WORK PLAN

Delineation of Subsurface Petroleum Hydrocarbon Contamination in the Vadose Zone Soils and Groundwater

Horse Heaven Hills Travel Plaza
101 Merlot Drive
Prosser, Washington 99350

Prepared for:
Horse Heaven Hills Travel Plaza
101 Merlot Drive
Prosser, WA 99350
And
Washington Department of Ecology (DOE)

Prepared By:
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May 28, 2014

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1.0 PROJECT DESCRIPTION

1.1 Purpose and Objectives

This work plan, prepared by Blue Mountain Environmental and Consulting Company, Inc. ("BMEC"), presents an approach for conducting additional delineation of the petroleum hydrocarbon (PHC) contamination in the vadose zone soils and groundwater for the Horse Heaven Hills Travel Plaza property located at 101 Merlot Drive, Prosser, Washington (hereafter referred to as the "Site").

The main objective of this Work Plan is to develop a sampling and analysis program that will further characterize the nature and extent of vadose zone soil and groundwater contamination per the Washington Department of Ecology (DOE) guidelines based on the Model Toxics Cleanup Act (MTCA) Method A Cleanup Levels for Unrestricted Land Use.

Specific objectives for the investigation include:

- Additional delineation of the horizontal and vertical extent of diesel fuel contamination in the vadose zone soils at concentrations exceeding the MTCA Method A Cleanup Levels for Unrestricted Land Use.

- Additional delineation of the horizontal extent of diesel fuel contamination in the shallow groundwater at concentrations exceeding the MTCA Method A Cleanup Levels for Unrestricted Land Use.

- Completion of a report documenting the field activities performed during the vadose zone soil and groundwater investigation including the results of field activities performed and potential recommendations for future work at the Site.

1.2 Location

Legal Description: Parcel number 1-3594-301-1661-001, in the northwest quarter of the southeast quarter of Section 35, Township 9 North, Range 24 East, Willamette Meridian, Benton County. The Site is locally known as Horse Heaven Hills Travel Plaza and the address is 101 Merlot Drive in Prosser, Washington 99350. A Site Location Map of the property and surrounding land is included as **Figure 1**.

1.3 Organization

Project Manager

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1.4 Schedule

The additional subsurface soil delineation and groundwater investigation will begin as soon as the work plan has been approved by the Client and DOE, and the appropriate subcontractor(s) (i.e., driller, underground utility locater, licensed land surveyor, and analytical laboratory) have been secured. The field investigation is expected to take approximately five to six business days for completion of all site work including boring advancement and soil sampling, installation of groundwater monitoring wells, development of the monitoring wells, and one round of groundwater sampling from the monitoring wells. A report on the field investigation and laboratory analytical data results would be completed within an estimated timeframe of six weeks following completion of all field activities.

1.5 Reports

The project report will include details of all field work and methodologies performed, a summary of analytical laboratory data and related human health risk-based assessments, certified laboratory data report, a Site Map, a sample location map, photographs of field activities,

beneficial water use determination (BWUD) survey results, a geologic cross-section of PHCs in soil, and conclusions and recommendations. All risk-based assessments will be in comparison to Ecology MTCA Method A Cleanup Levels for Unrestricted Land Use.

2.0 SITE BACKGROUND

2.1 Description of Provided Information

The Site is defined by a retail petroleum refueling station for standard passenger vehicles, as well as large truck-and-trailer rigs. The Site was developed as a retail fuel facility in 1995. A site investigation was performed at the Site by BMEC personnel on September 18, 2013 and the results of that site investigation indicated that PCS existed in shallow soils beneath several of the diesel fuel dispensers at concentrations exceeding MTCA Method A Cleanup Levels for Unrestricted Land Use. An additional subsurface investigation performed at the Site on March 13 and 14, 2014, confirmed that PCS existed beneath the diesel fuel dispensers at depths ranging up to approximately 8 feet below surface grade (bsg). Laboratory analytical results of one groundwater sample obtained from standing water pooled in the diesel fuel dispenser excavation pit indicated that shallow groundwater beneath the Site is also impacted by PHCs at concentrations exceeding MTCA Method A Cleanup Levels for Unrestricted Land Use.

The Site is located within the city limits of Prosser, Washington and is surrounded primarily by commercial properties. The property consists of one parcel of land with improvements and is accessible from Merlot Drive. The Site address is 101 Merlot Drive, Prosser, Washington 99350. The nearest roadway is Interstate I-82 which is approximately 500 feet north of the Site (**Figure 1**). The nearest surface water body is the Yakima River approximately one mile southeast and down-gradient (inferred) of the Site. The approximate Site elevation is 720 feet above mean sea level.

2.3 Geology and Hydrogeology

According to the U.S. Department of Agriculture Soil Survey of Yakima County, Washington, the Site is underlain by the Ashue Silt Loam which is considered very deep and moderately well-drained with moderately coarse textures. A typical cross-section of the Ashue Silt Loam includes a 9-inch thick surface layer of light brown to brown loam, underlain by an approximate 15-inch thick layer of light gray, gravelly sandy loam, and further underlain by light yellowish brown and pale brown very gravelly sand up to 60 inches thick.

According to Ecology Well Log ID# 139757, the subsurface lithology in the vicinity of the Site is as follows:

- Brown SAND from 0 to 10 feet bsg;
- 2-inch GRAVEL from 10 to 16 feet bsg;
- Black BASALT from 16 to 60 feet bsg;

- Porous (Vesicular) BASALT from 60 to 82 feet bsg;
- Black BASALT from 82 to 120 feet bsg; and
- SANDSTONE from 120 to 145 feet bsg.

Static water level for the water well was recorded at 12 feet bsg. The well yield was recorded at 75 gallons per minute for the 6-inch diameter water well. A copy of the Well Log ID# 139757 is included in **Appendix A**.

During the onsite field activities conducted March 13 and 14, 2014, the following subsurface lithology was encountered:

- Asphalt/concrete from 0 to 0.5 feet bgs, rounded pea gravel from 0.5 to 1.0 feet bsg;
- SILT with some rounded gravel from 1.0 to 2.5 feet bsg; and
- Silty, rounded GRAVEL (river rock) from 2.5 to 8.0 feet bsg.

Depth to shallow groundwater in the vicinity of the Site varies from 5 to 20 feet bsg. Groundwater was encountered during the March 13 and 14, 2014 field activities at an approximate depth of 8 to 8.5 feet bsg. During a site visit on April 23, 2014, the groundwater surface had risen to an elevation approximately three feet bsg. The inferred groundwater flow direction at the Site is to the south/southeast toward the Yakima River.

Geologically, the Site is located in the Yakima Fold Belt east of the Cascade Range in a much dryer climate that receives between 6 to 18 inches of precipitation annually. The Yakima Fold Belt is dominated by east-west trending anticlinal ridges and synclinal valley(s). The Site is located southeast of the Rattlesnake Mountains and immediately north of the Horse Heaven Hills. The near surface soils are formed primarily from deposition of Quaternary sediments that overlie Miocene Columbia River Basalt Group flood basalts. Fine-grained slackwater sediments characterized by rhythmically graded bedding were deposited throughout the Pleistocene atop the Miocene basalts in the area of the Columbia Gorge extending north to the Yakima Valley including the region surrounding the Site. Volcanic ash deposits and wind-blown loess deposits are also noted throughout the region.

3.0 SUBSURFACE INVESTIGATION APPROACH

3.1 Vadose Zone and Groundwater Investigation

The proposed vadose zone and groundwater investigation consists of the collection and laboratory analysis of soil and groundwater samples. Up to seven borings will be advanced to groundwater and subsequently converted to monitoring wells. The proposed locations of the monitoring wells are illustrated on **Figure 2.** Detailed descriptions of the proposed field

screening and soil sampling strategy are included below in Section 3.1.1. Detailed descriptions of the boring advancement and monitoring well installations are included below in Section 3.1.2.

3.1.1 Soil Sampling

Two soil samples shall be obtained from each borehole: One soil sample from the soil/groundwater interface and one soil sample from the interval yielding the highest field screening result. Up to 14 soil samples shall be obtained for laboratory analysis from the seven monitoring well borings. Field screening methodology shall consist of a combination of visual, olfactory, and photo-ionization detector (PID) assessment.

The field geologist will visually assess all soil brought to the surface per monitoring well boring, and record the soil on the borehole logs. The sampling technician and/or field geologist will field-screen each section of soil with a PID and the various PID readings will be recorded on the boring logs. Soil samples will be obtained for laboratory analyses based on a combination of the PID readings, olfactory and visible evidence, and location of soil/groundwater interface. If no PID, olfactory, or visible staining evidence is noted, a soil sample will be collected from the base of the boring by default. All soil samples will also be field-screened by sheen testing (adding water to a sample retained in a sampling spoon and checked for the presence of a visible oily sheen).

3.1.2 Drilling and Monitoring Well Installation

During March and April 2014 field activities conducted at the Site, well-rounded GRAVEL or RIVER ROCK was encountered near the base of the 8 foot deep excavation and BASALT bedrock was encountered at approximately 13 feet bsg in the excavation(s). Groundwater was encountered at an approximate depth of 8 feet bsg. Thus, monitoring well borings shall be advanced and continuously sampled via roto-sonic drilling methodology to depths of 15 to 20 feet bsg with screened intervals ranging from the base of the boring to approximately 5 feet bsg.

A total of seven 2-inch diameter, flush-mounted monitoring wells will be installed in the vicinity of the diesel fuel pump dispensers, in an attempt to assess the potential PHC impact to the shallow groundwater beneath the Site. Each monitoring well shall be constructed of schedule 40 PVC with 10 to 15 feet of 0.010-slotted screen. In theory, all seven monitoring wells should be installed no deeper than 20 feet bsg. Each well shall be completed with a sandpack installed from the base of the boring to a depth 2 to 3 feet above the top of the screened interval; a 2- to 3-foot bentonite plug shall be placed on top of the sandpack; a bentonite/grout mixture shall be placed on top of the sandpack to within approximately one foot of the ground surface; and the well shall be completed with a lock and cap.

A total of seven monitoring wells are proposed for installation during this phase of the subsurface vadose zone soils and groundwater investigation. The proposed locations of the seven monitoring wells are illustrated on **Figure 2**. Rationale for the location of the seven proposed monitoring wells is as follows:

- One monitoring well (MW-1) shall be located in an up-gradient position to assess the potential for any diesel fuel-related PHCs migrating onto the property via the groundwater.
- Two monitoring wells (MW-2 and MW-3) shall be located near the source of the diesel fuel contamination in an attempt to assess the magnitude of the dissolved-phase diesel fuel contamination in groundwater throughout the duration of the project. These two monitoring wells should be located near the location of diesel-impacted soil samples SS-6 and SS-14 (**Appendix B**).
- Four monitoring wells (MW-4 through MW-7) shall be located southwest to southeast of the former diesel fuel dispenser excavation pit, in an attempt to assess the migration of diesel fuel PHCs in the groundwater in the side-gradient (MW-4 and MW-7) to down-gradient (MW-5 and MW-6) direction from the diesel fuel source. These four monitoring wells shall assist in determining the horizontal extent and magnitude of the PHC plume down-gradient of the source of diesel fuel contamination, in addition to confirming the groundwater flow direction beneath the Site.

3.1.3 Monitoring Well Development and Groundwater Sampling

A minimum of 16 hours shall pass after the installation of each monitoring well, prior to the initialization of monitoring well development. Depth-to-water static level measurements shall be obtained per monitoring well from a mark on the PVC top of casing (north side) via a water level meter that has been decontaminated, prior to introduction into each successive monitoring well.

Each monitoring well shall be developed by manual surging repeatedly with a PVC surge block via 3- to 4-foot strokes continued for periods of 2 to 4 minutes. In between periods of surging, a dedicated bailer, peristaltic pump, or bladder pump will be used to remove approximately 10 standing well volumes from the well casing while measuring groundwater parameters (i.e., pH, temperature, and conductivity) to assess when stabilization of the aquifer in the vicinity of each specific monitoring well has occurred. When the groundwater parameters have all stabilized [temperature (± 3°F); pH (± 0.1 unit); conductivity (± 3%)] for three successive readings and subsequent to the removal of approximately 10 standing water well volumes, the monitoring well will be considered to be fully developed. Although turbidity will not be measured in the field, a visual assessment of turbidity will be monitored and noted during well development. The groundwater parameters shall be recorded on groundwater sampling data sheets and included in the ensuing report.

Immediately subsequent to monitoring well development, groundwater sampling in each well will be conducted using low-flow purging (submersible pump and tubing or peristaltic pump and tubing) or bailer and rope sampling techniques. During sampling, new tubing or new bailers will be lowered down the well casing. Groundwater sample containers will be prepared according to protocol established by the analytical laboratory.

3.1.4 Sample Collection

A fresh pair of latex or Nitrile gloves shall be donned, prior to collection of each successive soil and groundwater sample. Soil samples shall be collected in 4-ounce glass jars and/or three laboratory preserved 40-milliliter (ml) Environmental Protection Agency (EPA) vials per EPA Method 5035A. Soil samples collected in 4-ounce glass jars will be obtained with little to no head space. Soil samples collected in 40-ml vials will consist of approximately 5 gram aliquots of soil per vial as collected via the laboratory-provided T-Bar handle or plastic syringe device. Preservation of each 40-ml vial shall be prepared in the laboratory prior to sampling in the field.

Groundwater samples shall be collected in 1-Liter amber glass containers preserved with hydrochloric acid or unpreserved depending on which analysis will be performed on the sample. The samples will be stored in a cool environment (4 degrees Celsius) until relinquished (with properly completed chain-of-custody documentation) to OnSite Laboratory (OnSite) in Redmond, Washington. All sampling tools will be decontaminated between the collection of successive samples, or disposed of properly.

3.2 Laboratory Analytical Methods

The soil and groundwater samples will be relinquished to the laboratory for total petroleum hydrocarbon (TPH) - diesel range (TPH-D) and TPH – heavy oil (TPH-O) analysis via Northwest Method NWTPH-Dx, as well as benzene, toluene, ethylbenzene, and xylenes (BTEX) analysis via EPA Method 8021B. Field collection of all soil samples for BTEX analysis will be via EPA Method 5035A.

Furthermore, all soil samples with PHC concentrations exceeding MTCA Method A Cleanup Levels for Unrestricted Land Use (TPH-D or TPH-O > 2000 milligrams per Kilogram [mg/Kg]; benzene > 0.03 mg/Kg; toluene > 7 mg/Kg; ethylbenzene > 6 mg/Kg; and xylenes > 9 mg/Kg), shall also be analyzed via EPA Method 8270 SIM for PAHs. All groundwater samples with PHC concentrations exceeding MTCA Method A Cleanup Levels for Unrestricted Land Use (TPH-D or TPH-O > 500 micrograms per liter [µg/L]; benzene > 5 µg/L; toluene > 1000 µg/L; ethylbenzene > 700 µg/L; and xylenes > 1000 µg/L), shall also be analyzed via EPA Method 8270 SIM for polynuclear aromatic hydrocarbons (PAHs).

3.3 Data Quality Objectives and Sample Analysis

Data quality objectives for the proposed investigation are to generate data of known and documented quality that can be used to determine whether chemicals of potential concern are present above detection levels and at levels that pose an unacceptable risk to receptors. Data will be compared to MTCA Method A Cleanup Levels for Unrestricted Land Use to determine whether these levels are exceeded and to support decision-making regarding the need for further investigation.

3.4 Quality Assurance

Samples will be obtained according to standard field methods and will be prepared in accordance with protocol established by the analytical laboratory for containers, preservation, storage and transport to the laboratory. Proper chain-of-custody documentation will be prepared for all samples obtained for laboratory analysis. Appropriate decontamination procedures will be followed to prevent cross contamination of the drilling and sampling equipment between drill holes, as well as the soil and groundwater samples between sample depths and between drilling boring locations. During drilling, a continuous geologic boring log will be prepared describing the subsurface materials encountered, depth to groundwater, presence of saturated zones, field screening data, and any other pertinent geologic or environmental observations.

3.5 Investigation-Derived Waste Disposal

All soil and water (i.e., groundwater and decontamination water) investigation-derived waste (IDW) shall be containerized in separate 55-gallon drums. Each drum shall be properly labeled, sealed, and temporarily staged onsite at a location approved by the client, prior to future disposal at a licensed waste facility. All gloves, plastic, paper towels, bailers and rope shall be containerized in a plastic trash bag and disposed onsite and standard refuse.

3.6 Licensed Land Surveyor

Subsequent to installation of all monitoring wells, a land surveyor licensed in the state of Washington shall be hired to survey the elevation of the wells above mean sea level. The elevation datum per monitoring well shall be measured to the nearest hundredth of a foot from the north side of the inner 2-inch diameter PVC casing. Additionally, the surveyor shall provide northing and easting data for the location of each monitoring well.

3.7 Underground Utility Locator

Utility locating services, including private locating services shall be utilized prior to the commencement of any intrusive groundwork. An attempt will be made to locate all underground utilities via maps provided by the client and/or via the underground utility locating company personnel. All located underground utilities shall be illustrated on a map of the Site and included in the final report. Furthermore, a private utility locator shall be hired to clear each of the monitoring well locations, prior to the advancement of any subsurface drilling activities.

4.0 STATEMENT OF ENVIRONMENTAL PROFESSIONALS

We shall perform this vadose zone and groundwater investigation in accordance with generally accepted environmental practices and procedures, as of the date of this work plan. We shall employ the degree of care and skill ordinarily exercised under similar circumstances by reputable environmental professionals practicing in this area. The proposed monitoring well locations and sampling strategy recommended within this work plan are based upon site conditions we readily observed or which were reasonably ascertainable and present at the time of previous field work performed by BMEC personnel.

Brent N. Bergeron, WA Professional Geologist

Image Provided by ESRI

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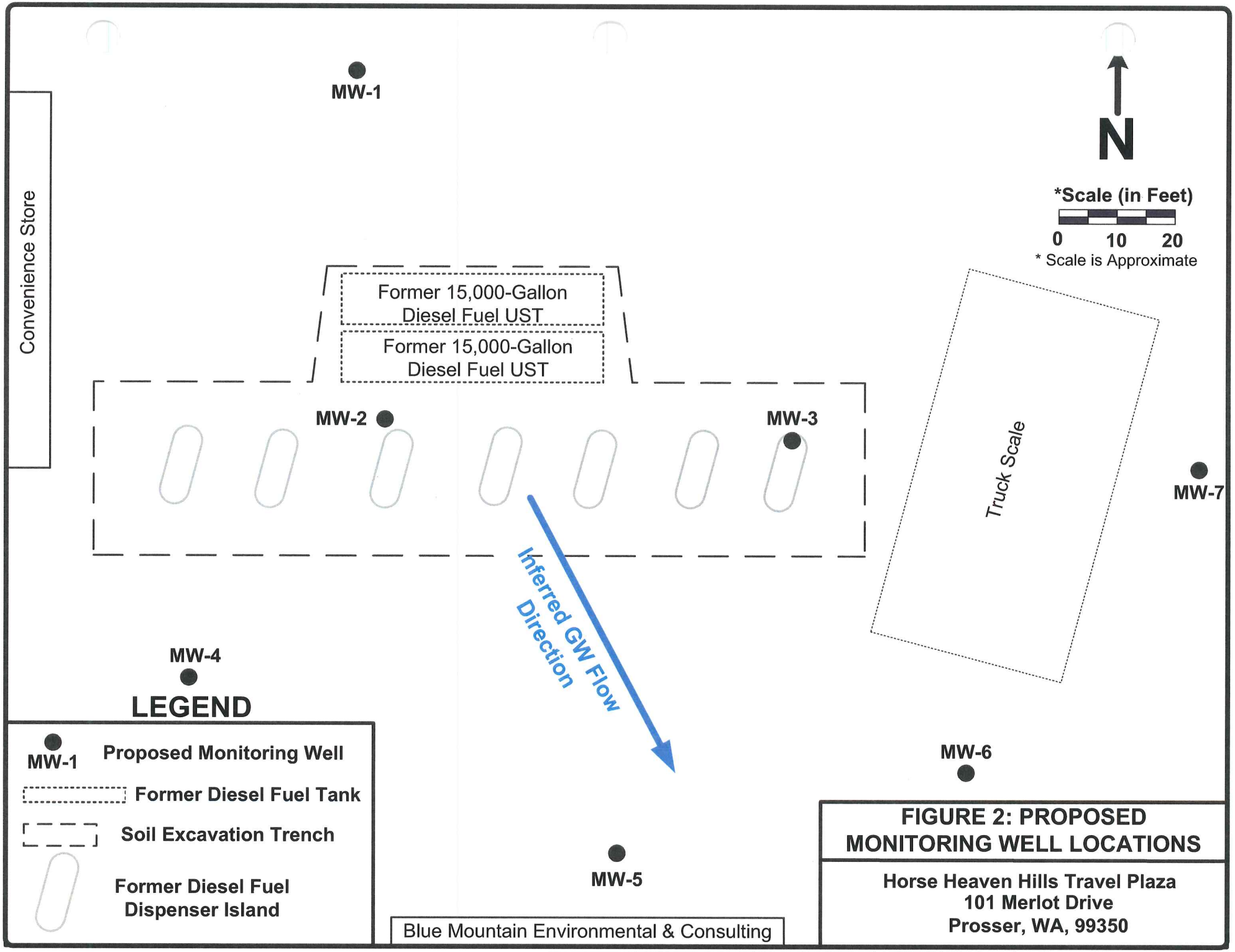
Horse Heaven Hills Truck Stop
101 Merlot Drive
Prosser, WA 99350

FIGURE 1: SITE LOCATION MAP


MW-1
N
*Scale (in Feet)
0 10 20
* Scale is Approximate
Convenience Store
Former 15,000-Gallon Diesel Fuel UST
Former 15,000-Gallon Diesel Fuel UST
MW-2
MW-3
Truck Scale
MW-7
Inferred GW Flow Direction
MW-4
LEGEND
MW-1 Proposed Monitoring Well
Former Diesel Fuel Tank
Soil Excavation Trench
Former Diesel Fuel Dispenser Island
MW-6
MW-5
Blue Mountain Environmental & Consulting
FIGURE 2: PROPOSED MONITORING WELL LOCATIONS
Horse Heaven Hills Travel Plaza
101 Merlot Drive
Prosser, WA, 99350

APPENDIX A

Well Log

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Application No. .....

Permit No. .....

1) OWNER: Name Felipe Olvera Address RT3 Box 3035 Prosser

2) LOCATION OF WELL: County Benton — SW ¼ SW ¼ Sec 35 T. 9 N., R. 24 W.M.

Bearing and distance from section or subdivision corner

(3) PROPOSED USE: Domestic [X] Industrial [ ] Municipal [ ]
Irrigation [ ] Test Well [ ] Other [ ]

(4) TYPE OF WORK: Owner's number of well (if more than one) .....
New well [X] Method: Dug [ ] Bored [ ]
Deepened [ ] Cable [ ] Driven [ ]
Reconditioned [ ] Rotary [X] Jetted [ ]

(5) DIMENSIONS: Diameter of well 6" inches.
Drilled ..... ft. Depth of completed well 145 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: ..." Diam. from ... ft. to ... ft.
Threaded [ ] ..." Diam. from ... ft. to ... ft.
Welded [ ] 6" Diam. from ... ft. to ... ft.

Perforations: Yes [ ] No [ ]
Type of perforator used .....
SIZE of perforations ... in. by ... in.
... perforations from ... ft. to ... ft.
... perforations from ... ft. to ... ft.
... perforations from ... ft. to ... ft.

Screens: Yes [ ] No [ ]
Manufacturer's Name .....
Type ..... Model No .....
Diam. ... Slot size ... from ... ft. to ... ft.
Diam. ... Slot size ... from ... ft. to ... ft.

Gravel packed: Yes [ ] No [ ] Size of gravel: .....
Gravel placed from ... ft. to ... ft.

Surface seal: Yes [X] No [ ] To what depth? 20 ft.
Material used in seal Bentonite
Did any strata contain unusable water? Yes [ ] No [X]
Type of water? ... Depth of strata ...
Method of sealing strata off .....

(7) PUMP: Manufacturer's Name Sears Roebuck
Type: Submersible HP ½

(8) WATER LEVELS: Land-surface elevation above mean sea level .... ft.
Static level 12 ft. below top of well Date 10-13-78
Artesian pressure ... lbs. per square inch Date .....
Artesian water is controlled by ... (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes [X] No [ ] If yes, by whom? US
Yield: 75 gal./min. with ... ft. drawdown after ... hrs.
" " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test .....
Bailer test ... gal./min. with ... ft. drawdown after ... hrs.
Artesian flow ... g.p.m. Date .....
Temperature of water ... Was a chemical analysis made? Yes [ ] No [ ]

(10) WELL LOG: N

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
Brown Sand	0	10
2" Gravel	10	16
Black Basalt	16	40
Broken Basalt	60	82
Black Basalt	82	120
Sand Stone	120	145

RECEIVED
NOV 13 1978
DEPT. OF ECOLOGY
WATER RESOURCES

Work started 10-11 19 78 Completed 10-13 19 78

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME [redacted] Donald W. George Drilling
(Person, firm, or corporation) (Type or print)

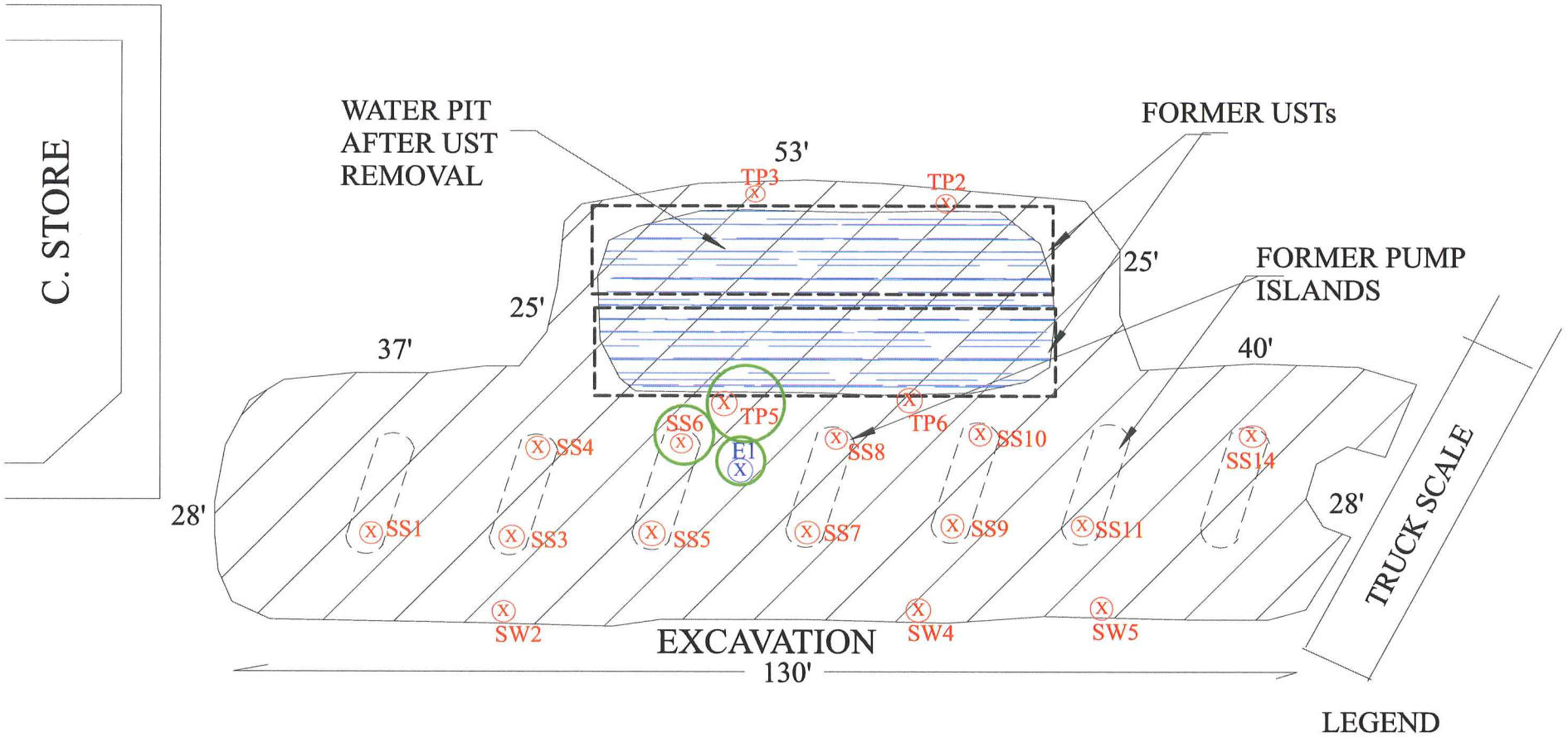
Address RT 4 Box 9005 W. Richland Wash

(Signed) Donald W. George
(Well Driller)

License No. 0491 Date 10-13 19 78

APPENDIX B

Figure 3 – Delineation of Subsurface Petroleum Hydrocarbon Contamination Report
(May 5, 2014)



LEGEND

(X) = SOIL SAMPLES EXCEEDING MTCA METHOD A CLEANUP LEVELS FOR TPH-Dx

(X) = WATER SAMPLE EXCEEDING MTCA LEVEL A METHOD LEVELS FOR TPH-Dx

◯ = SAMPLES EXCEEDING MTCA METHOD A CLEANUP LEVELS FOR PAHs

FIGURE 3: SAMPLE LOCATION MAP FOR SAMPLES THAT EXCEEDED MTCA CLEANUP LEVELS

Horse Heaven Hills Truck Stop
101 Merlot Drive
Prosser, WA 99350

N

Scale 1" = 12.5'

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