Whitty's LLC

Draft Remedial Investigation Work Plan
Whitten Oil #1 Site

370 W. 5th Avenue, Colville, WA 99114


117-727135-24001
January 29, 2025

TETRA TECH

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PRESENTED TO

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Colville, WA 99114

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TETRA TECH

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ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
%	Percent
ºC	Degrees Celsius
°F	Fahrenheit
µg/L	Micrograms per liter
amsl	Above mean sea level
AO	Agreed order
BTEX	Benzene, toluene, ethylbenzene, total xylenes
CSCSL	Washington Confirmed and Suspected Contaminated Sites List
DEF	Diesel exhaust fluid
DO	Dissolved oxygen
DPT	Direct push technology
EDB	1,2-Dibromoethane (Ethylene dibromide)
EDC	1,2-Dichloroethane (Ethylene dichloride)
EDR	Environmental Data Resources
FRP	Fiberglass-reinforced plastic
FS	Feasibility study
GPR	Ground-penetrating radar
GPS	Global-positioning system
HASP	Health and safety plan
HDPE	High-density polyethylene
HSL	Washington Hazardous Sites List
IEUCC	Inland Empire Utility Coordinating Council
JSA	Job safety analysis
LUST	Leaking underground storage tank
mg/L	Milligram per liter
MTBE	Methyl tertiary butyl ether
MTCA	Model Toxics Control Act
mV	Mili-volt
NTUs	Nephelometric turbidity units

Acronyms/Abbreviations	Definition
PID	Photoionization detector
PLP	Potentially liable persons
PPE	Personal protective equipment
PRR	Public records request
PVC	Polyvinylchloride
QA/QC	Quality assurance/quality control
ORC	Oxidation-reduction potential
RI	Remedial investigation
ROW	Right-of-way
RPD	Relative percent difference
SC	Specific conductance
SHA	Site hazard assessment
TPH-Dx	Total petroleum hydrocarbons-diesel range
TPH-Gx	Total petroleum hydrocarbons-gasoline range
TPH-O	Total petroleum hydrocarbon-residual oil
USCS	Unified Soil Classification System
USGS	United States Geological Survey
UST	Underground storage tank
VCP	Voluntary cleanup plan
VOCs	Volatile organic compounds
WAC	Washington Administrative Code
WA RGA	Washington Recovered Government Archive
WP	Work plan

1.0 INTRODUCTION

Tetra Tech, Inc. (Tetra Tech) prepared this remedial investigation (RI) work plan (WP) on behalf of Whitty's, LLC in relation to the Whitten Oil #1 facility. Whitten Oil #1 is a vehicle fueling, bulk oil, car wash, and convenience store business (the facility or site) located at 370 W. 5th Avenue in Colville, Stevens County, Washington. **Figure 1** (**Appendix A**) presents a location on a map.

This RIWP was developed as part of requirements specified in the Agreed Order (AO) No. DE 23302 between Washington Department of Ecology (Ecology), Whitty's LLC (Whitty's) and Whitten Oil, Inc. (Whitten). The AO identified both Whitty's and Whitten as potentially liable persons (PLPs).

The purpose of this RIWP is to guide upcoming field efforts that include the collection of data and information that will further define the extent of contamination, characterize facility conditions, and evaluate cleanup action alternatives through a feasibility study (FS). Additional RI work may be needed beyond the initial work specified herein. Tetra Tech proposes to prepare addendums to this RIWP that define these additional investigations. RI/FS work will be conducted pursuant to Washington State Model Toxics Control Act (MTCA) Cleanup Regulation (Chapter 173-340 Washington Administrative Code [WAC]).

This RIWP is organized as follows:

- **Section 1** provides a project introduction.
- **Section 2** presents background information.
- **Section 3** describes the physical setting.
- **Section 4** presents a preliminary conceptual model.
- **Section 5** describes the investigation methods.
- **Section 6** presents analytical methods and quality control.
- **Section 7** lists references referred to in this document.

Appendix A of this RIWP presents site figures, **Appendix B** Tetra Tech's health and safety plan (HASP), **Appendix C** standard operating procedures (SOPs), and **Appendix D** field logs.

2.0 BACKGROUND

This section includes background information for the facility.

2.1 FACILITY LOCATION AND DESCRIPTION

The facility is known as Whitten Oil #1. The facility is a bulk fuel storage, vehicle fueling, car wash, and convenience store business that resides in the northern and western portion of the City of Colville, in Stevens County, Washington. The facility rests along W. 5th Avenue, a busy thoroughfare in the northern portion of town. The facility occupies six (6) land parcels that total approximately 1.4 acres with a common address of 370 W. 5th Avenue.

The facility fronts the northern side of the 300 block of W. 5th Avenue. W. 5th Avenue is also a portion of the business route for Highway 395 that runs generally north and then west through Colville. The north side of the facility is bound by W. 6th Avenue, the west side is bound by N. Lincoln Street, and the east is bound by N. Washington Street. The facility's block covers portions of Block 2 of Hammond's Addition and Block 2 of Spokane Addition.

Table 2-1, below, lists individual parcel information. **Table 2-2**, below, provides other general property and facility information. **Figure 2** (**Appendix A**) provides a site plan showing the parcel boundaries existing structures, current and former underground storage tank (USTs) locations, monitoring well locations, pump islands, and other features.

Table 2-1. Parcel Information

County Parcel #	Approximately Location within Facility Boundary	Legal Description	Acres	Address	Building(s) and Year Constructed
0070900	Westernmost parcel	COLVILLE HAMMOND'S LOTS 7-12 BLK 2	0.5372	380 W. 5th Ave	Car wash (1987)
0070700	North central parcel	COLVILLE HAMMOND'S LOTS 4-6 BLK 2, ls S 100'	0.124	Not listed	Pump Island & UST (unknown)
0070800	Center parcel	COLVILLE HAMMOND'S S 100' LOTS 4-6 BLK 2	0.2066	370 W. 5th Ave	Store and part of fuel island (1997)
0125800	South central parcel	COLVILLE SPOKANE LOT 1 BLK 2, ls Hwy & E 100'	0.0362	Not listed	Part of fuel island (unknown)
0070600	Northeast parcel	COLVILLE HAMMOND'S LOTS 1-3 BLK 2	0.3673	316 W. 5th Ave	Farm implement building (1946*)
0125700	Southeast parcel	COLVILLE SPOKANE E 100' LOT 1 BLK 2	0.0861	Not listed	Pump island (2018)

Table 2-2. Facility Information

Feature	Description
Facility Name	Whitten Oil #1 or Whitty's Chevron
Ecology Site Notification ID	7372
Ecology Cleanup Site ID	9440
Ecology Facility ID	49354234
Prime Address	370 West 5th Avenue, Colville, WA 99114
Lots and Size	6 land parcels / lots comprising approximately 1.4 acres
Section / Township / Range	SW ¼ of NW ¼, Section 9, Township 35 North and Range 39 East of the Willamette Meridian
Latitude / Longitude	48° 32' 56.45" N, 117° 54' 34.39" W

Feature	Description
Abbreviated Legal Desc.	Portions of Blk 2, Hammond's Add. and Blk 2, Spokane Add. to the City of Colville
Cross Streets	Site is bounded by N. Lincoln Street to west, N. Washington Street to east, W. 6th Avenue to North, W. 5th Avenue to South.
Zoning	General Commercial
Current Ownership	Mr. Ankur Sood
Improvements	Convenience store (1997), car wash (1987), pump islands (various dates), warehouse (1996).
Current Use	Whitty's Chevron - fueling station, convenience store, car wash
Past Use	Fueling station, bulk fuel storage, store, car wash, pump sales facility, other

2.2 FACILITY SETTING

Colville is a town of approximately 5,000 residents that resides at the junction of US Highway 395 and Washington State Highway 20. The town is a mountain town that rest at the base of Colville Mountain on the north. The town elevation is roughly 1,635 feet above mean sea level (amsl). Whitten Oil #1 is located approximately 0.75 miles east of the meandering Colville River, which rests in a flat meadow where numerous historical oxbows demarcate prior pathways of the river. Between the site and the river is the approximately 100-acre Vaagen Bros Lumber Mill, which is the most prominent feature on the northern end of town.

Colville rests within the Colville (Chamokane) Valley, which extends northward from the Spokane River in the southern part of Stevens County to beyond Colville. The Colville River flows north then west until it flows into the Columbia River southwest of Kettle Falls, Washington. The Colville Valley is generally flat-bottomed, north-south oriented, and ranges from 1 to 3 miles in width. The valley floor is made up of fluvial deposits of considerable thickness throughout its length. The sides of the valley have a gradual slope and appear weathered. The surrounding area is mountainous, with many peaks nearing 5,000 feet in elevation. Mining and timber production have been principal industries through Colville's history.

2.3 FACILITY HISTORY

Tetra Tech reviewed historic information available through a variety of sources such as aerial photographs, various maps, and city directory listings, interviews, various City of Colville document sources, newspaper articles, and prior investigation documents to understand the general property history. Tetra Tech summarized information obtained during the historic review in the *Historical Site Review* letter report dated September 4, 2024 (Tetra Tech 2024). This section summarizes key information from Tetra Tech's historical review.

2.3.1 Historical Overview

The facility appears to date as far back as the late 1930s. Multiple entities have owned the facility and all or some of the land parcels that comprise the facility over the past approximately 90 years. However, ownership and historical records show that facility ownership from about 1973 onward has included two primary entities: the Whitten family and LDH Investments, Inc. (Sood family) (Tetra Tech 2024). LDH purchased the facility from the Whitten family in January of 2006 (Ecology 2013). Recent facility uses include a convenience store, car wash, propane refill station, and a recreational vehicle septic dump.

Historic maps suggest the subject property was likely a series of vacant lots from the earliest days of Colville, starting in the 1850s through the early 1900s. Structures at the facility property were first constructed in the late 1930s as a bulk fuel plant and service station that supplied bulk fuel locally and supplied fuel for automobiles. A prior site hazard assessment (SHA) report issued by Ecology also documented operation of a bulk fuel storage began in 1933 (Ecology 2013). Sanborn Maps depict the site as a gas and oil facility in 1940, although such uses are suspected to have been in place slightly earlier. The central portion of the facility has historically included petroleum storage and a service station, while the west and east portions of the block had other owners and uses until acquisition for expansion of the current facility.

This first business known to have operated on the property was Signal Oil. The operation had multiple petroleum storage tanks, some of which may have been aboveground. The operation also appeared to have several underground tanks that supplied fuel from a dispenser along W. 5th Avenue. Early on, the facility occupied only the northern portion of Lots 4, 5, and 6 of Block 2 of the Hammond's Addition. Records suggest these lots and operation were first owned by Mr. Roy Inman.

Past site features include a convenience store and/or shop building. Tetra Tech could not confirm through historical review that a vehicle maintenance/repair shop was formerly present. However, vehicle repair was common at historic fueling facilities; therefore, it is possible that limited vehicle maintenance may have occurred in the past. The facility's store/shop building will be referred to as store hereinafter for ease of reference and consistency.

Records for past and current operations has included at least seven (7) steel single-wall petroleum-containing underground storage tanks (USTs) and four (4) single-wall fiberglass-reinforced plastic (FRP or fiberglass) petroleum tanks. The fiberglass tanks exist today. **Figure 2** (**Appendix A**) shows the estimated location of these features based on review of historic and prior investigation documents (Tetra Tech 2024).

Former USTs #1, #2, and #3 were approximately 500-gallon gasoline tanks that adjoined the southwest corner of the prior store building. Former UST #4, which remains onsite was closed-in place. UST #4 once adjoined the north side of the former shop/store building. This tank is believed to currently reside under the north portion of the current convenience store. The current convenience store resides over most of the footprint of the former structure. Former USTs #5, #6, and #7 adjoined the former store to the north. Former UST #5 was 10,000-gallons in size, oriented east-west, and contained diesel. Former UST#6 was 12,000-gallons in size, oriented north-south, and held regular gasoline. Former UST #7 was smaller, oriented east-west, and its contents were suspected to be gasoline or diesel.

Considering the sizes and placements of the tanks, it appears at least three generations of petroleum tanks have been used onsite. Six of the steel tanks were removed and one steel tank was closed-in-place (Former UST #4) during a UST and soil removal project in 1989. Some petroleum contaminated soil was removed during tank removal, but residual soil contamination remains and is impacting groundwater.

Tanks removed in 1989 were replaced with the four FRP USTs in the existing UST basin adjoining the store building on the southwest (currently named UST #s 1 through 4, **Figure 2**). The northern or former bulk fuel storage portions of the site apparently also included aboveground or below ground storage tanks, and oil and gasoline stored in drums in warehouse(s). A former diesel product line extended from the UST basin/nest approximately 25 feet to the south, toward W. 5th Avenue. The product line then ran from west to east for approximately 75 feet before turning north and running another approximately 75 feet to a former diesel dispensing rack near the northeast corner of the former store building (**Figure 2**).

Whitten Oil #1 currently includes a convenience store that was built in 1997, a multi-bay car wash facility, a storage warehouse, and multiple pump islands that are served by the four (4) single-walled FRP USTs installed in 1989. The facility is reportedly connected to city water and sewer. It is unknown whether prior structures onsite were connected to the city sewer or storm sewer system.

Current pump islands include three clusters of fuel dispenser (pump) islands, including a 1991-installed set of two pump islands to the north, a 2018-installed set of two pump islands on the former Fogle Pump property to the east, and an older set of two pump islands to the south. The east adjoining former Fogle Pump property appeared to have been acquired in 2017. The southern pump islands appear proximal to the original dispenser locations depicted on Sanborn Maps. The northern pump islands were installed in 1991, but the area was once part of a bulk fuel plant in the 1960s. It is possible other pump or dispenser islands or tanks have been installed and removed from the site through time.

In conclusion, the middle parcels of the subject property have been used as a bulk fuel facility since approximately the late 1930s. Various tanks, buildings, and fueling structures have come and gone. Numerous prior USTs were removed, but not all contaminated soil was removed; contaminated soil and groundwater remain. There are four active FRP USTs onsite currently and one UST that remains closed-in-place that appears to rest under the current convenience store. There are also several sets of pump islands, a car wash, propane storage and sales, a recreational vehicle (RV) septic tank dump, and a storage building.

2.3.2 Historical Document Review

The following presents key information from Tetra Tech's historic review (Tetra Tech 2024). Tetra Tech's 2024 historical review includes a large number of attached documents such as city directory listings, maps, and aerial photographs. Tetra Tech refers the reader of this RIWP to Tetra Tech's 2024 historical review for those attached documents.

2.3.2.1 Historic Assessor Records

Historic assessor/appraisal records available from the Stevens County Historical Society document property uses, ownership, or management back to the early 1960s. Ownership or management of the facility included Signal Oil Service, Standard Oil Company, Humble Oil, Mr. L. M. Haag, Mr. Carroll Jeffrey Whitten, and Exxon. Early assessor records uncovered include commercial appraisal forms showing the facility with a gas station, a pump island and canopy, an office area supporting the station, a 16-foot by 36-foot "lean-to" structure, tire equipment, and a bulk plant with accompanying bulk plant building, tanks, and pump island.

Records document the gasoline station used different petroleum tanks than the bulk petroleum distribution plant. Two 12,000-gallon tanks and one 10,000-gallon tank are listed on one record as part of the bulk plant. A second record lists a possible 12,000-gallon tank, a possible 6,000-gallon tank, a 10,000-gallon tank, and 300 feet of 2-inch piping. These records also indicate the facility, either the gas station or bulk gas and oil distribution plant, were not always in operation.

Assessor records for 1995 were updated to show the facility with three FRP 10,000-gallon USTs and one FRP 6,000-gallon UST. A photo of the facility depicts it with an Exxon sign at the time. Building department records from 1997 indicate the store building with adjoining pump island was demolished and replaced with similar-sized building at nearly the same location, and new awning and pump island.

Tetra Tech also reviewed assessor records available for the former Fogle Pump & Supply property to the east, which is now part of the facility property. Those records indicate a large warehouse, and a triplex building once existed on the Fogle parcel(s). The triplex was torn down in 1986, and the large warehouse was removed in 2017. No tanks were found associated with the Fogle listings.

2.3.2.2 Historic Building Department Records

Tetra Tech reviewed City of Colville Building Department records during the 2024 historical review. City of Colville records for years 1991 through 2019 generally document activities associated with the former gas station area and the Fogle Pump & Supply portion of the facility property. **Table 2-3**, below, summarizes building record information.

Table 2-3. Building Record Review

Date	Details
1991	Install of northern fuel island
1995	Added two car wash bays to existing car wash facility
1996	Added parapet signage (Fogle)
1997	Building remodel (Fogle). Gas station building demolition and pump island and install C-store and island (center of facility property).
1998	Re-roof building (Fogle).
1999	Install metal pipe storage building and shed (Fogle).
2011	Repair station due to car damage.
2017	Building demolition (Fogle) and final framing inspection.
2018	Install new Whitty’s lighted sign, enclose the existing shed, add fuel dispensers, canopy, and bollards at propane tank.
2019	Enclose existing shed and extend car wash to include automated bay (Bay 6).

2.3.2.3 Fire Department Records – City of Colville

The City of Colville Fire Department provided two records associated with the facility. One incident occurred in August of 2020 when a propane refill valve froze up. It was tapped and the problem cleared up. A second incident occurred in March of 2019 where the department responded to a false alarm. Apparently, occupants were changing a battery and set off an alarm. It is notable no records for the facility report of a 1940s fire.

2.3.2.4 Historic Article Review

The following provides key chronologic information pertaining to the facility based on information reviewed in the Spokane Daily Chronicle newspaper archives dating from the 1940s through the 1970s (Tetra Tech 2024). The reader is referred to Tetra Tech’s historical review document (Tetra Tech 2024) for additional contextual information. **Table 2-4**, below, summarizes the historical review of articles.

Table 2-4. Historical Article Review

Date	Details
Spokane Daily Chronicle (newspaper)	
May 16, 1940	Mr. Roy Inman relinquishes interest in Western Auto Supply Store (nearby in Colville) to devote entire time to Signal Oil Station onsite.
May 23, 1941	Mr. Inman of Signal Oil Company Distribution made application for a permit to construct a 30-foot by 50-foot storage warehouse adjoining his station.

Date	Details
August 3, 1942	Mr. Inman, an agent of Signal Oil goes to Yukon to support construction of Alaska Highway. Mr. Inman takes his 1,000-gallon fuel truck to Seattle to embark for White Horse. Turns distribution accounts over to Mr. George Oakshott, who is the local Standard Oil Distributor. Inman's service station on West Fifth will be operated by Mrs. Inman and their daughters.
February 9, 1952	Mr. LaVern Bible leases Signal Service Station from Mr. William (Bill) Inman (son of Roy Inman).
July 5, 1952	Mr. Lawrence Haag buys Signal Oil Plant from Mr. Bill Inman.
December 11, 1965	The Colville City Council awards two contracts to supply city with petroleum. One contract was won by Pat Bryan and Son (Humble Oil) for supplying the city with approximately 15,000 gallons of regular gasoline during 1966.
December 27, 1965	Classified ad shows Signal Service Station for lease by Mr. Haag.
September 28, 1977	Article indicates Whitten Oil is filing for a license to sell beer and wine for home consumption at Whitten Oil in Colville. (Note: Supplementing records suggest the property was purchased by Mr. Carroll Whitten Jr. in 1973.)
Commercial Appraisal	
1964 – 1970s	This is part of commercial appraisal data from Stevens County Historical Archives. The facility is listed as Signal Oil Service, with Humble Oil Company, Standard Oil Company, and Exxon associated with the facility. It appears the on-site fueling station was Signal Oil and the bulk plant on the north side of the facility was managed by Standard Oil and later Humble Oil. Equipment listed in the appraisal included signs, bulk plant equipment, lube equipment, tanks, a hoist, three pumps, three 550-gallon underground tanks, a bulk plant building; apparent pipelines for gas, water, and air; a light post, a pump island, and a pump. Assessor lists L.M. Haag as a distributor. Some equipment owned by the operator, such as a floor jack, tire equipment, and tools. Notes suggest the service station portion of the facility was not in operation during some years, such as 1966. It is assumed the bulk plant was in operation during all years.

2.3.2.5 City Directory Review

Tetra Tech researched past uses of the facility through review of city directories, also referred to as reverse directories (i.e., R.L. Polk & Co. or Cole directories; Tetra Tech 2024). These directories document past occupants and sometimes operations. Tetra Tech contracted with Environmental Data Resources (EDR) to provide available city directory listings at periodic intervals. EDR provided available directory listings for the years of 1992 through 2020 (Tetra Tech 2024). The facility resides on the "even numbered" or northern side of the 300 block of addresses along W. 5th Avenue in Colville. **Table 2-5**, below, summarizes city directory review information.

Table 2-5. City Directory Review

Date	Details
1992	No occupants listed for the even numbers of the 300 block of W. 5th Avenue.

Date	Details
1995	Whitten Oil, Inc., and includes Whitty's Car Wash at the 370 and 380 W. 5th Avenue addresses, respectively. Fogle Pump is listed at 316 W. 5th Avenue (the parcel became part of the facility property in 2017).
2000	Whitty's Minimart and Fogle Pump & Supply.
2005	Whitty's Chevron Mini Mart and Fogle Pump & Supply.
2010	Whitty's Chevron and LDH Investments, Inc. (370 W. 5th Avenue) and Fogle Pump.
2014	Chevron Station Colville and Whitty's Chevron, and Fogle Pump.
2017	Chevron and Fogle Pump & Supply.
2020	ATM, Blue Rhino (propane), LDH Investments, Inc. and Whitty's Chevron (370 W. 5th Avenue). Fogle Pump & Supply was listed at 316 w. 5th Avenue; however, the property had been purchased and repurposed as LDH/Sood Family prior to 2020.

2.3.3 Topographic Maps

Tetra Tech's historic review (Tetra Tech 2024) included reviewed United States Geological Survey (USGS) topographic maps dated 1929, 1933, 1952, 1986, 1992, 2014, 2017, and 2020. These maps depicted the subject property resting at the northwest corner of the City of Colville, along or proximal to the primary highway that extends through town. The north-south railroad line of the Great Northern Railroad resides approximately 1,000 feet west of the facility. The 1929 topographic map showed numerous homes northeast of the facility. Swampy areas rest nearby to the west near the river and lumber mill. The facility may rest on former swampland that was elevated using fill. Minimal other distinguishing features were uncovered during topographic map review.

2.3.4 Historic Maps

Tetra Tech's historic review (Tetra Tech 2024) included review of maps such as Sanborn Fire Insurance Maps (Sanborn maps) and Metsker's Maps. Limited Sanborn maps were available that showed the facility parcels. Metsker's map years included 1933, 1941, 1950, 1956, and 1973; 2) an historic plat map of the City of Colville dated circa 1940s; and 3) a Record of Survey completed by Mid-Mountain Surveyors in 2017.

Sanborn maps updated in 1940 suggest a gasoline service station first appeared onsite during the 1930s and noted the presence of an automobile service and oil warehouse along the southwestern edge of curve of W. 5th Avenue curve. At the time, W. 5th Avenue was also known as the Colville – Kettle Falls Highway. Cabins formerly occupied the west side of the facility in the 1940s and later became a triplex in the 1960s and 1970s. The east side of the current facility was once Fogle Pump. **Table 2-6**, below, summarizes information from the historical map review.

Table 2-6. Historical Map Review

Source	Date	Details
Metsker's Map	1933	The map does not show facility property development. Inland Empire Highway adjoining on the south.

Source	Date	Details
Map of Colville	1940s	This map is a blueprint of the city plat and shows Block 2 of Hammonds Addition. The map does not show development on the facility property. No development is shown; however, all 12 lots are shown, where each lot is roughly 30 feet wide and 130 feet long. The original Signal facility occupied the northern portion of Lots 4, 5, and 6, plus a portion of Block 2 of the Spokane Addition to the south. This includes an area approximately 90 feet east-west by perhaps 150 feet north-south.
Metsker's Map	1941	No development was depicted on the map. The former highway adjoining on the south is now listed as W. 5th Avenue.
Metsker's Map	1950, 1956, 1973	The maps showed no significant changes from the 1941 map.
Facility Survey by Mid-Mountain Surveyors, Inc.	2017	The subject property is shown with current buildings but only shows two of the three pump islands currently present (as of at least 2024). A warehouse proximal to the northeast corner of the property is listed as "garage" and is slightly offsite.

2.3.5 Historical Aerial Photographs

Tetra Tech 2024 reviewed historical aerial photographs covering the facility area for the years 1946, 1953, 1958, 1962, 1974, 1983, 1992, 1995, 1998, 2006, 2011, 2015, and 2019. The following summarizes observations made. **Table 2-7**, below, present a review of historical aerial photographs.

Table 2-7. Historical Aerial Photograph Review

Date	Details
1946	The map shows the gas and oil building observed during Sanborn map review. North of the structure is the possible bulk plant, and west of the structure are smaller structures that appear to be small cabins. East of the structure is a building that may be the Allis-Chalmers building, which eventually became Fogle Pump & Supply. The northern edge of the facility property appears to include a row of housing or warehouses.
1953	The area remains similar to the 1946 photograph, except the cabins on the west side of the facility property appear to have been removed and replaced and a large warehouse structure or triplex.
1958	No significant changes were noted from the 1953 photograph.
1962	The facility property appears to include the original gas and oil structures, the lean-to shed connected to the north of the original building, a warehouse to the east, warehouses or buildings to the north, apparent residences to the northwest, and a larger warehouse along the property's southern/western boundary. It appears the warehouse to the east, possibly once built to support facility operations, eventually became Fogle Pump & Supply.
1974	The photograph is in infrared, and it is difficult to discern details. However, significant changes to the site were not apparent from view.

Date	Details
1983	On the photo, the subject property can be seen with the original pump island and canopy to the south, warehouse to the north, warehouses to the east (possibly Fogle Pump & Supply at the time), and a long warehouse to the west. Mature vegetation and possible residences can be seen on the north side of the subject property at the time. It should be noted the station building onsite at the time is not the same building that exists today.
1992	Details in the photograph are difficult to discern.
1995	The facility is beginning to resemble the current site configuration. The new (existing) tank basin, gasoline station and canopy, and the card lock facility to the north are discernible. East of the facility are several structures that may be operated by Fogle Pump & Supply at the time. The structures on the western end of the subject property were removed (circa 1987) and replaced with a car wash structure.
1998	The facility appears relatively unchanged from the 1995 photograph except the car wash building appears to have expanded.
2006	The facility appears generally unchanged from prior photograph. However, it is suspected the gasoline station building was removed and replaced with a similar structure. The east-adjoining Fogle Pump & Supply building and warehouses remain.
2011, 2015	No significant changes were discernible from the 2006 photograph.
2019	The facility appears generally as observed during Tetra Tech's 2024 site reconnaissance. The property includes the gas station and convenience store building, a car wash to the west, a UST basin southwest of the store, two pump islands to the south and southeast, an elongated warehouse to the northeast, and the cardlock facility to the north, and the propane distribution tank on the eastern side of the facility.

2.4 CURRENT UTILITIES AND INFRASTRUCTURE

Tetra Tech anticipates utilities to primarily run within the W. 6th Avenue right-of-way (ROW) adjoining the facility on the north. A 1990 map prepared by Delta Environmental Consultants, Inc. (Delta 1990) shows water, gas, sewer and electricity lines running parallel and north of the facility within the W. 6th Avenue ROW. Delta's 1990 map shows one electrical line within the facility boundary running parallel to W. 6th Avenue and sewer, electric, gas, and water lines running from north to south into the property to the car wash and a water line to the car wash and prior store/office building.

Tetra Tech anticipates that the lines along W. 6th Avenue are likely still present. Additional local lines that extend to subject property buildings from the main lines along W. 6th Avenue and local lines utility and product piping lines that run between buildings, pump islands, tanks, and the car wash are likely.

The following lists the current key infrastructure at the facility. **Figure 2** (**Appendix A**) shows the features.

- **Convenience store**: The current convenience store (market) resides in the south-central portion of the facility. The existing convenience store overlays the northern portion of the prior store footprint. Adjoining the store on the south is a concrete pad followed by pump island #1. Currently four fuel USTs reside in a tank basin installed in 1989 and adjoin the store on the southwest.
- **Storage warehouse with shed**: A large storage warehouse occupies the northeast corner of the facility. The warehouse adjoins the southwest intersection corner of W. 6th Avenue and N. Washington Street. A small shed adjoins the southwest corner of the warehouse.

- **Car wash:** A car wash covers a large area of the west central portion of the facility. The car wash has self-service bays and automatic car wash bay. The self-service bays occupy the western portion of the building, and the automatic car wash occupies the east end. A sump for the car wash resides on at the southwest corner of the car wash. Drainage from the sump appears to flow to a low area at the northwest corner of the property (southeast intersection corner of W. 6th Avenue and N. Lincoln Street).
- **Pump Islands:** The facility has four pump islands with overhead canopy structures.
  - Pump island #1 adjoins N. 5th Street on the north and the convenience store on the south.
  - Pump island #2 resides at the southeastern corner of the facility and adjoins W. 5th Avenue on the north and N. Washington Street on the west.
  - Pump island #3 resides in the north central portion of the facility, along with adjoining pump island #4. Pump island #3 is located northeast of the northeast corner of the car wash northeast of the car wash and north of the convenience store. Pump island #s is near the northeast corner of the car wash.
  - Pump island #4 adjoins W. 6th Avenue on the south and adjoins pump island #3 on the north.
- **UST basin (nest):** The current fuel USTs reside southwest of the convenience store building and adjoins W. 5th Avenue on the north. Four USTs occupy the tank basin. Three of the USTs hold 10,000-gallons of fuel and measure 8 feet by 27 feet in size. One UST holds 6,000 gallons of fuel and measures 8 feet by 16 feet in size.

  Vent lines for the tank basin run from south to north along the east side of the basin and extend to the southeast corner of the car wash where they attach to the building. Two UST monitoring points were installed in the tank are labeled CW-1 and CW-2. Tetra Tech believes these monitoring points were installed in tank basin backfill material to monitor for potential releases from the USTs, rather than for sampling as groundwater monitoring.

  From north to south, these operational USTs include the following:
  - UST #1 is a 10,000-gallon tank with regular gasoline.
  - UST #2 is a 10,000-gallon tank with off-road diesel.
  - UST #3 is a 6,000-gallon tank with supreme unleaded gasoline.
  - UST #4 is a 10,000-gallon tank with on-road diesel.
- **Other tanks:** Other existing facility tanks include a 3,000-gallon diesel exhaust fluid (DEF) UST that adjoins the south side of pump island #3 and an above-ground propane tank located west of the convenience store.

The ground surface of the facility is paved with asphalt. Concrete provides the driving / parking surface for the pump islands, covers the UST basin and DEF tank, and surrounds a portion of the convenience store.

2.5 CURRENT AND FUTURE LAND USE

Current land use is as a vehicle fueling, car wash, and convenience store facility. Future use is anticipated to remain as a vehicle fueling, car wash, and convenience store for the foreseeable future.

2.6 REGULATORY HISTORY

Tetra Tech obtained current environmental records of the facility and vicinity by contracting with EDR to conduct a search for records available for the facility and surrounding area and through an Ecology Public Records Request (PRR) (Tetra Tech 2024). Tetra Tech obtained approximately 100 records from Ecology, which were cataloged, reviewed, and summarized in a spreadsheet in Tetra Tech's 2024 historic records review. The following summarizes key information obtained during regulatory records review.

2.6.1 EDR Regulatory Record Review

2.6.1.1 Facility Regulatory Records

Table 2-8, below, lists the regulatory records that list the facility, Whitten Oil #1, identified through EDR's database search. **Table 2-8**, below, summarizes information obtained from EDR for the facility.

Table 2-8. Facility Regulatory Review

Database	Information Provided in Listing
Washington Recovered Government Archive (WA RGA)	WA RGA lists the facility for years 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, and 2010.
Leaking Underground Storage Tank (LUST)	LUST lists the facility for years 1995, 2011, and 2012
EDR Historical Auto Service Stations	Facility listed years of 1985, 1986, 1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996 under Whitten Oil, Inc. and in 2009 and 2010 under LDH Investments, Inc.
WA SPILLS	Spill is related to an on-site release of 20-gallons of diesel or marine gas oil on August 23, 2013. Reportedly the spill, which is considered historic, originated from a truck located over an impermeable surface.
UST FINDER and UST FINDER RELEASE	Lists the facility as having four open USTs and seven closed USTs. The listing appears accurate with respect to the UST installation and closure event that took place in 1989.
Washington Voluntary Cleanup Program (VCP)	Lists the facility as having cleanup started and as having participated on the VCP in the past. The facility is ranked a 4 (WARM) on Ecology's databases, where a 1 is of greatest concern and 5 is of least concern.
Washington ALLSITES. ALLSITES	Lists show the site as a LUST facility in the 1989/1990 timeframe, and as a UST facility beginning in 2000.
Washington Financial Assurance	The database lists Colony Insurance as an insurer for certain dates up through present.
Washington Hazardous Sites List (HSL)	The facility and two additional sites are on the HSL.
Washington Confirmed and Suspected Contaminated Sites List (CSCSL)	The facility and several additional sites nearby are on the CSCSL.
Washington LUST	The subject property and seven additional nearby sites were found with leaking tanks.
Washington UST	The Washington UST database listed the following tanks associated with the facility
Former USTs (Delta 1990)	
Delta documented the tanks as follows:	

Database	Information Provided in Listing
	- Tank 1 – Single wall steel tank of unknown age. Size estimated at 500-1,000 gallons. Used for gasoline (removed 1989) - Tank 2 – Single wall steel tank of unknown age. Size estimated at 550 gallons. Used for gasoline (removed 1989) - Tank 3 – Single wall steel tank of unknown age. Size estimated at 550 gallons. Used for gasoline (removed 1989) - Tank 4 – Single wall double-compartment steel tank of unknown age. Size estimated at 12,000-gallon total. Use for gasoline and diesel (closed-in-place under building in 1989). Reported to have leaked* - Tank 5 – Single wall steel tank of unknown age. Size estimated at 10,000 gallons. Used for diesel (removed 1989) - Tank 6 – Single wall steel tank of unknown age. Size estimated at 12,000 gallons. Used for gasoline (removed 1989) - Tank 7 – Single wall steel tank of unknown age and size and contents. Size anticipated to be smaller. ***Note:** Based on site photos and prior reports, most if not all of the above tanks leaked.*
Existing USTs	
	Delta documented the current tanks as follows. These correspond with current tank basin UST #s 1, 2, 3, 4 shown on **Figure 2**. - Tank 8 (New Tank 1) – a 10,000-gallon single-wall FRP tank with gasoline (operational). - Tank 9 (New Tank 2) – a 10,000-gallon single-wall FRP tank with off-road diesel (operational). - Tank 10 (New Tank 3) – a 6,000-gallon single-wall fiberglass (FRP) tank with supreme unleaded (operational) - Tank 11 (New Tank 4) – a 10,000-gallon single-wall FRP tank with on-road diesel (operational)* ***Note:** Former tank names varied throughout historic documents.*

The HSL, CSCSL, and LUST listings indicate cleanup has started. These database listings appear to relate to releases discovered or confirmed on August 10, 1989.

2.6.1.2 Adjoining and Nearby Properties Records Review

EDR also searched regulatory records for adjoining and nearby properties. EDR Site A12, Colville Maintenance at 440 N. HWY (Tetra Tech 2024) adjoins the facility to the west across N. Lincoln Street. Tetra Tech did not uncover evidence through the historic review that suggested releases on adjoining or nearby regulatory sites have impacted or are likely to impact the facility except for the Hartman Oil (a.k.a., Conoco, Busch Distributors, Sunset Mart) located at 285 W. 5th Avenue.

Hartman Oil is roughly 150 feet east-southeast and in a hydraulically upgradient location from the facility. Hartman Oil has a history similar to that of the facility; it has operated as a gasoline station with multiple past tanks and small bulk fuel storage site. Hartman Oil is listed on the Washington Independent Cleanup Reports (WA ICR), VCP, HSL, CSCSL, LUST, UST, ALLSTES, FINDS, UST Finder, UST Finder Release, EDR Historical Auto, and Washington Manifest databases.

Hartman Oil appears to 1) be a state cleanup site, 2) have received an enforcement order from Ecology, 3) impacted soil and groundwater. The site is listed as undergoing monitoring currently and ranks a 3 on the 1-5 WARM ranking method used by Ecology.

Hartman Oil is considered a potential concern to the facility due to existing releases, hydraulic upgradient proximity to the facility, and potential for migration of contaminants. Further investigation and possible sampling would be necessary to assess whether releases from the nearby Hartman Oil have affected the facility.

2.6.1.3 Orphan / Unmappable Sites

Orphan or "unmappable" sites were also examined in the EDR report. Several sites were found in the greater vicinity that do not appear would significantly affect the subject property. Also, it should be noted that Whitten Oil was also found listed on the unmappable "orphan sites" list in the EDR report, likely resulting from its listing vaguely at "W. 5th" with no address number at one time.

2.6.2 Ecology Records Review

Ecology provided Tetra Tech with roughly 100 prior reports or records pertaining to the facility in responds to the PRR. Tetra Tech's historic review document provides a chronological list of the documents (Tetra Tech 2024). The following provides a summary of the information in those documents.

In December 2023, Ecology sent letters to Whitty's LLC (LDH) and to Whitten Oil, Inc., to inform each party of pending liability with respect to the release of petroleum on the subject property (Ecology 2023). According to Ecology's 2023 letter, soil and groundwater samples collected at the facility since 1990 demonstrate that concentrations of petroleum hydrocarbons and volatile organic compounds (VOCs) exceed MTCA cleanup levels. Further, the letter suggests that the "release has potentially migrated from the source property and into residential properties" and that the release poses a threat to human health and the environment through various routes of exposure. It appears Ecology based its opinion on the results from former and recent groundwater monitoring, including the unresolved releases of the past and the anomalously elevated results discovered in groundwater samples collected by Fulcrum from monitoring well MW-7 in September of 2023.

2.6.2.1 Initial UST Removal and Assessment Work

Tetra Tech's review of Ecology reports indicated significant petroleum contamination was discovered in soil and groundwater during removal and installation of underground storage tanks in 1989. Seven (7) steel USTs were closed at the time. Six of those USTs were removed, and the former 12,000 two-compartment (diesel/gasoline) UST was closed in place and was reportedly leaking (**Figure 2**, former UST #4). This UST may remain under the northern wall of the current convenience store. Approximately 1,200 cubic yards of petroleum contaminated soil was removed at the time of tank closure work of the removed tanks. However, contamination remained in outlying soil and in groundwater. Contamination is also expected to remain in soil and possibly groundwater in the area proximal to former tank #4.

Delta investigated the facility further in March of 1990. Delta installed six borings, five of which were completed as groundwater monitoring wells (MWs 1, 2, 3, 4, and 6). Delta sampled soil from borings SB-2, SB-4, and SB-5, and groundwater from the five newly installed wells. Soil collected and analyzed from SB-5 and groundwater collected and analyzed from wells MW-2, MW-3, and MW-6 exhibited petroleum hydrocarbon contamination. Notes in Delta's 1990 report imply that a well at SB-5 was dry.

It should be noted that boring SB-2 (later monitoring well MW-2) appeared to be constructed in backfill associated with the UST and contaminated soil removal work north and west of the gas station building. Installing wells in recent excavation backfill is unusual and can lead to misleading results. At the time of this 1990, the highest concentration of petroleum contaminants in groundwater were found at MW-2. The benzene concentration (1,643 µg/L (micrograms per liter) exceeding the 5 µg/L cleanup level. Delta did not sample the tank basin monitoring points, CW-1 and CW-2, located at opposite ends of the UST basin. Tetra Tech did not find any well construction data related to CW-1 or CW-2 during the 2024 historic records review. Tetra Tech suspects CW-1 and CW-2 are monitoring points typically used to observe the tank basin for potential releases, rather than groundwater monitoring wells.

Delta indicated at the time of the 1990 work that remaining soil contamination posed little threat to humans or the environment, and that dissolved phase hydrocarbons in groundwater appeared to be restricted to the immediate vicinity of the former UST basin (Delta 1990). However, Tetra Tech believes that additional characterization is warranted to support this statement.

According to Fulcrum Environmental Consultants (Fulcrum; Whitten's consultant) a company called Northwest Environmental Solutions, Inc. (NES) completed soil borings and soil sampling in December 2005 to facilitate a change in ownership for the subject site to LDS Investments (Fulcrum 2023). Five soil borings were advanced to depths of 5 to 15 feet below ground surface (bgs). One soil sample was collected from the terminus of each boring. The results from analysis of five soil samples reportedly showed concentrations of petroleum hydrocarbons but concentrations were below MTCA cleanup levels (Fulcrum 2023). It is unknown whether a photoionization detector (PID) was used during soil screening. Other questions remain. The NES report was not provided by Ecology, so it is unknown whether Ecology has reviewed this document. Tetra Tech recommends full review of the NES report, if available.

In April of 2011, Ecology UST Inspector Mr. Doug Ladwig conducted an initial investigation that included review of prior site records. Mr. Ladwig focused on reports of the 1989 UST removal and 1990 site characterization work completed by Delta. Mr. Ladwig concluded that an Ecology SHA should be completed, based in part on information in Delta's report indicating the near surface groundwater table was left impacted with petroleum originating from former USTs.

Ecology completed the SHA in 2013. The SHA indicated "seven (7) USTs were removed, and a 12,000-gallon dual compartment tank located under the store/office building was left in place." The SHA ranked the facility a 4, where 1 represents a site with the greatest concern and 5 represents a site with the least concern. In conclusion, while the releases identified by Delta and Mr. Ladwig were left unresolved, Ecology indicated the right to initiate further investigation if new information indicates a potential or actual threat to human health or the environment.

Some discrepancies were noted within the SHA of 2013. Primarily, the number of USTs removed or closed appears different. The 2013 SHA indicates there were eight (8) prior facility USTs. The 1990 Delta Phase I Environmental Site Assessment contended there were seven (7) closed and/or removed USTs in 1989, and four new USTs were installed during that timeframe (11 tanks total). Tetra Tech presumes that seven USTs had been installed leading up to the 1989 closure activities, where one tank was a dual compartment tank. It is possible the 12,000-gallon dual gasoline/diesel UST resulted in confusion in the number of tanks. Current Ecology records indicate: 1) seven closed USTs, where six were removed and the one dual gasoline/diesel UST was closed in place, and 2) four current, operational USTs were installed in 1989 and are present in the tank basin southwest of the convenience store.

Later in 2013, a release of approximately 20 gallons of diesel occurred from a commercial truck. The spill reportedly occurred over an impermeable surface along the road nearby the facility. Incident report data forwarded by Ecology indicated the fire and road department used absorbent material and swept the roadway. No impacts to drains or waterways were identified. Ecology designated this release as "no further action required."

Prior UST inspections and/or tightness tests were examined from the early 1990s through the present. Some tests did not include all the tanks. In one instance a repair was required of a detector, in another instance monitoring was required for several months as there was not enough product to measure while an inspector was onsite. On a third instance, the spill buckets failed inspection. While these and other minor concerns were noted, no evidence of a significant release was discovered during review of prior inspections and tests.

Until 2017 the eastern portion of the property included a pump repair and sales facility called Fogle Pump, which shared the current block of land with the facility. No USTs, fueling, or releases were identified in association with Fogle Pump during historic and regulatory records review. It also appears Fogle operated a triplex apartment on the western portion property through the mid-1980s.

2.6.2.2 Fulcrum Investigations

Ecology provided many records of recent work completed by Fulcrum of Spokane, Washington. Based on Tetra Tech's review, it appears Fulcrum was initially retained by the current and past property owners in 2017 to help guide the facility through Ecology's VCP in pursuit of an eventual "no further action" determination. Fulcrum reportedly completed semi-annual groundwater sampling at the facility from 2017 through March of 2024.

The 2017 groundwater sampling by Fulcrum was an effort to assess the presence of benzene, toluene, ethylbenzene and total xylenes (BTEX) and gasoline-range total petroleum hydrocarbons (TPH-Gx). Fulcrum did not initially include analysis for diesel-range total petroleum hydrocarbons (TPH-Dx). From 2017 to 2020, Fulcrum personnel sampled groundwater from the original Delta-installed wells MW-3, MW-4, and MW-6, and also from the two UST basin observation points (CW-1 and CW-2). Of note, Fulcrum could not locate MW-1 and MW-2 in 2017; it was anticipated that these two wells had been paved-over with asphalt.

In 2020, Fulcrum installed a new groundwater monitoring well to replace MW-2. Fulcrum also installed replacement wells for MW-4 and MW-6 because they reported that these two wells had poor surface seals and were slow to recharge. Fulcrum also installed groundwater monitoring well MW-7 in the west end of the facility. Fulcrum samples the two observation points and five groundwater monitoring wells regularly from 2020 to the present. The monitoring locations include CW-1, CW-2, MW-2, MW-3, MW-4, MW-6, and MW-7. Of note: Fulcrum previously used the designation "MW-7" to designate blind field groundwater duplicate samples. Once monitoring well MW-7 was installed, the blind duplicate sample name was changed to "MW-8".

Fulcrum stated the following observations related to facility groundwater conditions:

- Monitoring data shows a trend of increased contaminant concentrations and areal extent that is inconsistent with ongoing degradation of a 1989 spill.
- Review of data from 2017 to present shows an increasing trend in both concentration and areal extent of petroleum hydrocarbons in groundwater.
- Results of this monitoring and trending data indicate a potential new release or releases of petroleum has or is occurring.

Fulcrum found the following with respect to water data collected from tank basin observation point CW-2:

- From 2018 to 2019, water sampled from location CW-2 exhibited low to non-detect concentrations of gasoline.
- From 2020-2021, Fulcrum reported an apparent increase in TPH-Gx with a chemical composition that appeared indicative of old, weathered gasoline.
- In September of 2022, Fulcrum noted a possible change in water chemistry that included detections of diesel.
- Fulcrum's analytical laboratory (Fremont) reported that the nature of hydrocarbons in water indicated a potential new release occurred after the March 2022 sampling event.

Table 2-9, below, summarizes results for monitoring conducted by Fulcrum from 2017 to March 2024.

Table 2-9. Fulcrum Monitoring Summary

Date	Data Summary
September 2017	Monitoring wells CW-1, CW-2, MW-3, MW-4, and MW-6 were sampled and analyzed for VOCs BTEX and for total petroleum hydrocarbons in the gasoline range (NWTPH-Gx or just TPH-Gx). Petroleum contaminants were found in MW-3 and MW-4 that did not exceed MTCA Method A Cleanup Levels (cleanup levels or CULs, as listed on Table 720-1 in MTCA statute and regulation, 173-340 WAC). Fulcrum recommended continued sampling.
December 2017	Monitoring wells CW-1, CW-2, MW-3, and MW-4 were sampled and analyzed for BTEX and TPH-Gx. MW-6 was found frozen with ice and was not sampled at the time. Petroleum contaminants were found in both MW-3 and MW-4. MW-4 was found with 6.81 µg/L (micrograms per liter, parts-per-billion, or ppb) of benzene, a concentration exceeding the 5 µg/L cleanup level. Fulcrum recommended continued sampling.
March 2018	Monitoring wells CW-1, CW-2, MW-3, MW-4, and MW-6 were sampled and analyzed for BTEX and TPH-Gx. Petroleum contaminants were found in MW-4 and MW-6 that did not exceed cleanup levels. Fulcrum recommended continued sampling.
June 2018	Monitoring wells CW-1, CW-2, MW-3, MW-4, and MW-6 were sampled and analyzed for BTEX and for TPH-Gx. Petroleum contaminants were found in MW-4 and MW-6. MW-4 was found with 5.84 µg/L of benzene, a concentration exceeding the 5 µg/L cleanup level. Fulcrum recommended continued sampling.
September 2018	Summarization data was uncovered for the September 2018 sampling event from Fulcrum's March 2020 groundwater monitoring report. The March 2020 report indicates MW-4 was found with 3,530 µg/L of NWTPH-Dx (diesel range; total diesel and oil) and 7.25 µg/L of benzene during the September 2018 event, exceeding respective cleanup levels of 500 and 5 µg/L. ***Note:*** *This is the first time Fulcrum's analysis included diesel-range hydrocarbons. It is unclear if silica gel cleanup standards were used. Silica gel cleanup can be used to distinguish the contribution from naturally occurring organic matter and polar metabolites (formed during weathering) in the NWTPH-Dx analysis.*
March 2019	Summarizing data was uncovered for the March 2019 sampling event from Fulcrum's March 2020 groundwater monitoring report. The March 2020 report indicates MW-4 was found with 596 µg/L of TPH-Dx, exceeding the 500 µg/L cleanup level. Groundwater from the same well was found with 4.46 µg/L of benzene during that timeframe, which does not exceed the 5 µg/L cleanup level.
September 2019	Monitoring wells CW-1, CW-2, MW-3, MW-4, and MW-6 were sampled and analyzed for BTEX, TPH-Gx, and for TPH-Dx. Petroleum contaminants were found in CW-1, MW-3, MW-4, and MW-6 (four out of five wells). MW-4 was found with 5.06 µg/L of benzene, a concentration exceeding the 5 µg/L cleanup level. MW-6 was found with TPH-Dx totaling 1,440 µg/L, exceeding the 500 µg/L cleanup level. Fulcrum recommended continued sampling.
March 2020	Monitoring wells CW-1, CW-2, MW-3, MW-4, and MW-6 were sampled and analyzed for BTEX, TPH-Gx, and for TPH-Dx. Petroleum contaminants were found in CW-2, MW-3, MW-4, and MW-6 (all but CW-1). MW-4 was found with 552 µg/L of TPH-Dx and MW-6 was found with a 1,580 µg/L of TPH-Dx, both of which exceed the 500 µg/L cleanup level. It is notable no benzene exceedances were identified; that filtration was applied to some samples with

Date	Data Summary
	entrained sediments; and that "heavy fuel oil" was identified in the diesel and heavy oil ranges in samples. Fulcrum recommended continued sampling.
September / October 2020	Monitoring wells MW-4 and MW-6 were decommissioned due to reported failing surface seals and poor recharge rates, and four new wells were installed onsite. The original MW-2 and MW-1 were never located and are suspected paved over. New wells installed by Fulcrum include a new MW-2, a new MW-4, a new MW-6, and an MW-7. Of those, the new MW-2, new MW-4, and new MW-6 appear placed somewhat proximal to the former locations of old wells with the same respective names. However, using the same well nomenclature can complicate comparison with prior groundwater sampling, flow, and elevation data. The new wells (MW-2, MW-4, MW-6, and MW-7) add to the existing network of three wells CW-1, CW-2, and MW-3 that were installed in 1989 or 1990. There are now a total of seven wells onsite. Composite soil samples were collected from drums of drill cuttings, and composite water samples were collected from the two drums of purge water. Samples were generally analyzed for BTEX, TPH-Gx, and for TPH-Dx. It appears no soil samples were collected from depth during soil boring or installation of new wells. It is unknown if field instruments such as a PID were used to help guide sampling. Groundwater analytical results from the September/October event indicated all wells but MW-3 include some concentration of petroleum. Well CW-2 was found with a combined (diesel and oil) TPH-Dx concentration of 5,347 µg/L, and the new MW-4 was found to have a concentration of 707 µg/L of TPH-Dx, which exceeds the cleanup level of 500 µg/L. Both of those wells also exceeded cleanup levels for TPH-Gx and benzene. The report suggests fluctuating concentrations of petroleum in groundwater may be associated with high and low groundwater elevations. Well MW-6 was also noted as in need of repair. Fulcrum recommended continued sampling.
March 2021	Monitoring wells CW-1, CW-2, new MW-2, MW-3, new MW-4, and new MW-6, and the recently installed MW-7 were sampled and analyzed for BTEX, TPH-Gx, and for TPH-Dx. These wells are hereinafter just MW-2 (dropping the "new" for example); however, comparing prior results with wells of similar names through time may be misleading. Petroleum was found in all wells but CW-1 and its blind duplicate, where blind field duplicates are now labeled "MW-8". Combined TPH-Dx concentrations exceeding the 500 µg/L cleanup level were identified by the report in MW-2 (3,834 µg/L), MW-4 (1,461 µg/L), and MW-6 (500 ug/l – technically not an exceedance). A concentration of TPH-Gx exceeding the 800 µg/L cleanup level was found in MW-4 (1,740 µg/L), and concentrations of benzene exceeding the 5 µg/L cleanup level were found in wells MW-2 (8.04 µg/L) and MW-4 (µg/L). Note: It is observed that levels of oil versus diesel in samples undergoing TPH-Dx analysis seem to vary greatly.
September 2021	Monitoring wells CW-1, CW-2, MW-2, MW-3, MW-4, MW-6, and MW-7 were sampled, and groundwater was analyzed for BTEX, TPH-Gx, and for TPH-Dx. Petroleum was found in all wells. Combined TPH-Dx concentrations exceeding the 500 µg/L cleanup level were identified by the report in MW-2 (1.010 µg/L), MW-4 (1,580 µg/L), and MW-6 (597 ug/l). Concentrations of TPH-Gx exceeding the 800 µg/L cleanup level were found in MW-4 (2,050 µg/L) and MW-2 (872 µg/L), and a concentration of benzene exceeding the 5 µg/L cleanup level was found in well MW-4 (128 µg/L). Elevated but consistent concentrations of diesel and gasoline are

Date	Data Summary
	identified in groundwater at MW-4, which along with CW-2 appears downgradient from the closed-in-place UST, which is perhaps a source. Fulcrum recommended continued sampling
March 2022	Monitoring wells CW-1, CW-2, MW-2, MW-3, MW-4, MW-6, and MW-7 were sampled, and groundwater was analyzed for BTEX, TPH-Gx, and for TPH-Dx. Petroleum was found in all wells. Combined TPH-Dx concentrations exceeding the 500 µg/L cleanup level were identified by the report in CW-2 (703 µg/L), MW-2 (1.175 µg/L), MW-3 (913 µg/L), MW-4 (1,130 µg/L), and MW-6 (600 ug/l). Concentrations of TPH-Gx exceeding the 800 µg/L cleanup level were found in MW-4 (1,840 µg/L) and MW-2 (828 µg/L), and a concentration of benzene exceeding the 5 µg/L cleanup level was found in well MW-4 (68.7 µg/L). Fulcrum recommended continued sampling.
September 2022	September 2022 data presented in the March of 2023 report suggests slight increases to the results found in March 2022. Results for prior sampling events were found visually harder to interpret after Fulcrum switched to using three-dimensional graphs by the timeframe of the March 2023 report.
March 2023	Monitoring wells CW-1, CW-2, MW-2, MW-3, MW-4, MW-6, and MW-7 were sampled, and groundwater was analyzed for BTEX, TPH-Gx, and for TPH-Dx. Petroleum was found in all wells. Combined TPH-Dx concentrations exceeding the 500 µg/L cleanup level were identified by the report in MW-2 (1,250 µg/L), MW-3 (518 µg/L), and MW-4 (1,250 µg/L). Concentrations of TPH-Gx exceeding the 800 µg/L cleanup level were found only in MW-4 (1,180 µg/L), and concentrations of benzene exceeding the 5 µg/L cleanup level were found in wells CW-1 (6.05 µg/L), CW-2 (104 µg/L), MW-3 (88.3 µg/L), and MW-4 (70.2 µg/L). It is notable that nearly all wells, except MW-7, exhibited some concentration of benzene. Fulcrum recommended continued sampling.
September 2023	Monitoring wells CW-1, CW-2, MW-2, MW-3, MW-4, MW-6, and MW-7 were sampled, and groundwater was analyzed for BTEX, TPH-Gx, and for TPH-Dx. Petroleum was found in all wells. Combined TPH-Dx concentrations exceeding the 500 µg/L cleanup level were identified by the report in CW-2 (719 µg/L), MW-02 (1,070 µg/L), MW-3 (521 µg/L), MW-4 (1,710 µg/L), and a significant concentration in MW-7 (34,100 µg/L). Concentrations of TPH-Gx exceeding the 800 µg/L cleanup level were found only in MW-4 (1,190 µg/L); however, concentrations of benzene exceeding the 5 µg/L cleanup level were found in wells CW-2 (75.1 µg/L), MW-3 (15.3 µg/L), and MW-4 (177 µg/L). ***Note:*** *It is notable groundwater with elevated diesel that was analyzed from MW-7 required 10 dilutions, that results had elevated detection limits, and that no trace heavy oil or BTEX was uncovered. The quality of this sample and analysis is in question and further discussion with Fulcrum and the laboratory should be completed, or a second sampling event may be necessary to determine whether this concentration is reliable. Also, nearly all wells, except MW-6 and MW-7, exhibited some concentration of benzene. Fulcrum indicates new contaminant sources may be responsible for elevated levels of petroleum in wells CW-2 (elevated benzene) and MW-7 (high levels of diesel), and it recommended additional investigation.*
March 2024	Monitoring wells CW-1, CW-2, MW-2, MW-3, MW-4, and MW-6 were sampled; however, MW-7 was not sampled. Groundwater from wells was analyzed for BTEX, TPH-Gx, and for TPH-Dx. Petroleum was found in all wells sampled. Combined TPH-Dx concentrations exceeding the

Date	Data Summary
	500 µg/L cleanup level were identified by the report in CW-02 (15,510 µg/L), MW-02 (738 µg/L), MW-3 (590 µg/L), and MW-4 (1,050 µg/L). Concentrations of TPH-Gx exceeding the 800 µg/L cleanup level were found only in MW-4 (1,270 µg/L); however, concentrations of benzene exceeding the 5 µg/L cleanup level were found in wells CW-2 (20.1 µg/L), MW-03 (40.6 µg/L), and MW-4 (95.8 µg/L). ***Note:*** *It is notable that the primary concern from the last event included the high concentration of diesel at MW-7. That well was not sampled this round. Fulcrum states the well was found inundated with sediment that prevented sampling. Also, according to Fulcrum, a spike in well CW-2 was found with diesel and oil-range hydrocarbons, with the majority of the wells showing a leveling off of increased concentrations.*
September 2024	Monitoring wells CW-1, CW-2, MW-2, MW-3, MW-4, and MW-6 were sampled; however, MW-7 was again not sampled, which is reportedly due to damaged well conditions. Groundwater from other wells was analyzed for BTEX, TPH-Gx, and for TPH-Dx. Petroleum was found in all wells sampled. Combined TPH-Dx concentrations exceeding the 500 µg/L cleanup level were identified by the report in CW-02 (6,350 µg/L) and in the field duplicate “MW-8” (a dupe of CW-2 at 5,210 µg/L), MW-02 (791 µg/L), and MW-4 (1,350 µg/L). Diesel at MW-3 (349 µg/L) was found below cleanup levels, Concentrations of TPH-Gx exceeding the 800 µg/L cleanup level were found only in MW-4 (967 µg/L); however, concentrations of benzene exceeding the 5 µg/L cleanup level were found in wells MW-03 (9.51 µg/L), and MW-4 (95.5 µg/L). According to Fulcrum, all monitoring wells display a decrease in gasoline concentrations compared to historical data. Diesel and oil-range concentrations were reported to increase in MW-02, MW-04, and MW-06. Concentrations of heavy petroleum appears to have decreased in wells MW-3 and CW-2.

2.7 CULTURAL RESOURCES

Tetra Tech does not anticipate significant cultural resources to be present at the facility. Development of the facility and surrounding area occurred sometime prior to 1940, with construction of the adjoining highway (W. 5th Avenue) and development of properties in the surrounding area having occurred since at least 1929. The current facility is mostly paved. The several on-site structures were constructed within the past 50 years and are not considered eligible for listing on the National Register of Historic Places. While the property does not appear to include cultural resources, it is possible further assessment, or evaluation may be required during excavation or drilling activities.

3.0 PHYSICAL SETTING

3.1 CLIMATE

According to the 1982 U.S. Soil Conservation Service (SCS) Soil Survey of Stevens County [now the Natural Resources Conservation Service (NRCS)], the local climate includes warm summers; hot in the valleys and cooler in mountains. Winters are cold in the mountains, but valleys are often colder than mountains because of cold air drainage. Average seasonal snowfall is 47 inches, and the average precipitation annually is about 18 inches. The average temperature in winter is 28 degrees Fahrenheit (°F), the average summer temperature is 65 °F, and the average temperature overall is about 46 °F. The average frost-free season is 100 to 125 days.

3.2 TOPOGRAPHY

Tetra Tech reviewed U.S. Geological Survey (USGS) topographic maps for the Colville area through the USGS on-line topoView application (https://ngmdb.usgs.gov/topoview/viewer/#4/40.00/-100.00). Stevens County lies within the Okanogan Highlands physiographic province. The county is bound on the north by Canada, which is approximately 30 air miles from Colville. The Columbia River is approximately 9 miles west of Colville and flows to the south. Kettle Falls and Kettle Falls dam on the river are approximately 9 miles northwest.

Colville resides within the Colville Valley at the junction with Church Flats and Garrison Flats. The Colville Valley has a gradual slope from south-southwest to north-northwest. The City of Colville resides on an upland terrace (Ecology 1971). The Colville Valley sits at an elevation of approximately 1575 feet amsl and is adjoined by mountains that rise to elevations of nearly 5,000 feet amsl. The Colville River and tributary streams in the valley flow to the north and northwest and empty into the Columbia River southwest of Kettle Falls.

The facility elevation is approximately 1590 feet amsl. The topography to the east and northeast of the facility along the base of Colville Mountain rise more quickly and may be glacial drift deposits and/or possibly redeposited glacial drift as an alluvial fan.

3.3 SOIL

Soil underlying the facility and vicinity is Colville silt loam. This very deep, artificially drained soil rests on bottomlands. It formed as mixed alluvium on slopes of 0 to 3 percent. The native vegetation is water-tolerant (possibly hydrophytic) grasses, forbs, and shrubs. Typically, the surface layer is dark gray calcareous silt loam about 17 inches thick. The subsoil is mottled gray calcareous silty clay loam approximately 10 inches thick. The upper part of the substratum is mottled light gray calcareous silty clay loam about 27 inches thick. The lower part of the substratum is mottled, white silt loam to a depth of 60 inches or more.

The permeability of this soil is moderately slow, and the available water capacity is very high. The effective rooting depth is limited by a high seasonal water table that is at a depth of just 2 to 4 feet during the months of February to June. Soil is subject to occasional flooding for long periods during the months of February to May (SCS 1982). Historical accounts of the area suggest the vicinity of the facility was likely artificially drained.

3.4 GEOLOGY & HYDROGEOLOGY

3.4.1 Regional

Glacial drift materials were deposited across the area by ice melt streams during past continental glaciation events. These Pleistocene age drift deposits cover the lower portions of hills and mountains. The deposits range in thickness and consist of silt, sand, gravel, clay, and till comprise the glacial drift (Ecology 1971). Clay and silt size material were likely deposited in lakes created by ice dams while sands and gravels were deposited by glacial outwash streams. Glacial drift thickness in the midlands and small valleys of Stevens County range between 25 and 100 feet thick. Glacial drift and alluvium can be hundreds of feet thick along the Spokane, Columbia, and Colville Rivers.

Alluvium overlies the glacial drift deposits within much of the Colville Valley. Alluvium consists of clay, silt, sand, and gravel mixtures, with characteristics similar to glacial drift. Bedrock underlying the Colville area is expected to be at least 200 feet or greater bgs (Ecology 1971). Bedrock consists of Cambrian to Mississippian age folded sedimentary rock.

Glacial drift and alluvium appear as stratified water-bearing units deposits while the fine-grained silt and clay lake deposits produce limited water. Wells completed in stream deposited sands and gravels produce moderate to large yields (Ecology 1971).

3.4.2 Local

The Colville area is underlain by serval hundred feet of stratified glacial deposits consisting of clay, silt, sand, and gravel (Ecology 1971). Silt and clay beds separate layers of sand and gravel. Wells completed in the sand and gravel beds range from 50 to over 236 feet deep and product moderate to large yields ranging from 250 to 1,900 gallons per minute (gpm) (Ecology 1971). Wells completed on the upland terrace may occur under artesian conditions.

Recharge to the Church Flat aquifer beneath Colville occurs through precipitation directly to the surface and adjoining mountains to the north and west (Ecology 1971). Surface water runoff from upland areas recharges the aquifer system along the glacial drift and underlying bedrock contact.

Tetra Tech searched for available well logs for the facility through Ecology's on-line map search application (https://appswr.ecology.wa.gov/WellConstruction/Map/WCLSWebMap/WellConstructionMapSearch.aspx). The database contained Resource Protection Well Reports for four facility wells (MW-2, MW-4, MW-6, MW-7) and two well decommission reports. Ecology's database had two reports for MW-6 with slightly different notes under the Well Data category. Tetra Tech suspects that one of these logs may have been mistakenly documented as MW-6 instead of MW-3, which is the only existing well that did not have a well report.

The lithology listed on all the logs was consistent between locations and documented approximately 3 feet of road base gravel fill followed by native clay to total depth of the boreholes at 15 feet bgs. Fill has been reported to be up to 5 feet in some areas (Delta 1990). The logs did not document that the upper 4- to 6-inches is likely asphalt. The Ecology well logs documented depth to water as 13 feet bgs; however, Delta (1990) documented the average depth to water as approximately 5 feet bgs. Groundwater flow reported by Delta (1990) is to the west to northwest.

3.5 SURFACE WATER AND TERRESTRIAL HABITAT

The facility area is fully developed with commercial, industrial, and residential properties. The closest surface water bodies appear to be on the eastern side of Colville Valley, approximately 0.5 miles to the west of the facility and adjoining the western side of the nearby lumber mill. The Colville Valley area along the river, tributaries, area valleys, and surrounding mountains appear to provide abundant ecological habitat.

Full development of the facility and adjoining areas with asphalt and concrete paving, buildings, and infrastructure do not provide terrestrial habitat. Therefore, this facility likely qualifies for a terrestrial ecological exclusion.

3.6 NATURE AND EXTENT OF CONTAMINATION

Characterization of the nature, extent, and magnitude of contamination present within facility soil and groundwater is incomplete. Groundwater sampling efforts by Fulcrum indicate the presence of historic potentially new sources of petroleum hydrocarbons related to former and/or current USTs. A limited number of soil samples have been collected and analyzed from subsurface soil to understand the potential sources that may remain that contribute to groundwater impacts.

Tetra Tech believes additional work to assess the nature, extent, and magnitude is needed. Assessment needs are as follows:

1. Additional subsurface soil samples are needed to help identify historic and possible new sources of contamination.
2. Groundwater monitoring well inspection and rehabilitation in select wells is needed as at least one has been silted in to ensure quality data is collected.
3. Installation of additional groundwater monitoring wells are needed to assess groundwater at the northern, northwestern property boundaries to assess the potential for off-site contaminant migration, and at near the southeastern property boundary as a background well and assess potential migration from off-site properties (i.e., Hartman Oil). Additional wells may be needed in the interior of the facility to assess potential new releases.
4. Soil vapor sampling is needed to assess potential vapor migration into the convenience store from residual petroleum hydrocarbons in soil.
5. Groundwater monitoring to assess current conditions.

The work under this RIWP will begin to address data gaps related to further understanding the nature and extent of contamination.

4.0 PRELIMINARY CONCEPTUAL SITE MODEL

The following presents the preliminary conceptual site model for the facility based on historic records and soil and groundwater monitoring data reviewed and summarized herein. Tetra Tech will update this conceptual site model as new information becomes available through RI efforts.

4.1 SOURCES OF CONTAMINATION

Tank removal activities conducted in 1989 identified petroleum hydrocarbon contamination to soil and groundwater associated with leaking USTs. Approximately 1,200 cubic yards of soil was removed in 1989 from around the tanks. However, impacted subsurface soil remained in the former USTs area and in the area of the closed-in-place UST. Groundwater sampling following tank removal activities indicated groundwater impacts from petroleum hydrocarbons. Impacts to soil and groundwater at the facility may also be present due to past spills, leaks, and overfills associated with prior or current USTs, product piping, and dispensing activities. A car wash is also operating at the facility; however, drains observed onsite do not appear to be drywells. Further investigation of all drains to ensure a sewer connection is recommended.

4.2 CONTAMINANT FATE AND TRANSPORT

Groundwater monitoring conducted from 2017 to through 2024 indicated petroleum hydrocarbon impacts are present. Recent groundwater monitoring results, specifically samples collected from MW-7 in September 2023, suggests that petroleum contaminated groundwater may be flowing off site. Additional groundwater sampling that also examines field parameters such as pH, specific conductance, dissolved oxygen, oxidation-reduction potential, specific conductance, temperature, and turbidity should be conducted. Additional parameters that assess natural attenuation may be needed in the future.

4.3 CONTAMINANTS OF CONCERN

Contaminants of concern identified for the facility through review of historic and regulatory information include parameters associated with past on-site fuel tank storage and distribution and the carwash. **Table 4-1**, below, lists the contaminants of concern identified for the facility along with associated cleanup levels that will be used to assess impacts to sampled media.

Table 4-1. Cleanup Levels for Contaminants of Concern

Analytical Parameter	Potential Source	MTCA Method A Cleanup Level		
		Soil Vapor (µg/m³)[h]	Soil (mg/kg)	Groundwater (µg/L)
Lead	Leaded gasoline	--	250[a]	15[f]
Volatile Organic Compounds (VOCs)	Leaks from tank and piping. Spills and overfills.		--	
Benzene		50	0.03[a]	5[f]
Ethylbenzene		130,000	6[a]	700[f]
Toluene		650,000	7[a]	1000[f]
Total Xylenes		13,000	9[a]	1000[f]
EDB (ethylene dibromide)		0.65	0.0051[a]	0.01[f]
EDC (1,2-Dichloroethane)		15	11[b]	0.48[g]
Naphthalene		11	5[a]	160[f]
Diesel Range Organics (TPH-Dx)	Leaks from tank and piping. Spills and overfills.	--	2000[a]	500[f]
Residual Range Organics (TPH-O)	Leaks from tank and piping. Spills and overfills.	--	2000[a]	500[f]
Gasoline Range Organics (TPH-Gx)	Leaks from tank and piping. Spills and overfills.	--	100 / 30[a]	800[f]
Carcinogen polynuclear aromatic hydrocarbons (PAHs)	Leaks from tank and piping. Spills and overfills.	--		
Benzo[a]anthracene			1.1[c] / 21[e]	
Benzo[a]pyrene			0.1* / 2.0[d]*	0.1[f]
Benzo[b]fluoranthene			1.1[c] / 21[e]	
Benzo[k]fluoranthene			11[c] / 210[e]	
Chrysene			110[c] / 2100[e]	
Dibenz(a,h) anthracene			0.1[c] / 2.1[e]	
Indeno1,2,3-cd pyrene			1.1[c] / 21[e]	
Naphthalene			5[a]*	160[f]**
1-Methylnaphthalene				
2-Methylnaphthalene				

Analytical Parameter	Potential Source	MTCA Method A Cleanup Level		
		Soil Vapor (µg/m³)[h]	Soil (mg/kg)	Groundwater (µg/L)

a – MTCA Method A Soil Cleanup Levels for Unrestricted Land Uses, Table 740-1
b – MTCA CLARC Table, Method B Direct Contact, Cancer (August 2023)
c – EPA Residential soil screening level, TR=1E-06, THQ=1.0 (November 2024)
d - EPA Industrial soil screening level, TR=1E-06, THQ=1.0 (November 2024)
e – MTCA Method A Industrial Cleanup Level.
f – MTCA Method A Groundwater Cleanup Level
g – MTCA CLARC Table, Method B Direct Contact Cancer (August 2023)
h – MTCA Method A Sub-Slab Soil Gas Screening Levels, Commercial Worker (CLARC Table, August 2023).
* Use benzo(a)pyrene cleanup levels to assess total sum of carcinogenic PAHs (cPAHs) after applying toxicity equivalent factor (TEF) multiplier.
** Cleanup level based on total naphthalene compounds.
µg/L- micrograms per liter
mg/kg – milligrams per kilogram
µg/m³ – Micrograms per cubic meter

4.4 EXPOSURE PATHWAYS AND RECEPTORS

The facility surface is paved with asphalt and concrete. Therefore, direct exposure to subsurface soil is limited to excavation and utility construction workers. However, soil vapor to convenience store workers and patrons is possible and has yet to be assessed. The facility and likely residents hydraulically downgradient of the facility obtain water from the City of Colville. However, a well inventory has not been conducted to assess potential receptor that may still use water for domestic or irrigation uses. Therefore, users of groundwater in a hydraulically downgradient location of the facility may have the potential for exposure if petroleum hydrocarbons are migrating off site.

4.5 DATA GAPS

Additional soil, groundwater, and soil vapor are required to further assess potential risk to receptors at and near the facility. A well inventory for the facility area may be needed to identify wells that have the potential to be impacted pending upcoming soil and groundwater results.

5.0 INVESTIGATION METHODS

The following sections present the investigation methods for this RI.

5.1 HEALTH AND SAFETY

Tetra Tech will prepare a HASP that complies with requirements in Occupational Safety and Health Administration (OSHA) 1910.120. **Appendix B** provides a copy of the HASP. Field personnel will task-specific job safety analyses (JSAs) as needed to identify specific job task steps and hazards, as needed.

All Tetra Tech personnel working at the facility will complete OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) 40-hour training and 8-hour refresher training. Field personnel will read the HASP prior to arriving for site work, maintain a copy of this RI (including HASP) in the field vehicle, and refer to the HASP as needed. Field personnel will ensure all personal protective equipment (PPE), first aid supplies, fire extinguisher, and other safety equipment, if any, are acquired and in the field vehicle prior to site arrival.

Tetra Tech will submit a utility locate ticket through the Washington Utility Notification Center (http://www.callbeforeyoudig.org/washington/index.asp). Stevens County locates are serviced by Inland Empire Utility Coordinating Council (IEUCC), which is reachable by calling 1-800-424-5555 or 811. The purpose of the utility locate will be to notify publicly owned utility companies of subsurface excavation activities at the facility so that utility lines may be located prior to drilling. It will take the utility locate service between 2 and 5 workdays to locate underground utilities (excludes holidays and weekend). Therefore, Tetra Tech will call the utility locate center at least 5 days prior to conducting excavation work.

Tetra Tech also expects that a private utility locate subcontractor will be needed to locate on-site utility lines owned by the Whitty's. Tetra Tech will contract with a subcontractor to help locate local, on-site electrical, water, and sewer lines as well as product piping runs and vent lines. We do not anticipate needing to conduct a ground-penetrating radar (GPR) study. However, a GPR may be required if lines cannot be successfully cleared using the private utility subcontractor.

Tetra Tech anticipates the facility to receive frequent traffic through most work areas. Field personnel will station the field vehicle(s) in a manner to help protect workers while conducting drilling and, particularly, well sampling work. Traffic safety cones will also be placed to alert drivers to the work area and keep the area clear of non-essential people and vehicles.

5.2 STANDARD OPERATING PROCEDURES

Field personnel will follow the investigation methods described in the following sections. Field personnel will also follow the standard operating procedures (SOPs) provided in **Appendix C**. This RIWP will take precedence over the SOPs in cases where the SOP differs from the methods described herein. **Table 5-1**, below, lists the SOP that field personnel will use to as a guide during field efforts.

Table 5-1. Standard Operating Procedures

SOP#	SOP Description
SOP-08A	Field Measurement of Geochemical Parameters Using a Multi-Meter and Flow-Through Cell
SOP-09	Sample Packaging and Shipping
SOP-10	Field Forms
SOP-11	Equipment Decontamination
SOP-12	Sample Documentation
SOP-13	Quality Control Samples
SOP-17	Monitoring Well Development
SOP-20	Field Measurement of Groundwater Level
SOP-21	Monitoring Well Construction
SOP-22	Soil Sample Collection
SOP-46	Low-Flow (Minimal Drawdown) Groundwater Sampling
SOP-48	Investigation-Derived Waste

5.3 FIELD EQUIPMENT

Tetra Tech will conduct an inspection of sampling and field screening equipment and obtain field supplies that will be used in the field. Field equipment anticipated for this project include, but is not limited to the following types of equipment:

- Digital camera
- Global-positioning system (GPS) unit
- Multi-parameter water quality meter
- Water quality meter calibration standards
- Electronic water level probe
- Pumps, tubing, and filters
- Sample collection and decontamination supplies
- Field tablet
- Hand tools for collecting and reviewing soil and rock
- Personal protective equipment (PPE)

Field personnel will ensure all equipment is clean, operational, and properly calibrated prior to taking it into the field. Field equipment will be maintained and calibrated as per manufacturer guidelines.

Equipment will be transported in such a manner as to maintain cleanliness to and from the Site as well as between sample locations. This may include placing equipment in sealed plastic tubs, plastic bags, and in the cab of the truck to minimize the potential for cross-contamination due to dust, mud, or other elemental factors.

5.4 FIELD DOCUMENTATION

Field personnel will document all work conducted during each field event and refer to **SOP-12** for guidance. Field notebooks, field, logs, and photographs will be used for documentation. Deviations from the methods described in this RIWP will be documented. Field personnel will scan and upload all field notes and logs to the project folder. Photographs will also be uploaded to the project folder. The project folder will be maintained on Tetra Tech's server, which is backed up daily.

Field instruments will be maintained and calibrated as per manufacturer guidelines. Field personnel will document the date and time of instrument calibration checks and calibration efforts, calibration fluids used, result the calibration / calibration checks, any issues observed, and corrective actions taken.

5.5 WELL INSPECTION AND REHABILITATION

Tetra Tech will contract with a Washington-licensed well driller to inspect and rehabilitate the existing five site wells (MW-2, MW-3, MW-4, MW-6, MW-7). At least one well has partially filled with accumulated sediment. The driller and Tetra Tech field personnel will assess the condition of each well. Sediment accumulation in the well of more than 2 inches will be removed through surging and pumping, bailing, and/or air until the well(s) are clear of sediment. The well may require abandonment if sediment cannot be cleared from the well.

Field personnel will also assess the condition of the flush-mount well head protector and underlying PVC well casing. The driller will repair or remove and replace flush-mount well protectors as needed.

5.6 SOIL VAPOR MONITORING POINT INSTALLATION AND SAMPLING

The following sections describe the methods and procedures for soil vapor monitoring point installation using a drill rig and vapor probe sampling. Tetra Tech will use data from the soil vapor probes to evaluate the presence of volatile organic compound (VOC) vapors in subsurface soil and assess the risk for vapor intrusion into the facility store building. Installation and integrity testing of soil vapor points will generally follow directions provided in **SOP-50A** and Ecology's guidance document for evaluation vapor intrusion (Ecology 2022). Soil vapor monitoring points are as follows:

1. Outdoor soil vapor monitoring point: Tetra Tech will contract with a Washington-licensed drilling company to install one soil vapor monitoring point outside the north side of the convenience store. This location will assess potential VOC vapors from the large tank buried under the northern side of the convenience store and former UST #s 5, 6, and 7.
2. Indoor soil vapor monitoring points: Tetra Tech will install two soil vapor monitoring points by hand inside the convenience store. One soil vapor monitoring location will be near the southwestern corner of the store and the second in the north-central portion of the store. The purpose of the southwestern monitoring probe is to assess vapor conditions near the existing UST basin. The purpose of the north-central monitoring probe is to assess potential VOC vapors from the tank buried beneath the building and/or former UST #s 5, 6, and 7.

5.6.1 Soil Vapor Monitoring Point Installation

Field personnel will provide oversight during drilling and installation activities. **Figure 3** (**Appendix A**) shows the anticipated soil vapor monitoring point locations. Field personnel will select final locations in the field based on facility features and conditions. Field personnel will document soil vapor point activities and construction details in a field notebook and on a soil vapor point log, respectively.

5.6.1.1 Outdoor Soil Vapor Monitoring Point

Tetra Tech's drilling subcontractor will use a direct push technology (DPT) drill rig and/or hand tools to drill a small diameter hole (e.g., 6- to 7-inch diameter) through the concrete slab or asphalt and into the sub-slab soil at each soil vapor monitoring point location. The DPT rig will then excavate soil to approximately 11 feet bgs. The outdoor soil vapor monitoring point will be installed as a nested set of two probes, which will be completed above the water table at approximately 5 feet and 10 feet bgs. The final depths of each probe will be determined in the field by using a PID and based on measured depth to water in nearby wells. The probe depths will target zones that exhibit the highest headspace measurements while maintaining a minimum vapor point spacing of approximately 5 feet, as possible.

Field personnel will implant a stainless-steel soil vapor probe at each desired depth. The soil vapor monitoring point will consist of a 6-inch long by 0.5-inch diameter manufactured stainless steel vapor probe with screen section. The top of the probe will have a 0.25-inch barbed section which will be fitted with 0.25-inch diameter tubing. The tubing will extend from the top of the probe to the surface and will be used to facilitate sample collection.

Each soil vapor probe will be encased in at least 1-foot of sand both above and below the probe, followed by a layer of granular bentonite that will be hydrated with potable water, which will ensure that soil vapor is only pulled from the corresponding installation depths. The drilling subcontractor will install a flush-mount protective casing and cover at the surface that will be approximately level with the concrete slab or asphalt. Concrete will be placed around the cover to the existing surface.

5.6.1.2 Indoor Soil Vapor Monitoring Point

Tetra Tech will contract with a local concrete cutting subcontractor to cut 6- to 7-inch diameter holes through the concrete floor of the convenience store at the two indoor soil vapor monitoring locations. Field personnel will use hand tools such as a hand auger, breaker bar, and gloved hands to remove soil to the lowest depth possible to accommodate the soil vapor probe. The excavation depth at each location will depend upon the thickness of asphalt or concrete at the location but is expected to be at least 8 inches below the base of the concrete building slab. Field personnel will select the exact installation locations and set depths based on site conditions.

Field personnel will implant a stainless-steel soil vapor probe at the base of excavation. The soil vapor monitoring point will consist of a 6-inch long by 0.5-inch diameter manufactured stainless steel vapor probe with screen section. The top of the probe will have a 0.25-inch barbed section which will be fitted with 0.25-inch diameter tubing. The tubing will extend from the top of the probe to top of the store floor surface and will be used to facilitate sample collection.

Field personnel will place sand around and over the probe to a level of at least 2-inches above the probe screen / base of the concrete slab, followed by a layer of granular bentonite that will be hydrated with potable water to create a seal, which to ensure that soil vapor is only pulled from the corresponding installation depths. Field personnel will then install a flush-mount protective casing and cover at the surface that will be level with the concrete slab or asphalt. Concrete will be placed around the cover to the existing concrete floor surface.

5.6.2 Soil Vapor Sampling Procedure

Field personnel will obtain soil vapor samples at all soil vapor monitoring locations. This includes the outdoor soil vapor monitoring point with the 5-foot and 10-foot nested pair and the three indoor monitoring points (**Figure 3**). **Section 6** discusses analytical methods and quality control samples.

Field personnel will conduct integrity tests on the vapor points according to SOP 50A to ensure there is not short circuiting to the atmosphere. For the outdoor nested soil vapor monitoring point, field personnel will conduct the integrity test on the deepest of the two soil vapor points. Modeling clay will be used to seal the area around the vapor monitoring point if the vapor point being tested fails to pass the integrity test. The integrity test will be repeated until the location passes the test. Field personnel will conduct field screening after the integrity test.

Field screening will involve attaching a vacuum pump to the soil vapor point tubing. A Tedlar bag will be attached to the outflow of the pump, where a PID will record the data. Once the readings have stabilized the vapor point will be sampled using a 1-liter Summa canister.

The Summa canister will be equipped with a flow controller provided by the laboratory. Field personnel will attach the Summa cannister new dedicated, disposable high-density polyethylene (HDPE) tubing to tubing of the soil vapor monitoring point. The valve on the Summa canister will then be opened. Field personnel will record the initial vacuum displayed on the gauge on the flow controller (typically between 25 and 30 inches of mercury), and the time that the valve on the canister was opened. The negative pressure in the Summa canister will draw vapors from subsurface soil, through the soil vapor probe and tubing, and through the flow controller to the Summa canister.

Field personnel will close the valve on the Summa canister once the vacuum in the canister is between 5 and 10 inches of mercury. Field personnel will record the final vacuum reading from the canister and the time the valve was closed. The flow controller will be disconnected from the Summa canister followed by securing the canister for return shipment to the laboratory.

5.6.3 Sample Nomenclature – Soil Vapor Monitoring Points

Field personnel will assign a unique sample name to each sample. The sample name format will be

SVMP-X-YY

Where:

SVMP = soil vapor monitoring point

X = sequential number of the on-site soil vapor monitoring point location

YY = bottom installation depth of the soil vapor probe.

For example, if the outdoor nested pair is soil vapor monitoring point number 1, then the probe set at 5 feet bgs will have the name SVMP-1-5 and the sample name for the probe at 10 feet will be SVMP-1-10.

5.7 SUBSURFACE SOIL BOREHOLES AND SAMPLING

5.7.1 Borehole Drilling

Tetra Tech will contract with a qualified, Washington-licensed drilling subcontractor to drill four boreholes using a DPT drill rig (**Figure 3**, **Appendix A**). The anticipated drill depth is 15 feet bgs based borehole and well data from prior investigations. The anticipated lithology includes 3 to 5 feet of sand gravel fill followed by clay to at least 15 feet bgs. The driller will complete all four boreholes as groundwater monitoring wells (MW-8, MW-8, MW-10, and MW-11) as per the guidelines in **Section 5.8**. Note: Fulcrum previously named field duplicates as MW-7, followed by installing well MW-7, then subsequently started using “MW-8” as the name of site groundwater duplicates. Field duplicates in the future will not use well names but designated nomenclature to distinguish it from other samples will still maintaining its “blind” nature to the laboratory. See **Section 6.2.2**.

The driller will retrieve soil cores over the full depth of the borehole using 4-foot-long polyvinylchloride (PVC) core sleeves. Field personnel will cut the core sleeves open to facilitate soil logging and soil sample collection. Field personnel will observe and document soil lithology including color, grain sizes generally following on the Unified Soil Classification System (USCS; ASTM D2487), moisture, any debris encountered, and discernible visual and olfactory indications of potential contamination on borehole logs for each drill location. **Appendix D** includes the field log. **SOP-22** provides soil sample guidance.

Field personnel will also conduct on-site soil screening for volatile organic vapors using a PID. The PID will be used to scan along the soil surface within each core section to help identify intervals with volatile organic vapors.

After the initial PID scan of the soil core, field personnel conduct further on-site soil screening by collecting an aliquot of soil from at least one depth interval in each 4-foot core section and screen the soil using the heated headspace method of analysis. Field personnel will put the soil aliquot in a resealable plastic bag and allow the soil to warm in the field vehicle, which will help release volatile organic vapors from the soil. Field personnel will use the PID to assess the concentration of volatile organic vapors in the bag using the PID. PID screening values will be documented on the field log (**Appendix D**).

Field personnel collect up to two soil samples for laboratory analysis from each borehole. One soil sample will be from the worst-case soil depth interval as identified through visual, olfactory, and/or PID readings. The second soil sample will be collected from the approximate air-water interface at the water table. In the case that there are no discernible impacts in depths above the air-water interface, then only the sample at the air-water interface will be collected for laboratory analysis. **Section 6** specifies analytical parameters and methods and project quality control (QC) requirements.

Field personnel will complete boreholes as groundwater monitoring wells and follow the construction and development guidelines in **Section 5.8**. Boreholes that maybe excavated and not completed as groundwater monitoring wells will be backfilled with bentonite to the surface followed by replacement of asphalt or concrete at the surface, depending on borehole location.

Field personnel will place the soil sample(s) immediately into a cooler containing doubled, re-sealable bags filled with ice for preservation. Personnel will replenish the ice, as needed to cool and maintain the samples between 0 and 6°C during temporary field storage and shipment. The cooler will be packaged as per laboratory instructions and field personnel will ensure adequate packing materials to prevent breakage during overnight shipment to the analytical laboratory. All samples will be handled, maintained, and shipped using standard chain-of-custody protocol.

5.7.2 Sample Nomenclature – Subsurface Soil

Field personnel will assign a unique sample name to each sample. The sample name format will be:

BH-X (YY-ZZ).

Where: **BH** = borehole

X = sequential number of the borehole drilled

(**YY-ZZ**) = sample depth interval in feet over which the soil sample was collected.

For example, a soil sample collected from 12.5 to 13.5 feet in borehole number 1 will be labeled BH-1(12.5-13.5).

5.8 MONITORING WELL INSTALLATION

Tetra Tech will install four (4) groundwater monitoring wells during this RI/FS. The well numbers will continue on from existing well numbers currently at the site, which will be MW-8, MW-9, MW-10, and MW-11 since current well numbers extend up to MW-7. Of note, Fulcrum previously used “MW-7” and “MW-8” nomenclature to denote field groundwater duplicates.

Well construction will adhere to the Ecology’s well construction laws and rules (Chapter 173-160 WAC). All groundwater monitoring wells will contain the following common design components: polyvinylchloride (PVC) casing consisting of solid riser, screen interval, and a top and bottom cap; filter pack; annular seal; well head protection. Field personnel will prepare a well construction log that shows the construction detail for each well. The drilling subcontractor will file a Resource Protection Well Report to Ecology that documents the construction design and well data. Refer herein and to **SOP-21** for guidance.

Whenever possible, the driller will install the well screen and casing within the center of the drill casing. Following placement of the well screen and casing, the driller will install the filter pack and annular seal while slowly removing the drill casing from the subsurface. The driller will exercise caution to prevent borehole collapse during installation of the filter pack and annular seal. The top of the well casing will be closed with a watertight compression cap.

5.8.1 Well Screen

Well screens will be constructed of 2-inch diameter PVC 0.010-factory-slotted well screen. Wells will be completed with either a 10-foot long well screen length from approximately 10 feet to 15 feet bgs, which is consistent with existing well completions and due to a static water level around 13 feet bgs. The 10-foot long well screen and completion depth are based on existing well construction. However, the well screen and completion depth will be assessed at the time of the investigation.

Well screens should be placed such that the screen spans across the static water level observed in the well at the time of well installation and accounting for historic fluctuation based on prior monitoring events. Setting the mid-point of the well screens at or near the static water level should allow for seasonal fluctuation within the screened zone. Field personnel will determine the final screen position based on site conditions

5.8.2 Well Filter Pack

Well filter pack will consist of well-rounded, well-sorted (poorly graded) silica sand. For consistency with existing well completions, Tetra Tech anticipates well construction will be as follows:

- Filter pack consisting of U.S. Mesh Number 20-40 size, or equivalent.
- Filter pack that will extend from below the well screen to 1 foot above the well screen, which will be approximately 4 feet bgs.

5.8.3 Well Annular Seal

Well annular seal will consist of sodium bentonite designed for use as a seal material. The annular seal will extend from the top of the filter pack to the top of the well, and may consists of bentonite pellets, tablets, chips, or powder, depending on subsurface conditions. The bentonite well seal will extend from the top of the filter pack at approximately 4 feet to approximately 1 foot bgs. The bentonite will be allowed to completely hydrate in conformance with the manufacturer's instructions

5.8.4 Well Head Protection

The driller will install a steel, traffic-rate, flush mount well head protector. The flush mount protector will extend from approximately 1-foot below the existing surface and set to be approximately flush with the surrounding grade. The protector will be secured with concrete.

Field personnel will mark the top of the north side of the PVC well casing with a black indelible ink. The notch will serve as the designated location for recording water level measurements and recording the top of casing elevation by a Washington licensed land surveyor.

5.8.5 Well Development

The drilling subcontractor will develop each newly completed well and re-develop all existing wells using surge and bail, surge and pump, or air methods, as appropriate. Refer herein and to **SOP-17** for guidance. Equipment will be decontaminated between wells.

Adjustment to the following guidelines may be necessary due to the fine-grained nature of the lithology present beneath the facility. General well development guidelines for this project are: 1) to develop each well until purged water is relatively clear of fine-grained sediment from the wells and annular space; 2) surge and develop each well over the entire saturated length of well screen; and 3) wells that are pumped dry will be allowed to recover before well development continues.

The following equation may be used to estimate three well volumes.

Three Well Volume Calculation

$$V=0.13(d^2)\ W$$

Where:

V = volume in gallons

0.13 = conversion value for 2-inch diameter well

d = casing diameter in inches

W = water column (total depth of well – depth to water) in feet

Field personnel will use a calibrated multi-parameter meter to monitor field parameters during development (**SOP-8A**). Field personnel will use a calibrated multi-parameter meter to measure and record field parameters during purging. Field personnel will check the calibration of the multi-parameter field meter daily. If calibration is needed, personnel will follow multi-parameter manufacturer guidelines. Field personnel will periodically check for instrument drift using pH calibration solutions. If the instrument indicates drift, the instrument will be re-calibrated.

During purging, field personnel will connect the outlet from the pump to the multi-parameter flow-through cell where field parameters will be monitored continuously throughout purging using a calibrated multi-parameter field meter.

Well development will continue until at least three of the following parameters stabilize to the following criteria. Field personnel will coordinate with the project manager if field parameters do not stabilize.

- pH stabilizes to ±0.1 pH units for three successive readings. (Readings should be separated by the removal of one well volume of water.)
- Temperature stabilizes to within ±1 degree Celsius (ºC).
- Conductivity stabilizes to within ±3 %.
- Oxidation-reduction potential stabilizes to within ±10 millivolts (mV).
- Dissolved oxygen stabilizes to within ±0.3 milligrams per liter (mg/L).
- Turbidity stabilizes as follows:
  - Well water is clear to the unaided eye in areas where local groundwater is known to be clear and turbidity readings are less than 10 nephelometric turbidity units (NTUs).
  - Turbidity stabilizes to within ±10 percent at concentrations greater than 10 NTU in areas known for turbid groundwater; final well water may be turbid to the eye.
- The sediment thickness in the well is less than 1 percent of the well screen length or less than approximately 1.2 inches (0.1 foot) for well screens less than 10 feet long.

Field personnel will containerize purged groundwater in a DOT-approved 55-gallon drum. Field personnel will label the drum as to its contents, date, and include project contact information. The drum(s) will be staged in an owner-approved location at the site pending waste characterization results (**Section 5.9**).

5.8.6 Well Monitoring Point Survey

The top of casing elevations and the top of the concrete well pad elevations will be determined to within ±0.01 foot for all existing and new on-site wells. All elevations will reference to an established National Geodetic Vertical Datum. For each monitor well, the surveyor will survey the marked reference point on the north side of the top of the PVC casing, and on north side of the top of the concrete pad. The locations and elevations will be used to accurately document wells for field efforts, site maps, evaluating the potentiometric surface, groundwater flow direction, and gradient across the Site.

5.9 GROUNDWATER SAMPLING

5.9.1 Water Levels

Synoptic water level measurements will be conducted in all wells before groundwater sampling. Field personnel will decontaminate the electronic water level tape (e-tape) prior to site use and between wells to prevent contamination. Field personnel will refer to **SOP-20** and the below during the event.

Static water level measurements will be collected first from wells anticipated to have the least contamination followed by those that have historically exhibited worst contamination. Field personnel will open each well and remove the J-plug or cap and allow the wells to vent and water level to stabilize to ambient conditions. Water levels will be recorded using the e-tape to the nearest 0.01-foot (hundredth foot) and measuring from the designated measuring point on the north side of the top of the PVC well casing. Field personnel will measure and verify the water level measurement at least three times before documenting the depth to water on the field log.

Decontamination of the e-tape/probe will include rinsing with de-ionized (preferable) or distilled water and scrubbing with Liquinox® soap, or equivalent, followed by additional rinses with de-ionized water.

5.9.2 Groundwater Purging and Sampling

Field personnel will change sample gloves frequently and don a new pair just prior to sample collection. Field sampling equipment and bottles will be transported to and from the facility and each well location in enclosed containers to limit the potential for cross contamination due to airborne dust, or contact with surfaces containing dust, mud, or impacted soil or surfaces.

Field personnel will purge and sample each well following low-flow sampling methods and use of an electric peristaltic or bladder pump with new dedicated, disposable tubing and bladder [**SOP-12** and EPA (2017)low-flow sampling**]**. Wells will be purged at a rate less than or equal to 1 liter per minute, and/or at a rate that will not induce a drawdown of water in the well of greater than 0.3 feet. Field personnel will monitor drawdown in the well using an electronic water level meter during purging. Purge water will discharge to a graduated 5-gallon bucket to monitor purge volume and rate. Field personnel will containerize all purge water in labeled, DOT-approved 55-gallon drums. Labels will list the drum contents, date, and contact information. The drum(s) will be stored in a central, owner-approved location until sample results have been received and proper off-site disposal arranged.

Field personnel will use a calibrated multi-parameter meter to measure and record field parameters during purging (**SOP-08A**). Field personnel will check the calibration of the multi-parameter field meter daily. If calibration is needed, personnel will follow multi-parameter manufacturer guidelines. Field personnel will periodically check for instrument drift using pH calibration solutions. If the instrument indicates drift, the instrument will be re-calibrated.

During purging, field personnel will connect the outlet from the pump to the multi-parameter flow-through cell where field parameters will be monitored continuously throughout purging using a calibrated multi-parameter field meter. Field personnel will use multi-parameter meters and electronic water level probes to collect and record field measurements of parameters on the field log including depth to water to assess drawdown, pH, specific conductance (SC), temperature, dissolved oxygen (DO), oxidation-reduction potential (ORP), and turbidity during well purging. The data will be used in combination with analytical laboratory data to evaluate water chemistry.

Wells will be purged until field parameters stabilize or, if stabilization cannot be reached, purging will cease after one of the following three occurrences:

1. Three well casing volumes of water have been purged; or
2. One hour of purging time has elapsed; or
3. The well is purged dry.

In the last instance, the well will be allowed to recover to 90% of its pre-purging level (based on volume of water in the casing) before samples are collected. If needed, field personnel will calculate 3 well volumes using the following equation:

Three Well Volume Calculation

$$V = 0.13(d^2)W$$

Where:

V = volume in gallons

0.13 = conversion value for 2-inch diameter well

d = casing diameter in inches

W = water column (total depth of well – depth to water) in feet

Field personnel will document field parameter readings at approximately 3- to 5-minute intervals during well purging. Well stabilization will be considered complete when parameters meet stabilization criteria in three consecutive readings. Personnel will record field parameters on the groundwater sampling log or electronically using a field tablet and software application for the multi-meter (**Appendix D**). If using a field tablet, field personnel ensure that the application stops recording data prior to sample collection after well purging meets field parameter criteria.

Table 5-1, below, provides the list of field parameters that will be monitored at all locations and their corresponding recommended stabilization criteria for well purging prior to sampling. The criteria are based on EPA guidance (EPA 2017). Field personnel shall document on the field log the units for each parameter that the instrument is set to record to on the field log. **Section 6** discusses project analytical parameters and methods and QC requirements.

Table 5-2. Field Parameters and Well Stabilization Criteria

Field Parameter for All Monitor Locations	Well Stabilization Criteria
pH (std units)	±0.1 unit
Temperature (°C)	3%
Specific Conductivity (SC)	3%
Oxidation-reduction potential (ORP)	±10 mV
Dissolved oxygen (DO)	10% for values >0.5 mg/L; or three consecutive values if < 0.5 mg/L
Turbidity	10% for values >5 NTU; or three consecutive values if < 5 NTU

Field personnel will pump water directly from the well to fill laboratory-provided samples containers after field parameter stabilization. Once collected, field personnel will place the sample(s) immediately into a cooler containing doubled, re-sealable bags filled with ice for preservation. Personnel will replenish the ice, as needed to cool and maintain the samples between 0 and 6°C during temporary field storage. The cooler will be packaged as per laboratory instructions and ensure adequate packing materials to prevent breakage during overnight shipment to the analytical laboratory. All samples will be handled, maintained, and shipped using standard chain-of-custody protocol. **Section 6** discusses field QC requirements.

5.9.3 Sample Nomenclature – Groundwater

Field personnel will assign a unique name to each groundwater monitoring well. Current on-site monitoring well numbers are MW-2, MW-3, MS-4, MW-6, and MW-6. New wells installed under this RIWP will be MW-8, MW-9, MW-10, and MW-11. Groundwater samples will be labeled as per their designated well number (e.g., MW-2, MW-6, etc.).

Note: Fulcrum used blind field groundwater duplicate names of "MW-7" and "MW-8" previously. Moving forward, blind field duplicates will be named as per the criteria in **Section 6.2.2**.

5.10 INVESTIGATION-DERIVED WASTE MANAGEMENT

Soil cuttings and groundwater purge water will be containerized in DOT-approved 55-gallon drums for temporary storage. Soil cuttings will be kept separate from purged groundwater. All waste management drums will be moved to a common, owner-approved on-site location for temporary storage. All drums will be labeled with drum labels that will include a description of contents, date, and Tetra Tech and owner contact information. Refer to **SOP-48** for guidance.

6.0 ANALYTICAL METHODS & QUALITY CONTROL

6.1 ANALYTICAL METHODS

Field personnel will order all sample containers directly from the analytical laboratory. The bottle order will account for all natural and field QC samples that need to be collected. In addition, several extra unpreserved bottles and preservatives shall be requested in the case that they are needed due to contamination, bad bottle seals, etc. Field personnel will ship soil and water samples to the laboratory by First Overnight Priority Overnight shipping via FedEx. FedEx in Hailey, Idaho lists 4:30pm as closing time for last "pickup". Therefore, depending on sample parameter holding times, crews may need to adjust field work hours to meet daily shipping needs.

As discussed in **Sections 5.3** and **Section 5.4**, a PID will be used for field screening during soil vapor monitoring and on-site field screening during subsurface drilling. **Section 5.5** and **Section 5.6** discusses field parameters and stabilization criteria to be used during this project.

The following tables list the laboratory analytical parameters, methods, holding time, and preservation requirements for this project. **Table 6-1** lists information for soil vapor, **Table 6-2** subsurface soil, and **Table 6-3** groundwater. Field personnel will use the tables to order sample containers from the laboratory and reference the sample preservation and holding time information to ensure proper sample collection and shipping times are met. Sample container numbers and types may vary depending upon the laboratory used.

Table 6-1. Soil Vapor Analytical Requirements

Analytical Parameter	Analytical Method	Container Type	Preservation	Holding Time
VOCs *(BTEX, EDC, EDB, MTBE, Naphthalene)*	EPA Method TO-15	1-liter Summa Canister	None	28 days

Table 6-2. Subsurface Soil Analytical Requirements

Analytical Parameter	Analytical Method	Container Type	Preservation	Holding Time
Lead	EPA Method 6020	8 oz glass jar	None	28 days
Volatile Organic Compounds (VOCs) (BTEX, EDB, EDC, MTBE, Naphthalene)	EPA Method 8260D (standard list)	40 milliliter glass vial	Chilled to ≤ 4 degrees C	14 days

Analytical Parameter	Analytical Method	Container Type	Preservation	Holding Time
Diesel Range Organics Residual Range Organics	Northwest Methods for Total Petroleum Hydrocarbons Diesel plus Heavy Oil (NWTPH-Dx+O)	8 oz glass jar	Chilled to ≤ 4 degrees C	7days
Gasoline Range Organics	Northwest Methods for Total Petroleum Hydrocarbons Gasoline (NWTPH-Gx)	40 milliliter glass vial	Chilled to ≤ 4 degrees C	7days
Carcinogen PAHs *(benzo[a]pyrene, benzo[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, chrysene, dibenz(a,h) anthracene, indeno1,2,3-cd pyrene)*	EPA Method 8270E SIM	8 oz glass jar	Chilled to ≤ 4 degrees C	14 days
EDB - 1,2-Dibromoethane *EDC - 1,2-Dichloroethane* *MTBE – Methyl tertiary butyl ether*				

Table 6-3. Groundwater Analytical Requirements

Analytical Parameter	Analytical Method	Container Type	Preservation	Holding Time
Lead	EPA Method 6020	250 milliliter glass	HNO_3, chilled to ≤ 4 degrees C	28 days
Volatile Organic Compounds (VOCs) (BTEX, EDB, EDC, MTBE, Naphthalene)	EPA Method 8260ULL (standard list)	40 milliliter glass vial	Chilled to ≤ 4 degrees C	14 days
Diesel Range Organics	Northwest Methods for Total Petroleum Hydrocarbons Diesel plus Heavy Oil (NWTPH-Dx+O)	40 milliliter glass vial	Chilled to ≤ 4 degrees C	7 days
Residual Range Organics	Northwest Methods for Total Petroleum Hydrocarbons Gasoline (NWTPH-Gx)	40 milliliter glass vial	Chilled to ≤ 4 degrees C	7 days
Carcinogen PAHs (benzo[a]pyrene, benzo[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, chrysene, dibenz(a,h) anthracene, indeno 1,2,3-cd pyrene	EPA Method 8270E SIM	2 x 40 milliliter glass vial	Chilled to ≤ 4 degrees C	7 days

6.2 QUALITY CONTROL

Tetra Tech's project manager and field personnel will be responsible for ensuring quality assurance/quality control (QA/QC) for the project, along with coordination with the analytical laboratory. The following sections describe field and laboratory QA/QC for this project that will help ensure quality data are collected to meet project objectives.

6.2.1 Field Equipment and Sample Integrity

Field quality control includes field personnel follow the methods and SOP outlined in this RIWP. The following sections discuss field QC for this project.

6.2.1.1 Field Instrument, Equipment, and Supplies

Field personnel will ensure all equipment is clean, operational, and properly calibrated. Field equipment will be maintained and calibrated as per manufacturer guidelines. Field personnel will document the date and time of instrument calibration checks and calibration efforts, calibration fluids used, result the calibration / calibration checks, any issues observed, and corrective actions taken.

Supplies and consumable items required for sampling will be based on the work described in Section 5. Supplies and consumables will be purchased new and inspected prior to the field effort. Field personnel will obtain all sample bottles from the analytical laboratory. The bottles will be ordered at least 1week prior to the field effort and the order checked for order accuracy upon arrival.

6.2.1.2 Cross-Contamination

Field personnel will work to minimize cross-contamination by:

1. Maintaining clean soil and groundwater collection equipment and supplies in either sealed plastic containers or plastic bags inside the field vehicle during travel and just prior to use.
2. Placing clean plastic sheeting onto the ground at each groundwater sampling staging area or to cover field tables or tailgate, as feasible, to reduce contact with potentially contaminated surfaces, such as asphalt or concrete and decontaminating table and tailgate surfaces.
3. Wiping the multi-parameter meter flow cell and rinsing the outside of the sonde with between groundwater sample locations.
4. Decontaminating soil sample equipment between sample intervals and locations. Refer to **SOP-11** for guidance.
5. Wiping down the peristaltic pump (or bladder pump) housing after use at each location.
6. Frequently changing sample gloves, including just prior to sample collection.

6.2.1.3 Sample Handling

Field personnel will handle and preserve all samples in the field as per laboratory requirements to maintain sample integrity. All samples will be maintained in a cooler containing doubled-resealable bags filled with ice and the ice replenished, as needed, prior to shipment to the laboratory. Samples will be cooled to temperatures between 0° and 6°C, but not frozen. Field personnel will replenish the ice, as needed during temporary field and office storage, and again just prior to priority overnight shipment to the analytical laboratory. All samples will be packed with sufficient packing material to prevent breakage during shipment and date, sign, and adhere custody seals to the outside of each cooler prior to shipment. Refer to **SOP-9** for guidance.

6.2.1.4 Chain-of-Custody

Field personnel will maintain custody of the samples until delivery to the overnight courier for shipment to the laboratory (**SOP-9**). Field personnel will document all samples on laboratory-provided chain-of-custody documents (**SOP-12**) at the time of sampling. The chain-of-custody will remain with the samples throughout storage and transportation.

Field personnel will:

1. Ensure all required portions of the form are filled out and accurate.
2. Check the chain-of-custody prior to shipment to ensure all sample information, including but not limited to sample names, dates, collection times, number of containers, media, preservatives, and analyses on the chain-of-custody are legible, complete, and accurate.
3. Check to ensure that the listed parameters for analyses are consistent with this RIWP.

Field personnel will then sign, date, and document the time on the chain-of-custody that the samples are transferred to overnight courier service. Field personnel will document times when ice is replenished in the field notebook. Field personnel will request a shipment receipt from the overnight courier and document tracking numbers in the field notebook so that each shipment can be tracked, if needed.

6.2.2 Field Quality Control Samples

The following tables specify QC samples field personnel will collect for each media during this project. **Table 6-4** lists QC samples for soil vapor, **Table 6-5** subsurface soil, and **Table 6-6** groundwater. Refer also to **SOP-13** for guidance (RIWP takes precedence).

When submitting soil and groundwater VOC samples for analysis, field personnel will consolidate VOC samples into one cooler, as possible, to reduce the number of trip blanks needed. When multiple coolers are used, copies of chain-of-custodies listing all samples in the shipment will need to be placed together in each sample cooler to ensure samples are property logged by laboratory personnel.

Table 6-4. Soil Vapor QC Samples

Sample Type	Sample Name	Purpose	# QC Samples Per Event	Objective
Outdoor Ambient Air	SVMP-Ambient Outdoor	Assess potential contaminants in ambient air for comparison with subsurface soil.	1	Provide background concentrations outside ambient air from other potential site sources (e.g., pump off-gassing, vehicle traffic) for comparison with subsurface soil vapor analytical results.
Indoor Ambient Air	SVMP-Ambient Indoor	Assess potential contaminants in ambient air for comparison with building sub slab soil.	1	Provide background concentrations of indoor ambient air for comparison with sub slab analytical results that may originate from other potential site sources (e.g., pump off-gassing, vehicle traffic) that may enter through features such as heating or venting systems, foundation, wall, or slab cracks, doors, stored indoor chemicals or building products, or other openings, for comparison with analytical results.

Table 6-5. Subsurface Soil QC Samples

QC Sample Type	Sample Name*	Purpose	# QC Samples Per Event	Objective
Field Duplicate	FD-Soil-1	Measure analytical precision.	1 per 20 soil samples	30% RPD
Rinsate Blank	RB-Soil-1	Measure of accuracy and representativeness. Quantify artifacts introduced from the environment during sampling, transport, or analysis of sample.	1 per 20 soil samples	Target analytes not detected
Field Blank	FB-Soil-1	Measure accuracy and representativeness. Quantify artifacts introduced from the environment during sampling, transport, or analysis of sample.	1 per event	Target analytes not detected
Trip Blank	Trip Blank-1	Measure accuracy and representativeness. Quantify artifacts introduced from vapor migration in sample and transport environment.	1 per cooler with VOC samples	Target analytes not detected

** Number samples sequentially in cases where more than one sample is collected per field QC sample type.*
RPD – Relative percent difference.

Table 6-6. Groundwater QC Samples

QC Sample Type	Sample Name*	Purpose	# QC Samples Per Event	Objective
Field Duplicate	FD-GW-1	Measure analytical precision.	1 per 20 soil samples	30% RPD
Rinsate Blank	RB-GW-1	Measure of accuracy and representativeness. Quantify artifacts introduced from the environment during sampling, transport, or analysis of sample.	1 per 20 soil samples	Target analytes not detected
Field Blank	FB-GW-1	Measure accuracy and representativeness. Quantify artifacts introduced from the environment during sampling, transport, or analysis of sample.	1 per event	Target analytes not detected
Trip Blank	Trip Blank-1	Measure accuracy and representativeness. Quantify artifacts introduced from vapor migration in sample and transport environment.	1 per cooler with VOC samples	Target analytes not detected

** Number samples sequentially in cases where more than one sample is collected per field QC sample type.*
RPD – Relative percent difference.

Field Duplicate Collection

Field duplicates are samples collected using the same methods, at the same place and same depth, and at the same time as the associated natural sample. Field duplicates are used to estimate sampling and laboratory analytical precision. Field personnel will collect the field duplicate consistent with collection of the natural sample. Field personnel will collect the sample using the same number of laboratory-provided samples containers as the associated natural sample and preserve the sample as per method and laboratory requirements. The field duplicate will be analyzed for the same analytical parameters as the associated natural sample.

Field personnel will document the name, date, and time of duplicate sample collection, along with the name of the associated natural sample in the field notebook and/or on the field log. Field personnel will place an arbitrary sample collection time for the duplicate sample on the chain-of-custody but record the actual sample time in the field notebook/field log. The field duplicate will be analyzed for the same analytical parameters as the associated natural sample.

Field Blank

Field personnel will collect a field blank using de-ionized water (preferable) or distilled water to evaluate the potential for cross-contamination from ambient field, sample handling, and laboratory conditions. The field blank will be collected by pouring blank water directly from the water container and into laboratory-provided sample containers. Field personnel will collect the sample using the same number of laboratory-provided samples containers as the associated natural samples and preserve the sample as per method and laboratory requirements. The field blank will be analyzed for the same analytical parameters as the associated natural samples.

Rinsate Blank

Field personnel will collect rinsate blanks using de-ionized (preferable) or distilled water.

- Soil-related rinsate blanks: Field personnel will pour the blank water directly from the original container and over decontaminated sampling equipment (i.e., trowel, spoon, putty knife) which will then flow directly from the equipment into laboratory-provided sample containers.
- Groundwater-related rinsate blanks: Field personnel will use new, dedicated disposable tubing and peristaltic pump to pump blank water from the original container, through the tubing, then directly from the tubing and into the laboratory-provided sample containers. If using a bladder pump, a new dedicated bladder pump will be used along with the tubing after the pump body has been decontaminated.

Field personnel will preserve the sample as per method and laboratory requirements and analyze the sample for the same analytical parameters as the associated natural samples

6.2.3 Laboratory Quality Control

The analytical laboratory will perform laboratory QC as per the analytical method and their internal requirements for environmental samples. The frequency and type of QC performed by the laboratory is often driven by the analytical method being performed. Each laboratory will report the results of their QC efforts in a QC summary, as applicable, with each analytical laboratory report. The following lists standard laboratory QC anticipated.

Laboratory Blanks

A laboratory blank (or method blank) is a sample of known matrix where the presence or absence of concentrations are known to be less than the laboratory minimum limit of detection (practical quantitation limit). The laboratory analyzes the blank to evaluate the accuracy.

Laboratory Control Samples (LCSs)

Laboratory Control Sample (or "LCS") means a sample of an inert matrix or a matrix with a consistent concentration of the analytes of interest, fortified with a verified known amount of the analytes of interest. The LCS is analyzed to assess the laboratory performance to successfully recover target analytes from a control matrix on a purified sample material, like homogenous sand or deionized water. Recovering the target analytes in the LCS assesses whether the analytical procedure is in control and evaluates the laboratory capability to report unbiased measurements. The LCSs are prepared in the same manner and undergo the same procedures as the project samples.

Laboratory Duplicate Sample

A laboratory duplicate is a split collected by the laboratory from one of the project samples being analyzed in the batch. The laboratory analyzes the two samples and compares the results using the relative percent difference (RPD). The duplicate samples are used to evaluate precision.

Matrix Spike Samples (MS Samples)

Matrix spikes are actual field samples to which known spiked concentrations of target analytes have been added prior to sample preparation and analytical testing. The MS is analyzed as a method performance assessment by measuring the effects of interferences caused by the specific sample matrix. Poor spike recoveries for MS/MSD samples could mean the sample matrix is causing matrix interference issues. These have occurred fairly frequently for groundwater samples from Triumph due to the elevated sulfate concentrations.

Matrix Spike Duplicate (MSD) Samples

A matrix spike duplicate is an additional replicate of the matrix spike sample following the same sample preparation and analytical testing as the original sample. MSDs are used to document the precision and bias of a method for a specific sample matrix. Following MS and MSD recovery results, the RPD is reported for each analyte as a means of measuring reproducibility. In addition to RPD, laboratories adhere to pre-determined control limits for MS-MSD recovery ranges for each analyte to evaluate performance.

6.2.4 Data Evaluation

Tetra Tech will conduct data review, verification, and validation on the laboratory data collected during this project. Data review will be conducted on chain-of-custody, sample handling (e.g., temperature and holding times), and laboratory data to ensure project data has been recorded, transmitted, and processed correctly. Data verification will be performed after the data review to evaluate whether the data complies with the scope of work, investigation methods, and data quality objectives.

Tetra Tech will conduct the data validation of project analytical data. Data validation will be conducted on laboratory QC data only for this project. It will be conducted to evaluate the general quality of the laboratory data relative to the end use. Validation is related to analyte- and sample-specific process that focuses on the project-specific data needs and documents any potentially unacceptable variances from the QAPP. Qualifiers will be assigned to project data, as needed, based laboratory QC.

Data review, verification, and validation efforts are based on the analytical support determined to be necessary in the planning stages of the project. Tetra Tech personnel performing data verification and validation will use the following documents, as needed, for guidance during the effort:

- EPA QA/G-8 Guidance on Environmental Data Verification and Data Validation (EPA 2002).
- Appendix A of EPA's Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use (EPA 2009).
- National Functional Guidelines for Superfund Inorganic Methods Data Review (EPA 2020a).

- National Functional Guidelines for Superfund Inorganic Methods Data Review (EPA 2020b).

Appendix D includes an example of the data review form that will be used to evaluate the data. The goal of the review will be to identify errors; evaluate completeness of all data collected, and how it was collected and handled; ensure that all non-direct measurement data was received; check for completeness of the data obtained and identify any deficiencies; review analytical laboratory documentation; and evaluate any programming or software related errors.

6.2.5 Data Management

Tetra Tech will maintain hard copies of field notebooks and field forms in a project folder. The field notebooks and forms will also be scanned and electronically kept in the project's electronic folder on Tetra Tech's server, which is backed up at least daily. Analytical data will be obtained from the laboratory in electronic format. The analytical reports will also be stored in the project folder on Tetra Tech's server as will all other project reports and documents.

Other data that may be used during this project include historic investigation and water quality monitoring reports. The existing documents will also be stored electronically in the project folder.

7.0 REFERENCES

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APPENDIX A: FIGURES

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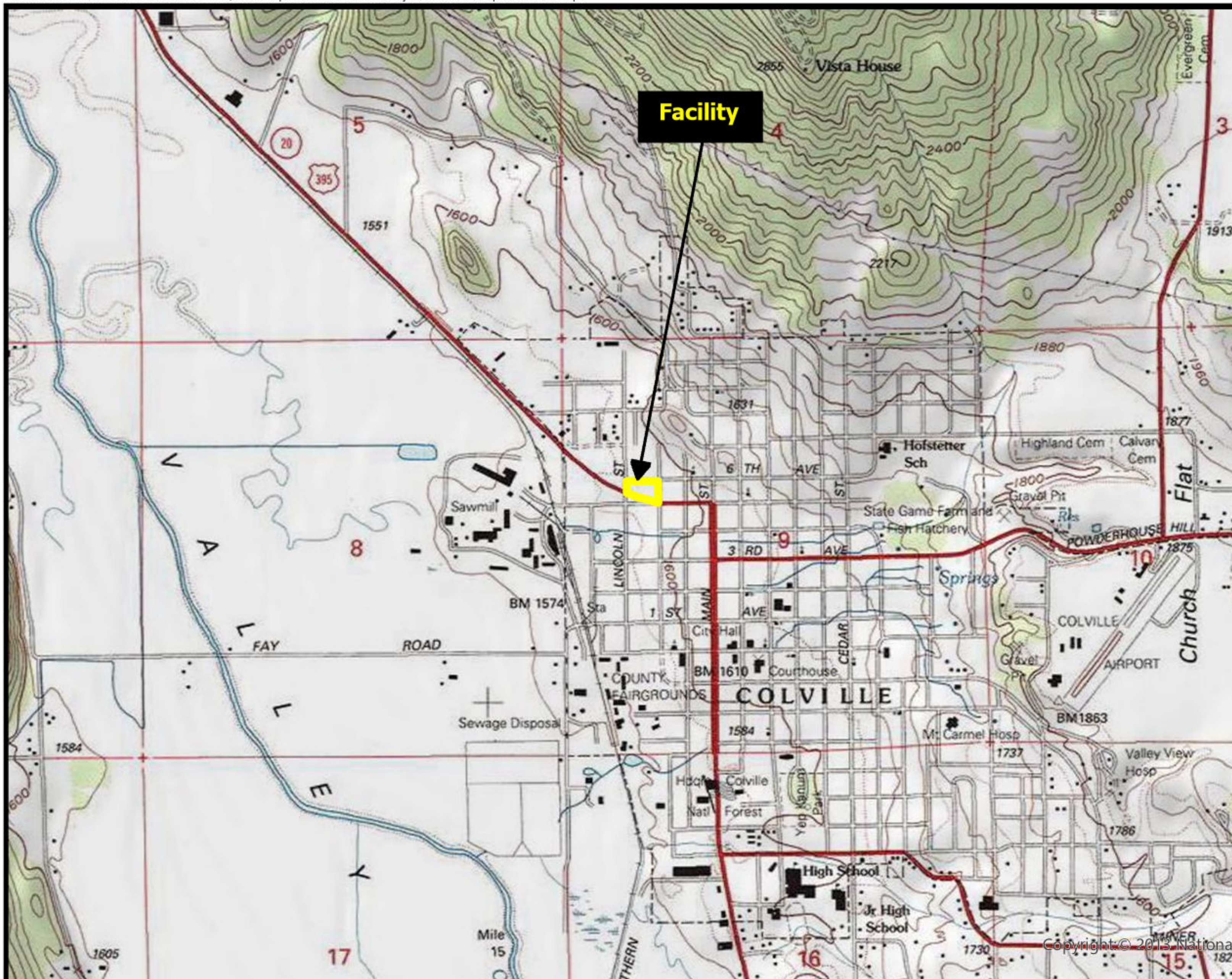

Whitten Oil #1

370 W. 5th Avenue,
Colville, Washington

Location Map

1212 N. Washington Street,
Suite 10
Spokane, WA 99201

DATE	DRAWN BY	FIGURE
01/24/2025	LOLA AKINTOMIDE	1

117-727135-24001

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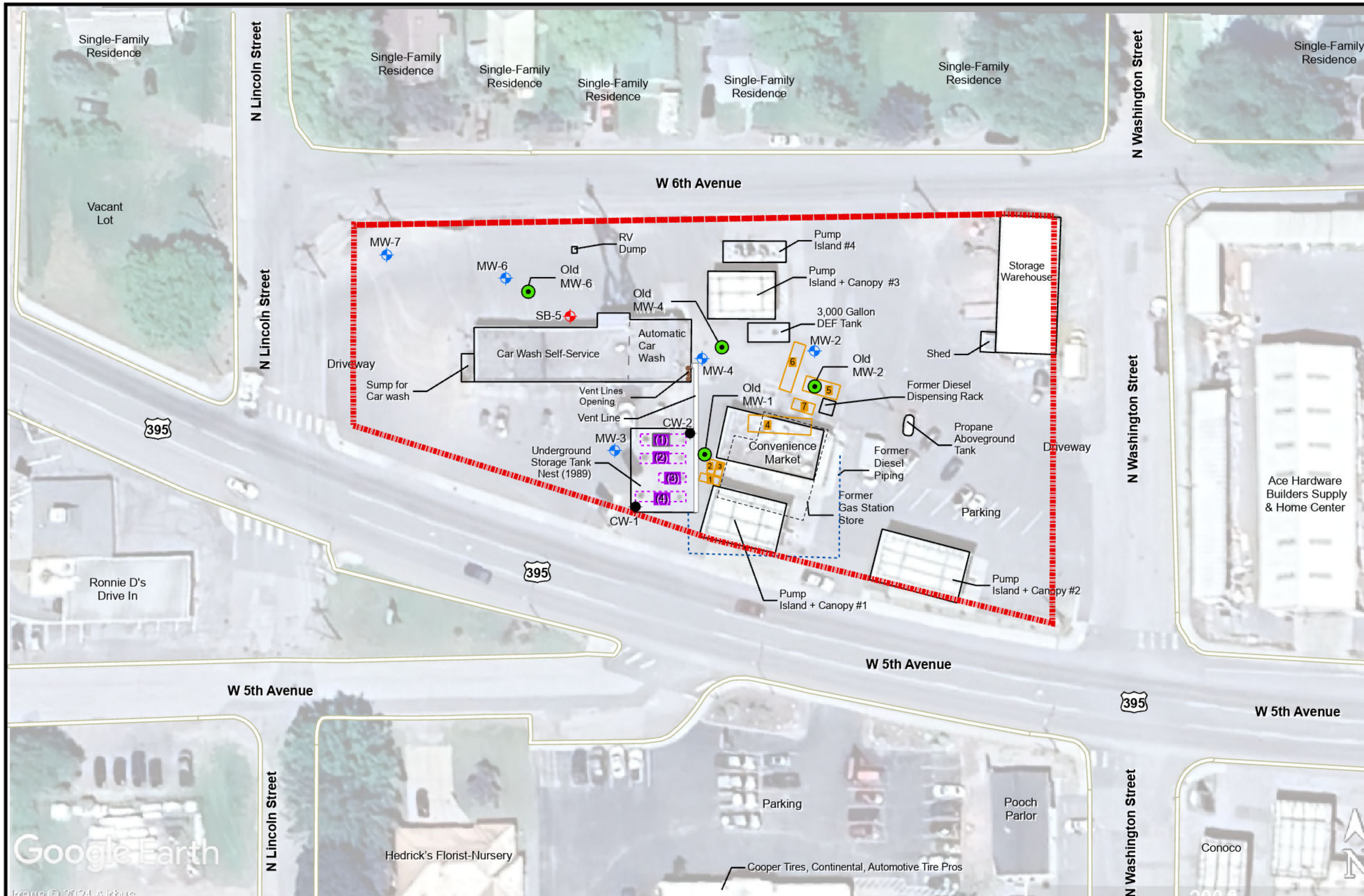

Legend

- Site Boundary
- Groundwater Monitoring Well Location (MW-#2-4, #6-7)
- Old Groundwater Monitoring Well Location (MW-#1, #2, #4, #6)
- Compliance Well (CW-#1-2)
- Stabilization Well (SB-5)
- Buildings or Structures
- Underground Storage Tank Nest
  - (1) 10,000 Gallon (8 feet X 27 feet) Regular Gasoline Tank
  - (2) 10,000 Gallon (8 feet X 27 feet) OffRoad Diesel Tank
  - (3) 6,000 Gallon (8 feet X 16 feet) Supreme Unleaded Gasoline Tank
  - (4) 10,000 Gallon (8 feet X 27 feet) On Road Diesel Tank
- Former Underground Storage Tank
  - 1 550 Gallon Gasoline Tank
  - 2 550 Gallon Gasoline Tank
  - 3 550 Gallon Gasoline Tank
  - 4 12,000 Gallon Gas/Diesel Two Compartments Tank (Closed in Place)
  - 5 10,000 Gallon Diesel Tank
  - 6 12,000 Gallon Regular Gasoline Tank
  - 7 10,000 Gallon (Unknown Product) Tank

Note: Please note that borings, wells, and other features on this map have not been professionally surveyed. Survey work is planned as part of the RI Work Plan. The positions of these features will be subsequently be adjusted on future figures.

N / W / E / S

0 25 50 100 Feet

Whitten Oil #1

370 W. 5th Avenue,
Colville, Washington

Site Plan

1212 N. Washington Street,
Suite 10
Spokane, WA 99201

DATE	DRAWN BY	FIGURE
01/24/2025	LOLA AKINTOMIDE	2

117-727135-24001

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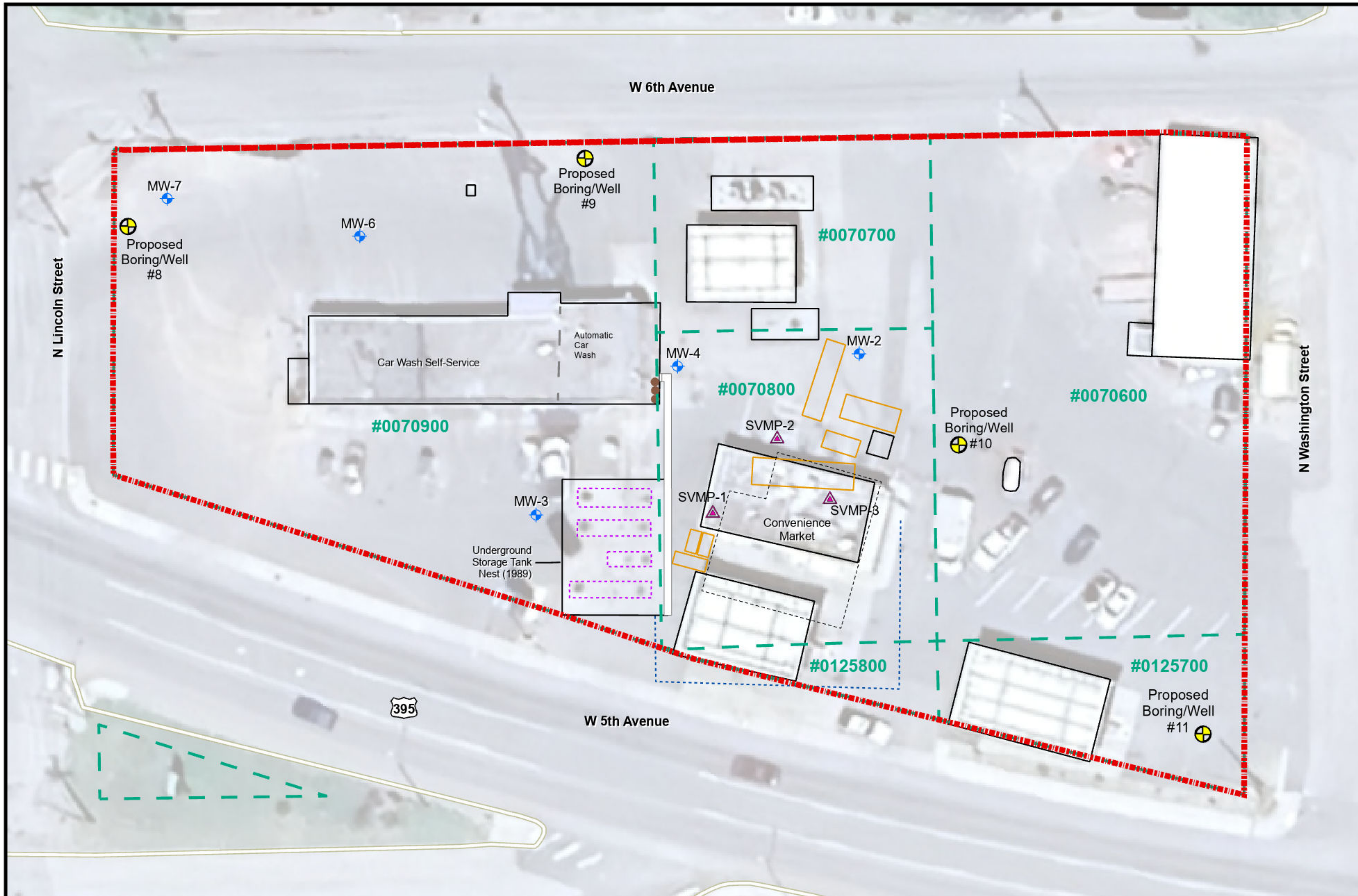


Legend

- Site Boundary
- Groundwater Monitoring Well Location (MW-#2-4, #6-7)
- Proposed Boring (BH #9-12)
- Soil Vapor Monitoring Point (SVMP #1-3)
- Steven County Parcel Boundary and Number #
- Buildings or Structures
- Underground Storage Tank Nest
- Former Underground Storage Tank

Note: Please note that borings, wells, and other features on this map have not been professionally surveyed. Survey work is planned as part of the RI Work Plan. The positions of these features will be subsequently be adjusted on future figures.

N
W E
S

0 10 20 40 Feet

Whitten Oil #1

370 W. 5th Avenue,
Colville, Washington

Investigation Locations

1212 N. Washington Street,
Suite 10
Spokane, WA 99201

DATE	DRAWN BY	FIGURE
01/24/2025	LOLA AKINTOMIDE	3

117-727135-24001

APPENDIX B: HEALTH AND SAFETY PLAN

TETRA TECH
Safety Excellence

HEALTH AND SAFETY PLAN (HASP)

01/25/2025 to 12/31/2025

Project Name: Whitten Oil #1 Site Investigation

370 W 5th Avenue
Colville, WA 99114

Project Number: 117-727135-24001

Plan Prepared By: ______________________________ Date: 01/23/2025
Flavio Ishihara
Technician IV

Plan Reviewed By: ______________________________ Date:
Rob Rolon, CIH, REM
Director of Health and Safety

SUMMARY OF CHANGES TABLE

Date	Work Activity	Description of Change	Page Number	
			Previous	Current
3/6/2023	Whole Plan	HASP original creation	N/A	X
8/8/2024	Whole Plan	Revise past HASP into updated format	N/A	X
9/4/2024	Review by H&S	Reviewed HASP	N/A	Signature Page
9/4/2024	Additional Controls	Added Additional Control Measures table	N/A	11

GENERAL PROJECT INFORMATION		
Site Name: Whitten oil #1 Site Investigation	**Site Contact: Arthur Sood**	**Telephone: (509) 684-9964**
Location: 370 W 5th Avenue, Colville, WA 99114	**Client Contact:** Jon Welge (Tt)	**Telephone:** (509) 263-5737
EPA ID No.: N/A	**Prepared By:** Flavio Ishihara (Tt)	**Date Prepared:** 01/23/2025
Project No.: 117-727135-24001	**Dates of Activities:** (HASP is not valid for periods longer than 12 months)	**Emergency Response** ☐ Yes ☒ No

Objectives:

The proposed Initial Groundwater Investigation project will supplement our first project that included Historical Site Investigation. It is the purpose of Initial Groundwater Investigation to provide the minimum background data to appropriately support groundwater investigation and further site investigation. This new project consists of the following:

- Task 1: Monitoring well assessment and servicing with drill crew
- Task 2: EPA low-flow groundwater sampling of up to five wells
- Task 3: Survey of horizontal and vertical positions of wells by prof. land surveyor (PLS)

Site Type: *Check as many as applicable.*

☒ Active	☐ Landfill	☒ Inner-City
☐ Inactive	☒ Railroad	☐ Rural
☒ Secured	☐ Residential	☐ Remote
☐ Unsecured, site not fenced separately	☒ Industrial	☐ Other (*specify*)

Field Work: ☐ Nonintrusive ☒ Intrusive

Project Scope of Work and Site Background

The proposed Initial Groundwater Investigation project will supplement our first project that included Historical Site Investigation. It is the purpose of Initial Groundwater Investigation to provide the minimum background data to appropriately support groundwater investigation and further site investigation. This new project consists of the following four (4) tasks:

- Task 1: Monitoring well assessment and servicing with drill crew
- Task 2: EPA low-flow groundwater sampling of up to five wells
- Task 3: Survey of horizontal and vertical positions of wells by prof. land surveyor (PLS)
- Task 4: Initial groundwater investigation report with survey data, flow data, and follow on

The subject property is the Whitten Oil #1 station, an active Chevron-branded fueling station site that includes a convenience store, a multi-bay carwash, a Pacific Pride diesel truck refueling island, a propane tank filling area, an RV pump out, and four fiberglass underground storage tanks (USTs) that hold diesel and gasoline. Recent historical review indicates the site has served Colville as a bulk fuel storage facility since the 1930s. The site was discovered to have significant releases in 1989 that remain unresolved.

Health and Safety Approver Comments or Additional Instructions:

- All project associated personnel must meet the requirements detailed in 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response (HAZWOPER) paragraphs (e, Training) and (f, Medical Surveillance).
- Ensure that the entire area has been adequately surveyed and marked for ALL utilities and that no intrusive work is conducted within the margin of error of the survey. ONLY subcontractors that have been pre-approved by Tetra Tech and (if required) the client may be utilized. Furthermore, subcontractors MUST provide JSA/AHAs for EACH of their assigned tasks, as well as comply with Tetra Tech requirements. Tetra Tech personnel must follow attached AHAs.
- Use safe lifting procedures when transferring supplies and equipment.
- Have potable water on-hand for eyewash, drench, hand washing and drinking.
- Minimum **PPE SHAL**L include, hard toe safety boots with 6-inch ankle support, ANSI Z87.1 Safety glasses, ANSI Z89.1 hardhats, Nitrile gloves with at least 6 mil thickness, ear plugs or muff with minimum 27 noise reduction rating (when drill rig is operating), and ANZI Class 2 high-visibility vest. This level of protection under HAZWOPER is commonly known as Level D.
- All project associated personnel shall wear long pants, long sleeve shirt, and appropriate weather garments (e.g., rain jackets, heavy coats, winter gloves with touchscreen fingers.
- As the scope of the work changes, the JSA should be reviewed and revised. Communicate revisions with H&S Dir for updating.
- **ALL EMPLOYEES HAVE SUSPEND/STOP WORK AUTHORITY –** All employees are reminded that they have both the authority and responsibility to stop work when they perceive that an unsafe condition exists that threatens themselves, their coworkers, or the environment. Every employee has the right to a safe and healthy workplace, and to understand the hazards of the workplace.
- **A minimum of two persons with appropriate training and medical surveillance must be on site for any fieldwork subject to Level 2 HASP requirements.**
- Report all incidents no matter how minor to Project Manager and OHSR. Use the Incident Reporting Quick Reference for instructions on incident reporting. See Incident Reporting Section below.

Incident Reporting Procedures for TOTAL

Tetra Tech personnel shall report incidents to the SSO and PM, as soon as possible. The following incidents shall be reported:

• Observations	• Chemical spill or release
• Near miss	• Fire
• Injury or illness (within one hour to expedite appropriate care if required),	• Motor vehicle accident
• Property or equipment damage	• Security related event (e.g., laptop stolen)

The Tetra Tech intranet home page, at “My Tetratech” web site, has a Toolbox Menu of items including “TOTAL (Report an Event)”. By selecting this link, the TOTAL Incident Reporting Employee Dashboard is activated. The employee reporting the incident selects “Reporting an Event” link to move through the steps of reporting the incident. The system was designed to be “fail safe” in that the user will not be able to skip any required information. TOTAL can also be accessed directly from the internet using the following web address: http://totalhs.tetratech.com/.

Tetra Tech’s Incident Reporting and Investigation Program requires that employees report all incidents as soon as possible, but within 24 hours. An initial report must be completed in TOTAL within that time frame. To expedite reporting of incidents, Tetra Tech now has a TOTAL Mobile application that allows incidents to be reported through smart phones. Tetra Tech personnel will need to download the mobile application to employ this feature.

Emergency Information		
Nearest Hospital		
Name: Providence Mount Carmel Hospital	Address: 982 E Columbia Ave, Colville, WA 99114	Phone Number: (509) 685-5100

Hospital (Providence Mount Carmel Hospital - 982 E Columbia Ave, Colville, WA 99114)

Route Map:

A Chevron
Leave at 11:41 AM
370 W 5th Ave, Colville, WA 99114

Head east on US-395 S / WA-20 / W 5th Ave toward N Washington St

0.3 mi

Turn left onto WA-20 / E 3rd Ave

0.6 mi

Turn right onto N Pine St

463 ft

Road name changes to S Pine St

0.1 mi

Turn left onto S Madison St

0.1 mi

Turn left onto E Birch Ave, then immediately turn right onto E Columbia Ave

443 ft

Turn left

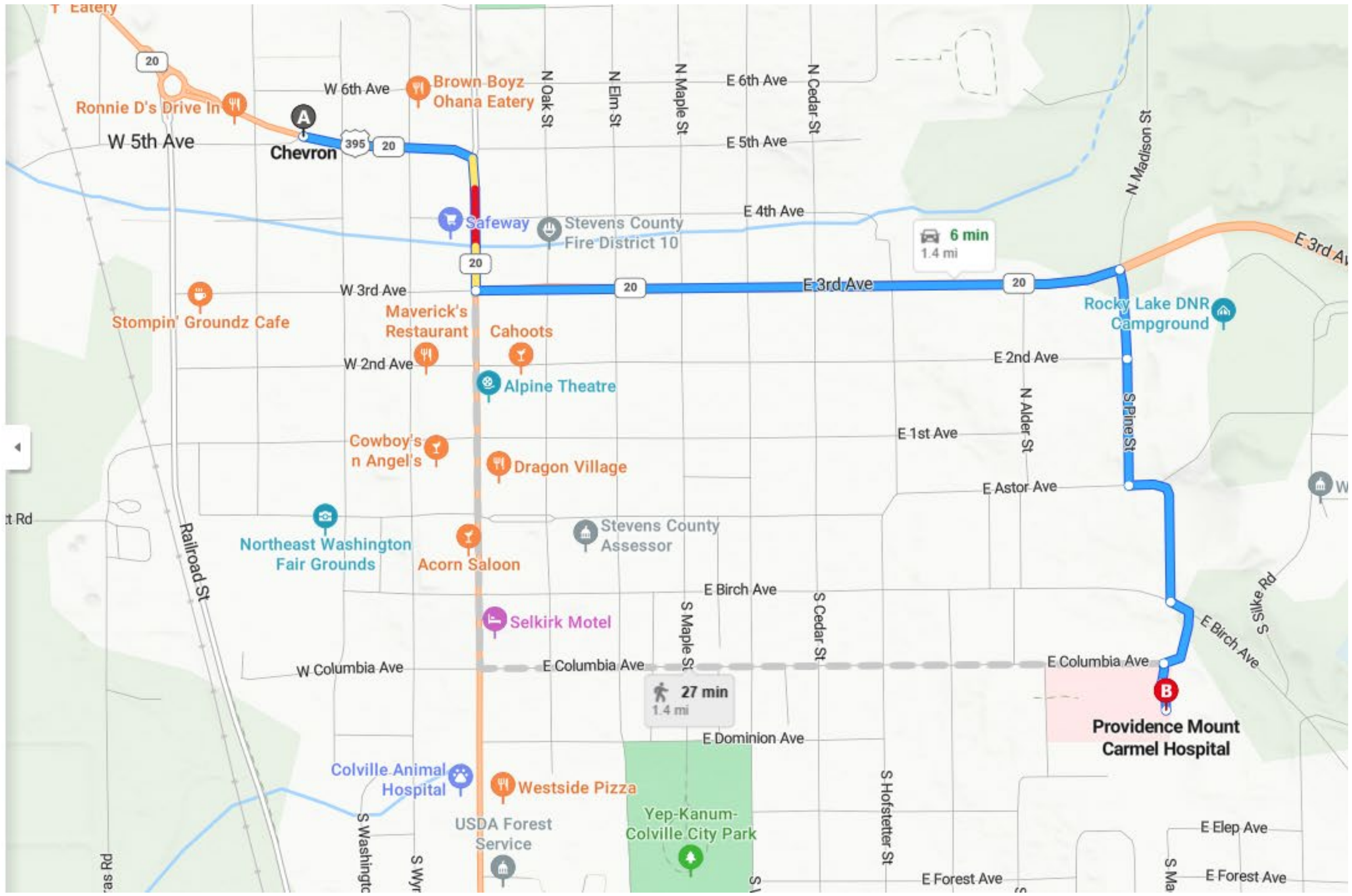
108 ft

Turn left

144 ft

Arrive at your destination on the left
The last intersection before your destination is E Columbia Ave
If you reach S Alder St, you've gone too far

B Providence Mount Carmel Hospital
Arrive by 11:48 AM



Situation	To Do Action	Contact Information
A. For emergencies (any situation requiring immediate medical attention).	1. Contact 911 2. Signal a site or medical emergency with three blasts of a loud horn (car horn, fog horn, or similar device) 3. Site personnel should evacuate to the area of safe refuge designated on the site map 4. Report incident (See C below)	**911**
B. For non-life-threatening injuries	1. Contact **WorkCare Incident Intervention Program** 2. Report incident (See C below)	**WorkCare Incident Intervention Program** – **888-449-7787**
C. Incident Reporting to Project Manager (PM) and Office Health and Safety Representative (OHSR)	1. Report incident to PM and OHSR	**Jon Welge – (509) 263-5737 mobile** **Flavio Ishihara – (208) 660-7665 mobile**
D. For motor vehicle accidents, contact police to file report if necessary.	1. If necessary, contact local police to file police report 2. Exchange information with other drivers/witnesses 3. Take photos of all vehicles involved. Include photos of area damaged as well as the entire profile of the vehicles involved.	911, or Colville Police Department – (509) 684-2525
E. Incident Reporting to corporate.	4. Report incident to Tetra Tech H&S	Rob Rolon Mobile (407) 448-9553 Jenn Fullmer Mobile (801) 712-5425
F. Complete documentation.	1. Complete IR-Form and submit within 24 hours to H&S / OHSR. 2. If access is available complete report in TOTAL within 24 hours. 3. Complete any supplemental forms as requested by supervisor / H&S within 72 hours.	Use the TOTAL application on your computer or mobile device. Use Incident Reporting Quick Reference for additional guidance.
G. Dangerous Goods Shipment Assistance	1. Call InfoTrac	800.535.5053
H. Ingestion of Hazardous Chemicals	1. Call Poison Control	800.222.1222

Job Title or Position:	Individual Name	Mobile Telephone No.
Project Manager (PM):	Jon Welge / Natalie Morrow	(509) 263-5737 / (406) 370-8170
Field Team Leader (FTL):	Flavio Ishihara	(208) 660-7665
Site Safety Health Officer (SSHO):	Flavio Ishihara	(208) 660-7665
Subcontractor SSHO:		

Note: This page must be posted on site.

Site Personnel and Responsibilities (include subcontractors):		
Employee Name and OU/Location	**Task(s)**	**Responsibilities**
PM: Jon Welge / Natalie Morrow	1	• Project Manager (PM): Manages the overall project, makes site safety health officer (SSHO) aware of pertinent project developments and plans, and maintains communications with client as necessary. Additionally, For projects lasting longer than one consecutive week on-site, the PM is responsible for conducting one field audit using Form AF-1.
FTL: Flavio Ishihara	1	• Field Team Leader: Directs field activities, makes SSHO aware of pertinent project developments and plans, and maintains communications with the Project Manager and the client as necessary
SSHO: Flavio Ishihara	1	• Site Safety Health Officer (SSHO): Ensures that appropriate personal protective equipment (PPE) is available, enforces proper use of PPE by on-site personnel and subcontractors; suspends investigative work if personnel are or may be exposed to an immediate health hazard; implements and enforces the HASP; identifies and controls site hazards when possible; communicates site hazards to all personnel; and reports any deviations observed from anticipated conditions described in the health and safety plan to the health and safety representative.
Field Personnel: Flavio Ishihara	1	• Field Personnel: Completes tasks as directed by the project manager, field team leader, and SSHO, and follows the HASP and all SWPs and guidelines established in the Tetra Tech, Inc., Health and Safety Manual.
Subcontractors:	1	• Tetra Tech-hired subcontractor personnel on site (a subcontract SSHO MUST be identified by name): Completes tasks as outlined in the project scope of work in accordance with the contract. Participates in all Tetra Tech on-site safety meetings and follows all procedures and guidelines established in this HASP, as well as the company health and safety plan and program.

Project Hazard Analysis Overview			
Field Activities Covered Under this HASP	**Level of Protection[1]**		**Date of Activities**
Task Description	**Primary**	**Contingency**	
1 Soil vapor point installation and sampling	☐ C ☒ D	☐ C ☐ D	2/1/2025 – 12/31/2025
2 Subsurface soil boreholes	☐ C ☒ D	☐ C ☐ D	2/1/2025 – 12/31/2025
3 Groundwater monitoring well installation and sampling	☐ C ☒ D	☐ C ☐ D	2/1/2025 – 12/31/2025

Note:

1. Level 2 HASP only authorized for Level of Protections C or D.
2. See page 10 for details on levels of protection. **Contingency level of protection section should be completed only if the upgraded level of protection is immediately available at the job site. If no contingency level of protection is denoted, all employees covered under this HASP must evacuate the immediate site area if air contaminant levels would require an upgrade of PPE.**

Known or Anticipated Site Hazards or Concerns: (Hazards covered by existing Safe Work Practices are listed on the next page)

Chemical Hazards (i.e., Chemicals of Concern-COC)

- ☐ Unknown or poorly characterized chemical hazards
- ☒ Inorganic chemicals
- ☒ Organic chemicals
- ☐ Oxygen deficiency
- ☒ Inorganic chemicals
- ☒ Organic chemicals
- ☐ Chemical warfare material
- ☒ OSHA-Regulated Chemicals (see HASP p. 9 list)
- ☐ Respirable silica
- ☐ Respirable particulates
- ☐ Respirable silica

Radioactive Hazards

- ☐ Non-ionizing radiation (lasers, radiofrequencies, UV)
- ☐ Ionizing radiation (alpha, beta, gamma, etc.)

Environmental Stress Conditions

- ☒ Heat stress
- ☒ Cold stress

Environmental Field Hazards

- ☒ Poisonous plants (e.g., poison ivy, poison oak)
- ☒ Infectious insects (e.g., spiders, ticks, swaps)

Physical Hazards

- ☒ Buried Utilities
- ☒ Surface or underground storage tanks
- ☒ General slips, trips, falls
- ☒ Uneven, muddy, rugged terrain
- ☐ Lift (man lift, cherry picker) use
- ☐ Industrial truck (forklift) use
- ☐ Wood or metal ladder use
- ☐ Dangerous goods shipped by air
- ☐ Elevated work (over 6' high)
- ☒ Heavy equipment use or operation
- ☐ Manual lifting of supplies or equipment
- ☒ High noise
- ☒ Portable hand tool use
- ☒ Overexertion/Repetitive Motions

Construction Activities

- ☒ Excavation or trenching
- ☐ Benching, shoring, bracing
- ☐ Grinding operations

Electrical Hazards

- ☐ Energized electrical systems
- ☐ Portable electrical tool use
- ☐ Servicing or maintenance of electrical systems

Driving Hazards

- ☐ Driving commercial vehicles
- ☒ Driving personal vehicles
- ☐ ATV use

Other Specific Hazards

- ☐ Ergonomics
- ☒ Work in strip or shaft mines
- ☐ Scientific diving operations
- ☐ Methamphetamine lab
- ☒ Working over or near water
- ☐ Mold
- ☐ Client-specific safety requirements (attach to HASP)
- ☐ Injury and Illness Prevention Program (California only)
- ☐ *Other (insert)*

Explosion or Fire Potential: ☐ High ☐ Medium ☒ Low ☐ Unknown

Applicable Safety Programs and Safe Work Practices (SWP). Attach to HASP:	Tasks Performed At Job Site that are NOT Covered by SWPs
☐ DCN 4-04 Traffic Zone Safety Program ☒ DCN 4-05 Trenching and Excavation Safety ☐ DCN 4-08 Asbestos Protection Program ☒ DCN 4-09 Haulage and Earth Moving ☒ DCN 4-10 Lead Protection Program ☐ SWP DCN 5-01 General Safe Work Practices ☒ SWP DCN 5-02 General Safe Work Practices HAZWOPER ☐ SWP DCN 5-03 Safe Work Practices for Office Employees ☒ SWP DCN 5-04 Safe Drilling Practices ☐ SWP DCN 5-05 Safe Direct Push (GeoProbe) Practices ☐ SWP DCN 5-06 Working Over or Near Water ☒ SWP DCN 5-07 Use of Heavy Equipment ☐ SWP DCN 5-08 Special Site Hazards (Firearms, Remote Sites, Mines, aircraft, etc.) ☐ SWP DCN 5-09 Safe Electrical Work Practices ☐ SWP DCN 5-10 Fall Protection Practices ☐ SWP DCN 5-11 Portable Ladder Safety ☒ SWP DCN 5-12 Drum and Container Handling Practices ☐ SWP DCN 5-13 Flammable Hazards and Ignition Sources ☒ SWP DCN 5-14 Spill and Discharge Control Practices ☒ SWP DCN 5-15 Heat Stress ☒ SWP DCN 5-16 Cold Stress ☐ SWP DCN 5-17 Biohazards ☐ SWP DCN 5-18 Underground Storage Tank Removal Practices ☐ SWP DCN 5-19 Safe Lifting Procedures ☐ SWP DCN 5-22 Hydrographic Data Collection ☐ SWP DCN 5-23 Permit-Required Confined Space Entry Practices ☐ SWP DCN 5-24 Non-Permit-Required Confined Space Entry Practices ☒ SWP DCN 5-26 Prevention of Sun Exposure ☐ SWP DCN 5-27 Respirator Cleaning Practices ☐ SWP DCN 5-28 Safe Use Practices for Use of Respirators ☐ SWP DCN 5-35 Underground Utilities, including 5-35F, Ground Disturbance Permit ☒ SWP DCN 5-36 Drill Rigs	**NOTE:** Many AHA's can be found on the Health & Safety intranet site at: Activity Hazard Assessment Library *Attach Activity Hazard Analysis (AHA) for each non-covered task* ☐ Project Documentation and Air Monitoring ☒ Soil boring with DPT, including soil and groundwater sampling ☐ Hazardous Materials Sampling (Asbestos, Mold & LBP) ☐ Private Drinking Water Well Sampling **Tetra Tech Employee Training and Medical Requirements:** **Basic Training and Medical** ☒ Initial 40 Hour Training ☐ 8-Hour Supervisor Training (one-time) ☒ Current 8-Hour Refresher Training ☐ Current Medical Clearance (including respirator use) ☒ Current First Aid Training ☒ Current CPR Training ☐ FOCUS FOUR – Environmental Field Hazards – Heat Stress ☐ FOCUS FOUR – Environmental Field Hazards – Plants ☐ FOCUS FOUR – Environmental Field Hazards – Insects ☒ FOCUS FOUR – Struck-By ☒ FOCUS FOUR – Slips, Trips, and Falls in the Field ☒ FOCUS FOUR – Overexertion **Other Specific Training and Medical Surveillance Requirements** ☐ Confined Space Training ☐ Level A Training ☐ Radiation Training ☐ OSHA 10-hour Construction Safety Training ☐ OSHA 30-hour Construction Safety Training ☐ Asbestos Awareness Training ☐ Asbestos B-Reader X-Ray ☐ Blood Lead Level and ZPP Pre, during and Post-Project ☐ Urinary Arsenic Level Pre and Post-Project ☐ MD-certified Asbestos Inspector ☐ Other ______________________

Chemical of Concerns (COC) Information						
COCs Present or Suspected at Site	**Highest Observed Concentration (specify units and sample medium)**	**Exposure Limit (specify ppm or mg/m^3)**	**IDLH Level (specify ppm or mg/m^3)**	**Primary Hazards of the Material (explosive, flammable, corrosive, toxic, volatile, radioactive, biohazard, oxidizer, or other)**	**Symptoms and Effects of Acute Exposure**	**Photoionization Potential (eV)**
Gasoline	N/A	Ceiling = 200 ppm*; ACGIH-TLV-TWA = 300 ppm ACGIH-TLV-STEL = 500 ppm NIOSH-REL-Carcinogen - as low as feasible *The OSHA limit of TWA = 300 ppm and STEL = 500 ppm was vacated by the court ruling of 1993.	Not Determined	Toxic, carcinogen	Irritant to eyes, nose, and mucous membranes; dermatitis; headache, weakness and exhaustion, blurred vision, dizziness, slurred speech, confusion and convulsions; chemical pneumonitis (aspiration of liquid); possible liver and kidney damage/cancer	NA
Diesel Fuel	NA	ACGIH-TLV-TWA = 100 mg/m3 for the inhalable fraction and vapor	10% of the LEL. (0.6 / 7.5%)	Toxic, carcinogen	Irritation of nose, throat and digestive tract; nausea and vomiting; central nervous system depression (headache, drowsiness, dizziness, loss of coordination and fatigue); pulmonary edema (accumulation of liquid in the lungs); and pneumonitis (inflammation of lungs)	NA
Polynuclear Aromatic Hydrocarbons (PAHs)	N/A	OSHA-PEL-TWA = 0.2 mg/m3 ACGIH-TLV-TWA = 0.2 mg/m3	80 mg/m3	Toxic, carcinogen	Dermatitis, bronchitis, cancer.	NA
Naphthalene	NA	**OSHA-PEL-TWA** = 10 ppm*; **ACGIH-TLV-TWA** = 10 ppm; **ACGIH-TLV-STEL** = 15 ppm;** **NIOSH-REL-TWA =** 10 ppm; **NIOSH-REL-STEL =** 15 ppm *The OSHA limit of TWA = 10 ppm and STEL = 15 ppm was vacated by the court ruling of 1993. **The ACGIH has issued a notice of intended change to remove the STEL and add skin too TWA.	250ppm	Toxic	Ulceration of nasal septum, dermatitis, GI disturbances, peripheral neuropathy, respiratory irritation, hyperpigmentation of skin, cancer.	NA

Chemical of Concerns (COC) Information						
COCs Present or Suspected at Site	Highest Observed Concentration (specify units and sample medium)	Exposure Limit (specify ppm or mg/m^3)	IDLH Level (specify ppm or mg/m^3)	Primary Hazards of the Material (explosive, flammable, corrosive, toxic, volatile, radioactive, biohazard, oxidizer, or other)	Symptoms and Effects of Acute Exposure	Photoionization Potential (eV)
Specify Information Sources: NIOSH Pocket Guide to Hazardous Chemicals, September 2005						

Note: In the Exposure Limit column, include Ceiling (C) and Short-Term Exposure Limits (STEL) if they are available. Also, use the following short forms and abbreviations to complete the table above.

A = Air
CARC = Carcinogenic
eV = Electron volt
U = Unknown
IDLH = Immediately dangerous to life or health
mg/m^3 = Milligram per cubic meter
NA = Not available
NE = None established
PEL = Permissible exposure limit
ppm = Part per million
REL = Recommended exposure limit
S = Soil
TLV = Threshold limit value

Monitoring Equipment: All monitoring equipment on site must be calibrated before and after each use and results recorded in the site logbook				
Instrument (Check all required)	**Task**	**Action Levels**	**Action Guideline**	**Comments**
☐ Combustible gas indicator model:	☐ 1 ☐ 2 ☐ 3 ☐ 4	0 to 10% LEL	Monitor; evacuate if confined space	
		10 to 25% LEL	Potential explosion hazard; interrupt task; notify SSHO	
		>25% LEL	Explosion hazard; STOP WORK IMMEDIATELY; evacuate site; notify SSHO	
☐ Oxygen meter model:	☐ 1 ☐ 2 ☐ 3 ☐ 4	>23.5% Oxygen	Potential fire hazard; evacuate site	
		23.5 to 19.5% Oxygen	Oxygen level normal, acceptable conditions	
		<19.5% Oxygen	Oxygen deficiency; interrupt task; evacuate site; notify SSHO	
☒ Photoionization detector model: ☐ 11.7 eV ☐ 10.6 eV ☐ 10.2 eV ☐ 9.8 eV ☐ Other (specify): ____________ PID being used to monitor soil obtained from boreholes and soil vapor during soil vapor / sub slab air sampling.	☐ 1 ☐ 2 ☐ 3 ☐ 4	Any response above background to 0.5 ppm above background	Level C is NOT authorized	1. Use Level D PPE, 2. Obtain initial and periodic background (BG) levels, monitor source areas (such as open excavations, DPT boreholes and concrete core holes or saw cuts) using PID, 3. If PID readings above of 0.5 ppm or more above BG are observed at a source area, monitor worker breathing zone (BZ) areas, 4. If BZ readings exceed 1 ppm for more than 3 minutes, evacuate the area, retreat upwind to a safe area (where BG levels exist) and allow work area to ventilate to OUTDOORS using mechanical means (fans, pumps) if possible. 5. Re-approach work area while monitoring with PID. If BG levels have been regained in the BZ, resume work and continue monitoring. 6. If BZ readings remain above BG, retreat upwind and contact Health and Safety for further direction.
☐ Other (specify):	☐ 1 ☐ 2 ☐ 3 ☐ 4	Specify: Benzene-specific Drager tube (such as 6728561) with a lower detection limit of AT LEAST 0.5 ppm	Specify: Any discernible color change	If available
☐ Other (specify):	☐ 1 ☐ 2 ☐ 3 ☐ 4	Specify: 0.5 to 250 ppm benzene reading >250 ppm	Specify: Level C Evacuate; notify SSHO	If available

Notes:
eV= electron volt LEL=Lower explosive limit mrem=Millirem PEL=Permissible exposure limit ppm=Part per million
a. Level B is required when chemical hazards are present but are uncharacterized. Level C may be acceptable for certain tasks in some situations. If you are uncertain, consult your OU H&S.

Protective Equipment: (Indicate type or material as necessary for each task.)				
Task	Primary Level of Protection (C, D)	PPE Component Description (Primary)	Contingency Level of Protection (C, D)	PPE Component Description (Contingency)
1	D	Respirator type: Not needed Cartridge type (if applicable): CPC material: Not needed Glove material(s): Nitrile, Leather, Surgical Boot material: Steel-toe, Steel-shank Other: ANSI Z87.1 Safety Glasses, ANSI 89.1 Hard Hat, Ear Plugs as needed, ANSI Class II Safety Vest, Overboots as needed	NA	**Level C is not authorized**
		Respirator type: Cartridge type (if applicable): CPC material: Glove material(s): Boot material: Other:		Respirator type: Cartridge type (if applicable): CPC material: Glove material(s): Boot material: Other:

Respirator Notes:
Respirator cartridges may only be used for a maximum time of 8 hours or one work shift, whichever is less, and must be discarded at that time. For job sites with organic vapors, respirator cartridges may be used as described in this note as long as the concentration is less than 200 parts per million (ppm), the boiling point is greater than 70 °Celsius, and the relative humidity is less than 85 percent. If any of these levels are exceeded, a site-specific respirator cartridge change-out schedule must be developed and included in the HASP using Tetra Tech Form RP-2 (Respiratory Hazard Assessment Form)

Notes:
All levels of protection must include eye, head, and foot protection. See **Health and Safety Approver Comments** for minimum PPE requirements.
CPC = Chemical protective clothing
Thermoluminescent Dosimeter (TLD) Badges must be worn during all field activities on sites with radiation hazards. TLDs must be worn under CPC.

Additional Control Measures (Indicate type or material as necessary for each task.)			
Task	Equipment (Equip)/ Engineering (Eng)/ Administrative (Adm)	Description of Additional Controls	Notes
1	Equip	First Aid Kit, Portable Eyewash, Sunscreen, Inspect Repellent w/20% DEET, Sawyer Premium Insect Repellent Clothing Treatment (permethrin treatment for clothing); Sabre Red maximum pepper gel spray; fully charged mobile device	Sawyer permethrin treatment needs client approval; Pepper spray is last resort for imminent dog attack.
1	Adm	Heat Illness Prevention Program Compliance Checklist; bottled water for drinking water	Water replenish schedule worksheet list the needed water amount per individual.

Project-Specific Industrial Hygiene Requirements

OSHA-Regulated Chemicals and Toxic Substances*:

Check any present on the job site in any medium (air, water, soil)

- ☐ No chemicals below are located on the job site
- ☐ Asbestos, 29 CFR 1910.1001
- ☐ alpha-Napthylamine, 29 CFR 1910.1004
- ☐ Methyl chloromethyl ether, 29 CFR 1910.1006
- ☐ 3,3'-Dichlorobenzidine (and its salts), 29 CFR 1910.1007
- ☐ bis-Chloromethyl ether, 29 CFR 1910.1008
- ☐ beta-Napthylamine, 29 CFR 1910.1009
- ☐ Benzidine, 29 CFR 1910.1010
- ☐ 4-Aminodiphenyl, 29 CFR 1910.1011
- ☐ Ethyleneimine, 29 CFR 1910.1012
- ☐ beta-Propiolactone, 29 CFR 1910.1013
- ☐ 2-Acetylaminoflourene, 29 CFR 1910.1014
- ☐ 4-Dimethylaminoazobenzene, 29 CFR 1910.1015
- ☐ N-nitrosomethylamine, 29 CFR 1910.1016
- ☐ Vinyl chloride, 29 CFR 1910.1017
- ☐ Inorganic arsenic, 29 CFR 1910.1018
- ☐ Beryllium, 29 CFR 1910.1024
- ☐ Lead, 29 CFR 1910.1025
- ☐ Chromium (VI), 29 CFR 1910.1026
- ☐ Cadmium, 29 CFR 1910.1027
- ☒ Benzene, 29 CFR 1910.1028
- ☐ Coke oven emissions,29 CFR 1910.1029
- ☐ Cotton Dust, 29 CFR 1910.1043
- ☐ 1,2-Dibromo-3-chloropropane, 29 CFR 1910.1044
- ☐ Acrylonitrile, 29 CFR 1910.1045
- ☐ Ethylene oxide, 29 CFR 1910.1047
- ☐ Formaldehyde, 29 CFR 1910.1048
- ☐ Methylenedianiline, 29 CFR 1910.1050
- ☐ 1,3-Butadiene, 29 CFR 1910.1051
- ☐ Methylene chloride, 29 CFR 1910.1052
- ☐ Respirable crystalline silica, 29 CFR 1910.1053

* **NOTE**: If any of the Regulated Chemicals is applicable, verify all specific standard requirements are implemented. Many states, including California and New Jersey, have chemical-specific worker protection requirements and standards for many chemicals and known or suspected carcinogens.

Hazard Communication (Chemical Products Tetra Tech Will Use or Store On Site)

Attach a Safety Data Sheet [SDS] for each item

☒ Hydrochloric acid (HCl)	☒ Nitric acid (HNO_3)	☐ Sodium hydroxide (NaOH)
☐ Sulfuric acid (H_2SO_4)	☐ Isopropyl alcohol	☐ Household bleach (NaOCl)
☐ Alconox or Liquinox	☐ Hexane	☐ Hydrogen gas
☒ Calibration gas (Isobutylene)	☐ Calibration gas (Pentane)	☐ Calibration gas (4-gas mixture)
☐ Calibration gas (Methane)	☐ HazCat Kit	☐ Mark I Kits (*number?*) ____________

☐ Other (*specify*) ____________

WARNING: Eyewash solution shall be readily available on ALL projects where corrosives (acids or bases) are used, including sample preservatives

On-Site Supplies:

☒ First Aid Kit	☒ Fire Extinguisher	☐ Air Horn	☐ Noise Dosimeter	☐ Oral Thermometer

Initial Isolation and Protective Action Distances (for emergency response)

Work Zones: For heavy equipment (i.e., drilling operations), exclusions zone will be established around each piece of operating equipment based on site conditions and or noise levels (DCN 2-04, Hearing Conservation Program) at each drilling location (i.e., a circular exclusion zone based on noise levels >85 dBA from the equipment or a minimum of 25 feet around the equipment, whichever is greater). Work zones will be delineated using cones, barrier tape or similar visual indicators.

Waste Management Practices

The soil samples will be disposed of by the laboratory after analysis. Investigative derived wastes from DPT for soil and groundwater grab samples will be returned to the borehole. Gloves, PPE, and disposable sampling equipment will be placed in plastic bags or drummed and disposed of by the subcontractor. The minor amounts of decon water that are expected to be generated will disposed of to the ground surface

Decontamination Procedures

The site safety coordinator overseas implementation of project decontamination procedures and is responsible for ensuring they are effective.

Personnel Decontamination

Level D Decon - ☐ Wet ☒ Dry

Level C Decon - ☐ Wet ☐ Dry

Level B Decon – Briefly outline the level B decontamination methods to be used on a separate page attached to this HASP.

Level A Decon – A Level 3 HASP is required. Notify your regional health and safety representative and health and safety director.

Equipment Decontamination

All tools, equipment, and machinery from the Exclusion Zone (hot) or Contamination Reduction Zone (warm) are decontaminated in the CRZ before they are removed to the Support Zone (cold). Equipment decontamination procedures are designed to minimize the potential for hazardous skin or inhalation exposure, cross-contamination, and chemical incompatibilities.

Respirator Decontamination

Respirators are decontaminated in compliance with SWP 5-27 and should be included with this HASP.

Waste Handling for Decontamination

Procedures for decontamination waste disposal meet all applicable local, state, and federal regulations.

Decontamination Equipment

☐ Washtubs
☐ Buckets
☐ Scrub brushes
☐ Pressurized sprayer
☐ Detergent [Type]
☐ Solvent [Type]
☐ Household bleach solution
Concentration/Dilution: ___________
☐ Deionized water
☐ Disposable sanitizer wipes
☐ Facemask sanitizer powder
☐ Wire brush
☒ Spray bottle
☐ Tubs / pools
☐ Banner/barrier tape
☐ Plastic sheeting
☐ Tarps and poles
☒ Trash bags
☐ Trash cans
☐ Duct tape
☒ Paper towels
☐ Folding chairs
☒ Other: Absorbents

Emergency Response Planning

During the pre-work briefing and daily tailgate safety meetings, all on-site employees will be trained in the provisions of emergency response planning, site communication systems, and site evacuation routes.

In the event of an emergency that necessitates evacuation of a work task area or the site, the following procedures will take place.

- The Tetra Tech SSHO will contact all nearby personnel using the on-site communications to advise the personnel of the emergency.
- The personnel will proceed along site roads to a safe distance upwind from the hazard source.
- The personnel will remain in that area until the SSHO, or an authorized individual provides further instructions.

In the event of a severe spill or a leak, site personnel will follow the procedures listed below.

- Evacuate the affected area and relocate personnel to an upwind location.
- Inform the Tetra Tech SSHO, a Tetra Tech office, and a site representative immediately.
- Locate the source of the spill or leak and stop the flow if it is safe to do so.
- Begin containment and recovery of spilled or leaked materials.
- Notify appropriate local, state, and federal agencies.

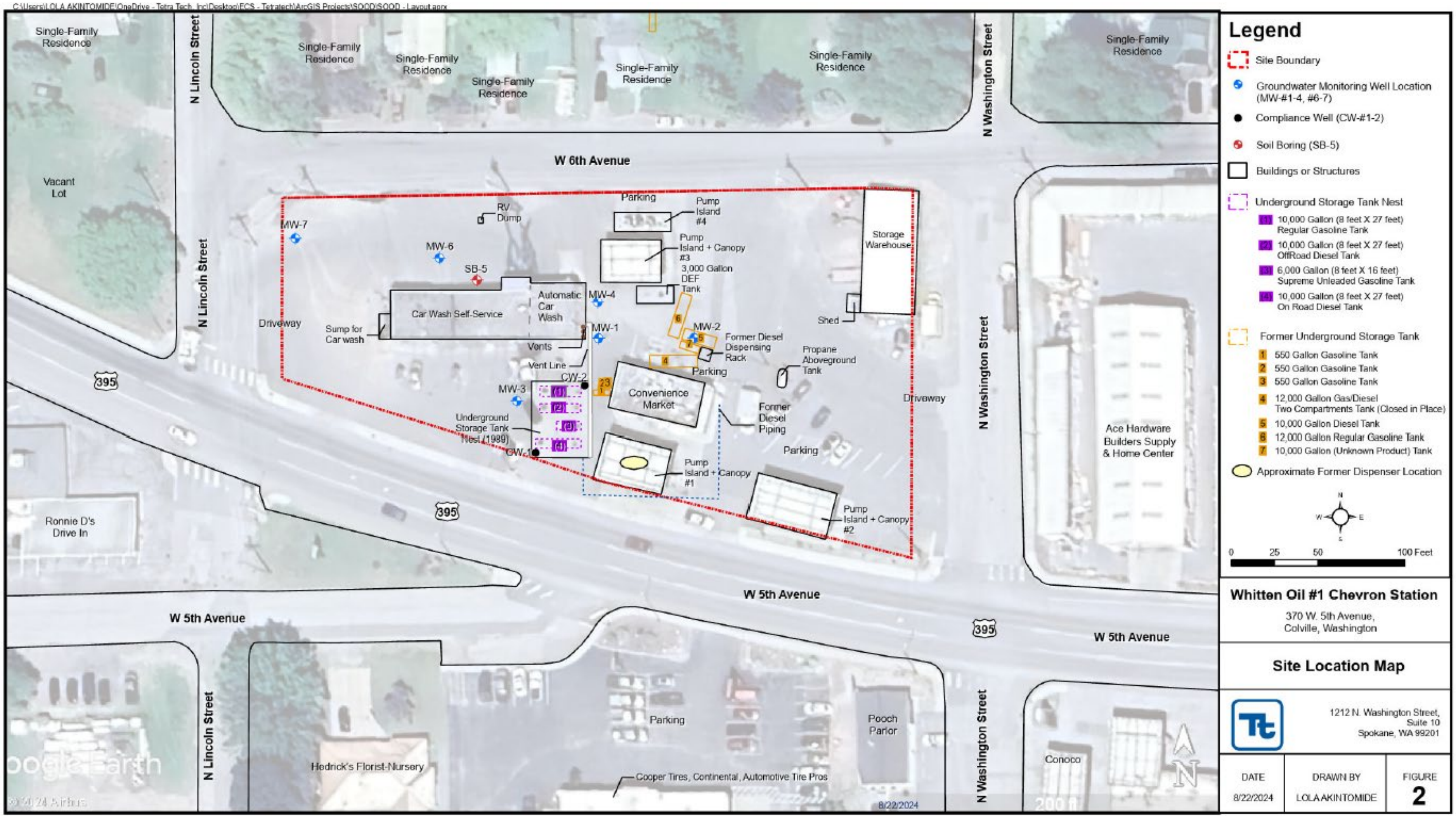
In the event of severe weather, site personnel will follow the procedures listed below.

- Site work shall not be conducted during severe weather, including high winds and lightning.
- In the event of severe weather, stop work, lower any equipment (drill rigs) and evacuate the affected area.
- Severe weather may cause heat or cold stress. Refer to SWPs 5-15 and 5-16 for information on both.

All work-related incidents must be reported. According to Tt reporting procedures, for non-emergency incidents you should:

- Notify WorkCare and Incident Intervention at 888.449.7787, or 800.455.6155
- Notify your Project Manager or Regional Safety Officer (RSO) via phone immediately.
- Complete a "Tetra Tech Incident Report" (Form IR) within 24 hours and send it to your RSO. If an injury or illness has occurred, the Form IR-A and the WorkCare HIPAA form must be completed at the same time the Form IR is completed.

Site Map (May be drawn after crews arrive onsite or inserted using aerial photographs, site figures, etc.):



APPROVAL AND SIGN-OFF FORM

Project No.: 117-727135-24001

I have read, understood, and agree with the information set forth in this Health and Safety Plan and will follow the direction of the SSHO as well as procedures and guidelines established in the Tetra Tech, Inc., Health and Safety Manual. I understand the training and medical requirements for conducting field work and have met these requirements.

Tetra Tech has prepared this plan solely for the purpose of the health and safety protection of Tetra Tech employees. Subcontractors, visitors, and others at the site, while required to read and follow the provisions outlined in this plan at a minimum, should refer to their safety program for specific information related to their health and safety protection.

Name	Company / Agency / Organization	Signature	Date

I have read, understood, and agree with the information set forth in this Health and Safety Plan and comply with and will enforce this HASP, as well as procedures and guidelines established in the Tetra Tech, Inc., Health and Safety Manual.

Name	Project-Specific Position	Signature	Date
Jon Welge, Spokane, WA	Project Manager		
Flavio Ishihara	Field Team Leader/ Site Safety Coordinator		
Lola Akintomide	Field Scientist		

Tetra Tech has prepared this plan solely for the purpose of the health and safety protection of Tetra Tech employees. Subcontractors, visitors, and others at the site, while required to read, acknowledge and follow the provisions outlined in this plan at a minimum, should refer to their safety program for specific information related to health and safety.

Note: Use Additional sheets as necessary to ensure that all personnel sign and affirm this document.

DEFINITIONS AND NOTES

Emergency Contacts

WorkCare - For issues requiring an Occupational Health Physician; assistance is available 24 hours per day, 7 days per week.

InfoTrac - For issues related to incidents involving the transportation of hazardous chemicals; this hotline provides accident assistance 24 hours per day, 7 days per week

U.S. Coast Guard National Response Center - For issues related to spill containment, cleanup, and damage assessment; this hotline will direct spill information to the appropriate state or region

Poison Control Center – For known or suspected poisoning.

Limitations:

The Level-Two HASP is not appropriate in some cases:

- Projects requiring the use of Level Of Protection PPE A and B.
- Projects involving unexploded ordnance (UXO), radiation sources as the primary hazard, or known chemical/biological weapons site must employ a comprehensive HASP
- Projects of duration longer than 365 days may need a comprehensive HASP (consult your OH H&S)

Decontamination:

Decontamination Solutions for Chemical and Biological Warfare Agents[a]: PPE and equipment can be decontaminated using 0.5 percent bleach (1 gallon laundry bleach to 9 gallons water) for biological agents (15 minutes of contact time for anthrax spores; 3 minutes for others) followed by water rinse for chemical and biological agents. In the absence of bleach, dry powders such as soap detergents, earth, and flour can be used. The powders should be applied and then wiped off using wet tissue paper. Finally, water and water/soap solutions can be used to physically remove or dilute chemical and biological agents. Do not use bleach solution on bare skin; use soap and water instead. Protect decontamination workers from exposure to bleach.

Decontamination for Radiological and Other Chemicals: Primary decontamination should use Alconox and water unless otherwise specified in chemical specific information resources. The effectiveness of radiation decontamination should be checked using a radiation survey instrument. Decontamination procedures should be repeated until the radiation meter reads less than 100 counts per minute over a 100-square-centimeter area when the probe is held 1 centimeter from the surface and moving slower than 2.5 centimeters per second.

Decontamination Corridor: The decontamination setup can be adjusted to meet the needs of the situation. The decontamination procedures can be altered to meet the needs of the specific situation when compound- and site-specific information is available.

Decontamination Waste: All disposable equipment, clothing, and decontamination solutions will be double-bagged or containerized in an acceptable manner and disposed of with investigation-derived waste.

Decontamination Personnel: Decontamination personnel should dress in the same level of PPE or one level below the entry team PPE level.

All investigation-derived waste should be left on site with the permission of the property owner and the EPA on-scene coordinator. In some instances, another contractor will dispose of decontamination waste and investigation-derived waste. DO NOT place waste in regular trash. DO NOT dispose of waste until proper procedures are established.

Notes:

[a] Source: Jane's Information Group. 2002. *Jane's Chem-Bio Handbook*. Page 39.

HASP FIELD FORMS

TETRA TECH, INC.

DAILY TAILGATE SAFETY MEETING FORM

This form describes the requirements and responsibilities for implementing an incident and injury-free workplace by providing guidance on the daily tailgate safety meeting discussion.

Daily tailgate safety meetings shall be held in a safe location at the start of each work day, shift or task change. The daily tailgate safety meetings shall review the planned work activities for the day, discuss and resolve the risks and mitigations, discuss any health, safety, security and environment (HSSE) concerns and raise the HSSE consciousness of each worker before they start work.

The Field Team Leader (FTL) or Site Safety and Health Officer (SSHO) will decide on the location of the daily tailgate safety meetings based on the overall safety of the individuals attending the meeting. Maintaining minimal background noise and establishing more comfortable areas for the meeting location is also preferred. Ultimately, the weather and surrounding environment could be the most limiting factor on the location of the meeting.

For this project, the Project Manager (PM) will:

- Verify that all work activities for this project are consistent with Document Control Number (DCN) 01-05, Health and Safety Management System, as well as any associated practices and permit requirements.
- Carry out all duties specified in the Health and Safety Management System.
- Ensure that all site personnel involved in a work activity are competent and correctly prepared for the work they will perform.
- Verify or delegate the responsibility to verify that the daily toolbox meeting is carried out.

For this project, the FTL will:

- Carry out all duties specified by the PM, as consistent with DCN 01-05.
- Conduct or supervise all work identified and agreed upon in the scope of work.
- Participate in the daily tailgate safety meeting whenever the scope of work requires a permit to work.
- Verify in the daily tailgate safety meeting, the specific roles and responsibilities of the FTL and SSHO are clearly understood by all members of the workforce.

For this project, the SSHO will:

- Carry out all duties specified by the PM, as consistent with DCN 01-05.
- Be accountable for the safe, responsible and reliable delivery of all work activities.
- Lead or designate an alternative conductor to lead the daily tailgate safety meeting.
- Verify in the daily tailgate safety meeting that workers have a clear understanding of the scope of work, hazards, controls and mitigations of the project.
- Verify in the daily tailgate safety meeting, the specific procedures and policies relevant to the project and are clearly understood by all members of the workforce.

Either the SSHO or FTL will facilitate the daily tailgate safety meeting each day. At least one, if not both individuals shall have a thorough understanding of the following:

- Tetra Tech's hazard/risk assessment process
- The site-specific APP/SSHP.
- The contract scope of work.
- The subcontractors on site and their health and safety officer.
- Site requirements of the client.

These meetings prior to starting work shall include, but are not limited to:

- The completion of the daily tailgate safety meeting form.
- A review of relevant Accident Prevention Plan (APP)/Site Safety and Health Plan (SSHP) elements.
  - Reviews of the APP/SSHP shall be performed when updated, modified or when deemed necessary by the SSHO or FTL.
- A review of all applicable permits.
- Any applicable Hazard Communication (HAZCOM) information review, including MSDSs, and labels.
- A review of 'Stop Work' procedures and responsibilities.
- Address any risks arising from the site walk, including but not limited to, equipment and materials use and location.
- Complete and review a Job Safety Analysis (JSA), appropriate Safe Work Practices (SWP) and applicable Activity Hazard Analysis (AHA) for the tasks to be completed.
- Implement the controls set forth in the JSA, SWP and AHA. Verify that all parties on site have a complete understanding of the work plan and controls that are in place.
- In addition, allocate resources and complete permits.

TETRA TECH, INC.
DAILY TAILGATE SAFETY MEETING FORM

Date: ______________ Time: ________________ Project No.:

Client: _________________________________ Site Location: ________________________

Site activities planned for today: ____

Does each job and task have a valid SWP, AHA, or JSA associated with it? Yes ☐ No ☐

Has everyone signed off on the APP/SSHP? Yes ☐ No ☐

Have newly identified risks been controlled and documented? Yes ☐ No ☐

Do not proceed unless the answer to all the above questions is Yes.

Current weather conditions: ____

Safety Topics Discussed
Review of Stop Work Authority
Are there multiple operations on site? Yes ☐ No ☐ If yes, describe.
Does the work activity require a MoC? Yes ☐ No ☐ If yes, has the MoC been authorized by the PM? Yes ☐ No ☐
Permits required? Yes ☐ No ☐ If yes, list permits covered in safety meeting.
Protective clothing and equipment for activities planned for today:
Chemical, physical, and biological hazards identified for activities planned for today:
Equipment hazards identified for activities planned for today:
Review of emergency procedures from APP/SSHP (including muster point locations):
Site-safety discussion topics:

TETRA TECH, INC.
DAILY TAILGATE SAFETY MEETING FORM

Best practices observed:

Lessons learned, near misses, other observations:

Post-job review:

Any "stop work" interventions:

Attendees

By signing in below, I certify that I understand the hazards and risk controls associated with each task I am to perform. I understand the permit requirements applicable to the work being performed and am aware that all tasks must be assessed. I am also aware of my obligation to "stop work." Furthermore, I am physically and mentally fit for duty and am not under the influence of any type of medication, drugs or alcohol that could affect my ability to work safety. I am aware of my responsibility to bring any injury, illness, or other safety issue to the attention of the SSHO.

By signing out below, I certify that I am uninjured unless I have already informed the FTL, PM, or SSHO.

Sign In Signature and Time	Sign Out Signature and Time

At the conclusion of this day, I certify that the job site is being left in a safe condition and there were no unissued reports of property damage, spill, fire, explosion, injury, illness, or first aid.

Meeting Conducted by:

Name

Title

Signature

TETRA TECH

HEALTH AND SAFETY PLAN AMENDMENT

Site Name: ____

Amendment Date: ____

Purpose or Reason for Amendment: ____

____

Required Additional Safe Work Practices or Activity Hazard Analyses: ____________________

____

Required Changes in PPE: ____

____

____

Action Level Changes: ____

____

____

____

AMENDMENT APPROVAL

RSO or Designee	____________ Name	____________ Signature	____________ Date
Site Safety Coordinator	____________ Name	____________ Signature	____________ Date

Date presented during daily site safety meeting: ____

TETRA TECH, INC.

FIELD AUDIT CHECKLIST

Project Name: ________________________________ Project No.: _______________________

Field Location: ________________________________ Completed by: _____________________

Project Manager: ________________________ Site Safety Coordinator: _____________________

General Items		In Compliance?		
Health and Safety Plan Requirements		Yes	No	NA
1	Approved health and safety plan (HASP) on site or available			
2	Names of on-site personnel recorded in field logbook or daily log			
3	HASP compliance agreement form signed by all on-site personnel			
4	Material Safety Data Sheets on site or available			
5	Designated site safety coordinator physically present on jobsite			
6	Daily tailgate safety meetings conducted and documented on Form HST-2			
7	Documentation available proving compliance with HASP requirements for medical examinations, fit testing, and training (including subcontractors)			
8	HASP onsite matches scope of work being conducted			
9	Emergency evacuation plan in place and hospital located			
10	Exclusion, decontamination, and support zones delineated and enforced			
11	HASP attachments present onsite (VPP sheet, audit checklist, AHA, etc.)			
12	Illness and injury prevention program reports completed (California only)			
Emergency Planning				
13	Emergency telephone numbers posted			
14	Emergency route to hospital posted			
15	Local emergency providers notified of site activities			
16	Adequate safety equipment inventory available			
17	First aid provider and supplies available			
18	Eyewash solution available when corrosive chemicals are present			
Air Monitoring				
19	Monitoring equipment specified in HASP available and in working order			
20	Monitoring equipment calibrated and calibration records available			
21	Personnel know how to operate monitoring equipment and equipment manuals available on site			
22	Environmental and personnel monitoring performed as specified in HASP			

Safety Items		In Compliance?		
Personal Protection		Yes	No	NA
23	Splash suit, if required			
24	Chemical protective clothing, if required			
25	Safety glasses or goggles (always required)			
26	Gloves, if required			
27	Overboots, if required			
28	Hard hat (always required)			
29	High visibility vest, if required			
30	Hearing protection, if required			
31	Full-face respirator, if required			
Instrumentation				
32	Combustible gas meter and calibration notes			
33	Oxygen meter and calibration notes			
34	Organic vapor analyzer and calibration notes			
Supplies				
35	Decontamination equipment and supplies			
35	Fire extinguishers			
37	Spill cleanup supplies			
Corrective Action Taken During Audit:				

Note: NA = Not applicable

Auditor’s Signature

Site Safety Coordinator’s Signature

Date

FIGURES

SAFE WORK PRACTICES

ACTIVITY HAZARD ANALYSIS

APPENDIX C: STANDARD OPERATING PROCEDURES

STANDARD OPERATING PROCEDURE
FIELD MEASUREMENT OF GEOCHEMICAL PARAMETERS
USING A MULTI METER AND FLOW-THROUGH CELL

1. Remove the protective cover from the multi-meter head. Remove the rubber cover from the dissolved oxygen (DO) sensor. Inspect the probes and sensors for damage, including cracks in the pH electrode or bubbles in the DO membrane. Repair as necessary according to manufacturer's instructions.

2. Rinse the probe with distilled water.

3. Connect the electronic unit to the probe and turn it on. Calibrate the device according to manufacturer's instructions.

4. Rinse the probe with distilled water to remove calibration solution.

5. Install the probe into the flow-through cell. Connect the hose from the outlet of the pump to the inlet barb on the flow-through cell. Install a hose on the outlet barb of the flow-through cell and place the other end of the hose into a bucket to capture the purge water.

6. Begin purging. After approximately five minutes, begin taking readings from the multi-meter. Record the various parameters into appropriate cells on the field form.

7. Refer to the project QAPP or SAP for stabilization criteria. The sample can be collected when the criteria have been met.

8. Disconnect the pump outlet hose from the flow through cell and collect the samples out of this hose. Do not collect samples from the discharge hose of the flow through cell.

SOP-09

STANDARD OPERATING PROCEDURE

SAMPLE PACKAGING AND SHIPPING

All environmental samples collected should be packaged and shipped using the following procedures:

PACKAGING

1. Label all sample containers with indelible ink (on the side, not on the cap or lid). Place labeled sample bottles in a high quality cooler containing an adequate amount of ice and/or frozen blue ice (appropriate for the season), making sure the cooler drain plug is taped shut.

2. Place the samples in an upright position and wrap the samples with absorbent, cushioning material for stability during transport. Samples should not be loose; the cooler should be able to withstand rough handling during shipment without sample breakage.

3. Fill out the appropriate shipping forms, and place the paperwork in a ziploc bag and tape it to the inside lid of the shipping container. Shipping forms usually include: 1) a chain-of-custody form, documenting the samples included in the shipment; 2) an analysis request form, specifying the laboratory analyses for each sample. If more than one cooler is used per chain of custody, put a photocopy in the other coolers and mark them as a copy.

4. Close and seal the cooler using fiberglass strapping tape.

5. Secure the shipping label with address, phone number, and return address clearly visible.

SHIPPING HAZARDOUS MATERIALS/WASTE

Hazardous materials need to be shipped using procedures specified under Federal Law. Samples need to be shipped in ziploc bags or paint cans filled with vermiculite, depending on the level of hazard. Special package labeling may be needed. Consult the project manager for specific shipping procedures.

TETRA TECH

STANDARD OPERATING PROCEDURE NO. 10
FIELD FORMS

All pertinent field investigations and sampling information shall be recorded on a field form (paper or electronic) during each day of the field effort and at each sample site. The field crew leader shall be responsible for ensuring that sufficient detail is recorded on the field forms. No general rules can specify the extent of information that must be entered on the field form. However, field forms shall contain sufficient information so that someone can reconstruct all field activity without relying on the memory of the field crew. All entries on paper forms shall be made in indelible ink weather conditions permitting. Each day's or site's entries will be initialed and dated at the end by the author.

Electronic logging pads (i.e. tablets) may also be utilized to record field data and photos. In general, electronic data is entered into the pad into a template that is preloaded prior to field work. Potential templates include but are not limited to groundwater and/or surface water sampling, drilling logs, well construction, and test pitting. For preprogramed templates, the user is queried for data entry via drop-down menus for sampling locations and any other field data being gathered. For general templates, the user manually enters the data onto the form in a similar fashion to what would have been done with hard copies of sampling forms. Once all of the field data is entered for particular sampling location, the electronic data is saved to the 'Cloud' storage, as well as onto the device hard drive. In remote locations, the upload will occur once the device is connected to the internet, or a cell signal is available.
Once the data is uploaded to the 'Cloud', it can then be accessed remotely by office personnel or managers who wish to view the data from the office. The data can be edited as necessary within the program. The electronic data will also be copied to the project folder. The logging pads records the location of the sampling. Based on the field site, the accuracy recorded will be limited and should only be used as a general location rather than an exact location. For projects requiring precise sampling locations, a survey grade GPS should be used.

At a minimum, entries on the field sheet (paper or electronic) or in field notebook shall include:

- Date and time of starting work and weather conditions.
- Names of field crew leader and team members
- Project name and type
- Description of site conditions and any unusual circumstances.
- Location of sample site, including map reference, if relevant
- Equipment ID numbers
- Details of actual work effort, particularly any deviations from the field work plan or standard operating procedures
- Field observations
- Any field measurements made (e.g., pH)

For sampling efforts, specific details for each sample should be recorded using Tetra Tech standardized field forms (paper or electronic). Surface water and groundwater field forms contain fill-in-the-blank type information in order that all pertinent information shall be recorded. In addition to the items listed above, the following information is recorded on field forms during sampling efforts:

- Time and date samples were collected
- Number and type (natural, duplicate, QA/QC) of samples collected
- Analysis requested
- Sampling method, particularly deviations from standard operating procedures

Strict custody procedures shall be maintained with the field forms. Field forms shall remain with the field team at all times, while being used in the field. Upon completion of the field effort, photocopies of the original paper field forms will be made and used as working documents; original field forms shall be filed in an appropriately secure manner. Electronic forms will be placed in the appropriate project folder on Tetra Tech's server.

STANDARD OPERATING PROCEDURE

EQUIPMENT DECONTAMINATION

The purpose of this section is to describe general decontamination procedures for field equipment in contact with mine/mill tailings, soil, or water. During field sampling activities, sampling equipment will become contaminated after it is used. Sampling equipment must be decontaminated between sample collection points if it is not disposable. Field personnel must wear disposable latex or vinyl gloves while decontaminating equipment at the project site. Change gloves between every sample. Every precaution must be taken by personnel to prevent contaminating themselves with the wash water and rinse water used in the decontamination process.

Table A-1 lists equipment and liquids necessary to decontaminate field equipment.

The following should be done in order to complete thorough decontamination:

1. Set up the decontamination zone upwind from the sampling area to reduce the chances of windborne contamination.

2. Visually inspect sampling equipment for contamination; use stiff brush to remove visible material.

3. The general decontamination sequence for field equipment includes: wash with Liquinox or an equivalent degreasing detergent; deionized water rinse; 10% dilute nitric acid rinse (if sampling for metals); deionized water rinse; rinse with sample water three times.

4. Rinse equipment with methanol in place of the nitric rinse if sampling for organic contamination. Follow with a deionized water rinse.

5. Decontaminated equipment that is to be used for sampling organics should be wrapped in aluminum foil if not used immediately.

6. Clean the outside of sample container after filling sample container.

Alternatively, field equipment can be decontaminated by steam cleaning, rinsing with 10% dilute nitric acid, and rinsing with deionized water.

All disposable items (e.g., paper towels, latex gloves) should be deposited into a garbage bag and disposed of in a proper manner. Contaminated wash water does not have to be collected, under most circumstances.

If vehicles used during sampling become contaminated, wash both inside and outside as necessary.

TABLE A-1. EQUIPMENT LIST FOR DECONTAMINATION

5-gallon plastic tubs	Liquinox (soap)
5-gallon plastic water-container	Hard bristle brushes
5-gallon carboy DI water	Garbage bags
1-gallon cube of 10% HNO_3	Latex gloves
1-gallon container or spray bottle of 10% Methanol or pesticide grade acetone for organics	Squeeze bottles
	Paper Towels

STANDARD OPERATING PROCEDURE

SAMPLE DOCUMENTATION

Sample documentation is an important step to ensure the laboratory, project manager, and field personnel are informed on the status of field samples. Depending on the specifics required for each project, a number of forms will need to be filled out. Most sample documentation forms are preprinted carbonless triplicates, enabling copies to be filed or mailed from labs or offices. The forms will be completed by field personnel, who have custody of the samples. The office copy will be kept in the project file and subsequent copies sent to the laboratory, or other designated parties. The responsibility for the completion of these forms will be with each field crew leader. It is important the field crew leader is certain field personnel are familiar with the completion process for filling out forms, and the expected information is included.

Potential documents to be completed clearly in ink for each sample generated include:

- Field Form
- Chain-of-Custody
- Custody Seal

If working on Superfund activities, the following additional forms will also be prepared:

- EPA Sample Tags
- SAS Packing Lists
- Sample Identification Matrix Forms
- Organic Traffic Report (if applicable)
- Inorganic Traffic Report (if applicable)

STANDARD OPERATING PROCEDURE

QUALITY CONTROL (QC) SAMPLES

Quality Control (QC) samples are submitted along with natural samples to provide supporting laboratory data to validate laboratory results. QC samples typically are submitted blind, and do not have any unique identifying codes that would enable the lab or others to bias these samples in any way. Usually, the time or sampling location is modified in a way which will separate blank and standard samples from the rest of the sample train. QC samples are identified only on field forms and in field notebooks. The following codes are typically used:

N - Natural Sample	Soil, water, air, or other material from a field site
SP - Split Sample	A portion of a natural sample collected for independent analysis; used in calculating laboratory precision
D - Duplicate Sample	Two samples taken from the same media under similar conditions; also used to calculate laboratory precision
BB - Bottle Blank	Deionized water collected in sample bottle; used to detect contamination in sample containers
CCB - Cross Contamination Blank	Deionized water run through decontaminated equipment and analyzed for residual contamination
BFS - Blind Field Standard	Certified chemical constituent(s) of known concentration; used to determine laboratory accuracy
TB - Travel or Trip Blank	Inert material (deionized water or diatomaceous earth) included in sample cooler; sent by the lab, the sample is used to determine if contamination by volatiles is present during collection or shipping

In general, selected QC samples will be inserted into the sample train within a group of 10 to 20 samples. Unless otherwise specified, QC samples will be prepared in the field. Deionized water for bottle blanks and cross-contamination blanks will be collected from carboys and cubitainers used in the field. An exception to field preparation of QC samples is some blind field standards. Since the analytes in some blind field standards are to be mixed according to specific manufacturer's instructions, field conditions may not provide the needed laboratory atmosphere. This is especially true for volatile organic compounds, which need to be prepared just before analyzing. Under these circumstances, such blind field standards will be shipped to the laboratory for preparation, keeping the concentration or manufacturer's QC Lot Number as blind as possible.

The number and types of samples submitted for each group of natural samples will be determined by the project manager and others, including state or Federal agencies, and will be defined in the project work plan. Each field crew leader will be responsible for all QC samples prepared in the field.

Methods for computing data validation statements can be found in EPA documents or obtained from the laboratory.

STANDARD OPERATING PROCEDURE

MONITORING WELL DEVELOPMENT

1. Visually inspect all well development equipment for damage - repair as necessary.

2. Decontaminate all stingers, air hoses, surge blocks by scrubbing with brush and Liquinox solution, rinsing with dilute nitric acid solution, and rinsing with deionized water. If sampling for organics, replace the nitric acid rinse with 10% methanol as per SOP 11.

3. If using compressed air method for well development, make certain compressor utilized does not produce air laden with hydraulic fluid for lubricating purposes. This may affect the integrity of the monitoring well for producing viable water quality data.

4. Develop well by using surging techniques (surge block or bailer) followed by well evacuation. Repeat this procedure until evacuated water is visibly clean and essentially sand-free. Refer to the work plan to determine appropriate disposal for purge water.

5. If specified in the project workplan, during evacuation process, collect water samples for field determinations of temperature, specific conductivity, and pH. Continue developing well until field parameters stabilize to within $\pm$5% on three consecutive measurements.

6. Report field observations and volume of water removed on standard form.

STANDARD OPERATING PROCEDURE
FIELD MEASUREMENT OF GROUND WATER LEVEL

1. Calibrate well probe to a steel tape prior to and following each field event. Note any corrections to the well probe measurements on field forms.

2. Check well probe prior to leaving for field for defects by placing probe in water and testing buzzer and light. Repair as necessary. Make certain the well probe, a tape measure calibrated to tenths of feet and extra batteries are in the carrying case.

3. Measure all wells (monitoring and domestic) from the top of the well casing in the north quadrant or from a designated measuring point, as appropriate. Measure and record distance from measuring point to ground level. Make sure measuring point is labeled on well, so future measurements can be made from the same location.

4. Obtain a depth to water from measuring point to the nearest hundredth of a foot. Record data on appropriate field forms.

5. Decontaminate well probe between each measurement by rinsing with deionized water. Additional decontamination, such as *Liquinox*® scrubbing, may be required for certain wells; consult the project work plan.

6. Measurements should be taken from the cleanest wells first, followed by wells of increased impacts.

STANDARD OPERATING PROCEDURE

MONITORING WELL CONSTRUCTION

Many states require certification and licensing for monitoring well drillers. Be sure you know the State's regulations before arriving on-site, especially if drilling outside your own State.

1. Safety equipment required on-site of the drill rig is mandatory. Personal protective equipment includes (at a minimum): hard hat, ear plugs, safety glasses, steel toed boots, gloves, first aid kit, and site safety plan - with routes to hospitals known by all personnel on-site.

2. Arrive on-site with properly sized drilling equipment and materials for site conditions. All drilling equipment and materials should be properly decontaminated prior to its arrival on-site. Decontamination usually includes steam - or hot water-cleaning methods.

3. Drilling muds or drilling solutions of any kind <u>are not to be used</u> during drilling activities in conjunction with monitoring well construction. Acceptable drilling techniques include air-rotary, cable tool, hollow-stem auger or sonic. If unconsolidated material is encountered, it may be necessary to drive steel casing during drilling to maintain borehole integrity. It is suggested threaded steel casing be used in lieu of welding joints together to minimize this source of potential well contamination. Hydraulic jacks or the drill rig can be used to pull back the steel casing following emplacement of plastic casing.

4. A detailed lithologic log shall be completed during drilling activities. Water bearing characteristics of the formations should also be noted on the log. In addition, details of monitoring well construction should also be described on the well log including total depth, perforated interval, sizes and types of construction materials, etc.

5. Seven (7) - to 10-inch outside diameter hollow-stem augers can used in drilling shallow exploration drill holes in many situations. Care is taken to avoid contamination due to oil and grease from the drill rig and split-spoon sampler. Appropriate decontamination is performed of the drill rig between drill holes. Soil and sediment samples are collected using a standard 1.4-inch inside diameter split-spoon sampler and a 140 pound drive hammer. The number of blows necessary to obtain an 18-inch length of sample is recorded on the exploration log. Appropriate decontamination of the split-spoon sampler is performed between sample depth intervals.
6. Install factory-slotted well screen and blank section of well casing into the borehole, with the well screen set at the desired depth interval, based on site conditions. The well screen and casing will be selected based on the type of contamination present; typically polyvinyl chloride (PVC), stainless steel or polytetrafluoroethylene (PTFE; for organics).
   Either a single- or multi-completion monitoring well can be constructed in a single borehole where hollow-stem auger drilling is not used.

7. Backfill the annular space below and above the perforated well screen and to at least 2-feet above the well screen with chemically-inert silica sand. Place a bentonite plug above the sand to ground surface. Where appropriate, begin pulling temporary steel casing out of borehole as the sand and bentonite are placed. For some sites, states may require bentonite (granular or chips) be placed to 3 feet above the level of silica sand followed by placement of a tremied bentonite slurry or grout to the surface. Monitoring well development is presented in SOP-22.

8. Place a locking well protector over well casing(s) after the outer steel drill casing has been removed from the borehole, if necessary. The locking well protector will either be a flush-mount well cover or steel riser with locking well cap. If a flush-mount well cover is used, an inner locking well cap will be installed. Place bentonite a plug below the bottom of well protector with a 1- to 2-inch layer of sand at the base and within

the flush-mount protector to allow drainage. This will allow water to drain from the flush-mount well to limit the surface casing from accumulating atmospheric water. Grout well protector in place.

9. Lock the well with high quality lock.

SOP-22

STANDARD OPERATING PROCEDURE

SOIL SAMPLE COLLECTION

This SOP describes the field equipment and sampling methods for surface and subsurface sampling of soil material. Methods explained in this SOP may be different from those identified in the project specific Sampling and Analysis Plan (SAP). The project specific SAP should be referenced for modifications to the methods noted below. All sampling equipment should be decontaminated before arriving on site.

FIELD EQUIPMENT

- Sharp shooter and clean-out shovel
- Stainless steel mixing bowl and sampling trowel
- Dilute (10%) hydrochloric acid
- Hand lens (10) power
- Steel tape (10 foot)
- pH and electrical conductivity meters (if required)
- Munsel color book (if required)
- No. 10 sampling screen
- Field forms and field book
- Bucket augers

SURFACE SAMPLING

Surface soil/tailings samples are collected from the surface to a depth of one inch unless otherwise specified in the project specific SAP. Sufficient sample will be collected for the analysis that will be performed but generally this will be on the order of one gallon. Soil samples will be collected in either wide mouth glass jars or resealable polyethylene bags (ziploc or equivalent).

Samples should be described according to the procedures outlined in the Unified Soil Classification System (USCS; method ASTM D2487) or the Soil Conservation Service (SCS) classification system. Soil texture should be classified by either the USCS or U.S. Department of Agriculture (USDA) classification. Descriptions shall be recorded in field books or on standard morphological description logs as provided in the SAP.

Samples should be collected from an area of approximately six square feet by digging up the top inch with the sampling trowel and placed in the mixing bowl. The sample should be screened with the 10 mesh sieve if coarse fragments are to be excluded from the sample. If a sod or duff layer is present, this layer should be pealed back to the top of the mineral soil.

The sample placed in the mixing bowl shall be well mixed and then a portion of the sample placed in the sample container. To select a sample from the mixing bowl, quarter the sample in the bowl and place an equal volume of soil from each quarter in the sample container. When sampling soil for organics, the samples should not be mixed.

All equipment used in the sampling of surface soils will be decontaminated using the procedures in SOP-11. All necessary paperwork will be filled out in accordance with SOP-12.

SUBSURFACE SAMPLING

Subsurface sampling will be completed using a bucket auger, split spoon sampler, or hand dug or backhoe excavated pits. Sampling procedures for each type of equipment is described below. Sample collection, homogenation, and transfer to sampling containers should follow the same procedures as outlined for collection of surface samples.

Bucket Auger

1. Arrive on-site equipped with stainless steel auger rod and several sizes of stainless steel bucket augers (e.g. 2-inch, 4-inch, 6-inch, etc.).

2. Bucket auger holes can be drilled as one size or in a telescoping manner if contamination between sample intervals is a concern. If a single sized, advance the bucket auger to the desired sampling interval depth and empty the contents of the auger in a stainless steel mixing bowl. For the telescoping method, advance the largest auger to an approximate depth of three feet, collecting specified depth increment samples as the auger is advanced. Install temporary decontaminated PVC casing with a diameter slightly smaller than the borehole to keep the hole open and reduce possible cross-contamination between depth intervals. Using the next size smaller bucket auger, repeat the process.
3. Select sample intervals for packaging for laboratory analysis in accordance with procedures described in the SAP.

4. Fill out appropriate paper work and bottle labels as necessary prior to leaving site.

5. Decontaminate all equipment between sample locations.

Split Spoon Sampler

1. Arrive on-site equipped with at least two standard 1.4 inch inside diameter split spoon samplers. If geotechnical information is desired, a 140 pound drive hammer is required.

2. Install sampler into borehole and advance to the desired depth with the 140 pound drop hammer or equivalent means. Record number of blow counts to complete sampling over each 18-inch interval, as necessary. Retrieve sampler and place on work table. Using the other sampler, repeat this sequence.

3. Record lithology and percent recovery from cores retrieved from split spoon sampler.

4. Based upon the project work plan or sampling and analysis plan, composite like core intervals by mixing in stainless steel bowl in a similar manner as described for surface sampling. When sampling for organics, the sample should not be mixed.

5. Decontaminate sampling equipment between each interval sampled if required by the SAP. Decontaminate sampling equipment between sampling sites.

Sonic Core Samples

1. Driller will provide plastic core sleeves to extract the continuous, disturbed core samples into. Driller will extract the cores in approximately 5-foot depth increments.

2. Record the top and bottom depths on the core sleeves.

3. Record lithology, including but not limited to grain sizes, moisture, color, staining, or odors observed. Use USCS guidelines to characterize the soil type encountered.

4. Collect soil samples as specified in the project work plan

Decontaminate sampling equipment between each interval sampled if required by the SAP. Decontaminate sampling equipment between sampling sites

Backhoe or Hand Dug Excavations

1. Locate the site to be sampled and insure that equipment can safely access the site. Minimize off road travel to prevent off site damage to surrounding vegetation.

2. Orient excavation to maximize use of the angle of the sun to illuminate the pit for photographs. Place excavated material a sufficient distance from the excavation.

3. Excavate to the prescribed depth. If the pit exceeds five feet in depth, OSHA construction standards for shoring or sloping must be observed to prevent accidental burials. Sampling personnel should enter the pit with care during and after excavation.

4. Soil profile descriptions shall be made from a hand cleaned surface along the pit wall. Complete profile descriptions and take photographs before pit is sampled.

5. Soil samples shall be collected from depth intervals specified in the SAP. When a depth interval is sampled, an equal volume of soil should be collected from the entire interval exposed on the pit wall. Soil samples will be collected with the stainless steel trowel and mixing bowl according to methods described for surface soil sampling. When sampling for organics, the sample should not be mixed.

6. After sampling is completed, the pit should be backfilled with excavated material in the reverse order that it was excavated so that topsoil material is returned to the top of the pit. When backfilling is complete the area should be cleaned-up to its original condition.

7. Decontaminate sampling equipment between sampling sites. Excavation equipment should be cleaned between sites with water (where possible) or with a shovel to remove accumulated dirt and mud.

STANDARD OPERATING PROCEDURE
LOW-FLOW (MINIMAL DRAWDOWN) GROUNDWATER SAMPLING

EQUIPMENT:

Peristaltic, bladder, or submersible pump
Tubing
Flow-through cell
Multi-parameter meter
Electronic water level probe
Weighted tape measure
Oil-water interface probe (project-specific)
Calibration fluids
0.45-micron in-line filters (project specific)
Sample bottles and labels
Preservatives
Coolers and ice
Decontamination equipment and supplies
Indelible markers and pens
Field sampling forms
Chain-of-custody forms
Well logs or completion information for all wells being sampled, as available

PROCEDURES

Pre-Field & Daily Calibration:

1. Inspect all sampling equipment for damage, proper calibration, and function prior to field event. Report any damage, calibration, or function issues to equipment manager.

2. Check calibration standard expiration dates. Replace standards as necessary.

3. Decontaminate all equipment prior to arrival at the project site. Keep clean by placing in plastic bags or other container.

4. Calibrate the multi-parameter meter at the beginning of each workday. Document calibration in field notebook. Re-calibrate the meter as needed during the workday if parameter drift is noticed.

Depth to Water and LNAPL Thickness Measurements:

1. Measure the depth to water using an electronic water level probe. Document the depth to water from the north side (default) of the top of the well casing, or other designated location on the top of the casing, as marked. Record depth to water to 0.01-foot accuracy on the field form.

   Project-specific: If indicated, use an oil-water interface probe to document the thickness of LNAPL (free product) in the well. Document the thickness of LNAPL and depth to water from the north side of the top of the well casing, or other designated location on the top of the casing, as marked. Record the depth to water and LNAPL thickness to 0.01-foot accuracy on the field form.

2. If required, measure the total well depth using the probe or a weighted tape measure following low flow purging. Lower the tape slowly so as to not disturb sediment that may reside at the bottom of the well. Document the thickness value on the well log to 0.01-foot accuracy, as possible. Evaluate any changes to the total depth from the well log and/or prior well depth data. This measurement will be used to calculate the water column thickness (depth to water – total depth), as needed.

3. Decontaminate equipment as per SOP-11.

Well Purging:

1. Where possible and if known, sample wells in the order from least contaminated to most contaminated.

2. Conduct well purging and sampling using a peristaltic, bladder, or submersible pump.

3. Place the pump intake at the location of the most contaminated zone within the well screen segment (EPA 2017). If this zone is not known, place the intake of the pump approximately 18 inches below the static water level, within the screened well interval.

4. For wells with LNAPL, seal the pump intake place the pump intake 18 to 24 inches below the base of the LNAPL.

5. Secure the pump/pump tubing to maintain a consistent pump intake level. Pump tubing should be dedicated, disposable tubing unless the well is fitted with a permanent, dedicated pump and tubing system.

6. Lower the electronic water level probe to 0.3 feet below the water table to monitor drawdown. Secure the probe to maintain a consistent monitoring level.

7. Connect the pump tubing to the flow-through cell and attach the multi-parameter meter probes.

8. Set the pump purge rate to minimize well drawdown. Adjust the flow rate as needed to maintain EPA's (2017) recommend well drawdown of no greater than 0.33 feet and a purge flow rate of no greater than 0.5 liters per minute to reduce turbulence.

9. Record field parameter readings at every 3- to 5-minute purge intervals (EPA 2017). Standard field parameters include temperature, pH, specific conductance, dissolved oxygen, oxidation-reduction potential, and turbidity.

10. Purge the well until three consecutive field parameter readings indicate stabilization. Stabilization criteria are listed below.

Field Parameter	Stabilization Criteria
pH	±0.1 unit
Temperature (°C)	3%
Specific Conductivity (SC)	3%

Field Parameter	Stabilization Criteria
Oxidation-reduction potential (ORP)	±10 mV
Dissolved oxygen (DO)	10% for values >0.5 mg/l; or three consecutive values if < 0.5 mg/L
Turbidity	10% for values >5 NTU; or three consecutive values if < 5 NTU

11. Once field parameters stabilize, disconnect the flow-through cell from the pump tubing.

12. Fill laboratory-provided sample containers directly from the pump tubing. Preserve samples with preservatives as per laboratory requirements.

13. Place samples in a cooler containing doubled, re-sealable bags filled with ice. Replenish ice as needed during the day, during transport, and prior to shipping to the laboratory.

14. Decontaminate all sampling equipment as per SOP-11.

15. Place disposable field sampling supplies in an approved waste receptacle for disposal at a sanitary landfill, unless specified otherwise in the work plan.

Also Refer to:

U.S. Environmental Protection Agency (EPA), 2017a. Low Stress (low flow) Purging and Sampling Procedure for Collection of Groundwater Samples from Monitoring Wells. Quality Assurance Unit, U.S. Environmental Protection Agency – Region 1. EQASOP-GW4. Revision 4, original date July 30, 1996, revised date September 19, 2017.

STANDARD OPERATING PROCEDURE

INVESTIGATION-DERIVED WASTES

In addition to the below procedures, field personnel will also review the EPA quick reference fact sheet (see attached) for management of investigation derived waste.

1.0 Soil

Investigation-derived waste originating from test pits will be returned to the test pit. Material removed from the test pit will be replaced back into the test pit in the approximate same depth and location as from where it was removed.

For soil borings drilled to investigate pesticides and/or herbicides, soil cuttings will be placed in 5-gallon buckets with sealable lids. The bucket sides and lids will be clearly labeled with the borehole number(s) and temporarily stored in one of the on-site buildings until analytical results are received. Soil cuttings from borings indicating concentrations of contaminants of concern above screening levels will be removed and disposed of in accordance with state and federal regulations after receipt of soil analytical results. Soil cuttings will be thin-spread on-site where analytical results indicate no contaminants of concern above screening levels.

For soil borings in areas suspected to be contaminated with volatile constituents (i.e. petroleum hydrocarbons, volatile organics, etc.), field personnel will use visual and olfactory, and on-site screening methods (i.e., PID, FID, where appropriate) to evaluate when soil is contaminated. A photoionization detector (PID) will be used to screen soil that may be contaminated with volatile organic compounds. Soil having a PID measurement greater than 100 parts per million (ppm), will be containerized in 5-gallon buckets with sealable lids and labeled appropriately. Soil showing readings of less than 100 ppm and showing no signs of visual contamination will be thin spread on the ground surface. The 5-gallon buckets will be sealed and stored in one of the on-site buildings. Buckets will be removed and disposed of in accordance with state and federal regulations after receipt of soil analytical results.

2.0 Groundwater

Groundwater purged from wells during development and sampling will either be released to the ground surface or contained in 55-gallon drums on site. Groundwater having a visible sheen/product will be drummed. Groundwater free of sheen/product will be released to the ground surface in a vegetated area away from the well. Any drums containing potentially contaminated groundwater will be labeled and stored in a secure area. The drums and purged groundwater will be removed and disposed of based on concentrations of contaminants in the groundwater and in accordance with state and federal regulations after receipt of groundwater analytical results.

APPENDIX D: FIELD FORMS AND LOGS

TETRA TECH 2525 PALMER STREET, SUITE 2 MISSOULA, MT 59808 (406) 543-3045	**LOG OF BORING** *(Applicable columns completed as necessary per project-specific needs/ requirements.)*	**BORING ID:** **WELL ID:** **PERMIT #:**	PAGE ___ of ____
SITE NAME:	PROJECT NAME & NUMBER.:	GENERAL BORING / WELL LOCATION:	
DRILLING CONTRACTOR:	DRILL RIG:		
DRILL METHOD: / BOREHOLE DIAMETER:	DATE STARTED:	DATE COMPLETED:	LOGGED BY:

Depth (ft)	Lithologic Description *(Grain sizes, color, moisture, fizz, staining, odor, etc.)*	USCS Class	Sample / Core Run (ft)	% Recovery	PID (ppm-v)		Depth (ft)	Remarks / Notes

FLUSH MOUNT WELL COMPLETION FORM

Project Name:		Project #:	Boring ID:	Well ID:
Well Location Description:			Tag / Permit #:	
Drilling Company:		Drill Method:	Borehole Diameter:	
Start Date:	End Date:	Logged By:	Company:	

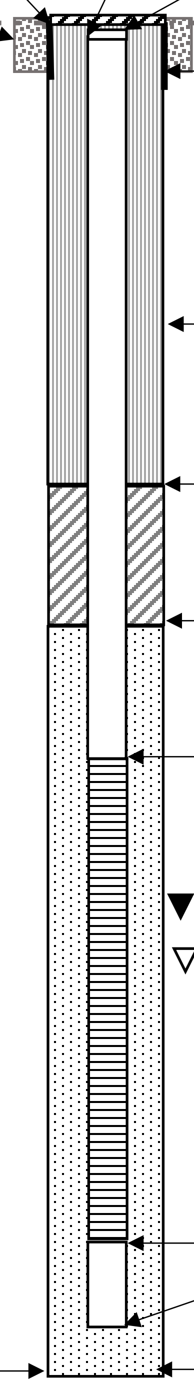
Marked Top of N Side PVC Well Casing (ft below grade):

Steel Protective Vault & Cover

PVC Well Cap

Concrete Surface Seal

Ground Surface



Bottom Depth of Steel Surface Casing (ft bgs): _______

Surface Seal: ______________________
Placement Method: _________________
Bags of Product: __________________

Well Casing Construction:
Material:____________________
Diameter: ___________________
Length: _____________________

Borehole Diameter (inches):

Top Bentonite Seal (Bottom of Surface Seal; 3 to 5 feet above filter pack; ft bgs): _______

Bentonite Seal: ___________________
Placement Method: ________________
Bags of Product: __________________

Top Filter Pack (Bottom of Bentonite Seal; Min 2 to Max 5 feet above well screen; ft bgs): ___________

Top Well Screen (ft bgs): ___________

Filter Pack Material: ______________
Placement Method: ________________
Bags of Product: _________________

▼ Static Water Level: ______ft bgs /______ ft btoc

▽ First Encountered Water (ft bgs): ___________

Well Screen Construction:
Material:____________________
Diameter: ___________________
Length: _____________________
Slot Size: ___________________

Bottom of Well Screen (ft bgs): _______

Well Sump Length (ft): ___________

Total Depth Well Sump (ft bgs): _______

Total Depth Borehole: ___________

Bottom Depth Filter Pack (ft bgs): _______

TETRA TECH

GROUNDWATER SAMPLING LOG

Project:	Date: Well #:
Project #:	Casing Diameter (inches):
Personnel:	MP Location:
Weather:	Depth to Water (feet BMP):
Free Product? ☐ Yes ☐ No ☐ Sheen	Total Depth Well (feet):
Depth to Free Product:	Well Screen Interval (feet):
Analytical Laboratory:	Overnight Carrier & Air Bill#

WELL EVACUATION

Purge & Sample Method: ☐ Peristaltic ☐ Bladder Pump ☐ Submersible Pump ☐ Bailer ☐ Other:

Pump/Tubing Intake Depth: Purge Start Time: Purge End Time:

Purge Rate: Min. Purge Volume: Total Purge Volume:

Comments *(Note any instrument, sampling, or field issues; deviations from SAP/QAPP; etc.):*

EVACUATION DATA *(use second page if needed)*

Parameter	Time	pH	Temperature	Specific Conductance	Ox-Red Potential	Dissolved Oxygen	TURBIDITY	Depth to Water	Cumulative Purge Volume
Meter Units:	Hrs:Min	Std. Units					NTU	Feet BTOC	Gallons or Liter

SAMPLE COLLECTION

Natural Sample ID#: **Date:** **Time:**

QC Sample Type	*Sample ID#*	*Date (Time)*	*QC Sample Type*	*Sample ID#*	*Date (Time)*
Duplicate [ ]			Eq. Rinse Blank [ ]		
MS/MSD [ ]			Field Blank [ ]		

ANALYTICAL REQUIREMENTS & ASSOCIATED SAMPLE CONTAINERS

X	Analytical Parameter	Analytical Method	Sample Container(s)	Preservative(s)	Filtered (Y / N / NA)?

FIELD METER INFORMATION

Meter	Serial No.	Calibration Date

EQUIPMENT DECONTAMINATION

Decontamination	Yes	No		Yes	No
Potable Water:			10% Nitric Acid:		
Liquinox:			DI Water:		
10% Methanol:			Steam		

Well ID# ____________________

Date: ____________________

Parameter	TIME	pH	TEMP	SC	ORP	DO	TURBIDITY	DTW	CUMULATIVE PURGE VOLUME
Meter Units									