Groundwater Sampling and Analysis Plan

June 23, 2015

Site Address:

5603 N. Waterfront Drive
Tacoma, Washington
King County Tax Parcel No.:

Prepared For:

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

Prepared By:

K. Craig Klein
Sr. Environmental Geologist
AAI Qualified Environmental Professional

Reviewed By:

Stephen M. Spencer
Principal
AAI Qualified Environmental Professional

Prepared By:
ECI | Environmental Consulting
PO Box 153
Fox Island, Washington 98333
(253) 238-9270

ECI Project No.: 0483-05

List of Appendices

Appendix 1: Project Figures

- Figure 1: Project Location Map
- Figure 2: Site Topographic Map
- Figure 3: Proposed Groundwater Monitoring Well Locations

1.0 Introduction

EcoCon, Inc. (ECI) has prepared this Groundwater Sampling and Analysis Plan (GSAP) for the property located at 5603 N. Waterfront Drive, in Tacoma Washington (the Property). In accordance with the Washington State Model Toxics Control Act (MTCA) Cleanup Regulations as established in Section 200 of Chapter 173-340 of the Washington Administrative Code (WAC 173-340-200), the Site is defined by the full lateral and vertical extent of contamination that has resulted from the former storage and dispensing of gasoline and diesel fuel since the installation of the underground storage tanks in 1972. Based on soil and groundwater assessments completed at the Site, soil and groundwater have been contaminated with gasoline-range organics (ORO), diesel-range organics (DRO), benzene, toluene, ethylbenzene, and/or total xylenes (BTEX).

In December 2014, ECI decommissioned and removed five Underground Storage Tanks (USTs) at the commercial marina located on the Property. The UST system consisted of: one 8,000 gallon diesel (single-walled steel measuring 8' x 22'), one 8,000 gallon gasoline (single-walled steel measuring 8' x 22'), two 3,000 gallon gasoline (single-walled steel measuring 6' x 13.4') and one 3,000 gallon diesel (single-walled steel measuring 6' x 13.4'). Each UST was decommissioned by removal and transported off-site for cleaning and disposal. Soil sampling conducted following the UST removal (site assessment) revealed the presence of DRO, GRO, BTEX, and total lead exceeding applicable MTCA Method A Cleanup Levels (CULs).

Between April 6, 2015 and May 1, 2015, approximately 658 tons of petroleum hydrocarbon-impacted soil were excavated from the former UST locations. In addition, approximately 80,000 gallons of groundwater was removed from the excavation cavity during the Site remediation activities. Analytical results for confirmation soil samples collected at the limits of the remedial excavation indicate that the petroleum contaminated soil had been effectively removed, and any remaining concentrations of contaminants of concern are below appropriate regulatory thresholds. Based on these results, ECI concluded that no additional assessment or remediation of the soil impacted by the petroleum hydrocarbon release at the Site was necessary and requested a No Further Action Likely opinion from Ecology, pending results of compliance groundwater monitoring.

The purpose of this GSAP is to describe the sample collection, handling, and analysis procedures to be implemented during compliance groundwater monitoring activities.

1.1 Site Location

The Subject Site is identified as the Breakwater Marina, a property that occupies a single tax parcel (Pierce County Parcel Number: 8950100010), 29.30 acres in size. The Site is located to the southeast of the Washington State Department of Transportation ferry dock (Pt. Defiance – Vashon Island) and northwest of the Tacoma Yacht Club (See Appendix A: Figures 1 and 2). 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 following is the legal description of the property as provided by Pierce County Assessor's website:

- Section 23 Township 21 Range 02 Quarter 11 - TACOMA TIDELAND SUPL 61: THAT POR OF BLK A 1961 SUPPLEMENTAL EXCEPTING THEREFROM BEG AT MOST WLY COR SD BLK A TH ON SWLY LI ON AZIMUTH OF 307 DEG 39 MIN 10 SEC 1561.83 FT TH ON AZIMUTH OF 238 DEG 57 MIN 10 SEC 265 FT TH ON AZIMUTH OF 142 DEG 25 MIN 30 SEC 730 FT TH ON AZIMUTH OF 238 DEG 56 MIN 25 SEC 216.76 FT TH ON AZIMUTH OF 142 DEG 25 MIN 30 SEC 540.19 FT TO NWLY LI OF BLK A TH ON AZIMUTH OF 71 DEG 00 MIN 10 SEC 925 FT TO BEG ALSO EXC FOLL DESC PROP BEG AT MOST WLY COR SD BLK A TH N 71 DEG 00 MIN 10 SEC E 925.09 FT TH S 37 DEG 34 MIN 30 SEC E 540.19 FT TO POB TH SWLY LI ON AZIMUTH OF 238 DEG 56 MIN 25 SEC 216.76 FT TH S 37 DEG 34 MIN 30 SEC E 740 FT TH S 58 DEG 57 MIN 10 SEC W 265 FT TH S 52 DEG 20 MIN 50 SEC E 981 FT TO SE COR OF BLK A TH N 58 DEG 57 MIN 10 SEC E 230 FT TH N 37 DEG 34 MIN 30 SEC W TO POB SEG E 7139 DC/BL 03-16-06BL.

1.3 Responsible Agency

The site work is currently under the direction or being reviewed by the Washington Department of Ecology (Ecology), therefore the work conducted under this GSAP is in general accordance with Ecology regulations MTCA WAC 173-340).

1.4 Project Organization

At the direction of the owner of the Subject Property, ECI is responsible for the work set forth in this GSAP. The following table summarizes the organization of duties for the GSAP:

Table 1: Project Organization

Project Position	Personnel/Contractor	Duties
Sr. Environmental Geologist	K. Craig Klein, ECI	Project Manager
Hydrogeologist	William Rodgers, ECI	Hydrogeologist
Environmental Technician	Kyle Spencer, ECI	Field Sampling
Driller - Auger	Cascade Drilling	Licensed driller (0 – 65/100 ft bgs
Driller – Direct Push	Standard Probe	Licensed driller (0 – 50 ft bgs)
Chemist	Libby Environmental	Accredited Laboratory
Private Utility Locate	Mt. View	Certified locating firm

1.5 Underground Utility Location

Prior to any subsurface sampling work an effort will be made in locating all underground utilities in the area. This will include calling the "call before you dig" public utility locating service (811) at a minimum two days prior to sampling activities. Also a private utility locating service will be utilized to locate any "private" underground utilities that may not have been marked by the public locating service.

2.0 Background

The Property has been used as a marina for boat docking and moorage since 1933. Fueling services began with the installation of three 3,000-gallon fuel USTs in 1972, with two 8,000-gallon USTs installed in 1975. The three smaller USTs were decommissioned in 2005, but fueling services were provided until September 2013 when the two 8,000-gallon USTS were taken out of service. Mr. Michael Marchetti has operated the marina since 1994 on land subleased from the Tacoma Yacht Club, who leases the land from the owner, Tacoma Metropolitan Park District.

2.1 Previous Investigations/Site Activities

Previous investigations at the Site have identified petroleum hydrocarbon contaminants in soil and groundwater adjacent to, and beneath the former locations of the USTs and product piping previously utilized for fueling services at the Site. Soil and groundwater samples collected during the investigations identified select petroleum hydrocarbon contaminants at concentrations above the MTCA Method A CULs.

Previous On- and Off-Property Environmental Reports:

- Phase II Site Assessment, Break Water Marina, 5603 N. Water Front Drive, Tacoma, WA. 98407, Northwest Environmental Solutions, Inc., December 2005
- Focused Subsurface Investigation / Underground Storage Tank Site Assessment, 5603 North Waterfront Drive, Tacoma, WA 98407 - EcoCon, Inc. (ECI) - November 26, 2013
- Supplemental Focused Subsurface Investigation (SFSI), Breakwater Marina, 5603 North Waterfront Drive, Tacoma, WA 98407 - EcoCon, Inc. (ECI) - January 13, 2014
- Underground Storage Tank Closure & Site Assessment Report, & Site Assessment Report, Department of Ecology Facility ID: 1794148 - EcoCon, Inc. (ECI) – January 29, 2015
- Remedial Excavation Report, 5603 North Waterfront Drive, Tacoma, WA 98407 - EcoCon, Inc. (ECI) - May 28, 2015

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. Depth of the borings ranged from eight to ten feet below ground surface (bgs) and 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 (COCs), identified as: GRO, DRO, and BTEX. Analysis indicated only one of the samples (groundwater sample B1-W collected from boring B1) contained concentrations of DRO (34,300 µg/L) above the applicable state cleanup levels of 500 µg/L MTCA Method A CUL, WAC 173-340-900: Table 720-1).

The results indicated that the areas investigated are impacted from one of the COCs (DRO), reported exceeding the applicable MTCA Method A CUL in groundwater. Therefore, based on the analytical results

obtained from this investigation, ECI recommended further investigation in the area of ECI Boring B1 (located on the northwestern edge of Tank #1) to further delineate groundwater contamination.

In December 2013, ECI directed the advancement of soil borings, 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 and northeast of boring B1. 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. Analysis indicated concentrations of DRO to be below laboratory method reporting limits (or non-detect) 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 located at the northwestern end of the 8,000 gallon UST. This localized area is impacted with DRO (34,300 µg/L) above the applicable MTCA Method A CUL in groundwater (500 µg/L). Therefore, based on the analytical results obtained from this SFSI and previous investigation, ECI recommended further remedial actions at the Site.

ECI completed the decommissioning and UST site assessment during the closure of the five USTs at the 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 MTCA Method A CULs. 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 CULs. One grab groundwater 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 method reporting limits (MRL), but below the MTCA Method A cleanup levels for DRO and lead in groundwater. None of the other analytes were identified above the MRL.

Between April 6, 2015 and May 1, 2015, approximately 658 tons of petroleum hydrocarbon-impacted soil were excavated from the area of the former USTs. Soil samples were collected throughout the excavation activities to guide the soil removal and to confirm that impacted soil containing hydrocarbon concentrations above the MTCA Method A CULs had been removed from the Site. In addition, approximately 80,000 gallons of groundwater were removed from the excavation during the Site remediation activities. Photographs of the remediation activities are included on Figure 5 in Appendix A.

Analytical results from soil samples collected indicate that the COCs remaining in soil at the site are at concentrations below the MTCA Method A CULs, and most are below laboratory MRLs. Based on these results, ECI concluded that no additional assessment or remediation of the soil impacted by the petroleum hydrocarbon release at the Site was necessary and recommended a No Further Action Likely opinion from Ecology, pending results of compliance groundwater monitoring.

3.0 Sample Collection Plan

3.1 Groundwater Monitoring

Four one-inch diameter groundwater monitoring wells will be installed at approximately equal distances from the northwest to the southeast extent of the remedial soil excavation. One additional monitoring well will be installed between the former excavation and the hillside to the southwest for use as an up-gradient well. Figure 3 (Appendix A) depicts the approximate locations of the proposed monitoring wells.

The wells will be advanced using hollow-stem auger drilling techniques. The five one-inch groundwater monitoring well installations will include placement of 1-inch diameter 0.01-inch slot Schedule 40 PVC well screen from the bottom of the boring to at least five feet below ground surface. The well screen will be coupled with blank 1-inch diameter Schedule 40 PVC well casing extending from the well screen to just below the ground surface. The annular space around the well screen will be filled with 10/20 silica sand from the bottom of the boring to at least one-foot above the top of the screen. The rest of the annular space will be filled with bentonite chips to two feet bgs, and with concrete from two feet bgs to the surface. The monitoring wells will be completed with a flush-mount steel monument. Each monitoring well completion will comply with the minimum standards for well construction (WAC 173-160). The onsite environmental professional will determine actual well construction specifications based on groundwater depth and physical and chemical soil conditions observed during drilling operations.

3.2 Investigative Derived Waste

All soil cuttings and decontamination fluids will be placed in in DOT-approved drums, properly labeled and placed onsite in a position that will not cause harm to human health or the environment. After the site investigation the disposition of these wastes will be determined at this time.

3.3 Sample Collection Procedures

Groundwater samples will be 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 will follow the procedures described below when collecting groundwater samples:

- The cap from the monitoring well will be removed and the groundwater level will be allowed to equilibrate to atmospheric pressure for a minimum of 20 minutes.
- The depth to groundwater in the monitoring well will be measured relative to the top of the well casing using an electronic water-level meter.

- Each monitoring well will be purged at a low-flow rate (100 to 300 milliliters per minute) using a peristaltic pump and dedicated polyethylene tubing. Temperature, pH and specific conductivity will be monitored during purging using a water quality meter to determine when these parameters stabilize.

4.0 Sample Handling Procedures

4.1 Sample Identification and Documentation

This section describes procedures for sample identification and chain of custody that will be used for the field activities. The purpose of these procedures is to ensure that the quality of samples is maintained during collection, transportation, storage, and analysis. All chain-of-custody requirements will comply with industry standard operating procedures (SOPs) for sample handling.

Sample documentation for custody purposes includes:

- Sample identification numbers,
- Sample labels,
- Custody seals,
- Chain-of-custody records,
- Field logbooks, and
- Analytical Records

5.0 Analytical Method/Contaminants of Concern

Groundwater samples will be delivered to Libby Environmental, an Ecology accredited laboratory, for analysis.
Based on historical Site activities noted from the ESA and the information obtained from the FSI, the COCs at the Site are identified as GRO, DRO, BTEX, and total lead. The concentrations of these contaminants in the samples collected will be compared to the MTCA Method A CULs for groundwater.

The following table is a summary of the COCs and respective analytical methods:

Table 2: Contaminants of Concern: Groundwater

Contaminant of Concern	Analytical Method	MTCA Method A CULs
Gasoline-range Organics	NWTPH-Gx	1,000 / 800 µg/L
Diesel-range Organics	NWTHP-Dx	500 µg/L
Benzene	EPA Method 8021B	5 µg/L
Toluene	EPA Method 8021B	1,000 µg/L
Ethylbenzene	EPA Method 8021B	700 µg/L
Total Xylenes	EPA Method 8021B	1,000 µg/L
Lead	EPA Method 200.8	15 µg/L

All samples will be prepared and/or analyzed within the required holding times and properly preserved and cooled after collection. Method blanks will be prepared and analyzed with the samples for all parameters. These applications will be performed under Ecology accreditation parameters. All appropriate laboratory quality assurance/quality control (QA/QC) method parameters will be applied.

6.0 Field Documentation

6.1 Field Log Books

Field logbooks are intended to provide sufficient information to reconstruct events that occurred during field activities. The following are examples of information to be included by the sampler(s) in a field logbook:

- Project name and location;
- Name, date, and time of entry;
- Names and responsibilities of field crew members;
- Name and titles of any site visitors involved in or actively observing the sampling.
- Descriptions of deviations from the sampling procedures and any problems encountered.
- Weather information including air temperature and recent precipitation.
- Date and time of sample collection.
- General observations, including setting / features, sampling location, topography, etc.
- Start and stop times of work.

6.2 Site Photographs

Photographs will be taken at each sampling location. Photographs will be taken to document field conditions, including the features and structures surrounding the sample locations. Photographs also will provide a record of the spatial relationships between the sampled area and surrounding features and structures.

6.3 Boring Logs

A boring log will be completed for each boring location. The form will record the sample ID, time of sample collection, and description of soils.

7.0 Final Report

A project report will be developed documenting the activities and results from the groundwater monitoring well installations and groundwater sampling. The report will include field data collected including soil and groundwater conditions and laboratory analysis. It will include figures showing sample locations and concentrations of COCs. It will also include recommendations for additional work and potential remedial actions.

Appendix A

Project Figures

Figure 1: Site Location Map - 1 Sheet
Figure 2: Site Topographic Map - 1 Sheet
Figure 3: Groundwater Monitoring Well Location Map - 1 Sheet

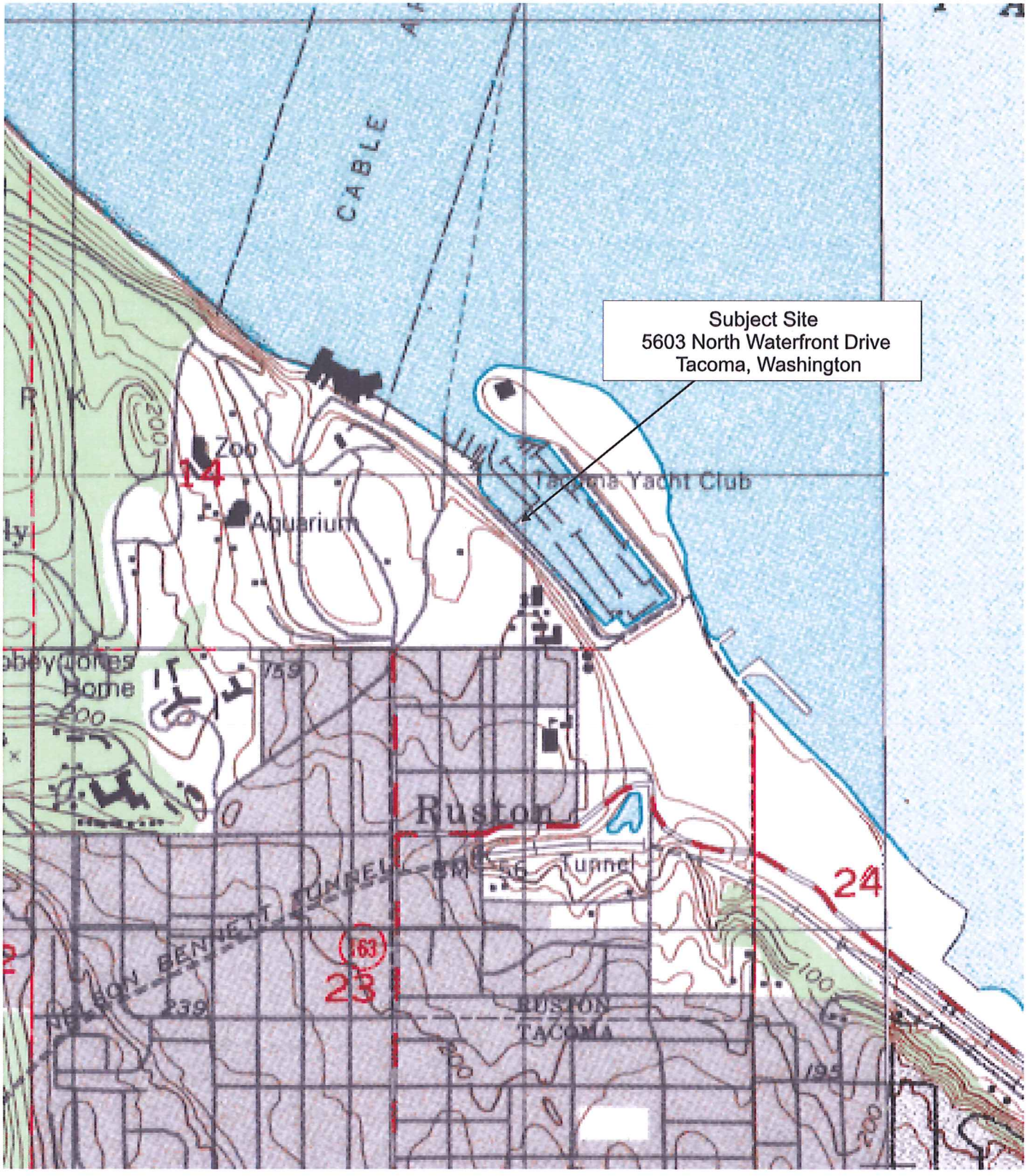
N
Not To Scale

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

Date:	June 29 ,2015
Completed By:	K. Reed
Reviewed By.:	S. Spencer
Version:	ECI-001
Project No.:	0483-06

Figure No.: 01
Sheet 01 of 03

ECI environmental services
www.ecoononline.com



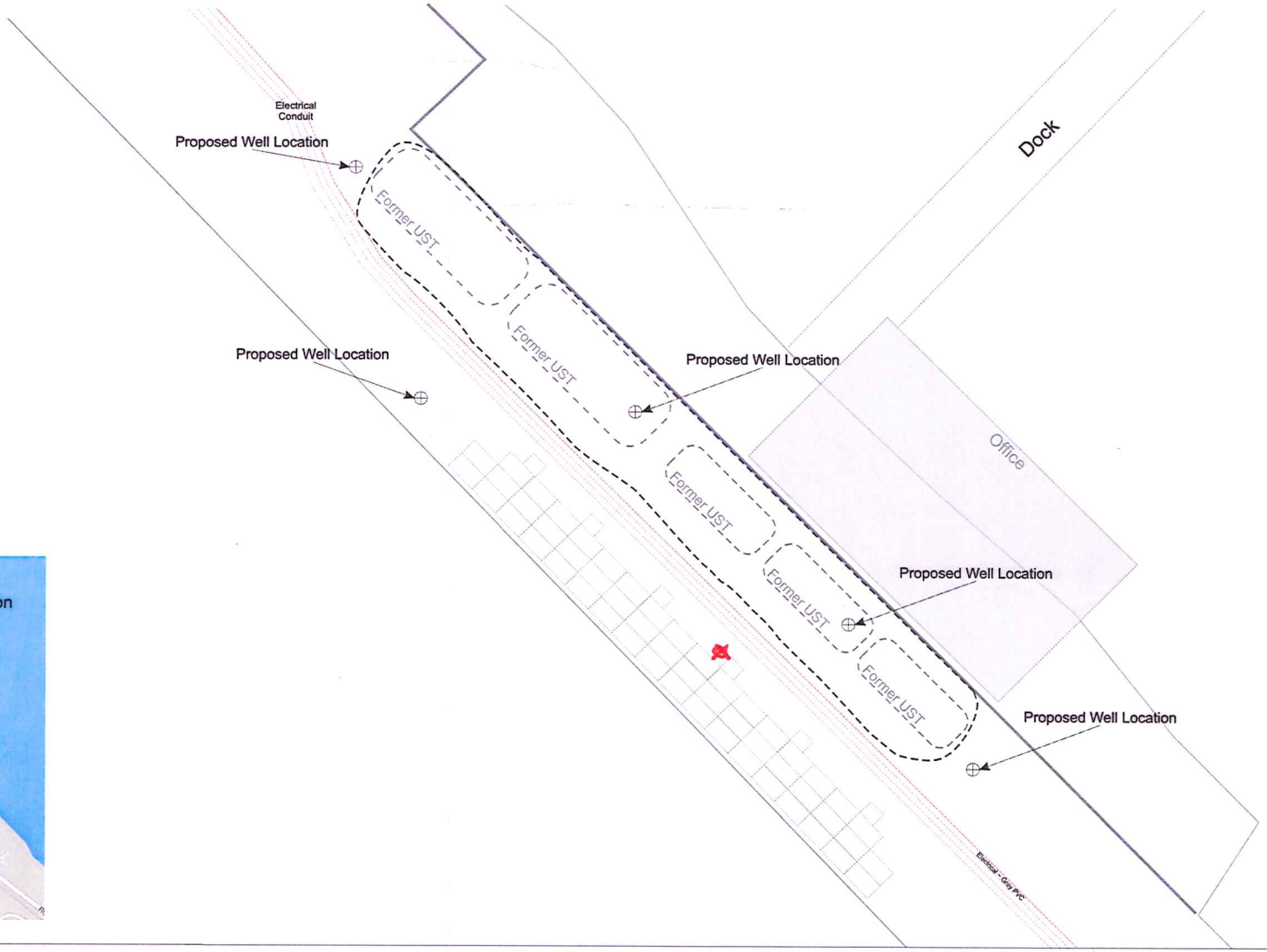
N
Not To Scale

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

Date:	June 29 ,2015
Completed By:	K. Reed
Reviewed By.:	S. Spencer
Version:	ECI-001
Project No.:	0483-06

Figure No.: 02
Sheet 02 of 03

ECI | environmental services
www.ecocononline.com



Explanation

⊕ Proposed Groundwater Monitoring Wells

N

0 10 20 40

Approximate Scale in Feet

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

Date:	June 29 ,2015
Completed By:	K. Reed
Reviewed By.:	S. Spencer
Version:	ECI-002-011315
Project No.:	0483-06

Figure No.: 03
Sheet 03 of 03

ECI environmental services
www.ecoononline.com