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FROM: Paul C. Grabau, Principal Hydrogeologist

DATE: January 8, 2016

RE: **SCOPE OF WORK FOR JANUARY 2016 GROUNDWATER SAMPLING AND ONGOING LNAPL MONITORING AND MAINTENANCE**
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 activities planned for the first quarter 2016 at the Whidbey Marine & Auto Supply Site in Freeland, Washington (Figure 1). The scope of work for ongoing light nonaqueous-phase liquid (LNAPL) monitoring and removal from monitoring well MW-9 also is provided. 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.

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. 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.

The approach for the completed 2015 sampling and monitoring activities included sampling Sea Level Aquifer monitoring wells MW-11 through MW-16 in February 2015; and Perched Groundwater Zone monitoring wells MW-2, MW-4, MW-6, and MW-8 and Sea Level Aquifer monitoring wells MW-11 through MW-16 in July 2015. Sea Level Aquifer monitoring well MW-9 was monitored for the presence of LNAPL on an approximately monthly basis in 2015, with LNAPL removal by bailing when encountered.

The following constituents were detected at concentrations exceeding MTCA Method A cleanup levels in groundwater samples collected from the Perched Groundwater Zone monitoring wells during the most recent groundwater monitoring and sampling event in July 2015:

- Monitoring well MW-2: Total petroleum hydrocarbons as oil-range organics (ORO);
- Monitoring well MW-4: Total petroleum hydrocarbons as gasoline-range organics (GRO) and as diesel-range organics (DRO) and benzene;
- Monitoring well MW-6: Benzene; and
- Monitoring well MW-8: GRO and benzene.

In general, the concentrations of GRO and benzene, toluene, ethylbenzene, and xylenes in groundwater samples collected from the Perched Groundwater Zone monitoring wells during the July 2015 monitoring event were the lowest detected to date.

The following constituents were detected at concentrations exceeding MTCA Method A cleanup levels in groundwater samples collected from the Sea Level Aquifer monitoring wells during the July 2015 monitoring event:

- Monitoring well MW-12: DRO, GRO, toluene, ethylbenzene, and xylenes; and
- Monitoring well MW-13: DRO; GRO; and benzene, toluene, ethylbenzene, and xylenes (BTEX).

The highest concentrations of GRO and BTEX over the past year have been detected in groundwater samples collected from Sea Level Aquifer monitoring well MW-13. No constituents analyzed for were detected at concentrations exceeding laboratory reporting limits in the groundwater samples collected from monitoring well MW-11 during the last two monitoring events. In five rounds of sampling conducted since December 2013, no constituents analyzed for were detected in groundwater samples collected from monitoring wells MW-15 or MW-16, the two Site monitoring wells farthest down-gradient in the Sea Level Aquifer. During the July 2015 monitoring event, toluene was detected in the sample collected from monitoring well MW-14; however, the concentration was significantly less than the MTCA Method A cleanup level. No obvious sources have been identified for DRO or ORO contamination in groundwater at the Site.

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 after initial measurements are completed. LNAPL was detected only once in monitoring well MW-9 during the periodic LNAPL monitoring and removal events conducted at the Site between April 30 and July 20, 2015. However, an LNAPL thickness of 0.06 foot was measured in monitoring well MW-9 on September 4 and October 15, 2015. In the technical memorandum regarding Scope of Work for 2015 Cleanup Action Activities dated January 2015, Farallon recommended installation of a 2-inch-diameter passive LNAPL skimmer pump for more-efficient recovery of LNAPL from monitoring well MW-9. However, a minimum initial LNAPL thickness of 0.25 inch (0.02 foot) is recommended for operation of the skimmer pumps researched. Further discussion of an alternative LNAPL removal method is provided below

SCOPE OF WORK

The recommended scope of work through approximately July 2016 is discussed below.

GROUNDWATER MONITORING AND SAMPLING

Select Perched Groundwater Zone and Sea Level Aquifer monitoring wells will be sampled in January 2016. Perched Groundwater Zone monitoring wells MW-2 (if feasible), MW-4, MW-6, and MW-8 and Sea Level Aquifer 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. Monitoring wells MW-2, MW-12 and MW-13 will also be sampled for DRO and ORO by Northwest Method NWTPH-Dx.

Farallon will sample Perched Groundwater Zone monitoring well MW-2 with a small-diameter bailer (0.75 inch) during the January 2016 monitoring event to attempt to pass by the tubing blockage in the well as was accomplished during the July 2015 monitoring event. No 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 has ever been detected in groundwater samples collected from monitoring well MW-3 since installation in December 2005. Monitoring well MW-7 has rarely had a volume of water sufficient for collection of samples. Therefore, monitoring wells MW-1, MW-3, and MW-7 will be monitored only for water level measurement during the January 2016 monitoring event. Monitoring well MW-5 has been dry since installation. No constituents analyzed for have been detected at concentrations exceeding MTCA Method A cleanup levels in groundwater samples collected from monitoring well MW-10 nor detected at concentrations exceeding laboratory reporting limits since May 2011. Therefore, monitoring well MW-10 will be monitored for water level measurement only.

LNAPL MONITORING AND RECOVERY

Farallon previously recommended installation of a 2-inch-diameter passive LNAPL skimmer pump for more-efficient recovery of LNAPL from monitoring well MW-9. The sorbent socks were removed from monitoring well MW-9 in April 2015 to allow evaluation of LNAPL accumulation without the influence of the sock sorption. A minimum initial LNAPL thickness of 0.25 inch (0.02 foot) is recommended for operation of the skimmer pumps researched. This thickness was exceeded during only one of the monitoring events conducted between April and July 2015. However, an LNAPL thickness of 0.06 foot was measured on September 4 and October 15, 2015. If LNAPL is encountered during the January 2016 groundwater monitoring event at a thickness that is comparable to or greater than the September and October 2015 results, Farallon recommends the purchase and installation of a passive LNAPL skimmer pump to increase the efficiency of LNAPL recovery. If the thickness of LNAPL continues to vary above and below the 0.02 foot-benchmark, sorbent socks will be employed instead of the passive skimmer for removal of LNAPL.

REPORTING

Following completion of the first quarter 2016 groundwater monitoring and LNAPL monitoring and maintenance events, 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.

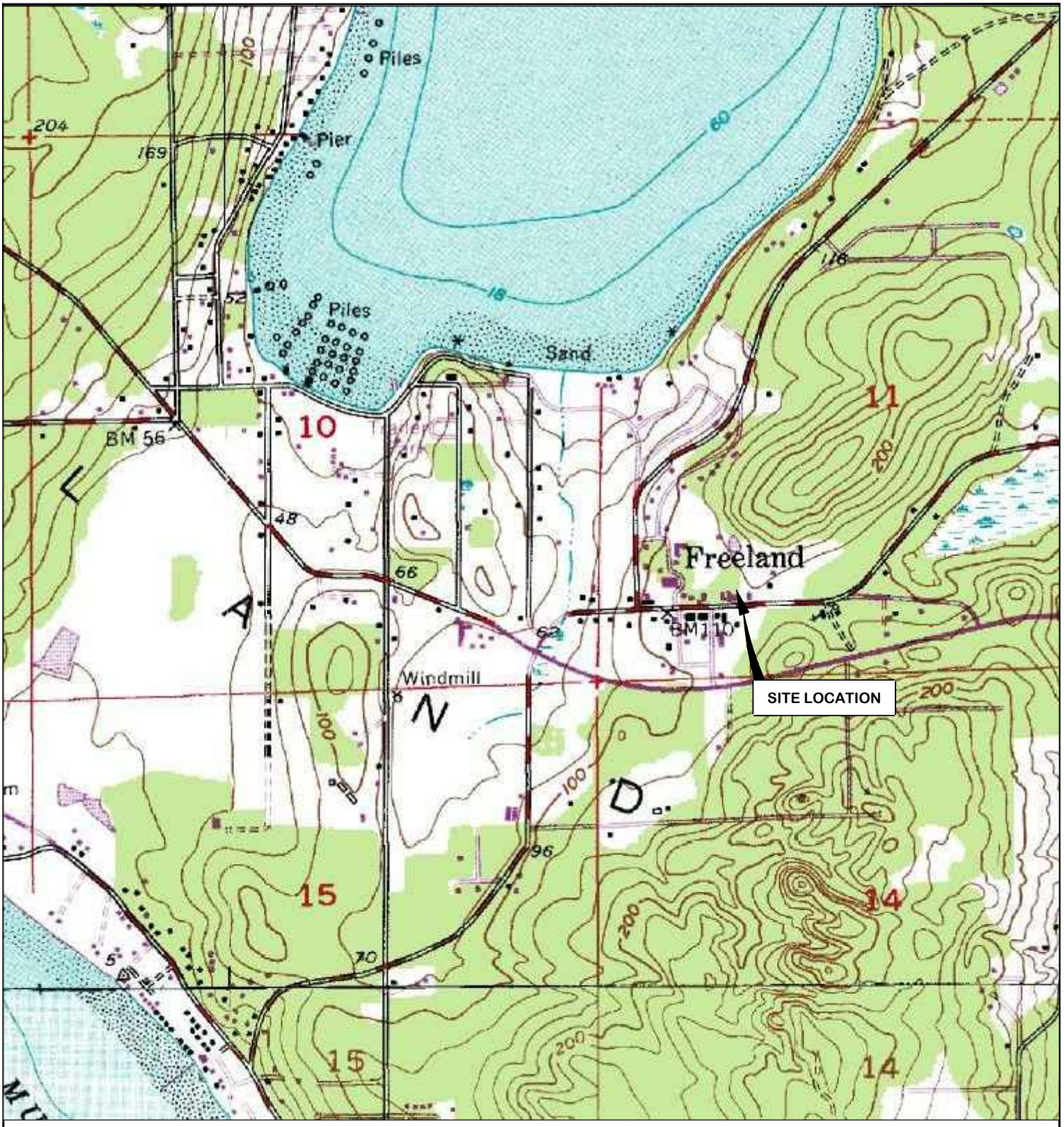
The Progress Report will be submitted to Ecology, the property owners who provided access to the monitoring wells, and other interested parties.

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 or LNAPL monitoring results, Farallon will notify Ecology of proposed changes to the groundwater monitoring and LNAPL recovery program.

Attachments: Figure 1, *Site Vicinity Map*
Figure 2, *Aerial Photograph Showing Monitoring Well Locations*

PCG:bw



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

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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

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FIGURE 2

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

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