DEPARTMENT OF
ECOLOGY
State of Washington

CLEANUP ACTION PLAN

Big B Mini Mart Site, Ellensburg, WA

FSID 386, CSID 4901

November 2020

Prepared by Floyd|Snider
Agreed Order DE 18243

Washington Department of Ecology
Toxics Cleanup Program
Central Regional Office
Union Gap, WA

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List of Acronyms and Abbreviations

Acronym/ Abbreviation	Definition
Anderson	Anderson Rock and Demolition Pits
ARAR	Applicable or relevant and appropriate requirement
AS	Air sparge
bgs	Below ground surface
BNSF	BNSF Railway Company
BTEX	Benzene, toluene, ethylbenzene, and total xylenes
CAP	Cleanup Action Plan
COC	Contaminant of concern
CSID	Cleanup Site ID
DRO	Diesel-range organics
DU	Decision unit
Ecology	Washington State Department of Ecology
EDR	Engineering Design Report

Acronym/ Abbreviation	Definition
FSID	Facility Site ID
GRO	Gasoline-range organics
HASP	Health and Safety Plan
IA	Interim action
ISCO	In Situ Chemical Oxidation
LNAPL	Light non-aqueous-phase liquid
µg/L	Micrograms per liter
mg/kg	Milligrams per kilograms
MNA	Monitored natural attenuation
MPE	Multi-phase extraction
MTCA	Model Toxics Control Act
NES	Northwest Environmental Solutions, Inc.
PID	Photoionization detector
POTW	Publicly Owned Treatment Works
RI/FS	Remedial Investigation and Feasibility Study
ROW	Right of way
Site	Big B Mini Mart Site
SVE	Soil vapor extraction
TEE	Terrestrial ecological evaluation
TPH	Total petroleum hydrocarbons
UST	Underground storage tank
WAC	Washington Administrative Code

Executive Summary

This document presents the Washington State Department of Ecology's (Ecology's) draft Cleanup Action Plan (CAP) for the Big B Mini Mart Site (Site) located 1611 Canyon Road in Ellensburg, Washington. This draft CAP is required as part of the site cleanup process under Chapter 173-340 Washington Administrative Code (WAC), Model Toxics Control Act (MTCA) Cleanup Regulations. This draft CAP describes the proposed cleanup action for this Site and sets forth the requirements that the cleanup action must meet. It will be revised as appropriate by Ecology following receipt of public comment.

The Big B property is located in Kittitas County (parcel no. 958654) within Township 17N, Range 18E, and Section 11. The property is located on approximately 43,960 square feet or 1.05 acres of rectangular paved and unpaved land. The southern half of the parcel consists of currently inactive service station facilities, and the northern half contains approximately 18,500 square feet of unused paved area. The Site is defined under MTCA by the extent of contamination that extends onto the adjacent Astro Station Mini Mart (herein referred to as Toad's) property as well as the adjacent railway right of way (ROW) land owned by BNSF Railway Company (BNSF).

The Big B property was first developed as a service station in the early 1970s. There is no known prior site use. The Zbinden Oil Company leased the property from BNSF or its predecessors from April 1971 through March 2002. The Zbinden Oil Company owned the facilities from 1972 through at least 1986. The Zbinden Oil Company subleased the property to Bernhard E. Schneider from February 1986 through September 1989. The Zbinden Oil Company subleased the property to Balbir Singh and Gurmit Singh Kaila from September 1989 through March 2002. In March 2002, Mr. Singh and Mr. Kaila began leasing directly from BNSF. Mr. Singh and Mr. Kaila continued operation of the facility until Neela Tara, Inc., assumed operations in September 2007, which continued until September 2009. Short Stop, LLC, acquired operation of the station following the end of Neela Tara, Inc.'s business tenure. Short Stop, LLC, ceased active operations in July 2014. At the time, product from underground storage tanks (USTs) was removed, thus placing the station's status into temporary closure. The UST system was permanently closed in November 2016.

Three of the USTs failed cathodic protection audits in June 2010, and in December 2010 the tanks failed corrosion protection tests. In April 2011, an Ecology UST inspector detected liquid consisting of petroleum hydrocarbons floating on groundwater in multiple monitoring or observation wells at the Site.

Several subsurface investigations and interim actions (IAs) were conducted at the Site between 1990 and 2019, which involved excavation of contaminated soil, free product removal, and onsite landfarming of contaminated soil. Results of subsurface investigations determined that concentrations of gasoline-range organics, diesel-range organics, benzene, toluene, ethylbenzene, total xylenes, and/or naphthalene were detected in soil and groundwater above their respective MTCA Method A cleanup levels in several areas where fuel products were stored or dispensed. Petroleum-impacted soil was encountered at depths ranging between 3.5 and 7 feet below ground surface and was found to extend southward onto the downgradient Toad's Mini Mart property as well as onto adjacent BNSF ROW to the west of the Big B property. The most heavily impacted areas are in the southern portion of the property, which was the location of a 12,000-gallon baffled UST that stored diesel. An IA following removal of the former diesel UST in 2016 removed 364 gallons of diesel product from the former tank location.

A Feasibility Study was conducted in 2018 to evaluate the most appropriate remedial approaches for the Site (Floyd|Snider 2018). Three remedies were evaluated, all involving excavation of contaminated soil. Alternative 1 includes excavation of all soil contaminated at concentrations greater than MTCA Method A levels site-wide; the remaining alternatives include removing all soil that is saturated with light non-aqueous-phase liquid (LNAPL) followed by either bioventing the remaining contaminated soil in place (Alternative 2) or treating the remaining contaminated soil with chemical oxidants (Alternative 3). All alternatives allow for onsite landfarming of contaminated soil and all alternatives have a biosparging contingency to treat groundwater should it not fall below MTCA Method A cleanup criteria within a reasonable restoration time frame. A pilot test of landfarming conducted in 2019 demonstrated the effectiveness of landfarming in treating soil to meet MTCA Method A cleanup levels. As presented in the Feasibility Study, Alternative 2, Removal of LNAPL Saturated Soil and Onsite Treatment – Bioventing was selected for implementation at the Site because it meets the MTCA criteria for selection of a cleanup action and is readily implementable.

Alternative 2 consists of excavation of 760 cubic yards of soil within the footprint of the current extent of LNAPL beneath the Site, while leaving behind approximately 2,100 cubic yards of residual hydrocarbon contamination in the soil outside of the LNAPL areas. Contaminated soil would be excavated and landfarmed on site to concentrations less than MTCA Method A cleanup levels and then reused as vadose zone backfill. Bioventing piping would be installed within remaining areas of impacted soil, and a blower used to oxygenate the subsurface to accelerate the natural biodegradation of the residual soil contamination. This alternative includes compliance monitoring of soil and groundwater following remedy implementation.

This executive summary was prepared for introductory purposes only, and the information provided should be used only in conjunction with the full text of this report. A complete description of the project, remedial methods, and results of the remedial actions are contained within this report.

1.0 Introduction

This document presents the Washington State Department of Ecology's (Ecology's) draft Cleanup Action Plan (CAP) for the Big B Mini Mart Site (Site) (Facility Site ID [FSID] #386, Cleanup Site ID [CSID] #4901) located 1611 Canyon Road in Ellensburg, Washington (Figure 1). This draft CAP is required as part of the site cleanup process under Chapter 173-340 Washington Administrative Code (WAC), Model Toxics Control Act (MTCA) Cleanup Regulations. Ecology named Gurmit Kaila Singh, BNSF, Short Stop, LLC; Big B, LLC; Balbir Singh and Neela Tara, Inc. as the Potentially Liable Persons for the Site. Big B LLC, Short Stop, LLC and BNSF have completed the investigation activities under Agreed Order 10813 with Ecology.

1.1 PURPOSE

The purpose of the draft CAP is to describe the selected cleanup alternative for the Site and to provide an explanatory document for public review. More specifically, this plan:

- Describes the Site;
- Summarizes current Site conditions;
- Summarizes the cleanup action alternative considered in the remedy selection process;
- Describes the selected cleanup action for the Site and the rationale for selecting this alternative;
- Identifies Site-specific cleanup levels and points of compliance for each hazardous substance and medium of concern for the proposed cleanup action;
- Identifies applicable state and federal laws for the proposed cleanup action;
- Discusses compliance monitoring requirements; and
- Presents a preliminary schedule for implementing the draft CAP.

Ecology has made a preliminary determination that the cleanup conducted in conformance with this draft CAP will comply with the requirements for selection of a remedy under WAC 173-340-360. As established in WAC 173-340-200, the Site is defined by the full vertical and lateral extent of soil and groundwater contaminated with gasoline-range organics (GRO); diesel-range organics (DRO); benzene, toluene, ethylbenzene, and total xylenes (BTEX); and naphthalene.

1.2 PREVIOUS STUDIES

Several environmental investigations and interim actions (IAs) have been conducted at the Site since 1990, as described in the Remedial Investigation and Feasibility Study (RI/FS) submitted to Ecology in 2018 (Floyd|Snider 2018).

1.2.1 SEACOR 1990

In November 1990, light non-aqueous-phase liquid (LNAPL) was observed to be accumulating on the groundwater surface within a test pit located north of the northern 10,000-gallon underground storage tank (UST) basin for the purpose of installing another UST. Subsequently, a fuel leak in the fiberglass fuel supply line near the northern pump island was discovered and repaired. In December 1990, approximately 420 cubic yards of impacted soil was excavated between the 10,000-gallon diesel UST and the more northern pump island (Figure 2). DRO at concentrations exceeding the MTCA Method A cleanup level was detected in western and southern sidewalls of the excavation. The extent of the excavation was limited due to utilities to the east, the property boundary to the west, the pump island to the north, and the UST basin to the south. Due to the limited extent of excavation, soil contamination remained in place following this IA. Clean fill was transported to the Site and used to backfill the excavation. Impacted soil was stockpiled in an area located approximately 150 feet to the north of the northern pump island and eventually disposed of off-site (SEACOR 1991).

In conjunction with the excavation activities, five monitoring wells (MW-1 through MW-5) were installed on the property. Figure 2 shows the locations of MW-2 and MW-3; MW-1, MW-4, and MW-5 were later replaced with MW-1A, MW-4A, and MW-5A). Soil results for MW-2 contained GRO and total xylene concentrations exceeding their respective MTCA Method A cleanup levels. Two rounds of groundwater sampling were conducted, and results indicated that petroleum hydrocarbons were present at concentrations that exceeded their respective MTCA cleanup levels in monitoring wells MW-2 through MW-5. The second round of groundwater sampling and analysis showed that benzene concentrations varied from 81 to 580 micrograms per liter (µg/L), and diesel was detected at concentrations ranging from 2,100 to 160,000 µg/L. Analysis for lead in either soil or groundwater was not performed even though it was likely that the UST system once contained leaded gasoline. The SEACOR investigation did not define the extent of the groundwater contamination; the impacted downgradient wells were located near the property boundary and no attempt was made to find the downgradient extent of the contamination plume.

1.2.2 Ecology and SAIC 1991

In April 1991, Ecology conducted site hazard assessment activities, which included installing an upgradient monitoring well (MW-6) and collecting groundwater and surface water samples (DPRA and SAIC 1991). The surface water sample was collected at the irrigation ditch outfall underneath the Interstate 90 overpass at Canyon Road. Soil samples were not collected from monitoring well MW-6 due to no recovery. Groundwater samples from monitoring well MW-6 and the irrigation ditch outfall indicated that all analytes were at concentrations less than their respective laboratory detection limits.

1.2.3 Ecology 2011

In February 2011, contractor Northwest Environmental Solutions, Inc. (NES) collected groundwater samples from four wells. The analyses showed DRO, GRO, lead, benzene, toluene, and xylenes at concentrations greater than the MTCA Method A groundwater cleanup levels.

Free product consisting of GRO floating on groundwater was observed by the Ecology UST inspection team conducting a field investigation on April 6, 2011, at the Site. The estimated thickness of free product or LNAPL was at least 0.04 feet (approximately 0.5 inches).

1.2.4 Floyd|Snider 2015 Initial Investigation

In May 2015, Floyd|Snider completed initial site investigation activities in order to delineate hydrocarbon impacts in soil and to investigate groundwater quality and flow direction. Twenty-two test pits were advanced on the property to delineate the nature and extent of soil impacts, and four monitoring wells (MW-1A, MW-4A, MW-5A, and MW-7) were installed (Figure 2). Previously installed monitoring wells MW-1, MW-4, and MW-5 were either damaged or missing; therefore, they were replaced with MW-1A, MW-4A, and MW-5A. Subsequently, three rounds of groundwater monitoring and sampling events were conducted.

Approximately 26 soil samples were collected and analyzed during test pit and monitoring well installation activities. GRO, DRO, BTEX, and naphthalene were detected at concentrations exceeding MTCA Method A cleanup levels. GRO was detected up to 3,700 milligrams per kilograms (mg/kg) and DRO up to 24,000 mg/kg. The distribution of benzene is generally associated with GRO impacts in soil. Oil-range organics were either non-detect or at concentrations less than cleanup levels.

Groundwater sampling results indicated that the lateral extent of dissolved-phase hydrocarbons in groundwater included the areas east-northeast of the station building and southeast of the former southern USTs. DRO was the primary contaminant of concern (COC) in groundwater. LNAPL was detected in monitoring wells MW-2, MW-4A, and MW-5A. Based on the apparent groundwater flow direction, the dissolved-phase plume extended off-property to the south and further investigation was necessary.

1.2.5 Floyd|Snider 2016 Supplemental Investigation Activities

Based on the initial investigation results, residual hydrocarbon impacts in soil were generally delineated beneath the property; however, data gaps remained, including delineating the extent of LNAPL beneath the property and the lateral extension of impacted groundwater to the east and southeast. Therefore, the following supplemental investigation activities were conducted in order to investigate these data gaps:

- Installation of 22 LNAPL piezometers (PZ-1 through PZ-22)
- Installation of three additional groundwater monitoring wells along the eastern property boundary (MW-8, MW-9, and MW-10)

- Groundwater sampling
- Performance of two LNAPL monitoring events

The piezometers were installed to investigate the extent and thickness of LNAPL on the property, and monitoring wells were installed to investigate the extent of dissolved-phase hydrocarbons off-property to the east. Past and current piezometer and monitoring well locations are shown on Figure 2.

1.2.6 2016 Interim Action

In October 2016, the four USTs were removed by NES and an IA for the removal of LNAPL was initiated by Floyd|Snider and Big B with the installation of a sump/skimmer system within a recovery trench dug along the southern boundary of the property (Figure 2). The objective of the interim action activities was to remove LNAPL, as stated in Ecology's June 9, 2016, letter (Ecology 2016a). The IA also included delineation of the lateral extent of soil contamination and/or LNAPL that may have migrated beyond the property boundary onto the adjacent Toad's Mini Mart Site or into the BNSF ROW. The field portion of the IA concluded in November 2017 due to diminishing free product recovery after the removal of approximately 364 gallons of LNAPL and the reduction of the LNAPL footprint across the Site. An IA Report, dated April 27, 2017, summarized the hydraulic recovery of LNAPL at the Site and was included as Appendix D in the RI/FS (Floyd|Snider 2018).

1.2.7 TRC Environmental Supplemental Off-Property Investigations

On November 6, 2017, TRC Environmental, on behalf of BNSF and Big B, conducted a supplemental off-property investigation at Ecology's request. Soil and groundwater samples at three off-property locations (B-1 through B-3) were collected in order to delineate the extent of petroleum hydrocarbons in soil and groundwater (Figure 2). These locations are all due west of the existing railroad berm, approximately 25 feet west of the rail centerline. Soil samples were collected continuously to a depth of 10 feet using a Geoprobe®, and groundwater samples were collected using a small-diameter temporary polyvinyl chloride well casing with a prepacked screen that was inserted into the Geoprobe® boring approximately from 5 to 10 feet below ground surface (bgs). Soil and groundwater analytical results from all three borings indicate that total petroleum hydrocarbon (TPH) concentrations were less than MTCA Method A cleanup levels. These off-property soil borings were successful in delineating the full extent of soil and groundwater impacts to the west and southwest. Activities and results were summarized in the IA Report, which was included as Appendix D in the RI/FS (Floyd|Snider 2018).

1.2.8 Floyd|Snider 2019 Interim Action Landfarming Pilot Test

An IA pilot test of landfarming was performed between July and November 2019 in pursuant to Agreed Order No. DE 16307, concerning the need for an IA pilot test of landfarming at the Site. The IA consisted of two key activities: (1) excavation of contaminated soils in an area known to contain residual LNAPL following UST decommissioning in 2016; and (2) landfarming of the excavated soils within the Site boundary as shown on Figure 1 of the Landfarming Pilot Test

Summary Report (Appendix A). The excavated area was approximately 2,200 square feet in size as measured at the top of slope. The results of the IA indicate that landfarming activities are a suitable remedial action for treatment of contaminated soils at the Site. The main conclusions of this study are as follows:

- The results show that, within 3 months, MTCA Method A cleanup levels can be achieved in soil excavated from areas of free product if conducted during the summer months.
- Odor during excavation and landfarming was not noted to be significant.
- There is ample space on the north lot of the property to perform landfarming on a larger scale.

A copy of the Landfarming Pilot Test Summary Report is provided in Appendix A.

1.3 REGULATORY FRAMEWORK

The Site is being managed under Agreed Order No. 16307, which requires Big B and BNSF prepare a draft CAP for the Site. The cleanup activities will be conducted under a Site development permit and critical area waiver issued by the City of Ellensburg.

2.0 Site Description

The Big B property is located in Kittitas County (parcel no. 958654) within Township 17N, Range 18E, and Section 11. The property is located on approximately 43,960 square feet or 1.05 acres of rectangular land. The southern half of the parcel consists of the currently inactive service station facilities, and the northern half contains approximately 18,500 square feet of unused paved area. The Big B property was first developed as a service station in the early 1970s. There is no known prior use of the property. The southern half of the property includes two former pump islands (northern and southern), a closed convenience store, and former locations of USTs including two former 10,000 gallon steel USTs, a former 4,000-gallon steel UST on the north side of the store, and a former 12,000-gallon baffled steel UST (split into 8,000 gallons of diesel storage and 4,000 gallons of unleaded gasoline storage) on the south end of the property.

The Site also includes releases that migrated to a portion of the property to the south. An active gasoline station and convenience shop, Toad's, is located to the south of the Big B property at 1703 Canyon Road. Soil and groundwater on the Toad's property are impacted by historical releases from the Big B property, and areas impacted are considered by Ecology to be part of the Site. Of note is that Toad's is also a separate site due to releases attributable to the gas station operations on that property. A voluntary cleanup action was conducted by Toad's owner that began in 2015 following discovery of free product under a dispenser in May 2014 that is attributable to the Toad's property. The cleanup action consisted of excavation of petroleum-contaminated soil around the dispensers and construction of a perimeter concrete containment wall. This document focuses on soil and groundwater conditions that are part of the Site. It does not describe releases attributable to the Toad's site nor does it describe cleanup activities to remediate and monitor those releases.

2.1 BIG B PROPERTY HISTORY

BNSF is a former owner of the Big B property. The property transferred from BNSF to Big B, the current owner, on June 30, 2014. The Zbinden Oil Company leased the Site from BNSF from April 1971 through March 2002. The Zbinden Oil Company owned the facilities on the property from 1972 through at least 1986. The Zbinden Oil Company subleased the Big B property to Bernhard E. Schneider from February 1986 through September 1989. The Zbinden Oil Company subleased the Big B property to Balbir Singh and Gurmit Singh Kaila from September 1989 through March 2002. In March 2002, Mr. Singh and Mr. Kaila began leasing directly from BNSF. Mr. Singh and Mr. Kaila continued operation of the facility until Neela Tara, Inc., assumed operations in September 2007, which continued until September 2009. Short Stop, LLC, acquired operation of the station following the end of Neela Tara, Inc.'s business tenure. In 1990, during an excavation for a UST replacement, a diesel release was discovered from a leak in a fuel distribution line. In December 1990, a former operator, Mr. Singh, performed an IA as part of an independent remedial action to remove DRO-contaminated soil and free product. A report of a release was received by Ecology and an initial investigation conducted in 1990–1991 that resulted in a "Further Action" determination and a Site Hazard Assessment. Currently, the Site is ranked as a "3" by Ecology.

Three of the USTs failed cathodic protection audits in June 2010, and in December 2010 the tanks failed corrosion protection tests. In February 2011, NES collected groundwater samples from four wells, although the locations of the samples were not conclusively identified. The analyses showed DRO, GRO, lead, benzene, toluene, and xylenes at concentrations greater than the MTCA Method A groundwater cleanup levels.

Two months after the sampling, a field investigation by Ecology UST inspectors on April 6, 2011, detected free product liquid consisting of GRO floating on groundwater in multiple monitoring or observation wells at the Site. The estimated thickness of free product (LNAPL) was at least 0.04 feet (approximately 0.5 inches).

Short Stop, LLC, ceased active operations by pumping the product from the USTs in July 2014, thus placing the station's status into temporary closure. The UST system was permanently closed in November 2016.

Historical and current tests of groundwater at the Site show that petroleum hydrocarbon contamination exceeds MTCA cleanup standards.

2.2 LAND USE

There is no current land use at the Big B property because it is an inactive fueling station. The property and the surrounding properties are zoned for commercial use. There are no nearby residences. It is anticipated that the Big B property will eventually be used as a fueling station or other commercial use. Canyon Road, a major arterial, is present at the east boundary. The area to the north and to the west beyond the railroad tracks is undeveloped. A gasoline service station is located adjacent to the south.

2.3 GEOLOGIC AND HYDROGEOLOGIC SETTING

The subsurface soils beneath the property consists of brown medium to coarse, gravelly sand to a sandy, coarse gravel and cobbles with approximately 20 percent large gravel and cobbles from the surface to approximately 14 feet bgs, which is the maximum depth that soils were sampled with the drill rig. A dark brown silt layer with some organic matter was encountered between 3 and 5 feet bgs in the southeastern half of the property. All Site soils are considered to have been deposited as recent alluvium in the floodplain of the Yakima River. Comparison of the test pit and soil boring logs across the Site show lateral and vertical heterogeneity typical of alluvial settings.

During the four groundwater monitoring events, the depth to groundwater across the Site was typically found to occur between 3.9 and 7.1 feet bgs. Groundwater elevations fluctuated seasonally, with variations of up to 2.5 feet observed. The local groundwater table is affected by agricultural irrigation, which may affect the natural seasonal pattern of groundwater fluctuation. Typically, the irrigation network is filled in mid-March and is drained in mid-October.

The July and October 2015 sampling events established groundwater flow direction over a larger area using data collected from the Toad's property. Based on these events, groundwater flow direction is generally to the southeast, toward the Toad's property. However, during the March 2016 event, groundwater flow direction was to the southwest (Figure 3). The change in groundwater flow direction was noted after the construction of the perimeter barrier wall surrounding the remediated area near the dispensers at the Toad's Site. It is not known whether this deviation in groundwater flow is anomalous or whether this flow pattern is more prevalent.

The nearest surface water body is Bull Ditch, which is an intermittent stream that branches off from Wilson Creek approximately 0.3 miles northwest of the southwest property boundary of the Big B property. Bull Ditch flows southeasterly.

2.4 HUMAN HEALTH AND ENVIRONMENTAL CONCERNS

Petroleum constituents have been detected in soil and groundwater. Therefore, soil and groundwater (with LNAPL) are impacted media but may also be considered contaminant sources. The potential exposure pathways associated with each medium/source are discussed in the following sections, along with rational for including or excluding that pathway.

2.4.1 Soil and Soil Vapor Pathway

Soil and soil vapor are potential exposure pathways to future onsite workers during construction and/or redevelopment activities. The impacted soil is considered to present a potential direct-contact exposure pathway, leaching to groundwater pathway, and future soil vapor to indoor air pathway. The Big B property is currently inactive and is fenced, so access is restricted to pedestrians. In addition, impacted soil is present within the upper 7 feet, which creates a potential terrestrial ecological evaluation (TEE) pathway for any unpaved portion of the Site, such as on the BNSF ROW. Figure 4 shows the extent of soil contamination at the Site.

2.4.2 Groundwater and Surface Water Pathway

The highest beneficial use of groundwater is assumed to be as a future source of drinking water. Currently, groundwater at this Site is not utilized for drinking. Within 1 mile of the Site are a number of hay field irrigation wells and several single household domestic wells; however, these wells are all screened with a deeper water-bearing zone (60 to 200 feet bgs) and are not located within 500 feet of the subject property.[1] Given that the extent of groundwater contamination is limited and found only in the uppermost feet of the aquifer, it does not pose a current threat to nearby well users. The potable drinking water pathway is considered complete but with a low potential for exposure based on the lack of drinking water wells in the vicinity of the plume.

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[1] https://fortress.wa.gov/ecy/waterresources/map/WCLSWebMap/WellConstructionMapSearch.aspx

Grab samples from B-1 through B-3 indicate that the dissolved-phase plume has been delineated to the west and southwest; therefore, there is no discharge of contaminants to the surface water of the Bull Ditch branch of Wilson Creek, which is approximately 300 feet south-southwest of the Site. Therefore, surface water is not considered to be a pathway of exposure. Figure 5 shows the extent of groundwater petroleum contamination at the Site.

2.5 TERRESTRIAL ECOLOGICAL EVALUATION

Under MTCA, exposure of terrestrial organisms to impacted soils must be evaluated by performing a TEE as described in WAC 173-340-7491. This evaluation involves examination of the nature of potential ecological receptors, the toxicity of soil contaminants to terrestrial organisms and wildlife, and the presence and nature of exposure pathways. The majority of contaminated soil at the Site is covered by buildings, pavement, and other physical barriers. These barriers will prevent wildlife from being exposed to the soil contamination, provided that an environmental covenant is imposed on portions of the impacted property to ensure that the exposure pathway is mitigated. As required by MTCA, a simplified TEE was completed for the Site using WAC 173-340-7492, Table 749-1, and is included as Appendix E in the RI/FS (Floyd|Snider 2018). Based on the results of Table 749-1, the TEE cannot be ended at this point. The TEE will be re-evaluated after cleanup activities and the area of remaining contaminated soil will be considered in an updated TEE.

2.6 CLEANUP STANDARDS

The following subsections summarize the COCs and cleanup levels established for the Site.

2.6.1 Contaminants of Concern

The following COCs were identified at the Site at levels exceeding MTCA Method A cleanup levels in either soil or groundwater or both: DRO, GRO, BTEX, and naphthalene.

2.6.2 Cleanup Levels

Considering the limited number of COCs at the Site, MTCA Method A cleanup levels will be used.

2.6.2.1 Soil

Groundwater is impacted at the Site. Under MTCA Method A, cleanup levels are determined by the most stringent criteria specified under state and federal laws and Tables 720-1, 740-1, and 745-1 of MTCA.

Impacted soil is present within the upper 7 feet, which creates a potential ecological exposure pathway. The Site is considered a commercial site. Industrial/commercial soil concentrations for the protection of terrestrial ecological receptors can be applied, which are 12,000 and 15,000 mg/kg for GRO and DRO, respectively. These concentrations are greater than MTCA Method A and, therefore, use of MTCA Method A cleanup levels will be protective of all pathways, including ecological.

Table 1 presents soil cleanup levels for Site COCs.

Table 1
Proposed Soil Cleanup Levels

Contaminant of Concern	On-Property Maximum Detected Concentration (mg/kg)	Protection of Groundwater MTCA Method A (1) (mg/kg)	Cleanup Levels for Protection of Terrestrial Ecological Receptors (2) (mg/kg)	Proposed Soil Cleanup Level (mg/kg)
DRO	24,000	2,000	15,000	2,000
GRO	3,700	30 (3)	12,000	30
Benzene	1.1	0.03	NA	0.03
Ethylbenzene	15	6	NA	6
Toluene	11	7	NA	7
Xylenes	47	9	NA	9
Naphthalene	6.9	5	NA	5

Notes:
1 Refer to the footnotes of Table 740-1 of MTCA for more details on cleanup level criteria.
2 Concentrations derived from WAC Table 749-2 and using the levels for Industrial/Commercial Sites.
3 Use this value when benzene is present in soil.

Abbreviation:
NA Not applicable

2.6.2.2 Groundwater

Groundwater cleanup levels are based on estimates of the highest beneficial use and the reasonable maximum exposure expected to occur under both current and potential future Site use. Under MTCA (WAC 173-340-720), drinking water is the highest beneficial use, and exposure to contaminants through ingestion and other domestic uses represents the reasonable maximum exposure for all sites. Therefore, groundwater analytical results are compared to MTCA Method A cleanup levels for all groundwater COCs. Table 2 presents groundwater cleanup levels for Site COCs.

Table 2
Proposed Groundwater Cleanup Levels

Contaminant of Concern	Maximum Detected Concentration (µg/L)	MTCA Method A Groundwater (1) (µg/L)	Proposed Cleanup Level (µg/L)
DRO	3,400	500	500
GRO	2,400	800 (2)	800
Benzene	270	5	5

Note:
1 Refer to the footnotes of Table 740-1 of MTCA for more details on cleanup level criteria.
2 Use this value when benzene is present.

2.6.2.3 Vapor

Soil gas to indoor air has not been assessed yet given that there are no occupied buildings on site and future remedial actions will remove most of the hydrocarbon sources. Therefore, after remedial actions, vapor intrusion will be assessed by direct measurement of soil gas concentrations in the subsurface above areas of residual soil contamination. Soil gas concentrations for TPH will be derived following the protocol outlined in Ecology's Vapor Intrusion Guidance and Implementation Memorandum No. 18 (Ecology 2018a and 2018b). Soil vapor sampling activities are detailed in the Engineering Design Report (EDR), which is included as Appendix B.

2.7 CLEANUP ACTION ALTERNATIVES

The general categories of remedial action that were presented and evaluated in the RI/FS (Floyd|Snider 2018) include the following:

- Monitored natural attenuation
- Institutional controls
- In situ remediation
- Ex situ remediation

These categories of remedial action can generally be applied as components of remedial actions and in some cases as standalone remedies.

Monitored Natural Attenuation. This involves regular soil and/or groundwater sampling to monitor the results of one or more naturally occurring physical, chemical, or biological processes that reduces the mass, toxicity, volume, or concentration of contaminants in soil. However, this alternative must be paired with source removal; by itself, it is not a complete remedial action and so is eliminated from further consideration as a standalone remedy.

Institutional Controls. Institutional controls are physical, legal, and administrative measures that are implemented to minimize or prevent human exposure to contamination by restricting access to the Site. Institutional controls often involve deed restrictions or covenants, site advisories, use restrictions, or consent decrees and would be implemented at the Site to limit or prohibit activities that may interfere with the integrity of any cleanup action or result in exposures to hazardous substances at the Site. Institutional controls are typically implemented in addition to other technologies when those technologies leave COCs on site at concentrations greater than cleanup levels. Similar to monitored natural attenuation, the institutional controls alternative as a standalone alternative is eliminated from further consideration, but the implementation of institutional controls in conjunction with other remedies is retained.

In Situ Remediation. In situ remediation involves treating in place the soil and groundwater to reduce contaminants to concentrations that comply with established cleanup standards. In situ soil remediation alternatives include soil vapor extraction (SVE), multi-phase extraction (MPE), bioremediation, and chemical oxidant applications. Groundwater remediation alternatives include air sparge (AS), MPE, enhanced bioremediation (bioventing or bio-sparging), and chemical oxidant injections. In situ remediation can require several years to reduce the contaminant concentrations to less than MTCA cleanup levels depending on site conditions and the effectiveness of the treatment system. In situ treatment can be a part of a combined remedy to bring down aqueous-phase contaminant concentrations to near compliance and then transition from active remediation to passive remediation (e.g., monitored natural attenuation). The overall effect is to reduce the restoration time frame.

The majority of the contamination in groundwater at the Site generally consists of mid-weight hydrocarbons, as opposed to lighter and more volatile COCs such as benzene that are more amenable to several in situ technologies such as SVE, MPE, or AS. Mid-weight hydrocarbons are more effectively addressed in situ by enhanced aerobic bioremediation technologies versus in situ technologies such as SVE or AS that rely on physical properties of contaminants to be effective.

Ex Situ Remediation. Ex situ remediation includes excavation of contaminated soil and either aboveground treatment or offsite disposal. Aboveground treatment technologies include biopiles, landfarming, and low-temperature thermal desorption. Offsite disposal consists of contaminated soil excavation and transport to an engineered, permitted landfill. Excavation and disposal provides the quickest permanent solution. Offsite disposal does not specifically address groundwater contamination except through removal of a continuing contaminant source. Follow-on in situ remediation techniques would likely be required in combination with source removal to remediate groundwater and any contaminated soil left in place. Contaminated soil excavated from the Site would likely be either landfarmed on site or transported to the Anderson Rock and Demolition Pits (Anderson) in Yakima, Washington, for landfarming.

2.8 INTITIAL SCREENING OF ALTERNATIVES

The purpose of identifying and screening potential cleanup action alternatives is to eliminate those alternatives that clearly are not applicable, not practicable, or are not technically feasible due to Site conditions or other constraints. Eliminated alternatives did not meet the following preliminary requirements: protective, permanent, effective, easy to implement, applicable to Site conditions, and/or cost effective relative to the resulting benefits.

2.8.1 Eliminated Alternatives

Of the initial alternatives reviewed, the following were excluded from further evaluation:

Soil Vapor Extraction. SVE for vadose zone remediation is effective when the primary contaminants are gasoline-related, which are typically easily volatilized. However, the majority of Site contaminants are related to the diesel release. Gasoline-related contaminants at the Site are present but are not extensive. Site conditions are not favorable for this technology.

Pump and Treat. Given the high groundwater table and recharge rate, pump and treat options/hydraulic recovery options for LNAPL are eliminated due to costs. In addition, the City of Ellensburg's Publicly Owned Treatment Works (POTW) will not accept any additional volume of wastewater to their facility.

Dual-Phase Extraction. Extracted liquids and vapor are treated and/or collected for disposal. For the same reasons as the above technology, conditions are not favorable for this technology.

Enhanced Biodegradation. This technology was rejected due to excessive complications associated with its operation and its requirement of offsite disposal of treated water, which is not possible due to limitations of the City of Ellensburg POTW.

Air Sparging. This technology is not as favorable for diesel-related constituents, which are the primary constituents in groundwater.

Barrier Wall. Barrier walls are often used in conjunction with groundwater extraction to maintain hydraulic control of the plume and prevent the migration of contaminants around or underneath the barrier. This technology is not favorable for the reasons listed above.

In Situ Chemical Oxidation (ISCO). ISCO treatment will reduce the contaminant mass associated with LNAPL, but it is difficult or impracticable to apply enough oxidant to treat all of the LNAPL; therefore, this is not a technology that can be used alone at the Site.

2.8.2 Retained Alternatives

Based on detailed screening, three remedial alternatives (Alternatives 1 through 3) were developed to address soil and groundwater contamination Site-wide in a reasonable restoration time frame. The three selected remedial alternatives provide a range of permanent cleanup actions for contaminated soil and groundwater at the Site. Each remedial alternative includes soil and groundwater monitoring to confirm effectiveness. All three alternatives will require an updated access agreement with BNSF that includes soil removal and monitoring well installation and monitoring on the BNSF ROW. The proposed alternatives (refer to Figure 6) are as follows:

- Alternative 1: Excavation of all soil on both Big B and Toad's properties and on BNSF ROW (to maximum extent practicable; some may extend under the BNSF rail line or possibly the Canyon Road ROW) with concentrations of COCs exceeding MTCA Method A cleanup levels.
- Alternative 2: Excavation of soil with LNAPL only, which addresses the requirement to remove LNAPL to the maximum extent practical. The remaining vadose zone soil with concentrations of COCs greater than cleanup levels outside of the LNAPL areas would be addressed by bioventing. Groundwater contamination will be addressed by biosparging as a contingency in case excavation and bioventing fail to meet groundwater cleanup levels in a reasonable restoration time frame.
- Alternative 3: Excavation of soil within the LNAPL areas extent only, which addresses the requirement to remove LNAPL to the maximum extent practical. Following

excavation, ISCO would be used to achieve MTCA Method A cleanup levels in remaining vadose zone soil with concentrations of COCs that exceed MTCA Method A cleanup levels. Groundwater contamination will be addressed by biosparging as a contingency in case excavation and bioventing fail to meet groundwater cleanup levels in a reasonable restoration time frame.

2.9 DETAILED EVALUATION OF ALTERNATIVES

The following sections describe the process used to evaluate the alternatives remaining after the initial screening and the rational for the remedy ultimately selected. This evaluation process included an evaluation of compliance with the minimum requirements set forth in WAC 173-340-360(2)(a) through WAC 173-340-360(2)(f). The Disproportionate Cost Analysis presented in the RI/FS is shown in Table 3.

2.9.1 Alternative 1—Excavation of Soil Exceeding MTCA Method A Cleanup Levels

Alternative 1 consists of excavation of approximately 3,260 cubic yards of contaminated soil exceeding MTCA Method A cleanup levels to the maximum extent practicable beneath the Site. The northern half of the property is paved and can contain up to approximately 1,000 cubic yards of contaminated soil for landfarming in biopiles if placed in approximately a pile with a 1-foot lift. Therefore, given the impracticality of onsite treatment due to space limitations, remaining contaminated soil would need to be transported to Anderson in Yakima, Washington, for landfarming. This alternative includes compliance monitoring of groundwater and soil. Bioventing would not be necessary with this alternative because all accessible soil source material beneath the Big B, BNSF, and Toad’s properties would be removed. If groundwater levels do not come into compliance following soil removal, biosparging would be used as a contingent remedy to achieve compliance. The excavation extent of soil exceeding MTCA Method A cleanup levels is shown on Figure 6. This alternative will require a review and approval with BNSF and an updated Access Agreement that includes soil removal on BNSF ROW prior to starting remedial activities.

Implementing Alternative 1 at the Site would require considerable costs to achieve cleanup levels when compared to Alternative 2. The 5-year groundwater restoration time frame is equal across all alternatives.

2.9.2 Alternative 2—Removal of LNAPL Saturated Soil and Onsite Treatment – Bioventing

Alternative 2 consists of excavation of soil within the footprint of the current LNAPL plume beneath the Site, while leaving behind residual hydrocarbon contamination at concentrations greater than MTCA Method A cleanup levels in the soil fringing and downgradient of the LNAPL areas as shown on Figure 6. The excavation of the entire area of LNAPL-containing soil and landfarming area for on-site ex situ treatment is shown on Figures 7 and 8. Approximately 760 cubic yards of LNAPL-contaminated soil would be excavated and landfarmed on site to concentrations less than MTCA Method A cleanup levels and then reused as vadose zone backfill. Contaminated soil may also be trucked off site for treatment or disposal if appropriate. This volume does not include the 240 cubic yards of contaminated soil already excavated and treated during the landfarming IA activities. Bioventing piping would be installed within remaining areas of impacted soil and a blower used to ventilate and encourage aerobic biodegradation of contamination in the remaining soil. This alternative includes compliance monitoring of soil and groundwater and institutional controls, if needed, and meets all MTCA criteria for selection of a cleanup action. It also includes a biosparging contingency to be implemented in case post-remedy groundwater monitoring does not indicate compliance with the cleanup levels in a reasonable restoration time frame. This alternative will require a review and approval with BNSF and an updated Access Agreement that includes soil removal on BNSF ROW prior to starting remedial activities.

2.9.3 Alternative 3—Remove LNAPL and Treat Residual Soil with ISCO

Alternative 3 includes the excavation of the entire area of the known LNAPL extent beneath the Big B, BNSF, and Toad's properties to the maximum extent possible. Excavation of contaminated soil would involve removal and stockpiling the upper 3 feet of clean overburden followed by the removal of approximately 3 to 8 feet of underlying contaminated soil containing LNAPL. Approximately 760 cubic yards of contaminated soil would be landfarmed on site to concentrations of COCs less than MTCA Method A cleanup levels and reused in the upper vadose zone following confirmation sampling. This volume does not include the 240 cubic yards of contaminated soil excavated and treated during the landfarming IA activities.

Approximately 2,365 cubic yards of soil contaminated at concentrations greater than MTCA Method A cleanup levels, following NAPL removal, will be treated by ISCO. This will be done by mixing onsite following LNAPL excavation using machinery to mix soil and oxidants together. Areas that are inaccessible to excavation and in situ mixing may be treated by injection if practical. The ISCO treatment areas are shown on Figure 6. This alternative will require a review and approval with BNSF and an updated Access Agreement that includes soil removal on BNSF ROW prior to starting remedial activities.

Implementing Alternative 3 at the Site would require considerable costs to achieve cleanup levels when compared with Alternative 2, and the environmental benefits for Alternative 3 are approximately equal with Alternative 2. The 5-year groundwater restoration time frame is equal across all alternatives.

3.0 Description of Selected Remedy

The selected remedy, based on the Disproportionate Cost Analysis, is Alternative 2. It meets all MTCA requirements for remedy selection. The key cleanup elements include the following:

- Negotiating an updated Access Agreement with BNSF that includes soil removal on BNSF ROW.
- Excavation of LNAPL-impacted soil as show in Figure 7
- Onsite landfarming of excavated soil and/or transportation and disposal of contaminated soil off site
- Installation of bioventing equipment following a bioventing pilot test
- Installation of monitoring wells and groundwater monitoring
- Sub-slab vapor assessment for the current building

The selected remedy will apply to the entire Site, which includes contaminated soil and groundwater beneath the Big B, Toad's, and BNSF properties.

3.1 DESCRIPTION OF THE CLEANUP ACTION

Alternative 2 includes several elements and will occur in phases. The first phase of remedial activities will be performed on the Big B property and BNSF property adjacent to the west of the Big B property. The second phase will be performed on Toad's property and BNSF property adjacent to the west of Toad's once the first phase excavation on the Big B property has been backfilled with treated soil and restored to original grade. Each element of both phases is summarized in the following sections, and details are provided in the EDR (Appendix B). The cleanup activities will be conducted under a Site development permit and critical area waiver issued by the City of Ellensburg.

3.1.1 Excavation of LNAPL-Saturated Soil

The entire area of LNAPL-containing soil beneath the Big B, BNSF, and Toad's properties will be excavated to the maximum extent possible. Three separate areas of LNAPL are shown on Figure 7 based on soil analytical data and visual observations of LNAPL in monitoring wells and piezometers.

Prior to initiating excavation activities, monitoring wells located within the excavation/shoring footprint will be decommissioned in accordance with Chapter 18.104 RCW.

Shoring will be composed of a 1:1 slope to facilitate the safe excavation of contaminated soil to the required depth of 8 feet bgs. However, excavation activities on BNSF property and adjacent to the railroad will have a sidewall slope ratio of not greater than 1:2 starting from 15.5 feet from the centerline of the railway in accordance with BNSF Guidelines for Temporary Shoring (BNSF and Union 2004). Excavation activities will be conducted using standard construction equipment.

Excavation of contaminated soil would involve removal and stockpiling the upper 3 feet of clean overburden followed by the removal of approximately 3 to 8 feet of underlying contaminated soil.

Soil deeper than 3 feet bgs is expected to be impacted by petroleum hydrocarbons. This soil will be excavated out to no more than 1 foot below the water table (expected to occur between 4 and 6 feet bgs). If free product is observed running out of the excavated soil, it will be allowed to drain back into the excavation (e.g., via drain holes in the excavator bucket) or captured using a vacuum hose and/or adsorbent pads. Once free of drainable liquids, impacted soil will be transported and stockpiled on site for ex situ biological treatment within the landfarming treatment area shown on Figure 8 (refer to Section 3.1.2 for details).

Contaminated soil excavated beneath Toad's property and the adjacent BNSF property will be directly loaded on trucks and transported to the Site for landfarming or, alternatively, may be taken off site for disposal to Anderson in Yakima, Washington. The excavation extent on Toad's property will be backfilled immediately, compacted with clean imported soil with a standard 90 percent field compaction, and repaved with asphalt to restore to the original surface conditions in accordance with the access agreement.

Excavations on BNSF property will be backfilled with clean imported fill below the water table and with laboratory-confirmed clean overburden soil above the water table, as per the access agreement. Approval to backfill above the water table with clean overburden will be obtained from BNSF prior to backfilling. If clean overburden soils do not meet BNSF requirements, excavations on the BNSF property will be backfilled above the water table with imported native sand and gravel from a local pit. In addition, soils on BNSF property will be compacted between 90 and 95 percent per the access agreement and in accordance with BNSF engineering requirements.

3.1.2 Onsite Ex Situ Biological Treatment

Excavated contaminated soil will be treated on site by landfarming and reused as vadose zone backfill following landfarming and confirmation that TPH concentrations are less than their respective MTCA Method A cleanup levels. Contaminated soil will be spread out in two separate areas (one main area for DRO-impacted soil located around the former UST that was removed in 2017 and a smaller area with GRO/DRO-impacted soil near the former fuel dispensers) using a 1- to 1.5-foot lift in the landfarming area in the northern paved portion of the lot (Figure 8). Excavated soil will be mixed with granulized and/or liquid fertilizer. Soil would also be placed on a plastic liner and bermed to contain stormwater. Fertilizer, primarily nitrogen, would be reapplied to the soil during tilling activities, which would occur at least once a month for a 1- to 3-month estimated treatment period during the summer months between late June and late August.

Once the landfarmed soil is free of odor and sheen, samples will be collected for laboratory analysis. If laboratory results indicate that COC concentrations are less than their respective MTCA Method A cleanup levels, the treated soil will be returned to the excavation area.

If after 3 months of treatment during summer months, soil cleanup levels in any sub-area have not been achieved, arrangements will be made to transport that soil for offsite disposal at a permitted facility, such as Anderson Landfill in Yakima, Washington, and acquiring approval from the Yakima Health District.

3.1.3 Bioventing

Bioventing will be used with this alternative in order to remediate impacted soil remaining in the vadose zone. Prior to installation of the full-scale bioventing system, a pilot study will be conducted in order to determine the radius of influence and other system parameters. This pilot test will use the existing piezometers and wells to the degree possible and will be conducted after excavation activities are completed and the extent of residual soil defined. A small blower will be placed above ground and tied into an existing monitoring well or piezometer. This blower will provide fresh air at various rates to the subsurface soils. Oxygen, carbon dioxide, lower explosive limit measurements, and differential pressure will be recorded from gas probe implants and/or existing well and piezometer locations using a four-gas meter and pressure gauge, which will compare those measurements with baseline measurements.

Generally, the radius of influence for bioventing can range from 5 feet for fine-grained soils to 100 feet for coarse-grained soils (USEPA 2017). Wells can be installed either horizontally or vertically. Figure 7 shows the proposed layout for the bioventing lines. The final design and layout will follow pilot test activities which could result in use of vertical wells. Construction materials and pilot test design details and protocols are detailed in the EDR (Appendix B).

3.2 CLEANUP STANDARDS AND POINTS OF COMPLIANCE

As discussed above and described in the RI/FS (Floyd|Snider 2018), given the relatively few hazardous substances, MTCA Method A cleanup levels were used to develop cleanup levels for COCs at the Site.

A point of compliance is defined in MTCA as the point or points on a site where cleanup levels must be met. MTCA defines a standard point of compliance as throughout the site, and unless a site qualifies for a conditional point of compliance, cleanup levels must be met in all media at the standard point of compliance (i.e., throughout the Site).

3.2.1 Point of Compliance

There are several points of compliance in regard to attaining cleanup levels in soil as listed below:

- For protection of groundwater, the standard point of compliance for groundwater is defined in WAC 173-340-720(8)(b) as “throughout the site from the uppermost level of the saturated zone extending vertically to the lowest most depth which could potentially be affected by the site,” meaning any groundwater at the Site that exceeds the cleanup standard, at any depth.
- For the protection from vapors, the point of compliance throughout the site extends from the ground surface to the uppermost groundwater saturated zone.

- For human exposure through direct contact, the point of compliance throughout the Site extends from the ground surface to 15 feet bgs.

3.3 APPLICABLE, RELEVANT, AND APPROPRIATE REQUIREMENTS

In the RI/FS, an evaluation of the applicable or relevant and appropriate requirements (ARARs) was completed for each remedial alternative and is summarized in Table 4.

As part of the cleanup standards determination, the MTCA Method A cleanup levels were compared to applicable state and federal standards to ensure that the most stringent and protective cleanup levels were selected for application at the Site. The following state and federal standards for groundwater were reviewed and found to be equivalent to or less stringent than that of the MTCA Method A cleanup levels:

- Maximum Contaminant Levels established under the Safe Drinking Water Act and published in 40 CFR 141
- Maximum Contaminant Level goals for non-carcinogens established under the Safe Drinking Water Act and published in 40 CFR 141
- Maximum Contaminant Levels established by the state board of health and published in WAC 246-290

There are no chemical-specific ARARs that apply to soil; therefore, the MTCA Method A soil cleanup levels for unrestricted land use are the most stringent applicable cleanup level. Refer to Table 4 for additional state and federal regulations that may apply to the Site.

3.4 RESTORATION TIME FRAME

Excavation of the LNAPL-containing soils will result in a significant reduction of contaminant mass. Experience with similar site conditions and COCs suggests that the bioventing system will reduce COC concentrations in the vadose zone relatively quickly; within 5 to 10 years after excavation is a reasonable expectation.

Semiannual groundwater monitoring activities will be used to monitor concentrations of COCs. Compliance monitoring (including performance and confirmational monitoring) is anticipated to continue for 5 to 10 years and will begin after the full-scale bioventing system has been installed. Performance sampling will occur on a semiannual basis, once during the high groundwater season (April) and once in the low groundwater season (October) until groundwater analytical data indicate that cleanup levels have been achieved. When cleanup levels in groundwater are first achieved, the bioventing system will be shut down and compliance sampling will begin after 3 months following shutdown to allow subsurface conditions to reach equilibrium; then the frequency of groundwater monitoring will be increased to quarterly until cleanup levels are met in four consecutive events. If groundwater cleanup levels are not met or do not show a declining trend in concentrations by the fifth year of groundwater performance monitoring following shutdown of the bioventing system, there will be a contingency action to evaluate and install a biosparging system or other contingency actions such as additional soil excavation (refer to Section 4.3.1.1).

4.0 Compliance Monitoring

There are three types of compliance monitoring identified for remedial cleanup actions performed under MTCA (WAC 173-340-410): protection, performance, and confirmational monitoring. A paraphrased definition for each is presented below (WAC 173-340-410[1]):

- **Protection Monitoring:** To evaluate whether human health and the environment are adequately protected during construction and the operation and maintenance period of an IA or cleanup action
- **Performance Monitoring:** To document that the cleanup action has attained cleanup standards
- **Confirmational Monitoring:** To evaluate the long-term effectiveness of the cleanup action once cleanup standards or other performance standards have been attained

The EDR (Appendix B) presents the details of compliance monitoring; basic summary elements are as follows.

4.1 PROTECTION MONITORING

A Health and Safety Plan (HASP) that meets the minimum requirements for such a plan identified in federal (Title 29 of the CFR, Parts 1910.120 and 1926) and state regulations (WAC 296) will be prepared prior to implementing the cleanup action. The HASP will identify the known physical, chemical, and biological hazards; hazard monitoring protocols; and administrative and engineering controls required to mitigate the identified hazards. Protection monitoring will be performed using a photoionization detector (PID) to measure volatiles and to ensure that personnel are not subject to unsafe conditions while working on the Site.

4.2 PERFORMANCE MONITORING

4.2.1 Excavation Confirmational Soil Sampling

Sidewall samples will be collected at the limits of the excavations to confirm the removal of LNAPL-saturated soil. Soil analytical results will be compared to DRO and GRO residual saturation values of 8,000 and 1,700 mg/kg, respectively, that were proposed in the 2016 Site Investigation Summary Report (Floyd|Snider 2016). In addition, Sudan IV dye field kits will be used to identify the presence of LNAPL (either residually trapped or mobile) in sidewall soil samples. Details are provided in the EDR (Appendix B).

The final lateral dimensions and shape of each excavation will determine the actual number and location of soil samples. At a minimum, one soil sample will be collected from each sidewall every 20 feet laterally and at a depth between 4 and 6 feet or from areas where field screening indicates that contamination is present. In addition, samples from the base of the excavation will be collected every 400 square feet as per Ecology's *Guidance for Remediation of Petroleum Contaminated Sites* (Ecology 2016b). Additional soil excavation will occur if these LNAPL residual saturation levels are exceeded or there are signs of LNAPL bleeding back into the excavation from the sidewalls.

4.2.2 Stockpiled Soil Sampling for Reuse and Backfilling

Stockpiled soil for immediate reuse will be sampled and analyzed to determine its ultimate disposition consistent with Ecology's Guidance for Remediation of Petroleum Contaminated Sites (Ecology 2016b). A minimum of three samples will be collected from each stockpile up to 100 cubic yards in volume, and five samples will be collected for stockpiles between 100 to 500 cubic yards in volume. Stockpile samples will be analyzed for the same constituents as the excavation samples. Stockpiles confirmed to be free of petroleum impacts in exceedance of MTCA Method A cleanup levels will be used as backfill. Any overburden stockpiles with concentrations of COCs exceeding MTCA Method A cleanup levels will be transported and placed within the landfarming area for treatment.

4.2.3 Landfarming Soil—Confirmational Soil Sampling

Confirmation samples will be collected once the soil (both DRO-impacted soil and GRO/DRO-impacted soil) in the landfarming areas is free of odor and sheen throughout the stockpile. Each stockpile will be thoroughly inspected for sheen, odor, and PID readings. Confirmation samples will be collected in accordance with Table 6.9 in Ecology's *Guidance for Remediation of Petroleum Contaminated Sites* (Ecology 2016b).

The landfarming area for the DRO-impacted soil will be divided up to four equal decision units (DU). The landfarming area for the smaller pile of GRO/DRO-impacted soil will be in one stockpile or its own separate DU. The number of confirmation soil samples will be based on the volume of each DU/stockpile (e.g., three samples for less than 100 cubic yards, five samples for 100 to 500 cubic yards, etc.). The soil samples will be analyzed for DRO by NWTPH-Dx, for GRO by NWTPH-Gx, and for volatile or semivolatile organic compounds including BTEX and naphthalene by USEPA Method 8260. Soil samples for volatile organics analysis shall be collected by USEPA Method 5035. Further details on sampling and analysis protocols are in Appendix B.

4.3 CONFIRMATIONAL MONITORING

4.3.1 Confirmational Groundwater Monitoring

Three monitoring wells, MW-2A (replaces the former MW-2 on the Big B property), MW-4B, and MW-9A, will be re-installed following excavation activities to replace those that were decommissioned (Figure 9). Performance groundwater sampling will be conducted on a semiannual basis on wells MW-2A, MW-4B, and MW-9A located on the Big B property, and wells MW-1 and MW-2 located on Toad's property. Wells will be sampled once in the dry season and once in the wet season. Monitored natural attenuation (MNA) parameters will be analyzed during the first four sampling events and total organic carbon will be analyzed once on the following performance wells: MW-2A (Big B), MW-4B (Big B), and MW-1 (Toad's). MNA monitoring will be conducted in accordance with WAC 173-340-820 and MNA parameters are summarized in the Sampling and Analysis Plan/Quality Assurance Project Plan (Appendix C of the Engineering Design Report).

Semiannual monitoring will be conducted until groundwater analytical data indicate that cleanup levels have been achieved in any particular well, at which time the frequency of groundwater monitoring will be increased to quarterly. At least four consecutive quarters of confirmational groundwater data will be collected from the following Big B wells: MW-2A, MW-4B, MW-7, MW-8, MW-9A, and MW-10; and from the following Toad's property wells: MW-1, MW-2, and MW-15. Once a well has achieved four consecutive quarters of compliance following shutdown of the bioventing system, it will be removed from the network.

4.3.1.1 Biosparge Contingency

There is a contingency for installation and implementation of biosparging system or other contingency actions such as additional soil excavation if groundwater cleanup levels are not met or if results do not show a decline in concentrations during the fifth year of groundwater compliance monitoring. A periodic 5-year review will be conducted that will review the groundwater data to determine if there is a declining trend in TPH concentrations due to remedial activities and biodegradation and not associated with seasonal fluctuations or changing groundwater flow directions. The data reviewed will include TPH concentrations with and without silica gel cleanup, MNA data, and groundwater fluctuations and flow direction. Select data will be used to properly perform a trend analysis using tools such as a non-parametric Mann-Kendall test or Ecology's Natural Attenuation Analysis Tool Package for Petroleum-Contaminated Groundwater (Ecology 2005).

4.3.2 Vapor Sampling

Future Site use plans include using the current building; therefore, a temporary sub-slab vapor point will be installed in the slab of the current building footprint (Figure 9). A Cox-Calvin & Associates, Inc., VAPOR PIN® point will be installed with a stainless-steel secure cover. The vapor pin will extend 6 inches below the surface of the concrete floor slab in order to collect soil vapors accumulating directly under the slab. The standard operating procedure will be followed during installation of the vapor pins (Appendix B of the EDR).

Once the vapor pin is installed, it will be allowed 48 hours to equilibrate, prior to collecting a soil vapor sample. Soil gas results will be compared to screening levels presented in the updated Table B-1 of Ecology's Vapor Intrusion Guidance; furthermore, if needed, results will be used to develop site-specific indoor air cleanup levels in accordance with Attachment B of Ecology's Implementation Memorandum No. 18 for petroleum vapor intrusion (Ecology 2018a and Ecology 2018b). Vapor pin installation and soil gas sampling details are included in the EDR, and activities will be conducted in accordance with Floyd|Snider's Vapor Intrusion Standard Guidelines (Appendix B).

4.3.3 Confirmational Soil Sampling

Once four consecutive quarters of groundwater sampling indicate that groundwater concentrations are less than MTCA Method A cleanup levels, soil samples will be collected from areas with the greatest remaining TPH impacts. Site-specific MTCA Method B cleanup levels will be developed for direct contact to confirm that the Site is in compliance.

4.4 PERMITS AND SCHEDULE FOR IMPLEMENTATION

The preferred remedial alternative requires the warm, dry summer months of June, July, and August in order to be effective. The excavation and landfarming are planned to start in early-June 2021, if feasible. Estimated durations are provided for discussion and planning purposes only:

Table 5
Cleanup Action Implementation Schedule

Implementation Step	Estimated Duration
Prepare and Submit Agency Review Draft CAP	February 24, 2020
Submit Public Review Draft CAP to Ecology	Within 45 calendar days of receipt of Ecology's Comments on the Agency Review Draft CAP
Public Comment Period for Draft CAP	30 days
Finalize and Submit Final CAP	Within 45 calendar days of receipt of Ecology's comments on the Public Review Draft CAP
Submit Progress Reports	Monthly on the 15th
Acquire Project Permits: • Engineered Grading permit • Site Development Permit • Critical Area Determination Waiver	July 2020 or early 2021
Remedial Action Construction; assume duration of 3 to 4 months, summer months only	Summer 2021
Submit Pilot Test Bioventing Work Plan	Within 90 days after excavation and backfilling activities are completed on the Big B property
Prepare Remedial Action Completion Report, Receive Ecology Approval, and Initiate Confirmation Groundwater Monitoring 90 days after approval	Winter 2021
Conduct Semiannual Groundwater Monitoring	2021–2031

4.5 INSTITUTIONAL/ENGINEERING CONTROLS

No institutional or engineering controls are anticipated to be necessary following completion of the cleanup action described herein, which will achieve cleanup levels in soil and groundwater across the Site in a reasonable restoration time frame.

5.0 References

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Big B Mini Mart Site

Cleanup Action Plan

Tables

Table 3
Evaluation of Cleanup Alternatives

Potential Alternative	Description	Disproportionate Cost Analysis – Relative Benefits Ranking[1]							Sustainability		Considered Potentially Applicable
		Protectiveness	Permanence	Long-Term Effectiveness	Implementability	Short-term Risk	Public Concerns[2]	Cost	Economic	Environmental	
Alternative 1: Full Soil Excavation to MTCA Method A CULs and Offsite Disposal	Excavation of approximately 3,500 cubic yards of soil exceeding MTCA Method A Cleanup levels to the maximum extent practicable. Soil will be transported offsite for disposal.	Highest level of protectiveness; impacted soil removed from beneath the Site to MTCA Method A cleanup levels. **Score: 3**	This alternative will achieve the highest level of permanence and reduce contaminant contaminations in groundwater and soil. **Score: 3**	Effective in permanently removing impacted soil below MTCA Method A cleanup levels to the maximum extent practicable and most effective in reducing groundwater concentrations. **Score: 3**	Implementable, technically possible, offsite disposal facilities are available. Excavation below the water table is not as feasible and shoring would be required. Stormwater construction management likely required. **Score: 3**	This alternative involves excavation to the groundwater interface. Shoring is required adjacent to a sidewalk and roadway, which can be a potential public safety concern. **Score: 2**	Likely public concerns regarding excavation safety and trucks entering and exiting the Site with impacted soil and clean backfill. Potential concern with impacted soil remaining beneath the right of way. **Score: NA**	Very High Approximately $856,082 **Score: 1**	High economic loss to future development of the property.	Partial negative balance of environmental impact due to CO_2 emissions from numerous trucks hauling soil to and from Anderson Pit. The increase in the carbon footprint due to raw material consumption (fuels and electricity), greenhouse gas emissions (heavy equipment and operating system) is not ideal or as sustainable Alternatives 2 and 3. In addition, Anderson Pit landfarms the petroleum impacted soil they receive.	Yes but the overall cost is high. Groundwater monitoring will be required.
Alternative 2: Excavation of LNAPL saturated soil, landfarmed, and installation of bioventing and a biosparging system as a contingency.	Excavation of approximately 1,000 cubic yards of soil exceeding Residual saturation levels to the maximum extent practicable. A grizzly will be used to separate cobbles and large gravel for finer material. Soil will be treated onsite in 1-foot lifts and reused as backfill. Bioventing and biosparging lines will be installed in areas of remaining residual contamination in order to remediate the vadose zone.	Moderate level of protectiveness; soil will be removed from beneath the Site to residual saturation levels to eliminate LNAPL accumulating on the groundwater. Bioventing will enhance biodegradation for remaining concentrations in the vadose zone and groundwater, which will help eliminate any vapor intrusion concerns. Remaining concentrations will be less than acceptable ecological levels for commercial properties. **Score: 1**	This alternative will achieve a moderately high level of permanence and will reduce contaminant contaminations in groundwater and soil to acceptable levels. **Score: 1**	Effective in permanently reducing concentrations in soil and groundwater to less than MTCA Method A cleanup levels. Biosparging will only be required as a contingency measure if groundwater cleanup levels are not being achieved in a reasonable restoration time frame **Score: 1**	Implementable and technically feasible. The lower volume of soil can easily be treated onsite in a 1- to 1.5-foot lift. Soil type is ideal for bioventing and biosparging and air discharge permits are not required. **Score: 1**	This alternative involves excavation to the groundwater interface but is not as extensive as Alternatives 1 and 3. Excavation adjacent to a sidewalk and roadway is limited and public safety concern is very minimal. **Score: 3**	Likely public concerns regarding excavation safety and equipment entering and exiting the Site during mob and demob. Site will be fenced and petroleum odors generated during landfarming and till will be minimal. Potential concern with impacted soil remaining beneath the right of way. **Score: NA**	Lowest Approximately $395,537 **Score: 3**	Lowest economic loss to future development of the property.	Partial negative balance of environmental impact due to raw material consumption (fuels and electricity), greenhouse gas emissions (heavy equipment and operating system), and noise and nuisance dust generation. This alternative is more sustainable than Alternative 1.	Yes, will require groundwater monitoring and potential future soil excavation to address vapor intrusion pathways.

Table 3
Evaluation of Cleanup Alternatives

		Disproportionate Cost Analysis – Relative Benefits Ranking[1]							Sustainability		Considered Potentially Applicable
Potential Alternative	Description	Protectiveness	Permanence	Long-Term Effectiveness	Implementability	Short-term Risk	Public Concerns[2]	Cost	Economic	Environmental	
Alternative 3: Excavation of soil to remediation levels, landfarmed, chem-ox treatment, and installation of bioventing system as a contingency.	Excavation of approximately 1,600 cubic yards of soil exceeding Residual saturation levels to the maximum extent practicable. A grizzly will be used to separate cobbles and large gravel for finer material. Soil will be treated onsite in 1-foot lifts and reused as backfill. Bioventing lines will be installed to remediate residual soil impacts and groundwater, if needed.	Moderately high level of protectiveness; soil will be removed from beneath the Site to remediation levels, which are protective of groundwater. Bioventing will be used to treat any residually-contaminated soil. Remaining concentrations will be less than acceptable ecological levels for commercial properties. **Score: 2**	This alternative will achieve a high level of permanence and will reduce contaminant contaminations in groundwater and soil to acceptable levels. **Score: 2**	Effective in permanently reducing concentrations in soil and groundwater to less than MTCA Method A cleanup levels. **Score: 2**	Implementable and technically feasible. The paved area in the northern portion of the property may not have a sufficient enough area to treat the volume of soil removed, unless the grizzly can removed enough cobbles and large gravel. Soil type is ideal for bioventing and air discharge permits are not required. **Score: 2**	This alternative involves excavation to the groundwater interface but is not as extensive as Alternatives 1 and 3. Excavation adjacent to a sidewalk and roadway is limited and public safety concern is very minimal. **Score: 1**	Likely public concerns regarding excavation safety and equipment entering and exiting the Site during mob and demob. Site will be fenced and petroleum odors generated during landfarming and till will be minimal. Potential concern with impacted soil remaining beneath the right of way. **Score: NA**	Low Approximately $533,538 **Score: 2**	Low economic loss to future development of the property	Partial negative balance of environmental impact due to raw material consumption (fuels and electricity), greenhouse gas emissions (heavy equipment and operating system), and noise and nuisance dust generation. This alternative is more sustainable than Alternative 1.	Yes, will require groundwater monitoring and potential future soil excavation to address vapor intrusion pathways

Note:

1 Alternatives were scored using a scale of 1 to 5 with a score of 1 being the least amount of benefits provided by the alternative and a score of 5 being the most amount of benefits provided by the alternative.
2 Public Concern scores are not used in the Disproportionate Cost Analysis Summary

Abbreviations:

CO_2	Carbon dioxide
CUL	Cleanup level
LNAPL	Light non-aqueous phase liquid
MTCA	Model Toxics Control Act

Table 4
Applicable or Relevant and Appropriate Requirements

Applicable or Relevant and Appropriate Requirements	Regulated Activity	Alternative 1	Alternative 2	Alternative 3	Evaluation
Kittitas County Codes					
Municipal Code 12.06	Stormwater Management Regulations	Applies	Applies	Applies	Less than one acre of disturbance is anticipated but best management practices will be applied
Municipal Code 9.45	Noise Control	Applies	Applies	Applies	Construction actions will meet the requirements of this chapter.
Washington State					
Washington Adminisrative Code 173-400	Emissions	Applies	Applies	Applies	Notice of Construction required for new potential emission sources.
Washington Administrative Code 173-400	Emissions	Applies	Does Not Apply	Applies	Regulates potential air pollution. Administrated through Yakima Air Agency
Washington Administrative Code 173-201A	Water Quality Standards for Surface Waters	Applies	Applies	Applies	The Model Toxics Control Act (MTCA) requires cleanup actions comply with applicable regulations.
Washington Administrative Code 173-303	Dangerous Waste Management	Does Not Apply	Does Not Apply	Does Not Apply	It is unlikely impacted soil and/or groundwater will designate as a dangerous waste.
Washington Administrative Code 173-340	Toxic Waste Cleanup (MTCA)	Applies	Applies	Applies	The remedial action will be conducted under MTCA. Remedial alternatives will comply with MTCA regulations.
Washington Administrative Code 173-350	Management of Solid Waste	Applies	Applies	Applies	The excavated soil is considered solid waste, whether it is transported to Andersons or placed in biopiles.
Washington Administrative Code 197-11 and 173-802	State Environmental Policy Act (SEPA)	Applies	Applies	Applies	A SEPA review is required for projects with potential significant environmental impacts.
Washington Administrative Code 173-218	Underground Injection Controls (UICs)	Does Not Apply	Does Not Apply	Does Not Apply	UIC regulations apply to oxidant injection galleries and wells.
RCW 90.48	Water Pollution Control (Construction Stormwater Permit)	Applies	Applies	Applies	A stormwater pollution prevention plan (SWPPP) is required for the applicable remediation alternatives.
Washington Administrative Code 173-160	Construction and Maintenance of Wells	Applies	Applies	Applies	Requirements are applicable to construction of monitoring wells and soil borings
Washington Administrative Code 173-162	Rules and Regulations Governing the Licensing of Well Contractors and Operators	Applies	Applies	Applies	The regulation establishes training standards for well contractors and operators
Federal Regulations					
Title 40 Code of Federal Regulations 131	Water Quality Standards (National Toxics Rule)	Applies	Applies	Applies	MTCA requires cleanup actions comply with applicable regulations.
Title 40 Code of Federal Regulations 141	Drinking Water Regulations	Applies	Applies	Applies	MTCA requires cleanup actions comply with applicable regulations.
Title 40 Code of Federal Regulations 143	National Secondary Drinking Water Standards	Applies	Applies	Applies	MTCA requires these be considered in establishing cleanup levels.
Title 40 Code of Federal Regulations 260-268	Hazardous Waste (Resource Conservation and Recovery Act)	Applies	Applies	Applies	MTCA requires cleanup actions comply with applicable regulations.
Title 33 of United States Code, Chapter 26	Water Pollution Control (Clean Water Act)	Applies	Applies	Applies	MTCA requires cleanup actions comply with applicable regulations.
Title 40 Code of Federal Regulations 50	Clean Air Act	Applies	Applies	Applies	MTCA requires cleanup actions comply with applicable regulations.
Title 40 Code of Federal Regulations 58	Ambient Air Quality Monitoring	Applies	Applies	Applies	MTCA requires cleanup actions comply with applicable regulations.

Big B Mini Mart Site

Cleanup Action Plan

Figures

Note:
· Orthoimage provided by Esri, accessed February, 2020.

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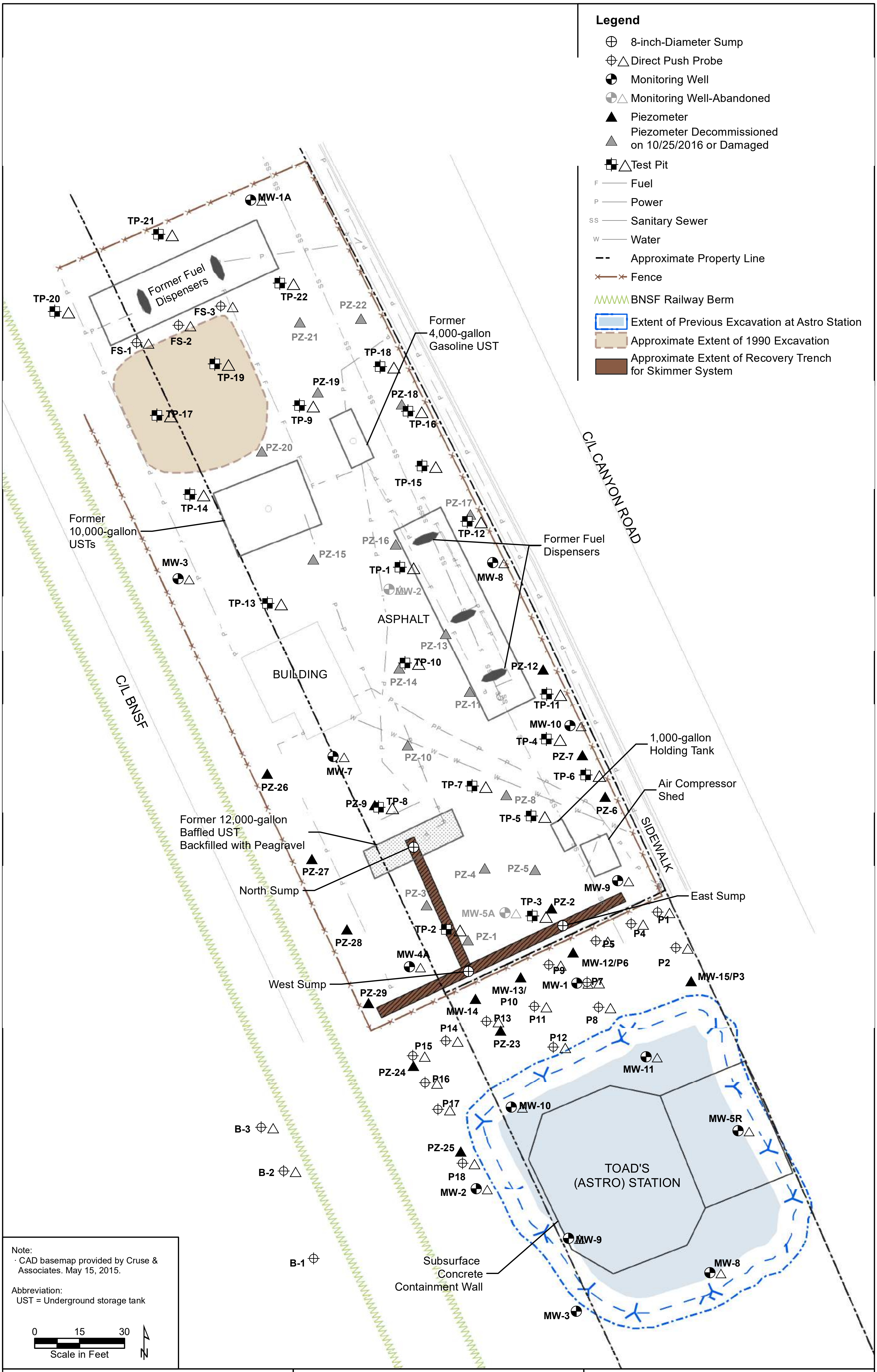
Cleanup Action Plan Big B Mini Mart Site Ellensburg, Washington

Figure 1
Vicinity Map

I:\GIS\Projects\CL-Ellensburg\MXD\Draft CAP\Figure 1 Vicinity Map.mxd
4/6/2020



Note:
· CAD basemap provided by Cruse & Associates. May 15, 2015.

Abbreviation:
UST = Underground storage tank

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Ellensburg, Washington

Figure 2
Site Map

I:\GIS\Projects\CL-Ellensburg\MXD\Draft CAP\Figure 2 Site Map.mxd
2/24/2020

Legend

1486.10 MW-1 ◒ Monitoring Well Location and Groundwater Elevation in NAVD 88

1486.10 Groundwater Contour (0.1-Foot Interval, NAVD 88) (Dashed where Inferred)

➡ Approximate Groundwater Flow Direction

Notes:
- * Groundwater elevation corrected for the presence of LNAPL.
- Orthoimage provided by Google Earth, 2015.

Abbreviations:
LNAPL = Light non-aqueous-phase liquid
NAVD 88 = North American Vertical Datum of 1988

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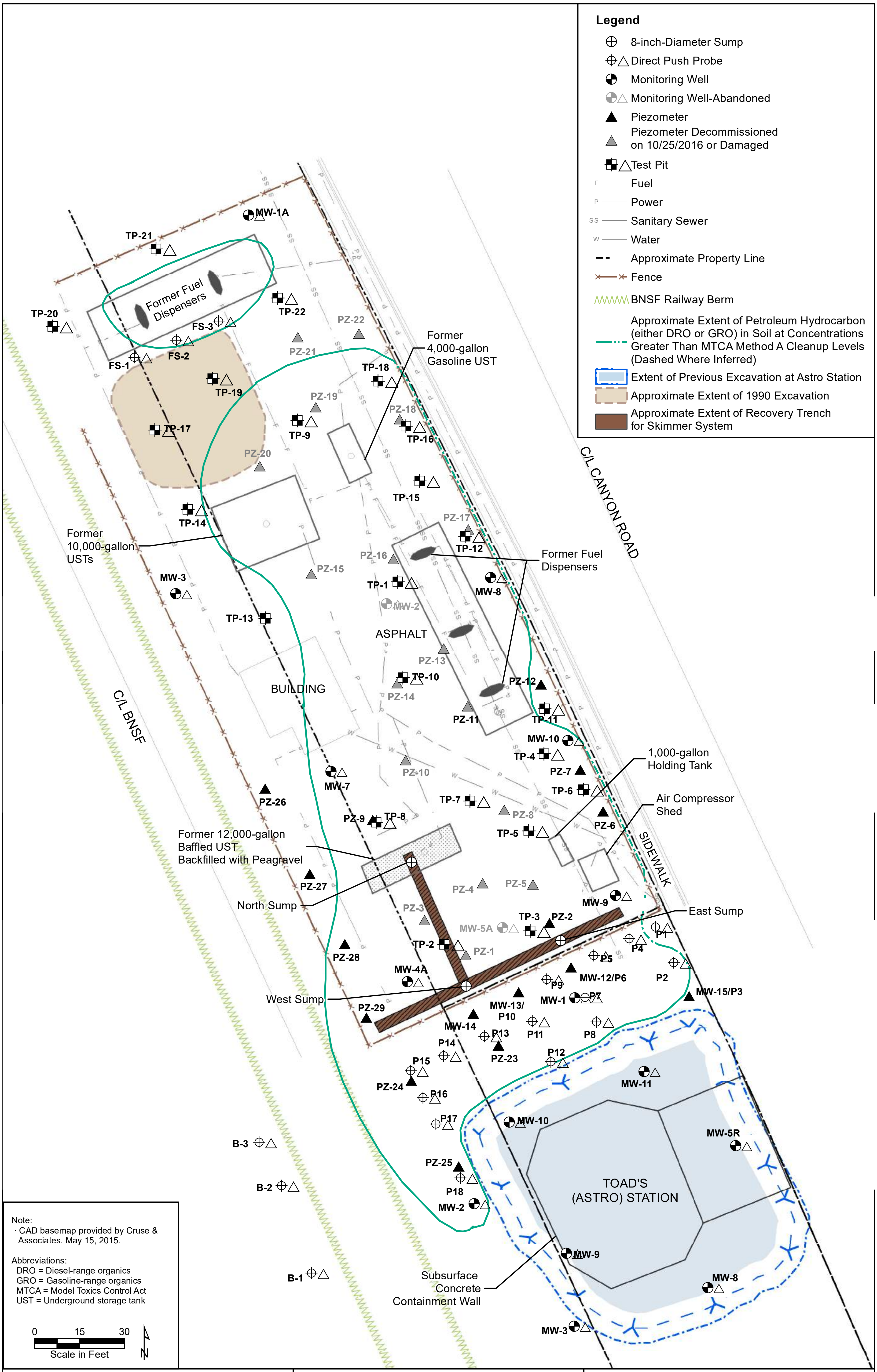
Cleanup Action Plan Big B Mini Mart Site Ellensburg, Washington

Figure 3
Groundwater Elevation and Contour Map
March 23, 2016

I:\GIS\Projects\CL-Ellensburg\MXD\Draft CAP\Figure 3 Groundwater Elevation and Contour Map March 23, 2016.mxd
2/24/2020



Note:
- CAD basemap provided by Cruse & Associates. May 15, 2015.

Abbreviations:
DRO = Diesel-range organics
GRO = Gasoline-range organics
MTCA = Model Toxics Control Act
UST = Underground storage tank

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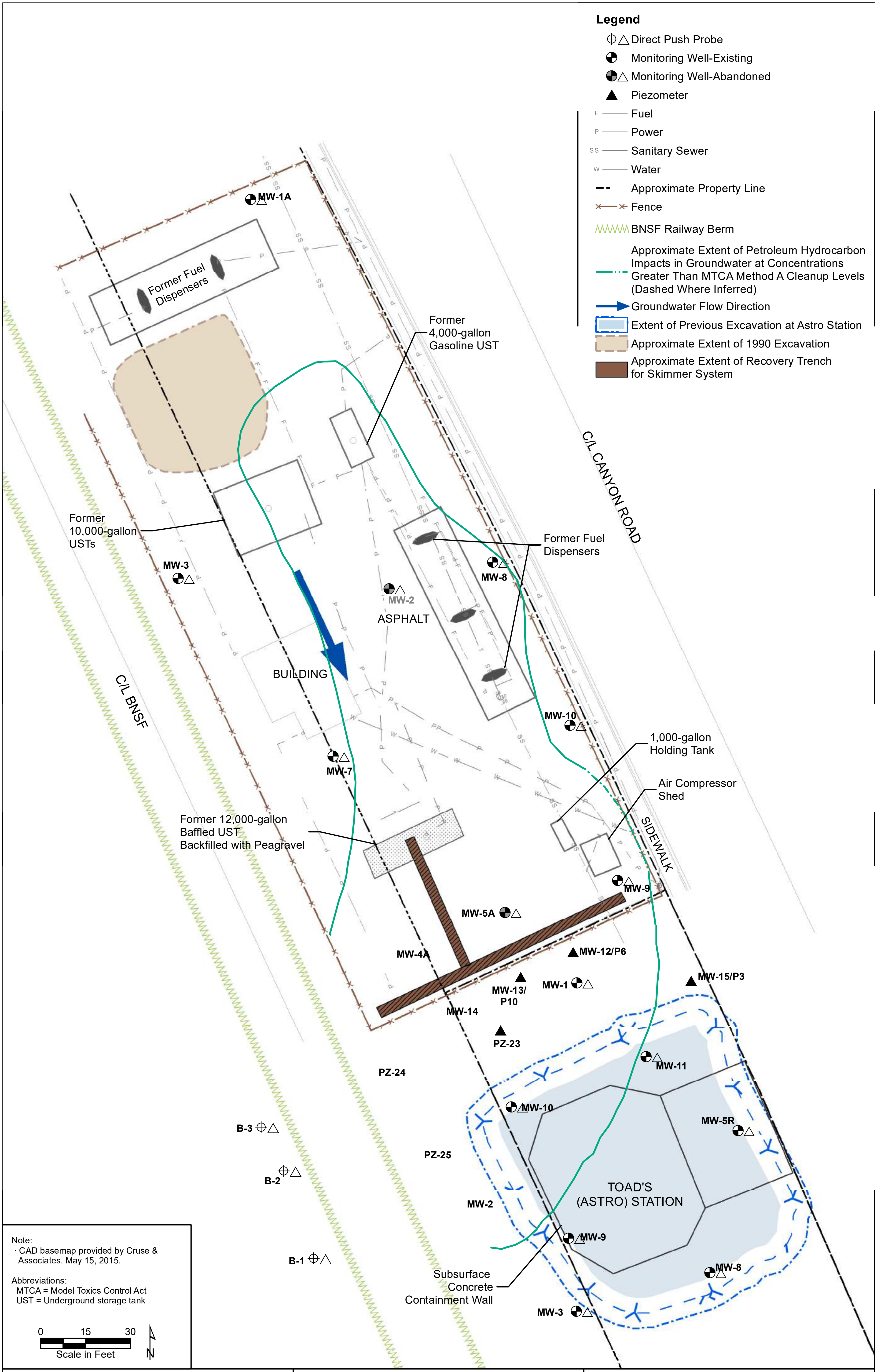
Figure 4
Approximate Extent of Petroleum Hydrocarbon Impacts in Soil

I:\GIS\Projects\CL-Ellensburg\MXD\Draft CAP\Figure 4 Approximate Extent of Petroleum Hydrocarbons Impacts in Soil.mxd
2/24/2020



Note:
- CAD basemap provided by Cruse & Associates. May 15, 2015.

Abbreviations:
MTCA = Model Toxics Control Act
UST = Underground storage tank

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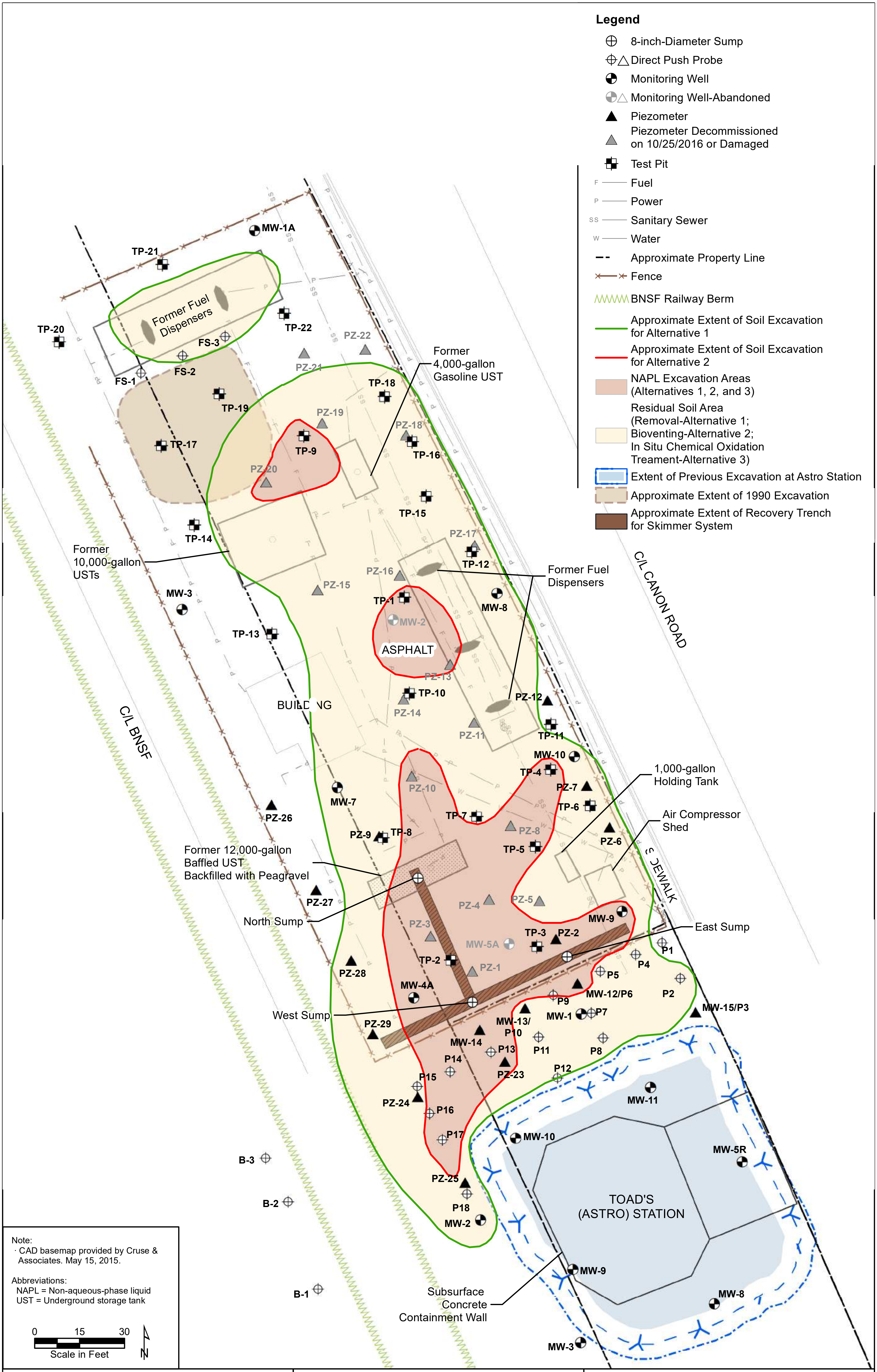
Figure 5
Approximate Extent of Petroleum Hydrocarbon Impacts in Groundwater



Note:
· CAD basemap provided by Cruse & Associates. May 15, 2015.

Abbreviations:
NAPL = Non-aqueous-phase liquid
UST = Underground storage tank

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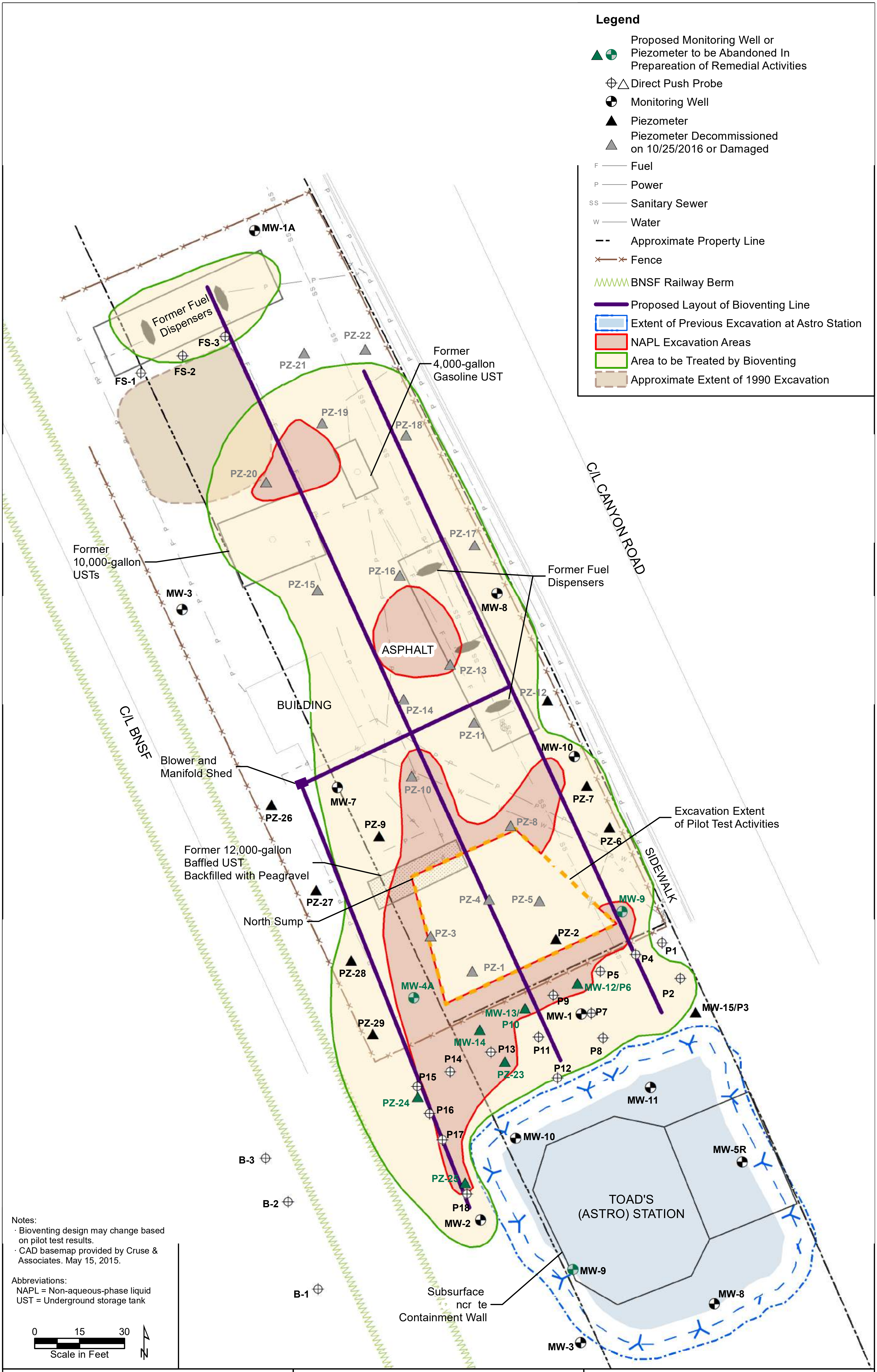
Figure 6
Approximate Extent of Soil Excavation for Alternatives 1, 2, and 3



Notes:
- Bioventing design may change based on pilot test results.
- CAD basemap provided by Cruse & Associates. May 15, 2015.

Abbreviations:
NAPL = Non-aqueous-phase liquid
UST = Underground storage tank

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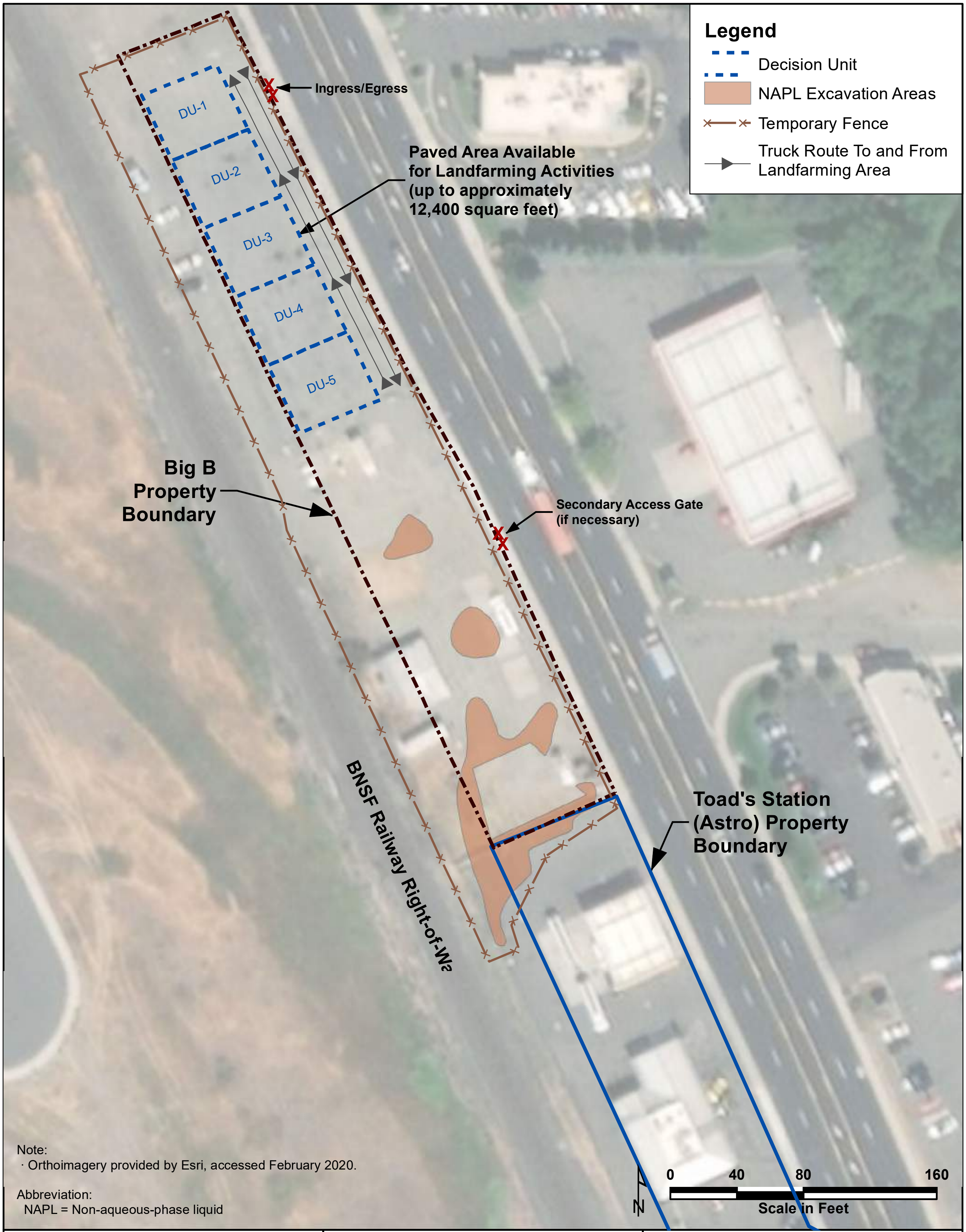
Figure 7
Approximate Extent of Soil Excavation and Extent of Bioventing System

I:\GIS\Projects\CL-Ellensburg\MXD\Draft CAP\Figure 7 Approximate Extent of Soil Excavation and Extent of Bioventing System.mxd
2/24/2020



Note:
· Orthoimagery provided by Esri, accessed February 2020.

Abbreviation:
NAPL = Non-aqueous-phase liquid

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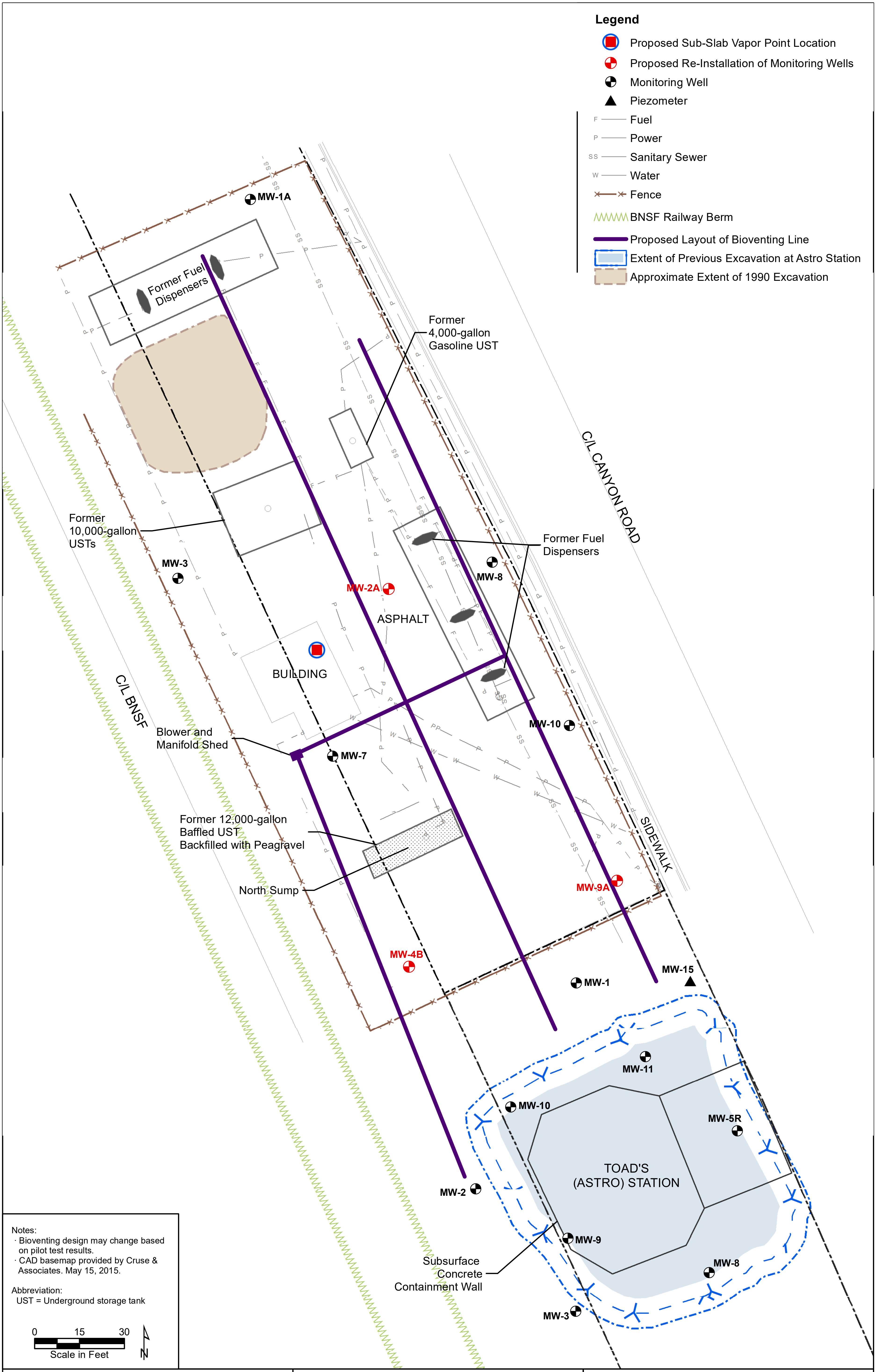
Cleanup Action Plan Big B Mini Mart Site Ellensburg, Washington

Figure 8
Property Map, Landfarming Area, and Extent of NAPL Excavation

I:\GIS\Projects\CL-Ellensburg\MXD\Draft CAP\Figure 8 Property Map, Landfarming Area, and Extent of NAPL Excavation.mxd
2/24/2020



Notes:
- Bioventing design may change based on pilot test results.
- CAD basemap provided by Cruse & Associates. May 15, 2015.

Abbreviation:
UST = Underground storage tank

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Figure 9
Proposed Wells to be Re-Installed

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6/26/2020

Big B Mini Mart Site

Cleanup Action Plan

Appendix A

Landfarming Pilot Test Summary Report

FLOYD | SNIDER
strategy ▪ science ▪ engineering

Two Union Square
601 Union Street, Suite 600
Seattle, WA 98101
tel: 206.292.2078 fax: 206.682.7867

January 10, 2020

Mr. John Mefford
Washington State Department of Ecology
1250 West Alder Street
Union Gap, WA 98903-0009

SUBJECT: LANDFARMING PILOT TEST SUMMARY REPORT
Big B Mini Mart
1611 Canyon Road
Ellensburg, Washington

Dear Mr. Mefford:

Floyd|Snider has prepared this letter to summarize the results of the landfarming pilot test performed between July and November 2019. The pilot test was conducted in response to a Washington State Department of Ecology email dated February 20, 2019 and pursuant to Agreed Order No. DE 16307, concerning the need for an interim action (IA) pilot test of landfarming at the Big B Mini Mart Site (Site) located in Ellensburg, Washington. Landfarming is a key component of the preferred cleanup action described in the final Remedial Investigation and Feasibility Study (RI/FS) for the Big B Site. The results from the pilot test provided useful information on the performance of on-site landfarming at the Site and confirmed its effectiveness as a key remedial component of the preferred cleanup action as described in the RI/FS for this Site.

DESCRIPTION OF PILOT TEST ACTIVITIES

The IA consisted of two key activities: (1) excavation of contaminated soils in an area known to contain residual light non-aqueous-phase liquids (LNAPL) following underground storage tank (UST) decommissioning in 2016; and (2) landfarming of the excavated soils within the Site boundary as shown on Figure 1. The excavated area was approximately 2,200 square feet in size as measured at the top of slope. The southern boundary of the excavated area was located adjacent to the existing east-west section of the previously installed LNAPL recovery trench.

The activities conducted during the pilot test were as follows:

- A Site development permit and critical area waiver were obtained from the City of Ellensburg; copies of the permit and wavier are included in Attachment 1.
- Underground utilities were located on the same day as the Site mobilization.
- LNAPL thickness measurements were collected in on- and off-property wells and piezometers.

- Monitoring well MW-5A was abandoned by a licensed driller on July 19, 2019. The excavation did not extend onto BNSF Railway property and, therefore, MW-4A was not abandoned.
- Any existing piezometers that would have interfered with construction activities were removed.
- Temporary erosion and stormwater controls were set up as required by permit. This included using Visqueen sheeting and hay bales beneath and surrounding the land farm test plot, placing filter socks in the stormwater drains, and covering the stockpiled soil with plastic sheeting. These best management practices (BMPs) were implemented to keep soil confined to the property and to prevent soil from entering stormwater drains, either on- or off-site.
- The top 3 feet of clean overburden soils was removed. Approximately 150 cubic yards (CY) of clean overburden was stockpiled adjacent to the excavation and covered. Five soil samples were collected from the overburden stockpile. Stockpile sample results are shown on Table 1.
- Contaminated soil was excavated between 3 and approximately 7 feet below ground surface (bgs). Groundwater was encountered at approximately 5.5 feet bgs. Wet excavated soil was allowed to drain back into the excavation prior to being placed in the landfarming area.
- The excavation was left open to monitor for free product seepage indicating the presence of LNAPL in adjacent soils. Free product was observed seeping in from the southwestern corner of the excavation. Sorbent pads were used to collect accumulated product in the excavation pit. Only a thin layer of LNAPL accumulated in the excavation pit, and seepage was no longer observed after 1 week.
- Significant odor was not noted during excavation; therefore, engineering controls to abate the odors were not necessary. In addition, volatile organic compounds were not detected at the site perimeter using a photoionization detector during the baseline sampling event.
- The sidewalls of the excavation were cut back at a 1:1 slope and were later backfilled in mid-November 2019 to the water table elevation with the clean overburden following receipt of the laboratory results confirming that the overburden stockpile contained concentrations of contaminants of concern (COCs) less than Model Toxics Control Act (MTCA) Method A cleanup levels.
- Cobbles were absent on this portion of the property; therefore, excavated soil was not placed through the mechanical grate that was brought to the Site to remove cobbles had they been encountered.
- Approximately 240 CY of contaminated soil was transported to the landfarming area shown on Figure 1. The soil was placed on plastic, which in turn was placed on top of

the existing asphalt surface. The soil in the landfarming area was uniformly spread out to a thickness of between 12 and 18 inches.

- The area was then bermed with hay bales and covered with plastic sheeting that was secured with sandbags.
- Once spread out, the soil in the landfarming area was divided into five equal windrowed decision units (DU), DU-01 through DU-05 (Figure 1). A representative baseline sample was collected on August 2, 2019, from the center point of each decision unit at a depth of approximately half of the thickness of treatment layer (6 to 9 inches).
- The five baseline samples were analyzed for the site COCs, including gasoline-range organics, diesel-range organics (DRO), benzene, toluene, ethylbenzene, xylene compounds, and naphthalene, as well as the soil nutrients nitrogen, phosphorus, and potassium (NPK).
- The soil was rototilled and/or turned over by backhoe on a weekly basis.
- Approximately 30 CY of cow manure was mixed in with the impacted soil on August 3, 2019, to provide a natural source of NPK and aerobic bacteria.
- Based on lack of available nitrogen in the soil after the first month of landfarming, liquid nitrogen was sprayed onto the soil followed by application of fertilizer granules in September and again in October.
- Soil pH was measured and found to be within optimal range of between 6 and 8.04 standard units; pH measurements are included in the laboratory reports (Attachment 2).
- Moisture was checked weekly and was added by spray hose if the soil appeared to be drying out. The soil moisture content ranged between 10 and 35 percent by weight based on the soil moisture content in samples analyzed by the laboratory.
- During the time on-site, the BMPs for prevention of runoff from the Site was inspected and remedied as needed (e.g., a filter sock was placed in the storm drain along Canyon Road and any accumulated debris was removed). No evidence of either soil or rainwater runoff was noted.

SOIL SAMPLE RESULTS

Samples were collected on a monthly basis to determine progress and effectiveness of landfarming activities. Baseline samples were collected on August 2, 2019, prior to tilling and adding amendments. Results indicated that the excavation was successful in removing highly impacted soil: DRO was present at concentrations greatly exceeding the MTCA Method A cleanup level of 2,000 milligrams per kilogram (mg/kg) in three of the five DUs. No other COCs were noted in the baseline samples, consistent with the results of the RI/FS, which indicated a release of diesel from the former UST in this area.

Performance sampling was conducted in accordance with the approved work plan submitted in April 2019. The first performance sampling event in September 2019 indicated significant reductions in DRO in four of the five DUs; DU-04 showed a slight increase in DRO. The second performance sampling event in October 2019 showed that DU-02, DU-04, and DU-05 contained DRO concentrations that were much less than the MTCA Method A DRO cleanup level. The soil in these DUs also had no petroleum odor noted during the sampling event. The remaining two DUs (DU-01 and DU-03) had DRO concentrations slightly exceeding the cleanup level. The final performance sampling event occurred in November 2019 and involved sampling only DU-1 and DU-3, and sampling results indicated DRO concentrations were much less than the MTCA Method cleanup level. Final concentrations from each DU's last sampling event (October or November 2019) ranged from 300 mg/kg to 1,200 mg/kg DRO. Soil analytical data are shown on Table 1 and laboratory results are included as Attachment 2.

Review of the chromatograms also indicates a trend toward progressively more-degraded hydrocarbons. For example, the chromatograms for DU-02 from August through October show this trend (pages A2-38, A2-81, and A2-121 of Attachment 2). Note the evenly distributed *n*-alkanes and the lighter end carbons are being reduced. The lighter carbon reduction is likely attributed to volatilization; however, the reduction of alkanes are attributed to oxidation via biological or chemical processes. Biological degradation of *n*-alkanes, interestingly, preferentially reduces *n*-alkanes with an even number of carbon atoms; carbon-12, -14, and -16 (C12, C14, and C16) are typically metabolized the fastest. After which, the remaining *n*-alkanes are reduced. When biological activity is present, the envelope of the *n*-alkanes will begin to appear ragged. The compounds remaining will appear as a hump with a few discernible peaks.

The soil in the landfarming area was placed back into the remaining excavation at an elevation lying above the water table in December 2019 and compacted. These soils will be subject to bioventing as part of the final cleanup plan for this Site.

LNAPL OBSERVATIONS

LNAPL thicknesses were recorded in wells and remaining piezometers during the final sampling event on November 7, 2019. On the Site, LNAPL was observed in monitoring wells MW-4A and MW-9; piezometer PZ-2; and the east, west, and north sumps. On the neighboring Astro Site, LNAPL was observed in piezometers PZ-23 and PZ-25. LNAPL varied in thickness from 0.04 to 0.22 feet. LNAPL thicknesses as measured in November 2019 are shown on Figure 2 and LNAPL plots that show LNAPL thicknesses starting prior to the 2016 UST removal are included as Attachment 3. The plots do not include locations on the Astro Site because the IA was not designed to remove LNAPL from those wells, nor do they include the sumps because LNAPL thicknesses in the sumps were affected by the skimmers. Recent LNAPL measurements and these plots indicate that LNAPL thickness has decreased significantly since the original IA activities conducted in October 2016. Areas of remaining LNAPL will be subject to excavation as part of the final cleanup plan for the Site.

CONCLUSIONS AND NEXT STEPS

The results of the IA indicate that landfarming activities are a suitable remedial action for treatment of contaminated soils at the Site. The main conclusions of this study are as follows:

- The results show that, within 3 months, MTCA Method A cleanup levels can be achieved in soil excavated from areas of free product.
- Odor during excavation was not noted to be significant. This is consistent with the prior experience at the Site when there also was a lack of appreciable odor during decommissioning of the USTs.
- Liquid nitrogen and fertilizer granules were necessary to facilitate biodegradation and should be added immediately after the soil is spread out. Further use of manure is not recommended because it cannot supply the levels of nitrogen needed and may skew analytical results if used in large quantities.
- There is ample space on the north lot of the property to perform landfarming area on a larger scale.

Details of how the final cleanup action will performed and how sampling will be conducted to confirm compliance will be provided in the draft Cleanup Action Plan with further details provided in the Engineering Design Report.

Sincerely,

State of Washington Licensed Geologist
2357
Gabriel Cisneros

State of Washington Licensed Geologist
605
Thomas Henry Colligan

Gabe Cisneros, LG 1/10/2020	Tom Colligan, LHG 1/10/2020
Geologist	Sr. Hydrogeologist & Associate Principal

Encl.:	Table 1	Soil Analytical Data
	Figure 1	Site Map, Excavation Extent, and Decision Units
	Figure 2	November 2019 LNAPL Thicknesses and Extent
	Attachment 1	Permits
	Attachment 2	Laboratory Reports
	Attachment 3	LNAPL Depth Plots

Copies:
Valerie K. Fairwell, Cascadia Law Group PLLC
Surgit Singh, Big B LLC
Scott MacDonald, BNSF Railway Company

Table

Table 1
Soil Analytical Data

Analysis Method		USEPA 8021B/8260C (1)					NWTPH-Gx	NWTPH-Dx	
Analyte		Benzene	Toluene	Ethylbenzene	Xylene (total)	Naphthalene	Gasoline-Range Organics	Diesel-Range Organics (2)	Oil-Range Organics (2)
Units		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
MTCA Method A Cleanup Level		0.03	7	6	9	5	30/100 (3)	2,000	2,000
Sample ID	Date								
Clean Overburden Stockpile									
Stockpile-01-080219 (4)	08/02/2019	--	--	--	--	--	22 U	55 U	110 U
Stockpile-02-080219 (4)	08/02/2019	--	--	--	--	--	22 U	56 U	110 U
Stockpile-03-080219 (4)	08/02/2019	--	--	--	--	--	19 U	200	190
Stockpile-04-080219 (4)	08/02/2019	--	--	--	--	--	22 U	110	55 U
Stockpile-05-080219 (4)	08/02/2019	--	--	--	--	--	23 U	56 U	110 U
Decision Unit (DU)									
DU-01	08/02/2019	0.27 U	0.27 U	0.34 U	0.34 U	0.67 U	67 U	**7,400**	53 U
	09/04/2019	0.020 U	0.020 U	0.024 U	0.024 U	0.049 U	49 U	**3,300**	49 U
	10/04/2019	--	--	--	--	--	--	**2,200**	50 U
	11/07/2019	--	--	--	--	--	--	860	52 U
DU-02	08/02/2019	0.36 U	0.36 U	0.45 U	0.45 U	0.90 U	90 U	**11,000**	48 U
	09/04/2019	0.015 U	0.015 U	0.019 U	0.019 U	0.038 U	38 U	**4,700**	50 U
	10/04/2019	--	--	--	--	--	--	1,200	54 U
DU-03	08/02/2019	0.35 U	0.35 U	0.44 U	0.44 U	0.87 U	220 U	**13,000**	57 U
	09/04/2019	0.017 U	0.017 U	0.021 U	0.021 U	0.042 U	42 U	**3,700**	60 U
	10/04/2019	--	--	--	--	--	--	**2,400**	55 U
	11/07/2019	--	--	--	--	--	--	650	55 U
DU-04	08/02/2019	0.21 U	0.21 U	0.26 U	0.26 U	0.52 U	52 U	1,400	56 U
	09/04/2019	0.020 U	0.020 U	0.025 U	0.025 U	0.050 U	50 U	**2,500**	50 U
	10/04/2019	--	--	--	--	--	--	760	56 U
DU-05	08/02/2019	0.21 U	0.21 U	0.26 U	0.26 U	0.52 U	52 U	**2,200**	60 U
	09/04/2019	0.022 U	0.022 U	0.028 U	0.028 U	0.056 U	5.6 U	300	60 U
	10/04/2019	--	--	--	--	--	--	300	55 U

Notes:

All results presented in this table are rounded to two significant figures.
-- Not analyzed.
BOLD/RED Detected at a concentration that exceeds the MTCA Method A cleanup level.
1 Volatile organic compounds were analyzed only if there were gasoline detections with the NWTPH-HCID screening results.
2 Silica gel cleanup was not used.
3 Criterion is for benzene present/no detectable benzene.
4 NWTPH-HCID screening result, which has been adjusted to reflect dry weight.

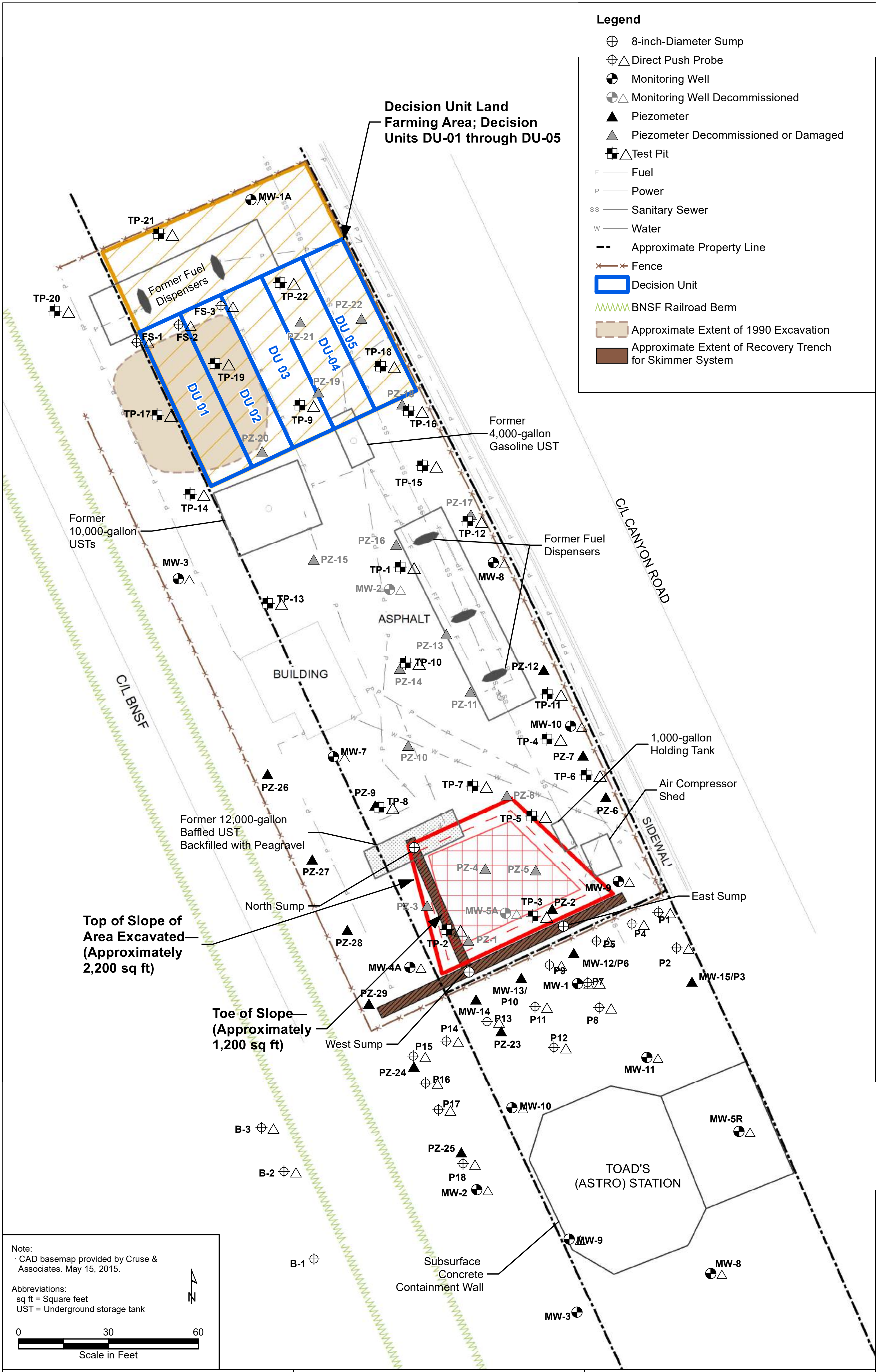
Abbreviations:

mg/kg Milligrams per kilogram
MTCA Model Toxics Control Act

Qualifier:

U Analyte was not detected at the given reporting limit.

Figures



Note:
- CAD basemap provided by Cruse & Associates. May 15, 2015.

Abbreviations:
sq ft = Square feet
UST = Underground storage tank

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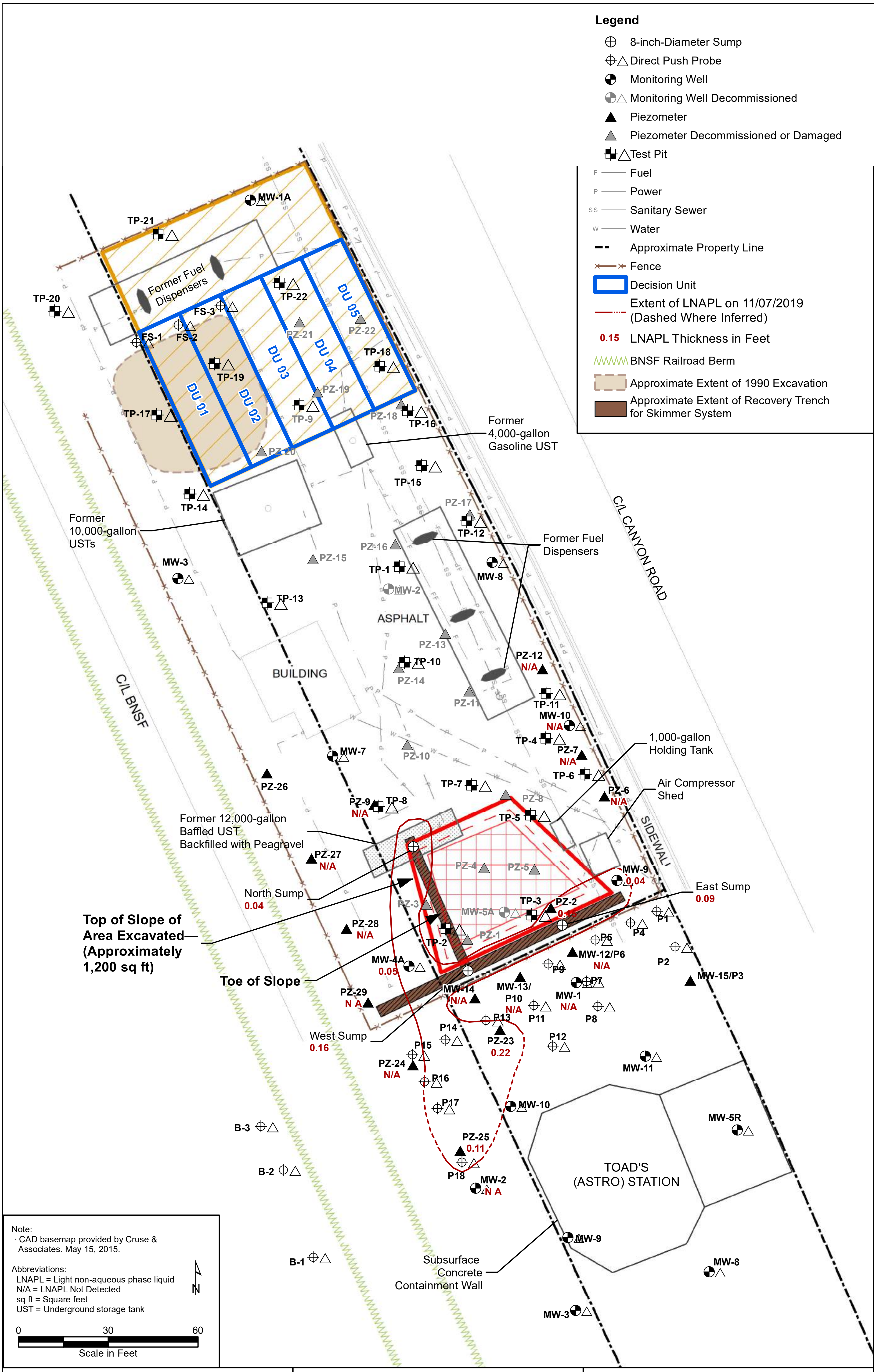
Landfarming Pilot Test Summary Report
Big B Mini Mart
Ellensburg, Washington

Figure 1
Site Map, Excavation Extent, and Decision Units

I:\GIS\Projects\CL-Ellensburg\MXD\Landfarming Pilot Test Summary Report\Figure 1 Site Map, Excavation Extent, and Decision Units.mxd
12/18/2019



Note:
· CAD basemap provided by Cruse & Associates. May 15, 2015.

Abbreviations:
LNAPL = Light non-aqueous phase liquid
N/A = LNAPL Not Detected
sq ft = Square feet
UST = Underground storage tank

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Landfarming Pilot Test Summary Report
Big B Mini Mart
Ellensburg, Washington

Figure 2
November 2019 LNAPL Thickness and Extent

I:\GIS\Projects\CL-Ellensburg\MXD\Landfarming Pilot Test Summary Report\Figure 2 November 2019 LNAPL Thickness and Extent.mxd
12/18/2019

Attachment 1
Permits

COMMUNITY DEVELOPMENT DEPARTMENT
501 N. Anderson St., Ellensburg WA 98926
Land Use Permitting (509) 962-7231 Construction Permitting (509) 962-7239
Kirsten Sackett, Director
Phone: (509) 962-7232 Fax: (509) 925-8655 E-Mail: sackettk@ci.ellensburg.wa.us

CRITICAL AREA DETERMINATION
CRITICAL AREA PRESENT BUT NO IMPACT - WAIVER

Date of Review Request: 6/11/2019
Date of Final Decision: 7/19/2019
Final Decision: Critical Area Present but No Impact - Waiver

Project Applicant: Northwest Environmental Solutions (NES), agent, for Surjit Singh, Big B, LLC; owner.

Project File #: P19-072

Project Description: The applicant submitted this Critical Areas Form (a Type I Review) and a Site Development Permit (P19-073) for a limited soil excavation on the Big B property located at 1611 Canyon Rd. in Ellensburg. A total of 450 cubic yards of soil will be excavated and spread out in a separate land farming area to reduce the levels of petroleum hydrocarbons over a three (3) month period. Then the soil will be put back in the hole. The norther portion of the subject parcel is located within the 100-Year FEMA Flood Zone A, specifically Firm Panel 5302340002C. The soil excavation work will take place approximately 100 feet south of the edge of the flood zone boundary. This work is being performed as part of an Interim Action and under an Agreed Order with the Washington Department of Ecology. Ecology was the lead agency on the project SEPA and issued a Determination of Non-Significance (DNS) on June 18, 2019.

Project Location: 1611 S. Canyon Rd, Ellensburg, WA, parcel # 958654; on the east side of Canyon Road, across the road from the Exxon/Circle K Store and Starbucks.

Rationale for Waiver:

1. ECC 15.620.060(A) states "Submittal. Prior to the city's consideration of any proposed activity not found to be exempt under ECC 15.610.020 or allowed pursuant to ECC 15.610.030, the applicant shall submit to the department complete information regarding the critical area on the application for the underlying development, on forms provided by the city." The applicant's agent provided such.
2. The City verified and reviewed the information per the critical area review process steps outlined in ECC 15.610.060(B)(1-5).
3. Per ECC 15.610.060(B)(6)(b), **"Critical Areas Present – No Impact"**, if the director determines there are critical areas within or adjacent to the project area, but that the best available science shows that the proposed activity is unlikely to degrade the functions or

values of the critical area, the director may **waive** the requirement for a Critical Area report. A waiver may be granted if there is substantial evidence that all of the following requirements will be met:

   i. There will be **no** alteration of the critical area or buffer;
   ii. The development proposal will not impact the critical area in a manner contrary to the purpose, intent, and requirements of this chapter; and
   iii. The proposal is consistent with other applicable regulations and standards. A summary of this analysis and the findings shall be included in any staff report or decision on the underlying permit.

4. Per the Site Plan/Work Plan map submitted by the applicant, the area of the property where the soil excavation will occur is located approximately 100 feet south of the 100-Year FEMA Flood Zone on the property. This is verified by FEMA Firm Panel 5302340002C. None of the land farming for this project would occur within this Flood Zone.
5. Therefore, the applicant's project may proceed under a **Critical Area Present, but No Impact – Waiver.**

FINAL DECISION

Critical Area Present but No Impact – Waiver. The project the applicant has proposed is permitted on a parcel within FEMA 100-Year Flood Zone, under ECC 15.610.060(B)(6)(b) with the following **condition:**

1. If future remedial activities and/or development permits expand this project closer to the border of the 100-Year Flood Zone shown on FEMA FIRM Panel 5302340002C, further Critical Area review may be required under ECC 15.600.

Kirsten Sackett
Kirsten Sackett, Administrator

July 19, 2019

COMMUNITY DEVELOPMENT DEPARTMENT
501 N. Anderson St., Ellensburg WA 98926
Land Use Permitting (509) 962-7231 Construction Permitting (509) 962-7239
Kirsten Sackett, Director
Phone: (509) 962-7232 Fax: (509) 925-8655 E-Mail: sackettk@ci.ellensburg.wa.us

SITE DEVELOPMENT PERMIT (ECC 15.250.020)
BIG B SOIL EXCAVATION PROJECT (A TYPE II PROJECT)

Final Decision: Approved, with conditions

Date of Final Decision: July 17, 2019

Proposal Name: Big B soil excavation project to remediate petroleum hydrocarbons

Applicant: Northwest Environmental Solutions (NES), agent, for Surjit Singh, Big B, LLC; owner.

Project File #: P19-073

Project Location: 1611 S. Canyon Rd, Ellensburg, WA, parcel # 958654; across the road from the Exxon/Circle K Store and Starbucks.

Proposal Description: The project involves a limited soil excavation on the Big B property located at 1611 Canyon Rd. in Ellensburg. A total of 450 cubic yards of soil will be excavated and spread out in a separate land farming area to reduce the levels of petroleum hydrocarbons over a three (3) month period. Then the soil will be put back in the hole. This is being performed as part of an Interim Action and under an Agreed Order with the Washington Department of Ecology. Ecology was the lead agency on the project SEPA and issued a Determination of Non-Significance (DNS) on June 18, 2019.

Decision: The Big B Site Development Project Permit for its Soil Excavation Project is hereby **approved** subject to the following **conditions:**

1. Applicant shall comply with the conditions in the Critical Area (P19-072) Determination.
2. Per the Conditions of the City of Ellensburg Public Works Dept. Memos of 5/3/19 and 7/9/19, the project will need to comply with the following:
    a. Storm water conditions are: wind erosion, de-watering and keeping all runoff of any kind contained to the site at all times with no discharge to the storm system. If there is any discharge offsite, the City needs to be notified immediately, so it can be reported to the Dept. of Ecology. See details for silt fencing (attached).
    b. Any alterations to existing utilities may require a separate permit. Caution is to be taken when excavating around the side sewer and the large private 21" concrete Twin Cities Food discharge main.
    c. The applicant can view the City of Ellensburg's Development Standards on the City's website, http://www.ci.ellensburg.wa.us/index.aspx?NID=339, for more information.

3. Per the Conditions of the City of Ellensburg Electrical Dept. Memo of 7/15/19, the project will need to comply with the following:

   a. City 24/7 access to the overhead distribution line, riser and vault must be maintained at all times. The City of Ellensburg Electrical Utility currently serves the above referenced location with an overhead service from a single phase 50kVA pole mount transformer located at the south east corner of the lot. The City has a 3-phase overhead distribution along the east side of this property adjacent to Canyon Rd. The city also has an underground riser and vault on the northern portion of the lot adjacent to the proposed land farming area.

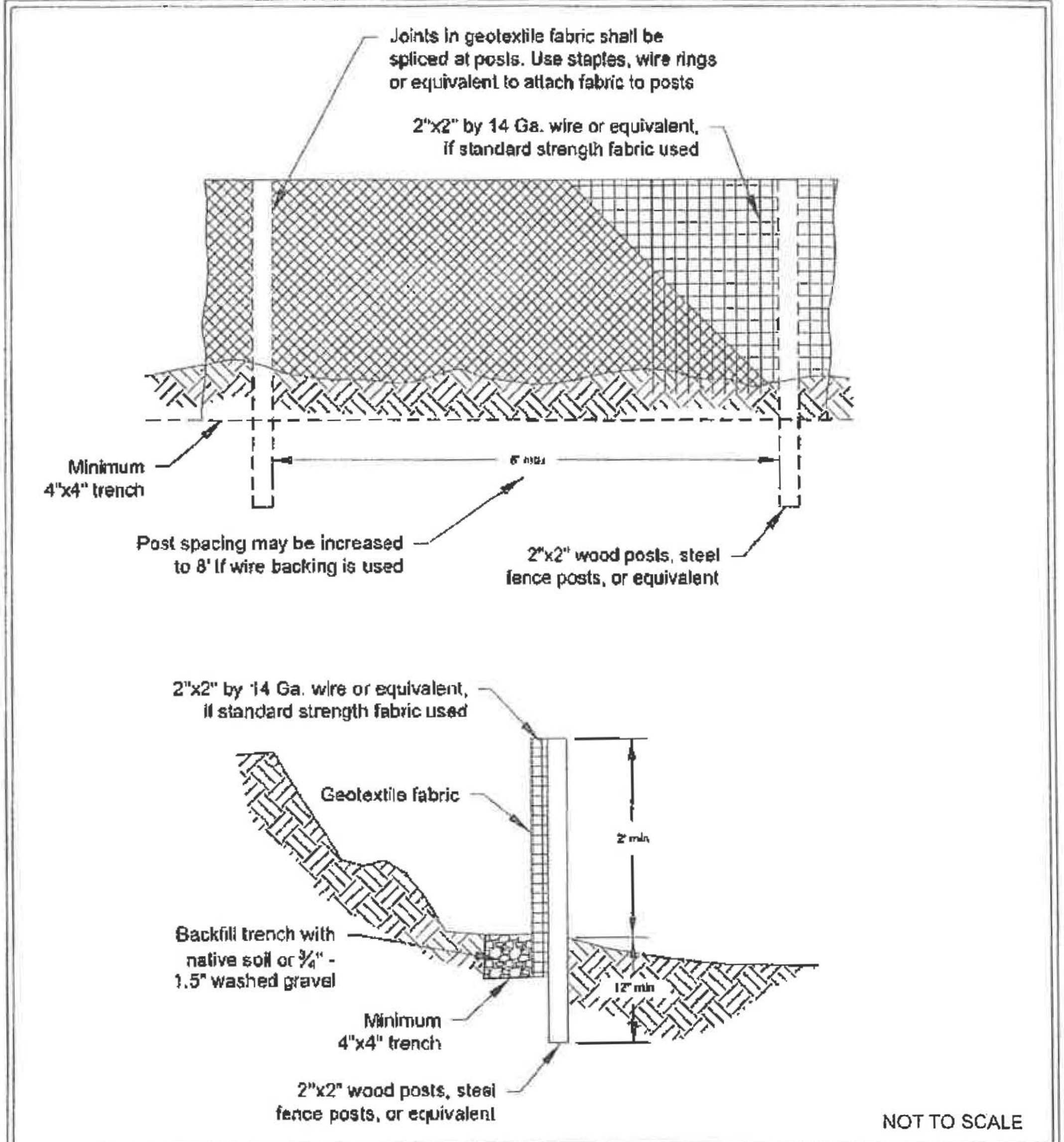
4. Applicant shall comply with the comment of the Fire Marshall, which states Emergency vehicle access must be provided during the project.
5. Per ECC 5.60.120, the hours of construction activity shall be no earlier than 6 am and no later than 10 pm.

Kirsten Sackett
Kirsten Sackett, Community Development Director

7-17-19
Date

Appeals: Pursuant to ECC 15.230.070, the City of Ellensburg establishes the appeal procedures which are contained in ECC 15.210.040(A) which shall be made to the Hearing Examiner, as applicable to the matter being appealed.

Figure 7.24: Silt Fence

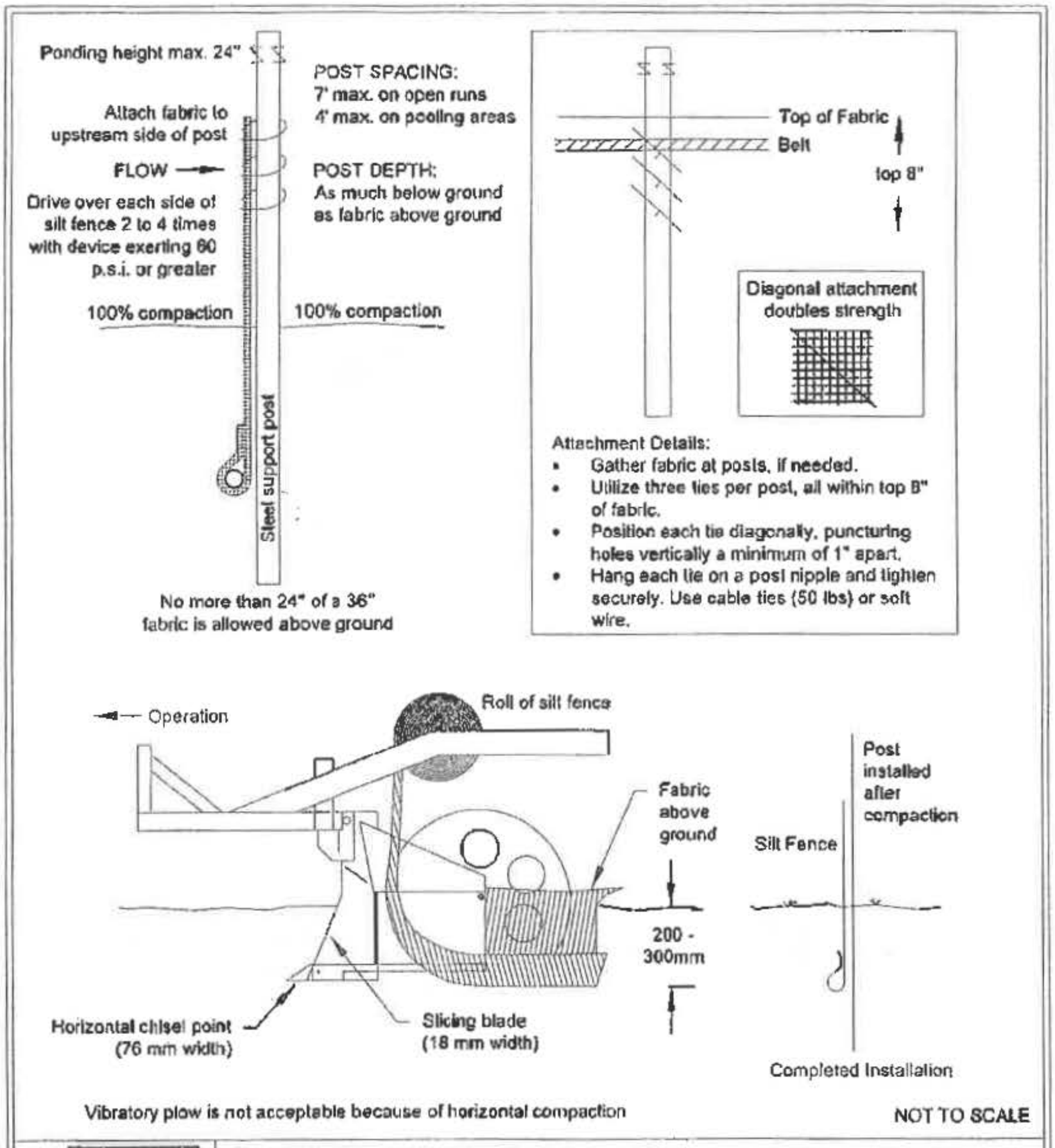


DEPARTMENT OF ECOLOGY
State of Washington

Silt Fence

Revised June 2016

Figure 7.25: Silt Fence Installation by Slicing Method



Attachment Details:

- Gather fabric at posts, if needed.
- Utilize three ties per post, all within top 8" of fabric.
- Position each tie diagonally, puncturing holes vertically a minimum of 1" apart.
- Hang each tie on a post nipple and tighten securely. Use cable ties (50 lbs) or soft wire.

Vibratory plow is not acceptable because of horizontal compaction

NOT TO SCALE

DEPARTMENT OF
ECOLOGY
State of Washington

Silt Fence Installation by Slicing Method

Revised June 2016

Attachment 2
Laboratory Reports

3600 Fremont Ave. N.
Seattle, WA 98103
T: (206) 352-3790
F: (206) 352-7178
info@fremontanalytical.com

Floyd | Snider
Gabe Cisneros
601 Union St., Suite 600
Seattle, WA 98101

RE: CL-Ellensburg
Work Order Number: 1908043

August 19, 2019

Attention Gabe Cisneros:

Fremont Analytical, Inc. received 11 sample(s) on 8/2/2019 for the analyses presented in the following report.

Ammonia by SM 4500 NH3 E
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.
Gasoline by NWTPH-Gx
Hydrocarbon Identification by NWTPH-HCID
Ion Chromatography by EPA Method 300.0
Sample Moisture (Percent Moisture)
Total Metals by EPA Method 6020B
Total Phosphorus by EPA Method 6020
Volatile Organic Compounds by EPA Method 8260D

This report consists of the following:

- Case Narrative
- Analytical Results
- Applicable Quality Control Summary Reports
- Chain of Custody

All analyses were performed consistent with the Quality Assurance program of Fremont Analytical, Inc. Please contact the laboratory if you should have any questions about the results.

Thank you for using Fremont Analytical.

Sincerely,

Brianna Barnes
Project Manager

DoD/ELAP Certification #L17-135, ISO/IEC 17025:2005
ORELAP Certification: WA 100009-007 (NELAP Recognized)

CLIENT: Floyd | Snider
Project: CL-Ellensburg
Work Order: 1908043

Work Order Sample Summary

Lab Sample ID	Client Sample ID	Date/Time Collected	Date/Time Received
1908043-001	DU-01-080219	08/02/2019 10:00 AM	08/02/2019 3:20 PM
1908043-002	DU-02-080219	08/02/2019 10:05 AM	08/02/2019 3:20 PM
1908043-003	DU-03-080219	08/02/2019 10:10 AM	08/02/2019 3:20 PM
1908043-004	DU-04-080219	08/02/2019 10:15 AM	08/02/2019 3:20 PM
1908043-005	DU-05-080219	08/02/2019 10:20 AM	08/02/2019 3:20 PM
1908043-006	Stockpile-01-080219	08/02/2019 11:00 AM	08/02/2019 3:20 PM
1908043-007	Stockpile-02-080219	08/02/2019 11:05 AM	08/02/2019 3:20 PM
1908043-008	Stockpile-03-080219	08/02/2019 11:10 AM	08/02/2019 3:20 PM
1908043-009	Stockpile-04-080219	08/02/2019 11:15 AM	08/02/2019 3:20 PM
1908043-010	Stockpile-05-080219	08/02/2019 11:20 AM	08/02/2019 3:20 PM
1908043-011	Trip Blank	07/19/2019 3:51 PM	08/02/2019 3:20 PM

Note: If no "Time Collected" is supplied, a default of 12:00AM is assigned

Case Narrative

WO#: **1908043**
Date: **8/19/2019**

CLIENT: Floyd | Snider
Project: CL-Ellensburg

I. SAMPLE RECEIPT:
Samples receipt information is recorded on the attached Sample Receipt Checklist.

II. GENERAL REPORTING COMMENTS:
Results are reported on a wet weight basis unless dry-weight correction is denoted in the units field on the analytical report ("mg/kg-dry" or "ug/kg-dry").

Matrix Spike (MS) and MS Duplicate (MSD) samples are tested from an analytical batch of "like" matrix to check for possible matrix effect. The MS and MSD will provide site specific matrix data only for those samples which are spiked by the laboratory. The sample chosen for spike purposes may or may not have been a sample submitted in this sample delivery group. The validity of the analytical procedures for which data is reported in this analytical report is determined by the Laboratory Control Sample (LCS) and the Method Blank (MB). The LCS and the MB are processed with the samples and the MS/MSD to ensure method criteria are achieved throughout the entire analytical process.

III. ANALYSES AND EXCEPTIONS:
Exceptions associated with this report will be footnoted in the analytical results page(s) or the quality control summary page(s) and/or noted below.

8/19/19: Rev1 includes quantification of HCID detections.

Qualifiers & Acronyms

WO#: **1908043**
Date Reported: **8/19/2019**

Qualifiers:

* - Flagged value is not within established control limits
B - Analyte detected in the associated Method Blank
D - Dilution was required
E - Value above quantitation range
H - Holding times for preparation or analysis exceeded
I - Analyte with an internal standard that does not meet established acceptance criteria
J - Analyte detected below Reporting Limit
N - Tentatively Identified Compound (TIC)
Q - Analyte with an initial or continuing calibration that does not meet established acceptance criteria (<20%RSD, <20% Drift or minimum RRF)
S - Spike recovery outside accepted recovery limits
ND - Not detected at the Reporting Limit
R - High relative percent difference observed

Acronyms:

%Rec - Percent Recovery
CCB - Continued Calibration Blank
CCV - Continued Calibration Verification
DF - Dilution Factor
HEM - Hexane Extractable Material
ICV - Initial Calibration Verification
LCS/LCSD - Laboratory Control Sample / Laboratory Control Sample Duplicate
MB or MBLANK - Method Blank
MDL - Method Detection Limit
MS/MSD - Matrix Spike / Matrix Spike Duplicate
PDS - Post Digestion Spike
Ref Val - Reference Value
RL - Reporting Limit
RPD - Relative Percent Difference
SD - Serial Dilution
SGT - Silica Gel Treatment
SPK - Spike
Surr - Surrogate

Analytical Report

Work Order: **1908043**
Date Reported: **8/19/2019**

Client: Floyd | Snider
Collection Date: 8/2/2019 10:00:00 AM
Project: CL-Ellensburg
Lab ID: 1908043-001
Matrix: Soil
Client Sample ID: DU-01-080219

Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.

Batch ID: 25389 Analyst: DW

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Diesel (Fuel Oil)	7,430	211	D	mg/Kg-dry	10	8/6/2019 5:44:03 PM
Heavy Oil	ND	52.6		mg/Kg-dry	1	8/6/2019 1:07:57 PM
Surr: 2-Fluorobiphenyl	96.4	50 - 150		%Rec	1	8/6/2019 1:07:57 PM
Surr: o-Terphenyl	111	50 - 150		%Rec	1	8/6/2019 1:07:57 PM

Gasoline by NWTPH-Gx

Batch ID: 25413 Analyst: CR

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Gasoline	ND	66.9	D	mg/Kg-dry	20	8/8/2019 12:28:32 PM
Surr: Toluene-d8	92.1	65 - 135	D	%Rec	20	8/8/2019 12:28:32 PM
Surr: 4-Bromofluorobenzene	161	65 - 135	DS	%Rec	20	8/8/2019 12:28:32 PM

NOTES:

S - Outlying surrogate recovery attributed to TPH interference. The method is in control as indicated by the Method Blank (MB) & Laboratory Control Sample (LCS).

Volatile Organic Compounds by EPA Method 8260D

Batch ID: 25413 Analyst: KT

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Benzene	ND	0.268	D	mg/Kg-dry	20	8/7/2019 8:22:22 PM
Toluene	ND	0.268	D	mg/Kg-dry	20	8/7/2019 8:22:22 PM
Ethylbenzene	ND	0.335	D	mg/Kg-dry	20	8/7/2019 8:22:22 PM
m,p-Xylene	ND	0.669	D	mg/Kg-dry	20	8/7/2019 8:22:22 PM
o-Xylene	ND	0.335	D	mg/Kg-dry	20	8/7/2019 8:22:22 PM
Naphthalene	ND	0.669	D	mg/Kg-dry	20	8/7/2019 8:22:22 PM
Surr: Dibromofluoromethane	102	56.5 - 129	D	%Rec	20	8/7/2019 8:22:22 PM
Surr: Toluene-d8	94.7	64.5 - 151	D	%Rec	20	8/7/2019 8:22:22 PM
Surr: 1-Bromo-4-fluorobenzene	107	54.8 - 168	D	%Rec	20	8/7/2019 8:22:22 PM

NOTES:

Diluted due to matrix.

Ion Chromatography by EPA Method 300.0

Batch ID: 25429 Analyst: SS

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Nitrite (as N)	ND	1.08		mg/Kg-dry	1	8/8/2019 8:49:00 PM
Nitrate (as N)	ND	1.08		mg/Kg-dry	1	8/8/2019 8:49:00 PM

Total Phosphorus by EPA Method 6020

Batch ID: 25388 Analyst: CO

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Phosphorus	456	16.3		mg/Kg-dry	1	8/6/2019 1:50:56 PM

Analytical Report

Work Order: **1908043**
Date Reported: **8/19/2019**

Client: Floyd | Snider
Collection Date: 8/2/2019 10:00:00 AM
Project: CL-Ellensburg
Lab ID: 1908043-001
Matrix: Soil
Client Sample ID: DU-01-080219

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Metals by EPA Method 6020B				Batch ID: 25388		Analyst: CO
Potassium	607	40.8		mg/Kg-dry	1	8/9/2019 12:32:57 PM
Sample Moisture (Percent Moisture)				Batch ID: R53048		Analyst: CJ
Percent Moisture	8.65	0.500		wt%	1	8/5/2019 1:19:28 PM
Ammonia by SM 4500 NH3 E				Batch ID: 25392		Analyst: SS
Nitrogen, Ammonia	ND	1.09		mg/Kg-dry	1	8/6/2019 10:20:00 AM

Analytical Report

Work Order: **1908043**
Date Reported: **8/19/2019**

Client: Floyd | Snider
Project: CL-Ellensburg
Lab ID: 1908043-002
Client Sample ID: **DU-02-080219**

Collection Date: 8/2/2019 10:05:00 AM
Matrix: Soil

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				Batch ID: 25389		Analyst: DW
Diesel (Fuel Oil)	11,100	192	D	mg/Kg-dry	10	8/6/2019 6:14:25 PM
Heavy Oil	ND	48.1		mg/Kg-dry	1	8/6/2019 2:08:08 PM
Surr: 2-Fluorobiphenyl	74.4	50 - 150		%Rec	1	8/6/2019 2:08:08 PM
Surr: o-Terphenyl	116	50 - 150		%Rec	1	8/6/2019 2:08:08 PM
Gasoline by NWTPH-Gx				Batch ID: 25413		Analyst: CR
Gasoline	ND	89.5	D	mg/Kg-dry	20	8/8/2019 1:28:48 PM
Surr: Toluene-d8	92.4	65 - 135	D	%Rec	20	8/8/2019 1:28:48 PM
Surr: 4-Bromofluorobenzene	150	65 - 135	DS	%Rec	20	8/8/2019 1:28:48 PM

NOTES:
S - Outlying surrogate recovery attributed to TPH interference. The method is in control as indicated by the Method Blank (MB) & Laboratory Control Sample (LCS).

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Volatile Organic Compounds by EPA Method 8260D				Batch ID: 25413		Analyst: KT
Benzene	ND	0.358	D	mg/Kg-dry	20	8/7/2019 8:52:29 PM
Toluene	ND	0.358	D	mg/Kg-dry	20	8/7/2019 8:52:29 PM
Ethylbenzene	ND	0.448	D	mg/Kg-dry	20	8/7/2019 8:52:29 PM
m,p-Xylene	ND	0.895	D	mg/Kg-dry	20	8/7/2019 8:52:29 PM
o-Xylene	ND	0.448	D	mg/Kg-dry	20	8/7/2019 8:52:29 PM
Naphthalene	ND	0.895	D	mg/Kg-dry	20	8/7/2019 8:52:29 PM
Surr: Dibromofluoromethane	98.8	56.5 - 129	D	%Rec	20	8/7/2019 8:52:29 PM
Surr: Toluene-d8	93.5	64.5 - 151	D	%Rec	20	8/7/2019 8:52:29 PM
Surr: 1-Bromo-4-fluorobenzene	105	54.8 - 168	D	%Rec	20	8/7/2019 8:52:29 PM

NOTES:
Diluted due to matrix.

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Sample Moisture (Percent Moisture)				Batch ID: R53048		Analyst: CJ
Percent Moisture	10.0	0.500		wt%	1	8/5/2019 1:19:28 PM

Client: Floyd | Snider
Collection Date: 8/2/2019 10:10:00 AM
Project: CL-Ellensburg
Lab ID: 1908043-003
Matrix: Soil
Client Sample ID: DU-03-080219

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				Batch ID: 25389		Analyst: DW
Diesel (Fuel Oil)	12,800	230	D	mg/Kg-dry	10	8/6/2019 6:44:41 PM
Heavy Oil	ND	57.4		mg/Kg-dry	1	8/6/2019 2:38:11 PM
Surr: 2-Fluorobiphenyl	55.3	50 - 150		%Rec	1	8/6/2019 2:38:11 PM
Surr: o-Terphenyl	116	50 - 150		%Rec	1	8/6/2019 2:38:11 PM
Gasoline by NWTPH-Gx				Batch ID: 25413		Analyst: CR
Gasoline	ND	218	D	mg/Kg-dry	50	8/8/2019 1:58:57 PM
Surr: Toluene-d8	92.5	65 - 135	D	%Rec	50	8/8/2019 1:58:57 PM
Surr: 4-Bromofluorobenzene	135	65 - 135	DS	%Rec	50	8/8/2019 1:58:57 PM
NOTES: S - Outlying surrogate recovery attributed to TPH interference. The method is in control as indicated by the Method Blank (MB) & Laboratory Control Sample (LCS).						
Volatile Organic Compounds by EPA Method 8260D				Batch ID: 25413		Analyst: KT
Benzene	ND	0.348	D	mg/Kg-dry	20	8/7/2019 9:22:36 PM
Toluene	ND	0.348	D	mg/Kg-dry	20	8/7/2019 9:22:36 PM
Ethylbenzene	ND	0.435	D	mg/Kg-dry	20	8/7/2019 9:22:36 PM
m,p-Xylene	ND	0.871	D	mg/Kg-dry	20	8/7/2019 9:22:36 PM
o-Xylene	ND	0.435	D	mg/Kg-dry	20	8/7/2019 9:22:36 PM
Naphthalene	ND	0.871	D	mg/Kg-dry	20	8/7/2019 9:22:36 PM
Surr: Dibromofluoromethane	97.4	56.5 - 129	D	%Rec	20	8/7/2019 9:22:36 PM
Surr: Toluene-d8	95.2	64.5 - 151	D	%Rec	20	8/7/2019 9:22:36 PM
Surr: 1-Bromo-4-fluorobenzene	104	54.8 - 168	D	%Rec	20	8/7/2019 9:22:36 PM
NOTES: Diluted due to matrix.						
Sample Moisture (Percent Moisture)				Batch ID: R53048		Analyst: CJ
Percent Moisture	14.1	0.500		wt%	1	8/5/2019 1:19:28 PM

Analytical Report

Work Order: **1908043**
Date Reported: **8/19/2019**

Client: Floyd | Snider
Collection Date: 8/2/2019 10:15:00 AM
Project: CL-Ellensburg
Lab ID: 1908043-004
Matrix: Soil
Client Sample ID: DU-04-080219

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				Batch ID: 25389		Analyst: DW
Diesel (Fuel Oil)	1,350	22.3		mg/Kg-dry	1	8/6/2019 9:16:03 PM
Heavy Oil	ND	55.8		mg/Kg-dry	1	8/6/2019 3:08:23 PM
Surr: 2-Fluorobiphenyl	100	50 - 150		%Rec	1	8/6/2019 3:08:23 PM
Surr: o-Terphenyl	99.8	50 - 150		%Rec	1	8/6/2019 3:08:23 PM
Gasoline by NWTPH-Gx				Batch ID: 25413		Analyst: CR
Gasoline	ND	51.8	D	mg/Kg-dry	10	8/8/2019 2:29:05 PM
Surr: Toluene-d8	91.4	65 - 135	D	%Rec	10	8/8/2019 2:29:05 PM
Surr: 4-Bromofluorobenzene	119	65 - 135	D	%Rec	10	8/8/2019 2:29:05 PM
Volatile Organic Compounds by EPA Method 8260D				Batch ID: 25413		Analyst: KT
Benzene	ND	0.207	D	mg/Kg-dry	10	8/7/2019 9:52:43 PM
Toluene	ND	0.207	D	mg/Kg-dry	10	8/7/2019 9:52:43 PM
Ethylbenzene	ND	0.259	D	mg/Kg-dry	10	8/7/2019 9:52:43 PM
m,p-Xylene	ND	0.518	D	mg/Kg-dry	10	8/7/2019 9:52:43 PM
o-Xylene	ND	0.259	D	mg/Kg-dry	10	8/7/2019 9:52:43 PM
Naphthalene	ND	0.518	D	mg/Kg-dry	10	8/7/2019 9:52:43 PM
Surr: Dibromofluoromethane	96.1	56.5 - 129	D	%Rec	10	8/7/2019 9:52:43 PM
Surr: Toluene-d8	92.2	64.5 - 151	D	%Rec	10	8/7/2019 9:52:43 PM
Surr: 1-Bromo-4-fluorobenzene	107	54.8 - 168	D	%Rec	10	8/7/2019 9:52:43 PM

NOTES:
Diluted due to matrix.

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Sample Moisture (Percent Moisture)				Batch ID: R53048		Analyst: CJ
Percent Moisture	19.6	0.500		wt%	1	8/5/2019 1:19:28 PM

Analytical Report

Work Order: **1908043**
Date Reported: **8/19/2019**

Client: Floyd | Snider
Project: CL-Ellensburg
Lab ID: 1908043-005
Client Sample ID: **DU-05-080219**

Collection Date: 8/2/2019 10:20:00 AM
Matrix: Soil

Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.

Batch ID: 25389 Analyst: DW

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Diesel (Fuel Oil)	2,150	23.9		mg/Kg-dry	1	8/6/2019 3:38:29 PM
Heavy Oil	ND	59.7		mg/Kg-dry	1	8/6/2019 3:38:29 PM
Surr: 2-Fluorobiphenyl	104	50 - 150		%Rec	1	8/6/2019 3:38:29 PM
Surr: o-Terphenyl	107	50 - 150		%Rec	1	8/6/2019 3:38:29 PM

Gasoline by NWTPH-Gx

Batch ID: 25413 Analyst: CR

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Gasoline	ND	52.3	D	mg/Kg-dry	10	8/8/2019 2:59:12 PM
Surr: Toluene-d8	92.9	65 - 135	D	%Rec	10	8/8/2019 2:59:12 PM
Surr: 4-Bromofluorobenzene	120	65 - 135	D	%Rec	10	8/8/2019 2:59:12 PM

Volatile Organic Compounds by EPA Method 8260D

Batch ID: 25413 Analyst: KT

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Benzene	ND	0.209	D	mg/Kg-dry	10	8/7/2019 10:22:50 PM
Toluene	ND	0.209	D	mg/Kg-dry	10	8/7/2019 10:22:50 PM
Ethylbenzene	ND	0.262	D	mg/Kg-dry	10	8/7/2019 10:22:50 PM
m,p-Xylene	ND	0.523	D	mg/Kg-dry	10	8/7/2019 10:22:50 PM
o-Xylene	ND	0.262	D	mg/Kg-dry	10	8/7/2019 10:22:50 PM
Naphthalene	ND	0.523	D	mg/Kg-dry	10	8/7/2019 10:22:50 PM
Surr: Dibromofluoromethane	96.6	56.5 - 129	D	%Rec	10	8/7/2019 10:22:50 PM
Surr: Toluene-d8	92.6	64.5 - 151	D	%Rec	10	8/7/2019 10:22:50 PM
Surr: 1-Bromo-4-fluorobenzene	107	54.8 - 168	D	%Rec	10	8/7/2019 10:22:50 PM

NOTES:
Diluted due to matrix.

Sample Moisture (Percent Moisture)

Batch ID: R53048 Analyst: CJ

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Percent Moisture	18.2	0.500		wt%	1	8/5/2019 1:19:28 PM

Analytical Report

Work Order: **1908043**
Date Reported: **8/19/2019**

Client: Floyd | Snider
Collection Date: 8/2/2019 11:00:00 AM
Project: CL-Ellensburg
Lab ID: 1908043-006
Matrix: Soil
Client Sample ID: Stockpile-01-080219

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Hydrocarbon Identification by NWTPH-HCID				Batch ID: 25389		Analyst: DW
Gasoline	ND	21.9		mg/Kg-dry	1	8/6/2019 11:16:22 PM
Mineral Spirits	ND	32.8		mg/Kg-dry	1	8/6/2019 11:16:22 PM
Kerosene	ND	54.7		mg/Kg-dry	1	8/6/2019 11:16:22 PM
Diesel (Fuel Oil)	ND	54.7		mg/Kg-dry	1	8/6/2019 11:16:22 PM
Heavy Oil	ND	109		mg/Kg-dry	1	8/6/2019 11:16:22 PM
Mineral Oil	ND	109		mg/Kg-dry	1	8/6/2019 11:16:22 PM
Surr: 2-Fluorobiphenyl	101	50 - 150		%Rec	1	8/6/2019 11:16:22 PM
Surr: o-Terphenyl	107	50 - 150		%Rec	1	8/6/2019 11:16:22 PM
Sample Moisture (Percent Moisture)				Batch ID: R53048		Analyst: CJ
Percent Moisture	14.1	0.500		wt%	1	8/5/2019 1:19:28 PM

Analytical Report

Work Order: **1908043**
Date Reported: **8/19/2019**

Client: Floyd | Snider
Collection Date: 8/2/2019 11:05:00 AM
Project: CL-Ellensburg
Lab ID: 1908043-007
Matrix: Soil
Client Sample ID: Stockpile-02-080219

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Hydrocarbon Identification by NWTPH-HCID				Batch ID: 25389		Analyst: DW
Gasoline	ND	22.2		mg/Kg-dry	1	8/6/2019 11:46:17 PM
Mineral Spirits	ND	33.3		mg/Kg-dry	1	8/6/2019 11:46:17 PM
Kerosene	ND	55.5		mg/Kg-dry	1	8/6/2019 11:46:17 PM
Diesel (Fuel Oil)	ND	55.5		mg/Kg-dry	1	8/6/2019 11:46:17 PM
Heavy Oil	ND	111		mg/Kg-dry	1	8/6/2019 11:46:17 PM
Mineral Oil	ND	111		mg/Kg-dry	1	8/6/2019 11:46:17 PM
Surr: 2-Fluorobiphenyl	98.8	50 - 150		%Rec	1	8/6/2019 11:46:17 PM
Surr: o-Terphenyl	103	50 - 150		%Rec	1	8/6/2019 11:46:17 PM
Sample Moisture (Percent Moisture)				Batch ID: R53048		Analyst: CJ
Percent Moisture	15.4	0.500		wt%	1	8/5/2019 1:19:28 PM

Analytical Report

Work Order: **1908043**
Date Reported: **8/19/2019**

Client: Floyd | Snider
Collection Date: 8/2/2019 11:10:00 AM
Project: CL-Ellensburg
Lab ID: 1908043-008
Matrix: Soil
Client Sample ID: Stockpile-03-080219

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				Batch ID: 25389		Analyst: DW
Diesel (Fuel Oil)	204	19.2		mg/Kg-dry	1	8/7/2019 12:16:21 AM
Heavy Oil	194	47.9		mg/Kg-dry	1	8/7/2019 12:16:21 AM
Surr: 2-Fluorobiphenyl	96.7	50 - 150		%Rec	1	8/7/2019 12:16:21 AM
Surr: o-Terphenyl	103	50 - 150		%Rec	1	8/7/2019 12:16:21 AM
Hydrocarbon Identification by NWTPH-HCID				Batch ID: 25389		Analyst: DW
Gasoline	ND	19.2		mg/Kg-dry	1	8/7/2019 12:16:21 AM
Mineral Spirits	ND	28.8		mg/Kg-dry	1	8/7/2019 12:16:21 AM
Kerosene	ND	47.9		mg/Kg-dry	1	8/7/2019 12:16:21 AM
Diesel (Fuel Oil)	DETECT	47.9		mg/Kg-dry	1	8/7/2019 12:16:21 AM
Heavy Oil	DETECT	95.9		mg/Kg-dry	1	8/7/2019 12:16:21 AM
Mineral Oil	ND	95.9		mg/Kg-dry	1	8/7/2019 12:16:21 AM
Surr: 2-Fluorobiphenyl	96.7	50 - 150		%Rec	1	8/7/2019 12:16:21 AM
Surr: o-Terphenyl	103	50 - 150		%Rec	1	8/7/2019 12:16:21 AM
Sample Moisture (Percent Moisture)				Batch ID: R53048		Analyst: CJ
Percent Moisture	11.0	0.500		wt%	1	8/5/2019 1:19:28 PM

Analytical Report

Work Order: **1908043**
Date Reported: **8/19/2019**

Client: Floyd | Snider
Collection Date: 8/2/2019 11:15:00 AM
Project: CL-Ellensburg
Lab ID: 1908043-009
Matrix: Soil
Client Sample ID: Stockpile-04-080219

Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.

Batch ID: 25389 Analyst: DW

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Diesel (Fuel Oil)	114	22.1		mg/Kg-dry	1	8/7/2019 12:46:17 AM
Heavy Oil	ND	55.3		mg/Kg-dry	1	8/7/2019 12:46:17 AM
Surr: 2-Fluorobiphenyl	107	50 - 150		%Rec	1	8/7/2019 12:46:17 AM
Surr: o-Terphenyl	112	50 - 150		%Rec	1	8/7/2019 12:46:17 AM

Hydrocarbon Identification by NWTPH-HCID

Batch ID: 25389 Analyst: DW

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Gasoline	ND	22.1		mg/Kg-dry	1	8/7/2019 12:46:17 AM
Mineral Spirits	ND	33.2		mg/Kg-dry	1	8/7/2019 12:46:17 AM
Kerosene	ND	55.3		mg/Kg-dry	1	8/7/2019 12:46:17 AM
Diesel (Fuel Oil)	DETECT	55.3		mg/Kg-dry	1	8/7/2019 12:46:17 AM
Heavy Oil	ND	111		mg/Kg-dry	1	8/7/2019 12:46:17 AM
Mineral Oil	ND	111		mg/Kg-dry	1	8/7/2019 12:46:17 AM
Surr: 2-Fluorobiphenyl	107	50 - 150		%Rec	1	8/7/2019 12:46:17 AM
Surr: o-Terphenyl	112	50 - 150		%Rec	1	8/7/2019 12:46:17 AM

Sample Moisture (Percent Moisture)

Batch ID: R53048 Analyst: CJ

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Percent Moisture	11.3	0.500		wt%	1	8/5/2019 1:19:28 PM

Analytical Report

Work Order: **1908043**
Date Reported: **8/19/2019**

Client: Floyd | Snider
Collection Date: 8/2/2019 11:20:00 AM
Project: CL-Ellensburg
Lab ID: 1908043-010
Matrix: Soil
Client Sample ID: Stockpile-05-080219

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Hydrocarbon Identification by NWTPH-HCID				Batch ID: 25389		Analyst: DW
Gasoline	ND	22.5		mg/Kg-dry	1	8/7/2019 1:16:15 AM
Mineral Spirits	ND	33.7		mg/Kg-dry	1	8/7/2019 1:16:15 AM
Kerosene	ND	56.2		mg/Kg-dry	1	8/7/2019 1:16:15 AM
Diesel (Fuel Oil)	ND	56.2		mg/Kg-dry	1	8/7/2019 1:16:15 AM
Heavy Oil	ND	112		mg/Kg-dry	1	8/7/2019 1:16:15 AM
Mineral Oil	ND	112		mg/Kg-dry	1	8/7/2019 1:16:15 AM
Surr: 2-Fluorobiphenyl	114	50 - 150		%Rec	1	8/7/2019 1:16:15 AM
Surr: o-Terphenyl	120	50 - 150		%Rec	1	8/7/2019 1:16:15 AM
Sample Moisture (Percent Moisture)				Batch ID: R53048		Analyst: CJ
Percent Moisture	11.8	0.500		wt%	1	8/5/2019 1:19:28 PM

Work Order: 1908043
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Ammonia by SM 4500 NH3 E

Sample ID: **MB-25392** SampType: **MBLK** Units: **mg/Kg** Prep Date: **8/5/2019** RunNo: **53078**
Client ID: **MBLKS** Batch ID: **25392** Analysis Date: **8/6/2019** SeqNo: **1048767**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Nitrogen, Ammonia	ND	1.00									

Sample ID: **LCS-25392** SampType: **LCS** Units: **mg/Kg** Prep Date: **8/5/2019** RunNo: **53078**
Client ID: **LCSS** Batch ID: **25392** Analysis Date: **8/6/2019** SeqNo: **1048768**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Nitrogen, Ammonia	19.7	1.00	20.00	0	98.4	85	115				

Sample ID: **1908043-001ADUP** SampType: **DUP** Units: **mg/Kg-dry** Prep Date: **8/5/2019** RunNo: **53078**
Client ID: **DU-01-080219** Batch ID: **25392** Analysis Date: **8/6/2019** SeqNo: **1048770**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Nitrogen, Ammonia	ND	1.09						0		30	

Sample ID: **1908043-001AMS** SampType: **MS** Units: **mg/Kg-dry** Prep Date: **8/5/2019** RunNo: **53078**
Client ID: **DU-01-080219** Batch ID: **25392** Analysis Date: **8/6/2019** SeqNo: **1048771**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Nitrogen, Ammonia	17.7	1.10	22.00	0.7112	77.2	80	120				S

NOTES:
S - Outlying spike recovery(ies) observed. A duplicate analysis was performed and recovered within range.

Sample ID: **1908043-001AMSD** SampType: **MSD** Units: **mg/Kg-dry** Prep Date: **8/5/2019** RunNo: **53078**
Client ID: **DU-01-080219** Batch ID: **25392** Analysis Date: **8/6/2019** SeqNo: **1048772**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Nitrogen, Ammonia	21.6	1.09	21.74	0.7112	96.2	80	120	17.70	19.9	20	

Work Order: 1908043
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Ion Chromatography by EPA Method 300.0

Sample ID: **MB-25429** SampType: **MBLK** Units: **mg/Kg** Prep Date: **8/8/2019** RunNo: **53154**
Client ID: **MBLKS** Batch ID: **25429** Analysis Date: **8/8/2019** SeqNo: **1050394**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Nitrite (as N)	ND	1.00									
Nitrate (as N)	ND	1.00									

Sample ID: **LCS-25429** SampType: **LCS** Units: **mg/Kg** Prep Date: **8/8/2019** RunNo: **53154**
Client ID: **LCSS** Batch ID: **25429** Analysis Date: **8/8/2019** SeqNo: **1050395**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Nitrite (as N)	7.36	1.00	7.500	0	98.1	90	110				
Nitrate (as N)	7.28	1.00	7.500	0	97.1	90	110				

Sample ID: **1908043-001ADUP** SampType: **DUP** Units: **mg/Kg-dry** Prep Date: **8/8/2019** RunNo: **53154**
Client ID: **DU-01-080219** Batch ID: **25429** Analysis Date: **8/8/2019** SeqNo: **1050397**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Nitrite (as N)	ND	1.09						0		30	
Nitrate (as N)	ND	1.09						0		30	

Sample ID: **1908043-001AMS** SampType: **MS** Units: **mg/Kg-dry** Prep Date: **8/8/2019** RunNo: **53154**
Client ID: **DU-01-080219** Batch ID: **25429** Analysis Date: **8/8/2019** SeqNo: **1050398**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Nitrite (as N)	7.90	1.08	8.109	0	97.5	80	120				
Nitrate (as N)	7.82	1.08	8.109	0	96.4	80	120				

Sample ID: **1908043-001AMSD** SampType: **MSD** Units: **mg/Kg-dry** Prep Date: **8/8/2019** RunNo: **53154**
Client ID: **DU-01-080219** Batch ID: **25429** Analysis Date: **8/8/2019** SeqNo: **1050399**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Nitrite (as N)	7.91	1.08	8.096	0	97.7	80	120	7.904	0.115	30	

Work Order: 1908043
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Ion Chromatography by EPA Method 300.0

Sample ID: **1908043-001AMSD**	SampType: **MSD**			Units: **mg/Kg-dry**		Prep Date: **8/8/2019**		RunNo: **53154**			
Client ID: **DU-01-080219**	Batch ID: **25429**					Analysis Date: **8/8/2019**		SeqNo: **1050399**			
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Nitrate (as N)	7.89	1.08	8.096	0	97.5	80	120	7.817	0.943	30	

Work Order: 1908043
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Total Phosphorus by EPA Method 6020

Sample ID: **MB-25388**	SampType: **MBLK**			Units: **mg/Kg**		Prep Date: **8/5/2019**				RunNo: **53133**		
Client ID: **MBLKS**	Batch ID: **25388**					Analysis Date: **8/6/2019**				SeqNo: **1050008**		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val		%RPD	RPDLimit	Qual
Phosphorus	ND	14.3										

Sample ID: **LCS-25388**	SampType: **LCS**			Units: **mg/Kg**		Prep Date: **8/5/2019**				RunNo: **53133**		
Client ID: **LCSS**	Batch ID: **25388**					Analysis Date: **8/6/2019**				SeqNo: **1050009**		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val		%RPD	RPDLimit	Qual
Phosphorus	417	16.0	400.0	0	104	80	120					

Sample ID: **1908048-001ADUP**	SampType: **DUP**			Units: **mg/Kg-dry**		Prep Date: **8/5/2019**				RunNo: **53133**		
Client ID: **BATCH**	Batch ID: **25388**					Analysis Date: **8/6/2019**				SeqNo: **1050011**		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val		%RPD	RPDLimit	Qual
Phosphorus	552	20.2						723.9		26.9	20	R

NOTES:
R - High RPD observed. The method is in control as indicated by the LCS.

Sample ID: **1908048-001AMS**	SampType: **MS**			Units: **mg/Kg-dry**		Prep Date: **8/5/2019**				RunNo: **53133**		
Client ID: **BATCH**	Batch ID: **25388**					Analysis Date: **8/6/2019**				SeqNo: **1050013**		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val		%RPD	RPDLimit	Qual
Phosphorus	990	20.9	522.4	723.9	51.0	75	125					S

NOTES:
S - Outlying spike recovery(ies) observed. A duplicate analysis was performed with similar results indicating a possible matrix effect.

Sample ID: **1908048-001AMSD**	SampType: **MSD**			Units: **mg/Kg-dry**		Prep Date: **8/5/2019**				RunNo: **53133**		
Client ID: **BATCH**	Batch ID: **25388**					Analysis Date: **8/6/2019**				SeqNo: **1050016**		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val		%RPD	RPDLimit	Qual
Phosphorus	1,040	20.6	514.1	723.9	62.0	75	125	990.5		5.12	20	S

Work Order: 1908043
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Total Phosphorus by EPA Method 6020

Sample ID: **1908048-001AMSD**		SampType: **MSD**			Units: **mg/Kg-dry**		Prep Date: **8/5/2019**		RunNo: **53133**			
Client ID: **BATCH**		Batch ID: **25388**					Analysis Date: **8/6/2019**		SeqNo: **1050016**			
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual	

NOTES:
S - Outlying spike recovery(ies) observed. A duplicate analysis was performed with similar results indicating a possible matrix effect.

Work Order: 1908043
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Total Metals by EPA Method 6020B

Sample ID: **MB-25388**	SampType: **MBLK**	Units: **mg/Kg**	Prep Date: **8/5/2019**	RunNo: **53067**					
Client ID: **MBLKS**	Batch ID: **25388**		Analysis Date: **8/9/2019**	SeqNo: **1050468**					

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Potassium	ND	35.7									

Sample ID: **LCS-25388**	SampType: **LCS**	Units: **mg/Kg**	Prep Date: **8/5/2019**	RunNo: **53067**
Client ID: **LCSS**	Batch ID: **25388**		Analysis Date: **8/9/2019**	SeqNo: **1050469**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Potassium	421	40.0	400.0	0	105	80	120				

Sample ID: **1908048-001ADUP**	SampType: **DUP**	Units: **mg/Kg-dry**	Prep Date: **8/5/2019**	RunNo: **53067**
Client ID: **BATCH**	Batch ID: **25388**		Analysis Date: **8/9/2019**	SeqNo: **1050471**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Potassium	827	50.6						683.2	19.0	20	

Sample ID: **1908048-001AMS**	SampType: **MS**	Units: **mg/Kg-dry**	Prep Date: **8/5/2019**	RunNo: **53067**
Client ID: **BATCH**	Batch ID: **25388**		Analysis Date: **8/9/2019**	SeqNo: **1050473**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Potassium	1,060	52.2	522.4	683.2	71.4	75	125				S

NOTES:
S - Outlying spike recovery(ies) observed. A duplicate analysis was performed with similar results indicating a possible matrix effect.

Sample ID: **1908048-001AMSD**	SampType: **MSD**	Units: **mg/Kg-dry**	Prep Date: **8/5/2019**	RunNo: **53067**
Client ID: **BATCH**	Batch ID: **25388**		Analysis Date: **8/9/2019**	SeqNo: **1050474**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Potassium	1,040	51.4	514.1	683.2	69.0	75	125	1,056	1.76	20	S

NOTES:
S - Outlying spike recovery(ies) observed. A duplicate analysis was performed with similar results indicating a possible matrix effect.

Work Order: 1908043
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.

Sample ID: **MB-25389** SampType: **MBLK** Units: **mg/Kg** Prep Date: **8/5/2019** RunNo: **53093**
Client ID: **MBLKS** Batch ID: **25389** Analysis Date: **8/6/2019** SeqNo: **1049029**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel (Fuel Oil)	ND	20.0									
Heavy Oil	ND	50.0									
Surr: 2-Fluorobiphenyl	18.7		20.00		93.5	50	150				
Surr: o-Terphenyl	19.9		20.00		99.6	50	150				

Sample ID: **LCS-25389** SampType: **LCS** Units: **mg/Kg** Prep Date: **8/5/2019** RunNo: **53093**
Client ID: **LCSS** Batch ID: **25389** Analysis Date: **8/6/2019** SeqNo: **1049030**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel (Fuel Oil)	459	20.0	500.0	0	91.8	65	135				
Surr: 2-Fluorobiphenyl	20.4		20.00		102	50	150				
Surr: o-Terphenyl	20.7		20.00		103	50	150				

Sample ID: **1908043-001ADUP** SampType: **DUP** Units: **mg/Kg-dry** Prep Date: **8/5/2019** RunNo: **53093**
Client ID: **DU-01-080219** Batch ID: **25389** Analysis Date: **8/6/2019** SeqNo: **1049043**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel (Fuel Oil)	5,930	196						7,432	22.4	30	D
Heavy Oil	ND	490						0		30	D
Surr: 2-Fluorobiphenyl	10.7		19.62		54.5	50	150		0		D
Surr: o-Terphenyl	15.3		19.62		78.0	50	150		0		D

Sample ID: **1908043-001AMS** SampType: **MS** Units: **mg/Kg-dry** Prep Date: **8/5/2019** RunNo: **53093**
Client ID: **DU-01-080219** Batch ID: **25389** Analysis Date: **8/6/2019** SeqNo: **1049044**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel (Fuel Oil)	7,530	189	473.1	7,432	20.6	65	135				DS
Surr: 2-Fluorobiphenyl	20.1		18.92		106	50	150				D
Surr: o-Terphenyl	19.2		18.92		102	50	150				D

Work Order: 1908043
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.

Sample ID: **1908043-001AMS** SampType: **MS** Units: **mg/Kg-dry** Prep Date: **8/5/2019** RunNo: **53093**
Client ID: **DU-01-080219** Batch ID: **25389** Analysis Date: **8/6/2019** SeqNo: **1049044**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

NOTES:
S - Analyte concentration was too high for accurate spike recovery(ies).

Sample ID: **1908043-001AMSD** SampType: **MSD** Units: **mg/Kg-dry** Prep Date: **8/5/2019** RunNo: **53093**
Client ID: **DU-01-080219** Batch ID: **25389** Analysis Date: **8/6/2019** SeqNo: **1049045**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel (Fuel Oil)	7,260	212	530.9	7,432	-33.3	65	135	7,529	3.71	30	DS
Surr: 2-Fluorobiphenyl	11.1		21.24		52.5	50	150		0		D
Surr: o-Terphenyl	17.0		21.24		80.0	50	150		0		D

NOTES:
S - Analyte concentration was too high for accurate spike recovery(ies).

Sample ID: **1908047-001ADUP** SampType: **DUP** Units: **mg/Kg-dry** Prep Date: **8/5/2019** RunNo: **53093**
Client ID: **BATCH** Batch ID: **25389** Analysis Date: **8/7/2019** SeqNo: **1049055**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel (Fuel Oil)	ND	27.3						0		30	
Heavy Oil	364	68.2						381.0	4.54	30	
Surr: 2-Fluorobiphenyl	27.8		27.29		102	50	150		0		
Surr: o-Terphenyl	29.1		27.29		106	50	150		0		

Work Order: 1908043
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Hydrocarbon Identification by NWTPH-HCID

Sample ID: **MB-25389** SampType: **MBLK** Units: **mg/Kg** Prep Date: **8/5/2019** RunNo: **53099**
Client ID: **MBLKS** Batch ID: **25389** Analysis Date: **8/6/2019** SeqNo: **1049190**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Gasoline	ND	20.0									
Mineral Spirits	ND	30.0									
Kerosene	ND	50.0									
Diesel (Fuel Oil)	ND	50.0									
Heavy Oil	ND	100									
Mineral Oil	ND	100									
Surr: 2-Fluorobiphenyl	18.7		20.00		93.5	50	150				
Surr: o-Terphenyl	19.9		20.00		99.6	50	150				

Sample ID: **LCS-25389** SampType: **LCS** Units: **mg/Kg** Prep Date: **8/5/2019** RunNo: **53099**
Client ID: **LCSS** Batch ID: **25389** Analysis Date: **8/6/2019** SeqNo: **1049191**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel (Fuel Oil)	459	50.0	500.0	0	91.8	65	135				
Surr: 2-Fluorobiphenyl	20.4		20.00		102	50	150				
Surr: o-Terphenyl	20.7		20.00		103	50	150				

Work Order: 1908043
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Gasoline by NWTPH-Gx

Sample ID: **LCS-25413** SampType: **LCS** Units: **mg/Kg** Prep Date: **8/7/2019** RunNo: **53148**
Client ID: **LCSS** Batch ID: **25413** Analysis Date: **8/8/2019** SeqNo: **1050415**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Gasoline	24.2	5.00	25.00	0	96.9	65	135				
Surr: Toluene-d8	1.22		1.250		97.6	65	135				
Surr: 4-Bromofluorobenzene	1.27		1.250		101	65	135				

Sample ID: **MB-25413** SampType: **MBLK** Units: **mg/Kg** Prep Date: **8/7/2019** RunNo: **53148**
Client ID: **MBLKS** Batch ID: **25413** Analysis Date: **8/8/2019** SeqNo: **1050417**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Gasoline	ND	5.00									
Surr: Toluene-d8	1.18		1.250		94.1	65	135				
Surr: 4-Bromofluorobenzene	1.15		1.250		92.4	65	135				

Sample ID: **1908043-001BDUP** SampType: **DUP** Units: **mg/Kg-dry** Prep Date: **8/7/2019** RunNo: **53148**
Client ID: **DU-01-080219** Batch ID: **25413** Analysis Date: **8/8/2019** SeqNo: **1050405**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Gasoline	ND	66.9						0		30	D
Surr: Toluene-d8	15.6		16.74		93.2	65	135		0		D
Surr: 4-Bromofluorobenzene	27.7		16.74		166	65	135		0		DS

NOTES:
S - Outlying surrogate recovery attributed to TPH interference. The method is in control as indicated by the Method Blank (MB) & Laboratory Control Sample (LCS).

Sample ID: **LCSD-25413** SampType: **LCSD** Units: **mg/Kg** Prep Date: **8/7/2019** RunNo: **53148**
Client ID: **LCSS02** Batch ID: **25413** Analysis Date: **8/8/2019** SeqNo: **1050416**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Gasoline	26.5	5.00	25.00	0	106	65	135	24.23	8.95	20	
Surr: Toluene-d8	1.22		1.250		97.8	65	135		0		
Surr: 4-Bromofluorobenzene	1.26		1.250		101	65	135		0		

Work Order: 1908043
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Volatile Organic Compounds by EPA Method 8260D

Sample ID: **LCS-25413** SampType: **LCS** Units: **mg/Kg** Prep Date: **8/7/2019** RunNo: **53113**
Client ID: **LCSS** Batch ID: **25413** Analysis Date: **8/7/2019** SeqNo: **1049528**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	0.954	0.0200	1.000	0	95.4	64.3	133				
Toluene	0.986	0.0200	1.000	0	98.6	67	144				
Ethylbenzene	0.998	0.0250	1.000	0	99.8	74	129				
m,p-Xylene	2.02	0.0500	2.000	0	101	70	124				
o-Xylene	1.02	0.0250	1.000	0	102	68.1	139				
Naphthalene	0.971	0.0500	1.000	0	97.1	46.5	167				
Surr: Dibromofluoromethane	1.22		1.250		97.3	56.5	129				
Surr: Toluene-d8	1.23		1.250		98.1	64.5	151				
Surr: 1-Bromo-4-fluorobenzene	1.26		1.250		101	54.8	168				

Sample ID: **MB-25413** SampType: **MBLK** Units: **mg/Kg** Prep Date: **8/7/2019** RunNo: **53113**
Client ID: **MBLKS** Batch ID: **25413** Analysis Date: **8/7/2019** SeqNo: **1049529**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	ND	0.0200									
Toluene	ND	0.0200									
Ethylbenzene	ND	0.0250									
m,p-Xylene	ND	0.0500									
o-Xylene	ND	0.0250									
Naphthalene	ND	0.0500									
Surr: Dibromofluoromethane	1.19		1.250		95.4	56.5	129				
Surr: Toluene-d8	1.20		1.250		95.9	64.5	151				
Surr: 1-Bromo-4-fluorobenzene	1.22		1.250		97.5	54.8	168				

Sample ID: **1908024-001BDUP** SampType: **DUP** Units: **mg/Kg-dry** Prep Date: **8/7/2019** RunNo: **53113**
Client ID: **BATCH** Batch ID: **25413** Analysis Date: **8/7/2019** SeqNo: **1049514**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	ND	0.0248						0		30	
Toluene	ND	0.0248						0		30	

Work Order: 1908043
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Volatile Organic Compounds by EPA Method 8260D

Sample ID: **1908024-001BDUP** SampType: **DUP** Units: **mg/Kg-dry** Prep Date: **8/7/2019** RunNo: **53113**
Client ID: **BATCH** Batch ID: **25413** Analysis Date: **8/7/2019** SeqNo: **1049514**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Ethylbenzene	ND	0.0310						0		30	
m,p-Xylene	ND	0.0621						0		30	
o-Xylene	ND	0.0310						0		30	
Naphthalene	ND	0.0621						0		30	
Surr: Dibromofluoromethane	1.51		1.552		97.3	56.5	129		0		
Surr: Toluene-d8	1.46		1.552		93.9	64.5	151		0		
Surr: 1-Bromo-4-fluorobenzene	1.51		1.552		97.4	54.8	168		0		

Sample ID: **1908043-002BMS** SampType: **MS** Units: **mg/Kg-dry** Prep Date: **8/7/2019** RunNo: **53113**
Client ID: **DU-02-080219** Batch ID: **25413** Analysis Date: **8/7/2019** SeqNo: **1049517**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	16.5	0.358	17.91	0	92.0	63.5	133				D
Toluene	16.7	0.358	17.91	0	93.4	63.4	132				D
Ethylbenzene	18.0	0.448	17.91	0	100	54.5	134				D
m,p-Xylene	36.0	0.895	35.81	0	101	53.1	132				D
o-Xylene	18.4	0.448	17.91	0	102	53.3	139				D
Naphthalene	19.6	0.895	17.91	0	110	52.3	124				D
Surr: Dibromofluoromethane	21.6		22.38		96.3	56.5	129				D
Surr: Toluene-d8	21.0		22.38		94.0	64.5	151				D
Surr: 1-Bromo-4-fluorobenzene	22.6		22.38		101	54.8	168				D

Sample ID: **1908043-002BMSD** SampType: **MSD** Units: **mg/Kg-dry** Prep Date: **8/7/2019** RunNo: **53113**
Client ID: **DU-02-080219** Batch ID: **25413** Analysis Date: **8/8/2019** SeqNo: **1049518**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	16.7	0.358	17.91	0	93.0	63.5	133	16.47	1.06	30	D
Toluene	17.0	0.358	17.91	0	95.0	63.4	132	16.73	1.60	30	D
Ethylbenzene	18.5	0.448	17.91	0	104	54.5	134	17.95	3.19	30	D
m,p-Xylene	36.5	0.895	35.81	0	102	53.1	132	36.04	1.38	30	D

Work Order: 1908043
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Volatile Organic Compounds by EPA Method 8260D

Sample ID: **1908043-002BMSD** SampType: **MSD** Units: **mg/Kg-dry** Prep Date: **8/7/2019** RunNo: **53113**
Client ID: **DU-02-080219** Batch ID: **25413** Analysis Date: **8/8/2019** SeqNo: **1049518**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
o-Xylene	18.4	0.448	17.91	0	103	53.3	139	18.35	0.0829	30	D
Naphthalene	19.2	0.895	17.91	0	107	52.3	124	19.61	2.04	30	D
Surr: Dibromofluoromethane	21.4		22.38		95.6	56.5	129		0		D
Surr: Toluene-d8	20.9		22.38		93.5	64.5	151		0		D
Surr: 1-Bromo-4-fluorobenzene	23.0		22.38		103	54.8	168		0		D

Work Order: 1908043
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Sample Moisture (Percent Moisture)

Sample ID: **1908031-004ADUP**	SampType: **DUP**				Units: **wt%**		Prep Date: **8/5/2019**		RunNo: **53048**		
Client ID: **BATCH**	Batch ID: **R53048**						Analysis Date: **8/5/2019**		SeqNo: **1048106**		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Percent Moisture	15.7	0.500						15.23	3.28	20	

Sample ID: **1908043-010ADUP**	SampType: **DUP**				Units: **wt%**		Prep Date: **8/5/2019**		RunNo: **53048**		
Client ID: **Stockpile-05-080219**	Batch ID: **R53048**						Analysis Date: **8/5/2019**		SeqNo: **1048120**		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Percent Moisture	13.1	0.500						11.80	10.8	20	

Fremont Analytical

Sample Log-In Check List

Client Name: **FS**　　Work Order Number: **1908043**

Logged by: **Clare Griggs**　　Date Received: **8/2/2019 3:20:00 PM**

Chain of Custody

1. Is Chain of Custody complete? Yes ☑ No ☐ Not Present ☐
2. How was the sample delivered? Client

Log In

3. Coolers are present? Yes ☑ No ☐ NA ☐

4. Shipping container/cooler in good condition? Yes ☑ No ☐
5. Custody Seals present on shipping container/cooler? (Refer to comments for Custody Seals not intact) Yes ☐ No ☐ Not Required ☑

6. Was an attempt made to cool the samples? Yes ☑ No ☐ NA ☐

7. Were all items received at a temperature of >0°C to 10.0°C* Yes ☑ No ☐ NA ☐

8. Sample(s) in proper container(s)? Yes ☑ No ☐
9. Sufficient sample volume for indicated test(s)? Yes ☑ No ☐
10. Are samples properly preserved? Yes ☑ No ☐
11. Was preservative added to bottles? Yes ☐ No ☑ NA ☐

12. Is there headspace in the VOA vials? Yes ☐ No ☐ NA ☑
13. Did all samples containers arrive in good condition(unbroken)? Yes ☑ No ☐
14. Does paperwork match bottle labels? Yes ☑ No ☐

15. Are matrices correctly identified on Chain of Custody? Yes ☑ No ☐
16. Is it clear what analyses were requested? Yes ☑ No ☐
17. Were all holding times able to be met? Yes ☑ No ☐

Special Handling (if applicable)

18. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☑

Person Notified: 　　Date:

By Whom: 　　Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person

Regarding:

Client Instructions:

19. Additional remarks:

Item Information

Item #	Temp ºC
Cooler	8.9
Sample	9.4
Temp Blank	6.6

* Note: DoD/ELAP and TNI require items to be received at 4°C +/- 2°C

Fremont Analytical
3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790
Fax: 206-352-7178

Chain of Custody Record & Laboratory Services Agreement

Client: ~~Gabe Cisneros~~ Floyd Snider cg 8/2/19
Address: 601 Union St. Ste. 600
City, State, Zip: Seattle, WA 98101
Telephone: 206-292-2078
Fax:

Date: 8/2/19 **Page:** 1 **of:** 1
Project Name: CL-Ellensburg
Project No:
Collected by: Gabe Cisneros
Location: 1611 Canyon Rd, Ellensburg, WA
Report To (PM): Gabe Cisneros
PM Email: gabe.cisneros@floydsnider.com

Laboratory Project No (Internal): 1908043
Special Remarks: Total Nitrogen = Nitrite, Nitrate & Ammonia
NPK = Nitrogen + phosphorous + potassium
Sample Disposal: ☐ Return to client ☐ Disposal by lab (after 30 days)

Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	VOCs (EPA 8260 / 624)	GX/BTEX	BTEX & NAPHTHALENE 8260	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8)	Total (T) | Dissolved (D)	Anions (IC)***	EDB (8011)	NPK	← See Anions Ammonia			Comments
1 DU-01-080219	8/2/19	1000	S			X	X		X						X		X	X			8260 Method
2 DU-02-080219		1005				X	X		X												
3 DU-03-080219		1010				X	X		X												
4 DU-04-080219		1015				X	X		X												
5 DU-05-080219		1020				X	X		X												
6 Stockpile-01-080219		1100						X													Follow up analyses may be done if there are detections
7 Stockpile-02-080219		1105						X													
8 Stockpile-03-080219		1110						X													
9 Stockpile-04-080219		1115						X													
10 Stockpile-05-080219		1120						X													

***Matrix:** A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, [✓ S = Soil], SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

****Metals (Circle):** MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl U V Zn

*****Anions (Circle):** Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride [✓ Nitrate+Nitrite] [✓ Ammonia]

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above and that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished x Date/Time 8/2/19 1520
Received x Date/Time 8/2/19 1520
Relinquished x Date/Time
Received x Date/Time

Turn-around Time:
☒ Standard
☐ 3 Day
☐ 2 Day
☐ Next Day
Same Day ______ (specify)

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Fremont
Analytical

3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790
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Chain of Custody Record & Laboratory Services Agreement

Date: 8/2/19 **Page:** 1 **of:** 1

Laboratory Project No (internal): 1908043

Project Name: CL-Ellensburg

Project No:

Collected by: Gabe Cisneros

Location: 1611 Canyon Rd, Ellensburg, WA

Report To (PM): Gabe Cisneros

PM Email: gabe.cisneros@floydsnider.com

g 8/2/19

Client: ~~Gabe Cisneros~~ Floyd Snider

Address: 601 Union St. Ste. 600

City, State, Zip: Seattle, WA 98101

Telephone: 206-292-2078

Fax:

Special Remarks:
Total Nitrogen = Nitrite Nitrate & Ammonia
NPK = Nitrogen + phosphorous + potassium

Sample Disposal: ☐ Return to client ☐ Disposal by lab (after 30 days)

edits per GC 8/12/19 PM3

	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	VOCs (EPA 8260 / 624)	GX/BTEX	BTEX & NAPHTHALENE 8260	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8)	Total (T) | Dissolved (D)	Anions (IC)***	EDB (8011)	NPK	<-See Anions Ammonia	Quantify HCID		Comments
1	Du-01-080219	8/2/19	1000	S			X	X		X						X		X	X			8260 Method
2	Du-02-080219		1005				X	X		X												
3	Du-03-080219		1010				X	X		X												
4	Du-04-080219		1015				X	X		X												
5	Du-05-080219		1020				X	X		X												
6	Stockpile-01-080219		1100						X													Follow up analyses
7	Stockpile-02-080219		1105						X													may be done if there
8	Stockpile-03-080219		1110						X											X		are detections
9	Stockpile-04-080219		1115						X											X		
10	Stockpile-05-080219		1120						X													

***Matrix:** A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, [✓ S = Soil], SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

****Metals (Circle):** MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl U V Zn

*****Anions (Circle):** Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride [✓ Nitrate+Nitrite] [✓ Ammonia]

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above and that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

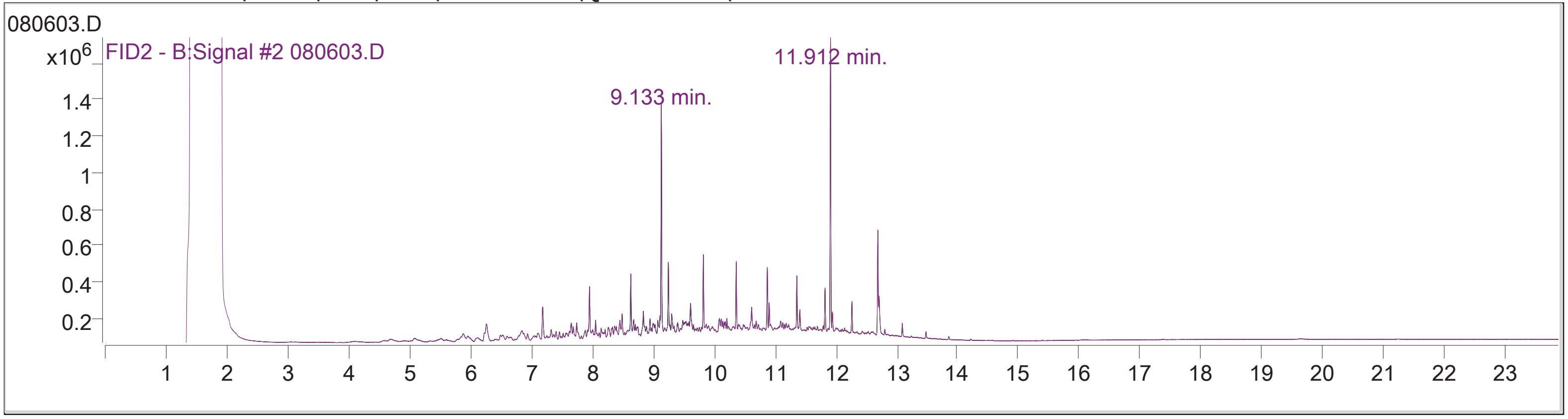
Relinquished x	Date/Time 8/2/19 1520	Received x	Date/Time 8/2/19 1520
Relinquished x	Date/Time	Received x	Date/Time

Turn-around Time:
☒ Standard
☐ 3 Day
☐ 2 Day
☐ Next Day
Same Day ______ (specify)

Quantitation Results Report

Agilent Technologies

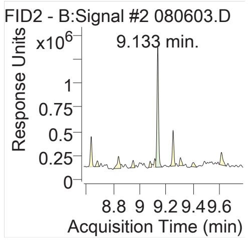
Data File	080603.D	Operator	DMW
Acq. Method	DXACQ050317sgtest2-190617	Acq. Date-Time	8/6/2019 8:38:02 AM
Sample Name:	DX-CCV-		dualfid
Vial	2	Multiplier	1.00
DA Method File	DX-190617-NWTPH_FINAL.m O-DXEX-S	Last Calib Update	6/17/2019 9:49:03 AM
Batch Name	D:\GC-24\Data\2019\190806BACK\QuantResults\25389 NWTPH.batch.bin		



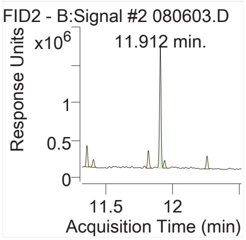
Compound	RT	Resp.	Conc.	Units		Dev(Min)
Internal Standards						
System Monitoring Compounds						
2-Fluorobiphenyl	9.133	1056148	18.254	ug/mL		-0.043
Spiked Amount:	Range: - %			Recovery = NA%		
O-Terphenyl	11.912	1334637	18.388	ug/mL		-0.011
Spiked Amount:	Range: - %			Recovery = NA%		
Target Compounds						
Diesel	11.912	30489537	510.360	ug/mL	m	
Heavy Oil	17.500	0	0.000	ug/mL	md	

(#) = Qualifier Out of Range; (m) = Manual Integration; (+) = Area Summed; (*) = Surrogate Percent Recovery Out of Range; (d): Zeroed Peak

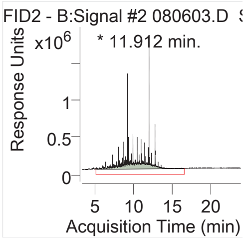
2-Fluorobiphenyl



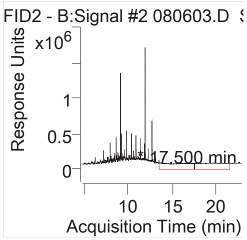
O-Terphenyl



Diesel

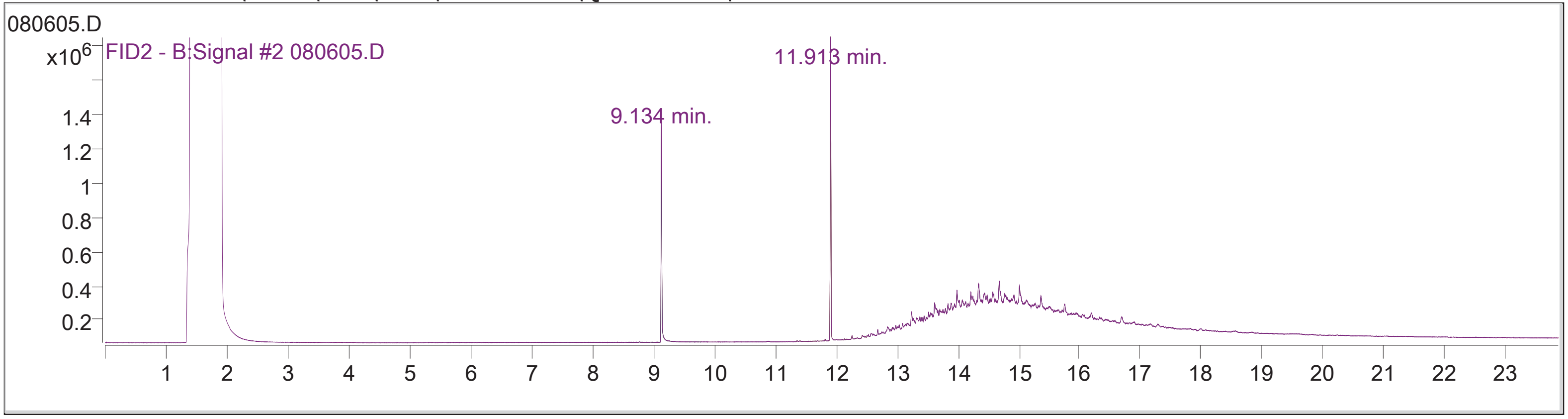


Heavy Oil



Quantitation Results Report

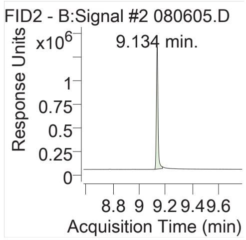
Data File	080605.D	Operator	DMW
Acq. Method	DXACQ050317sgtest2-190617	Acq. Date-Time	8/6/2019 9:07:58 AM
Sample Name:	OIL-CCV-		dualfid
Vial	1	Multiplier	1.00
DA Method File	DX-190617-NWTPH_FINAL.m O-DXEX-S	Last Calib Update	6/17/2019 9:49:03 AM
Batch Name	D:\GC-24\Data\2019\190806BACK\QuantResults\25389 NWTPH.batch.bin		



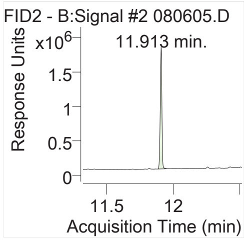
Compound	RT	Resp.	Conc.	Units		Dev(Min)
Internal Standards						
System Monitoring Compounds						
2-Fluorobiphenyl	9.134	1133680	19.551	ug/mL		-0.043
Spiked Amount:	Range: - %			Recovery = NA%		
O-Terphenyl	11.913	1524142	21.050	ug/mL		-0.010
Spiked Amount:	Range: - %			Recovery = NA%		
Target Compounds						
Diesel	10.750	0	0.000	ug/mL	md	
Heavy Oil	14.681	51784754	1009.045	ug/mL	m	

(#) = Qualifier Out of Range; (m) = Manual Integration; (+) = Area Summed; (*) = Surrogate Percent Recovery Out of Range; (d): Zeroed Peak

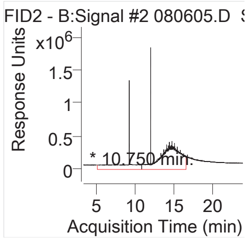
2-Fluorobiphenyl



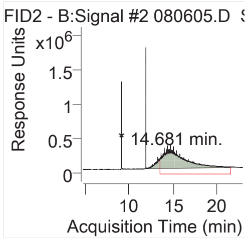
O-Terphenyl



Diesel



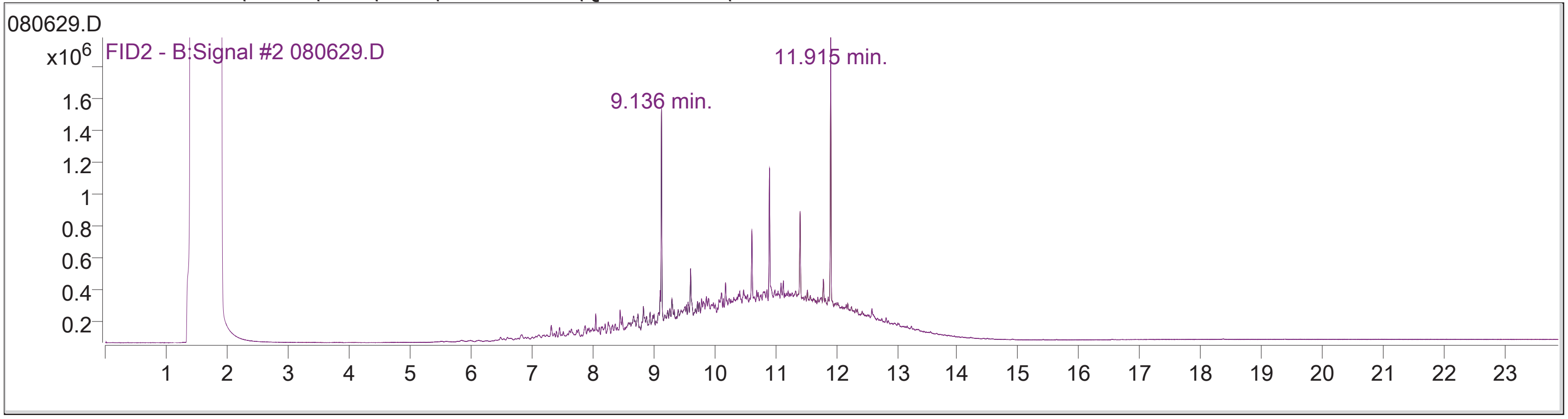
Heavy Oil



Quantitation Results Report

Agilent Technologies

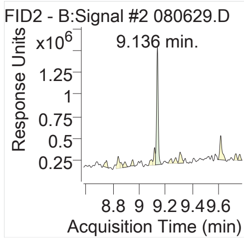
Data File	080629.D	Operator	DMW
Acq. Method	DXACQ050317sgtest2-190617	Acq. Date-Time	8/6/2019 3:08:23 PM
Sample Name:	1908043-004A		dualfid
Vial	111	Multiplier	1.00
DA Method File	DX-190617-NWTPH_FINAL.m O-DXEX-S	Last Calib Update	6/17/2019 9:49:03 AM
Batch Name	D:\GC-24\Data\2019\190806BACK\QuantResults\25389 NWTPH.batch.bin		



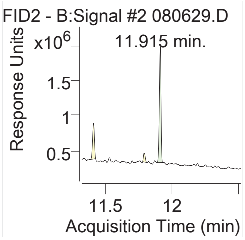
Compound	RT	Resp.	Conc.	Units		Dev(Min)
Internal Standards						
System Monitoring Compounds						
2-Fluorobiphenyl	9.136	1166717	20.105	ug/mL		-0.041
Spiked Amount:	Range: - %			Recovery = NA%		
O-Terphenyl	11.915	1447427	19.972	ug/mL		-0.007
Spiked Amount:	Range: - %			Recovery = NA%		
Target Compounds						
Diesel	11.915	71424146	1195.245	ug/mL	m	
Heavy Oil	18.360	519757	0.000	ug/mL	m	

(#) = Qualifier Out of Range; (m) = Manual Integration; (+) = Area Summed; (*) = Surrogate Percent Recovery Out of Range; (d): Zeroed Peak

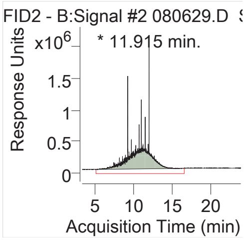
2-Fluorobiphenyl



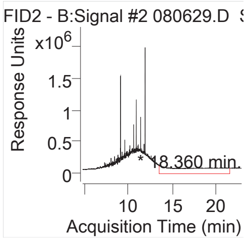
O-Terphenyl



Diesel

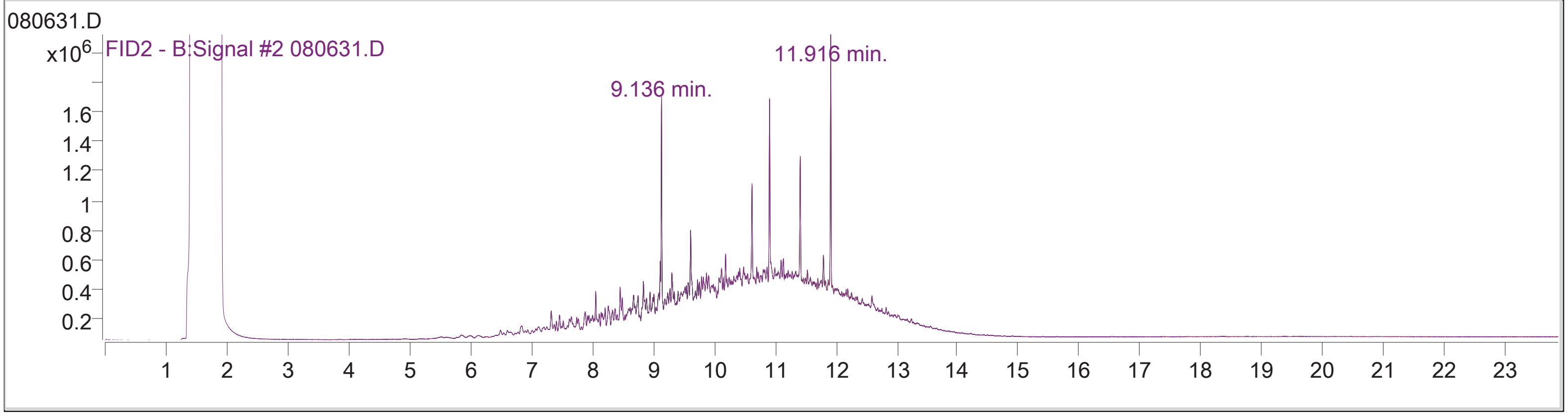


Heavy Oil



Quantitation Results Report

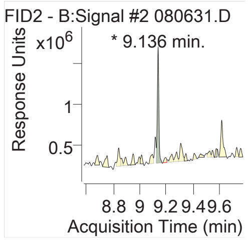
Data File	080631.D	Operator	DMW
Acq. Method	DXACQ050317sgtest2-190617	Acq. Date-Time	8/6/2019 3:38:29 PM
Sample Name:	1908043-005A		dualfid
Vial	112	Multiplier	1.00
DA Method File	DX-190617-NWTPH_FINAL.m O-DXEX-S	Last Calib Update	6/17/2019 9:49:03 AM
Batch Name	D:\GC-24\Data\2019\190806BACK\QuantResults\25389 NWTPH.batch.bin		



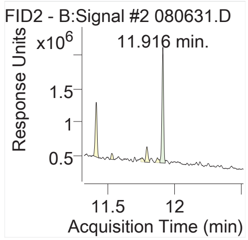
Compound	RT	Resp.	Conc.	Units		Dev(Min)
Internal Standards						
System Monitoring Compounds						
2-Fluorobiphenyl	9.136	1204666	20.740	ug/mL	m	-0.040
Spiked Amount:	Range: - %			Recovery = NA%		
O-Terphenyl	11.916	1543139	21.317	ug/mL		-0.007
Spiked Amount:	Range: - %			Recovery = NA%		
Target Compounds						
Diesel	11.916	107813330	1804.080	ug/mL	m	
Heavy Oil	18.350	646134	0.000	ug/mL	m	

(#) = Qualifier Out of Range; (m) = Manual Integration; (+) = Area Summed; (*) = Surrogate Percent Recovery Out of Range; (d): Zeroed Peak

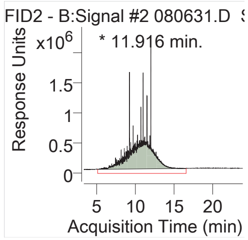
2-Fluorobiphenyl



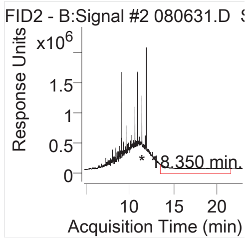
O-Terphenyl



Diesel



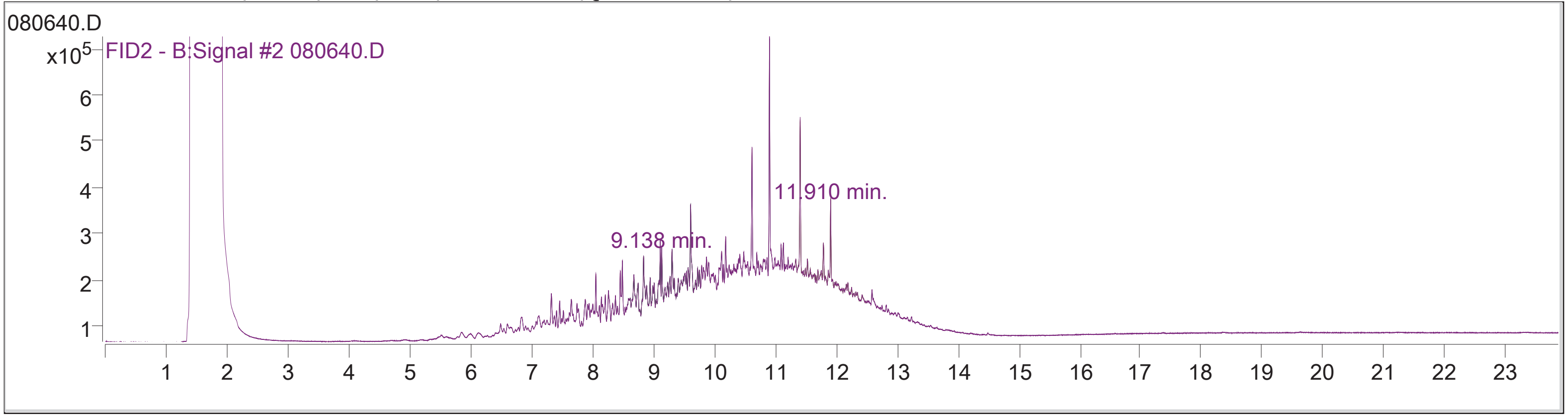
Heavy Oil



Quantitation Results Report

Agilent Technologies

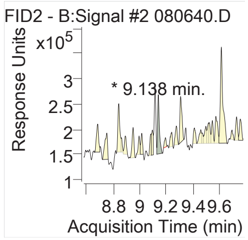
Data File	080640.D	Operator	DMW
Acq. Method	DXACQ050317sgtest2-190617	Acq. Date-Time	8/6/2019 5:44:03 PM
Sample Name:	1908043-001A 10X		dualfid
Vial	127	Multiplier	1.00
DA Method File	DX-190617-NWTPH_FINAL.m O-DXEX-S	Last Calib Update	6/17/2019 9:49:03 AM
Batch Name	D:\GC-24\Data\2019\190806BACK\QuantResults\25389 NWTPH.batch.bin		



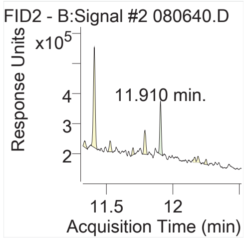
Compound	RT	Resp.	Conc.	Units		Dev(Min)
Internal Standards						
System Monitoring Compounds						
2-Fluorobiphenyl	9.138	112063	2.449	ug/mL	m	-0.039
Spiked Amount:	Range: - %			Recovery = NA%		
O-Terphenyl	11.910	141778	1.631	ug/mL		-0.013
Spiked Amount:	Range: - %			Recovery = NA%		
Target Compounds						
Diesel	10.906	42210100	706.459	ug/mL	m	
Heavy Oil	19.623	628859	0.000	ug/mL	m	

(#) = Qualifier Out of Range; (m) = Manual Integration; (+) = Area Summed; (*) = Surrogate Percent Recovery Out of Range; (d): Zeroed Peak

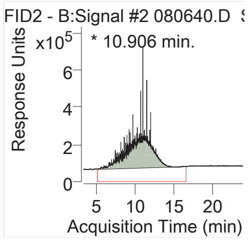
2-Fluorobiphenyl



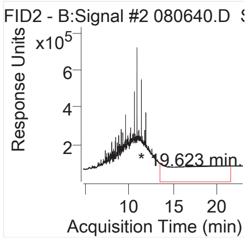
O-Terphenyl



Diesel

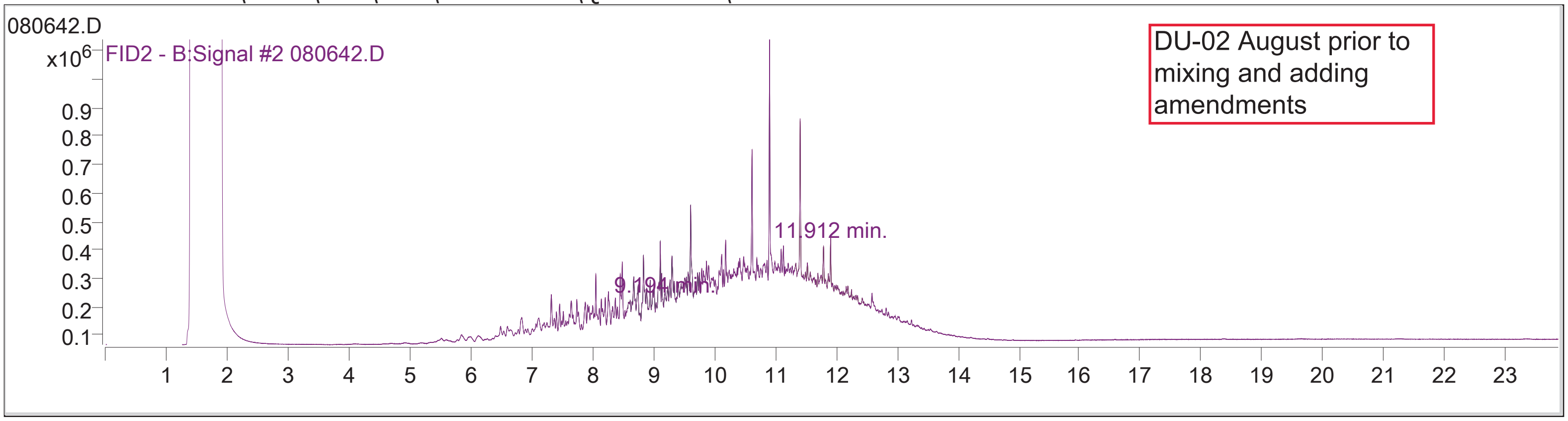


Heavy Oil



Quantitation Results Report

Data File	080642.D	Operator	DMW
Acq. Method	DXACQ050317sgtest2-190617	Acq. Date-Time	8/6/2019 6:14:25 PM
Sample Name:	1908043-002A 10X		dualfid
Vial	131	Multiplier	1.00
DA Method File	DX-190617-NWTPH_FINAL.m O-DXEX-S	Last Calib Update	6/17/2019 9:49:03 AM
Batch Name	D:\GC-24\Data\2019\190806BACK\QuantResults\25389 NWTPH.batch.bin		

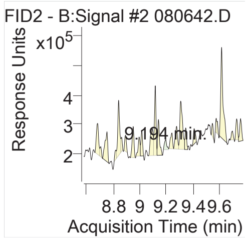


DU-02 August prior to mixing and adding amendments

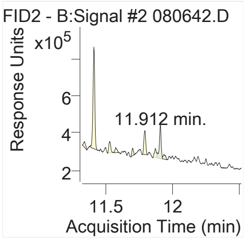
Compound	RT	Resp.	Conc.	Units		Dev(Min)
Internal Standards						
System Monitoring Compounds						
2-Fluorobiphenyl	9.194	40999	1.260	ug/mL		0.017
Spiked Amount:	Range: - %			Recovery = NA%		
O-Terphenyl	11.912	167392	1.991	ug/mL		-0.011
Spiked Amount:	Range: - %			Recovery = NA%		
Target Compounds						
Diesel	10.910	69038383	1155.329	ug/mL	m	
Heavy Oil	19.630	714005	0.000	ug/mL	m	

(#) = Qualifier Out of Range; (m) = Manual Integration; (+) = Area Summed; (*) = Surrogate Percent Recovery Out of Range; (d): Zeroed Peak

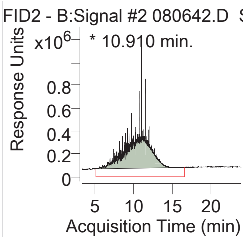
2-Fluorobiphenyl



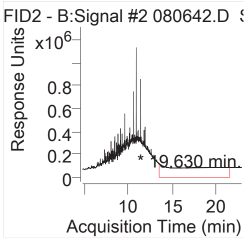
O-Terphenyl



Diesel



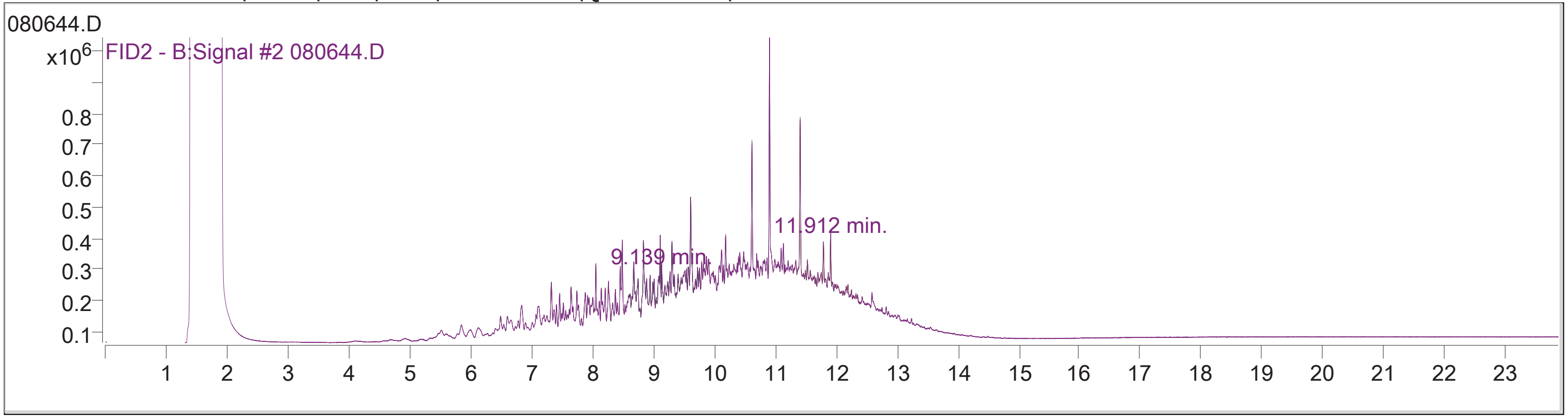
Heavy Oil



Quantitation Results Report

Agilent Technologies

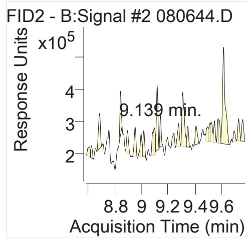
Data File	080644.D	Operator	DMW
Acq. Method	DXACQ050317sgtest2-190617	Acq. Date-Time	8/6/2019 6:44:41 PM
Sample Name:	1908043-003A 10X		dualfid
Vial	132	Multiplier	1.00
DA Method File	DX-190617-NWTPH_FINAL.m O-DXEX-S	Last Calib Update	6/17/2019 9:49:03 AM
Batch Name	D:\GC-24\Data\2019\190806BACK\QuantResults\25389 NWTPH.batch.bin		



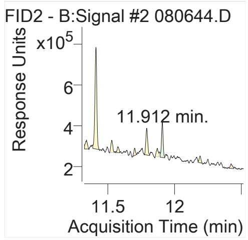
Compound	RT	Resp.	Conc.	Units		Dev(Min)
Internal Standards						
System Monitoring Compounds						
2-Fluorobiphenyl	9.139	69908	1.744	ug/mL		-0.038
Spiked Amount:	Range: - %			Recovery = NA%		
O-Terphenyl	11.912	150310	1.751	ug/mL		-0.011
Spiked Amount:	Range: - %			Recovery = NA%		
Target Compounds						
Diesel	10.909	66473227	1112.410	ug/mL	m	
Heavy Oil	19.630	678177	0.000	ug/mL	m	

(#) = Qualifier Out of Range; (m) = Manual Integration; (+) = Area Summed; (*) = Surrogate Percent Recovery Out of Range; (d): Zeroed Peak

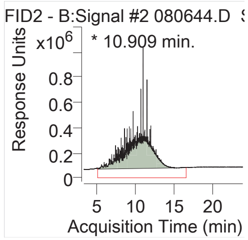
2-Fluorobiphenyl



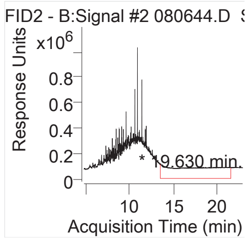
O-Terphenyl



Diesel



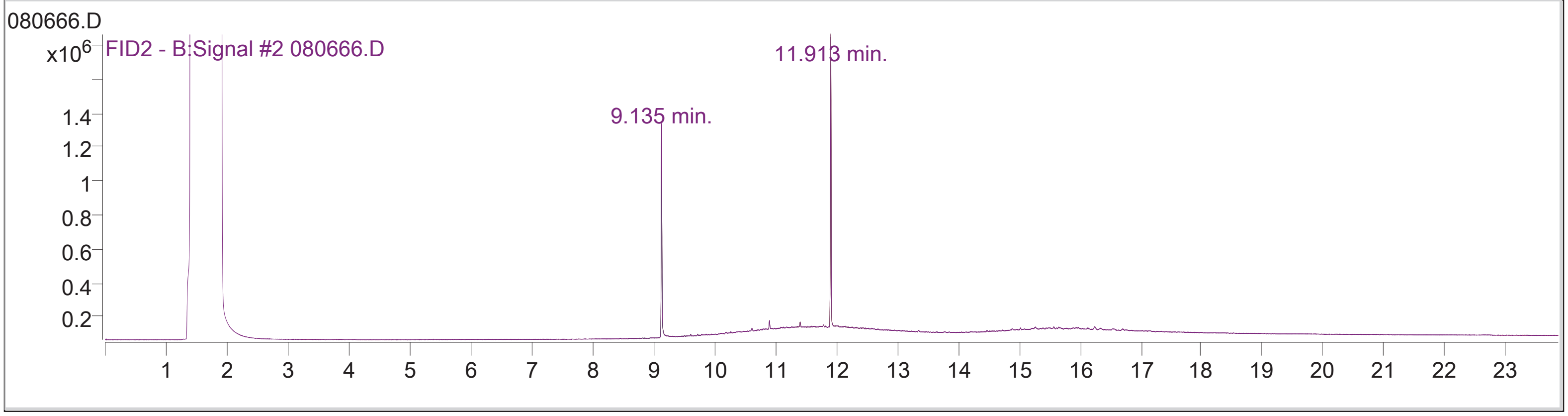
Heavy Oil



Quantitation Results Report

Agilent Technologies

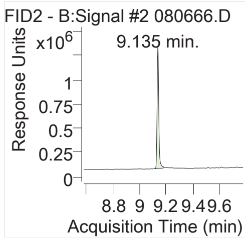
Data File	080666.D	Operator	DMW
Acq. Method	DXACQ050317sgtest2-190617	Acq. Date-Time	8/7/2019 12:16:21 AM
Sample Name:	1908043-008A		dualfid
Vial	115	Multiplier	1.00
DA Method File	DX-190617-NWTPH_FINAL.m O-DXEX-S	Last Calib Update	6/17/2019 9:49:03 AM
Batch Name	D:\GC-24\Data\2019\190806BACK\QuantResults\25389 NWTPH.batch.bin		



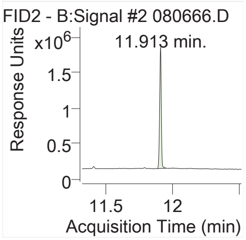
Compound	RT	Resp.	Conc.	Units		Dev(Min)
Internal Standards						
System Monitoring Compounds						
2-Fluorobiphenyl	9.135	1120244	19.327	ug/mL		-0.042
Spiked Amount:	Range: - %			Recovery = NA%		
O-Terphenyl	11.913	1493258	20.616	ug/mL		-0.009
Spiked Amount:	Range: - %			Recovery = NA%		
Target Compounds						
Diesel	11.913	12964320	217.142	ug/mL	m	
Heavy Oil	16.248	11688053	202.433	ug/mL	m	

(#) = Qualifier Out of Range; (m) = Manual Integration; (+) = Area Summed; (*) = Surrogate Percent Recovery Out of Range; (d): Zeroed Peak

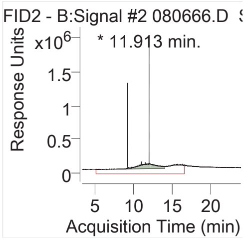
2-Fluorobiphenyl



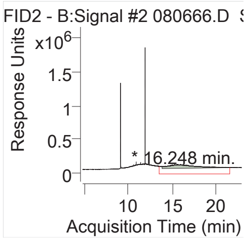
O-Terphenyl



Diesel

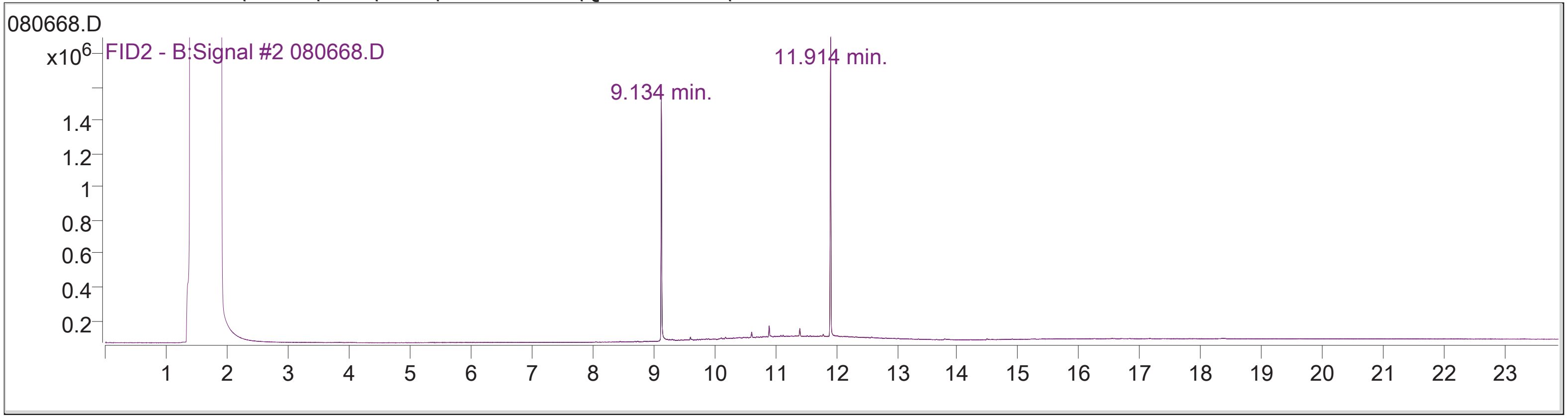


Heavy Oil



Quantitation Results Report

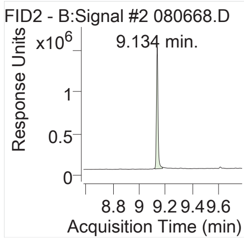
Data File	080668.D	Operator	DMW
Acq. Method	DXACQ050317sgtest2-190617	Acq. Date-Time	8/7/2019 12:46:17 AM
Sample Name:	1908043-009A		dualfid
Vial	116	Multiplier	1.00
DA Method File	DX-190617-NWTPH_FINAL.m O-DXEX-S	Last Calib Update	6/17/2019 9:49:03 AM
Batch Name	D:\GC-24\Data\2019\190806BACK\QuantResults\25389 NWTPH.batch.bin		



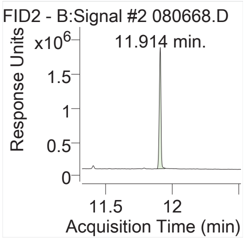
Compound	RT	Resp.	Conc.	Units		Dev(Min)
Internal Standards						
System Monitoring Compounds						
2-Fluorobiphenyl	9.134	1243293	21.386	ug/mL		-0.042
Spiked Amount:	Range: - %			Recovery = NA%		
O-Terphenyl	11.914	1626487	22.488	ug/mL		-0.009
Spiked Amount:	Range: - %			Recovery = NA%		
Target Compounds						
Diesel	11.913	6394971	107.229	ug/mL	m	
Heavy Oil	18.358	2827657	24.192	ug/mL	m	

(#) = Qualifier Out of Range; (m) = Manual Integration; (+) = Area Summed; (*) = Surrogate Percent Recovery Out of Range; (d): Zeroed Peak

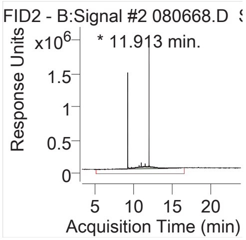
2-Fluorobiphenyl



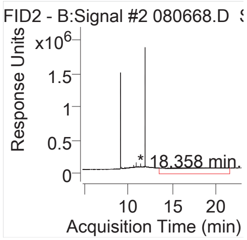
O-Terphenyl



Diesel



Heavy Oil



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F: (206) 352-7178
info@fremontanalytical.com

Floyd | Snider
Gabe Cisneros
601 Union St., Suite 600
Seattle, WA 98101

RE: CL-Ellensburg
Work Order Number: 1909032

September 12, 2019

Attention Gabe Cisneros:

Fremont Analytical, Inc. received 6 sample(s) on 9/4/2019 for the analyses presented in the following report.

Ammonia by SM 4500 NH3 E
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.
Gasoline by NWTPH-Gx
Ion Chromatography by EPA Method 300.0
pH by EPA Method 9045
Sample Moisture (Percent Moisture)
Total Metals by EPA Method 6020B
Total Phosphorus by EPA Method 6020
Volatile Organic Compounds by EPA Method 8260D

This report consists of the following:

- Case Narrative
- Analytical Results
- Applicable Quality Control Summary Reports
- Chain of Custody

All analyses were performed consistent with the Quality Assurance program of Fremont Analytical, Inc. Please contact the laboratory if you should have any questions about the results.

Thank you for using Fremont Analytical.

Sincerely,

Brianna Barnes
Project Manager

DoD/ELAP Certification #L17-135, ISO/IEC 17025:2005
ORELAP Certification: WA 100009-007 (NELAP Recognized)

Date: *09/12/2019*

CLIENT: Floyd | Snider
Project: CL-Ellensburg
Work Order: 1909032

Work Order Sample Summary

Lab Sample ID	Client Sample ID	Date/Time Collected	Date/Time Received
1909032-001	DU-01-090419	09/04/2019 12:00 AM	09/04/2019 4:30 PM
1909032-002	DU-02-090419	09/04/2019 12:00 AM	09/04/2019 4:30 PM
1909032-003	DU-03-090419	09/04/2019 12:00 AM	09/04/2019 4:30 PM
1909032-004	DU-04-090419	09/04/2019 12:00 AM	09/04/2019 4:30 PM
1909032-005	DU-05-090419	09/04/2019 12:00 AM	09/04/2019 4:30 PM
1909032-006	Trip Blank	08/26/2019 10:35 AM	09/04/2019 4:30 PM

Note: If no "Time Collected" is supplied, a default of 12:00AM is assigned

Case Narrative

WO#: **1909032**
Date: **9/12/2019**

CLIENT: Floyd | Snider
Project: CL-Ellensburg

I. SAMPLE RECEIPT:
Samples receipt information is recorded on the attached Sample Receipt Checklist.

II. GENERAL REPORTING COMMENTS:
Results are reported on a wet weight basis unless dry-weight correction is denoted in the units field on the analytical report ("mg/kg-dry" or "ug/kg-dry").

Matrix Spike (MS) and MS Duplicate (MSD) samples are tested from an analytical batch of "like" matrix to check for possible matrix effect. The MS and MSD will provide site specific matrix data only for those samples which are spiked by the laboratory. The sample chosen for spike purposes may or may not have been a sample submitted in this sample delivery group. The validity of the analytical procedures for which data is reported in this analytical report is determined by the Laboratory Control Sample (LCS) and the Method Blank (MB). The LCS and the MB are processed with the samples and the MS/MSD to ensure method criteria are achieved throughout the entire analytical process.

III. ANALYSES AND EXCEPTIONS:
Exceptions associated with this report will be footnoted in the analytical results page(s) or the quality control summary page(s) and/or noted below.

Qualifiers:

* - Flagged value is not within established control limits
B - Analyte detected in the associated Method Blank
D - Dilution was required
E - Value above quantitation range
H - Holding times for preparation or analysis exceeded
I - Analyte with an internal standard that does not meet established acceptance criteria
J - Analyte detected below Reporting Limit
N - Tentatively Identified Compound (TIC)
Q - Analyte with an initial or continuing calibration that does not meet established acceptance criteria (<20%RSD, <20% Drift or minimum RRF)
S - Spike recovery outside accepted recovery limits
ND - Not detected at the Reporting Limit
R - High relative percent difference observed

Acronyms:

%Rec - Percent Recovery
CCB - Continued Calibration Blank
CCV - Continued Calibration Verification
DF - Dilution Factor
HEM - Hexane Extractable Material
ICV - Initial Calibration Verification
LCS/LCSD - Laboratory Control Sample / Laboratory Control Sample Duplicate
MB or MBLANK - Method Blank
MDL - Method Detection Limit
MS/MSD - Matrix Spike / Matrix Spike Duplicate
PDS - Post Digestion Spike
Ref Val - Reference Value
RL - Reporting Limit
RPD - Relative Percent Difference
SD - Serial Dilution
SGT - Silica Gel Treatment
SPK - Spike
Surr - Surrogate

Client: Floyd | Snider
Project: CL-Ellensburg
Lab ID: 1909032-001
Client Sample ID: **DU-01-090419**

Collection Date: 9/4/2019
Matrix: Soil

Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.

Batch ID: 25727 Analyst: DW

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Diesel (Fuel Oil)	3,270	197	D	mg/Kg-dry	10	9/11/2019 12:27:56 PM
Heavy Oil	ND	49.3		mg/Kg-dry	1	9/10/2019 6:34:32 PM
Surr: 2-Fluorobiphenyl	117	50 - 150		%Rec	1	9/10/2019 6:34:32 PM
Surr: o-Terphenyl	95.5	50 - 150		%Rec	1	9/10/2019 6:34:32 PM

Gasoline by NWTPH-Gx

Batch ID: 25723 Analyst: KT

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Gasoline	ND	48.8	D	mg/Kg-dry	10	9/10/2019 11:39:31 AM
Surr: Toluene-d8	102	65 - 135	D	%Rec	10	9/10/2019 11:39:31 AM
Surr: 4-Bromofluorobenzene	108	65 - 135	D	%Rec	10	9/10/2019 11:39:31 AM

NOTES:
Diluted due to matrix.

Volatile Organic Compounds by EPA Method 8260D

Batch ID: 25723 Analyst: KT

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Benzene	ND	0.0195		mg/Kg-dry	1	9/6/2019 7:36:43 PM
Toluene	ND	0.0195		mg/Kg-dry	1	9/6/2019 7:36:43 PM
Ethylbenzene	ND	0.0244		mg/Kg-dry	1	9/6/2019 7:36:43 PM
m,p-Xylene	ND	0.0488		mg/Kg-dry	1	9/6/2019 7:36:43 PM
o-Xylene	ND	0.0244		mg/Kg-dry	1	9/6/2019 7:36:43 PM
Naphthalene	ND	0.0488		mg/Kg-dry	1	9/6/2019 7:36:43 PM
Surr: Dibromofluoromethane	107	56.5 - 129		%Rec	1	9/6/2019 7:36:43 PM
Surr: Toluene-d8	103	64.5 - 151		%Rec	1	9/6/2019 7:36:43 PM
Surr: 1-Bromo-4-fluorobenzene	103	54.8 - 168		%Rec	1	9/6/2019 7:36:43 PM

Ion Chromatography by EPA Method 300.0

Batch ID: 25746 Analyst: SS

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Nitrite (as N)	ND	1.03		mg/Kg-dry	1	9/10/2019 11:02:00 AM
Nitrate (as N)	ND	1.03		mg/Kg-dry	1	9/10/2019 11:02:00 AM

Total Phosphorus by EPA Method 6020

Batch ID: 25708 Analyst: WC

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Phosphorus	558	17.8		mg/Kg-dry	1	9/11/2019 2:34:40 PM

Total Metals by EPA Method 6020B

Batch ID: 25708 Analyst: WC

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Potassium	1,630	44.5		mg/Kg-dry	1	9/11/2019 2:34:40 PM

Analytical Report

Work Order: **1909032**
Date Reported: **9/12/2019**

Client: Floyd | Snider
Collection Date: 9/4/2019
Project: CL-Ellensburg
Lab ID: 1909032-001
Matrix: Soil
Client Sample ID: DU-01-090419

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Sample Moisture (Percent Moisture)				Batch ID: R53665		Analyst: CJ
Percent Moisture	10.0	0.500		wt%	1	9/5/2019 8:30:35 AM
Ammonia by SM 4500 NH3 E				Batch ID: 25747		Analyst: SS
Nitrogen, Ammonia	ND	1.10		mg/Kg-dry	1	9/11/2019 9:45:00 AM
pH by EPA Method 9045				Batch ID: R53797		Analyst: WF
Hydrogen Ion (pH)	7.91			pH	1	9/10/2019 2:22:12 PM

Analytical Report

Work Order: **1909032**
Date Reported: **9/12/2019**

Client: Floyd | Snider **Collection Date:** 9/4/2019
Project: CL-Ellensburg
Lab ID: 1909032-002 **Matrix:** Soil
Client Sample ID: **DU-02-090419**

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				Batch ID: 25727		Analyst: DW
Diesel (Fuel Oil)	4,680	199	D	mg/Kg-dry	10	9/11/2019 12:57:46 PM
Heavy Oil	ND	49.9		mg/Kg-dry	1	9/10/2019 7:04:26 PM
Surr: 2-Fluorobiphenyl	134	50 - 150		%Rec	1	9/10/2019 7:04:26 PM
Surr: o-Terphenyl	110	50 - 150		%Rec	1	9/10/2019 7:04:26 PM
Gasoline by NWTPH-Gx				Batch ID: 25723		Analyst: KT
Gasoline	ND	37.9	D	mg/Kg-dry	10	9/10/2019 11:09:21 AM
Surr: Toluene-d8	102	65 - 135	D	%Rec	10	9/10/2019 11:09:21 AM
Surr: 4-Bromofluorobenzene	105	65 - 135	D	%Rec	10	9/10/2019 11:09:21 AM
NOTES: Diluted due to matrix.						
Volatile Organic Compounds by EPA Method 8260D				Batch ID: 25723		Analyst: KT
Benzene	ND	0.0152		mg/Kg-dry	1	9/6/2019 8:06:49 PM
Toluene	ND	0.0152		mg/Kg-dry	1	9/6/2019 8:06:49 PM
Ethylbenzene	ND	0.0189		mg/Kg-dry	1	9/6/2019 8:06:49 PM
m,p-Xylene	ND	0.0379		mg/Kg-dry	1	9/6/2019 8:06:49 PM
o-Xylene	ND	0.0189		mg/Kg-dry	1	9/6/2019 8:06:49 PM
Naphthalene	ND	0.0379		mg/Kg-dry	1	9/6/2019 8:06:49 PM
Surr: Dibromofluoromethane	105	56.5 - 129		%Rec	1	9/6/2019 8:06:49 PM
Surr: Toluene-d8	103	64.5 - 151		%Rec	1	9/6/2019 8:06:49 PM
Surr: 1-Bromo-4-fluorobenzene	103	54.8 - 168		%Rec	1	9/6/2019 8:06:49 PM
Ion Chromatography by EPA Method 300.0				Batch ID: 25746		Analyst: SS
Nitrite (as N)	ND	1.19		mg/Kg-dry	1	9/10/2019 11:26:00 AM
Nitrate (as N)	ND	1.19		mg/Kg-dry	1	9/10/2019 11:26:00 AM
Total Phosphorus by EPA Method 6020				Batch ID: 25725		Analyst: WC
Phosphorus	698	18.7		mg/Kg-dry	1	9/11/2019 8:20:11 PM
Total Metals by EPA Method 6020B				Batch ID: 25725		Analyst: WC
Potassium	1,370	46.8		mg/Kg-dry	1	9/11/2019 8:20:11 PM

Analytical Report

Work Order: **1909032**
Date Reported: **9/12/2019**

Client: Floyd | Snider
Collection Date: 9/4/2019
Project: CL-Ellensburg
Lab ID: 1909032-002
Matrix: Soil
Client Sample ID: DU-02-090419

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Sample Moisture (Percent Moisture)				Batch ID: R53690		Analyst: SBM
Percent Moisture	15.9	0.500		wt%	1	9/5/2019 4:36:12 PM
Ammonia by SM 4500 NH3 E				Batch ID: 25747		Analyst: SS
Nitrogen, Ammonia	ND	1.18		mg/Kg-dry	1	9/11/2019 9:45:00 AM
pH by EPA Method 9045				Batch ID: R53797		Analyst: WF
Hydrogen Ion (pH)	7.85			pH	1	9/10/2019 2:22:12 PM

Client: Floyd | Snider
Collection Date: 9/4/2019
Project: CL-Ellensburg
Lab ID: 1909032-003
Matrix: Soil
Client Sample ID: **DU-03-090419**

Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.

Batch ID: 25727 Analyst: DW

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Diesel (Fuel Oil)	3,720	238	D	mg/Kg-dry	10	9/11/2019 1:27:38 PM
Heavy Oil	ND	59.5		mg/Kg-dry	1	9/10/2019 7:34:23 PM
Surr: 2-Fluorobiphenyl	105	50 - 150		%Rec	1	9/10/2019 7:34:23 PM
Surr: o-Terphenyl	108	50 - 150		%Rec	1	9/10/2019 7:34:23 PM

Gasoline by NWTPH-Gx

Batch ID: 25723 Analyst: KT

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Gasoline	ND	42.2	D	mg/Kg-dry	10	9/10/2019 10:39:12 AM
Surr: Toluene-d8	101	65 - 135	D	%Rec	10	9/10/2019 10:39:12 AM
Surr: 4-Bromofluorobenzene	103	65 - 135	D	%Rec	10	9/10/2019 10:39:12 AM

NOTES:
Diluted due to matrix.

Volatile Organic Compounds by EPA Method 8260D

Batch ID: 25723 Analyst: KT

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Benzene	ND	0.0169		mg/Kg-dry	1	9/6/2019 8:36:58 PM
Toluene	ND	0.0169		mg/Kg-dry	1	9/6/2019 8:36:58 PM
Ethylbenzene	ND	0.0211		mg/Kg-dry	1	9/6/2019 8:36:58 PM
m,p-Xylene	ND	0.0422		mg/Kg-dry	1	9/6/2019 8:36:58 PM
o-Xylene	ND	0.0211		mg/Kg-dry	1	9/6/2019 8:36:58 PM
Naphthalene	ND	0.0422		mg/Kg-dry	1	9/6/2019 8:36:58 PM
Surr: Dibromofluoromethane	103	56.5 - 129		%Rec	1	9/6/2019 8:36:58 PM
Surr: Toluene-d8	101	64.5 - 151		%Rec	1	9/6/2019 8:36:58 PM
Surr: 1-Bromo-4-fluorobenzene	101	54.8 - 168		%Rec	1	9/6/2019 8:36:58 PM

Ion Chromatography by EPA Method 300.0

Batch ID: 25746 Analyst: SS

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Nitrite (as N)	ND	1.17		mg/Kg-dry	1	9/10/2019 11:49:00 AM
Nitrate (as N)	ND	1.17		mg/Kg-dry	1	9/10/2019 11:49:00 AM

Total Phosphorus by EPA Method 6020

Batch ID: 25725 Analyst: WC

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Phosphorus	709	19.5		mg/Kg-dry	1	9/11/2019 8:24:58 PM

Total Metals by EPA Method 6020B

Batch ID: 25725 Analyst: WC

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Potassium	1,020	48.9		mg/Kg-dry	1	9/11/2019 8:24:58 PM

Analytical Report

Work Order: **1909032**
Date Reported: **9/12/2019**

Client: Floyd | Snider
Collection Date: 9/4/2019
Project: CL-Ellensburg
Lab ID: 1909032-003
Matrix: Soil
Client Sample ID: DU-03-090419

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Sample Moisture (Percent Moisture)				Batch ID: R53690		Analyst: SBM
Percent Moisture	18.1	0.500		wt%	1	9/5/2019 4:36:12 PM
Ammonia by SM 4500 NH3 E				Batch ID: 25747		Analyst: SS
Nitrogen, Ammonia	ND	1.18		mg/Kg-dry	1	9/11/2019 9:45:00 AM
pH by EPA Method 9045				Batch ID: R53797		Analyst: WF
Hydrogen Ion (pH)	7.67			pH	1	9/10/2019 2:22:12 PM

Analytical Report

Work Order: **1909032**
Date Reported: **9/12/2019**

Client: Floyd | Snider
Collection Date: 9/4/2019
Project: CL-Ellensburg
Lab ID: 1909032-004
Matrix: Soil
Client Sample ID: DU-04-090419

Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.

Batch ID: 25727 Analyst: DW

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Diesel (Fuel Oil)	2,480	223	D	mg/Kg-dry	10	9/11/2019 1:57:33 PM
Heavy Oil	ND	55.8		mg/Kg-dry	1	9/10/2019 8:04:12 PM
Surr: 2-Fluorobiphenyl	117	50 - 150		%Rec	1	9/10/2019 8:04:12 PM
Surr: o-Terphenyl	115	50 - 150		%Rec	1	9/10/2019 8:04:12 PM

Gasoline by NWTPH-Gx

Batch ID: 25723 Analyst: KT

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Gasoline	ND	50.1	D	mg/Kg-dry	10	9/10/2019 10:09:04 AM
Surr: Toluene-d8	101	65 - 135	D	%Rec	10	9/10/2019 10:09:04 AM
Surr: 4-Bromofluorobenzene	98.7	65 - 135	D	%Rec	10	9/10/2019 10:09:04 AM

NOTES:
Diluted due to matrix.

Volatile Organic Compounds by EPA Method 8260D

Batch ID: 25723 Analyst: KT

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Benzene	ND	0.0200		mg/Kg-dry	1	9/6/2019 9:07:06 PM
Toluene	ND	0.0200		mg/Kg-dry	1	9/6/2019 9:07:06 PM
Ethylbenzene	ND	0.0250		mg/Kg-dry	1	9/6/2019 9:07:06 PM
m,p-Xylene	ND	0.0501		mg/Kg-dry	1	9/6/2019 9:07:06 PM
o-Xylene	ND	0.0250		mg/Kg-dry	1	9/6/2019 9:07:06 PM
Naphthalene	ND	0.0501		mg/Kg-dry	1	9/6/2019 9:07:06 PM
Surr: Dibromofluoromethane	105	56.5 - 129		%Rec	1	9/6/2019 9:07:06 PM
Surr: Toluene-d8	102	64.5 - 151		%Rec	1	9/6/2019 9:07:06 PM
Surr: 1-Bromo-4-fluorobenzene	101	54.8 - 168		%Rec	1	9/6/2019 9:07:06 PM

Ion Chromatography by EPA Method 300.0

Batch ID: 25746 Analyst: SS

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Nitrite (as N)	ND	1.22		mg/Kg-dry	1	9/10/2019 12:12:00 PM
Nitrate (as N)	5.77	1.22		mg/Kg-dry	1	9/10/2019 12:12:00 PM

Total Phosphorus by EPA Method 6020

Batch ID: 25725 Analyst: WC

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Phosphorus	843	19.6		mg/Kg-dry	1	9/11/2019 8:29:44 PM

Total Metals by EPA Method 6020B

Batch ID: 25725 Analyst: WC

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Potassium	1,600	49.0		mg/Kg-dry	1	9/11/2019 8:29:44 PM

Analytical Report

Work Order: **1909032**
Date Reported: **9/12/2019**

Client: Floyd | Snider
Collection Date: 9/4/2019
Project: CL-Ellensburg
Lab ID: 1909032-004
Matrix: Soil
Client Sample ID: **DU-04-090419**

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Sample Moisture (Percent Moisture)				Batch ID: R53690		Analyst: SBM
Percent Moisture	18.4	0.500		wt%	1	9/5/2019 4:36:12 PM
Ammonia by SM 4500 NH3 E				Batch ID: 25747		Analyst: SS
Nitrogen, Ammonia	ND	1.19		mg/Kg-dry	1	9/11/2019 9:45:00 AM
pH by EPA Method 9045				Batch ID: R53797		Analyst: WF
Hydrogen Ion (pH)	7.81			pH	1	9/10/2019 2:22:12 PM

Client: Floyd | Snider
Collection Date: 9/4/2019
Project: CL-Ellensburg
Lab ID: 1909032-005
Matrix: Soil
Client Sample ID: **DU-05-090419**

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				Batch ID: 25735		Analyst: DW
Diesel (Fuel Oil)	304	23.8		mg/Kg-dry	1	9/9/2019 10:58:59 PM
Heavy Oil	ND	59.5		mg/Kg-dry	1	9/9/2019 10:58:59 PM
Surr: 2-Fluorobiphenyl	63.4	50 - 150		%Rec	1	9/9/2019 10:58:59 PM
Surr: o-Terphenyl	72.3	50 - 150		%Rec	1	9/9/2019 10:58:59 PM
Gasoline by NWTPH-Gx				Batch ID: 25723		Analyst: KT
Gasoline	ND	5.59		mg/Kg-dry	1	9/10/2019 9:38:56 AM
Surr: Toluene-d8	101	65 - 135		%Rec	1	9/10/2019 9:38:56 AM
Surr: 4-Bromofluorobenzene	98.1	65 - 135		%Rec	1	9/10/2019 9:38:56 AM
Volatile Organic Compounds by EPA Method 8260D				Batch ID: 25723		Analyst: KT
Benzene	ND	0.0223		mg/Kg-dry	1	9/6/2019 9:37:17 PM
Toluene	ND	0.0223		mg/Kg-dry	1	9/6/2019 9:37:17 PM
Ethylbenzene	ND	0.0279		mg/Kg-dry	1	9/6/2019 9:37:17 PM
m,p-Xylene	ND	0.0559		mg/Kg-dry	1	9/6/2019 9:37:17 PM
o-Xylene	ND	0.0279		mg/Kg-dry	1	9/6/2019 9:37:17 PM
Naphthalene	ND	0.0559		mg/Kg-dry	1	9/6/2019 9:37:17 PM
Surr: Dibromofluoromethane	102	56.5 - 129		%Rec	1	9/6/2019 9:37:17 PM
Surr: Toluene-d8	101	64.5 - 151		%Rec	1	9/6/2019 9:37:17 PM
Surr: 1-Bromo-4-fluorobenzene	101	54.8 - 168		%Rec	1	9/6/2019 9:37:17 PM
Ion Chromatography by EPA Method 300.0				Batch ID: 25746		Analyst: SS
Nitrite (as N)	2.82	2.37	D	mg/Kg-dry	2	9/10/2019 12:35:00 PM
Nitrate (as N)	68.6	5.92	D	mg/Kg-dry	5	9/9/2019 6:17:00 PM
Total Phosphorus by EPA Method 6020				Batch ID: 25725		Analyst: WC
Phosphorus	962	19.5		mg/Kg-dry	1	9/11/2019 8:34:31 PM
Total Metals by EPA Method 6020B				Batch ID: 25725		Analyst: WC
Potassium	3,270	48.7		mg/Kg-dry	1	9/11/2019 8:34:31 PM
Sample Moisture (Percent Moisture)				Batch ID: R53690		Analyst: SBM
Percent Moisture	18.5	0.500		wt%	1	9/5/2019 4:36:12 PM

Analytical Report

Work Order: **1909032**
Date Reported: **9/12/2019**

Client: Floyd | Snider
Collection Date: 9/4/2019
Project: CL-Ellensburg
Lab ID: 1909032-005
Matrix: Soil
Client Sample ID: **DU-05-090419**

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Ammonia by SM 4500 NH3 E				Batch ID: 25747		Analyst: SS
Nitrogen, Ammonia	1.92	1.21		mg/Kg-dry	1	9/11/2019 9:45:00 AM
pH by EPA Method 9045				Batch ID: R53797		Analyst: WF
Hydrogen Ion (pH)	7.92			pH	1	9/10/2019 2:22:12 PM

Work Order: 1909032
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Ammonia by SM 4500 NH3 E

Sample ID: **MB-25747** SampType: **MBLK** Units: **mg/Kg** Prep Date: **9/9/2019** RunNo: **53818**
Client ID: **MBLKS** Batch ID: **25747** Analysis Date: **9/11/2019** SeqNo: **1065280**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Nitrogen, Ammonia	ND	1.00									

Sample ID: **LCS-25747** SampType: **LCS** Units: **mg/Kg** Prep Date: **9/9/2019** RunNo: **53818**
Client ID: **LCSS** Batch ID: **25747** Analysis Date: **9/11/2019** SeqNo: **1065281**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Nitrogen, Ammonia	19.6	1.00	20.00	0	97.9	85	115				

Sample ID: **1909032-004ADUP** SampType: **DUP** Units: **mg/Kg-dry** Prep Date: **9/9/2019** RunNo: **53818**
Client ID: **DU-04-090419** Batch ID: **25747** Analysis Date: **9/11/2019** SeqNo: **1065286**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Nitrogen, Ammonia	ND	1.21						0		30	

Sample ID: **1909032-004AMS** SampType: **MS** Units: **mg/Kg-dry** Prep Date: **9/9/2019** RunNo: **53818**
Client ID: **DU-04-090419** Batch ID: **25747** Analysis Date: **9/11/2019** SeqNo: **1065287**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Nitrogen, Ammonia	16.8	1.20	24.07	0.3588	68.5	80	120				S

NOTES:
S - Outlying spike recovery(ies) observed. A duplicate analysis was performed with similar results indicating a possible matrix effect.

Sample ID: **1909032-004AMSD** SampType: **MSD** Units: **mg/Kg-dry** Prep Date: **9/9/2019** RunNo: **53818**
Client ID: **DU-04-090419** Batch ID: **25747** Analysis Date: **9/11/2019** SeqNo: **1065288**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Nitrogen, Ammonia	14.6	1.22	24.31	0.3588	58.5	80	120	16.85	14.4	20	S

NOTES:
S - Outlying spike recovery(ies) observed. A duplicate analysis was performed with similar results indicating a possible matrix effect.

Work Order: 1909032
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Ion Chromatography by EPA Method 300.0

Sample ID: **MB-25746** SampType: **MBLK** Units: **mg/Kg** Prep Date: **9/9/2019** RunNo: **53777**
Client ID: **MBLKS** Batch ID: **25746** Analysis Date: **9/9/2019** SeqNo: **1064481**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Nitrite (as N)	ND	1.00									
Nitrate (as N)	ND	1.00									

Sample ID: **LCS-25746** SampType: **LCS** Units: **mg/Kg** Prep Date: **9/9/2019** RunNo: **53777**
Client ID: **LCSS** Batch ID: **25746** Analysis Date: **9/9/2019** SeqNo: **1064482**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Nitrite (as N)	7.83	1.00	7.500	0	104	90	110				
Nitrate (as N)	7.45	1.00	7.500	0	99.3	90	110				

Sample ID: **1909032-001ADUP** SampType: **DUP** Units: **mg/Kg-dry** Prep Date: **9/9/2019** RunNo: **53777**
Client ID: **DU-01-090419** Batch ID: **25746** Analysis Date: **9/9/2019** SeqNo: **1064484**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Nitrite (as N)	ND	5.43						0		30	D
Nitrate (as N)	ND	5.43						0		30	D

Sample ID: **1909032-001AMS** SampType: **MS** Units: **mg/Kg-dry** Prep Date: **9/9/2019** RunNo: **53777**
Client ID: **DU-01-090419** Batch ID: **25746** Analysis Date: **9/9/2019** SeqNo: **1064485**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Nitrite (as N)	10.3	5.50	8.255	0	125	80	120				DS
Nitrate (as N)	9.63	5.50	8.255	0	117	80	120				D

NOTES:

S - Outlying spike recovery(ies) observed. A duplicate analysis was performed with similar results indicating a possible matrix effect.

Work Order: 1909032
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Ion Chromatography by EPA Method 300.0

Sample ID: **1909032-001AMSD** SampType: **MSD** Units: **mg/Kg-dry** Prep Date: **9/9/2019** RunNo: **53777**
Client ID: **DU-01-090419** Batch ID: **25746** Analysis Date: **9/9/2019** SeqNo: **1064486**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Nitrite (as N)	10.2	5.40	8.103	0	126	80	120	10.29	0.804	30	DS
Nitrate (as N)	9.40	5.40	8.103	0	116	80	120	9.631	2.44	30	D

NOTES:

S - Outlying spike recovery(ies) observed. A duplicate analysis was performed with similar results indicating a possible matrix effect.

Work Order: 1909032
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Total Phosphorus by EPA Method 6020

Sample ID: **MB-25708** SampType: **MBLK** Units: **mg/Kg** Prep Date: **9/5/2019** RunNo: **53817**
Client ID: **MBLKS** Batch ID: **25708** Analysis Date: **9/11/2019** SeqNo: **1065269**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Phosphorus	ND	16.1									

Sample ID: **LCS-25708** SampType: **LCS** Units: **mg/Kg** Prep Date: **9/5/2019** RunNo: **53817**
Client ID: **LCSS** Batch ID: **25708** Analysis Date: **9/11/2019** SeqNo: **1065270**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Phosphorus	396	16.0	400.0	0	99.0	80	120				

Sample ID: **1908417-014ADUP** SampType: **DUP** Units: **mg/Kg-dry** Prep Date: **9/5/2019** RunNo: **53817**
Client ID: **BATCH** Batch ID: **25708** Analysis Date: **9/11/2019** SeqNo: **1065272**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Phosphorus	514	18.5						640.4	21.9	20	R

NOTES:
R - High RPD observed. The method is in control as indicated by the LCS.

Sample ID: **1908417-014AMS** SampType: **MS** Units: **mg/Kg-dry** Prep Date: **9/5/2019** RunNo: **53817**
Client ID: **BATCH** Batch ID: **25708** Analysis Date: **9/11/2019** SeqNo: **1065276**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Phosphorus	951	18.5	462.5	640.4	67.1	75	125				S

NOTES:
S - Outlying spike recovery(ies) observed. A duplicate analysis was performed with similar results indicating a possible matrix effect.

Sample ID: **1908417-014AMSD** SampType: **MSD** Units: **mg/Kg-dry** Prep Date: **9/5/2019** RunNo: **53817**
Client ID: **BATCH** Batch ID: **25708** Analysis Date: **9/11/2019** SeqNo: **1065277**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Phosphorus	864	18.6	466.2	640.4	47.9	75	125	950.6	9.57	20	S

Work Order: 1909032
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Total Phosphorus by EPA Method 6020

Sample ID: **1908417-014AMSD** SampType: **MSD** Units: **mg/Kg-dry** Prep Date: **9/5/2019** RunNo: **53817**
Client ID: **BATCH** Batch ID: **25708** Analysis Date: **9/11/2019** SeqNo: **1065277**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

NOTES:
S - Outlying spike recovery(ies) observed. A duplicate analysis was performed with similar results indicating a possible matrix effect.

Sample ID: **MB-25725** SampType: **MBLK** Units: **mg/Kg** Prep Date: **9/6/2019** RunNo: **53832**
Client ID: **MBLKS** Batch ID: **25725** Analysis Date: **9/11/2019** SeqNo: **1065699**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Phosphorus	ND	15.9									

Sample ID: **LCS-25725** SampType: **LCS** Units: **mg/Kg** Prep Date: **9/6/2019** RunNo: **53832**
Client ID: **LCSS** Batch ID: **25725** Analysis Date: **9/11/2019** SeqNo: **1065700**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Phosphorus	389	16.1	403.2	0	96.5	80	120				

Sample ID: **1909040-001ADUP** SampType: **DUP** Units: **mg/Kg-dry** Prep Date: **9/6/2019** RunNo: **53832**
Client ID: **BATCH** Batch ID: **25725** Analysis Date: **9/11/2019** SeqNo: **1065704**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Phosphorus	354	16.3						388.7	9.48	20	

Sample ID: **1909040-001AMS** SampType: **MS** Units: **mg/Kg-dry** Prep Date: **9/6/2019** RunNo: **53832**
Client ID: **BATCH** Batch ID: **25725** Analysis Date: **9/11/2019** SeqNo: **1065706**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Phosphorus	711	16.4	409.6	388.7	78.7	75	125				

Work Order: 1909032
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Total Phosphorus by EPA Method 6020

Sample ID: **1909040-001AMSD** SampType: **MSD** Units: **mg/Kg-dry** Prep Date: **9/6/2019** RunNo: **53832**
Client ID: **BATCH** Batch ID: **25725** Analysis Date: **9/11/2019** SeqNo: **1065707**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Phosphorus	795	16.5	412.8	388.7	98.4	75	125	710.9	11.1	20	

Work Order: 1909032
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

pH by EPA Method 9045

Sample ID: **MB-R53797** SampType: **MBLK** Units: **pH** Prep Date: **9/10/2019** RunNo: **53797**
Client ID: **MBLKS** Batch ID: **R53797** Analysis Date: **9/10/2019** SeqNo: **1064836**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Hydrogen Ion (pH)	6.44										

Sample ID: **LCS-R53797** SampType: **LCS** Units: **pH** Prep Date: **9/10/2019** RunNo: **53797**
Client ID: **LCSS** Batch ID: **R53797** Analysis Date: **9/10/2019** SeqNo: **1064837**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Hydrogen Ion (pH)	7.04		7.000	0	101	95	105				

Sample ID: **1909084-001ADUP** SampType: **DUP** Units: **pH** Prep Date: **9/10/2019** RunNo: **53797**
Client ID: **BATCH** Batch ID: **R53797** Analysis Date: **9/10/2019** SeqNo: **1064839**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Hydrogen Ion (pH)	7.81							7.550	3.39	10	

Date: *9/12/2019*

Work Order: 1909032
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Total Metals by EPA Method 6020B

Sample ID: **MB-25725** SampType: **MBLK** Units: **mg/Kg** Prep Date: **9/6/2019** RunNo: **53751**
Client ID: **MBLKS** Batch ID: **25725** Analysis Date: **9/9/2019** SeqNo: **1063859**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Potassium	ND	39.7									

Sample ID: **LCS-25725** SampType: **LCS** Units: **mg/Kg** Prep Date: **9/6/2019** RunNo: **53751**
Client ID: **LCSS** Batch ID: **25725** Analysis Date: **9/9/2019** SeqNo: **1063860**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Potassium	391	40.3	403.2	0	97.0	80	120				

Sample ID: **1909040-001ADUP** SampType: **DUP** Units: **mg/Kg-dry** Prep Date: **9/6/2019** RunNo: **53751**
Client ID: **BATCH** Batch ID: **25725** Analysis Date: **9/9/2019** SeqNo: **1063862**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Potassium	444	40.6						666.0	40.1	20	R

NOTES:
R - High RPD observed. The method is in control as indicated by the LCS.

Sample ID: **1909040-001AMS** SampType: **MS** Units: **mg/Kg-dry** Prep Date: **9/6/2019** RunNo: **53751**
Client ID: **BATCH** Batch ID: **25725** Analysis Date: **9/9/2019** SeqNo: **1063866**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Potassium	925	41.0	409.6	666.0	63.1	75	125				S

NOTES:
S - Outlying spike recovery(ies) observed. A duplicate analysis was performed with similar results indicating a possible matrix effect.

Sample ID: **1909040-001AMSD** SampType: **MSD** Units: **mg/Kg-dry** Prep Date: **9/6/2019** RunNo: **53751**
Client ID: **BATCH** Batch ID: **25725** Analysis Date: **9/9/2019** SeqNo: **1063867**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Potassium	844	41.3	412.8	666.0	43.2	75	125	924.6	9.09	20	S

Work Order: 1909032
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Total Metals by EPA Method 6020B

Sample ID: **1909040-001AMSD**	SampType: **MSD**	Units: **mg/Kg-dry**	Prep Date: **9/6/2019**	RunNo: **53751**	
Client ID: **BATCH**	Batch ID: **25725**		Analysis Date: **9/9/2019**	SeqNo: **1063867**	

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

NOTES:
S - Outlying spike recovery(ies) observed. A duplicate analysis was performed with similar results indicating a possible matrix effect.

Sample ID: **MB-25708**	SampType: **MBLK**	Units: **mg/Kg**	Prep Date: **9/5/2019**	RunNo: **53793**
Client ID: **MBLKS**	Batch ID: **25708**		Analysis Date: **9/10/2019**	SeqNo: **1064791**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Potassium	ND	40.3									

Sample ID: **LCS-25708**	SampType: **LCS**	Units: **mg/Kg**	Prep Date: **9/5/2019**	RunNo: **53793**
Client ID: **LCSS**	Batch ID: **25708**		Analysis Date: **9/10/2019**	SeqNo: **1064792**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Potassium	437	40.0	400.0	0	109	80	120				

Sample ID: **1908417-014ADUP**	SampType: **DUP**	Units: **mg/Kg-dry**	Prep Date: **9/5/2019**	RunNo: **53793**
Client ID: **BATCH**	Batch ID: **25708**		Analysis Date: **9/10/2019**	SeqNo: **1064796**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Potassium	2,050	46.2						2,190	6.58	20	

Sample ID: **1908417-014AMS**	SampType: **MS**	Units: **mg/Kg-dry**	Prep Date: **9/5/2019**	RunNo: **53793**
Client ID: **BATCH**	Batch ID: **25708**		Analysis Date: **9/10/2019**	SeqNo: **1064798**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Potassium	2,900	46.2	462.5	2,190	153	75	125				ES

NOTES:
S - Outlying spike recovery(ies) observed. A duplicate analysis was performed with similar results indicating a possible matrix effect.
E - Estimated value. The amount exceeds the linear working range of the instrument.

Work Order: 1909032
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Total Metals by EPA Method 6020B

Sample ID: **1908417-014AMSD**	SampType: **MSD**	Units: **mg/Kg-dry**	Prep Date: **9/5/2019**	RunNo: **53793**	
Client ID: **BATCH**	Batch ID: **25708**		Analysis Date: **9/10/2019**	SeqNo: **1064799**	

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Potassium	2,360	46.6	466.2	2,190	35.6	75	125	2,895	20.5	20	ERS

NOTES:

S - Outlying spike recovery(ies) observed. A duplicate analysis was performed with similar results indicating a possible matrix effect.

R - High RPD observed. The method is in control as indicated by the LCS.

E - Estimated value. The amount exceeds the linear working range of the instrument.

QC SUMMARY REPORT

Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.

Sample ID: **MB-25727** SampType: **MBLK** Units: **mg/Kg** Prep Date: **9/6/2019** RunNo: **53758**
Client ID: **MBLKS** Batch ID: **25727** Analysis Date: **9/9/2019** SeqNo: **1063983**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel (Fuel Oil)	ND	20.0									
Heavy Oil	ND	50.0									
Surr: 2-Fluorobiphenyl	19.7		20.00		98.7	50	150				
Surr: o-Terphenyl	20.6		20.00		103	50	150				

Sample ID: **LCS-25727** SampType: **LCS** Units: **mg/Kg** Prep Date: **9/6/2019** RunNo: **53758**
Client ID: **LCSS** Batch ID: **25727** Analysis Date: **9/9/2019** SeqNo: **1063984**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel (Fuel Oil)	571	20.0	500.0	0	114	65	135				
Surr: 2-Fluorobiphenyl	24.2		20.00		121	50	150				
Surr: o-Terphenyl	23.5		20.00		117	50	150				

Sample ID: **1908347-002ADUP** SampType: **DUP** Units: **mg/Kg-dry** Prep Date: **9/6/2019** RunNo: **53758**
Client ID: **BATCH** Batch ID: **25727** Analysis Date: **9/9/2019** SeqNo: **1063986**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel (Fuel Oil)	ND	21.0						0		30	H
Heavy Oil	ND	52.4						0		30	H
Surr: 2-Fluorobiphenyl	22.4		20.98		107	50	150		0		H
Surr: o-Terphenyl	23.5		20.98		112	50	150		0		H

Sample ID: **1909007-001AMS** SampType: **MS** Units: **mg/Kg-dry** Prep Date: **9/6/2019** RunNo: **53758**
Client ID: **BATCH** Batch ID: **25727** Analysis Date: **9/9/2019** SeqNo: **1063988**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel (Fuel Oil)	4,840	23.9	598.0	5,160	-53.2	65	135				SE
Surr: 2-Fluorobiphenyl	80.1		23.92		335	50	150				S
Surr: o-Terphenyl	37.8		23.92		158	50	150				S

Work Order: 1909032
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.

Sample ID: **1909007-001AMS** SampType: **MS** Units: **mg/Kg-dry** Prep Date: **9/6/2019** RunNo: **53758**
Client ID: **BATCH** Batch ID: **25727** Analysis Date: **9/9/2019** SeqNo: **1063988**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

NOTES:
S - Analyte concentration was too high for accurate spike recovery(ies).
S - Outlying surrogate recovery attributed to TPH interference. The method is in control as indicated by the Method Blank (MB) & Laboratory Control Sample (LCS).

Sample ID: **1909007-001AMSD** SampType: **MSD** Units: **mg/Kg-dry** Prep Date: **9/6/2019** RunNo: **53758**
Client ID: **BATCH** Batch ID: **25727** Analysis Date: **9/9/2019** SeqNo: **1063989**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel (Fuel Oil)	3,780	23.4	585.4	5,160	-235	65	135	4,842	24.6	30	SE
Surr: 2-Fluorobiphenyl	60.6		23.42		259	50	150		0		S
Surr: o-Terphenyl	27.4		23.42		117	50	150		0		

NOTES:
S - Analyte concentration was too high for accurate spike recovery(ies).
S - Outlying surrogate recovery attributed to TPH interference. The method is in control as indicated by the Method Blank (MB) & Laboratory Control Sample (LCS).

Sample ID: **MB-25735** SampType: **MBLK** Units: **mg/Kg** Prep Date: **9/6/2019** RunNo: **53774**
Client ID: **MBLKS** Batch ID: **25735** Analysis Date: **9/9/2019** SeqNo: **1064330**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel (Fuel Oil)	ND	20.0									
Heavy Oil	ND	50.0									
Surr: 2-Fluorobiphenyl	15.2		20.00		76.0	50	150				
Surr: o-Terphenyl	17.2		20.00		85.8	50	150				

Sample ID: **LCS-25735** SampType: **LCS** Units: **mg/Kg** Prep Date: **9/6/2019** RunNo: **53774**
Client ID: **LCSS** Batch ID: **25735** Analysis Date: **9/9/2019** SeqNo: **1064331**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel (Fuel Oil)	518	20.0	500.0	0	104	65	135				
Surr: 2-Fluorobiphenyl	17.6		20.00		88.2	50	150				
Surr: o-Terphenyl	17.1		20.00		85.7	50	150				

Work Order: 1909032
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.

Sample ID: **LCS-25735** SampType: **LCS** Units: **mg/Kg** Prep Date: **9/6/2019** RunNo: **53774**
Client ID: **LCSS** Batch ID: **25735** Analysis Date: **9/9/2019** SeqNo: **1064331**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Sample ID: **1909065-001ADUP** SampType: **DUP** Units: **mg/Kg-dry** Prep Date: **9/6/2019** RunNo: **53774**
Client ID: **BATCH** Batch ID: **25735** Analysis Date: **9/9/2019** SeqNo: **1064333**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel (Fuel Oil)	ND	26.3						0		30	
Heavy Oil	ND	65.6						0		30	
Surr: 2-Fluorobiphenyl	16.3		26.26		61.9	50	150		0		
Surr: o-Terphenyl	17.9		26.26		68.2	50	150		0		

Sample ID: **1909065-001AMS** SampType: **MS** Units: **mg/Kg-dry** Prep Date: **9/6/2019** RunNo: **53774**
Client ID: **BATCH** Batch ID: **25735** Analysis Date: **9/9/2019** SeqNo: **1064334**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel (Fuel Oil)	602	26.7	666.8	0	90.3	65	135				
Surr: 2-Fluorobiphenyl	19.5		26.67		73.0	50	150				
Surr: o-Terphenyl	19.6		26.67		73.5	50	150				

Sample ID: **1909065-001AMSD** SampType: **MSD** Units: **mg/Kg-dry** Prep Date: **9/6/2019** RunNo: **53774**
Client ID: **BATCH** Batch ID: **25735** Analysis Date: **9/9/2019** SeqNo: **1064335**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel (Fuel Oil)	602	24.9	623.5	0	96.5	65	135	602.1	0.0761	30	
Surr: 2-Fluorobiphenyl	16.3		24.94		65.5	50	150		0		
Surr: o-Terphenyl	16.5		24.94		66.3	50	150		0		

Work Order: 1909032
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Gasoline by NWTPH-Gx

Sample ID: **LCS-25723** SampType: **LCS** Units: **mg/Kg** Prep Date: **9/6/2019** RunNo: **53715**
Client ID: **LCSS** Batch ID: **25723** Analysis Date: **9/6/2019** SeqNo: **1063274**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Gasoline	26.2	5.00	25.00	0	105	65	135				
Surr: Toluene-d8	1.27		1.250		102	65	135				
Surr: 4-Bromofluorobenzene	1.21		1.250		96.9	65	135				

Sample ID: **LCSD-25723** SampType: **LCSD** Units: **mg/Kg** Prep Date: **9/6/2019** RunNo: **53715**
Client ID: **LCSS02** Batch ID: **25723** Analysis Date: **9/6/2019** SeqNo: **1063275**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Gasoline	28.9	5.00	25.00	0	116	65	135	26.25	9.77	20	
Surr: Toluene-d8	1.28		1.250		102	65	135		0		
Surr: 4-Bromofluorobenzene	1.21		1.250		97.0	65	135		0		

Sample ID: **MB-25723** SampType: **MBLK** Units: **mg/Kg** Prep Date: **9/6/2019** RunNo: **53715**
Client ID: **MBLKS** Batch ID: **25723** Analysis Date: **9/6/2019** SeqNo: **1063284**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Gasoline	ND	5.00									
Surr: Toluene-d8	1.26		1.250		101	65	135				
Surr: 4-Bromofluorobenzene	1.16		1.250		92.5	65	135				

Sample ID: **1909046-021BDUP** SampType: **DUP** Units: **mg/Kg-dry** Prep Date: **9/6/2019** RunNo: **53715**
Client ID: **BATCH** Batch ID: **25723** Analysis Date: **9/6/2019** SeqNo: **1063279**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Gasoline	ND	6.80						0		30	
Surr: Toluene-d8	1.71		1.699		101	65	135		0		
Surr: 4-Bromofluorobenzene	1.57		1.699		92.3	65	135		0		

Work Order: 1909032
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Gasoline by NWTPH-Gx

Sample ID: **1909032-005BDUP** SampType: **DUP** Units: **mg/Kg-dry** Prep Date: **9/6/2019** RunNo: **53715**
Client ID: **DU-05-090419** Batch ID: **25723** Analysis Date: **9/6/2019** SeqNo: **1063522**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Gasoline	ND	5.56						0		30	
Surr: Toluene-d8	1.42		1.391		102	65	135		0		
Surr: 4-Bromofluorobenzene	1.36		1.391		97.8	65	135		0		

Work Order: 1909032
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Volatile Organic Compounds by EPA Method 8260D

Sample ID: **LCS-25723** SampType: **LCS** Units: **mg/Kg** Prep Date: **9/6/2019** RunNo: **53714**
Client ID: **LCSS** Batch ID: **25723** Analysis Date: **9/6/2019** SeqNo: **1063263**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	1.03	0.0200	1.000	0	103	64.3	133				
Toluene	1.04	0.0200	1.000	0	104	67	144				
Ethylbenzene	1.05	0.0250	1.000	0	105	74	129				
m,p-Xylene	2.10	0.0500	2.000	0	105	70	124				
o-Xylene	1.05	0.0250	1.000	0	105	68.1	139				
Naphthalene	0.895	0.0500	1.000	0	89.5	46.5	167				
Surr: Dibromofluoromethane	1.28		1.250		102	56.5	129				
Surr: Toluene-d8	1.27		1.250		102	64.5	151				
Surr: 1-Bromo-4-fluorobenzene	1.24		1.250		99.5	54.8	168				

Sample ID: **LCSD-25723** SampType: **LCSD** Units: **mg/Kg** Prep Date: **9/6/2019** RunNo: **53714**
Client ID: **LCSS02** Batch ID: **25723** Analysis Date: **9/6/2019** SeqNo: **1063264**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	1.02	0.0200	1.000	0	102	74.6	124	1.032	0.774	20	
Toluene	1.04	0.0200	1.000	0	104	67	144	1.044	0.456	20	
Ethylbenzene	1.03	0.0250	1.000	0	103	74	129	1.048	1.67	20	
m,p-Xylene	2.07	0.0500	2.000	0	104	70	124	2.103	1.38	20	
o-Xylene	1.02	0.0250	1.000	0	102	68.1	139	1.045	2.21	20	
Naphthalene	0.910	0.0500	1.000	0	91.0	46.5	167	0.8949	1.72	20	
Surr: Dibromofluoromethane	1.28		1.250		102	56.5	129		0		
Surr: Toluene-d8	1.27		1.250		102	64.5	151		0		
Surr: 1-Bromo-4-fluorobenzene	1.24		1.250		99.0	54.8	168		0		

Sample ID: **MB-25723** SampType: **MBLK** Units: **mg/Kg** Prep Date: **9/6/2019** RunNo: **53714**
Client ID: **MBLKS** Batch ID: **25723** Analysis Date: **9/6/2019** SeqNo: **1063265**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	ND	0.0200									
Toluene	ND	0.0200									

Work Order: 1909032
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Volatile Organic Compounds by EPA Method 8260D

Sample ID: **MB-25723** SampType: **MBLK** Units: **mg/Kg** Prep Date: **9/6/2019** RunNo: **53714**
Client ID: **MBLKS** Batch ID: **25723** Analysis Date: **9/6/2019** SeqNo: **1063265**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Ethylbenzene	ND	0.0250									
m,p-Xylene	ND	0.0500									
o-Xylene	ND	0.0250									
Naphthalene	ND	0.0500									
Surr: Dibromofluoromethane	1.25		1.250		100	56.5	129				
Surr: Toluene-d8	1.26		1.250		101	64.5	151				
Surr: 1-Bromo-4-fluorobenzene	1.23		1.250		98.6	54.8	168				

Sample ID: **1909046-021BDUP** SampType: **DUP** Units: **mg/Kg-dry** Prep Date: **9/6/2019** RunNo: **53714**
Client ID: **BATCH** Batch ID: **25723** Analysis Date: **9/6/2019** SeqNo: **1063256**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	ND	0.0272						0		30	
Toluene	ND	0.0272						0		30	
Ethylbenzene	ND	0.0340						0		30	
m,p-Xylene	ND	0.0680						0		30	
o-Xylene	ND	0.0340						0		30	
Naphthalene	0.300	0.0680						0.2755	8.60	30	
Surr: Dibromofluoromethane	1.75		1.699		103	56.5	129		0		
Surr: Toluene-d8	1.74		1.699		102	64.5	151		0		
Surr: 1-Bromo-4-fluorobenzene	1.66		1.699		97.8	54.8	168		0		

Sample ID: **1909032-005BDUP** SampType: **DUP** Units: **mg/Kg-dry** Prep Date: **9/6/2019** RunNo: **53714**
Client ID: **DU-05-090419** Batch ID: **25723** Analysis Date: **9/6/2019** SeqNo: **1063504**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	ND	0.0223						0		30	
Toluene	ND	0.0223						0		30	
Ethylbenzene	ND	0.0279						0		30	
m,p-Xylene	ND	0.0559						0		30	

Work Order: 1909032
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Volatile Organic Compounds by EPA Method 8260D

Sample ID: **1909032-005BDUP** SampType: **DUP** Units: **mg/Kg-dry** Prep Date: **9/6/2019** RunNo: **53714**
Client ID: **DU-05-090419** Batch ID: **25723** Analysis Date: **9/6/2019** SeqNo: **1063504**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
o-Xylene	ND	0.0279						0		30	
Naphthalene	ND	0.0559						0		30	
Surr: Dibromofluoromethane	1.42		1.397		102	56.5	129		0		
Surr: Toluene-d8	1.42		1.397		101	64.5	151		0		
Surr: 1-Bromo-4-fluorobenzene	1.39		1.397		99.2	54.8	168		0		

Sample ID: **1909007-001BMS** SampType: **MS** Units: **mg/Kg-dry** Prep Date: **9/6/2019** RunNo: **53714**
Client ID: **BATCH** Batch ID: **25723** Analysis Date: **9/7/2019** SeqNo: **1063497**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	11.4	0.213	10.66	0	107	63.5	133				D
Toluene	11.5	0.213	10.66	0	108	63.4	132				D
Ethylbenzene	11.3	0.266	10.66	0.1353	105	54.5	134				D
m,p-Xylene	23.0	0.533	21.32	0.5241	105	53.1	132				D
o-Xylene	11.2	0.266	10.66	0.1416	104	53.3	139				D
Naphthalene	10.6	0.533	10.66	0	99.7	52.3	124				D
Surr: Dibromofluoromethane	14.0		13.32		105	56.5	129				D
Surr: Toluene-d8	13.6		13.32		102	64.5	151				D
Surr: 1-Bromo-4-fluorobenzene	13.4		13.32		101	54.8	168				D

Sample ID: **1909007-001BMSD** SampType: **MSD** Units: **mg/Kg-dry** Prep Date: **9/6/2019** RunNo: **53714**
Client ID: **BATCH** Batch ID: **25723** Analysis Date: **9/7/2019** SeqNo: **1063498**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	11.7	0.213	10.66	0	110	63.5	133	11.42	2.33	30	D
Toluene	11.7	0.213	10.66	0	110	63.4	132	11.46	1.91	30	D
Ethylbenzene	11.7	0.266	10.66	0.1353	108	54.5	134	11.32	3.19	30	D
m,p-Xylene	23.5	0.533	21.32	0.5241	108	53.1	132	22.96	2.49	30	D
o-Xylene	11.5	0.266	10.66	0.1416	107	53.3	139	11.20	2.99	30	D
Naphthalene	11.0	0.533	10.66	0	103	52.3	124	10.62	3.69	30	D

Work Order: 1909032
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Volatile Organic Compounds by EPA Method 8260D

Sample ID: **1909007-001BMSD** SampType: **MSD** Units: **mg/Kg-dry** Prep Date: **9/6/2019** RunNo: **53714**
Client ID: **BATCH** Batch ID: **25723** Analysis Date: **9/7/2019** SeqNo: **1063498**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Dibromofluoromethane	14.0		13.32		105	56.5	129		0		D
Surr: Toluene-d8	13.5		13.32		101	64.5	151		0		D
Surr: 1-Bromo-4-fluorobenzene	13.7		13.32		103	54.8	168		0		D

Work Order: 1909032
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Sample Moisture (Percent Moisture)

Sample ID: **1909029-003ADUP** SampType: **DUP** Units: **wt%** Prep Date: **9/5/2019** RunNo: **53665**
Client ID: **BATCH** Batch ID: **R53665** Analysis Date: **9/5/2019** SeqNo: **1062362**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Percent Moisture	16.1	0.500						13.38	18.2	20	

Sample ID: **1909031-010ADUP** SampType: **DUP** Units: **wt%** Prep Date: **9/5/2019** RunNo: **53665**
Client ID: **BATCH** Batch ID: **R53665** Analysis Date: **9/5/2019** SeqNo: **1062375**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Percent Moisture	16.3	0.500						14.43	11.9	20	

Sample ID: **1909046-024ADUP** SampType: **DUP** Units: **wt%** Prep Date: **9/5/2019** RunNo: **53690**
Client ID: **BATCH** Batch ID: **R53690** Analysis Date: **9/5/2019** SeqNo: **1062799**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Percent Moisture	11.1	0.500						12.15	8.87	20	

Sample ID: **1909032-005ADUP** SampType: **DUP** Units: **wt%** Prep Date: **9/5/2019** RunNo: **53690**
Client ID: **DU-05-090419** Batch ID: **R53690** Analysis Date: **9/5/2019** SeqNo: **1062806**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Percent Moisture	18.2	0.500						18.54	1.93	20	

Fremont Analytical

Sample Log-In Check List

Client Name: **FS**
Work Order Number: **1909032**
Logged by: **Carissa True**
Date Received: **9/4/2019 4:30:00 PM**

Chain of Custody

1. Is Chain of Custody complete? Yes ☑ No ☐ Not Present ☐
2. How was the sample delivered? Client

Log In

3. Coolers are present? Yes ☑ No ☐ NA ☐
4. Shipping container/cooler in good condition? Yes ☑ No ☐
5. Custody Seals present on shipping container/cooler? (Refer to comments for Custody Seals not intact) Yes ☐ No ☐ Not Required ☑
6. Was an attempt made to cool the samples? Yes ☑ No ☐ NA ☐
7. Were all items received at a temperature of >0°C to 10.0°C* Yes ☑ No ☐ NA ☐
8. Sample(s) in proper container(s)? Yes ☑ No ☐
9. Sufficient sample volume for indicated test(s)? Yes ☑ No ☐
10. Are samples properly preserved? Yes ☑ No ☐
11. Was preservative added to bottles? Yes ☐ No ☑ NA ☐
12. Is there headspace in the VOA vials? Yes ☐ No ☐ NA ☑
13. Did all samples containers arrive in good condition(unbroken)? Yes ☑ No ☐
14. Does paperwork match bottle labels? Yes ☑ No ☐
15. Are matrices correctly identified on Chain of Custody? Yes ☑ No ☐
16. Is it clear what analyses were requested? Yes ☑ No ☐
17. Were all holding times able to be met? Yes ☑ No ☐

Special Handling (if applicable)

18. Was client notified of all discrepancies with this order? Yes ☑ No ☐ NA ☐

Person Notified: Gabe
Date: 9/4/2019
By Whom: Carissa True
Via: ☑ eMail ☐ Phone ☐ Fax ☐ In Person
Regarding: Confirmation of analysis.
Client Instructions: See revised COC

19. Additional remarks:

Item Information

Item #	Temp ºC
Cooler 1	9.4
Sample 1	2.5
Temp Blank 1	6.9

* Note: DoD/ELAP and TNI require items to be received at 4°C +/- 2°C

Fremont Analytical

3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790
Fax: 206-352-7178

Chain of Custody Record & Laboratory Services Agreement

Date: 9/4/19 Page: 1 of: 1

Laboratory Project No (internal): 1909032

Project Name: CL-Ellensburg

Project No:

Collected by: Gabe Cisneros

Location: 1611 Canyon Rd, Ellensburg, WA

Report To (PM):

PM Email: gabe.cisneros@floydsnider.com

Client: Floyd|Snider

Address: 601 Union Street Ste. 600

City, State, Zip: Seattle 98101

Telephone: 206-292-2078

Fax:

Special Remarks:
Total Nitrogen = Nitrite + Nitrate + Ammonia
NPK = Nitrogen + phosphorus + Potassium

Sample Disposal: ☐ Return to client ☐ Disposal by lab (after 30 days)

	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	VOCs (EPA 8260 / 624)	GX/BTEX + Naphth. 8260	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8)	Total (T) / Dissolved (D)	Anions (IC)***	EDB (8011)	NPK ← See Anions	Ammonia	pH	Comments
1	DU-01-~~090319~~ 090419 gc	9/4/19		S		X				X						X		X	X	X	8260 Method
2	DU-02-090419	↓		↓		X				X						X		X	X	X	
3	DU-03-090419					X				X						X		X	X	X	
4	DU-04-090419					X				X						X		X	X	X	Changes made by Gabe Cisneros
5	DU-05-090419					X				X						X		X	X	X	9/5/19
6																					
7																					
8																					
9																					
10																					

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, [✓ S = Soil], SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL Individual: Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl U V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride [✓ Nitrate+Nitrite + Ammonia]

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above and that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished x Date/Time 9/4/19 1630

Received x Kayla Potter Date/Time 9/4/19 1630

Relinquished x Date/Time

Received x Date/Time

Turn-around Time:
☒ Standard
☐ 3 Day
☐ 2 Day
☐ Next Day
Same Day ______ (specify)

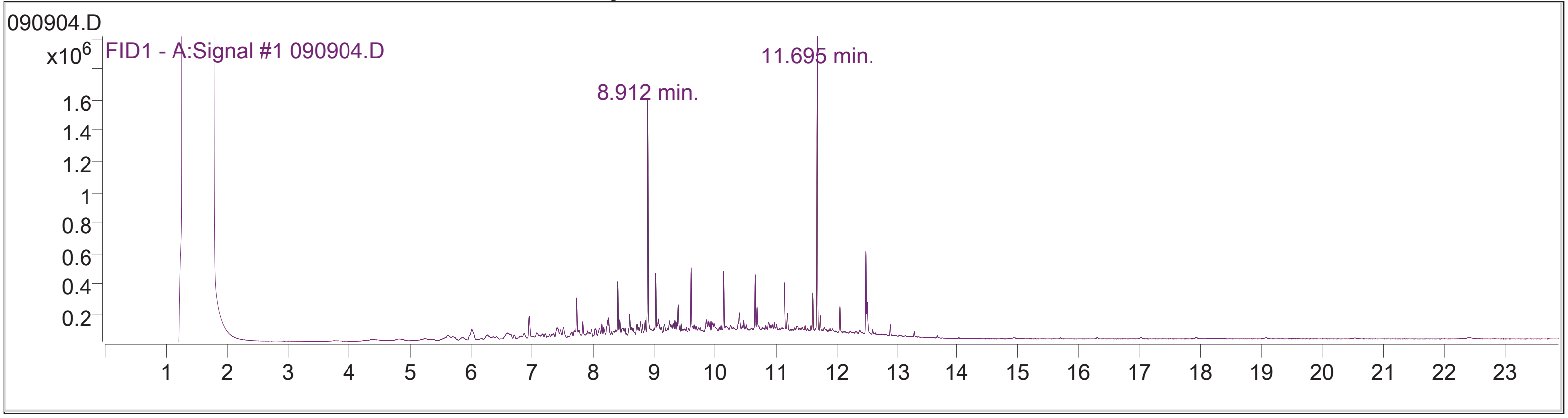
COC 1.2 - 2.22.17

www.fremontanalytical.com

Quantitation Results Report

Agilent Technologies

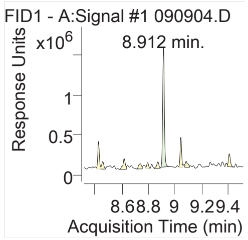
Data File	090904.D	Operator	DMW
Acq. Method	DXACQ050317sgtest2-190617	Acq. Date-Time	9/9/2019 9:55:16 AM
Sample Name:	DX-CCV-		dualfid
Vial	2	Multiplier	1.00
DA Method File	DX-190613-NWTPH_FINAL.m O-DXEX-S	Last Calib Update	6/14/2019 8:56:41 AM
Batch Name	D:\GC-24\Data\2019\190909FRONT\QuantResults\25727.batch.bin		



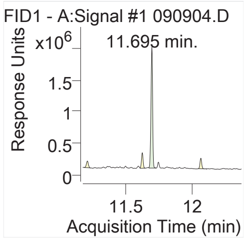
Compound	RT	Resp.	Conc.	Units		Dev(Min)
Internal Standards						
System Monitoring Compounds						
2-Fluorobiphenyl	8.912	1331320	22.357	ug/mL		0.000
Spiked Amount:	Range: - %			Recovery = NA%		
O-Terphenyl	11.695	1677935	21.466	ug/mL		-0.078
Spiked Amount:	Range: - %			Recovery = NA%		
Target Compounds						
Diesel	11.695	32704019	499.678	ug/mL	m	
Heavy Oil	17.500	0	0.000	ug/mL	md	

(#) = Qualifier Out of Range; (m) = Manual Integration; (+) = Area Summed; (*) = Surrogate Percent Recovery Out of Range; (d): Zeroed Peak

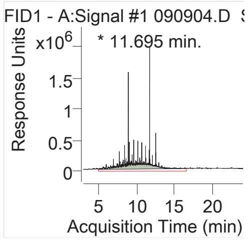
2-Fluorobiphenyl



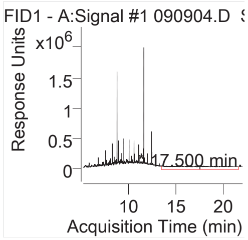
O-Terphenyl



Diesel



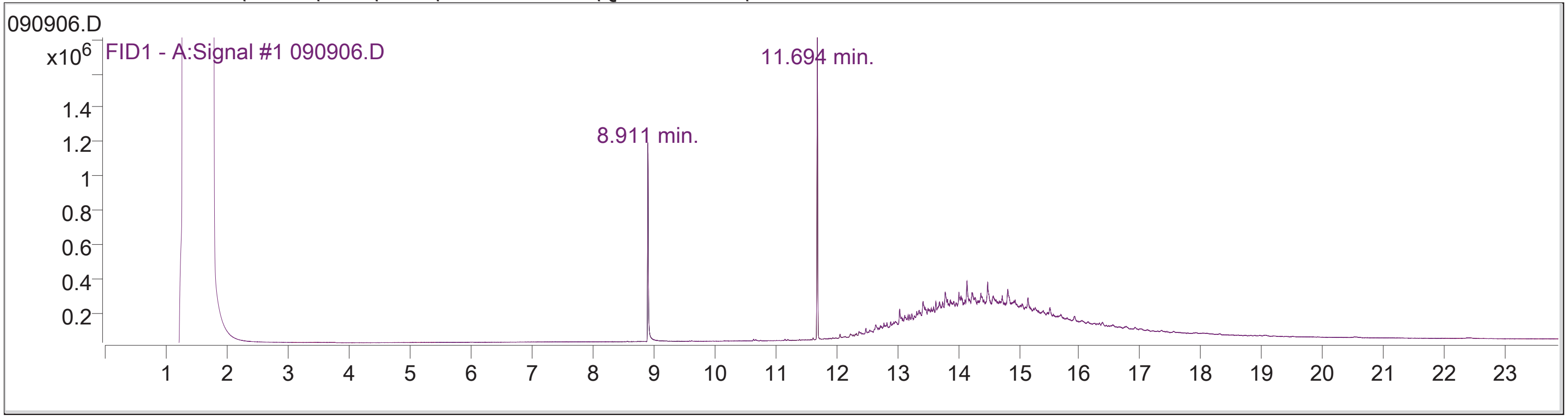
Heavy Oil



Quantitation Results Report

Agilent Technologies

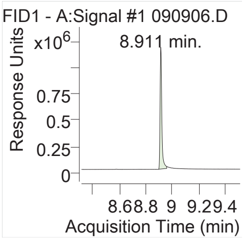
Data File	090906.D	Operator	DMW
Acq. Method	DXACQ050317sgtest2-190617	Acq. Date-Time	9/9/2019 10:25:13 AM
Sample Name:	OIL-CCV-		dualfid
Vial	1	Multiplier	1.00
DA Method File	DX-190613-NWTPH_FINAL.m O-DXEX-S	Last Calib Update	6/14/2019 8:56:41 AM
Batch Name	D:\GC-24\Data\2019\190909FRONT\QuantResults\25727.batch.bin		



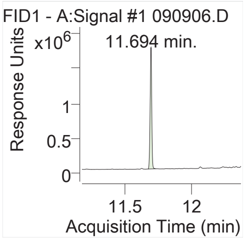
Compound	RT	Resp.	Conc.	Units		Dev(Min)
Internal Standards						
System Monitoring Compounds						
2-Fluorobiphenyl	8.911	1075096	18.194	ug/mL		0.000
Spiked Amount:	Range: - %			Recovery = NA%		
O-Terphenyl	11.694	1494274	19.064	ug/mL		-0.079
Spiked Amount:	Range: - %			Recovery = NA%		
Target Compounds						
Diesel	10.750	0	0.000	ug/mL	md	
Heavy Oil	14.151	52052907	853.295	ug/mL	m	

(#) = Qualifier Out of Range; (m) = Manual Integration; (+) = Area Summed; (*) = Surrogate Percent Recovery Out of Range; (d): Zeroed Peak

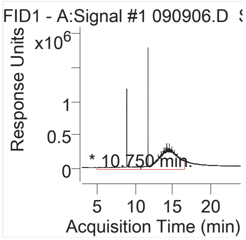
2-Fluorobiphenyl



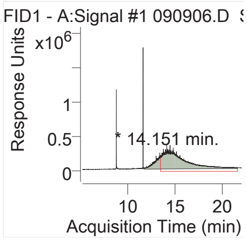
O-Terphenyl



Diesel



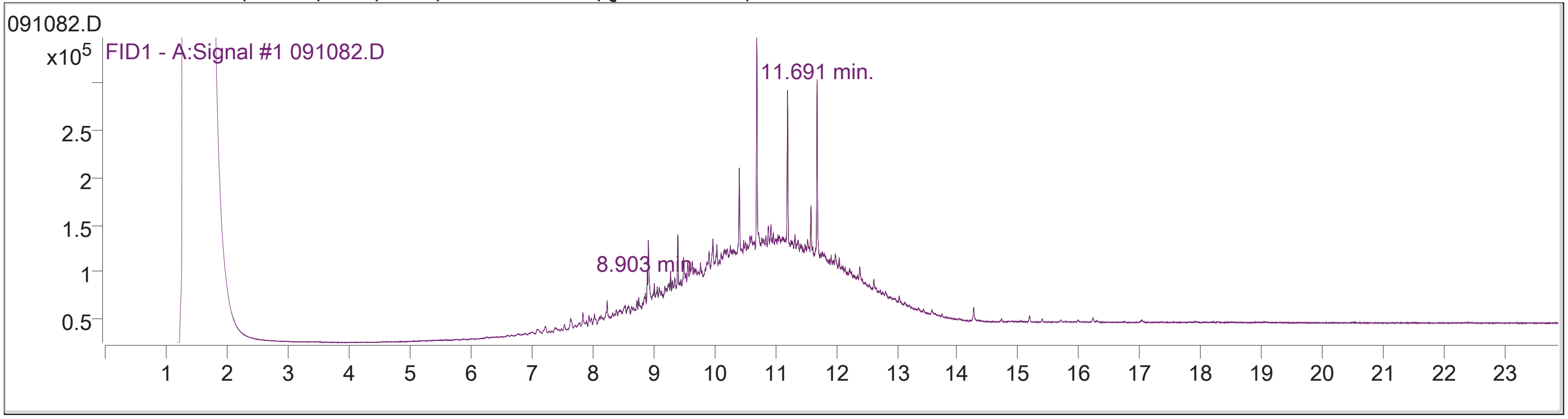
Heavy Oil



Quantitation Results Report

Agilent Technologies

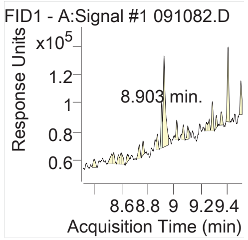
Data File	091082.D	Operator	DMW
Acq. Method	DXACQ050317sgtest2-190617	Acq. Date-Time	9/11/2019 12:27:56 PM
Sample Name:	1909032-001A 10X		dualfid
Vial	6	Multiplier	1.00
DA Method File	DX-190613-NWTPH_FINAL.m O-DXEX-S	Last Calib Update	6/14/2019 8:56:41 AM
Batch Name	D:\GC-24\Data\2019\190909FRONT\QuantResults\25727.batch.bin		



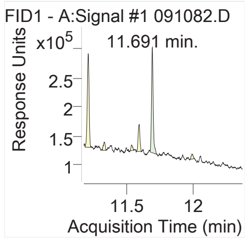
Compound	RT	Resp.	Conc.	Units		Dev(Min)
Internal Standards						
System Monitoring Compounds						
2-Fluorobiphenyl	8.903	24066	1.118	ug/mL		-0.008
Spiked Amount:	Range: - %			Recovery = NA%		
O-Terphenyl	11.691	160752	1.627	ug/mL		-0.082
Spiked Amount:	Range: - %			Recovery = NA%		
Target Compounds						
Diesel	10.702	21929554	332.224	ug/mL	m	
Heavy Oil	17.025	1076232	0.000	ug/mL	m	

(#) = Qualifier Out of Range; (m) = Manual Integration; (+) = Area Summed; (*) = Surrogate Percent Recovery Out of Range; (d): Zeroed Peak

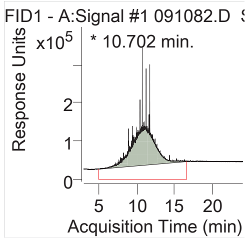
2-Fluorobiphenyl



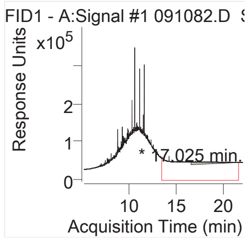
O-Terphenyl



Diesel



Heavy Oil

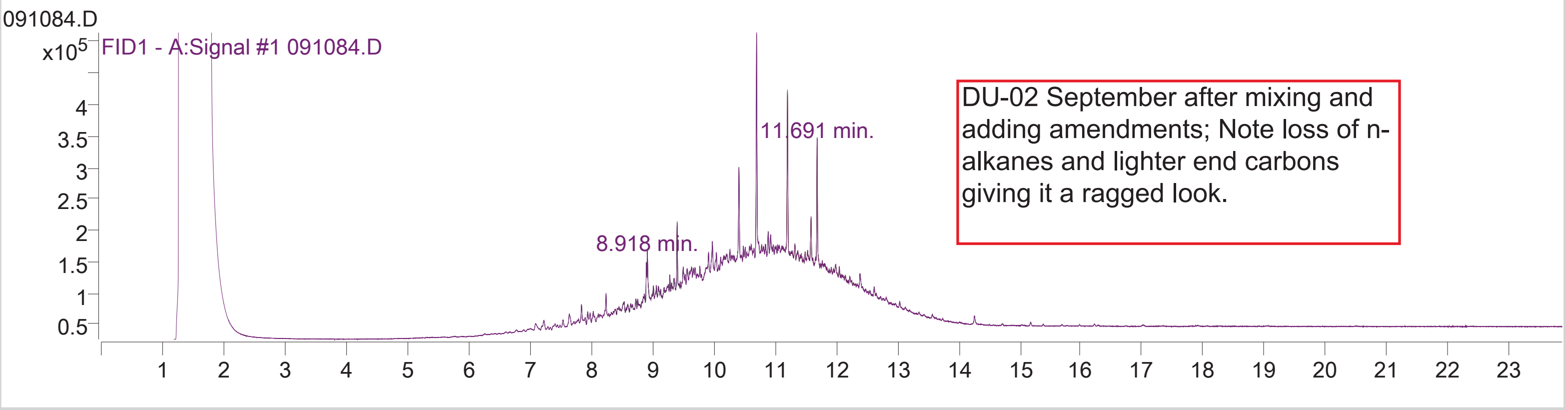


A2-80

Quantitation Results Report

Agilent Technologies

Data File	091084.D	Operator	DMW
Acq. Method	DXACQ050317sgtest2-190617	Acq. Date-Time	9/11/2019 12:57:46 PM
Sample Name:	1909032-002A 10X		dualfid
Vial	7	Multiplier	1.00
DA Method File	DX-190613-NWTPH_FINAL.m O-DXEX-S	Last Calib Update	6/14/2019 8:56:41 AM
Batch Name	D:\GC-24\Data\2019\190909FRONT\QuantResults\25727.batch.bin		

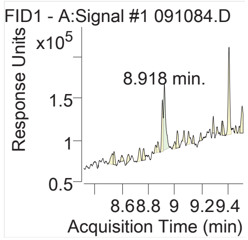


DU-02 September after mixing and adding amendments; Note loss of n-alkanes and lighter end carbons giving it a ragged look.

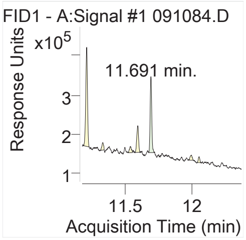
Compound	RT	Resp.	Conc.	Units	Dev(Min)
Internal Standards					
System Monitoring Compounds					
2-Fluorobiphenyl	8.918	85973	2.124	ug/mL	0.007
Spiked Amount:	Range: - %			Recovery = NA%	
O-Terphenyl	11.691	165802	1.693	ug/mL	-0.082
Spiked Amount:	Range: - %			Recovery = NA%	
Target Compounds					
Diesel	10.703	30728899	468.981	ug/mL m	
Heavy Oil	17.020	1020612	0.000	ug/mL m	

(#) = Qualifier Out of Range; (m) = Manual Integration; (+) = Area Summed; (*) = Surrogate Percent Recovery Out of Range; (d): Zeroed Peak

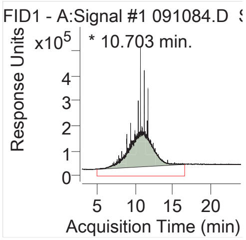
2-Fluorobiphenyl



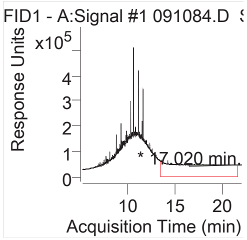
O-Terphenyl



Diesel



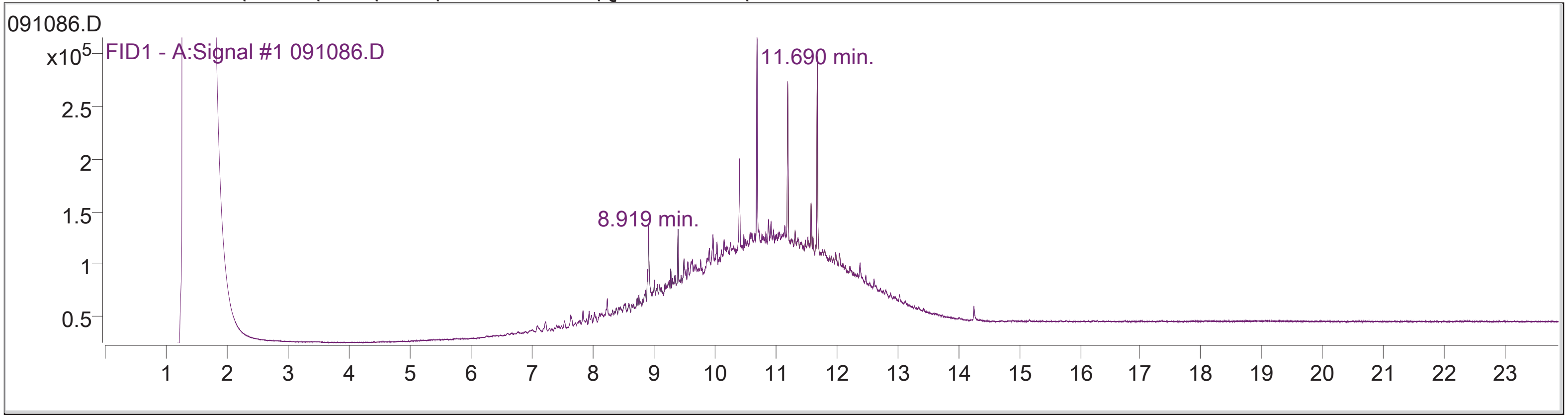
Heavy Oil



Quantitation Results Report

Agilent Technologies

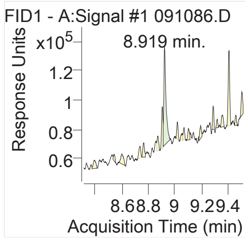
Data File	091086.D	Operator	DMW
Acq. Method	DXACQ050317sgtest2-190617	Acq. Date-Time	9/11/2019 1:27:38 PM
Sample Name:	1909032-003A 10X		dualfid
Vial	8	Multiplier	1.00
DA Method File	DX-190613-NWTPH_FINAL.m O-DXEX-S	Last Calib Update	6/14/2019 8:56:41 AM
Batch Name	D:\GC-24\Data\2019\190909FRONT\QuantResults\25727.batch.bin		



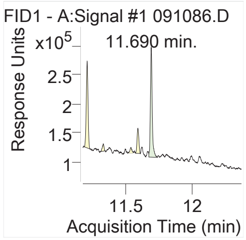
Compound	RT	Resp.	Conc.	Units		Dev(Min)
Internal Standards						
System Monitoring Compounds						
2-Fluorobiphenyl	8.919	75493	1.953	ug/mL		0.008
Spiked Amount:	Range: - %			Recovery = NA%		
O-Terphenyl	11.690	180081	1.880	ug/mL		-0.083
Spiked Amount:	Range: - %			Recovery = NA%		
Target Compounds						
Diesel	10.702	20665423	312.577	ug/mL	m	
Heavy Oil	19.059	848899	0.000	ug/mL	m	

(#) = Qualifier Out of Range; (m) = Manual Integration; (+) = Area Summed; (*) = Surrogate Percent Recovery Out of Range; (d): Zeroed Peak

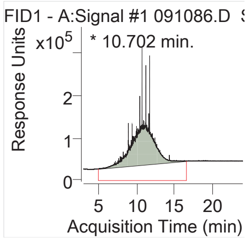
2-Fluorobiphenyl



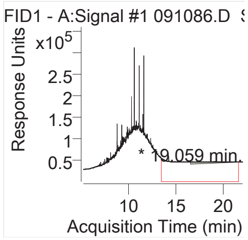
O-Terphenyl



Diesel



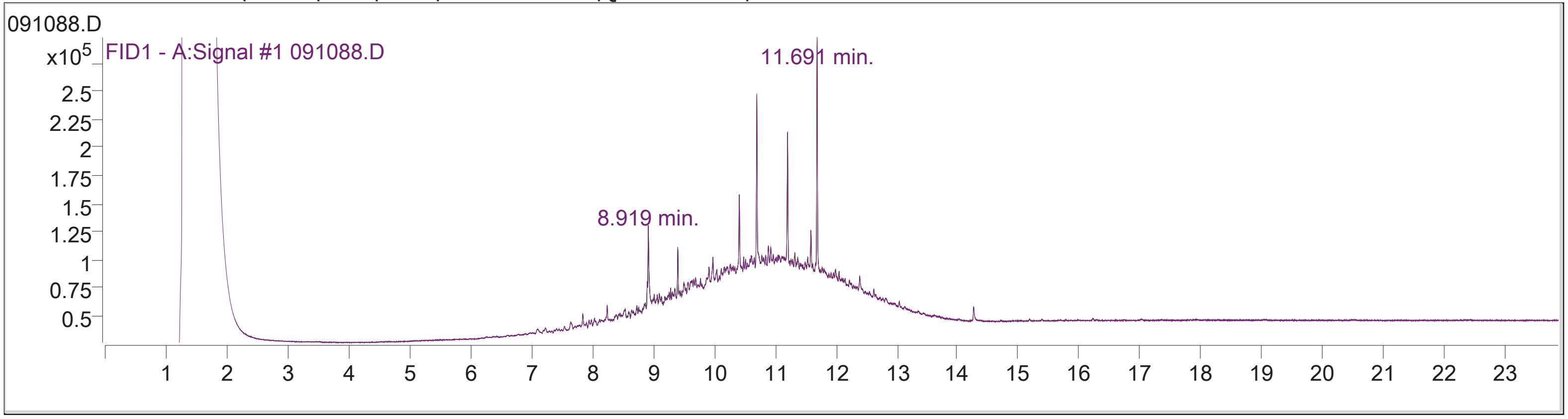
Heavy Oil



Quantitation Results Report

Agilent Technologies

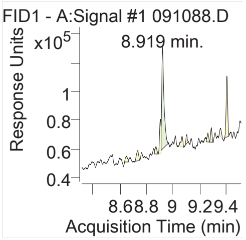
Data File	091088.D	Operator	DMW
Acq. Method	DXACQ050317sgtest2-190617	Acq. Date-Time	9/11/2019 1:57:33 PM
Sample Name:	1909032-004A 10X		dualfid
Vial	9	Multiplier	1.00
DA Method File	DX-190613-NWTPH_FINAL.m O-DXEX-S	Last Calib Update	6/14/2019 8:56:41 AM
Batch Name	D:\GC-24\Data\2019\190909FRONT\QuantResults\25727.batch.bin		



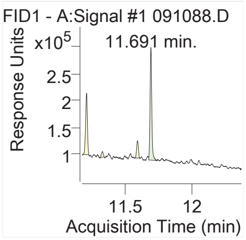
Compound	RT	Resp.	Conc.	Units	Dev(Min)
Internal Standards					
System Monitoring Compounds					
2-Fluorobiphenyl	8.919	82528	2.068	ug/mL	0.008
Spiked Amount:	Range: - %			Recovery = NA%	
O-Terphenyl	11.691	187061	1.971	ug/mL	-0.082
Spiked Amount:	Range: - %			Recovery = NA%	
Target Compounds					
Diesel	11.691	14813767	221.633	ug/mL m	
Heavy Oil	17.026	1029409	0.000	ug/mL m	

(#) = Qualifier Out of Range; (m) = Manual Integration; (+) = Area Summed; (*) = Surrogate Percent Recovery Out of Range; (d): Zeroed Peak

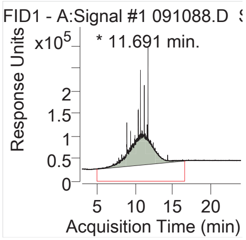
2-Fluorobiphenyl



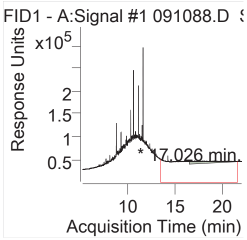
O-Terphenyl



Diesel



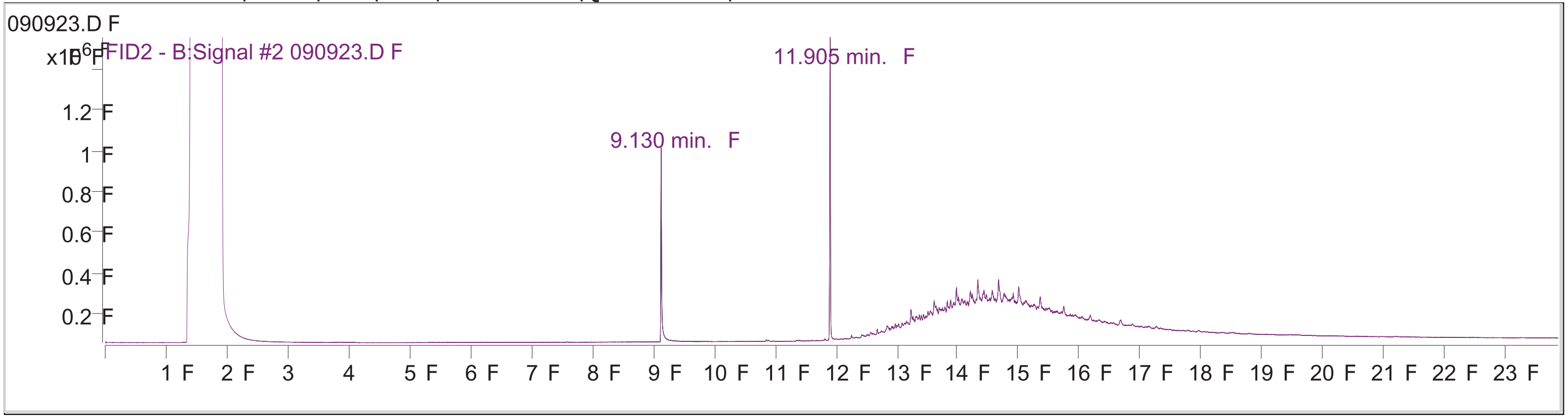
Heavy Oil



Quantitation Results Report

Agilent Technologies

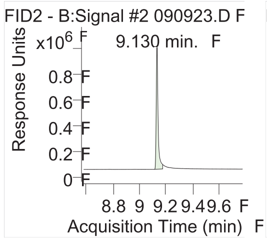
Data File	090923.D	Operator	DMW
Acq. Method	DXACQ050317sgt st2-190617	Acq. Date-Time	9/9/2019 2:54:02 PM
Sample Name	OIL-CCV-25715B		dualfid
Vial	1	Multiplier	1.00
DA Method File	DX-190617-NWTPH_FINAL.m	Last Calib Update	6/17/2019 9:49:03 AM
	O-DXEX-S		
Batch Name	D:\GC-24\Data\2019\190909BACK\QuantResults\25735.batch.bin		



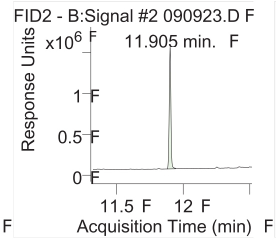
Compound	RT	Resp.	Conc.	Units		Dev(Min)
Internal Standards						
System Monitoring Compounds						
2-Fluorobiphenyl	9.130	924918	16.057	ug/mL		-0.046
Spiked Amount:	Range: -		%Recovery = NA%			
O-Terphenyl	11.905	1302529	17.937	ug/mL		-0.018
Spiked Amount:	Range: -		%Recovery = NA%			
Target Compounds						
Diesel	10.750	0	0.000	ug/mL	md	
Heavy Oil	14.672	44447037	861.435	ug/mL	m	

(#) = Qualifier Out of Range; (m) = Manual Integration; (+) = Area Summed; (*) = Surrogate Percent Recovery Out of Range; (d): Zeroed Peak

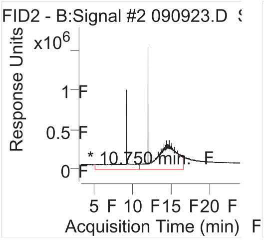
2-Fluorobiphenyl



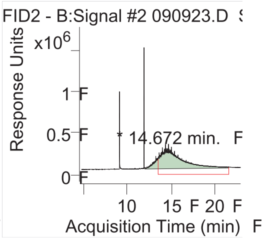
O-Terphenyl



Diesel



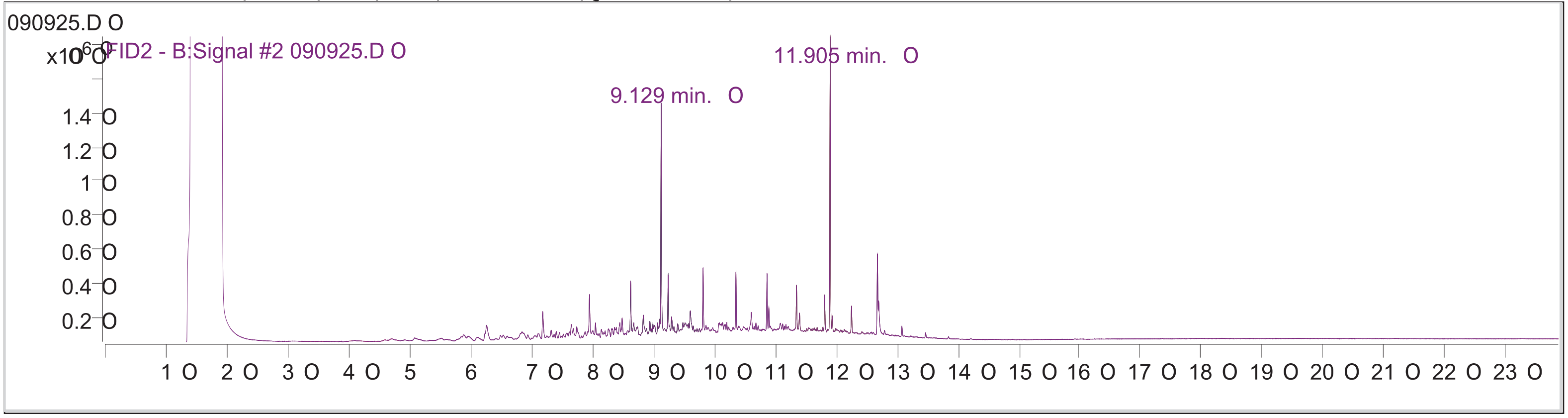
Heavy Oil



Quantitation Results Report

Data File: 090925.D
Operator: DMW
Acq. Method: DXACQ050317sgt st2-190617
Acq. Date-Time: 9/9/2019 3:23:51 PM
Sample Name: DX-CCV-25715B
dualfid
Vial: 2
Multiplier: 1.00
DA Method File: DX-190617-NWTPH_FINAL.m -DXEX-S
Last Calib Update: 6/17/2019 9:49:03 AM
Batch Name: D:\GC-24\Data\2019\190909BACK\Quant Results\25735.batch.bin

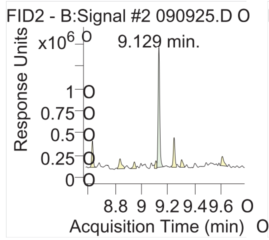
090925.D



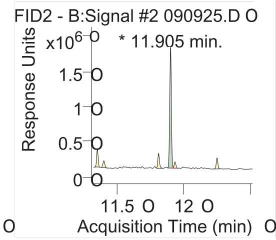
Compound	RT	Resp.	Conc. Units		Dev(Min)
Internal Standards					
System Monitoring Compounds					
2-Fluorobiphenyl	9.129	1158440	19.966 ug/mL		-0.047
Spiked Amount: R	ange: - %R		covery = NA%		
o-Terphenyl	11.905	1478144	20.404 ug/mL	m	-0.018
Spiked Amount: R	ange: - %R		covery = NA%		
Target Compounds					
Diesel	11.905	27998194	468.677 ug/mL	m	
Heavy Oil	17.500	0	0.000 ug/mL	md	

(#) = Qualifier Out of Range; (m) = Manual Integration; (+) = Area Summed; (*) = Surrogate Percent Recovery Out of Range; (d): Zeroed Peak

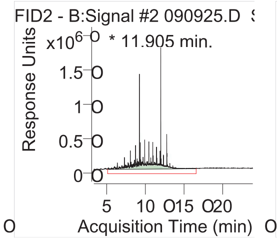
2-Fluorobiphenyl



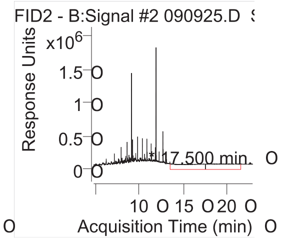
o-Terphenyl



Diesel



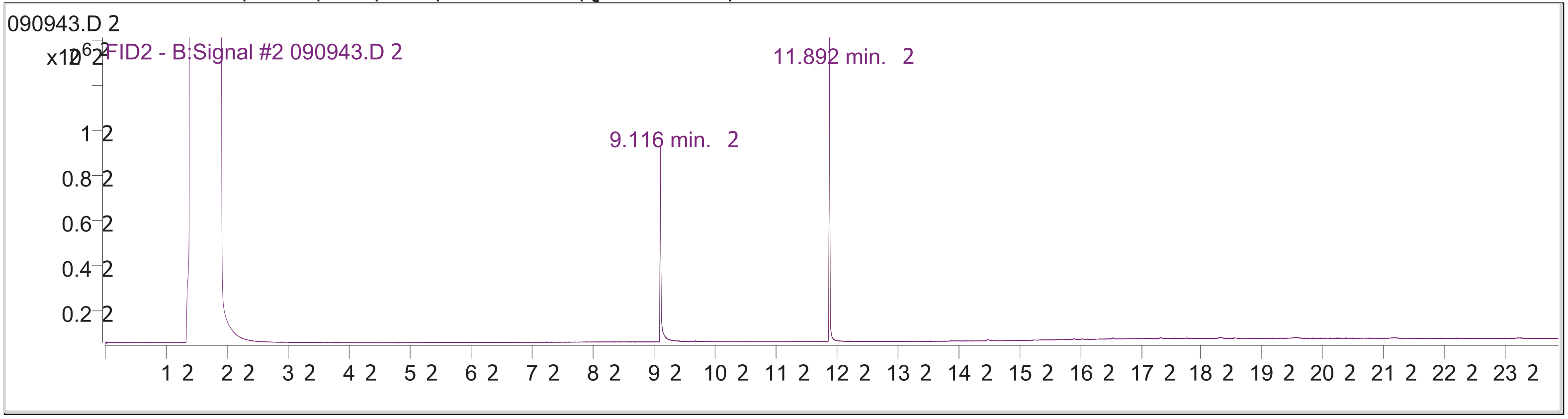
Heavy Oil



Quantitation Results Report

Agilent Technologies

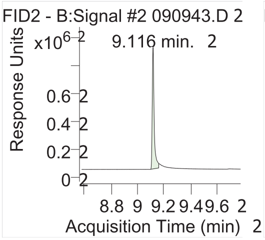
Data File	090943.D	Operator	DMW
Acq. Method	DXACQ050317sgt st -190617	Acq. Date-Time	9/9/ 019 7:59:58 PM
Sample Name	MB- 5735		dualfid
Vial	91	Multiplier	1.00
DA Method File	DX-190617-NWTPH_FINAL.m O-DXEX-S	Last Calib Update	6/17/ 019 9:49:03 AM
Batch Name	D:\GC- 4\Data\ 019\190909BACK\QuantResults\ 5735.batch.bin		



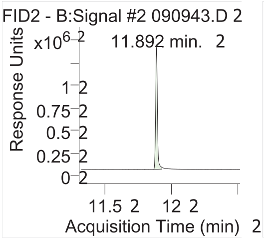
Compound	RT	Resp.	Conc.	Units		Dev(Min)
Internal Standards						
System Monitoring Compounds						
-Fluorobiphenyl	9.116	873585	15.197	ug/mL		-0.061
Spiked Amount:	Range: - %R			Recovery = NA%		
O-Terphenyl	11.89	1 47440	17.163	ug/mL		-0.031
Spiked Amount:	Range: - %R			Recovery = NA%		
Target Compounds						
Diesel	11.89	601306	10. 94	ug/mL	m	
Heavy Oil	19.556	001144	7.565	ug/mL	m	

(#) = Qualifier Out of Range; (m) = Manual Integration; (+) = Area Summed; (*) = Surrogate Percent Recovery Out of Range; (d): Zeroed Peak

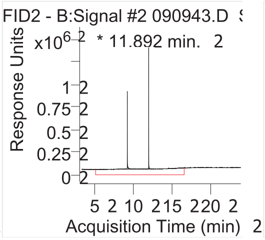
-Fluorobiphenyl



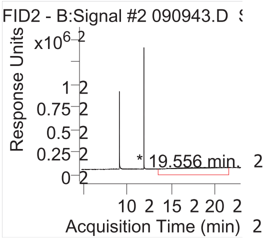
O-Terphenyl



Diesel



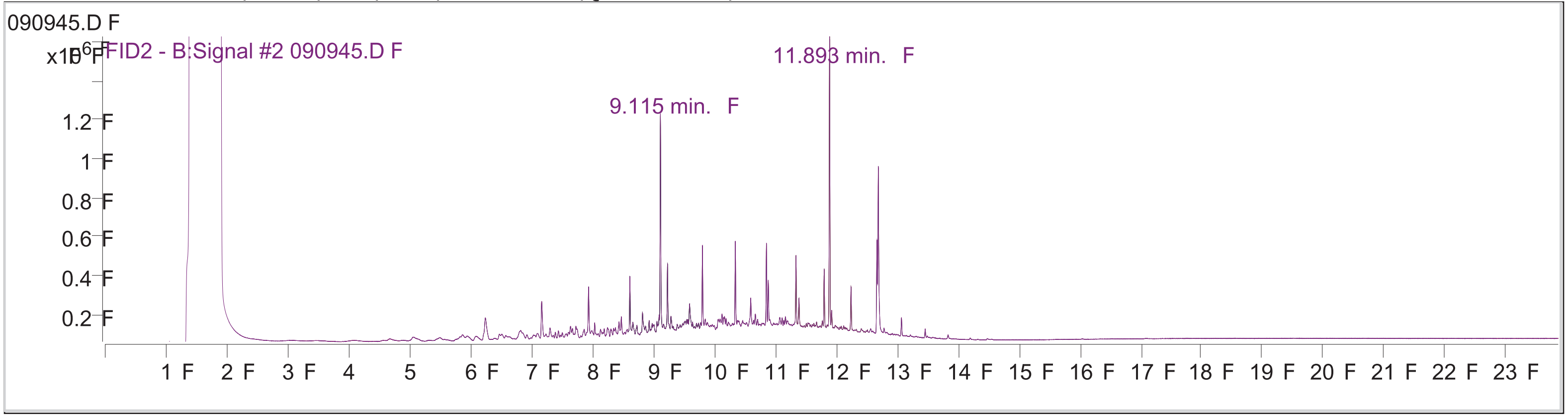
Heavy Oil



Quantitation Results Report

Data File: 090945.D
Acq. Method: DXACQ050317sgt st2-190617
Sample Name: LCS-25735
Vial: 92
DA Method File: DX-190617-NWTPH_FINAL.m
O-DXEX-S
Batch Name: D:\GC-24\Data\2019\190909BACK\QuantResults\25735.batch.bin

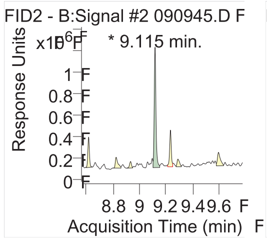
Operator: DMW
Acq. Date-Time: 9/9/2019 8:29:46 PM
dualfid
Multiplier: 1.00
Last Calib Update: 6/17/2019 9:49:03 AM



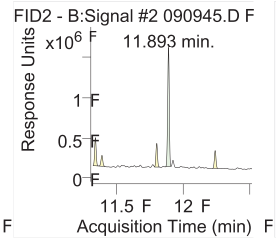
Compound	RT	Resp.	Conc.	Units		Dev(Min)
Internal Standards						
System Monitoring Compounds						
2-Fluorobiphenyl	9.115	1019982	17.648	ug/mL	m	-0.061
Spiked Amount: Range: - %			Recovery = NA%			
O-Terphenyl	11.893	1245617	17.137	ug/mL		-0.030
Spiked Amount: Range: - %			Recovery = NA%			
Target Compounds						
Diesel	11.893	31531610	527.795	ug/mL	m	
Heavy Oil	17.500	0	0.000	ug/mL	md	

(#) = Qualifier Out of Range; (m) = Manual Integration; (+) = Area Summed; (*) = Surrogate Percent Recovery Out of Range; (d): Zeroed Peak

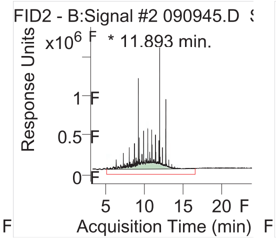
2-Fluorobiphenyl



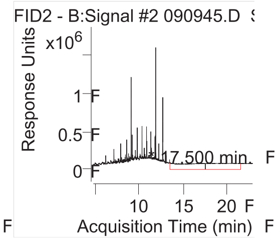
O-Terphenyl



Diesel

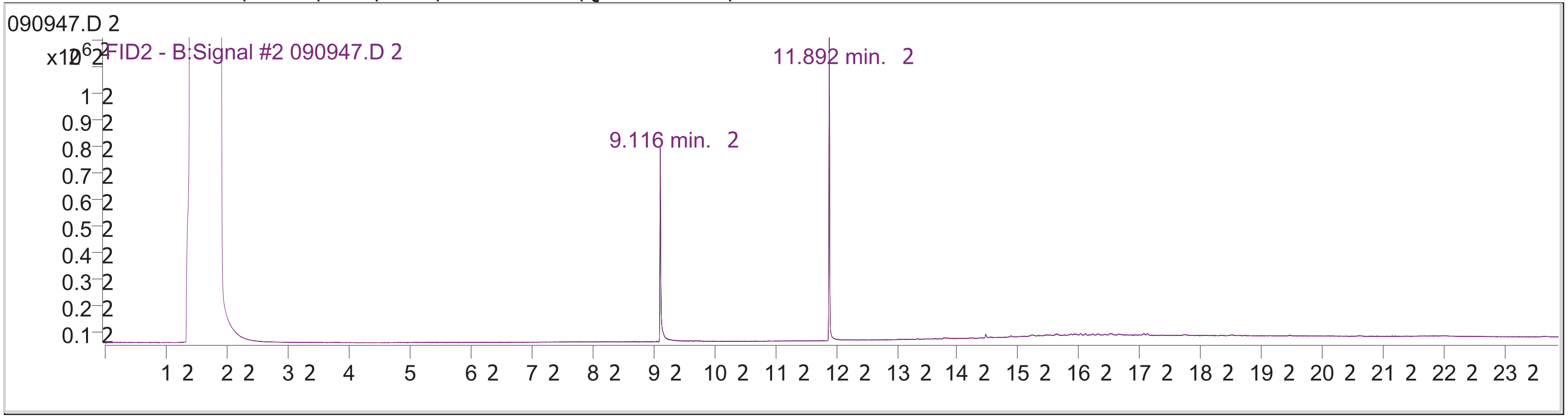


Heavy Oil



Quantitation sults 2port 2

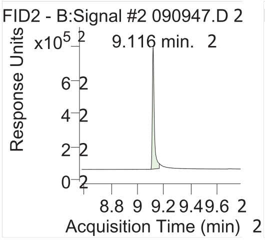
Data Fil 2 e	090947.D	Op rator 2	DMW2
Acq. M ethod 2	DXACQ050317sgt st -190617 2	Acq. Dat -Tim e 2	9/9/ 019 8:59:39 PM 2
Sampl Nam e: 22	1909065-001A 2		dualfid 2
Via	93 2	Multipli r 2	1.00 2
DA M ethod Fil 2e	DX-190617-NWTPH_FINAL.m	Last Calib Updat 2e	6/17/ 019 9:49:03 AM 2
	O-DXEX-S 2		
Batch Nam e 2	D:\GC- 4\Data\ 019\190909BACK\Quant sults\ 5735.batch.bin 2		



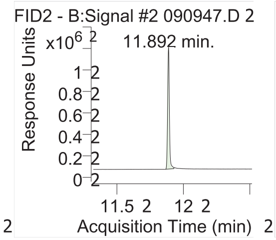
Compound	RT	Resp.	Conc.	Units		Dev(Min)
Internal Standards						
System Monitoring Compounds						
-Fluorobiph nyl	9.116 2	757 43 2	13. 50	ug/mL 2		-0.060 2
Spik d Amount: R 2	ang : - %R 2			cov ry = NA%2		
O-T rph nyl 2	11.89	2 1049668 2	14.385	ug/mL 2		-0.031
Spik d Amount: R 2	ang : - %R 2			cov ry = NA%2		
Target Compounds						
Di s l 2	11.89	2 40917	2 7.079	ug/mL 2	m	
H avy Oil 2	16.535 2	446636	2 57.157	ug/mL 2	m	

(#) = Qualifier Out of Range; (m) = Manual Integration; (+) = Area Summed; (*) = Surrogate Percent Recovery Out of Range; (d): Zeroed Peak

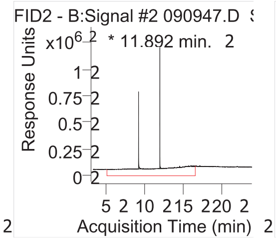
-Fluorobiph nyl



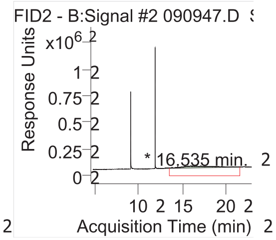
O-T rph nyl



Di s l 2



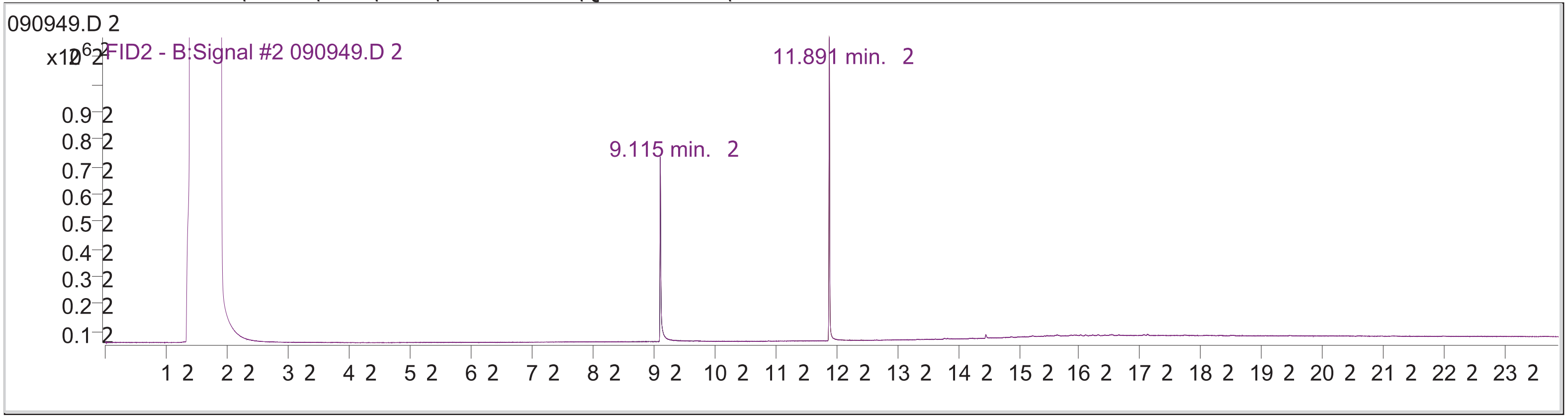
H avy Oil 2



Quantitation sults 2port 2

Data Fil 2 e 090949.D
Acq. M etho2d 2 DXACQ050317sgt st -190617 2
Sampl Nam e: 22 1909065-001ADUP 2
Via 94 2
DA M etho2d Fil 2e DX-190617-NWTPH_FINAL.m
O-DXEX-S 2
Batch Nam e 2 D:\GC- 4\Data\ 019\190909BACK\Quant 2sults\ 5735.batch.bin 2

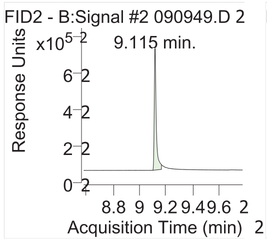
Op rator 2 DMW2
Acq. Dat -Tim e 2 9/9/ 019 9: 9: 6 PM 2
dualfid 2
Multipli r 2 1.00 2
Last Calib Updat 2e 6/17/ 019 9:49:03 AM 2



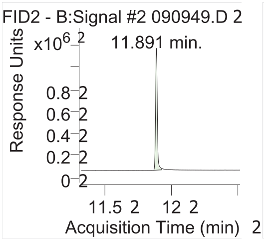
Compound	RT	Resp.	Conc. Units		Dev(Min)
Internal Standards					
System Monitoring Compounds					
-Fluorobiph nyl	9.115 2	70505	2 1 .376 ug/mL 2		-0.061
Spik d Amount: R 2	ang : - %R 2		cov ry = NA%2		
O-T rph nyl 2	11.891 2	997701 2	13.655 ug/mL 2		-0.03
Spik d Amount: R 2	ang : - %R 2		cov ry = NA%2		
Target Compounds					
Di s l 2	11.891 2	397545 2	6.884 ug/mL 2	m	
H avy Oil 2	17.110 2	4 41910 2	5 .642 ug/mL 2	m	

(#) = Qualifier Out of Range; (m) = Manual Integration; (+) = Area Summed; (*) = Surrogate Percent Recovery Out of Range; (d): Zeroed Peak

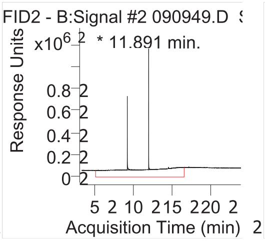
-Fluorobiph nyl



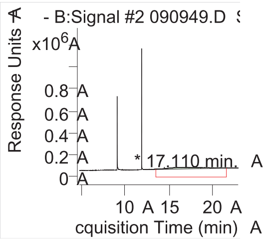
O-T rph nyl



Di s l 2



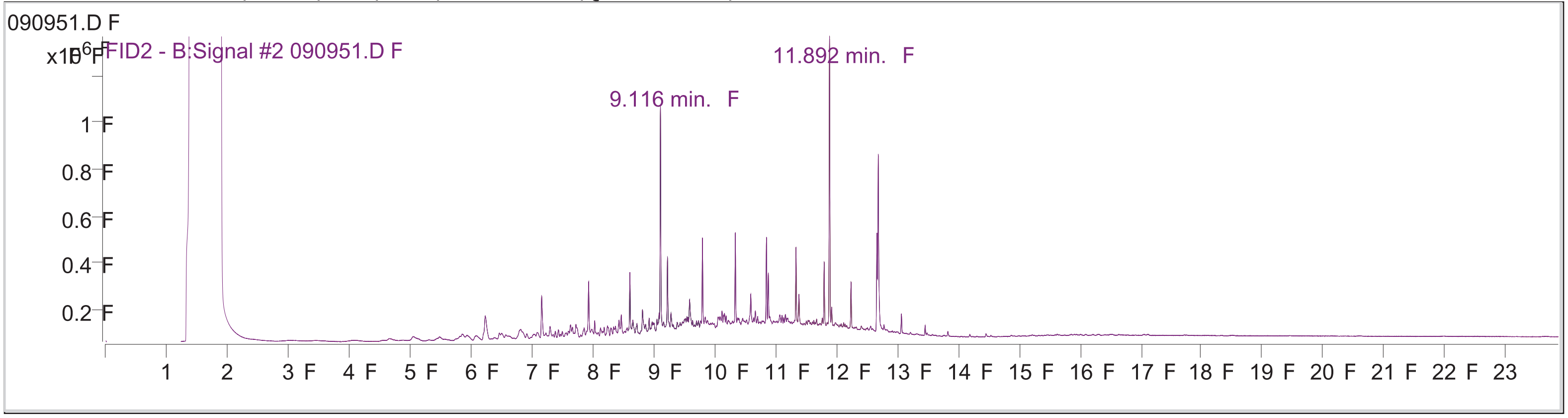
Heavy Oi A



Quantitation sults Fport F

Agilent Technologies

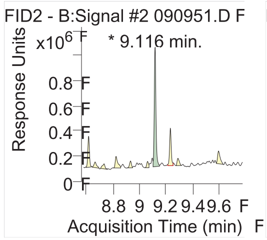
Data il e	090951.D	Op rator F	DMWF
Acq. M ethod F	DXACQ050317sgt st2-190617 F	Acq. Dat -Tim e F	9/9/2019 9:59:16 PM F
Sam l Nam e: FF	1909065-001AMS		dualfid F
Via	95 F	Mu tipli r F	1.00 F
DA M ethod i e	DX-190617-NWTPH_ INAL.m F O-DXEX-S	Last Calib Updat F	6/17/2019 9:49:03 AM F
Batch Nam e F	D:\GC-24\Data\2019\190909BACK\Quant Fsults\25735.batch.bin F		



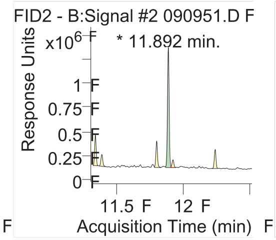
Compound	RT	Resp.	Conc. Units		Dev(Min)
Internal Standards					
System Monitoring Compounds					
2- luorobiph nyl	9.116 F	838570 F	14.611 ug/mL F	mF	-0.060 F
S ik d Amount: R F	ang : - %R F		cov ry = NA%F		
O-T rph nyl F	11.892 F	1071832 F	14.696 ug/mL F	mF	-0.031 F
Spik d Amount: R F	ang : - %R F		cov ry = NA%F		
Target Compounds					
Di s l F	11.892 F	27428939 F	459.152 ug/mL F	mF	
H avy Oil F	16.530 F	1767918	2.873 ug/mL F	m F	

(#) = Qualifier Out of Range; (m) = Manual Integration; (+) = Area Summed; (*) = Surrogate Percent Recovery Out of Range; (d): Zeroed Peak

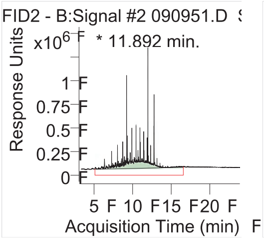
2- luorobiph nyl



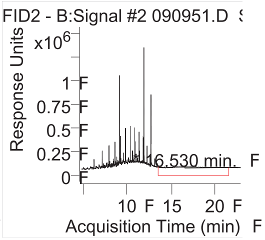
O-T r h nyl



Di s



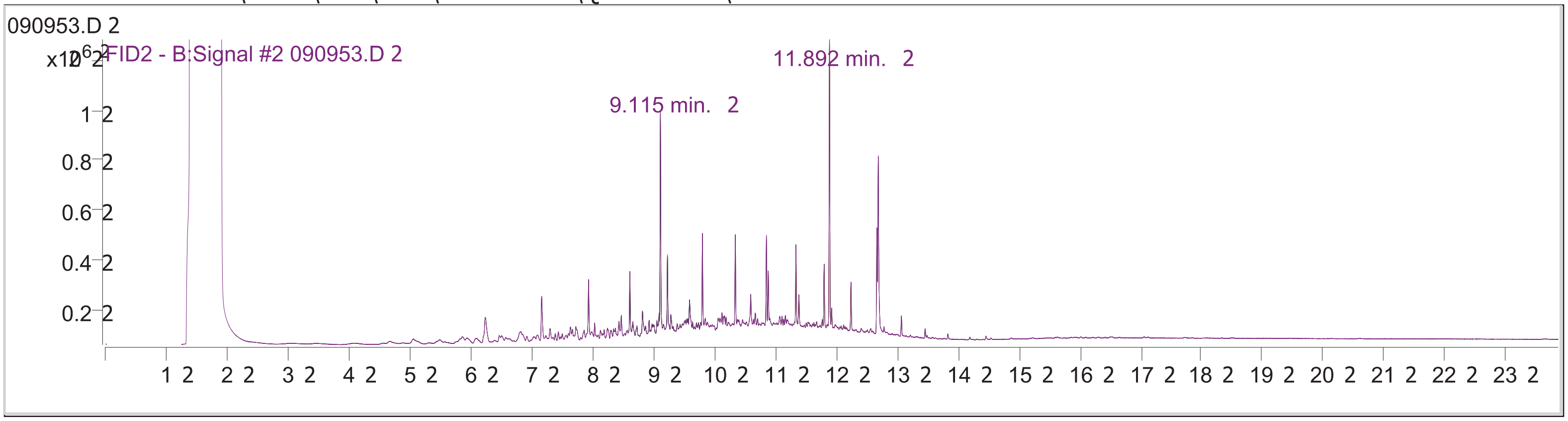
H avy Oil F



Quantitation 2sults 2port 2

Agilent Technologies

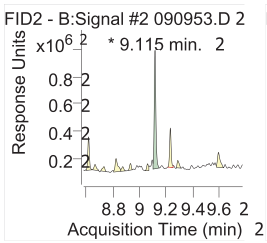
Data File 2	090953.D 2	Operator 2	DMW2
Acq. Method 2	DXACQ050317sgt st -190617 2	Acq. Date-Time 2	9/9/ 019 10: 9:03 PM 2
Sample Name: 2	1909065-001AMSD 2		dualfid 2
Vial 2	96 2	Multiplier 2	1.00 2
DA Method File 2	DX-190617-NWTPH_FINAL.m O-DXEX-S 2	Last Calib Update 2	6/17/ 019 9:49:03 AM 2
Batch Name 2	D:\GC- 4\Data\ 019\190909BACK\Quant sults\ 5735.batch.bin 2		



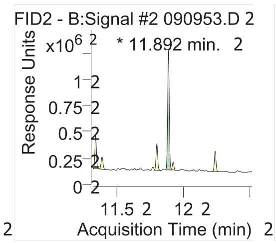
Compound	RT	Resp.	Conc.	Units	Dev(Min)
Internal Standards					
System Monitoring Compounds					
-Fluorobiphenyl 2	9.115 2	749184 2	13.115 ug/mL 2	m	-0.061 2
Spiked Amount: R 2	ang : - %R 2		Recovery = NA%2		
O-Terphenyl 2	11.89	2 9693 5 2	13. 56 ug/mL 2	m	-0.031 2
Spiked Amount: R 2	ang : - %R 2		Recovery = NA%2		
Target Compounds					
Diesel 2	11.891 2	9314510 2	490.700 ug/mL 2	m	
Heavy Oil 2	17.058 2	1669008 2	0.884 ug/mL 2	m	

(#) = Qualifier Out of Range; (m) = Manual Integration; (+) = Area Summed; (*) = Surrogate Percent Recovery Out of Range; (d): Zeroed Peak

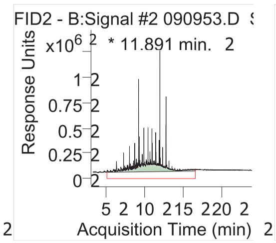
-Fluorobiphenyl 2



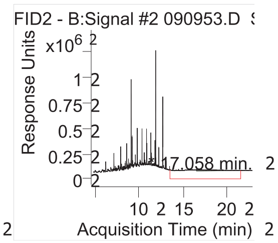
O-Terphenyl 2



Diesel 2



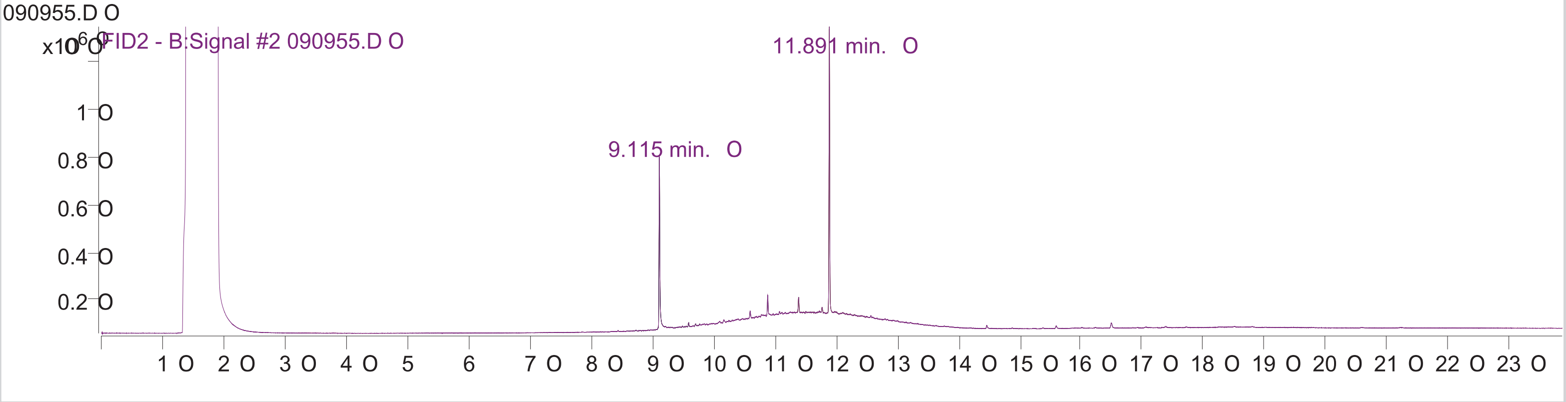
Heavy Oil 2



Quantitation Results Report

Agilent Technologies

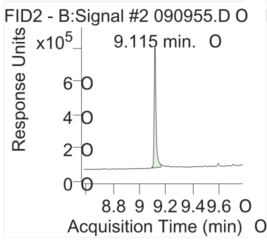
Data File	090955.D	Operator	DMW
Acq. Method	DXACQ050317sgtest2-190617	Acq. Date-Time	9/9/2019 10:58:59 PM
Sample Name	1909032-005A		dualfid
Vial	97	Multiplier	1.00
DA Method File	DX-190617-NWTPH_FINAL.m -DXEX-S	Last Calib Update	6/17/2019 9:49:03 AM
Batch Name	D:\GC-24\Data\2019\190909BACK\QuantResults\25735.batch.bin		



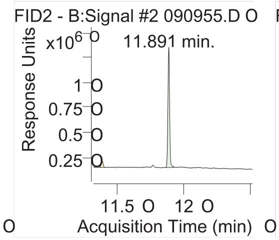
Compound	RT	Resp.	Conc.	Units		Dev(Min)
Internal Standards						
System Monitoring Compounds						
2-Fluorobiphenyl	9.115	724036	12.694	ug/mL		-0.062
Spiked Amount: Range: - %Recovery = NA%						
o-Terphenyl	11.891	1055965	14.473	ug/mL		-0.031
Spiked Amount: Range: - %Recovery = NA%						
Target Compounds						
Diesel	11.891	15748652	263.727	ug/mL	m	
Heavy Oil	16.497	2290644	13.389	ug/mL	m	

(#) = Qualifier Out of Range; (m) = Manual Integration; (+) = Area Summed; (*) = Surrogate Percent Recovery Out of Range; (d): Zeroed Peak

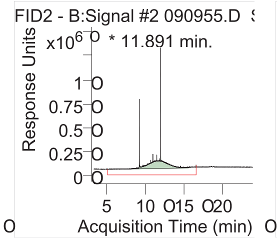
2-Fluorobiphenyl



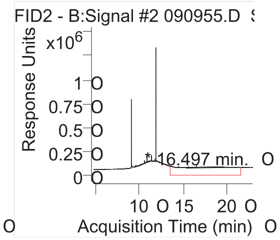
o-Terphenyl



Diesel



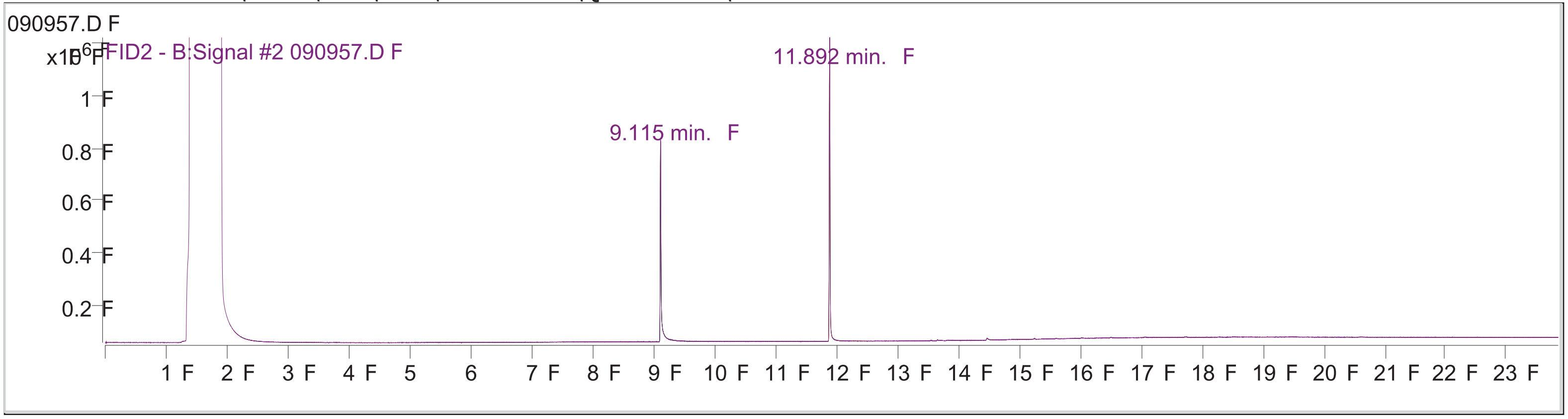
Heavy Oil



Quantitation Results Report

Agilent Technologies

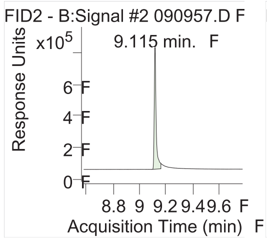
Data File	090957.D	Operator	DMW
Acq. Method	DXACQ050317sgt st2-190617	Acq. Date-Time	9/9/2019 11:28:45 PM
Sample Name:	1909062-012A		dualfid
Vial	101	Multiplier	1.00
DA Method File	DX-190617-NWTPH_FINAL.m O-DXEX-S	Last Calib Update	6/17/2019 9:49:03 AM
Batch Name	D:\GC-24\Data\2019\190909BACK\QuantResults\25735.batch.bin		



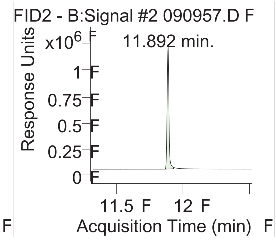
Compound	RT	Resp.	Conc. Units		Dev(Min)
Internal Standards					
System Monitoring Compounds					
2-Fluorobiphenyl	9.115	773768	13.526 ug/mL		-0.061
Spiked Amount:	Range: - %R		Recovery = NA%		
O-Terphenyl	11.892	1109863	15.230 ug/mL		-0.031
Spiked Amount:	Range: - %R		Recovery = NA%		
Target Compounds					
Diesel	11.891	438261	7.566 ug/mL	m	
Heavy Oil	19.467	2149304	10.546 ug/mL	m	

(#) = Qualifier Out of Range; (m) = Manual Integration; (+) = Area Summed; (*) = Surrogate Percent Recovery Out of Range; (d): Zeroed Peak

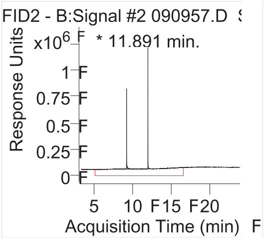
2-Fluorobiphenyl



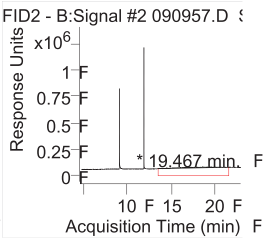
O-Terphenyl



Diesel



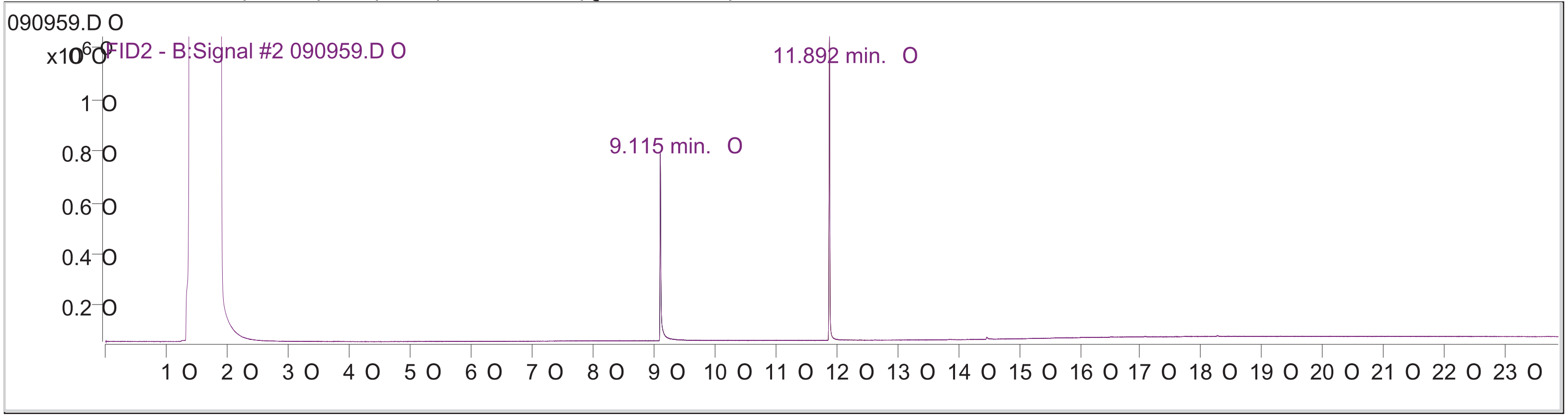
Heavy Oil



Quantitation Osults Oport O

Data Fil O e 090959.D O
Acq. M ethod O DXACQ050317sgt st2-190617 O
Sampl Nam e: OO 1909062-031A O
Vial O 112 O
DA M ethod Fil Oe DX-190617-NWTPH_FINAL.m O -DXEX-S O
Batch Nam e O D:\GC-24\Data\2019\190909BACK\Quant sults\25735.batch.bin O

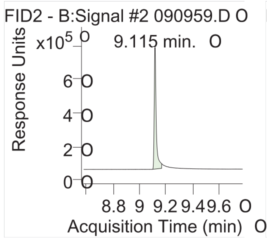
p rator O DMWO
Acq. Dat -Tim e O 9/9/2019 11:58:42 PM O
dualfid O
Multipli r O 1.00 O
Last Calib Updat Oe 6/17/2019 9:49:03 AM O



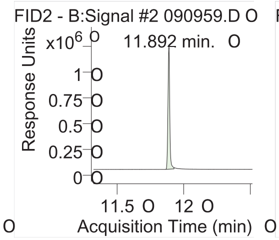
Compound	RT	Resp.	Conc. Units	Dev(Min)
Internal Standards				
System Monitoring Compounds				
2-Fluorobiph nyl O	9.115 O	763972 O	13.362 ug/mL O	-0.062 O
Spik d Amount: R O	ang : - %R O		cov ry = NA%O	
-T rph nyl O	11.892 O	1112343 O	15.265 ug/mL O	-0.030 O
Spik d Amount: R O	ang : - %R O		cov ry = NA%O	
Target Compounds				
Di s l O	11.892 O	531207 O	9.121 ug/mL O mO	
H avy il O	18.265 O	1855472 O	4.635 ug/mL O m O	

(#) = Qualifier Out of Range; (m) = Manual Integration; (+) = Area Summed; (*) = Surrogate Percent Recovery Out of Range; (d): Zeroed Peak

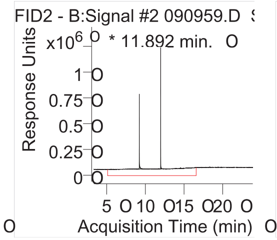
2-Fluorobiph nyl O



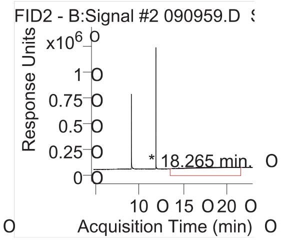
-T rph nyl O



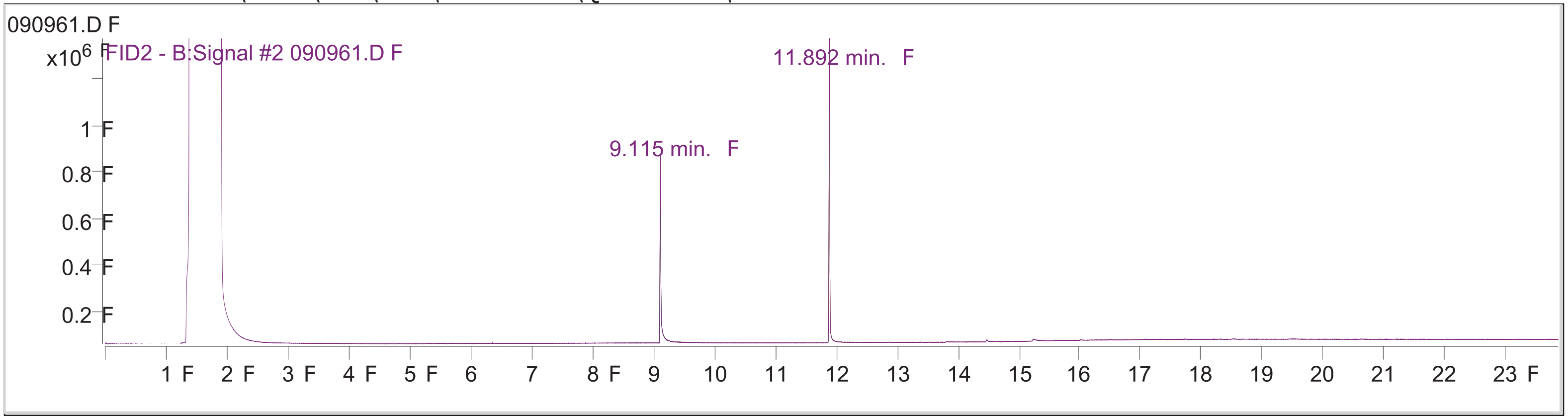
Di s l O



H avy il O



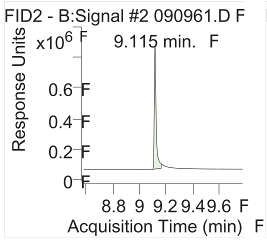
Data Fil e	090961.D	Op rator	DMWF
Acq. M etFhod	DXACQ050317sgt st2-190617	Acq. Date-Tim e F	9/10/2019 12:28:27 AM F
Sample Nam e: F	1909070-002A		dualfid F
Vial	115	Mu tiplier	1.00 F
DA M etFhod Fil e	DX-190617-NWTPH_FINAL.m O-DXEX-S F	Last Calib Updat Fe	6/17/2019 9:49:03 AM F
Batch Nam e F	D:\GC-24\Data\2019\190909BACK\QuantResults\25735.batch.bin F		



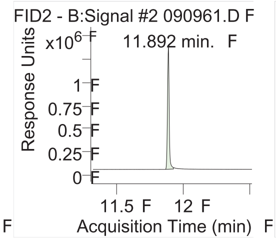
Compound	RT	Resp.	Conc.	Units	Dev(Min)
Internal Standards					
System Monitoring Compounds					
2-F uorobiphenyl	9.115	813332	14.189	ug/mL	-0.061 F
Spiked Amount: R F	ange: - %R F			ecovery = NA%F	
O-Terphenyl	11.892	1179515	16.209	ug/mL F	-0.031 F
Spiked Amount: R F	ange: - %R F			ecovery = NA%F	
Target Compounds					
Diesel	11.892	488142	8.400	ug/mL F m F	
Heavy Oil	18.526	1956539	6.668	ug/mL F m F	

(#) = Qualifier Out of Range; (m) = Manual Integration; (+) = Area Summed; (*) = Surrogate Percent Recovery Out of Range; (d): Zeroed Peak

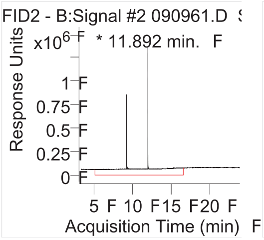
2-F uorobiphenyl



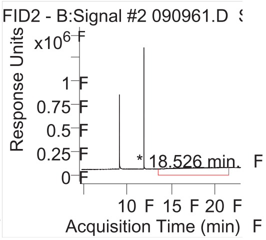
O-Terphenyl



Diesel F



Heavy Oil F



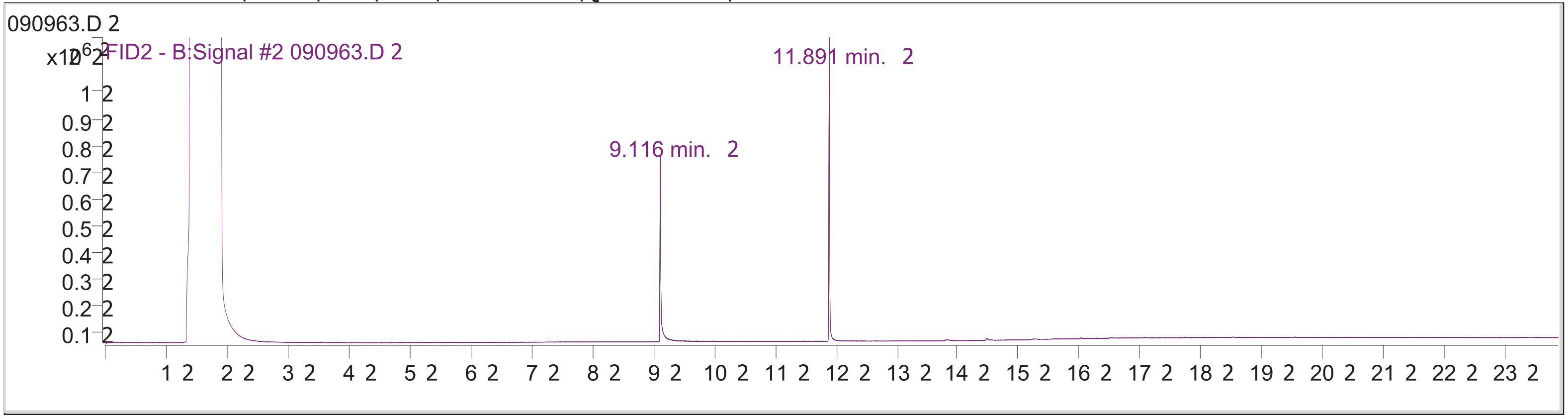
A2-95

Quantitation Results Report

Agilent Technologies

Data File 090963.D
Acq. Method DXACQ050317sgtest-190617
Sample Name: 1909070-003A
Vial 116
DA Method File DX-190617-NWTPH_FINAL.m
O-DXEX-S
Batch Name D:\GC- 4\Data\ 019\190909BACK\QuantResults\ 5735.batch.bin

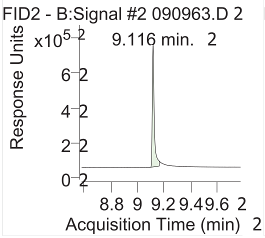
Operator DMW
Acq. Date-Time 9/10/ 019 1 :58:16 AM
dualfid
Multiplier 1.00
Last Calib Update 6/17/ 019 9:49:03 AM



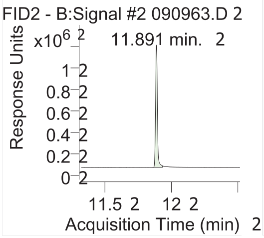
Compound	RT	Resp.	Conc. Units	Dev(Min)
Internal Standards				
System Monitoring Compounds				
-Fluorobiphenyl	9.116	717611	1 .586 ug/mL	-0.061
Spiked Amount:	Range: -		%Recovery = NA%	
O-Terphenyl	11.891	109087	14.964 ug/mL	-0.03
Spiked Amount:	Range: -		%Recovery = NA%	
Target Compounds				
Diesel	11.891	6 0074	10.608 ug/mL m	
Heavy Oil	18.5 4	198 911	7.198 ug/mL m	

(#) = Qualifier Out of Range; (m) = Manual Integration; (+) = Area Summed; (*) = Surrogate Percent Recovery Out of Range; (d): Zeroed Peak

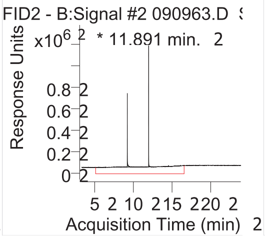
-Fluorobiphenyl



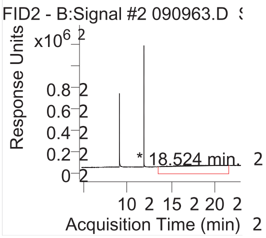
O-Terphenyl



Diesel



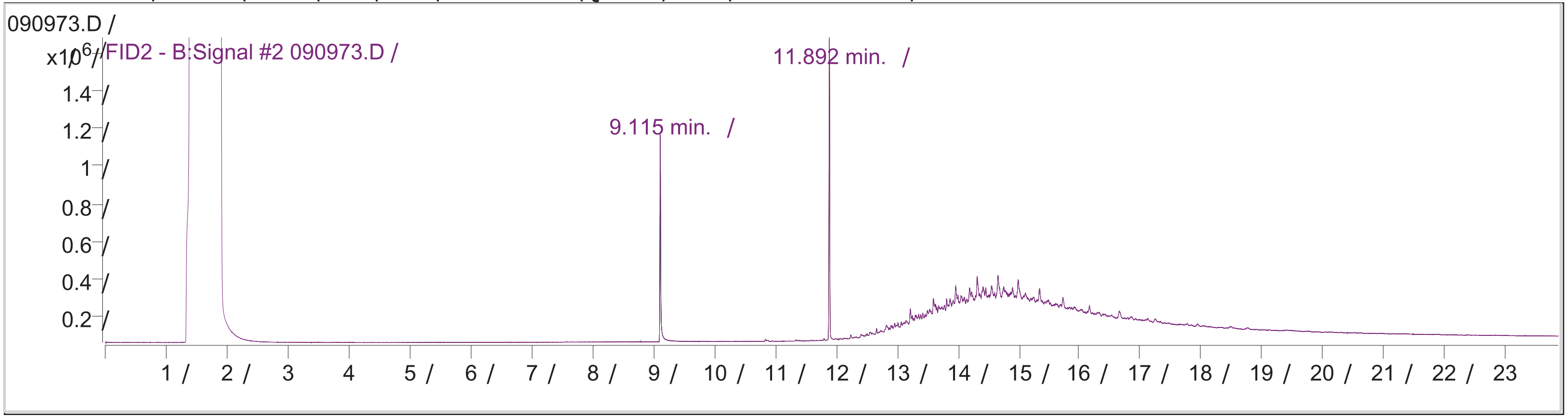
Heavy Oil



Quantitation Results Report /

Data File /	090973.D	Operator /	DMW/
Acq. Method /	DXACQ050317sgt st2-190617 /	Acq. Date-Time /	9 10 2019 9:36:04 AM
Sample Name: //	OIL-CCV-25735B /		dualfid /
Vial	1 /	Multiplier /	1.00 /
DA Method File /	DX-190617-NWTPH_FINAL.m O-DXEX-S /	Last Calib Update /	6 17 2019 9:49:03 AM /
Batch Name /	D:\GC-24\Data\2019\190909BACK\QuantResults\25735.batch.bin /		

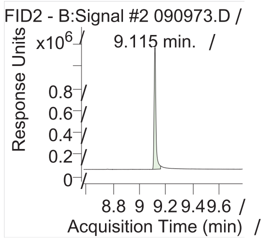
090973.D /



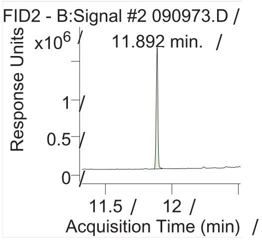
Compound	RT	Resp.	Conc.	Units	Dev(Min)
Internal Standards					
System Monitoring Compounds					
2-Fluorobiphenyl	9.115 /	1066650 /	18.429	ug mL	-0.062 /
Spiked Amount: R /	Range : - %R /			Recovery = NA%	
O-Terphenyl	11.892 /	1435363 /	19.803	ug mL	-0.030 /
Spiked Amount: R /	Range : - %R /			Recovery = NA%	
Target Compounds					
Diesel /	10.750 /	0 /	0.000	ug mL / md /	
Heavy Oil /	14.661 /	56413301 /	1102.156	ug mL / m	

(#) = Qualifier Out of Range; (m) = Manual Integration; (+) = Area Summed; (*) = Surrogate Percent Recovery Out of Range; (d): Zeroed Peak

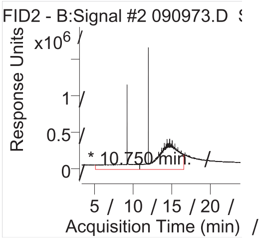
2-Fluorobiphenyl



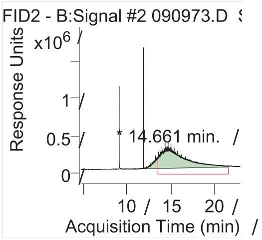
O-Terphenyl



Diesel /

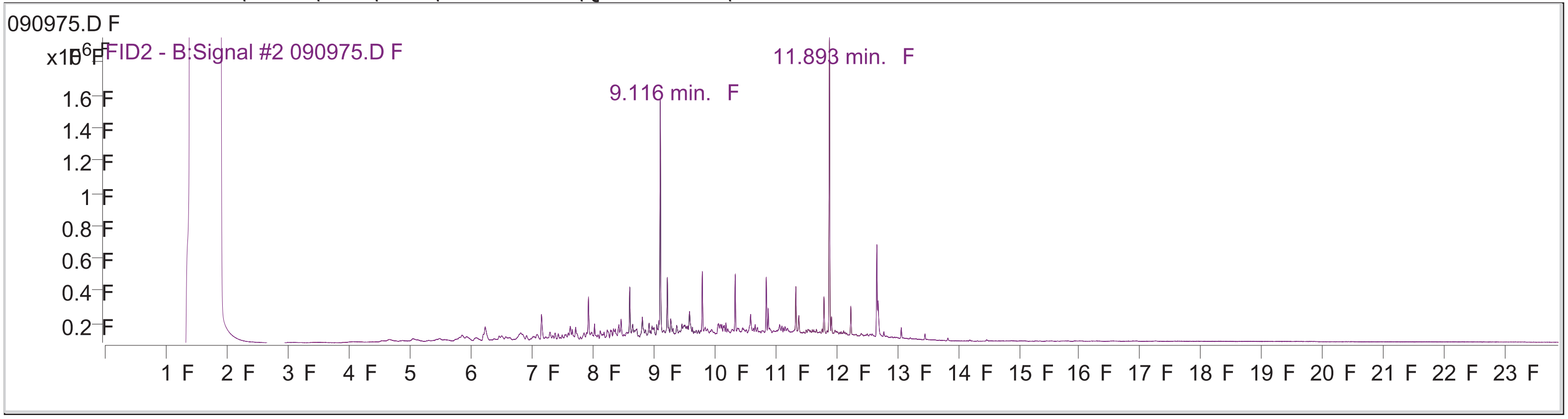


Heavy Oil /



Quantitation sults Fport F

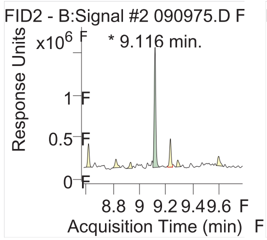
Data il e	090975.D	Op rator F	DMWF
Acq. M thod F	DXACQ050317sgt st2-190617 F	Acq. Dat -Tim e F	9/10/2019 10:06:00 AM F
Sam l Nam e: FF	DX-CCV-25735B F		dualfid F
Via	2 F	Multipli r F	1.00 F
DA M thod i e	DX-190617-NWTPH_ INAL.m F O-DXEX-S	Last Calib Updat F	6/17/2019 9:49:03 AM F
Batch Nam e F	D:\GC-24\Data\2019\190909BACK\Quant Fsults\25735.batch.bin F		



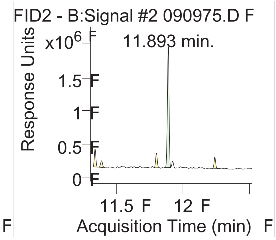
Compound	RT	Resp.	Conc. Units		Dev(Min)
Internal Standards					
System Monitoring Compounds					
2- luorobiph nyl	9.116 F	1216747 F	20.942 ug/mL F	m F	-0.061 F
S ik d Amount: R F	ang : - %R F		cov ry = NA%F		
O-T rph nyl	11.893 F	1571322 F	21.713 ug/mL F		-0.029 F
S ik d Amount: R F	ang : - %R F		cov ry = NA%F		
Target Compounds					
Di s l F	11.893 F	29104644 F	487.189 ug/mL F	mF	
H avy Oil F	17.500 F	0 F	0.000 ug/mL F	md F	

(#) = Qualifier Out of Range; (m) = Manual Integration; (+) = Area Summed; (*) = Surrogate Percent Recovery Out of Range; (d): Zeroed Peak

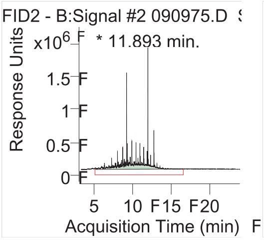
2- luorobiph nyl



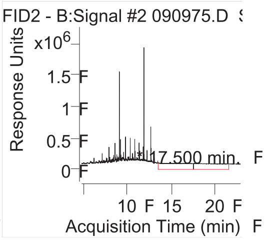
O-T r h nyl



Di s



H avy Oil F



Fremont Analytical

3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790
Fax: 206-352-7178

Chain of Custody Record & Laboratory Services Agreement

Date: 9/4/19 **Page:** 1 **of:** 1

Laboratory Project No (internal): 1909032

Client: Floyd|Snider

Address: 601 Union Street Ste. 600

City, State, Zip: Seattle 98101

Telephone: 206-292-2078

Fax:

Project Name: CL-Ellensburg

Project No:

Collected by: Gabe Cisneros

Location: 1611 Canyon Rd Ellensburg WA

Report To (PM):

PM Email: gabe.cisneros@floydsnider.com

Special Remarks: Total Nitrogen = Nitrite + Nitrate + Ammonia

NPK = Nitrogen + phosphorus + Potassium

Sample Disposal: ☐ Return to client ☐ Disposal by lab (after 30 days)

	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	VOCs (EPA 8260 / 624)	GX/BTEX + Naphth. 8260	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8)	Total (T) | Dissolved (D)	Anions (IC)***	EOB (8011)	NPK ← See Anions	Ammonia	pH		Comments
1	DU-01-~~090319~~ 090419 gc	9/4/19		S		X				X						X		X	X	X		8260 Method
2	DU-02-090419	↓		↓		X				X						X		X	X	X		
3	DU-03-090419					X				X						X		X	X	X		Changes made by Gabe Cisneros 9/5/19
4	DU-04-090419					X				X						X		X	X	X		
5	DU-05-090419					X				X						X		X	X	X		
6																						
7																						
8																						
9																						
10																						

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, [✓ S = Soil], SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl U V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride [✓ Nitrate+Nitrite + Ammonia]

Turn-around Time:

☒ Standard
☐ 3 Day
☐ 2 Day
☐ Next Day
Same Day ______ (specify)

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above and that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished x	Date/Time 9/4/19 1630	Received x Kayla Potter	Date/Time 9/4/19 1630
Relinquished x	Date/Time	Received x	Date/Time

3600 Fremont Ave. N.
Seattle, WA 98103
T: (206) 352-3790
F: (206) 352-7178
info@fremontanalytical.com

Floyd | Snider
Tom Colligan
601 Union St., Suite 600
Seattle, WA 98101

RE: CL-Ellensburg
Work Order Number: 1910080

October 15, 2019

Attention Tom Colligan:

Fremont Analytical, Inc. received 6 sample(s) on 10/4/2019 for the analyses presented in the following report.

Ammonia by SM 4500 NH3 E

Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.

Ion Chromatography by EPA Method 300.0

pH by EPA Method 9045

Sample Moisture (Percent Moisture)

This report consists of the following:

- Case Narrative
- Analytical Results
- Applicable Quality Control Summary Reports
- Chain of Custody

All analyses were performed consistent with the Quality Assurance program of Fremont Analytical, Inc. Please contact the laboratory if you should have any questions about the results.

Thank you for using Fremont Analytical.

Sincerely,

Brianna Barnes
Project Manager

CC:
Gabe Cisneros

DoD/ELAP Certification #L17-135, ISO/IEC 17025:2005
ORELAP Certification: WA 100009-007 (NELAP Recognized)

Date: *10/15/2019*

CLIENT: Floyd | Snider
Project: CL-Ellensburg
Work Order: 1910080

Work Order Sample Summary

Lab Sample ID	Client Sample ID	Date/Time Collected	Date/Time Received
1910080-001	DU-01-10042019	10/04/2019 11:00 AM	10/04/2019 4:14 PM
1910080-002	DU-02-10042019	10/04/2019 11:10 AM	10/04/2019 4:14 PM
1910080-003	DU-03-10042019	10/04/2019 11:30 AM	10/04/2019 4:14 PM
1910080-004	DU-04-10042019	10/04/2019 11:40 AM	10/04/2019 4:14 PM
1910080-005	DU-05-10042019	10/04/2019 12:00 PM	10/04/2019 4:14 PM
1910080-006	TB-10042019	10/04/2019 11:05 AM	10/04/2019 4:14 PM

Note: If no "Time Collected" is supplied, a default of 12:00AM is assigned

Case Narrative

WO#: **1910080**

Date: **10/15/2019**

CLIENT: Floyd | Snider

Project: CL-Ellensburg

I. SAMPLE RECEIPT:

Samples receipt information is recorded on the attached Sample Receipt Checklist.

II. GENERAL REPORTING COMMENTS:

Results are reported on a wet weight basis unless dry-weight correction is denoted in the units field on the analytical report ("mg/kg-dry" or "ug/kg-dry").

Matrix Spike (MS) and MS Duplicate (MSD) samples are tested from an analytical batch of "like" matrix to check for possible matrix effect. The MS and MSD will provide site specific matrix data only for those samples which are spiked by the laboratory. The sample chosen for spike purposes may or may not have been a sample submitted in this sample delivery group. The validity of the analytical procedures for which data is reported in this analytical report is determined by the Laboratory Control Sample (LCS) and the Method Blank (MB). The LCS and the MB are processed with the samples and the MS/MSD to ensure method criteria are achieved throughout the entire analytical process.

III. ANALYSES AND EXCEPTIONS:

Exceptions associated with this report will be footnoted in the analytical results page(s) or the quality control summary page(s) and/or noted below.

Qualifiers:

* - Flagged value is not within established control limits
B - Analyte detected in the associated Method Blank
D - Dilution was required
E - Value above quantitation range
H - Holding times for preparation or analysis exceeded
I - Analyte with an internal standard that does not meet established acceptance criteria
J - Analyte detected below Reporting Limit
N - Tentatively Identified Compound (TIC)
Q - Analyte with an initial or continuing calibration that does not meet established acceptance criteria (<20%RSD, <20% Drift or minimum RRF)
S - Spike recovery outside accepted recovery limits
ND - Not detected at the Reporting Limit
R - High relative percent difference observed

Acronyms:

%Rec - Percent Recovery
CCB - Continued Calibration Blank
CCV - Continued Calibration Verification
DF - Dilution Factor
HEM - Hexane Extractable Material
ICV - Initial Calibration Verification
LCS/LCSD - Laboratory Control Sample / Laboratory Control Sample Duplicate
MB or MBLANK - Method Blank
MDL - Method Detection Limit
MS/MSD - Matrix Spike / Matrix Spike Duplicate
PDS - Post Digestion Spike
Ref Val - Reference Value
RL - Reporting Limit
RPD - Relative Percent Difference
SD - Serial Dilution
SGT - Silica Gel Treatment
SPK - Spike
Surr - Surrogate

Analytical Report

Work Order: **1910080**
Date Reported: **10/15/2019**

Client: Floyd | Snider
Collection Date: 10/4/2019 11:00:00 AM
Project: CL-Ellensburg
Lab ID: 1910080-001
Matrix: Soil
Client Sample ID: **DU-01-10042019**

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				Batch ID: 26105		Analyst: DW
Diesel (Fuel Oil)	2,170	100	D	mg/Kg-dry	5	10/11/2019 10:54:19 AM
Heavy Oil	ND	50.0		mg/Kg-dry	1	10/10/2019 11:49:55 PM
Surr: 2-Fluorobiphenyl	103	50 - 150		%Rec	1	10/10/2019 11:49:55 PM
Surr: o-Terphenyl	107	50 - 150		%Rec	1	10/10/2019 11:49:55 PM
Ion Chromatography by EPA Method 300.0				Batch ID: 26116		Analyst: SS
Nitrite (as N)	ND	1.11		mg/Kg-dry	1	10/14/2019 12:40:00 PM
Nitrate (as N)	ND	1.11		mg/Kg-dry	1	10/14/2019 12:40:00 PM
Sample Moisture (Percent Moisture)				Batch ID: R54424		Analyst: SBM
Percent Moisture	12.0	0.500		wt%	1	10/8/2019 8:26:52 AM
Ammonia by SM 4500 NH3 E				Batch ID: 26085		Analyst: SS
Nitrogen, Ammonia	ND	1.13		mg/Kg-dry	1	10/10/2019 11:00:00 AM
pH by EPA Method 9045				Batch ID: R54533		Analyst: WF
Hydrogen Ion (pH)	7.90			pH	1	10/11/2019 4:03:38 PM

Analytical Report

Work Order: **1910080**
Date Reported: **10/15/2019**

Client: Floyd | Snider
Collection Date: 10/4/2019 11:10:00 AM
Project: CL-Ellensburg
Lab ID: 1910080-002
Matrix: Soil
Client Sample ID: DU-02-10042019

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				Batch ID: 26105		Analyst: DW
Diesel (Fuel Oil)	1,200	21.5		mg/Kg-dry	1	10/11/2019 12:19:43 AM
Heavy Oil	ND	53.7		mg/Kg-dry	1	10/11/2019 12:19:43 AM
Surr: 2-Fluorobiphenyl	83.4	50 - 150		%Rec	1	10/11/2019 12:19:43 AM
Surr: o-Terphenyl	85.2	50 - 150		%Rec	1	10/11/2019 12:19:43 AM
Ion Chromatography by EPA Method 300.0				Batch ID: 26116		Analyst: SS
Nitrite (as N)	1.22	1.15		mg/Kg-dry	1	10/14/2019 1:03:00 PM
Nitrate (as N)	9.39	1.15		mg/Kg-dry	1	10/14/2019 1:03:00 PM
Sample Moisture (Percent Moisture)				Batch ID: R54424		Analyst: SBM
Percent Moisture	14.2	0.500		wt%	1	10/8/2019 8:26:52 AM
Ammonia by SM 4500 NH3 E				Batch ID: 26085		Analyst: SS
Nitrogen, Ammonia	ND	1.16		mg/Kg-dry	1	10/10/2019 11:00:00 AM
pH by EPA Method 9045				Batch ID: R54533		Analyst: WF
Hydrogen Ion (pH)	8.04			pH	1	10/11/2019 4:03:38 PM

Analytical Report

Work Order: **1910080**
Date Reported: **10/15/2019**

Client: Floyd | Snider
Collection Date: 10/4/2019 11:30:00 AM
Project: CL-Ellensburg
Lab ID: 1910080-003
Matrix: Soil
Client Sample ID: DU-03-10042019

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				Batch ID: 26105		Analyst: DW
Diesel (Fuel Oil)	2,380	110	D	mg/Kg-dry	5	10/11/2019 11:24:21 AM
Heavy Oil	ND	54.8		mg/Kg-dry	1	10/11/2019 12:50:04 AM
Surr: 2-Fluorobiphenyl	87.7	50 - 150		%Rec	1	10/11/2019 12:50:04 AM
Surr: o-Terphenyl	85.1	50 - 150		%Rec	1	10/11/2019 12:50:04 AM
Ion Chromatography by EPA Method 300.0				Batch ID: 26116		Analyst: SS
Nitrite (as N)	ND	1.14		mg/Kg-dry	1	10/14/2019 2:35:00 PM
Nitrate (as N)	ND	1.14		mg/Kg-dry	1	10/14/2019 2:35:00 PM
Sample Moisture (Percent Moisture)				Batch ID: R54424		Analyst: SBM
Percent Moisture	14.5	0.500		wt%	1	10/8/2019 8:26:52 AM
Ammonia by SM 4500 NH3 E				Batch ID: 26085		Analyst: SS
Nitrogen, Ammonia	ND	1.16		mg/Kg-dry	1	10/10/2019 11:00:00 AM
pH by EPA Method 9045				Batch ID: R54533		Analyst: WF
Hydrogen Ion (pH)	7.89			pH	1	10/11/2019 4:03:38 PM

Client: Floyd | Snider
Collection Date: 10/4/2019 11:40:00 AM
Project: CL-Ellensburg
Lab ID: 1910080-004
Matrix: Soil
Client Sample ID: DU-04-10042019

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				Batch ID: 26105		Analyst: DW
Diesel (Fuel Oil)	761	22.3		mg/Kg-dry	1	10/11/2019 1:20:15 AM
Heavy Oil	ND	55.8		mg/Kg-dry	1	10/11/2019 1:20:15 AM
Surr: 2-Fluorobiphenyl	85.1	50 - 150		%Rec	1	10/11/2019 1:20:15 AM
Surr: o-Terphenyl	87.3	50 - 150		%Rec	1	10/11/2019 1:20:15 AM
Ion Chromatography by EPA Method 300.0				Batch ID: 26116		Analyst: SS
Nitrite (as N)	2.03	1.20		mg/Kg-dry	1	10/14/2019 2:59:00 PM
Nitrate (as N)	61.9	4.79	D	mg/Kg-dry	4	10/15/2019 11:21:00 AM
Sample Moisture (Percent Moisture)				Batch ID: R54424		Analyst: SBM
Percent Moisture	17.6	0.500		wt%	1	10/8/2019 8:26:52 AM
Ammonia by SM 4500 NH3 E				Batch ID: 26085		Analyst: SS
Nitrogen, Ammonia	ND	1.21		mg/Kg-dry	1	10/10/2019 11:00:00 AM
pH by EPA Method 9045				Batch ID: R54533		Analyst: WF
Hydrogen Ion (pH)	7.93			pH	1	10/11/2019 4:03:38 PM

Analytical Report

Work Order: **1910080**
Date Reported: **10/15/2019**

Client: Floyd | Snider
Collection Date: 10/4/2019 12:00:00 PM
Project: CL-Ellensburg
Lab ID: 1910080-005
Matrix: Soil
Client Sample ID: DU-05-10042019

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				Batch ID: 26105		Analyst: DW
Diesel (Fuel Oil)	295	21.9		mg/Kg-dry	1	10/11/2019 2:20:49 AM
Heavy Oil	ND	54.7		mg/Kg-dry	1	10/11/2019 2:20:49 AM
Surr: 2-Fluorobiphenyl	83.0	50 - 150		%Rec	1	10/11/2019 2:20:49 AM
Surr: o-Terphenyl	84.1	50 - 150		%Rec	1	10/11/2019 2:20:49 AM
Ion Chromatography by EPA Method 300.0				Batch ID: 26116		Analyst: SS
Nitrite (as N)	2.03	1.16		mg/Kg-dry	1	10/14/2019 3:22:00 PM
Nitrate (as N)	59.4	4.64	D	mg/Kg-dry	4	10/15/2019 11:44:00 AM
Sample Moisture (Percent Moisture)				Batch ID: R54424		Analyst: SBM
Percent Moisture	15.2	0.500		wt%	1	10/8/2019 8:26:52 AM
Ammonia by SM 4500 NH3 E				Batch ID: 26085		Analyst: SS
Nitrogen, Ammonia	ND	1.18		mg/Kg-dry	1	10/10/2019 11:00:00 AM
pH by EPA Method 9045				Batch ID: R54533		Analyst: WF
Hydrogen Ion (pH)	7.73			pH	1	10/11/2019 4:03:38 PM

Date: *10/15/2019*

Work Order: 1910080
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Ammonia by SM 4500 NH3 E

Sample ID **MB-26085** SampType: **MBLK** Units: **mg/Kg** Prep Date: **10/8/2019** RunNo: **54501**
Client ID: **MBLKS** Batch ID: **26085** Analysis Date: **10/10/2019** SeqNo: **1080421**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Nitrogen, Ammonia	ND	1.00									

Sample ID **LCS-26085** SampType: **LCS** Units: **mg/Kg** Prep Date: **10/8/2019** RunNo: **54501**
Client ID: **LCSS** Batch ID: **26085** Analysis Date: **10/10/2019** SeqNo: **1080422**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Nitrogen, Ammonia	20.0	1.00	20.00	0	100	72.7	119				

Sample ID **1910080-001ADUP** SampType: **DUP** Units: **mg/Kg-dry** Prep Date: **10/8/2019** RunNo: **54501**
Client ID: **DU-01-10042019** Batch ID: **26085** Analysis Date: **10/10/2019** SeqNo: **1080424**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Nitrogen, Ammonia	ND	1.13						0		30	

Sample ID **1910080-001AMS** SampType: **MS** Units: **mg/Kg-dry** Prep Date: **10/8/2019** RunNo: **54501**
Client ID: **DU-01-10042019** Batch ID: **26085** Analysis Date: **10/10/2019** SeqNo: **1080425**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Nitrogen, Ammonia	17.3	1.14	22.70	0.5597	73.6	28.3	149				

Sample ID **1910080-001AMSD** SampType: **MSD** Units: **mg/Kg-dry** Prep Date: **10/8/2019** RunNo: **54501**
Client ID: **DU-01-10042019** Batch ID: **26085** Analysis Date: **10/10/2019** SeqNo: **1080426**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Nitrogen, Ammonia	17.5	1.13	22.60	0.5597	75.1	28.3	149	17.26	1.59	20	

Work Order: 1910080
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Ion Chromatography by EPA Method 300.0

Sample ID **MB-26116** SampType: **MBLK** Units: **mg/Kg** Prep Date: **10/11/2019** RunNo: **54559**
Client ID: **MBLKS** Batch ID: **26116** Analysis Date: **10/14/2019** SeqNo: **1081699**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Nitrite (as N)	ND	1.00									
Nitrate (as N)	ND	1.00									

Sample ID **LCS-26116** SampType: **LCS** Units: **mg/Kg** Prep Date: **10/11/2019** RunNo: **54559**
Client ID: **LCSS** Batch ID: **26116** Analysis Date: **10/14/2019** SeqNo: **1081700**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Nitrite (as N)	7.21	1.00	7.500	0	96.1	90	110				
Nitrate (as N)	7.13	1.00	7.500	0	95.1	90	110				

Sample ID **1910080-002ADUP** SampType: **DUP** Units: **mg/Kg-dry** Prep Date: **10/11/2019** RunNo: **54559**
Client ID: **DU-02-10042019** Batch ID: **26116** Analysis Date: **10/14/2019** SeqNo: **1081703**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Nitrite (as N)	1.27	1.16						1.219	3.83	30	
Nitrate (as N)	10.2	1.16						9.393	8.69	30	

Sample ID **1910080-002AMS** SampType: **MS** Units: **mg/Kg-dry** Prep Date: **10/11/2019** RunNo: **54559**
Client ID: **DU-02-10042019** Batch ID: **26116** Analysis Date: **10/14/2019** SeqNo: **1081704**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Nitrite (as N)	7.32	1.15	8.614	1.219	70.8	80	120				S
Nitrate (as N)	16.7	1.15	8.614	9.393	84.3	80	120				

NOTES:
S - Outlying spike recovery(ies) observed.

Work Order: 1910080
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Ion Chromatography by EPA Method 300.0

Sample ID **1910080-002AMSD** SampType: **MSD** Units: **mg/Kg-dry** Prep Date: **10/11/2019** RunNo: **54559**
Client ID: **DU-02-10042019** Batch ID: **26116** Analysis Date: **10/14/2019** SeqNo: **1081705**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Nitrite (as N)	7.27	1.17	8.775	1.219	68.9	80	120	7.316	0.692	30	S
Nitrate (as N)	16.4	1.17	8.775	9.393	79.8	80	120	16.65	1.59	30	S

NOTES:
S - Outlying spike recovery(ies) observed.

Work Order: 1910080
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

pH by EPA Method 9045

Sample ID **MB-R54533** SampType: **MBLK** Units: **pH** Prep Date: **10/11/2019** RunNo: **54533**
Client ID: **MBLKS** Batch ID: **R54533** Analysis Date: **10/11/2019** SeqNo: **1081012**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Hydrogen Ion (pH)	7.34										

Sample ID **LCS-R54533** SampType: **LCS** Units: **pH** Prep Date: **10/11/2019** RunNo: **54533**
Client ID: **LCSS** Batch ID: **R54533** Analysis Date: **10/11/2019** SeqNo: **1081013**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Hydrogen Ion (pH)	7.08		7.000	0	101	95	105				

Sample ID **1910080-001ADUP** SampType: **DUP** Units: **pH** Prep Date: **10/11/2019** RunNo: **54533**
Client ID: **DU-01-10042019** Batch ID: **R54533** Analysis Date: **10/11/2019** SeqNo: **1081015**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Hydrogen Ion (pH)	7.92							7.900	0.253	10	

Work Order: 1910080
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.

Sample ID **MB-26105** SampType: **MBLK** Units: **mg/Kg** Prep Date: **10/10/2019** RunNo: **54525**
Client ID: **MBLKS** Batch ID: **26105** Analysis Date: **10/10/2019** SeqNo: **1080880**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel (Fuel Oil)	ND	20.0									
Heavy Oil	ND	50.0									
Surr: 2-Fluorobiphenyl	20.6		20.00		103	50	150				
Surr: o-Terphenyl	20.9		20.00		105	50	150				

Sample ID **LCS-26105** SampType: **LCS** Units: **mg/Kg** Prep Date: **10/10/2019** RunNo: **54525**
Client ID: **LCSS** Batch ID: **26105** Analysis Date: **10/10/2019** SeqNo: **1080881**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel (Fuel Oil)	569	20.0	500.0	0	114	65	135				
Surr: 2-Fluorobiphenyl	21.4		20.00		107	50	150				
Surr: o-Terphenyl	19.9		20.00		99.6	50	150				

Sample ID **1910120-001ADUP** SampType: **DUP** Units: **mg/Kg-dry** Prep Date: **10/10/2019** RunNo: **54525**
Client ID: **BATCH** Batch ID: **26105** Analysis Date: **10/10/2019** SeqNo: **1080884**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel (Fuel Oil)	ND	24.8						0		30	
Heavy Oil	ND	62.1						0		30	
Surr: 2-Fluorobiphenyl	21.5		24.83		86.6	50	150		0		
Surr: o-Terphenyl	21.8		24.83		87.9	50	150		0		

Sample ID **1910120-001AMS** SampType: **MS** Units: **mg/Kg-dry** Prep Date: **10/10/2019** RunNo: **54525**
Client ID: **BATCH** Batch ID: **26105** Analysis Date: **10/10/2019** SeqNo: **1080885**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel (Fuel Oil)	711	24.0	600.5	14.39	116	65	135				
Surr: 2-Fluorobiphenyl	25.7		24.02		107	50	150				
Surr: o-Terphenyl	24.3		24.02		101	50	150				

Work Order: 1910080
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.

Sample ID **1910120-001AMS** SampType: **MS** Units: **mg/Kg-dry** Prep Date: **10/10/2019** RunNo: **54525**
Client ID: **BATCH** Batch ID: **26105** Analysis Date: **10/10/2019** SeqNo: **1080885**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Sample ID **1910120-001AMSD** SampType: **MSD** Units: **mg/Kg-dry** Prep Date: **10/10/2019** RunNo: **54525**
Client ID: **BATCH** Batch ID: **26105** Analysis Date: **10/10/2019** SeqNo: **1080886**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel (Fuel Oil)	733	25.5	638.5	14.39	113	65	135	711.0	3.09	30	
Surr: 2-Fluorobiphenyl	28.4		25.54		111	50	150		0		
Surr: o-Terphenyl	27.2		25.54		106	50	150		0		

Sample ID **1910080-004ADUP** SampType: **DUP** Units: **mg/Kg-dry** Prep Date: **10/10/2019** RunNo: **54525**
Client ID: **DU-04-10042019** Batch ID: **26105** Analysis Date: **10/11/2019** SeqNo: **1080897**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel (Fuel Oil)	538	23.7						761.3	34.3	30	R
Heavy Oil	ND	59.3						0		30	
Surr: 2-Fluorobiphenyl	21.3		23.71		89.7	50	150		0		
Surr: o-Terphenyl	21.1		23.71		88.9	50	150		0		

NOTES:
R - High RPD observed. The method is in control as indicated by the LCS.

Work Order: 1910080
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Sample Moisture (Percent Moisture)

Sample ID **1910080-001ADUP** SampType: **DUP** Units: **wt%** Prep Date: **10/8/2019** RunNo: **54424**
Client ID: **DU-01-10042019** Batch ID: **R54424** Analysis Date: **10/8/2019** SeqNo: **1079189**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Percent Moisture	11.8	0.500						12.02	2.02	20	

Sample ID **1910109-001ADUP** SampType: **DUP** Units: **wt%** Prep Date: **10/8/2019** RunNo: **54424**
Client ID: **BATCH** Batch ID: **R54424** Analysis Date: **10/8/2019** SeqNo: **1079202**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Percent Moisture	9.64	0.500						9.932	3.02	20	

Fremont Analytical

Sample Log-In Check List

Client Name: **FS**

Logged by: **Carissa True**

Work Order Number: **1910080**

Date Received: **10/4/2019 4:14:00 PM**

Chain of Custody

1.	Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
2.	How was the sample delivered?	Client		

Log In

3.	Coolers are present?	Yes ☑	No ☐	NA ☐
4.	Shipping container/cooler in good condition?	Yes ☑	No ☐	
5.	Custody Seals present on shipping container/cooler? (Refer to comments for Custody Seals not intact)	Yes ☐	No ☐	Not Required ☑
6.	Was an attempt made to cool the samples?	Yes ☑	No ☐	NA ☐
7.	Were all items received at a temperature of >0°C to 10.0°C *	Yes ☑	No ☐	NA ☐
8.	Sample(s) in proper container(s)?	Yes ☑	No ☐	
9.	Sufficient sample volume for indicated test(s)?	Yes ☑	No ☐	
10.	Are samples properly preserved?	Yes ☑	No ☐	
11.	Was preservative added to bottles?	Yes ☐	No ☑	NA ☐
12.	Is there headspace in the VOA vials?	Yes ☐	No ☐	NA ☑
13.	Did all samples containers arrive in good condition(unbroken)?	Yes ☑	No ☐	
14.	Does paperwork match bottle labels?	Yes ☑	No ☐	
15.	Are matrices correctly identified on Chain of Custody?	Yes ☑	No ☐	
16.	Is it clear what analyses were requested?	Yes ☑	No ☐	
17.	Were all holding times able to be met?	Yes ☑	No ☐	

Special Handling (if applicable)

18.	Was client notified of all discrepancies with this order?	Yes ☐	No ☐	NA ☑

Person Notified: ☐ Date ☐

By Whom: ☐ Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person

Regarding:

Client Instructions:

19. Additional remarks:

Anions logged in for Nitrite and Nitrate (not N+N) per project.

Item Information

Item #	Temp ºC
Cooler 1	2.3
Sample 1	8.9
Temp Blank 1	9.7

* Note: DoD/ELAP and TNI require items to be received at 4°C +/- 2°C

Fremont Analytical

3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790
Fax: 206-352-7178

Chain of Custody Record & Laboratory Services Agreement

Date: 10/4/2019 Page: 1 of: 1

Laboratory Project No (internal): 1910080

Project Name: CL - Ellensburg

Special Remarks: cc results to gabe cisneros

Client: Floyd Snider

Project No:

Address: 601 Union St, Ste 600

Collected by: K Anderson

City, State, Zip: Seattle, WA 98101

Location: Big B Ellensburg WA

Telephone: 206-292-2078

Report To (PM): Tom Colligan

Sample Disposal: ☐ Return to client ☒ Disposal by lab (after 30 days)

Fax:

PM Email: tom.colligan@floydsnider.com

	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	VOCs (EPA 8260 / 624)	GX/BTEX	G/BTEX + naphthalene	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8)	Total (T) | Dissolved (D)	Anions (IC)***	EDB (8011)	NPK-sel anions	Ammonia	pH		Comments
1	DU-01-10042019	10/4/19	1100	Soil						X						X		X	X	X		add vials for BTEX/naph by 8260
2	DU-02-10042019	↓	1110	↓						X						X		X	X	X		" "
3	DU-03-10042019		1130							X						X		X	X	X		" "
4	DU-04-10042019		1140							X						X		X	X	X		" "
5	DU-05-10042019		1200							X						X		X	X	X		" "
6	TB-10042019		1205	—																		" "
7																						
8																						
9																						
10																						

***Matrix:** A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

****Metals (Circle):** MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl U V Zn

*****Anions (Circle):** Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride [✓ Nitrate+Nitrite + Ammonia]

Turn-around Time:

☒ Standard

☐ 3 Day

☐ 2 Day

☐ Next Day

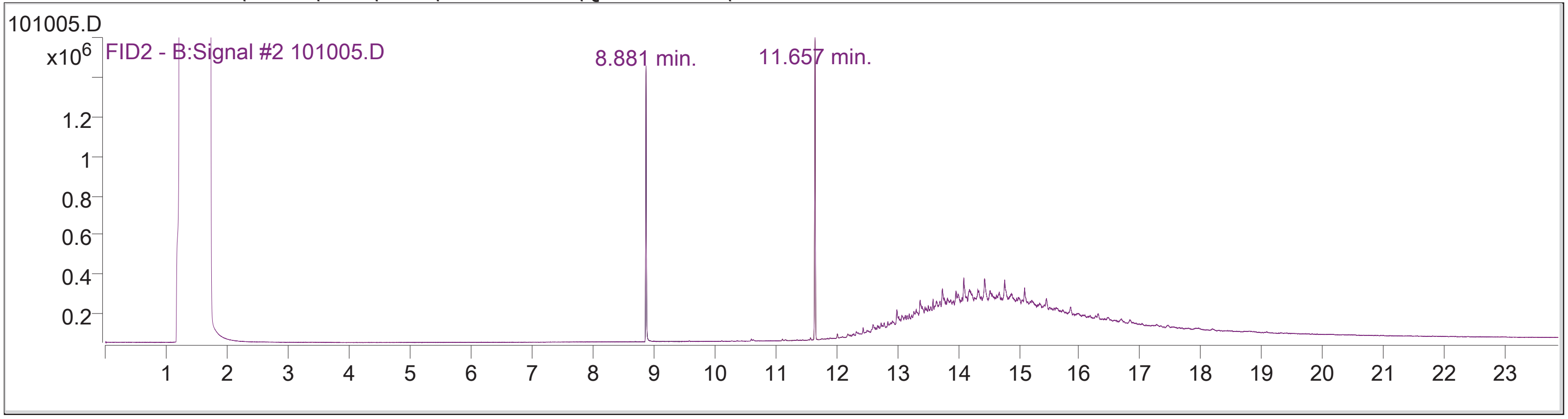
Same Day ______ *(specify)*

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above and that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished	Date/Time	Received	Date/Time
x	10/4/2019 1613	x	10/4/19 16:14
x		x	

Quantitation Results Report

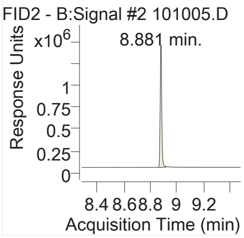
Data File	101005.D	Operator	DMW
Acq. Method	DXACQ050317sgtest2-190617	Acq. Date-Time	10/10/2019 2:51:42 PM
Sample Name:	OIL-CCV-26080C		dualfid
Vial	1	Multiplier	1.00
DA Method File	DX-191008-NWTPH_FINAL.m O-DXEX-S	Last Calib Update	10/9/2019 2:51:58 PM
Batch Name	D:\GC-24\Data\2019\191008BACK\QuantResults\26105.batch.bin		



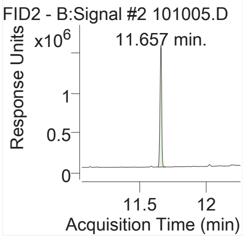
Compound	RT	Resp.	Conc.	Units		Dev(Min)
Internal Standards						
System Monitoring Compounds						
2-Fluorobiphenyl	8.881	1149298	19.344	ug/mL		-0.001
Spiked Amount:	Range: - %			Recovery = NA%		
O-Terphenyl	11.657	1362148	19.658	ug/mL		-0.001
Spiked Amount:	Range: - %			Recovery = NA%		
Target Compounds						
Diesel	10.750	0	0.000	ug/mL	md	
Heavy Oil	14.099	49772744	984.946	ug/mL	m	

(#) = Qualifier Out of Range; (m) = Manual Integration; (+) = Area Summed; (*) = Surrogate Percent Recovery Out of Range; (d): Zeroed Peak

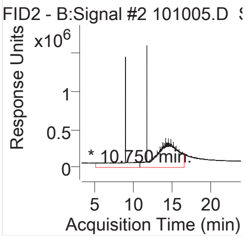
2-Fluorobiphenyl



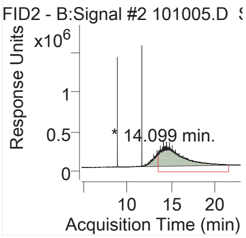
O-Terphenyl



Diesel

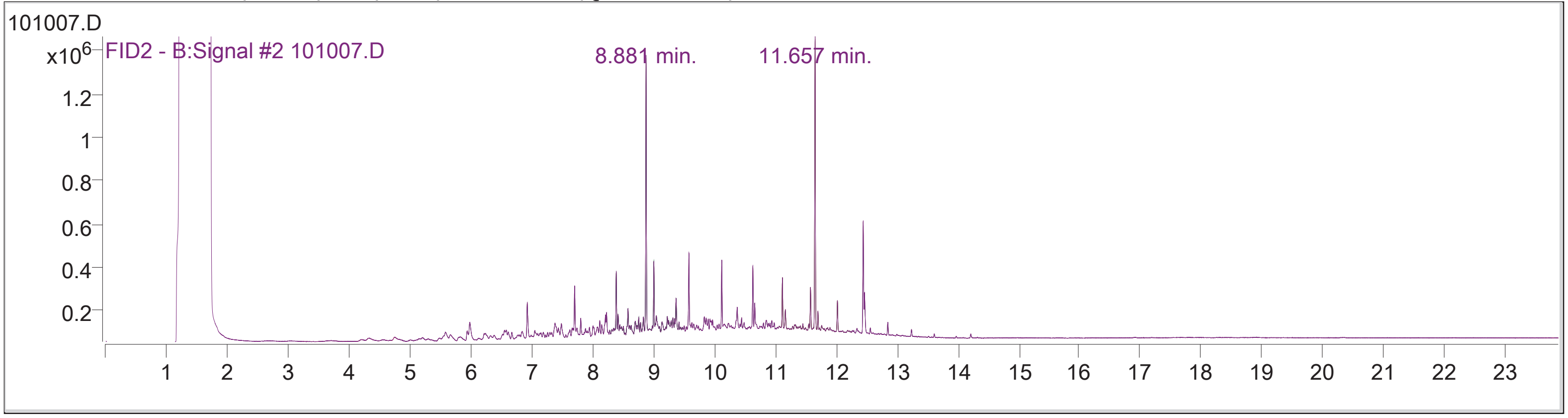


Heavy Oil



Quantitation Results Report

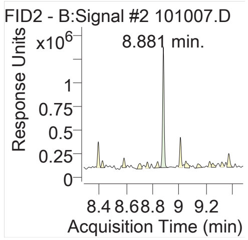
Data File	101007.D	Operator	DMW
Acq. Method	DXACQ050317sgtest2-190617	Acq. Date-Time	10/10/2019 3:21:38 PM
Sample Name:	DX-CCV-26080C		dualfid
Vial	2	Multiplier	1.00
DA Method File	DX-191008-NWTPH_FINAL.m O-DXEX-S	Last Calib Update	10/9/2019 2:51:58 PM
Batch Name	D:\GC-24\Data\2019\191008BACK\QuantResults\26105.batch.bin		



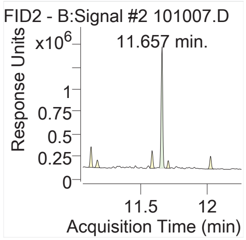
Compound	RT	Resp.	Conc.	Units		Dev(Min)
Internal Standards						
System Monitoring Compounds						
2-Fluorobiphenyl	8.881	1043513	17.423	ug/mL		-0.001
Spiked Amount:	Range: - %			Recovery = NA%		
O-Terphenyl	11.657	1179789	16.762	ug/mL		-0.001
Spiked Amount:	Range: - %			Recovery = NA%		
Target Compounds						
Diesel	11.657	25344597	478.110	ug/mL	m	
Heavy Oil	17.500	0	0.000	ug/mL	md	

(#) = Qualifier Out of Range; (m) = Manual Integration; (+) = Area Summed; (*) = Surrogate Percent Recovery Out of Range; (d): Zeroed Peak

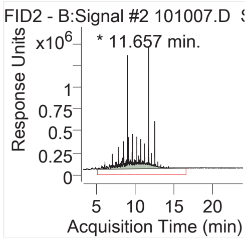
2-Fluorobiphenyl



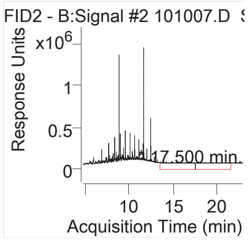
O-Terphenyl



Diesel



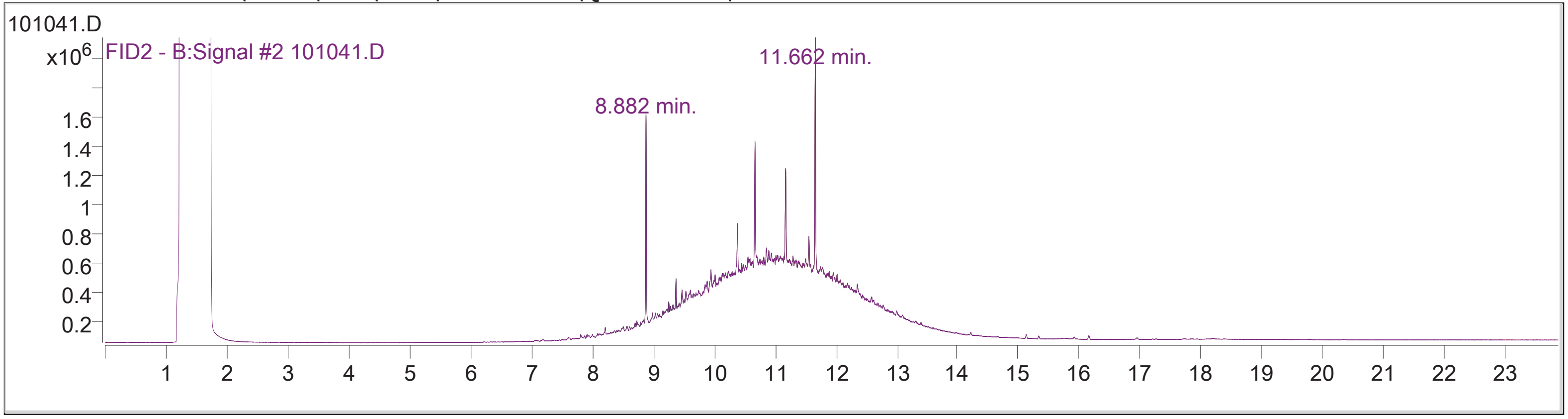
Heavy Oil



Quantitation Results Report

Agilent Technologies

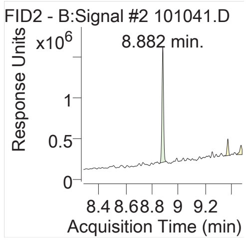
Data File	101041.D	Operator	DMW
Acq. Method	DXACQ050317sgtest2-190617	Acq. Date-Time	10/10/2019 11:49:55 PM
Sample Name:	1910080-001A		dualfid
Vial	101	Multiplier	1.00
DA Method File	DX-191008-NWTPH_FINAL.m O-DXEX-S	Last Calib Update	10/9/2019 2:51:58 PM
Batch Name	D:\GC-24\Data\2019\191008BACK\QuantResults\26105.batch.bin		



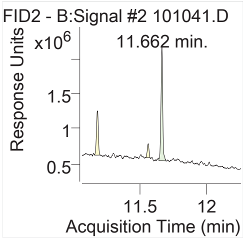
Compound	RT	Resp.	Conc.	Units		Dev(Min)
Internal Standards						
System Monitoring Compounds						
2-Fluorobiphenyl	8.882	1213389	20.508	ug/mL		0.000
Spiked Amount:	Range: - %			Recovery = NA%		
O-Terphenyl	11.662	1476685	21.477	ug/mL		0.004
Spiked Amount:	Range: - %			Recovery = NA%		
Target Compounds						
Diesel	11.661	112672845	2167.196	ug/mL	m	
Heavy Oil	16.947	1931911	7.027	ug/mL	m	

(#) = Qualifier Out of Range; (m) = Manual Integration; (+) = Area Summed; (*) = Surrogate Percent Recovery Out of Range; (d): Zeroed Peak

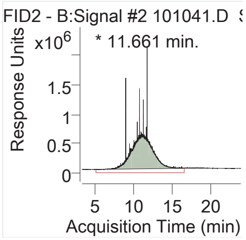
2-Fluorobiphenyl



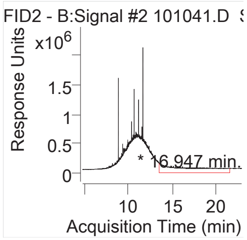
O-Terphenyl



Diesel

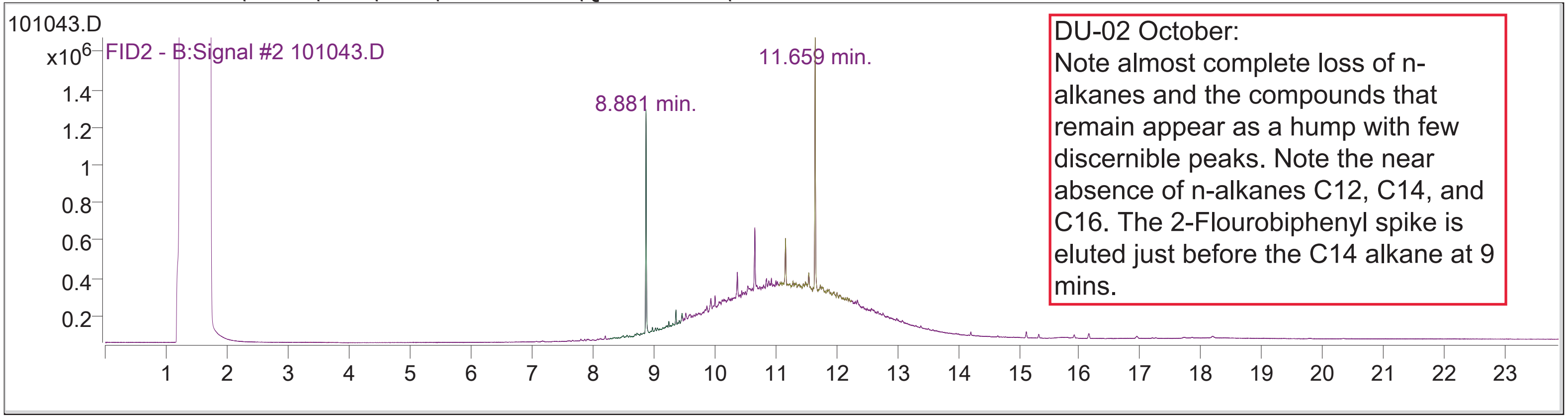


Heavy Oil



Quantitation Results Report

Data File	101043.D	Operator	DMW
Acq. Method	DXACQ050317sgtest2-190617	Acq. Date-Time	10/11/2019 12:19:43 AM
Sample Name:	1910080-002A		dualfid
Vial	102	Multiplier	1.00
DA Method File	DX-191008-NWTPH_FINAL.m O-DXEX-S	Last Calib Update	10/9/2019 2:51:58 PM
Batch Name	D:\GC-24\Data\2019\191008BACK\QuantResults\26105.batch.bin		

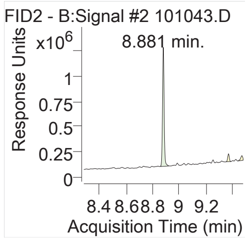


DU-02 October:
Note almost complete loss of n-alkanes and the compounds that remain appear as a hump with few discernible peaks. Note the near absence of n-alkanes C12, C14, and C16. The 2-Flourobiphenyl spike is eluted just before the C14 alkane at 9 mins.

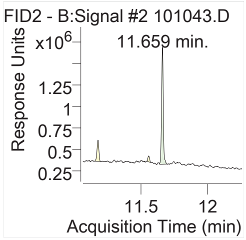
Compound		RT	Resp.	Conc.	Units		Dev(Min)
Internal Standards							
System Monitoring Compounds							
2-Fluorobiphenyl		8.881	1002428	16.677	ug/mL		-0.001
Spiked Amount:	Range:	- %			Recovery = NA%		
O-Terphenyl		11.659	1197688	17.046	ug/mL		0.001
Spiked Amount:	Range:	- %			Recovery = NA%		
Target Compounds							
Diesel		11.658	58501065	1119.416	ug/mL	m	
Heavy Oil		16.939	1835946	5.065	ug/mL	m	

(#) = Qualifier Out of Range; (m) = Manual Integration; (+) = Area Summed; (*) = Surrogate Percent Recovery Out of Range; (d): Zeroed Peak

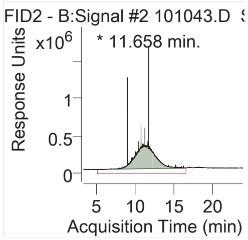
2-Fluorobiphenyl



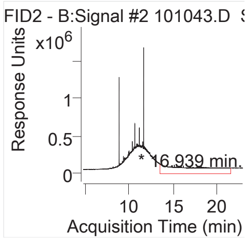
O-Terphenyl



Diesel



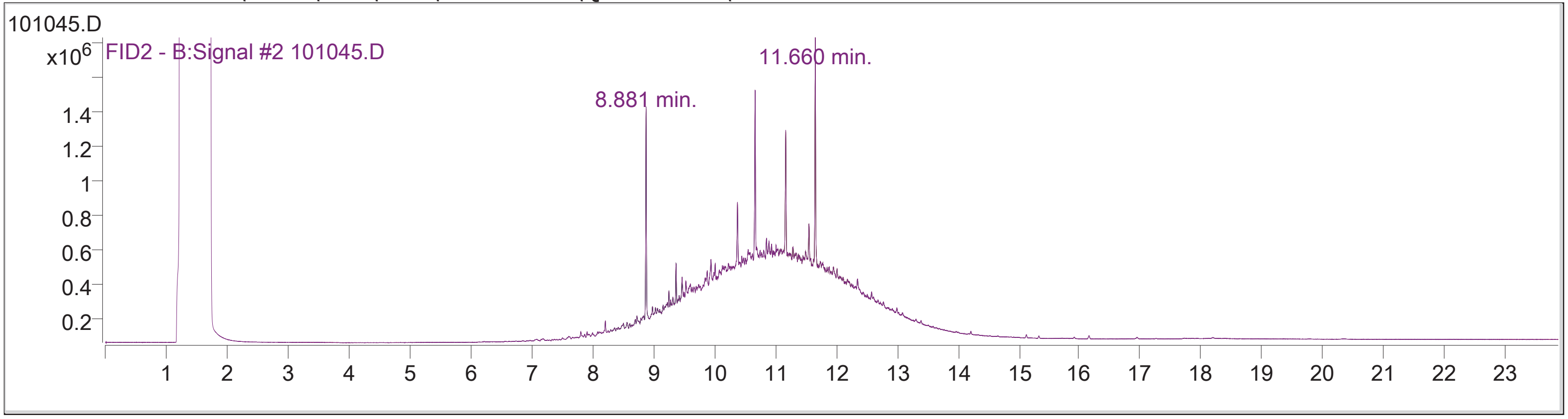
Heavy Oil



Quantitation Results Report

Agilent Technologies

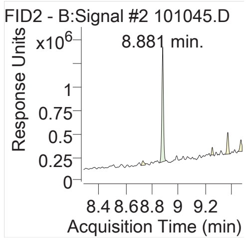
Data File	101045.D	Operator	DMW
Acq. Method	DXACQ050317sgtest2-190617	Acq. Date-Time	10/11/2019 12:50:04 AM
Sample Name:	1910080-003A		dualfid
Vial	103	Multiplier	1.00
DA Method File	DX-191008-NWTPH_FINAL.m O-DXEX-S	Last Calib Update	10/9/2019 2:51:58 PM
Batch Name	D:\GC-24\Data\2019\191008BACK\QuantResults\26105.batch.bin		



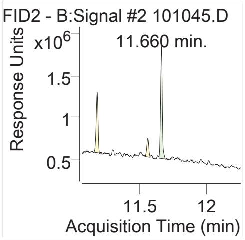
Compound	RT	Resp.	Conc.	Units		Dev(Min)
Internal Standards						
System Monitoring Compounds						
2-Fluorobiphenyl	8.881	1050031	17.542	ug/mL		-0.001
Spiked Amount:	Range: - %			Recovery = NA%		
O-Terphenyl	11.660	1195905	17.018	ug/mL		0.002
Spiked Amount:	Range: - %			Recovery = NA%		
Target Compounds						
Diesel	11.660	106198061	2041.962	ug/mL	m	
Heavy Oil	16.945	1716638	2.626	ug/mL	m	

(#) = Qualifier Out of Range; (m) = Manual Integration; (+) = Area Summed; (*) = Surrogate Percent Recovery Out of Range; (d): Zeroed Peak

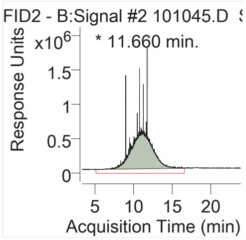
2-Fluorobiphenyl



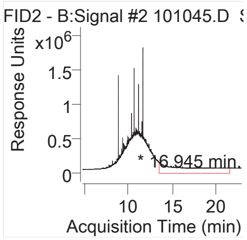
O-Terphenyl



Diesel

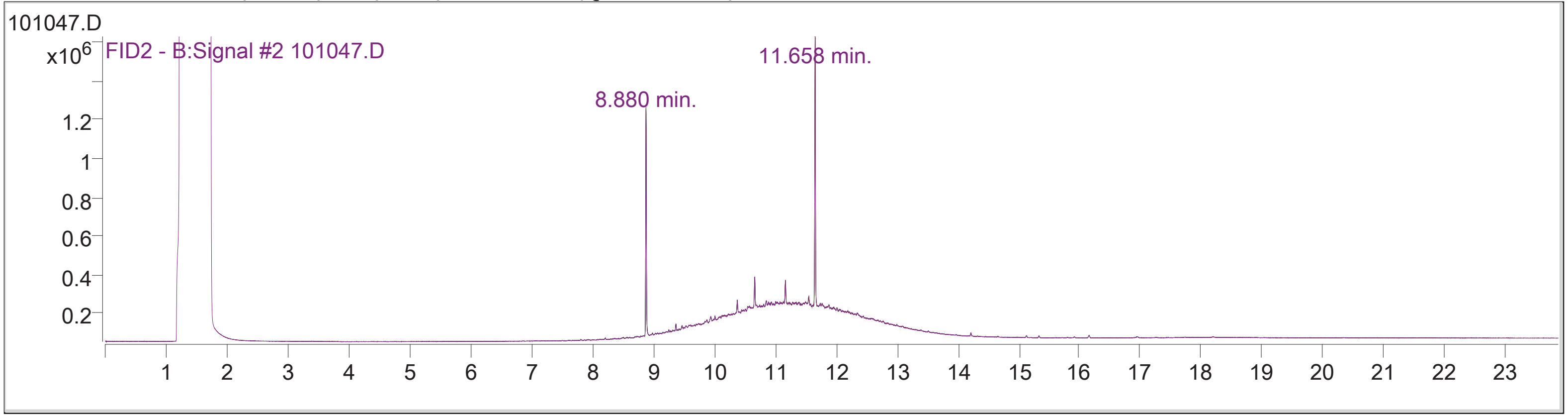


Heavy Oil



Quantitation Results Report

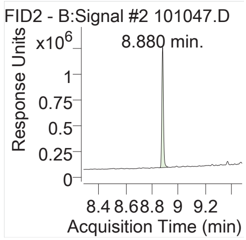
Data File	101047.D	Operator	DMW
Acq. Method	DXACQ050317sgtest2-190617	Acq. Date-Time	10/11/2019 1:20:15 AM
Sample Name:	1910080-004A		dualfid
Vial	104	Multiplier	1.00
DA Method File	DX-191008-NWTPH_FINAL.m O-DXEX-S	Last Calib Update	10/9/2019 2:51:58 PM
Batch Name	D:\GC-24\Data\2019\191008BACK\QuantResults\26105.batch.bin		



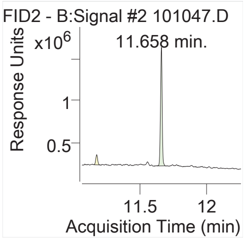
Compound	RT	Resp.	Conc.	Units		Dev(Min)
Internal Standards						
System Monitoring Compounds						
2-Fluorobiphenyl	8.880	1021142	17.017	ug/mL		-0.002
Spiked Amount:	Range: - %			Recovery = NA%		
O-Terphenyl	11.658	1223726	17.460	ug/mL		0.000
Spiked Amount:	Range: - %			Recovery = NA%		
Target Compounds						
Diesel	11.658	35902323	682.316	ug/mL	m	
Heavy Oil	16.946	1273710	0.000	ug/mL	m	

(#) = Qualifier Out of Range; (m) = Manual Integration; (+) = Area Summed; (*) = Surrogate Percent Recovery Out of Range; (d): Zeroed Peak

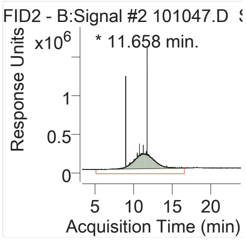
2-Fluorobiphenyl



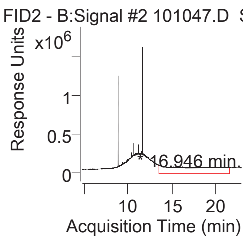
O-Terphenyl



Diesel

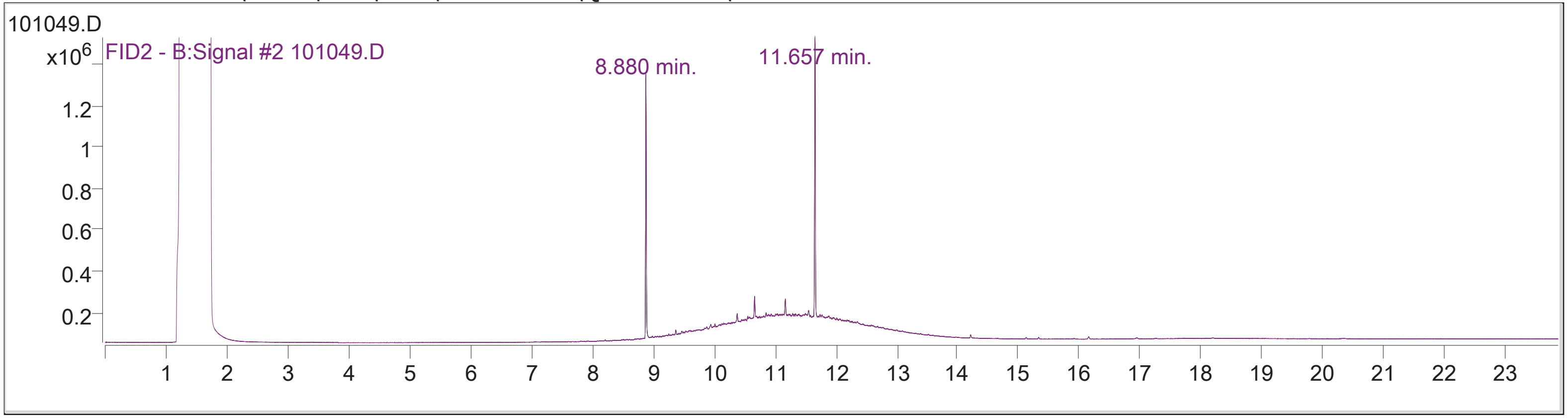


Heavy Oil



Quantitation Results Report

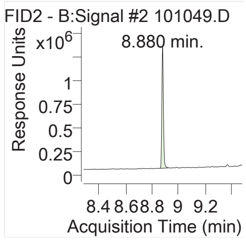
Data File	101049.D	Operator	DMW
Acq. Method	DXACQ050317sgtest2-190617	Acq. Date-Time	10/11/2019 1:50:36 AM
Sample Name:	1910080-004ADUP		dualfid
Vial	105	Multiplier	1.00
DA Method File	DX-191008-NWTPH_FINAL.m O-DXEX-S	Last Calib Update	10/9/2019 2:51:58 PM
Batch Name	D:\GC-24\Data\2019\191008BACK\QuantResults\26105.batch.bin		



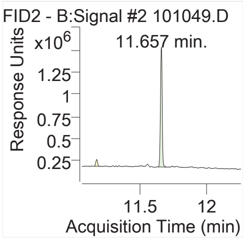
Compound		RT	Resp.	Conc.	Units		Dev(Min)
Internal Standards							
System Monitoring Compounds							
2-Fluorobiphenyl		8.880	1071926	17.939	ug/mL		-0.002
Spiked Amount:	Range: - %				Recovery = NA%		
O-Terphenyl		11.657	1243892	17.780	ug/mL		-0.001
Spiked Amount:	Range: - %				Recovery = NA%		
Target Compounds							
Diesel		11.657	24103667	454.108	ug/mL	m	
Heavy Oil		16.944	1291006	0.000	ug/mL	m	

(#) = Qualifier Out of Range; (m) = Manual Integration; (+) = Area Summed; (*) = Surrogate Percent Recovery Out of Range; (d): Zeroed Peak

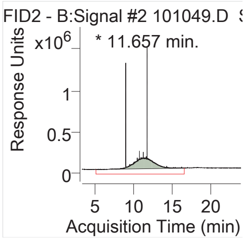
2-Fluorobiphenyl



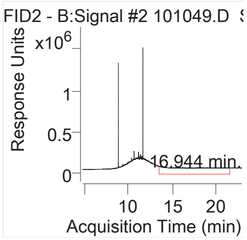
O-Terphenyl



Diesel



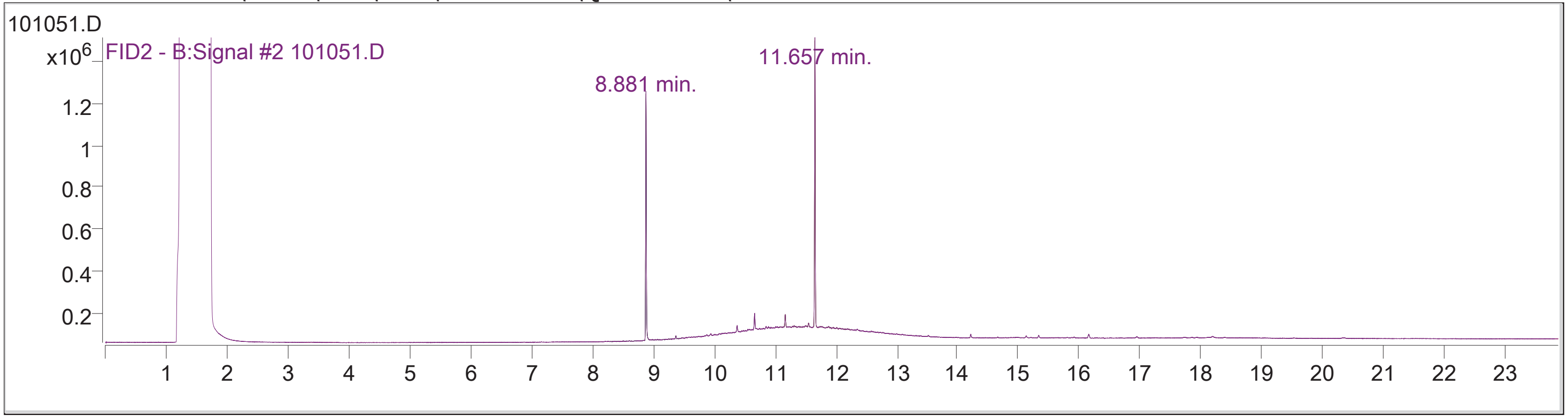
Heavy Oil



Quantitation Results Report

Agilent Technologies

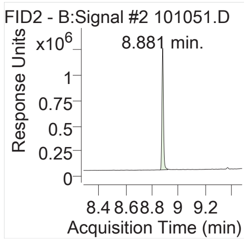
Data File	101051.D	Operator	DMW
Acq. Method	DXACQ050317sgtest2-190617	Acq. Date-Time	10/11/2019 2:20:49 AM
Sample Name:	1910080-005A		dualfid
Vial	106	Multiplier	1.00
DA Method File	DX-191008-NWTPH_FINAL.m O-DXEX-S	Last Calib Update	10/9/2019 2:51:58 PM
Batch Name	D:\GC-24\Data\2019\191008BACK\QuantResults\26105.batch.bin		



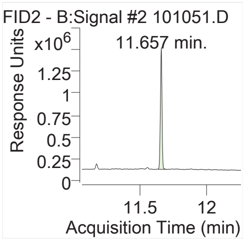
Compound	RT	Resp.	Conc.	Units		Dev(Min)
Internal Standards						
System Monitoring Compounds						
2-Fluorobiphenyl	8.881	998202	16.601	ug/mL		-0.001
Spiked Amount:	Range: - %			Recovery = NA%		
O-Terphenyl	11.657	1183475	16.821	ug/mL		-0.001
Spiked Amount:	Range: - %			Recovery = NA%		
Target Compounds						
Diesel	11.657	14584610	269.993	ug/mL	m	
Heavy Oil	18.189	1581350	0.000	ug/mL	m	

(#) = Qualifier Out of Range; (m) = Manual Integration; (+) = Area Summed; (*) = Surrogate Percent Recovery Out of Range; (d): Zeroed Peak

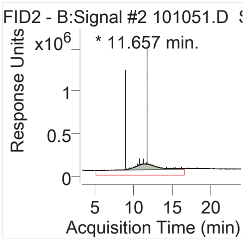
2-Fluorobiphenyl



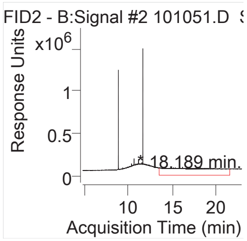
O-Terphenyl



Diesel



Heavy Oil



3600 Fremont Ave. N.
Seattle, WA 98103
T: (206) 352-3790
F: (206) 352-7178
info@fremontanalytical.com

Floyd | Snider
Gabe Cisneros
601 Union St., Suite 600
Seattle, WA 98101

RE: CL-Ellensburg
Work Order Number: 1911096

November 15, 2019

Attention Gabe Cisneros:

Fremont Analytical, Inc. received 3 sample(s) on 11/8/2019 for the analyses presented in the following report.

Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.
Ion Chromatography by EPA Method 300.0
pH by EPA Method 9045
Sample Moisture (Percent Moisture)
Total Metals by EPA Method 6020B
Total Phosphorus by EPA Method 6020

This report consists of the following:

- Case Narrative
- Analytical Results
- Applicable Quality Control Summary Reports
- Chain of Custody

All analyses were performed consistent with the Quality Assurance program of Fremont Analytical, Inc. Please contact the laboratory if you should have any questions about the results.

Thank you for using Fremont Analytical.

Sincerely,

Brianna Barnes
Project Manager

CC:
Tom Colligan

DoD/ELAP Certification #L17-135, ISO/IEC 17025:2005
ORELAP Certification: WA 100009-007 (NELAP Recognized)

CLIENT:	Floyd | Snider
Project:	CL-Ellensburg
Work Order:	1911096

Work Order Sample Summary

Lab Sample ID	Client Sample ID	Date/Time Collected	Date/Time Received
1911096-001	DU-01-110719	11/07/2019 9:00 AM	11/08/2019 9:00 AM
1911096-002	DU-03-110719	11/07/2019 9:10 AM	11/08/2019 9:00 AM
1911096-003	Trip Blank	10/29/2019 10:41 AM	11/08/2019 9:00 AM

Note: If no "Time Collected" is supplied, a default of 12:00AM is assigned

Case Narrative

WO#: **1911096**
Date: **11/15/2019**

CLIENT: Floyd | Snider
Project: CL-Ellensburg

I. SAMPLE RECEIPT:
Samples receipt information is recorded on the attached Sample Receipt Checklist.

II. GENERAL REPORTING COMMENTS:
Results are reported on a wet weight basis unless dry-weight correction is denoted in the units field on the analytical report ("mg/kg-dry" or "ug/kg-dry").

Matrix Spike (MS) and MS Duplicate (MSD) samples are tested from an analytical batch of "like" matrix to check for possible matrix effect. The MS and MSD will provide site specific matrix data only for those samples which are spiked by the laboratory. The sample chosen for spike purposes may or may not have been a sample submitted in this sample delivery group. The validity of the analytical procedures for which data is reported in this analytical report is determined by the Laboratory Control Sample (LCS) and the Method Blank (MB). The LCS and the MB are processed with the samples and the MS/MSD to ensure method criteria are achieved throughout the entire analytical process.

III. ANALYSES AND EXCEPTIONS:
Exceptions associated with this report will be footnoted in the analytical results page(s) or the quality control summary page(s) and/or noted below.

Qualifiers:

* - Flagged value is not within established control limits
B - Analyte detected in the associated Method Blank
D - Dilution was required
E - Value above quantitation range
H - Holding times for preparation or analysis exceeded
I - Analyte with an internal standard that does not meet established acceptance criteria
J - Analyte detected below Reporting Limit
N - Tentatively Identified Compound (TIC)
Q - Analyte with an initial or continuing calibration that does not meet established acceptance criteria (<20%RSD, <20% Drift or minimum RRF)
S - Spike recovery outside accepted recovery limits
ND - Not detected at the Reporting Limit
R - High relative percent difference observed

Acronyms:

%Rec - Percent Recovery
CCB - Continued Calibration Blank
CCV - Continued Calibration Verification
DF - Dilution Factor
HEM - Hexane Extractable Material
ICV - Initial Calibration Verification
LCS/LCSD - Laboratory Control Sample / Laboratory Control Sample Duplicate
MB or MBLANK - Method Blank
MDL - Method Detection Limit
MS/MSD - Matrix Spike / Matrix Spike Duplicate
PDS - Post Digestion Spike
Ref Val - Reference Value
RL - Reporting Limit
RPD - Relative Percent Difference
SD - Serial Dilution
SGT - Silica Gel Treatment
SPK - Spike
Surr - Surrogate

Analytical Report

Work Order: **1911096**
Date Reported: **11/15/2019**

Client: Floyd | Snider
Collection Date: 11/7/2019 9:00:00 AM
Project: CL-Ellensburg
Lab ID: 1911096-001
Matrix: Soil
Client Sample ID: DU-01-110719

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				Batch ID: 26464		Analyst: DW
Diesel (Fuel Oil)	864	20.6		mg/Kg-dry	1	11/12/2019 7:52:19 PM
Heavy Oil	ND	51.6		mg/Kg-dry	1	11/12/2019 7:52:19 PM
Surr: 2-Fluorobiphenyl	101	50 - 150		%Rec	1	11/12/2019 7:52:19 PM
Surr: o-Terphenyl	108	50 - 150		%Rec	1	11/12/2019 7:52:19 PM
Ion Chromatography by EPA Method 300.0				Batch ID: 26460		Analyst: TN
Nitrite (as N)	ND	1.17		mg/Kg-dry	1	11/12/2019 1:02:00 AM
Nitrate (as N)	37.4	5.86	D	mg/Kg-dry	5	11/12/2019 8:54:00 PM
Total Phosphorus by EPA Method 6020				Batch ID: 26475		Analyst: WC
Phosphorus	711	18.7		mg/Kg-dry	1	11/14/2019 7:00:59 PM
Total Metals by EPA Method 6020B				Batch ID: 26475		Analyst: WC
Potassium	1,590	46.8		mg/Kg-dry	1	11/14/2019 7:00:59 PM
Sample Moisture (Percent Moisture)				Batch ID: R55276		Analyst: SBM
Percent Moisture	15.2	0.500		wt%	1	11/13/2019 1:18:41 PM
pH by EPA Method 9045				Batch ID: R55355		Analyst: WF
Hydrogen Ion (pH)	7.81			pH	1	11/15/2019 4:27:59 PM

Analytical Report

Work Order: **1911096**
Date Reported: **11/15/2019**

Client: Floyd | Snider
Collection Date: 11/7/2019 9:10:00 AM
Project: CL-Ellensburg
Lab ID: 1911096-002
Matrix: Soil
Client Sample ID: DU-03-110719

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				Batch ID: 26464		Analyst: DW
Diesel (Fuel Oil)	645	21.9		mg/Kg-dry	1	11/12/2019 8:22:41 PM
Heavy Oil	ND	54.7		mg/Kg-dry	1	11/12/2019 8:22:41 PM
Surr: 2-Fluorobiphenyl	95.3	50 - 150		%Rec	1	11/12/2019 8:22:41 PM
Surr: o-Terphenyl	96.9	50 - 150		%Rec	1	11/12/2019 8:22:41 PM
Ion Chromatography by EPA Method 300.0				Batch ID: 26460		Analyst: TN
Nitrite (as N)	1.67	1.22		mg/Kg-dry	1	11/12/2019 1:25:00 AM
Nitrate (as N)	34.0	6.10	D	mg/Kg-dry	5	11/12/2019 9:17:00 PM
Total Phosphorus by EPA Method 6020				Batch ID: 26475		Analyst: WC
Phosphorus	694	19.4		mg/Kg-dry	1	11/14/2019 7:06:36 PM
Total Metals by EPA Method 6020B				Batch ID: 26475		Analyst: WC
Potassium	2,300	48.6		mg/Kg-dry	1	11/14/2019 7:06:36 PM
Sample Moisture (Percent Moisture)				Batch ID: R55276		Analyst: SBM
Percent Moisture	19.6	0.500		wt%	1	11/13/2019 1:18:41 PM
pH by EPA Method 9045				Batch ID: R55355		Analyst: WF
Hydrogen Ion (pH)	7.94			pH	1	11/15/2019 4:27:59 PM

QC SUMMARY REPORT

Ion Chromatography by EPA Method 300.0

Sample ID: **MB-26460** SampType: **MBLK** Units: **mg/Kg** Prep Date: **11/11/2019** RunNo: **55234**
Client ID: **MBLKS** Batch ID: **26460** Analysis Date: **11/11/2019** SeqNo: **1098596**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Nitrite (as N)	ND	1.00									
Nitrate (as N)	ND	1.00									

Sample ID: **LCS-26460** SampType: **LCS** Units: **mg/Kg** Prep Date: **11/11/2019** RunNo: **55234**
Client ID: **LCSS** Batch ID: **26460** Analysis Date: **11/11/2019** SeqNo: **1098597**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Nitrite (as N)	7.28	1.00	7.500	0	97.1	90	110				
Nitrate (as N)	7.28	1.00	7.500	0	97.1	90	110				

Sample ID: **1911096-002ADUP** SampType: **DUP** Units: **mg/Kg-dry** Prep Date: **11/11/2019** RunNo: **55234**
Client ID: **DU-03-110719** Batch ID: **26460** Analysis Date: **11/12/2019** SeqNo: **1098602**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Nitrite (as N)	1.39	1.24						1.672	18.4	30	
Nitrate (as N)	38.6	1.24						43.35	11.6	30	E

NOTES:
E - Estimated value. The amount exceeds the linear working range of the instrument.

Sample ID: **1911096-002AMS** SampType: **MS** Units: **mg/Kg-dry** Prep Date: **11/11/2019** RunNo: **55234**
Client ID: **DU-03-110719** Batch ID: **26460** Analysis Date: **11/12/2019** SeqNo: **1098603**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Nitrite (as N)	9.95	1.23	9.223	1.672	89.7	80	120				
Nitrate (as N)	50.7	1.23	9.223	43.35	79.3	80	120				ES

NOTES:
S - Outlying spike recovery(ies) observed. A duplicate analysis was performed and recovered within range (Nitrate).
E - Estimated value. The amount exceeds the linear working range of the instrument.

Work Order: 1911096
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Ion Chromatography by EPA Method 300.0

Sample ID: **1911096-002AMSD** SampType: **MSD** Units: **mg/Kg-dry** Prep Date: **11/11/2019** RunNo: **55234**
Client ID: **DU-03-110719** Batch ID: **26460** Analysis Date: **11/12/2019** SeqNo: **1098604**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Nitrite (as N)	9.62	1.23	9.202	1.672	86.4	80	120	9.948	3.36	30	
Nitrate (as N)	51.4	1.23	9.202	43.35	87.0	80	120	50.66	1.37	30	E

NOTES:
E - Estimated value. The amount exceeds the linear working range of the instrument.

Work Order: 1911096
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Total Phosphorus by EPA Method 6020

Sample ID: **MB-26475** SampType: **MBLK** Units: **mg/Kg** Prep Date: **11/12/2019** RunNo: **55348**
Client ID: **MBLKS** Batch ID: **26475** Analysis Date: **11/14/2019** SeqNo: **1100489**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Phosphorus	ND	15.9									

Sample ID: **LCS-26475** SampType: **LCS** Units: **mg/Kg** Prep Date: **11/12/2019** RunNo: **55348**
Client ID: **LCSS** Batch ID: **26475** Analysis Date: **11/14/2019** SeqNo: **1100490**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Phosphorus	404	15.6	390.6	0	103	80	120				

Sample ID: **1911095-001ADUP** SampType: **DUP** Units: **mg/Kg-dry** Prep Date: **11/12/2019** RunNo: **55348**
Client ID: **BATCH** Batch ID: **26475** Analysis Date: **11/14/2019** SeqNo: **1100492**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Phosphorus	347	18.9						239.3	36.7	20	R

NOTES:
R - High RPD observed. The method is in control as indicated by the LCS.

Sample ID: **1911095-001AMS** SampType: **MS** Units: **mg/Kg-dry** Prep Date: **11/12/2019** RunNo: **55348**
Client ID: **BATCH** Batch ID: **26475** Analysis Date: **11/14/2019** SeqNo: **1100494**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Phosphorus	839	18.8	469.1	239.3	128	75	125				S

NOTES:
S - Outlying spike recovery(ies) observed. A duplicate analysis was performed with similar results.

Sample ID: **1911095-001AMSD** SampType: **MSD** Units: **mg/Kg-dry** Prep Date: **11/12/2019** RunNo: **55348**
Client ID: **BATCH** Batch ID: **26475** Analysis Date: **11/14/2019** SeqNo: **1100495**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Phosphorus	865	18.9	472.9	239.3	132	75	125	839.3	2.98	20	S

Work Order: 1911096
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Total Phosphorus by EPA Method 6020

Sample ID: **1911095-001AMSD**	SampType: **MSD**			Units: **mg/Kg-dry**		Prep Date: **11/12/2019**		RunNo: **55348**		
Client ID: **BATCH**	Batch ID: **26475**					Analysis Date: **11/14/2019**		SeqNo: **1100495**		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

NOTES:
S - Outlying spike recovery(ies) observed. A duplicate analysis was performed with similar results.

Sample ID: **1911095-001APDS**	SampType: **PDS**			Units: **mg/Kg-dry**		Prep Date: **11/12/2019**		RunNo: **55348**			
Client ID: **BATCH**	Batch ID: **26475**					Analysis Date: **11/14/2019**		SeqNo: **1100496**			
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Phosphorus	652	18.8	469	239	88.0	75	125				

Work Order: 1911096
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

pH by EPA Method 9045

Sample ID: **MB-R55355** SampType: **MBLK** Units: **pH** Prep Date: **11/15/2019** RunNo: **55355**
Client ID: **MBLKS** Batch ID: **R55355** Analysis Date: **11/15/2019** SeqNo: **1100708**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Hydrogen Ion (pH)	7.77										

Sample ID: **LCS-R55355** SampType: **LCS** Units: **pH** Prep Date: **11/15/2019** RunNo: **55355**
Client ID: **LCSS** Batch ID: **R55355** Analysis Date: **11/15/2019** SeqNo: **1100709**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Hydrogen Ion (pH)	7.06		7.000	0	101	95	105				

Sample ID: **1911096-001ADUP** SampType: **DUP** Units: **pH** Prep Date: **11/15/2019** RunNo: **55355**
Client ID: **DU-01-110719** Batch ID: **R55355** Analysis Date: **11/15/2019** SeqNo: **1100711**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Hydrogen Ion (pH)	7.78							7.810	0.385	10	

Work Order: 1911096
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Total Metals by EPA Method 6020B

Sample ID: **MB-26475** SampType: **MBLK** Units: **mg/Kg** Prep Date: **11/12/2019** RunNo: **55329**
Client ID: **MBLKS** Batch ID: **26475** Analysis Date: **11/14/2019** SeqNo: **1100073**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Potassium	ND	39.7									

Sample ID: **LCS-26475** SampType: **LCS** Units: **mg/Kg** Prep Date: **11/12/2019** RunNo: **55329**
Client ID: **LCSS** Batch ID: **26475** Analysis Date: **11/14/2019** SeqNo: **1100074**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Potassium	392	39.1	390.6	0	100	80	120				

Sample ID: **1911095-001ADUP** SampType: **DUP** Units: **mg/Kg-dry** Prep Date: **11/12/2019** RunNo: **55329**
Client ID: **BATCH** Batch ID: **26475** Analysis Date: **11/14/2019** SeqNo: **1100076**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Potassium	781	47.3						795.9	1.90	20	

Sample ID: **1911095-001AMS** SampType: **MS** Units: **mg/Kg-dry** Prep Date: **11/12/2019** RunNo: **55329**
Client ID: **BATCH** Batch ID: **26475** Analysis Date: **11/14/2019** SeqNo: **1100078**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Potassium	1,280	46.9	469.1	795.9	103	75	125				

Sample ID: **1911095-001AMSD** SampType: **MSD** Units: **mg/Kg-dry** Prep Date: **11/12/2019** RunNo: **55329**
Client ID: **BATCH** Batch ID: **26475** Analysis Date: **11/14/2019** SeqNo: **1100079**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Potassium	1,250	47.3	472.9	795.9	96.1	75	125	1,277	2.14	20	

Work Order: 1911096
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.

Sample ID: **LCS-26464** SampType: **LCS** Units: **mg/Kg** Prep Date: **11/12/2019** RunNo: **55250**
Client ID: **LCSS** Batch ID: **26464** Analysis Date: **11/12/2019** SeqNo: **1098257**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel (Fuel Oil)	544	20.0	500.0	0	109	65	135				
Surr: 2-Fluorobiphenyl	21.3		20.00		106	50	150				
Surr: o-Terphenyl	20.5		20.00		103	50	150				

Sample ID: **MB-26464** SampType: **MBLK** Units: **mg/Kg** Prep Date: **11/12/2019** RunNo: **55250**
Client ID: **MBLKS** Batch ID: **26464** Analysis Date: **11/12/2019** SeqNo: **1098258**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel (Fuel Oil)	ND	20.0									
Heavy Oil	ND	50.0									
Surr: 2-Fluorobiphenyl	19.6		20.00		98.2	50	150				
Surr: o-Terphenyl	20.7		20.00		104	50	150				

Sample ID: **1911124-001ADUP** SampType: **DUP** Units: **mg/Kg-dry** Prep Date: **11/12/2019** RunNo: **55250**
Client ID: **BATCH** Batch ID: **26464** Analysis Date: **11/12/2019** SeqNo: **1098779**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel (Fuel Oil)	ND	19.5						60.47	9.69	30	
Diesel Range Organics (C12-C24)	54.9	19.5						60.47	9.69	30	
Heavy Oil	ND	48.8						0		30	
Surr: 2-Fluorobiphenyl	20.7		19.51		106	50	150		0		
Surr: o-Terphenyl	20.1		19.51		103	50	150		0		

NOTES:

DRO - Indicates detections eluting from dodecane through tetracosane (~C12-C24). Chromatographic pattern does not resemble a known petroleum distillate.

Sample ID: **1911124-001AMS** SampType: **MS** Units: **mg/Kg-dry** Prep Date: **11/12/2019** RunNo: **55250**
Client ID: **BATCH** Batch ID: **26464** Analysis Date: **11/12/2019** SeqNo: **1098539**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel (Fuel Oil)	632	19.7	491.4	60.47	116	65	135				

Work Order: 1911096
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.

Sample ID: **1911124-001AMS** SampType: **MS** Units: **mg/Kg-dry** Prep Date: **11/12/2019** RunNo: **55250**
Client ID: **BATCH** Batch ID: **26464** Analysis Date: **11/12/2019** SeqNo: **1098539**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: 2-Fluorobiphenyl	22.0		19.65		112	50	150				
Surr: o-Terphenyl	20.6		19.65		105	50	150				

Sample ID: **1911124-001AMSD** SampType: **MSD** Units: **mg/Kg-dry** Prep Date: **11/12/2019** RunNo: **55250**
Client ID: **BATCH** Batch ID: **26464** Analysis Date: **11/12/2019** SeqNo: **1098540**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel (Fuel Oil)	685	20.1	502.7	60.47	124	65	135	631.7	8.10	30	
Surr: 2-Fluorobiphenyl	25.2		20.11		125	50	150		0		
Surr: o-Terphenyl	23.7		20.11		118	50	150		0		

Sample ID: **1911121-001ADUP** SampType: **DUP** Units: **mg/Kg-dry** Prep Date: **11/12/2019** RunNo: **55250**
Client ID: **BATCH** Batch ID: **26464** Analysis Date: **11/12/2019** SeqNo: **1098717**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel (Fuel Oil)	ND	21.5						0		30	
Heavy Oil	ND	53.7						0		30	
Surr: 2-Fluorobiphenyl	22.1		21.46		103	50	150		0		
Surr: o-Terphenyl	23.0		21.46		107	50	150		0		

Date: *11/15/2019*

Work Order: 1911096
CLIENT: Floyd | Snider
Project: CL-Ellensburg

QC SUMMARY REPORT

Sample Moisture (Percent Moisture)

Sample ID: **1911101-004ADUP**	SampType: **DUP**			Units: **wt%**		Prep Date: **11/13/2019**			RunNo: **55276**			
Client ID: **BATCH**	Batch ID: **R55276**					Analysis Date: **11/13/2019**			SeqNo: **1098885**			
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual	
Percent Moisture	10.9	0.500						10.88	0.113	20		

Sample ID: **1911096-002ADUP**	SampType: **DUP**			Units: **wt%**		Prep Date: **11/13/2019**			RunNo: **55276**			
Client ID: **DU-03-110719**	Batch ID: **R55276**					Analysis Date: **11/13/2019**			SeqNo: **1098900**			
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual	
Percent Moisture	20.8	0.500						19.62	5.91	20		

Sample Log-In Check List

Client Name: **FS**
Work Order Number: **1911096**
Logged by: **Carissa True**
Date Received: **11/8/2019 9:00:00 AM**

Chain of Custody

1. Is Chain of Custody complete? Yes ☑ No ☐ Not Present ☐
2. How was the sample delivered? Client

Log In

3. Coolers are present? Yes ☑ No ☐ NA ☐
4. Shipping container/cooler in good condition? Yes ☑ No ☐
5. Custody Seals present on shipping container/cooler? (Refer to comments for Custody Seals not intact) Yes ☐ No ☐ Not Required ☑
6. Was an attempt made to cool the samples? Yes ☑ No ☐ NA ☐
7. Were all items received at a temperature of >0°C to 10.0°C* Yes ☑ No ☐ NA ☐
8. Sample(s) in proper container(s)? Yes ☑ No ☐
9. Sufficient sample volume for indicated test(s)? Yes ☑ No ☐
10. Are samples properly preserved? Yes ☑ No ☐
11. Was preservative added to bottles? Yes ☐ No ☑ NA ☐
12. Is there headspace in the VOA vials? Yes ☐ No ☐ NA ☑
13. Did all samples containers arrive in good condition(unbroken)? Yes ☑ No ☐
14. Does paperwork match bottle labels? Yes ☑ No ☐
15. Are matrices correctly identified on Chain of Custody? Yes ☑ No ☐
16. Is it clear what analyses were requested? Yes ☑ No ☐
17. Were all holding times able to be met? Yes ☑ No ☐

Special Handling (if applicable)

18. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☑

Person Notified:
Date:
By Whom:
Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person
Regarding:
Client Instructions:

19. Additional remarks:

Item Information

Item #	Temp ºC
Cooler 1	5.3
Sample 1	0.1
Temp Blank 1	3.5

* Note: DoD/ELAP and TNI require items to be received at 4°C +/- 2°C

Fremont Analytical

3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790
Fax: 206-352-7178

Chain of Custody Record & Laboratory Services Agreement

Date: 11/7/19 **Page:** **of:**

Laboratory Project No (internal): 1911096

Project Name: CL-Ellensburg

Project No:

Collected by: Gabe Cisneros

Location: 1611 Canyon Rd, Ellensburg, WA

Report To (PM): Gabe Cisneros

PM Email: gabe.cisneros@floydsnider.com

Client: Floyd|Snider

Address: 601 Union Street, Ste 600

City, State, Zip: Seattle, WA 98101

Telephone: 206-292-2078

Fax:

Special Remarks:
CC results to Tom Colligan
NPK = Nitrogen + Phosphorus + Potassium

Sample Disposal: ☐ Return to client ☐ Disposal by lab (after 30 days)

	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	VOCs (EPA 8260 / 624)	GX/BTEX	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8)	Total (T) | Dissolved (D)	Anions (IC)***	EDB (8011)	NPK - See Anions	pH			Comments
1	DU-01-110719	11/7	0900	S						X								X	X			Hold VOAs for BTEX/NAPH/Gas by 8260
2	DU-03-110719	11/7	0910	S						X								X	X			
3																						
4																						
5																						
6																						
7																						
8																						
9																						
10																						

***Matrix:** A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

****Metals (Circle):** MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl U V Zn

*****Anions (Circle):** Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride [✓ Nitrate+Nitrite]

Turn-around Time:
☒ Standard
☐ 3 Day
☐ 2 Day
☐ Next Day
Same Day ______ *(specify)*

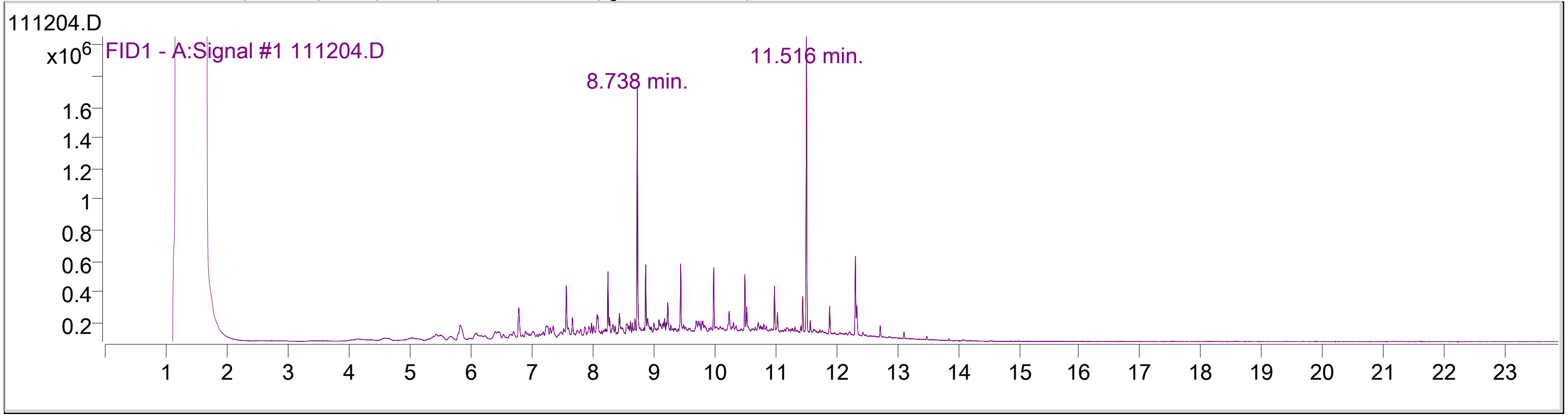
I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above and that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished x	Date/Time 11/8/19 0550	Received x	Date/Time 11/8/19 0900
Relinquished x	Date/Time	Received x	Date/Time

Quantitation Results Report

Agilent Technologies

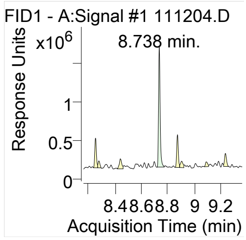
Data File	111204.D	Operator	DMW
Acq. Method	DXACQ050317sgtest2-190617	Acq. Date-Time	11/12/2019 8:36:23 AM
Sample Name:	DX-CCV-		dualfid
Vial	2	Multiplier	1.00
DA Method File	DX-191111-NWTPH_FINAL.m O-DXEX-S	Last Calib Update	11/11/2019 10:48:24 AM
Batch Name	D:\GC-24\Data\2019\191112FRONT\QuantResults\26464.batch.bin		



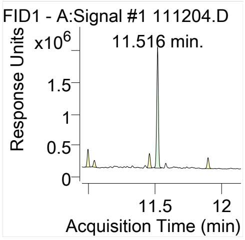
Compound	RT	Resp.	Conc.	Units		Dev(Min)
Internal Standards						
System Monitoring Compounds						
2-Fluorobiphenyl	8.738	1328652	20.056	ug/mL		-0.026
Spiked Amount:	Range: - %			Recovery = NA%		
O-Terphenyl	11.516	1677644	19.453	ug/mL		-0.029
Spiked Amount:	Range: - %			Recovery = NA%		
Target Compounds						
Diesel	11.516	34062478	506.189	ug/mL	m	
Heavy Oil	17.500	0	0.000	ug/mL	md	

(#) = Qualifier Out of Range; (m) = Manual Integration; (+) = Area Summed; (*) = Surrogate Percent Recovery Out of Range; (d): Zeroed Peak

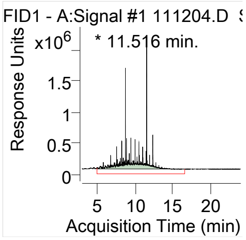
2-Fluorobiphenyl



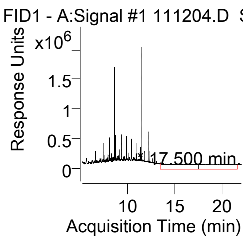
O-Terphenyl



Diesel

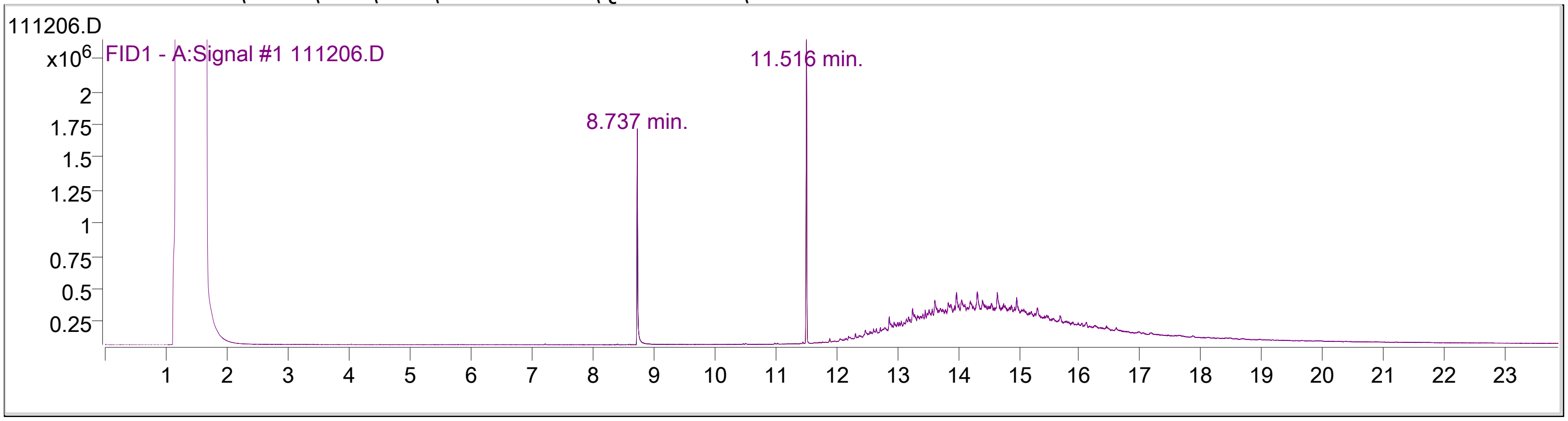


Heavy Oil



Quantitation Results Report

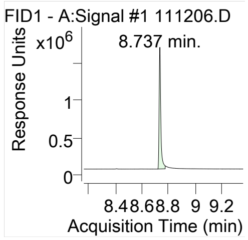
Data File	111206.D	Operator	DMW
Acq. Method	DXACQ050317sgtest2-190617	Acq. Date-Time	11/12/2019 9:06:38 AM
Sample Name:	OIL-CCV-		dualfid
Vial	1	Multiplier	1.00
DA Method File	DX-191111-NWTPH_FINAL.m O-DXEX-S	Last Calib Update	11/11/2019 10:48:24 AM
Batch Name	D:\GC-24\Data\2019\191112FRONT\QuantResults\26464.batch.bin		



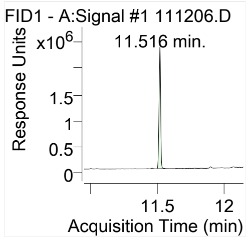
Compound	RT	Resp.	Conc.	Units		Dev(Min)
Internal Standards						
System Monitoring Compounds						
2-Fluorobiphenyl	8.737	1457800	21.940	ug/mL		-0.027
Spiked Amount:	Range: - %			Recovery = NA%		
O-Terphenyl	11.516	1972356	22.905	ug/mL		-0.029
Spiked Amount:	Range: - %			Recovery = NA%		
Target Compounds						
Diesel	10.750	0	0.000	ug/mL	md	
Heavy Oil	14.319	61452338	976.581	ug/mL	m	

(#) = Qualifier Out of Range; (m) = Manual Integration; (+) = Area Summed; (*) = Surrogate Percent Recovery Out of Range; (d): Zeroed Peak

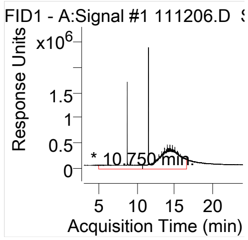
2-Fluorobiphenyl



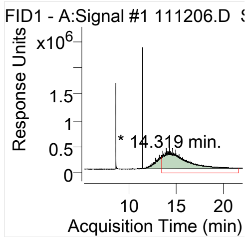
O-Terphenyl



Diesel

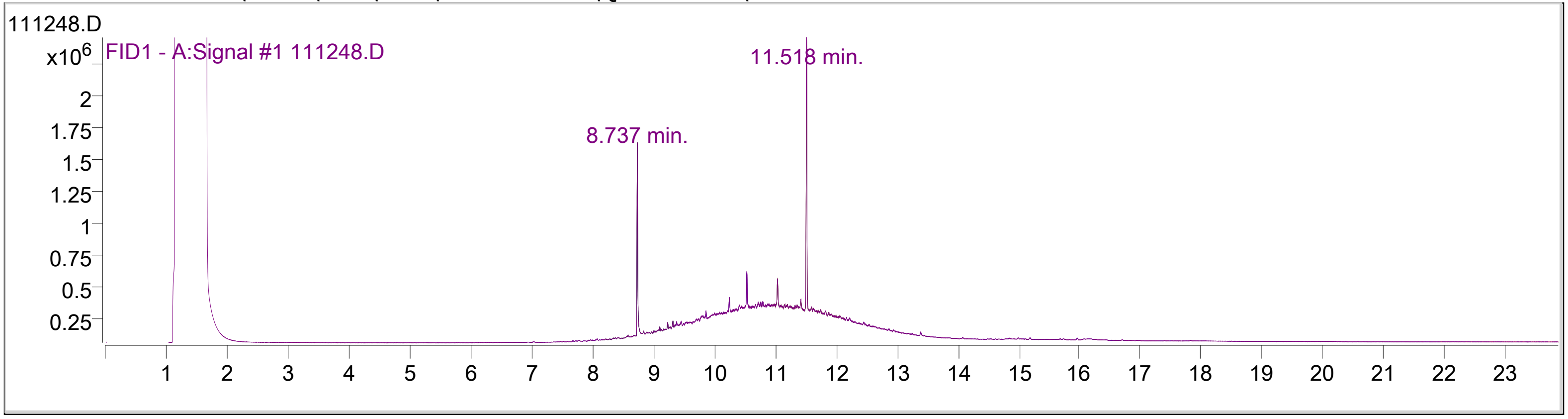


Heavy Oil



Quantitation Results Report

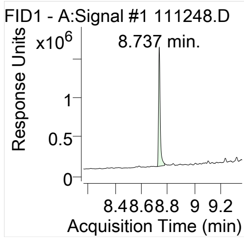
Data File	111248.D	Operator	DMW
Acq. Method	DXACQ050317sgtest2-190617	Acq. Date-Time	11/12/2019 7:52:19 PM
Sample Name:	1911096-001A		dualfid
Vial	54	Multiplier	1.00
DA Method File	DX-191111-NWTPH_FINAL.m O-DXEX-S	Last Calib Update	11/11/2019 10:48:24 AM
Batch Name	D:\GC-24\Data\2019\191112FRONT\QuantResults\26464.batch.bin		



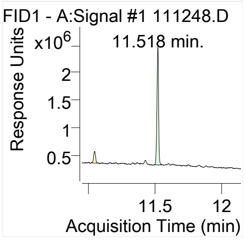
Compound		RT	Resp.	Conc.	Units		Dev(Min)
Internal Standards							
System Monitoring Compounds							
2-Fluorobiphenyl		8.737	1342555	20.259	ug/mL		-0.027
Spiked Amount:	Range:	- %			Recovery = NA%		
O-Terphenyl		11.518	1858477	21.571	ug/mL		-0.027
Spiked Amount:	Range:	- %			Recovery = NA%		
Target Compounds							
Diesel		11.518	56013212	836.956	ug/mL	m	
Heavy Oil		16.699	840159	4.363	ug/mL	m	

(#) = Qualifier Out of Range; (m) = Manual Integration; (+) = Area Summed; (*) = Surrogate Percent Recovery Out of Range; (d): Zeroed Peak

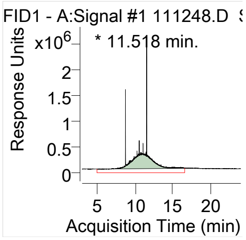
2-Fluorobiphenyl



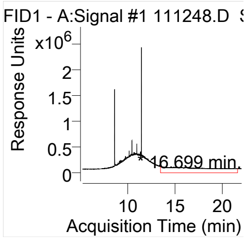
O-Terphenyl



Diesel

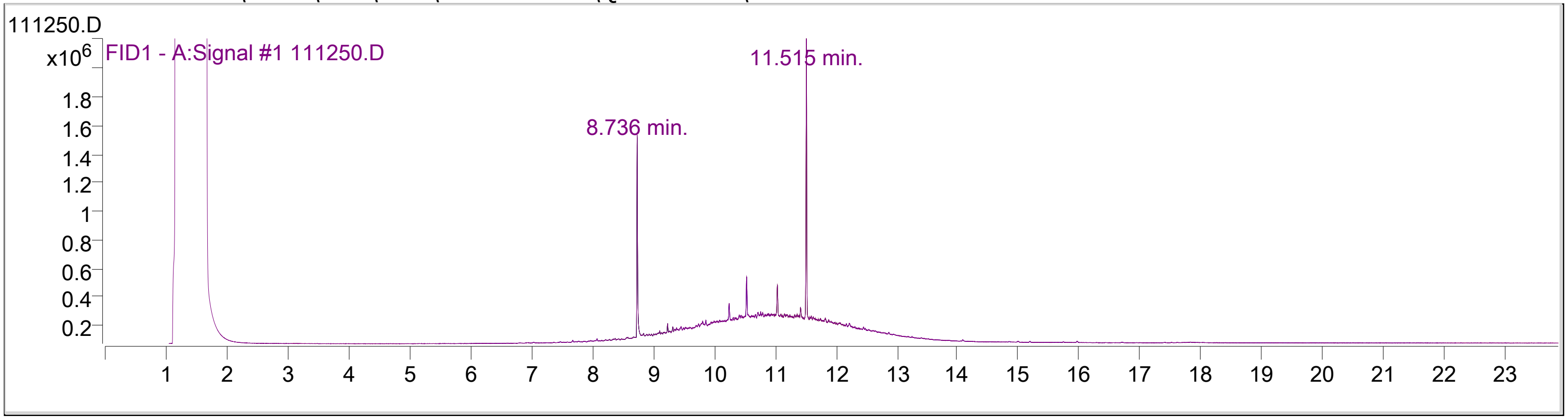


Heavy Oil



Quantitation Results Report

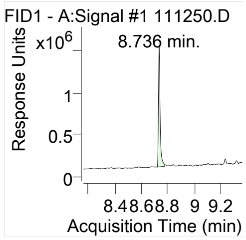
Data File	111250.D	Operator	DMW
Acq. Method	DXACQ050317sgtest2-190617	Acq. Date-Time	11/12/2019 8:22:41 PM
Sample Name:	1911096-002A		dualfid
Vial	55	Multiplier	1.00
DA Method File	DX-191111-NWTPH_FINAL.m O-DXEX-S	Last Calib Update	11/11/2019 10:48:24 AM
Batch Name	D:\GC-24\Data\2019\191112FRONT\QuantResults\26464.batch.bin		



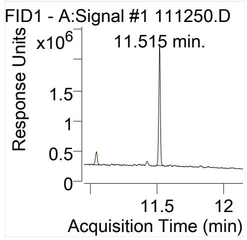
Compound	RT	Resp.	Conc.	Units		Dev(Min)
Internal Standards						
System Monitoring Compounds						
2-Fluorobiphenyl	8.736	1260370	19.060	ug/mL		-0.028
Spiked Amount:	Range: - %			Recovery = NA%		
O-Terphenyl	11.515	1670788	19.372	ug/mL		-0.030
Spiked Amount:	Range: - %			Recovery = NA%		
Target Compounds						
Diesel	11.515	39612403	589.819	ug/mL	m	
Heavy Oil	17.821	363175	0.000	ug/mL	m	

(#) = Qualifier Out of Range; (m) = Manual Integration; (+) = Area Summed; (*) = Surrogate Percent Recovery Out of Range; (d): Zeroed Peak

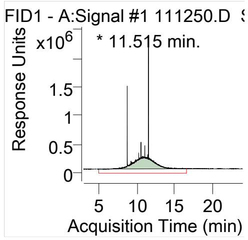
2-Fluorobiphenyl



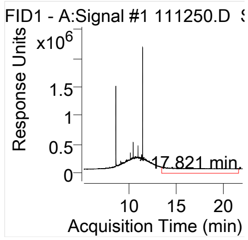
O-Terphenyl



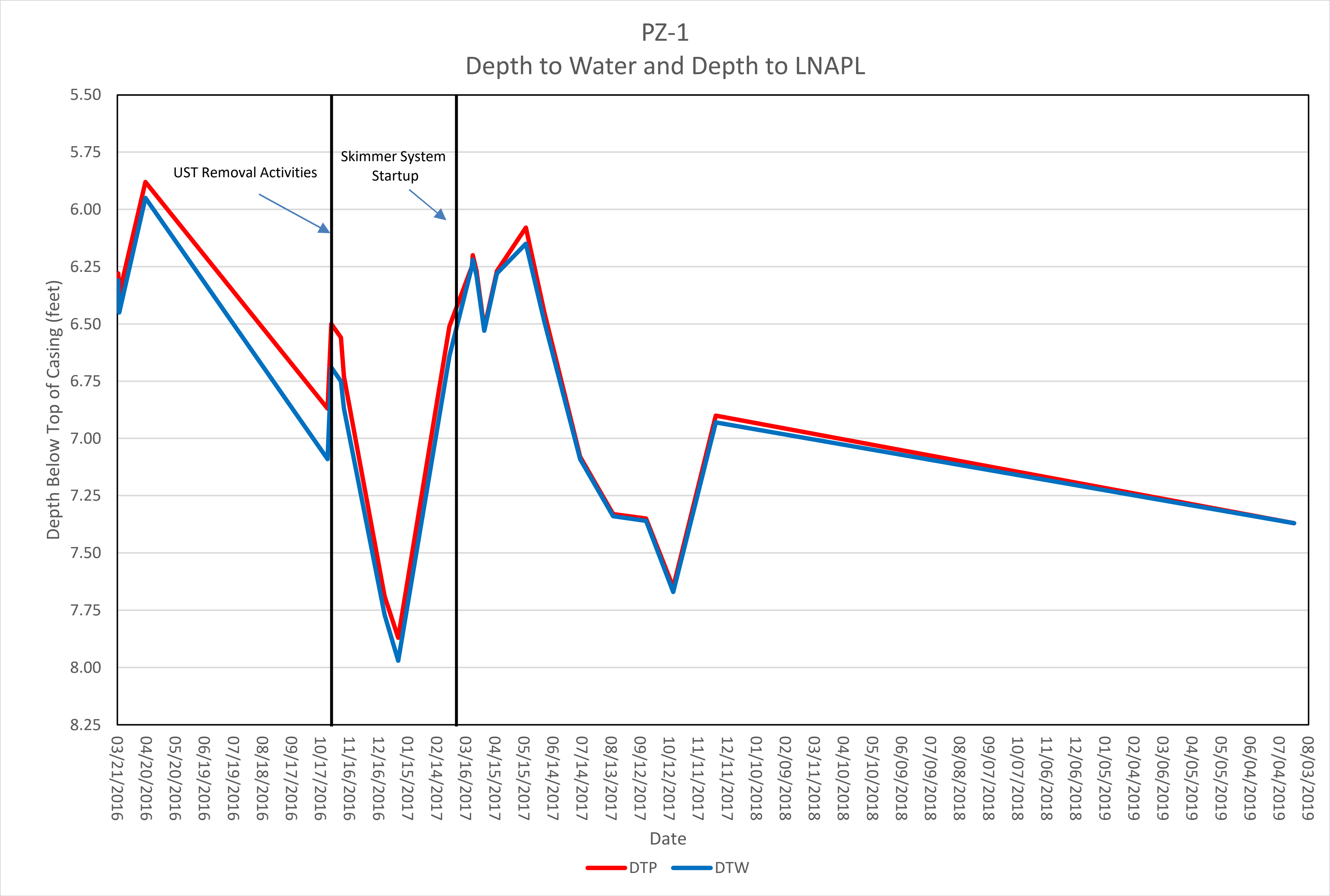
Diesel



Heavy Oil



Attachment 3
LNAPL Depth Plots


PZ-1
Depth to Water and Depth to LNAPL
5.50
5.75
6.00
6.25
6.50
6.75
7.00
7.25
7.50
7.75
8.00
8.25
Depth Below Top of Casing (feet)
UST Removal Activities
Skimmer System Startup
03/21/2016
04/20/2016
05/20/2016
06/19/2016
07/19/2016
08/18/2016
09/17/2016
10/17/2016
11/16/2016
12/16/2016
01/15/2017
02/14/2017
03/16/2017
04/15/2017
05/15/2017
06/14/2017
07/14/2017
08/13/2017
09/12/2017
10/12/2017
11/11/2017
12/11/2017
01/10/2018
02/09/2018
03/11/2018
04/10/2018
05/10/2018
06/09/2018
07/09/2018
08/08/2018
09/07/2018
10/07/2018
11/06/2018
12/06/2018
01/05/2019
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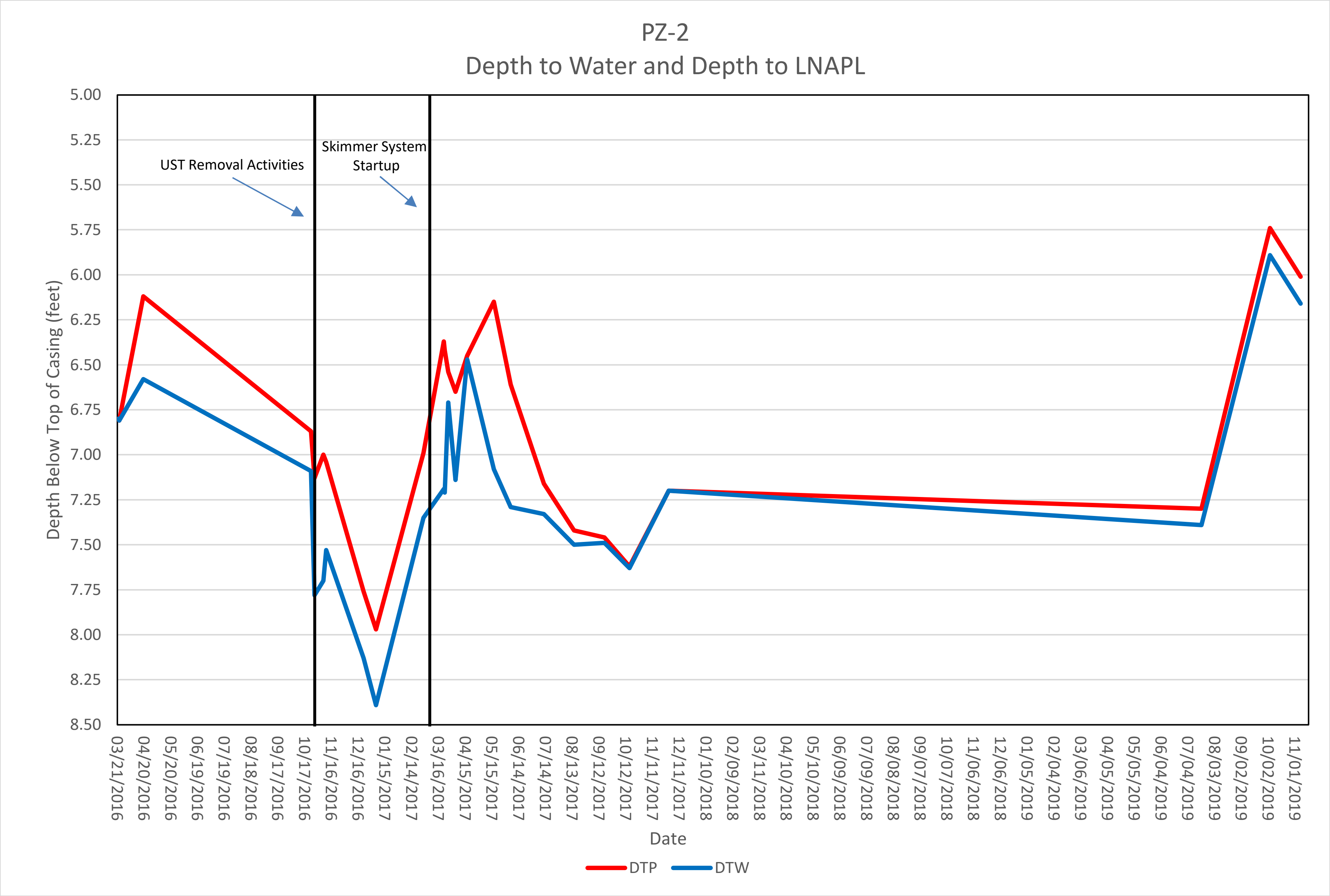
07/04/2019
08/03/2019
Date
DTP
DTW


PZ-2
Depth to Water and Depth to LNAPL
UST Removal Activities
Skimmer System Startup
Depth Below Top of Casing (feet)
5.00
5.25
5.50
5.75
6.00
6.25
6.50
6.75
7.00
7.25
7.50
7.75
8.00
8.25
8.50
Date
03/21/2016
04/20/2016
05/20/2016
06/19/2016
07/19/2016
08/18/2016
09/17/2016
10/17/2016
11/16/2016
12/16/2016
01/15/2017
02/14/2017
03/16/2017
04/15/2017
05/15/2017
06/14/2017
07/14/2017
08/13/2017
09/12/2017
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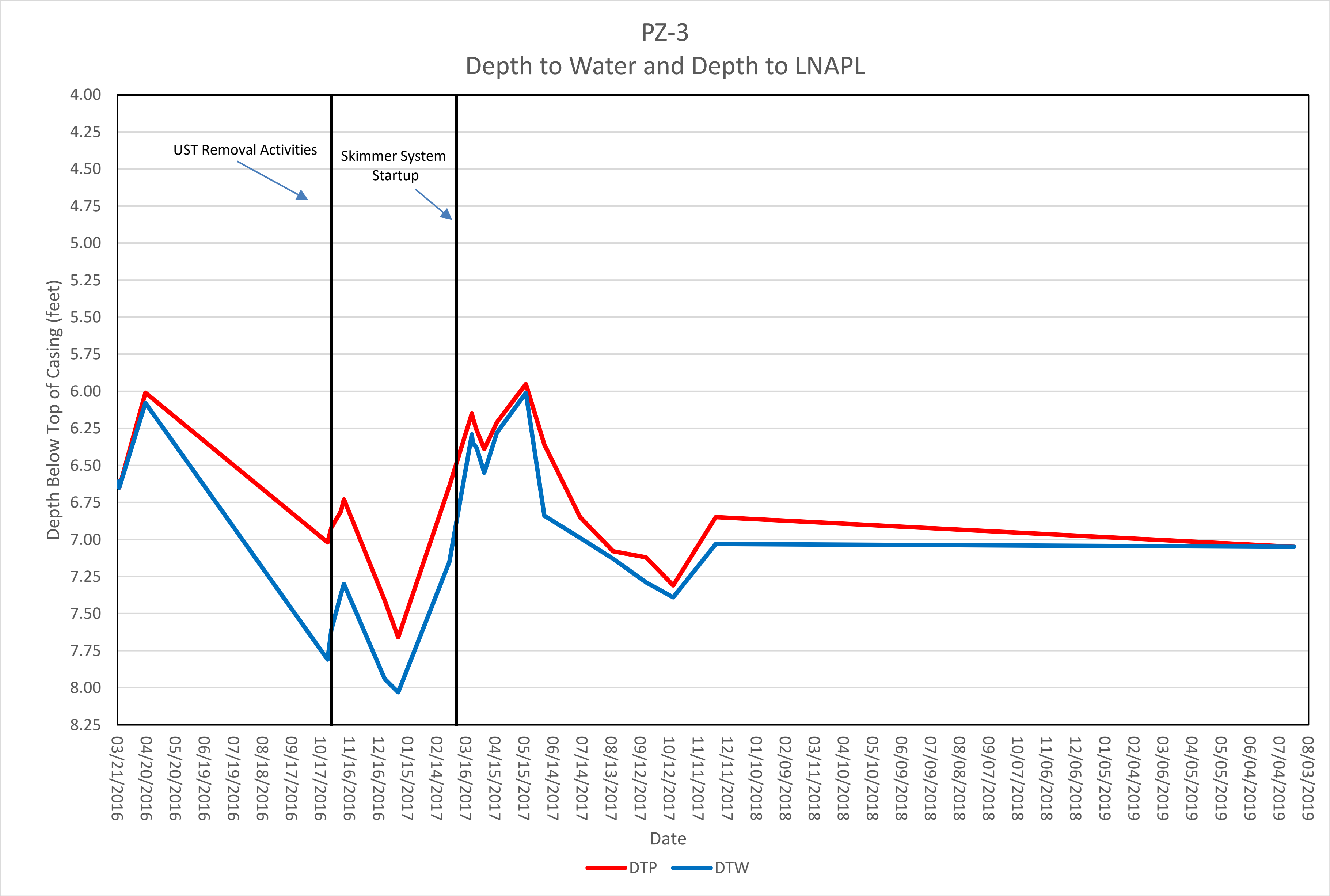
11/01/2019
DTP
DTW


PZ-3
Depth to Water and Depth to LNAPL
Depth Below Top of Casing (feet)
4.00
4.25
4.50
4.75
5.00
5.25
5.50
5.75
6.00
6.25
6.50
6.75
7.00
7.25
7.50
7.75
8.00
8.25
UST Removal Activities
Skimmer System Startup
03/21/2016
04/20/2016
05/20/2016
06/19/2016
07/19/2016
08/18/2016
09/17/2016
10/17/2016
11/16/2016
12/16/2016
01/15/2017
02/14/2017
03/16/2017
04/15/2017
05/15/2017
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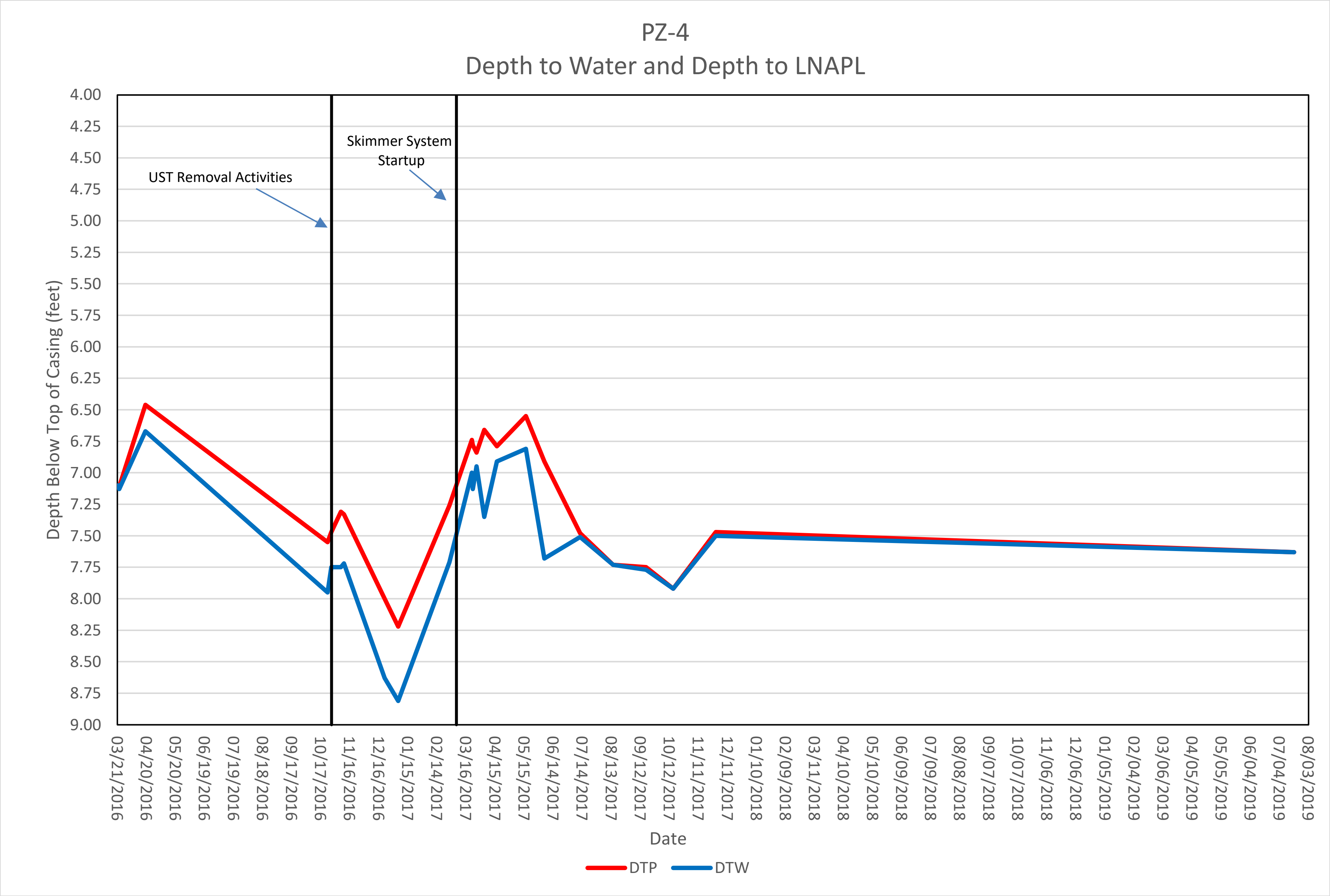
08/03/2019
Date
DTP
DTW


PZ-4
Depth to Water and Depth to LNAPL
Depth Below Top of Casing (feet)
4.00
4.25
4.50
4.75
5.00
5.25
5.50
5.75
6.00
6.25
6.50
6.75
7.00
7.25
7.50
7.75
8.00
8.25
8.50
8.75
9.00
UST Removal Activities
Skimmer System Startup
03/21/2016
04/20/2016
05/20/2016
06/19/2016
07/19/2016
08/18/2016
09/17/2016
10/17/2016
11/16/2016
12/16/2016
01/15/2017
02/14/2017
03/16/2017
04/15/2017
05/15/2017
06/14/2017
07/14/2017
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12/06/2018
01/05/2019
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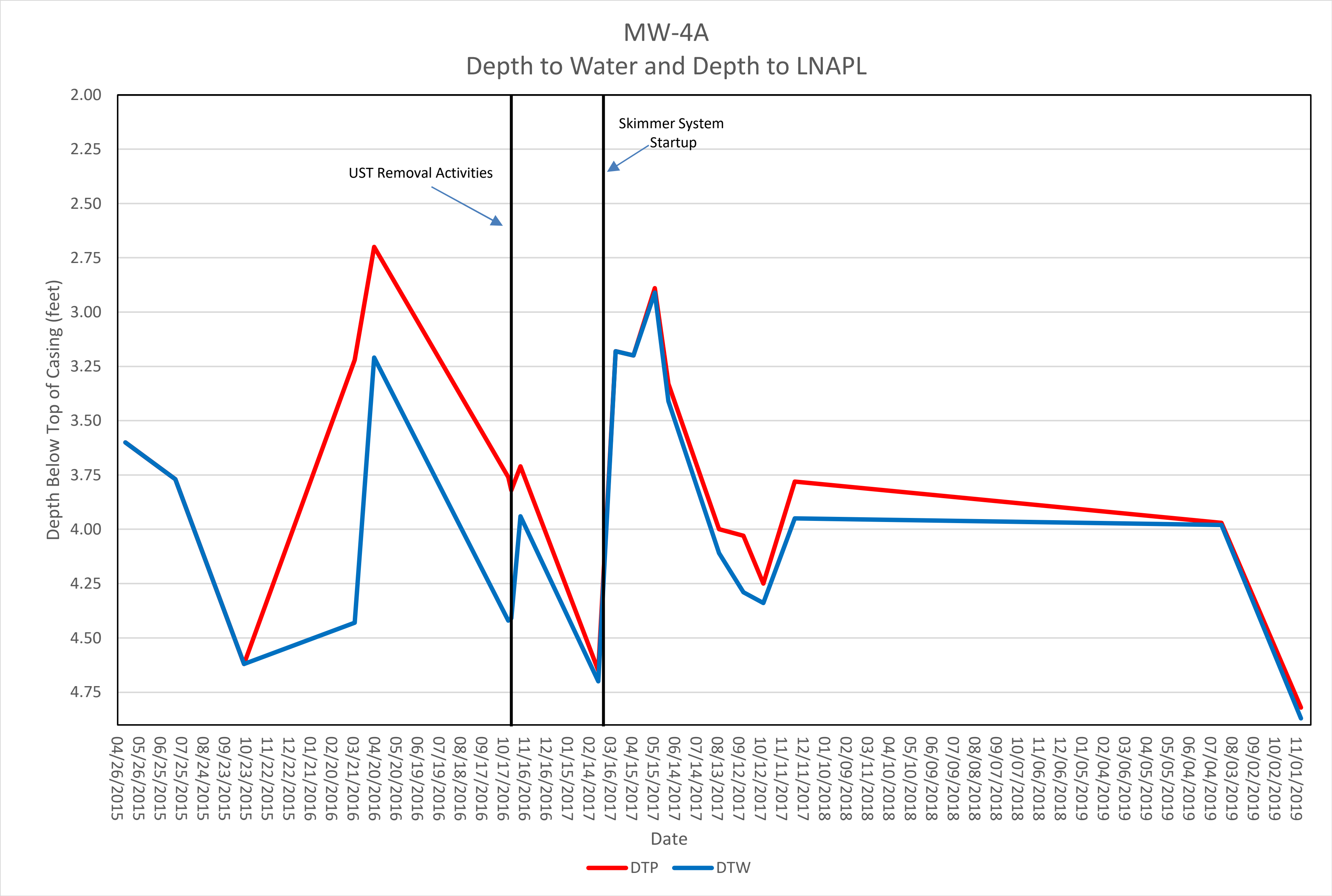
08/03/2019
Date
DTP
DTW


MW-4A
Depth to Water and Depth to LNAPL
Depth Below Top of Casing (feet)
2.00
2.25
2.50
2.75
3.00
3.25
3.50
3.75
4.00
4.25
4.50
4.75
UST Removal Activities
Skimmer System Startup
Date
04/26/2015
05/26/2015
06/25/2015
07/25/2015
08/24/2015
09/23/2015
10/23/2015
11/22/2015
12/22/2015
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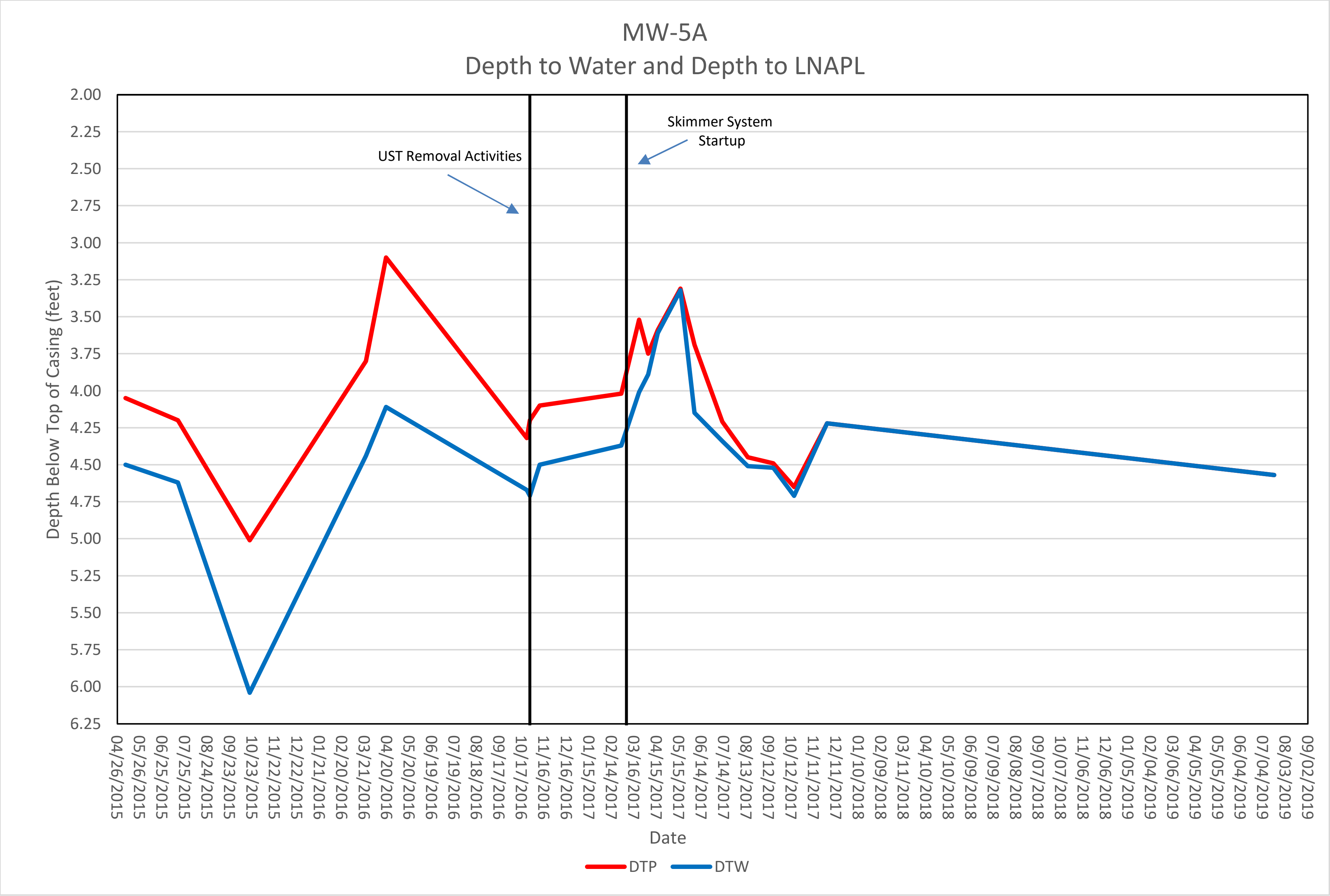
11/01/2019
DTP
DTW


MW-5A
Depth to Water and Depth to LNAPL
Depth Below Top of Casing (feet)
2.00
2.25
2.50
2.75
3.00
3.25
3.50
3.75
4.00
4.25
4.50
4.75
5.00
5.25
5.50
5.75
6.00
6.25
UST Removal Activities
Skimmer System Startup
04/26/2015
05/26/2015
06/25/2015
07/25/2015
08/24/2015
09/23/2015
10/23/2015
11/22/2015
12/22/2015
01/21/2016
02/20/2016
03/21/2016
04/20/2016
05/20/2016
06/19/2016
07/19/2016
08/18/2016
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01/15/2017
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11/06/2018
12/06/2018
01/05/2019
02/04/2019
03/06/2019
04/05/2019
05/05/2019
06/04/2019
07/04/2019
08/03/2019
09/02/2019
Date
DTP
DTW

Big B Mini Mart Site

Cleanup Action Plan

Appendix B
Engineering Design Report

LIMITATIONS

This report has been prepared for the exclusive use of Big B LLC, their authorized agents, and regulatory agencies. It has been prepared following the described methods and information available at the time of the work. No other party should use this report for any purpose other than that originally intended, unless Floyd|Snider agrees in advance to such reliance in writing. The information contained herein should not be utilized for any purpose or project except the one originally intended. Under no circumstances shall this document be altered, updated, or revised without written authorization of Floyd|Snider.

Big B Mini Mart Site
Engineering Design Report

This document was prepared for
Mr. Surjit Singh
under the supervision of:

State of Washington
605
Licensed Geologist
Thomas Henry Colligan

7/28/2020

Name: Thomas H. Colligan
Date: 7/28/2020

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List of Acronyms and Abbreviations

Acronym/ Abbreviation	Definition
Anderson	Anderson Rock and Demolition Pits
BMP	Best management practice
BNSF	BNSF Railway Company
BTEX	Benzene, toluene, ethylbenzene, and xylenes
CAP	Cleanup Action Plan
cfm	Cubic feet per minute
COC	Contaminant of concern
DRO	Diesel-range organics
DU	Decision unit
Ecology	Washington State Department of Ecology
EDR	Engineering Design Report
GRO	Gasoline-range organics
HASP	Health and Safety Plan
HCID	Hydrocarbon identification
LNAPL	Light non-aqueous-phase liquid
mg/kg	Milligrams per kilogram
MNA	Monitored natural attenuation
MTCA	Model Toxics Control Act
ORO	Oil-range organics
PID	Photoionization detector
POC	Point of compliance
ppm	Parts per million
PVC	Polyvinyl chloride
RI/FS	Remedial Investigation and Feasibility Study
ROI	Radius of influence
ROW	Right of way
SEPA	State Environmental Policy Act
Site	Big B Mini Mart Site

Acronym/ Abbreviation	**Definition**
TOC	Total organic carbon
TPH	Total petroleum hydrocarbons
USEPA	U.S. Environmental Protection Agency
UST	Underground storage tank
WAC	Washington Administrative Code

1.0 Introduction

Floyd|Snider has prepared this Engineering Design Report (EDR) to meet the requirements of EDRs as defined in Washington Administrative Code (WAC) 173-340-400(4)(a) and in accordance with the Scope of Work per the 2019 Agreed Order No. DE 16307 between the Washington State Department of Ecology (Ecology) and the Potentially Liable Persons.

This EDR describes the engineering concepts and design criteria for the cleanup action selected by the Ecology for the Big B property located at 1611 Canyon Road in Ellensburg, Washington (Figure 1.1).

1.1 PURPOSE AND OBJECTIVES

The objective of this document is to provide sufficient detail to implement the post-excavation activities. The draft Cleanup Action Plan (CAP) identified a two-part cleanup action that includes the following:

- Light non-aqueous-phase liquid (LNAPL)-saturated soil that is present in three separate areas at the Big B Mini Mart Site (Site). Remediation will consist of removal of LNAPL-saturated soil by excavation and treatment via landfarming activities on the northern, paved portion of the property.
- Remaining soil with total petroleum hydrocarbon (TPH) impacts greater than Model Toxics Control Act (MTCA) Method A cleanup levels but not saturated with LNAPL will be remediated in situ by bioventing.

The majority of the remedial construction consists of excavation of LNAPL-saturated soil and ex situ treatment of that soil in the landfarming area. Design criteria for these remedial actions are the following:

- Remedial activities will be reviewed and approved by BNSF Railway Company (BNSF) and an updated Access Agreement will be negotiated that includes soil removal on BNSF right of way (ROW) prior to starting remedial activities.
- Excavation of LNAPL-saturated soil shall be completed per Section 3.2.
- LNAPL-saturated soil will be treated in the landfarming area (details provided in Section 3.5).
- After the excavation activities, the bioventing system will be installed to address soil in the vadose zone that contains hydrocarbon concentrations greater than MTCA Method A cleanup levels. This EDR describes bioventing pilot test activities that will be performed after excavation activities. A pilot test summary report will be submitted that summarizes the results and the proposed final design and layout of the bioventing system.
- A soil vapor assessment shall be performed to determine whether there is a vapor intrusion risk for occupants in a potential future building.

Design criteria that address groundwater contamination include the following:

- Removal of LNAPL-saturated soil from the smear zone
- Bioventing of residual soil in the vadose zone and seasonally unsaturated smear zone
- Implementation of a groundwater monitoring program to confirm the effectiveness of the Site cleanup Site cleanup
- As a contingency, installation and implementation of a biosparge system, or other contingency actions such as additional soil excavation, if groundwater does not meet MTCA Method A cleanup levels after 5 years of monitoring

Design criteria for the general completion of the project include the following:

- Remediation work shall comply with applicable or relevant and appropriate requirements.
- Remediation work shall comply with appropriate industry, professional engineering, and technical standards.

1.2 ROLES AND RESPONSIBILITIES

Big B, BNSF, Big B's consultant, the selected contractor and their subcontractors, and Ecology will be involved as part of the project. Big B is the contracting party and is ultimately responsible for the performance of the work. Big B's consultant will ensure that implementation of the EDR is satisfactory, will provide remedial construction oversight, will provide all sampling required and discussed in this report, and will document the performance of the remedial construction. The contractor and their subcontractors will be responsible for all remedial construction Site work including implementation of best management practices (BMPs), excavation, transport and placement of LNAPL-saturated soil within the onsite ex situ treatment area, offsite disposal, installation of bioventing system, site security, and other responsibilities to implement the selected remedial action. Ecology will provide review and approval of reports as described herein.

1.3 DOCUMENT ORGANIZATION

The remainder of this EDR is organized as follows:

- **Section 2.0.** Presents a description of the Site and a brief summary from the CAP describing the contaminants of concern (COCs) and cleanup levels for the Site.
- **Section 3.0.** Presents the design for the remedial construction activities at the Site. This includes permitting, site preparation, excavation, soil handling and disposal or landfarming treatment, the bioventing pilot test, and well and vapor point installation.
- **Section 4.0.** Presents the monitoring that will be conducted as part of the remedial excavation and construction, including confirmation sampling.
- **Section 5.0.** Presents the health and safety components that will be followed as part of the remedial construction.

- **Section 6.0.** Presents the schedule for implementation.
- **Section 7.0.** Presents a discussion of the reporting that will be completed as part of the remedial construction.
- **Section 8.0.** Presents the references for this document.

2.0 Site Description and Summary of Environmental Conditions

The Big B property is located in Kittitas County (parcel no. 958654) within Township 17N, Range 18E, and Section 11. The property is located on approximately 43,960 square feet or 1.05 acres of rectangular paved and unpaved land. The southern half of the parcel consists of currently inactive service station facilities, and the northern half contains approximately 18,500 square feet of unused paved area (Figure 2.1). The Site is defined under MTCA by the extent of contamination that is beneath the Big B property and extends onto the adjacent Astro Station Mini Mart (herein referred to as Toad's) property as well as the adjacent railway ROW land owned by BNSF.

The property was first developed as a service station in the early 1970s. There is no known prior property use. The southern half of the property includes two former pump islands (northern and southern), a closed convenience store, and former locations of underground storage tanks (USTs) including two former 10,000-gallon steel USTs, a former 4,000-gallon steel UST on the north side of the store, and a former 12,000-gallon baffled steel UST (split into 8,000 gallons of diesel storage and 4,000 gallons of unleaded gasoline storage) on the south end of the property (Figure 2.2 of the Remedial Investigation and Feasibility Study [RI/FS]; Floyd|Snider 2018).

The Site also includes releases that migrated to a portion of the property to the south. An active gasoline station and convenience shop, Toad's, is located to the south of the Big B property at 1703 Canyon Road. Soil and groundwater on the Toad's property are impacted by historical releases from the Big B property, and areas impacted are considered by Ecology to be part of the Site. Of note is that the Toad's property is also a separate site due to releases attributable to the gas station operations on that property. An interim action was conducted in 2016 at Toad's (Cleanup Site ID 12318), which consisted of excavation and disposal of petroleum-contaminated soil off site. This document focuses on soil and groundwater conditions that are a part of the Site. It does not describe releases attributable to the Toad's site nor does it describe cleanup activities to remediate and monitor those releases.

Refer to the draft CAP for further information on Site geologic and hydrologic conditions.

2.1 CONTAMINANTS OF CONCERN

The following COCs were identified at the Site at concentrations exceeding MTCA A cleanup levels in either soil or groundwater or both: diesel-range organics (DRO); gasoline-range organics (GRO); benzene, toluene, ethylbenzene, and xylenes (BTEX); and naphthalene.

2.2 CLEANUP LEVELS

The following sections summarize the COCs and cleanup levels established for the Site. These cleanup levels, presented in Tables 2.1 and 2.2, are copied from the draft CAP. Refer to the RI/FS for a more thorough description of these cleanup levels.

2.2.1 Soil Cleanup Levels

The cleanup levels for soil are presented in Table 2.1 for GRO, DRO, BTEX, and naphthalene. MTCA Method A cleanup levels are used for soil.

Table 2.1
Soil Cleanup Levels

Contaminant of Concern	On-Property Maximum Detected Concentration (mg/kg)	Protection of Groundwater MTCA Method A (1) (mg/kg)	Cleanup Levels for Protection of Terrestrial Ecological Receptors (2) (mg/kg)	Proposed Soil Cleanup Level (mg/kg)
DRO	24,000	2,000	15,000	2,000
GRO	3,700	30 (3)	12,000	30
Benzene	1.1	0.03	NA	0.03
Ethylbenzene	15	6	NA	6
Toluene	11	7	NA	7
Xylenes	47	9	NA	9
Naphthalene	6.9	5	NA	5

Notes:
1 Refer to the footnotes of Table 740-1 of MTCA for more details on cleanup level criteria.
2 Concentrations derived from WAC Table 749-2 and using the levels for Industrial/Commercial Sites.
3 Use this value when benzene is present in soil.

Abbreviations:
mg/kg Milligrams per kilogram
NA Not applicable

2.2.2 Point of Compliance for Soil

The actual and potential exposure pathways include the direct contact pathway, the soil leaching to groundwater pathway, and the vapor intrusion pathway. Soil cleanup levels must be met throughout the Site. The points of compliance extend throughout the soil profile from the ground surface and may extend below the water table.

2.2.3 Groundwater Cleanup Levels

The cleanup levels for groundwater at the Site are presented in Table 2.2 for DRO, GRO, and benzene. Cleanup levels are based on estimates of the highest beneficial use and the reasonable maximum exposure expected to occur under both current and potential future Site use. Under MTCA (WAC 173-340-720), drinking water is the highest beneficial use, and exposure to contaminants through ingestion and other domestic uses represents the reasonable maximum exposure for all sites. Therefore, groundwater analytical results are compared to MTCA Method A cleanup levels for all groundwater COCs. Table 2.2 presents groundwater cleanup levels for Site COCs.

Table 2.2
Groundwater Cleanup Levels

Contaminant of Concern	Maximum Detected Concentration (µg/L)	MTCA Method A Groundwater (1) (µg/L)	Proposed Cleanup Level (µg/L)
DRO	3,400	500	500
GRO	2,400	800 (2)	800
Benzene	270	5	5

Note:
1 Refer to the footnotes of Table 740-1 of MTCA for more details on cleanup level criteria.
2 Use this value when benzene is present.

Abbreviations:
µg/L Micrograms per liter

2.2.4 Groundwater Point of Compliance

The standard point of compliance (POC) for groundwater under MTCA is "throughout the site from the uppermost level of the saturated zone extending vertically to the lowest most depth which could potentially be affected by the site" (WAC 173-340-720(8)(b)). At the Site, the standard POC for groundwater is applied.

3.0 Remedial Construction Activities

3.1 PERMITTING

Local permitting requirements for remedial construction fall within the City of Ellensburg jurisdiction. The applicable requirements for the work require that a Site Development Permit will be obtained with the City of Ellensburg along with a Critical Area Determination Waiver because the landfarming area will be within the 100-year flood zone. The Site Development Permit will detail the steps taken to mitigate wind erosion and stormwater from leading to runoff into the city's storm system. In addition, due to the volume of soil to be excavated, an Engineered Grading Permit is required under the municipal code. Remediation activities, including excavation, landfarming, and trenching for the bioventing system, will disturb less than 1 acre. Therefore, a Construction Stormwater General Permit and Stormwater Pollution Prevention Plan are not required; however, all applicable BMPs related to control of stormwater runoff will be implemented.

A State Environmental Policy Act (SEPA) checklist will be completed describing the remedial action. Ecology is the lead agency for the SEPA review and will provide a SEPA checklist along with the draft CAP that will undergo public comment.

3.2 SITE PREPARATION AND UTILITY REMOVAL

The first construction activity that will be conducted at the Site is site preparation. These activities will be conducted to provide erosion and sediment control BMPs, address surface contamination, and secure the Site with fencing around the perimeter.

3.2.1 Site Preparation

Prior to the start of the excavation activities, the following activities will be conducted (in no particular order):

Access Agreement: Prior to starting remedial activities, BNSF will review and approve of soil removal activities on BNSF ROW and an updated access agreement will be negotiated that includes soil removal and monitoring well installation on BNSF ROW.

Site Security: A perimeter fence currently exists at the Site on the southern half of the property. However, in order to secure the staging area for landfarming, the current perimeter fence will be expanded to include the northern portion of the property where the landfarming treatment will be conducted. The fence will be maintained for the duration of the work. An access gate onto the property will be on the northeastern portion of the property along Canyon Road. An ingress and egress route will be located between Canyon Road and the landfarming area. A secondary access gate along Canyon Road will be added if deemed necessary (Figure 3.1).

Excavation activities performed on the Toad's property will occur after the LNAPL excavation activities on the Big B property are completed through backfilling of landfarmed soil to allow access for heavy equipment to safely traverse the Big B property to access the Toad's property. A perimeter fence will be temporarily placed around the excavation footprint on the Toad's property in a manner that will have the least impact on Toad's business operations (Figure 3.1).

Monitoring Well Decommissioning and Removal: Prior to initiating excavation activities, monitoring wells located within the excavation/shoring footprint will be decommissioned in accordance with Chapter 18.104 RCW. These include monitoring wells MW-4A, located on BNSF ROW, and MW-9 located on the Big B property and monitoring wells MW-12/P6, MW-13/P10, MW-14, PZ-23, located on the Toad's property, and PZ-24, and PZ-25, located on BNSF ROW (Figure 3.2). If field observations determine that the excavation needs to be expanded to include any other wells, those wells will be decommissioned and re-installed. Re-installation of the monitoring well network is discussed in further detail in Section 3.8.

Stormwater Control: Temporary erosion and stormwater controls will be set up as required by the City of Ellensburg's Site Development Permit. These controls will include using Visqueen sheeting and hay bales beneath and surrounding the landfarming plot, placing filter socks in the stormwater drains, and covering the stockpiled soil with plastic sheeting. These BMPs will be implemented to keep soil confined to the property and to prevent soil from entering stormwater drains, either on or off site.

Staging and Stockpile Areas: The stockpiled soil in the landfarming area will be uniformly spread out to a thickness of between 12 and 18 inches. The soil will be placed on and covered with plastic sheeting secured with sandbags. The soil will be covered with plastic sheeting secured with sandbags to prevent wind erosion of soil and to abate TPH odors; although, odors were not an issue during the 2019 pilot test. Once spread out, the soil in the landfarming area will be divided into five equal windrowed sub-areas, or decision units (DUs; Figure 3.1).

South of the Big B and Toad's property boundary, approximately 120 cubic yards and 90 cubic yards of TPH contaminated soil is expected to be excavated beneath BNSF and Toad's properties, respectively. Excavated soil will be placed in the landfarming area for ex situ treatment or directly loaded on trucks and transported off site for disposal to the Anderson Rock and Demolition Pits (Anderson) Landfill in Yakima, Washington (refer to Section 3.4.2 for details). Soil for offsite disposal will either be direct loaded or, more likely, stockpiled on the Big B property and loaded onto trucks following completion of excavation. Trucks egress and ingress routes will be located on the Big B property to minimize disruption to Toad's business.

3.2.2 Utility Protection, Abandonment, or Removal

All utilities have already been abandoned on the property except for a sanitary sewer line that is oriented north-south and an overhead electric line in the southeastern corner of the Big B property. The sanitary sewer is approximately 12 feet bgs, which is deeper than the planned excavation depth and will not be encountered; however, care will be taken not to excavate to this depth within the vicinity of the sanitary sewer utility (Figure 3.2). The electric overhead is connected to the air compressor shed and will be disconnected if required. Both a public and a private utility locate will be conducted to verify the presence or absence of utilities, including BNSF-owned utilities or utilities along the BNSF ROW.

A private utility locate will be completed on both BNSF and Toad's properties to identify any potential utilities in the subsurface. The sanitary sewer line is also present beneath the Toad's property at a depth of 12 feet bgs. Any utilities encountered will be protected during cleanup activities.

3.2.3 Erosion and Sediment Controls

Erosion and sediment control BMPs will be installed and maintained for the duration of the project. These will be installed to prevent offsite migration of contamination via dust, trackout, or stormwater and for general environmental control. The following BMPs, or equivalent, will be used:

- Using Visqueen sheeting and hay bales beneath and surrounding the landfarming plot to prevent offsite migration.
- Placing filter socks in the stormwater drains that will be checked on a daily basis during excavation activities and on a weekly basis during landfarming activities. Filter socks will be cleaned or replaced, if necessary.
- Covering the stockpiled soil with plastic sheeting as erosion control devices.
- Maintain excavation equipment in good working order. The contractor must immediately clean up any contaminated soil resulting from any spilled hydraulic oils or other hazardous materials.
- Minimize equipment traffic through the excavation area to prevent contaminated soils from being transported via trackout to other parts of the Site or off site.
- Establish truck haul routes before beginning offsite transport of contaminated soil and use onsite truck routes that minimize or prevent traffic over contaminated areas.
- Locate loading areas for contaminated soil in, or at the edge of, the stockpile location(s).
- Ensure that all transported soil, on or off site, does not contain free liquids.
- Load trucks in a manner that prevents the spilling, tracking, or dispersal of contaminated soils, and cover loads prior to exiting the Site during times of heavy rain, or if the soil being transported has considerable odor or is excessively dry and will generate dust on public highways.
- Remove soil from the wheels of vehicles before they exit the Site for demobilization or soil transport.

3.3 LNAPL-SATURATED SOIL EXCAVATION

3.3.1 General

Remedial activities include the excavation of the entire area of LNAPL-containing soil beneath the Big B, BNSF, and Toad's properties to the maximum extent possible, as shown on Figures 3.1 and 3.2. The total excavation volume of contaminated soil from these properties is expected to be approximately 760 cubic yards. Excavation sidewalls will be at a 1:1 slope to facilitate the safe excavation of contaminated soil to an expected maximum depth of 7 to 8 feet bgs. However, any excavation activities on BNSF property will be conducted such that the active BNSF rail line is not adversely impacted. Consistent with BNSF Guidelines for Temporary Shoring, the excavation adjacent to the railroad will have a sidewall slope ratio of not greater than 1:2 starting from 15.5 feet from the centerline of the railway (BNSF and Union 2004). Excavations will not use shoring.

Excavation activities will occur over two phases, north and south of the Big B and Toad's property boundary. The first will be performed on the Big B property and BNSF property adjacent to the west of the Big B property, north of the Big B and Toad's property boundary. After the Big B property is backfilled and compacted to grade, a second phase will be performed on Toad's property and BNSF property adjacent to the west of Toad's, south of the Big B and Toad's property boundary.

3.3.2 Soil Excavation and Handling

Excavation will be conducted using standard construction equipment. Contaminated soil will be placed within the designated treatment area will be placed on plastic on pavement and covered with plastic sheeting when not being worked. Refer to Section 3.5 for further treatment area details.

3.3.3 Asphalt Surface—Toad's Property

The asphalt surface will be cut removed for disposal at an asphalt recycling facility and repaved in accordance with the access agreements with Toad's and BNSF following completion of backfilling and compaction.

3.3.4 Presumed Clean Overburden Soil

Excavation of contaminated soil would involve removal and stockpiling the upper 3 feet of clean overburden followed by the removal of approximately 3 to 8 feet of underlying contaminated soil. During excavation, presumed clean overburden soil will be field-screened using olfactory, visual (staining or sheen), and photoionization detector (PID) methods to prevent commingling with underlying contaminated soil. Presumed clean overburden soil will be segregated from suspected contaminated soil (i.e., soil with odor, sheen, or PID response) and stockpiled separately on site. Stockpiled overburden soil will be sampled and analyzed for the Site COCs to confirm that concentrations are less than applicable cleanup levels prior to using the soil as backfill. Details of stockpile sampling are in Section 4.1.2.

3.3.5 LNAPL-Saturated Soil

During the first phase of cleanup activities, three separate excavations are planned on the Big B and BNSF properties to remove approximated 550 cubic yards of LNAPL-saturated soil. During the second phase of cleanup activities, approximately 210 cubic yards of LNAPL-saturated soil will be excavated from the Toad's property and adjacent BNSF property. These preliminary extents are shown on Figure 3.2 and are based on soil analytical data and visual observations of LNAPL in monitoring wells and piezometers. However, each excavation will be expanded beyond their respective proposed extent if LNAPL is observed seeping into the excavation from a sidewall. In addition, field screening tests for assessing LNAPL presence will be conducted using OilScreenSoil (Sudan IV)® dye test field kits. If the Sudan IV field kits indicate that LNAPL-saturated soil is present along a sidewall, the excavation will be expanded prior to the collection of confirmation samples as described in Section 4.0. The use of Sudan IV dye as a field indicator of LNAPL was successfully confirmed during the prior LNAPL Removal Interim Action at this Site. However, the excavation extent to the west is limited by the BNSF ROW and will be negotiated in an updated access agreement with BNSF.

In general, soil will be excavated out to 1 to 2 feet below the water table (expected to occur between 4 and 6 feet bgs). If free product is observed running out of the excavated soil, it will be allowed to drain back into the excavation (e.g., via drain holes in the excavator bucket or on the sloped sidewall walls on plastic adjacent to the excavation) or captured using a vacuum hose and/or adsorbent pads.

In general, to prevent soil sloughing, the sidewalls will be sloped at a 1:1 ratio; however, the excavation on BNSF property and adjacent to the railroad will have a sidewall slope ratio of not greater than 1:2 starting from 15.5 feet from the centerline of the railway (BNSF 2004). The excavation extents shown on Figure 3.2 represents the minimum base of the excavation area. The area may expand depending on field observations and results of confirmational sampling.

Excavated soil beneath the Big B property, adjacent BNSF property, and Toad's property, once free of drainable liquids, will be transported and stockpiled on site for ex situ biological treatment within the landfarming treatment area shown on Figure 3.2 (refer to Section 3.5). However, excavated soil from the Toad's property may alternatively be managed in accordance with Section 3.4.2.

3.4 STOCKPILE MANAGEMENT

Stockpiles will likely be necessary and will be segregated based on the end disposal, treatment, or clean overburden to be used at backfill. Stockpiled soil for reuse will be sampled and analyzed to determine its ultimate disposition (refer to Section 4.1.2 for sampling details).

3.4.1 Clean Overburden Soil

Clean overburden soil will be temporarily stockpiled on the Big B property and covered with Visqueen plastic sheeting until laboratory results indicate the soil can be reused consistent with Ecology's Guidance for Remediation of Petroleum Contaminated Sites (Ecology 2016). All backfilled soil will be placed above the water table. Imported sand and gravel fill will be used to backfill below the water table.

3.4.2 Potential Offsite Disposal (Toad's Property)

Approximately 210 cubic yards of contaminated soil excavated beneath Toad's property will be placed in the landfarming area for onsite ex situ treatment. However, if landfarming and ex situ treatment of this soil is not feasible due to smaller than expected volumes, winter conditions, soil samples do not meet cleanup levels after 90 days, or lack of available landfarming area, the contaminated soil will be transported off site for disposal to the Anderson Landfill in Yakima, Washington. If trucks are not available for direct loading, contaminated soil will be placed on Visqueen plastic sheeting and stockpiled on the Big B property and properly managed to prevent runoff until trucks are available for offsite disposal. Approval from Yakima Health District will be acquired prior to hauling contaminated soil to the Anderson Landfill.

3.5 ONSITE EX SITU BIOLOGICAL TREATMENT

Excavated contaminated soil will be treated on site and reused as vadose zone backfill. Contaminated soil will be placed within a treatment area in two separate areas (one area for DRO-impacted soil and a smaller area with GRO/DRO-impacted soil) and subject to regular aeration and tilling. The paved northern half of the property will be used for the treatment area. The sequence of activities for the landfarming treatment will be as follows:

- Temporary erosion and stormwater controls will be set up as required by the City of Ellensburg's development permit. This includes using Visqueen sheeting and hay bales beneath and surrounding the landfarming plot and placing filter socks in the stormwater drains.
- The soil in the DRO and GRO/DRO landfarming areas will be uniformly spread out to a thickness of between 12 and 18 inches. The stockpiled soil will be placed on and covered with plastic sheeting and secured with sandbags. These BMPs will be implemented to keep soil confined to the property and to prevent soil from entering stormwater drains, either on or off site.
- Soil will be covered with plastic to control odor. However, odor was not an issue during the 2019 landfarming pilot test.
- The soil will always be covered with plastic sheeting secured with sandbags to prevent wind erosion of soil.
- Once spread out, the DRO-impacted soil in the landfarming area will be divided up to four equal windrowed sub-areas, or DUs. The GRO/DRO-impacted soil will be consolidated into its own DU separate from the DRO-impacted soil.

- The soil in the landfarming areas will be rototilled or turned over by backhoe at least once every 2 weeks. During the landfarming activities, the BMPs for prevention of runoff from the Site will be inspected and remedied, as needed.
- Nitrogen and phosphorus fertilizer will be added if low levels of nitrogen, phosphorous, and potassium are observed. Ideally, the nitrogen level should be maintained to a ratio of no greater than 1:100 of the TPH concentration.
- Soil pH will be checked after 1 month to ensure that it is within the range of between 6 and 8 standard units, with the optimum pH range ideally between 6.5 and 7.5.
- Moisture will be checked weekly and added by spray hose if the soil appears to be drying out. The optimum soil moisture range for biodegradation is between 10 and 35 percent.

3.6 BIOVENTING

Bioventing will be used to remediate impacted soil remaining in the vadose/smear zone after excavation activities are complete to ensure protection of groundwater. The potential proposed bioventing design layout is shown on Figure 3.2, pending pilot test results. Bioventing wells can be installed horizontally or vertically; both methods will have the screens placed in the vadose zone just above the high groundwater table in areas with remaining residual contamination. However, a pilot test needs to be conducted prior to installation of a full-scale system in order to determine the Site-specific radius of influence (ROI) and assist in final design layout (whether it be horizontal or vertical piping). Generally, the ROI can range from 5 feet for fine-grained soils to 100 feet for coarse-grained soils (USEPA 2017). The following are steps that will be taken to perform the pilot test. Further details will be provided in a pilot test work plan to be submitted 90 days after completion of the excavation and backfilling activities conducted on the Big B property. General details for the pilot test as described below.

Appendix A includes a schematic diagram of a basic air injection system that will be utilized during the bioventing pilot test. The system is relatively simple involving a blower and monitoring points spaced at increasing distances from the injection point. Fresh air is injected at a low-flow rate and will not produce significant air emissions or require aboveground vapor-phase treatment. Due to shallow groundwater, it is not necessary to install vapor screens at various depths as shown in the schematic diagram.

As part of the pilot test, at least four vapor monitoring points will be installed and spaced at increasing distances (5, 10, 20, and 30 feet) from the injection point. One monitoring point will be installed in an area without hydrocarbon impacts, adjacent to PZ-12, and the rest will be installed within an area with known hydrocarbon impacts (Figure 3.2). However, the final location for the pilot test may change and will be dependent on the remedial excavation extent. The vapor monitoring points will be installed using a rotohammer to create a 1-inch-diameter pilot hole to install the screen and tubing to a depth of 3 feet bgs to ensure that the screens will not be submerged during high groundwater levels (refer to Floyd|Snider Standard Guidelines on Vapor Intrusion included in Appendix B for soil vapor probe installation details).

A small 1.5 horsepower regenerative blower will be placed above ground and tied into an existing monitoring well (MW-10) or piezometer (PZ-6). An inline check valve will be used to regulate the air flow into the well. This blower will be sufficient to provide fresh air at a low flow rate to the subsurface soils for a short-term study to determine the ROI and to stimulate aerobic biodegradation. At a minimum, the blower will be capable of producing a maximum airflow of 50 cubic feet per minute (cfm); however, given the volume of contaminated soil at the Site, it is likely that the air flow required would be much less than 20 cfm, per equation in Example 2-2 in the U.S. Environmental Protection Agency's (USEPA's) Manual for Bioventing Principles and Practice Volume II: Bioventing Design (USEPA 1995).

Prior to providing fresh air to a well or piezometer (either MW-10 or PZ-6 would be good candidates), baseline measurements of carbon dioxide, oxygen, and lower explosive limit will be measured from all monitoring points using a 4-gas meter. Three tubing volumes will be purged prior to recording baseline measurements. A low-flow extraction of 0.03 to 0.07 cfm will be used.

During purging, measurements of carbon dioxide, oxygen, and lower explosive limit will be recorded at 3- to 5-minute intervals using a 4-gas meter. Purging will continue until parameters are approximately stable (within 10 percent) for three consecutive readings, or a maximum of 30 minutes of purging has elapsed. Final measurements will be recorded as baseline concentrations.

The pilot test may also include measuring the pressure effect in an adjacent well and/or piezometer location. This will be accomplished by using a Magnehelic™ or equivalent pressure gauge fixed to a 2-inch polyvinyl chloride (PVC) cap. The cap with a pressure gauge will be placed over the top of casing of either an adjacent monitoring well or piezometer, such as MW-9, PZ-7, or PZ-12. The initial pressure will be recorded, and once the blower is turned on, the pressure over time will be recorded. Typical record sheets for the bioventing pilot test study are included in Appendix A.

While providing fresh air, the pilot test will consist of collecting carbon dioxide, oxygen, and lower explosive limit measurements from the newly installed measuring points using a 4-gas meter over time and compare those measurements with baseline measurements. Typically, measurement of soil gas will be conducted at 2, 4, 6 and 8 hours, depending on permeability of the soil. Increases in oxygen and decreases in carbon dioxide concentrations indicate that fresh air is influencing the sampling point.

After the injection test, the blower is turned off and measurements are collected again from adjacent locations over time, depending on the rate at which oxygen is utilized. If oxygen uptake is rapid, more frequent monitoring is required. If it is slower, less frequent readings are acceptable. Increases in carbon dioxide and decreases in oxygen concentrations are indications of biological metabolism of constituents. Typical record sheets for the bioventing pilot test study are included in Appendix A.

If the pilot test indicates that the lateral ROI is at least 20 feet at reasonably low injection rates of 10 to 20 cfm, then the proposed bioventing system will consist of 2-inch piping with either horizontal or vertical screens placed above the groundwater table with areas of remaining residual contamination as shown on Figure 3.2. If results indicate that the lateral ROI is greater or less than 20 feet, the system layout will be redesigned to be more efficient or more effective, respectively. An EDR addendum will be prepared following the pilot test to provide details such as the field limits of residual soil contamination, pilot test results, and a proposed final design and specifications of the system. The addendum will also include an Operations and Maintenance Plan.

3.6.1 Operations and Maintenance

An Operations and Maintenance Plan will be prepared following installation of the full-scale bioventing system.

3.7 BACKFILL AND FINAL GRADING

Clean overburden soil with COC concentrations less than MTCA Method cleanup levels will be used to backfill the excavations such that the remaining excavation depth is 4 feet or less. The excavation extent on BNSF property will be backfilled with clean imported fill below the water table and with laboratory-confirmed clean overburden soil above the water table, as per the access agreement. Approval to backfill above the water table with clean overburden will be obtained from BNSF prior to backfilling. If clean overburden soils do not meet BNSF requirements, excavations on the BNSF property will be backfilled above the water table with imported native sand and gravel from a local pit. In addition, soils on BNSF property will be compacted between 90 and 95 percent per the access agreement and in accordance with BNSF engineering requirements.

The excavation extent on the Big B property will be backfilled to surface reusing the landfarmed soil within the vadose zone backfill once COC concentrations are less than MTCA Method A cleanup levels. Refer to Sections 4.1.2.1 and 4.1.2.3 for stockpile sampling and landfarmed treatment details, respectively.

In order to minimize business impact on Toad’s, the excavation will be immediately backfilled with clean imported soil. Backfill material will be compacted, and the excavation footprint will be repaved to match the original surface on the BNSF ROW and Toad’s property.

3.8 MONITORING WELL INSTALLATION AND DEVELOPMENT

After remedial activities are completed and the bioventing system has been installed, three monitoring wells will be installed in order to conduct performance and compliance monitoring and sampling. Monitoring wells MW-2A, MW-4B, and MW-9A will be replaced and installed on the Big B and BNSF properties (Figure 3.2). Ecology will discuss the necessity of well replacement with the Potentially Liable Persons group, if any additional wells are decommissioned during excavation activities. Ecology has the final decision concerning the groundwater points of compliance.

Wells will be installed by a licensed driller in accordance with applicable regulations using a direct-push probe/hollow-stem auger combo rig. Soil samples will be collected continuously to a total depth of 15 feet and logged by field personnel under the direction of a licensed geologist. All down-hole drilling equipment will be decontaminated before use and between drilling locations.

The wells will be constructed of 2-inch-diameter Schedule 40 PVC pipe with a flush threaded riser, including a threaded end plug and a machine-slotted 10-foot-long, 10-slot well screen. The wells will be screened from 3 to 13 feet bgs. The annular space around the screen zone of each well will be backfilled with clean silica sand. The annular space above the filter pack will be sealed with bentonite chips. Bentonite placed above the water table will be hydrated with potable water. All materials will be placed concurrently with casing withdrawal. The surface of each well will be completed with a flush-mounted, traffic-grade steel monument, and the well will be secured by a lockable gasket cap.

As-built construction details, including the total depth of each boring and the placement depths of the filter pack, the bentonite seal, and the surface completion, will be measured to the nearest 0.1 foot. Well logs, including soil sample description and as-built construction details, will be prepared after well completion.

All existing and new wells on the property will be developed by surging with a bailer or surge block followed by purging with an electric whaler pump. Surging and purging will be repeated until evacuated water is visibly clean and essentially sand-free. Well development will proceed until field parameters stabilize to within ±10 percent on three consecutive measurements or until 10 well volumes have been purged. All down-hole well development tools will be decontaminated prior to use for each well. Well construction and well development activities will be conducted in accordance to Floyd|Snider's Well Construction and Well Development Standard Guidelines, which are included in Appendix B.

3.9 SOIL VAPOR ASSESSMENT

Future Site-use plans include using the existing building; therefore, a temporary sub-slab vapor point will be installed in the slab of the current building footprint (Figure 3.3). A Cox-Calvin & Associates, Inc., VAPOR PIN® point will be installed with a stainless-steel secure cover. The vapor pin will extend 6 inches below the surface of the concrete floor slab in order to collect soil vapors accumulating directly under the slab. The standard operating procedure will be followed during installation of the vapor pins (Appendix B).

Once the vapor pin is installed, it will be allowed 48 hours to equilibrate, prior to collecting a soil vapor sample. Soil gas results will be compared to screening levels presented in the updated Table B-1 of Ecology's Vapor Intrusion Guidance; furthermore, if needed, results will be used to develop site-specific indoor air cleanup levels in accordance with Attachment B of Ecology's Implementation Memorandum No. 18 for petroleum vapor intrusion (Ecology 2018a and Ecology 2018b). Vapor pin installation and soil gas sampling activities will be conducted in accordance with Floyd|Snider's Vapor Intrusion Standard Guidelines (Appendix B).

3.10 SURVEY

A licensed surveyor will locate all monitoring wells after installation and survey of the top of well casing to the nearest 0.01 foot in the horizontal and vertical directions. Monitoring well coordinates will be reported relative to the in North American Datum of 1983 Washington State Plane South. Elevations will be reported relative to the North American Vertical Datum of 1988. Well logs will include the Washington State Plane South coordinates of the well and the top of well casing elevation. The coordinate and elevation reference systems will be noted on the well logs.

3.11 5-YEAR BIOSPARGING CONTINGENCY PLAN

Contingency actions will begin for installation and implementation of biosparge system if groundwater cleanup levels are not met after 5 years or if groundwater results do not show a decline in concentrations that will achieve compliance within 5 years following beginning of the bioventing system. A periodic 5-year review will be conducted that will review the groundwater data to determine if there is a declining trend in TPH concentrations due to remedial activities and biodegradation and not associated with seasonal fluctuations or changing groundwater flow directions. The data reviewed will include TPH concentrations with and without silica gel cleanup, Monitored natural attenuation (MNA) data, and groundwater fluctuations and flow direction. Select data will be used to properly perform a trend analysis using tools such as a non-parametric Mann-Kendall test or Ecology’s Natural Attenuation Analysis Tool Package for Petroleum-Contaminated Groundwater (Ecology 2005).

4.0 Monitoring and Reporting

4.1 COMPLIANCE MONITORING REQUIREMENTS

Compliance monitoring requirements associated with the remedy implementation consist of protection monitoring during construction activities, performance monitoring to ensure that remedy construction is in accordance with the project plans and design, and confirmational monitoring following remedy completion to confirm the long-term effectiveness of the remedy.

4.1.1 Protection Monitoring

Protection monitoring will be conducted during both remedy construction and landfarming activities to confirm the protection of human health and the environment. Protection monitoring requirements will be described in a Health and Safety Plan (HASP) addressing worker activities during remedy construction.

4.1.2 Performance Monitoring

Performance monitoring (also commonly referred to as confirmational monitoring) will be conducted during remedial activities. Performance monitoring will consist of collecting clean overburden stockpile samples, collecting confirmation samples along the excavation sidewalls and bottom, landfarming confirmation sampling, and confirmational monitoring of the groundwater well network.

4.1.2.1 Clean Overburden Stockpile Sampling for Reuse and Backfilling

Stockpiled soil for reuse will be sampled and analyzed to determine its ultimate disposition consistent with Ecology's Guidance for Remediation of Petroleum Contaminated Sites (Ecology 2016). A minimum of three samples will be collected from each stockpile up to 100 cubic yards in volume, and five samples will be collected for stockpiles between 100 to 500 cubic yards in volume. Collecting soil samples from the stockpile will be conducted in accordance to Floyd|Snider's Soil Sampling Standard Guideline, which is included in Appendix B. Stockpile samples will be analyzed for any or all of the following:

- Hydrocarbon identification (HCID) by NWTPH-HCID
- GRO by NWTPH-Gx
- DRO and oil-range organics (ORO) by NWTPH-Dx
- BTEX and naphthalene by USEPA Method 8021B

NWTPH-HCID methodology will be used first on the clean overburden stockpile samples to determine the presence (or absence) and type of petroleum product. If the results for the HCID were positive for gasoline or diesel, or both, then the appropriate follow-up analytical method will be used to quantify the product type detected. Stockpiles confirmed to be free of petroleum impacts in exceedance of MTCA Method A cleanup levels will be used to backfill the excavations, such that the remaining excavation depth is 4 feet or less. Clean overburden stockpiles with hydrocarbon detections exceeding their respective MTCA Method A cleanup levels will be transported and placed within the landfarming area for treatment.

4.1.2.2 Excavation Confirmation Soil Sampling

Sidewall samples will be collected at the limits of the excavations to confirm the removal of LNAPL-saturated soil. Soil analytical results will be compared to the site-specific DRO and GRO residual saturation values of 8,000 and 1,700 mg/kg, respectively, that were proposed in the 2016 Site Investigation Summary Report (Floyd|Snider 2016).

During the interim action activities and off-property investigation, Sudan IV dye field kits were used to identify the presence of LNAPL (either residually trapped or mobile) in select soil samples after the sample had been shaken in water. The red dye stains petroleum products and provides a visual contrast for the presence of LNAPL in soil samples but does not distinguish the product type. Concentrations between 500 parts per million (ppm) and 2,500 ppm can be observed by the bead turning pink. Sudan IV field kit results indicated a distinct LNAPL layer in locations PZ-23, PZ-24, PZ-28, and PZ-29, which are all locations with DRO concentrations between 12,000 and 13,000 mg/kg. Since the installation of the piezometers, PZ-23 has had a recordable LNAPL thickness and a DRO concentration of 13,000 mg/kg in soil. LNAPL thickness monitoring has occurred at the Site between November 2016 and November 2019, and LNAPL has never been observed in piezometers PZ-24, PZ-28, or PZ-29. Additionally, DRO was detected in a soil sample collected just above groundwater in MW-7 at a concentration of 7,200 mg/kg. Four quarters of groundwater results from MW-7 show that DRO has never been detected at concentrations from monitoring well MW-7. Therefore, using a residual saturation value of 8,000 mg/kg DRO is considered conservative.

The final lateral dimensions and shape of each excavation will determine the actual number and location of soil samples. At a minimum, one soil sample will be collected from each sidewall every 20 feet laterally and at a depth between 4 and 6 feet or from areas where field screening indicates that contamination is present. In addition, samples from the base of the excavation will be collected every 400 square feet as per Ecology's Guidance for Remediation of Petroleum Contaminated Sites (Ecology 2016). Collecting soil samples from the excavation sidewalls and base will be conducted in accordance with Floyd|Snider's Soil Sampling Standard Guideline (Appendix B). Appropriate sample collection depths will also be determined using the depths that contamination was encountered in previous borings within the vicinity. Soil samples will be analyzed for the following:

- GRO by NWTPH-Gx
- DRO and ORO by NWTPH-Dx
- BTEX and naphthalene by USEPA Method 8021B

The excavation extents will be expanded laterally, and the sidewall will be re-sampled if laboratory results indicate that a sidewall sample contains DRO or GRO at concentrations exceeding 8,000 and 1,700 mg/kg, respectively. The additionally excavated soil will be placed in the landfarming area for treatment.

4.1.2.3 Landfarming Soil—Confirmation Sample

Confirmation samples will be collected once the soil (both DRO-impacted soil and GRO/DRO-impacted soil) in the landfarming area is completely free of odor and sheen (PID readings will be collected as well) throughout the stockpile. Confirmation samples will be collected in accordance with Table 6.9 in Ecology's *Guidance for Remediation of Petroleum Contaminated Sites* (Ecology 2016).

The landfarming area for the DRO-impacted soil will be divided into and up to four equal decision units (DU) or stockpiles; the number of DUs will be determined in the field and based on total volume. The landfarming area for the GRO/DRO-impacted soil will be in one stockpile within its own DU. The number of confirmation soil samples will be based on the volume of each DU/stockpile (e.g., three samples for less than 100 cubic yards, five samples for 100 to 500 cubic yards, etc.). The soil samples will be analyzed for DRO by NWTPH-Dx, for GRO by NWTPH-Gx, and for volatile or semivolatile organic compounds including BTEX and naphthalene by USEPA Method 8260. Soil samples for volatile organics analysis shall be collected by USEPA Method 5035. Further details on sampling and analysis protocols are in Appendix C. In addition, soil sampling activities will be conducted in accordance with Floyd|Snider's Soil Sampling Standard Guideline, which is included in Appendix B.

If COC levels in confirmation samples are less than 80 percent of the MTCA Method A cleanup levels, then the landfarming activities will cease.

If COC levels are between 80 and 100 percent of the MTCA Method A cleanup levels in any one of the DUs or GRO/DRO-impacted DU stockpile, then an additional sample will be collected from that DU. If the second sample result is less than the cleanup level, than the landfarming activities will cease in that DU.

If COC levels are greater than the MTCA Method A cleanup levels in any one DU, soil tilling will occur in that area for one additional month.

Soil in a sub-area that has concentrations less than cleanup levels will be returned to the excavation area.

If after 3 months of summer month treatment, soil cleanup levels in any sub-area have not been achieved, arrangements will be made to transport that soil for offsite disposal at a permitted facility, such as Anderson Landfill in Yakima, Washington. Should landfarming occur during fall or spring months, then several additional months of treatment may be required to achieve cleanup levels.

4.1.2.4 Vapor Assessment

A vapor sample will be collected from beneath the slab of the current building (Figure 3.3). Results will be compared to screening levels presented in the updated Table B-1 of Ecology's Vapor Intrusion Guidance; furthermore, if needed, results will be used to develop site-specific indoor air cleanup levels in accordance with Attachment B of Ecology's Implementation Memorandum No. 18 for petroleum vapor intrusion (Ecology 2018a and Ecology 2018b). The vapor pin installation and soil gas sampling activities will be conducted in accordance to Floyd|Snider's Vapor Intrusion Standard Guideline and the standard operating procedures (SOP), which are included in Appendix B.

Once the vapor pin is installed, it will be allowed 48 hours to equilibrate, prior to collecting a soil vapor sample. Prior to collecting the sample, the water dam method will be used to determine if there is a leak to ambient air (see Appendix B for details). A 1-liter laboratory-certified SUMMA® canister will be used for soil vapor collection, and a second SUMMA canister will be used for purging. Once the sample train has been set up and connected, a closed-valve test will be conducted, prior to soil vapor sample collection, to check for leaks in the sampling train. The closed-valve test will be conducted for approximately 5 minutes. After the closed-valve test, a minimum of three tubing volumes will be purged. Purging will be completed using a non-certified 1- or 6-liter SUMMA canister. After the sampling train has been purged, the shallow soil vapor sample will be collected over a 10-minute period at a flow rate of less than 167 milliliters per minute. The flow rate will be controlled by a flow regulator, which is set by the laboratory. Soil gas samples will be analyzed for the following:

- BTEX, naphthalene, and the three air-phase petroleum hydrocarbon fractions, as per Ecology's Implementation Memorandum No. 18 (Ecology 2018b)

Soil vapor concentrations will be compared to screening levels presented in the updated Table B-1 of Ecology's Vapor Intrusion Guidance and presented in Ecology's Implementation Memorandum No. 18 (Ecology 2018a and 2018b). In addition to the dam test, leak testing will also be conducted using isopropyl alcohol as a tracer gas. Standard guidelines for vapor point installation and soil vapor sampling are included in Appendix B.

4.1.2.5 Groundwater Monitoring Compliance Monitoring Plan

Semiannual groundwater monitoring will be conducted on the following performance wells on the Big B property: MW-2A, MW-4B, and MW-9A; and the following Toad's property wells: MW-1 and MW-2 (Table 4.1). Performance sampling will be conducted on a semiannual basis following backfilling of excavation areas and reinstallation of monitoring wells. Performance groundwater samples will be collected once in the dry season and once in the wet season. MNA parameters will be analyzed during the first four sampling events and total organic carbon (TOC) will be analyzed once on the following performance wells: MW-2A (Big B), MW-4B (Big B), and MW-1 (Toad's).

Semiannual performance monitoring will be conducted until groundwater analytical data indicate that cleanup levels have been achieved, at which time the frequency of groundwater monitoring will be increased to quarterly. At least four consecutive quarters of confirmational groundwater data will be collected from compliance wells MW-2A, MW-4B, MW-7, MW-8, MW-9A, and MW-10 on the Big B property; and from the following Toad's property wells: MW-1, MW-2, and MW-15. Once a well has achieved four quarters of compliance following shutdown of the bioventing system, it will be removed from the network. Depth to groundwater measurements will be collected during groundwater sampling events.

Table 4.1
Performance and Compliance Monitoring Network and Analyte List

Analyte	Semi-Annual Performance Monitoring Wells[1]	Quarterly Compliance Monitoring Wells[1]
DRO with and without SGC, GRO, BTEX, and Naphthalene	Big B: MW-2A, MW-4B, and MW-9A Toads Wells: MW-1 and MW-2	Big B Wells: MW-2A, MW-4B, MW-7, MW-8, MW-9A, and MW-10 Toads Wells: MW-1, MW-2, and MW-15
MNA Parameters and TOC	Big B: MW-2A and MW-4B Toads Wells: MW-1	NA

Note:
1 The number of monitoring wells may be adjusted pending analytical results and further discussions with Ecology.

Groundwater sampling will be conducted in accordance with standard industry practice and Floyd|Snider's Standard Guideline for low-flow sampling (Appendix B). Further details on sampling and analysis protocols are in Appendix C. All wells will be purged and sampled using low-flow procedures to achieve the lowest turbidity practicable with a peristaltic pump and disposable polyethylene tubing. The tubing intake will be set at mid-screen in each well. Prior to and during sampling, depth to water will be measured to the nearest 0.01 foot using a water level indicator. The monitoring well will be purged prior to sampling at a maximum rate of 0.5 liters per minute. During purging, field parameters (i.e., temperature, pH, specific conductivity, and turbidity) will be recorded at 3- to 5-minute intervals using a multiparameter groundwater meter. Purging will continue until temperature, pH, turbidity, and specific conductivity are approximately stable (within 10 percent) for three consecutive readings, or a maximum of 30 minutes of purging has elapsed. Refer to Appendix B for sampling guidelines, which includes groundwater sampling field sheets.

After the well has been purged, the groundwater sample will be collected by directly filling the laboratory-provided bottles from the pump discharge line at the same flow rate that was used for purging. Groundwater samples will be analyzed for the following constituents:

- GRO by NWTPH-Gx
- DRO by NWTPH-Dx
- BTEX and naphthalene by USEPA Method 8260

Select wells, MW-2A (Big B), MW-4B (Big B), and MW-1 (Toad's), will be analyzed for MNA parameters, and MNA monitoring will be conducted in accordance with WAC 173-340-820. After the first two early rounds of groundwater monitoring results, the MNA parameters to be analyzed may be adjusted. The following geochemical parameters will be recorded in the field for MNA monitoring:

- Dissolved oxygen (Horiba)
- Redox potential (Horiba)
- pH (Horiba)
- Conductivity (Horiba)
- Temperature (Horiba)
- Ferrous iron (Hach Field Kits)

Additional geochemical MNA indicators that will be submitted to a laboratory for analysis will consist of the following:

- Nitrate by USEPA Method 300.0
- Manganese (soluble) by USEPA Method 200.8
- Sulfate by USEPA Method 300.0
- Methane by RSK-175

TOC will be analyzed in three wells, MW-2A (Big B), MW-4B (Big B), and MW-1 (Toad's), once during the first performance sampling event. TOC will be analyzed using USEPA Method 9060A. All laboratory analytical methods, including reporting limits and quantitation limits, are presented in the SAP/QAPP.

4.1.2.6 Confirmational Soil Sampling and Site-Specific Cleanup Levels

Once four consecutive quarters of groundwater sampling indicate that groundwater concentrations are less than MTCA Method A cleanup levels, between soil samples will be collected from areas with the greatest remaining TPH impacts. Site-specific MTCA Method B cleanup levels will be developed, in accordance with Ecology guidelines, for direct contact to confirm that the Site is in compliance (Ecology 2016).

5.0 Health and Safety

5.1 HEALTH AND SAFETY

The project work described in this EDR will comply with the health and safety standards prescribed by the Occupational Safety and Health Act and the Washington State Department of Labor and Industries' Division of Occupational Safety and Health. A project-specific HASP has been prepared for the work to be done, along with an addendum to include COVID-19 precautions (Appendix D). In addition, the excavation and landfarming contractor selected to conduct the remedial activities will prepare and provide a HASP covering their activities. Copies of the HASPs will be on site at all times, and visitors entering the work area will be required to review and sign the project-specific HASP.

Appropriate Site control measures will be maintained in all work areas to limit access during and after work hours. These include maintaining the Site perimeter fence, clearing of underground utilities, excavation hazards, and working near live railroad tracks.

5.2 DECONTAMINATION PROCEDURES

All construction equipment will be decontaminated prior to leaving the Site and to prevent trackout of dirt, mud, stone, or contaminated soil. Equipment and vehicle decontamination generally consists of sweeping (if dry) and/or pressure washing with detergent solution followed by a potable water rinse.

Equipment decontamination wash water will be contained such that it does not flow onto uncontaminated portions of the Site. Care will be taken to prevent run off into storm drains and off property. If decontamination wash water is collected in a containment area, it will be managed according to the procedures for handling and disposal of contaminated groundwater.

6.0 Schedule for Implementation

A general schedule for implementation of the cleanup action was provided in the DCAP and is shown below in Table 6.1. Once permits are obtained, a construction start date and detailed schedule will be provided to Ecology.

Table 6.1
Cleanup Action Implementation Schedule

Implementation Step	Estimated Duration
Prepare and Submit Agency Review Draft CAP	February 24, 2020
Submit Public Review Draft CAP to Ecology	Within 45 calendar days of receipt of Ecology's Comments on the Agency Review Draft CAP
Public Comment Period for Draft CAP	30 days
Finalize and Submit Final CAP	Within 45 calendar days of receipt of Ecology's comments on the Public Review Draft CAP
Submit Progress Reports	Monthly on the 15th
Acquire Project Permits: • Engineered Grading permit • Site Development Permit • Critical Area Determination Waiver	July 2020 or early 2021
Remedial Action Construction; assume duration of 3 to 4 months, summer months only	Summer 2021
Submit Pilot Test Bioventing Work Plan	Within 90 days after excavation and backfilling activities are completed on the Big B property
Prepare Remedial Action Completion Report, Receive Ecology Approval Initiate Groundwater Performance Monitoring 90 days after approval	Winter 2021
Conduct Semiannual Groundwater Performance Monitoring	2021–2031

7.0 Reporting

A draft construction completion report will be prepared and submitted to Ecology within 90 days following completion of the remedial construction. Information provided in the construction completion will include the following:

- Description of remedial activities, including deviations from this EDR
- Photograph documentation of construction activities and the finished construction
- Information on the lateral and vertical limits of all excavations, including maps illustrating excavation areas and other pertinent information
- Detailed sampling and analysis information, including location, matrix, analytical methods, and data quality review findings for the performance and confirmational monitoring
- Demonstration from the performance monitoring data that soil cleanup levels were achieved for landfarmed soil prior to placing back into the excavations
- Stockpile soil profiling and disposal documentation, including quantities of soil removed and transported off site for disposal, and landfill certificates of disposal
- EDR addendum that will include the bioventing pilot test results and the final bioventing system design
- Operations and Maintenance Plan for the bioventing system

Relevant laboratory analytical data collected during the remedial action will also be uploaded to Ecology's Environmental Information Management database (within 60 days after the data have been validated).

8.0 References

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Washington State Department of Ecology (Ecology). 2005. *User's Manual: Natural Attenuation Analysis Tool Package for Petroleum-Contaminated Ground Water*. Prepared by the Toxics Cleanup Program. Publication No. 05-09-091A (Version 1.0). July.

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Big B Mini Mart Site

Engineering Design Report

Figures

Note:
- Orthoimage provided by Esri, 7/19/2010.

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Big B Mini Mart Site
Ellensburg, Washington

Figure 1.1
Vicinity Map

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4/6/2020

Note:
· Orthoimagery provided by ESRI, 2017.

Abbreviation:
NAPL = Non Aqueous Phase Liquid

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Figure 2.1
Property Map

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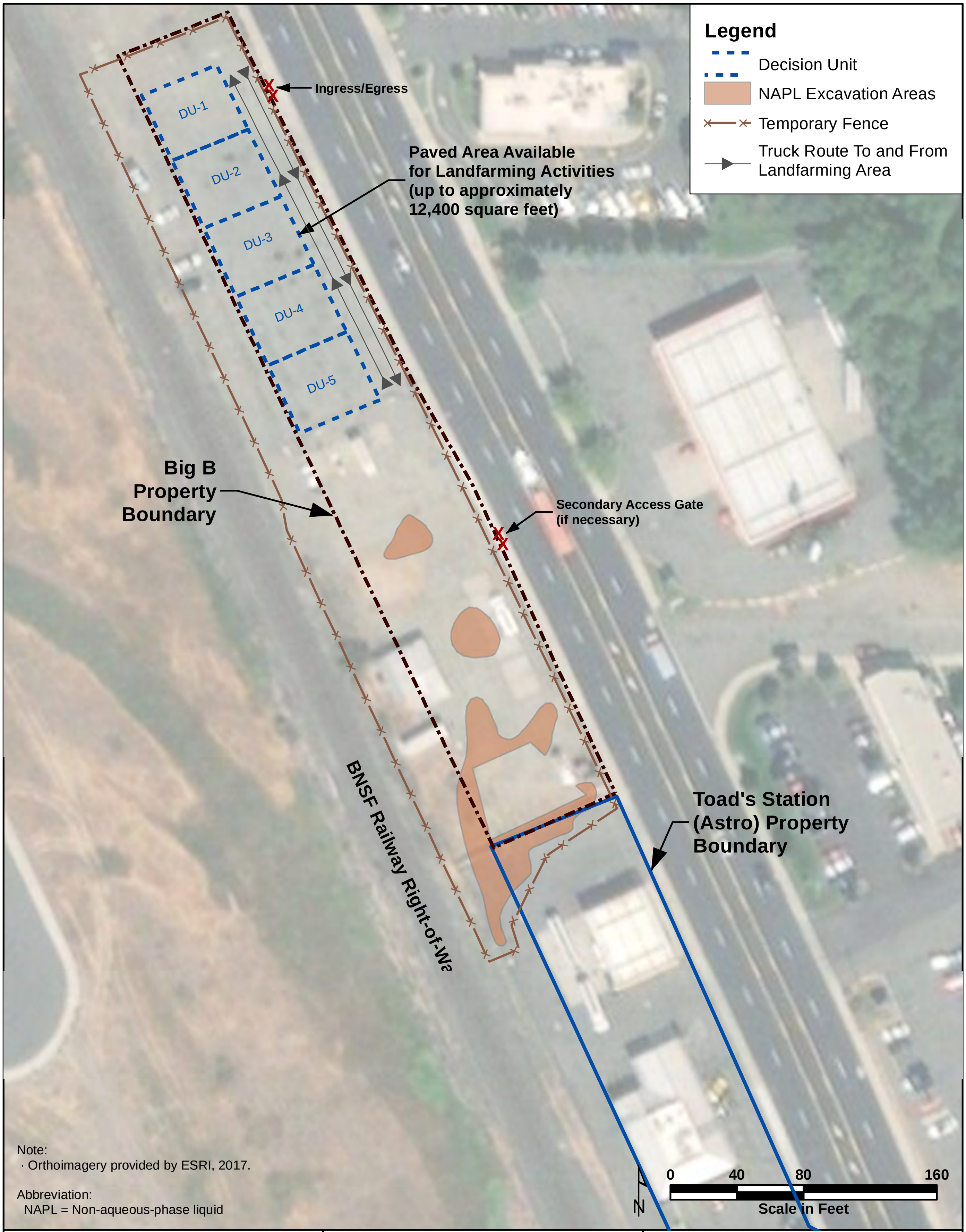
4/6/2020



Note:
· Orthoimagery provided by ESRI, 2017.

Abbreviation:
NAPL = Non-aqueous-phase liquid

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Big B Mini Mart Site
Ellensburg, Washington

Figure 3.1
Property Map, Landfarming Area, and Extent of NAPL Excavation

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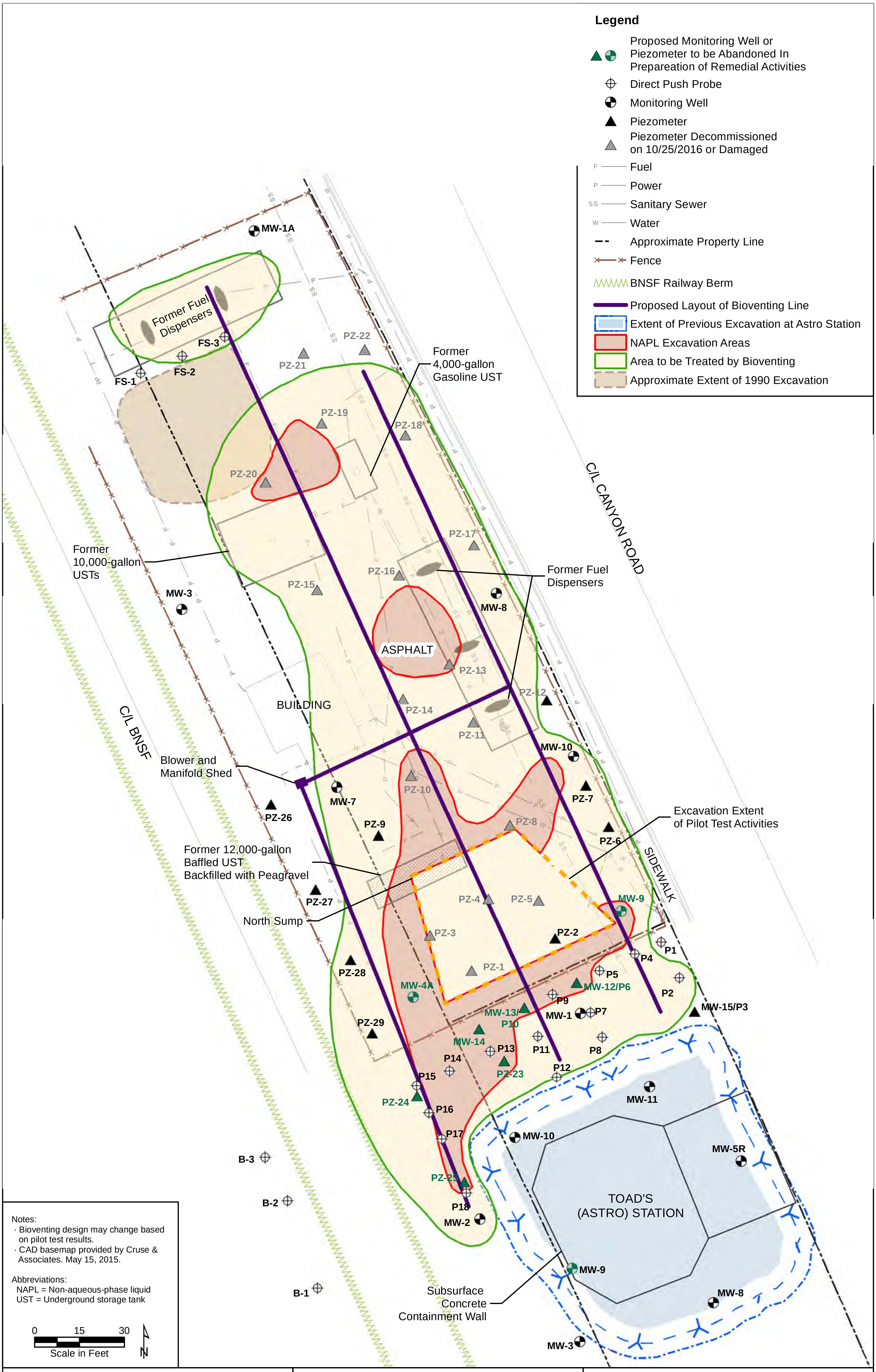
2/24/2020



Notes:
- Bioventing design may change based on pilot test results.
- CAD basemap provided by Cruse & Associates. May 15, 2015.

Abbreviations:
NAPL = Non-aqueous-phase liquid
UST = Underground storage tank

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Big B Mini Mart Site
Ellensburg, Washington

Figure 3.2
Approximate Extent of Soil Excavation and Extent of Bioventing System

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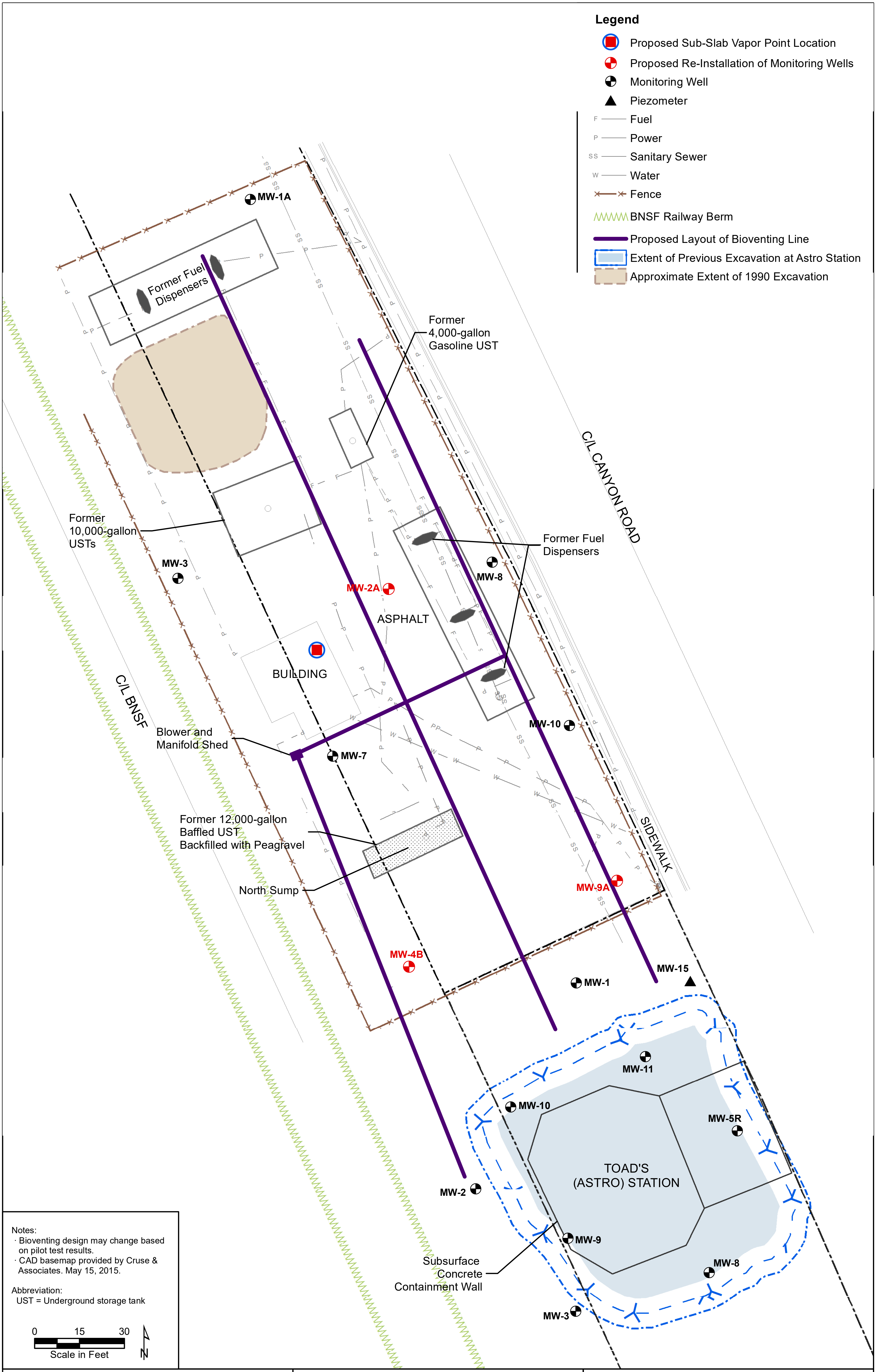
2/24/2020



Notes:
- Bioventing design may change based on pilot test results.
- CAD basemap provided by Cruse & Associates. May 15, 2015.

Abbreviation:
UST = Underground storage tank

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Big B Mini Mart Site
Ellensburg, Washington

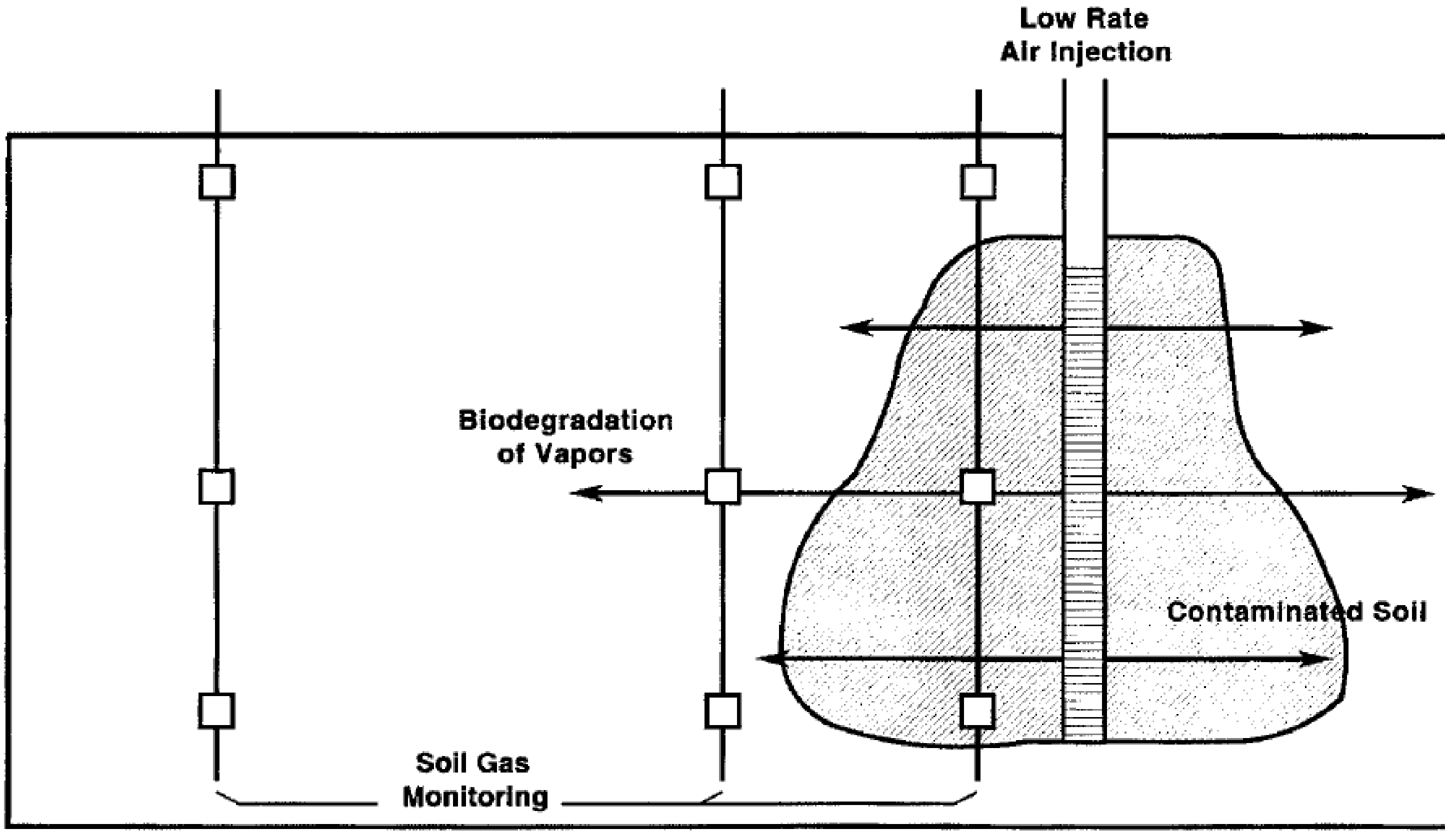
Figure 3.3
Proposed Wells to be Re-Installed

I:\GIS\Projects\CL-Ellensburg\MXD\Draft CAP\Appendix EDR\Figure 3.3 Proposed Wells to be Re-Installed.mxd
6/26/2020

Big B Mini Mart Site

Engineering Design Report

Appendix A
Bioventing Schematic and Field Form



Air injection configuration for a bioventing system.

Schematic diagram of a basic air injection system that will be utilized during the bioventing pilot test. The system is relatively simple involving a blower and monitoring points spaced at increasing distances from the injection point. Fresh air is injected at a low-flow rate and will not produce significant air emissions or require aboveground vapor-phase treatment. Schematic from Figure 2-6 in USEPA's 1995 *Bioventing Principles and Practices Volume II: Bioventing Design*.

Figure 8-1. Typical Record Sheet for In Situ Respiration Test.

SITE ______________________________ **MONITORING POINTS** ______________________________

DATE ______________________________ **O_2 METER NO.** ______________ **CO_2 METER NO.** ______________

LOCATION ______________________________ **HYDROCARBON METER NO.** ______________________________

SAMPLER(S) ______________________________ **SHUT DOWN DATE** ______________ **TIME** ______________

Date/ Time	CO_2%	O_2%	Total Hydrocarbon	Helium	Comments	Date/ Time	CO_2%	O_2%	Total Hydrocarbon	Helium	Comments

Figure 8-2. Typical Record Sheet for Air Permeability Test.

SITE ____________________

DATE ____________________

SAMPLER(S) ____________________

TYPE OF TEST ____________________

TEST DATE ____________________

TIME ____________________

Pressure/Vacuum ("H_2O)

Distance from Vent Well (ft)						Distance from Vent Well					
Time	ln(t)	MP1	MP2	MP3	MP4	Time	ln(t)	MP5	MP6	MP7	MP8

Big B Mini Mart Site

Engineering Design Report

Appendix B
Standard Guidelines

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F|S STANDARD GUIDELINE

Soil Sample Collection

DATE/LAST UPDATE: October 2019

These procedures should be considered standard guidelines and are intended to provide useful guidance when in the field, but are not intended to be step by step procedures, as some steps may not be applicable to all projects.

All field staff should be sufficiently trained in the standard guidelines for the sampling method they intend to use and should review and understand these procedures prior to going into the field. It is the responsibility of the field staff to review the standard guidelines with the field manager or project manager and identify any deviations from these guidelines prior to field work. When possible, the project-specific Sampling and Analysis Plan should contain any expected deviations and should be referenced in conjunction with these standard guidelines.

1.0 Scope and Purpose

This standard guideline presents commonly used procedures for collection of soil samples for characterization and laboratory analysis. The methods presented in this guideline apply to the collection of soil samples during the following characterization activities: soil borings via drilling, manual collection of shallow soil samples, test pit excavation, excavation confirmation, and stockpile characterization. Specific details regarding the collection of discrete and composite samples, and special sampling techniques for volatile organic compounds (VOCs) are also included. The guideline is intended to be used by staff who collect soil samples in the field.

It is important that the field staff completing the soil sample collection discusses the specific needs for a particular investigation with the project geologist, the project manager, or whoever will ultimately be responsible for interpreting the findings of the field investigation. This discussion is in addition to field training and general knowledge about soil sampling, and should happen prior to entering the field, with additional follow-up before finalizing the field forms, after the investigation is complete.

2.0 Equipment and Supplies

Soil Sampling Equipment and Tools:

- Tape measure or measuring wheel
- Stainless steel bowls and spoons
- Graduated plunger and collection tubes for VOC samples (if needed)
- Trash bags
- Decontamination tools including:
    - Paper towels
    - Spray bottles of alconox (or similar) solution
    - Deionized or distilled water
- Adhesive drum labels, or paint or grease pen
- Washington State Department of Transportation- (WSDOT) approved drums for investigation-derived waste (IDW) disposal, if needed (if drilling, to be provided by driller)
- Camera
- Hand-held global position system (GPS; optional)
- Coolers, sample jars, labels, ice

Paperwork:

- Work Plan and/or Sampling and Analysis Plan/Quality Assurance Project Plan (SAP/QAPP)
- Health and Safety Plan (HASP)
- Sample collection forms printed in Rite in the Rain paper, or Rite in the Rain field notebook

Personal Equipment:

- Steel-toed boots
- Safety vest
- Safety glasses
- Nitrile gloves
- Rain gear
- Work gloves

3.0 Standard Procedures

3.1 OFFICE PREPARATION

Prior to going into the field, review the SAP/QAPP tables to become familiar with the desired sample intervals, nomenclature, field Quality Assurance (QA) samples, analytes, sample containers, and holding times for each analytical method.

At least one week prior to sampling, coordinate with the laboratory specified in the SAP/QAPP to get coolers and appropriate sample containers. Familiarize yourself with the volume requirements and container types, preservation methods, and holding times for each class of analytes.

3.2 GENERAL SOIL SAMPLE COLLECTION PROCEDURES

1. Locate the desired sample location and depth interval using a handheld GPS or by taking field measurements from known site features. Note the soil type and any other observations or indications of contamination on a soil boring log (enclosed), soil sample collection form or field notebook, as described in the Soil Logging Standard Guideline. Note the location and depth of the sample and take a photograph, if possible.
2. Refer to subsections 3.2.1 through 3.2.4 for the appropriate soil collection procedures for drilling, shallow soil, test pit excavation, excavation confirmation, and stockpiles. If collecting samples for VOC analysis by the U.S. Environmental Protection Agency (USEPA) Method 5035, refer to Section 3.3 for specific sample collection procedures for this method. If composite soil sampling is recommended, refer to Section 3.4 for details.
3. Once soil has been collected from the desired depth or interval, mix thoroughly until the sample is homogenous in color, texture, and moisture.
4. Fill the required laboratory-provided jars, taking care not to overfill. If large gravels (diameter greater than ~ 1 inch) are encountered, these should be discarded to ensure that an adequate soil volume is collected for analysis. If necessary, use a clean paper towel to remove soil particles from the threaded mouth of the jar before securing lids to ensure a good seal.
5. Label each jar with the sample name, date, time, field staff initials and required analyses. If collecting a field duplicate, use the sample nomenclature specified in the work plan and note the field duplicate name and sample time in the sample log. If extra volume for matrix spike/matrix spike duplicate (MS/MSD) analysis is being collected, use the same name on all jars. Soil samples should be protected from moisture by placing the filled sample jars into separate sealed Ziploc bags before placing them into a cooler.

6. Complete a chain-of-custody form for all samples, including sample names, date and time of collection, number of containers, and required analyses and methods. Keep samples on ice to maintain temperatures of 4-6 degrees Celsius (°C) and transport to the laboratory under chain-of-custody procedures.

3.2.1 Soil Sample Collection via Drilling

These procedures should be used for drilling via direct-push, hollow stem auger, or roto-sonic methods where a pre-designated sample interval (i.e. 0 to 5 feet below ground surface [bgs]) is retrieved from the subsurface using a split spoon sampling device, lined core, or bag sampler.

1. Ensure that reusable sampling equipment has been thoroughly decontaminated prior to sampling.
2. Use a stainless steel spoon or trowel, or disposable scoop to remove an equal volume of soil across the targeted depth interval from the sampler.
   a. If using a split spoon sampler or other reusable sampler, avoid collecting the soil that is touching the sides of the sampler to the extent practical.
   b. If the soil touching a reusable sampler must be collected to obtain adequate volume for analysis, notify the PM and record in the field logbook.

3.2.2 Manual Collection of Shallow Soil Samples

These procedures should be used for shallow soil sampling via scoop, trowel, shovel, or hand auger.

1. Dig or auger to the bottom depth of the shallowest sample to be collected, using a tool that has been cleaned and decontaminated. Verify that the target depth has been reached using a measuring tape.
2. If using a scoop or trowel, collect the soil directly into a decontaminated stainless steel bowl.
3. If using a shovel, the soil may either be collected in bowls or set as aside on plastic sheeting in favor of collecting the sample from the sidewall of the hole. If sampling the sidewall, use a decontaminated or disposable scoop or trowel to collect soil from the target depth, or scrape along the sidewall to collect soil across a target depth interval. Transfer soil to a decontaminated stainless steel bowl, repeating until a sufficient volume has been collected.
4. If using a hand auger, empty the cylinder of the auger directly into a decontaminated stainless steel bowl. It may be necessary to empty the hand auger onto plastic sheeting or into a bowl in order to reach the target depth without overflowing the sampler.
5. Any soil from depth intervals that are not targeted for sampling should be set aside on plastic sheeting and returned to the hole after sampling.

3.2.3 Sample Collection from Test Pits or Limited Soil Excavations

These procedures should be used for collecting samples from test pit explorations excavated using a back hoe or excavator. These same general procedures should also be followed for post-excavation soil samples used to confirm that an excavation has removed contaminated material or to document post-excavation conditions after target excavation limits have been reached.

1. Measure the length, width, and depth of the test pit or excavation area to verify that the target extents have been reached. The lateral spacing of the test pit or excavation confirmation samples, or exact location of samples should be specified in the work plan and typically depend on the size of the excavation area but can vary significantly from project to project.
2. If not specified in the work plan, sidewall samples may be collected either midway between the ground surface and base of the excavation, or incrementally along the entire height of the sidewall. Both sidewall and base (bottom) samples should penetrate a minimum of 6 inches beyond the excavated surface.
3. If the test pit or excavation is less than 4 feet deep, or has been benched to accommodate safe entry, a sample may be collected directly from the sidewall(s). To collect soil from a sidewall, use a decontaminated or disposable scoop, trowel, or shovel to obtain soil from the desired depth or depth interval directly into a decontaminated stainless steel bowl.
4. If a test pit or excavation cannot be safely entered, instruct the excavator operator to scoop sidewall material from the target depth or depth interval. Collect the soil sample from the excavator bucket using a decontaminated stainless steel spoon, trowel, or disposal scoop, avoiding material that has come into contact with the teeth or sides of the bucket. Place an adequate volume of soil into a decontaminated stainless steel bowl. If necessary, follow the compositing procedures in Section 3.4.

3.2.4 Stockpile Sampling

These procedures should be used for classifying stockpiled soil, including excavated soil and imported backfill material.

1. Where potentially contaminated soils have been previously excavated and stockpiled on site, Washington State Department of Ecology (Ecology) guidance recommends using a decontaminated or disposable scoop or trowel, penetrating 6 to 12 inches beneath the surface of the pile at several locations until sufficient volume for analysis is achieved. A decontaminated shovel may also be used to facilitate collection of soil from large piles. The locations for soil collection should be where contamination is most likely to be present based on field screening (i.e. staining, odor, sheen, or elevated photoionization detector [PID] readings). If there are not field indications of contamination, the locations should be distributed evenly around the stockpile.

2. The stockpile may need to be broken up into sections for sample collection depending on the size of the pile (i.e., segregate the pile in half or quarters). If this is necessary, it is important to document where each set of samples were collected from (i.e., north quadrant) and create a field sketch of the pile for reference.
3. If a sampling frequency is not specified in the work plan, the general rule of thumb for contaminated soil stockpile profiling is to collect and submit 3 analytical samples (these samples can be multi-point composites or grabs) for stockpiles less than 100 cubic yards (CY), 5 samples for stockpiles between 100 and 500 CY, 7 samples for stockpiles 500 to 1,000 CY, 10 samples for stockpiles 1,000 to 2,000 CY, and 10 samples for stockpiles larger than 2,000 CY with an additional sample collected for every 500 CY of material. This rule of thumb is consistent with Ecology guidance for site remediation.
4. Samples for characterization of stockpiles of imported backfill or other presumed clean material should also be collected as described above. If not described in the work plan, the typical sample frequency for imported or clean material characterization is one sample per 500 CY.

3.3 SOIL SAMPLE COLLECTION FOR VOC ANALYSIS

If collecting soil samples for VOC analysis by USEPA Method 5035, collect these samples first before disturbing the soil. This method uses a soil volume gauge fitted with a disposable soil sampling plunger tube to collect a soil plug that can be discharged directly to a VOA vial, limiting the loss of volatiles during sampling. The collection of VOC samples using the 5035 method specifies use of an airtight VOA vial with a septum lid. Ecology's interpretation of the USEPA 5035 method allows for field preservation of the sample with methanol or sodium bisulfate, or laboratory preservation (i.e. field collection into an un-preserved vial). It is important to note that if laboratory preservation is the selected method, samples must be received at the laboratory within 48-hours of sample collection. The method of sample preservation for the 5035 method will vary for each site and is dependent on site-specific conditions. Preservation method selection should be coordinated with the laboratory and specified in the sampling plan.

1. Note the volume of soil needed for analysis as specified by the laboratory (commonly 5 or 10 grams). Raise the handle of the soil volume gauge to the slot in the gauge body corresponding to the desired volume and turn clockwise until the tabs in the handle lock into the slot.
2. Insert a sample tube at the open end of the gauge body and turn clockwise until the tabs on the tube lock into the "0 gram" slot. Remove the cap from the sample tube and press directly (where possible) into the shallow soil, soil core/sampler, excavation base or sidewall, or stockpile.
3. Continue pressing the sample tube until the plunger is stopped by the sample volume gauge. If a depth interval (for example 9 to10 feet) is targeted for VOC sampling, collect small volumes of soil across this interval until the sample tube is filled

4. Twist counterclockwise to disengage the sample tube, then depress the plunger to eject the soil plug directly into a laboratory-provided VOA vial. If multiple vials per sample are required, the same plunger may be re-used to fill the remaining vials.

3.4 COMPOSITE SAMPLE COLLECTION

For this guideline, composites are considered to be samples that are collected across more than one location, or multiple depth intervals at a single location. Samples collected over continuous depth intervals within a sampling device (i.e. split spoon) are addressed for each sampling method in Section 3.2 above.

Compositing of sample material may be performed in the field, or by the analytical laboratory. To collect a field composite sample, identify the locations and depth(s) that will comprise the composite. Collect soil from the first target sub-sample depth or depth interval and hold in a decontaminated stainless steel bowl, covered with aluminum foil to prevent cross contamination and label with the location and depth. Continue to collect and hold individual sub-samples until all components of the composite have been collected, then transfer an equal amount of each sub-sample to a clean bowl and homogenize. Fill necessary sample jars from homogenized composite. In some cases, project plans may require that each individual sample that comprised the composite be collected in jars and submitted to the laboratory in the event that individual sample analysis is desired, or if laboratory compositing is requested in addition to field compositing as a field quality control measure. In this case, label each individual jar, but indicate HOLD on the chain-of-custody, and note that the sample is part of composite XYZ.

To collect a laboratory composite sample, collect, and label each sub-sample using the procedures described above in Section 3.2. Record each sub-sample on the chain-of-custody form, and indicate on this form which samples should be composited by the laboratory and the desired name of the composite sample. It is important to communicate to the laboratory if discrete samples will also require analysis (in some cases) or only the composite sample.

4.0 Decontamination

All reusable equipment that comes into contact with soil should be decontaminated prior to moving to the next sampling location.

Stainless steel bowls and spoons, and any tools used for sample processing will be decontaminated between each sample; alternatively, disposable bowls and spoons may be used. Equipment decontamination will consist of a tap water rinse to remove soil particles, followed by scrubbing with brushes and an alconox (or other soap)/clean water solution and a final rinse with distilled or deionized water.

5.0 Investigation-Derived Waste

Unless otherwise specified in the project work plan, waste soils will be contained, transported, disposed of in accordance with applicable laws, and stored in a designated area until transported off-site for disposal.

The approach to handling and disposal of these materials is as follows. For IDW that is containerized, such as waste soils, 55-gallon drums approved by WSDOT will be used for temporary storage pending profiling and disposal. Each container holding IDW will be sealed and labeled as to its contents (e.g., “soil”), the dates on which the wastes were placed in the container, the owner’s name and contact information for the field person who generated the waste, and the site name.

IDW that is placed into drums for temporary storage will be characterized relative to applicable waste criteria using data from the sampling locations whenever possible. Material that is designated for off-site disposal will be transported to an off-site facility permitted to accept the waste. Manifests will be used, as appropriate for disposal.

Disposable sampling materials and incidental trash such as paper towels and personal protective equipment (PPE) used in sample processing will be placed in heavy duty garbage bags or other appropriate containers and disposed of as solid waste in the municipal collection system (i.e., site Dumpster).

6.0 Field Documentation

All observations including sample collection locations, soil descriptions, sample depths, collection times, analyses, and field QC samples should be recorded on a boring log, soil sample collection form, or bound field notebook. Information recorded should additionally include personnel present (including subcontractors), purpose of field event, weather conditions, sample collection date and times, sample analytes, and any deviations from the SAP.

Enclosures: Boring Log

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	PROJECT:	LOCATION:	BORING ID:
	LOGGED BY:	COORDINATE SYSTEM:	
DRILLED BY:		NORTHING:	EASTING:
DRILLING EQUIPMENT:		GROUND SURFACE ELEVATION:	
DRILLING METHOD:		TOTAL DEPTH (ft bgs):	DEPTH TO WATER (ft bgs):
SAMPLING METHOD:		BORING DIAMETER:	DRILL DATE:

Depth (feet)	USCS	Description	Drive	Recovery	# of Blows	PID (ppm)	Sample ID
0							

ABBREVIATIONS:
ft bgs = feet below ground surface
ppm = parts per million
USCS = Unified Soil Classification System
▼ = denotes groundwater table

NOTES:

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PROJECT:

LOCATION:

BORING ID:

LOGGED BY:

COORDINATE SYSTEM:

DRILLED BY:

NORTHING:

EASTING:

DRILLING EQUIPMENT:

GROUND SURFACE ELEVATION:

DRILLING METHOD:

TOTAL DEPTH (ft bgs):

DEPTH TO WATER (ft bgs):

SAMPLING METHOD:

BORING DIAMETER:

DRILL DATE:

Depth (feet)	USCS	Description	Drive	Recovery	# of Blows	PID (ppm)	Sample ID

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ft bgs = feet below ground surface
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NOTES:

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F|S STANDARD GUIDELINE

Low-Flow Groundwater Sample Collection

DATE/LAST UPDATE: October2019

These procedures should be considered standard guidelines and are intended to provide useful guidance when in the field, but are not intended to be step-by-step procedures, as some steps may not be applicable to all projects.

All field staff should be sufficiently trained in the standard guidelines for the sampling method they intend to use and should review and understand these procedures prior to going into the field. It is the responsibility of the field staff to review the standard guidelines with the field manager or project manager and identify any deviations from these guidelines prior to field work. When possible, the project-specific Sampling and Analysis Plan should contain any expected deviations and should be referenced in conjunction with these standard guidelines.

1.0 Scope and Purpose

This standard guideline provides details necessary for collecting representative groundwater samples from monitoring wells using low-flow methods. These guidelines are designed to meet or exceed guidelines set forth by the Washington State Department of Ecology (Ecology). Low-Flow sampling provides a method to minimize the volume of water that is purged and disposed from a monitoring well, and minimizes the impact that purging has on groundwater chemistry during sample collection.

2.0 Equipment and Supplies

Groundwater Sampling Equipment and Tools:

- For wells with head less than 25 feet:
    - Peristaltic pump with fully-charged internal battery or standalone battery and appropriate connectors

- For wells with head greater than 25 feet:
    - Bladder pump and controller, as well as an air cylinder, or air compressor (with extension cord if near an electrical outlet; with battery and appropriate connectors or generator if not near an outlet)

      OR
    - Low-flow submersible pump and controller (with extension cord if near an electrical outlet; with battery and appropriate connectors or generator if not near an outlet)
- Multi-parameter water quality meter
- Water level meter
- Poly tubing
- Silicone tubing
- Filters (if field filtering)
- Tools for opening wells (1/2-inch, 9/16-inch, and 5/8-inch sockets, ratchet, screwdriver)
- Well keys
- Tube cutters, razor blade, or scissors
- 5-gallon buckets and clamp
- Paper towels
- Bailer or pump to drain well box if full of stormwater
- Hammer
- Alconox (or similar decontamination solution), deionized water, spray bottles
- Tape measure
- Trash bags

Lab Equipment:

- Sample jars/bottles
- Coolers
- Chain-of-Custody Forms
- Labels
- Ice
- Ziploc bags

Paperwork:

- Field notebook with site maps
- Table of well construction details and/or well logs, if available
- Sampling forms (enclosed)
- Purge water plan
- Rite-in-the-Rain pens, paper, and permanent markers
- Site-Specific Health and Safety Plan (HASP)
- Sampling and Analysis Plan (SAP) and/or Quality Assurance Project Plan (QAPP) (including tables of analytes and bottle types)

Personal Protective Equipment (PPE):

- Boots/waders
- Safety vest
- Safety glasses
- Rain gear
- Nitrile gloves
- Work gloves

3.0 Standard Procedures

Low-Flow groundwater sampling consists of purging groundwater within the well casing at a rate equal to or less than the flow rate of representative groundwater from the surrounding aquifer into the well screen. The flow rate will depend on the hydraulic conductivity of the aquifer and the drawdown, with the goal of minimizing drawdown within the monitoring well. Field parameters are monitored during purging and groundwater samples are collected after field parameters have stabilized. Deviations from these procedures should be approved by the Project Manager and fully documented.

3.1 CALIBRATION OF WATER QUALITY METERS

All multi-parameter water quality meters to be used will be calibrated prior to each sampling event. Calibration procedures are outlined in each instrument's specific user manual.

3.2 MONITORING, MAINTENANCE, AND SECURITY

Prior to sampling, depth to water and total depth measurements will be collected and recorded for accessible monitoring wells onsite (or an appropriate subset for larger sites). Check for an existing measuring point (notch or visible mark on top of casing). If a measuring point is not observed, a measuring point should be established on the north side of the casing. The conditions of the well box and bolts will also be observed and deficiencies will be recorded on the sampling forms or logbook (i.e., missing or stripped bolt). The following should also be recorded:

- Condition of the well box, lid, bolts, locks, and gripper cap, if deficiencies
- Condition of gasket if deficient and if water is present in the well box
- Note any obstructions or kinks in the well casing
- Note any equipment in the well casing, such as transducers, bailers, or tubing
- Condition of general area surrounding the well, such as subsidence, potholes, or if the well is submerged within a puddle.

Replace any missing or stripped bolts, and redevelop wells if needed.

3.3 LOW-FLOW PURGING METHOD AND SAMPLING PROCEDURES

Groundwater samples will be collected using low-flow purging and sampling procedures consistent with Ecology guidelines and the U.S. Environmental Protection Agency (USEPA) standard operating procedures (USEPA 1996). The following describes the Low-Flow purging and sampling procedures for collecting groundwater samples using a peristaltic pump. If the water level is greater than 20 feet below ground surface (bgs), Grundfos or Geotech submersible pumps or bladder pumps can be used since their pumping rates can be adjusted to low-flow levels.

- Place the peristaltic pump and water quality equipment near the wellhead. Slowly lower new poly tubing down into the well casing approximately to the middle of the well screen. If the depth of the well screen is not known, lower the tubing to the bottom of the well, making sure that the tubing has not been caught on the slotted well casing, and then raise the tubing 3 to 5 feet off the bottom of the casing. Document the estimated depth of the tubing placement within the well. Connect the tubing to the peristaltic pump using new flex tubing and connect the discharge line to the flow-through cell of the water quality meter. The discharge line from the flow cell should be directed to a bucket to contain the purged water.
- If using a low-flow submersible pump, connect the pump head to dedicated or disposable tubing. If using a bladder pump, connect both the air intake and water discharge ports to decontaminated or disposable tubing, using the manufacturer's instructions to ensure a secure connection. Lower the pump with tubing into the well as described above and connect the water discharge tubing directly to the flow-through cell.
- Measure the depth to water to the nearest 0.01 foot with a decontaminated water level meter and record the information on a sampling form.
- Start pumping the well at a purge rate of 0.1 to 0.2 liters per minute and slowly increase the rate. Purge rate is adjusted using a speed control knob or arrows on peristaltic and low-flow submersible pumps. The purge rate for bladder pumps is controlled by the air compressor, which first pressurizes the pump chamber in order

to compress the flexible bladder and force water through the discharge line, and then vents the chamber in order to allow the bladder to refill with water.

  - A good rule of thumb is to pressurize to 10 psi + 0.5 psi/foot of tubing depth and begin with 4 discharge/refill cycles per minute; using greater air pressure and accelerating the pump cycles will increase the purge rate.

- Check the water level. If the water level is dropping, lower the purge rate. Maintain a steady flow with no or minimal drawdown (less than 0.33 feet according to USEPA 2002). Maintaining a drawdown of less than 0.33 feet may not be feasible depending on hydrogeological conditions. If possible, measure the discharge rate of the pump with a graduated cylinder or use a stopwatch when filling sampling jars (500 milliliters [mL] polyethylene or glass ambers) to estimate the rate. When purging water through a flow cell, the maximum flow rate for accurate water quality readings is about 0.5 liters per minute (L/minute).
- Monitor and record water quality parameters every three to five minutes after one tubing volume (including the volume of water in the flow cell) has been purged.
  - One foot of ¼-inch interior diameter tubing holds about 10 mL of water, and flow-through cells typically hold less than 200 mL of water; one volume should be purged after about 5 minutes at a flow rate of 0.1 L/minute.
- Water-quality indicator parameters that will be monitored and recorded during purging include:
  - pH
  - Specific conductivity
  - Dissolved oxygen
  - Temperature
  - Turbidity
  - Oxidation reduction potential (ORP)
- Purging will continue until temperature, pH, turbidity, and specific conductivity are approximately stable (when measurements are within 10 percent) for three consecutive readings, or 30 minutes have elapsed. Because these field parameters (especially dissolved oxygen and ORP) may not reach the stabilization criteria, collection of the groundwater sample will be based on the professional judgment of field personnel at the time of sampling.
- The water sample can be collected once the criteria above have been met.
- If drawdown in the well cannot be maintained at 0.33 feet or less, reduce the flow or turn off the pump for 15 minutes and allow for recovery. If the water quality parameters have stabilized, and if at least two tubing volumes and the flow cell volume have been purged, then sample collection can proceed when the water level has recovered and the pump is turned back on. This should be noted on the sampling form.

- To collect the water sample, maintain the same pumping rate. After the well has been purged and the sample bottles have been labeled, the groundwater sample will be collected by directly filling the laboratory-provided bottles from the pump discharge line prior to passing through the flow cell. All sample containers should be filled with minimum disturbance by allowing the water to flow down the inside of the bottle or vial. When collecting a volatile organic compound (VOC) sample, fill to the top to form a meniscus over the mouth of the vial prior to placing the cap to eliminate air bubbles. Be careful not to overflow preserved bottles/pre-cleaned Volatile Organic Analyte (VOA) vials.
- If sampling for filtered metals, collect these samples last and fit an in-line filter at the end of the discharge line. Take note of the flow direction arrow on the filter prior to fitting. A minimum of 0.5 to 1 liter of groundwater must pass through the filter prior to collecting the sample.
- Sample labels will clearly identify the project name, sampler's initials, sample location and unique sample id, analysis to be performed, date, and time. After collection, samples will be placed in a cooler maintained at a temperature of approximately 4 to 6 degrees Celsius (°C) using ice. Chain-of-Custody Forms will be completed. Upon transfer of the samples to the laboratory, the Chain-of-Custody Form will be signed by the persons transferring custody of the sample containers to document change in possession.
- When sample collection is complete at a designated location, remove and properly dispose of the non-dedicated tubing. In most cases, this waste is considered solid waste and can be disposed of as refuse. Close and lock the well.

4.0 Decontamination

All reusable equipment that comes into contact with groundwater should be decontaminated using the processes described in this section prior to moving to the next sampling location.

Water Level Meter: The water level indicator and tape will be decontaminated between sampling locations and at the end the day by spraying the entire length of tape that came in contact with groundwater with an Alconox (or similar)/clean water solution followed by a thorough rinse with distilled or deionized water.

Water Quality Sensors and Flow-Through Cell: Distilled water or deionized water will be used to rinse the water quality sensors and flow-through cell. No other decontamination procedures are recommended since they are sensitive equipment. After the sampling event, the water quality meters will be cleaned and maintained according to the specific manual.

Submersible Pump (if applicable: Decontaminating the pump requires running the pump in three progressively cleaner grades of water.

1. Fill a bucket with approximately 4 gallons or more to sufficiently cover the pump of an Alconox (or similar)/clean water solution. Place the pump and the length of the

power cord (if applicable) that was in contact with water into the bucket and run the pump for approximately two minutes or until the volume of water in the bucket has been exhausted.

2. Fill a second bucket containing approximately 4 gallons or more to sufficiently cover the pump of clean water. Place the pump and cord into this bucket and run the pump for approximately two minutes or until the volume of water in the bucket has been exhausted.
3. Fill a third bucket with approximately 4 gallons or more to sufficiently cover the pump of distilled or deionized water. Place the pump and cord into this bucket and run the pump for approximately two minutes or until the volume of water in the bucket has been exhausted.

Bladder Pump: Clean the inside and outside of the pump body with an Alconox (or similar)/clean water solution, followed by a thorough rinse with distilled or deionized water. The outside of the air supply line that came in contact with groundwater may also be cleaned with Alconox (or similar) solution and re-used; bladders and water discharge lines must be replaced after each sample is collected.

5.0 Investigation-Derived Waste (IDW)

Unless otherwise specified in the project work plan, water generated during groundwater sampling activities will be contained, transported, disposed of in accordance with applicable laws, and stored in a designated area until transported off-site for disposal.

The approach to handling and disposal of these materials for a typical cleanup site is as follows. For IDW that is containerized, such as purge water, 55-gallon drums (or other smaller sized drums) approved by the Washington State Department of Transportation will be used for temporary storage pending profiling and disposal. Each container holding IDW will be sealed and labeled as to its contents (e.g., “purge water”), the dates on which the wastes were placed in the container, the owner’s name and contact information for the field person who generated the waste, and the site name.

IDW containerized within drums will be characterized relative to applicable waste criteria using data from the sampling locations whenever possible. Material that is designated for off-site disposal will be transported to an off-site facility permitted to accept the waste. Manifests will be used, as appropriate for disposal.

Disposable sampling materials and incidental trash such as paper towels and PPE used in sample processing will be placed in heavy-duty garbage bags or other appropriate containers and disposed of as trash in the municipal collection system.

6.0 Field Documentation

Groundwater sampling activities will be documented in field sampling forms and/or field notebooks, and Chain-of-Custody Forms. Information recorded will, at a minimum, include personnel present (including subcontractors or client representatives), purpose of field event, weather conditions, sample collection date and times, sample analytes, depths to water, water quality parameters, well box/lid conditions, amount of purged water generated, and any deviations from the SAP. Photographs of damaged well casings or well boxes should be taken.

7.0 References

USEPA. 1996. Low-Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells, Revision 2. Region 1. July 30, 1996.

_____. 2002. Groundwater Sampling Guidelines for Superfund and CAR Project Managers. Office of Solid Waste and Emergency Response. EPA 542.S-02-001. May 2002.

Enclosures: Groundwater or Surface Water Sample Collection Form

GROUNDWATER OR SURFACE WATER SAMPLE COLLECTION FORM

Project Name: ______________________________ Date of Collection: ______________________________

Project Number: ______________________________ Field Personnel: ______________________________

Purge Data

Well ID: ______________________________ Secure: ☐ Yes ☐ No Well Condition/Damage Description: ______________________________

____

Depth Sounder decontaminated Prior to Placement in Well: ☐ Yes ☐ No One Casing Volume (gal): ______________________________

Depth of water (from top of well casing): ______________________________ Well Casing Type/Diameter/Screened Interval: ______________________________

After 5 minutes of purging (from top of casing): ______________________________

Begin purge (time): ______________________________

End purge (time): ______________________________

Volume purged: ______________________________

Purge water disposal method: ______________________________

Volume of Schedule 40 PVC Pipe

Diameter	O.D.	I.D.	Volume (Gal/Linear Ft.)	Weight of Water (Lbs/Lineal Ft.)
1 ¼”	1.660”	1.380”	0.08	0.64
2”	2.375”	2.067”	0.17	1.45
3”	3.500”	3.068”	0.38	3.2
4”	4.500”	4.026”	0.66	5.51
6”	6.625”	6.065”	1.5	12.5

Time	Depth to Water	Vol. Purged	pH	DO	Conductivity	Turbidity	Temp	ORP	Comments

Sampling Data

Sample No: ______________________________ Location and Depth: ______________________________

Date Collected (mo/dy/yr): ______________________ Time Collected: ______________ Weather: ______________________________

Type: ☐ Ground Water ☐ Surface Water Other: ______________________________ Sample: ☐ Filtered ☐ Unfiltered Other: ______________________________

Sample Collected with: ☐ Bailer ☐ Pump Other: ______________________ Type: ______________________________

Water Quality Instrument Data Collected with: Type: ☐ Horiba U-50 Other: ______________________________

Sample Decon Procedure: Sample collected with (circle one): decontaminated all tubing; disposable and/or dedicated silicon and poly tubing Other: ______________

Sample Description (Color, Turbidity, Odor, Other): ______________________________

Sample Analyses

TPH-D	(HCl)	☐	Chlor / Fluor	(unpres)	☐	COD / TOC	(H2SO4)	☐	Orthophos	(FILTER)	☐	Diss. Metals	(HNO3)	☐
TPH-G	(HCl)	☐	BTEX	(HCl)	☐	Total Metals	(HNO3)	☐	TKN/Phos	(N2SO4)	☐	VOCs	(HCl)	☐

Additional Information

Types of Sample Containers:	Quantity:	Duplicate Sample Numbers:	Comments:

Signature: ______________________________ **Date:** ______________________________

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F|S STANDARD GUIDELINE

Well Construction

DATE/LAST UPDATE: May 2015

These procedures should be considered standard guidelines and are intended to provide useful guidance when in the field, but are not intended to be step-by-step procedures, as some steps may not be applicable to all projects.

All field staff should be sufficiently trained in the standard guidelines and should review and understand these procedures prior to going in the field. It is the responsibility of the field staff to review the standard guidelines with the field manager or project manager and identify any deviations from these guidelines prior to field work. When possible, the project-specific Sampling and Analysis Plan should contain any expected deviations and should be referenced in conjunction with these standard guidelines.

1.0 Scope and Purpose

This standard guideline presents commonly used procedures for the installation of resource protection wells, in accordance with applicable sections of the Washington State Minimum Standards for Construction and Maintenance of Wells (Washington Administrative Code [WAC] 173-160, Part Two) and ASTM Standard Practice for Design and Installation of Groundwater Monitoring Wells (ASTM D5092-04[2010]e1). These wells may include groundwater monitoring wells, piezometers, groundwater extraction wells, injection wells, or vapor extraction wells. The guideline is intended to be used by field staff who are overseeing well drilling and construction.

2.0 Equipment and Supplies

Well Installation Equipment and Tools:

- Tape measure or measuring wheel
- Weighted tape or leadline
- Water level meter
- Hand-held Global Positioning System (GPS; optional)
- Camera
- Trash bags

- Well construction materials including polyvinyl chloric (PVC) screen and riser, sandpack, bentonite and well monument will be provided by the drilling subcontractor.

Paperwork

- Work Plan and/or Sampling and Analysis Plan (SAP)/Quality Assurance Project Plan (QAPP)
- Health and Safety Plan (HASP)
- Copies of figures showing previous boring locations and boring logs from previous investigations and historical depth to water levels, if available
- Well installation forms (printed on Rite in the Rain paper)
- Permanent markers and pencils

Personal Equipment:

- Steel-toed boots
- Hard hat
- Safety vest
- Safety glasses
- Nitrile gloves
- Ear plugs
- Rain gear
- Work gloves

3.0 Standard Procedures

3.1 PREPARATION

First, before going into the field, it is important to discuss the project needs with the Project Manager (PM). These include the appropriate aquifer for well screening (especially if it is not the shallowest aquifer), soil sampling interval (if applicable to drilling method), screen length and placement (especially important at tidally influenced sites), well construction materials (i.e., screen slot size and grain size of the filter pack), surface completion of the wells, and any other important construction details. Any non-standard materials needed for well construction should also be communicated to the drilling firm when the work is scheduled, or a minimum of two weeks prior to the field event. Select a boring log template that is appropriate for the project needs.

Next, review the work plan and existing materials such as cross-sections, historical depth to water levels, or boring logs from previous investigations (if available) to familiarize yourself with the site geology. In addition to site-specific information (or alternatively if other information is not available), a geologic map of the area from a reputable source such as the U.S. Geological Survey (USGS) may also be reviewed.

Finally, check the area of the site where drilling will occur for underground objects. A OneCall locate request should be made at least one week and no less than three days prior to commencement of drilling in order to give public utility locators time to mark known, buried utility lines. All planned boring locations should be marked on the ground with white spray paint prior to making a locate request. In almost all cases, site maintenance managers or equivalent should be consulted for site selection and a private utility locator should clear any underground objects using electromagnetic techniques from the drilling area. If drilling in close proximity to buried utilities, field staff may need to request authorization for use of an air knife or vacuum extraction to clear the borehole to a depth below the utility lines.

3.2 DRILLING

1. Mark the desired well location using coordinates pre-loaded into a handheld GPS, or by measuring from known Site features. It is best to use both methods, if possible.
2. Before drilling begins, record the following information on each log:
   a. Operator's name and company, equipment make/model, equipment measurements (i.e., sampler length and diameter, hammer weight and stroke if using hollow stem auger, boring diameter).
   b. Your name, date, project, boring name, and approximate descriptive location relative to existing site features. Include a description of the ground surface and whether or not concrete coring was necessary; if so, include core diameter, concrete thickness, and subcontractor information.
   c. A small hand drawn map showing your location with measurements to a stationary reference point, or GPS coordinates (or ideally, both). This is also a good place to note if you have had to move a boring location because of underground utilities, access issues, etc. It is important to record the reason for relocation and the direction and distance moved (i.e., moved 10 feet to the north due to presence of subsurface water line).
3. If you are using a hollow stem auger, it is important to communicate to the driller how often you would like a split spoon sample collected. Typically this would be continuous or every 5 feet but may be different depending on the project needs. Usually this is established before the driller issues a quote. Any changes will affect the cost of the work and should be discussed with the PM.
   a. Record any feedback from the driller about the drilling conditions. This may include difficult drilling or rig chatter (usually caused by hard materials), heaving sands (usually caused by hydrostatic pressure on the borehole), caving, or hole instability.

4. For split spoon samples, record the number of hammer blows (blow counts) necessary to drive the sampler each 6-inch increment, as reported by the driller. If more than 50 blows are needed, record the distance that the sampler was driven in 50 blows (i.e., 2-inches in 50 blows). This is referred to as the standard penetration test (SPT).
5. For all drilling methods, create a log of the soils encountered according to the Floyd|Snider Soil Logging Standard Guideline. Pay particular attention to the moisture content of the soils, making careful notation of the water table where free water is first encountered. After drilling has been completed to the desired depth, confirm the depth to the water table using a water level meter.

3.3 WELL DESIGN AND CONSTRUCTION

1. Determine the length and placement of the well screen based on the observed depth to the water table, the specifics of the work plan, and the observed lithology. The well screen is typically set across the water table of shallow aquifers for monitoring wells and piezometers. However, the screened interval may be fully submerged for groundwater extraction wells, sites with very shallow groundwater, or wells installed in deeper aquifers below confining units. If an area is tidally influenced, note the tide elevation during well completion; if the tide is at a high or low at the time of drilling the well screen may need to be lowered or raised accordingly so that the screen spans the water table when the tide is at zero. The hydraulic conductivity of the aquifer material will also factor into well screen placement. For example, wells screened in tight silts may not produce enough water to adequately develop and sample. In this case, it may be preferable to screen the well in a more transmissive unit. Include the length of any required bottom caps or sumps below the well casing when determining the total depth of the boring required to place the well screen at the desired interval. The Washington State minimum standards also require that the diameter of the well screen relative to the diameter of the borehole (annual space) be small enough to allow placement of a filter pack that is 4 inches in diameter larger than the screen. For example, a 2-inch diameter monitoring well should be completed within a borehole that has a minimum 6-inch diameter.

6. Determine the filter pack material. The purpose of the filter pack is to prevent fine-grained aquifer material from entering the well while still allowing groundwater to flow through. Filter pack is composed of clean, rounded, relatively uniform silica sand. The choice of sand for the filter pack will depend on the grain size range of the aquifer material, with emphasis on the finest aquifer material. Filter pack material should be approximately 10 to 15 times the grain size of the surrounding aquifer material. The particle size ranges of fine, medium, and coarse sand, and the particle size ranges of common filter pack materials are given in the two tables below. As indicated in these tables, suitable filter pack choices for an aquifer with appreciable fine sand would include a range from 20-40 to 10-20 sand. For aquifers where the smallest particle size is medium sand, a filter pack of 2-12 sand or similar may be appropriate. More precise filter pack designs are possible based on grain size curves (see Driscoll 1986, Blair 2006).

Unified Soil Classification System (USCS) Classification	U.S. Sieve Size	Grain Size (inches)	Grain Size (millimeters)
Fine Sand	40 to 200	.003 to 0.16	.074 to .42
Medium Sand	10 to 40	.016 to .06	.42 to 1.68
Coarse Sand	10 to 4	.06 to 0.19	1.68 to 4.76

Example Sand Pack Gradations (U.S. Sieve Sizes)	Grain Size (inches)	Grain Size (millimeters)
32-40	.016 to .02	.42 to .55
20-40	.016 to .03	.42 to .84
16-30	.05 to .02	.59 to 1.2
10-20	.03 to .08	.84 to 2
2-12	.06 to .3	1.7 to 8

7. Determine the screen slot diameter. The purpose of the well screen is to allow groundwater to flow into and through the well screen for sample collection. Monitoring well casings are typically constructed of PVC (Washington State minimum standards require Schedule 40 or thicker-walled PVC for borings up to 200 feet deep); however, materials such as stainless steel may be used for the purposes of longevity, heat, specific chemical resistance, or other site-specific concerns. The screened interval of the well consists of a series of slots that are commonly 0.01 inch or 0.02 inch in width. Similar to filter pack material, narrower slots allow less fine-grained material and also less groundwater to pass through them. The screen slot size should be selected to retain approximately 90% or greater of the filter pack material. The largest screen slot size practical should be selected.

8. Once the driller has assembled the well casing of the appropriate length, oversee placement of the casing and filter pack. The casing should be centered in the borehole and level. When using a hollow stem auger, the sand is typically poured from the surface while the augers are being lifted from the borehole. When using sonic drilling or other methods where the drill rods are removed prior to sand placement, it is preferable to use a Tremie tube lowered to the bottom of the borehole to deliver the sand, which helps to ensure that the sand has actually reached the bottom of the borehole. As the driller is pouring sand into the annular space, monitor the height of the sand in the borehole using a weighted tape or leadline to ensure that the space is being filled evenly. If possible, use a surge block to force water from the well out into the sand pack periodically to eliminate any bridges or gaps in the sand. The sand pack

placement is complete when it has reached a height minimum of 1 foot (but no more the 5 feet) above the top of the well screen.

9. A bentonite seal must be placed above the sand pack to isolate the screened interval of the aquifer and to prevent the annular space from acting as a preferential pathway for surface water, water above the screen zone, or other liquid (i.e., free product). The purpose of the bentonite plug is to prevent downward migration inside the borehole, which has the potential to cause groundwater contamination. Monitor the placement of the bentonite plug above the sand pack. The bentonite plug is typically composed of dehydrated bentonite chips, which are poured into the annual space from the surface; or a bentonite slurry, which is pumped into the space via a Tremie tube. A bentonite chip seal is still recommended (but not necessary) immediately above the sand pack when using bentonite slurry to minimize migration of the slurry into the sandpack. Pumping is preferable in situations where bentonite will be placed below the water table. The U.S. Environmental Protection Agency (USEPA) recommends that the bentonite seal consist of a minimum of 2 feet of bentonite placed above the sand pack. If using a bentonite chip seal, hydrate the chips with clean water so that they expand to seal the borehole.
10. Communicate the desired surface completion to the driller (i.e., an aboveground well monument or a monument flush with the ground surface) if you have not already done so. Verify that the well monument has been installed correctly. For flush-mounted wells, ensure that the well is level with the surrounding grade, especially in areas with pedestrian or vehicle traffic. In areas with frequent or heavy vehicle traffic, heavy-duty traffic-rated monuments or manholes should be used. For aboveground well monuments (i.e., stand pipes), ensure that the monument is level, anchored in a minimum of 2 feet of concrete, and protected by steel bollards, unless otherwise specified in the work plan. The concrete surrounding any well monument should seal the borehole at the ground surface.

4.0 Decontamination

All reusable equipment that comes into contact with soil and groundwater should be decontaminated as follows prior to moving to the next sampling location.

Split spoons, stainless steel bowls and spoons, the water level tape, and any other tools used for well drilling and installation must be decontaminated between boring locations. If collecting soils samples for chemical analysis, split spoons and any tools used for sample processing will be decontaminated between each sample; alternatively, disposable bowls and spoons may be used. Equipment decontamination will consist of a tap water rinse to remove soil particles, followed by scrubbing with brushes and an alconox (or similar)/clean water solution, and a final rinse with distilled or deionized water.

5.0 Investigation-Derived Waste

Unless otherwise specified in the project work plan, waste soils, liquids, and other drilling materials generated during well drilling and installation will be contained in accordance with applicable laws, and stored in a designated area until transported off-site for disposal.

The approach to handling and disposal of these materials is as follows. For investigation-derived waste (IDW) that is contained, such as waste soils, 55-gallon drums approved by the Washington State Department of Transportation (WSDOT) will be supplied by the driller and used for temporary storage pending profiling and disposal. Each container holding IDW will be sealed and labeled with its contents (e.g., “soil cuttings”), the date(s) on which the wastes were placed in the container, the owner’s name, contact information for the field person who generated the waste, and the site name.

IDW contained within drums will be characterized relative to applicable waste criteria using data from the sampling locations whenever possible. Material that is designated for off-site disposal will be transported to an off-site facility permitted to accept the waste. Manifests will be used as appropriate for disposal.

Disposable sampling materials and incidental trash such as paper towels and personal protective equipment (PPE) used in sample processing will be placed in heavy-duty garbage bags or other appropriate containers and disposed of as solid waste in the municipal collection system (i.e., site dumpster).

6.0 Field Documentation

All observations should be recorded on a soil boring/well completion form appropriate for the drilling method or in a bound field notebook. Field staff should record as much detail as possible in the field log (including well construction materials, Ecology well ID tag number, and surface completions) and note any anomalies or details that varied from the SAP. After the field work is complete, a set of final well construction logs (usually electronic) that serve as the record for the project will be completed in consultation with the project manager or field manager.

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F|S STANDARD GUIDELINE

Well Development

DATE/LAST UPDATE: May 2015

These procedures should be considered standard guidelines and are intended to provide useful guidance when in the field, but are not intended to be step-by-step procedures, as some steps may not be applicable to all projects.

All field staff should be sufficiently trained in the standard guidelines and should review and understand these procedures prior to going in the field. It is the responsibility of the field staff to review the standard guidelines with the field manager or project manager and identify any deviations from these guidelines prior to field work. When possible, the project-specific Sampling and Analysis Plan should contain any expected deviations and should be referenced in conjunction with these standard guidelines.

1.0 Scope and Purpose

This Standard Guideline for Well Development presents commonly used procedures for monitoring well development for newly installed monitoring wells and/or existing wells that may require redevelopment. Monitoring well development restores hydraulic conductivity with the surrounding formations that were disturbed during the drilling process. Development removes residual fines from well filter pack materials and the borehole wall and reduces the turbidity of the water, which provides more representative groundwater samples. These wells may include groundwater monitoring wells, piezometers, or groundwater extraction wells. This guideline describes the purge and surge method of development and is intended to be used by field staff who are overseeing or completing well development. Often, the drilling subcontractors are asked to complete well development activities subsequent to new well installations, in which case, Floyd|Snider staff would oversee the development. Other development methods, such as jetting, are not described herein, but may be used if specified in the project-specific Work Plan or Sampling and Analysis Plan (SAP).

Well development shall be completed by continuous pumping at a steady rate using a portable pump and polyethylene tubing, with regular surging (e.g., using a surge block) to force water through the filter pack and surrounding formation. Wells should ideally be developed either during installation (following sand placement but prior to sealing) or soon after installation, unless otherwise specified in the work plan, using the described methodologies or equivalents. For wells that are completed using a grout or concrete seal, if development does not take place prior to sealing, it should be completed within 48 hours following well installation in order allow for grout and concrete to cure.

2.0 Equipment and Supplies

Well Development Equipment and Tools:

- Appropriate high volume pump (centrifugal, submersible, etc.) and correct diameter tubing, or bailer
- Hose clamps (optional)
- Power source (generator, 12-volt battery, or car battery) and appropriate power adapter for pump
- Water quality meter or turbidity meter (if needed)
- 2-, 4-, or 6-inch surge block (typically provided by the driller)
- Water level meter
- Washington State Department of Transportation (WSDOT)-approved 55-gallon drums
- Equipment decontamination supplies including:
  - Scrub brushes
  - Alconox or other soap
  - Distilled or deionized water
  - Paper towels
- Trash bags
- Camera

Paperwork:

- Work Plan and/or SAP/Quality Assurance Project Plan (QAPP)
- Bound field notebook or appropriate field forms
- Well development form (printed on Rite in the Rain paper)
- Health and Safety Plan (HASP)
- Well installation forms (printed on Rite in the Rain paper)

Personal Equipment:

- Steel-toed boots

- Safety vest
- Safety glasses
- Nitrile gloves
- Rain gear
- Work gloves

3.0 Standard Procedures

3.1 OFFICE PREPARATION

Meet with the project manager to identify key information and goals of the well development, including how long after construction the wells should be developed. Determine if Floyd|Snider or the driller will be doing the development.

3.2 WELL DEVELOPMENT PROCEDURES

The following procedures are general guidelines for monitoring well development. These same procedures are also appropriate for extraction wells, injection wells, and/or piezometers. Specific instructions provided in individual work plans shall supersede these procedures in the event there are discrepancies.

Visually inspect all well development equipment for damage; repair as necessary.

1. Decontaminate all hoses, surge blocks, and/or submersible pump by scrubbing with brush and alconox or other soap solution and rinsing with deionized water.
2. Prior to development, use a water level meter to measure the depth in each well to the static water level and total depth to a reference mark on the top of the well casing.
3. Attach a length of clean or disposable tubing, approximately 5 feet longer than the well casing, to the outlet of the submersible pump.
4. Each well development cycle consists of surging followed by well evacuation (pumping). Surging may be accomplished with a surge block sized to fit snugly inside the well casing, or with the submersible pump. Surging using a pump increases the hydraulic gradient and velocity of groundwater near the well by drawing the water level down and moving more fine-grained soil particles into the well casing. Surging using a pump is only effective if the well produces enough water for continuous pumping and the pump is of a large enough diameter relative to the well casing. If pumping must be stopped to allow the well to recharge, a surge block is preferable for surging. If using a surge block, connect polyvinyl chloride (PVC) pipe or other rods longer than the well casing to the surge block. Lower the surging device into the well to a depth within the screened interval. A bailer can be used to surge in situations

when a surge block is not available and the well has insufficient recharge for the submersible pump.

5. During development, it is important to note the color and clarity of the water and any other visual or olfactory observations on the field form or in the field notebook. Note any significant changes as development progresses.
6. Surging should consist of a minimum of ten consecutive surges (i.e., quickly raise and lower surge block or pump in well) with an appropriately sized surge block or pump over the full length of the screen. For long well screens (greater than 10 feet), surging should be done in short intervals of 2 to 3 feet at a time. In cases where the screen extends to above the water table, clean water may have to be added to the well to develop the top of the filter pack.
7. After surging, water is purged from well until the pumped stream starts to run clear. At that point, stop pumping and initiate another surge cycle. If a well has more hydraulic head than the pump is able to overcome, or if an insufficient volume of water for pumping is present, a disposable bailer may also be used for purging.
8. Repeat this procedure until evacuated water is visibly clear and essentially free of sediment. Perform a minimum of three surge and pump cycles.
9. Well development will be terminated when the variation in the turbidity Nephelometric Turbidity Units (NTUs) readings is less than 10 percent or until the discharge is visibly clear and free of sediment after a minimum of three surge and purge cycles. As an alternative, periodic water samples can be collected for field measurements of temperature, specific conductivity, and pH; well development should continue until field parameters stabilize to within ±5 percent on three consecutive measurements or 10 well volumes have been purged. If it is not possible reduce the turbidity further, the well should be purged up to a maximum of four hours or as determined sufficient by the field geologist or project manager.
10. Report field observations and volume of water removed on the standard well development form (attached). Take final water level measurements and record then on the field form or in the field notebook.
11. Contain the purged water and manage in accordance with the project-specific SAP or Section 5.0 below. Prior to developing the next well or after the completion of development activities, decontaminate all reusable equipment used in development in accordance with Section 4.0 below.
12. If feasible, it is best to wait at least two weeks after development to sample the wells. Wells can be sampled a minimum of 48 hours after the completion of development if the project schedule requires a quick turnaround. However, the groundwater sample will be more representative of static conditions in the aquifer if allowed to stabilize for at least one to two weeks after development.

4.0 Decontamination

All reusable equipment that comes into contact with groundwater should be decontaminated as follows prior to moving to the next sampling location.

Water level meter and surge block: The water level indicator and tape will be decontaminated between sampling locations and at the end the day by spraying the entire length of tape that came in contact with groundwater with an Alconox (or similar)/clean water solution followed by a thorough rinse with distilled or deionized water. Surge block decontamination will consist of a tap water rinse to remove soil particles, followed by scrubbing with brushes and an alconox (or similar)/clean water solution and a final rinse with distilled or deionized water.

Submersible Pump: Decontaminating the pump requires running the pump in three progressively cleaner grades of water. Place the pump and the length of the power cord that was in contact with water into a bucket containing approximately four gallons of an Alconox (or similar)/clean water solution. Run the pump for approximately two minutes or until the volume of water in the bucket has been exhausted. Next, place the pump and cord into a second bucket containing approximately four gallons of clean water and run the pump for approximately two minutes or until the volume of water in the bucket is exhausted. Lastly, place the pump and power cord into a third bucket containing approximately four gallons of distilled or deionized water and run the pump for approximately two minutes or until the volume of water in the bucket is exhausted. The soap/water solution and rinse water may be re-used. When done for the day, dry the exterior of the pump and power cord with clean paper towels to the extent practical prior to storage. All decontamination water and rinse water (including soapy solution) should be managed in accordance with Section 5.0 below.

5.0 Investigation-Derived Waste

Unless otherwise specified in the project work plan, well development and decontamination water generated during development and any drilling materials will be contained and stored in a designated area until transported off-site for disposal in accordance with applicable laws.

The approach to handling and disposal of these materials is as follows. For investigation-derived waste (IDW) that is contained, such as well development water, WSDOT-approved 55-gallon drums will be supplied by the driller and used for temporary storage pending profiling and disposal. Each container holding IDW will be sealed and labeled as to its contents (e.g., “MW-1 Well development water”), the date(s) on which the wastes were placed in the container, the owner’s name, contact information for the field person who generated the waste, and the site name.

IDW contained within drums will be characterized relative to applicable waste criteria using data from the sampling locations whenever possible. Material that is designated for off-site disposal will be transported to an off-site facility permitted to accept the waste. Manifests will be used as appropriate for disposal.

Disposable sampling materials and incidental trash such as paper towels and personal protective equipment (PPE) used in sample processing will be placed in heavy duty garbage bags or other appropriate containers and disposed of as trash in the municipal collection system (i.e., site dumpster).

6.0 Field Documentation

Well development procedures will be documented on the well development field form (attached) or a bound field notebook. Information recorded will at a minimum include date, personnel present (including subcontractors), purpose of field event, weather conditions, depth of water, well construction details for the well(s) being developed (i.e., diameter, total depth, screen interval), water quality field measurements (if collected), amount of purged water generated, and any deviations from the SAP.

Enclosure: Well Development Field Form

Well Development Field Form

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Project Name:______________________________ Date: _________________

Project Number:______________________________ Field Personnel: _________________________________

Driller (if applicable): ___________________________

Purge Data

Well ID:	**Total Well Depth:**	**Well Condition/Damage Description:**

Well Casing Type/Diameter/Screened Level:	**One Casing Volume (gal):**
Method of Development (Circle): Surge Block Pump Surge Bailer	**Equipment Used (type of pump, etc.):**

Begin Purge (time):

End Purge (time):

Gallons Purged (time):

Purge Water Disposal Method (circle):

On-site Storage Tank On-site Treatment Drum Other:

Volume of Schedule 40 PVC Pipe

Diameter	O.D.	I.D.	Volume (Gal/Linear Ft.)	Weight of Water (Lbs/Lineal Ft.)
1 ¼"	1.660"	1.380"	0.08	0.64
2"	2.375"	2.067"	0.17	1.45
3"	3.500"	3.068"	0.38	3.2
4"	4.500"	4.026"	0.66	5.51
6"	6.625"	6.065"	1.5	12.5

Time	Depth to Water (feet)	Vol. Purged (gallons)	Rate (gpm)	pH	Conductivity	Turbidity	Temp	Comments
			--	--	--	--	--	Prior to purging

Notes:

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strategy ▪ science ▪ engineering

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F|S STANDARD GUIDELINE

Vapor Intrusion

DATE/LAST UPDATE: February 2019

These procedures should be considered standard guidelines and are intended to provide useful guidance when in the field, but are not intended to be step-by-step procedures, as some steps may not be applicable to all projects.

All field staff should be sufficiently trained in the standard guidelines for the sampling method they intend to use and should review and understand these procedures prior to going into the field. It is the responsibility of the field staff to review the standard guidelines with the field manager or project manager and identify any deviations from these guidelines prior to field work. When possible, the project-specific Sampling and Analysis Plan should contain any expected deviations and should be referenced in conjunction with these standard guidelines.

1.0 Scope and Purpose

This standard guideline provides details necessary to complete vapor intrusion monitoring, which may include soil vapor point and sub-slab installation, soil vapor point monitoring and/or sampling, indoor air sampling, and remediation system compliance monitoring. Field screening for volatile organic compounds (VOCs) is most often conducted with a photoionization detector (PID) and confirmed via analytical sample collection. The most common sampling methods are included herein. These guidelines are designed to meet or exceed guidelines set forth by the Draft Washington State Department of Ecology's (Ecology's), *Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action* (Ecology 2015 and 2018a). In addition, refer to Ecology's *Updated Process for Initially Assessing the Potential for Petroleum Vapor Intrusion: Implementation Memorandum No. 14* (Ecology 2016), Ecology's *Petroleum Vapor Intrusion (PVI): Updated Screening Levels, Cleanup Levels, and Assessing PVI Threats to Future Buildings: Implementation Memorandum No. 18* (Ecology 2018b), and the U.S. Environmental Protection Agency's (USEPA's) *Technical Guide For Addressing Petroleum Vapor Intrusion At Leaking Underground Storage Tank Sites* and *OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air* (USEPA 2015a and 2015b). Defining the lateral and vertical inclusion zones will determine if soil vapor sampling is required. The Interstate Technology and Regulatory Council (ITRC) online guidance for soil vapor intrusion (ITRC 2014) is another good source of information.

2.0 Equipment and Supplies

The following is a list of typical equipment and supplies that may be necessary to complete vapor intrusion monitoring. It is important to note that this list is for a typical project; site-specific conditions may warrant additional or different equipment for completion of the work.

Sub-Slab, Soil Vapor Point, and Vapor Pin® Installation:

- Rotary hammer drill
- Drill bit
- Vapor point (AMS or similar)
- Stainless steel (SST) dummy tip (optional)
- Teflon™, nylon, or stainless steel tubing
- Sand pack
- Bentonite chips
- Protective cover for permanent point
- Swagelok® on/off valve (optional)
- Caps or compression fittings
- Quick set (concrete) or hydraulic cement
- Paper towels
- Nylon ferrules
- Vapor Pin® Kits (Cox-Colvin & Associates), which include the following:
    - Brass or stainless steel Vapor Pins®
    - Vapor Pin® sleeves
    - Vapor Pin® caps
    - Plastic or stainless steel flush mount covers
    - Spanner screwdriver
    - Stainless steel drilling guide
    - Installation and extraction tool
    - Bottle brush
    - Water dam for leak testing
    - Vapor Pin® Standard Operating Procedures (SOP)
- Shop vac

Soil Vapor Point or Remediation System Screening and/or Sampling:

- PID
- Connector
- Teflon™ or nylon tubing
- Air sampling pump or peristaltic pump
- Tedlar® bag or SUMMA® canisters
- Two adjustable wrenches (to tighten SUMMA® canister connections)
- Duplicate sampling (as necessary if duplicate sample collection is required)
- Soil gas manifolds
- Ferrules/fittings
- Helium (or other detection gas, such as isopropyl alcohol, if leak detection is necessary)
- Helium detector (if leak detection is necessary with helium)
- Soil vapor sampling sheet (attached)

Indoor Air Sampling:

- PID
- Flow regulator
- SUMMA® canisters (6-liter, lab certified)
- Sampling cane (optional)
- At least two adjustable wrenches
- Indoor air building survey form (enclosed)

3.0 Standard Procedures

Soil vapor samples and/or indoor air samples should be collected from a sufficient number of locations to assess the presence of VOCs and potential exposure to workers or occupants of potentially impacted buildings or future building locations.

3.1 PRE-SCREENING ASSESSMENT

When completing a vapor intrusion survey or indoor air sampling, it is important to complete a pre-sampling survey to document potential activities or storage items that may cause interference with sample results. Some important things to note (list is not comprehensive):

- If smoking has occurred in the building

- Storage of potential contaminants (cleaners, fuels, paints, or paint thinners, etc.)
- HVAC system operation (on or off)
- Temperature and weather (wind direction, barometric pressure, etc.)
- Vehicle maintenance or industrial activities on the property or in the immediate vicinity (especially upwind)
- If new carpet or furniture is present

A pre-sampling soil vapor building survey form can be found at the end of this document. Be mindful of your surroundings and make a comprehensive list of potential factors that may influence sample results.

3.2 SOIL VAPOR POINT INSTALLATION

Soil vapor points can be installed along the outside perimeter of a building or in the lowest level of a building directly through the slab (or beneath the floor into the subsurface if there is not a slab). It is important to evaluate the presence of utilities prior to drilling into the subsurface or through a concrete slab.

If the sampling point is for one time use, tubing inserted into a hole drilled in the slab is sufficient. However, if the sampling is to be part of a long-term monitoring program, a more robust sampler, such as a Geoprobe or AMS probe for permanent soil gas point is recommended. Five different methods for installing soil vapor installation points are described here.

1. For temporary sub-slab points:
    a. Drill a hole into the subsurface. Using a rotary hammer drill and a 3/8-inch drill bit (typical diameter size but not necessary), drill a hole through the concrete floor slab of the building and into the sub-slab material to some depth (e.g., 7 to 8 centimeters [cm] or 3 inches). Drilling into the sub-slab material will create an open cavity, which will prevent obstruction of the tubing intake by small pieces of gravel. Once the thickness of the slab is known, the tubing will be cut to ensure that the probe tubing does not reach the bottom of the hole in order to avoid obstruction with sub-slab material. Sample tubing can be placed directly into the sub-slab. Evaluate and note the sub-slab conditions.
    b. Care should be taken to reduce cross-contaminating sub-slab vapor and indoor air vapor. This may be done by sealing the sample point with VOC-free hydraulic cement, hydrated bentonite, or with VOC-free putty to the top of the slab. Once sealed, wait 15 to 30 minutes before sampling.

2. Installation guidelines for a sub-slab Vapor Pin®:[1]

Figure 1. Assembled VAPOR PIN®

   a. Check for buried obstacles and utilities. Set up wet/dry vacuum to collect drill cuttings. Also, look for nearby cracks or other holes in the slab that may cause short circuiting and influence from indoor air.
   b. Drill a 1.5-inch (38 millimeters [mm]) diameter hole at least 1.75 inches (45 mm) into the slab. Use of a Vapor Pin® drilling guide is recommended in the SOP.
   c. Drill a 0.625-inch (16 mm) diameter hole through the slab and approximately 1 inch (25 mm) into the underlying soil to form a void. Hole must be 0.625 inches (16 mm) in diameter to ensure proper seal. The Cox-Colvin SOP recommends using the drill guide provided in the kit. Remove the drill bit, brush the hole with the bottle brush provided in the kit, and remove the loose cuttings with a vacuum.
   d. Place the lower end of Vapor Pin® assembly into the drilled hole. Place the small hole located in the handle of the installation/extraction tool provided in the kit over the vapor pin to protect the barb fitting, and tap the Vapor Pin® into place using a dead blow hammer or rubber mallet. Make sure the installation/extraction tool is aligned parallel to the Vapor Pin® to avoid damaging the barb fitting.
   e. For flush mount installations, cover the Vapor Pin® with a flush mount cover, using either the plastic cover or the optional stainless-steel Secure Cover provided by Vapor Pin®.
   f. Allow 48 hours or more for the sub-slab soil-gas conditions to re-equilibrate prior to sampling.

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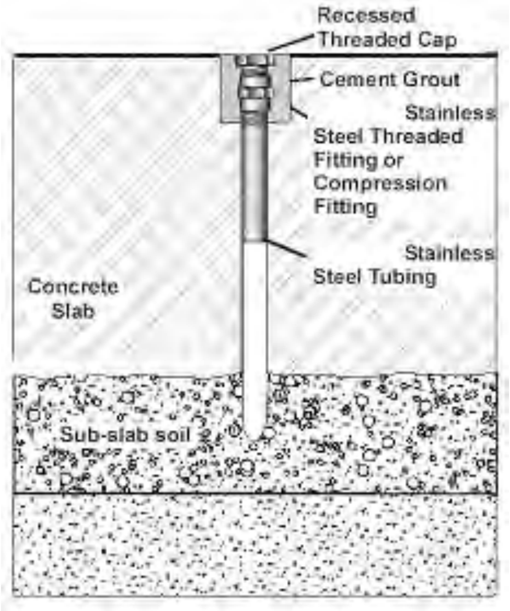
[1] Additionally, refer to Cox-Colvin SOP Installation and Extraction of the Vapor Pin®, which is included with the Vapor Pin® kit.

3. Suggested installation guidelines for temporary outdoor soil gas points using a rotary hammer and drill bit:
    a. Manufacturers, such as Geoprobe or AMS, make soil gas implant systems designed for use with their equipment. Stainless steel or polyvinyl chloride (PVC) screen can also be used to construct an appropriate soil gas point. The probe screen will be fitted with a Swagelok® or similar fitting and connected to a length of 0.25-inch outer diameter, rigid wall nylon or Teflon™ tubing that will be above grade. Refer to the manufacturer or driller's instructions for specific details regarding assembly and deployment.
    b. To seal the point, the implant should be surrounded with a clean sand pack. Concrete (VOC-free hydraulic cement preferred) should be used above the seal to the top of the slab. Placement of some sort of cap or protective device is recommended if the sampling point will remain in place for some time after the soil gas sample is collected. Once sealed, wait 15 to 30 minutes before sampling.
4. Suggested installation guidelines for outside permanent points installed with a Geoprobe rig or hand auger:
    a. Advance the boring using a geoprobe or hand auger to the required maximum depth. Install a 6-inch long by 0.75-inch diameter stainless steel screen that is capped on the bottom end and fitted with a Swagelok® fitting connected on the other end (or similar approved screen or soil vapor point). Attach a length of 0.25-inch outer diameter rigid wall nylon or Teflon™ tubing to the probe screen that will be above grade. The above grade end of the probe should be fitted with a stainless steel Swagelok® on/off control valve or similar valve (optional), which is used to prevent short-circuiting of ambient air into the probes and to conduct closed-valve tests. Teflon™ tape should be used on threaded joints to ensure a good seal. Depending on the work plan, it might be necessary to collect an air equipment blank sample through the vapor probe components prior to installation.
    b. The 6-inch screen tip should be vertically centered in a 1-foot long interval containing standard sand pack, resulting in 3 inches of sand above and below the screen. The sand pack will be covered with a 1-foot interval of dry granular bentonite, which should be covered with at least 2 feet of pre-hydrated granular bentonite. The dry granular bentonite is emplaced immediately above the sand pack to ensure that pre-hydrated granular bentonite slurry does not flow down to the probe screen and seal it. The remainder of the borehole will be filled with pre-hydrated granular bentonite slurry (mixed at the surface and poured in) to approximately 12 inches below ground surface (bgs). The top portion should be completed with a 1-foot thick cement cap. A flush-mounted well box or other suitable protective cover should be installed to protect the nylon/Teflon™ tubing and on/off control valve.

5. Suggested equipment and installation guidelines for permanent sub-slab vapor points within a building; however, site-specific conditions may warrant additional or different equipment for completion of the work:
    a. To install the sub-slab vapor probes, a rotary hammer drill will be used to create a “shallow” hole (e.g., ¼-inch deep) that partially penetrates the slab (do not completely penetrate the slab). A portable vacuum can be used to remove the drill cuttings from the hole without compromising the soil vapor samples. Next, a smaller diameter “inner” hole (e.g., 0.8 cm or 5/16 inch diameter) will be drilled through the remainder of the slab and into the sub-slab material to some depth (e.g., 7 to 8 cm or 3 inches). Drilling into the sub-slab material will create an open cavity which will prevent obstruction of the probes by small pieces of gravel. Once the thickness of the slab is known, the tubing will be cut to ensure that the probe tubing does not reach the bottom of the hole and in order to avoid obstruction with sub-slab material.
    b. Each sub-slab vapor point should consist of vacuum-rated Nylon, Teflon™, or stainless steel tubing with ¼-inch outer diameter by 0.15-inch inner diameter, and stainless-steel compression to thread fittings (e.g., ¼-inch outer diameter Swagelok® (SS-400-7-4) NPT female thread connectors or similar equipment). This will be capped with sub-slab tamper resistant cap or other similar protective caps that will be inset into the floor to avoid trip hazards. When time to sample, the sub-slab tamper resistant cap will be removed and Nylon tubing will be attached to the sub-slab vapor point with a ¼-inch out diameter (SS-400-1-4) male NPT. Prior to the installation of one of the sub-slab vapor probes, an air equipment blank sample will be collected if required by the work plan (See Section 3.4.3).
    c. Teflon™ tape should be used with all stainless steel treads. All fittings should be attached prior to installing the probe in the sub-slab. A sub-slab tamper resistant cap will be used to ensure that the top of the probe is flush with the surface so as not to interfere with day-to-day use of the building. Portland cement can be used as a surface seal and allowed to cure for at least 24 hours prior to sampling. Hydraulic cement may also be used if free of VOCs, and requires less cure time (typically less than one hour) prior to sample collection. A typical soil gas probe schematic is provided here for reference.



Sub-slab soil gas probe schematic (Source: Ecology 2016a)

3.3 SOIL VAPOR POINT SAMPLING USING TEDLAR® BAGS

The objective of the vapor sampling procedures is to collect representative samples of the targeted media and analyze the gas for the presence of VOCs. Typically, a low volume air pump is used to pull a sample through the sampling train.

1. Connect proper tubing to your sampling point and to your low volume air pump.
2. Purge for 3 to 5 minutes to ensure that you are collecting a representative sample.
3. After purging, connect your Tedlar® bag to your air pump and collect your sample (Note: Tedlar® bags should be filled at a rate of approximately 5 liters per minute).
4. A PID is typically used in conjunction with sample collection in a Tedlar® bag.
    a. Connect the PID probe to the sample container using a section of tubing
    b. Use the PID to read the organic vapor level present in the sample.

Soil Vapor samples are typically collected into 1-liter Tedlar® bags and have a short (typically less than 72-hours) holding time. Samples collected into Tedlar® bags should be transported to the laboratory immediately under chain-of-custody protocol and stored in a dark container at ambient temperature during transport out of direct UV-light. Do not ship Tedlar® bags to the laboratory using an air transportation method as the pressure could compromise the sample or the bag. If air transport is necessary, do not completely fill the Tedlar® to avoid bursting. Soil vapor grab samples can also be collected into 1-liter SUMMA® canisters to provide additional holding time, lower laboratory method detection limits for some analytes, or sample delivery alternatives.

3.4 SOIL VAPOR AND SUB-SLAB SAMPLING WITH SUMMA® CANISTERS

Prior to soil vapor sampling, check all soil vapor sampling supplies to ensure the right sampling equipment arrived from the lab including duplicate Tees, if duplicate sample collection is necessary, and purging canisters. Conduct the following:

- Confirm that all SUMMA® canisters have at least 27 to 30 inches of mercury (in. Hg) prior to going out in the field to sample.
- Check and record all manifold and SUMMA® canister tags and numbers.
- Make sure all connections on the SUMMA® canisters and manifolds are tight.
- Order Helium (or other tracer gas) if needed and rent a helium detector.

Once the sub-slab or soil vapor probes are installed and the concrete well seal at each vapor point has fully cured, vapor sampling activities may commence (ideally a minimum of 2 hours is necessary for probe equilibration, depending on surface seal cure time). Alternatively, existing monitoring wells that are appropriately screened for a vapor intrusion assessment may be used. If indoor air samples will be collected, they may be collected simultaneously during the sub-slab sampling activities (details found in Section 3.6) if required by the work plan. If feasible, vapor sampling should not be conducted during or immediately after a significant rain event (i.e., greater than an inch of rainfall) due to the reduced effective diffusion coefficient and decrease in relative vapor saturation in the unsaturated zone. For sub-slab or soil vapor probe sampling, 1-liter lab certified SUMMA® canisters should be used in order to minimize the volume of soil vapor collected.

A closed-valve test should be conducted prior to soil vapor sample collection to check for leaks in the sampling train. A closed-valve test is conducted by capping the ends with proper Swagelok caps and/or closing any valves at the sampling point and purge canister. Once all ends are closed tight, turn the sampling canister valve on for 5 minutes. If the sampling train maintains its original vacuum for 5 minutes, the equipment will be assumed to be functional and there are no leaks. If the vacuum reading starts to drop, turn off the valves right away, check all connections, tighten if necessary, and re-test. If this passes, the only location that a leak can occur is from the soil ground seal around the vapor probe, which will be tested using helium or another tracer gas during sampling (See Section 3.4.1).

After the close-valve test, a minimum of three tubing volumes should be purged. Purging can be completed using a non-certified 6-Liter SUMMA® canister or a vacuum pump. The maximum flow rate during purging will not exceed the flow rate limit used for subsequent sampling and care will be taken not to over purge. An excel spreadsheet to help calculate tubing volume and purging time can be found at the end of this document.

After the sampling train has been purged, sub-slab soil vapor samples will be collected over a 10 minute period at a flow rate of less than 167 milliliters per minute (mL/min). The flow rate will be controlled by a flow regulator, which is set by the lab. Sub-slab soil vapor samples will be collected in laboratory-certified and pre-evacuated 1-liter SUMMA® canisters. Each SUMMA®

canister will be supplied with an analytical test report certifying that the canister is "clean" to concentrations less than the respective method detection limits (MDLs). Each canister will be equipped with a pre-calibrated flow controller sampling train to allow collection of the desired sample. Prior to collecting the samples, the SUMMA® canister ID numbers will be recorded in the field notebook along with the initial canister vacuums, prior to sampling.

Soil vapor samples will be collected per the following steps:

1. Opening the valve on the top of the SUMMA® canister and recording the time in the log book;
2. Observing the vacuum gauge on the sampling train to ensure that the vacuum in the canister is decreasing over time;
3. Shutting off the valve once the vacuum gage reads between 4.0 and 5.0 inches of mercury (in. Hg).

3.4.1 Leak Testing

In addition to soil gas sampling activities, leak testing may be required at sampling locations and should be conducted using the following soil gas sampling set-up procedures:

When helium is being used as a tracer gas:

- Place a large plastic bag (or other acceptable shroud) around the SUMMA® canister, sampling apparatus, and vapor probe.
- Cut a small hole in the bag to allow tubing to be inserted to introduce tracer gas, such as helium, and to subsequently fill the plastic bag.
- Keep the tracer gas (i.e., helium) concentration in the bag at 10 percent by volume or higher.

When isopropyl alcohol is being used as a tracer gas:

- Soak towels in isopropyl alcohol.
- Place soaked towels over the sampling probe and wrap around all connections.

Detections of the tracer gas in the soil gas samples would indicate that the canister, valves, or ground surface seal to the sample probe have potentially leaked ambient air into the sample. Small amounts of sample train leakage is permissible; however, the leak percentage should not exceed 10 percent of the soil gas results. If the leak percentage exceeds 10 percent, the sampling point may have to be resampled. The integrity of the soil vapor samples can be assessed by estimating the percent leakage as shown here in micrograms per square meter (μg/m^3):

$$\%\ \text{leakage} = 100 \times \frac{\text{helium concentration in soil vapor sample } [\mu g/m^3]}{\text{average helium concentration measured inside the shroud } [\mu g/m^3]}$$

The above equation for helium can be used because the known average helium concentration can be determined via field screening with a helium detector. Tracer gas leaks should not occur if the sampling train passes a properly performed closed-valve test and given the low flow rate of 167 mL/min.

3.4.2 Final Readings

Once the sampling is completed and the final vacuum is recorded, the sampling train will be removed from the canister and a Swagelok® cap will be tightly fitted to the inlet port of the canister. A PID can be used to record vapor readings from the manifold connection and logged in the notebook and/or soil vapor sampling sheet (enclosed). In addition, the initial canister vacuums, vacuum testing times, purging times, purged volumes, helium readings, sampling starts and times, final vacuum readings, and PID readings should be recorded on a vapor sampling sheet. Some of this information will also be required on the chain-of-custody.

3.4.3 Equipment Blank

Occasionally, the work plan requires an equipment blank to be collected. An equipment blank can be conducted by collecting a sample of clean air or nitrogen through the probe materials before installation in the ground. Analysis of the equipment blank can provide information on the cleanliness of new materials. Clean stainless steel, Nylon or Teflon® tubing and a certified regulator should be used. Lab-certified canisters (the sample canister and the source canister/cylinder, if applicable) or Tedlar® bags can be used to collect an equipment blank.

3.5 USE OF MONITORING WELLS FOR SOIL GAS SAMPLING

While dedicated soil gas probes are typically used to collect soil gas samples, existing monitoring wells that are appropriately located and screened can also be used for this purpose, with limitations. This is an advantage when evaluating the risk of vapor intrusion solely from contaminated aquifers (as compared to contaminated vadose zone soil) as the soil gas that will be sampled can reflect a soil gas sample that lies close to the zone of saturation and represents a worse case condition for equilibrium partitioning of contamination in groundwater to the gas phase. Also, monitoring wells are typically constructed at a deeper depth than soil vapor probes and are less influenced by changes in barometric pressure. They are also inherently constructed to be well sealed against breakthrough from atmospheric air (while purging and sampling). For an existing well to be used for soil gas sampling, it must have at least 2 to 3 feet of open screen above the water table during sample collection.

The main disadvantage of using existing monitoring wells is that the required purge volume would be much greater because of the significantly larger diameter of the well screen as compared to probes. This requires the use of a larger air pump or small blower instead of the SKC hand pump or peristaltic pump. While purging, care must be taken to minimize the vacuum in the well casing which may be large enough to raise the water column high enough to cover the exposed well screen and invalidate the use of the well for sampling soil gas. Appropriate temporary fittings will need to be installed to allow the reduction of the well casing sufficient to allow connection to the collection tubing.

3.6 INDOOR AIR AND OUTDOOR AMBIENT AIR SAMPLE COLLECTION

Indoor air sampling should be conducted in an environment that is representative of normal building use. Indoor air and outdoor ambient air samples are typically collected into 6-liter SUMMA® canisters and can either be a grab (not often recommended) or time weighted samples. For time weighted samples, the laboratory will provide preprogrammed flow controllers for the samples for your desired sample duration. An 8-hour flow controller is the most common to assess typical working conditions or to provide a time-weighted average (TWA) to assess residential risk (a 24-hour flow controller may also be used for residential assessments). SUMMA® canisters should be placed in an area that is close to the breathing zone (i.e., 3 to 5 feet above the floor level), a sampling cane can be connected to the SUMMA® canister to sample indoor air at breathing zone height.

As a basic guideline and starting point, indoor air samples should at a minimum be collected from the basement (if applicable), first floor living or work area, and from outdoors (ambient/upwind). For a typical-size, one-floor residential building or a commercial building less than 1,500 square feet, USEPA recommends the collection of one time-integrated sample within the occupied area (USEPA 2015b). Other site-specific factors will influence the specific placement location of the SUMMA® canisters, such as proximity to subsurface source area(s) or penetrations through the slab or foundation.

Ambient air samples should be collected from a location protected from the elements (wind, rain, snow, or ice) and vehicle traffic on the upwind side of the building (5 to 15 feet away) during the same sampling event the indoor air samples are collected in order to provide information about the outside influences on indoor air quality (i.e., vapors from automotive fuels and exhaust). USEPA recommends that ambient air sampling begin at least 1 hour prior to indoor air sampling and should continue at least 30 minutes before indoor monitoring is complete (USEPA 2015b).

3.6.1 Connection Guidelines

Refer to specific guidelines provided by the laboratory, as equipment can be slightly different from lab to lab. It is important to note the initial vacuum reading on the gauge as well as the post-sampling vacuum. For reference, initial vacuum should be between 27 and 30 inches of mercury, while post-sample vacuum should be between 4 and 5 inches of mercury. Sample collection start and finish times should also be recorded. After sample collection, the SUMMA® canister valve should be shut and the flow controllers should be disconnected from the SUMMA® canisters. Both the controller and the canister ID (unique laboratory tracking ID) should be recorded on the chain-of-custody and the samples should be packed appropriately for delivery to the laboratory following chain-of-custody protocol.

3.6.2 Testing Method and Reporting Limit Considerations

Indoor air samples can be analyzed using various methods, such as TO-15, TO-15 SIM, and TO-17. When considering which analytical method to use, always consider current and future site use and analytical reporting limits to ensure that reporting limits for the selected methods can meet the cleanup levels applicable for the site.

3.7 REMEDIATION SYSTEM VAPOR SAMPLE COLLECTION

Remediation systems that have a soil vapor extraction (SVE) component often require compliance monitoring to evaluate mass removal and effluent discharge limits. Both screening (with a PID) and sampling are routinely conducted during active operation. Tedlar® bags are often used to simplify SVE system screening. Fill a bag following the procedures described in this section and use a PID to measure the VOCs in the sample. Record the maximum observed concentration. Vapor samples for laboratory analysis are most often collected in 1-liter Tedlar® bags, but SUMMA® canisters can also be used. It is a good idea to fill out the label on the Tedlar® bag prior to sample collection.

If the sample port is under vacuum (i.e., SVE manifold or wellhead), it is often necessary to reduce the flow somewhat and to use a hand or mechanical pump to extract the vapor from the line. If the sample port is under a high vacuum, it may be necessary to step down the flow (i.e., close the flow valve) in order to collect a sample. Follow steps in Section 3.3 for sample collection and delivery.

If the sample port is under pressure (i.e., SVE system discharge), the sample can be collected without the use of a pump. Simply attach a clean piece of tubing securely to the sample port, connect the Tedlar® bag to the tubing, open the Tedlar® bag, slowly open the sample port valve, and be careful not to overfill the bag. Remove the Tedlar® bag when full, close the Tedlar® bag (do not over-tighten), and close the sample port valve. Follow steps in Section 3.3 for sample delivery.

4.0 Field Documentation

Soil vapor probe and monitoring point installation field activities should be documented in field notebooks and completion diagrams or boring logs should be completed to document construction. Information recorded will include personnel present, total depth, type and length of implant or screen, screen and filter pack intervals, bentonite seal intervals and surface completion details. Photographs of construction activities should be taken. After probe and monitoring point installation is complete, location coordinates should be recorded with a global positioning system (GPS). If GPS cannot be used (i.e., location within a building), it is important to document the location by recording representative measurements to fixed points.

All sampling activities must be documented in a field notebook and/or on field forms appropriate for the sampling activity. Information recorded will include at a minimum personnel present, date, and time of sample collection, length of sample purge time, and any deviations from the project's work plan or sampling and analysis plan.

Weather conditions should also be recorded and should include temperature, barometric pressure, wind direction and speed, humidity, and degree of cloud cover. Additional site-specific details should also be noted including surface soil conditions, presence of standing water, wet soil, irrigation activities, and if possible, groundwater elevations.

5.0 References

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Enclosures: Indoor Air Building Survey Form
Purge Volume Calculations during Soil Vapor Sampling
Soil Vapor Sampling Sheet

INDOOR AIR BUILDING SURVEY FORM

Date:

Site Name:

Title:

Building Use:

Occupants: ____________________

Building Address: ____________________

Property Owner: ____________________

Contact's Phone: ____________________

Number of Occupants: ____________________

Business or Residential: ____________________

Building Characteristics

Building Type: ☐ Residential ☐ Multifamily ☐ Office

☐ Commercial ☐ Industrial ☐ Mall

Describe Building:____

____

Number of Floors Below Grade: _____________ ☐ Basement ☐ Slab-On-Grade ☐ Crawl Space

Bldg Dimensions: Width:______ Length: ________ Height: _________

Basement Floor: Dirt / Concrete / Painted? Foundation Walls: Concrete / Cinder Blocks / Stone

VENTILATION SYSTEM

☐ Central Air Conditioning
☐ Conditioning Units
☐ Mechanical Fans
☐ Kitchen Range Hood
☐ Bathroom Vans
☐ Outside Air Intake

Other:_________________________

HEATING SYSTEM

☐ Hot Air Circulation
☐ Heat Pump
☐ Hot Air Radiation
☐ Hot Water Radiation
☐ Wood
☐ Kerosene Heater
☐ Steam Radiation
☐ Electric Baseboard

Other:_____________

Outside Contaminant Sources

Nearby surrounding property sources: Gas Stations / Emission Stacks

Soil Contamination: Petroleum Hydrocarbons / Solvents

Heavy Vehicle Traffic: Yes / No

Indoor Contaminant Sources

Identify all potential sources found in the building (including attached garages), the location of the source (floor and room), and whether the item was removed from the building 48 hrs prior to indoor sampling event. Any ventilation implemented after removal of the items should be completed at least 24 hours prior to the commencement of the indoor air sampling event.

Potential Sources	Location(s)	Removed (Yes / No / NA)
Gasoline storage cans		
Gas powered equipment		
Kerosene storage cans		
Paints / Thinners / Strippers		
Cleaning solvents / Dry cleaners		
Oven cleaners		
Carpet / upholstery cleaners		

Other house cleaning products		
Moth Balls		
Potential Sources	**Location(s)**	**Removed (Yes / No / NA)**
Polishes / waxes		
Insecticides		
Furniture / floor polish		
Nail polish / polish remover		
Hairspray		
Cologne / perfume		
Air fresheners		
Fuel tank (inside building)		
Wood stove or fireplace		
New furniture		
New carpeting / New flooring		
Hobbies – glues, paints		
Other: __________________		
Other: __________________		
Other: __________________		

SAMPLING INFORMATION

Sampler(s) ____

☐ Indoor Air / Outdoor Air ☐ Sub-slab ☐ Soil Vapor Point ☐ Exterior Soil Gas

☐ Tedlar® Bag ☐ Sorbent ☐ SUMMA® ☐ Other _________

Analytical Method: TO-15 / TO-17 / Other: _________________

WEATHER CONDITIONS

Was there a significant rain event in the last 24 hours? Yes / No

Temperature: _________ Atmospheric Pressure: _______________ Pressure: Rising or Falling?

Describe the general weather conditions: ____

Wind Speed and Direction: ____

PURGE VOLUME CALCULATIONS DURING SOIL VAPOR SAMPLING

Sample Tubing Purge												
Tubing Length (feet)	**Pi**	**Casing Radius (inches)**	**Area of Casing Radius (Pi(R^2)) (inches)**	**Length of casing (feet)**	**Conversion of feet to inches**	**Number of Casing Volumes to Purge**	**Conversion of cubic inches to mL**	**Purge Volume (mL)**	**Purge Volume (L)**	**Purge rate (mL/min)**	**Purge Time (min)**	
5	3.141593	0.125	0.049087	5	60	1	16.387064	48.263888	0.048264	167	0.29	
5	3.141593	0.125	0.049087	5	60	3	16.387064	144.79166	0.144792	167	0.87	
5	3.141593	0.125	0.049087	5	60	7	16.387064	337.84721	0.337847	167	2.02	

Annular Space Purge												
Annular Space Length (inches)	**Pi**	**Boring Radius (inches)**	**Area of Boring Radius (radius^2)**	**Volume of Annular Space (inches)**	**Assumed Porosity of Sand Pack***	**Air Filled Volume of Annular Space (cubic inches)**	**Number of Casing Volumes to Purge**	**Conversion of cubic inches to mL**	**Purge Volume (mL)**	**Purge Volume (L)**	**Purge rate (mL/min)**	**Purge Time (min)**
12	3.141593	2	12.56637	150.7964	0.3	45.23893	1	16.387064	741.3333	0.741333	167	4.44
12	3.141593	2	12.56637	150.7964	0.3	45.23893	3	16.387064	2224	2.224	167	13.32
12	3.141593	2	12.56637	150.7964	0.3	45.23893	7	16.387064	5189.333	5.189333	167	31.07

Summary of Purge Durations	
One Purge Volume	4.73
Three Purge Volumes	14.18
Seven Volumes	33.10

SOIL VAPOR SAMPLING SHEET

Site Reference: ______________________________________

Date: ______________________________________

Address: _______________________________________

Personnel: ____

	Vacuum Test		**Purging**				**Helium**		**Sampling**				**PID**		
Soil Vapor Sampling Point ID	**Time Start Vacuum Testing**	**Time Stop Vacuum Testing**	**Time Start Purging**	**Time Stop Purging**	**Purging Rate (mL/min)**	**Total Volume Purged (mL)**	**Time of Helium Reading**	**Helium Reading (%)**	**Time Start Sampling**	**Time Stop Sampling**	**Canister Vacuum Before Sampling (in Hg)**	**Canister Vacuum After Sampling (in Hg)**	**Time of PID Reading**	**PID Reading**	**Notes**
					167										
					167										

Notes:

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VaporPin®

Standard Operating Procedure Installation and Extraction of the Vapor Pin®

Updated September 9, 2016

Scope:

This standard operating procedure describes the installation and extraction of the VAPOR PIN® for use in sub-slab soil-gas sampling.

Purpose:

The purpose of this procedure is to assure good quality control in field operations and uniformity between field personnel in the use of the VAPOR PIN® for the collection of sub-slab soil-gas samples or pressure readings.

Equipment Needed:

- Assembled VAPOR PIN® [VAPOR PIN® and silicone sleeve(Figure 1)]; Because of sharp edges, gloves are recommended for sleeve installation;
- Hammer drill;
- 5/8-inch (16mm) diameter hammer bit (hole **must** be 5/8-inch (16mm) diameter to ensure seal. It is recommended that you use the drill guide). (Hilti™ TE-YX 5/8" x 22" (400 mm) #00206514 or equivalent);
- 1½-inch (38mm) diameter hammer bit (Hilti™ TE-YX 1½" x 23" #00293032 or equivalent) for flush mount applications;
- ¾-inch (19mm) diameter bottle brush;
- Wet/Dry vacuum with HEPA filter (optional);
- VAPOR PIN® installation/extraction tool;
- Dead blow hammer;
- VAPOR PIN® flush mount cover, if desired;
- VAPOR PIN® drilling guide, if desired;
- VAPOR PIN® protective cap; and
- VOC-free hole patching material (hydraulic cement) and putty knife or trowel for repairing the hole following the extraction of the VAPOR PIN®.

Figure 1. Assembled VAPOR PIN®

Installation Procedure:

1) Check for buried obstacles (pipes, electrical lines, etc.) prior to proceeding.

2) Set up wet/dry vacuum to collect drill cuttings.

3) If a flush mount installation is required, drill a 1½-inch (38mm) diameter hole at least 1¾-inches (45mm) into the slab. Use of a VAPOR PIN® drilling guide is recommended.

4) Drill a 5/8-inch (16mm) diameter hole through the slab and approximately 1-inch (25mm) into the underlying soil to form a void. Hole **must** be 5/8-inch (16mm) in diameter to ensure seal. It is recommended that you use the drill guide.

VAPOR PIN® protected under US Patent # 8,220,347 B2, US 9,291,531 B2 and other patents pending

5) Remove the drill bit, brush the hole with the bottle brush, and remove the loose cuttings with the vacuum.

6) Place the lower end of VAPOR PIN® assembly into the drilled hole. Place the small hole located in the handle of the installation/extraction tool over the vapor pin to protect the barb fitting, and tap the vapor pin into place using a dead blow hammer (Figure 2). Make sure the installation/extraction tool is aligned parallel to the vapor pin to avoid damaging the barb fitting.

Figure 2. Installing the VAPOR PIN®

During installation, the silicone sleeve will form a slight bulge between the slab and the VAPOR PIN® shoulder. Place the protective cap on VAPOR PIN® to prevent vapor loss prior to sampling (Figure 3).

Figure 3. Installed VAPOR PIN®

7) For flush mount installations, cover the vapor pin with a flush mount cover, using either the plastic cover or the optional stainless-steel Secure Cover (Figure 4).

Figure 4. Secure Cover Installed

8) Allow 20 minutes or more (consult applicable guidance for your situation) for the sub-slab soil-gas conditions to re-equilibrate prior to sampling.

9) Remove protective cap and connect sample tubing to the barb fitting of the VAPOR PIN®. This connection can be made using a short piece of Tygon™ tubing to join the VAPOR PIN® with the Nylaflow tubing (Figure 5). Put the

Nylaflow tubing as close to the VAPOR PIN® as possible to minimize contact between soil gas and Tygon™ tubing.


Figure 5. VAPOR PIN® sample connection

10) Conduct leak tests in accordance with applicable guidance. If the method of leak testing is not specified, an alternative can be the use of a water dam and vacuum pump, as described in SOP Leak Testing the VAPOR PIN® via Mechanical Means (Figure 6). For flush-mount installations, distilled water can be poured directly into the 1 1/2 inch (38mm) hole.


Figure 6. Water dam used for leak detection

11) Collect sub-slab soil gas sample or pressure reading. When finished, replace the protective cap and flush mount cover until the next event. If the sampling is complete, extract the VAPOR PIN®.

Extraction Procedure:

1) Remove the protective cap, and thread the installation/extraction tool onto the barrel of the VAPOR PIN® (Figure 7). Turn the tool clockwise continuously, don't stop turning, the VAPOR PIN® will feed into the bottom of the installation/extraction tool and will extract from the hole like a wine cork, DO NOT PULL.

2) Fill the void with hydraulic cement and smooth with a trowel or putty knife.


Figure 7. Removing the VAPOR PIN®

- Prior to reuse, remove the silicone sleeve and protective cap and discard. Decontaminate the VAPOR PIN® in a hot water and Alconox® wash, then heat in an oven to a temperature of 265° F (130° C) for 15 to 30 minutes. For both steps, **STAINLESS – ½ hour, BRASS 8 minutes**

3) Replacement parts and supplies are available online.

Cox-Colvin & Associates, Inc.
Environmental Services

Standard Operating Procedure
Leak Testing Vapor Pin™ Via Mechanical Means

December 3, 2013

Scope:

The operating procedure describes the methodology to test a Vapor Pin™ or equivalent sub-slab sampling device and sample train for leakage of indoor air. Mechanical leak testing is generally simpler and less costly than testing with tracer gases such as helium, but relevant state, program, or other guidance documents should be consulted to determine if a specific type of leak test is needed.

Purpose:

The purpose of this procedure is to ensure that indoor air does not leak past the Vapor Pin™ or associated tubing and hardware and dilute the sub-slab soil gas sample with indoor air.

Equipment Needed:

Stick-up installation: 2-inch diameter plastic pipe couple, Play-Doh, Sculpey, or modeling clay (clay) free of volatile organic compounds (VOCs). Stick-up and flush-mount installations: distilled water; Vapor Pin™; vacuum pump (hand-operated or peristaltic); vacuum gauge; stopcock; and sample train, including sample tubing, tee fittings, vacuum gauge and other hardware, and sample container.

Procedures:

1. Drill a 5/8" diameter hole in the concrete slab and install the Vapor Pin™ as per the Standard Operating Procedure (SOP). For a flush-mount installation, drill the 1-1/2" diameter hole first, and follow Use of the Vapor Pin™ Drilling Guide and Secure Cover. Testing evacuated ("Summa") canisters and regulators in accordance with ASTM standard D7663-11 or Restek Corporation's *A Guide to Whole Air Canister Sampling* prior to starting field work eliminates most risk of leakage when sampling with the Vapor Pin™.

2. Install the Vapor Pin™ as described in the SOP Installation and Extraction of the Vapor Pin™.

3. Clean the slab within a 2-inch radius of the Vapor Pin™ to remove all dust. Avoid wetting the concrete or wait until the concrete is dry before proceeding, and avoid cleaning with VOC-containing substances. A whisk broom or shop vacuum is recommended. Remaining dust can be picked up with a scrap of clay.

4. For a flush-mount installation, water is poured directly into the 1-1/2" depression without the need for a water dam - proceed to the next step. For a stick-up installation, roll a 1-inch diameter ball of clay between your palms to form a "snake" approximately 7 inches long and press it against the end of the 2" pipe couple. Push the couple against the slab to form a seal between the pipe and the concrete. Notice that water soluble clays such as Play-Doh may absorb enough water to be unsuitable for tests lasting more than one hour.

5. Assemble the sample train (tubing, sample canister, tee fittings, stopcock, vacuum pump, etc.) separately from the Vapor Pin^{TM} and impose a vacuum of 15" mercury equivalent (in Hg). Close the stopcock and verify that the sample train can hold a vacuum for one to five minutes with no more than 0.5 in Hg loss of vacuum. Depending on sample configuration, the stopcock might or might not remain in the sample train during sampling. An example is shown in Figure 1.

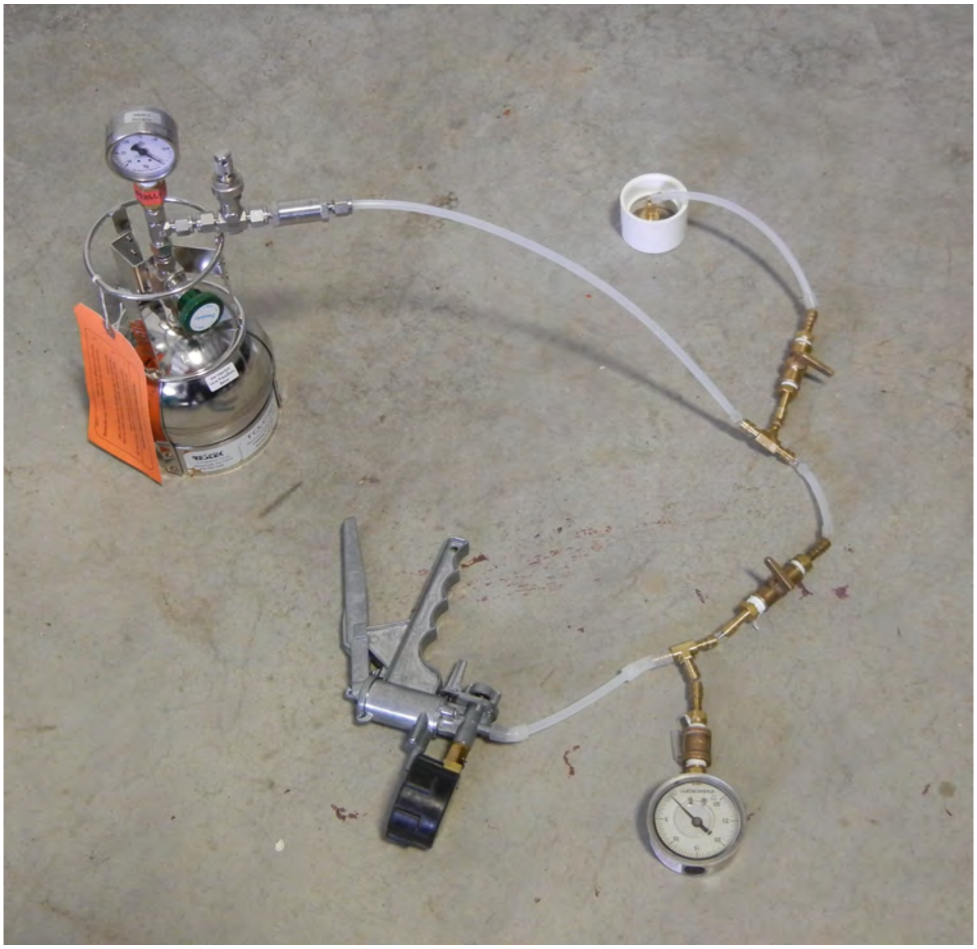

Figure 1. Example of Sub-Slab Sampling and Leak-Test Setup

6. Attach the sample tubing to the top of the Vapor Pin™ and pour enough distilled water into the pipe couple or flush-mount depression to immerse the tubing connection to the Vapor Pin™.

7. Purge and sample the sample point as required by the data quality objectives. Water level might drop slightly due to absorption into the concrete, but if there is a sudden drop in water level, the appearance of water in sample tubing, or other indication of water entering the sub-slab, remove the distilled water from the couple or depression, and reposition the Vapor Pin™ to stop the leakage before resuming the leak test and sampling. In Figure 1, the stopcocks are used to isolate the Vapor Pin™ during vacuum testing and subsequently to allow the vacuum gauge and hand pump to be removed prior to sampling.

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strategy ▪ science ▪ engineering

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F|S STANDARD GUIDELINE

COVID-19 Health and Safety Guidelines

This Special Condition must be appended to all Floyd|Snider Standard Guidelines beginning immediately (March 26, 2020) and until such a time that the COVID-19 crisis is no longer a Washington health risk as determined by the Governor of the State of Washington.

Floyd|Snider is dedicated to helping our community during this unique time in history. Our work is essential to the continued protection of our community and the environment. As such, this special condition is to inform our staff on how to both comply with the "Stay Home – Stay Healthy" Order issued by the Washington Governor effective March 25, 2020, and continue our business safely.

Much of our work can be done from home, but there is vital work that must be done in the field to collect data, implement construction, and move forward our clients' essential work. We will continue our field work in a safe and thoughtful manner, acknowledging that there may be cases where it is determined that field work will be delayed, due to lack of needed supplies; concerns with availability of staff or teaming partners; or concerns regarding potential exposure risks to our staff members, clients, subcontractors or the public.

DATE/LAST UPDATE: March 27, 2020

These procedures should be considered standard guidelines and are intended to provide useful guidance when in the field, but are not intended to be step-by-step procedures, as some steps may not be applicable to all projects.

All field staff should be sufficiently trained in the standard guidelines and special procedures for the sampling method they intend to use and should review and understand these procedures prior to going into the field. It is the responsibility of the field staff to review the standard guidelines and special conditions with the field manager or project manager and identify any deviations from these guidelines prior to field work. When possible, the project-specific Sampling and Analysis Plan should contain any expected deviations and should be referenced in conjunction with these standard guidelines and special conditions.

1.0 Special Condition Applicability

Much of our field work is done outside and can be done while maintaining safe social distancing (defined as maintaining 6 feet of distance between people at all times). Adjustments will be made as needed to move field work forward while ensuring staff safety. Decisions regarding going forward with field work or postponing will be made on an event-by-event basis by the Project Manager (PM), in consultation with Principals as necessary.

ALL field staff have stop work authority. If at any time you feel uncomfortable with the planned work, or cannot safely complete a task once onsite, stop work and communicate with your project team. Employee health and safety takes precedence over schedule and budget. Keep your PM informed of any concerns so the team can identify a solution.

2.0 Equipment and Supplies

The following is a list of additional equipment and supplies necessary to maintain health and safety during the COVID-19 pandemic. This list is intended as a guide to facilitate planning and preparation and is not intended to be all encompassing.

- Project-specific personal protection equipment (PPE), including but not limited to, disposable nitrile gloves, work gloves, and safety glasses
- Hand cleaner, including soap and water or hand sanitizer. 5-gallon buckets may be used to create a temporary wash station.
- Surface cleaner, including disinfection wipes, paper towels, and spray disinfectant
    - Bleach (or similar disinfectant solution)
    - Distilled or deionized water
    - Spray bottles
- Trash bags
- Informational “dash card” with talking points explaining our work

3.0 Special Condition Guidelines and/or Procedures

This special condition outlines Floyd|Snider’s general requirements to keep employees safe including requirements regarding staying home when sick, considerations in determining if field work can proceed, additional field preparation requirements, safety precautions to take while in the field, and communication protocols at the completion of field events.

If you or someone you are in direct extended contact with are at high-risk for severe illness from COVID-19 (are age 65 or older; live in a nursing home or long-term care facility; suffer from heart conditions, lung disease, asthma; are immunocompromised; or are pregnant) and you are not available to perform field work due to heightened risk, communicate with your PM and help to identify suitable backup personnel to complete the field work.

As mentioned above, everyone has stop work ability. If you feel uncomfortable with an assigned task, before or during fieldwork, pause and speak with your PM.

3.1 FLOYD|SNIDER GENERAL REQUIREMENTS AROUND COVID-19

It is critical that individuals NOT report to work, which includes field work, while they or anyone they have come in direct contact with is experiencing symptoms of illness such as fever, cough, gastrointestinal symptoms, loss of sense of taste or smell, shortness of breath, sore throat, runny/stuffy nose, body aches, chills, or fatigue. Individuals should consult their doctor over the phone and potentially seek medical attention if they develop these symptoms, especially any respiratory illness. If you or anyone you have come in direct contact with are sick and exhibit ANY of the COVID-19 symptoms described above, you must do the following:

- If you are experiencing any of the symptoms listed above, stay home and do not return to work until you are free of fever (100.4 °F [38.0 °C] or greater using an oral thermometer), signs of a fever, and any other symptoms for at least 72 hours, without the use of fever-reducing or other symptom-altering medicines (e.g., cough suppressants), and at least 7 days have passed since symptoms first appeared.
- You should monitor your health for fever, cough, and shortness of breath during the 14 days after the last day you were in close contact with a person with confirmed or suspected COVID-19. You should not go to work or school and should avoid public places for 14 days.
- Notify your PM if you are part of a field team and help to identify suitable backup personnel to complete the field work.
- If you have a suspected case of COVID-19, do not go back to work until testing has come back negative, or a 14-day quarantine period has passed following subsidence of symptoms.
- If you have a confirmed case of COVID-19, you must tell Tiffany Volosin immediately, and she will relay information to the firm and any subconsultants you have come in contact with in the field, without revealing your identity. You will then be required to remain home until cleared by a medical professional.

As mentioned above, everyone has stop work ability. If you feel uncomfortable with an assigned task, before or during fieldwork, pause and speak with your PM.

3.2 GENERAL CDC GUIDANCE ON STAYING HEALTHY

General guidelines from the Centers for Disease Control and Prevention (CDC) can be found at https://www.cdc.gov/coronavirus/2019-nCoV/index.html. Basic hygiene requirements provided by the CDC include the following:

- Practice and encourage good hand hygiene.

  - Wash your hands often with soap and water for at least 20 seconds, especially after coming in contact with high-touch surfaces; direct contact with another person; going to the bathroom; before eating; and after blowing your nose, coughing, or sneezing.
  - If soap and water are unavailable, use an alcohol-based hand sanitizer that contains at least 60 percent alcohol to clean hands. Soap and water should be used preferentially if hands are visibly dirty.
  - Avoid touching your face.
- Practice and encourage good respiratory etiquette.
  - Cover your nose and mouth when coughing and sneezing. Sneeze into your elbow, not your hands. If you do cough or sneeze into your hands, wash your hands immediately, per above.
  - Avoid close (within 6 feet) contact with other people. Because COVID-19 can be carried by people who do not show symptoms, proper distancing is necessary to reduce potential for transfer.
  - If you or someone you are in direct contact with are ill, you must stay home.

3.3 PLANNING FOR FIELD WORK

As part of the field work planning process, the project team must review the following to make a threshold decision regarding whether the work may go forward or should be postponed due to the inability to ensure social distancing and to safely follow other mandatory procedures essential to the task.

- Does the work require use of subcontractors or equipment or involve other conditions that would make maintaining a safe social distance (6 feet) difficult?
- Is interacting closely with the public required to conduct the work?

Decisions regarding postponing a field event will be made on an event-by-event basis by the PM, in consultation with Principals as necessary. Reasons for postponing may include management concerns, field staff concerns, availability of field equipment or PPE necessary to complete the work, or subcontractor availability or safety concerns.

If it is determined that the field work will move forward, field planning must include the following steps:

- Confirm subcontractor/subconsultants have COVID-19 policies/procedures in place for their and your protection:
  - What is their corporate stance on the current condition?
  - What protocols will they put in place to ensure that their workers are safe?
  - What protocols will they put in place to reduce potential exposure to our workers and the public?

- Confirm with your laboratory and equipment vendors (if using rental equipment) what protocols they have in place for pickup/drop off, business hours, and any other changes from their standard operating procedures and turnaround times that may affect your fieldwork.
- If fieldwork is out of town, coordinate with the hotel to confirm they are still open and ensure they are sanitizing rooms appropriately.
    - If feasible, consider commuting to jobsites from home rather than booking a hotel to minimize potential exposure.
- Discuss potential risk factors that may arise during the work with your project team. Take extra caution to limit the potential for these risk factors to impact you.
- Prior to mobilization, coordinate with the client or local businesses to identify restroom and hand-washing facilities available for use and confirm their sanitation practices.
    - Consider renting portable restrooms and hand-washing stations for field events that do not have a restroom onsite. It may not be possible to find a nearby business that will allow you to enter and use the restroom.
    - Request additional/increased sanitation (disinfecting) of portable toilets and hand-washing stations, at least twice per week, and ensure they are fully stocked.
- Identify additional gear/supplies that may be necessary for increased health and safety protection that are not typical on our job sites: If you are using a lot of reusable equipment that will require decontamination (both of the equipment and its storage cases, coolers, etc.), consider if use of a bleach/water wash and towels/rags would be better than use of disposable disinfectant wipes that are in high demand and low supply.
- Conduct an inventory check for PPE including gloves, paper towels, soap and water, sanitizer wipes, and hand sanitizer. If any of these necessary items are not available in sufficient quantity, coordinate with Tyler Scott or Terry Duncan, and if not available in time, coordinate with your PM to determine if work can be rescheduled. Identify additional supplies to bring to the site to support safe work. For example:
    - **Work Stations:** Think through how you will maintain social distancing (minimum of 6 feet) at all times on your site. If you are processing soil or sediment samples, bring two tables to allow for two different workspaces. Identify alternative methods for moving heavy equipment if it is usually a two-person job, and have the equipment necessary to complete this work in a safe manner.
    - **Hand-Washing Stations:** If you will not have access to a restroom facility, bring extra buckets, deionized water, and soap to set up your own hand-washing station onsite.
- Bring sufficient copies of field documents/forms and pens, etc., to allow for each employee to have their own set and use electronic communication whenever

possible. Determine which staff member will use field notebooks and pens and maintain that individual setup throughout the day's work. Do not share hand-held supplies, unless gloves are used at all times to handle those supplies until those supplies are disinfected.

3.4 PERFORMING FIELD WORK

3.4.1 Prior to Fieldwork and Entering the Site

The day before fieldwork: The Health and Safety Officer (HSO) should call all employees to confirm healthy status prior to mobilization to the field. If a staff member answers "yes" to any of the questions below, they will not be allowed to complete the fieldwork. For all subcontractors, the HSO should contact the subcontractor to ask the following questions to their field staff assigned to the job prior to their arrival at the site. If a subcontractor answers "yes" to any of the questions, request that someone else get assigned to the job as they will not be allowed onsite.

- Have you, or anyone in your household, been in contact with a person that has tested positive for COVID-19 within the last 14 days?
- Have you, or anyone in your household, been in contact with a person that is in the process of being tested for COVID-19 or suspects they are ill from COVID-19?
- Have you been medically directed to self-quarantine due to possible exposure to COVID-19?
- Are you having trouble breathing or have you had flu-like symptoms within the past 48 hours, including fever, cough, gastrointestinal symptoms, loss of sense of taste or smell, shortness of breath, sore throat, runny/stuffy nose, body aches, chills, or fatigue?

Prior to Entering the Site: The Site Safety Officer (SSO) or Field Lead must ask the above questions again to all staff (Floyd|Snider and subcontractors) prior to beginning work and should continue to assess throughout the day.

- Anyone who has met any of the above criteria and **is not displaying symptoms** must immediately leave the site, the HSO shall notify their PM, and the employee may not return to the site for 14 days.
- Anyone meeting any of the above criteria who **is displaying symptoms** or starts to feel unwell onsite must immediately leave the site, should seek immediate medical advice, notify Tiffany Volosin (and their office manager if a subcontractor), and remain home until medical clearance is received.
- If any person arriving onsite shows obvious symptoms of illness, they will be sent home immediately, prior to accessing the jobsite.

3.4.2 During Mobilization

- Wear gloves during equipment and cooler loading.
- Keep field vehicles stocked with disinfecting wipes and hand sanitizer.
- If using the field van or a rental vehicle, wipe down the door handles (inside and out), steering wheel, shifters (gearing, windshield wipers, turn signals, etc.), radio dials, and any other frequently touched area with a disinfecting wipe (or spray and wipe with disinfectant solution) when you enter and when you exit the vehicle.
- If ice is necessary to complete the field work, avoid visiting supermarkets during times set aside for vulnerable populations, which are typically in the morning. Purchase ice at a different time of day or at another business such as a gas station.

3.4.3 During Field Work

- Maintain 6-foot distance from others at all times. When close contact is unavoidable, stop work and discuss how to proceed, such as dividing tasks or additional disinfection methods.
    - Conduct Safety Meetings in small groups while maintaining distance. The Field Lead/SSO will note all attendees rather than passing around sign in sheets to confirm attendance.
- Implement “Take 5”s. Take 5 minutes between EACH task to identify new hazards, possible ways for unacceptable contact to occur, and methods to avoid those conditions. Record results of these Take 5s in the field notebook.
- Gloves should be worn at all times while onsite. This includes wearing gloves when handling coolers and equipment, when packing equipment and gear, during bottle delivery to the laboratory, and during completion of the work. While wearing gloves for all activities, also be cognizant of the limited supply of these materials. Change gloves only when needed per our standard sampling procedures, and for compliance with this Special Condition.
    - The type of glove worn should be appropriate to the task, and work gloves should be used when acceptable rather than nitrile, recognizing the limited supply of these PPE. If gloves are not typically required for the task, then any type of glove is acceptable, and work gloves are recommended.
    - Wash hands after removing gloves.
    - Store gloves close to the point where they will be used to avoid touching multiple surfaces to obtain fresh gloves – for example if using multiple vehicles to transport equipment to different places onsite, ensure there is a supply of gloves in each vehicle.
- Isolate sick field staff. CDC recommends that employees who become sick during the day should be sent home immediately. If they are unable to make their way home on

their own, the employee or subconsultant should be separated from other employees. If necessary, call 911 for transport and be sure to mention any COVID-19 symptoms so emergency responders are prepared.

- Do not share tools or any multi-user devices and accessories such as iPads, laptops, hand-held radios, computer stations, etc., unless sanitized between users.
- Do not share PPE.
- Sanitize reusable PPE per manufacturer's recommendation prior to each use.
- Ensure used disposable PPE is disposed of properly.
- Eye protection should be worn all times while onsite.
- Job site offices/trailers and break/lunchrooms must be cleaned at least twice per day (doorknobs, keyboards, counters, and other surfaces).
- Do not use a common water cooler. All staff should bring their own filled water bottles sufficient for the day.
- Utilize disposable hand towels and no-touch trash receptacles, when possible.
- Avoid cleaning techniques, such as using pressurized air or water sprays, that may result in the generation of bioaerosols. If these methods are required, ensure that all other staff are outside of and well away from the spray area, and confirm use of proper PPE, including eye protection, before starting cleaning.

3.4.4 Throughout the Field Event

- Commute separately to field sites to maintain social distancing (minimum of 6 feet). Check with your PM to determine whether separate vehicles are a project-billable or admin expense.
- Use paper towel or wipes (or wear protective gloves) when using pay parking kiosks, fueling vehicles, or at other locations that require contact with surfaces touched by others, such as gas nozzles and keypads. Wipe down credit cards after use.
- Identify specific locations and practices for daily trash such as paper, hand towels, gloves, and food containers.
- Trash from trailers or the job site should be changed frequently by someone wearing gloves. After changing the trash, the employee should throw the gloves away and wash their hands.
- Floyd|Snider staff will provide a copy of this Special Condition to all employees on the jobsite, pointing out this list of key CDC recommendations:
    - How to Protect Yourself: https://www.cdc.gov/coronavirus/2019-ncov/prepare/prevention.html
    - If You are Sick: https://www.cdc.gov/coronavirus/2019-ncov/if-you-are-sick/index.html
    - COVID-19 Frequently Asked Questions: https://www.cdc.gov/coronavirus/2019-ncov/faq.html

3.3.5 During Demobilization

- Wear gloves during equipment and cooler loading and unloading.
- Keep field vehicles stocked with disinfecting wipes and hand sanitizer.
- If using the field van or a rental vehicle, wipe down the door handles (inside and out), steering wheel, shifters (gearing, windshield wipers, turn signals, etc.), radio dials, and any other frequently touched area with a disinfecting wipe when you enter and when you exit the vehicle.
- At the end of each use for hand-held field equipment, or at the end of the workday, decontamination procedures listed above for all equipment and vehicles should be conducted prior to packing vehicles or leaving the site. This includes all reusable field equipment and hand-held equipment and cases (even if used with gloves), such as GPS, pumps, pump cords, and meters.
- Close down and secure the site each day. Do not leave any equipment or gear onsite overnight.
- Communicate the status of equipment inventory to Terry Duncan and Tyler Scott at the end of the field event. Send an email indicating the remaining quantities in the supply room for gloves, disinfectant wipes, deionized water, Alconox, paper towels, bleach, and shop rags.
- Workers should wash work clothes prior to wear again and change immediately upon arriving home to avoid transfer to your home environment.

4.0 What to Do If Your Team Is Approached by Law Enforcement or the Public

If you are approached by a member of the public, a land owner, or law enforcement inquiring about your work or with a concern with compliance with the “Stay Home – Stay Healthy” Order, you may choose to respond by informing them that you are conducting work on an environmental cleanup site, which is considered by the state to be an essential service. Reference “Dash Cards” may be used to provide additional information to the questioning party. If they have additional concerns, they may call Allison Geiselbrecht, Kate Snider, Jessi Massingale, or Tiffany Volosin to discuss.

If you determine that you need to demobilize from the Site earlier than planned, conduct demobilization activities as listed above before leaving the Site. Notify your PM as soon as it is appropriate to do so. Your safety from all angles is paramount.

Big B Mini Mart Site

Engineering Design Report

Appendix C
Sampling and Analysis Plan and Quality Assurance Project Plan

Table of Contents

List of Tables

List of Acronyms and Abbreviations

Acronym/ Abbreviation	Definition
BTEX	Benzene, toluene, ethylbenzene, and xylenes
COC	Constituent of concern
DO	Dissolved oxygen
DU	Decision unit

Acronym/ Abbreviation	Definition
Ecology	Washington State Department of Ecology
EDD	Electronic data deliverable
EDR	Engineering Design Report
EIM	Environmental Information Management
LCS	Laboratory control sample
LCSD	Laboratory control sample duplicate
LNAPL	Light non-aqueous phase liquid
mg/L	Milligrams per liter
MIS	Multi-increment sampling
MS	Matrix spike
MSD	Matrix spike duplicate
MTCA	Model Toxics Control Act
NTU	Nephelometric turbidity units
PID	Photoionization detector
PVC	Polyvinyl chloride
QA	Quality assurance
QC	Quality control
RPD	Relative percent difference
SAP/QAPP	Sampling and Analysis Plan/Quality Assurance Project Plan
Site	Big B Mini Mart Site
USEPA	U.S. Environmental Protection Agency
VOC	Volatile organic compound

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1.0 Project Description

This Sampling and Analysis Plan/Quality Assurance Project Plan (SAP/QAPP) presents the specific field protocols and field and laboratory quality assurance/quality control (QA/QC) procedures associated with remedial activities detailed in the Engineering Design Report (EDR) for the Big B Mini Mart Site (Site) located in Ellensburg, Washington.

1.1 INTRODUCTION

The EDR describes the field activities to be performed as part of the preferred remedial alternative, including the following:

- Utility surveys via existing maps and conductible survey
- Groundwater sampling via new and existing wells
- Soil sampling via excavation and landfarming activities
- Vapor sampling via newly installed vapor points
- Site survey of well elevations and Site features

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2.0 Project Organization and Responsibility

The various QA field, laboratory, and management responsibilities of key project personnel are defined below.

2.1 MANAGEMENT RESPONSIBILITIES

Tom Colligan—Floyd|Snider Project Manager

Tom Colligan, Project Manager, will have overall responsibility for project implementation. As Project Manager he will be responsible for maintaining QA on this project and ensuring that the remedial objectives are met. The Project Manager will perform the following:

- Approve the SAP/QAPP.
- Monitor project activity and quality.
- Provide overview of field activities to the Washington State Department of Ecology (Ecology).
- Provide technical representation of project activities at meeting.

2.2 QUALITY ASSURANCE RESPONSIBILITIES

Chell Black—Floyd|Snider Data Manager

The Data Manager will be responsible for the data validation of all sample results from the analytical laboratories and entering the data into a database. The Data Manager will also perform the following:

- Review laboratory reports.
- Load analytical data to Ecology’s Environmental Information Management (EIM) database.
- Advise on data corrective action procedures.
- Perform QA/QC on analytical data reports.
- Oversee database management and queries.

2.3 LABORATORY RESPONSIBILITIES

An Ecology-accredited laboratory will perform all analytical services in support of the remediation activities.

Laboratory Project Manager

The Laboratory Project Manager will report directly to the Floyd|Snider Data Manager. Responsibilities include the following:

- Ensure that all resources of the laboratory are available.
- Advise Floyd|Snider’s Data Manager of laboratory status.

- Review and approve final analytical reports.
- Coordinate laboratory analyses.
- Supervise in-house chain-of-custody procedures.
- Schedule sample analyses.
- Oversee data review.

2.4 FIELD RESPONSIBILITIES

Gabe Cisneros—Floyd|Snider Field Lead

The Field Lead will be responsible for leading and coordinating the day-to-day activities in the field. The Field Lead will report directly to the Floyd|Snider Project Manager.

The Field Lead will perform the following:

- Coordinate with the Project Manager.
- Coordinate and manage field staff including sampling staff, subcontractor, and drillers.
- Review field data including field logs and field measurement data.
- Adhere to the work schedule.
- Prepare construction completion reports.

3.0 Laboratory Quality Assurance Objectives

The objective of this section is to clarify laboratory data QA objectives for field sampling and laboratory analyses. Specific procedures for sampling, chain-of-custody, laboratory instrument calibration, laboratory analysis, reporting of data, internal QC, audits, preventative maintenance of field/laboratory equipment, and corrective action are described in subsequent sections of this SAP/QAPP.

3.1 LABORATORY QUALITY ASSURANCE OBJECTIVES

The quality of analytical data generated is assessed by the frequency and type of internal QC checks developed for analysis type. Laboratory results will be evaluated against QA objectives by reviewing results for analysis of method blanks, matrix spikes (MSs), duplicate samples, laboratory control samples (LCSs), calibrations, performance evaluation samples, and interference checks as required by the specific analytical methods. Data quality objectives are summarized in Table C.1.

3.2 PRECISION

Precision measures the reproducibility of measurements under a given set of conditions. Specifically, precision is a quantitative measure of the variability of a group of measurements compared to their average values. Analytical precision is measured through MS/matrix spike duplicate (MSD) samples for organic analysis and through laboratory duplicate samples for inorganic analyses.

Analytical precision measurements will be carried out on project-specific samples at a minimum laboratory duplicate frequency of 1 per laboratory analysis group or 1 in 20 samples, whichever is more frequent per matrix analyzed, as practical. Laboratory precision will be evaluated against quantitative relative percent difference (RPD) performance criteria.

Field precision will be evaluated by the collection of blind field duplicates at a minimum frequency of 1 per laboratory analysis group or 1 in 20 samples. Currently, no performance criteria have been established for field duplicates. Field duplicate precision will, therefore, be screened against an RPD of 75 percent for all samples. However, no data will be qualified based solely on field duplicate precision.

Precision measurements can be affected by the nearness of a chemical concentration to the method detection limit, where the percent error (expressed as RPD) increases. The equation used to express precision is as follows:

$$\mathrm{RPD} = \frac{(C_1 - C_2) \times 100\%}{(C_1 + C_2)/2}$$

Where:

C_1 = larger of the two observed values
C_2 = smaller of the two observed values

3.3 ACCURACY

Accuracy is an expression of the degree to which a measured or computed value represents the true value. Analytical accuracy may be assessed by analyzing "spiked" samples with known standards (surrogates, LCSs, and/or MS) and measuring the percent recovery. Accuracy measurements on MS samples will be carried out at a minimum frequency of 1 in 20 samples per matrix analyzed. Because MS/MSDs measure the effects of potential matrix interferences of a specific matrix, the laboratory will perform MS/MSDs only on samples from this investigation and not from other projects. Surrogate recoveries will be determined for every sample analyzed for organics.

Laboratory accuracy will be evaluated against quantitative LCS, MS, and surrogate spike recoveries using limits for each applicable analyte. Accuracy can be expressed as a percentage of the true or reference value, or as a percent recovery in those analyses where reference materials are not available and spiked samples are analyzed. The equation used to express accuracy is as follows:

$$\%R = 100\% \times (S-U)/C_{sa}$$

Where:
%R = percent recovery
S = measured concentration in the spiked aliquot
U = measured concentration in the unspiked aliquot
C_{sa} = actual concentration of spike added

3.4 REPRESENTATIVENESS

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Care will be taken in the design of the sampling program to ensure sample locations are properly selected, sufficient numbers of samples are collected to accurately reflect conditions at the location(s), and samples are representative of the sampling location(s). A sufficient volume of sample will be collected at each sampling location to minimize bias or errors associated with sample particle size and heterogeneity.

3.5 COMPARABILITY

Comparability is a qualitative parameter expressing the confidence with which one dataset can be compared to another. In order to ensure results are comparable, samples will be analyzed using standard U.S. Environmental Protection Agency (USEPA) methods and protocols. Calibration and reference standards will be traceable to certified standards and standard data reporting formats will be employed. Data will also be reviewed to verify that precision and accuracy criteria were achieved and, if not, that data were appropriately qualified.

3.6 COMPLETENESS

Completeness is a measure of the amount of data that is determined to be valid in proportion to the amount of data collected. Completeness will be calculated as follows:

$$C = \frac{\text{(Number of acceptable data points) x 100}}{\text{(Total number of data points)}}$$

The data quality objective for completeness for all components of this project is 95 percent. Data that were qualified as estimated because the QC criteria were not met will be considered valid for the purpose of assessing completeness. Data that were qualified as rejected will not be considered valid for the purpose of assessing completeness.

3.7 QUALITY CONTROL PROCEDURES

3.7.1 Field Quality Control Procedures

Trip blanks will be included in each cooler with samples being analyzed for volatile organic compounds (VOCs) to ensure the sample containers do not contribute to any detected analyte concentrations and to identify any artifacts of improper sample handling, storage, or shipping. A rinsate blank QC sample will also be collected for each sampling event on the non-dedicated field equipment (i.e., stainless steel bowl and spoon) to ensure that field decontamination procedures are effective. All field QC samples will be documented in the field logbook and verified by the QA Manager or designee. A blind field duplicate will be collected at a frequency of 1 in 20 samples to evaluate the efficiency of field decontamination procedures, variability from sample handling, and site heterogeneity. When there are fewer than 20 samples, a field duplicate will still be collected. When there are more than 20 samples, a second field duplicate will be collected.

3.7.2 Laboratory Quality Control Procedures

Laboratory Quality Control Criteria. Certain samples will be spiked and the recoveries of spiked compounds compared to the QC criteria. Results of the laboratory QC samples from each sample group will be reviewed by the analyst immediately after a sample group has been analyzed. The QC sample results will then be evaluated to determine whether control limits were exceeded. If control limits are exceeded in the sample group, corrective action (e.g., method modifications followed by reprocessing the affected samples) will be initiated prior to processing a subsequent group of samples.

All primary chemical standards and standard solutions used in this project will be traceable to documented and reliable commercial sources. Standards will be validated to determine their accuracy by comparison with an independent standard. Any impurities identified in the standard will be documented.

The following paragraphs summarize the procedures that will be used to assess data quality throughout sample analysis.

Laboratory Duplicates. Analytical duplicates provide information on the precision of the analysis and are useful in assessing potential sample heterogeneity and matrix effects. Analytical duplicates are subsamples of the original sample that are prepared and analyzed as a separate sample. A minimum of 1 duplicate will be analyzed per sample group or for every 20 samples, whichever is more frequent.

Matrix Spikes and Matrix Spike Duplicates. Analysis of MS samples provides information on the extraction efficiency of the method on the sample matrix. By performing MSD analyses, information on the precision of the method is also provided for organic analyses. A minimum of 1 MS/MSD will be analyzed for every sample group or for every 20 samples, whichever is more frequent. MS/MSD analyses will be performed on project-specific samples (i.e., batch QC using samples from other projects is not permitted). When there are fewer than 20 samples, a MS/MSD will still be analyzed. When there are more than 20 samples, a second MS/MSD will be analyzed.

Laboratory Control Samples and Laboratory Control Sample Duplicate. An LCS is a method blank sample carried throughout the same process as the samples to be analyzed, with a known amount of standard added. The blank spike compound recovery assesses analytical accuracy in the absence of any sample heterogeneity or matrix effects. All LCS and laboratory control sample duplicate (LCSD) data for metals and organic compounds will be reported. The LCS/LCSD will be performed once per analysis batch.

Surrogate Spikes. All project samples analyzed for organic compounds will be spiked with appropriate surrogate compounds as defined in the analytical methods. Surrogate recoveries will be reported by the laboratories; however, no sample result will be corrected for recovery using these values.

Method Blanks. Method blanks are analyzed to assess possible laboratory contamination at all stages of sample preparation and analysis. A minimum of 1 method blank will be analyzed for every extraction batch or 1 for every 20 samples, whichever is more frequent.

4.0 Sample Handling and Custody Documentation

Sample possession and handling must be traceable from the time of sample collection, through laboratory and data analysis, to the time sample results are reported. A field form and field logbook entries will be completed for each location occupied and each sample collected.

4.1 SAMPLE HANDLING

To control the integrity of the samples during transit to the laboratory and during hold prior to analysis, established preservation and storage measures will be taken. Sample containers will be labeled with the client name, location name/number, sample number, sampling date and time, required analyses, and initials of the individual processing the sample. The Field Lead will check all container labels, chain-of-custody form entries, and logbook entries for completeness and accuracy at the end of each sampling day.

4.2 SAMPLE CHAIN-OF-CUSTODY

Sample labeling and custody documentation will be performed as described in this document. Custody procedures will be used for all samples at all stages in the analytical or transfer process and for all data and data documentation whether in hardcopy or electronic format.

4.3 SAMPLE PRESERVATION

Samples requiring field preservation will be placed into pre-preserved sample jars supplied by the laboratory (i.e., VOCs and metals, depending on media). Immediately after the sample jars are filled with each media, they will be placed in the appropriate cooler with a sufficient number of ice packs (or crushed ice) to keep them cool through the completion of that day's sampling and transport to the laboratory.

4.4 SAMPLE SHIPMENT

Technical field staff will be responsible for all sample tracking and chain-of-custody procedures in the field. The Field Lead will be responsible for final sample inventory and will maintain sample custody documentation. At the end of each day, and prior to transfer, chain-of-custody form entries will be made for all samples. Each shipment of coolers will be accompanied by chain-of-custody forms; the forms will be signed at each point of transfer and will include sample numbers. All chain-of-custody forms will be completed in indelible ink. Copies of all forms will be retained as appropriate and included as appendices to QA/QC reports to management.

Prior to shipping or transport, sample containers will be wrapped and securely packed inside the cooler with ice packs or crushed ice by the field technician or designee. The original, signed chain-of-custody forms will be transferred with the cooler. The cooler will be secured and appropriately sealed and labeled for immediate shipping or transport via vehicle. Samples will be delivered to the laboratory under custody following completion of sampling activities.

4.5 SAMPLE RECEIPT

The designated sample custodian at the laboratory will accept custody of the samples and verify that the chain-of-custody form matches the samples received. The laboratory Project Managers will ensure that the chain-of-custody forms are properly signed upon receipt of the samples and will note questions or observations concerning sample integrity on the chain-of-custody forms. The laboratory will contact the QA Manager immediately if discrepancies are discovered between the chain-of-custody forms and the sample shipment upon receipt. The laboratory Project Manager, or designee, will specifically note any coolers that do not contain ice packs/crushed ice or are not sufficiently cold upon receipt.

5.0 Data Reduction, Validation, and Reporting

Initial data reduction, evaluation, and reporting at the laboratory will be carried out as described in the appropriate analytical protocols and the laboratories' QA Manuals. QC data resulting from methods and procedures described in this document will also be reported.

5.1 DATA REDUCTION AND REPORTING

The laboratory will be responsible for internal checks on data reporting and will correct errors identified during the QA review. Close contact will be maintained with the laboratory to resolve any QC problems in a timely manner. The analytical laboratory will be required, where applicable, to report the following:

- **Project Narrative.** This summary, in the form of a cover letter, will discuss problems, if any, encountered during any aspect of analysis. This summary should discuss, but not be limited to, QC, sample shipment, sample storage, and analytical difficulties. Any problems encountered (actual or perceived) and their resolutions will be documented in as much detail as necessary.
- **Sample IDs.** Records will be produced that clearly match all blind duplicate QA samples with laboratory sample identification codes.
- **Chain-of-Custody Records.** Legible copies of the chain-of-custody forms will be provided as part of the data package. This documentation will include the time of receipt and condition of each sample received by the laboratory. Additional internal tracking of sample custody by the laboratory will also be documented.
- **Sample Results**. The data package will summarize the results for each sample analyzed. The summary will include the following information when applicable:
    - Field sample identification code and the corresponding laboratory identification code
    - Sample matrix
    - Date of sample extraction
    - Date and time of analysis
    - Weight and/or volume used for analysis
    - Final dilution volumes or concentration factor for the sample
    - Percent moisture in solid samples
    - Identification of the instrument used for analysis
    - Method reporting and quantitation limits
    - Analytical results reported with reporting units identified
    - All data qualifiers and their definitions
    - Electronic data deliverables (EDDs)

- **Quality Assurance/Quality Control Summaries.** This section will contain the results of all QA/QC procedures. Each QA/QC sample analysis will be documented with the same information required for the sample results (refer to above). No recovery or blank corrections will be made by the laboratory. The required summaries are listed below; additional information may be requested.
- **Method Blank Analysis.** The method blank analyses associated with each sample and the concentration of all compounds of interest identified in these blanks will be reported.
- **Surrogate Spike Recovery.** All surrogate spike recovery data for organic compounds will be reported. The name and concentration of all compounds added, percent recoveries, and range of recoveries will be listed.
- **Matrix Spike Recovery.** All MS recovery data for metals and organic compounds will be reported. The name and concentration of all compounds added, percent recoveries, and range of recoveries will be listed. The RPD for all duplicate analyses will be reported.
- **Matrix Duplicate.** The RPD for all matrix duplicate analyses will be reported.
- **Laboratory Control Samples and Laboratory Control Sample Duplicates.** All LCS/LCSD for metals and organic compounds will be reported. The RPD for all duplicate analyses shall be reported.
- **Blind Duplicates.** Blind duplicates will be reported in the same format as any other sample. RPDs will be calculated for duplicate samples and evaluated as part of the data quality review.

5.2 DATA VALIDATION

Once data are received from the laboratory, a number of QC procedures will be followed to provide an accurate evaluation of the data quality. Specific procedures will be followed to assess data precision, accuracy, and completeness of the laboratory data.

A data quality review (Compliance Screening, Stages 1 & 2a) of the analytical data will follow USEPA National Functional Guidelines in accordance with the QAPP limits (USEPA 2017a and USEPA 2017b). All chemical data will be reviewed with regard to the following:

- Chain of custody/documentation.
- Sample preservation and holding times.
- Instrument performance (calibration, tuning, sensitivity).
- Method blanks.
- Reporting limits.
- Surrogate recoveries.

- MS/MS recoveries.
- LCS recoveries.
- Laboratory and field duplicate RPDs.

In addition, because the primary constituents of concern (COCs) at the Site are petroleum hydrocarbons, sample chromatograms will be reviewed relative to lab standards as part of the data quality review process. Data validation results will be prepared documenting the QC review and were included in the Remedial Investigation and Feasibility Study. Final validated data will be entered into the Floyd|Snider project database and uploaded to Ecology's EIM system.

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6.0 Corrective Actions

Corrective action procedures are described in this section.

6.1 CORRECTIVE ACTION FOR FIELD SAMPLING

The Field Lead will be responsible for correcting field errors in sampling or documenting equipment malfunctions during the field sampling effort and will be responsible for resolving situations in the field that may result in non-compliance with this SAP/QAPP. All corrective measures will be immediately documented in the field logbook.

6.2 CORRECTIVE ACTION FOR LABORATORY ANALYSES

The laboratory is required to comply with their Standard Operating Procedures. The laboratory Project Manager will be responsible for ensuring that appropriate corrective actions are initiated as required for conformance with this SAP/QAPP. All laboratory personnel will be responsible for reporting problems that may compromise the quality of the data.

Test sample and QC sample data will be reviewed to determine if there is an exceedance of QC limits. If any QC sample exceeds the project-specified control limits, the analyst will identify and correct the anomaly before continuing with the sample analysis. The analyst will document the corrective action taken in a memorandum submitted to the QA Manager. A narrative describing the anomaly, the steps taken to identify and correct the anomaly, and the treatment of the relevant sample batch (i.e., recalculation, reanalysis, and/or re-extraction) will be submitted with the data package.

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7.0 Field Investigation Procedures

The following sections describe the specific protocols that will be used to gather site data to be used in the Site Investigation Work Plan. Refer to the work plan for the specific sampling methods.

7.1 UNDERGROUND UTILITY INVESTIGATION PROTOCOLS

A public utility locate notification will be completed in accordance with state law at least 3 business days prior to the start of the investigation. Public utility locate information will be provided to the drilling contractor prior to the start of work. In addition, a private locate will be performed to define the location of the underground storage tank piping and utilities beneath the property.

7.2 GROUNDWATER SAMPLING PROTOCOL

Three new groundwater monitoring wells will be installed and developed according to standard industry procedures. The wells will be 2-inch-diameter polyvinyl chloride (PVC) and drilled using an 8–inch outside diameter hollow-stem auger with samples collected at 2.5-foot intervals. The screened interval shall be 10 feet long and the well will be screened across the water table observed at the time of drilling. All wells will be surface-mounted as described in the EDR.

Groundwater samples will be collected from all monitoring wells after purging with low-flow techniques, using a peristaltic pump and disposable polyethylene tubing as described below.

Groundwater monitoring will be conducted on the following wells MW-2A, MW-4B, MW-8, MW-9A, and MW-10 on the Big B property, and wells MW-1, MW-2, and MW-15 on Toad's property.

Performance and Compliance Monitoring Network and Analyte List

Analyte	Semi-Annual Performance Monitoring Wells[1]	Quarterly Compliance Monitoring Wells[1]
DRO, GRO, BTEX, and Naphthalene	Big B: MW-2A, MW-4B, and MW-9A Toads Wells: MW-1 and MW-2	Big B Wells: MW-2A, MW-4B, MW-7, MW-8, MW-9A, and MW-10 Toads Wells: MW-1, MW-2, and MW-15
MNA Parameters and TOC	Big B: MW-2A and MW-4B Toads Wells: MW-1	NA

Note:

1 The number of monitoring wells may be adjusted pending analytical results and further discussions with Ecology.

7.2.1 Monitoring Well Development

All newly installed wells will be developed by surging with a bailer or surge block followed by well evacuation. All down-hole well development tools will be decontaminated prior to use for each well. Surging and evacuation will be repeated until evacuated water is visibly clean and essentially sand-free. During well evacuation, water samples will be collected for field determination and documentation of temperature, specific conductivity, and pH. Well development will proceed until field parameters stabilize to within ±10 percent on three consecutive measurements or until 10 well volumes have been purged.

7.2.2 Monitoring Well Sampling Activities

Groundwater samples will be collected from all site wells adhering to following the procedure:

1. After the protective casing has been opened, the condition of the monument/well will be observed and noted on the field log.
2. A decontaminated water level indicator will be used to measure depth-to-water from the top of the PVC well casing. The depth-to-water measurement will be accurate to the nearest 0.01 foot.
3. Wells will be gauged for measurable light non-aqueous phase liquid (LNAPL) thickness using an interface probe.
4. If LNAPL is observed, a disposable bailer will be used to collect a product sample instead of a sample of groundwater for dissolved constituents.
5. Disposable, new polyethylene tubing will be lowered into the well to the midpoint depth of the screened interval or, if the groundwater level is below this depth, the midpoint depth of the water column. A peristaltic pump will be used to begin purging the water. Purge water will be collected and disposed of as described in Section 7.6.
6. The well will be purged at rates that maintain less than 0.1 foot of drawdown in the well and generate non-turbid water (less than 10 nephelometric turbidity units [NTU]). Generally, this translates to a flow-rate of less than 0.5 liters/minute.
7. During purging, field parameters (temperature, pH, dissolved oxygen [DO], conductivity, salinity, and turbidity) in the purge water as well as depth-to-water will be recorded at 3- to 5-minute intervals. If the field measurements for turbidity, DO, and electrical conductivity are approximately stable (within 10 percent) for three consecutive readings, the groundwater sample will be collected. If DO is less than 5 milligrams per liter (mg/L), three consecutive readings within 1 mg/L will be considered stable. If turbidity readings are negative values, the measurement will be recorded as less than 1 NTU. Because these field parameters (particularly turbidity) may not reach these stringent stabilization criteria at a particular well, collection of each groundwater sample will be based on the field personnel's best professional

judgment at the time of sampling. The last set of field parameters measured during purging will represent field parameters for the groundwater sample.

8. The groundwater sample will be collected by directly filling the laboratory-provided bottles from the pump discharge line (maintaining the same flow rate as purging). All labeled, filled bottles will immediately be placed in coolers packed with ice. Samples collected for dissolved metals analysis will be filtered at the laboratory

7.2.3 Groundwater Sample Nomenclature and Handling Procedures

The sample number format for monitoring well groundwater samples will be the well number. Groundwater screening samples will be "boring number-screen top depth-screen bottom depth" For example, an example collected from MW-4 from 4 to 14 feet would be labeled "MW4-4-14'." Every groundwater sample will have a unique identifier, and the collection date will be known from the bottle label and chain-of-custody form. The sample format for monitoring wells with LNAPL will be the same as above but with "LNAPL" at the end of the identifier. For example, an LNAPL sample from Monitoring Well MW-2 would be labeled "MW2-4-14-LNAPL." Sample labels will also include the time of collection and initials of sampler on the bottle label.

The samples will be shipped overnight or delivered to the laboratory on the day following collection to ensure that the analytical holding times, specified in Table C.2, are met.

7.2.4 Laboratory Analysis

The analyses to be performed on groundwater samples collected during the site investigation are summarized in Table C.3.

7.3 SOIL SAMPLING PROTOCOL

Soil samples will be collected from the sidewalls and base of the excavations. The final lateral dimensions and shape of each excavation will determine the actual number and location of soil samples. At a minimum, one soil sample will be collected from each sidewall every 20 feet laterally and at a depth between 4 and 6 feet or from areas where field screening indicates that contamination is present. In addition, samples from the base of the excavation will be collected every 400 square feet.

In addition, stockpile samples will be collected from the clean overburden prior to being used as backfill. Stockpiled soil for reuse will be sampled and analyzed to determine its ultimate disposition consistent with Ecology's Guidance for Remediation of Petroleum Contaminated Sites (Ecology 2016). A minimum of three samples will be collected from each stockpile up to 100 cubic yards in volume, and five samples will be collected for stockpiles between 100 to 500 cubic yards in volume. Stockpile samples will be analyzed for the same constituents as the excavation samples.

7.3.1 Excavation Sampling Procedure

Excavation sidewalls will be sampled according to the following procedure:

1. An excavator will be used to remove soil at the direction of a field technician.
2. Soil samples from the excavation sidewalls and base will be screened for organic vapors using a photoionization detector (PID). Selected intervals showing elevated PID response will be analyzed. These soil intervals will be sampled directly from the sidewall using USEPA Method 5035A (for VOCs and gasoline-range organics/benzene, toluene, ethylbenzene, and xylenes [BTEX] only). This preservation method uses a Teflon corer to collect a sealed sample that minimizes loss of volatiles during sampling and transport.
3. Soil samples for other analyses will be collected from sand-sized material from the excavator bucket, using a decontaminated stainless-steel scoop or trowel. Soil samples will be placed in a decontaminated stainless-steel bowl and homogenized until the soil is uniform in color and texture. Homogenized samples will be placed in laboratory-provided clean jars.
4. All labeled, filled sample jars will be placed in a field cooler packed with ice. Standard chain-of-custody procedures will be implemented for all sampling events.
5. Clean overburden soil will be stockpiled on the property within the fenced area. Samples from the stockpiled soil will be collected and processed as described in Section 7.3.3.
6. The excavation soil will be backfilled with clean stockpiled soil or clean imported soil.

7.3.2 Soil Sample Nomenclature and Handling Procedures

The sample number format for excavation soil samples will be “Excavation Number-top depth-bottom depth.” For example, a surface sample collected from southern excavation, EX-01 from 5.0 to 5.5 feet would be labeled “EX01-5.0-5.5.” A duplicate sample would be labeled “EX01-5.0-5.5-B.” Every soil sample will have a unique identifier, and the collection date will be known from the sample bottle and chain-of- custody form. Sample labels will include the time of collection and initials of sampler on the bottle label.

The samples will be delivered to the laboratory as soon as possible following collection to ensure that analytical holding times specified in Table C.2 are met.

7.3.3 Clean Overburden Stockpiled Soil

During excavation activities, impacted soil will be stockpiled separately from otherwise clean soil. Field screening activities, such as noting odor, PID readings, sheen, and staining, will be used to identify impacted soil. Only clean overburden soil will be placed back into the excavation and compacted following completion of excavation activities. Visibly contaminated soil from excavation will be placed in the landfarming area. The stockpiled landfarming soil will be placed on and covered with plastic, and surrounded by a straw waddle, and sampled for disposal according to Table 6.9 in Ecology’s Guidance for Remediation of Petroleum Contaminated Soil (Ecology 2016).

7.3.4 Landfarming Soil—Confirmation Sampling

Confirmation samples will be collected once the soil (both DRO-impacted soil and GRO/DRO-impacted soil) in the landfarming area is completely free of odor and sheen (PID readings will be collected as well) throughout the stockpile. Confirmation samples will be collected in accordance with Table 6.9 in Ecology's *Guidance for Remediation of Petroleum Contaminated Sites* (Ecology 2016).

The landfarming area for the DRO impacted soil will be divided into and up to 4 equal decision units (DU) or stockpiles; the number of decision units will be determined in the field and based on total volume. The landfarming area for the GRO/DRO impacted soil will be in one stockpile within its own DU. The number of confirmation soil samples will be based on the volume of each DU/stockpile (e.g., 3 samples for less than 100 cubic yards, 5 samples for 100 to 500 cubic yards, etc.). The soil samples will be analyzed for DRO by NWTPH-Dx, GRO by NWTPH-Gx, and for volatile or semi-volatile organic compounds including BTEX and naphthalene by EPA Method 8260. Soil samples for volatile organics analysis shall be collected by Method 5035. Further details on sampling and analysis protocols are in Appendix C. In addition, soil sampling activities will be conducted in accordance with Floyd|Snider's Soil Sampling Standard Guideline, which is included in Appendix B.

If COC levels in confirmation samples are less than 80 percent of the MTCA Method A cleanup levels, then the landfarming activities will cease.

If COC levels are between 80 and 100 percent of the MTCA Method A cleanup levels in any one of the DUs or GRO/DRO-impacted DU stockpile, then an additional sample will be collected from that DU. If the second sample result is less than the cleanup level, than the landfarming activities will cease in that DU.

If COC levels are greater than the MTCA Method A cleanup levels in any one DU, soil tilling will occur in that area for one additional month.

Soil in a sub-area that has concentrations less than the criteria described above will be returned to the excavation area.

If after 3 months of summer month treatment, soil cleanup levels in any sub-area have not been achieved, arrangements will be made to transport that soil for offsite disposal at a permitted facility, such as Anderson landfill in Yakima, Washington. Should landfarming occur during fall or spring months, then several additional months of treatment may be required to achieve cleanup levels.

7.3.5 Laboratory Analysis

The analyses to be performed on soil samples collected from the excavation, landfarmed soil, and clean overburden stockpiled soil during are summarized in Table C.3.

7.4 SOIL VAPOR SAMPLING

A vapor sample will be collected from beneath the slab of the current building (Figure 3.3). Results will be compared to screening levels presented in the updated Table B-1 of Ecology's Vapor Intrusion Guidance; furthermore, if needed, results will be used to develop site-specific indoor air cleanup levels in accordance with Attachment B of Ecology's Implementation Memorandum No. 18 for petroleum vapor intrusion (Ecology 2018a and Ecology 2018b). The vapor pin installation and soil gas sampling activities will be conducted in accordance to Floyd|Snider's Vapor Intrusion Standard Guideline and the standard operating procedures (SOP), which are included in Appendix B.

Once the vapor pin is installed, it will be allowed 48 hours to equilibrate, prior to collecting soil a vapor sample. Prior to collecting the sample, the water dam method will be used to determine if there is a leak to ambient air (Appendix B). A 1-liter laboratory-certified SUMMA® canister will be used for soil vapor collection, and a second SUMMA canister will be used for purging. Once the sample train has been set up and connected, a closed-valve test will be conducted, prior to soil vapor sample collection, to check for leaks in the sampling train. The closed-valve test will be conducted for approximately 5 minutes. After the closed-valve test, a minimum of three tubing volumes will be purged. Purging will be completed using a non-certified 1- or 6-liter SUMMA canister. After the sampling train has been purged, the shallow soil vapor sample will be collected over a 10-minute period at a flow rate of less than 167 milliliters per minute. The flow rate will be controlled by a flow regulator, which is set by the laboratory. Soil gas samples will be analyzed for the following:

- BTEX, naphthalene, isopropyl alcohol, and the three air-phase petroleum hydrocarbon fractions, as per Ecology's Implementation Memorandum No. 18 (Ecology 2018b)

Soil vapor concentrations are compared to screening levels presented in the updated Table B-1 of Ecology's Vapor Intrusion Guidance and presented in Ecology's Implementation Memorandum No. 18. Leak testing will be conducted using isopropyl alcohol as a tracer gas. The samples will be delivered to the laboratory as soon as possible following collection to ensure that analytical holding times specified in Table C.2 are met and analyses to be performed are summarized in Table C.3.

7.5 EQUIPMENT DECONTAMINATION

Field sampling equipment, such as the augers, split-spoons, and a water level indicator will be cleaned between each use. Equipment for reuse will be decontaminated according to the procedure below, before each sample interval.

1. Water will be sprayed over equipment to dislodge and remove any remaining sediments.
2. Surfaces of equipment contacting sample material will be scrubbed with brushes using an Alconox solution.

3. Scrubbed equipment will be rinsed and scrubbed with clean water.
4. Equipment will undergo a final spray rinse of deionized water.

7.6 SURVEYING

All wells, soil vapor sampling points, and site features, such as building corners, will be professionally surveyed after sampling is complete by a Washington State licensed surveyor. The Site will be surveyed with a horizontal accuracy of 1.0 foot and a vertical accuracy of 0.01 feet. Mapping will be conducted using NAD 83(1991) as the horizontal datum and the North American Vertical Datum of 1988 (NAVD 88).

7.7 INVESTIGATION-DERIVED WASTE MANAGEMENT

Investigation-derived waste (IDW) solids, including soil, if free of visual evidence of contamination, will be placed in their original location at the site when possible. Visibly contaminated soil from the excavation will be placed in the landfarming area for ex situ treatment.

Soil generated during monitoring well and soil vapor point installation activities will be placed in drums and labeled. Investigation-derived waste liquids, such as well development waters and decontamination fluids will be drummed on-site and appropriately labeled. The IDW will be stored on site pending waste profiling and proper disposal, which will be coordinated by Floyd|Snider. Soil and groundwater sampling results will be used to generate a waste profile. Material that is designated for offsite disposal will be transported to an offsite facility permitted to accept the waste

All disposable sampling material and PPE (e.g., paper towels, disposable coveralls, and gloves) used in sample processing will be placed in heavyweight garbage bags or other appropriate containers. Disposable supplies will be removed from the Site by sampling personnel and placed in a municipal solid waste refuse container for disposal at a solid waste landfill.

8.0 References

U.S. Environmental Protection Agency (USEPA). 2017a. *National Functional Guidelines for Inorganic Superfund Methods Data Review.* Prepared by the Office of Superfund Remediation and Technology Innovation. EPA-540-R-2017-001/OLEM 9355.0-135. January.

_____. 2017b. *National Functional Guidelines for Organic Superfund Methods Data Review.* Prepared by the Office of Superfund Remediation and Technology Innovation. EPA-540-R-2017-002/OLEM 9355.0-136. January.

Washington State Department of Ecology (Ecology). 2016. *Guidance for Remediation of Petroleum Contaminated Sites*. Publication No. 10-09-057. Toxics Cleanup Program. June.

———. 2018a. *Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action.* Publication No. 09-09-047. Toxics Cleanup Program. April.

———. 2018b. *Updated Screening Levels, Cleanup Levels, and Assessing PVI Threats to Future Buildings. Implementation Memorandum No. 18.* Publication No. 17-09-043. January.

Tables

Table C.1
Data Quality Assurance Criteria

Parameter	Reference	Precision (Relative Percent Difference)	Accuracy (Percent Difference from Standard)	Completeness (Percentage of Data Validated)
Soil				
DRO	NWTPH-Dx	± 20%	± 50%	95%
GRO	NWTPH-Gx	± 20%	± 50%	95%
Volatile Organic Compounds				
Benzene	USEPA Method 8021 or 8260	± 20%	± 50%	95%
Toluene				
Ethylbenzene				
Xylenes				
Naphthalene	USEPA Method 8260			
Methyl tert-butyl ether				
Ethylene dichloride				
n-Hexane				
Ethylene dibromide				
Metals				
Lead	USEPA Method 6020	± 20%	± 30%	95%
Water or LNAPL				
DRO	NWTPH-Dx	± 20%	± 60%	95%
GRO	NWTPH-Gx	± 20%	± 60%	95%
Volatile Organic Compounds				
Benzene	USEPA Method 8021 or 8260	± 20%	± 30%	95%
Toluene				
Ethylbenzene				
Xylenes				
Naphthalene	USEPA Method 8260 (2)			
Methyl tert-Butyl Ether				
Ethylene Dichloride				
n-Hexane				
Ethylene Dibromide	USEPA Method 8011			
Metals				
Lead	USEPA Method 6020	± 20%	± 50%	95%
Monitored Natural Attenuation Parameters				
Nitrate	USEPA 300.0	± 20%	± 20%	95%
Sulfate	USEPA 300.0	± 20%	± 30%	95%
Manganese (soluble)	USEPA 200.8	± 20%	± 30%	95%
Methane	RSK-175	± 20%	± 50%	95%
Ferrous iron (soluble)	Hach field kit	NA	NA	NA
Total Organic Carbon	USEPA 9060A	± 20%	± 20%	95%
Soil-Gas				
APH [EC5-8 aliphatics] fraction	MA-APH	± 30%	± 30%	90%
APH [EC9-12 aliphatics] fraction				
APH [EC9-10 aromatics] fraction				
Benzene	USEPA Method TO-15			90%
Ethylbenzene				
Toluene				
Xylenes, total				
Naphthalene				
Isopropyl alcohol (for leak detection)				

Abbreviations:

APH	Air-phase petroleum hydrocarbons
DRO	Diesel-range organics
GRO	Gasoline-range organics
LNAPL	Light non-aqueous-phase liquid
NA	Not applicable
USEPA	U.S. Environmental Protection Agency

Table C.2
Analytical Requirements, Methods, Preservation, Bottle Type, and Holding Times

Parameter	Reference	Bottle Type	Preservative	Holding Time
Soil				
DRO	NWTPH-Dx	(1) 4-oz WMG	None, cool to ≤6°C	14 days to extract, then 40 to analyze
GRO	NWTPH-Gx	(4) Glass 40-mL VOA vials with PTFE Septum	Methanol and cool to ≤6 °C or none and cool to ≤6 °C	14 days to analyze with MeOH preservation or if none, 2 days at ≤6 °C, 14 days at ≤-7 °C
VOCs				
Benzene	USEPA Method 8260	(4) Glass 40-mL VOA vials with PTFE Septum (GRO and VOCs taken from the same 4 VOA vials)	Methanol and cool to ≤6 °C or none and cool to ≤6 °C	14 days to analyze with MeOH preservation or if none, 2 days at ≤6 °C, 14 days at ≤-7 °C
Toluene				
Ethylbenzene				
Xylenes				
Ethanol				
Methyl tert-butyl ether				
Ethylene dichloride				
Naphthalenes				
n-Hexane				
Ethylene dibromide				
Metals				
Lead	USEPA Method 6020	(1) 4-oz WMG	None, cool to ≤6 °C	6 months (or freeze for 1 year) 28 days for mercury
Water or LNAPL				
DRO	NWTPH-Dx	(2) 500-mL amber glass	None, cool to ≤6 °C	7 days to extract, then 40 days to analyze
GRO	NWTPH-Gx	(5) 40-mL VOA vials with PTFE Septum	Hydrochloric acid to pH ≤2.0, cool to ≤6 °C	14 days to analyze
VOCs				
Benzene	USEPA Method 8260	(5) 40-mL VOA vials with PTFE Septum (GRO and VOCs taken from the same 5 VOA vials)	Hydrochloric acid to pH ≤2.0, cool to ≤6 °C	14 days to analyze
Toluene				
Ethylbenzene				
Xylenes				
Methyl tert-butyl ether				
Ethylene dichloride				
Naphthalenes				
n-Hexane				
Ethylene dibromide	USEPA Method 8011			
Metals (total)				
Lead	USEPA Method 6020	(1) 500-mL HDPE	Nitric acid, cool to ≤6 °C	6 months
Monitored Natural Attenuation Parameters				
Nitrate	USEPA 300.0	250-mL poly	None, cool to ≤6 °C	48 hours to analyze
Sulfate	USEPA 300.0	250-mL poly	None, cool to ≤6 °C	28 days to analyze
Manganese (soluble)	USEPA 200.8	1-L poly	0.45 micron filter; nitric acid (HNO3), cool to ≤6 °C	180 days to analyze
Methane	RSK-175	(3) 40-mL glass VOA vials	Hydrochloric acid to pH ≤2.0, cool to ≤6 °C	14 days to analyze
Ferrous iron (soluble)	Hach field kit	NA	NA	24 hours

Total Organic Carbon (TOC)	USEPA 9060A	250-mL amber glass	H2SO4	28 days
Soil-Gas				
APH [EC5-8 aliphatics]	MA-APH	1-L SUMMA silicone-coated canister	None	30 days
APH [EC9-12 aliphatics]				
APH [EC9-10 aromatics]				
Benzene	USEPA Method TO-15			
Ethylbenzene				
Toluene				
Xylenes, total				
Soil-Gas (cont.)				
Naphthalene	USEPA Method TO-15	1-L SUMMA silicone-coated canister	None	30 days
Isopropyl alcohol				

Abbreviations:

°C	Degrees Celsius
APH	Air-phase petroleum hydrocarbon
DRO	Diesel-range organics
GRO	Gasoline-range organics
HDPE	High-density polyethylene
LNAPL	Light non-aqueous-phase liquid
MeOH	Methanol
mL	Milliliters
oz	Ounces
PTFE	Polytetrafluoroethylene (Teflon)
USEPA	U.S. Environmental Protection Agency
VOA	Volatile organic analysis
VOC	Volatile organic compound
WMG	Wide-mouth glass jar

Table C.3
Analytical Methods, Detection Limits, and Reporting Limits

Parameter	Reference	Units	Estimated Detection Limit	Reporting Limit/PQL
Soil				
DRO	NWTPH-Dx	mg/kg	5	25–50
GRO	NWTPH-Gx		0.3	2
VOCs				
Benzene	USEPA Method 8260C	mg/kg	0.006	0.02
Toluene			0.002	0.02
Ethylbenzene			0.002	0.02
Xylenes			0.006	0.06
Ethanol			25	50
Naphthalene			0.002	0.02
Methyl tert-butyl ether			0.00004-0.00007	0.005
Ethylene dibromide			0.0025	0.005
Ethylene dichloride			0.00004–0.00007	0.005
n-Hexane			0.00004–0.00007	0.005
Metals				
Lead	USEPA Method 6020	mg/kg	0.02	1
Water or LNAPL				
DRO	NWTPH-Dx	µg/L	9	50
GRO	NWTPH-Gx		6	100
VOCs				
Benzene	USEPA Method 8260C	µg/L	0.02	1
Toluene			0.03	1
Ethylbenzene			0.03	1
Xylenes			0.09	3
Ethanol			500	1,000
Naphthalene			0.14	2
Methyl tert-butyl ether			0.07	2
Ethylene dichloride			0.05	2
n-Hexane			0.17	5
Ethylene dibromide	USEPA Method 8011B		0.002	0.01
Metals (total)				
Lead	USEPA Method 6020A or 200.8	µg/L	0.07	1
Monitored Natural Attenuation Parameters				
Nitrate	USEPA 300.0	µg/L	4.61	300
Sulfate	USEPA 300.0		1.45	100
Manganese (Soluble)	USEPA 200.8		0.0715	1
Methane	RSK-175		2.32	8.63
Ferrous Iron (Soluble)	Hach field kit		200	200
Total Organic Carbon	USEPA 9060A	mg/L	0.50	0.50

Parameter	**Reference**	**Units**	**Estimated Detection Limit**	**Reporting Limit/PQL**
Soil-Gas				
APH [EC5-8 aliphatics]	MA-APH	µg/m3	46	46
APH [EC9-12 aliphatics]			35	35
APH [EC9-10 aromatics]			25	25
Benzene	USEPA Method TO-15		0.022	0.32
Ethylbenzene			0.11	0.43
Toluene			0.13	0.38
Xylenes, total			0.33	1.6
Naphthalene			0.073	0.26
Isopropyl Alcohol (for leak detection)			0.59	3.0

Abbreviations:

APH	Air-phase petroleum hydrocarbon
DRO	Diesel-range organics
GRO	Gasoline-range organics
µg/L	Micrograms per liter
µg/m³	Micrograms per cubic meter
mg/kg	Milligrams per kilogram
PQL	Practical quantitation limit
USEPA	U.S. Environmental Protection Agency

Big B Mini Mart Site

Engineering Design Report

Appendix D
Health and Safety Plan

Table of Contents

List of Attachments

List of Acronyms and Abbreviations

Acronym/ Abbreviation	Definition
bgs	Below ground surface
COC	Contaminant of concern
CPR	Cardiopulmonary resuscitation
CRZ	Contamination reduction zone
°F	Degrees Fahrenheit
EZ	Exclusion zone
HASP	Health and Safety Plan
HAZWOP	Hazardous Waste Operations
HSO	Health and Safety Officer
LNAPL	Light non-aqueous-phase liquid
MTCA	Model Toxics Control Act

Acronym/ Abbreviation	**Definition**
PID	Photoionization detector
PM	Project Manager
PPE	Personal protective equipment
ROI	Radius of influence
Site	Big B Mini Mart Site
SS	Site Supervisor
SSO	Site Safety Officer
SZ	Support zone
TWA	Time-Weighted Average
UST	Underground storage tank
VOC	Volatile organic compound
WAC	Washington Administrative Code

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1.0 Plan Objectives and Applicability

This Health and Safety Plan (HASP) has been written to comply with the standards prescribed by the Occupational Safety and Health Act (OSHA) and the Washington Industrial Safety and Health Act (WISHA).

The purpose of this HASP is to establish protection standards and mandatory safe practices and procedures for all personnel involved with remediation, operations, and maintenance activities at Big B Mini Mart Service Station. This HASP assigns responsibilities, establishes standard operating procedures, and provides for contingencies that may occur during field work activities. This plan consists of site descriptions, a summary of work activities, an identification and evaluation of chemical and physical hazards, monitoring procedures, personnel responsibilities, a description of site zones, decontamination and disposal practices, emergency procedures, and administrative requirements.

The provisions and procedures outlined by this HASP apply to all Floyd|Snider personnel on-site. Contractors, subcontractors, other oversight personnel, and all other persons involved with the field work activities described herein are required to develop and comply with their own HASP. All Floyd|Snider staff conducting field activities are required to read this HASP and indicate that they understand its contents by signing the Health and Safety Officer/Site Supervisors' (HSO/SS') copy of this plan.

It should be noted that this HASP is based on information that was available as of the date indicated on the title page. It is possible that additional hazards that are not specifically addressed by this HASP may exist at the work site, or may be created as a result of on-site activities. It is the firm belief of Floyd|Snider that active participation in health and safety procedures and acute awareness of on-site conditions by all workers is crucial to the health and safety of everyone involved. Should project personnel identify a site condition that is not addressed by this HASP and have any questions or concerns about site conditions, they should immediately notify the HSO/SS and an addendum will be provided to this HASP.

The HSO/SS has field responsibility for ensuring that the provisions outlined herein adequately protect worker health and safety and that the procedures outlined by this HASP are properly implemented. In this capacity, the HSO/SS will conduct regular site inspections to ensure that this HASP remains current with potentially changing site conditions. The HSO/SS has the authority to make health and safety decisions that may not be specifically outlined in this HASP, should site conditions warrant such actions. In the event that the HSO/SS leaves the site while work is in progress, an alternate Site Safety Officer (SSO) will be designated. Personnel responsibilities are further described in Section 4.0.

This HASP has been reviewed by the Project Manager (PM) and the HSO/SS prior to commencement of work activities. All Floyd|Snider personnel shall review the plan and be familiar with on-site health and safety procedures. A copy of the HASP will be on-site at all times.

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2.0 Emergency Contacts and Information

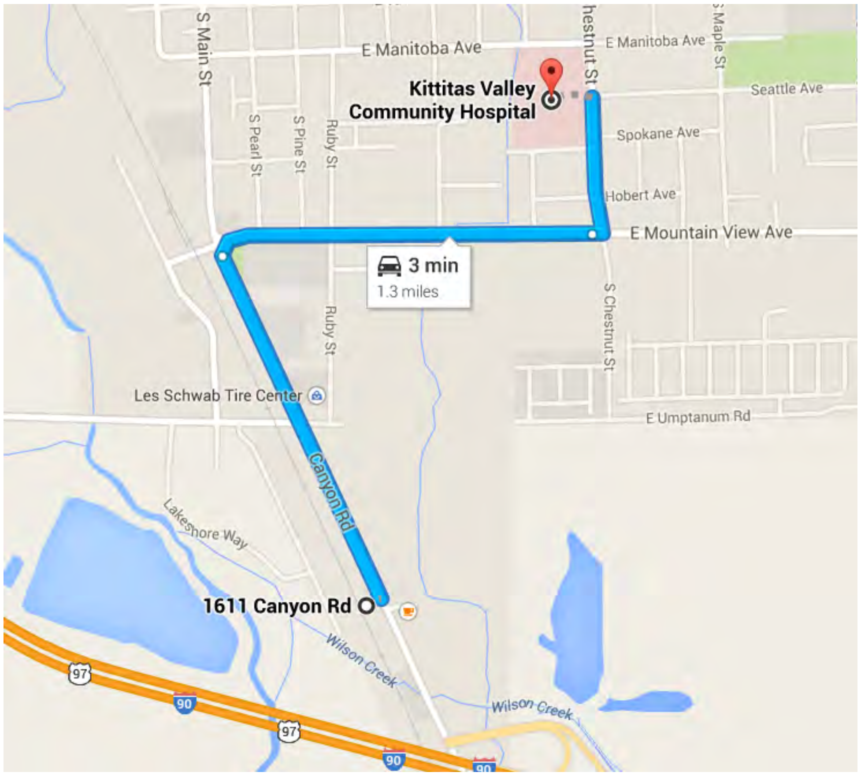
2.1 DIAL 911

In the event of any emergency, dial 911 to reach fire, police, and first aid.

2.2 HOSPITAL AND POISON CONTROL

Nearest Hospital Location and Telephone: Refer to Figure 1 below for map and directions to the hospital.	Kittitas Valley Community Hospital 603 South Chestnut Street Ellensburg, WA 98926 (509) 962-9841
Washington Poison Control Center:	(800) 222-1222

Figure 1 - Hospital Directions



1. Start at: 1611 Canyon Road in Ellensburg, WA 98926
2. Head north-northwest on Canyon Road toward Umptanum Road 0.5 mi
3. Turn right onto W Mountain View Ave 0.5 mi
4. Turn left onto S Chestnut Street 0.2 mi
5. Arrive at: Kittitas Valley Community Hospital-ER; 603 S Chestnut Street, Ellensburg, Washington

2.3 PROVIDE INFORMATION TO EMERGENCY PERSONNEL

All Floyd|Snider project personnel should be prepared to give the following information:

Information to Give to Emergency Personnel	
Site Location:	Big B Mini Mart Service Station 1611 Canyon Road Ellensburg, WA 98926 **Nearest Cross Street:** I-90 to the south or Umptanum Rd to the north
Number that You are Calling from:	This information can be found on the phone you are calling from.
Type of Accident or Type(s) of Injuries:	Describe accident and/or incident and number of personnel needing assistance.

2.4 FLOYD|SNIDER AND BIG B MINI MART EMERGENCY CONTACTS

After contacting emergency response crews as necessary, contact the Floyd|Snider PM and a Floyd|Snider principal to report the emergency. The Floyd|Snider PM may then contact Surjit Singh, or direct the field staff to do so.

Floyd|Snider Emergency Contacts:

Contact	Office Phone Number	Cell Phone Number
Tom Colligan, PM	(206) 292-2078	(206) 276-8527
Gabe Cisneros, HSO/SS		(206) 582-8223
Kate Snider, Principal		(206) 375-0762

Big B Mini Mart Emergency Contacts:

Contact	Office Phone Number	Cell Phone Number
Surjit Singh	N/A	(509) 560-1111

Utility Company Emergency Contacts:

Contact	Normal Business Hours Phone Numbers (8 a.m. to 5 p.m.)	After Hours Emergency Phone Number
Puget Sound Energy – Electric	(888) 728-9343	(888) 225-5773
Puget Sound Energy – Natural Gas	(888) 728-9343	(888) 225-5773
City of Ellensburg – Water, Gas, Electric	(509) 962-7230	(509) 962-7230
Ellensburg Energy SVCS	(509) 962-7124	(509) 962-7224
Ellensburg Telephone	(509) 985-1203	(509) 925-1425

3.0 Background Information

3.1 SITE BACKGROUND

The property is located at 1611 Canyon Road in Ellensburg, Washington, and is currently a temporarily closed gasoline service station with upgrades planned for the near future. The Big B property is located in Kittitas County (parcel no. 958654) within Township 17N, Range 18E, and Section 11 on approximately 43,960 square feet or 1.05 acres of rectangular land. The southern half of the parcel consists of the currently inactive service station facilities, and the northern half contains approximately 18,500 square feet of unused paved area. The Big B Mini Mart Site (Site) was first developed as a service station in the early 1970s. There is no known prior site use. The southern half of the property includes two former pump islands (northern and southern), a closed convenience store, and former locations of underground storage tanks (USTs) including two former 10,000-gallon steel USTs, a former 4,000-gallon steel UST on the north side of the store, and a former 12,000-gallon baffled steel UST (split into 8,000 gallons of diesel storage and 4,000 gallons of unleaded gasoline storage) on the south end of the property.

The property is on the west side of Canyon Road, just north of Interstate 90, and is surrounded by commercial use properties to the north, south, and east, and a BNSF railway to the west. An Astro gasoline service station is adjacent to the south and a Shell station is located across Canyon Road to the east. Canyon Road is a four-lane major throughway with off- and on-ramp access to I-90, just southeast of the property. Entrances to the property are located northeast and southeast of the fuel dispensers along Canyon Road. The property includes a large undeveloped area on the north side; ecology blocks have been placed in the driveways to prevent truckers from using this portion of the property to park their rigs and containers. The entire southern portion of the property is fenced.

3.2 SCOPE OF WORK

The scope of work includes excavation of soil within the footprint of the current light non-aqueous-phase liquid (LNAPL) plume beneath the Site, while leaving behind residual hydrocarbon contamination at concentrations greater than Model Toxics Control Act (MTCA) Method A levels in the soil fringing and downgradient of the LNAPL areas. Approximately 760 cubic yards of LNAPL-contaminated soil would be excavated and landfarmed on site to concentrations less than MTCA Method A cleanup levels and then reused as vadose zone backfill. Contaminated soil may also be trucked off site for treatment or disposal if appropriate. A pilot test will be conducted in order to determine the radius of influence (ROI) for the installation of the bioventing system. After determining the ROI and performing excavation and backfilling activities, bioventing piping would be installed within remaining areas of impacted soil and a blower will be used to ventilate and encourage aerobic biodegradation of contamination in the remaining soil. This alternative includes compliance monitoring of soil and groundwater and institutional controls. Floyd|Snider will perform the following scope of work:

- Oversight of Site preparations and staging

- Oversight of excavation activities, including clean overburden from 0 to 3 feet below ground surface (bgs) and LNAPL-saturated soil from 3 to 7 feet bgs
- Oversight of the placement of LNAPL-saturated soil within the landfarming area
- Collection of soil samples of the clean overburden soil and landfarmed soil for analysis
- Oversight of the backfilling with the clean overburden soil
- Oversight of the re-installation of four monitoring wells and installation of soil vapor points
- Collection of groundwater and soil gas samples

4.0 Primary Responsibilities and Requirements

4.1 PROJECT MANAGER

The PM will have overall responsibility for the completion of the project, including the implementation and review of this HASP. The PM will review health and safety issues as needed and as consulted, and will have authority to allocate resources and personnel to safely accomplish the field work.

The PM will direct all Floyd|Snider personnel involved in field work at the Site. If the project scope changes, the PM will notify the HSO/SS so that the appropriate addendum will be included in the HASP. The PM will ensure that all Floyd|Snider personnel on-site have received the required training, are familiar with the HASP, and understand the procedures to follow should an accident and/or incident occur on-site.

4.2 HEALTH AND SAFETY OFFICER AND SITE SUPERVISOR

The HSO/SS will approve this HASP and any amendments thereof, and will ultimately be responsible for full implementation of all elements of the HASP.

The HSO/SS will advise the PM and project personnel on all potential health and safety issues of the remediation activities to be conducted at the site. The HSO/SS will specify required exposure monitoring to assess site health and safety conditions, modify the site HASP based on field assessment of health and safety accidents and/or incidents, and recommend corrective action if needed. The HSO/SS will report all accidents and/or incidents to the PM. If the HSO/SS observes unsafe working conditions by Floyd|Snider personnel or any contractor personnel, the HSO/SS will suspend all work until the hazard has been addressed.

4.3 SITE SAFETY OFFICER

The SSO may be a person dedicated to assisting the HSO/SS during field work activities. The SSO will ensure that all personnel have appropriate personal protective equipment (PPE) on-site and PPE is properly used. The SSO will assist the HSO/SS in field observation of Floyd|Snider personnel safety. If a health or safety hazard is observed, the SSO shall suspend all work activity. The SSO will conduct on-site safety meetings daily before work commences. All health and safety equipment will be calibrated daily and records kept in the daily field logbook. The SSO may perform exposure monitoring if needed and will ensure that equipment is properly maintained.

4.4 FLOYD|SNIDER PROJECT PERSONNEL

All Floyd|Snider project personnel involved in field work activities will take precautions to prevent accidents and/or incidents from occurring to themselves and others in the work areas. Employees will report all accidents and/or incidents or other unsafe working conditions to the

HSO/SS or SSO immediately. Employees will inform the HSO/SS or SSO of any physical conditions that could impact their ability to perform field work.

4.5 TRAINING REQUIREMENTS

All Floyd|Snider project personnel must comply with applicable regulations specified in Washington Administrative Code (WAC) Chapter 296-843, Hazardous Waste Operations (HAZWOP), administered by the Washington State Department of Labor and Industries. Project personnel will be 40-hour HAZWOP trained and maintain their training with an annual 8-hour refresher. Personnel with limited tasks and minimal exposure potential will be required to have 24-hour training and a site hazard briefing and be escorted by a trained employee. Personnel with defined tasks that do not include potential contact with disturbed site soils, waste, groundwater, or dust (e.g., surveying, utility locating) are not required to have any level of hazardous waste training beyond a site emergency briefing and hazard orientation by HSO/SS. Floyd|Snider project personnel will fulfill the medical surveillance program requirements.

In addition to the 40-hour course and 8-hour refreshers, the HSO/SS will have completed an 8-hour HAZWOP Supervisor training as required by WAC 296-843-20015. At least one person on-site during field work will have current cardiopulmonary resuscitation (CPR)/First Aid certification. All field personnel will have a minimum of 3 days of hazardous materials field experience under the direction of a skilled supervisor. Documentation of all required training will be maintained on site.

Additional site-specific training that covers on-site hazards, PPE requirements, use and limitations, decontamination procedures, and emergency response information as outlined in this HASP will be given by the HSO/SS before on-site work activities begin. Daily health and safety meetings will be documented on the Daily Tailgate Safety Meeting Form included in this HASP as Attachment 1.

4.6 MEDICAL SURVEILLANCE

All Floyd|Snider field personnel are required to participate in Floyd|Snider's medical surveillance program, which includes biennial audiometric and physical examinations for employees involved in HAZWOP projects. The program requires medical clearance before respirator use or participating in HAZWOP activities. Medical examinations must be completed before conducting field work activities and on a biennial basis. These medical monitoring programs must be in compliance with all applicable worker health and safety regulations.

5.0 Hazard Evaluation and Risk Analysis

In general, there are three broad hazard categories that may be encountered during site work: chemical exposure hazards, fire/explosion hazards, and physical hazards. Sections 5.1 through 5.3 discuss the specific hazards that fall within each of these broad categories.

5.1 CHEMICAL EXPOSURE HAZARDS

This section describes potential chemical hazards associated with soil sample collection. Based on previous site investigation information, the chemicals present at this site that have been retained as site contaminants of concern are gasoline and diesel range hydrocarbons in soil and gasoline and diesel range hydrocarbons, benzene, toluene, and total xylenes in groundwater.

Human health hazards are presented in the table below. This information covers potential toxic effects that might occur if relatively significant acute and/or chronic exposure were to happen. This information does not mean that such effects will occur from the planned site activities. Potential routes of exposure include inhalation, dermal contact, ingestion, and eye contact. The primary exposure route of concern during site work is ingestion of contaminated soil, though such exposure is considered unlikely and highly preventable. In general, the chemicals that may be encountered at this site are not expected to be present at concentrations that could produce significant exposures. The types of planned work activities and use of monitoring procedures and protective measures will limit potential exposures at this site. The use of appropriate PPE and decontamination practices will assist in controlling exposure through all pathways to the contaminants listed in the table below. In addition, a 10.6 eV Photoionization Detector (PID), or equivalent device, will be used to monitor the concentration of organic vapors in workers' breathing zones. Suspend work if the concentration of vapors is measured at 5 parts per million (ppm) or greater over a period of 1 minute, and wait for concentrations to decrease before restarting work or move the work area upwind. If vapor concentrations within the breathing zone remain above these levels, a respirator will be donned. Contractors will follow their own health and safety protocol when concerning elevated organic vapor concentrations during UST decommissioning and trenching activities.

Chemical Hazard	Department of Safety and Health Permissible Exposure Limits (8-hour TWA/STEL)	Highest Concentration	Routes of Exposure	Potential Toxic Effects
Gasoline Range Hydrocarbons	300 ppm/500 ppm	3,700 mg/kg in soil. 2,400 µg/L in groundwater.	Inhalation, skin absorption, ingestion, skin/eye contact	Irritation to eyes, skin, mucus membranes; headache; fatigue; blurred vision; dizziness; slurred speech; confusion; convulsions; liver, kidney damage.

Chemical Hazard	Department of Safety and Health Permissible Exposure Limits (8-hour TWA/STEL)	Highest Concentration	Routes of Exposure	Potential Toxic Effects
Diesel Range Hydrocarbons	N/A	24,000 mg/kg in soil. 3,400 µg/L in groundwater.	Inhalation, skin absorption, ingestion, skin/eye contact	Irritation to eyes, skin, mucus membranes; headache; fatigue; blurred vision; dizziness; slurred speech; confusion; convulsions; liver, kidney damage.
Naphthalene	10 ppm/15 ppm	640 mg/kg in soil. 1.30 mg/L in groundwater.	Inhalation, skin absorption, ingestion, skin/eye contact	Irritation to eyes, headache; excitement; malaise; nausea, vomiting; abdominal pain; bladder irritation; profuse sweating; jaundice; renal shutdown, dermatitis, optical neuritis, corneal damage
Benzene	1 ppm/5 ppm	1.1 mg/kg in soil. 270 µg/L in groundwater.	Inhalation, skin absorption, ingestion, skin/eye contact	Irritation to eyes, skin, mucus membranes, resp. sys.; headache; fatigue; nausea, staggered gait; blurred vision; dizziness; slurred speech; bone marrow cancer [carc.]
Toluene	200 ppm/300 ppm	11 mg/kg in soil. 3.1 µg/L in groundwater.	Inhalation, skin absorption, ingestion, skin/eye contact	Irritation to eyes, skin, mucus membranes, resp. sys.; confusion; headache; euphoria; dilated pupils; dizziness; anxiety; insomnia; liver and kidney damage
Ethylbenzene	100 ppm/125 ppm	15 mg/kg in soil. 84 µg/L in groundwater.	Inhalation, skin absorption, ingestion, skin/eye contact	Irritation to eyes, skin, resp. sys.; throat irritation; dizziness; weakness; drowsiness; narcosis; kidney damage; hemorrhage of lung tissue.
Xylenes	100 ppm/150 ppm	47 mg/kg in soil. 78 µg/L in groundwater.	Inhalation, skin absorption, ingestion, skin/eye contact	Irritation to eyes, skin, nose, throat; excitement; drowsy; staggered gait; nausea; vomit; abdomen pain; liver and kidney damage

Abbreviations:

µg/L	Micrograms per liter
mg/kg	Milligrams per kilogram
STEL	Short-Term Exposure Limit
TWA	Time-Weighted Average

5.2 FIRE AND EXPLOSION HAZARDS

Flammable and combustible liquid hazards may occur from buried in-place USTs. When on-site storage is necessary, such material will be stored in containers approved by the Washington State Department of Transportation in a location not exposed to strike hazards and provided with secondary containment. A minimum 2-A:20-B fire extinguisher will be located within 25 feet of the storage location and where refueling occurs. Any subcontractors bringing flammable and combustible liquid hazards to the site are responsible for providing appropriate material for containment and spill response, and the handling of these provisions should be addressed in their respective HASP. Transferring of flammable liquids (e.g., gasoline) will occur only after making positive metal-to-metal connection between the containers, which may be achieved by using a bonding strap. Storage of ignition and combustible materials will be kept away from fueling operations.

5.3 PHYSICAL HAZARDS

When working in or around any hazardous, or potentially hazardous, substances or situations, all site personnel should plan all activities before starting any task. Site personnel shall identify health and safety hazards involved with the work planned and consult with the HSO/SS as to how the task can be performed in the safest manner, and if personnel have any reasons for concern or uncertainty.

All field personnel will adhere to general safety rules including wearing appropriate PPE—hard hats, steel-toed boots, high-visibility vests, safety glasses, gloves, and hearing protection, as appropriate. Eating, drinking, and/or use of tobacco or cosmetics will not be permitted in work areas. Personnel will prevent splashing of liquids containing chemicals and minimize dust emissions.

The following table summarizes a variety of physical hazards that may be encountered at the Site during work activities. For convenience, these hazards have been categorized into several general groupings with recommended preventative measures.

Hazard	Cause	Preventative Measures
Head strike	Falling and/or sharp objects, bumping hazards.	Hard hats will be worn by all personnel at all times when overhead hazards exist, such as during drilling activities and around large, heavy equipment. Maintain a safe distance from equipment that is equivalent to the full, extended reach of all moving parts. Maintain visual contact with equipment operators. Be mindful of your position and keep out of the intended pathway(s) of moving vehicles.

Hazard	Cause	Preventative Measures
Foot/ankle twist, crush, slip/trip/fall	Sharp objects, dropped objects, uneven, and/or slippery surfaces.	Steel-toed boots must be worn at all times on-site while heavy equipment is present. Pay attention to footing on uneven or wet terrain and do not run. Keep work areas organized and free from unmarked trip hazards. Do not place body parts in areas where articulated or moving parts are present; unless parts have been locked and/or blocked.
Engulfment/entrapment from the collapse of an excavation or trench	Excavation collapse	An excavation competent person or someone that has experience around excavations should be on site to enforce safety requirements. Do not enter any excavation or trench that is deeper than 4 feet from the ground surface. Keep equipment away from the edge of a trench or excavation to prevent collapse of the wall of the excavation. Do not stand or walk within 6 feet of the edge of any excavation.
Collect a soil sample from a piece of heavy equipment	Being struck by moving or mobile equipment	Approach equipment to collect environmental samples after the equipment has been grounded and moving parts have been secured, the operator has granted permission, and the operator has removed his/her hands from the controls.
Hand cuts, splinters, and chemical contact	Hands or fingers pinched or crushed, chemical hazards including dermal exposure to laboratory sample preservatives. Cut or splinters from handling sharp/rough objects and tools.	Nitrile safety gloves will be worn to protect the hands from dust and chemicals. Leather or cotton outer gloves will be used when handling sharp-edged rough materials or equipment. Do not collect soil samples from the excavator bucket until the bucket is resting on the ground at least 6 feet away from the test pit, the thumb on the bucket is lowered, eye contact is made with the operator, and the operator’s hands are off the controls. Refer to preventive measures for mechanical hazards below.
Eye damage from flying materials, or splash hazards	Sharp objects, poor lighting, exposure due to flying debris or splashes.	Safety glasses will be worn at all times on-site. Care will be taken during decontamination procedures to avoid splashing, or dropping equipment into decontamination water. Face shields may be worn over safety glasses if splashing is occurring during sampling or decontamination.

Hazard	Cause	Preventative Measures
Electrical hazards	Underground utilities, overhead utilities. Electrical cord hazards, such as well development pumps.	Utility locator service will be used prior to remediation activities to locate all underground utilities. Visual inspection of work areas will be conducted prior to starting work. Whenever possible, avoid working under overhead high voltage lines. Make sure that no damage to extension cords occurs. If an extension cord is used, make sure it is the proper size for the load that is being served and rated SJOW or STOW (an "-A" extension is acceptable for either) and inspected prior to use for defects. The plug connection on each end should be of good integrity. Insulation must be intact and extend to the plugs at either end of the cord.
Mechanical hazards	Heavy equipment such as drill rigs, excavator, service trucks, etc. Conducting work in road right-of-ways (on the road shoulder).	Ensure the use of competent operators, backup alarms, "kill" switches, regular maintenance, daily mechanical checks on all hoses and cables, and proper guards. Verify that "whip checks" or similar securing devices are installed on "quick-connections," where the failure of high-pressure connections could lead to the whipping of hoses. Discuss the need for plastic sheeting or other methods to contain drips (hydraulic oil, motor oil, etc.) to determine if measures are needed to prevent releases to the ground. Subcontractors will supply their own HASP. All project personnel will make eye contact with operator and obtain a clear OK before approaching or working within swing radius of heavy equipment, staying clear of swing radius. Obey on-site speed limits.
Traffic hazards	Vehicle traffic and hazards when working near right-of-ways.	Multiple field staff will work together (buddy system) and spot traffic for each other. Avoid working with your back to traffic whenever possible. Set up fencing to prevent third parties from entering site.
Noise damage to hearing	Machinery creating more than 85 decibels TWA, less than 115 decibels continuous noise, or peak at less than 140 decibels.	Wear earplugs or protective ear covers when a conversational level of speech is difficult to hear at a distance of 3 feet or if an employee must shout to be understood by nearby coworkers; when in doubt, a sound level meter may be used on-site to document noise exposure.

Hazard	Cause	Preventative Measures
Strains from improper lifting	Injury due to improper lifting techniques, over-reaching/overextending, lifting overly heavy objects.	Use proper lifting techniques and mechanical devices where appropriate. The proper lifting procedure first involves testing the weight of the load by tipping it. If in doubt, ask for help. Do not attempt to lift a heavy load alone. Take a good stance and plant your feet firmly with legs apart, one foot farther back than the other. Turn the forward foot and point it in the direction of the eventual movement. Make sure you stand on a level area with no slick spots or loose gravel. Use as much of your hands as possible, not just your fingers. Keep your back straight, almost vertical. Bend at the hips, holding load close to your body. Keep the weight of your body over your feet for good balance. Use large leg muscles to lift. Push up with the foot positioned in the rear as you start to lift. Avoid quick, jerky movements and twisting motions. Never try to lift more than you are accustomed to lifting.
Cold stress	Cold temperatures and related exposure.	Workers will wear appropriate clothing, and take breaks in a heated environment when working in cold temperatures. **Further detail on cold stress is provided in Section 5.3.1.**
Accidents due to inadequate lighting	Improper illumination.	Work will proceed during daylight hours only, or under sufficient artificial light.
Perform operation and maintenance of a bioventing system	General hazards	Operate equipment according to established procedures and/or the manufacturer's recommendations. Inspect and evaluate the exterior and interior of the treatment system enclosure that contains the blower and manifold for potential, unanticipated hazards prior to beginning work. Use approved, intrinsically-safe equipment, appliances, and associated switches in hazardous locations. Do not place ignition sources within treatment enclosures or near monitoring points. Post warnings, such as, 'no smoking or open flames' signs, if unauthorized/untrained personnel may approach the system. Keep a spill kit within the blower shed.

5.3.1 Cold Stress

Field work is expected to be completed in winter or spring months; therefore, exposure to cold temperatures may occur. Exposure to moderate levels of cold can cause the body's internal temperature to drop to a dangerously low level, causing hypothermia. Symptoms of hypothermia include: slow, slurred speech; mental confusion; forgetfulness; memory lapses; lack of coordination; and drowsiness.

To prevent hypothermia, site personnel will stay dry and avoid exposure. Site personnel will have access to a warm, dry area, such as a vehicle, to take breaks from the cold weather and warm up. Site personnel will be encouraged to wear sufficient clothing in layers such that outer clothing is wind- and waterproof and inner layers retain warmth (wool or polypropylene), if applicable. Personnel will wear water-protective gear, such as rain coats and pants, during sediment sampling to avoid getting clothing wet. Site personnel will keep hands and feet well-protected at all times. The signs and symptoms and treatment for hypothermia are summarized below.

Signs and Symptoms

- Mild hypothermia (body temperature of 98–90 degrees Fahrenheit [°F])
    - Shivering
    - Lack of coordination, stumbling, fumbling hands
    - Slurred speech
    - Memory loss
    - Pale, purplish gray, or dusky cold skin
- Moderate hypothermia (body temperature of 90–86 °F)
    - Shivering stops
    - Unable to walk or stand
    - Confused and irrational
- Severe hypothermia (body temperature of 86–78 °F)
    - Severe muscle stiffness
    - Very sleepy or unconscious
    - Ice cold skin
    - Death

Treatment of Hypothermia—Proper Treatment Depends on the Severity of the Hypothermia

- Mild hypothermia
    - Move to warm area.
    - Stay active.
    - Remove wet clothes and replace with dry clothes or blankets and cover the head.
    - Drink warm (not hot) sugary drinks.
- Moderate hypothermia
    - All of the above, plus:
        - call 911 for an ambulance.

    - cover all extremities completely.
    - place very warm objects, such as hot packs or water bottles, on the victim's head, neck, chest, and groin.
- Severe hypothermia
    - Call 911 for an ambulance.
    - Treat the victim very gently.
    - Do not attempt to re-warm—the victim should receive treatment in a hospital.

Frostbite

Frostbite occurs when the skin freezes and loses water. In severe cases, amputation of the frostbitten area may be required. While frostbite usually occurs when the temperatures are 30 °F or lower, wind chill factors can allow frostbite to occur in above-freezing temperatures. Frostbite typically affects the extremities, particularly the feet and hands. Frostbite symptoms include cold, tingling, stinging, or aching feeling in the frostbitten area followed by numbness and skin discoloration: Paler skin may change from red to purple, then to white or very pale, and darker skin may become more pale, dusky, or purplish. Frostbitten skin will be waxy and firm while still frozen and may redden, swell, or blister when thawed. Should any of these symptoms be observed, wrap the area in soft cloth, do not rub the affected area, and seek medical assistance. Call 911 if the condition is severe.

Protective Clothing

Wearing the right clothing is the most important way to avoid cold stress. The type of fabric also makes a difference. Cotton loses its insulation value when it becomes wet. Wool, on the other hand, retains its insulation even when wet. The following are recommendations for working in cold environments:

- Wear *at least three layers* of clothing.
    - An outer layer to break the wind and allow some ventilation (like Gortex or nylon)
    - A middle layer of down or wool to absorb sweat and provide insulation even when wet
    - An inner layer of cotton or synthetic weave to allow ventilation
- Wear a hat—up to 40 percent of body heat can be lost when the head is left exposed.
- Wear insulated boots.
- Keep a change of dry clothing available in case work clothes become wet.
- Do not wear tight clothing—loose clothing allows better ventilation.

Work Practices

- Drinking—Drink plenty of liquids, avoiding caffeine and alcohol. It is easy to become dehydrated in cold weather. Workers will be provided access to at least 1 quart of drinking water per hour.
- Work Schedule—If possible, heavy work should be scheduled during the warmer parts of the day. Take breaks out of the cold in heated vehicles.
- Buddy System—Try to work in pairs to keep an eye on each other and watch for signs of cold stress.

5.3.2 Biohazards

Bees and other insects may be encountered during the field work tasks. Persons with allergies to bees will make the HSO/SS aware of their allergies and will avoid areas where bees are identified. Controls such as repellents, hoods, nettings, masks, or other PPE may be used. Report any insect bites or stings to the HSO/SS and seek first aid, if necessary. Inspect the work area for hazardous plants, medical waste (syringes and similar items), and indications of hazardous organisms, and avoid such areas if possible.

Site personnel will maintain a safe distance from any urban wildlife encountered, including stray dogs, raccoons, and rodents, to preclude a bite from a sick or injured animal.

5.3.3 Traffic Hazards

For work being conducted near or alongside a roadway, signs, signals, and barricades should be utilized. Because signs, signals, and barricades do not always provide appropriate protection, spotters will be used to ensure traffic is monitored during work activities along roadways. All workers will wear high visibility reflective neon/orange vests. Although lane closures are not anticipated for off-site work, traffic control plans and city-issued permits will be required for any lane closures. If lane closures are required, an addendum to this HASP will be required to document the health and safety procedures associated with lane closure and use of flaggers.

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6.0 Site Monitoring

The following sections describe site monitoring techniques and equipment that are to be used during site field activities. The HSO/SS, or a designated alternate, is responsible for site control and monitoring activities.

6.1 SITE MONITORING

All noise-generating activities will be conducted during the allowable noise-generating hours as stated by the City of Ellensburg. Construction Noise Hours for the City of Ellensburg are between 7:00 a.m. and 9:00 p.m. Monday through Friday.

Visual monitoring for dust will be conducted by the HSO/SS to ensure that inhalation of contaminated soil particles does not occur. If visible dust is present in the work area, either work will cease, and the area will be cleared until the dust settles, or dust masks will be worn. Water may be used to suppress any dust clouds generated during work activities.

A PID will be used on-site for characterization of soil samples collected. This PID will also be used to monitor vapor concentrations in breathing air of total volatile organic compounds (VOCs) in parts per million. Should the PID read a sustained concentration of total VOCs greater than 5 ppm over a period of 1 minute, the HSO/SS will stop work and evacuate the area until vapor concentrations return to background levels. If necessary, actions may be taken to reduce vapor concentrations in the work area by covering exposed soil in drums, or drilling cuttings, moving upwind, or using fans or foam to dissipate vapors from the work area. If vapor concentrations within the breathing zone remain above these levels, a respirator will be donned.

The HSO/SS will visually inspect the work site at least daily to identify any new potential hazards. If new potential hazards are identified, immediate measures will be taken to eliminate or reduce the risks associated with these hazards.

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7.0 Hazard Analysis by Task

The following section identifies potential hazards associated with each task listed in Section 3.2 of this HASP.

Task	**Potential Hazard**
Oversight of excavation activities with an excavator	Exposure to loud noise; overhead hazards; head, foot, ankle, hand, and eye hazards; electrical and mechanical hazards; lifting hazards; dust inhalation hazards; potential dermal or eye exposure to site contaminants in soil; fall hazards; engulfment; traffic hazards; being struck by heavy equipment (excavator bucket, company vehicles); and heat and cold exposure hazards. Other hazards may include contact with utilities or damage to utilities, incorrectly functioning excavator/fluid release from equipment, pinch points from handling tools and equipment, falling equipment, malfunctioning high-pressure fittings (whip checks) and hydraulic lines, biological hazards, and third parties being in close proximity to work zones.
Collection of soil samples from the excavator bucket and soil samples from landfarmed soil	Chemical hazards include potential dermal or eye exposure to site contaminants in soil. Physical hazards include slip, trip, or fall hazards, failing and engulfment into a test pit with excavation collapse, falling equipment, being struck by moving or mobile equipment, pinch points, noise hazards, malfunctioning high pressure pneumatic and hydraulic lines; heat and cold exposure hazards; and biological hazards. Pinch points in areas where articulated or moving parts are present, unless locked and/or blocked.
Oversight of drilling activities and installation of monitoring wells and soil vapor points	Exposure to loud noise; overhead hazards; head, foot, ankle, hand, and eye hazards; electrical and mechanical hazards; lifting hazards; dust inhalation hazards; potential dermal or eye exposure to site contaminants in soil; fall hazards; engulfment; traffic hazards; being struck by heavy equipment (drill rig, company vehicles); and heat and cold exposure hazards. Other hazards may include contact with utilities or damage to utilities, incorrectly functioning excavator/fluid release from equipment, pinch points from handling tools and equipment, falling equipment, malfunctioning high-pressure fittings (whip checks) and hydraulic lines, exposure to chemicals; biological hazards, and third parties being in close proximity to work zones.
Development of monitoring wells	Being struck by vehicles, encroachment of the work zone by third parties, pinch points, slip, trip falls, cuts and contusions from handling/moving equipment, lifting hazards and musculoskeletal injuries, electric shock from the use of corded electrical tools and equipment; potential dermal or eye exposure to site contaminants in groundwater; accidental release to ground.

Task	Potential Hazard
Collection of groundwater and floating product samples	Being struck by vehicles, encroachment of the work zone by third parties, pinch points, slip, trip falls, cuts and contusions from handling sample bottles or moving equipment, lifting hazards and musculoskeletal injuries, electric shock from the use of corded electrical tools and equipment; potential dermal or eye exposure to site contaminants in groundwater and floating product; accidental release to ground.
Performing operation and maintenance of the bioventing system	Fire/explosions from ignition sources; release of hazardous energy (electrical, mechanical, pressure); exposure to chemicals; pinch/crush points, cuts and concussions, and musculoskeletal injuries associated with the removal and replacements of well lids or moving heavy objects.

8.0 Personal Protective Equipment

All work involving heavy equipment and drilling will proceed in Level D PPE, which shall include hard hat, high-visibility vest/jacket, steel-toed boots, hearing protection, eye protection, and nitrile gloves.

All personnel will be properly fitted and trained in the use of PPE. The level of protection will be upgraded by the HSO/SS whenever warranted by conditions present in the work area. The HSO/SS will periodically inspect equipment such as gloves and hard hats for defects.

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9.0 Site Control and Communication

9.1 SITE CONTROL

Pedestrians and other unauthorized personnel will not be allowed in the work areas. Access to the work site will be restricted to designated personnel. The purpose of site control is to minimize the public's potential exposure to site hazards, to prevent vandalism in the work area, to prevent access by unauthorized persons, and to provide adequate facilities for workers. If members of the public enter the work area, field staff will stop work until the public have left the work area. The site will be fenced to prevent potential third party injuries.

Work area controls and decontamination areas will be provided to limit the potential for chemical exposure associated with site activities, and transfer of contaminated media from one area of the site to another. The support zone (SZ) for the site includes all areas outside the work area and decontamination areas. An exclusion zone/contamination reduction zone (EZ/CRZ) and SZ will be set up for work being conducted within the limits of the site. Only authorized personnel shall be permitted access to the EZ/CRZ. For work being conducted outside the limits of the site (road shoulders), the EZ/CRZ around work locations will be demarcated with cones and/or barrier hazard tape as needed to effectively limit unauthorized access. Staff will decontaminate all equipment and gear as necessary prior to exiting the CRZ. Decontamination areas will be constructed with plastic sheeting on the ground, to reduce transport of contaminated soils from the EZ to the SZ.

9.2 COMMUNICATION

All site work will occur in teams and the primary means of communication on-site and with off-site contacts will be via cell phones. An agreed-upon system of alerting via air horns and/or vehicle horns may be used around heavy equipment to signal an emergency if shouting is ineffective.

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10.0 Decontamination

Decontamination procedures will be strictly followed to prevent off-site spread of contaminated soil or water. The HSO/SS will assess the effectiveness of decontamination procedures by visual inspection.

10.1 CONTAMINATION PREVENTION

To avoid personal contact with contaminants, do the following:

- Do not walk through areas of obvious or known contamination.
- Do not directly handle or touch contaminated materials.
- Make sure all PPE have no cuts or tears prior to donning.
- Fasten all closures on suits, and cover with tape, if necessary.
- Take particular care to protect any skin injuries.
- Stay upwind of airborne contaminants.
- Do not carry cigarettes, gum, food, drinks, or similar items into contaminated areas.

To avoid spreading equipment and sample contamination:

- Take care to limit contact with heavy equipment and vehicles.
- If contaminated tools are to be placed on non-contaminated equipment/vehicles for transport to the decontamination pad, use plastic to keep the non-contaminated equipment clean.
- Bag sample containers prior to emplacement of sample material.

The PM and SSO will specify the decontamination requirements for personnel and equipment to be implemented for each task. The exclusion zone and the work site in general must include an established SZ and personnel and equipment decontamination areas. The minimum decontamination that will be required for all field operations will consist of Level D decontamination as described below.

10.2 DECONTAMINATION

The majority of field activities are expected to be conducted using Level D or modified Level D PPE. Decontamination for activities requiring Level D protection will consist of the following:

- Remove and dispose of gloves.

Decontamination procedures are described below:

Decontamination Measures for Soiled PPE

Station Number	Operation	Procedure
1	Equipment Drop	Deposit equipment used on-site (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths. Segregation at the drop reduces the probability of cross-contamination.
2	Glove Removal	Remove gloves. Deposit in container with plastic liner.
3	Field Wash	Hands and face are thoroughly washed. Shower as soon as possible.
4	Construction Equipment	All construction equipment will be decontaminated prior to leaving the Site. Equipment and vehicle decontamination generally consists of sweeping (if dry) and/or pressure washing with detergent solution followed by a potable water rinse.

11.0 Emergency Response and Contingency Plan

This section defines the emergency action plan for the Site. It will be rehearsed with all site personnel and reviewed whenever the plan is modified or the HSO/SS believes that site personnel are unclear about the appropriate emergency actions.

A muster point of refuge (that is clear of adjacent hazards and not located downwind of site remediation activities) will be identified by the HSO/SS and communicated to the field team each day. In an emergency, all site personnel and visitors will evacuate to the muster point for roll call. It is important that each person on-site understand their role in an emergency, and that they remain calm and act efficiently to ensure everyone's safety.

After each emergency is resolved, the entire project team will meet and debrief on the incident—the purpose is not to fix blame, but to improve the planning and response to future emergencies. The debriefing will review the sequence of events, what was done well, and what could be improved. The debriefing will be documented in a written format and communicated to the PM. Modifications to the emergency plan will be approved by the PM.

Reasonably foreseeable emergency situations include medical emergencies, accidental release of hazardous materials (such as gasoline or diesel) or hazardous waste, and general emergencies such as vehicle accident, fire, thunderstorm, and earthquake. Expected actions for each potential incident are outlined below.

11.1 MEDICAL EMERGENCIES

In the event of a medical emergency, the following procedures should be used:

1. Stop any imminent hazard if you can safely do so.
2. Remove ill, injured, or exposed person(s) from immediate danger if moving them will clearly not cause them harm and no hazards exist to the rescuers.
3. Evacuate other on-site personnel to a safe place in an upwind or cross-wind direction until it is safe for work to resume.
4. If serious injury or a life-threatening condition exists, call **911** for paramedics, fire department, and police.
    a. Clearly describe the location, injury, and conditions to the dispatcher. Designate a person to go to the site entrance and direct emergency equipment to the injured person(s). Provide the responders with a copy of this HASP to alert them to chemicals of potential concern.
5. Trained personnel may provide first aid/cardiopulmonary resuscitation if it is necessary and safe to do so. Remove contaminated clothing and PPE only if this can be done without endangering the injured person.
6. Call the PM and HSO/SS.
7. Immediately implement steps to prevent recurrence of the accident.

Refer to Figure 1 in Section 2.2 for a map showing the nearest hospital location with phone number and address.

11.2 ACCIDENTAL RELEASE OF HAZARDOUS MATERIALS OR WASTES

The steps to follow after the accidental release of hazardous materials or wastes are as follows:

1. Evacuate all on-site personnel to a safe place in an upwind direction until the HSO/SS determines that it is safe for work to resume.
2. Instruct a designated person to contact the PM and confirm a response.
3. Contain the spill, if it is possible and can be done safely.
4. If the release is not stopped, contact 911 to alert the fire department.
5. Contact the Washington Emergency Management Division at 1-800-258-5990 and the National Response Center at 1-800-424-8802 to report the release. In addition, notify the Washington State Department of Ecology's Central Regional Office at 1-509-575-2490.
6. Initiate cleanup.
7. The PM will submit a written report to the Washington State Department of Ecology in the event of a reportable release of hazardous materials or wastes.

11.3 GENERAL EMERGENCIES

In the case of fire, explosion, earthquake, or imminent hazards, work shall be halted and all on-site personnel will be immediately evacuated to a safe place. The local police/fire department shall be notified if the emergency poses a continuing hazard, by calling 911.

In the event of a thunderstorm, outdoor work will be discontinued until the threat of lightning has abated. During the incipient phase of a fire, the available fire extinguisher(s) may be used by persons trained in putting out fires, if it is safe for them to do so. Contact the fire department as soon as feasible.

11.4 EMERGENCY COMMUNICATIONS

In the case of an emergency, an air horn or vehicle horn will be used as needed to signal the emergency. One long (5-second) blast will be given as the emergency/stop work signal. If the air horn is not working, a vehicle horn and/or overhead waving of arms will be used to signal the emergency. In any emergency, all personnel will evacuate to the designated refuge area and await further instruction.

11.5 EMERGENCY EQUIPMENT

The following minimum emergency equipment will be readily available on-site and functional at all times:

- First Aid Kit—contents approved by the HSO/SS
- Portable fire extinguisher (2-A:10 B/C min)
- Spill Kit
- Flashlight

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12.0 Administrative Requirements

12.1 RECORDKEEPING

The HSO/SS, or a designated alternate, will be responsible for keeping attendance lists of personnel present at site health and safety meetings, accident reports, and signatures of all personnel who have read this HASP.

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13.0 Approvals

Project Manager	Date
Project Health & Safety Officer	Date

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14.0 Signature Page

I have read this Health and Safety Plan and understand its contents. I agree to abide by its provisions and will immediately notify the HSO/SS if site conditions or hazards not specifically designated herein are encountered.

Name (Print)	Signature	Date	Company/Affiliation

Attachment 1
Daily Tailgate Safety Meeting Form

DAILY TAILGATE SAFETY MEETING AND DEBRIEF FORM

Instructions:
To be completed by supervisor prior to beginning of work each day, when changes in work procedures occur, or when additional hazards are present. Please maintain a copy of this form with the site-specific HASP for the record.

PROJECT NAME AND ADDRESS:	WORK COMPLETED/TOOLS USED:

TOPICS/HAZARDS DISCUSSED:

Chemicals of concern:
Slip, trip, fall:
Heat or cold stress:
Required PPE:
Other Potential Hazards:
• Environmental:
• Physical:
• Biological:
• Other :

INFORMAL TRAINING CONDUCTED (Name, topics):

NAMES OF EMPLOYEES:

ADDITIONAL HAZARDS IDENTIFIED AT END OF WORK DAY:

Near Misses/Incidents? If so proceed to Page 2 Near Miss and Incident Reporting Form

Supervisor's Signature/Date: ____

NEAR MISS AND INCIDENT REPORTING FORM

INCIDENTS:

INJURIES:

NEAR MISSES:

CORRECTIVE ACTIONS:

Supervisor's Signature/Date: ____