Interim Action Addendum #4 Work Plan – Remedial Excavation Near MW14

Coleman Oil R99 Renewable Diesel Spill
Wenatchee, Washington

Prepared for:

Coleman Oil Company, LLC
335 Mill Road
Lewiston, Idaho 83501

August 4, 2023

Prepared by:

HydroCon, LLC
510 Allen Street, Suite B Kelso, Washington 98626
p: (360) 703-6079   f: (360) 703-6086
www.hydroconllc.net

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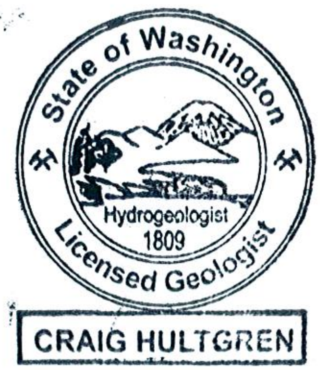

Prepared by:

Craig Hultgren, LHG
Technical Director

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Acronyms

Able	Able Clean-up Technologies, Inc.
AST	Aboveground Storage Tank
bgs	below ground surface
BNSF	Burlington Northern – Santa Fe Railroad
BTEX	benzene, toluene, ethylbenzene, and total xylenes
cPAHs	carcinogenic polynuclear aromatic hydrocarbons
COC	Chemical of Concern
Coleman Oil	Coleman Oil Company
CBR	Columbia River Basalt
CUL	cleanup level
DRPH	diesel range petroleum hydrocarbons
Ecology	Washington Department of Ecology
EDB	1,2-dibromoethane
EDC	1,2-dichloroethane
EDR	Environmental Data Resources
EEC	Environmental Engineering & Consulting, Inc.
EPA	Environmental Protection Agency
EPH	Extractable Petroleum Hydrocarbons
ESA	Environmental Site Assessment
ESPR	Emergency Spill Response Plan
GRPH	gasoline range petroleum hydrocarbons
HydroCon	HydroCon Environmental LLC
µg/L	micrograms per liter
mg/Kg	milligrams per Kilogram
LNAPL	light nonaqueous-phase liquid
MTBE	Methyl tert-butyl ether
MTCA	Model Toxics Control Act
NRCES	NRC Environmental Services, Inc.
ORPH	oil range petroleum hydrocarbons
PID	photoionization detector
PCBs	Polychlorinated Biphenyls
PUD	Public Utilities District
QAPP	Quality Assurance Project Plan
SAP	Sampling and Analysis Plan
SRI	Supplemental Remedial Investigation
TPH	total petroleum hydrocarbons
UST	underground storage tank
VCP	Voluntary Cleanup Program

Acronyms (continued)

VOCs	volatile organic compounds
VPH	Volatile Petroleum Hydrocarbons
WAC	Washington Administrative Code

1.0 INTRODUCTION

HydroCon Environmental, LLC (HydroCon), has prepared this Draft Interim Action Addendum #4 Work Plan (Work Plan) to perform a remedial excavation of petroleum contaminated soil (PCS) in the vicinity of monitoring well MW14 in the Uplands area of the Coleman Oil fuel storage facility located at 600 S. Worthen Street in Wenatchee, Washington (herein referred to as "the Site").

This Work Plan has been prepared to meet the requirements of Exhibit B – Scope of Work and Schedule of Agreed Order No. DE 15389 entered into by Coleman Oil Company, LLC; Coleman, Services IV, LLC; and the Washington State Department of Ecology (Ecology) with an effective date of September 18, 2017 (Agreed Order). The Agreed Order is a continuation of previous and ongoing significant oil spill response activities and removal actions conducted under the Administrative Order on Consent for Removal Activities issued by the U. S. Environmental Protection Agency (EPA) on May 5, 2017 (EPA Docket No. CWA-10-2017-0114).

The site, as defined under the Washington State Model Toxics Control Act Cleanup Regulation (MTCA), Chapter 173-340 of the Washington Administrative Code (WAC §173-340-200), comprises the portion of the Property and adjacent properties where hazardous substances have come to be located in soil, groundwater, and surface water at concentrations suspected to exceed applicable cleanup levels (herein referred to as the Site) as a result of releases at the Property.

1.1 Document Purpose and Objectives

HydroCon has been retained by Coleman Oil to provide environmental consulting services for this project. This Work Plan has been prepared to review existing environmental conditions, perform an exploratory test pit investigation near MW14 to assess the extent of PCS to be removed from the Site and provide oversight of a remedial excavation to remove the PCS from the ground and dispose at a licensed disposal facility. The purpose of the Work Plan is to ensure that the test pit investigation is sufficiently scoped to acquire the necessary information to determine the extent of PCS in the area near MW14; the sample collection, handling, and analysis will result in data that meets data quality objectives; and the scope of the remedial excavation is well documented to provide field personnel a clear understanding of the remedial action goals for successful completion of the interim action that meets Washington State Model Toxics Control Act (MTCA) Regulation in Chapters 173-340-350 and 173-340-360 of the Washington Administrative Code (WAC §173-340-350 and §173-340-360).

1.2 Document Organization

The Work Plan is organized as follows:

> **Section 1, Introduction**, describes the purpose and objectives of the interim action, document organization, responsible agency, and project organization.

Section 2, Background Information, provides a site description, property ownership and operational history, a summary of the release of R99 renewable diesel fuel to the subsurface, a summary of remedial measures taken at the Site, the geologic and hydrogeologic setting, and a description of routine groundwater monitoring at the Site.

Section 3, Remaining Source of GRPH and Related VOCs in the Uplands, describes the source area of GRPH and associated VOCs near MW14 that is affecting groundwater quality at the Site.

Section 4, Interim Action Tasks, presents and describes additional environmental investigations to be conducted to define the nature and extent of impacts from the R99 Renewable Diesel spill.

Section 5, References, lists the references cited in this report.

Appendix A, Sampling and Analysis Plan (SAP), provides scope, types, and details of sampling tasks.

Appendix B, Quality Assurance Project Plan (QAPP), which outlines the procedures that will be used to ensure the data collected and analyzed meets project requirements.

1.3 Responsible Agency

Ecology is the lead regulatory agency for the cleanup action at the Property as promulgated in the MTCA. The cleanup action is being conducted under Agreed Order No. DE 15389.

1.4 Project Organization

The names and responsibilities of key project representatives and personnel involved in the cleanup action at the Property are listed below:

- John Mefford, LHG Ecology's assigned Project Manager
- Jim Cach, Coleman Oil Company's Project Manager
- Craig Hultgren, LHG, HydroCon, Project Manager
- Rob Honsberger, HydroCon, Field Lead
- Kurt Johnson, APEX Laboratory, Forensic Chemist and Quality Assurance Officer

2.0 BACKGROUND INFORMATION

A summary of Site information, operational history, and the release of R99 renewable diesel fuel is provided below. Further details are discussed in detail the Supplemental Remedial Investigation (SRI) Work Plan (HydroCon 2018a) and the Draft SRI Report (HydroCon 2018b) as well as previous groundwater monitoring reports.

2.1 Site Description

The Property is located at 600 S. Worthen Street in Wenatchee, Washington (Figure 1). The Chelan County Assessor (2017) online records listed the street address as 600 South Worthen Street with a legal description of Manufacturers Amended Block 4 Lots 1-9, 1.27 acres. The Property was listed in the Chelan County Assessor (2017) online records as County Assessor Property Identification No. 10398, Treasurer Map Property Identification No. (Property ID) 55798, and Chelan County Assessor Parcel No. 222011693005 with a listed owner of Coleman Services V LLC.

The Site comprises the following four parcels:

- Chelan County Parcel No. 222011693005 with a listed owner of Coleman Services V LLC (Coleman property);
- Chelan County Parcel No. 222010693001 with a listed owner of Chelan County Public Utilities Department (PUD) (substation to north of Coleman property);
- Chelan County Parcel No. 222011693105 with a listed owner of Chelan County PUD (shoreline east of Coleman Property); and
- Chelan County Parcel No. 222011693100 with a listed owner of Chelan County PUD (shoreline to northeast of Coleman property).

2.2 Property Ownership and Operational History

The historical information provided herein regarding the Property was acquired from Blue Mountain Environmental Consulting (2007) and Farallon (2017b).

The Property was first owned and occupied by Standard Oil Company and has been a bulk fuel facility since 1921. Based on information obtained from Sanborn maps, two vertical gasoline aboveground storage tanks (ASTs), four oil ASTs, one kerosene AST, and four structures were present on the Property in the 1920s. The number and configurations of ASTs have changed over time. A 4,000-square-foot, wood-framed building used for offices and warehouse storage was constructed on the northwestern corner of the Property in 1935. By the 1950s, a tank farm was present on the south-central portion of the Property and included 10 approximately 20,000-gallon vertical ASTs.

The Chelan County Assessor (2017) online records indicated that North Central Petroleum, Inc. purchased the Property in 1980. In the early 1990s, a tank farm was present south of the warehouse and office building and contained eleven 19,000-gallon horizontal ASTs and one 1,000-gallon horizontal waste oil AST. An underground storage tank (UST) and cardlock system were installed in 1997, which included inventory control and tank monitoring features and two pump islands (Blue Mountain Environmental Consulting, 2007).

Coleman Services IV, LLC purchased the Property in January 2007 from North Central Petroleum, Inc. (Chelan County Assessor 2017). Some features of the Property were modified over the next 10 years. The eleven 19,000-gallon ASTs were replaced by eight 2,100-gallon ASTs (Tank Farm B) (Figure 2), and one of the two pump islands was dismantled. From 2010 to 2017, the Property included a 4,000-square-foot, wood-framed building used for offices and warehouse storage; a 1,591-square-foot, wood-framed storage building on the northeastern corner of the Property; a truck fuel loading rack east of the warehouse and office building; a four-compartment UST and associated card lock pump island on the eastern and south-central portions of the Property; and two tank farms (Figure 2). Tank Farm B, south of the warehouse and office building, included eight 2,100-gallon petroleum ASTs and associated pumps (Figure 2). Tank Farm A, located on the south-central portion of the Property included two 25,000-gallon ASTs, two 20,000-gallon ASTs, one 19,500-gallon AST, five 19,400-gallon ASTs, and associated pumps and piping (Figure 2). The northern portion of the Property was fenced, including the buildings, bulk fuel tank farms, and truck fuel loading rack. The card lock pump island was present south of and outside of the fence (Blue Mountain Environmental Consulting, 2007).

In March and April 2017, the truck fuel loading rack, associated piping, and the eight 2,100-gallon ASTs in Tank Farm B were dismantled and removed from the Property. In June and July 2017, the 4,000-square-foot, wood-framed warehouse and office building and the 1,591-square-foot storage building were demolished and removed, and the remaining ASTs were emptied of petroleum and cleaned.

Currently, only the UST, card lock pump island, and a fenced truck parking area to the south of the card lock are used in operations conducted at the Property.

2.3 Release of R99 Renewable Diesel Fuel

A petroleum sheen was discovered on the west side of the Columbia River approximately 300 feet north of the Site on March 17, 2017. Subsequent line tightness testing revealed that two lines could not hold pressure and review of Coleman Oil inventory records indicated that the release was most likely from the R99 renewable diesel fuel line. Inventory records revealed an estimated total loss of approximately 4,543 gallons.

Subsequent testing included the installation of groundwater monitoring wells, soil borings, and test pits in different phases between March and September 2017 by Farallon (2017) and March, April and August 2018 by HydroCon (2018b and 2018c) (Figure 2). This testing indicated soil and groundwater had been impacted at concentrations above MTCA Method A cleanup levels, including impacts to soil and groundwater near the location of the sheen.

2.4 Remedial Measures

Several remedial measures have been performed at the Site since the discovery of the release.

- Pads and booms were placed in the Columbia River in the observed sheen discharge area to recover product after discovery of the release. This practice has continued along with daily reporting regarding Columbia River conditions, now reduced to daily observations but weekly reporting.
- A remedial excavation was performed at the Coleman Oil facility near the point of release. Approximately 741 tons of petroleum contaminated soil was removed for offsite disposal.
- Sumps were placed in the remedial excavation backfill. Pumps were placed in the sumps to recover product and maintain a cone of depression to minimize product migration. Effluent from the sumps was routed to an oil/water separator and settling tanks prior to treatment using granular activated carbon (GAC). The treated water was disposed under permit into the City of Wenatchee's sanitary sewer system.
- Farallon Consulting and Ecology's consultant (Environmental Partners, Inc. [EPI]) installed fifteen wells at the Site (MW-1 through MW-11, BH-1 through BH-3, and RW-1). Product recovery via skimming using a peristaltic pump and tubing and/or passive recovery using hydrophobic socks occurred in some of the wells.
- In April 2018, HydroCon performed a supplemental remedial investigation (2018 SRI) that included the addition of fourteen new 4-inch diameter monitoring wells (MW12 through MW23, MW01S and MW03S). Three wells with persistent light nonaqueous-phase liquid (LNAPL) measurements (MW-9, MW-10, and BH-1) were fitted with pumps and connected with underground piping for pressurized air to operate the pumps, and conduit for electrical power for heat tape at each pumping well and effluent piping to collect the recovered groundwater and product. The recovered groundwater and product from these wells were routed through three oil/water separators, into storage tanks and then through filtration and GAC and into storage tanks. The treated water was analyzed prior to discharge in batches under an agreement between Coleman Oil and the City of Wenatchee into the City's sanitary sewer system. Pumping of the three wells began on May 5, 2018.
- In August 2018 nine new 4-inch diameter monitoring wells (MW24 through MW32) were installed at the Site. Two of the wells used to recover product and contaminated groundwater (MW-9 and MW-10) were deepened, completed as 4-inch diameter wells, and renamed MW09R and MW10R, respectively.

- A release of diesel and gasoline from a 55-gallon drum onto the ground surface occurred at the Site near the northeastern corner of Tank Farm A in early September 2018. In response, a total of 16.83 tons of petroleum contaminated soil was removed by excavation. Confirmation soil sampling results indicated that the lateral extent of contamination had been removed. However, the concentration of GRPH and DRPH in the excavation floor sample collected near the groundwater interface exceeded their respective MTCA Method A cleanup level. No further excavation was attempted due to the proximity of the Tank Farm A containment and a massive boulder that was too large to remove using the excavation equipment. Further remedial action in this area was considered in the feasibility study that was prepared later for the Site.

- The remediation system for recovering product and treating groundwater was expanded in November 2018 to include six more recovery points (MW17, MW24, MW28, MW29, MW30, and MW32). The modified remediation system now consists of three separate zones that pump LNAPL and contaminated groundwater into three OWSs. These zones include the MW09R zone (MW09R, MW17, and MW32); the MW10R zone (MW10R, MW24, and MW28); and the BH-1 zone (BH01R, MW29, and MW30) with all 9 wells active. The expanded remediation system began pumping on November 2, 2018. As of December 31, 2019, a total of 454.47 gallons of product had been recovered (HydroCon 2020b). The majority of the product is believed to be R99 from the 2017 release. Other fuel products have been identified by forensic analysis to be present in the subsurface, including gasoline, non-R99 diesel fuel, and lubricating oil, so it is likely that some of the recovered product includes petroleum products other than R99.

- On May 21-23, 2019 a remedial excavation was performed at the former Control Valve Building (CVB) and Tank Farm B. The PCS at this area of the site had the highest concentrations of GRPH and related VOCs including BTEX and naphthalene. A total of 875 tons of PCS was removed and disposed at the Greater Wenatchee Regional Landfill. Monitoring well MW13 was removed during the excavation process. Replacement well MW13R was installed in a similar location after the remedial excavation was completed. Two sets of 4-inch diameter slotted Schedule 40 PVC piping were placed inside the excavation at a depth of approximately 5 feet bgs for future use as conveyance piping for the application of treated and oxygen enriched groundwater. Post remediation groundwater sampling has revealed that a dramatic improvement in groundwater quality has been achieved from this remedial action with no detection of GRPH, BTEX and naphthalene in MW13R.

- The Site's groundwater treatment system was upgraded in 2020. The new system was activated in August 2020 and recirculates treated water into sumps located in the uplands area of the Site instead of discharging it into the City of Wenatchee's sanitary sewer system. Petroleum contaminated water is collected from 9 pumping wells (MW09R, MW10R, BH01R, MW17, MW24, MW28, MW29, MW30, and MW32) and treated using granular activated carbon (GAC), the same as the previous system. The treated water is temporarily placed into storage tanks located in Tank Farm A. The treated water is enriched with oxygen using

0.075% hydrogen peroxide (H202) and then discharged into one or more of the sumps that were placed in the uplands area during remedial excavations in 2017 and 2019. This creates a closed loop system designed to enhance the biologic degradation of residual hydrocarbons at the Site. Since December 31, 2019 measurement and product recovery from remediation system was halted due to the lack of observable product collecting in the OWS. However, the OWS are checked and skimmed on a bi-weekly basis for the presence of free product. Algae and iron bacteria have been the only things observed and removed in the OWS.

2.5 Geologic & Hydrogeologic Setting

The Site is located in the Wenatchee Valley approximately 150 feet west south-west of the Columbia River at an elevation of approximately 660 feet above mean sea level (Figure 1). The topography of the Site slopes very gently to the north north-east parallel to the Columbia River.

The soils beneath the Site are consistent with ice-age alluvial deposits underlain by the Chumstick Formation bedrock. The alluvium consists primarily of silt and silty sand, with layers of clay, sand, gravel, cobbles and boulders. The thickness of the alluvium ranges from 6 to 31.5 feet. Boring logs and drilling observations indicate that a more massive, well cemented sandstone layer is beneath thin layers of mudstone, shale and sandstone and the sandstone appears to be acting as an aquitard in this area. The groundwater level is within a few feet of the top of the Chumstick Formation and always above the sandstone layer. An exception is at MW22 where the groundwater is approximately 15 feet above the top of the Chumstick formation. The MW22 area has been disturbed by previous excavation and has been backfilled with construction and other debris.

Contaminant transport and groundwater flow appears to follow the surface of the Chumstick formation and field observations paired with analytical data suggest that the petroleum contamination penetrates a few feet into the formation and travels laterally within the shaley sandstone and shale, siltstone, mudstone of the Chumstick formation. The groundwater flow direction and the dip of the sandstone surface are both to the north/northeast, except in the region between the Site and the Columbia River (near the riverbank), where both are more to the east. Aquifer testing performed in February 2018 demonstrated that none of the wells tested are hydraulically connected. However, over 200 gallons of R99 (based on product recovery totals) has been recovered from the Columbia River with the apparent discharge points (Seeps SL01 through SL04) located west of monitoring wells BH-2 (south) to MW-10 (north).

2.6 Groundwater Monitoring at the Site

Routine groundwater monitoring (quarterly to semi-annual) has been performed at the site since 2018. In 2020 the Site's groundwater treatment system was upgraded. The new system recirculates treated water into sumps located in the uplands area of the Site instead of discharging it into the City of Wenatchee's sanitary sewer system. Petroleum contaminated water is collected from 9 pumping wells

(MW09R, MW10R, BH01R, MW17, MW24, MW28, MW29, MW30, and MW32) and treated using granular activated carbon (GAC), the same as the previous system. The treated water is temporarily placed into storage tanks located in Tank Farm A. The treated water is enriched with oxygen using 0.075% hydrogen peroxide (H202) and then discharged into one or more of the sumps that were placed in the uplands area during remedial excavations in 2017 and 2019. This creates a closed loop system designed to enhance the biologic degradation of residual hydrocarbons at the Site. The new treatment system has been automated and requires less manpower to operate and maintain. Therefore, Coleman Oil has decided to take over the O&M and Columbia River level monitoring and boom management at the site.

2.6.1 Revised Frequency of Groundwater Monitoring at the Site

Based on the capabilities of the new remediation system as well as the improved Site conditions due to remedial interim actions taken at the Site, HydroCon petitioned Ecology to modify groundwater monitoring[1]. These modifications were approved by Ecology with the following stipulations:

- Beginning in 2021, groundwater monitoring will be performed on a semi-annual basis at selected monitoring wells agreed upon by Ecology (MW-6, MW-8, MW09R, MW10R, MW-11, MW13R, MW14, MW17, MW20, MW21, MW24, MW28, MW29, MW30, MW32, BH01R and BH-2) until all contaminants of concern are reduced below their respective MTCA Method A cleanup levels (CUL). Once that occurs, the groundwater monitoring schedule will revert back to a quarterly basis until the concentration of all contaminants of concern (COCs) remain below their CULs at all wells being monitored for 4 consecutive quarters.
- At Ecology's request, at least one monitoring event during the final quarterly sampling process will include sampling of all site monitoring wells to verify that the "clean wells" have remained below the cleanup level.

2.7 Remaining Source of Gasoline Range Petroleum Hydrocarbons and Related VOCs in Uplands

The remedial action taken in May 2019 at the former CVB and Tank Farm B was successful at reducing GRPH, BTEX and naphthalene to concentrations below their respective MRLs in MW13R and downgradient. A plume of GRPH and to a lesser extent BTEX remains in the area north of this remedial excavation around monitoring well MW14. Application of treated groundwater from the recirculation system has been applied to this area via conveyance piping along the West Trench to enhance biodegradation of contamination near MW13 but

[1] HydroCon, *Addendum to the 2019 O&M Monitoring Report – Modifications to Site Monitoring*, August 10, 2020

has had only limited success. Remedial action similar to what was performed in May 2019 is warranted to reduce the concentrations of GRPH and related VOCs to concentrations below their respective MTCA Method A cleanup levels. The intent of this remedial action is to remove GRPH and associated VOCs as contaminants of concern (COCs) from the Site. Tasks to perform the remedial interim action is provided below.

3.0 INTERIM ACTION TASKS

The following section presents the tasks to perform the Interim Action. Details of sample collection and handling and quality control are provided in the Sampling and Analysis Plan (Appendix A).

In summary, the interim action tasks include the following:

- Perform subsurface exploration around MW14 area via test pits to delineate the lateral extent and to some degree the vertical extent of PCS that needs to be removed by excavation.
- Waste profiles will be submitted to the Wenatchee Regional Landfill to acquire a disposal permit.
- Prepare test pit logs to document soil conditions, field screening and sampling from each exploratory test pit.
- Abandon MW14 prior to the remedial excavation.
- Perform remedial excavation to remove as much of the PCS as practical near MW14.
- Remove water that accumulates inside the remedial excavation cavity, if warranted. The water will be placed into the Site's recirculation system for treatment.
- Install monitoring well MW14R near the same location as the original well.
- Develop monitoring well MW14R using surging and pumping techniques.
- Survey the newly installed MW14R, test pit locations and margins of the remedial excavation.

Additional information on these tasks is provided in the following sections.

3.1 Pre-Field Tasks

Tasks discussed below will be performed prior to initiation of fieldwork.

3.1.1 Disposal Permit Acquisition

Coleman Oil will submit the necessary paperwork to renew the waste profile they have on record with the Wenatchee Regional Landfill. PCS generated from the remedial excavation will be disposed under permit at the landfill.

3.1.2 Utility Locates

HydroCon will contact the Washington 1-call utility locates hotline to request a public utility locates. White paint marks will be placed on the ground to delineate the area that needs to be surveyed, as is required by law, prior to calling in the locate request. In addition, a private utility locate contractor will be hired to clear test pit and boring locations prior to drilling.

3.1.3 Health and Safety Plan

HydroCon will update the site-specific Health and Safety Plan to guide field safety protocols, in accordance with rules established by the Occupational Safety and Health Administration (OSHA) and Washington Industrial Safety and Health Act (WISHA) consistent with WAC 173-340-810 and WAC 296-62.

3.2 Field Work

The tasks described in the following section will be performed as part of the field work.

3.2.1 Field Screening

Field soil screening will be used to guide sample collection during test pitting and soil sampling. During test pitting, field screening will be used to select soil samples for laboratory analysis and to define the extent of PCS in the subsurface to confirm field observations.

Volatile vapor screening will be conducted in the field using a photoionization detector (PID) to measure the volatile organic compounds (VOCs) and other gases in concentration in soil samples. The PID will be calibrated daily to a test gas standard of 100 ppm isobutylene. Procedures for using the PID are in the attached standard operating procedures (SOP 1).

In addition, field screening will include observations regarding odors and/or soil discoloration that indicate soil contamination. Soil sheen testing will be performed as described in SOP 1 to assess if a hydrocarbon sheen is produced on soil samples when clear water is introduced.

3.2.2 Abandoning MW14

Monitoring well MW14 is located within the footprint of the proposed remedial excavation and will be abandoned by grouting in-place and then removal by excavation in accordance with Chapter 173-160 WAC.

3.2.3 Test Pits

Test pits will be installed near MW14 to delineate the lateral extent of PCS that will need to be removed by excavation. Based on review of water level measurements in MW14 taken during routine groundwater monitoring, the depth to water is anticipated to be around 7 to 8 feet bgs. Each test pit will be advanced to a total depth of approximately 8 feet bgs (or groundwater). The samples will be field screened by a photoionization detector (PID) and selected soil samples will be submitted for laboratory analysis of GRPH, DRPH, and BTEX. Figure 2 show the approximate initial location of the exploratory test pits. These locations will be moved, as necessary, to accomplish the vertical delineation. Wood stakes will be driven into the ground to mark the remedial excavation area.

3.2.4 **Remedial Excavation**

The excavation will be performed using a conventional excavator owned and operated by a remediation contractor. The initial excavation limits will be determined by the test pitting exercise. The excavation will extend down to the soil/groundwater interface. PCS will be directly loaded into dump trucks and transported to the Wenatchee Regional landfill for disposal. No free liquids will be placed into the dump truck. The landfill will track the total volume of PCS disposed and provide HydroCon with a copy of all weight tickets. The disposal documentation will be included as an attachment in the report.

Soil samples will be collected from the final sidewalls and floor of the excavation. If the bottom of the excavation is the top of the Chumstick Formation (i.e., bedrock), there will be no floor sample taken. The limits of the excavation will be evaluated on the basis of field screening results (PID readings, sheen testing, visual and olfactory observations). Field screening procedures are included in the Sampling and Analysis Plan (Appendix A). Based on field screening results, the excavation may be extended to remove additional PCS. The primary objective of the excavation is to remove PCS within the vadose zone and approximately one foot below the water table.

It is expected that the excavation will extend slightly below the water table in most areas. The water table is estimated to be approximately 8 feet below grade during the time of the year the excavation will be conducted (September). A sump pump will be onsite to remove excess groundwater as necessary to minimize contaminant migration and impacting clean fill materials. Excavation water will be pumped to the onsite remediation system for treatment and disposal or if highly turbid, via vacuum truck for offsite disposal.

PID readings and soil samples will be obtained from the excavation sidewalls and bottom at approximately 25 square foot intervals. Additional PID readings may be collected to evaluate sidewall and bottom conditions. These will be compared to paired PID/analytical data in the report to help evaluate the effectiveness of the remedial excavation.

Since it is expected that all PCS in the excavation bottom will not be removed, four-inch diameter perforated piping will be placed in the bottom of the excavation for possible future remedial actions, such as application of treated water into the Uplands or injection of petroleum degrading formulations such as carbon-based capture and treat products.

The remedial excavation will be backfilled with clean native cobbles and boulders stockpiled at the site along with clean imported granular soil. Imported soil will be obtained from a local quarry.

3.2.5 Installation of Monitoring Well MW14R

A new monitoring well (MW14R) will be installed near the original location. The original well was constructed to a depth of 20 feet. The replacement well will be installed to a depth of 17 feet to avoid extending the well into the Chumstick Formation. The screened interval will be placed from approximately 5 to 17 feet bgs. The well will be developed using surging and pumping techniques. A clean stainless-steel bailer will be used to surge the wells and a peristaltic pump attached to a new length of HDPE tubing will be used to pump turbid water from the well. This process will be repeated until no further improvement in water clarity is observed.

3.2.6 Surveying

A licensed surveyor contractor will survey the location and elevation of the ground surface and top of the PVC casing at the scribed reference mark for MW14R. The surveyor will also survey the location of each test pit and the lateral limits of the remedial excavation.

3.2.7 Chemical Analysis

All soil samples will be analyzed for the following:

- DRPH and ORPH by Northwest Method NWTPH-Dx
- GRPH by Northwest Method NWTPH-Gx
- BTEX by EPA Method 8260B

HydroCon will utilize the same protocols and methodology detailed in the SAP (Appendix A). The QAPP (Appendix B) outlines the procedures that will be used to ensure the data collected and analyzed meets project requirements.

3.3 Schedule and Implementation

The test pit work and well abandonment is tentatively scheduled to occur in August 2023, depending on the availability of the excavation contractor. HydroCon anticipates that the test pit work will require no more than two days of fieldwork to complete. The remedial excavation work is tentatively scheduled to occur in early September prior to the next planned semi-annual groundwater sampling event.

HydroCon anticipates the remedial excavation work and backfilling to take approximately one week to complete. A draft report will be completed within 90 days of receipt of the final laboratory data.

3.4 *Report Preparation*

Upon completion of the field investigation HydroCon will prepare a report documenting the results of the investigation. The report will include the following:

- Documentation of field activities.
- Site plan showing pertinent site features and sample locations.
- Data summary tables.
- Test pit logs.
- Well log.
- Analytical laboratory report.
- Data evaluation and presentation of findings.
- Soil disposal documentation.
- Recommendations for additional remedial actions, if any.

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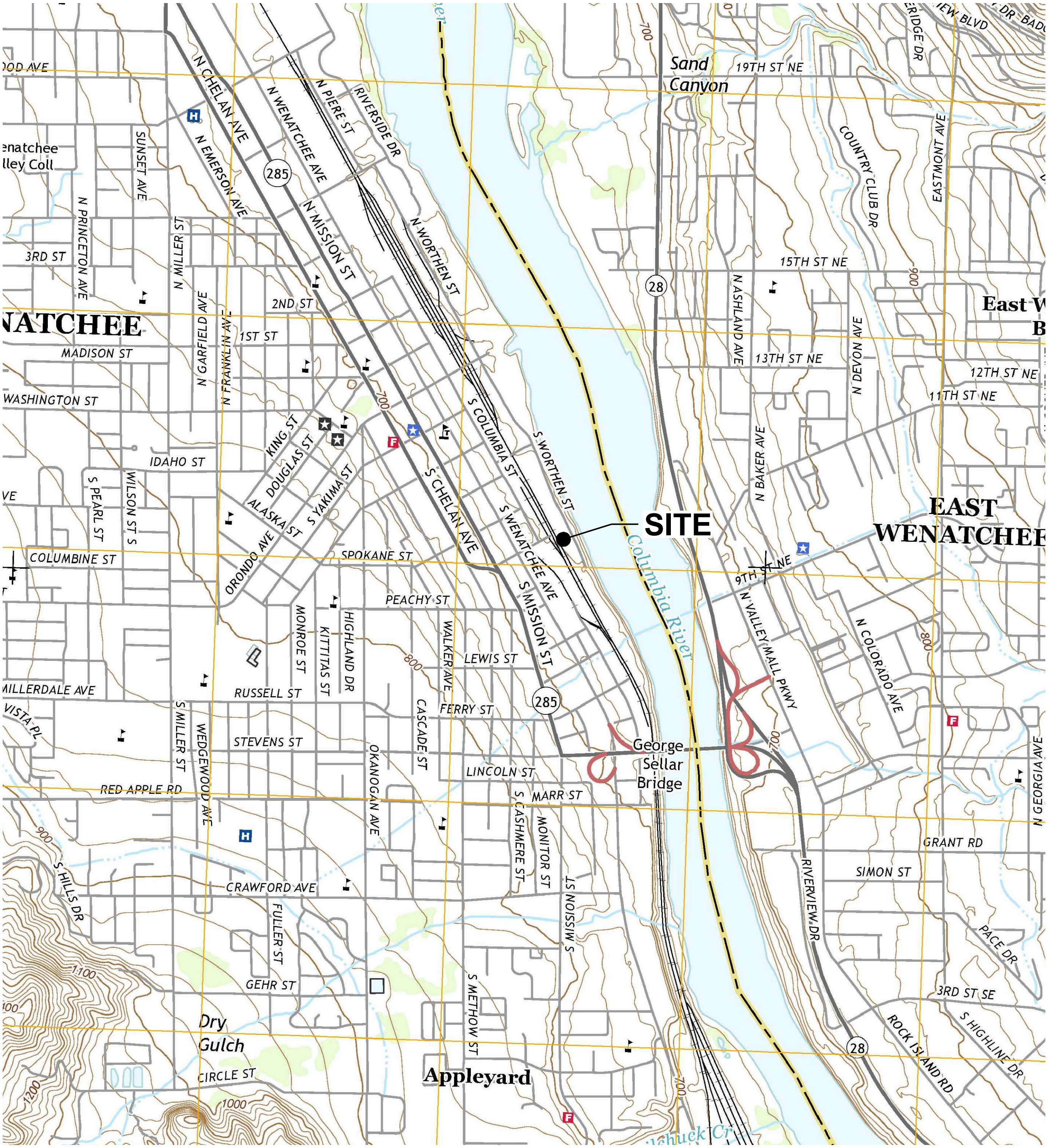
FIGURES



NOTE(S):
USGS, WENATCHEE QUADRANGLE
WASHINGTON
7.5 MINUTE SERIES (TOPOGRAPHIC)

0 2000 4000
SCALE IN FEET
1" = 2000'

Hydro Con
510 Allen St. Suite B Kelso, Wa 98626, Ph(360)-703-6086

DATE: 10-18-18
DWN: JJT
CHK: RH
APPROVED: RH
PRJ. MGR: CH
PROJECT NO: 2017-074

FIGURE 1
SITE LOCATION MAP

COLEMAN OIL COMPANY
3 CHEHALIS ST.
WENATHCEE, WA.

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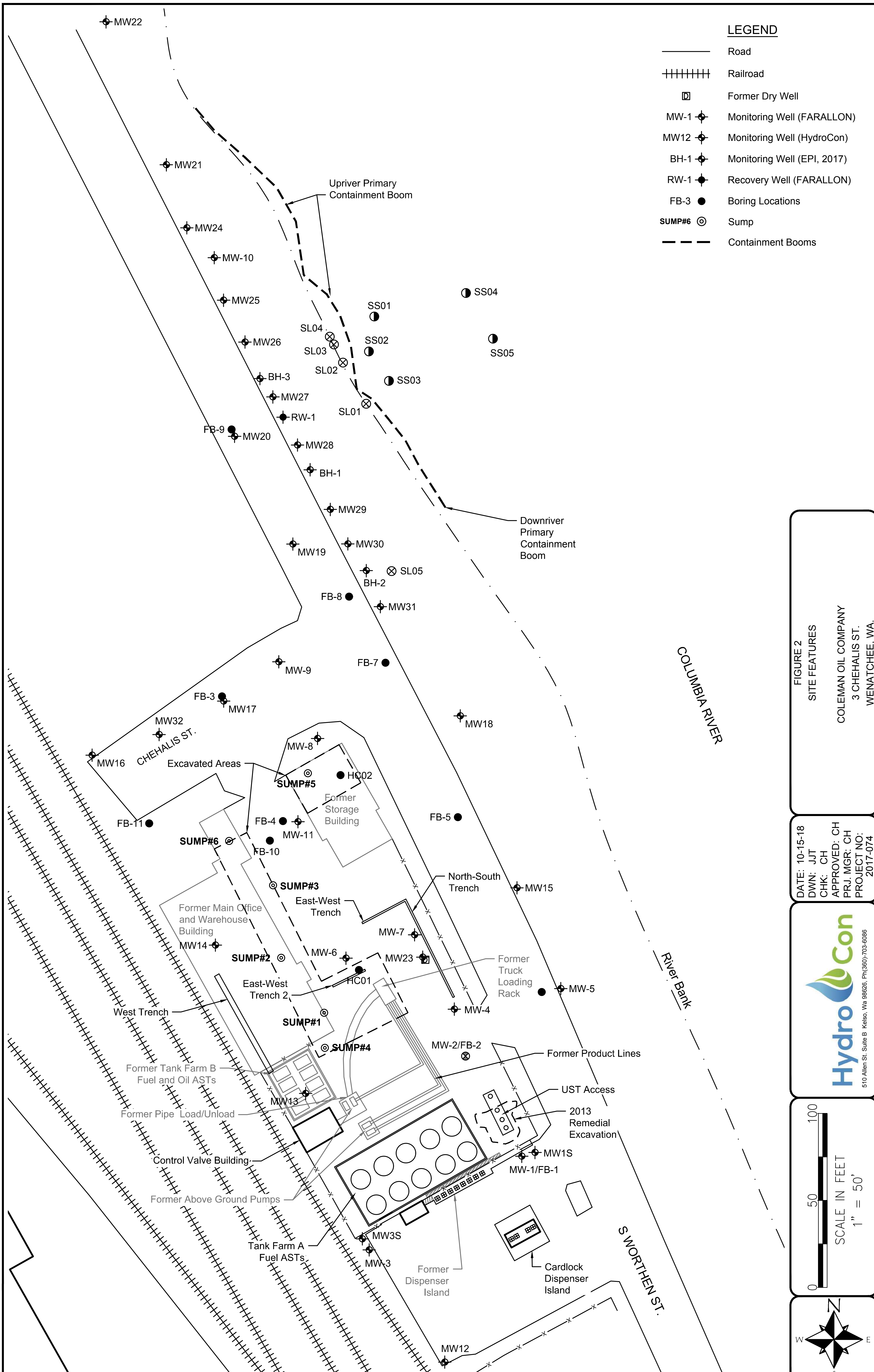

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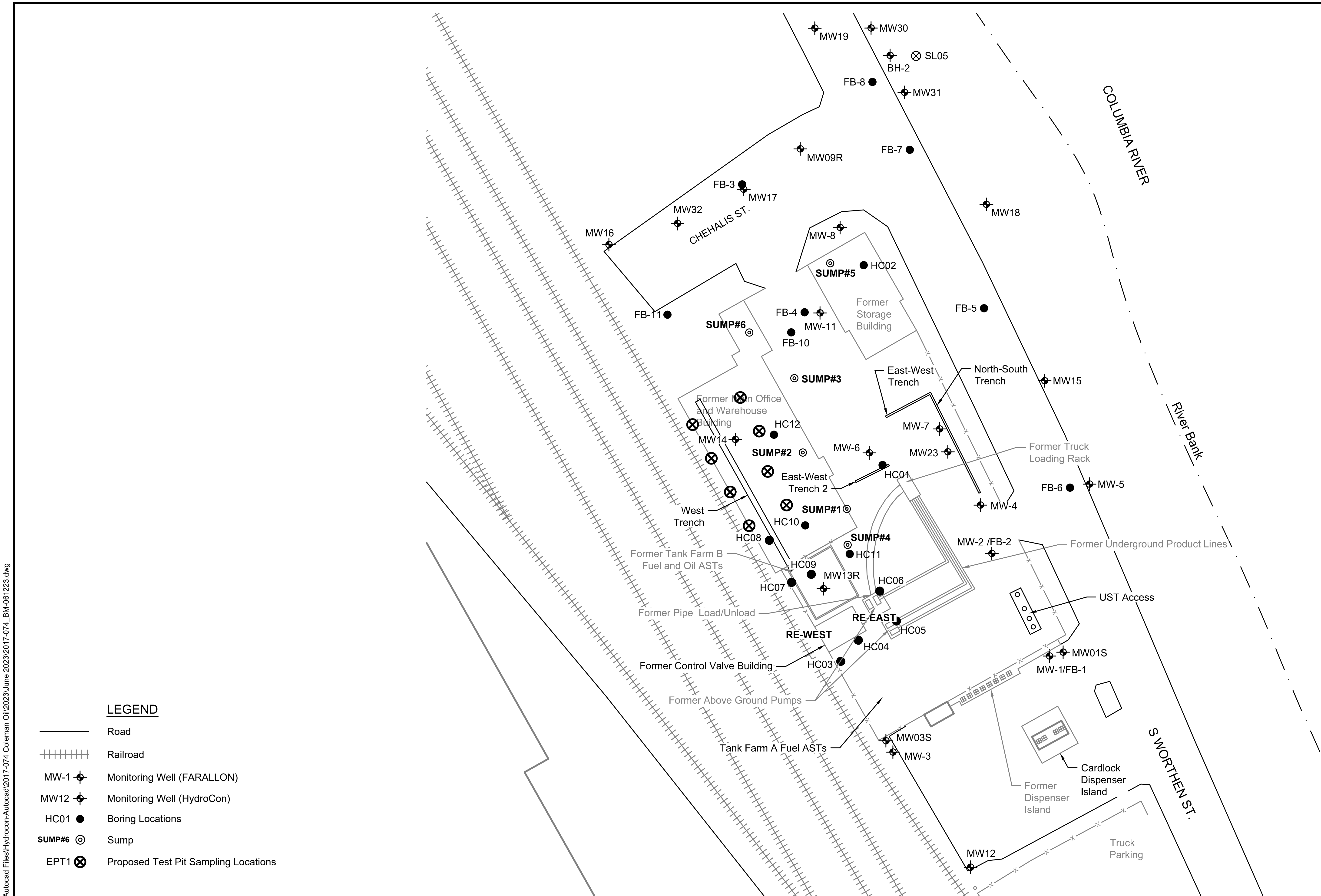


FIGURE 3
PROPOSED TEST PIT LOCATIONS

COLEMAN OIL COMPANY
3 CHEHALIS ST.
WENATCHEE, WA.

DATE: 6-12-23
DWN: JJT
CHK: CH
APPROVED: CH
PRJ. MGR: CH
PROJECT NO: 2017-074

HydroCon
510 Allen St. Suite B Kelso, Wa 98626, Ph(360)-703-6086

SCALE IN FEET
1" = 50'
0 50 100

N
W E
S

APPENDIX A

SAMPLING AND ANALYSIS PLAN

Interim Action #4 - Sampling and Analysis Plan

Coleman Oil R99 Renewable Diesel Spill
Wenatchee, Washington

Prepared for:

Coleman Oil Company, LLC
335 Mill Road
Lewiston, Idaho 83501

August 4, 2023

Prepared by:

HydroCon, LLC
510 Allen Street, Suite B Kelso, Washington 98626
p: (360) 703-6079 f: (360) 703-6086
www.hydroconllc.net

Interim Action #4 - Sampling and Analysis Plan

Coleman Oil R99 Renewable Diesel Spill
Wenatchee, Washington

Prepared for:

Coleman Oil Company LLC
335 Mill Road
Lewiston, Idaho 83501

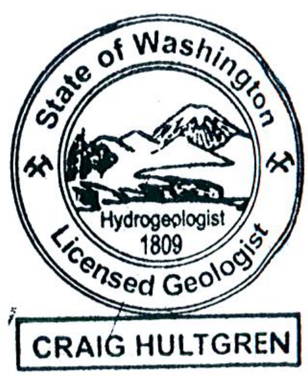
HydroCon Project No: 2017-074

Prepared by:

Rob Honsberger
Project Geologist

Reviewed by:

Craig Hultgren, LHG
Technical Director



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Test Pit Log
Boring Log
Well Development Form
Field Report Form
Chain-of-Custody Form

Acronyms

AST	Aboveground Storage Tank
BTEX	benzene, toluene, ethylbenzene, and total xylenes
cPAHs	carcinogenic polynuclear aromatic hydrocarbons
COC	Chemical of Concern
Coleman Oil	Coleman Oil Company
DRPH	diesel range petroleum hydrocarbons
Ecology	Washington Department of Ecology
EDB	1,2-dibromoethane
EDC	1,2-dichloroethane
EPA	Environmental Protection Agency
ESPR	Emergency Spill Response Plan
GRPH	gasoline range petroleum hydrocarbons
HydroCon	HydroCon Environmental LLC
µg/L	micrograms per liter
mg/Kg	milligrams per Kilogram
LNAPL	light nonaqueous-phase liquid
MTBE	Methyl tert-butyl ether
MTCA	Model Toxics Control Act
ORPH	oil range petroleum hydrocarbons
PID	photoionization detector
PCBs	Polychlorinated Biphenyls
QAPP	Quality Assurance Project Plan
SAP	Sampling and Analysis Plan
SRI	Supplemental Remedial Investigation
UST	underground storage tank
VCP	Voluntary Cleanup Program
VOCs	volatile organic compounds
WAC	Washington Administrative Code

1.0 INTRODUCTION

This Sampling and Analysis Plan (SAP) has been prepared by HydroCon Environmental (HydroCon) on behalf of Coleman Oil Company (Coleman) to describe sampling procedures and methods for the Interim Acton #4 – Remedial Excavation Near MW14 that will be conducted at the Coleman Facility located at 3 East Chehalis Street in Wenatchee, Washington (hereinafter referred to as the Property shown on Figure 1).

This SAP supports implementation components described in the Interim Action #4 Work Plan. The purpose of the SAP is to ensure sample collection, handling, and analysis conducted after completion of the cleanup action will result in data that meets the data quality objectives for the cleanup action at the Property. The SAP includes requirements for sampling activities, including sampling frequency and location, analytical testing, documentation, and quality assurance/quality control for compliance monitoring.

1.1 *Responsible Agency*

The Washington State Department of Ecology (Ecology) is the lead regulatory agency for the cleanup action at the Property as promulgated in the MTCA. The SRI work plan has been prepared to meet the requirements of Exhibit B – Scope of Work and Schedule of Agreed Order No. DE 15389 entered into by Coleman Oil Company, LLC; Coleman, Services IV, LLC; and the Washington State Department of Ecology (Ecology) with an effective date of September 18, 2017 (Agreed Order). The Agreed Order is a continuation of previous and ongoing significant oil spill response activities and removal actions conducted under the Administrative Order on Consent for Removal Activities issued by the U. S. Environmental Protection Agency (EPA) on May 5, 2017 (EPA Docket No. CWA-10-2017-0114).

1.2 *Project Organization*

The names and responsibilities of key project representatives and personnel involved in the cleanup action at the Site are listed in below:

- John Mefford, LHG, Ecology's assigned Project Manager
- Jim Cach, Coleman Oil Company's Project Manager
- Craig Hultgren, LHG, HydroCon's Project Manager
- Rob Honsberger, HydroCon, Field Lead
- Kurt Johnson, APEX Laboratory, Forensic Chemist and Quality Assurance Officer

2.0 DATA QUALITY OBJECTIVES

Data Quality Objectives (DQOs) will be used to develop and implement procedures to verify that data collected is of sufficient quality to adequately address the objectives of the cleanup action at the Property as defined in the SRI. Observations and measurements will be made and recorded in such a manner as to yield results representative of the media and conditions observed and/or measured. Goals for representativeness will be met by verifying that sampling locations are selected properly, a sufficient number of samples are collected, and field screening and laboratory analyses are conducted properly.

The quality of the laboratory data and the applicable quality control procedures are described in the Quality Assurance Project Plan (QAPP), which is included in the Interim Action Addendum #4 Work Plan.

The objectives of the Interim Action Addendum #4 – Remedial Excavation Near MW14 include:

- Perform subsurface exploration around MW14 area via test pits to delineate the lateral extent and to some degree the vertical extent of PCS that needs to be removed by excavation.
- Waste profiles will be submitted to the Wenatchee Regional Landfill to acquire a disposal permit.
- Prepare test pit logs to document soil conditions, field screening and sampling from each exploratory test pit.
- Abandon MW14 prior to the remedial excavation.
- Perform remedial excavation to remove as much of the PCS as practical near MW14.
- Remove water that accumulates inside the remedial excavation cavity, if warranted. The water will be placed into the Site's recirculation system for treatment.
- Install monitoring well MW14R near the same location as the original well.
- Develop monitoring well MW14R using surging and pumping techniques.
- Survey the newly installed MW14R and temporary boring locations.

2.1 *Field Assessment/Sampling Methodologies*

Soil sampling will be conducted during fieldwork including test pit excavations and confirmation sampling during remedial excavation.

All field operations will be supervised by personnel experienced in site assessment and sampling activities and under the direct supervision of a Washington State licensed Hydrogeologist. A Washington State licensed driller will conduct well abandonment and drilling activities. Field operations will be performed in accordance with the Site's Health and Safety Plan.

All necessary permits for excavation, drilling, and soil disposal will be obtained from City, County and State jurisdictions. The permits needed to conduct the work are currently being identified as of this writing.

2.1.1 Test Pit Excavations

Up to 8 exploratory test pits will be advanced using a backhoe to examine subsurface conditions at selected areas near MW14. The purpose of these excavations is to delineate the lateral extent of PCS in the subsurface that is affecting groundwater quality at the Site. The delineation will assist the scoping of the remedial excavation process.

A backhoe will be utilized to advance each test pit down to a maximum depth of 8 feet bgs. Depth to water is anticipated to be approximate 7 to 8 feet bgs during this investigation. The field geologist will examine the soil for lithologic composition and field screen for the presence of contamination utilizing the techniques described in Section 2.4.2. HydroCon anticipates that the soil near MW14 will be contaminated. All of this soil will be removed by the remedial excavation. Test pits excavated further away from MW14 may not have any impacted soil until the soil/groundwater interface is encountered. In this case, HydroCon will direct the excavation contractor to place that soil onto separate plastic sheeting to prevent cross contamination.

Any contaminated soil determined by field screening methodology will be placed in a separate pile. Selected soil samples will be collected at depths where elevated PID readings are discovered. Samples will be collected directly from the excavation bucket and placed into laboratory-supplied sample jars. Once sampling is complete, the soil will be placed back into the excavation cavity.

All test pits will be advanced to supplement understanding of subsurface soil conditions and assist in scoping the remedial excavation. These test pits will be placed at selected areas near MW14 to further characterize the nature and extent of contamination. Continuous soil sampling will be performed from the ground surface to the bottom of each borehole to obtain detailed lithologic information of the investigation area.

2.2 *Drilling Method*

Installation of monitoring well MW14R will be constructed with Sonic drilling methods. Sonic drilling is used for environmental explorations because sonic drilling offers the benefit of significantly reduced drill cuttings, a major cost element. Sonic drilling offers rapid formation penetration utilizing vibration frequency as the mechanism to advance the drilling tools thereby increasing production. It can reduce fieldwork time generating overall project cost reductions. The continuous core sample recovery rate is superior to other relevant drilling methods which is an important factor for this investigation.

Sonic drilling is accomplished by advancing a hollow drill rod for the first 10 feet, followed by advancing an override casing over the drill cuttings. A sonic casing is then driven to override the core barrel, resulting in a continuously cased borehole. Soil within the core barrel is then extruded in a new plastic sleeve which is observed by the geologist. This process is repeated to the target depth of the soil boring/monitoring well. Upon completion the boring is backfilled with bentonite or a monitoring well is installed. Additional details on Sonic drilling and well installation is provided in Standard Operating Procedure (SOP) 6 in Appendix A.

2.3 *Monitoring Well Installation*

A replacement monitoring well will be constructed in accordance with Ecology well drilling and installation guidelines as outlined in Washington Administrative Code (WAC) 173-360, Minimum Standards for Construction and Maintenance of Wells. Replacement well MW14R will be fitted with 4-inch diameter threaded Schedule 40 PVC riser casing, and a 10-foot length of 0.010-inch machine-slotted casing with a flush threaded bottom cap.

The annular space between the filter screen and the borehole will be filled with clean graded 10-20 sand pack to a depth up to three feet above the top of the screen. Hydrated bentonite or grout will be placed on top of the sand and will extend to approximately 1 foot below ground surface. A traffic-rated steel or aluminum monument will be set in concrete over the top of each well.

Each monitoring well assembly will be measured prior to placement in the borehole. The well materials will be steam-cleaned prior to placement. Each well will be fitted with a locking compression cap.

2.3.1 **Monitoring Well Development**

Each monitoring well will be developed prior to sampling by surging and pumping techniques described in greater detail in SOP 4. The wells will be surged during well installation using a clean surge block. The surge block will be lowered into the well after the placement of the filter pack. The well will be surged repeatedly until no more settlement of the filter pack is observed. If necessary, additional sand will be placed down the annulus to bring the filter pack up to the desired depth after surging is completed.

Once construction of the well is completed, groundwater will be extracted from the well. A clean stainless-steel bailer will be used to bail out sediment. New LDPE tubing will then be placed down the well and attached to a centrifugal or peristaltic pump. A minimum of 10 casing volumes will be removed from the well. Pumping will terminate when field parameters (pH, specific conductance, temperature, and turbidity) have stabilized and water clarity is no longer improving (see SOP 11). The water generated from well development will be transferred into labeled 55-gallon drums and ultimately be processed in the on-site groundwater remediation system.

2.3.2 **Surveying**

HydroCon will contract with a licensed surveyor to measure the elevation of the top of the PVC casing of each monitoring well at the scribed reference mark, the top of each well monument lid, and key features at the Property so that a scaled map can be produced for the Property. Ecology requires that the measuring point must be accurately located in both the latitude and longitude plane relative to the Washington State plane [South Zone NAD83)] as well as the vertical dimension using the North American Vertical Datum of 1988 (NAVD88).

2.4 *Soil Sampling from Test Pits*

Select soil samples will be collected from each test pit. Subsurface soil samples will be collected directly out of the backhoe bucket. Samples will be collected based on depth, lithology, and field screening results. A minimum of 2 soil samples will be collected from each test pit.

The borehole logging is described on SOP 2. Samples collected for volatile organic compound (VOC) analysis will be collected as described in SOP 12.

2.4.1 **Soil Classification Method**

Collected samples will be described in a boring log form using the Unified Soil Classification System (SOP 2) in accordance with *American Society of Testing and Materials (ASTM), Standard D-2488, Standard Practice for Description and Identification of* soils (Visual Manual Procedures*, ASTM* 2000[1]). A qualified geologist will oversee the drilling and will be responsible for generating boring logs as necessary.

The following section describes the methods to be used for collecting soil, sediment, and product (sheen) samples during the field investigation.

2.4.2 **Field Screening Methods**

Field soil screening will be used to guide sample collection during drilling, excavation and soil sampling. During drilling and excavations, field screening will be used to select soil samples for laboratory

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[1] American Society of Testing and Materials. 2000. *ASTM Standard D-2488, Standard Practice for Description and Identification of soils* (*Visual Manual Procedures)*.

analysis and to define the extent of PCS in the subsurface to confirm field observations. These include visual and olfactory observations, sheen testing and using a photo ionization detector (PID) calibrated daily to a test gas standard of 100 ppm isobutylene.

Volatile vapor screening will be conducted in the field using a PID to measure the volatile organic compounds (VOCs) and other gases in concentration in soil samples. Procedures for using the PID and other field screening methods used to identify petroleum hydrocarbon contamination are in the attached standard operating procedures (SOP 1).

2.5 *Contaminants of Concern*

Based on the results of the investigations performed at the site, the following primary chemicals of concern for soil, sediment, and groundwater at the Site include:

- Diesel-range petroleum hydrocarbons (DRPH)
- Oil-range petroleum hydrocarbons (ORPH)
- Gasoline-range petroleum hydrocarbons (GRPH)
- Benzene, Toluene, Ethylbenzene, and total Xylenes (BTEX).

2.5.1 **Soil and Groundwater Analytical Procedures**

Soil and groundwater samples will be analyzed using the following analyses:

- DRPH and ORPH using Northwest Method NWTPH-Dx
- GRPH using Northwest Method NWTPH-Gx
- BTEX using EPA Method 8260B

Containers, preservatives, and holding times for each analysis are provided in the QAPP.

Each sample will be analyzed for at detection limits low enough to detect compliance with the cleanup levels.

In addition to investigative samples, Quality Assurance/Quality Control (QA/QC) samples will also be collected for laboratory analysis. These include: duplicates, equipment rinsate blank, trip blanks, and matrix spike/matrix spike duplicates.

- Duplicates - Collected once per 20 investigative samples; and
- Trip blank - collected one per cooler for investigative samples.

More information relating to quality the QA/QC procedures are presented in the QAPP.

2.6 *Equipment Decontamination Procedures*

Non-dedicated sampling equipment (e.g., spoons, drill cores) will be decontaminated between uses as described in attached SOP 8.

3.0 SAMPLE DOCUMENTATION AND SHIPMENT

3.1 *Field Forms*

HydroCon will document field activity with the following forms found in Appendix B:

- Test Pit Log Form will be used to document soil classification, field screening and soil sampling information.
- Boring Log Form will be used to document pertinent drilling, sampling, well construction, field screening and soil classification information.
- Well Development Form will be used to document development information, measurements, and observations made during well development procedures.
- Field reports will be used to document field activity, decision making, communication and other relevant topics during each day of the field work.
- Chain-of-custody forms will be filled out to direct the analytical requirements for all samples collected at the Site.

3.2 *Packaging and Shipping*

All samples shall be packaged and shipped to Apex laboratory in Tigard, Oregon according to procedures described in SOP 7 and required by the laboratory.

3.3 *Sample Chain-of-Custody Forms and Custody Seals*

A chain-of-custody (COC) form will be completed with all required information and accompany all samples, see Appendix B for forms. The COC provides a record document of the transfer of sample custody from the field sampler to the laboratory. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record.

4.0 INVESTIGATION-DERIVED WASTE

4.1 *Investigation-Derived Waste Management*

Investigation-derived waste (IDW) such as soil from drill cuttings, well development and decontamination water, disposable sampling equipment, protective equipment/clothing, etc. shall be containerized for disposal as described in SOP 9.

Drummed soil will be transported to a licensed disposal facility. Drummed water will be transported to the Site's recirculation system for treatment. Solid waste, (used gloves, garbage, disposable equipment, etc.) will be disposed of in a dumpster.

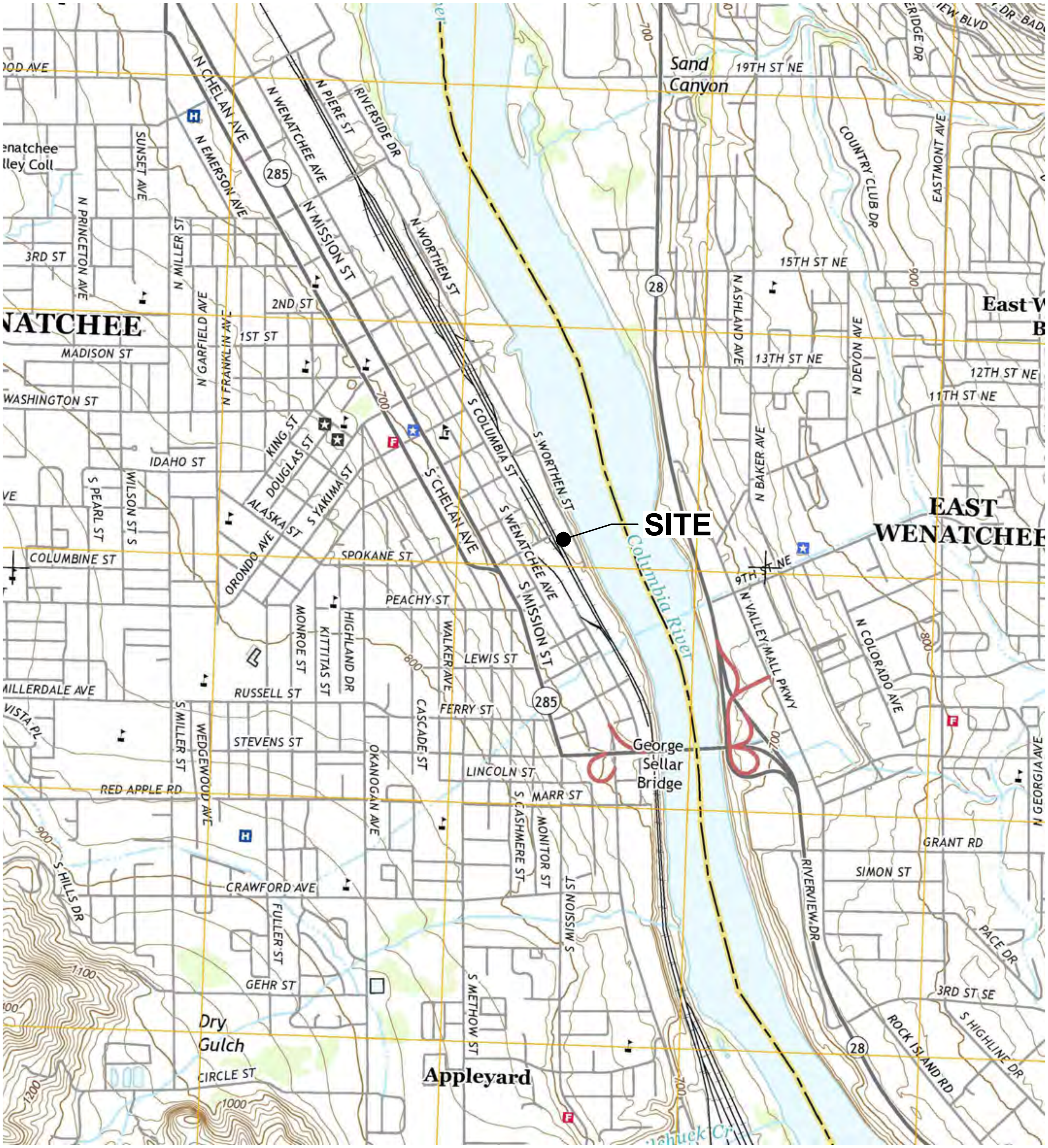
4.2 *Characterization of Investigation-Derived Waste*

IDW will be managed accordingly following sample analytical results and approval from the waste disposal facility. Disposal permits will be obtained from the disposal facility prior to commencement of the field work. Disposal documentation will be included in the Addendum #4 Remedial Excavation Near MW14 report.

5.0 REPORTING

Data collected as part of this SAP will be summarized and reported in the Addendum #4 Remedial Excavation Near MW14 Report, as described in the Work Plan, following completion of fieldwork and analytical activities.

FIGURES



NOTE(S):
USGS, WENATCHEE QUADRANGLE
WASHINGTON
7.5 MINUTE SERIES (TOPOGRAPHIC)

0 2000 4000
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Hydro Con
510 Allen St. Suite B Kelso, Wa 98626, Ph(360)-703-6086

DATE: 10-18-18
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2017-074

FIGURE 1
SITE LOCATION MAP

COLEMAN OIL COMPANY
3 CHEHALIS ST.
WENATHCEE, WA.

C:\Users\Josh\Desktop\Autocad Files\Hydrocon-Autocad\2017-074 Coleman Oil\2018\Oct 2018\2017-074_BM-101718.dwg

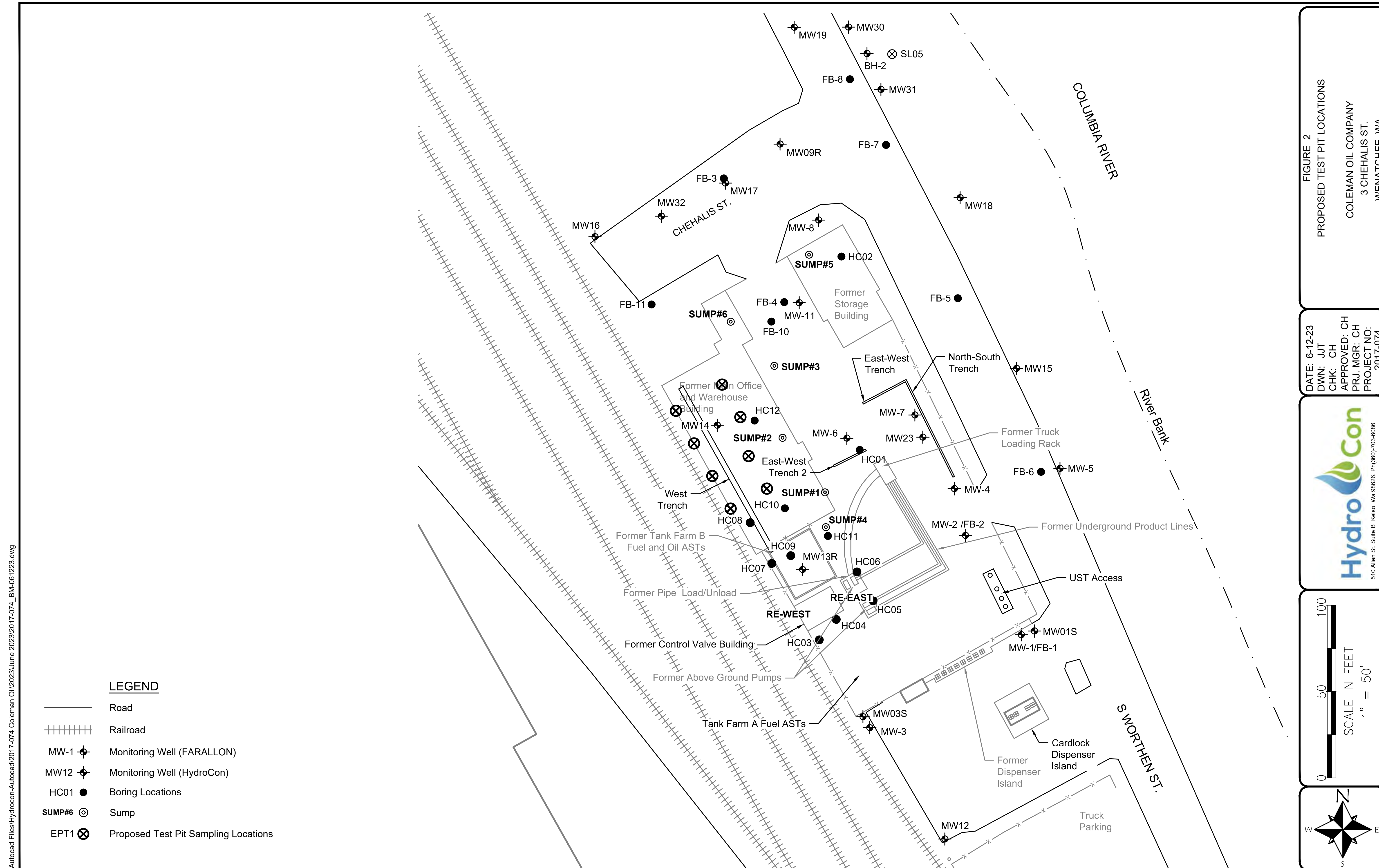
FIGURE 2
PROPOSED TEST PIT LOCATIONS
COLEMAN OIL COMPANY
3 CHEHALIS ST.
WENATCHEE, WA.
DATE: 6-12-23
DWN: JJT
CHK: CH
APPROVED: CH
PRJ. MGR: CH
PROJECT NO: 2017-074
HydroCon
510 Allen St. Suite B Kelso, Wa 98626, Ph(360)-703-6086
SCALE IN FEET
1" = 50'
0
50
100
N
W
E
S
LEGEND
Road
Railroad
MW-1 Monitoring Well (FARALLON)
MW12 Monitoring Well (HydroCon)
HC01 Boring Locations
SUMP#6 Sump
EPT1 Proposed Test Pit Sampling Locations
COLUMBIA RIVER
River Bank
CHEHALIS ST.
S WORTHEN ST.
MW19
MW30
SL05
BH-2
FB-8
MW31
MW09R
FB-7
FB-3
MW17
MW32
MW16
MW18
MW-8
SUMP#5
HC02
Former Storage Building
FB-5
FB-11
SUMP#6
FB-4
MW-11
FB-10
SUMP#3
East-West Trench
North-South Trench
MW15
Former Main Office and Warehouse Building
HC12
MW14
MW-7
SUMP#2
MW-6
MW23
Former Truck Loading Rack
East-West Trench 2
HC01
FB-6
MW-5
West Trench
SUMP#1
MW-4
HC10
HC08
SUMP#4
MW-2 /FB-2
Former Underground Product Lines
Former Tank Farm B Fuel and Oil ASTs
HC11
HC09
MW13R
HC06
HC07
UST Access
Former Pipe Load/Unload
RE-EAST
HC05
RE-WEST
HC04
MW01S
MW-1/FB-1
Former Control Valve Building
HC03
Former Above Ground Pumps
Tank Farm A Fuel ASTs
MW03S
MW-3
Cardlock Dispenser Island
Former Dispenser Island
MW12
Truck Parking
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APPENDIX A

STANDARD OPERATING PROCEDURES

STANDARD OPERATING PROCEDURE – SOP 1
HYDROCARBON FIELD SCREENING

This standard operating procedure (SOP) presents the qualitative field screening methods for hydrocarbons in soil. Field screening results are site-specific. The results may vary with soil type, soil moisture and organic content, ambient air temperature, and type of contaminant.

Field screening will be conducted on soil samples obtained from exploratory boreholes or excavations. Field screening results are used as a general guideline to delineate areas with potential residual hydrocarbons in soils. In addition, field screening results are used as a basis for selecting soil samples for chemical analysis. The field screening methods employed include 1) visual examination, 2) sheen testing, and 3) headspace vapor testing using an Mini Rae 2000 photoionization detector (PID) (or equivalent) calibrated daily to a test gas standard of 100 parts per million isobutylene.
Sheen testing and headspace vapor testing are more sensitive screening methods that have been effective in detecting hydrocarbon concentrations below typical underground storage tank (UST) regulatory cleanup guidelines. The results of headspace and sheen screening should be included on the borehole logs or field notes.

VISUAL SCREENING

Visual screening consists of inspecting the soil for the presence of stains indicative of residual petroleum hydrocarbons. Visual screening is generally more effective in detecting the presence of heavier petroleum hydrocarbons, such as motor oil, or when hydrocarbon concentrations are high. Indications of the presence of hydrocarbons typically include a mottled appearance or dark discoloration of the soil.

SHEEN TESTING

Sheen testing involves immersion of the soil sample in water and observing the water surface for signs of sheen. A representative soil sample is placed into a clean stainless steel or plastic pan filled with clean water with as little disturbance as possible. Visual evidence of sheen forming on the surface of the water is classified as follows:

- No sheen (NS): No visible sheen on the water surface

- Colorless Sheen (CS): Light, nearly colorless sheen; spread is irregular, not rapid; film dissipates rapidly (Note: light colorless sheens can be confused with sheens produced by organic content). Note that this sheen may or may not indicate the presence hydrocarbons.

- Heavy Sheen (HS): Light to heavy colorful film with iridescence; stringy, spread is rapid; sheen flows off the sample; most or all of water surface is covered with sheen

Following the sheen test, the pan must be decontaminated with methanol and distilled water prior to the next sampling event.

HEADSPACE VAPOR TESTING

Headspace vapor testing involves placing a small representative soil sample in a plastic sample bag. The sealed sample bag should be allowed to sit at ambient temperature for approximately ten minutes. The sample bag is then shaken slightly to promote volatilization to the air trapped in the bag. The probe of a PID equipped with a 10.6 eV bulb or equivalent, calibrated to isobutylene, is inserted into the bag to withdraw air from the bag. The instrument measures the concentration of organic vapors within the sample bag headspace in parts per million (ppm).

STANDARD OPERATING PROCEDURE - SOP 2
LOGGING OF SOIL BOREHOLES

The following procedures are used for completing the Soil Boring Log Form (Figure 1-1). These procedures, which must be used for HydroCon projects where soil boring techniques are performed during field exploration, establish the minimum information that must be recorded in the field to adequately characterize soil boreholes.

These procedures are adapted from ASTM D-2488-84 (attached). Field staff is encouraged to examine ASTM D-2488-84 in its entirety. This standard operating procedure (SOP) has made minor modifications to emphasize environmental investigations as opposed to geotechnical investigations (for which the standards were written). Because environmental projects are each unique and because job requirements can vary widely, the minimum standards presented may need to be supplemented with additional technical descriptions or field test results. However, all soil boring field logs, regardless of special project circumstances, must include information addressed in this SOP to achieve the minimum acceptable standards required by HydroCon.

HEADING INFORMATION

- Project Number: Use the standard contract number.
- Client: Identify the name of the client and the project site location.
- Location: If stationing, coordinates, mileposts, or similar are applicable identify the location of the project. If this information is not available, identify the facility (i.e., 20 ft NE of Retort #1).
- Drilling Method: Identify the bit size and type, drilling fluid (if used), and method of drilling (e.g., rotary, hollow-stem auger, cable tool) and the name of the drill rig (e.g., Mobil B 61, CME 55).
- Diameter: Provide the diameter of the borehole. If the borehole has variable diameters, provide the depth interval for each diameter.
- Sampling Method: Identify the type of sampler(s) used (e.g., standard split spoon, Dames & Moore sampler, grab).
- Drilling Contractor: Provide the name of the drilling contractor.
- HydroCon Staff: Enter the name(s) of HydroCon staff performing logging and sampling activities.
- Water Level Information: Provide the date, time, depth to static water, and casing depth. Generally, water levels should be taken each day before resuming drilling and at the completion of drilling. If water is not encountered in the boring, this information should be recorded.
- Boring Number: Provide the boring number. A numbering system should be developed prior to drilling that does not conflict with other site information, such as previous drilling or other sampling activities.

- Sheet: Number the sheets consecutively for each boring and continue the consecutive depth numbering.
- Drilling Start and Finish: Provide the drilling start and finish dates and times.

For consecutive sheets provide, at a minimum, the job number, the boring number, and the sheet number.

TECHNICAL DATA

- Sampler Type: Provide the sampler type (e.g., SS = split spoon, DM = Dames & Moore split spoon, G = grab).
- Depth of Casing: Enter the depth of the casing below ground surface immediately prior to sampling.
- Driven/Recovery: Provide the length that the sampler was driven and the length of sample recovered in the sampler. This column would not apply to grab samples.
- Sample Number/Sample Depth: Provide the sample number. The sample numbering scheme should be established prior to drilling. One method is to use the boring number and consecutive alphabetical letters. For instance, the first sample obtained from boring MW-4 would be identified as 4A and the second would be identified as 4B, and so on. Another method for sample identification is naming the boring number with the depth. For example, the sample from Boring 1 at 10 ft would be labeled B1-10'. The depth of the sample is the depth of the casing plus the length to the middle of the recovered sample to the nearest 0.1 ft. Typically, split spoon samplers are 18 in. long. Samples should be obtained from the middle of the recovered sample. The depth of the sample with the casing at 10 ft would then be 10.7 ft.
- Number of Blows: For standard split spoon samplers, record the number of blows for each 6 in. of sampler penetration. A typical blow count of 6, 12, and 14 is recorded as 6/12/14. Refusal is a penetration of less than 6 in. with a blow count of 50. A partial penetration of 50 blows for 4 in. is recorded as 50/4". For nonstandard split spoons (e.g., 5-ft tube used for continuous sampling), total blows will be recorded.
- Blank Columns: Two blank columns are provided. Project managers are encouraged to use these columns for site-specific information, usually related to the contaminants of concern. Examples for a hydrocarbon site would be sheen and PID readings of the samples.
- Depth: Use a depth scale that is appropriate for the complexity of the subsurface conditions. The boxes located to the right of the scale should be used to graphically indicate sample locations as shown in the example.
- Surface Conditions: Describe the surface conditions (e.g., paved, 4-in. concrete slab, grass, natural vegetation and surface soil, oil-stained gravel).
- Soil Description: The soil classification and definition of soil contacts should follow the format described in SOP-2, *Field Classification of Soil*.

- Comments: Include all pertinent observations. Drilling observations might include drilling chatter, rod-bounce (boulder), sudden differences in drilling speed, damaged samplers, and malfunctioning equipment. Information provided by the driller should be attributed to the driller. Information on contaminants might include odor, staining, color, and presence or absence of some indicator of contamination. Describe what it is that indicates contamination (e.g., fuel-like odor, oily sheen in drill cuttings, yellow water in drill cuttings).

STANDARD OPERATING PROCEDURE - SOP 3
LOW-FLOW PERISTALTIC PUMP GROUNDWATER SAMPLING

This standard operating procedure (SOP) is designed to assist the user in taking representative groundwater samples from wells. Groundwater samples will be collected using low-flow (minimal drawdown) purging and sampling methods as discussed in U.S. EPA, Ground Water Issue, Publication Number EPA/540/S-95/504, July 1996 by Puls, R.W. and M.J. Barcelona - "Low Stress (low flow) Purging and Sampling Procedure for the Collection of Ground Water Samples from Monitoring Wells."

The field sampler's objective is to purge and sample the well so that the water that is discharged from the pump, and subsequently collected, is representative of the formation water from the aquifer's identified zone of interest.

This SOP is applied when the wells to be sampled are not equipped with dedicated down well equipment.

INITIAL PUMP FLOW TEST PROCEDURES

Measure and record the Static Water Level (SWL) on field data sheet following the procedures outlined in SOP 10.

If possible, the optimum flow rate for each well will be established during well development/redevelopment or in advance of the actual sampling event. The appropriate tubing type (Teflon, HDPE, PVC, polyethylene, etc…) should be preselected based on the analytes of interest.

The mid-point of the saturated screen length is used by convention as the location of the tubing intake (i.e. if total well depth is 30 ft below grade surface (bgs) and well is screened from 20-30 ft with a SWL of less than 20 ft., base of tubing should be lowered to 25 ft.). If the head in the well is within the screened interval tubing intake should be placed at ½ of the static well head (i.e. for previous example SWL is at 22 ft. bgs, tubing intake should be placed at 26 ft bgs as 30-22 = 8ft of head in well, 30 – (8*½) = 26 ft.).

Site specific work plans may change the location of sample intake depth in order to sample from the highest yielding zone within the screened interval. In wells with a fully saturated screen length over 10 feet, testing should be performed if possible during development to determine highest water yielding zone within screened interval.

After tubing installation and confirmation that the SWL has returned to its original level (as determined prior to tubing installation), the peristaltic pump should be started at a discharge rate less than 0.5 liters per minute (0.13 gal/min) without any In-Line Flow Cell connected. The water level in the well casing must be monitored continuously for any change from the original measurement. If significant drawdown is observed, the pump's flow rate should be incrementally reduced until the SWL drawdown ceases and stabilizes. Total drawdown from the initial (static) water level should not exceed 0.3 feet. In any case, the water level in the well should not be lowered below the top of the screen/intake zone of the well.

Once the specific well's optimum flow rate, without an In-Line Flow Cell connected, has been determined and documented, connect the In-Line Flow Cell system (if available) to be used to the well discharge and determine the control settings required to achieve the well's determined optimum flow rate with the In-Line Flow Cell connected (due to the system's back-pressure, the flow rate will be decreased by ten to 20 percent).

PURGE AND SAMPLING EVENTS

Prior to the initiation of purging a well, the Static Water Level will be measured and documented. The peristaltic pump will be started utilizing its documented control settings and its flow rate will be confirmed by volumetric discharge measurement with the In-Line Flow Cell connected. If necessary, any minor modifications to the control settings to achieve the well's optimum flow rate will be documented on the gauging sheet. When the optimum pump flow rate has been established, the SWL drawdown has stabilized within the required range, and at least one pump system volume (down well extraction tubing, pump head tubing, and discharge tubing volume) has been purged, begin taking field measurements for pH, temperature (T), conductivity (Ec), oxygen reduction potential (ORP), dissolved oxygen (DO), and turbidity (TU) using an in-line flow cell or if unavailable individual water quality meters. All water chemistry field measurements will be documented on the gauging sheet. Measurements should be taken every three to five minutes until stabilization has been achieved. Stabilization is achieved after all parameters have stabilized for three consecutive readings. In lieu of measuring all five parameters, a minimum subset would include pH, conductivity, and turbidity or dissolved oxygen. Three consecutive measurements indicating stability should be within:

Temperature	± 3 percent of reading (minimum of ± 0.2 C)
pH	± 0.1 units, minimum
Conductance	± 3 percent of reading
Dissolved Oxygen	± 10 percent of reading
Redox (ORP)	± 10 mV
Turbidity	± 10 percent NTU or < 10 NTU (Turbidity is not a water chemistry indicator parameter but is useful as an indicator of pumping stress on the formation)

When water quality parameters have stabilized, and there has been no change in the stabilized SWL (i.e., no continuous drawdown), sampling collection may begin.

EQUIPMENT LIST

The following equipment is needed to conduct low flow purging and sampling:

- Portable peristaltic pump equipped with a flow controller set to operate at the specific well's documented optimum flow rate.
- Disposable down well sampling tubing of sufficient length to intake groundwater at the target sampling depth for each well.
- In-Line Flow Cell and meter(s) with connection fittings and tubing to measure water quality.
- Water quality meters as backup in-case of in-line flow cell malfunction.
- Water Level Probe or installed dedicated water level measurement system.
- Photoionization detector (PID).
- Sample containers appropriate for the analytical requirements.
- Field measurement documentation forms.
- 300 to 500 milliliter graduated cylinder or measuring cup.
- Five gallon bucket(s) for containerizing purge water.
- Wristwatch with second hand or stopwatch.
- Sufficient cleaning and decontamination supplies if portable Water Level Probe is utilized.

PROCEDURE

- Calibrate all field instruments at the start of each day's deployment per the instrument manufacturer's instructions. Record calibration data.
- Drive to the first well scheduled to be sampled (typically the least contaminated). Make notes in the field log book describing the well condition and activity in the vicinity of the well. Decontaminate the portable water gauging probe by washing with phosphate-free detergent, rinsing with potable water, and rinsing with deionized water.
- Remove the wellhead cover and take a measurement of the well vapor space with a PID. Record the measurement on the gauging and sampling sheet.
- Measure the depth to water from the surveyed reference mark on the wellhead and record the measurement on the gauging and sampling sheet. Lock the water level meter in place so that the level can be monitored during purging and sampling. When placing the probe in the well, take precautions to not disturb or agitate the water.
- Insert a sufficient length of disposable sampling tubing into the well casing to insure that the tip of the tubing is located within the appropriate sampling depth within the well screen.
- Insert a new length of flexible silicone tubing into the peristaltic pump head fixture.
- Connect the down well sampling tubing to the silicone tubing in the peristaltic pump head fixture.
- Connect a new length of disposable pump discharge tubing to the silicone tubing in the peristaltic pump head fixture and secure to drain the flow-rate test purge water into the purge water collection container.
- Start the peristaltic pump. Set the pump controller settings to the documented settings for the specific well. Confirm the flow rate is equal to the well's established optimum flow rate. Modify as necessary (documenting any required modifications).
- Monitor the water level and confirm that the SWL drawdown has stabilized within the well's allowable limits.
- Remove the pump discharge tubing.
- Connect the pump discharge tubing to the In-Line flow cells "IN" fitting.
- Connect the Flow Cell's "OUT" line and secure to drain the purge water into the purge water collection container.
- After a single pump-system's volume (down well sampling tubing, pump head silicone tubing, and discharge tubing volume) has been adequately purged, read, and record water quality field measurements every three to five minutes until all parameters have stabilized within their allowable ranges for at least three consecutive measurements. When stabilization has been achieved, sample collection may begin.
- Disconnect the flow cell, and it's tubing, from the pump discharge line before collecting samples. Decrease the pump rate to 100 milliliters per minute or less by lowering the pump controller's setting prior to collecting samples for volatiles. Refer to the task instructions for the correct order and procedures for filling sample containers. Place the samples in a cooler with enough ice to keep them at 4 degrees Centigrade.

- Once samples for volatiles have been collected, re-establish pump flow rate to the original purge flow rate by inputting the documented controller settings for the well without the In-Line Flow Cell connected, and collect remaining samples.
- When all sample containers have been filled, make a final measurement of the well's Static Water Level and record the measurement on the gauging and sampling sheet. Measure the Total Depth of the well and record the measurement, as well.
- Measure and record total purge volume collected. Consolidate generated purge water.
- Remove and decontaminate the Portable Water Level Probe with phosphate-free detergent, rinsing with potable water and rinsing with deionized water.
- Disconnect and dispose of each length of down well sampling tubing, silicone pump head tubing, and pump discharge tubing.
- Secure the peristaltic pump in the portable pump carrying case.
- Secure the wellhead cover and secure with its lock. Move equipment to next well to be sampled.
- At the end of each day, post calibrate all field instruments and record the measurements.
- Clean and decontaminate the In-Line Flow Cell with phosphate-free detergent, rinsing with potable water, and rinsing with deionized water.
- Photocopies of all completed forms should be made each day. The copies should be retained on site. The original forms will be kept in the HydroCon project file.

STANDARD OPERATING PROCEDURE – SOP 4
WELL DEVELOPMENT

BACKGROUND

This standard operating procedure (SOP) describes procedures for well development and completion which were adopted from regulatory guidance for well completion found in the Resource Conservation and Recovery Act (RCRA) Ground Water Monitoring Technical Enforcement Guidance Document (EPA, 1986), and the Environmental Protection Agency (EPA) Handbook (EPA, 1991).

All well drilling and installation procedures create a skin, or filter cake, on the borehole wall. During well development, the fine particulate matter is removed from the well or saturated formation near the screen. A secondary function of development is to settle the annular fill to a stable position.

The following factors influence the success of well development:

- The drilling method employed in the well construction
- The design and completion of the well
- The type and gradation of geologic material surrounding the screen

Because of the small size of weathering products from the volcanic tuff, in some of the alluvial canyon aquifers in the region, it is virtually impossible to eliminate turbidity while developing the well.

Well Development Methods

There are various techniques that may be effective in developing wells depending on the hydrogeologic conditions encountered in the aquifer, drilling method used, and well design. Since hydrogeologic conditions may be complex and unpredictable, a single SOP cannot be developed that will apply to all possible situations. Rather, the methods discussed briefly below are intended to be used as alternatives or as a series of steps to achieve acceptable well development results. Refer to site-specific work plan for more information on the scope of work activities for determining the most appropriate method to be used for existing conditions.

- Wire-Brush Method - Running a tight-fitting wire brush up and down the interior of the well casing, screen, and sump serves to remove sediment and debris particles and clears the screen openings. Use of the wire-brush method followed by bailing is an effective primary development scheme preliminary to surging or pumping.

- Bailing Method - Bailing involves inserting and withdrawing of a bailer or length of pipe with an end cap on the bottom. Bailing serves to remove turbid water and exerts a surging action as the bailer passes the screen. After wire brushing of the well interior has been performed, the well is bailed to remove sediment and debris. The bailing method is also used as an alternative when the formation or water-producing zone fails to supply water at sufficient rates to sustain development by pumping.

- Mechanical Surging - Surging involves raising and lowering a surge block inside the well to force water to flow into and out of a screen and through the filter pack. The seals on the surge block are the same diameter as the inside of the well casing or one-half inch smaller if surging is conducted inside the screened interval. Turbid water must frequently be bailed from the well so that fines are not forced into the formatting and to prevent sand from locking up the surge block.

- Swabbing Method - A swab is a mechanical surging device that is pulled upward through the water column in a well. Swabbing may be done with single- or double-swab flanges and with or without water-bypass vents. Water may be injected into the well to the formation through the swabbing tool. In this method, water flows into one part of the screen, through the filter pack and adjacent formation, and out in another part of the screen. Swabbing is an aggressive development method that may be suitable if the introduction of water is acceptable. Swabbing is not recommended for wells with plastic casing or screens.

- High-Velocity Jetting - Jetting, or forcing water through the screen from nozzles on a pipe assembly, can clear screen openings. The jetting method is not always advisable as it forces the fines back into the filter pack and formation and adds large volumes of water to the system.

- Overpumping - A simple method of removing fines from a water-bearing formation is by overpumping. This method involves alternately pumping the well at a rate that will force it to become dry and allowing it to recover. The overpumping method is not always effective, particularly in unconsolidated formations, and may result in a formation that is partially developed.

- Pump Development - Pump development is commonly used as the final phase of well development for ER Project monitor wells after wire brushing and bailing methods have been performed. A submersible pump and packer assembly, if applicable, is installed and pumping at a sustainable rate is conducted until the water attains acceptable criteria to complete well development.

PROCEDURE

Preoperation Activities

Decontaminate all equipment that will enter the well or come into contact with the development water before developing each well.

Well development may begin as soon as is practical after the well is installed, but typically no sooner than 24-hours after grouting is completed. Do not use any dispersing agents, acids, or disinfectants to enhance the development of the well unless otherwise specified.

Well Development Activities

Open the surface protective lid and remove the well cap (if applicable). Monitor air quality at the top of the casing and in the breathing zone using a PID or other suitable field monitoring instrument.

Measure and record depth to water and total depth of the well. A minimum of three depth to water measurements should be taken with adequate time between measurements to ensure water table elevation is stable prior to development.

Begin bailing to remove turbid water from the well and sediment from the sump. Measure and record initial field chemical parameters (pH, electrical conductivity, and temperature) and turbidity. Periodically measure field parameters as specified in the site-specific work plan. Note and record volumes of water produced as bailing proceeds.

Begin pump-development procedures. For wells with multiple completions, each water-bearing zone is isolated using inflatable packers above and below the screen. The following general steps are taken to develop each screen individually and in succession:

- The drilling contractor installs a submersible pump-and-packer assembly across the first screen to be developed. Pumping is initiated at a sustainable rate that will not induce excessive drawdown.
- A transducer and/or a bubble piezometer may be installed in the well to measure water levels during the pump-development phase.
- When the pump has been turned on, collect a sample of the development water to measure and record initial field chemical parameters and turbidity. Note the initial color, clarity, and any obvious odor of the water. Periodically monitor water quality parameters throughout the pump-development phase as prescribed in the work plan. Likewise, note and record flow measurements (flow rate and volume produced) as indicated by an in-line flow meter. Continue to record measurements until the screen interval has been fully developed.

In general, well development procedures will continue for each screen interval until (1) the development water becomes free of suspended sediment, (2) an appropriate volume of water has been purged, and (3) field parameters have stabilized. Criteria for completing well development are described as follows:

- Turbidity Criteria - Well development shall continue until the turbidity readings stabilize or cannot be improved. If the well is not free of sediment after the required volume of water has been removed, continue pumping until twice that volume has been purged.
- Purge Volume Criteria - For wells where borehole drilling was conducted without the use of drilling fluid (water, mud, or additives), purge a minimum of ten casing volumes of water before stopping well development. In situations where the groundwater flow from the screen interval is exceeded by the development pumping rate, the well may temporarily dry up.

- Field Parameter Criteria - This criterion for well development has been met when field parameters (temperature, pH, turbidity, dissolved oxygen, ORP) have stabilized over a minimum of three continuous monitoring measurements.

Documentation

Complete the appropriate data entry requirements on the Well Development field form to document well development procedures and measurements.

STANDARD OPERATING PROCEDURE – SOP 5
FIELD CLASSIFICATION OF SOIL

This standard operating procedure (SOP) presents the field classification of soils to be used by HydroCon field staff. In general, HydroCon has adopted ASTM D-2488-84 (attached), *Standard Practice for Description and Identification of Soils* (Visual-Manual Procedures). ASTM D-2488-84 uses the Universal Soil Classification (USC) system for naming soils. Field personnel are encouraged to study these procedures.

Soil descriptions should be precise and comprehensive without being verbose. The overall impression of the soil should not be distorted by excessive emphasis on minor constituents. In general, the similarities of consecutive soil samples should be emphasized and minor differences de-emphasized. These descriptions will be used to interpret aquifer properties and other potential contaminant transport properties, rather than interpret the exact mineralogy or tectonic environment. We are primarily interested in engineering and geochemical properties of the soil.

Soil descriptions should be provided in the Soil Description column of the soil boring log for each sample collected. If there is no difference between consecutive soil samples, subsequent descriptions can be noted as "same as above" or minor changes such as "increasing sand" or "becomes dark brown" can be added.

The format and order of soil descriptions should be as follows:

1. Group symbol—The group symbol should be placed in the Unified Symbol column
2. USC group name—The USC name should be identical to the ASTM D-2488-84 Group Name with the appropriate modifiers
3. Minor components
4. Color
5. Moisture
6. Additional descriptions.

The minimum elements of the soil descriptions are discussed below.

DEFINITIONS OF SOIL TYPES

The USCS is an engineering properties system that uses grain size to classify soils. The first major distinction is between fine-grained soils (more than 50 percent passing the No. 200 sieve (75 µm/0.029 in.]) and coarse-grained soils (more than 50 percent retained by the No. 200 sieve). HydroCon has small No. 200 sieves available for the field geologists. These are necessary to classify soils that are near the cutoff size.

Fine-grained soils are classified as either silts or clays. Field determinations of silts and clays are based on observations of dry strength, dilatancy, toughness, and plasticity. Field procedures for these tests are included in ASTM D-2488-84 (Exhibit 1). If these tests are used, the results should be included in the soil description. At least one complete round of field tests should be performed for a site if these materials are encountered, preferably at the beginning of the field investigation. The modifiers “fat” and “lean” are used by ASTM to describe soils of high and low plasticity. The soil group symbols (i.e., CL, MH) already indicate plasticity characteristics, and these modifiers are not necessary in the description. Soils with high plasticity can be emphasized by describing them as “silty CLAY with high plasticity.” Plasticity is an important descriptor because it is often used to interpret whether an ML soil is acting as either a leaky or a competent aquitard. For example, an ML soil can be dilatent/nonplastic and serve as a transport pathway, or it can be highly plastic and very impervious.

Coarse-grained soils are classified as either predominantly gravel or sand, with the No. 4 sieve (4.75 mm/0.19 in.) being the division. Modifiers are used to describe the relative amounts of fine-grained soil, as noted below:

Description	Percent Fines	Group Symbol
Gravel (sand)	<5 percent	GW, GP (SW, SP)
Gravel (sand) with silt (clay)	5–15 percent	Hyphenated names
Silty (clayey) gravel (sand)	>15 percent	GM, GC (SM, SC)

The gradation of a coarse-grained soil is included in the specific soil name (i.e., fine to medium SAND with silt). Estimating the percent of size ranges following the group name is encouraged for mixtures of silt sand and gravel. Use of the modifiers “poorly graded” or “well graded” is not necessary as they are indicated by the group symbol.

A borderline symbol is shown with a slash (GM/SM). This symbol should be used when the soil cannot be distinctly placed in either soil group. A borderline symbol should also be used when describing interbedded soils of two or more soil group names when the thickness of the beds are approximately equal, such as “interbedded lenses and layers of fine sand and silt.” The use of a borderline symbol should not be used indiscriminately. Every effort should be made to place the soil into a single group.

One very helpful addition to the soil log form description is the percentage of silt/sand/gravel. Even if the geologist did not have sufficient time to properly define the soil, this percentage breakdown allows classification at a later date.

MINOR COMPONENTS

Minor components, such as cobbles, roots, construction debris, and kitchen sinks, should be preceded by the appropriate adjective reflecting relative percentages: Trace (0–5 percent), few (5–10 percent), little (15–25 percent), and some (30–45 percent). The word “occasional” can be applied to random particles of a larger size than the general soil matrix (i.e., occasional cobbles, occasional brick fragments). The term “with” indicates definite characteristics regarding the percentage of secondary particle size in the soil name. It will not be used to describe minor components. If a non-soil component exceeds 50 percent of an interval, it should be stated in place of the group name.

COLOR

The basic color of a soil, such as brown, gray, or red, must be given. The color term can be modified by adjectives such as light, dark, or mottled. Especially note staining or mottling. This information may be useful to establish water table fluctuations or contamination. The Munsell soil color chart designation is the HydroCon color standard. These charts are readily available and offer a high degree of consistency in descriptions between geologists.

MOISTURE CONTENT

The degree of moisture present in the soil should be defined as dry, moist, or wet. Moisture content can be estimated from the criteria listed in Table 3 of ASTM D-2488-84.

ADDITIONAL DESCRIPTION

Features such as discontinuities, inclusions, joints, fissures, slickensides, bedding, laminations, root holes, and major mineralogical components should be noted if they are observed. Anything unusual should be noted. Additional soil descriptions may be made at the discretion of the project manager or as the field conditions warrant. The Soil Boring Log Form lists some optional descriptions, as does Table 13 of the ASTM standard. The reader is referred to the ASTM standard for procedures of these descriptions.

CONTACTS BETWEEN SOIL TYPES

The contact between two soil types must be clearly marked on the soil boring log. The field geologist or engineer, who has the advantage of watching the drilling rate and cuttings removal and can converse with the driller in real-time has the best perspective for interpreting the interval. If the contact is obvious and sharp, draw it in with a straight line. If it is gradational, a slanted line over the interval is appropriate. In the case where it is unclear, a dashed line over the most likely interval is used. In the preparation of cross-sections, it is impossible to interpret boring logs where soil sample descriptions change over a five or ten foot sample interval and there is no indication where this change would likely occur.

STANDARD OPERATING PROCEDURE – SOP 6
SONIC DRILLING

This standard operating procedure (SOP) describes procedures for sonic drilling soil borings, soil sampling, and monitoring well installation. Because each site is unique, these procedures should be viewed as guidelines and will likely require modification based on site and subsurface conditions present.

This SOP is intended as an overview and description of techniques for field personnel overseeing sonic drilling projects, and is not intended to guide subcontract drilling personnel in specific drilling techniques.

SONIC DRILLING OVERVIEW

Sonic drilling consists of a dual-cased system that uses high frequency mechanical vibration to collect intact, minimally disturbed continuous core soil samples, and to advance drill casing into the ground for well construction. The sonic drilling system may also utilize low speed rotational motion along with down-pressure to advance the drill bit. Sonic drilling is also referred to as Rotasonic, Rotosonic, Sonicore, Vibratory, and Resonantsonic drilling.

Advantage of using sonic drilling are that it provides a unique combination of low disturbance, large diameter continuous cores, high soil sample quality, and relatively fast drilling rates in deep gravel conditions. The outer casing prevents cross-contamination when drilling through contaminated zones or multiple aquifers. Sonic drilling also generates as much as 50% less investigation-derived waste soil cuttings compared to other common drilling methods.

The core barrel and drill rods are equipped with right hand threads and are rotated in a clockwise direction. The outer casing is equipped with left hand threads and is rotated in a counter-clockwise direction during drilling. In this manner, the core barrel and drill rods are not unscrewed as the outer casing is advanced.

Sonic Drilling Procedures

Down-hole drill tools and samplers will be steam-cleaned prior to arrival onsite and between each borehole location to minimize the potential for cross-contamination between borehole. Either a temporary decontamination pad will be constructed or a self-contained steam cleaning trailer will be used for steam cleaning the drilling tools and downhole equipment. All IDW generated during drilling, sampling, and decontamination will be containerized until characterized for disposal.

During drilling, the inner drill rods and core barrel may be advanced ahead of the outer casing to obtain a relatively undisturbed core sample. While drilling fluids (air or water) are occasionally used with sonic drilling, for environmental applications it is generally preferable not to add drilling fluids to the formation.

Soil samples are be collected and logged on a continuous basis during drilling as described below. Drill cuttings will be observed by the field geologist and each borehole will be logged in general accordance with ASTM D 2488, as described in the soil logging SOP (SOP 1).

In general, soil samples are recovered if possible using a ten-foot long, four-inch diameter core barrel advanced during drilling to yield a continuous core. The sample core may be extruded directly from the core barrel into a plastic sleeve, or onto a sampling table for observation. Samples may be collected with clear plastic or stainless steel liners placed inside the core barrel. Each ten-foot long core section will typically be subdivided into shorter sections placed in new clear plastic bags, and laid out in sequence for logging. A geologist will visually inspect all recovered samples, and perform any required field screening and sample collection.

Upon drilling completion, the boring will be abandoned by pumping full of bentonite grout, with an asphalt or concrete surface patch placed at the surface. Refer to the sampling and analysis plan (SAP) and Work Plan for details of the soil boring, including sample depth, boring total depth, and media analytical testing.

Telescoped Drilling

In order to isolate any potentially contaminated shallow groundwater, an oversized steel transmission casing can be installed from the ground surface, penetrating five to ten feet (or another appropriate distance) into the water table. A bentonite seal can be placed inside the base of the casing, and drilling continued using smaller-diameter steel casing. The temporary steel transmission casings can then be removed during monitoring well construction. This “telescoping” method is an industry standard protection for drilling through contaminated or potentially-contaminated aquifers. Once drilling reaches the desired depth, the drill bit is removed from the boring, the conductor casing backed out of the hole approximately two feet, and high density bentonite grout is placed in the bottom of the borehole and mechanically pushed into the borehole, forcing it laterally into the surrounding soil formation and outside the conductor casing annulus. Then a smaller diameter drill casing is used to drill the deeper borehole. As the monitoring well is constructed, the drill string is backed out of the hole and sealed above the well’s screened interval using pressurized bentonite grout below the water table. If no monitoring well is to be installed in the boring, the boring will be pumped full of bentonite grout as describe above.

Typical Well Installation Procedures

Wells are typically constructed as described below:

- Depending on the well location and depth, the sand filter pack will be installed by manually pouring sand from the ground surface as described below. The sand level will be measured with a stainless steel weighted tape during placement to detect bridging.
- The well casing will be surged and/or bailed with a clean surge block, stainless steel bailer, or submersible pump during placement of the sand pack and prior to the placement of bentonite in order to settle the sand pack. Sand pack settlement will be monitored by sounding until no further settlement is observed. Sand will be placed to one foot above the screen to prevent bentonite migration into the screen.
- After surging and confirming that the top of the sand pack reaches one foot above the top of the screen, bentonite will be installed to a depth of approximately one-foot below ground surface (bgs).

- The top of the well casing will be cut uniform and flat such that it is at a depth just below grade. A file will be used to cut a “reference mark” on the outside of the well casing.
- A protective monument will be installed flush to grade and the well casing will be furnished with a locking cap.
- Upon completion, the total depth of the well will be sounded such that construction details can be recorded to 0.01-foot accuracy. Total depth (length) of well, sump interval, screen intervals, and top of well below grade will be calculated and recorded. The top of the flush monument will represent ground datum unless a monument is set next to the well completion.
- Well logs and drilling reports will be furnished to the appropriate regulatory agency as required under state law.
- All information regarding soil conditions encountered in the boreholes and well construction details will be recorded on the Soil Borehole Log Form as described in SOP 1 (Logging of Soil Boreholes).

STANDARD OPERATING PROCEDURE – SOP 7
SAMPLE PACKAGING AND SHIPPING

Specific requirements for sample packaging and shipping must be followed to ensure the proper transfer and documentation of environmental samples collected during field operations. Procedures for the careful and consistent transfer of samples from the field to the laboratory are outlined herein.

EQUIPMENT REQUIRED

Specific equipment or supplies necessary to properly pack and ship environmental samples include the following:

- Ice in sealed bags or blue ice
- Sealable airtight bags
- Plastic garbage bags
- Coolers
- Bubble wrap
- Fiber reinforced packing tape
- Scissors
- Chain-of-custody seals
- Airbills for overnight shipment
- Sample analysis request forms.

PROCEDURE

The following steps should be followed to ensure the proper transfer of samples from the field to the laboratories:

- Appropriately document all samples using the proper logbooks and tracking forms.
- Make sure all applicable laboratory quality control sample designations have been made on the sample analysis request forms. Samples that will be archived for future possible analysis should be clearly identified on the sample analysis request (chain-of-custody) form. Such samples should also be labeled on the sample analysis request form as "Do Not Analyze”: Hold and archive for possible future analysis" because some laboratories interpret "archive" as meaning to continue holding the residual sample after analysis.
- Notify the laboratory contact and the project quality assurance/quality control (QA/QC) coordinator that samples will be shipped and the esti-mated arrival time. Send copies of all chain-of-custody, sample analysis request, and packing list forms to the laboratory *QAIQC* coordinator.
- Clean the outside of all dirty sample containers to remove any residual contamination.
- Check sample containers against the chain-of-custody forms to make sure all samples intended for shipment are accounted for.

- Store each sample container in a sealable bag that allows the sample label to be read. Volatile organic analyte (VOA) vials for a single sample must be encased in bubble wrap or foam rubber before being sealed in bags.
- Choose the appropriate size cooler (or coolers) and line with bubble wrap and a plastic garbage bag.
- Fill the cooler with the samples, separating glass containers with bubble wrap and allowing room for ice to keep the samples cold. Add enough ice or blue ice to keep the samples refrigerated overnight. Avoid separating the- samples from the ice with excess bubble wrap because it will insulate the containers from the ice. After all samples and ice have been added to the cooler, use bubble wrap to fill any empty space to keep the samples from shifting during transport.
- Remember to consolidate any VOA samples in a single cooler, and ship them with a trip blank, if the quality assurance project plan calls for one.
- Once all the samples are packed, close the plastic garbage bag and fasten it with a chain-of-custody seal.
- Store the signed chain-of-custody, sample analysis request, and packing list forms in a sealable bag and tape it to the inside of the cooler lid.
- Once the cooler is sufficiently packed to prevent shifting of the containers, close the lid and seal it shut using fiber reinforced packing tape. Also, if the cooler has a drain at the bottom, it should be taped shut.
- As security against unauthorized handling of the samples, apply one or two chain-of-custody seals across the opening of the cooler lid. Be sure the seals are properly affixed to the cooler so they are not removed during shipment.
- Label the cooler with destination and return addresses, and add other appropriate stickers, such as "This End Up," "Fragile," and "Handle With Care."
- If an overnight courier is used, fill out the airbill as required and fasten it to the top of the cooler. The identification number sticker should be taped to the lid, because tracking problems can occur if a sticker is removed during shipment.

STANDARD OPERATING PROCEDURE
EQUIPMENT DECONTAMINATION FOR SOIL AND WATER SAMPLING
SOP 8

This standard operating procedure (SOP) describes procedures for decontamination of sampling equipment, drilling equipment and other tools that could come in to contact with contaminated media. Procedures were adopted from guidance documents and reports prepared by USEPA and include:

- Technical Enforcement Guidance Document (USEPA, November 1992).
- Compendium of Superfund Field Operations Methods (EPA, December 1987).
- Protocol for Ground-Water Evaluations (USEPA, September 1986).
- Technical Guidance Manual for Hydrogeologic Investigations and Ground Water Monitoring Programs (Ohio EPA, June, 1993).
- Field Sampling Procedures Manual (New Jersey DEP, July 1986).
- ASTM 5088-90 Standard Practice for Decontamination of Field Equipment Used at Nonradioactive Waste Sites (1992).

Personnel performing the decontamination procedures will wear protective clothing as specified in the site-specific Health and Safety Plan.

Benefits of an appropriately developed, executed, and documented equipment decontamination program are three-fold:

- Minimize the spread of contaminants within a study area or from site to site,
- Reduce the potential for worker exposure, and
- Improve data quality and reliability by eliminating the opportunity for cross-contamination

DECONTAMINATION REAGENTS

- Detergents shall be nonphosphate
- Acid rinses (inorganic constituents) shall be reagent grade nitric or hydrochloric acid
- Solvent rinses (organic constituents) shall be pesticide grade methanol, hexane, isopropopanol or acetone
- Deionized water rinse shall be organic free, reagent grade (generally provided by laboratory)
- Tap water rinse shall be either local tap water or distilled water available from retail stores. Note that this distilled water generally contains low levels of organic contaminants and can not be used for Deionized rinse or blanks.

INORGANIC CONTAMINATED SAMPLING EQUIPMENT

- Wash equipment with nonphosphate detergent, scrubbing off any residues
- Rinse generously with tap water
- Rinse equipment with Acid Rinse (0.1 N nitric or hydrochloric)
- Rinse with Reagent Water
- Allow to air dry

After decontaminating all sampling equipment, the gloves and other disposables will be placed in garbage bags. The wash and rinse will be containerized for proper disposal.

ORGANICALLY CONTAMINATED SAMPLING EQUIPMENT

- Wash equipment with nonphosphate detergent, scrubbing off any residues
- Rinse generously with tap water
- Rinse equipment with Solvent Rinse
- Rinse with Reagent Water
- Allow to air dry

After decontaminating all sampling equipment, the gloves and other disposables will be placed in garbage bags. The wash and rinse will be containerized for proper disposal.

DECONTAMINATION OF SAMPLING PUMPS

When pumps (e.g., submersible or bladder) are submerged below the water surface to collect water samples, they shall be thoroughly cleaned and flushed between uses. This cleaning process consists of an external detergent wash and high-pressure tap water rinse, or steam cleaning of pump casing, tubing, and cables, followed by a flush of potable water through the pump. This flushing can be accomplished by placing the pump in a newly purchased plastic garbage can filled with tap water and pumping multiple volumes through the pump. The procedure should be repeated first with detergent water and then with tap water. Blanks can be performed by pouring Reagent Water through the pump into the appropriate sample container.

SOP 9

INVESTIGATION-DERIVED WASTE HANDLEING

This standard operating procedure (SOP) presents equipment and methods required to manage investigation-derived waste.

REQUIRED EQUIPMENT

- 55-gallon drums
- Paint markers
- Tools
- Ziploc bag
- Drum labels

SOLID WASTE HANDLING

1. Solid wastes needing to be containerized will be placed in 55-gallon drums or other approved containers. Solid residues known to be from a contaminated area should not be combined with other residues.

2. After proper decontamination, protective clothing and used disposable sampling equipment should be drummed together and separated from other waste types.

3. Protective clothing and disposable sampling equipment should be collected daily and placed in a dedicated drum for this waste type. Personal protective equipment that does not come in contact with contaminated media can be disposed of (except footwear) along with domestic waste. However, disposable footwear should always be containerized in drums for proper disposal.

4. All filled or partially filled drums must be properly closed, sealed, labeled, and staged before demobilization. If storage is anticipated in excess of 2 weeks, the drums should be covered with a wind/rain resistant cover, such as a plastic or polyethylene tarp.

STANDARD OPERATING PROCEDURE
FIELD MEASUREMENT OF TEMPERATURE, PH AND ELECTRICAL CONDUCTIVITY FOR GROUNDWATER
SOP 11

This standard operating procedure (SOP) describes general methods for collecting field measurements of temperature, pH, and electrical conductivity (EC) (field parameters) during groundwater sampling. These measurements are collected during well purging prior to sampling to evaluate the representativeness of the water being tested. The procedures outlined in this SOP are suitable for most commercially available instruments.

PROCEDURE

Purge the well until three continuous readings of the field parameters differ within the range shown below or a minimum of three well casing volumes. The well casing volume is calculated using the *Groundwater Sampling Form.* Field parameters should be collected continuously during purging of the third or last well casing volume.

- Rinse a 250- or 500-ml plastic beaker with small portions of sample water three times.
- Rinse electrodes with sample water.
- Fill beaker and measure sample temperature to nearest 1°C using NBS-calibrated mercury thermometer or similar.
- Adjust pH meter temperature compensator to sample temperature.
- Immerse electrodes in sample while swirling the sample, if needed, to provide thorough mixing. Turn on temperature meter, allow temperature to stabilize and record value on sampling form. Turn on pH meter, allow the meter to stabilize and record on sampling form. Turn on Conductance meter, allow the meter to stabilize and record on sampling form. Note any problems such as unusual drift of meter.
- Following temperature, pH, and conductance measurements, measure oxidation-reduction potential (ORP) using the pre-calibrated ORP meter. Lastly measure dissolved oxygen (DO) using pre-calibrated DO meter.
- Repeat procedure for a total of at least three measurements with three to five minutes between each measurement.
- The groundwater is considered stabilized if the following criteria are met with three consecutive measurements:

Temperature	± 3 percent of reading (minimum of ± 0.2 C)
pH	± 0.1 units, minimum
Conductance	± 3 percent of reading
Dissolved Oxygen	± 10 percent of reading
Redox (ORP)	± 10 mV
Turbidity	± 10 percent NTU or < 10 NTU (Turbidity is not a water chemistry indicator parameter but is useful as an indicator of pumping stress on the formation)

INSTRUMENT CALIBRATION

Calibrate pH meter in the field laboratory at the beginning of any day of fieldwork or field laboratory work when field parameters will be measured, then recalibrate each time and at a minimum of every ten samples analyzed. Meters will be calibrated according to manufactures instructions.

MAINTENANCE

- Store meters in the field laboratory, with pH electrodes immersed in a Paraffin-covered beaker of tap water.
- Inspect electrodes weekly.
- Check batteries each time meter is used. Carry a spare battery pack and a screwdriver into the field.

SOP 12

COLLECTING SOIL SAMPLES WITH VOCs

This standard operating procedure (SOP) address the collection of soil samples with volatile organic compounds (VOCs) and is consistent with Option 2: Lab Preservation of Washington Department of Ecology's *Implementation Memorandum #5, Collecting and Preparing Soil Samples for VOC Analysis, 2004.*

REQUIRED EQUIPMENT

- Sampling and Analysis Plan (SAP)
- Site logbook
- Non-volatile pens and markers
- Scale
- New, clean, and chemical-resistant pair of disposable gloves (e.g., Nitrile gloves)
- Laboratory-supplied empty 40 ml VOA vials with 0.25 mm thick PTFE-lined septas
- Insulated cooler(s), chain-of-custody seals, Ziploc® bags
- Sample labels and appropriate documentation

TYPICAL PROCEDURES

1. Screen the sample matrix with a calibrated photo-ionizationdetector (PID) and record the value.
2. Collect soil sample from the matrix with as little disturbance as possible with a decontaminated stainless steel spoon or new plastic sampling tool.
3. Place approximately 25 grams directly into a 40 ml vial and immediately seal with septa.
4. Place samples in Ziploc® bag.

5. Place samples in insulated cooler.

6. Record all information in field logbook.

7. Ship to Laboratory with instructions to preserve or analyze the sample within 48 hours of sample collection and whether the sample is expected to have a concentration above or below 200 ug/kg based on the PID reading.

APPENDIX B

FIELD FORMS

Hydro Con

BORING NUMBER
PROJECT NAME
PROJECT NUMBER
LOGGED BY
DATE

North

SAMPLE INFORMATION							STRATA	Well Diagram	Description Sequence USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.	BOREHOLE/WELL CONSTRUCTION DETAILS
Sample ID	Sample Type	Blow Counts	% Recov.	PID	Sheen	Depth (Feet)				
						--				**WELL CONSTRUCTION**
						--				DEPTHS (feet bgs)
						--				Borehole
						--				Sump
						5 --				Screen
						--				Casing
						--				Backfill
						--				Sand Pack
						--				Bentonite
						10 --				Concrete
						--				Stabliizers
						--				
						--				
						--				
						15 --				
						--				
						--				
						--				
						--				
						20 --				
						--				**MATERIALS USED**
						--				Casing:
						--				Well Screen:
						--				End Cap:
						25 --				Sand Pack:
						--				Bentonite:
						--				Concrete:
						--				Monument:
						--				Well Cap:
						30 --				Other:

DRILLING CONTRACTOR		CASING ELEVATION	
DRILLING METHOD		GROUND SURFACE ELEVATION	
BOREHOLE DIAMETER		COORDINATES (X & Y)	
SAMPLING METHOD		DATUM	
START CARD NUMBER		SURVEYING CONTRACTOR	

TEST PIT LOG – TP __

Site Name:______________________________
Date:___________________________________
X & Y Coordinates:______________________
Survey Contractor: ______________________

Project #: _______________________________
Engineer: _______________________________
Elevation: _______________________________
Datum: _______________________________

DEPTH INTERVAL

- **Soil Description (USCS)**
- **Notes of odor/staining/sheen**
- **PID reading**
- **Sample Collection Information**

APEX LABS

CHAIN OF CUSTODY

COC ____of____

Lab # ____________________

12232 S.W. Garden Place, Tigard, OR 97223 Ph: 503-718-2323 Fax: 503-718-0333

Company:	Project Mgr:	Project Name:	Project #

Address:	Phone:	Fax:	Email:

Sampled by:

ANALYSIS REQUEST

This image cannot currently be displayed.

Site Location: OR WA

Other:

SAMPLE ID	LAB ID #	DATE	TIME	MATRIX	# OF CONTAINERS	**NWTPH-HCID**	**NWTPH-Dx**	**NWTPH-Gx**	**BTEX**	**8260 RBDM VOCs**	**8260 Halo VOCs**	**8260 VOCs**	**8270 SIM PAHs**	**8082 PCBs**	**8081 Chlor. Pest**	**RCRA Metals (8)**	**Priority Metals (13)**	**Al, Sb, As, Ba, Be, Cd Ca, Cr, Co, Cu, Fe, Pb Hg, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Tl, V, Zn**	**TCLP Metals (8)**	**1200- COLS**	**1200-Z**							

Normal Turn Around Time (TAT) = 7-10 Business Days

TAT Requested (circle)

24 HR **48 HR** **72 HR**

4 DAY **5 DAY** **Other: _____________**

SAMPLES ARE HELD FOR 30 DAYS

SPECIAL INSTRUCTIONS:

RELINQUISHED BY:		**RECEIVED BY:**	**RELINQUISHED BY:**		**RECEIVED BY:**
Signature:	Date:	Signature:	Signature:	Date:	Signature:
Printed Name:	Time:	Printed Name:	Printed Name:	Time:	Printed Name:
Company:		Company:	Company:		Company:

HydroCon	# DAILY FIELD REPORT	Hydrocon Job Number:
	Project Name:	Date:
360.703.6079/Fax 360.703.6086 510 Allen Street, Suite B; Kelso, WA 98626	Client:	Page: Of
Prepared By:	Location:	Arrival: Departure:
Purpose:	Weather:	Permit:

GROUNDWATER SAMPLE COLLECTION FORM

Well I.D. Number:

Project Name:.______________________________ Sample I.D.______________________________Time:________
Hydrocon Project #:________________________ Field Duplicate I.D.____________________Time:________
Date___________________________________ Personnel:____

WELL INFORMATION

Monument condition: ☐ Good ☐ Needs repair______________________ ☐ Water in Monument
Well cap condition: ☐ Good ☐ Replaced ☐ Needs replacement ☐ Surface Water in Well
Headspace reading: ☐ Not measured ________ ppm ☐ Odor_______________
Well diameter: ☐ 2-inch ☐ 4-inch ☐ 6-inch ☐ Other _____________
Comments ____

PURGING INFORMATION

Total well depth_____________ft Bottom: ☐ Hard ☐ Soft ☐ Not measured Screen Interval(s):_______________
Depth to product______________ft
Depth to water_______________ft Intake Depth (BTOC)____________ Begin Purging Well:____________
Casing volume ______________ft (H_2O) X ___________gal/ft = _____________gal. X 3 =___________gal.
Volume Conversion Factors: 3/4"=0.02 gal/ft 1"=0.04 gal/ft 2"=0.16 gal/ft 4"=0.65 gal/ft 6"= 1.47 gal/ft

PURGING/DISPOSAL METHOD

Pump type ☐ Peristaltic ☐ Centrifugal ☐ Dedicated Bladder ☐ Non-Dedicated Bladder Other______________
Bailer type:_________________ Water Disposal:: ☐ Drummed ☐ Remediation System ☐ Other ________________

FIELD PARAMETERS

Odor and/or Sheen:____________________

Time	Water Level (BTOC)	Purge Rate (L/min)	Temp. (^{0}C)	Sp. Cond. (mS/cm) (±3%)	Dissolved Oxygen (±10% or ≤1.00 ±0.2)	pH (SU) (±0.1)	ORP (mV)	Turbidity (NTU) (± 10% or ≤10)

Stabilization achieved if three successive measurements for pH, Conductivity and Turbidity or Dissolved Oxygen are recorded within their perspective stabilization criteria. A minimum of six measurements should be recorded.
Purging Comments:____

SAMPLE INFORMATION

Container Type	Bottle Count	Preservative	Field Filtered?	Analysis
			No 0.45 0.10	
			No 0.45 0.10	
			No 0.45 0.10	
			No 0.45 0.10	
			No 0.45 0.10	

Sampling Comments:____
____

WELL DEVELOPMENT

Well ID #:____________________ Project name: ____________________
Date:____________________ Project #:____________________
Time:____________________ Engineer:____________________

WELL INFORMATION

Monument condition o Good o Needs repair____________________
Well cap condition o Good o Locked o Replaced o Needs replacement
Headspace reading o Not measured ________ ppm
Elevation mark o Yes o Added o Other ____________________
Well diameter o 1.5-inch o 2-inch o 4-inch o Other ____________
o Odor ____________ o Comments____________________

WELL MEASUREMENTS

Total well depth____________ft o Clean bottom o Muddy bottom o Not measured
Depth to product____________ft
Depth to water____________ft
Casing volume ____________ft (H_2O) X __________gpf = ________
Casing volumes 1"=0.04 gpf 1.5"=0.09 gpf 2"=0.16 gpf 4"=0.65 gpf 6"= 1.47 gpf

PURGING INFORMATION

Pump type o Peristaltic o Submersible o Centrifugal o Other ____________
Purge tubing o New LDPE o New HDPE o New Teflon o Other ____________
Bailer type o Disposable o Stainless o PVC o Other ____________
Bailer cord used o Monofillament o Other ____________
Purge start time____________Purge stop time____________Purge Rate (GPM)__________
Total Volume Purged (gallons) ____________

FIELD PARAMETERS

Meters used o FlowThru Cell o Hach o Hanna o Other____________

Gallons	pH	Temp.	Conductivity	Turbidity	Dissolved Oxygen	ORP

NOTES/COMMENTS

____
____
____
____

Engineer's Signature____________________Date____________

APPENDIX B

QUALITY ASSURANCE PROJECT PLAN

Quality Assurance Project Plan

Coleman Oil R99 Renewable Diesel Spill
Wenatchee, Washington

Prepared for:
Coleman Oil Company
335 Mill Road
Lewiston, Idaho 83501

August 4, 2023

Prepared by:

HydroCon, LLC
1339 Commerce Avenue, Suite 211, Longview, Washington 98632
p: (360) 998-2902 f: (360) 703-6086
www.hydroconllc.net

Quality Assurance Project Plan (QAPP)

Coleman Oil R99 Renewable Diesel Spill
Wenatchee, Washington

Prepared for:
Coleman Oil Company LLC
335 Mill Road
Lewiston, Idaho 83501

HydroCon Project No: 2017-074

Prepared by:

Craig Hultgren, LHG
Principal Geologist

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Acronyms

Able	Able Clean-up Technologies, Inc.
AO	Agreed Order
BTEX	benzene, toluene, ethylbenzene, and total xylenes
cPAHs	carcinogenic polynuclear aromatic hydrocarbons
COC	Chemical of Concern
Coleman Oil	Coleman Oil Company
DQOs	data quality objectives
DRPH	diesel range petroleum hydrocarbons
Ecology	Washington Department of Ecology
EPA	Environmental Protection Agency
GRPH	gasoline range petroleum hydrocarbons
HASP	Health and Safety Plan
HydroCon	HydroCon Environmental LLC
µg/L	micrograms per liter
mg/Kg	milligrams per Kilogram
MTCA	Model Toxics Control Act
ORPH	oil range petroleum hydrocarbons
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance and quality control
SAP	Sampling and Analysis Plan
SRI	Supplemental Remedial Investigation
WAC	Washington Administrative Code

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) has been prepared by HydroCon Environmental (HydroCon) on behalf of Coleman Oil Company (Coleman) to provide specific requirements for quality assurance and quality control (QA/QC) procedures for the Interim Action Addendum #4 – Remedial Excavation Near MW14 that will be conducted at the Coleman Facility located at 3 East Chehalis Street in Wenatchee, Washington (hereinafter referred to as the Property) (Figure 1).

This QAPP has been prepared to meet the requirements of Exhibit B – Scope of Work and Schedule of Agreed Order No. DE 15389 entered into by Coleman Oil Company, LLC; Coleman, Services IV, LLC; and the Washington State Department of Ecology (Ecology) with an effective date of September 18, 2017 (Agreed Order). The Agreed Order is a continuation of previous and ongoing significant oil spill response activities and removal actions conducted under the Administrative Order on Consent for Removal Activities issued by the U. S. Environmental Protection Agency (EPA) on May 5, 2017 (EPA Docket No. CWA-10-2017-0114).

This QAPP is part of the Interim Action Addendum #4 – Remedial Excavation Near MW14 and will be conducted in accordance with the associated Work Plan. Figure 2 shows historical and current site features and sampling locations.

The purpose of the QAPP is to:

- Assist the project manager and project team to focus on the factors affecting data quality during the planning stage of the project.
- Facilitate communication among field, laboratory, and project staff as the project progresses.
- Document the planning, implementation, and assessment procedures for QA/QC activities for the Interim Action.
- Verify that the data quality objectives (DQOs) are achieved.
- Provide a record of the project to facilitate final report preparation.

The data quality objectives (DQOs) for the project include both qualitative and quantitative objectives, which define the appropriate type of data and specify the tolerable levels of potential decision errors that will be used as a basis for establishing the quality and quantity of data needed to support the Interim Action. To verify that the DQOs are achieved, this QAPP details aspects of sample collection and analysis including analytical methods, QA/QC procedures, and data quality reviews. This QAPP describes both qualitative and quantitative measures of data quality to verify that the DQOs are achieved.

2.0 PROJECT ORGANIZATION

The project organization for the completion of the Interim Action, including identification of key personnel and their responsibilities is described below.

2.1 Key Personnel

HydroCon has been contracted by Coleman to plan and implement the Interim Action Addendum #4 – Remedial Excavation Near MW14 at the Site. Key personnel and their roles for the project are listed in the table below.

Name	Role	Organization	Phone
Craig Hultgren, LHG	Project Manager	HydroCon	(360) 998-2902 office (360) 431-6253 cell
Robert Honsberger	Field Manager	HydroCon	(206) 856-6679
Mannon Tanner	Project QA/QC Officer	HydroCon	(360) 998-2902 office
John Mefford, LHG	Ecology Project Manager	Ecology	(509) 731-9613

2.2 Responsibilities of Key Personnel

The responsibilities of key personnel involved in the Interim Action are described below.

2.2.1 Regulatory Agency

The Washington State Department of Ecology (Ecology) is the lead regulatory agency for the Interim Action at the Property as promulgated in the Model Toxics Control Act (MTCA). The Interim Action is being conducted as an Agreed Order (AO) in accordance with WAC 173-340-530 of the MTCA. Mr. John Mefford is the assigned project manager for Ecology. Communications regarding changes to sampling and analysis plans, deviation of work plans, and general inquiries will be addressed to Mr. Mefford.

2.2.2 Project Manager

The Project Manager has overall responsibility for developing the QAPP, monitoring the quality of the technical and managerial aspects of the Interim Action, and implementing the QAPP and corresponding corrective measures, where necessary.

2.2.3 Project QA/QC Officer

The QA/QC Officer has the responsibility to monitor and verify that the work is performed in accordance with the Sampling and Analysis Plan (SAP) and other applicable procedures. The QA/QC Officer has the responsibility to assess the effectiveness of the QA/QC program and to recommend modifications to the program when applicable. The QA/QC Officer is responsible for assuring that the personnel assigned to the project are trained relative to the requirements of the QA/QC program and for reviewing and verifying the disposition of nonconformance and corrective action reports.

2.2.4 Project Staff

Members of the project staff are responsible for understanding and implementing the QA/QC program as it relates to the Interim Action objectives as presented in the CAP.

3.0 DATA QUALITY OBJECTIVES

The DQOs for the Interim Action will be used to develop and implement procedures to verify that data collected is of sufficient quality to adequately address the objectives of the Interim Action at the Site. Observations and measurements will be made and recorded in such a manner as to yield results representative of the media and conditions observed and/or measured. Goals for representativeness will be met by verifying sampling locations are selected properly, a sufficient number of samples are collected, and field screening and laboratory analyses are conducted properly.

The quality of the laboratory data will be assessed by precision, accuracy, representativeness, completeness, and comparability. Definitions of these parameters and the applicable QC procedures are described in Subsections 3.2 through 3.6 of this QAPP. Quantitative DQOs for applicable parameters (e.g., precision, accuracy, and completeness) are provided following each definition. Laboratory DQOs have been established by the analytical laboratory.

3.1 Quantitation Limits

The specific analytes and corresponding laboratory practical quantitation limits that will be required for the Interim Action are presented in Table 1. The detection or reporting limits for actual samples may be higher depending on the sample matrix, moisture content, and laboratory dilution factors. Laboratory control limits are also presented in Table 1.

3.2 Precision

Precision measures the reproducibility of measurements under a given set of conditions. Specifically, it is a quantitative measure of the variability of two or more measurements compared to their average values. Precision is calculated from results of duplicate sample analyses. Precision is quantitatively expressed as the relative percent difference (RPD) and is calculated as follows:

$$RPD = \frac{(C_1 - C_2)}{(C_1 - C_2)/2} x\ 100$$

Where:
RPD = relative percent difference
C_1 = larger of the two duplicate results (i.e., the highest dedicated concentration)
C_2 = smaller of two duplicate results (i.e., the lowest dedicated concentration)

There are no specific RPD criteria for organic chemical analyses. Quantitative RPD criteria for organic analyses will be based on laboratory-derived control limits.

3.3 Accuracy

Accuracy is a measure of the closeness (bias) of the measured value to the true value. The accuracy of chemical analytical results is assessed by “spiking” samples in the laboratory with known standards (a surrogate or matrix spike of known concentration) and determining the percent recovery (%R). The accuracy is measured as the %R and is calculated as follows:

$$\%R = \frac{(M_{sa} - M_{ua})}{C_{sa}} x\ 100$$

Where:

- %R = percent recovery
- M_{sa} = measured concentration in spiked aliquot
- M_{ua} = measured concentration in unspiked aliquot
- C_{sa} = actual concentration of spiked added

Laboratory matrix spikes and surrogates will be carried out at the analytical laboratory in accordance with the United States Environmental Protection Agency (EPA) SW-846 and Ecology methods and procedures for inorganic and organic chemical analyses. The frequency of matrix spikes and matrix spike duplicates will each be one per batch of 20 samples or less for soil and sediment samples. Quantitative percent recovery criteria for organic analyses will be based on laboratory- derived control limits for surrogate recovery and matrix spike results.

The accuracy of sample results can also be affected by the introduction of contaminants to the sample during collection, handling, or analysis. Contamination of the sample can occur because of improperly cleaned sampling equipment, exposing samples to chemical concentrations in the field or during transport to the laboratory, or because of chemical concentrations in the laboratory. To demonstrate that the samples collected are not contaminated, laboratory method blank samples will be analyzed.

3.3.1 Laboratory Method Blanks

The laboratory will run method blanks at a minimum frequency of 5 percent or one per batch to assess potential contamination of the sample within the laboratory.

3.4 Representativeness

Representativeness is a qualitative assessment of how closely the measured results reflect the actual concentration or distribution of the constituent concentrations in the matrix sampled. The sampling plan design, sample collection techniques, sample handling protocols, sample analysis methods, and data review procedures have been developed to verify that the results obtained are representative of the Site conditions.

3.5 Completeness

Completeness is defined as the percentage of measurements judged to be valid. Results will be considered valid if they are not rejected during data validation (Section 6, Data Management, Reduction, Quality Assurance, Review, and Reporting). Completeness is calculated as follows:

$$C = \frac{(Number\ of\ Valid\ Measurements)}{(Total\ Number\ of\ Measurements)} x\ 100$$

Objectives for completeness are based, in part, on the subsequent uses of the data (i.e., the more critical the use, the greater the completeness objective). The objectives for completeness of samples are expressed as percentages, which refer to the minimum acceptable percentages of samples received at the laboratory in good condition and acceptable for analysis. The objectives of completeness for other samples are 95 percent for soil and water samples. These objectives will be met through the use of proper sample containers, proper sample packaging procedures to prevent breakage during shipment, proper sample preservation, and proper labeling and chain-of- custody procedures. A loss of 5 to 10 percent of intended samples is common, and the goals set are sufficient for intended data uses.

The objectives for completeness of chemical analyses are also expressed as percentages and refer to the percentages of analytical requests for which usable analytical data are produced. The initial objective for completeness of chemical analyses in the laboratory is 95 percent.

3.6 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. The use of standard Ecology and EPA methods and procedures for both sample collection and laboratory analysis will make the data collected comparable to both internal and other data generated.

4.0 DATA COLLECTION APPROACH

Procedures for collecting, preserving, transporting, and storing samples are described in Sections 4.0 and 5.0 of the SAP. Sampling protocols will be performed in accordance with generally accepted environmental practices and will meet or exceed current regulatory standards and guidelines. Sampling procedures may be modified, if necessary, to satisfy amendments to current regulations, methods, or guidelines. The data collection approach for key elements of the Interim Action field program will verify the project DQOs are met or exceeded. The key elements include soil samples collected and analytical results used to demonstrate that the concentrations of chemicals of concern (COCs) at the limits of the remedial excavation are below applicable cleanup levels as defined in the SAP. The total number of samples collected and specific analyses to be performed will be based on field screening results, field observations, and analytical results for performance and confirmational monitoring.

5.0 ANALYTICAL PROCEDURES

APEX Laboratory (APEX) of Tigard, Oregon has been selected as the laboratory to conduct the analyses for COCs of the samples collected for the Interim Action. APEX is certified by Ecology and meets the QA/QC requirements of both Ecology and the EPA. The contact for APEX is:

Name	Role	Organization	Phone
Kurt Johnson	Project Contact	APEX	(360) 556-6513

A *Laboratory Quality Assurance Manual* from APEX is available on file at HydroCon's office for review and reference. The manual will be followed throughout the Interim Action. Access to laboratory personnel, equipment, and records pertaining to samples, collection, transportation, and analysis can be provided. A list of Analytical Methods, Container, Preservation, and Holding Time Requirements is provided in Table 2.

6.0 DATA MANAGEMENT, REDUCTION, QUALITY ASSURANCE, REVIEW, AND REPORTING

This section outlines the procedures to be followed for the inventory, control, storage, and retrieval of data collected during performance of the Interim Action. The procedures contained in this QAPP are designed to verify that the integrity of the collected data is maintained for subsequent use. Moreover, project-tracking data (e.g., schedules and progress reports) will be maintained to monitor, manage, and document the progress of the Interim Action.

6.1 Data Types

A variety of data will be generated by the Interim Action, including sampling and analytical data. The laboratory analytical data will be transmitted to HydroCon as an electronic file. This method will facilitate the subsequent validation and analysis of these data while avoiding transcription errors that may occur with computer data entry. Examples of data types include manually recorded field data, such as boring logs, and electronically reported laboratory data.

6.2 Data Transfer

Procedures controlling the receipt and distribution of incoming data packages to HydroCon and outgoing data reports from HydroCon include the following:

- Incoming documents will be date-stamped and filed. Correspondence and transmittal letters for reports, maps, and data will be filed chronologically. Data packages, such as those from field personnel, laboratories (such as soil data), and surveyors

(elevation data), will be filed by project task, subject heading, and date. If distribution is required, the appropriate number of copies will be made and distributed to the appropriate persons or agencies.
- A transmittal sheet will be attached to project data and reports sent out. A copy of each transmittal sheet will be kept in the administrative file and the project file. The Project Manager, selected project team member(s) and QA/QC Officer will review outgoing reports and maps.

6.3 Data Inventory

Procedures for filing, storage, and retrieval of project data and reports are discussed below.

6.3.1 Document Filing and Storage

Project files and raw data files will be maintained at HydroCon's office. Files will be organized by project tasks or subject heading. Hard copy project files will be archived for a minimum of 3 years after completion of the project. Electronic copies of files will be maintained in a project directory and backed up on a daily, weekly, and monthly basis.

Records will be kept and maintained as required under WAC 173-340-850 as required under Section VII (G) of Agreed Order No. DE 15389. The records will be maintained for at least 10 years from the date of completion of the compliance monitoring or as long as institutional controls remain in effect.

6.3.2 Access to Project Files

Access to project files will be controlled and limited to Coleman and its authorized representatives, Ecology, and HydroCon personnel. If a document is to be used for a long period, a copy will be used, and the original will be returned to the project file. Electronic access to final reports, figures, and tables will be write-protected in the project directory.

Draft reports will be submitted to Coleman Oil and Ecology for review. Once comments/edits are addressed the documents will be finalized, signed and stamped by a licensed hydrogeologist. An electronic copy of the documents will be submitted via email to Mr. Mefford (Ecology) and Mr. Cach (Coleman Oil). An unbound hard copy will be mailed to Mr. Mefford.

6.4 Independent Data Quality Review

Data quality review will be performed where applicable using the current EPA *National Functional Guidelines for Organic Data Review (1999)*. The following types of QC information will be reviewed, as appropriate:

- Method deviations
- Sample extraction and holding times
- Method reporting limits
- Blank samples (equipment rinsate and laboratory method)
- Duplicate samples

- Matrix spike/matrix spike duplicate samples (accuracy)
- Surrogate recoveries
- Percent completeness and RPD (precision)
- QA review of the final analytical data packages for samples collected during the Interim Action.

6.5 Data Reduction and Analysis

The Project Manager and QA/QC Officer are responsible for data review and validation. Data validation parameters are outlined in Section 3.0, Data Quality Objectives. The particular type of analyses and presentation method selected for any given data set will depend on the type, quantity, quality, and prospective use of the data in question. The analysis of the project data will require data reduction for the preparation of tables, charts, and maps. To verify the data are accurately transferred during the reduction process, a minimum of two data reviews will be performed, one by the QA/QC Officer or Project Manager and another by the Project Principal, prior to issuing the documents.

6.5.1 Data Reporting Formats

The physical and chemical characterization information developed in connection with the Interim Action will be presented in the final report in the following format.

6.5.1.1 Summary Tables and Plots

The laboratory reports will be sorted according to various parameters to summarize the information for easier assimilation and presentation. Soil sampling and analysis data will be sorted several ways, including by sample point number, constituent, and date of sample collection. The parameters chosen for sorting will depend on the selection of the most appropriate format and the utility of that format in demonstrating the physical and chemical characteristics of interest.

6.5.1.2 Maps

Plan maps needed to illustrate results of the Interim Action will be assembled or prepared. They may include, but are not limited to, plan maps of the Site showing confirmed and suspected sources, sampling locations, chemical concentrations for selected chemicals, the Site features and potential preferential pathways (e.g., underground utility lines), and cross section locations (if produced).

6.5.1.3 Cross Section

Vertical profiles or cross sections may be generated from field data to display the Site stratigraphy, extent of soil excavation, or other aspects of the Interim Action.

6.6 Quality Control Summary Report

A QC summary report will be included in a separate section of the Interim Actioin Report prepared by HydroCon based on the QC summary data provided by the laboratory and validation report provided by the QA/QC validator.

7.0 QUALITY CONTROL PROCEDURES

This section provides a description of the QC procedures for both field activities and laboratory analysis. The field QC procedures include standard operating procedures for sample collection and handling, equipment calibration, and field QC samples.

7.1 Field Quality Control

Field QC samples (e.g., duplicate samples) will be collected during this project; the purpose of these samples is also discussed in Section 3.0, Data Quality Objectives. In addition, standard operating procedures will be implemented during field screening activities. The procedural basis for these field data collection activities will be documented on the field report forms, as described in Section 6.0, Sample Documentation and Shipment, of the SAP. Deviations from the established protocols will be documented on the field report forms.

7.2 Laboratory Quality Control

Analytical laboratory QA/QC procedures are provided in APEX's *Laboratory Quality Assurance Manual* that is on file at HydroCon's office.

7.3 Data Quality Control

Data generated by APEX will undergo two levels of QA/QC evaluation: one by the laboratory and one by HydroCon. As specified in the *Laboratory Quality Assurance Manual for APEX*, the laboratory will perform initial data reduction, evaluation, and reporting. The analytical data will then be validated by the QA/QC Officer. The following types of QC information will be reviewed, as appropriate:

- Method deviations
- Sample transport conditions (temperature and integrity)
- Sample extraction and holding times
- Method reporting limits
- Blank samples
- Duplicate samples
- Surrogate recoveries
- Percent completeness
- RPD (precision)

HydroCon and the QA/QC Officer will review field records and results of field observations and measurements to verify procedures were properly performed and documented. The review of field procedures will include:

- Completeness and legibility of field logs.
- Preparation and frequency of field QC samples.
- Equipment calibration and maintenance.
- Sample Chain of Custody forms.

Corrective actions are described in Section 10.0, Corrective Action.

7.4 Data Assessment Procedures

The Project Manager and QA/QC Officer are responsible for data review and validation. Upon receipt of each data package from the laboratory, calculations using the equations presented for precision, accuracy, and completeness will be performed. Results will be compared to quantitative DQOs, where established, or qualitative DQOs. Data validation parameters are outlined in Section 3.0, Data Quality Objectives.

7.5 Quality Control Summary Report

A QC summary report will be prepared by HydroCon and the QA/QC Officer and included in a separate section of the Interim Action Report based on the QC summary data provided by the laboratory.

8.0 PERFOMANCE AND SYSTEM AUDITS

Performance audits will be completed for both sampling and analysis work. Field performance will be monitored through regular review of Sample Chain of Custody forms, field forms, and field measurements. The Project Manager and/or the QA/QC Officer may also perform periodic review of work in progress at the Site.

Accreditations received from Ecology for each analysis by the analytical laboratory demonstrate the laboratory's ability to properly perform the requested methods. Therefore, a system audit of the analytical laboratory during the course of this project will not be conducted.

The Project Manager and/or QA/QC Officer will oversee communication with the analytical laboratory on a frequent basis while samples are being processed and analyzed at the laboratory. This will allow HydroCon to assess progress toward meeting the DQOs and to take corrective measures if problems arise.

The analytical laboratory will be responsible for identifying and correcting, as appropriate, deviations from performance standards as discussed in the laboratory QA/QC Plan. The laboratory will communicate to the Project Manager or the QA/QC Officer deviations to the performance standards and the appropriate corrective measures made during sample analysis. Corrective actions are discussed in Section 10.0.

9.0 PREVENTATIVE MAINTENANCE

Operation and maintenance manuals will accompany field parameter analysis and measurement equipment. Included in these manuals will be procedures for calibration, operation, and troubleshooting. Maintenance activities will be documented in the project field report forms and/or equipment logbooks. A schedule of preventive maintenance activities will be maintained. In addition, spare parts and tools will be included in each equipment storage case to minimize equipment downtime.

10.0 CORRECTIVE ACTION

Corrective actions will be the joint responsibility of the Project Manager and the QA/QC Officer. Corrective procedures can include:

- Identifying the source of the violation
- Re-analyzing samples, if holding time criteria permit
- Re-sampling and analyzing
- Re-measuring parameter
- Evaluating and amending sampling and analytical procedures; and/or
- Qualifying data to indicate the level of uncertainty.

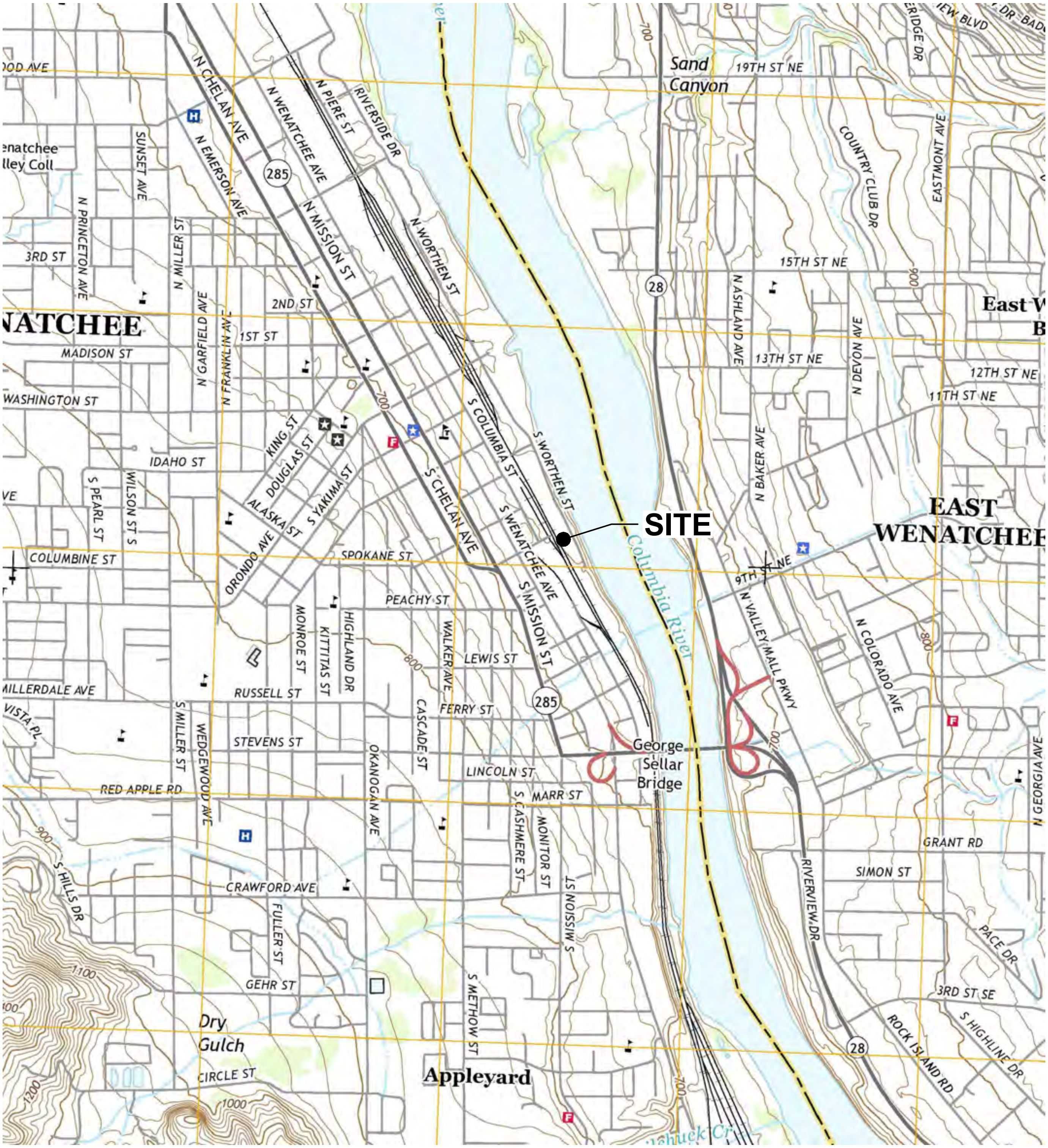
During field sampling operations, the Project Manager and field team members will be responsible for identifying and correcting protocols that may compromise the quality of the data. Corrective actions taken will be documented in the field notes.

11.0 QUALITY ASSURANCE REPORTS

The Interim Action Report will include a QA section that summarizes data quality information in the deliverables generated during the project. This summary will include at a minimum:

- Assessment of data accuracy and completeness.
- Results of performance and/or system audits.
- Significant QA problems and their impacts on the DQOs.

FIGURES



NOTE(S):
USGS, WENATCHEE QUADRANGLE
WASHINGTON
7.5 MINUTE SERIES (TOPOGRAPHIC)

0 2000 4000
SCALE IN FEET
1" = 2000'

N
W E
S

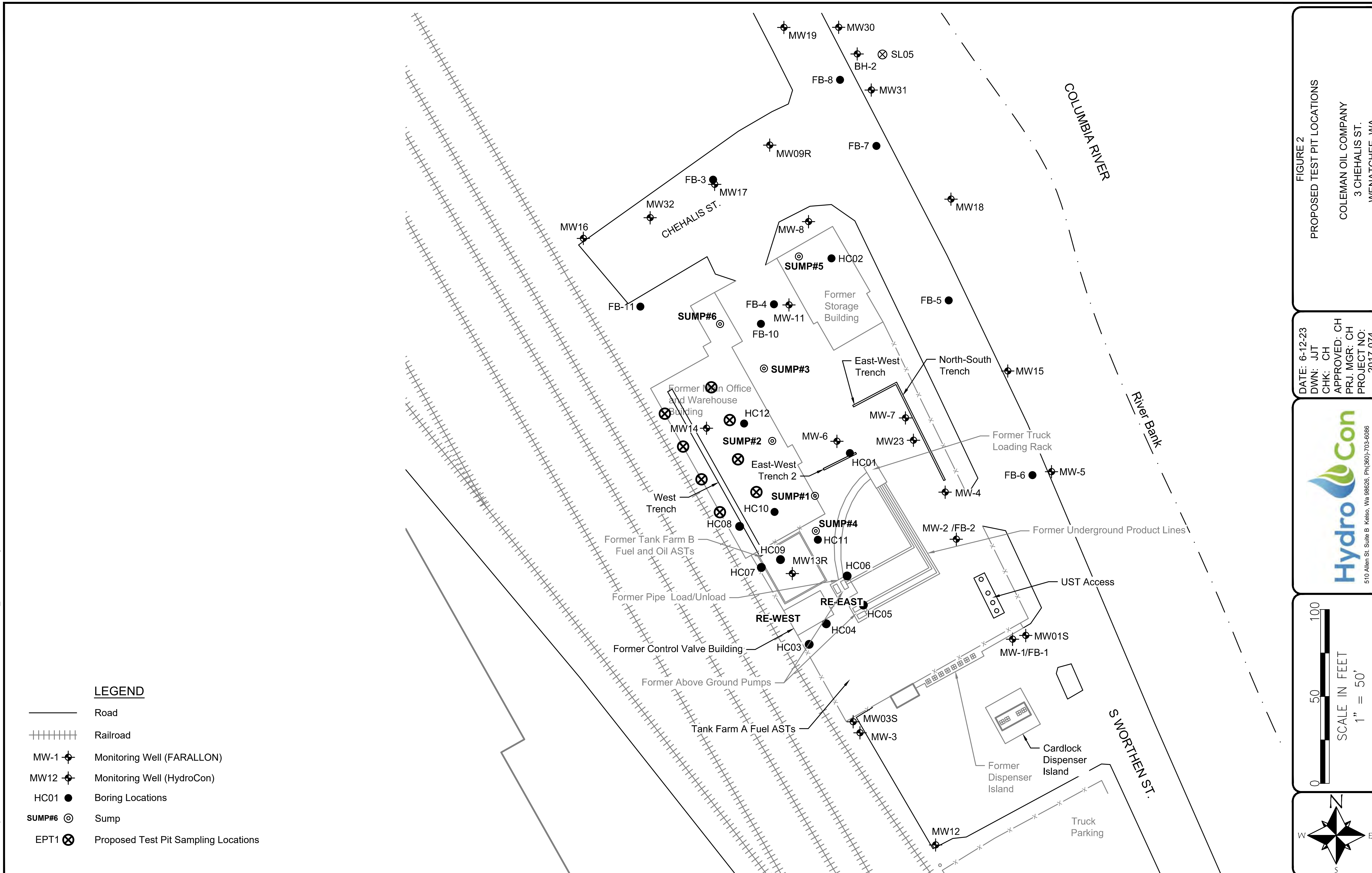
Hydro Con
510 Allen St. Suite B Kelso, Wa 98626, Ph(360)-703-6086

DATE: 10-18-18
DWN: JJT
CHK: RH
APPROVED: RH
PRJ. MGR: CH
PROJECT NO:
2017-074

FIGURE 1
SITE LOCATION MAP

COLEMAN OIL COMPANY
3 CHEHALIS ST.
WENATHCEE, WA.

C:\Users\Josh\Desktop\Autocad Files\Hydrocon-Autocad\2017-074 Coleman Oil\2018\Oct 2018\2017-074_BM-101718.dwg



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TABLES

Table 1. Analytical Method Details - Apex Laboratories

					Surr.	DUP	Matrix Spike		Blank Spike		
Method	**Analyte**	**MDL**	**MRL**	**Units**	**%R**	**RPD**	**%R**	**RPD**	**%R**	**RPD**	**CAS #**
Diesel and/or Oil Hydrocarbons by NWTPH-Dx in Soil											
NWTPH-Dx	Diesel	10.0	25.0	mg/kg dry wt	-	30	50-150	50	76-115	20	68334-30-5
NWTPH-Dx	Oil	20.0	50.0	mg/kg dry wt	-	30	-	-	-	-	Oil
NWTPH-Dx	o-Terphenyl (Surr)			Surrogate	50-150	-	-	-	-	-	84-15-1
Diesel and/or Oil Hydrocarbons by NWTPH-Dx in Water											
NWTPH-Dx	Diesel	0.0400	0.0800	mg/L	-	30	50-150	-	52-120	20	68334-30-5
NWTPH-Dx	Oil	0.0800	0.160	mg/L	-	30	-	-	-	-	Oil
NWTPH-Dx	o-Terphenyl (Surr)			Surrogate	50-150	-	-	-	-	-	84-15-1
Gasoline Range Hydrocarbons (Benzene through Naphthalene) by NWTPH-Gx in Soil											
NWTPH-Gx (MS)	Gasoline Range Organics	2.50	5.00	mg/kg dry wt	-	30	70-130	-	80-120	20	8006-61-9
NWTPH-Gx (MS)	4-Bromofluorobenzene (Sur)			Surrogate	50-150	-	-	-	-	-	460-00-4
NWTPH-Gx (MS)	1,4-Difluorobenzene (Sur)			Surrogate	50-150	-	-	-	-	-	540-36-3
Gasoline Range Hydrocarbons (Benzene through Naphthalene) by NWTPH-Gx in Water											
NWTPH-Gx (MS)	Gasoline Range Organics	0.0500	0.100	mg/L	-	30	70-130	-	80-120	20	8006-61-9
NWTPH-Gx (MS)	4-Bromofluorobenzene (Sur)			Surrogate	50-150	-	-	-	-	-	460-00-4
NWTPH-Gx (MS)	1,4-Difluorobenzene (Sur)			Surrogate	50-150	-	-	-	-	-	540-36-3
BTEX Compounds by EPA 8260C in Soil											
5035A/8260C	Benzene	5.00	10.0	ug/kg dry wt	-	30	77-121	35	80-120	30	71-43-2
5035A/8260C	Ethylbenzene	12.5	25.0	ug/kg dry wt	-	30	76-122	35	80-120	30	100-41-4
5035A/8260C	Toluene	25.0	50.0	ug/kg dry wt	-	30	77-121	35	80-120	30	108-88-3
5035A/8260C	m,p-Xylene	25.0	50.0	ug/kg dry wt	-	30	77-124	35	80-120	30	Xylenes(mp)
5035A/8260C	o-Xylene	12.5	25.0	ug/kg dry wt	-	30	77-123	35	80-120	30	95-47-6
5035A/8260C	Xylenes, total	37.5	75.0	ug/kg dry wt	-	30	78-124	30	80-120	30	1330-20-7
5035A/8260C	1,4-Difluorobenzene (Surr)			Surrogate	80-120	-	-	-	-	-	540-36-3
5035A/8260C	Toluene-d8 (Surr)			Surrogate	80-120	-	-	-	-	-	2037-26-5
5035A/8260C	4-Bromofluorobenzene (Surr)			Surrogate	80-120	-	-	-	-	-	460-00-4
BTEX Compounds by EPA 8260C in Water											
EPA 8260C	Benzene	0.100	0.200	ug/L	-	30	79-120	30	80-120	30	71-43-2
EPA 8260C	Ethylbenzene	0.250	0.500	ug/L	-	30	79-121	30	80-120	30	100-41-4
EPA 8260C	Toluene	0.500	1.00	ug/L	-	30	80-121	30	80-120	30	108-88-3
EPA 8260C	m,p-Xylene	0.500	1.00	ug/L	-	30	80-121	30	80-120	30	Xylenes(mp)
EPA 8260C	o-Xylene	0.250	0.500	ug/L	-	30	78-122	30	80-120	30	95-47-6
EPA 8260C	Xylenes, total	0.750	1.50	ug/L	-	30	79-121	30	80-120	30	1330-20-7
EPA 8260C	1,4-Difluorobenzene (Surr)			Surrogate	80-120	-	-	-	-	-	540-36-3
EPA 8260C	Toluene-d8 (Surr)			Surrogate	80-120	-	-	-	-	-	2037-26-5
EPA 8260C	4-Bromofluorobenzene (Surr)			Surrogate	80-120	-	-	-	-	-	460-00-4

Notes:

MRL = Method Reporting Limint
MDL = Method Detection Limit
Surr. %R = Surrogate percent recovery
RPD = relative percent difference
DUP = Duplicate
mg/kg = milligrams per kilogram
ug/L = micrograms per liter

Table 2. Analytical Methods, Container, Preservation, and Holding Time Requirements for Soil and Sediment

Analytical Method	Container	Number of Containers	Preservation Requirements	Holding Time
TPH-DRPH and TPH-ORPH Northwest Method NWTPH-Dx	4 oz glass jar	1	4 ° C	14 days
TPH-GRPH Northwest Method NWTPH-Gx	EPA 5035 Kit	2	4 ° C	14 days
BTEX EPA 5035/8260C	EPA 5035 Kit	4	4 ° C	14 days
Polynuclear Aromatic Hydrocarbons	4 oz glass jar	1	4 ° C	14 days
Volatile Organic Compounds	EPA 5035 Kit	2	4 ° C	14 days
Total Lead	4 oz glass jar	1		
Moisture Content	4 oz glass jar	1	4 ° C	14 days
Grain Size	16-ounce HDPE		--	28 days
Total Solids	8-ounce glass jar		--	14 days
Total Organic Carbon	8-ounce glass jar		4 ° C	1 year

NOTES:

° C = degrees Celsius
BTEX = benzene, toluene, ethylbenzene, and total xylenes
EPA = United States Environmental Protection Agency
FBI SOP = Friedman & Bruya, Inc. Standard Operating Procedure
GRPH = gasoline-range petroleum hydrocarbons
mL = milliliters
oz = ounce
TPH = total petroleum hydrocarbons
VOA = volatile organic analysis

Table 3. Analytical Methods, Container, Preservation, and Holding Time Requirements for Water

Analyte(s) and Method	40 mL VOA Glass Vials (preserved with HCl)	250 mL Plastic Bottle (preserved with HNO3)	1,000 mL Amber Glass Bottle (unpreserved)	500 mL Amber Glass Bottle (HCL)
Benzene, Toluene, Ethylbenzene, & Total Xylenes (BTEX) and naphthalene **EPA Method 8021B or 8260C**	3	-	-	-
Total Lead	-	U	-	-
Filtered Lead **EPA Method 200.8**	-	P	-	-
Gasoline-Range Petroleum Hydrocarbons (GRPH) **Northwest Method NWTPH-Gx**	3	-	-	-
Oil-Range Petroleum Hydrocarbons (ORPH) and	-	-	-	1
Diesel-Range Petroleum Hydrocarbons (DRPH) **Northwest Method NWTPH-Dx**	-	-	-	1
Polynuclear Aromatic Hydrocarbons **EPA Method 8270SIM**	-	-	1	-

NOTES:
HCl = hydrochloric acid
HNO3 = nitric acid
VOA = volatile organic analysis
EPA = Environmental Protection Agency
U = Unpreserved
P = Preserved