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September 7, 2015 ECI Project Number: 0483-06

Mr. Michael Marchetti
Breakwater Marina
5603 N. Waterfront Drive
Tacoma, Washington 98407

Re: **Focused Groundwater Assessment**

Breakwater Marina
5603 N. Waterfront Drive
Tacoma, Washington 98407

Mr. Marchetti:

Pursuant to your recent request, EcoCon, Inc. (ECI) completed a Focused Groundwater Assessment (FGA) for the property located at 5603 N. Waterfront Drive in Tacoma, Washington (the Property). The location of the property is presented on Appendix A; Figure 1). This FGA was conducted in accordance with ECI's "*Groundwater Sampling and Analysis Plan*", approved by the Tacoma/Pierce County Health Department (TPCHD) and State of Washington Department of Ecology (Ecology) in July and August 2015, for the purpose of post-remediation compliance monitoring.

This report details field activities and observations, sampling activities, chemical analysis, and provides conclusions and recommendations.

Attached to this report are the following:

- Appendix A: Project Figures;
- Appendix B: Sample Analytical Results;
- Appendix C: Boring Logs

Scope of Work

The scope of work for this FGA included:

- Development of a Groundwater Sampling and Analysis Plan;
- Public and Private utility location on the Property;
- Preparation of site-specific Health and Safety Plan (HASP);
- Drilling and completion of monitoring wells;
- Collection and laboratory analysis of groundwater samples; and
- Preparation of this report.

Property and Site Location & Description

The Property (addressed as 5603 North Waterfront Drive, Tacoma, Washington) is a commercial marina located within Section 23, Township 21 North, and Range 02 East of the Willamette Meridian (Figures 1 & 2, Appendix A). According to the Pierce County Assessor records, the Property is identified as Pierce County Tax Parcel 8950100010, and consists of an irregular shaped lot that occupies 29.30 acres (1,276,308 square feet). The Site is located to the southeast of the Washington State Department of Transportation Pt. Defiance – Vashon Island ferry dock and the Tacoma Yacht Club (See Appendix A: Figure 1). The Site is currently zoned as Municipal Area (City of Tacoma) and a portion of the Metropolitan Parks District Point Defiance Park (Pierce County Assessor Website, 2013). This report is written exclusively for the Breakwater Marina, which includes the infrastructure (175 slips from 25 – 100 feet) associated with a marina. The current owner of the parcel has confirmed that the site is located within the Metropolitan Park District.

The "Site" is defined by Ecology as the full lateral and vertical extent of contamination that has resulted from five former gasoline and diesel underground storage tanks (USTs) at the Property used to provide fuel for marina clients and customers. Based on information gathered to date, the Site had soil and/or groundwater contaminated with; gasoline-range organics (GRO), diesel-range organics (DRO); benzene, toluene, ethylbenzene, and/or total xylenes (BTEX); and lead.

Physical Setting

The Site is located in the physiographic setting called the Puget Sound Lowlands, an elongate structural and topographic basin between the Olympic Peninsula (Olympic Mountains) and northern Willapa Hills on the west, and the Cascade subcontinent (Cascade Range) to the east. The area has been impacted by repeated glaciation and crustal deformation related to the Cascadia subduction zone. The present landscape largely results from those repeated cycles of glacial scouring and deposition and tectonic activity, subsequently modified by land sliding, stream erosion and deposition, and human activity.

The most recent glacier to override the area, during the Vashon Stade of the Fraser Glaciation, was marked by the advance and retreat of the Puget Lobe of the Cordilleran Ice Sheet in western Washington, and retreated from the area by approximately 13,650 years ago. This glacier was about 5,000 feet thick near Seattle and approximately 1,500 feet thick in the area of the Site, with its termination approximately 12 miles south of Olympia. This area is filled in with deep deposits of glacial debris which can reach thicknesses of at least 2000 feet in the Tacoma area. Bedrock beneath the thick glacial deposits in the Puget Sound Lowlands consists of oceanic crustal rocks.

According to the United States Geological Survey (USGS) 1:24000 Gig Harbor Quadrangle 7.5-minute Series Topographic Map, the Property is at an elevation of approximately 12 feet above mean sea level

(msl) (Appendix A; Figure 2). A steep embankment is located southwest of the Property across South Waterfront Drive. The topography of the Property and vicinity generally slopes to the northeast.

Geological and hydrogeological conditions can often affect, to some extent, the environmental integrity of Site. Underlying soil and bedrock formations may facilitate or impede the migration of chemical contaminants in groundwater, and may even be the source of contaminants such as radon and metals.

The primary aquifers in the Puget Sound region are typically overlain by relatively impermeable glacial till deposits, that are present at or near the ground surface. Within these till deposits are localized areas or lenses of water-bearing sands and gravels that may result in a shallow, localized, perched water table. Lateral and vertical migration of shallow groundwater may be impeded by the relatively impermeable nature of the till and by the sometimes-discontinuous nature of the perched water-bearing sands and gravel.

Perched and discontinuous zones of shallow groundwater may be seasonally or perennially present, depending on site-specific conditions. Shallow groundwater flow directions fluctuate and tend to follow topographic gradient but are also affected by seasonal high water tables and variable soil characteristics.

Groundwater migration pathways may also be influenced by man-made subsurface conditions created by soil excavation and filling, and underground utilities. These conditions may cause groundwater to migrate in different directions along those paths of least resistance.

Shallow groundwater beneath the Site was expected to flow to the northeast towards the Dalco Passage of the Puget Sound. However, the vicinity of the Site has been filled and a seawall constructed. As a result, the groundwater flow at the site appears to be to the southeast.

Previous Investigations

Previous investigations at the Site have identified petroleum hydrocarbon contaminants in soil and groundwater adjacent to and beneath the locations of the former underground storage tanks (USTs) and product piping previously utilized for fueling services at the Site. Soil and groundwater samples collected during the investigations identified one or more of the following petroleum hydrocarbon contaminants at concentrations above the Model Toxics Control Act (MTCA) Method A Cleanup Levels (CULs): gasoline-range organics (GRO), diesel-range organics (DRO), and select volatile organic compounds benzene, toluene, ethylbenzene and xylenes (BTEX), and/or lead.

Focused Subsurface Investigation/Underground Storage Tank Assessment – November 2013

In November 2013, ECI directed the advancement of soil borings adjacent to the five USTs, as described in ECI's letter report entitled "*Focused Subsurface Investigation/Underground Storage Tank Assessment*", dated November 15, 2013. Thirteen borings were advanced as part of this focused subsurface investigation. Areas investigated included soils and groundwater adjacent to the five USTs. The depth of the borings ranged from eight to ten feet below ground surface (bgs) and the depth to groundwater ranged from five to six feet bgs.

Soil samples were collected from three to four feet bgs and from the groundwater interface. Groundwater and soil samples were analyzed for the site contaminants of concern (COC), identified as: GRO, DRO, and BTEX. Analysis indicated only one of the samples contained DRO concentrations above the Ecology MTCA Method A CUL for Unrestricted Land Use of 500 µg/L (*WAC 173-340-900: Table 720-1*) at 34,300 µg/L. That sample was groundwater sample B1-W collected from boring B1, located adjacent to the northwestern most UST. Based on the analytical results obtained from this investigation, ECI recommended further investigation in the area of that UST to further delineate groundwater contamination.

Supplemental Focused Subsurface Investigation – December 2013

In December 2013, ECI directed the advancement of additional soil borings at the Site, as described in ECI's letter report titled "*Supplemental Focused Subsurface Investigation*" (SFSI), dated January 13, 2014. Six borings were advanced as part of this SFSI. Areas investigated included adjacent soils and groundwater to the northwest of the northwestern most UST. The depth of the borings reached ten feet bgs, and depth to groundwater ranged from eight to nine feet bgs.

Soil samples were collected from the groundwater interface. Groundwater samples collected from each boring were analyzed for DRO. Analytical results indicated concentrations of DRO below laboratory reporting limits in all six of the groundwater samples. Because the laboratory analysis did not detect concentrations of target analytes in groundwater, and the field screening of soil samples did not indicate the presence of contamination, the soil samples collected were not analyzed.

These results, and the results from the previous investigations, indicated a localized area of impacted groundwater adjacent to the northwestern most UST. This localized area appeared to be impacted with DRO above the applicable Ecology MTCA Method A CUL in groundwater (500 µg/L). Therefore, based on the analytical results obtained from the SFSI and previous investigations, ECI recommended further remedial actions at the Breakwater Marina Site.

UST Decommissioning and UST Site Assessment – December 2014

ECI completed the decommissioning and UST site assessment during the closure of the five USTs at the Subject Site in December 2014. The system consisted of one 8,000-gallon diesel UST, one 8,000-gallon gasoline UST, two 3,000-gallon gasoline USTs and one 3,000-gallon diesel UST.

Each UST was decommissioned by removal and transported off-site for cleaning and disposal. The Soil sampling conducted following the UST removal (site assessment) confirmed the presence of DRO, GRO, benzene, total xylenes, and lead exceeding applicable Ecology MTCA Method A Cleanup Levels.

Soil sample analytical results reported GRO in fifteen (15) samples, DRO in three (3) samples, benzene in two (2) samples, total xylenes in three (3) samples, and lead in one (1) of the samples at concentrations that exceed their applicable MTCA Method A soil cleanup levels. One groundwater grab sample was collected from the excavation following the removal of the USTs.

Analytical results of the groundwater sample reported the presence of DRO and lead at concentrations above laboratory reporting limits but below the MTCA Method A cleanup levels for DRO and lead in groundwater. None of the other analytes were identified above the laboratory reporting limits.

Interim Remedial Action – May 2015

During May 2015, ECI completed an interim remedial action to remediate the previously identified impacted soil and groundwater at the Subject Site. This interim action included excavation and off-site disposal of petroleum contaminated soil (PCS), pumping and off-site disposal of groundwater, and collection and analysis of soil and groundwater samples in multiple locations.

Confirmation samples collected during the remedial action confirmed that the COC concentrations in soil were below their respective MTCA Method A Cleanup Levels for unrestricted land use. Details regarding the interim remedial action are included in ECI's "*Remedial Excavation Report*", dated May 28, 2015.

Groundwater Sampling and Analysis Plan – April 2015

It was expected that the environmental quality of groundwater would be restored by virtue of source removal, therefore no additional active remediation was proposed for this media of concern. A groundwater sampling and analysis plan was established and submitted to Tacoma-Pierce County Health Department on April 9, 2015, detailing the proposed monitoring well locations and compliance sampling methodology. The plan was subsequently approved in an electronic correspondence dated July 20, 2015.

Regulatory Compliance

Regulatory compliance for this project is based on the Ecology MTCA Method A Groundwater Cleanup Levels (WAC 173-340-900 –720-1). Table 1 presents the COCs and their respective cleanup levels.

Table 1: Contaminants of Concern & Applicable Cleanup Levels – Groundwater

Primary Contaminant of Concern	Analytical Method	Groundwater Cleanup Levels (CUL) in µ/L
Gasoline range organics (GRO)	NWTPH-Gx	1,000 /800[1]
Diesel range organics (DRO)	NWTPH-Dx	500
Benzene	EPA Test Method 8021C	5
Toluene	EPA Test Method 8021C	1,000
Ethylbenzene	EPA Test Method 8021C	700
Xylenes	EPA Test Method 8021C	1,000
Total Lead	EPA Test Method 7010	15 µg/L

Contaminants of Concern (COCs)

As discussed above, the COCs for the Site were identified as GRO, DRO, BTEX, and lead, and are included for the purposes of compliance monitoring.

Groundwater Monitoring Well Installation and Sampling Activities

Pre-Site Work Activities

Prior to the subsurface work the "call before you dig service" (811) was called 48 hours in advance of site activities. A private utility survey to clear each proposed boring location was also completed by Mountain View Locating Services of Boney Lake, Washington,

Site Work and Sample Collection

On August 20-21, 2015, Standard Environmental Probe advanced six (6) borings using direct-push techniques under the supervision of an ECI environmental professional. The borings were completed as 1-inch diameter resource protection wells (MW1 through MW6) constructed of 3-4 feet of blank PVC casing, flush-threaded to approximately 5-10 feet of 0.010-inch slotted well screen. Well MW1 was

[1] 1000 µg/L: Gasoline mixtures without benzene and the total of ethylbenzene, toluene and xylenes are less than 1% of the gasoline mixture. 800 µg/L: All other gasoline mixtures (MTCA Table 740-1).

compete to a depth of 13 feet below ground surface (bgs), wells MW2-MW5 were completed to a depth of 12 feet bgs and MW6 was completed to a depth of 8 feet bgs. The well construction details were determined based on field observations during drilling and observations made during previous environmental investigations. The locations of the monitoring wells are shown on Figure 3 in Appendix A, and the boring logs are included in Appendix C.

Groundwater samples were collected on August 24, 2015. Samples were collected in accordance with American Society of Testing and Materials (*ASTM) Guideline* D6771-02 "*Standard Practice for Low-Flow Purging and Sampling for Wells and Devices Used for Ground-Water Quality Investigations*". ECI field staff followed the procedures described below when collecting groundwater samples:

- The cap from the monitoring well was removed and the groundwater level was allowed to equilibrate to atmospheric pressure for a minimum of 20 minutes.
- The depth to groundwater in the monitoring well was measured relative to the top of the well casing using an electronic water-level meter.
- Each monitoring well was purged at a low-flow rate (100 to 300 milliliters per minute) using a peristaltic pump and dedicated polyethylene tubing.
- Temperature, pH, turbidity, and specific conductivity were monitored during purging using a water quality meter to determine when these parameters stabilized.

Samples were collected in new laboratory-provided analyte-specific sample containers and assigned a unique sample ID. The samples were placed in a climate controlled container and maintained at or below 4° Celsius until they were delivered to the laboratory under industry standard chain of custody protocol.

Analytical Results

Six groundwater samples were submitted to Libby Environmental, Inc. of Olympia, Washington for analysis of site specific COCs described in Table 1. The analytical results indicated that GRO, DRO and BTEX were not detected above the respective laboratory reporting limit, and lead that was either not detected above the reporting limit or was detected at concentrations below the MTCA cleanup levels. A summary of the sample analytical results is provided in Table 2 (below), and the laboratory analytical report is included with this report as Appendix B.

Table 2: Summary of Groundwater Analytical Results

Sample ID	GRO (µg/L)	DRO (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (µg/L)	Total Lead (µg/L)
MW1	ND	ND	ND	ND	ND	ND	8.3
MW2	ND	ND	ND	ND	ND	ND	ND
MW3	ND	ND	ND	ND	ND	ND	ND
MW4	ND	ND	ND	ND	ND	ND	6.0
MW5	ND	ND	ND	ND	ND	ND	6.0
MW6	ND	ND	ND	ND	ND	ND	5.3
Laboratory Reporting Limit	100	200	1	2	1	3	5
MTCA Method A CUL's	1000	500	5	1,000	700	1,000	15

ND: Not detected above the laboratory practical quantitation limit (PQL)

Site Groundwater Characteristics

Groundwater levels for monitoring wells MW1 through MW6 were measured on August 24, 2015. The depth to groundwater ranged from 5.80 feet to 6.90 feet below the top of the monitoring well casings. The locations and elevations of the monitoring wells were professionally surveyed by Informed Land Survey of Tacoma, Washington. The calculated groundwater elevations ranged from 6.60 feet to 7.06 feet above mean sea level (amsl).

Table 3: Groundwater Elevation Data

Well ID	Top of Well Casing Elevation (feet amsl)	Depth to Water (feet amsl)	Groundwater Elevation (feet amsl)
MW1	13.30	6.70	6.60
MW2	13.53	6.65	6.88
MW3	12.86	5.80	7.06
MW4	13.64	6.90	6.74
MW5	12.98	6.37	6.61
MW6	12.82	6.10	6.72

The groundwater levels measured may not be representative of natural conditions, as two of the monitoring wells were installed within the former UST excavation area (with the associated very coarse backfill materials in the subsurface) and four of the monitoring wells were installed in the fill materials used when originally constructing South Waterfront Drive. In addition, a seawall lies directly to the north and northeast of the wells and appears to restrict the tidal influence on groundwater elevations in the area of the wells.

Groundwater would normally be expected to flow to the northeast towards the water of the marina and the Puget Sound; however, groundwater flow gradient and direction were determined to be approximately 0.003 feet/foot to the east-southeast during this investigation. Groundwater was previously observed infiltrating the excavation during the remedial activities coming from the hillside to the southwest. It appears that the seawall redirects the groundwater flow to the southeast.

Summary and Conclusions

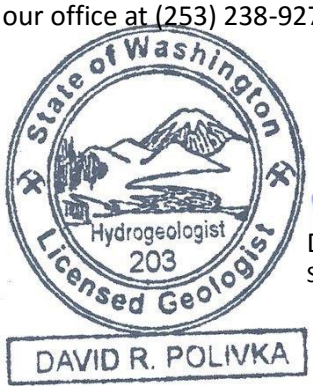
Six groundwater monitoring wells were installed at the Site in August 2015. On August 24, 2015, confirmation/compliance groundwater samples were collected from six monitoring wells installed at the Site. The samples were collected to evaluate the post-remediation groundwater quality.

Sample analytical results reported concentrations of all COCs below their respective laboratory reporting limits and/or applicable cleanup levels. ECI plans to conduct groundwater sampling events for the next three consecutive quarters to evaluate the effectiveness of the remedial action. Should the groundwater concentrations remain below the applicable MTCA Method A Cleanup Levels, ECI will recommend that a determination of "no further action" be issued for the Site.

ECI appreciates the opportunity to provide environmental consulting services on this project. Should you have any questions, please contact our office at (253) 238-9270.

Respectfully Submitted,

K. Craig Klein
Sr. Environmental Geologist



David R. Polivka, L.G./L.HG.
Senior Hydrogeologist

Qualifications of This Report

Although this Focused Groundwater Assessment has been a reasonably thorough attempt to investigate the potential presence of contamination, there is always the possibility that additional sources of

contamination have escaped detection due to the limitations of this study, the inaccuracy of governmental records, and the presence of undetected and unreported environmental incidents. ECI reserves the right to alter our findings based on our review of any information obtained and reviewed after the date of this report.

Our professional services have been performed using that degree of care and skill ordinarily exercised, under similar conditions, by reputable environmental consultants practicing in this or similar localities. No other warranty, expressed or implied, is made as to the professional information included in this report. Should you have any questions regarding this report, please contact our office at (253) 238-9270.

List of Appendices

Appendix A: Project Figures

- Figure 1 - Project Location Map
- Figure 2 - Site Topographic Map
- Figure 3 - Groundwater Monitoring Well Location Map & Sample Results

Appendix B: Project Analytical Results

- Laboratory Analytical Report
- Sample Chain of Custody

Appendix C: Boring Logs

Appendix A

Project Figures

Figure 1: Subject Site Location Map
Figure 2: Subject Site Topographic Map
Figure 3: Monitoring Well & Sample Location Map

N
Not To Scale

Project Location Map
Groundwater Monitoring Project
5603 North Waterfront Drive
Tacoma, Washington

Date:	September 9 ,2015
Completed By:	K. Spencer
Reviewed By.:	S. Spencer
Version:	ECI-003-090915
Project No.:	0483-06

Figure No.: 01
Sheet 01 of 03

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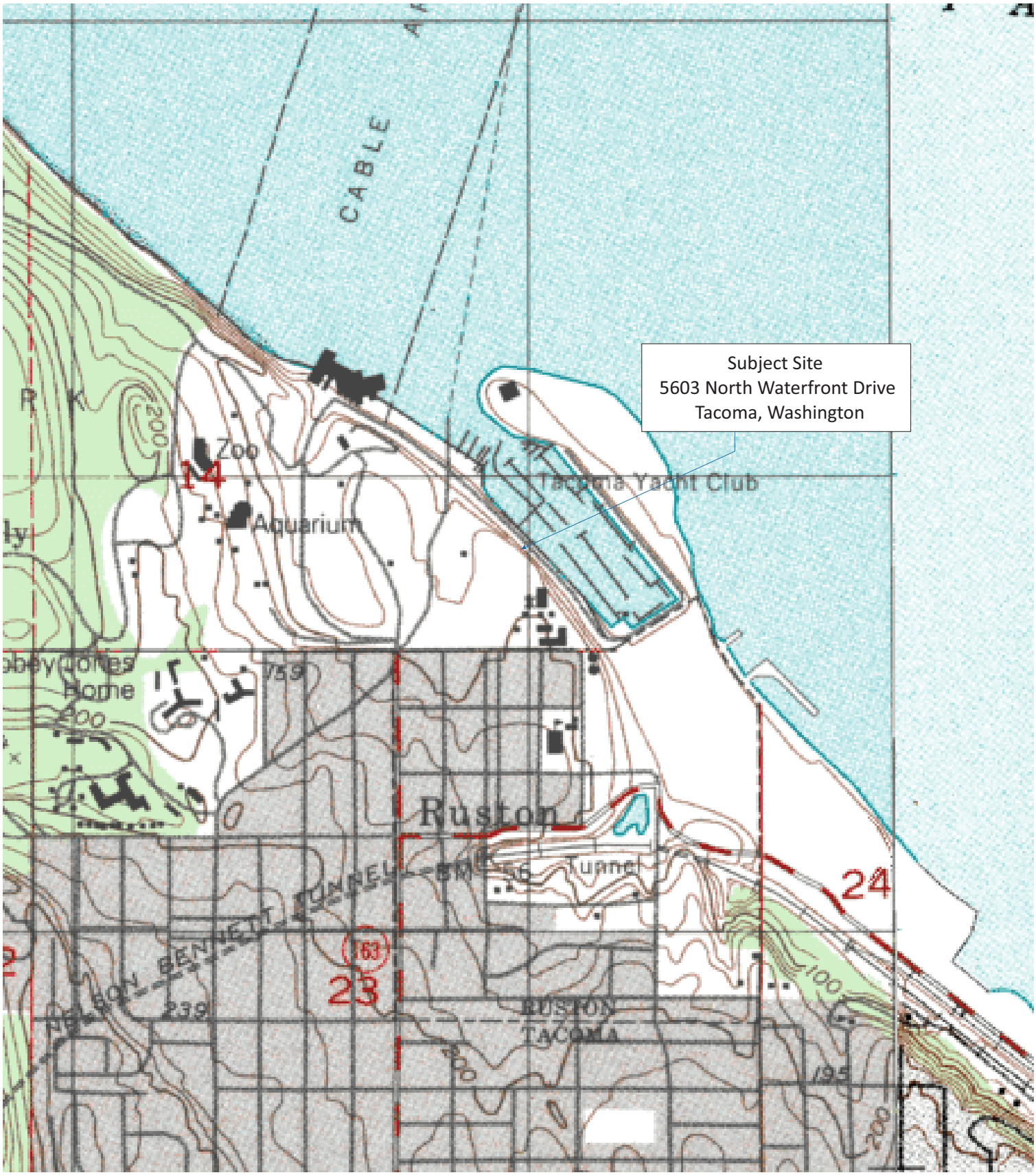

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Not To Scale

Site Topographic Map
Groundwater Monitoring Project
5603 North Waterfront Drive
Tacoma, Washington

Date:	September 9 ,2015
Completed By:	K. Spencer
Reviewed By.:	S. Spencer
Version:	ECI-003-090915
Project No.:	0483-06

Figure No.: 02
Sheet 02 of 03

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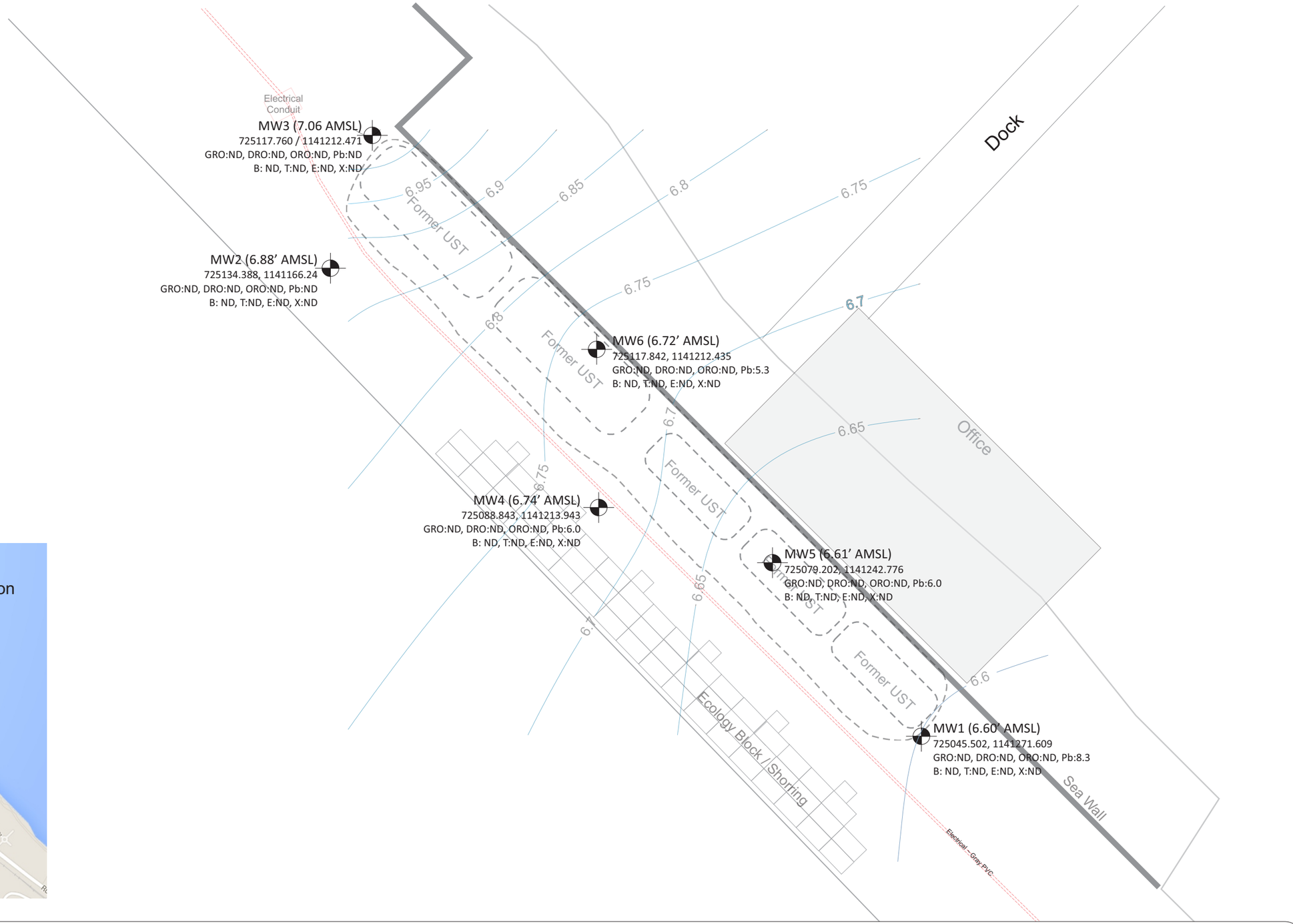

N

0 15 30 60

Approximate Scale in Feet

Explanation

⊕	Groundwater Monitoring Wells
AMSL	Above Mean Sea Level
B,T,E,X	Benzene, Toluene, Ethylbenzene, Xylenes
GRO	Gasoline Range Organics
DRO	Diesel Range Organics
ORO	Oil Range Organics

Groundwater Monitoring Well Location Map & Sample Results

Groundwater Monitoring Project
5603 North Waterfront Drive
Tacoma, Washington

Date:	September 9 ,2015
Completed By:	K. Spencer
Reviewed By.:	S. Spencer
Version:	ECI-003-090915
Project No.:	0483-06

Figure No.: 03
Sheet 03 of 03

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Appendix B

Analytical Results

Laboratory Analytical Report
Chain of Custody

Libby Environmental, Inc.
4139 Libby Road NE • Olympia, WA 98506-2518

September 3, 2015

Craig Klein
ECI
P.O. Box 153
Fox Island, WA 98333

Dear Ms. Klein:

Please find enclosed the analytical data report for the Breakwater Marina Project located in Tacoma, Washington.

The results of the analyses are summarized in the attached tables. Applicable detection limits and QA/QC data are included. The sample(s) will be disposed of in 30 days unless we are contacted to arrange long term storage.

Libby Environmental, Inc. appreciates the opportunity to have provided analytical services for this project. If you have any further questions about the data report, please give me a call. It was a pleasure working with you on this project, and we are looking forward to the next opportunity to work together.

Sincerely,

Sherry L. Chilcutt
Senior Chemist
Libby Environmental, Inc.

Phone (360) 352-2110 • Fax (360) 352-4154 • libbyenv@aol.com

Libby Environmental, Inc.

Chain of Custody Record

www.LibbyEnvironmental.com

4139 Libby Road NE
Olympia, WA 98506
Ph: 360-352-2110
Fax: 360-352-4154

Client: ECI

Address:

City: State: Zip:

Phone: Fax:

Client Project # 0483-06

Date: 8/24/15 Page: 1 of 1

Project Manager: Klein

Project Name: Breakwater Marina

Location: Tacoma City, State: WA

Collector: Mulderig Date of Collection: 8/24/15

Email:

	Sample Number	Depth	Time	Sample Type	Container Type	VOA 8021B	VOA 8021B BTEX Only	VOA 8260	SEMI VOL 8270	NWTPH-HCID	NWTPH-Gx	NWTPH-Dx	NWTPH-Dx Ext.	PAH 8270	PCB's 8082	MTCA 5 Metals	Lead		Field Notes
1	MW-1		1000	W		X				X	X					X			
2	MW-2		1100																
3	MW-3		1200																
4	MW-4		1240																
5	MW-5		1315																
6	MW-6		1450																
7																			
8																			
9																			
10																			
11																			
12																			
13																			
14																			
15																			
16																			
17																			

Relinquished by:	Date / Time	Received by:	Date / Time
[signature]	8/24/15 1500	[signature]	8/25/15 10:12
Relinquished by:	Date / Time	Received by:	Date / Time
Relinquished by:	Date / Time	Received by:	Date / Time

Sample Receipt:

Good Condition?	Y
Cold?	Y
Seals Intact?	Y
Total Number of Containers	27

Remarks:

TAT: 24HR 48HR (5-DAY)

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

Libby Environmental, Inc.

4139 Libby Road NE
Olympia, WA 98506
Phone: (360) 352-2110
FAX: (360) 352-4154
Email: libbyenv@aol.com

BREAKWATER MARINA PROJECT
ECI
Tacoma, Washington
Libby Project # L150825-2
Client Project # 0483-06

Analyses of Gasoline (NWTPH-Gx) & BTEX (EPA Method 8260C) in Water

Sample Number	Date Analyzed	Benzene (µg/l)	Toluene (µg/l)	Ethylbenzene (µg/l)	Xylenes (µg/l)	Gasoline (µg/l)	Surrogate Recovery (%)
Method Blank	8/29/15	nd	nd	nd	nd	nd	91
LCS	8/29/15	92%	84%				90
MW-1	8/29/15	nd	nd	nd	nd	nd	87
MW-1 Dup	8/29/15	nd	nd	nd	nd	nd	85
MW-2	8/29/15	nd	nd	nd	nd	nd	89
MW-3	8/29/15	nd	nd	nd	nd	nd	88
MW-4	8/29/15	nd	nd	nd	nd	nd	86
MW-5	8/29/15	nd	nd	nd	nd	nd	79
MW-6	8/29/15	nd	nd	nd	nd	nd	95
MW-6 MS	8/29/15	97%	87%				90
MW-6 MSD	8/29/15	94%	83%				88
Practical Quantitation Limit		1	2	1	3	100	

"nd" Indicates not detected at the listed detection limits.
"int" Indicates that interference prevents determination.

ACCEPTABLE RECOVERY LIMITS FOR SURROGATE (Toluene-d8): 65% TO 135%

ANALYSES PERFORMED BY: Sherry Chilcutt

Libby Environmental, Inc.

4139 Libby Road NE
Olympia, WA 98506
Phone: (360) 352-2110
FAX: (360) 352-4154
Email: libbyenv@aol.com

BREAKWATER MARINA PROJECT
ECI
Tacoma, Washington
Libby Project # L150825-2
Client Project # 0483-06

Analyses of Diesel (NWTPH-Dx) in Water

Sample Number	Date Analyzed	Surrogate Recovery (%)	Diesel (µg/l)
Method Blank	8/27/15	98	nd
MW-1	8/27/15	96	nd
MW-2	8/27/15	97	nd
MW-3	8/27/15	87	nd
MW-4	8/27/15	92	nd
MW-5	8/27/15	94	nd
MW-6	8/27/15	105	nd
MW-6 Dup	8/27/15	110	nd
Practical Quantitation Limit			200

"nd" Indicates not detected at the listed detection limits.
"int" Indicates that interference prevents determination.

ACCEPTABLE RECOVERY LIMITS FOR SURROGATE (2-F Biphenyl): 65% TO 135%

ANALYSES PERFORMED BY: Maria Friedrich & Kodey Eley

Libby Environmental, Inc.

4139 Libby Road NE
Olympia, WA 98506
Phone: (360) 352-2110
FAX: (360) 352-4154
Email: libbyenv@aol.com

BREAKWATER MARINA PROJECT
ECI
Tacoma, Washington
Libby Project # L150825-2
Client Project # 0483-06

Analyses of Total Lead in Water by EPA 7010 Series

Sample Number	Date Analyzed	Lead µg/L
Method Blank	8/30/15	nd
MW-1	8/30/15	8.3
MW-2	8/30/15	nd
MW-3	8/30/15	nd
MW-4	8/30/15	6.0
MW-5	8/30/15	6.0
MW-6	8/30/15	5.3
Practical Quantitation Limit		5.0

"nd" Indicates not detected at the listed detection limits.

ANALYSES PERFORMED BY: Dirk Peterson

Libby Environmental, Inc.

4139 Libby Road NE
Olympia, WA 98506
Phone: (360) 352-2110
FAX: (360) 352-4154
Email: libbyenv@aol.com

BREAKWATER MARINA PROJECT
ECI
Tacoma, Washington
Libby Project # L150825-2
Client Project # 0483-06

QA/QC for Lead in Water by EPA 7010 Series

Sample Number	Date Analyzed	Lead (% Recovery)
LCS	8/30/15	112%
L150828-3 MS	8/30/15	96%
L150828-3 MSD	8/30/15	97%
RPD	8/30/15	1%

ACCEPTABLE RECOVERY LIMITS FOR MATRIX SPIKES: 75%-125%
ACCEPTABLE RPD IS 20%

ANALYSES PERFORMED BY: Dirk Peterson

Appendix C

Sample Collection Forms

Project Boring Logs
Monitoring Well Sampling Logs

ECI environmental services
www.ecocononline.com

Project: Breakwater Marina

Location: 5603 S. Waterfron Drive Tacoma, WA

Client:

Boring ID: MW1

Project Number:

Date Start/Finish:	8/20/2015	**Drilling Method:**	Direct Push
Logged By:	Kaden Reed	**Auger ID/OD:**	
Checked By:		**Borehole ID/OD:**	2"
Contractor:	Standard Environmental Probe	**Sampler:**	N/A
Operator:	Chris Ross	**Hammer Wt./Fall:**	
Boring Location:		**Ground Elevation:**	
Coordinates:		**Water Depth:**	6'
Weather:	Overcast	**Boring Depth:**	15'

Unified Soil Classification System

NON-COHESIVE SOILS	GW	WELL-GRADED GRAVEL, FINE TO COARSE GRAVEL
	GP	POORLY-GRADED GRAVEL
	GM	SILTY GRAVEL
	GC	CLAYEY GRAVEL
	SW	WELL-GRADED SAND, FINE TO COARSE SAND
	SP	POORLY-GRADED SAND
	SM	SILTY SAND
	SC	CLAYEY SAND
COHESIVE SOILS	ML	SILT
	CL	CLAY
	OL	ORGANIC SILT, ORGANIC CLAY
	MH	SILT OF HIGH PLASTICITY, ELASTIC SILT
	CH	CLAY OF HIGH PLASTICITY, FAT CLAY
	OH	ORGANIC CLAY, ORGANIC SILT
	PT	PEAT

Depth (ft bgs)	Sample No.	Time	Sample Condition	PID Reading	Remarks	Soil and Rock Description	Unified Classification	Graphical Representation
1						Silty sand w/ trace gravel, fine-grained, dark brown, coarse, no odor	SM	
2								
3								
4								
5						Silty sand, fine-grained, dark brown, wet, no odor	SM	
6						Water level - 6'		
7								
8								
9						Silty gravel, medium-coarse, brown, dense, no odor	GM	
10								
11								
12								
13								
14								
15						Boring terminated @ 15'		
16								
17								
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Notes:

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Project:	Breakwater Marina	**Boring ID:**	**MW2**
Location:	5603 S. Waterfron Drive Tacoma, WA	**Project Number:**	
Client:			
Date Start/Finish:	8/20/2015	**Drilling Method:**	Direct Push
Logged By:	Kaden Reed	**Auger ID/OD:**	
Checked By:		**Borehole ID/OD:**	2"
Contractor:	Standard Environmental Probe	**Sampler:**	N/A
Operator:	Chris Ross	**Hammer Wt./Fall:**	
Boring Location:		**Ground Elevation:**	
Coordinates:		**Water Depth:**	5'
Weather:	Overcast	**Boring Depth:**	12'

Unified Soil Classification System

NON-COHESIVE SOILS	GW	WELL-GRADED GRAVEL, FINE TO COARSE GRAVEL
	GP	POORLY-GRADED GRAVEL
	GM	SILTY GRAVEL
	GC	CLAYEY GRAVEL
	SW	WELL-GRADED SAND, FINE TO COARSE SAND
	SP	POORLY-GRADED SAND
	SM	SILTY SAND
	SC	CLAYEY SAND
COHESIVE SOILS	ML	SILT
	CL	CLAY
	OL	ORGANIC SILT, ORGANIC CLAY
	MH	SILT OF HIGH PLASTICITY, ELASTIC SILT
	CH	CLAY OF HIGH PLASTICITY, FAT CLAY
	OH	ORGANIC CLAY, ORGANIC SILT
	PT	PEAT

Depth (ft bgs)	Sample No.	Time	Sample Condition	PID Reading	Remarks	Soil and Rock Description	Unified Classification	Graphical Representation
1						Silty sand w/ trace gravel, fine-grained, brown, dense, no odor	SM	
2								
3								
4								
5						Water level - 5'		
6						Silty gravel, medium-coarse, brown, dense, no odor	GM	
7								
8								
9								
10						Silty sand, fine-grained, brown, dense, no odor	SM	
11								
12						Silty gravel, medium-coarse, brown, dense, no odor. Boring terminated @ 12'	GM	
13								
14								
15								
16								
17								
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19								
20								
21								
22								
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Notes:

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Project: Breakwater Marina

Location: 5603 S. Waterfron Drive Tacoma, WA

Client:

Boring ID: MW3

Project Number:

Date Start/Finish:	8/20/2015	**Drilling Method:**	Direct Push
Logged By:	Kaden Reed	**Auger ID/OD:**	
Checked By:		**Borehole ID/OD:**	2"
Contractor:	Standard Environmental Probe	**Sampler:**	N/A
Operator:	Chris Ross	**Hammer Wt./Fall:**	
Boring Location:		**Ground Elevation:**	
Coordinates:		**Water Depth:**	7'
Weather:	Overcast	**Boring Depth:**	13'

Unified Soil Classification System

NON-COHESIVE SOILS	GW	WELL-GRADED GRAVEL, FINE TO COARSE GRAVEL
	GP	POORLY-GRADED GRAVEL
	GM	SILTY GRAVEL
	GC	CLAYEY GRAVEL
	SW	WELL-GRADED SAND, FINE TO COARSE SAND
	SP	POORLY-GRADED SAND
	SM	SILTY SAND
	SC	CLAYEY SAND
COHESIVE SOILS	ML	SILT
	CL	CLAY
	OL	ORGANIC SILT, ORGANIC CLAY
	MH	SILT OF HIGH PLASTICITY, ELASTIC SILT
	CH	CLAY OF HIGH PLASTICITY, FAT CLAY
	OH	ORGANIC CLAY, ORGANIC SILT
	PT	PEAT

Depth (ft bgs)	Sample No.	Time	Sample Condition	PID Reading	Remarks	Soil and Rock Description	Unified Classification	Graphical Representation
1						Silty sand w/ trace gravel, med-grained, brown, dense, no odor	SM	
2								
3								
4								
5								
6								
7						Silty sand, fine-grained, brown, dense, wet, no odor. Water level - 7'	SM	
8								
9						Gravelly sand, coarse-grained, brown, wet, no odor	SP	
10								
11								
12								
13						Boring terminated @ 13'		
14								
15								
16								
17								
18								
19								
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23								
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Notes:

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Project:	Breakwater Marina	**Boring ID:**	**MW4**
Location:	5603 S. Waterfron Drive Tacoma, WA	**Project Number:**	
Client:			
Date Start/Finish:	8/20/2015	**Drilling Method:**	Direct Push
Logged By:	Kaden Reed	**Auger ID/OD:**	
Checked By:		**Borehole ID/OD:**	2"
Contractor:	Standard Environmental Probe	**Sampler:**	N/A
Operator:	Chris Ross	**Hammer Wt./Fall:**	
Boring Location:		**Ground Elevation:**	
Coordinates:		**Water Depth:**	8'
Weather:	Sunny, warm	**Boring Depth:**	12'

Unified Soil Classification System

NON-COHESIVE SOILS	GW	WELL-GRADED GRAVEL, FINE TO COARSE GRAVEL
	GP	POORLY-GRADED GRAVEL
	GM	SILTY GRAVEL
	GC	CLAYEY GRAVEL
	SW	WELL-GRADED SAND, FINE TO COARSE SAND
	SP	POORLY-GRADED SAND
	SM	SILTY SAND
	SC	CLAYEY SAND
COHESIVE SOILS	ML	SILT
	CL	CLAY
	OL	ORGANIC SILT, ORGANIC CLAY
	MH	SILT OF HIGH PLASTICITY, ELASTIC SILT
	CH	CLAY OF HIGH PLASTICITY, FAT CLAY
	OH	ORGANIC CLAY, ORGANIC SILT
	PT	PEAT

Depth (ft bgs)	Sample No.	Time	Sample Condition	PID Reading	Remarks	Soil and Rock Description	Unified Classification	Graphical Representation
1						Silty sand w/ trace gravel, fine-grained, brown, dense, no odor	SM	
2								
3								
4								
5								
6						Sand w/ gravel, coarsefine-grained, brown, dense, wet, no odor.	SM	
7								
8						Water level - 8'		
9						Silty gravel, med-coarse grained, brown, wet, no odor	GM	
10								
11								
12								
13						Boring terminated @ 13'		
14								
15								
16								
17								
18								
19								
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Notes:

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Project:	Breakwater Marina	**Boring ID:**	**MW5**
Location:	5603 S. Waterfron Drive Tacoma, WA	**Project Number:**	
Client:			

Date Start/Finish:	8/21/2015	**Drilling Method:**	Direct Push
Logged By:	Kaden Reed	**Auger ID/OD:**	
Checked By:		**Borehole ID/OD:**	2"
Contractor:	Standard Environmental Probe	**Sampler:**	N/A
Operator:	Chris Ross	**Hammer Wt./Fall:**	
Boring Location:		**Ground Elevation:**	
Coordinates:		**Water Depth:**	7'
Weather:	Overcast, cool	**Boring Depth:**	15'

Unified Soil Classification System

NON-COHESIVE SOILS	GW	WELL-GRADED GRAVEL, FINE TO COARSE GRAVEL
	GP	POORLY-GRADED GRAVEL
	GM	SILTY GRAVEL
	GC	CLAYEY GRAVEL
	SW	WELL-GRADED SAND, FINE TO COARSE SAND
	SP	POORLY-GRADED SAND
	SM	SILTY SAND
	SC	CLAYEY SAND
COHESIVE SOILS	ML	SILT
	CL	CLAY
	OL	ORGANIC SILT, ORGANIC CLAY
	MH	SILT OF HIGH PLASTICITY, ELASTIC SILT
	CH	CLAY OF HIGH PLASTICITY, FAT CLAY
	OH	ORGANIC CLAY, ORGANIC SILT
	PT	PEAT

Depth (ft bgs)	Sample No.	Time	Sample Condition	PID Reading	Remarks	Soil and Rock Description	Unified Classification	Graphical Representation
1						Silty gravel, very coarse grained, gray, wet, no odor	GM	
2								
3								
4								
5						Silty gravel, very coarse grained, gray, wet, no odor	GM	
6						Water level - 6'		
7								
8								
9								
10								
11								
12						Silty gravel, very coarse grained, gray, wet, no odor	GM	
13								
14						Silty gravel, very coarse grained, gray, wet, no odor	GM	
15						Boring terminated @ 15'		
16								
17								
18								
19								
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21								
22								
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Notes:

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Project:	Breakwater Marina	**Boring ID:**	**MW6**
Location:	5603 S. Waterfron Drive Tacoma, WA	**Project Number:**	
Client:			

Date Start/Finish:	8/21/2015	**Drilling Method:**	Direct Push
Logged By:	Kaden Reed	**Auger ID/OD:**	
Checked By:		**Borehole ID/OD:**	2"
Contractor:	Standard Environmental Probe	**Sampler:**	N/A
Operator:	Chris Ross	**Hammer Wt./Fall:**	
Boring Location:		**Ground Elevation:**	
Coordinates:		**Water Depth:**	7'
Weather:	Overcast, cool	**Boring Depth:**	15'

Unified Soil Classification System

NON-COHESIVE SOILS	GW	WELL-GRADED GRAVEL, FINE TO COARSE GRAVEL
	GP	POORLY-GRADED GRAVEL
	GM	SILTY GRAVEL
	GC	CLAYEY GRAVEL
	SW	WELL-GRADED SAND, FINE TO COARSE SAND
	SP	POORLY-GRADED SAND
	SM	SILTY SAND
	SC	CLAYEY SAND
COHESIVE SOILS	ML	SILT
	CL	CLAY
	OL	ORGANIC SILT, ORGANIC CLAY
	MH	SILT OF HIGH PLASTICITY, ELASTIC SILT
	CH	CLAY OF HIGH PLASTICITY, FAT CLAY
	OH	ORGANIC CLAY, ORGANIC SILT
	PT	PEAT

Depth (ft bgs)	Sample No.	Time	Sample Condition	PID Reading	Remarks	Soil and Rock Description	Unified Classification	Graphical Representation
1						Silty sandw w/ trace gravel, fine-med grained, brown, dry, no odor	SM	
2								
3								
4								
5							GM	
6						Silty gravel, very coarse grained, gray, wet, no odor. Water level - 6'		
7								
8						Silty gravel, very coarse grained, gray, wet, no odor. Boring terminated @ 15'	GM	
9								
10								
11								
12								
13								
14								
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