TECHNICAL MEMORANDUM

LANDAU ASSOCIATES
ENVIRONMENTAL | GEOTECHNICAL | NATURAL RESOURCES

TO: Andy Kallus, Washington State Department of Ecology

FROM: Stacy Lane, L.G.

DATE: December 20, 2011

RE: LONG-TERM COMPLIANCE MONITORING GROUNDWATER SAMPLING AND ANALYSIS PLAN NORTH MARINA WEST END SITE EVERETT, WASHINGTON

This technical memorandum presents the sampling and analysis plan (SAP) for groundwater quality monitoring associated with a cleanup action being conducted at the North Marina West End site (Site) in Everett, Washington. The cleanup action is being conducted under a consent decree between the Port of Everett (Port) and the Washington State Department of Ecology (Ecology). The cleanup action, as described in the Draft Cleanup Action Plan (DCAP; Attachment 1 of the consent decree), includes long-term compliance groundwater monitoring consisting of monitoring groundwater quality from eight existing monitoring wells along the shoreline on a quarterly basis for 1 year to demonstrate compliance with cleanup standards. The eight monitoring wells identified for groundwater monitoring consist of vertical wells RI-MW-1, RI-MW-3, RI-MW-4, RI-MW-5, RI-MW-11, RI-MW-12, and RI-MW-13, and angled well RI-MW-11-A. The well locations are shown on Figure 1.

In accordance with the Remedial Investigation/Feasibility Study (RI/FS) West End Site Work Plan (Work Plan; Landau Associates 2009) and Addendum No. 1 to the Work Plan (Landau Associates 2010), the groundwater samples will be collected within 1 hour before and 1 hour after a low tide [elevation 0 ft mean lower low water (MLLW), or lower].

SAMPLE COLLECTION PROCEDURES

The groundwater samples will be collected using the procedures established in Appendix G of the Work Plan and Addendum No. 1 to the Work Plan. These procedures include collecting the samples from the upper 2 ft of the water column to avoid sampling within the saltwater wedge. Also, at the angled well (RI-MW-11A), field parameters will be measured at multiple depths (approximately every 5 ft) prior to purging to confirm the depth of the freshwater and saltwater interface.

Groundwater will be collected in the appropriate sample container provided by the analytical laboratory. The samples will be preserved by cooling to a temperature of 4°C and as required by the analytical method. Maximum holding and extraction times until analysis is performed will be strictly adhered to by field personnel and the analytical laboratory. Sample containers, preservatives, and holding

times for each chemical analysis are presented in Table 1. For the dissolved metal analyses, the samples will be filtered in the field using an in-line 0.45 micron disposable filter to remove any suspended material.

LABORATORY ANALYSES

In accordance with the DCAP, each of the groundwater samples will be analyzed for dissolved arsenic. Groundwater samples collected at monitoring wells RI-MW-1 and RI-MW-3 will also be analyzed for dissolved copper, and groundwater samples collected at monitoring wells RI-MW-11 and RI-MW-11A will be analyzed for vinyl chloride. A summary of the analyses for groundwater samples collected at each well and the analytical methods is provided in Table 2.

QUALITY ASSURANCE PROCEDURES

Procedures for quality assurance established in Appendix G of the Work Plan will be used during the long-term groundwater compliance monitoring. These include collecting one blind field duplicate for each analyses to be performed, field trip blanks, and laboratory matrix spike and matrix spike duplicate samples. The blind field duplicate samples will be collected from monitoring wells RI-MW-1 and RI-MW-11A. The duplicate samples will be identified as RI-MW-20 and RI-MW-21, respectively. The blind field duplicate collected at RI-MW-1 will be analyzed for dissolved arsenic and dissolved copper and the blind field duplicate collected at RI-MW-11A will be analyzed for vinyl chloride.

The field trip blanks will consist of deionized water sealed in a sample container by the analytical laboratory. The trip blank will accompany vinyl chloride groundwater sample containers during transportation to and from the field, and then will be returned to the laboratory with the shipment of vinyl chloride samples. The trip blank will remain unopened until submitted to the laboratory for analysis of vinyl chloride to determine possible sample contamination during transport. Laboratory matrix spike samples will be analyzed for dissolved arsenic, dissolved copper, and vinyl chloride. A laboratory matrix spike duplicate sample will be analyzed for vinyl chloride and a laboratory duplicate sample will be analyzed for dissolved arsenic and dissolved copper.

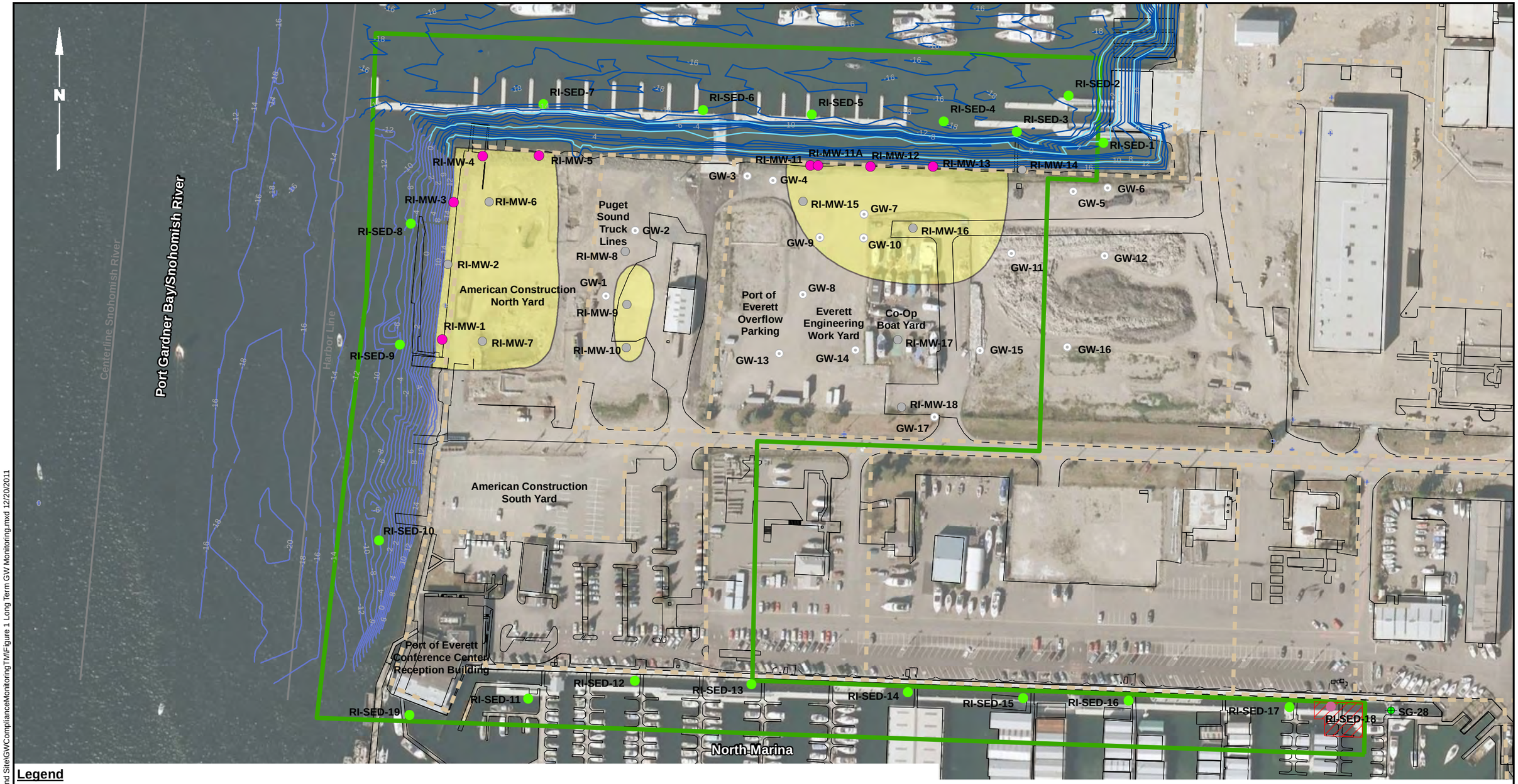
SCHEDULE

The first of the long-term compliance groundwater quality monitoring events is scheduled for December 21, 2011. Subsequent groundwater quality monitoring events will occur approximately every three months (March, June, and September 2012).

REFERENCES

Landau Associates. 2010. Technical Memorandum to Andy Kallus, Washington State Department of Ecology, re: *RI/FS Work Plan West End Site Addendum No. 1, Groundwater Quality Monitoring at Conditional Point of Compliance, Port of Everett, Washington*. Larry Beard and Stacy Lane, Landau Associates. March 8.

Landau Associates. 2009. *Final RI/FS Work Plan, West End Site, Everett, Washington*. Prepared for the Port of Everett. March 20.



Legend

- 2009 Sediment Sampling Locations - Concentrations Above SQS and Below CSL (Landau Associates)
- 2009 Sediment Sampling Location - Concentrations Below SQS (Landau Associates)
- Everett Shipyard RI Sediment Location
- Proposed Groundwater Compliance Monitoring Location
- Previous Groundwater Compliance Monitoring Location
- Previous Direct - Push Groundwater Grab Sample Location
- Approximate Extent of Sediment Exceeding Fluoranthene SQS
- Post Dredge Minor Contour (2' Interval, MLLW)
- Post Dredge Major Contour (10' Interval, MLLW)
- West End Site Boundary
- Approximate Boundary of Leasehold
- Bathymetry (MLLW) Based on Data Collected in 2003 & 2004
- Harbor Line and River Center Line
- Residual Groundwater Contamination Area

Notes:
1. At locations where lube oil was analyzed, diesel and gasoline range petroleum hydrocarbons were also analyzed but were not detected.

0 160 320
Scale in Feet

Data Source: Google Earth (2008 Image); Elevation Contours, Harbor Line, and Centerline of Snohomish River: Port of Everett Hydrographic Survey of Tall Ship Moorage; Post Dredge Elevation Contours (2005, PND Engineers)

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North Marina West End Site Cleanup Action Plan Port of Everett, Washington	**Long-Term Groundwater Compliance Monitoring Locations**	Figure 1

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TABLE 1
SAMPLE CONTAINERS, PRESERVATIVES, AND HOLDING TIMES
WEST END SITE
EVERETT, WA

Analyses	Sample Container	Preservation	Holding Time
Groundwater Samples			
VOCs (vinyl chloride)	3 - 40 ml vial	HCl to pH <2; Cool 4°C	14 days
Dissolved arsenic and copper (a)	1 - 1 L polyethelene	5 ml - HNO_3 (c); Cool 4°C	6 months

(a) Dissolved metals samples must be filtered prior to preservation; therefore, samples will be filtered in the field.

TABLE 2
COMPLIANCE MONITORING ANALYTICAL PARAMETERS
WEST END SITE
EVERETT, WASHINGTON

Location	Analyte	Analytical Method
MW-1	Arsenic, Copper	EPA Method 6020
MW-3	Arsenic, Copper	EPA Method 6020
MW-4	Arsenic	EPA Method 6020
MW-5	Arsenic	EPA Method 6020
MW-11	Arsenic, Vinyl Chloride	EPA Method 6020/ 8270C-SIM
MW-11A	Arsenic, Vinyl Chloride	EPA Method 6020/ 8270C-SIM
MW-12	Arsenic	EPA Method 6020
MW-13	Arsenic	EPA Method 6020