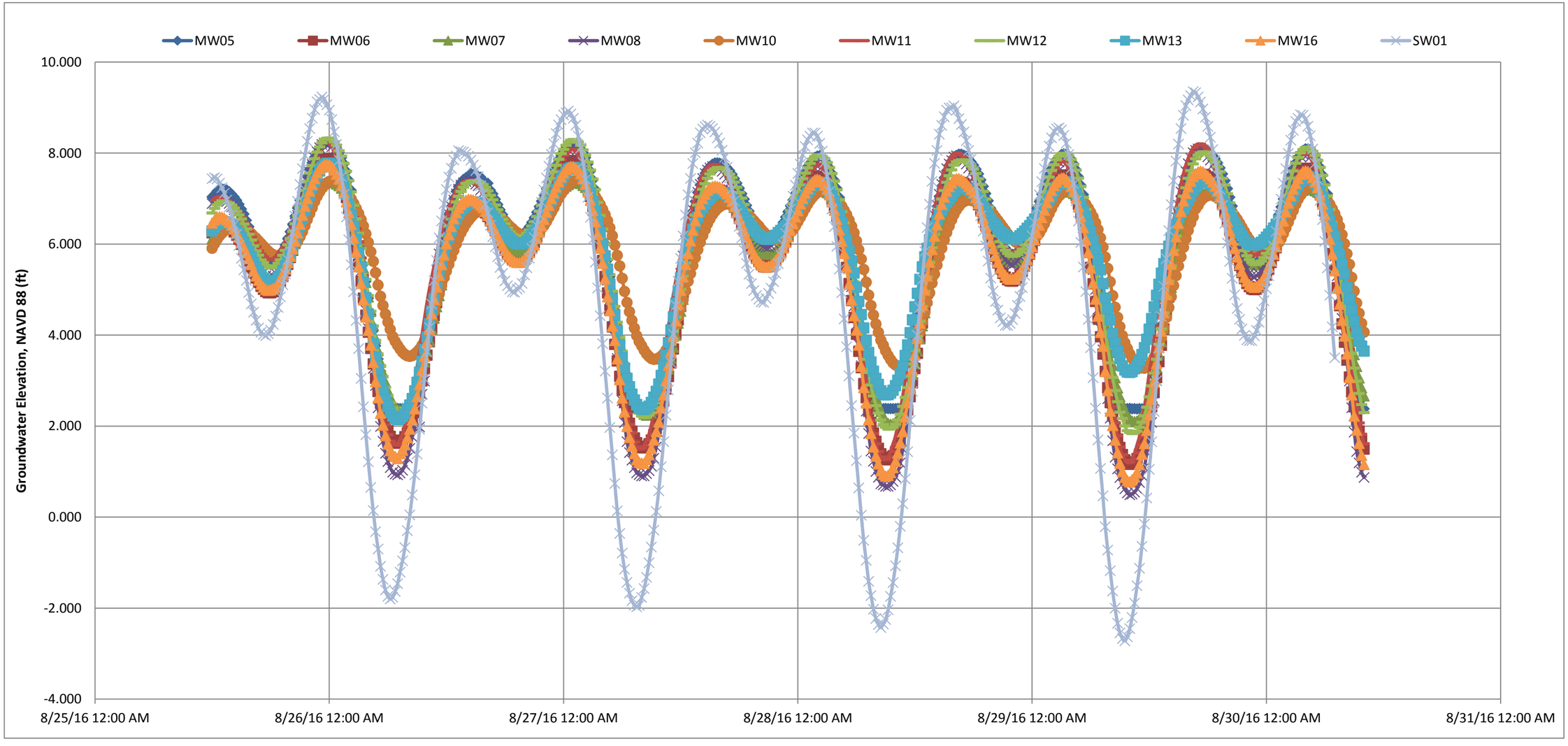
Mean groundwater elevations calculated using the Serfes Method (1991) with data collected over a 72-hour period, 8/26/2016 at 12:00 a.m. to 8/28/2016 at 11:45 p.m.

Lateral hydraulic gradients were calculated using the solution to the standard "three-point problem" for groundwater flow.

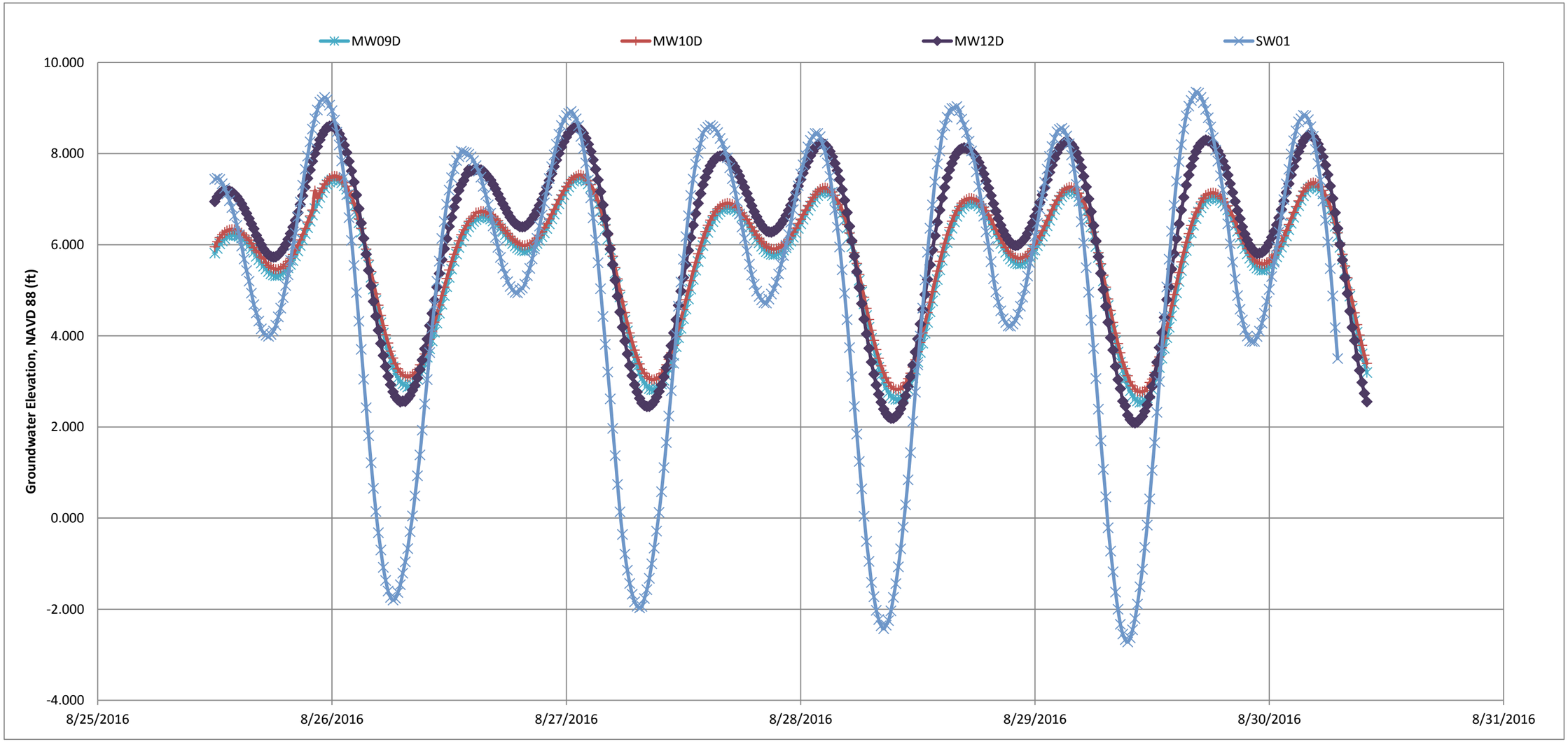
Groundwater-flow direction are in degrees, clockwise from north.

GRAPHS

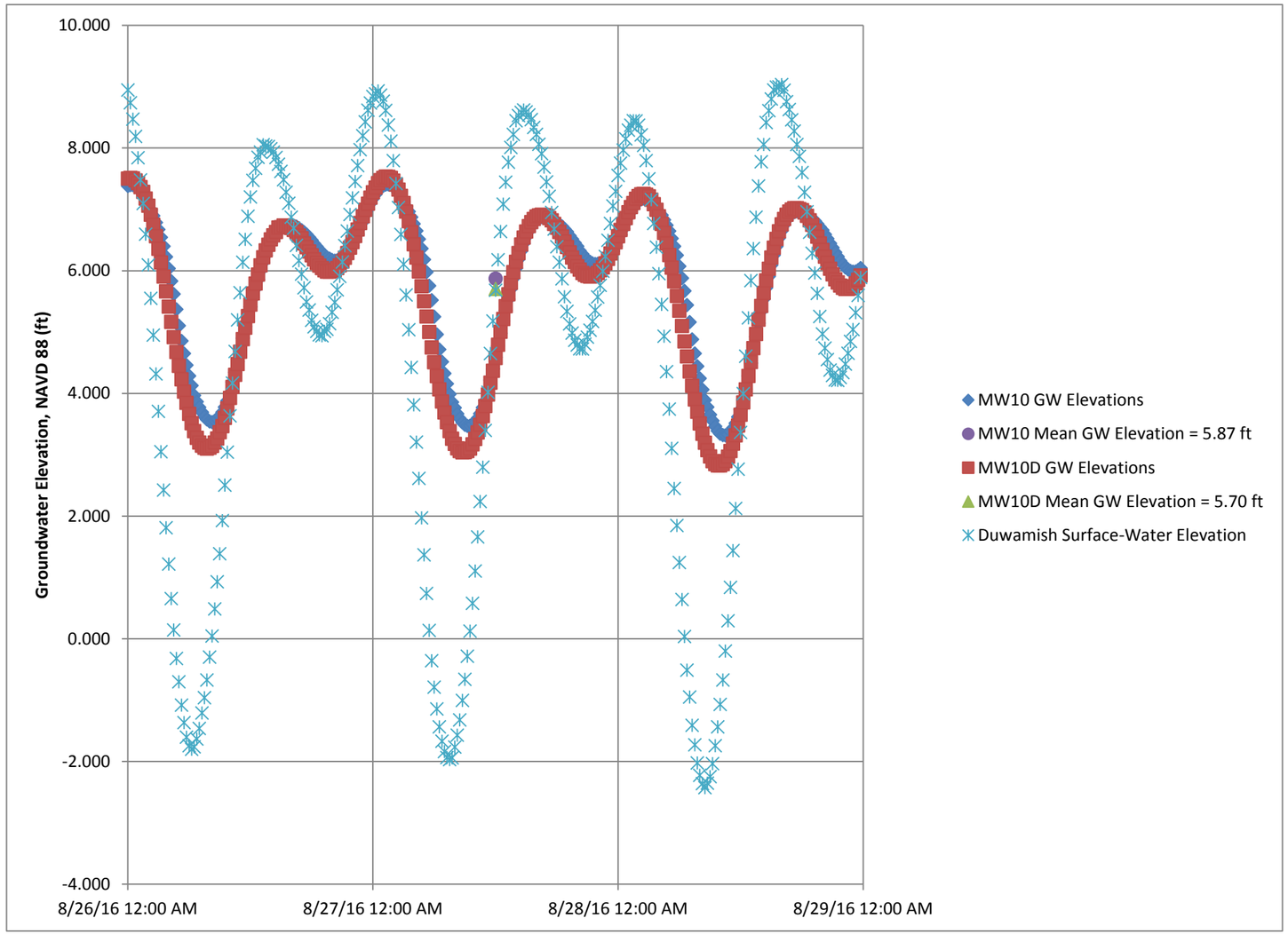
GRAPH 1
Shallow Wells - Groundwater Elevation Measurements
Duwamish Marine Center
6365 First Avenue South
Seattle, Washington



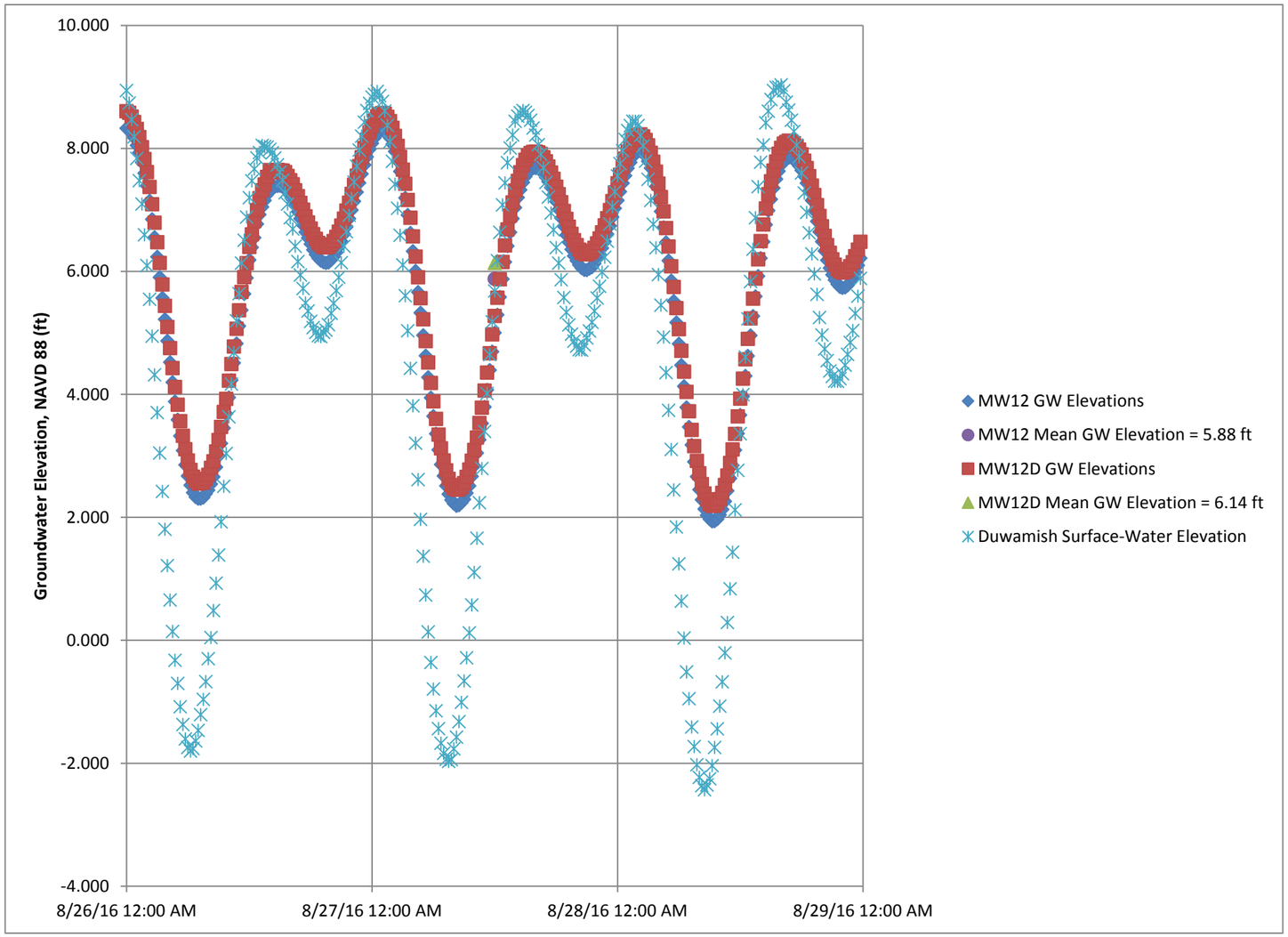
GRAPH 2
Deep Wells - Groundwater Elevation Measurements
Duwamish Marine Center
6365 First Avenue South
Seattle, Washington



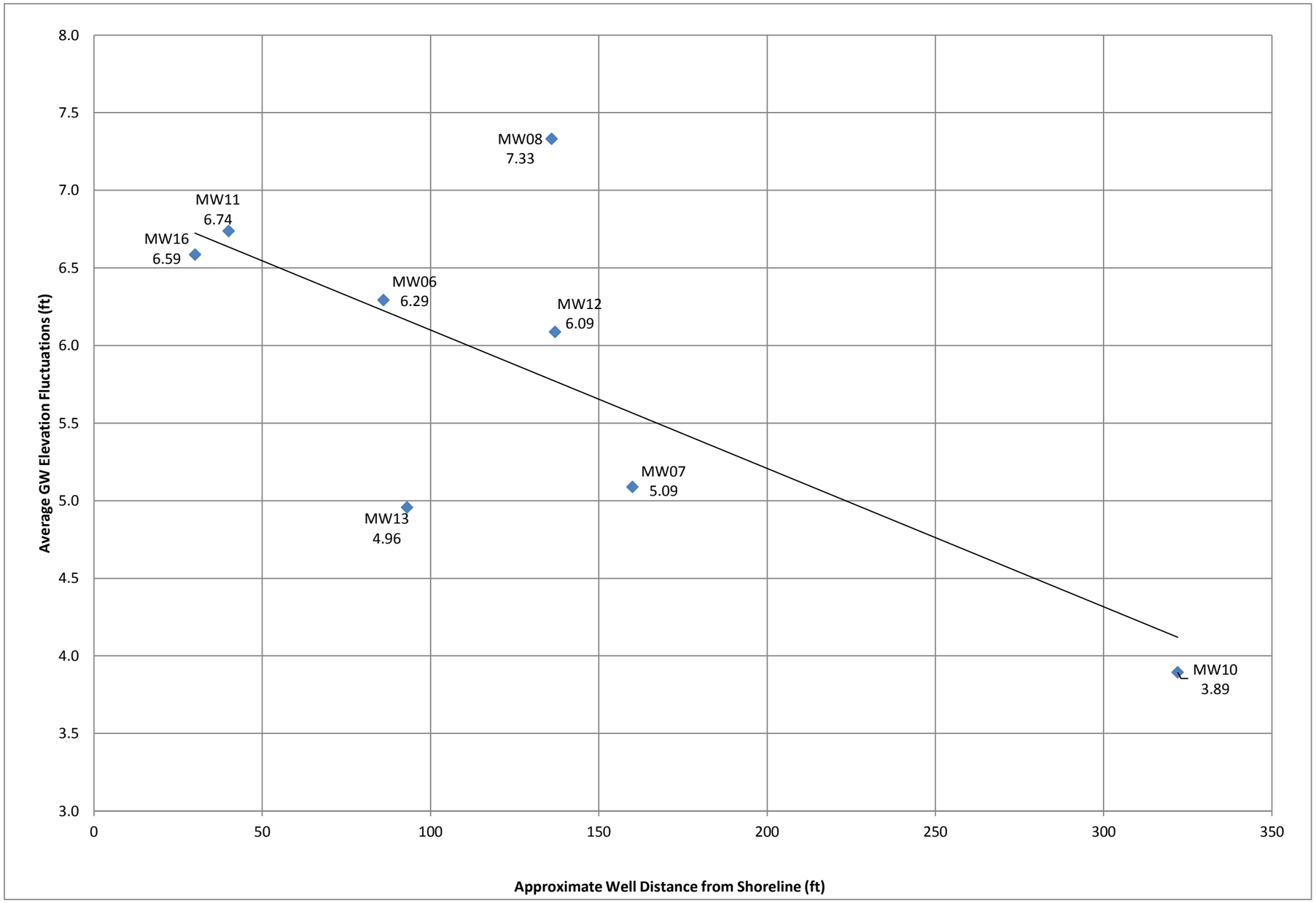
GRAPH 3-1
Well Pair MW10/MW10D Groundater Elevation Comparison
Duwamish Marine Center
6365 First Avenue South
Seattle, Washington



GRAPH 3-2
Well Pair MW12/MW12D Groundater Elevation Comparison
Duwamish Marine Center
6365 First Avenue South
Seattle, Washington

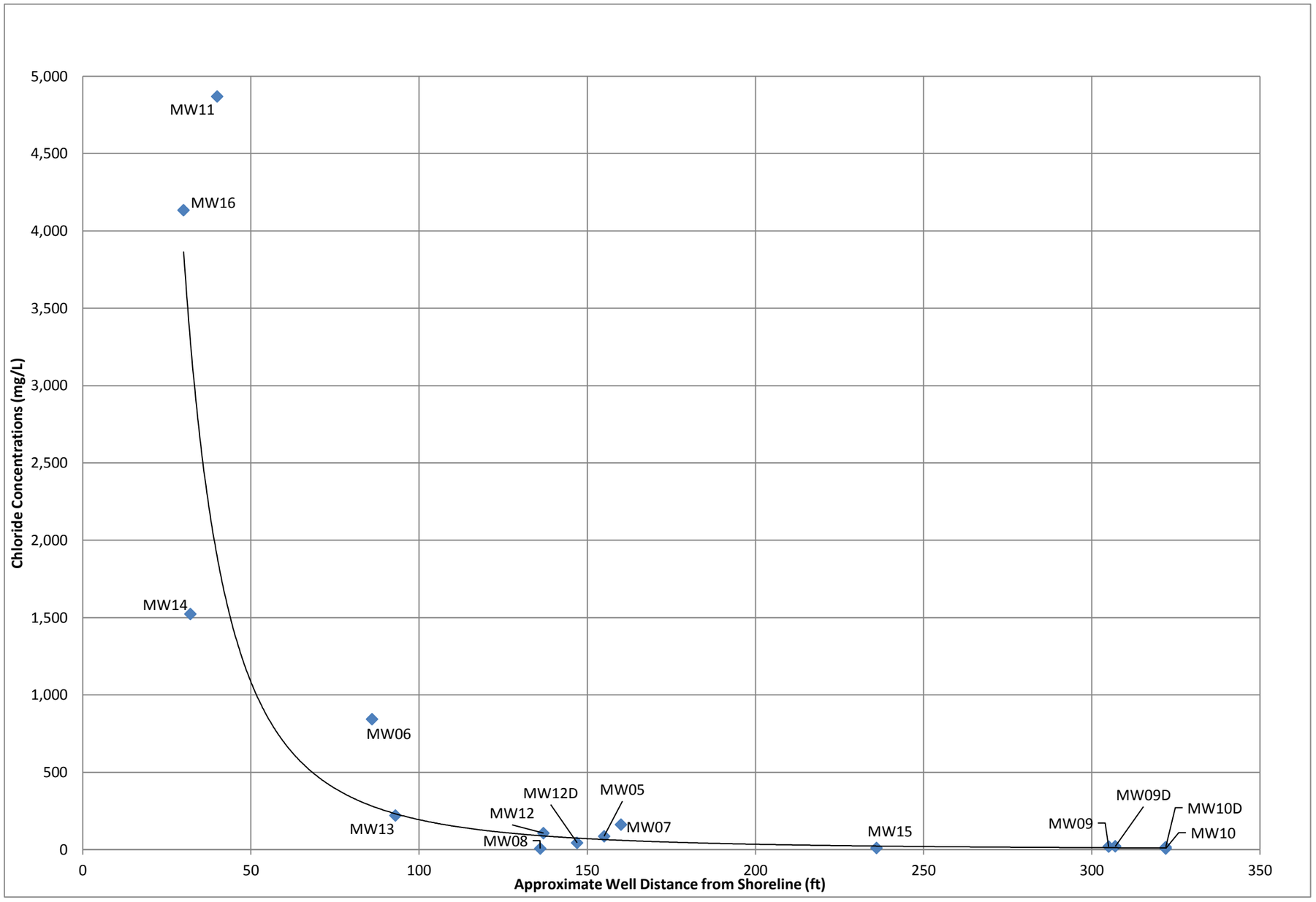


GRAPH 4
Well Distance From Shoreline vs Groundwater-Elevation Fluctuations
Duwamish Marine Center
6365 First Avenue South
Seattle, Washington



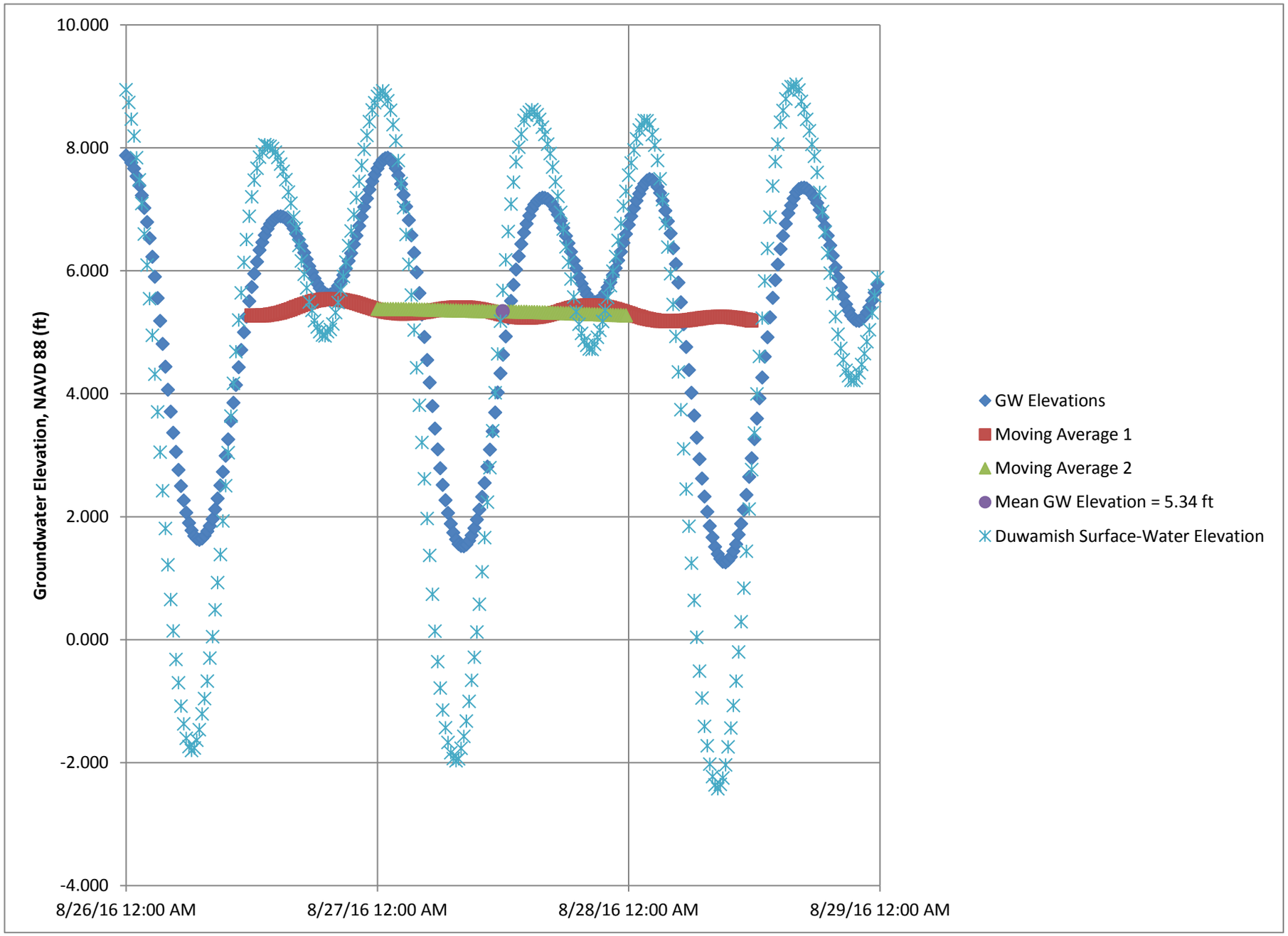
Notes:
Fluctuation of groundwater elevations in each shallow well were calculated between high and low-low tide for each day between 8/26/2016 and 8/29/2016. These values were then averaged for each well.

GRAPH 5
Well Distance From Shoreline vs Chloride Concentration
Duwamish Marine Center
6365 First Avenue South
Seattle, Washington

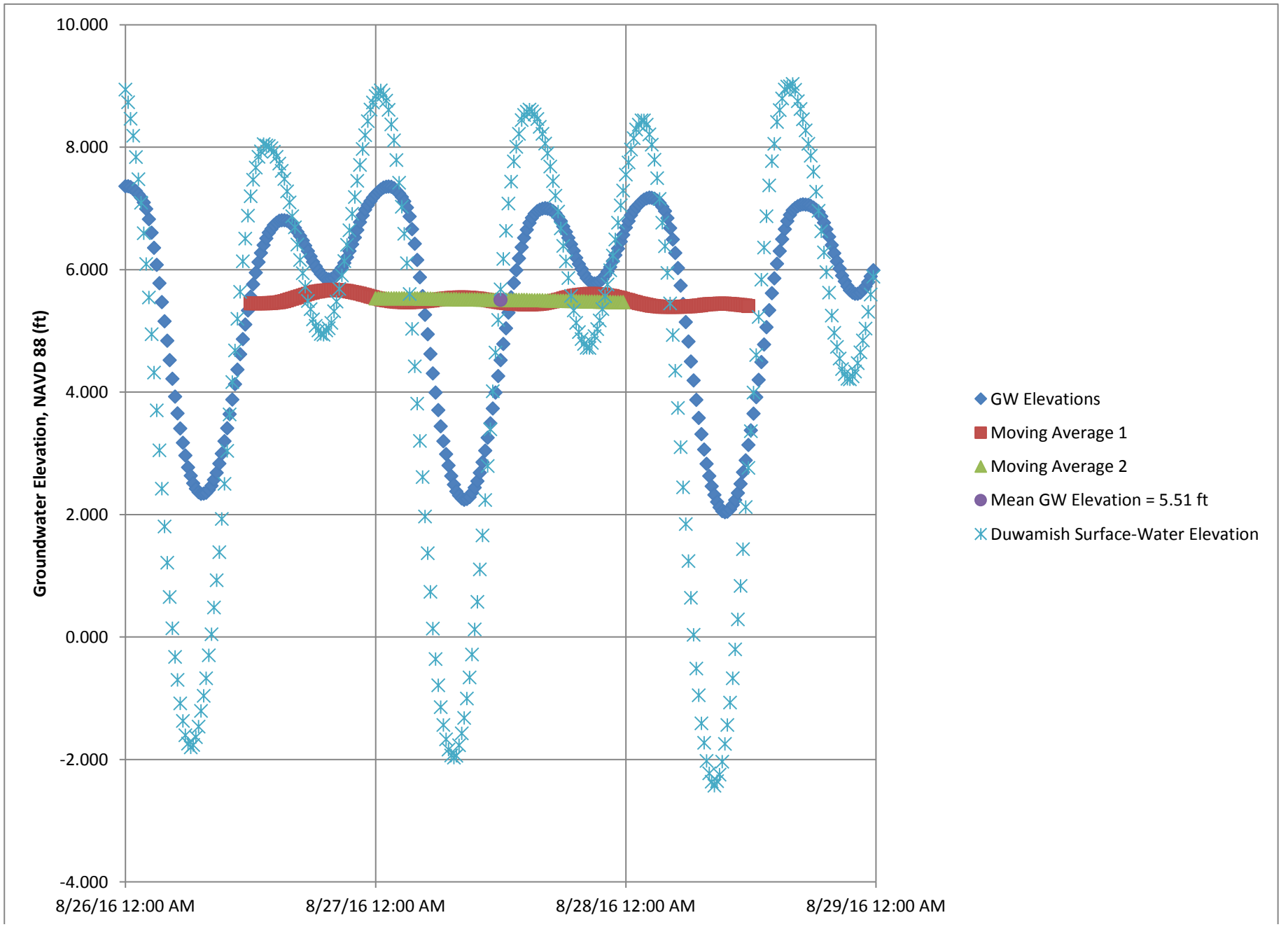


Notes:
Brackish water in tidal estuaries contain chloride levels between 500 and 5,000 mg/L.
Geochemical-parameter values are averages based on the groundwater-sampling events outlined in Table 2-8 of the RI report.

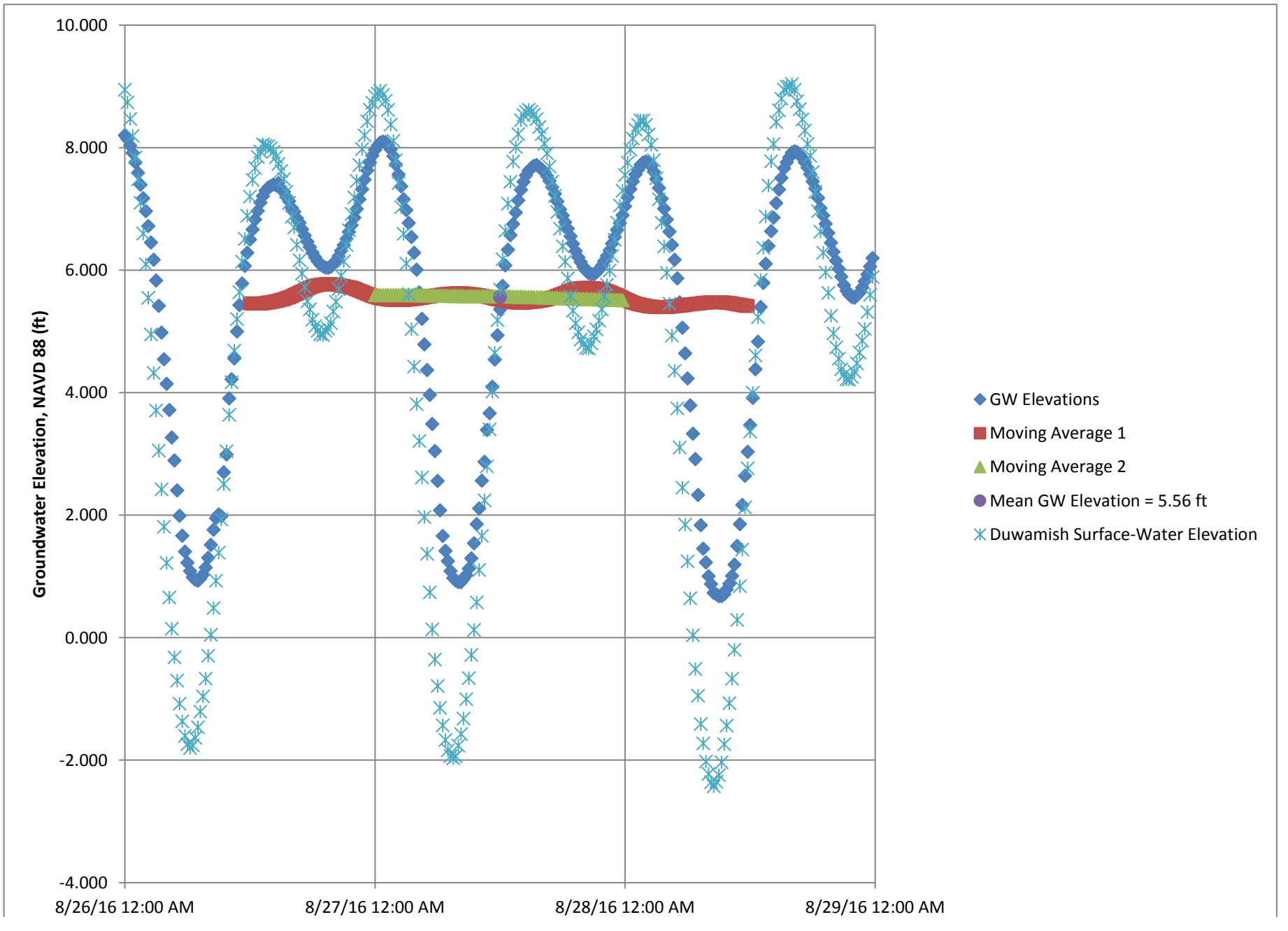
GRAPH 6-1
Well MW06 Hydrograph
Duwamish Marine Center
6365 First Avenue South
Seattle, Washington



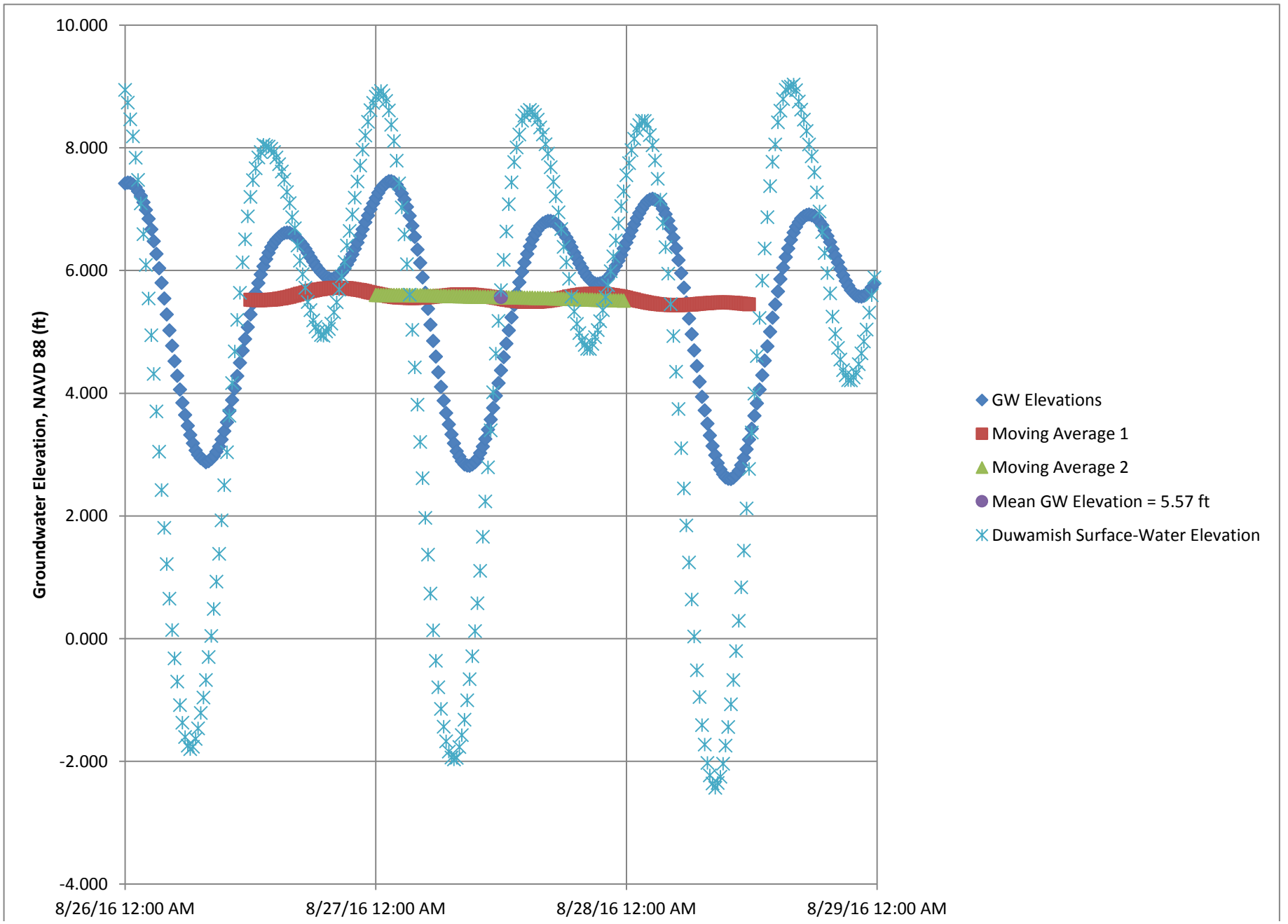
GRAPH 6-2
Well MW07 Hydrograph
Duwamish Marine Center
6365 First Avenue South
Seattle, Washington



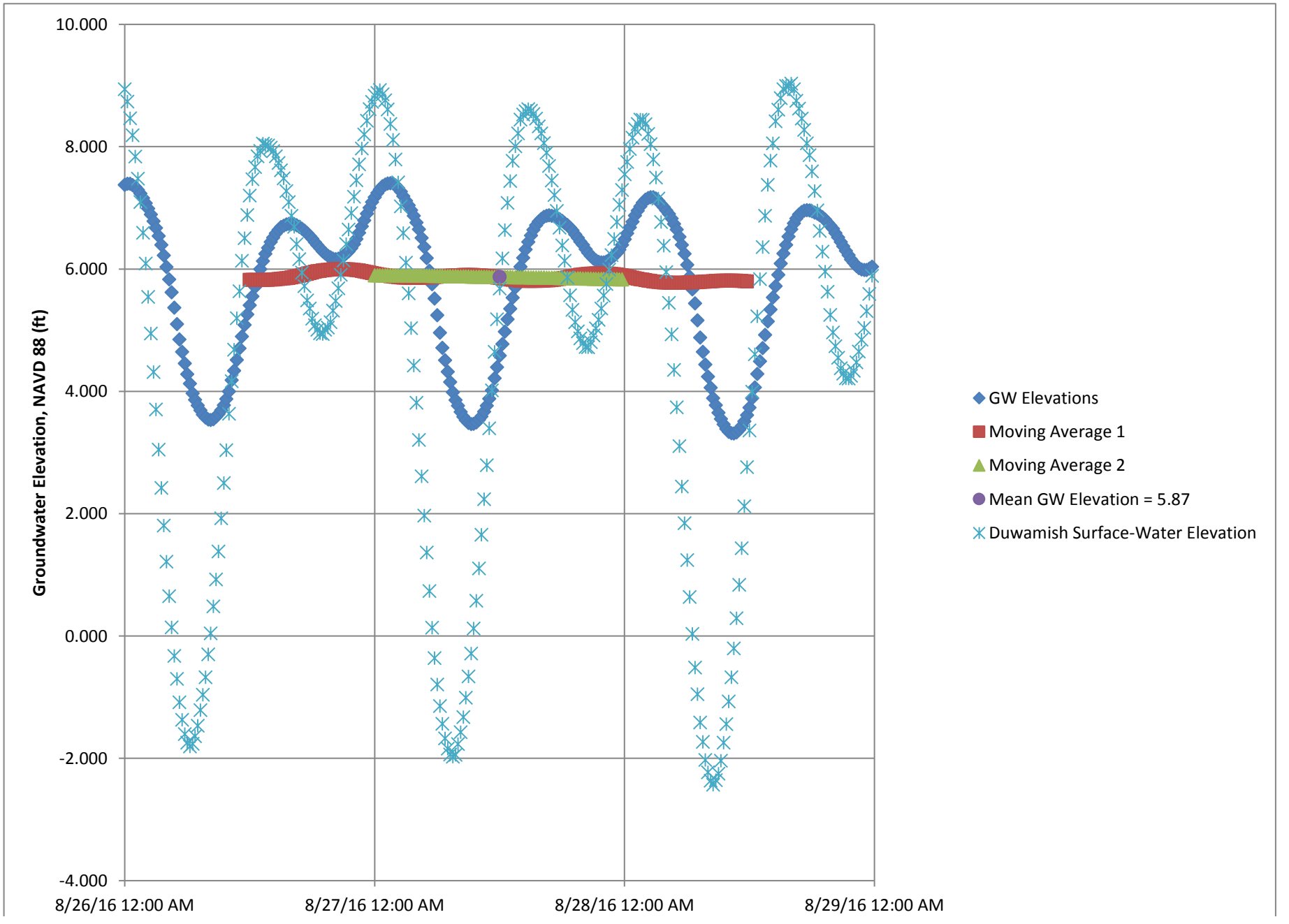
GRAPH 6-3
Well MW08 Hydrograph
Duwamish Marine Center
6365 First Avenue South
Seattle, Washington



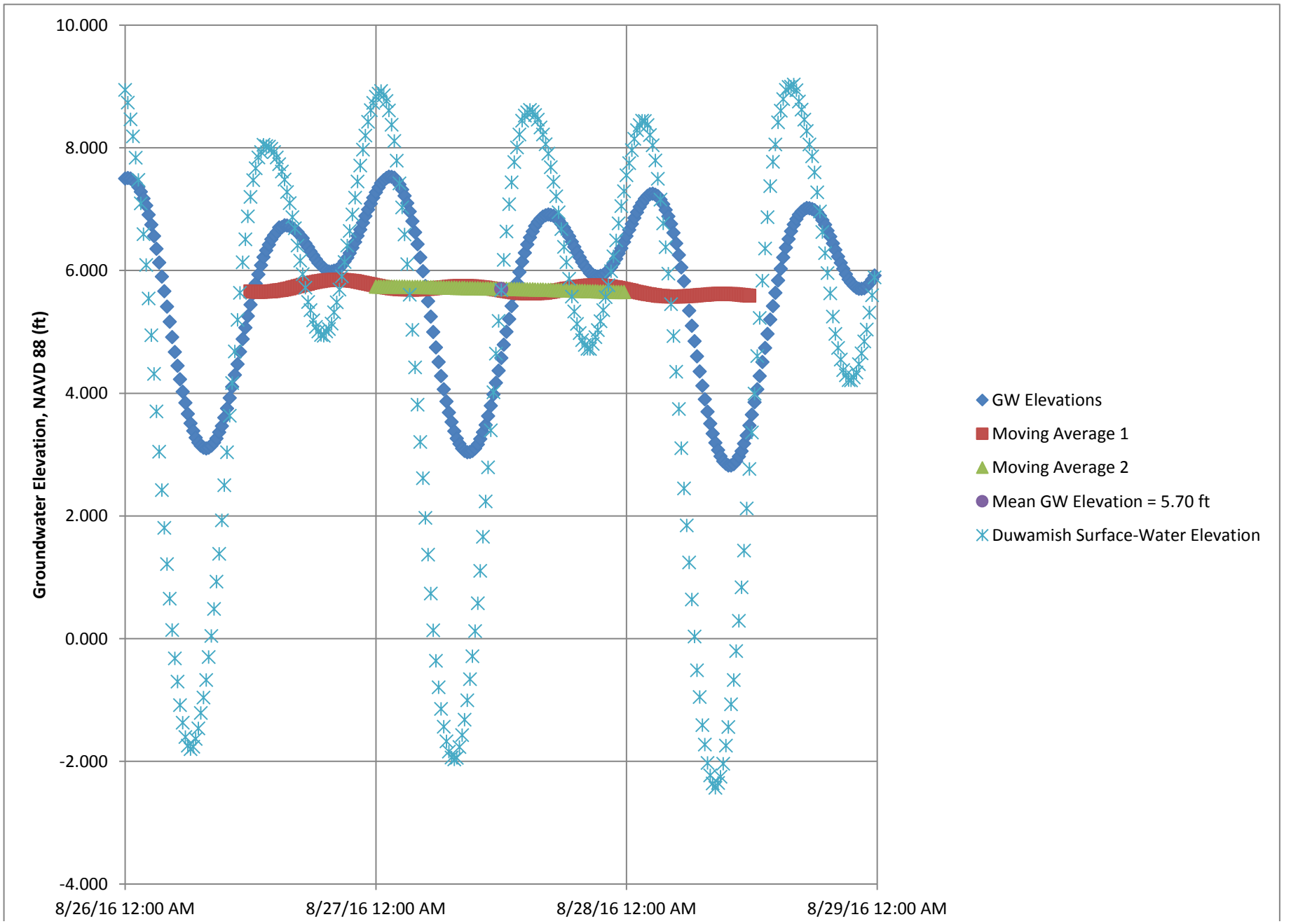
GRAPH 6-4
Well MW09D Hydrograph
Duwamish Marine Center
6365 First Avenue South
Seattle, Washington



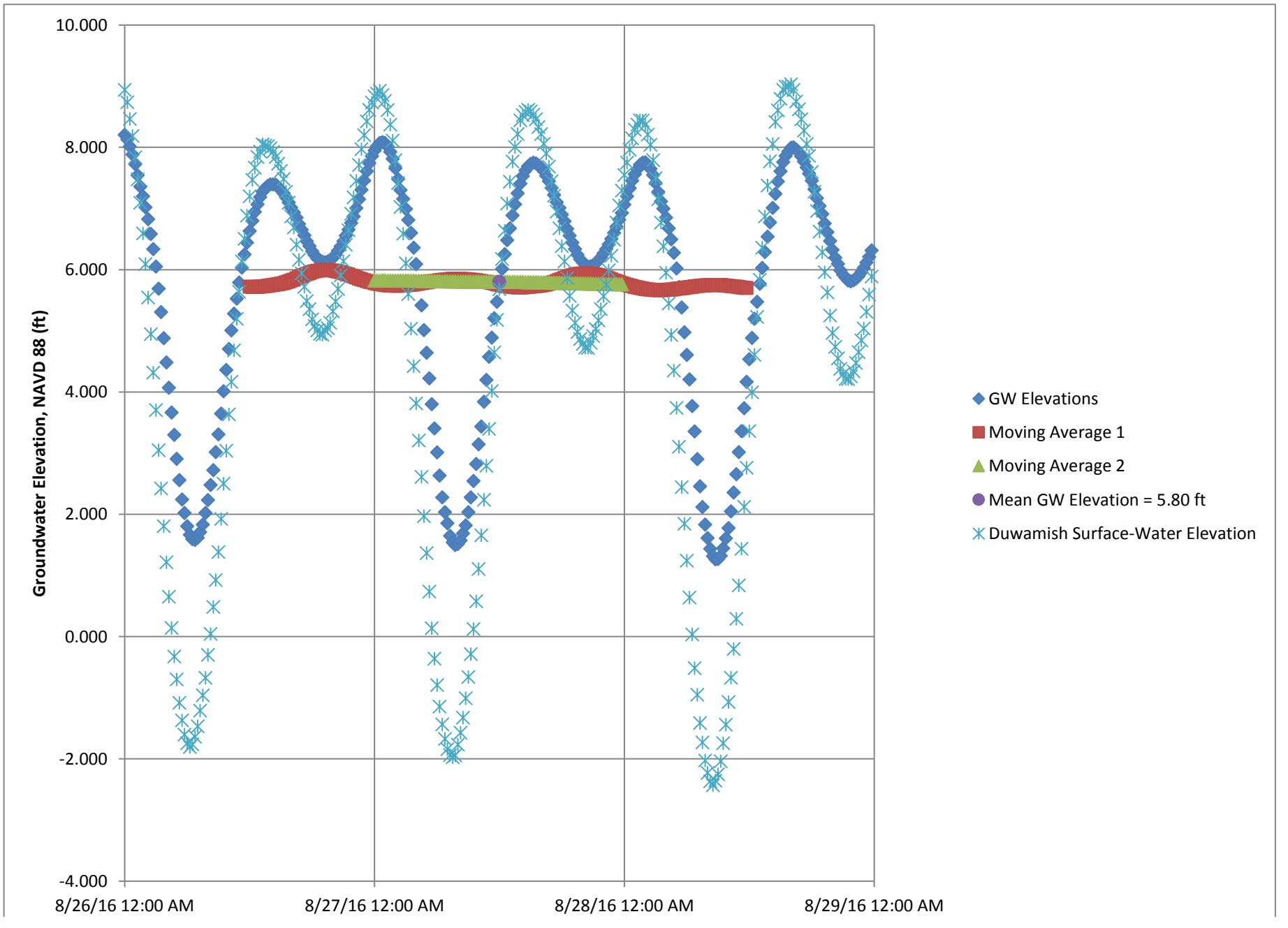
GRAPH 6-5
Well MW10 Hydrograph
Duwamish Marine Center
6365 First Avenue South
Seattle, Washington



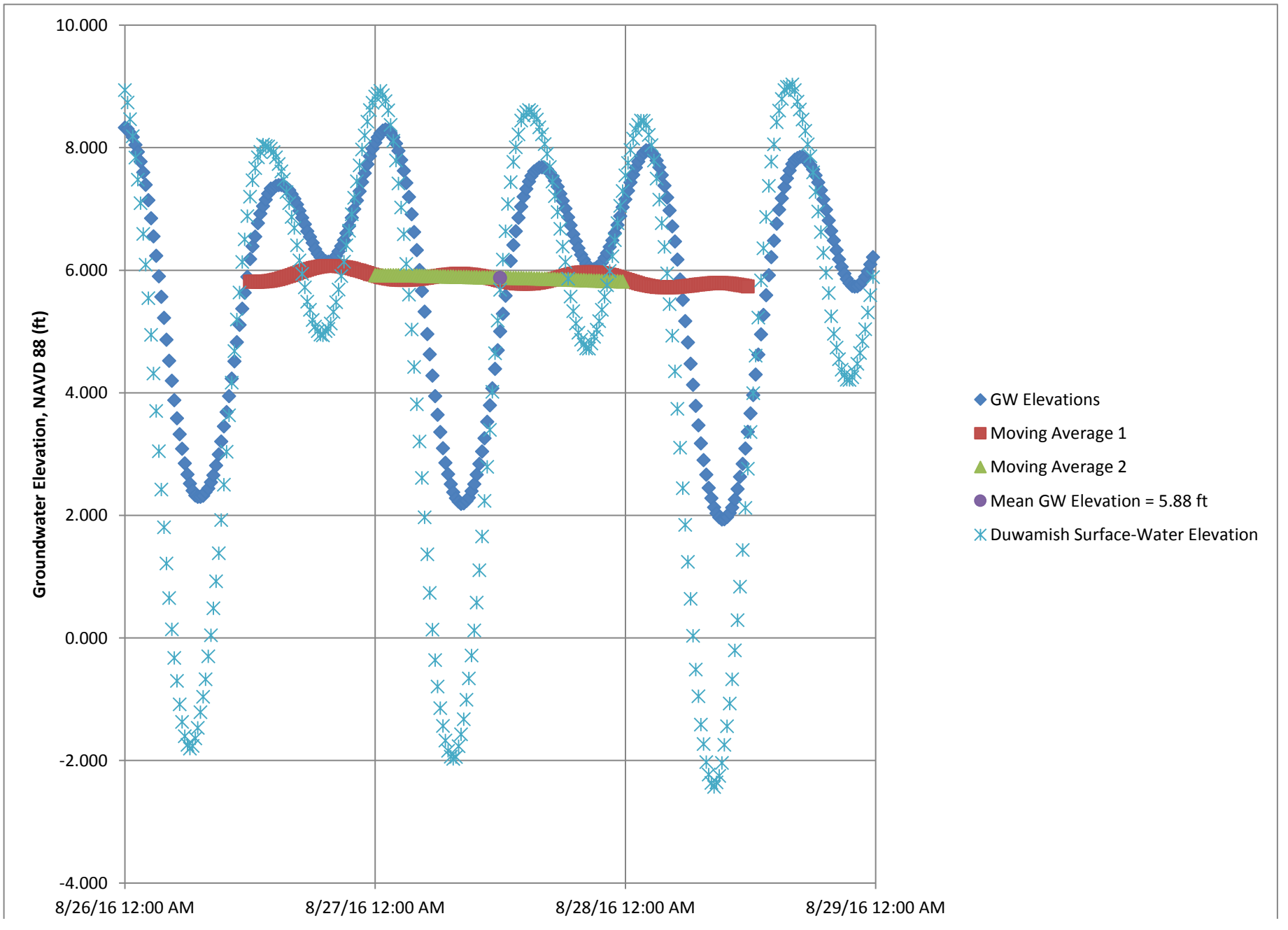
GRAPH 6-6
Well MW10D Hydrograph
Duwamish Marine Center
6365 First Avenue South
Seattle, Washington



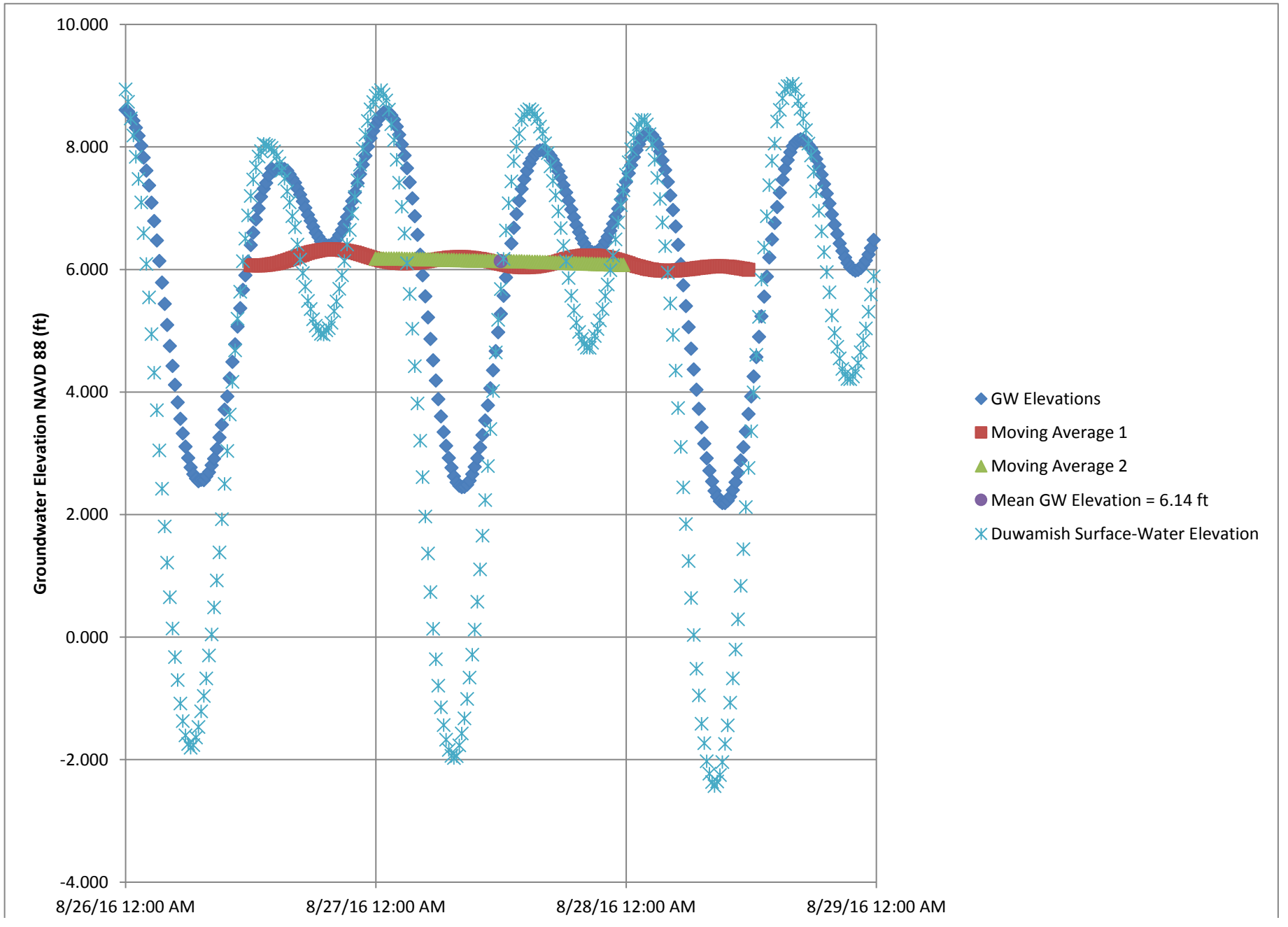
GRAPH 6-7
Well MW11 Hydrograph
Duwamish Marine Center
6365 First Avenue South
Seattle, Washington



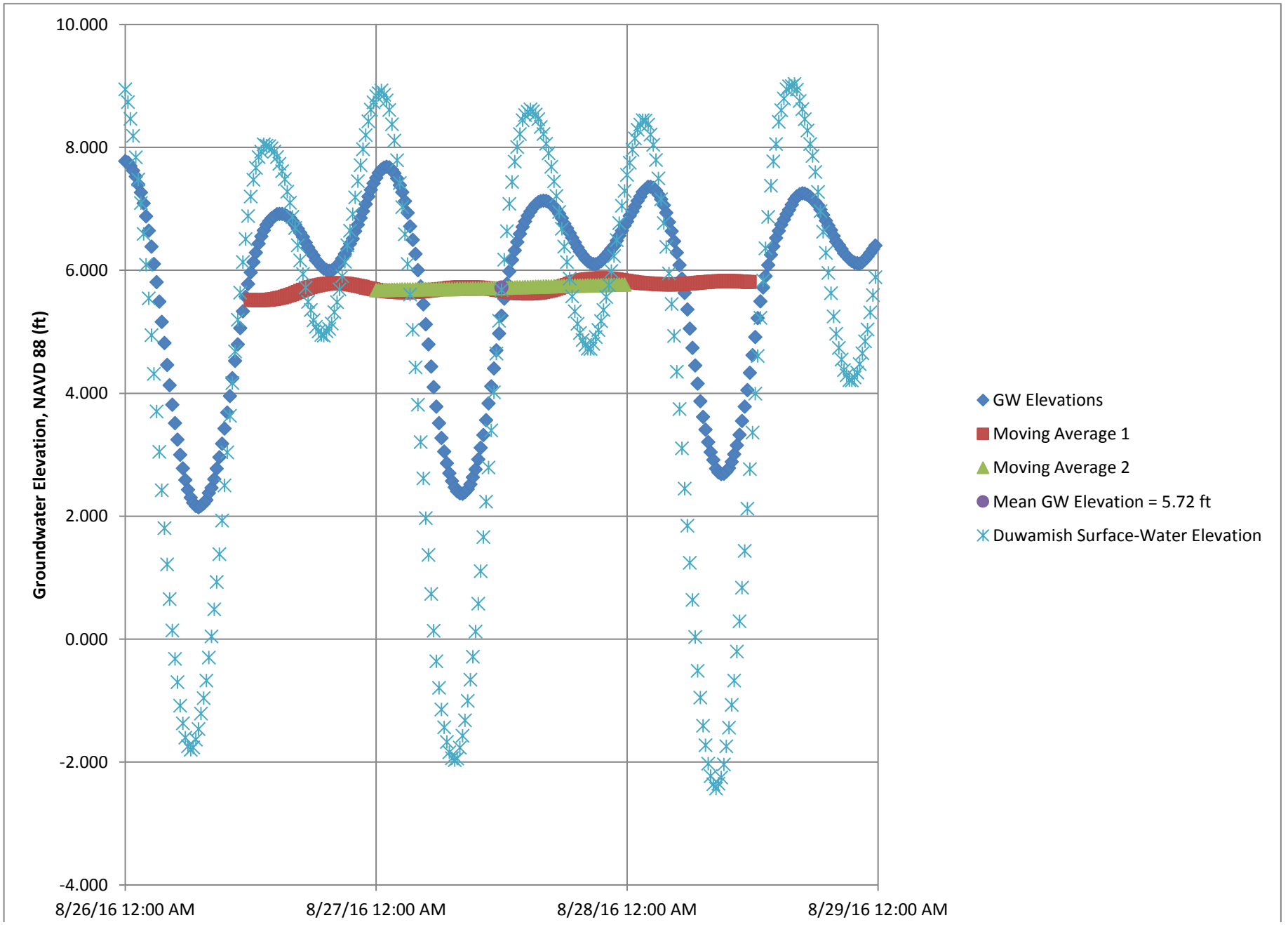
GRAPH 6-8
Well MW12 Hydrograph
Duwamish Marine Center
6365 First Avenue South
Seattle, Washington



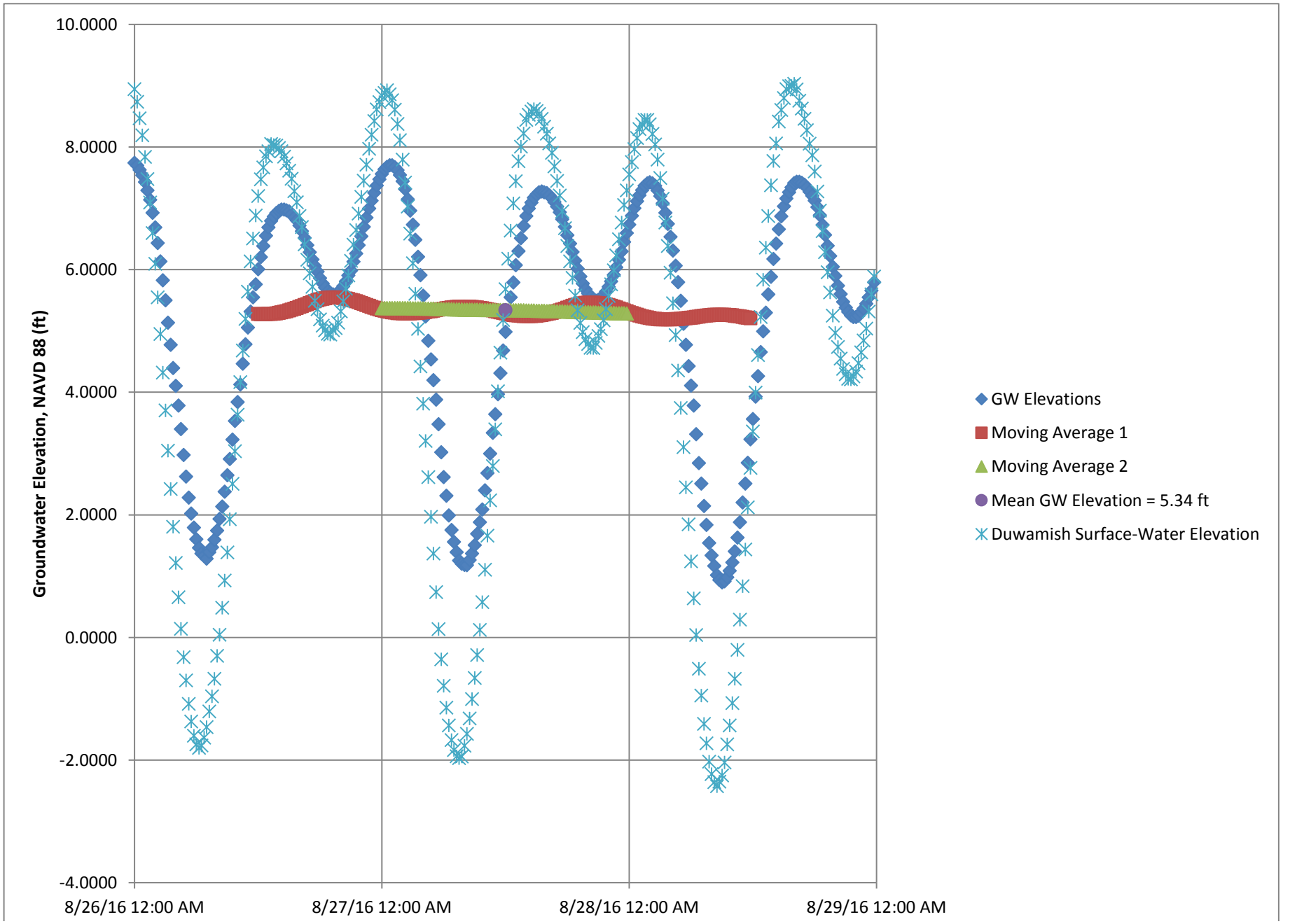
GRAPH 6-9
Well MW12D Hydrograph
Duwamish Marine Center
6365 First Avenue South
Seattle, Washington



GRAPH 6-10
Well MW13 Hydrograph
Duwamish Marine Center
6365 First Avenue South
Seattle, Washington



GRAPH 6-11
Well MW16 Hydrograph
Duwamish Marine Center
6365 First Avenue South
Seattle, Washington



APPENDIX G

Terrestrial and Ecological Evaluation

Voluntary Cleanup Program

Washington State Department of Ecology
Toxics Cleanup Program

TERRESTRIAL ECOLOGICAL EVALUATION FORM

Under the Model Toxics Control Act (MTCA), a terrestrial ecological evaluation is necessary if hazardous substances are released into the soils at a Site. In the event of such a release, you must take one of the following three actions as part of your investigation and cleanup of the Site:

1. Document an exclusion from further evaluation using the criteria in WAC 173-340-7491.
2. Conduct a simplified evaluation as set forth in WAC 173-340-7492.
3. Conduct a site-specific evaluation as set forth in WAC 173-340-7493.

When requesting a written opinion under the Voluntary Cleanup Program (VCP), you must complete this form and submit it to the Department of Ecology (Ecology). The form documents the type and results of your evaluation.

Completion of this form is not sufficient to document your evaluation. You still need to document your analysis and the basis for your conclusion in your cleanup plan or report.

If you have questions about how to conduct a terrestrial ecological evaluation, please contact the Ecology site manager assigned to your Site. For additional guidance, please refer to www.ecy.wa.gov/programs/tcp/policies/terrestrial/TEEHome.htm.

Step 1: IDENTIFY HAZARDOUS WASTE SITE	
Please identify below the hazardous waste site for which you are documenting an evaluation.	
Facility/Site Name: Duwamish Marine Center	
Facility/Site Address: 6365 First Avenue South	
Facility/Site No: 21945598	VCP Project No.: Agreed Order DE8072

Step 2: IDENTIFY EVALUATOR			
Please identify below the person who conducted the evaluation and their contact information.			
Name: Stuart Hyde		Title: Project Geologist	
Organization: G-Logics, Inc.			
Mailing address: 40 2nd Ave SE			
City: Issaquah	State: WA	Zip code: 98027	
Phone: 425-391-6874	Fax: 425-313-3074	E-mail: stuarth@g-logics.com	

Step 3: DOCUMENT EVALUATION TYPE AND RESULTS

A. Exclusion from further evaluation.

1. Does the Site qualify for an exclusion from further evaluation?

☐ Yes *If you answered **"YES,"** then answer **Question 2**.*

☒ No or Unknown *If you answered **"NO" or "UKNOWN,"** then skip to **Step 3B** of this form.*

2. What is the basis for the exclusion? *Check all that apply. Then skip to **Step 4** of this form.*

Point of Compliance: WAC 173-340-7491(1)(a)

☐ All soil contamination is, or will be,* at least 15 feet below the surface.

☐ All soil contamination is, or will be,* at least 6 feet below the surface (or alternative depth if approved by Ecology), and institutional controls are used to manage remaining contamination.

Barriers to Exposure: WAC 173-340-7491(1)(b)

☐ All contaminated soil, is or will be,* covered by physical barriers (such as buildings or paved roads) that prevent exposure to plants and wildlife, and institutional controls are used to manage remaining contamination.

Undeveloped Land: WAC 173-340-7491(1)(c)

☐ There is less than 0.25 acres of contiguous[#] undeveloped[±] land on or within 500 feet of any area of the Site and any of the following chemicals is present: chlorinated dioxins or furans, PCB mixtures, DDT, DDE, DDD, aldrin, chlordane, dieldrin, endosulfan, endrin, heptachlor, heptachlor epoxide, benzene hexachloride, toxaphene, hexachlorobenzene, pentachlorophenol, or pentachlorobenzene.

☐ For sites not containing any of the chemicals mentioned above, there is less than 1.5 acres of contiguous[#] undeveloped[±] land on or within 500 feet of any area of the Site.

Background Concentrations: WAC 173-340-7491(1)(d)

☐ Concentrations of hazardous substances in soil do not exceed natural background levels as described in WAC 173-340-200 and 173-340-709.

* An exclusion based on future land use must have a completion date for future development that is acceptable to Ecology.

[±] "Undeveloped land" is land that is not covered by building, roads, paved areas, or other barriers that would prevent wildlife from feeding on plants, earthworms, insects, or other food in or on the soil.

[#] "Contiguous" undeveloped land is an area of undeveloped land that is not divided into smaller areas of highways, extensive paving, or similar structures that are likely to reduce the potential use of the overall area by wildlife.

B. Simplified evaluation.

1. Does the Site qualify for a simplified evaluation?

☒ Yes *If you answered **"YES,"** then answer **Question 2** below.*

☐ No or Unknown *If you answered **"NO"** or **"UNKNOWN,"** then skip to **Step 3C** of this form.*

2. Did you conduct a simplified evaluation?

■ Yes *If you answered **"YES,"** then answer **Question 3** below.*

☐ No *If you answered **"NO,"** then skip to **Step 3C** of this form.*

3. Was further evaluation necessary?

☐ Yes *If you answered **"YES,"** then answer **Question 4** below.*

■ No *If you answered **"NO,"** then answer **Question 5** below.*

4. If further evaluation was necessary, what did you do?

☐ Used the concentrations listed in Table 749-2 as cleanup levels. *If so, then skip to **Step 4** of this form.*

☐ Conducted a site-specific evaluation. *If so, then skip to **Step 3C** of this form.*

5. If no further evaluation was necessary, what was the reason? *Check all that apply. Then skip to **Step 4** of this form.*

Exposure Analysis: WAC 173-340-7492(2)(a)

☐ Area of soil contamination at the Site is not more than 350 square feet.

☒ Current or planned land use makes wildlife exposure unlikely. Used Table 749-1.

Pathway Analysis: WAC 173-340-7492(2)(b)

☐ No potential exposure pathways from soil contamination to ecological receptors.

Contaminant Analysis: WAC 173-340-7492(2)(c)

☐ No contaminant listed in Table 749-2 is, or will be, present in the upper 15 feet at concentrations that exceed the values listed in Table 749-2.

☐ No contaminant listed in Table 749-2 is, or will be, present in the upper 6 feet (or alternative depth if approved by Ecology) at concentrations that exceed the values listed in Table 749-2, and institutional controls are used to manage remaining contamination.

☐ No contaminant listed in Table 749-2 is, or will be, present in the upper 15 feet at concentrations likely to be toxic or have the potential to bioaccumulate as determined using Ecology-approved bioassays.

☐ No contaminant listed in Table 749-2 is, or will be, present in the upper 6 feet (or alternative depth if approved by Ecology) at concentrations likely to be toxic or have the potential to bioaccumulate as determined using Ecology-approved bioassays, and institutional controls are used to manage remaining contamination.

C. Site-specific evaluation. A site-specific evaluation process consists of two parts: (1) formulating the problem, and (2) selecting the methods for addressing the identified problem. Both steps require consultation with and approval by Ecology. *See* WAC 173-340-7493(1)(c).

1. Was there a problem? *See* WAC 173-340-7493(2).

☐ Yes *If you answered **"YES,"** then answer **Question 2** below.*

☐ No *If you answered **"NO,"** then identify the reason here and then skip to **Question 5** below:*

- ☐ No issues were identified during the problem formulation step.
- ☐ While issues were identified, those issues were addressed by the cleanup actions for protecting human health.

2. What did you do to resolve the problem? *See* WAC 173-340-7493(3).

☐ Used the concentrations listed in Table 749-3 as cleanup levels. *If so, then skip to **Question 5** below.*

☐ Used one or more of the methods listed in WAC 173-340-7493(3) to evaluate and address the identified problem. *If so, then answer **Questions 3 and 4** below.*

3. If you conducted further site-specific evaluations, what methods did you use?
Check all that apply. See WAC 173-340-7493(3).

- ☐ Literature surveys.
- ☐ Soil bioassays.
- ☐ Wildlife exposure model.
- ☐ Biomarkers.
- ☐ Site-specific field studies.
- ☐ Weight of evidence.
- ☐ Other methods approved by Ecology. If so, please specify:

4. What was the result of those evaluations?

- ☐ Confirmed there was no problem.
- ☐ Confirmed there was a problem and established site-specific cleanup levels.

5. Have you already obtained Ecology's approval of both your problem formulation and problem resolution steps?

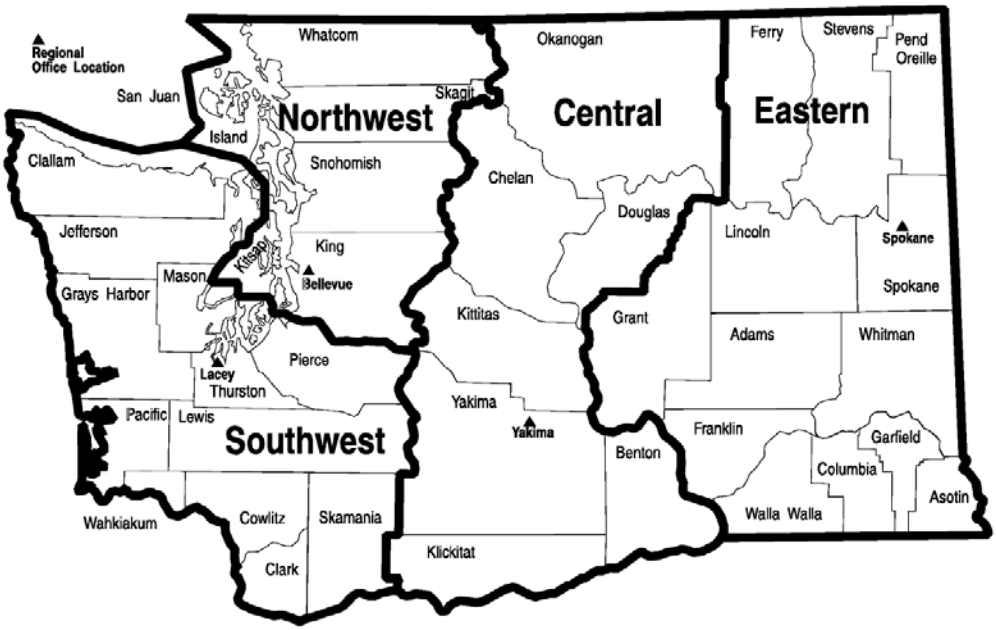
☐ Yes If so, please identify the Ecology staff who approved those steps:

☐ No

Step 4: SUBMITTAL

Please mail your completed form to the Ecology site manager assigned to your Site. If a site manager has not yet been assigned, please mail your completed form to the Ecology regional office for the County in which your Site is located.

Northwest Region: Attn: VCP Coordinator 3190 160th Ave. SE Bellevue, WA 98008-5452	**Central Region:** Attn: VCP Coordinator 1250 West Alder St. Union Gap, WA 98903-0009
Southwest Region: Attn: VCP Coordinator P.O. Box 47775 Olympia, WA 98504-7775	**Eastern Region:** Attn: VCP Coordinator N. 4601 Monroe Spokane WA 99205-1295



Duwamish Marine Center, 01-0979-G, 5/2/17

Terrestrial Ecological Evaluation Process- Simplified or Site-Specific Evaluation?

Documentation Form

	Terrestrial Concern	Response (Circle One)
*1	Is the site is located on or directly adjacent to an area where management or land use plans will maintain or restore native or semi-native vegetation?	Yes / (No)
*2a	Is the site used by a threatened or endangered species?	Yes / (No)
*2b	Is the site used by a wildlife species classified by the state department of fish and wildlife as a "priority species" or "species of concern" under Title 77 RCW?	Yes / (No)
*2c	Is the site used by a plant species classified by the Washington state department of Natural Resources natural heritage program as "endangered," "threatened," or "sensitive" under Title 79 RCW.	Yes / (No)
*3	Is the site (area where the contamination is located) located on a property that contains at least ten acres of native vegetation within 500 feet of the area where the contamination is located?	Yes / (No)
4	Has the department determined that the site may present a risk to significant wildlife populations?	Yes / (No)

*1 This includes for example, green-belts, protected wetlands, forestlands, locally designated environmentally sensitive areas, open space areas managed for wildlife, and some parks or outdoor recreation areas. This does not include park areas used for intensive sport activities such as baseball or football.

*2a What are the threatened or endangered species in Washington state?

*2b Which plant species are classified as threatened, endangered, or sensitive? Where can I find out more information about this topic?

*2c For plants, "used" means that a plant species grows at the site or has been found growing at the site. For animals, "used" means that individuals of a species have been observed to live, feed or breed at the site.

*3 For this analysis, do not include native vegetation beyond the property boundary.

The following sources shall be used in making this determination: Natural Vegetation of Oregon and Washington, J.F. Franklin and C.T. Dyrness, Oregon State University Press, 1988, and L.C. Hitchcock, C.L. Hitchcock, J.W. Thompson and A. Cronquist, 1955-1969, Vascular Plants of the Pacific Northwest(5 volumes). Areas planted with native species for ornamental or landscaping purposes shall not be considered to be native vegetation. [WAC 173-340-7491(2)(c)(i)]

(Here's a link to the Seattle Public Library and the Washington State Library to borrow a copy of Natural Vegetation of Oregon and Washington, J.F. Franklin and C.T. Dyrness, Oregon State University Press, 1988, or you may purchase it through your favorite bookseller. Here's an additional link to a useful online Field Guide to Selected Rare Plants of Washington developed by the Washington State Department of Natural Resources' Natural Heritage Program (WNHP) and the Spokane District of the U.S.D.I. Bureau of Land Management (BLM) which contains fact sheets for 139 vascular plant species and one lichen species.
Here is an aid to calculating area and an aerial photo depicting a site, its 500 foot boundary and several labeled circles identifying various areas for reference in judging the area of native vegetation within the 500 foot radius.

[Exclusions Main] [TEE Definitions] [Simplified or Site-Specific?] [Simplified Ecological Evaluation] [Site-Specific Ecological Evaluation] [WAC 173-340-7493] [Index of Tables]

[TEE Home]

Washington State Department of Ecology
Toxics Cleanup Program

Terrestrial Ecological Evaluation Process- Simplified Evaluation

Documentation Form

Criteria # (Concern)	Criteria	Response (Circle One)
1 (exposure)	Is the total area of soil contamination at the site less than or equal to 350 square feet	**Yes (End TEE)** / **No**
2 (exposure)	Does land use at the site and surrounding area make substantial wildlife exposure unlikely based on completion of Table 749-1?	**Yes (End TEE)** / **No**
3 (pathway)	Is there a potential exposure pathway from soil contamination to soil biota, plants, or wildlife?	**Yes** / **No (End TEE)**
4 (contaminant)	Are the hazardous substances at your site listed in Table 749-2 and is (or will) their location in the soil at your site be at a depth not exceeding the point of compliance, and at concentrations that do not exceed the values provided in Table 749-2.	**Yes (End TEE)** / **No** **Note: You must perform bioassays for contaminants at your site if no table value is provided.**
5 (contaminant)	Will hazardous substances listed in Table 749-2 be present in the soil at your site within 6 feet of the ground surface at concentrations likely to be toxic, or with the potential to bioaccumulate, based on bioassays using methods approved by the department.	**Yes** / **No (End TEE)**

[Exclusions Main] [TEE Definitions] [Simplified or Site-Specific?] [Simplified Ecological Evaluation] [Site-Specific Ecological Evaluation] [WAC 173-340-7493] [Index of Tables]

[TEE Home]

Table 749-1

Simplified Terrestrial Ecological Evaluation-Exposure Analysis Procedure

Estimate the area of contiguous (connected) undeveloped land on the site or within 500 feet of any area of the site to the nearest 1/2 acre (1/4 acre if the area is less than 0.5 acre).	
1) From the table below, find the number of points corresponding to the area and enter this number in the field to the right.	4
Area (acres) / Points: 0.25 or less / 4; 0.5 / 5; 1.0 / 6; 1.5 / 7; 2.0 / 8; 2.5 / 9; 3.0 / 10; 3.5 / 11; 4.0 or more / 12	
2) Is this an industrial or commercial property? If yes, enter a score of 3. If no, enter a score of 1	3
3)[a] Enter a score in the box to the right for the habitat quality of the site, using the following rating system[b]. High=1, Intermediate=2, Low=3	3
4) Is the undeveloped land likely to attract wildlife? If yes, enter a score of 1 in the box to the right. If no, enter a score of 2.[c]	2
5) Are there any of the following soil contaminants present: Chlorinated dioxins/furans, PCB mixtures, DDT, DDE, DDD, aldrin, chlordane, dieldrin, endosulfan, endrin, heptachlor, benzene hexachloride, toxaphene, hexachlorobenzene, pentachlorophenol, pentachlorobenzene? If yes, enter a score of 1 in the box to the right. If no, enter a score of 4.	1
6) Add the numbers in the boxes on lines 2-5 and enter this number in the box to the right. If this number is larger than the number in the box on line 1, the simplified evaluation may be ended.	9

Notes for Table 749-1

[a] It is expected that this habitat evaluation will be undertaken by an experienced field biologist. If this is not the case, enter a conservative score of (1) for questions 3 and 4.

[b] **Habitat rating system.** Rate the quality of the habitat as high, intermediate or low based on your professional judgment as a field biologist. The following are suggested factors to consider in making this evaluation:

> **Low:** Early successional vegetative stands; vegetation predominantly noxious, nonnative, exotic plant species or weeds. Areas severely disturbed by human activity, including intensively cultivated croplands. Areas isolated from other habitat used by wildlife.

High: Area is ecologically significant for one or more of the following reasons: Late-successional native plant communities present; relatively high species diversity; used by an uncommon or rare species; priority habitat (as defined by the Washington Department of fish and Wildlife); part of a larger area of habitat where size or fragmentation may be important for the retention of some species.

Intermediate: Area does not rate as either high or low.

[c] Indicate "yes" if the area attracts wildlife or is likely to do so. Examples: Birds frequently visit the area to feed; evidence of high use b mammals (tracks, scat, etc.); habitat "island" in an industrial area; unusual features of an area that make it important for feeding animals; heavy use during seasonal migrations.

[Area Calculation Aid] [Aerial Photo with Area Designations] [TEE Table 749-1] [Index of Tables]

[Exclusions Main] [TEE Definitions] [Simplified or Site-Specific?] [Simplified Ecological Evaluation] [Site-Specific Ecological Evaluation] [WAC 173-340-7493]

[TEE Home]

DEPARTMENT OF ECOLOGY
State of Washington

Duwamish Marine Center:
Uplands Ecological Risk Analysis

Memorandum

To: Victoria Sutton, Site Manager
Toxics Cleanup Program
Northwest Regional Office

From: Arthur Buchan, Toxicologist
Information & Policy Section
Toxics Cleanup Program

Date: November 07, 2017

This memorandum represents a Department of Ecology uplands ecological risk analysis with recommendations regarding the Remedial Investigation/Feasibility Study Work Plan (Sound Earth Strategies 2013), and Updates to the Remedial Investigation/Feasibility Study Work Plan (Sound Earth Strategies 2014) for the Duwamish Marine Center Site (Facility Site ID No. 21945598), located at:

Duwamish Marine Center
6365 First Avenue South
Seattle, WA

Determination:

Ecology has reviewed the applicability of a Terrestrial Ecological Evaluation (TEE), WAC 173-340-7490 through 7494 (Ecology, 2007) based on the information provided (Sound Earth Strategies 2013, 2014). The recommendations that have been made in this memorandum are based on future cleanup decisions that will be made by the consultant/property owner.

For Questions regarding this Memorandum, please contact:

Arthur Buchan
Phone: (360) 407-7146
Email: abuc461@ecy.wa.gov

Comments/Recommendations

Exclusionary Criteria

No further evaluation of the TEE is required if any of the below exclusionary criteria are met at the site:

1. **Contamination below the point of compliance (340-7491(1) (a)).** This exclusion should not apply. It appears contamination is located at a shallower depth than 15 ft bgs.
2. **Incomplete exposure pathway (340-7491(1) (b)).** This exclusion should not apply. It appears there are complete exposure pathways in the upland area. A figure with the exposure pathways has been provided in Appendix A (*Duwamish Marine Center Site – Exposure Pathways*). However, if all soil contaminated with hazardous substances is, or will be, covered by buildings, paved roads, pavement, or other physical barriers that would prevent plants or wildlife from being exposed to the soil contamination, then (with the implementation of an institutional control to maintain that barrier) the site would qualify for this exclusion.
3. **Area of contiguous undeveloped land (340-7491(1) (c)).** This exclusion should not apply. It appears that there is greater than 0.25 acres of contiguous undeveloped land on or within 500 ft of the site (app. 1.98 acres on the site, 0.32 acres off the site), and it also appears hazardous bioaccumulatives are present (i.e. pentachlorophenol, PCB mixtures, etc.). Please see Appendix B and C (*Duwamish Marine Center Site – Contiguous Undeveloped Land*).

Discussion: It appears that the site does not qualify for an exclusion from the TEE requirements unless the conditions of Exclusionary Criteria (2) have been met.

Simplified or Site-Specific Criteria:

If the site cannot be excluded as discussed above, then a simplified or site-specific TEE is required. A site-specific TEE is required if any of the below criteria apply:

1. **Management or land use plans maintain or restore native vegetation (340-7491(2) (a) (i)).** It does not appear that this criterion would apply.
2. **Use by threatened or endangered species (340-7491(2) (a) (ii)).** It does not appear that this criterion would apply.
3. **Amount of native vegetation located on the property within 500 ft. of the site (340-7491(2) (a) (iii)).** It does not appear that this criterion would apply. There does not appear to be greater than 10 acres of native vegetation within 500 ft of the site, located within the property boundaries. Please see either Appendix A, B, or C.
4. **Department determination (340-7491(2) (a) (iv)).** This criterion should not apply. The department has not determined that the site may present a risk to significant wildlife populations.

Discussion: It appears that this site would qualify for a Simplified TEE. It does not appear that a Site-Specific TEE would be necessary.

TEE Summary: It appears a simplified TEE would be required at this site unless the site has been excluded from the TEE requirements as described under the Exclusionary Criteria (2).

Simplified TEE Requirements:

The simplified TEE evaluation may be ended if any of the following criteria apply:

1. **Exposure analysis (total area of soil contamination) (340-7492(2) (a) (i)).** This criterion should not apply. It appears the total area of soil contamination > 350 square feet.
2. **Exposure analysis (substantial wildlife exposure) (340-7492(2) (a) (ii)).** It appears this criterion could apply. This information should be verified. However, under the scenario presented, the Simplified TEE may be ended if substantial wildlife exposure is unlikely. This would be indicated by point total in Box 6 > Box 1. The undeveloped land located within the site should be considered as the largest area of contiguous undeveloped land at approximately 1.9 acres. Based on the acreage (2.0 acres), the point total assigned should be 8 pts. This point total would then be compared to the points added for boxes 2-5 (which is 9). Under this scenario, the simplified process should be ended. Please see Appendix D (*Duwamish Marine Center Site: Table 749-1, Exposure Analysis Scenario*).
3. **Pathways analysis (340-7492(2) (b)).** This criterion should not apply. It appears there is contamination in the undeveloped areas within the site. However, as with the Exclusionary Criteria described above, if all soil contaminated with hazardous substances is, or will be, covered by buildings, paved roads, pavement, or other physical barriers that would prevent plants or wildlife from being exposed to the soil contamination, then (with the implementation of an institutional control to maintain that barrier) the site would qualify for either an exclusion, or qualify to end the Simplified TEE.
4. **Contaminants analysis (340-7492(2) (c)).** This criterion should not apply. There appears to be contaminants sampled and analyzed for that are above the values listed in Table 749-2 (either unrestricted or industrial/commercial columns).

Discussion: It appears that (in most likelihood) a simplified TEE would be required at this site, unless it has been established that an incomplete pathway either currently exists, or is planned to be implemented at this site. If it has been established that an incomplete pathway is applicable, then it may be excluded with the implementation of an environmental covenant designed to maintain the barrier. However (if the site is not excluded), it appears that the site would qualify for a Simplified TEE, that could possibly be ended under the Exposure Analysis Scenario (substantial wildlife exposure) (340-7492(2) (a) (ii)), with the understanding that the information used to assign point totals in Appendix D has been verified and agreed upon by Ecology.

References Cited

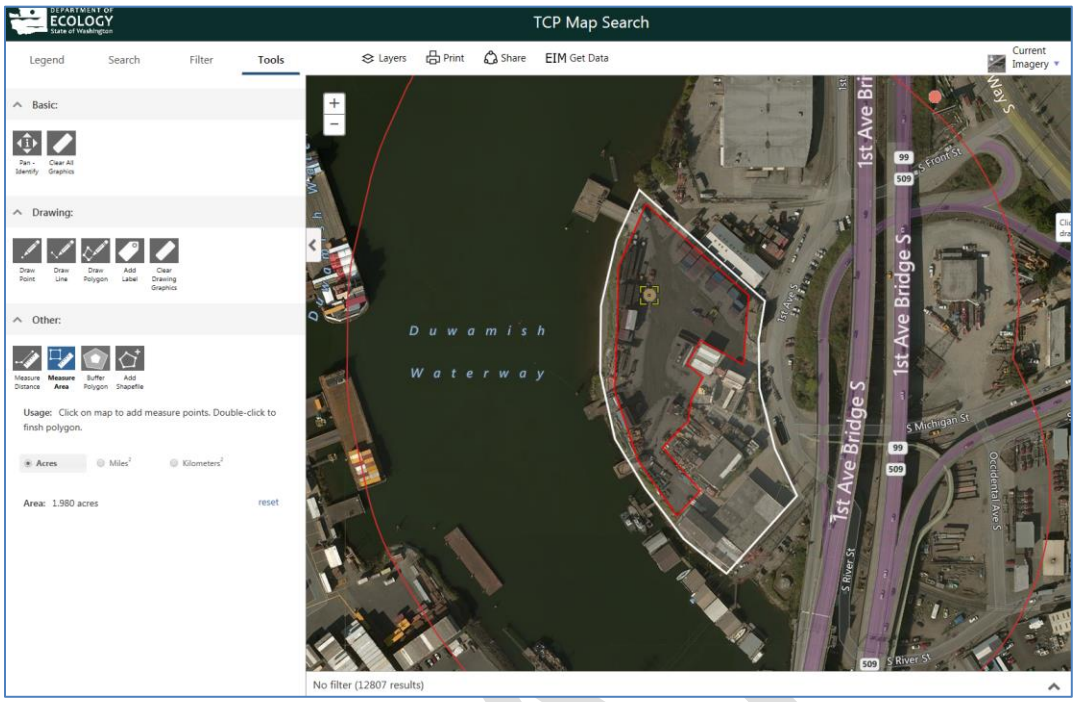
Ecology. (2007). *Model Toxics Control Act statute and regulation, Chapter 173-340 WAC.* (Ecology Publication No. 94-06). Lacey, WA: Washington State Department of Ecology, Toxics Cleanup Program.

Sound Earth Strategies. (2013). *Remedial Investigation/Feasibility Study Work Plan: Duwamish Marine Center.* Sound Earth Strategies, Inc., 2013.

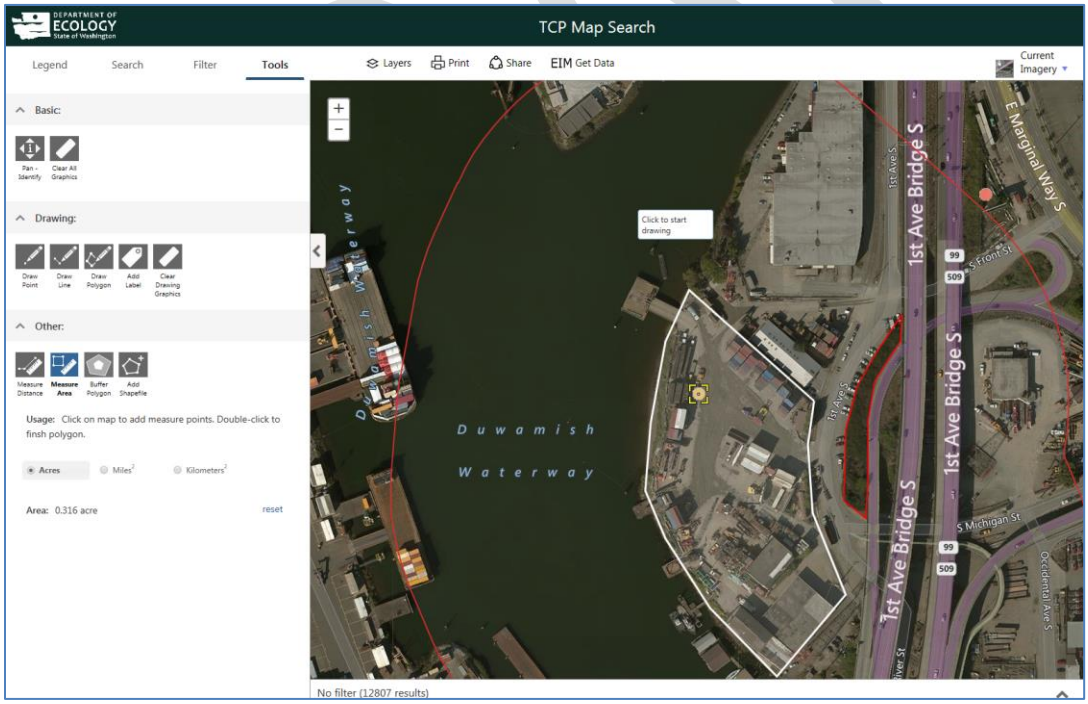
Sound Earth Strategies. (2014). *Technical Memorandum: Updates to the Remedial Investigation/Feasibility Study Work Plan: Duwamish Marine Center.* Sound Earth Strategies, Inc., 2014.

Appendix A: Duwamish Marine Center Site - Exposure Pathways

Appendix B: Duwamish Marine Center Site with 500 ft. Buffer- Contiguous Undeveloped Land (On-Site)



Appendix C: Duwamish Marine Center Site with 500 ft. Buffer- Contiguous Undeveloped Land (Off-Site)



Appendix D: Duwamish Marine Center Site: Table 749-1, Exposure Analysis Scenario

Table 749-1
Simplified Terrestrial Ecological Evaluation – Exposure Analysis Procedure under WAC 173-340-7492(2)(a)(ii).[a]

Estimate the area of contiguous (connected) undeveloped land on the site or within 500 feet of any area of the site to the nearest 1/2 acre (1/4 acre if the area is less than 0.5 acre). "Undeveloped land" means land that is not covered by existing buildings, roads, paved areas or other barriers that will prevent wildlife from feeding on plants, earthworms, insects or other food in or on the soil.	
1) From the table below, find the number of points corresponding to the area and enter this number in the box to the right.	
Area (acres) / Points: 0.25 or less – 4; 0.5 – 5; 1.0 – 6; 1.5 – 7; 2.0 – 8; 2.5 – 9; 3.0 – 10; 3.5 – 11; 4.0 or more – 12	8
2) Is this an industrial or commercial property? See WAC 173-340-7490(3)(c). If yes, enter a score of 3 in the box to the right. If no, enter a score of 1.	3
3) Enter a score in the box to the right for the habitat quality of the site, using the rating system shown below[b]. (High = 1, Intermediate = 2, Low = 3)	3
4) Is the undeveloped land likely to attract wildlife? If yes, enter a score of 1 in the box to the right. If no, enter a score of 2. See footnote c.	2
5) Are there any of the following soil contaminants present: Chlorinated dioxins/furans, PCB mixtures, DDT, DDE, DDD, aldrin, chlordane, dieldrin, endosulfan, endrin, heptachlor, benzene hexachloride, toxaphene, hexachlorobenzene, pentachlorophenol, pentachlorobenzene? If yes, enter a score of 1 in the box to the right. If no, enter a score of 4.	1
6) Add the numbers in the boxes on lines 2 through 5 and enter this number in the box to the right. If this number is larger than the number in the box on line 1, the simplified terrestrial ecological evaluation may be ended under WAC 173-340-7492 (2)(a)(ii).	9

Footnotes:

a It is expected that this habitat evaluation will be undertaken by an experienced field biologist. If this is not the case, enter a conservative score (1) for questions 3 and 4.

b **Habitat rating system.** Rate the quality of the habitat as high, intermediate or low based on your professional judgment as a field biologist. The following are suggested factors to consider in making this evaluation:
Low: Early successional vegetative stands; vegetation predominantly noxious, nonnative, exotic plant species or weeds. Areas severely disturbed by human activity, including intensively cultivated croplands. Areas isolated from other habitat used by wildlife.
High: Area is ecologically significant for one or more of the following reasons: Late-successional native plant communities present; relatively high species diversity; used by an uncommon or rare species; priority habitat (as defined by the Washington Department of Fish and Wildlife); part of a larger area of habitat where size or fragmentation may be important for the retention of some species.
Intermediate: Area does not rate as either high or low.

c Indicate "yes" if the area attracts wildlife or is likely to do so. Examples: Birds frequently visit the area to feed; evidence of high use by mammals (tracks, scat, etc.); habitat "island" in an industrial area; unusual features on an area that make it important for feeding animals; heavy use during seasonal migrations.

Contiguous undeveloped land = 1.9 acres (on site)

Contiguous undeveloped land = .3 acres (off site)

Box 6 > Box 1

Appendix E: Duwamish Marine Center Site: List of Contaminants of Ecological Concern under the Simplified TEE Scenario.

Table 749-2
Priority Contaminants of Ecological Concern for Sites that Qualify for the Simplified Terrestrial Ecological Evaluation Procedure.[a]

Priority contaminant	Soil concentration (mg/kg)	
	Unrestricted land use[b]	Industrial or commercial site
METALS:[c]		
Antimony	See note d	See note d
Arsenic III	20 mg/kg	20 mg/kg
Arsenic V	95 mg/kg	260 mg/kg
Barium	1,250 mg/kg	1,320 mg/kg
Beryllium	25 mg/kg	See note d
Cadmium	25 mg/kg	36 mg/kg
Chromium (total)	42 mg/kg	135 mg/kg
Cobalt	See note d	See note d
Copper	100 mg/kg	550 mg/kg
Lead	220 mg/kg	220 mg/kg
Magnesium	See note d	See note d
Manganese	See note d	23,500 mg/kg
Mercury, inorganic	9 mg/kg	9 mg/kg
Mercury, organic	0.7 mg/kg	0.7 mg/kg
Molybdenum	See note d	71 mg/kg
Nickel	100 mg/kg	1,850 mg/kg
Selenium	0.8 mg/kg	0.8 mg/kg
Silver	See note d	See note d
Tin	275 mg/kg	See note d
Vanadium	26 mg/kg	See note d
Zinc	270 mg/kg	570 mg/kg
PESTICIDES:		
Aldicarb/aldicarb sulfone (total)	See note d	See note d
Aldrin	0.17 mg/kg	0.17 mg/kg
Benzene hexachloride (including lindane)	10 mg/kg	10 mg/kg
Carbofuran	See note d	See note d
Chlordane	1 mg/kg	7 mg/kg
Chlorpyrifos/chlorpyrifos-methyl (total)	See note d	See note d
DDT/DDD/DDE (total)	1 mg/kg	1 mg/kg
Dieldrin	0.17 mg/kg	0.17 mg/kg
Endosulfan	See note d	See note d
Endrin	0.4 mg/kg	0.4 mg/kg
Heptachlor/heptachlor epoxide (total)	0.6 mg/kg	0.6 mg/kg
Hexachlorobenzene	31 mg/kg	31 mg/kg
Parathion/methyl parathion (total)	See note d	See note d
Pentachlorophenol	11 mg/kg	11 mg/kg
Toxaphene	See note d	See note d
OTHER CHLORINATED ORGANICS:		
Chlorinated dibenzofurans (total)	3E-06 mg/kg	3E-06 mg/kg
Chlorinated dibenzo-p-dioxins (total)	5E-06 mg/kg	5E-06 mg/kg
Hexachlorophene	See note d	See note d
PCB mixtures (total)	2 mg/kg	2 mg/kg
Pentachlorobenzene	168 mg/kg	See note d
OTHER NONCHLORINATED ORGANICS:		
Acenaphthene	See note d	See note d
Benzo(a)pyrene	30 mg/kg	300 mg/kg
Bis (2-ethylhexyl) phthalate	See note d	See note d
Di-n-butyl phthalate	200 mg/kg	See note d
PETROLEUM:		
Gasoline Range Organics	200 mg/kg	12,000 mg/kg except that the concentration shall not exceed residual saturation at the soil surface.
Diesel Range Organics	460 mg/kg	15,000 mg/kg except that the concentration shall not exceed residual saturation at the soil surface.

Footnotes:

a Caution on misusing these chemical concentration numbers. These values have been developed for use at sites where a site-specific terrestrial ecological evaluation is not required. They are not intended to be protective of terrestrial ecological receptors at every site. Exceedances of the values in this table do not necessarily trigger requirements for cleanup action under this chapter. The table is not intended for purposes such as evaluating sludges or wastes.
This list does not imply that sampling must be conducted for each of these chemicals at every site. Sampling should be conducted for those chemicals that might be present based on available information, such as current and past uses of chemicals at the site.

b Applies to any site that does not meet the definition of industrial or commercial.

c For arsenic, use the valence state most likely to be appropriate for site conditions, unless laboratory information is available. Where soil conditions alternate between saturated, anaerobic and unsaturated, aerobic states, resulting in the alternating presence of arsenic III and arsenic V, the arsenic III concentrations shall apply.

d Safe concentration has not yet been established. See WAC 173-340-7492(2)(c).