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TECHNICAL MEMORANDUM

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FROM: Paul C. Grabau, Principal Hydrogeologist

DATE: January 14, 2015

RE: **SCOPE OF WORK FOR 2015 CLEANUP ACTION ACTIVITIES**
WHIDBEY MARINE & AUTO SUPPLY SITE
FREELAND, WASHINGTON
FARALLON PN: 454-001

Farallon Consulting, L.L.C. (Farallon) has prepared this Technical Memorandum to present the scope of work for groundwater monitoring and sampling and cleanup action activities planned for 2015 at the Whidbey Marine & Auto Supply Site in Freeland, Washington (Figure 1). The Site is defined as the area on and down-gradient of the former Whidbey Marine & Auto Supply facility at 1689 Main Street where concentrations of petroleum hydrocarbon constituents in soil and/or groundwater exceed Washington State Model Toxics Control Act Cleanup Regulation (MTCA) cleanup levels as a result of a release from the Whidbey Marine & Auto Supply facility. An aerial photograph showing the monitoring well locations at the Site is provided on Figure 2.

The cleanup action at the Site is being conducted under the Washington State Department of Ecology (Ecology) Voluntary Cleanup Program and in accordance with the provisions of MTCA, as established in Chapter 173-340 of the Washington Administrative Code. The Site has been assigned Toxics Cleanup Program Identification No. NW1529 by Ecology.

The scope of work provided herein was developed at the request of Ecology during a meeting with the former owner of the Whidbey Marine & Auto Supply facility and Farallon on December

4, 2014. At the meeting, the concept of developing a flexible groundwater monitoring approach was discussed along with measures for enhanced recovery of petroleum hydrocarbons light nonaqueous-phase liquid (LNAPL). A flexible monitoring approach was proposed in which the sampling frequency and scope would be based on the results of sampling of down-gradient Sea Level Aquifer monitoring wells MW-14 through MW-16 in early 2015. Monitoring wells MW-14 through MW-16 serve as sentinel wells in the Sea Level Aquifer. Given the lack of detections to date of petroleum hydrocarbon constituents in groundwater samples collected from monitoring wells MW-15 and MW-16, the farthest down-gradient monitoring wells, the near-term scope of work for enhanced LNAPL recovery and further monitoring using a variable monitoring frequency was considered appropriate given the limited funding currently available for the monitoring and cleanup activities.

BACKGROUND

Investigations conducted at the Site confirmed that soil and groundwater have been impacted by a release of gasoline from an underground storage tank at the former Whidbey Marine & Auto Supply facility. Cleanup activities conducted at the Site have included soil vapor extraction (SVE) from the vadose zone above the Perched Groundwater Zone, and injection of chemical oxidants into the Perched Groundwater Zone. The SVE operations at the Site removed over 12,000 pounds of gasoline-range organic vapors from vadose-zone soil. The in-situ chemical oxidant injection was intended to target contamination in the Perched Groundwater Zone only and was not expected to have a significant effect on groundwater quality in the deeper Sea Level Aquifer.

Two groundwater zones are monitored at the Site: the Perched Groundwater Zone at approximately 55 feet below ground surface, and the Sea Level Aquifer at approximately 100 to 105 feet below ground surface. The groundwater flow direction is west in the Perched Groundwater Zone, and southeast in the Sea Level Aquifer.

Total petroleum hydrocarbons as gasoline-range organics (GRO) and xylenes were detected at concentrations exceeding MTCA Method A cleanup levels in groundwater samples collected from Perched Groundwater Zone monitoring wells MW-4, MW-6, and MW-8 during the last groundwater monitoring event, which was conducted in July 2014. The highest concentrations of GRO and xylenes detected in groundwater samples collected from the Perched Groundwater Zone were from monitoring well MW-4, consistent with the previous monitoring event during which Perched Groundwater Zone monitoring wells were sampled.

Broken tubing in Perched Groundwater Zone monitoring well MW-2 caused a blockage that prevented collection of a groundwater sample from this well during the July 2014 monitoring event. Total petroleum hydrocarbons as diesel-range organics (DRO) and as oil-range organics (ORO) also were detected previously in groundwater samples collected from monitoring well MW-2. No obvious sources for DRO or ORO contamination in groundwater have been identified at the Site.

DRO, GRO, toluene, ethylbenzene, and xylenes were detected at concentrations exceeding MTCA Method A cleanup levels in groundwater samples collected from Sea Level Aquifer monitoring wells MW-12 and MW-13 over the last year of monitoring. Benzene also was detected at a concentration exceeding the MTCA Method A cleanup level in the samples collected from monitoring well MW-13.

The highest concentrations of GRO, benzene, toluene, ethylbenzene, and xylenes (BTEX) detected in groundwater samples collected over the last year have been from Sea Level Aquifer monitoring well MW-13. For the first time since monitoring well MW-11 was installed in April 2009, none of the constituents analyzed for were detected at concentrations exceeding MTCA Method A cleanup levels in the groundwater sample collected from this well during the July 2014 monitoring event. In three rounds of sampling since December 2013, none of constituents analyzed for have been detected in groundwater samples collected from monitoring wells MW-15 or MW16, the two farthest down-gradient monitoring wells in the Sea Level Aquifer. During the July 2014 monitoring event, GRO and toluene were detected in the samples collected from monitoring well MW-14, but at concentrations considerably less than MTCA cleanup levels. Based on these results, the distance that dissolved-phase petroleum hydrocarbons have migrated down-gradient in the Sea Level Aquifer is less than 250 feet, assuming worst-case conditions near monitoring well MW-9, where LNAPL is present.

LNAPL thicknesses measured in monitoring well MW-9 have ranged up to approximately 1 foot. LNAPL-recovery methods include placement of sorbent socks in the monitoring wells, and periodic bailing. The results of an LNAPL baildown test conducted in monitoring well MW-9 in July 2014 indicate a relatively low LNAPL transmissivity. LNAPL transmissivity provides a useful measure of potential free-phase petroleum hydrocarbon mobility in the subsurface and can be used to help assess the potential performance of LNAPL recovery methods. The low LNAPL transmissivity value estimated from the baildown test suggests that typical hydraulic LNAPL recovery methods may not be effective at removing LNAPL mass at the Site. Based in part on the baildown test results, an alternative LNAPL recovery method is recommended as discussed below.

SCOPE OF WORK

The recommended scope of work for 2015 is discussed below.

GROUNDWATER MONITORING AND SAMPLING

Select Sea Level Aquifer monitoring wells will be sampled in early January 2015. The monitoring wells to be sampled for the initial 2015 monitoring event were selected based on an evaluation of previous analytical results for the Sea Level Aquifer monitoring wells and recent discussions with Ecology. For the initial 2015 monitoring event at the Site, monitoring wells MW-11 through MW-16 will be sampled and analyzed for GRO and BTEX by Northwest Method NWTPH-Gx and U.S. Environmental Protection Agency (EPA) Method 8021B, respectively. Groundwater samples collected from monitoring wells MW-12 and MW-13 will be

analyzed also for DRO and ORO by Northwest Method NWTPH-Dx. None of the constituents analyzed for have been detected at concentrations exceeding MTCA Method A cleanup levels in groundwater samples collected from monitoring well MW-10 and none have been detected at concentrations exceeding laboratory reporting limits since May 2011. Therefore, monitoring well MW-10 will be monitored for water level measurement only.

The scope and timing of the second 2015 groundwater monitoring and sampling event will depend on whether any of the constituents analyzed for in groundwater samples collected from monitoring wells MW-14 through MW-16 are detected at concentrations exceeding the laboratory reporting limits during the January 2015 monitoring event. Monitoring wells MW-14 through MW-16 serve as sentinel down-gradient monitoring wells for the Sea Level Aquifer. Low concentrations of GRO and toluene were detected in groundwater samples collected from monitoring well MW-14 for the first time during the July 2014 monitoring event. A flow chart of the decision matrix for the 2015 groundwater sampling program is provided on Figure 3.

In the event that one or more of the constituents analyzed for are detected in groundwater samples collected from Sea Level Aquifer monitoring wells MW-14 through MW-16 during the January 2015 monitoring event, these three monitoring wells will be re-sampled in April 2015, followed by the Site-wide monitoring event described below for July 2015. The analytical methods described above for these monitoring wells for the January 2015 monitoring event would be used for the April monitoring event.

If none of the constituents analyzed for are detected at concentrations exceeding the laboratory reporting limits in groundwater samples collected from monitoring wells MW-14 through MW-16 during the January 2015 monitoring event, select Perched Groundwater Zone and Sea Level Aquifer monitoring wells at the Site will be sampled in July 2015. The monitoring wells selected for sampling during the July 2015 monitoring event were chosen based on previous detections of target constituents in groundwater samples collected from the wells, or a history of sufficient water in the well for sample collection. Groundwater samples collected from each of the select monitoring wells sampled will be analyzed for GRO and BTEX. In addition, groundwater samples collected from monitoring wells where DRO and/or ORO has been detected previously will be analyzed for these constituents also.

The monitoring wells from which groundwater samples will be collected for chemical analyses during the July 2015 monitoring event include Sea Level Aquifer monitoring wells MW-11 through MW-16 and Perched Groundwater Zone monitoring wells MW-2 (if feasible), MW-4, MW-6, and MW-8. Farallon recommends attempting to sample Perched Groundwater Zone monitoring well MW-2 with a small-diameter (0.75 inch) bailer during the July 2015 monitoring event to attempt to pass by the tubing blockage in the well. None of the constituents analyzed for have been detected at concentrations exceeding laboratory reporting limits in groundwater samples collected from monitoring well MW-1 since September 2008, and none have ever been detected in groundwater samples collected from monitoring well MW-3 since its installation in December 2005. In addition, monitoring well MW-7 has rarely had a sufficient volume of water

for collection of samples. Therefore, monitoring wells MW-1, MW-3, and MW-7 will be monitored for water level measurement only during the July 2015 monitoring event. Monitoring well MW-5 has been dry since installation.

It is anticipated that Sea Level Aquifer monitoring wells MW-11 through MW-16 will be sampled again in October 2015. The final scope for the fourth quarter 2015 groundwater monitoring and sampling event will be developed and presented to Ecology based on a review of the groundwater analytical results from earlier 2015 monitoring events.

LNAPL MONITORING AND RECOVERY

Farallon recommends installation of a 2-inch-diameter passive LNAPL skimmer pump for more-efficient recovery of LNAPL from monitoring well MW-9. Passive skimmer pumps require periodic manual emptying of recovered LNAPL from the pump reservoir. The frequency for maintenance of the skimmer pump will be determined based on the LNAPL recovery rate relative to the pump LNAPL reservoir size. A typical reservoir size for a 2-inch-diameter passive LNAPL skimmer pump is 30 ounces. The frequency of mobilizations to the Site for LNAPL recovery maintenance will be determined based on the LNAPL recovery rate over the first 2 months of operation, and will be adjusted as necessary to maximize the recovery effort. The recovery data will be used to assess the feasibility of more-active recovery methods based on LNAPL recovery rates, temporal variability, and thickness measurements. Recovered LNAPL will be placed into a covered steel drum stored in the fenced remediation compound area on the former Whidbey Marine & Auto Supply facility.

REPORTING

Following completion of each monitoring event described herein, a Progress Report will be prepared to summarize the investigation activities and present the analytical results. At a minimum, the report will include the following:

- A summary of the groundwater monitoring and sampling activities;
- A summary of the analytical results, and summary tables for the groundwater samples collected;
- A summary table of depths to groundwater and groundwater elevations in the Site monitoring wells;
- Figures depicting groundwater elevations, flow direction, and analytical results for the monitoring wells;
- A summary of LNAPL recovery activities; and
- Farallon's conclusions pertaining to the monitoring results.

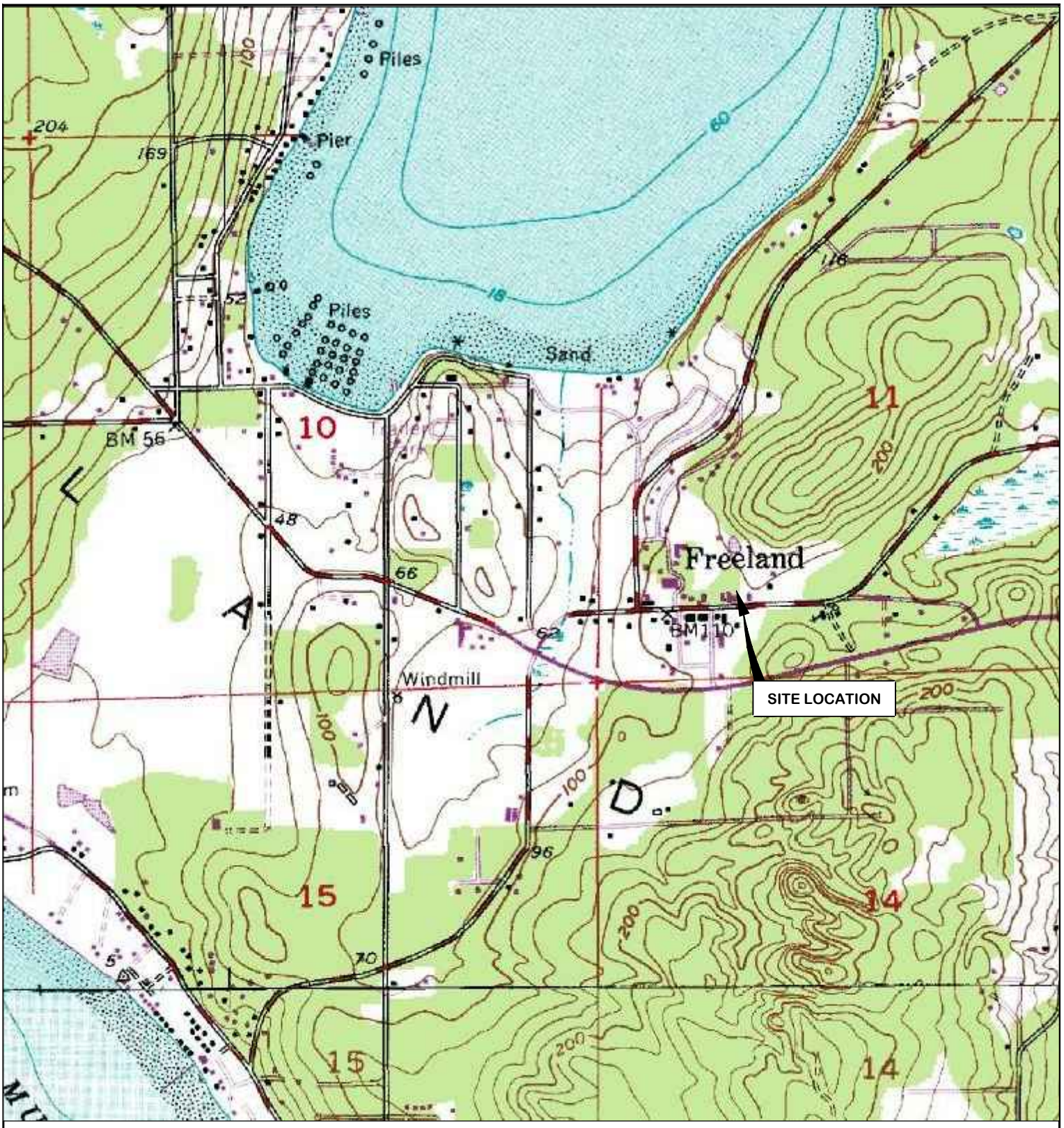
The Progress Report will be submitted to Ecology, the property owners who provided access to the monitoring wells, and other interested parties within 45 days of completion of quality assurance/quality control review of the analytical data.

CLOSING

The scope of work presented herein is intended to focus data collection efforts considering available resources to maximize the efficiency of ongoing monitoring and cleanup efforts. If modifications to the scope of work are warranted based on the evaluation of groundwater analytical results following each monitoring event, Farallon will notify Ecology of any proposed changes to the groundwater monitoring and LNAPL-recovery program.

Attachments: Figure 1, *Site Vicinity Map*
Figure 2, *Aerial Photograph Showing Monitoring Well Locations*
Figure 3, *2015 Sampling Program Decision Matrix Flow Chart*

PCG:bjj



REFERENCE: 7.5 MINUTE USGS QUADRANGLE FREELAND, WASHINGTON. DATED 1993

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FIGURE 1

SITE VICINITY MAP
WHIDBEY MARINE & AUTO SUPPLY SITE
FREELAND, WASHINGTON

FARALLON PN: 454-001

Drawn By: DEW Checked By: PJ Date: 7/11/07 Disk Reference: 454001

LEGEND

- PERCHED ZONE MONITORING WELL
- SEA LEVEL AQUIFER MONITORING WELL

0 60
Scale in feet

N

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FIGURE 2

AERIAL PHOTOGRAPH SHOWING
MONITORING WELL LOCATIONS
WHIDBEY MARINE & AUTO SUPPLY SITE
FREELAND, WASHINGTON

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Drawn By: DEW Checked By: PG Date: 11/7/2014 Disk Reference: AERIAL

Figure 3
2015 Sampling Program Decision Matrix Flow Chart
Whidbey Marine & Auto Supply Site
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