Exhibit C

PUBLIC REVIEW DRAFT REMEDIAL INVESTIGATION AND FEASIBILITY STUDY REPORT

TRUCK CITY SITE

Prepared for
SKAGIT COUNTY
MOUNT VERNON, WASHINGTON
October 23, 2014
Project No. 0714.02.02

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REPORT TRACKING SHEET		
Date	Initials	Actions
8/27/14	YV	draft report
9/11/14	YV	Continue with draft report
9/11/14	AMF	Barely start technical review. Review formatting, that's about all.
9/11/14	YV	Changed the title of report from Focused Site Assessment to RI/FS per Ecology Manager
9/12/14	AMF	Continue technical review. ***Not finished.*** Cross-checks done; read through up to Section 2.4.
9/14/14	AMF	Finish redline review.
9/14/14	YV	Review and revise report; accept tech edits
9/15/2014	JLC	Senior Review
9/15/2014	YV	Review and address edits/comments
9/16/14	KAS	Produce as draft.
9/18/14	SF	Skagit Co Prosecuting Attorney review report
9/19/14	YV	Review Steve Fallquist edits; revise draft report
9/19/14	YV	Incorporate surface water component
9/22/14	YV	Incorporate additional edits per meeting (SF & MFA)
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9/26/14	YV	Finalize draft report per discussion with J.Darling
9/29/14	YV	Incorporate edits from Ecology
10/01/14	YV	Incorporate final edits from Ecology to final draft for Public Review RI/FS
		Senior review of changes –Jclary per YV's forwarded email
10/2/14	MCM	Produce pdf
10/7/14	YV	Revision per Ecology.
10/7/14	MCM	Produced pdf (per YV change was made to page 4 of text report/page 10 of the pdf) Created new text doc w/updated footer. Replaced text doc in larger pdf, kept file date same.
10/23/14	YV	Revised with additional changes from Ecol

NOTE: On the final version, please make sure that at the end of the attachment TOC area, appendix/attachment headers don't separate from their titles over the page break (select the title paragraph and code the paragraph to "keep with next.")

DRAFT REMEDIAL INVESTIGATION AND FEASIBILITY STUDY REPORT

TRUCK CITY SITE PROPERTY

The material and data in this report were prepared under the supervision and direction of the undersigned.

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ACRONYMS AND ABBREVIATIONS

AEG	Associated Environmental Group, LLC
AGI	Applied Geotechnology, Inc.
ASTM	American Society for Testing and Materials, International
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and total xylenes
COI	chemical of interest
the County	Skagit County, Washington
CSM	conceptual site model
CUL	cleanup level
Ecology	Washington State Department of Ecology
EPH	extractable petroleum hydrocarbons
ESA	environmental site assessment
IHS	indicator hazardous substance
MFA	Maul Foster & Alongi, Inc.
mg/kg	milligrams per kilogram
MTC	Materials Testing & Consulting, Inc.
MTCA	Model Toxics Control Act
NAPL	nonaqueous-phase liquid
NWTPH	Northwest Total Petroleum Hydrocarbons
ORCa	Regenesis Oxygen Release Compound Advanced
PAH	polycyclic aromatic hydrocarbon
PID	photoionization detector
POC	point of compliance
the Property	Truck City parcel and four adjoining undeveloped parcels to the south in Mount Vernon, Washington
RCRA	Resource Conservation and Recovery Act
RI/FS	remedial investigation and feasibility study
ROW	right-of-way
TEE	terrestrial ecological evaluation
TPH	total petroleum hydrocarbons
TPH-HCID	total petroleum hydrocarbon identification
Truck City parcel	Skagit County parcel P29546
µg/L	micrograms per liter
USEPA	U.S. Environmental Protection Agency
UST	underground storage tank
VOC	volatile organic compound
VPH	volatile petroleum hydrocarbons
WAC	Washington Administrative Code

1 INTRODUCTION

On behalf of Skagit County (the County), Maul Foster & Alongi, Inc. (MFA) has prepared this Public Review Draft Remedial Investigation and Feasibility Study (RI/FS) report for the Truck City site ("Site") (Facility Site ID: 2673, Cleanup Site ID: 5176). The Site is located at 3216 Old Highway 99 South, Mount Vernon in Skagit County, Washington (Figure 1). The Site, in combination with other adjacent parcels, is proposed for construction of the Skagit County jail. The proposed jail property (Property) comprises the following five parcels: Skagit County parcels P29546 (Truck City parcel) and four adjoining undeveloped parcels to the south, P119262, P119263, P119265, and P119267 (Figure 2). The parcels are owned by various parties, and Skagit County (the "County") has executed purchase and sale agreement(s) for the parcels. The Truck City parcel comprises the entire Site based on data available at this time. As part of that effort, the County is pursuing a Prospective Purchaser Consent Decree with the Washington State Department of Ecology (Ecology). The Truck City parcel was developed by 1953 and operated as a truck stop and restaurant until the truck stop burned in 1976. The parcel was redeveloped to its current configuration in 1978, and operations have not changed since then.

1.1 Regulatory Framework

The County anticipates negotiating a Prospective Purchaser Consent Decree with the Washington State Department of Ecology (Ecology) to support purchase of the Property and construction of the County jail. The purpose of this RI/FS is to characterize the nature and extent of the hazardous substance contamination, evaluate potential risk to human health, and screen potential cleanup alternatives. This assessment has been completed for the Property to address the substantive requirements of Washington Administrative Code (WAC) 173-340 of the Model Toxics Control Act (MTCA). Remedial investigation activities were conducted generally consistent with the Ecology-approved work plan (MFA, 2014). Additionally, the scope of work for the remedial investigation was developed in general accordance with the American Society for Testing and Materials, International (ASTM) Standard E 1903-11, Standard Guide for Environmental Site Assessments: Phase II Environmental Site Assessment Process (ASTM, 2011), and ASTM Standard EE 1689–95, Standard Guide for Developing Conceptual Site Models for Contaminated Sites (ASTM, 2014).

1.2 Site Assessment Objectives

Historical site assessments identified hazardous substances, including petroleum hydrocarbons and associated volatile organic compounds (VOCs), and chemicals of interest (COIs), in soil and groundwater at the Property. Site assessment objectives included the following:

- Generate data to further characterize the nature and extent of contaminants at the Truck City parcel of the Property to allow for risk screening and to support an evaluation of potential cleanup actions.

- Assess the potential for migration of COIs to adjoining and inferred downgradient areas to the west, southwest in the right-of-way (ROW) of Old Highway 99 South (adjacent west of the Property), and south of the Truck City parcel.
- Develop a conceptual site model (CSM) and evaluate potential risk to current and reasonably likely future human receptors at the Property.
- Evaluate potential risk to current and reasonably likely future human receptors on the Property.
- Evaluate potential cleanup options for impacted media on the Property.

2 BACKGROUND

This section describes the physical location and characteristics of the Property, including the geology and hydrogeology, and summarizes the site history and previous investigations.

2.1 Site Description

The Site is located in section 32, township 34 north, range 4 east, of the Willamette Meridian. The Site comprises five rectangular parcels: the Truck City parcel, an 8.01-acre tax parcel (parcel number P29546); two 1.0-acre tax parcels (parcel numbers P119262 and P119263); a 1.75-acre tax parcel (parcel number P119265); and a 1.88-acre tax parcel (parcel number P119267) (refer to Figure 2). The Site's surface topography is generally flat. Access to the Site is from Old Highway 99 South, adjacent to the west Property boundary.

Fifteen former underground storage tank (UST) locations were identified at the Truck City parcel. Historical UST nests include the northern UST and southern UST nests, which had housed four USTs and three USTs, respectively (Figure 2). These USTs were decommissioned and removed in 1993 during an interim remedial action conducted by Ecology (Ecology, 1993). The USTs had a capacity of 5,000 gallons each. The current and only operational UST nest at the facility is the eastern UST nest, which houses three 5,000-gallon gasoline USTs and one 15,000-gallon diesel UST. This UST system was upgraded in 1998. Two 500-gallon USTs, located between the diesel pump islands and the gasoline pump islands, and a former septic tank, used as a waste oil tank, were also decommissioned and removed during the interim removal action. Additionally, a UST, of unknown size (and presumably a former heating oil tank), may be located beneath the retail store footprint. This UST reportedly was decommissioned in place. Figure 3 presents the Site's site features and previous environmental investigation features.

The Property is currently zoned "Public." The proposed county jail is designated as an Essential Public Facility by the City of Mt Vernon. The Truck City parcel contains six buildings associated with the commercial operations of the gas station, truck stop and truck wash, restaurant, and retail store. Five of the buildings—the contractor's staging shop, office space, truck wash building, retail store, and restaurant/café—were constructed in 1978. The building currently used for storage was constructed in 1957.

The gas station pump islands, fueling facilities, and truck scale (weigh station) are located in the western area of the Truck City parcel. The diesel pump islands and the Truck City parcel's current operational USTs are located in the central area of the parcel, adjacent south of the truck wash building. Long-term truck parking is designated in the east area of the parcel. Figure 4 presents the Site's current site features and recent investigation locations.

2.2 Site History

Archival records indicate that the vicinity once was generally rural farmland with local residences. The Property/Site was developed by 1953 and operated as a truck stop and restaurant until the truck stop burned in 1976. The parcel was redeveloped to its current configuration in 1978, and operations have not significantly changed since then. Several subsurface investigations were conducted at the Site between 1989 and 2014. Ecology completed an interim soil remedial cleanup action in 1993.

2.3 Previous Investigations

Site investigations have been conducted on the Site since 1989 to assess potential petroleum hydrocarbon impacts related to the operation of the retail gasoline station. Applied Geotechnology, Inc. (AGI) conducted a hydrocarbon assessment of the Site in 1989. AGI advanced eight borings, to approximately 15 to 20 feet below ground surface (bgs), adjacent to the northern, southern, and eastern UST nests; gasoline and diesel pump islands; and truck wash area. Six of the borings were completed as 2-inch-diameter monitoring wells AGI concluded that soil and groundwater gasoline and diesel petroleum hydrocarbon contamination was present around the northern and southern UST nests, and the potential exists for off-site migration of these COIs. Detected concentrations of gasoline- and diesel-range total petroleum hydrocarbons (TPH) and associated petroleum fuel VOCs, specifically benzene, toluene, and total xylenes, are above Ecology's current MTCA Method A cleanup levels (CULs). Groundwater flow direction at the Site was assessed to be west to southwesterly (AGI, 1989).

Ecology conducted an interim action cleanup in 1993. Seven USTs, 5,000 gallons in capacity each and located in the northern and southern UST nests, were decommissioned and removed along with associated product lines. Two additional 500-gallon-capacity USTs, as well as a septic tank full of waste oil, were encountered during the contaminated-soil-excavation activities and were also removed. Ecology reported that, because the septic system had been used for waste oil disposal and was connected to the parcel's storm drain system, the septic tank may be one of the contaminant sources at this parcel (Ecology, 1993). The interim action removed 6,244 cubic yards of contaminated soil and 89,991 gallons of contaminated water. The impacted soil was placed on an on-site treatment pad in the northeastern area of the Site for aeration and biodegradation. Final confirmation samples from the stockpiled soil showed detections of gasoline-range TPH below CULs, with residual diesel-range TPH concentrations above CULs. The USTs were reported to be in good condition, with no holes. However, impacted soil was apparent in the excavation pit (sidewalls and base of the excavation). A petroleum sheen was also observed in groundwater that had seeped into the pit. Ecology also reported the presence of free product in the form of fuel seeps from the excavation sidewalls (Ecology, 1993). The monitoring wells installed in the excavation area by AGI were destroyed during excavation activities. Ecology concluded that groundwater contamination at the Site may be an ongoing issue.

Associated Environmental Group, LLC (AEG) conducted a site characterization of the Site in 2005. Eleven borings were advanced via a direct-push-probe drilling rig to depths ranging from approximately 5 to 8 feet bgs. The borings were placed in the perimeters north, east, and south of the pump islands and UST nests. Shallow soil and groundwater samples were collected at all borings. Analytical results for all samples indicated no detectable presence of petroleum hydrocarbons (AEG, 2005).

In 2005, an unknown volume of diesel was spilled at the Site when a truck driver filling a rig allowed an unattended fueling nozzle to fall out of the tank during fueling activities. The spill spread to a ditch (known as Maddox Creek) which is located adjacent to and west of the Site and flows south parallel to Old Highway 99 South to Hickox Road (approximately 0.68 mile south of the Site). This spill went unreported until Ecology Spills Team traced the source back to the Truck City parcel (Ecology, Environmental Report Tracking System #546209, 2005). Sheen was observed in Maddox Creek. Ecology retained NRC Environmental Services to clean up the spill. Absorbent booms and pads were placed in Maddox Creek. Subsequently, Materials Testing & Consulting, Inc. (MTC) conducted sediment sampling within Maddox Creek, in the vicinity of the Site, to assess whether residual contamination remains in Maddox Creek. Based on current data the sediments in Maddox Creek no longer appears to be impacted by releases at the Site.

Materials Testing & Consulting, Inc. (MTC) conducted an initial Phase II environmental site assessment (ESA) in February 2014 and a supplemental ESA in March 2014. Eleven borings were advanced, via a direct-push-probe drilling rig, to a maximum depth of 15 feet bgs. The borings were located in and outside of the former excavation remediation area. Soil samples were collected from all borings for laboratory analyses. One groundwater sample was collected from a boring placed south of the former UST nests in the western area of the Truck City parcel. MTC assessed the condition of several remaining monitoring wells at the Site and concluded that most wells were inaccessible or unusable (MTC, 2014a). A secondary groundwater sample was collected from an existing well located north of the truck scale. Three surficial soil samples were also collected at adjoining parcels to the south. MTC concluded that the remediated area contained localized, residual soil contaminated with petroleum at concentrations below MTCA Method A CULs. However, impacted soil, at concentrations above MTCA CULs for gasoline- and diesel-range TPH, was documented adjacent to the truck scale (MTC, 2014b). Laboratory analytical results for the two groundwater samples indicated no detectable TPH in the gasoline and diesel ranges or associated VOCs, specifically benzene, toluene, ethylbenzene, and total xylenes (BTEX).

The following is a list of reports that have been completed in association with the evaluation of petroleum hydrocarbon impacts on the Site. Environmental concerns identified by MFA are discussed in the next section (Section 2.4).

- Hydrocarbon contamination assessment (AGI, 1989).

- Interim action cleanup report (Ecology, 1993).
- Site characterization (AEG, 2005).
- Phase II ESA—supplemental investigation (MTC, 2014b).
- Phase II ESA (MTC, 2014a).

2.4 Known or Potential Environmental Conditions

A number of features were identified as known or potential environmental conditions at the Site. The sampling approach was designed to investigate these features as well as to address data gaps, including the following:

- **Confirmed soil and groundwater impacts:** Environmental assessments and investigations completed at the Site between 1989 and 2014 indicated detections of TPH and VOCs (specifically BTEX) at levels exceeding MTCA Method A soil and groundwater CULs for unrestricted land use. The areas of impact included the former northern and southern UST nests and associated former gasoline pump island and auto service repair area at the western side of the Truck City parcel. A former septic tank containing waste oil, located west of the diesel pump islands, was also confirmed as a source of groundwater contamination at this parcel. The extent of the TPH and VOC impacts was not fully delineated.

- **Off-Site west of Truck City parcel:** The potential for off-Site migration of petroleum-hydrocarbon-impacted groundwater to the west-southwest of the Truck City parcel exists because of confirmed soil and groundwater contamination near the western Site boundary of this facility. The ROW of Old Highway 99 South, adjacent west-southwest of the Truck City parcel, was a data gap requiring investigation.

- **Truck scale area:** Soil remedial action, completed by Ecology in 1993 near the western Site boundary of the Truck City parcel, was limited because of the truck scale. Residual soil contamination was present on the east side of the truck scale. Migration of petroleum-hydrocarbon-impacted groundwater west of the truck scale raised environmental concerns.

- **Truck washing area:** This area was not investigated during previous subsurface investigations. The truck washing area may serve as a conduit for soil and/or groundwater contamination.

2.5 Geology and Hydrogeology

The Site and vicinity have been mapped as recent alluvium and artificial fill. Alluvium deposits encountered at the Site, at locations of investigation, consist of floodplain sequences ranging from fluvial silty sand and well sorted sand, to silt with intervening clay. Fill, comprising sandy gravel to gravelly silty sand, was generally present to approximately 3 to 5 feet bgs at the Truck City parcel, except in the former UST nests, where soil remedial cleanup action by Ecology in 1993 overexcavated this area to depths of approximately 9.5 feet bgs. A cross section transect of the Site and corresponding geologic cross section are presented in Figures 5 and 6, respectively.

The matrix of the unconfined shallow aquifer appears to be silty sand. Depth to groundwater, encountered during subsurface exploration activities, was variable throughout the Site, ranging approximately from 3.5 to 9.5 feet bgs. The static water level at completed monitoring wells TC-1 through TC-6, at the Truck City parcel, ranged approximately from 5.80 to 6.45 feet bgs during the groundwater monitoring and sampling event conducted on July 18, 2014. The direction of groundwater migration at the Site during the July 2014 groundwater event, based on professionally surveyed elevations at monitoring wells TC-1 through TC-6, is generally to the south-southeast, with tangent to the west (refer to Figure 7).

AGI reported a west-to-southwesterly groundwater flow direction at the Site during their investigation in October 1989, based on water levels measured from installed monitoring wells. Seasonal groundwater flow direction fluctuations are expected at the Site and vicinity because of the shallow depth to groundwater in the floodplain area. The local and regional discharge points in the area appear to be to the west-southwest, toward Britt Slough and the Skagit River. At its closest points, Britt Slough and the Skagit River are located approximately 0.5 mile and 1.5 mile, respectively, west of the Site. Maddox Creek, located adjacent west of the Site, flows south parallel to Old Highway 99 South; intersects at Hickox Road; and flows west from this intersection.

3 FIELD AND ANALYTICAL METHODS

Field site assessment activities were conducted in July 2014 and focused on further characterization of impacted areas at the Site, potential off-Site migration of contaminants, and addressing data gaps. The investigation included evaluation of soil and groundwater for potential COIs, including gasoline-, diesel-, and lube-oil-range TPH; VOCs, including petroleum-hydrocarbons-associated VOCs (specifically BTEX); polycyclic aromatic hydrocarbons (PAHs); and U.S. Environmental Protection Agency (USEPA) Resource Conservation and Recovery Act (RCRA) metals (including arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver).

The investigations included collection of groundwater and soil samples at the following locations (see Figure 4).

TRUCK CITY PARCEL

Borings TCBH-1 and TCBH-3 and monitoring well TC-3: Advanced adjacent south of the two former UST nests and adjacent to the former gasoline pump island. Soil and groundwater samples were collected from borings and dedicated monitoring wells to evaluate whether petroleum hydrocarbons and associated VOCs remain after completion of Ecology's interim remedial action in 1993.

Boring TCBH-2 and monitoring wells TC-2 and TC-4: Advanced adjacent north, south, and west, respectively, to the truck scale. Soil and groundwater samples were collected from borings and dedicated monitoring wells to evaluate whether confirmed contaminated soil under the truck scale, on the east side, has impacted adjacent downgradient areas. Monitoring wells TC-2 and TC-4 serve as sentinel wells downgradient of areas of potential contamination and adjacent to the parcel's western Site boundary.

Monitoring well TC-5: Advanced adjacent east of the former septic waste-oil tank and directly downgradient of the current diesel pump islands. Soil and groundwater samples were collected from a dedicated monitoring well to evaluate whether petroleum hydrocarbons and associated VOCs remain after the removal and decommissioning of this UST and completion of soil excavation in this area in 1993.

Monitoring wells TC-1 and TC-6: Advanced downgradient of the former USTs, former gasoline pump island, and former septic waste-oil tank. Soil and groundwater samples were collected during installation of and following development of, respectively, dedicated monitoring wells to evaluate whether COIs have migrated and potentially impacted nearby areas south-southwest. Monitoring well TC-6 serves as a sentinel well downgradient of areas of potential contamination and adjacent to the parcel's southwest Site boundary.

Boring TCBH-4: Advanced adjacent and inferred downgradient of the current fuel UST nest. Soil and groundwater samples were collected to generally evaluate the integrity of the USTs and associated product lines.

Boring TCBH-5: Advanced adjacent and inferred downgradient of the truck wash. Soil and groundwater samples were collected to generally evaluate the subsurface area adjacent to the truck wash.

Boring TCBH-6: Advanced in the eastern area of the parcel. Soil and groundwater samples were collected to generally evaluate the eastern area of the parcel where truck rigs generally are parked.

WEST-SOUTHWEST OF TRUCK CITY PARCEL

Borings TCBH-7 through TCBH-9: Advanced in the ROW (west side of Highway 99 South) downgradient off Site and directly west and southwest of areas formerly confirmed as impacted on the west side of the Truck City facility. Soil and groundwater samples were collected from borings to evaluate whether COIs have migrated and potentially impacted nearby areas west-southwest.

SOUTH OF TRUCK CITY PARCEL

Borings TCBH-10 through TCBH-14: Advanced south and southeast of the Truck City facility in undeveloped parcels of the Site. Soil and groundwater samples were collected from borings to evaluate the potential of COIs migrating off Site to the south and southeast.

3.1 Soil Sampling

Soil samples were collected from continuous soil cores at all borings advanced with a direct-push drilling rig from the ground surface to total depth, which was generally completed at 15 feet bgs. Soil samples for laboratory analyses were targeted from various locales throughout each location of subsurface investigation—from the capillary fringe of the water table; to depths indicative of changes from fill to native soil; and at or near the bottom of each borehole, at the maximum depth explored (refer to Figure 4 for sample locations).

Soil samples were collected generally between 3.5 and 9.5 feet bgs and at 15.0 feet bgs. Soil conditions were described and visual and olfactory observations of the soil were recorded. Soil collected during the investigation was also screened for organic vapors, using a photoionization detector (PID). Boring logs are provided in Appendix A.

Under standard chain-of-custody procedures, samples were submitted to Friedman and Bruya, Inc. of Seattle, Washington, for analysis. A subset of the soil samples collected was analyzed. The selection of samples for analysis was based on observed potential impacts, elevated head-space readings collected with a PID, depth of the sample with respect to the capillary fringe and total depth of the borehole, and/or information from previous investigations. Table 1 summarizes soil samples submitted for analysis.

Selected soil samples from borings TC-1 through TC-6 (which were completed as dedicated 2-inch-diameter monitoring wells in the western area of the Truck City parcel) were collected to further evaluate the extent of historical source impacts to the subsurface. These samples were analyzed for the following COIs:

- Diesel- and residual-range TPH by Northwest Total Petroleum Hydrocarbon (NWTPH)-Dx Extended Method
- Gasoline-range TPH by NWTPH-Gx with USEPA 5035 sample preparation
- VOCs associated with petroleum fuel, specifically BTEX, by USEPA 8021B with USEPA 5035 sample preparation
- VOCs by USEPA 8260B
- RCRA metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver) by USEPA 6020 series
- PAHs by USEPA 8270

Soil samples from borings TCBH-1 through TCBH-6 (which were not completed as monitoring wells) were collected at locations of potential environmental concern that were not investigated previously. These samples were analyzed for the following COIs:

- Diesel- and residual-range TPH by NWTPH-Dx Extended
- Gasoline-range TPH by NWTPH-Gx with USEPA 5035 sample preparation
- VOCs associated with petroleum fuel, specifically BTEX, by USEPA 8021B with USEPA 5035 sample preparation

Following consultation with Ecology, because there were no obvious indications of soil and/or groundwater impacts at boring TCBH-2 (potentially at levels above MTCA CULs), MFA did not advance a boring directly west and off Site of the Truck City parcel (inferred downgradient) of TCBH-2.

However, soil samples from borings TCBH-7 through TCBH-9 (which also were not completed as monitoring wells) were advanced off Site and inferred downgradient on the west side of Old Highway 99 South ROW. These samples were analyzed for the following COIs:

- Diesel- and residual-range TPH by NWTPH-Dx Extended
- Gasoline-range TPH by NWTPH-Gx with USEPA 5035 sample preparation
- VOCs associated with petroleum fuel, specifically BTEX, by USEPA 8021B with USEPA 5035 sample preparation

Soil samples from borings TCBH-10 through TCBH-14 (which also were not completed as monitoring wells) were advanced at the southern parcels adjacent to the Truck City parcel. These samples were analyzed for the following COIs:

- Total petroleum hydrocarbon identification (TPH-HCID) by NWTPH-HCID
- VOCs associated with petroleum fuel, specifically BTEX, by USEPA 8021B with USEPA 5035 sample preparation

Based on laboratory analytical results, there were no indications of impacts at these borings; hence, followup analyses to identify the potential type of petroleum hydrocarbons present at these borings were not conducted.

Laboratory analyses for extractable petroleum hydrocarbons (EPH) were completed on soil samples collected during installation of monitoring well TC-5 to evaluate the potential for the presence of nonaqueous-phase liquids (NAPL); these fractions are required for MTCA Method B and Method C CULs.

3.2 Groundwater Sampling

Groundwater samples were collected from the water table and from the lower extent of the shallow aquifer[1] to evaluate petroleum hydrocarbons and VOCs as well as potential density-driven impacts characteristic of a dense NAPL release (e.g., tetrachloroethene [or perchloroethylene] from former auto repair services at the Truck City parcel). Groundwater samples were collected from dedicated monitoring wells and borings advanced on the Site and off Site (Figure 4). All groundwater sampling was conducted using the methods and protocols outlined in the sampling and analysis plan. Groundwater field sampling data sheets are provided in Appendix B. Pacific Geomatic Services conducted a professional land survey of all boreholes and monitorings wells advanced at the Site (Appendix C). Groundwater elevation data from surveyed monitoring wells was used for drafting a groundwater potentiometric map for the Site.

[1] The lower screened interval extended to the bottom of each borehole.

Groundwater samples were analyzed for most of the COIs that were analyzed for soil. Table 2 presents a summary of samples submitted for analyses and their respective laboratory analyses.

Additionally, laboratory analyses for volatile petroleum hydrocarbons (VPH) and EPH were completed for selected groundwater samples collected at areas of the Truck City parcel where NAPL was suspected. MTCA cleanup regulations require TPH fractions at such NAPL-affected locations. For Method B and Method C CULs, the fractionated approach must be used to collect and analyze the presence and concentration of TPH to obtain analytical results for the hydrocarbon-phase partitioning. The EPH and VPH analyses provide a toxicological-based approach to characterizing and evaluating risks posed by petroleum impacts.

At borings that were completed as established monitoring wells, TC-1 through TC-6, MFA collected groundwater samples a minimum of 24 hours after completion of monitoring well development.

Selected groundwater samples from areas with confirmed historical petroleum fuel releases (including areas in the vicinity of monitoring wells TC-1, TC-3, and TC-5) were analyzed for COIs outlined in Ecology MTCA Cleanup Table 830-1, Required Testing for Petroleum Releases:

- Table 830-1, Required Testing for Petroleum Releases, Gasoline Range Organics (GRO) suite, which includes gasoline-range TPH, BTEX, hexane, dibromoethane, 1-2 ethylene dibromide, dichloroethane, 1-2 ethylene dichloride, methyl tertiary-butyl ether, total lead, naphthalenes, and VPH
- Table 830-1, Required Testing for Petroleum Releases, Diesel Range Organics (DRO) suite, which includes diesel- and residual-range TPH, BTEX, carcinogenic PAHs, naphthalenes, and EPH
- RCRA metals (including arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver) by USEPA 6020 series

To evaluate the potential for a biodegradation process at the Site, selected groundwater samples from TC-1 and TC-3 were also analyzed for the following geochemical parameters to prescreen for the presence of electron acceptors:

- Nitrate by USEPA 353.2
- Manganese by USEPA 6020A
- Ferrous iron by USEPA ApplEnvMic7-87-1536
- Sulfate by ASTM D516-02
- Methane by RSK 175

4 ANALYTICAL RESULTS

Laboratory analytical reports are provided in Appendix D. Analytical data and the laboratory's internal quality assurance and quality control data were reviewed to assess whether they meet project-specific data quality objectives. This review was performed consistent with accepted USEPA procedures for evaluating laboratory analytical data and appropriate laboratory and method-specific guidelines (USEPA, 2004, 2008). Data validation memoranda summarizing data evaluation procedures, usability of data, and deviations from specific field and/or laboratory methods for the investigation data are presented in Appendix E. The data are considered acceptable for their intended use, with the appropriate data qualifiers assigned.

4.1 Soil

Soil analytical results are summarized in Table 1. Thirty soil samples were collected from 20 boring locations—six borings completed as monitoring wells (TC-1 through TC-6) and 14 temporary borings (TCBH-1 through TCBH-14) (Figure 8). One duplicate soil sample was collected. All soil samples collected were analyzed. Twenty-five soil samples were analyzed for TPH; six samples were analyzed for TPH-HCID. Four samples were analyzed for the full VOC suite by USEPA 8260C, and 27 samples were analyzed for BTEX. Additionally, three samples were analyzed for PAHs, four for metals, and one for EPH.

Gasoline-range TPH, at concentrations above the MTCA Method A CUL, were detected only at TCBH-3 (8.5 feet bgs; 2,800 milligrams per kilogram [mg/kg])). Ethylbenzene was the only VOC detected above the Method A CUL and was also found at TCBH-3 (8.5 feet bgs; 7.8 mg/kg)). The remaining COIs either were not detected or were detected at concentrations below their respective CULs (Table 1). The risk screening section (Section 6) includes a discussion of soil chemical detections compared to their respective CULs.

Of the eight metals analyzed, arsenic, barium, chromium, and lead were the only metals detected in the four soil samples submitted for analysis of total metals, with depths ranging from approximately 6.5 to 15.0 feet bgs. Detections for all metals did not exceed Method A CULs (Table 1). The risk screening section (Section 6) includes a discussion of soil chemical detections compared to their respective CULs.

4.2 Groundwater

The groundwater analytical results are summarized in Table 2 and shown in Figure 9. Eighteen groundwater samples were collected out of 20 combined boring and monitoring well locations. One duplicate groundwater sample was collected. All groundwater samples collected were analyzed. Fifteen groundwater samples were analyzed for TPH; three samples were analyzed for TPH-HCID. Three groundwater samples were analyzed for the full VOC suite by USEPA 8260B, and the remaining samples were analyzed for BTEX. Additionally, four samples were analyzed for PAHs, two for total metals, one for dissolved metals, and two samples each for EPH and VPH.

Gasoline-range TPH, at concentrations above the MTCA Method A CUL, were exhibited only at TCBH-3, TC-3, and TC-5 (380 to 1,900 micrograms per liter [μg/L]). Elevated diesel-range TPH was detected only at TCBH-1 (790 μg/L). Elevated benzene was found only at TC-5 (22 μg/L). Additionally, arsenic (7.1 μg/L) was the only metal (total metals analysis) detected above the CUL; however, laboratory analysis for arsenic, as dissolved metals, indicated a detection of 1.37 μg/L. Hence, it appears that the turbid groundwater sample with a heavy presence of sediments was the source of the elevated arsenic. The remaining COIs either were not detected or were detected at concentrations below their respective CULs (Table 2). The risk screening section (Section 6) includes a discussion of groundwater chemical detections compared to their respective CULs. Figure 10 presents an overview of the environmental investigation.

5 CONCEPTUAL SITE MODEL

The CSM describes potential chemical sources, release mechanisms, environmental transport processes, exposure routes, and receptors. Development of a CSM is dynamic and iterative and may be refined as additional information becomes available. The primary purpose of the CSM is to describe pathways by which human and ecological receptors could be exposed to site-related chemicals. A complete exposure pathway consists of four necessary elements: (1) a source and mechanism of chemical release to the environment, (2) an environmental transport medium for a released chemical, (3) a point of potential contact with the impacted medium (referred to as the exposure point), and (4) an exposure route (e.g., soil ingestion) at the exposure point. The CSM describes potential exposure scenarios based on information collected during the site assessment. All of these components and the relationship between them are fundamental in determining potential adverse effects that could be posed by constituents at the site.. Elements of potentially complete exposure scenarios relevant to human health and ecological receptors are discussed below and are presented in Figure10.

5.1 Source Characterization

Archival records indicate that the Property/Site was developed by 1953 and operated as a truck stop with fueling, automotive services, and a restaurant until the truck stop burned in 1976. The parcel was redeveloped to its current configuration in 1978, and operations as a truck stop with fueling services and a café continued. Several subsurface investigations were conducted at the Site between 1989 and 2014. Ecology completed a soil remedial cleanup action in 1993.

Chemicals of potential concern on the Site include TPH, VOCs (primarily BTEX), PAHs, and metals in soil and groundwater. The current fueling operations at the Truck City parcel provide potential continuing sources of hazardous-substance releases at the Site. Based on previous investigations, the sources of soil and groundwater contamination are likely the historical operation of a gasoline station at the Truck City parcel (including gasoline- and diesel-fuel-containing USTs, product lines, pump islands, and surface spills), and automotive repair services.

A previous investigation by AGI concluded that soil and groundwater gasoline and diesel petroleum hydrocarbon contamination was present around the former northern and southern UST nests, and the potential exists for off-Site migration of these COIs. Ecology's interim cleanup action in 1993, involving decommissioning and removal of seven USTs and a septic tank full of waste oil, documented petroleum-contaminated soil and groundwater. Petroleum-contaminated soil encountered in the area of the former USTs and automotive repair services was excavated and removed; however, excavation west of these structures was limited by the truck scale. Thus, contaminated soil remains on the east side of the truck scale. Ecology concluded that the septic tank may be one of the contaminant sources and groundwater contamination at the Site likely would be an ongoing issue (Figure 3). Further characterization is needed to define the lateral and vertical extent of petroleum hydrocarbon and associated VOC contamination at the Truck City parcel and to assess the potential of off-Site migration of COIs.

5.2 Fate and Transport of Contaminants

The primary mechanisms likely to influence the fate and transport of chemicals at the Site include natural biodegradation of organic chemicals, sorption to soil, advection and dispersion in groundwater, volatilization from soil or groundwater to air, and leaching of chemicals from soil to groundwater. The relative importance of these processes will vary, depending on the chemical and physical properties of a released contaminant. The properties of soil and the dynamics of groundwater flow also shape contaminant fate and transport.

Chemicals with sufficiently high solubility could leach from soil to pore water, and dissolved chemicals could be transported to surface water (such as Maddox Creek) and/or downward to local groundwater. Petroleum hydrocarbons and benzene are the primary COIs that were encountered in soil and groundwater at concentrations above MTCA Method A CULs. In the dissolved phase, volatilization, dispersion, retardation, and biodegradation may further reduce concentrations of chemicals in groundwater downgradient of a source area. During the July 2014 subsurface investigation, groundwater flow direction was primarily to the south-southeast, with tangent to the west (Figure 7). The regional groundwater discharge and inferred primary groundwater flow direction in the area are to the west-southwest. The fate and transport of these COIs are discussed in more detail in the next section. Based on current data the sediments in Maddox Creek no longer appears to be impacted by releases at the Site.

Much of the Truck City parcel, as it relates to the gasoline station and truck wash area on the western side of this parcel, is paved. However, the eastern side of it is composed of unpaved and gravel surfaces. No contamination was identified with the eastern side of this parcel or the remaining four undeveloped parcels south of the Truck City parcel.

Petroleum-hydrocarbon- and benzene-impacted soil identified during this subsurface investigation is limited to one area, boring TCBH-3, adjacent to the former northern UST (Figure 8). Impacted soil was not encountered adjacent west of the truck scale; however, Ecology had identified residual impacted soil adjacent on the east side of the truck scale. Petroleum-hydrocarbon- and benzene-impacted groundwater was identified at three areas—the former northern and southern USTs and the former septic waste-oil tank. These three areas represent localized residual impacts encountered during this subsurface investigation. Impacted groundwater was not encountered at three investigation locations adjacent west of the truck scale.

Volatile chemicals in groundwater or in soil in the vadose zone have the potential to volatilize and migrate in the vapor phase. Chemicals such as benzene may volatilize into overlying buildings. Figure 11 presents a CSM summarizing potential transport pathways.

5.3 Potential Human Health Exposure Scenarios

The Site currently contains two buildings. The northern building is used as the convenience store for the gasoline station. The southern building is a café. The remaining parcels of the Site are undeveloped. The footprint of the proposed county jail encompasses the central area of the Truck City parcel and adjoining southern parcels of the Site. The northwestern portion of the proposed jail will overlie one of the three localized residual contaminated areas at the Site (contamination identified associated with boring TC-5) and is in vicinity of the localized contamination at TCBH-3. Figure 12 presents an overlay of the proposed jail with respect to current residual impacted areas at the Site.

Therefore, it is possible that construction workers, county workers, and/or jail residents may occupy this area of the Site at some time in the foreseeable future. Any future development will need to be protective of future occupants and workers.

The following are potentially complete human health exposure pathways.

Commercial/construction/ workers—There are currently no building structures at the localized impacted area at the Site. Therefore, there are no current commercial workers potentially exposed to COIs in soil. However, construction activities likely will be performed as part of site redevelopment. Construction workers could contact indicator hazardous substances (IHSs) in soil at 0 to 15 feet bgs through incidental ingestion, dermal contact, and inhalation of impacted soil particulates. There is currently no potable water use at or near the Site and there are no known plans to develop this resource. However, the impacted groundwater is shallow. Future construction workers may be exposed to the impacted shallow groundwater through ingestion, dermal contact, and inhalation of chemicals volatilizing from groundwater and appropriate protection of construction workers will be required. In the future, potable water to the Site may be provided by the Skagit County Public Utility District No. 1 ("PUD"), including for any future development.

Remedial action will be required to protect persons from potential exposure to volatile chemicals from the subsurface. Soil gas has the potential to migrate, and persons in nearby future buildings could potentially be exposed to IHSs in the absence of remedial action.

Note, this is an assessment of current potential exposure scenarios if the Site is not remediated prior to constructing buildings. The intent of future cleanup actions (Section 8) and the subsequent recommended cleanup alternative is to remediate the soil and groundwater so that these scenarios are addressed and concerns are negated once buildings are constructed.

5.4 Terrestrial Ecological Evaluation

A terrestrial ecological evaluation (TEE) was performed for the Site, following the evaluation procedures outlined in WAC 173-340-7490 and 173-340-7493. The site-specific TEE includes problem formulation and an ecological screening evaluation.

The purpose of problem formulation is to determine if important terrestrial ecological receptors (e.g., native plants and wildlife) could potentially have significant exposure to site-related hazardous substances in upland soil. As described above, the Site has two buildings, and about one-fourth of the Site is paved (in the Truck City parcel). The rest of the Site is vegetated with grass, weeds, and shrubs. The density and diversity of plants on the site are low. The Site is expected to be developed as a county jail.

All contamination to a depth of 15 feet below ground surface (bgs), which is the point of compliance for soil, will be excavated and removed from the Site. Therefore the simplified TEE determined that the Site will not pose a substantial threat to potential ecological receptors (see Appendix A). Therefore, soil analytical results will not be compared to ecological screening values.

5.5 Cleanup Standards

According to MTCA, the cleanup standards for a particular site have two primary components: chemical-specific CULs and points of compliance (POCs). The CUL is the concentration of a chemical in a specific environmental medium that will not pose unacceptable risks to human health or the environment. The POC is the location where the CUL must be met.

MTCA provides three different options for establishing CULs for human health: Method A, Method B, and Method C. MTCA Method A is designed for cleanups at relatively simple sites, such as small sites that have only a few hazardous substances. Method B can be used at any site. Method C is used primarily for industrial sites. For Methods B and C, either the standard or the modified approach can be used. The standard method uses generic default assumptions to calculate CULs, and the modified method allows for site-specific adjustments to some assumptions when calculating CULs.

5.5.1 Soil Cleanup Levels

The Site historically has been used for commercial purposes, and it is anticipated that it will be used for public purposes in the future. Soil on the Site, at the Truck City parcel, is impacted mainly with TPH and benzene. The impacts appear to be localized in extent.

The primary exposure mechanism for soil at the Site is direct contact. The soil-to-groundwater pathway has been mitigated by the implementation of interim actions at the Truck City parcel, including petroleum-contaminated-soil removal and capping with asphalt pavement in the former UST and gasoline pump islands, which limits infiltration of stormwater and leaching of residual soil contamination. CULs were developed for soil based on a direct-contact exposure pathway. Terrestrial ecological CULs were not considered, based on the TEE exclusion. Method A CULs are deemed applicable at the Site.

These CULs are calculated to derive concentrations that are estimated to result in no acute or chronic toxic effects on human health from noncarcinogens, and concentrations for which the upper bound on the estimated excess cancer risk is less than or equal to one in one million (1×10^{-6}) for carcinogens.

5.5.1.1 Points of Compliance in Soil

The soil POC is the depth bgs at which soil CULs shall be attained. The standard POC is soil within 15 feet of the ground surface throughout the entire site. This standard POC is applied to soil on the Site. Hence, all contaminated soil will be excavated to a depth of 15 feet bgs, removed, and disposed of offsite at a regulated landfill. As discussed below, impacts have not been detected in soil below approximately 8.5 feet bgs.

5.5.2 Groundwater Cleanup Levels

The Site historically has been used for commercial purposes, and it is anticipated that it will be used for public purposes in the future. Currently, shallow groundwater at the Truck City parcel is impacted with TPH and benzene. The impacts appear to be localized. Method A CULs are deemed applicable at the Site.

Arsenic-impacted groundwater was exhibited only at monitoring well TC-2. In our professional opinion, this elevated detection was due to the high sediments in the groundwater sample collected, as indicated by laboratory analytical results for dissolved arsenic (Table 2).

5.5.2.1 Points of Compliance in Groundwater

For groundwater, the POC is the point or points where the groundwater CULs must be attained for a site to be in compliance with the cleanup standards. Groundwater CULs shall be attained in all ground water from the POC to the outer boundary of the hazardous substance plume. A conditional POC may be established if it is not practicable to meet the CULs throughout the site within a reasonable restoration timeframe (WAC 173-340-720(8)(c)). A conditional POC for groundwater is not proposed for the Site at this time.

For surface water, the POC is where Maddox Creek daylights at the south west corner of the Site Site boundary.

5.5.3 Surface Water Cleanup Levels

Based on current data the sediments in Maddox Creek no longer appears to be impacted by releases at the Site. However surface water quality will be monitored where Maddox Creek daylights at the south west corner of the Site Site boundary which is the POC for surface water.

6 RISK SCREENING

The soil and groundwater sample results were compared to MTCA Method A CULs for unrestricted land use (Tables 1 and 2). IHSs are evaluated below by comparing the concentrations found in soil and groundwater to their respective CULs. An IHS is defined as a chemical exceeding a CUL at one or more locations.

6.1 Soil

Soil analytical results are compared to MTCA Methods A soil CULs for unrestricted land use. Gasoline-range TPH and ethylbenzene were detected in soil at concentrations above MTCA Method A soil CULs (Table 1 and Figure 8).

The gasoline-range TPH and ethylbenzene concentrations (2,800 mg/kg and 7.8 mg/kg, respectively) exhibited in the sample collected from 8.5 feet bgs at boring TCBH-3 exceeded their respective Method A soil CULs of 30 mg/kg and 6 mg/kg, respectively. Laboratory analytical results for the remaining soil samples did not indicate detections above the Method A CULs.

Gasoline-range TPH and ethylbenzene are considered IHSs for the Site because of their elevated detections.

6.2 Groundwater

Groundwater analytical results are compared to MTCA Method A CULs. Gasoline- and diesel-range TPH and benzene were detected in groundwater at concentrations above MTCA Method A groundwater CULs (Table 2 and Figure 9).

Gasoline-range TPH concentrations exceeding the Method A groundwater CUL of 800 μg/L (with presence of benzene in groundwater) were exhibited at two locations (1,900 μg/L at TCBH-3 and 800 μg/L at TC-5). Diesel-range TPH concentrations exceeding the Method A groundwater CUL of 500 μg/L were also exhibited at TCBH-3 and additionally at TCBH-1 (1,100 μg/L and 790 μg/L, respectively). Laboratory analytical results also indicated elevated concentration of benzene (22 μg/L) at TC-5, which exceeds its Method A groundwater CUL of 5 μg/L. The single benzene concentration exhibited in groundwater appears indicative that it is a localized, residual concentration from an older petroleum fuel impact.

Arsenic (7.1 μg/L) was exhibited only at TC-2 above its Method A groundwater CUL (5 μg/L); however, it appears that this elevated concentration may be due to the high sediments present in the groundwater sample analyzed for total arsenic. The laboratory analytical result for dissolved arsenic at TC-2 was 1.7 μg/L.

Gasoline- and diesel-range TPH and benzene are considered IHSs for the Site because of their elevated detections.

6.3 Summary

Gasoline-range TPH is the common IHS identified in both soil and groundwater media at the Truck City parcel. Other IHSs identified include diesel-range TPH and benzene in groundwater and ethylbenzene in soil. The impacted soil exhibited at TCBH-3 (8.5 feet bgs) is in the area of the soil remedial action conducted by Ecology in 1993. It appears that localized soil contamination remains adjacent south of the former northern UST nest. Additionally, soil contaminated with residual gasoline- and diesel-range TPH remains on the east side of the truck scale at approximately 4.5 to 10.5 feet bgs (Ecology, 1993; MTC, 2014b).

Groundwater contamination at the Truck City parcel also appears to be localized—limited to areas adjacent to the former USTs and septic waste-oil tank. The gasoline- and diesel-range TPH and benzene concentrations exhibited are indicative of residual contamination in an area where an interim soil remedial action has been completed. Groundwater analytical results from borings and monitoring wells located inferred downgradient of this area did not exhibit detections of the identified IHSs. Laboratory results also indicate no detectable concentrations of COIs at the remaining southern parcels of the Site.

Environmental concerns have been raised regarding the potential for off-Site migration of IHSs to areas west-southwest of the Truck City parcel because of fluctuations in local groundwater flow direction from west-southwest to south-southeasterly. However, groundwater analytical results from all borings and monitoring wells advanced along the western and southwestern Site boundary of the Truck City parcel and at borings advanced on the ROW of Old Highway 99 South indicate no detectable concentrations of IHSs. Additionally, due to the completed remediation activities in Maddox Creek in 2005 to address surface water impact from the Truck City parcel, and based on current data the sediments in Maddox Creek no longer appears to be impacted by releases at the Site (Ecology, 2014).

The lateral and vertical extents of gasoline- and diesel range TPH and selected VOCs identified in soil and groundwater at the Truck City parcel have been sufficiently characterized to select an appropriate cleanup standard and remedy.

7 CONCLUSIONS

A site investigation was completed in order to evaluate the nature and extent of the following COIs in soil and groundwater at the Site: gasoline-, diesel- and lube-oil-range TPH, VOCs, PAHs, and metals. The site investigation results and risk screening indicate that of these COIs, only TPH and selected VOCs are IHSs in soil and groundwater. Exceedances of applicable CULs for these IHSs are localized in soil (depth and areal extent) as well as in groundwater (localized dissolved phase). Human exposure pathways were deemed complete for the identified IHSs in groundwater, while ecological exposure pathways were deemed incomplete.

Findings from collective previous and the recent subsurface investigations and Ecology's interim soil remedial action indicate that historical operations related to the Truck City former USTs and gasoline pump islands are the source of TPH and selected VOC soil and groundwater contamination beneath the Site. The lateral and vertical extent of the dissolved-phase TPH plume has been characterized during this RI/FS. Monitoring wells installed adjacent west of the truck scale and downgradient of former USTs/former gasoline pump islands (along the western Site boundary of the Truck City parcel) and near the south and southwestern area of this parcel may serve as sentinel wells to the IHSs exhibited in the dissolved phase in groundwater.

The final remedial action to address residual petroleum-contaminated soil and groundwater at the Truck City parcel will address the exposure scenarios identified in Section 5.

8 CLEANUP ACTION EVALUATION

This section summarizes two remedial alternatives for addressing the contamination identified on the Truck City parcel. These alternatives are not all-inclusive, but represent the most likely cleanup scenarios and encompass a range from relatively aggressive to relatively limited remedial actions. Depending on the configuration of the Site redevelopment, additional cleanup alternatives could be developed and evaluated.

8.1 Alternative 1: Soil Excavation and In situ Treatment

This alternative represents one of two options for soil and groundwater remediation, but both Alternatives 1 and 2 include the same proposed remedy for petroleum-hydrocarbon-contaminated soil and groundwater. Alternative 1 includes the following actions:

- Petroleum-Hydrocarbon-Contaminated Soil and Groundwater Remedial Action

  Excavation Tasks

  - Excavate impacted soil at the four residual localized impacted areas (including in the vicinity of borings TCBH-1 and TCBH-3 and monitoring well TC-5 and the east side of the truck scale) to approximately 14 feet bgs. Remove the truck scale and associated concrete pad prior to excavation activities. Characterize each area of excavation by collecting soil samples throughout the excavation to assess the lateral and vertical extent of impact. Collect confirmation soil samples from each area of excavation. Collect representative stockpile soil samples and dispose of impacted soil at a permitted disposal facility. The initial area of excavation will be determined based on field screening results. The final excavation area will be determined by confirmation sampling of the excavation sidewalls and base of the excavation pit. Overexcavation of petroleum-contaminated soil below the groundwater table, in the smear zone, is necessary to remove the impacted zone. It is anticipated that removal of up to three monitoring wells will be necessary during soil excavation activities, as these wells are currently located in the vicinity of the proposed soil remedial action. Reinstallation of new monitoring wells in these excavated areas, after completion of this task, will be necessary.

Because the ground water is shallow, each excavation pit will be dewatered. Impacted water will be contained in an appropriately sized tank and will be remediated by cycling of water through granular activated carbon filters and sediment filters. Water samples will be collected from the storage tank and submitted for analysis of TPH and BTEX as well as measurement of the treated water's turbidity to ensure water quality prior to discharging water into the Site's stormwater system. A permit for discharge to the City of Mount Vernon's stormwater system will be obtained prior to discharge.

For cost estimating purposes, the total estimated volume of excavated soil, based on collective subsurface investigation results, is assumed to be 500 cubic yards and is assumed suitable for disposal at a RCRA Subtitle D landfill.

– Backfill the excavation area with clean, imported fill to existing ground surface elevation and compact consistent with construction specifications associated with the jail. Implement vapor intrusion protection in building construction as necessary.

In Situ Bioremediation—Enhanced Aerobic Biodegradation Tasks

– The second phase of this remedial action involves using enhanced aerobic biodegradation to expedite the biodegradation of TPH and VOCs in soil and groundwater by adding oxygen (as an electron acceptor). The addition of a controlled-release supplemental source of oxygen enables the indigenous microorganisms (bacteria) to expedite the biodegradation process. An industry standard oxygen release compound will be added as a soil amendment (dry powder) to the backfill material and applied to each excavation area. Installation of the backfill-mixed oxygen release material will account for the anticipated groundwater smear zone. Installation of a bioremediation product that releases oxygen in the dissolved phase when it is hydrated will provides terminal electron acceptors to support the oxidative biodegradation of petroleum hydrocarbons and VOCs. It is anticipated that generous application of a bioremediation product throughout the smear zone at each localized residual impacted area will remediate both residual saturated soil and groundwater contamination.

– Conduct a baseline groundwater sampling event at the Site's monitoring wells before initiating the in situ bioremediation task. Conduct two years of consecutive quarterly groundwater monitoring events followed by semiannual monitoring for a minimum of one additional year to meet the following objectives: (1) confirm effectiveness of the bioremediation treatment; (2) collect the necessary data for compliance with consent decree based on compliance with CULs; and (3) confirm that petroleum-hydrocarbon-impacted groundwater is not migrating past the POC or downgradient of the Site boundary. Throughout this monitoring period, selected groundwater samples will be analyzed for geochemical parameters (including nitrate, manganese, ferrous iron, sulfate, and methane) to continue assessment of the presence of electron acceptors during the biodegradation process and to evaluate the biodegradation of TPH and selected VOCs.

- The estimated cost for this alternative of $537,800 is presented in Table 3.

8.2 Alternative 2: Soil Excavation and Monitored Natural Attenuation

Alternative 2 includes the same approach for remediation of petroleum-hydrocarbon-contaminated soil and groundwater by overexcavation of impacted soil through the smear zone, but excludes the in situ groundwater treatment component. The task of subsequent groundwater monitoring and sampling events is also consistent with Alternative 1. The estimated cost for this alternative of $506,000 is presented in Table 4.

8.3 Evaluation of Cleanup Alternatives

Alternative 1 provides a more aggressive, and therefore more conservative, approach to remediation of petroleum-hydrocarbon- and VOC-impacted soil and groundwater. Alternative 2 provides a protective but lower-cost approach than Alternative 1. Alternative 2 poses a higher risk of potential migration of impacted groundwater to downgradient areas and likely requires a longer timeframe for obtaining compliance with CULs.

8.3.1 MTCA Threshold Requirements

Cleanup actions are subject to the threshold requirements set forth in WAC 173-340-360 (2)(a). Under the threshold requirements, the cleanup action shall:

- Protect human health and the environment.
- Comply with cleanup standards.
- Comply with applicable state and federal laws.
- Provide for compliance monitoring.

8.3.1.1 Protect Human Health and the Environment and Comply with Cleanup Standards

Alternatives 1 and 2 reduce or eliminate risk from contaminated soil and groundwater through a combination of removal and monitored natural attenuation, or removal and chemical treatment. These remedial actions would eliminate exposure pathways and protect human health and the environment and would comply with cleanup standards.

8.3.1.2 Comply with Applicable State and Federal Laws

The selected CULs are consistent with MTCA. Additionally, local, state, and federal laws related to environmental protection, health and safety, transportation, and disposal apply to each proposed alternative. During remedial design, the selected alternative would be designed to comply with applicable, relevant, and appropriate requirements.

8.3.1.3 Provide for Compliance Monitoring

There are three types of compliance monitoring: protection, performance, and confirmational. Protection monitoring is designed to protect human health and the environment during the construction and operation and maintenance phases of the cleanup action. Performance monitoring confirms that the cleanup action has met cleanup and/or performance standards. Confirmational monitoring confirms the long-term effectiveness of the cleanup action once cleanup standards have been met or other performance standards have been attained. Both cleanup alternatives would meet this provision, as both would require varying levels of all three types of compliance monitoring.

8.4 Other Criteria

MTCA states that when selecting a cleanup alternative, preference shall be given to "permanent solutions to the maximum extent practicable." "Permanent" is defined in WAC 173-340-200 as a cleanup action in which the cleanup standards of WAC 173-340-700 through 760 are met without further action being required at the site being cleaned up or at any other site involved with the cleanup action, other than the approved disposal of any residue from the treatment of hazardous substances.

In order to determine the "maximum extent practicable" for each alternative, a disproportionate-cost analysis outlined in WAC 173-340-360(3)(e) is used. Costs are determined to be disproportionate to benefits if the incremental cost of a more expensive alternative over that of a lower-cost alternative exceeds the incremental degree of benefits achieved by the more expensive alternative. As outlined in WAC 173-340-360(3)(f), the evaluation criteria used were a mix of qualitative and quantitative factors, including protectiveness, permanence, effectiveness over the long term, management of short-term risks, technical and administrative implementability, and consideration of public concerns.

The cleanup alternatives are evaluated by the criteria below.

8.4.1 Protectiveness

Protectiveness is a factor by which human health and the environment are protected by the cleanup action, including the degree to which existing risks are reduced; time required to reduce risk at the Site and attain cleanup standards; on-site and off-site risks resulting from implementing the cleanup action alternative; and improvement of the overall environmental quality. Both of the cleanup alternatives are protective. Alternative 1 has the highest degree of protectiveness because it would actively reduce groundwater petroleum hydrocarbon and associated VOC concentrations below CULs in a relatively short timeframe (one to two years). Alternative 2 is slightly less protective because a longer remediation timeframe would be required to meet groundwater CULs. Groundwater exposure pathways are deemed complete for human receptors and incomplete for ecological receptors. Based on the localized residual contamination, it is unlikely that petroleum-impacted groundwater will migrate off Site at elevated concentrations after completion of the remedial actions proposed in either alternative.

8.4.2 Permanence

Permanence is a factor by which the cleanup action alternative permanently reduces the toxicity, mobility, or volume of hazardous substances. It takes into account the adequacy of the alternative in destroying the hazardous substances, the reduction or elimination of hazardous substance releases and sources of releases, the degree of irreversibility of the waste-treatment process, and the characteristics and quantity of treatment residuals generated. Removal of soils is a permanent remedial action because it permanently eliminates the source of releases at the Site. Both alternatives are equivalently permanent with respect to groundwater, as petroleum hydrocarbons and associated VOCs are removed and destroyed by physical and subsequent enhanced aerobic bioremediation or natural attenuation processes. Therefore, Alternative 1 is ranked higher than alternative 2 for permanence.

8.4.3 Effectiveness over Long Term

Long-term effectiveness includes the degree of certainty that the alternative will be successful; the reliability of the alternative for the expected duration of hazardous substances remaining on site at concentrations that exceed CULs; the magnitude of residual risk with the alternative in place; and the effectiveness of controls required to manage treatment residues or remaining wastes. Long-term effectiveness of Alternative 1 is considered slightly higher than that of Alternative 2, since it has a greater likelihood of successfully decreasing petroleum hydrocarbon and associated VOC concentrations to below CULs over a shorter timeframe.

8.4.4 Management of Short-Term Risks

Short-term risks to remediation workers, the public, and the environment are assessed under this criterion. Generally, short-term risks are expected to be linearly related to the amount of material handled, treated, and/or transported and disposed of (e.g., worker injury per cubic yard excavated [equipment failure], public exposure per cubic yard-mile transported [highway accident]).

This factor addresses the risk to human health and the environment associated with the alternative during construction and implementation, and the effectiveness of measures that will be taken to manage such risks. Potential exposure via transport, handling, and excavation required for both of the alternatives could lead to short-term risks. Alternative 2 does not require handling of oxidizing chemicals, and therefore involves lower short-term risks than Alternative 1.

8.4.5 Technical and Administrative Implementability

This factor addresses whether the alternative can be implemented and is technically possible. The availability of necessary materials; regulatory requirements; scheduling; access for construction operations and monitoring; and integration with existing and neighboring site uses must be considered. The proposed alternatives are both well proven and have been employed at many sites throughout the United States; both are readily implementable and rank equivalently.

8.4.6 Public Concerns

This factor includes considering concerns from individuals; community groups; and local governments, tribes, federal and state agencies, and any other organization that may have an interest in or knowledge of the site and that may have a preferred alternative. Both alternatives provide opportunity for members of the public to review and comment on plans.

8.4.7 Disproportionate-Cost Analysis

In accordance with WAC 173-340-360(3)(e), the most practicable permanent solution evaluated will be the baseline cleanup action alternative to which the other cleanup action alternatives are compared. On this basis, Alternative 2 is the baseline alternative for this analysis. Table 5 summarizes the comparative analysis. Each alternative was given a rating between 1 and 5 (5 being optimal, 1 being inadequate). Where there were only slight differences, fractional ratings were applied.

Based on these criteria, Alternative 1 has a slightly higher rating (4.8) than Alternative 2 (4.4) (Table 5). The cost for Alternative 1 ($537,800) is slightly higher than the cost of Alternative 2 ($506,000). However, Alternative 1 provides longer-term effectiveness and protectiveness.

8.4.8 Recommended Cleanup Alternative

MFA recommends alternative 1 based on an evaluation of the criteria presented above.

LIMITATIONS

The services undertaken in completing this report were performed consistent with generally accepted professional consulting principles and practices. No other warranty, express or implied, is made. These services were performed consistent with our agreement with our client. This report is solely for the use and information of our client unless otherwise noted. Any reliance on this report by a third party is at such party's sole risk.

Opinions and recommendations contained in this report apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this report.

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