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Draft Cleanup Action Plan

Glacier Park East Site
Chumstick Highway and U.S. Highway 2
Leavenworth, Washington
Facility Site ID No. 349
Cleanup Site ID No. 4234
Agreed Order No. DE 16838

Prepared For:

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ABBREVIATIONS AND ACRONYMS

Abbreviation/ Acronym	Definition
ALs	Action levels
AO	Agreed Order
ARAR	Applicable or relevant and appropriate regulation
AST	Aboveground storage tank
bgs	Below ground surface
BNSF	BNSF Railway Company
BTEX	Benzene, toluene, ethylbenzene, and total xylenes
CAP	Cleanup Action Plan
CMP	Compliance Monitoring Plan
COC	Chemical of concern
CSM	Conceptual site model
CUL	Cleanup level
CUSA	Chevron USA, Inc.
DCAP	Draft Cleanup Action Plan
DRO	Diesel-range organics
EC	Environmental Covenant
Ecology	Washington State Department of Ecology
EDR	Engineering Design Report
GPE	Glacier Park East
GRO	Gasoline-range organics
GWBU	Groundwater-bearing unit
HASP	Health and Safety Plan
µg/m^3	Micrograms per cubic meter
MNA	Monitored natural attenuation

Abbreviation/ Acronym	Definition
MTCA	Model Toxics Control Act
No.	Number
O&M	Operation and maintenance
ORO	Oil-range organics
PLP	Potentially liable party
RAO	Remedial action objective
RI/FS	Remedial Investigation/Feasibility Study
RTF	Restoration Time Frame
SAP	Sampling and Analysis Plan
SFS	Supplemental Feasibility Study
SGC	Silica gel cleanup
SRI	Supplemental Remedial Investigation
SVE	Soil vapor extraction
TEE	Terrestrial Ecological Evaluation
TPH	Total petroleum hydrocarbons
TRC	TRC Environmental Corporation
WAC	Washington Administrative Code

1.0 INTRODUCTION

On behalf of BNSF Railway Company (BNSF) and Chevron USA, Inc. (CUSA), TRC Environmental Corporation (TRC) is pleased to present this *Draft Cleanup Action Plan* (DCAP) for the Glacier Park East (GPE) property located northeast of the intersection of U.S. Highway 2 and Chumstick Highway (formerly State Route 209) in Leavenworth, Washington (subject property). The location of the subject property is shown on Figure 1. The Site boundary lies within multiple parcels and is shown on Figure 2. The Site is currently under an Agreed Order (AO) with the Washington State Department of Ecology (Ecology), AO Number (No.) DE 16838 issued in 2020, and is assigned Cleanup Site No. 4234, and Facility Site No. 349.

This DCAP has been prepared in general accordance with the Ecology Model Toxics Control Act and implementing regulations, collectively referred as "MTCA." This DCAP is required as part of the Site cleanup process under MTCA. The purpose of the DCAP is to identify the proposed cleanup action for the Site and to provide an explanatory document for public review. Washington Administrative Code (WAC) 173-340-380 in the MTCA regulation describes the required elements of a DCAP. In compliance with these requirements, this DCAP:

- describes the Site;
- summarizes current Site conditions;
- summarizes the cleanup action alternatives considered in the Supplemental Feasibility Study (SFS);
- describes the selected cleanup action for the Site and the rationale for selecting this alternative;
- identifies Site-specific cleanup levels (CULs) and points of compliance for each chemical of concern (COC) and medium of concern for the proposed cleanup action;
- identifies applicable state and federal laws for the proposed cleanup action;
- discusses compliance monitoring requirements; and
- presents the schedule for implementing the DCAP.

1.1 Declaration

Ecology has made a preliminary determination that a cleanup conducted in conformance with this DCAP will comply with the requirements for selection of a remedy under WAC 173-340-360.

1.2 Applicability

Cleanup standards specified in this DCAP are applicable only to the BNSF GPE Site. They were developed as a part of an overall remediation process under Ecology oversight using the authority of MTCA and should not be considered as setting precedents for other sites.

1.3 Administrative Record

The documents used to make the decisions presented in this DCAP are on file in the administrative record for the Site. Major documents are listed in the reference section. The entire administrative record for the Site is available for public review by appointment at Ecology's Central regional offices, located at 1250 West Alder Street, Union Gap, Washington 98903-0009. Results from the following applicable studies and reports are summarized to provide background information pertinent to the DCAP:

- *Remedial Investigation/Feasibility Study Report* (GeoEngineers 1997)
- *Supplemental Remedial Investigation* (TRC 2022)
- *Supplemental Feasibility Study* (TRC 2023)

1.4 Cleanup Process

Cleanup conducted under the MTCA process requires the potentially liable parties (PLPs) or Ecology to prepare specific documents. These procedural tasks and resulting documents, along with the AO task number or MTCA section requiring their completion, are listed below with a brief description of each task:

- **Public Participation (WAC 173-340-600)**: Summarizes the methods that will be implemented to encourage coordinated and effective public involvement. Ecology prepares this document.

- **Supplementary Remedial Investigation and Feasibility Study Work Plan (AO Task 1):** The PLPs shall prepare a work plan with the purpose of updating the conceptual site model (CSM) and performing a Supplemental Remedial Investigation and Feasibility Study (SRI/SFS) for the cleanup of impacted soil and groundwater at the Site.

- **Permits and Substantive Conditions of Permit-Exempt Laws (AO Task 2):** The PLPs must identify any necessary permits prior to conducting investigation work and comply with the substantive requirements of laws for which MTCA creates a permit exemption.

- **Remedial Investigation Field Work (AO Task 3):** The PLPs shall carry out the Supplemental Remedial Investigation (SRI) field work according to the schedule presented in the approved SRI Work Plan as field conditions allow.

- **Supplemental Remedial Investigation and Supplemental Feasibility Study Report (AO Task 4 and 5, WAC 173-340-350):** The PLPs shall document the investigations and evaluations conducted at the Site from the discovery phase to the SRI/SFS document. The SRI collects and presents information on the nature and extent of Site-related constituent impacts and the risks posed by the impacts. The SFS presents and evaluates Site cleanup alternatives and may propose a preferred cleanup alternative.

- **Revised Draft Cleanup Action Plan (AO Task 6, WAC 173-340-380):** PLPs will submit an Agency Review Draft of an updated DCAP for Ecology's review. The DCAP sets cleanup

standards for the Site and selects the cleanup actions intended to achieve the cleanup standards.

- **Engineering Design Report (EDR; WAC 173-340-400):** The report will outline details of the selected cleanup action, including engineered systems and design components from the DCAP. This may include construction plans and specifications with technical drawings. The PLPs usually prepare the document and Ecology approves it. Public comment is optional.

- **Operation and Maintenance Plan (O&M Plan; WAC 173-340-400):** The O&M Plan summarizes the requirements for inspection and maintenance of remediation operations. It includes actions required to operate and maintain equipment, structures, or other remedial systems. The PLPs usually prepare the document, and Ecology approves it.

- **Cleanup Action As-Built Report (WAC 173-340-400):** The report provides details on the cleanup activities along with documentation of adherence to or variance from the DCAP following implementation of the cleanup action. The PLPs usually prepare the document, and Ecology approves it.

- **Compliance Monitoring Plan (CMP; WAC 173-340-410):** The CMP details the monitoring activities required to confirm the cleanup action is performing as intended. The PLPs usually prepare the document, and Ecology approves it.

2.0 SITE DESCRIPTION

2.1 Physical Site Characteristics

The subject property is located northeast of the intersection of U.S. Highway 2 and Chumstick Highway (formerly State Route 209) in Leavenworth, Chelan County, Washington (Figure 1). Per AO No. DE 16838, the subject property is defined as the 1.72-acre area described in records maintained by the Chelan County Assessor's office, comprising of Chelan County Parcel Nos. 241701430700 and 241701430025. Portions of the subject property are located within the boundaries of the Site. As defined in MTCA, the Site comprises all locations where impacts have come to be located.

The City of Leavenworth is in the upper reaches of the Wenatchee River Valley at an elevation of approximately 1,170 feet above mean sea level. The subject property is currently zoned as General Commercial per the City of Leavenworth's website. The subject property includes the BNSF parcel and is bordered by Chelan County Public Utilities District property to the northeast, U.S. Highway 2 to the south, and Chumstick Highway to the west. The subject property is presently vacant with a gravel-covered lot north of the asphaltic cap. Outside the cap and gravel covered lot, the Site is partially vegetated.

The cap is barricaded with closely spaced bollards to prevent vehicular traffic from entering. The subject property is located approximately 800 feet northwest of the Wenatchee River with a generally flat topography. Ponderosa pine trees cover most of the subject property east of the gravel lot. The capped

area is covered by clean fill material and an engineered and elevated asphaltic concrete cap, which is surrounded by sloped sidewalls and protected by boulders on three sides. The asphaltic concrete cap is shown on Figures 2 and 3**.**

2.2 Site History

The subject property was first developed during the mid-1920s when Standard Oil Company of California (predecessor in interest to CUSA) leased the property from Great Northern Railroad to construct a bulk fuel storage facility. The bulk fuel storage facility consisted of one 20,000-gallon aboveground storage tank (AST), one 13,000-gallon AST, a pump house, a warehouse/office building, a truck loading rack, a drum storage facility, and an unloading rack for receiving product from rail tank cars. Two smaller ASTs (approximately 5,000 gallons each) were reportedly used to store gasoline for a brief period. The structures were removed from the property in 1990. The locations of historical structures are shown on Figure 2.

In 1992, the property was temporarily used as a staging area for equipment and soil from the U.S. Highway 2 bridge construction over the Wenatchee River. Chelan County historically plows and places snow from Chumstick Highway and U.S. Highway 2 onto the gravel lot during winter months adjacent to the capped area.

3.0 REMEDIAL INVESTIGATIONS AND PREVIOUS REMEDIAL ACTIONS

Numerous environmental investigations have been completed at the Site. The assessments to date have satisfied the purpose of a remedial investigation (WAC 173-340-350(7)(a)):

> *"…collect data necessary to adequately characterize the site for the purpose of developing and evaluating cleanup action alternatives…"*

The totality of prior assessments and the SRI Report (TRC 2022) have met this objective. Each iterative phase of investigation has contributed to the characterization of the lateral and vertical extent of COC impacts as well as historical sources of environmental impacts. These assessments have satisfied the requirements of WAC 173-340-350(7)(c)(iii)(B) and (C) for characterization of the extent of impacts and WAC 173-340-350(7)(c)(iii)(G) for identifying sources of impact. The historical reports are referenced in the SRI Report, which also includes summary tables of historical soil and groundwater data. The final Revised SRI was submitted to Ecology on July 26, 2022.

A SFS was submitted to Ecology on April 6, 2023. The SFS was submitted under the requirements of the AO and included an evaluation of remedial alternatives and an evaluation of the cost and benefit of those cleanup alternatives that meet the threshold criteria for consideration. Ecology indicated their approval of the selected Alternative 2 in a letter dated June 30, 2023 (Ecology 2023).

3.1 Site Geology

The central portion of the subject property was filled with approximately 10 to 15 feet of clean imported soil prior to capping with asphaltic concrete. Native soils are laterally variable and the soil units present vary in thickness and extent. Based on the U.S. Geological Survey (USGS) geologic map, the subject property is underlain by Pleistocene glacial drift. Previous investigations indicate the native subsurface soil is primarily about 10 to 25 vertical feet of silty sand with 5 to 20 vertical feet of sandy silt beneath.

3.2 Site Surface Water

No surface water body is present at the subject property. The nearest body of water is the Wenatchee River, located about 800 feet southeast of the subject property and roughly 40 feet lower in elevation than the Site. The sloped asphaltic concrete cap includes a stormwater conveyance system designed to direct surface water away from the Site. Infiltration of stormwater and snowmelt is occurring around the periphery of the asphaltic cap and contributing to the presence of localized transient water in the vadose zone.

3.3 Site Groundwater

Groundwater at the subject property has been encountered in two separate zones: shallow transient water in the vadose zone and a deeper unconfined groundwater-bearing unit (GWBU). Historically the shallow transient water has been encountered seasonally at a depth of about 15 feet below ground surface (bgs). It is typically encountered during spring and is laterally discontinuous.

The deeper unconfined GWBU is laterally continuous and has been encountered at depths of approximately 50 to 75 feet bgs at multiple wells across the subject property. Based on piezometric measurements, groundwater at the subject property generally flows toward the north-northwest away from the Wenatchee River.

3.4 Soil Investigation

The extent of impacted soil defined in the Remedial Investigation and Feasibility Study (RI/FS) (GeoEngineers 1997) was capped beneath 10 to 15 feet of clean fill soil in 2003 as the approved remedy under the 2001 AO No. DE 01TCPCR3168. The SRI, completed in 2022, included sampling to further characterize the lateral limits of impacts to soil. This was performed by collecting and analyzing additional soil samples during drilling of SB-1 through SB-6 and GWB-1 (Figure 2).

Gasoline-range organics (GRO) was the only COC that exceeded the MTCA Method A CUL during the SRI. GRO exceeded the CUL at four locations (SB-1, SB-2, SB-4, and SB-6). The maximum depth of impacts was 25 feet bgs at SB-6. Exceedances of the CUL at PZ-2 (completed in 2016), SB-1, and SB-2 indicate that GRO impacts extend beyond the footprint of the cap to the northeast in the top 10 feet of the soil column.

All other COCs are contained beneath the cap. Diesel-range organics (DRO), oil-range organics (ORO), and benzene, toluene, ethylbenzene, and total xylenes (BTEX) were not detected at concentrations exceeding the respective CULs in any of the additional samples. Naphthalene was detected in one location (PZ-2 at 7.5 feet bgs), but it is not present at 8 feet bgs. Additionally, the naphthalene detections in soil are not more than twice the CUL, and less than ten percent of the samples' exceeded the CUL for naphthalene. Therefore, in accordance with WAC-173-340-740 (7)(d) and (e), naphthalene is not a COC.

Soil data from borings advanced through the cap (SB-4 and SB-6) and data from shallow piezometer PZ-4 confirm the presence of GRO impacts to soil beneath the cap.

3.5 Groundwater Investigations

The shallow transient water is present only during brief periods of the year (primarily spring) and is not laterally continuous across the Site. The shallow transient water was observed in PZ-1 and PZ-3 between April and May 2017. No water has been observed in PZ-1 and PZ-3 during the monitoring events completed since May 2017. The shallow transient water has been observed in PZ-2 sporadically during spring and summer events from 2016 through 2021. The presence of shallow transient water beneath the cap was confirmed briefly with the installation of PZ-4 during the SRI in June 2021; however, the piezometers were dry during the latter half of 2021. Observations of shallow transient water beneath the cap during the SRI are consistent with findings in 2016 and 2017 when the presence of saturated conditions was identified in the three shallow piezometers (PZ-1, PZ-2, and PZ-3) installed around the perimeter of the cap. The shallow transient water is temporarily perched on less permeable soils, impeding vertical migration.

The deeper unconfined GWBU is impacted with GRO, DRO, and ORO at concentrations exceeding the respective CULs. Following installation of the soil cap in 2003, groundwater COC concentrations generally declined in all monitoring wells and remained less than the respective CULs until approximately 2007. COC concentrations increased between 2007 and 2011, with a subsequent decline in concentrations in more recent years. Concentrations of GRO exceeding the CUL have been limited to well MW-3. Concentrations of DRO and ORO greater than the respective CULs in the deeper unconfined GWBU have been limited to wells MW-3 and MW-4 historically, with only sporadic detections in wells MW-1 and MW-2.

COCs have not been detected in downgradient well MW-5. Upgradient well MW-6 has had one detection (June 2018) of DRO and ORO less than the MTCA Method A CULs in the sample prepared without silica gel cleanup (SGC). COCs in the deeper unconfined GWBU have continued to attenuate over time and their presence in groundwater at concentrations greater than the CULs is only reported in samples analyzed without SGC. This finding strongly indicates that the petroleum present is highly degraded through environmental weathering and will continue to degrade over time.

3.6 Previous Remedial Actions

3.6.1 Soil Isolation Cap

A Cleanup Action Plan (CAP) was implemented in 2003 under the previous AO (DE 01TCPCR3168). The selected cleanup action for the AO was soil isolation by capping and groundwater monitoring for a minimum of 5 years. The soil isolation cap consisted of approximately 10 to 15 feet of imported clean soil. The soil cap raised the elevation of the Site above the surrounding roadways and adjacent areas. A layer of asphaltic concrete was placed over the top of the soil and the western edge of the sloped soil cap where it meets Chumstick Highway. Surface slopes direct stormwater flow toward the catch basin on the cap and into the stormwater detention tank where sediment settles before water is discharged to the City of Leavenworth storm sewer system. The northern, eastern, and southern edges of the cap are surrounded and protected by a large rock barrier to prevent erosion and limit access to the surface of the cap.

During the 5-year review in 2008 Ecology concluded that continued impacts to groundwater following installation of the cap indicated that the remedial action was not sufficiently protective of groundwater. Ecology indicated an Environmental Covenant (EC) should be implemented. The required institutional controls included a long-term plan to monitor and document the integrity of the soil isolation cap and long-term groundwater monitoring.

An EC meeting the requirements of the Uniform Environmental Covenants Act (UECA) dated November 26, 2012, was filed with the Chelan County Recorder's office and recorded on March 11, 2013. The EC included restrictions on property use and soil disturbance.

3.7 Feasibility Study Field Activities

In October 2022 two small scale pilot tests were completed as part of the SFS to assist in evaluating the potential remedial alternatives.

3.7.1 Bioventing Pilot Test

A small-scale bioventing pilot test was conducted on October 4, 2022, to determine whether a bioventing strategy could be employed to stimulate aerobic bacterial populations and encourage the biotransformation of petroleum-impacted soil mass. The test consisted of a 3-hour bioventing study conducted at shallow well PZ-4, located within the core of the remaining impacts within the cap. The test used a vacuum blower to slowly pull soil gas out of the test well over a period of time to observe soil gas characteristics before and after low-flow bioventing was employed.

Soil gas data were collected prior to the test, during the test, and after the test at the test well, PZ-4. The soil gas data showed that oxygen levels in the test well were depressed and eventually fell to 0.0 percent during the test. Carbon dioxide concentrations suggest that aerobic respiration is occurring at a moderate rate but may be limited in its generation rate(s) due to a depletion of available oxygen. In addition, carbon

monoxide, hydrogen sulfide, and lower explosive limits (LEL) observed during the test indicate that anaerobic processes, including methanogenesis, are also occurring within the areas of impacts where oxygen is the most depleted.

The test was also intended to determine if air flow permeabilities and the responses were conducive to bioventing. Pressure testing conducted during the test suggest that a radius of 30 feet would facilitate the turnover of sufficient oxygen if implemented at a low vacuum and recovery rate. Additional details of this pilot test can be found in the SFS (TRC 2023).

3.7.2 SVE Pilot Test

A soil vapor extraction (SVE) pilot test was conducted on October 5, 2022 to determine short-term air flow rates in the different geological zones, observe pneumatic response effects to SVE applications, and estimate mass recovery rates. The SVE pilot test was conducted in the shallow vadose zone, at location PZ-4, located within the area of impacts under the cap. In addition, a second SVE pilot test was conducted in the deeper soils, at location MW-4, which is screened within the deeper unconfined GWBU.

The testing consisted of extracting soil gasses from MW-4 at a moderately low flow rate and separately at shallow well PZ-4 at a high flow rate. Responses to the applied vacuum recorded in nearby shallow and deep observation wells demonstrated that the effects of the vacuum propagation were primarily lateral, with the strongest vacuum effects observed in wells situated in similarly constructed depths and soil types. Vacuum responses in shallow wells during testing suggest that the vertical effects of the vacuum response were minimal. Findings from the SVE pilot test suggest that higher flow rates can be achieved in the shallower vadose zone soils compared with the deeper vadose zone soils. The construction of the shallower vadose zone wells additionally contributed to better flow rates due to the available unsaturated well-screen length.

Soil gas testing was performed at the conclusion of the SVE tests by collecting soil gas samples from wells MW-4 and PZ-4. A concentration of 1,000,000 micrograms per cubic meter (µg/m^3) GRO was detected at PZ-4 after several hours of operation. GRO in soil gas was detected at much higher concentrations than DRO in both tests.

GRO was detected in the deeper soil gas sample collected at MW-4 at concentrations of 230,000 µg/m^3, and DRO was detected at a concentration of 7,800 µg/m^3 at the end of the test. In this deeper vadose zone location, DRO comprised approximately 15 percent of the total petroleum hydrocarbons (TPH) at this location. DRO in shallower soil gas comprised approximately 30 percent of the TPH, indicating that higher concentration DRO remains in the shallow source area compared with the deeper soils. Additional details of this pilot test can be found in the SFS (TRC 2023).

3.8 Site-Related Constituents and Locations

The primary sources of petroleum-related impacts are the former ASTs and truck loading rack. Subsequent investigations in 1991 and 1995 further characterized the lateral and vertical extent of

impacted soil beneath the Site and confirmed the depth of groundwater. Those investigations also confirmed the presence of impacts to groundwater.

Based on the location and extent of soil impacts, the primary release(s) were to the surface or near-surface from historical leaks in above-grade and below-grade product lines and/or releases during fuel transloading at the loading rack. Impacts from these surface and near-surface releases migrated vertically through preferential pathways to the deeper unconfined GWBU at depths between 50 to 60 feet bgs.

COCs are those compounds that were detected in soil and/or groundwater during the SRI at concentrations exceeding laboratory method detection limits and are potentially associated with release(s) from the fuel bulk storage and transloading operation.

The COCs for soil and groundwater at the Site are DRO, ORO, and GRO.

4.0 CLEANUP STANDARDS

MTCA requires the establishment of cleanup standards for individual sites. The two primary components of cleanup standards are CULs and points of compliance. CULs identify the concentration at which a COC does not threaten human health of the environment. Media exceeding the CULs are addressed through a cleanup remedy that minimizes or restricts uncontrolled exposure to the impacted material. Points of compliance represent the locations on the Site where the CULs must be met.

4.1 Overview

The work documented herein is intended to comply with the laws and regulations of the State of Washington. The work to be performed during implementation of the selected remedy will be performed under the AO and will comply with MTCA (WAC 173-340).

4.2 Terrestrial Ecological Evaluation

The Site is partially covered by an asphaltic concrete cap and crushed gravel. The property qualifies for a Terrestrial Ecological Evaluation (TEE) exclusion (TEE Evaluation form included in the SRI), based upon WAC 173-340-7491(1)(c)(i), which states that:

> *"For sites contaminated with hazardous substances other than those specified in (c)(ii), there is less than 1.5 acres of contiguous undeveloped land on the Site or within 500 feet of the area of the Site."*

As the Site does not contain any of the compounds listed in 173-340-7491(1)(c)(ii) and there is not 1.5 acres of undeveloped land contiguous to the Site or within 500 feet of the Site, it qualifies for the TEE exclusion.

Surface water and sediment are also not considered potential receptors because (1) the nearest surface water body (i.e., the Wenatchee River) is greater than 800 feet from the Site, and (2) a completed pathway of migration to surface water does not exist. In addition, storm sewer and other utility piping are completed above the seasonal high-water table of the deeper unconfined GWBU and do not serve as preferential pathways for migration of groundwater.

4.3 Conceptual Site Exposure Model

The CSM is based on the data collected during the investigative actions performed at the Site and identifies potential human and ecologic exposure pathways. The CSM therefore forms the basis for CUL development and selection. The CSM is summarized below and outlined on Figure 4. Additional specifics of the CSM development can be found in the SRI.

The primary historical source area for petroleum hydrocarbon impacts is in the northwest corner of the Site. Operations related to the ASTs and truck loading rack were identified as potential sources of petroleum-related impacts. Impacts from these operational activities migrated vertically through preferential pathways to the deeper unconfined GWBU at depths between 50 to 60 feet bgs; however, they do not appear to have migrated any significant distance laterally from the source area.

The extent of impacted soil defined in the 1997 RI/FS was capped beneath 10 to 15 feet of clean fill soil in 2003. Additional GRO impacts to soil were identified beyond the footprint of the cap to the east and northeast during the SRI. The approximate extent of COCs at concentrations exceeding the CULs is shown on Figure 2.

Concentrations of COCs greater than CULs in the deeper unconfined GWBU historically have been limited to wells MW-3 and MW-4, with only sporadic detections in wells MW-1 and MW 2. The downgradient well (MW-5) has had no detections of COCs. MW-6 (upgradient) has had one detection of DRO and ORO in 2018 at concentrations less than the MTCA Method A CULs in groundwater.

The CSM also evaluates current and potential future exposure pathways based upon the current and foreseeable future land uses. A CSM outlining the primary sources, COCs, media of concern, transport mechanisms, and exposure pathway analysis is shown on Figure 4.

The current and potential future exposure pathways include the following:

- Inhalation of volatilized vapors from impacted soil and groundwater;
- Ingestion and direct contact with soil;
- Direct contact with groundwater; and
- Consumption of groundwater, although this is not a complete exposure pathway, it must be considered under MTCA regulations.

Potential human receptors associated with these exposure pathways are primarily construction workers. The majority of the Site is covered by a cap and clean fill soil up to 15 feet thick. As previously mentioned, a small area of the impacted soil with GRO concentrations greater than the CUL extends beyond the

footprint of the protective cap (Figure 2). There is no potential for indoor air exposures as the Site is currently covered by a soil isolation cap and an EC is in place limiting the use of the property. Future development of the Site for residential or commercial uses is also unlikely. There are currently no completed exposure pathways based on the Site use and the EC.

Direct exposure to shallow transient water is unlikely because this water, when intermittently present is covered with an impermeable cap in most areas where COCs have been detected at concentrations exceeding CULs. In areas where COCs in shallow transient water extend beyond the cap, exposure is mitigated via the EC.

The potential exposure pathways that have been identified as incomplete are described below:

- Groundwater migration to surface water. The nearest surface water body is approximately 800 feet south from impacted groundwater at the Site and the established groundwater flow direction at the Site is generally northerly. The most hydraulically downgradient well is not impacted. Therefore, there are no complete exposures to surface water receptors.

- Human ingestion of freshwater organisms.

- Terrestrial ecological exposures do not require further evaluation based on the exclusions contained in the MTCA regulations under WAC 173-340-7491(1)(c)(i), and specifically the insufficient acreage of contiguous habitat surrounding the Site to ecological receptors, as described in Section 4.2.

4.4 Site Cleanup Levels

CULs for affected media were evaluated in accordance with MTCA and take into consideration exposure pathways to humans based on current and likely future uses. The selected CULs must be protective of human health and the environment after completion of the selected remedial action and implementation of institutional and/or engineering controls and must consider the exposure pathways that remain after remedy implementation.

Based on the CSM the environmental media of concern are soil and groundwater. Potential exposure pathways to humans include ingestion and dermal exposure from soil and groundwater, and inhalation of volatilized vapors from soil or groundwater.

Based on the zoning and current and expected future use, MTCA Method A CULs for soil and groundwater are applicable The MTCA Method A Soil CULs for Unrestricted Land Uses (WAC 173-340-900; Table 740-1) are the applicable CULs for soil. The MTCA Method A CULs for Groundwater (WAC 173-340-900; Table 720-1) are the applicable CULs for groundwater. The selected soil CULs are protective of potential direct exposure to soils shallower than 15 feet bgs and are generally accepted as being protective of groundwater to a drinking water standard. Potential soil exposures are limited by the Ecology approved soil cap constructed in 2003. The cap was also designed to be protective of the soil-

to-groundwater migration pathway by significantly reducing surface infiltration. The COCs for affected media and the corresponding CULs are summarized in Table 1.

4.5 Point of Compliance

MTCA defines the point of compliance as the point or points where CULs shall be attained. Once CULs are met at the point of compliance, the Site is no longer considered a threat to human health or the environment. As provided for in WAC 173-340-720(8)(c):

> *"…where it can be demonstrated under WAC 173-340-350 through 173-340-390 that it is not practicable to meet the cleanup level throughout the site within a reasonable restoration time frame, Ecology may approve a conditional point of compliance that shall be as close as practicable to the source of hazardous substances, and except as provided under WAC 173-340-720(8)(d), does not exceed the property boundary."*

MTCA defines conditional points of compliance, including soil depths, for several potential receptor exposure pathways.

Soil. WAC 173-340-740(6) gives the point of compliance requirements for soil. The standard point of compliance for soil based on protection of human exposure via the direct contact pathway is Site-wide to a depth of 15 feet bgs as the typical maximum depth of soil disturbing activities (WAC 173-340-740(6)(d)). The capped area of the Site serves to meet this requirement. The standard point of compliance for soil CULs based on protection of groundwater is throughout the soil column. Impacts to the shallow transitory water will be addressed by this remedial action.

Groundwater. WAC 173-340-720(8)(a) and (b) gives the point of compliance requirements for groundwater. The standard point of compliance for groundwater CULs will be beneath the Site to the outer boundary of the impacted area, and from the top of the saturated zone to the lowest depth that could be affected by the Site.

5.0 CLEANUP ACTION SELECTION

5.1 Remedial Action Objectives

Remedial action objectives (RAOs) have been established to provide the technical basis for evaluating remedial alternatives that protect human health and the environment under the MTCA cleanup process (WAC 173-340-350). Based on the assessment of conditions and the applicable CULs presented in Section 4.4, the RAOs have been established as follows:

- Protect human receptors from exposure to soil outside of the currently capped area with COCs exceeding the MTCA Method A CULs to a depth of 15 feet bgs.

- Protect human receptors from direct contact with and ingestion of groundwater with COCs at concentrations exceeding CULs.

- Reduce concentrations of COCs in groundwater to levels protective of human health and the environment.

5.2 Cleanup Action Alternatives

The following cleanup action alternatives that meet the RAOs for the Site were evaluated in the SFS (TRC 2023):

- Alternative 1 – Containment, Monitored Natural Attenuation (MNA), Removal, and Institutional Controls
- Alternative 2 – Containment, Bioventing, and Institutional Controls
- Alternative 3 – Containment, Soil Vapor Extraction, and Institutional Controls
- Alternative 4 – Containment, Surface Water Diversion (French Drain), and Institutional Controls

These alternatives are summarized below and in Tables 2 and 3. Additional details on these alternatives can be found in the SFS (TRC 2023).

5.2.1 Alternative 1 – Containment, MNA, Removal, and Institutional Controls

Alternative 1 considers containment by maintaining the existing asphalt cap that diverts runoff and snow melt to the localized stormwater systems, includes the removal of off-property soil impacts, monitoring the natural attenuation of groundwater, and placement of institutional controls on the property. This alternative assumes that the cap would remain in place and would require regular inspections, sealcoating as appropriate to maintain its functionality and repair costs to adequately maintain the cap. A limited excavation would be performed to eliminate off-property impacts observed during the SRI in the upper 15 feet at three locations to the northeast. This excavation would eliminate the direct contact exposure pathway from these impacts.

The monitoring of natural groundwater attenuation would include the collection of duplicate groundwater samples and the use of supplementary sample analysis using the SGC process. Biogenic interferences of polar organics are contributing to elevated concentrations of DRO and ORO, as evidenced in comparative analyses with and without using the SGC process since 2016. This alternative would further use institutional controls to limit the potential for direct contact and would require regular inspections of the cap to ensure its intended functionality. Additional best management practices such as plowing winter snow into locations that will limit the volume of infiltration, should facilitate a shorter restoration time frame by reducing the mass of material leaching to groundwater.

This alternative assumes that the impacted soil-leaching-to-groundwater pathway becomes insignificant in 15 years and may require four additional monitoring events to be conducted during future 5-Year Reviews by Ecology.

5.2.2 Alternative 2 – Containment, Bioventing, and Institutional Controls

Alternative 2 includes containment by maintaining the existing asphalt cap that diverts runoff and snow melt to the localized stormwater systems, includes the installation of a bioventing system in the shallow vadose zone to facilitate the aerobic biodegradation of the shallow soil impacts, and placement of institutional controls on the property. This alternative assumes that the cap would remain in place and would require regular inspections, sealcoating as appropriate to maintain its functionality and repair costs to adequately maintain the cap. Bioventing would be implemented to eliminate the soil-leaching-to-groundwater pathway by enhancing natural attenuation through the introduction of additional available oxygen in the subsurface. The radial effects of bioventing would extend into the off-property soil impacts located to the northeast and would cause the impacts to attenuate to concentrations less than soil CULs. Confirmation soil sampling would be performed to confirm that soil conditions have attenuated in the area outside the cap.

This alternative would further use institutional controls to limit the potential for direct contact and would require regular inspections of the cap to ensure its intended functionality. Additional best management practices such as plowing winter snow into locations that will limit the volume of infiltration, should facilitate a shorter restoration time frame by reducing the mass of material leaching to groundwater.

This alternative assumes that bioventing would operate for a period of 7 years with concurrent groundwater monitoring.

5.2.3 Alternative 3 – Containment, Soil Vapor Extraction, and Institutional Controls

Alternative 3 consists of containment by maintaining the existing asphalt cap that diverts runoff and snow melt to the localized stormwater systems, includes implementing SVE to physically remove remaining sorbed COC mass in the vadose zone, and placement of institutional controls on the property. This alternative assumes that the cap would remain in place and would require regular inspections, sealcoating as appropriate to maintain its functionality and repair costs to adequately maintain the cap. SVE would be implemented to eliminate the soil leaching to groundwater pathway. The radial effects of SVE would extend throughout the off-property soil impacts located to the northeast and would cause the impacts to attenuate to concentrations less than soil CULs. Confirmation soil sampling would be performed to confirm that soil conditions have attenuated in the area outside the cap.

This alternative would further use institutional controls to limit the potential for direct contact and would require regular inspections of the cap to ensure its intended functionality. Additional best management practices such as plowing winter snow into locations that will limit the volume of infiltration, should facilitate a shorter restoration time frame by reducing the mass of material leaching to groundwater.

This alternative assumes that SVE would operate for a period of 3 years with concurrent groundwater monitoring.

5.2.4 Alternative 4 – Containment, Surface Water Diversion (French Drain), Removal, and Institutional Controls

Alternative 4 consists of containment by maintaining the existing asphalt cap that diverts runoff and snow melt to the localized stormwater systems, includes the installation of a hydraulic diversion trench (French drain) around the capped portions of the source area, and placement of institutional controls on the property. This alternative assumes that the cap would remain in place and would require regular inspections, sealcoating as appropriate to maintain its functionality and repair costs to adequately maintain the cap. A shallow trench would be installed along the periphery of the existing asphalt cap to intercept and re-route stormwater from rainwater and snowmelt prior to infiltration. By minimizing the volume of water that is currently infiltrating around the sides of the cap, the soil-leaching-to-groundwater pathway would be physically interrupted and prevent the continued migration of impacts to the deeper unconfined GWBU.

A limited excavation would be performed to eliminate off-property impacts observed during the SRI in the upper 15 feet at three locations to the northeast. This excavation would eliminate the direct contact exposure pathway from these impacts. This alternative would further use institutional controls to limit the potential for direct contact and would require regular inspections of the cap to ensure its intended functionality. Additional best management practices such as plowing winter snow into locations that will limit the volume of infiltration, should facilitate a shorter restoration time frame by reducing the mass of material leaching to groundwater.

This alternative assumes groundwater compliance is achieved after 10 years and would require semi-annual monitoring during that period.

5.3 Regulatory Requirements

Regulatory requirements for cleanup actions are set forth by MTCA. The specific minimum requirements are included in WAC 173-340-360(2). These requirements are summarized in the sections below.

5.3.1 Threshold Requirements

At a minimum, an alternative must meet MTCA's threshold requirements as specified in WAC 173-340-360(2)(a) before being considered for further evaluation. WAC 173-340-360(2)(a) specifies that cleanup actions shall:

- protect human health and the environment;
- comply with cleanup standards;
- comply with applicable state and federal laws; and
- provide for compliance monitoring.

5.3.2 Other Requirements

WAC 173-340-360(2)(b) also mandates other requirements that must be met by any cleanup action alternative:

- Use permanent solutions to the maximum extent practicable;
- Provide for a reasonable restoration time frame; and
- Consider public concerns.

Additional criteria for choosing a cleanup alternative that is permanent to the maximum extent practicable are specified in WAC 173-340-360(3)(f) and WAC 173-340-360(4):

- Protectiveness;
- Permanence;
- Effectiveness over the long term;
- Management of short-term risks;
- Technical and administrative implementability;
- Consideration of public concerns;
- Restoration time frame; and
- Cost.

Table 3 summarizes the evaluation of cleanup action alternatives in relation to these MTCA requirements.

5.3.3 Groundwater Cleanup Action Requirements

Groundwater cleanup action requirements specifying the permanence of groundwater cleanup actions are specified in WAC 173-340-360(2)(c). All four of the cleanup action alternatives presented in the SFS fulfill this requirement as presented in Table 3.

5.3.4 Cleanup Action Expectations

Cleanup action expectations are specified in WAC 173-340-370. This regulation specifies the types of cleanup actions expected by Ecology as a result of the feasibility study process. Ecology does however recognize that at some sites conforming to these expectations may not be appropriate. These expectations are described below:

- Treatment technologies will be emphasized at sites containing liquid wastes, areas impacted with high concentrations of hazardous substances, highly mobile materials, or discrete areas of hazardous substances.

- To minimize the need for long-term management of impacted materials, all hazardous substances will be destroyed, detoxified, or removed to concentrations less than CULs.

- Engineering controls, such as containment, may be used for sites that contain large volumes of materials with relatively low levels of hazardous substances where treatment is impracticable.

- Active measures will be taken to prevent precipitation and subsequent runoff from coming into contact with impacted soils and waste materials in order to minimize the potential for migration of hazardous substances.

- When hazardous substances remain on-site at concentrations that exceed CULs, those hazardous substances will be consolidated to the maximum extent practicable where needed to minimize the potential for direct contact and migration of hazardous substances.

- For sites adjacent to a surface water body, active measures will be taken to prevent or minimize releases to surface water via surface runoff and groundwater discharges in excess of CULs.

- Natural attenuation of hazardous substances may be appropriate at sites where:

    - source control (including removal and/or treatment of hazardous substances) has been conducted to the maximum extent practicable;

    - leaving impacts on-site during the restoration time frame does not pose an unacceptable threat to human health or the environment;

    - there is evidence that natural biodegradation or chemical degradation is occurring and will continue to occur at a reasonable rate at the site; and

    - appropriate monitoring requirements are conducted to ensure that the natural attenuation process is taking place and that human health and the environment are protected.

- Cleanup action alternative will not result in a significantly greater overall threat to human health and the environment than other alternatives.

5.3.5 Applicable, Relevant, and Appropriate State and Federal Laws, and Local Requirements

WAC 173-340-710(1) specifies that all cleanup actions completed shall comply with applicable, relevant, and appropriate regulations (ARARs). Applicable ARARs to these cleanup activities are presented in Table 4.

5.4 Evaluation of Cleanup Action Alternatives

The four cleanup alternatives summarized in Section 5.2 were evaluated using the requirements summarized in Section 5.3 to select the appropriate cleanup action. A summary of this evaluation is provided in Table 3. A summary of this comparative evaluation is provided in the following sections. For further details on this evaluation please refer to the SFS (TRC 2023).

5.4.1 Threshold Requirements

Threshold requirements for cleanup actions are specified in WAC 173-340-360(2)(a). The following sections summarizes the minimum requirements.

5.4.1.1 Protection of Human Health and the Environment

Assuming the remedy is effective, each of the four alternatives is expected to achieve protection of human health and the environment.

5.4.1.2 Compliance with Cleanup Standards

Assuming the remedy is effective, each of the four alternatives is expected to achieve compliance with the CULs.

5.4.1.3 Compliance with Local, State, and Federal Laws

Each of the four alternatives are expected to be completed in compliance with applicable state and federal laws listed in Table 4. Local laws will be reviewed and established during the engineering design phase. Those local laws that are found to be more stringent will be followed.

5.4.1.4 Provision for Compliance Monitoring

Compliance monitoring requirements are specified in WAC 173-340-410 and include three types of monitoring: protection, performance, and confirmation. Protection monitoring confirms that human health and the environment are adequately protected during construction and operation of cleanup actions. This monitoring will be maintained through the use of implementation of a health and safety plan (HASP) throughout Site activities. Performance monitoring confirms that the cleanup actions have attained the CULs. All four alternatives include a performance monitoring period. Confirmation monitoring confirms the long-term effectiveness of the cleanup action.

5.4.2 Other Requirements

This section presents a summary of the evaluation and comparison of the proposed remedial alternatives for selecting the preferred cleanup action. In accordance with MTCA, the alternatives were evaluated relative to the criteria specified in WAC 173-340-360(2)(b), WAC 173-340-360(3)(f), and WAC 173-340-360(4). A summary of the evaluation of the proposed alternatives is provided in Table 3. The overall

evaluation was then used to calculate the relative ranking of each alternative compared to the other alternatives.

5.4.2.1 Use of Permanent Solutions to the Maximum Extent Practicable

WAC 173-340-360(2)(b)(i) specifies that the cleanup action use permanent solutions to the maximum extent practicable. To determine if a cleanup action uses permanent solutions to the maximum extent practicable WAC 173-340-360(3)(f) specifies that the alternatives be evaluated for the following criteria:

- Protectiveness;
- Permanence;
- Effectiveness over the long term;
- Management of short-term risks;
- Technical and administrative implementability;
- Consideration of public concerns; and
- Cost.

Each criterion also includes subcriteria as a component of the evaluation. The detailed numerical scores provided for each alternative for each evaluation criterion and subcriteria are summarized below and in Table 3.

The subjective rankings are based on professional judgment, the understanding and application of established scientific and engineering principles, experience with other sites and similar technologies, vendor information, and understanding of specific Site conditions that could affect each of the alternatives.

- Protectiveness is defined in WAC 173-340-360(3)(f)(i) as the overall protectiveness of human health and the environment. This includes reducing risks on-Site and off-Site through the implementation of the alternative and improving environmental quality.

  All remedial alternatives are protective of human health and the environment. Two of the alternatives actively remediate soil beneath the Site (Alternatives 2 and 3), while the other two alternatives provide barriers to prevent exposures. Alternatives 2 and 3 would be the most protective if implemented properly by reducing concentrations of shallow soil impacts and ultimately, COCs in groundwater by actively removing impacts. Alternative 3 reduces risks very quickly, and therefore scored slightly higher than Alternative 2. Alternatives 1 and 4 scored lower by a comparative lack of mass removal. Alternative 3 received the highest score followed by, in order, Alternatives 2, 4, and 1.

- Permanence is defined in WAC 173-340-360(3)(f)(ii) as the ability for an alternative to permanently reduce toxicity, mobility, or volume of hazardous substances.

Alternatives 2 and 3 are permanent remedial alternatives that would reduce toxicity through a reduction in COC concentrations in soil, immediately reduce mobility due to the *in situ* nature of remediation and reduce the volume of impacts. Alternatives 1 and 4 would not permanently treat the remaining contaminant mass and therefore, scored lower for permanence. Alternative 2 received the highest score followed by, in order, Alternatives 3, 4, and 1.

- Effectiveness over the long term is defined in WAC 173-340-360(3)(f)(iv) as how successful the alternative is expected to be and how reliable the cleanup action is expected to be during the cleanup action until COC concentrations are less than CULs.

  Alternatives 2 and 3 are ranked highest for long-term effectiveness primarily because they remove or reduce impacts and provide a high level of effectiveness throughout implementation. These technologies also fall into the upper hierarchy of suggested alternatives and carry less residual risk based on their restoration time frames. While Alternative 3 scores higher than Alternative 2 for its degree of certainty, Alternative 3 produces some waste that ranks it equally with Alternative 2 for long-term effectiveness.

  The presence of the asphalt cap will continue to protect the long-term conditions; however Alternatives 1 and 4 do not actively remove or reduce the volume of impacts and are appropriately ranked lower than Alternatives 2 and 3. Alternative 4 does reduce the mobility of impacts and therefore scores higher than Alternative 1. Alternatives 2 and 3 received similar scores, followed by, in order, Alternatives 4 and 1.

- Management of short-term risks is defined in WAC 173-340-360(3)(f)(v) as the risk of implementing a cleanup action including during construction.

  The management of short-term risks require that the environmental benefit of the alternatives is weighed against the potential for risks associated with the necessary work to complete that alternative. Each of the alternatives has manageable short-term risks and effective measures for mitigating those risks. Alternative 1 has been ranked the highest for this criterion because it does not involve any intrusive work and, therefore, little to no short-term risks. Alternatives 2, 3, and 4 have moderate to high levels of short-term risks associated with implementation. Alternative 3 is ranked lower than Alternative 2 because it requires installation of substantial improvements with noxious emissions monitoring and on-Site personnel for 6 to 8 weeks. Alternative 4 ranks lowest due to substantial on-Site trenching, potential to generate sediment, and a risk of erosion during implementation. Alternative 1 received the highest score followed by, in order, Alternatives 2, 3, and 4.

- Technical and administrative implementability is defined in WAC 173-340-360(3)(f)(vi) as considering whether the alternative is technically possible.

  This criterion includes the concepts of technical possibility, access, necessary resources, monitoring requirements, and integration into existing facility features. All alternatives are

technically possible to implement, but primarily vary based on their overall complexity. Alternative 1 received the highest implementability score because it is the least complex of the alternatives to implement due its simplicity and overall lack of intrusive activities. Alternatives 3 and 4 received the same lowest score due to complexity of implementation (Alternative 3) and the uncertainty to adequately eliminate the surface-water-to-soil-pathway and to install in areas along the flanks of the cap (Alternative 4). Alternative 1 received the highest score followed by, in order, Alternatives 2, 3, and 4.

- Consideration of public concerns is defined in WAC 173-340-360(3)(f)(vii) as whether the community has concerns with the chosen cleanup action. The community can include, but is not limited to, individuals, local governments, tribes, and federal agencies.

  Integrating and addressing public concerns are integral in the success of implementing and maintaining the selected alternative. Alternatives 2 and 3 are ranked highest with the same score based on the moderate level of disruption to local businesses, impacts on traffic, and limited potential for major public concerns. Alternative 1 is ranked lower with excavation to address off-property soil impacts on the northeast-adjacent property and restoration time frame will be longer without active remediation. Alternative 4 ranked the lowest with the most anticipated public concern with excavation of off-property soil impacts, French drain installation, and transportation of impacted soil to the regional landfill. Based on a subjective evaluation of likely and perceived public concerns, Alternatives 2 and 3 are ranked highest, followed, in order, by Alternatives 1 and 4.

- Cost is defined in WAC 173-340-360(3)(f)(iii) to include the cost to construct the alternative, if needed, long-term costs including operations and maintenance, monitoring costs, and agency oversight costs.

  Costs include estimates of pre-remedial agency and permitting requirements, remedial actions as applicable, monitoring and maintenance costs, and restoration and closure tasks. The following table summarizes these estimated costs, and a more detailed analysis of costs can be found in the SFS (TRC 2023). These costs are for comparison purposes only and actual implementation costs will vary from those provided below. These estimated costs incorporate a variety of necessary assumptions, and the validity of those assumptions cannot be fully known at this time.

Remedial Alternatives Cost Summary

Remedial Alternative	Remediation Cost Estimate
1. Containment, MNA, Removal, and Institutional Controls	$ 556,943
2. Containment, Bioventing and Institutional Controls	$ 648,000
3. Containment, Soil Vapor Extraction (SVE) and Institutional Controls	$ 793,000
4. French Drain, Removal, and Institutional Controls	$ 692,000

5.4.2.2 Disproportionate Cost Analysis Results

Under WAC 173-340-360(3)(e), a cleanup action shall not be considered practicable "*if the incremental cost of the alternative over that of a lower cost alternative exceeds the incremental degree of benefits achieved by the alternative over that of the other lower cost alternative.*" The determination of practicability is made using an analysis of benefit versus cost. The disproportionate cost analysis (DCA) can be performed quantitatively using the judged scoring of the non-cost criteria as the net benefit.

Each alternative was assigned a score for each of the non-cost evaluation criteria, with a score of 5 representing the highest overall perceived benefit and a score of 1 representing the lowest overall perceived benefit. The raw scores that were assigned in Table 3 are summarized (rank) and weighted for each criterion according to weighting factors established by Ecology (value) in Table 5. The sum of the individual weighted scores for each alternative represents a value of the overall benefit of the alternative. This overall benefit is also graphically represented on Table 5 against the estimated costs.

Alternatives 2 and 3 had the highest net benefit calculations with Alternative 3 being slightly higher. Alternative 2, however, has a cost that is approximately $150,000 lower than Alternative 3. The cost for Alternative 1 is the lowest of the four alternatives; however, the net benefit for Alternative 1 is the lowest of all four alternatives. Based on this analysis Alternative 2 was chosen as the preferred cleanup action.

5.5 Restoration Time Frame

Restoration time frame (RTF) is evaluated using the following factors described in WAC 173-340-360(4)(b):

- Potential risks posed by the Site to human health and the environment;
- Practicability of achieving a shorter restoration time frame;
- Current use of the Site;
- Potential future use of the Site;
- Availability of alternative water supplies;
- Likely effectiveness and reliability of institutional controls;
- Ability to monitor and control migration of hazardous substances from the Site;
- Toxicity of hazardous substances at the Site; and

- Natural processes that reduce concentrations of hazardous substances at the Site.

Estimates of RTF are necessarily subjective. RTF was ranked based upon the general aggressiveness of each of the alternatives and their perceived certainty. Alternatives 2 and 3 were similarly ranked highest. They were judged to be most aggressive based on the highest quantity of contaminant mass removed in a short period of time. Alternative 4 was ranked lower because it does not actively remediate impacts or reduce their mobility, leaving them in place. Alternative 1 was ranked the lowest because it does not actively address the soil-leaching-to-groundwater pathway, will require the longest time frame to reach remedial cleanup goals, will rely on continued containment and the natural attenuation of groundwater through dispersion, dissolution, and biological breakdown over a period of 30 years. Based on these considerations, Alternatives 2 and 3 were ranked highest, followed, in order, by Alternatives 4 and 1. The RTF ratings are included in Table 3.

Based on the regulatory considerations, Site-specific conditions and assessment of the remedial technologies summarized in the SFS, and the preferred remedy (Alternative 2), the RTF for groundwater is expected to be approximately 7 years.

6.0 SELECTED REMEDIAL ACTION

In consideration of the findings of the SRI and SFS and in accordance with the requirements of the AO, the final cleanup remedy has been selected. Alternative 2 – Containment, Bioventing and Institutional Controls was selected as the selected remedy. This alternative includes a combination of engineering controls, mass reduction and institutional provisions to ensure a cleanup within a reasonable RTF. The time to Site closure under this approach is estimated to be achieved in 7 years.

The selected remedy, Containment, Bioventing and Institutional Controls, relies on mitigating direct contact exposure pathways, interrupting the soil-to-groundwater leaching pathway, maintaining the engineering controls, and provides for compliance monitoring. Containment will include the continued use of an asphalt cap to address the direct-contact and soil-leaching-to-groundwater pathways. Bioventing will be conducted below the cap to treat and address the residual petroleum mass. Institutional controls in the form of an EC will be applied to the Site to ensure that the soils remain covered, that the cap is adequately maintained, and the groundwater monitoring program will ensure that groundwater continues to attenuate. Figure 3 depicts the currently proposed remedial Site layout.

The implementation of this alternative will not interfere with Site operations as it has a minimal construction and operational footprint with no appurtenances on adjoining properties. This alternative can be implemented immediately after installation of remedial wells, piping, and equipment infrastructure. A start-up and shakedown period would be required following remedial equipment installation to fully ensure that all equipment is operated with appropriate safety measures in place.

6.1 Design and Permitting

6.1.1 Engineering Design Report

Prior to any Site work, an EDR will be prepared that will meet the requirements of an EDR as stated in WAC 173-340-400(4)(a). The EDR will provide sufficient information for the development and review of construction plans and specifications. The following documents will be prepared under separate cover and attached to the EDR as appendices:

- **HASP:** Details the potential project hazards and the actions to be taken to address and respond to hazards.
- **System O&M Plan:** Details the practices and procedures necessary to operate and maintain the mechanical systems. The O&M Plan will provide information on process operating procedures, process data collection/reporting, and preventative maintenance.
- **CMP:** Details the scope, parameters, methods, and frequency to monitor remediation performance; informs system optimizations; and evaluates attainment of CULs.

6.1.2 Compliance Monitoring Plan

A CMP will be prepared under WAC 173-340-410 that describes the monitoring to be conducted both prior to and during the cleanup action. The CMP will additionally contain a WAC 173-340-820 compliant Sampling and Analysis Plan (SAP).

The SAP will identify groundwater monitoring frequencies and analytical tests to be performed during cleanup activities (protection and performance monitoring) and for the duration of the compliance period (confirmational monitoring).

6.1.2.1 Protection Monitoring

Protection monitoring, which includes health and safety measures, is required for those individuals working at and visiting the Site who may reasonably be expected to come into contact with impacted media during cleanup action construction (e.g., during trenching activities to install the biovent piping that will include excavation of petroleum-impacted soil and installation of biovent wells) or during implementation of the remedial activities. The remediation contractor(s) will prepare a Site HASP. Health and safety measures, including protection monitoring to be implemented during construction activities, will be described in the HASP. A separate HASP will be prepared for use during remediation system O&M activities.

6.1.2.2 Performance Monitoring

Performance monitoring will be conducted at startup of the bioventing system and periodically during O&M to confirm the cleanup action is achieving cleanup standards over time and/or meeting other

performance metrics. Performance-based sampling and analysis will be implemented to ensure that the design criteria used to base the cleanup approach are being met and when system shutdown can occur.

Performance groundwater monitoring will be performed at selected locations to demonstrate conditions needed for biological degradation are present, natural attenuation is occurring, and the groundwater COC impacts are stable or decreasing. MNA includes periodically collecting groundwater samples for field water quality parameters (e.g., dissolved oxygen and oxidation reduction potential) and conducting specific laboratory analyses to confirm the natural processes are occurring (Ecology 2005). Groundwater sampling for COCs will also be collected periodically from the existing monitoring well network to evaluate attainment of CULs.

Quality assurance/quality control samples will be collected and analyzed during O&M activities and evaluated for conformance with the data quality objectives.

6.1.2.3 Confirmational Monitoring

The CMP will identify the specific requirements for future groundwater monitoring activities at the Site. Groundwater confirmational monitoring will be conducted to evaluate groundwater cleanup progress until CULs are met. Groundwater samples will be analyzed for COCs and natural attenuation parameters. Initially, groundwater confirmational sampling will be conducted on a quarterly basis. The conformational monitoring plan (i.e., network, sampling matrices, frequency, and analytes) will be determined in the later stages of the remediation using current knowledge of Site monitoring infrastructure and residual impacts.

In addition to the confirmational groundwater sampling, confirmational soil sampling will be performed off-property to the northeast following treatment to confirm that soil conditions have attenuated in that area.

6.1.3 Permitting

Due to the concentrations of TPH in the Site soil gas, it may be necessary to secure a Notice of Construction (NOC) permit from Ecology's Central regional offices to discharge the soil gas to the atmosphere. The total yearly discharge limit for total petroleum hydrocarbons is 1,500 pounds per year (lbs/yr). The concentrations of effluent gasses will be monitored to ensure compliance with the permit conditions. Control technology will be required to be maintained during the operation of the bioventing system until it can be determined that concentrations are less than the discharge limits. Permits will be obtained for biovent wells.

6.2 Site Preparation

Prior to mobilization, a survey will be conducted to establish the property line to the east, establish the corners of the asphalt cap for incorporation into the revised EC, and provide a topographic surface elevation of the cap for the as-built drawings.

Site preparations may include the installation of erosion control features. Erosion control consisting of silt fencing will be erected down-slope from any trench locations prior to any groundbreaking work. Catch

basin filters will be inserted into catch basins and surrounding curb drains on the adjacent City streets to prevent the mobilization of sediment to the stormwater system.

6.3 System Installation

The application of a slight vacuum in bioventing wells will accommodate the steady replenishment of atmospheric oxygen to the vadose zone. Sufficient oxygen will be continually pulled into the vadose zone by the removal of subsurface air from each of the remedial bioventing wells.

This approach assumes that approximately eight bioventing wells would be installed to below the top of the cap and screened within the residual petroleum mass to adequately allow for sufficient oxygen exchanges throughout the impacted vadose zone. Bioventing wells will be screened throughout zones of known petroleum impacts and into the shallow perched water table. The introduction of atmospheric oxygen at the groundwater surface interface will allow for the direct dissolution of oxygen into the groundwater. Additionally, the bioventing system will be arranged such that the operation of the vacuum bioventing can be changed to active pressurized bioventing as necessary for the purposes of system optimization.

Pressure testing conducted during the pilot study suggest that a radius of 30 feet would likely facilitate the turnover of sufficient oxygen if implemented at a low vacuum and recovery rate. Wells will be spaced such that there is adequate vacuum coverage throughout the impacted areas and beneath the asphalt cap. Sufficient conservative overlap of the estimated vacuum coverage will be considered in the design phase to ensure the biological populations can thrive. Actual spacing of bioventing wells and locations for trenching and piping will be prepared in the EDR.

This approach will include the addition of one or more bioventing wells along the subject property line near the northeast portion of the Site to treat the off-property impacts in shallow soils. The number, location, and depths of these wells will ultimately be determined during preparation of the EDR. Figure 3 depicts the currently proposed locations for bioventing wells.

The bioventing system will consist of a small remedial equipment container with a vacuum blower, moisture separating knockout tank, flow and vacuum meters, and vacuum control valving features. In addition, sufficient effluent vapor control equipment may be necessary to meet local discharge requirements and control nuisance odors, as appropriate. The bioventing system will be equipped with automated alarms and integrated control interlocks to safeguard the system, and public and Site personnel from damage or injury.

Repairs to the asphalt cap will be conducted once the wells and piping have been installed. Cap repairs will include backfilling and compaction of soils in locations where trenching has occurred and replacing any removed asphalt. The complete and adequate repairs to the cap will ensure that short-circuiting of atmospheric air will not occur during operation of the bioventing system. Additionally, the cap repairs will be conducted to promote adequate drainage of rainwater and snow melt and prevent infiltration into the subsurface.

6.4 System Operation and Monitoring

Regular O&M will be required to optimize the oxygen supply rates and facilitate biological growth through the operation of the bioventing system. Monitoring the physical parameters of the operating equipment will be required to maintain the longevity of the equipment. O&M will be performed according to a routine schedule that will be established in the O&M Manual that will be prepared following the completion of as-built drawings and the attainment of all cut sheets and testing/commissioning reports from equipment vendors and contractors. Once bioventing has met the design objectives (i.e., CULs in groundwater), active remediation will be discontinued.

6.5 Environmental Covenant

An EC was recorded on March 11, 2013 with the Chelan County records office. The 2013 EC will be updated to include any changes to the institutional controls applied to those portions of the subject property that exceed the CULs in soil and groundwater as a result of the remedial activities. The surveyed coordinates of the asphalt cap have been recorded in the current EC to establish areas that are restricted for future modifications without Ecology approval. Updates will be made to the EC to the restricted areas to reflect the limits of the asphalt cap and anywhere groundwater is impacted at concentrations exceeding a CUL. Restrictions will be applied to the asphalt cap that will require routine inspections and maintenance to keep the cap in good working order, and to maintain its ability to cover and limit infiltration in areas of remaining soil impacts. Additional restrictions will be applied to prohibit the removal or use of impacted groundwater.

6.6 Schedule

Bioventing is expected to be implemented for up to 7 years and will cease when groundwater CULs are met. Monitoring of groundwater will be conducted for approximately 2 years following cessation of active bioventing to demonstrate attainment of CULs.

ECs and institutional controls established for the Site will remain in place until a no further action (NFA) determination is provided by Ecology.

7.0 REFERENCES

GeoEngineers. 1997. *Remedial Investigation/Feasibility Study Report*, Glacier Park East Site, Leavenworth, Washington. Prepared for Burlington Northern Railroad and the TCLP Group. 27 February.

TRC Environmental Corporation (TRC). 2022. *Revised Supplemental Remedial Investigation Report, Glacier Park East Site, Leavenworth, Washington.* Prepared for BNSF Railway Company and Chevron USA, Inc. 25 July.

TRC Environmental Corporation (TRC). 2023. *Revised Supplemental Feasibility Study Report, Glacier Park East Site, Leavenworth, Washington.* Prepared for BNSF Railway Company and Chevron USA, Inc. 6 April.

Washington State Department of Ecology (Ecology). 2005. *Guidance on Remediation of Petroleum-Contaminated Ground Water by Natural Attenuation*. July.

Washington State Department of Ecology (Ecology). 2023. *Ecology Comments on Supplemental Feasibility Study Report for Glacier Park Budget Fuel East*. 30 June.

Tables

Table 1
Summary of Cleanup Levels
Draft Cleanup Action Plan
Glacier Park East Site
Chumstick Highway and U.S. Highway 2, Leavenworth, WA

COC[a]	Soil		Groundwater	
	Applicable CUL[b] (mg/kg)	Regulatory Basis	Applicable CUL[c] (µg/L)	Regulatory Basis
GRO	100 / 30[d]	MTCA Method A	1,000 / 800[d]	MTCA Method A
DRO	2,000	MTCA Method A	500	MTCA Method A
ORO	2,000	MTCA Method A	500	MTCA Method A

Notes:

a Chemicals of concern (COCs) are based on those outlined in the Ecology-approved *Supplemental Remedial Investigation Work Plan* dated October 28, 2020.

b Model Toxics Control Act (MTCA) Method A Soil Cleanup Levels (CULs) from Table 740-1 in Washington Administrative Code (WAC) Chapter 173-340-900.

c MTCA Method A Groundwater CULs from Table 720-1 in WAC Chapter 173-340-900.

d When benzene is also identified as a COC or when the sum of toluene, ethylbenzene, and total xylenes exceeds 1 percent of the GRO concentration.

mg/kg Milligrams per kilogram.

µg/L Micrograms per liter.

Compounds:

GRO Gasoline-range organics

DRO Diesel-range organics

ORO Oil-range organics

Table 2
Remedial Alternatives Summary
Draft Cleanup Action Report
Glacier Park East Site
Chumstick Highway and U.S. Highway 2, Leavenworth, WA

Remedial Alternative	Description
Alternative 1 – Containment, Monitored Natural Attenuation, Removal, and Institutional Controls	Implement institutional controls to maintain a surface cap and place a deed restriction on the impacted property. Requires limited off-property soil excavation. Will require implementation of institutional controls in soil and groundwater and long-term monitoring.
Alternative 2 – Containment, Bioventing, and Institutional Controls	Stimulate biodegradation through the addition of oxygen. Effectiveness limited to oxygen distribution. Will require continued institutional controls in soil and groundwater and long-term monitoring. Assumes 7 years of bioventing operation.
Alternative 3 – Containment, Soil Vapor Extraction (SVE), and Institutional Controls	Apply SVE technology to degrade soil impacts beneath the cap that may contribute to dissolved phase impacts in groundwater. Effectiveness limited to SVE radius of influence. Will require implementation of institutional controls in soil and groundwater and long-term monitoring. Assumes 3 years of SVE operation.
Alternative 4 – Containment, Surface Water Diversion, Removal, and Institutional Controls	Install a French Drain around the periphery of the soil isolation cap to divert surface water. Requires limited off-property soil excavation. Will require implementation of institutional controls in soil and groundwater and long-term monitoring.

Table 3
Evaluation of Cleanup Action Alternatives
Draft Cleanup Action Plan
Glacier Park East Site
Chumstick Highway and U.S. Highway 2, Leavenworth, WA

	Alternative 1		Alternative 2		Alternative 3		Alternative 4	
Criteria	**Containment, Monitored Natural Attenuation, Removal, and Institutional Controls**	***Score*** [a]	**Containment, Bioventing, and Institutional Controls**	***Score*** [a]	**Containment, Soil Vapor Extraction (SVE), and Institutional Controls**	***Score*** [a]	**Containment, Surface Water Diversion, Removal, and Institutional Controls**	***Score*** [a]
Protectiveness	Overall protectiveness of human health and the environment, including the degree to which existing risks are reduced, time required to reduce risk at the facility and attain cleanup standards, on-site and off-site risks resulting from implementing the alternative, and improvement of the overall environmental quality.							
Overall Protectiveness	*Protective if maintained*	*1*	*Protective when complete*	*3*	*Protective when complete*	*4*	*Protective if maintained*	*2*
Reduces Existing Risks	*Reduces risks when implemented*	*1*	*Reduces risks when implemented*	*4*	*Reduces risks when implemented*	*4*	*Reduces risks when implemented*	*3*
Time Required to Reduce Risk	*Longer duration to reduce risks*	*1*	*Shorter duration to reduce risks*	*3*	*Shortest duration to reduce risks*	*4*	*Longer duration to reduce risks*	*2*
On-Site Risks	*Reduces risks with lower level of certainty*	*1*	*Reduces risks with high level of certainty*	*4*	*Reduces risks with high level of certainty*	*4*	*Reduces risks with moderate to low level of certainty*	*3*
Off-Site Risks	*Reduces risks with lower level of certainty*	*1*	*Reduces risks with moderate level of certainty*	*3*	*Reduces risks with high level of certainty and eliminates vapor intrusion potential*	*4*	*Reduces risks with moderate to high level of certainty*	*1*
Improvement in Environmental Quality	*No immediate change in environmental quality*	*1*	*Moderate level of improvement*	*3*	*High level of improvement*	*4*	*Low level of improvement*	*2*
Criterion Score		***1.0***		***3.3***		***4.0***		***2.2***
Permanence	The degree to which the alternative permanently reduces the toxicity, mobility or volume of hazardous substances, including the adequacy of the alternative in destroying the hazardous substances, the reduction or elimination of hazardous substance releases and sources of releases, the degree of irreversibility of waste treatment process, and the characteristics and improvement of the overall environmental quality.							
Reduces Toxicity, Mobility, and Volume	*Reduces toxicity, mobility, and volume slowly*	*1*	*Reduces toxicity, mobility, and volume*	*5*	*Reduces toxicity, mobility, and volume rapidly*	*5*	*Reduces toxicity, mobility and volume slowly*	*2*
Degree of Irreversibility	*Low degree of irreversibility*	*1*	*Largely Irreversible*	*4*	*Irreversible*	*5*	*Low degree of irreversibility*	*2*
Waste Characteristics	*No waste stream*	*5*	*Generates no air waste stream*	*4*	*Generates air waste stream*	*2*	*No waste stream*	*5*
Criterion Score		***2.3***		***4.3***		***4.0***		***3.0***
Long-Term Effectiveness	Long-term effectiveness includes the degree of certainty that the alternative will be successful, the reliability of the alternative during the period of time hazardous substances are expected to remain on site at concentrations that exceed cleanup levels, the magnitude of residual risk with the alternative in place, and the effectiveness of controls required to manage treatment residues or remaining wastes. The following types of cleanup action components may be used as a guide, in descending order, when assessing the relative degree of long-term effectiveness: Reuse or recycling; destruction or detoxification; immobilization or solidification; on-site or off-site disposal in an engineered, lined and monitored facility; on-site isolation or containment with attendant engineering controls; and institutional controls and monitoring.							
Degree of Certainty	*Relatively uncertain*	*1*	*Moderately to highly certain*	*4*	*Highly certain*	*5*	*Somewhat certain*	*2*
Reliability	*Moderately reliable*	*1*	*Moderately to highly reliable*	*4*	*Moderately to highly reliable*	*4*	*Somewhat reliable*	*2*
Residual Risk	*High*	*1*	*Moderate to low risk*	*4*	*Moderate, includes waste*	*3*	*High*	*1*
Technology Hierarchy	*Low*	*1*	*Moderate*	*4*	*Moderate to high*	*4*	*Low to Moderate*	*2*
Criterion Score		***1.0***		***4.0***		***4.0***		***1.8***
Short-Term Risk Management	The risk to human health and the environment associated with the alternative during construction and implementation, and the effectiveness of measures that will be taken to manage such risks.							
During Construction and Implementation	*Low risks*	*5*	*Fewer risks*	*4*	*Moderate to low risks*	*3*	*Moderate risks associated with trenching*	*3*
Effectiveness of Risk Management	*Very Effective*	*5*	*Moderately effective*	*3*	*Moderately effective*	*3*	*Moderately effective*	*2*
Criterion Score		***5.0***		***3.5***		***3.0***		***2.5***

Table 3
Evaluation of Cleanup Action Alternatives
Draft Cleanup Action Plan
Glacier Park East Site
Chumstick Highway and U.S. Highway 2, Leavenworth, WA

	Alternative 1		Alternative 2		Alternative 3		Alternative 4	
Criteria	**Containment, Monitored Natural Attenuation, Removal, and Institutional Controls**	***Score*** [a]	**Containment, Bioventing, and Institutional Controls**	***Score*** [a]	**Containment, Soil Vapor Extraction (SVE), and Institutional Controls**	***Score*** [a]	**Containment, Surface Water Diversion, Removal, and Institutional Controls**	***Score*** [a]
Implementability	Ability to be implemented including consideration of whether the alternative is technically possible, availability of necessary off-site facilities, services and materials, administrative and regulatory requirements, scheduling, size, complexity, monitoring requirements, access for construction operations and monitoring, and integration with existing facility operations and other current or potential remedial actions.							
Technically Possible	*Possible if property owner agrees to environmental covenant.*	*5*	*Possible, based on pilot testing and subsurface data.*	*4*	*Possible, based on pilot testing and subsurface data*	*4*	*Possible, but with some uncertainty associated with infiltration routes*	*2*
Access	*No issues related to access for implementing deed restrictions*	*5*	*No issues related to access*	*4*	*No issues related to access*	*4*	*Access off of capped area will be more challenging*	*3*
Availability of Necessary Resources	*Readily available*	*5*	*Available, possible delays with subcontractor*	*4*	*Available, possible delays with subcontractor*	*4*	*Readily Available*	*5*
Scheduling, Size, and Complexity	*Very low complexity; environmental covenant can be prepared within 2 to 4 weeks.*	*5*	*Moderate complexity and size; bioventing installation and startup can be completed within 6 to 8 weeks*	*4*	*Moderate complexity and size; AS/SVE installation and startup can be completed within 8 to 10 weeks*	*3*	*Moderate complexity and size; installation of French drain can be completed in ~4 weeks.*	*3*
Monitoring Requirements	*Moderate to low*	*4*	*Moderate*	*3*	*Higher*	*2*	*Moderate to low*	*4*
Integration with Existing Features	*High*	*5*	*Moderate*	*4*	*Moderate*	*4*	*Moderate*	*4*
Criterion Score		***4.8***		***3.8***		***3.5***		***3.5***
Public Concerns	Whether the community has concerns regarding the alternative and, if so, the extent to which the alternative addresses those concerns. This process includes concerns from individuals, community groups, local governments, tribes, federal and state agencies, or any other organization that may have an interest in or knowledge of the Site.							
Concerns	*Potential concerns regarding impacts remaining in soil and groundwater.*	***2.0***	*Potential concerns regarding equipment and noise, soil removal in close proximity to buried utilities and highway. Potential concerns regarding impacts remaining in groundwater and potentially necessary modification of the remedy if future development is desired. Possible if all property owner agree to environmental covenant. Cap is already in place, but will need to be maintained.*	***3.0***	*Potential concerns regarding equipment and noise, fugitive vapors. Potential concerns regarding impacts remaining in groundwater and potentially necessary modification of the remedy if future development is desired. Possible if all property owner agree to environmental covenant. Cap is already in place, but will need to be maintained.*	***3.0***	*Potential concerns regarding impacts remaining in soil and groundwater and potentially necessary modification of the remedy if future development is desired. Possible if all property owner agree to environmental covenant. Cap is already in place, but will need to be maintained.*	***1.0***
Restoration Time Frame	Determination of whether a cleanup action provides for a reasonable restoration time frame based on criteria in WAC 173-340-360(4)(b).							
Time Frame	*Longest time frame*	***1.0***	*Moderate time frame (7 ± years)*	***4.0***	*Moderate time frame (3 - 5 years)*	***4.0***	*Longer time frame (10+ years)*	***2.0***
TOTAL SCORE	***17.2***		***26.0***		***25.5***		***15.9***	
Conceptual Level Cost	**$556,943**		**$648,000**		**$793,000**		**$692,000**	

Note:
a Each sub-criterion is scored from 5 (best) to 1 (worst) based on the perceived benefit; the total criterion score is the average of the associated sub-criterion scores.

Table 4
Applicable or Relevant and Appropriate Requirements for the Cleanup Action
Draft Cleanup Action Plan
Glacier Park East Site
Chumstick Highway and U.S. Highway 2, Leavenworth, WA

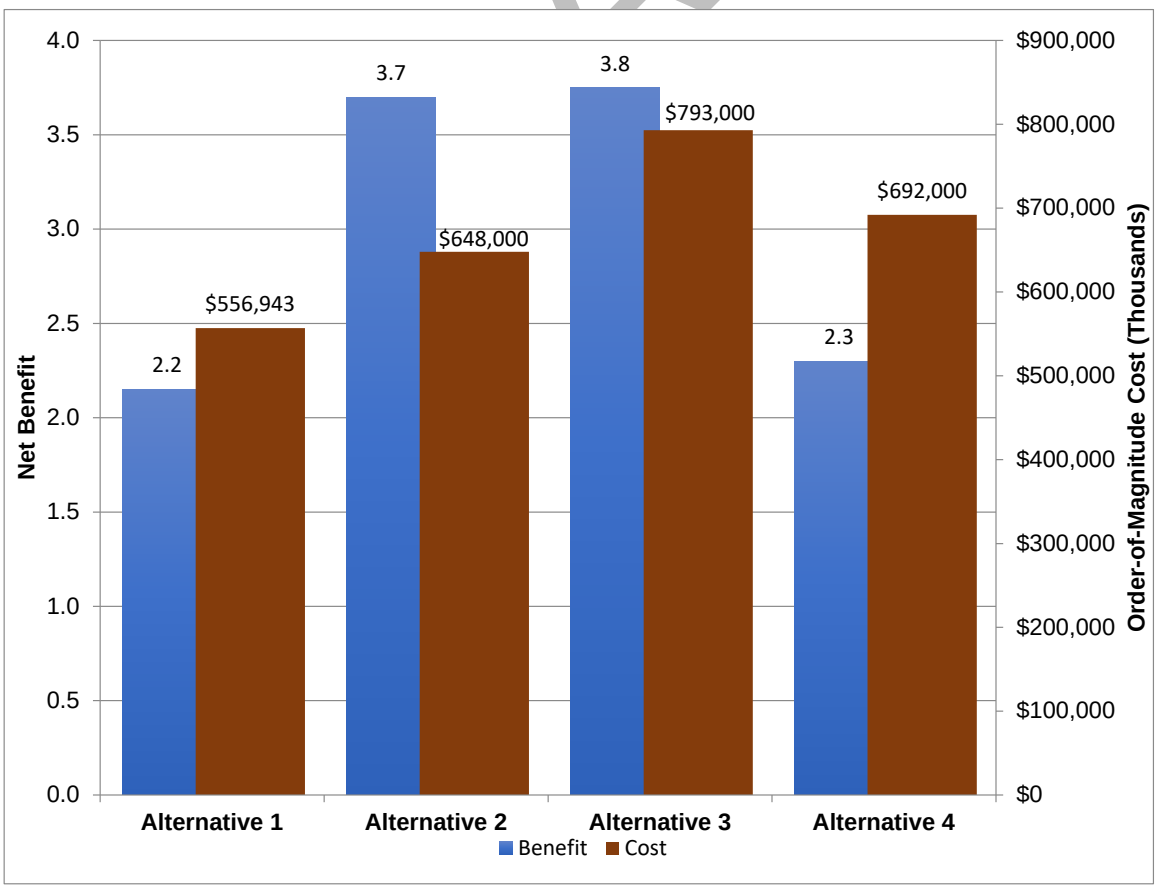
Jurisdiction	Summary of ARARs		Applicability of ARARs
State of Washington Regulations	Ch. 173-160 WAC	Minimum standards for construction and maintenance of wells	Applies to the construction of new wells on Site and ongoing use of existing wells.
	Ch. 173-162 WAC	Regulation and licensing of well contractors and operators	Applies to the installation and decommissioning of wells.
	Ch. 173-303 WAC	Dangerous waste regulations	May apply to waste generated during the project.
	Ch. 173-304 WAC	Minimum functional standards for solid waste handling	Applies to solid wastes generated during the remedial action.
	Ch. 173-340 WAC	Model Toxics Control Act-Cleanup	Applies to all on-Site work.
	Ch. 173-350 WAC	Solid waste handling standards	Applies to solid wastes generated during the remedial action.
	Ch. 173-400 WAC	General Regulations for Air Pollution Sources	Applies to air emissions during remedial action.
	Ch. 197-11 WAC	SEPA rules	Applies to all on-Site work.
	Ch. 18.104 RCW	Water well construction	Applies to the construction of new wells on-Site.
	Ch. 64.70 RCW	Uniform Environmental Covenants Act	Applies to institutional controls.
	Ch. 70.105D RCW	Hazardous Waste Cleanup - Model Toxics Control Act	Applies to all on-Site work.
Federal Regulations	29 CFR 1910	Occupational Safety and Health Standards	Applies to all on-Site work.
	42 USC 7401	Clean Air Act	Applies to all on-Site work.
	40 CFR 50	National Ambient Air Quality Standards	Applies to all on-Site work.
	40 CFR 260-268	Hazardous Waste Regulations	Applies to all on-Site work that generates hazardous waste.

Notes:

ARAR	Applicable or relevant and appropriate requirement.
CFR	Code of Federal Regulations.
MTCA	Model Toxics Control Act.
RCW	Revised Code of Washington.
SEPA	State Environmental Policy Act.
USC	United States Code.
WAC	Washington Administrative Code.

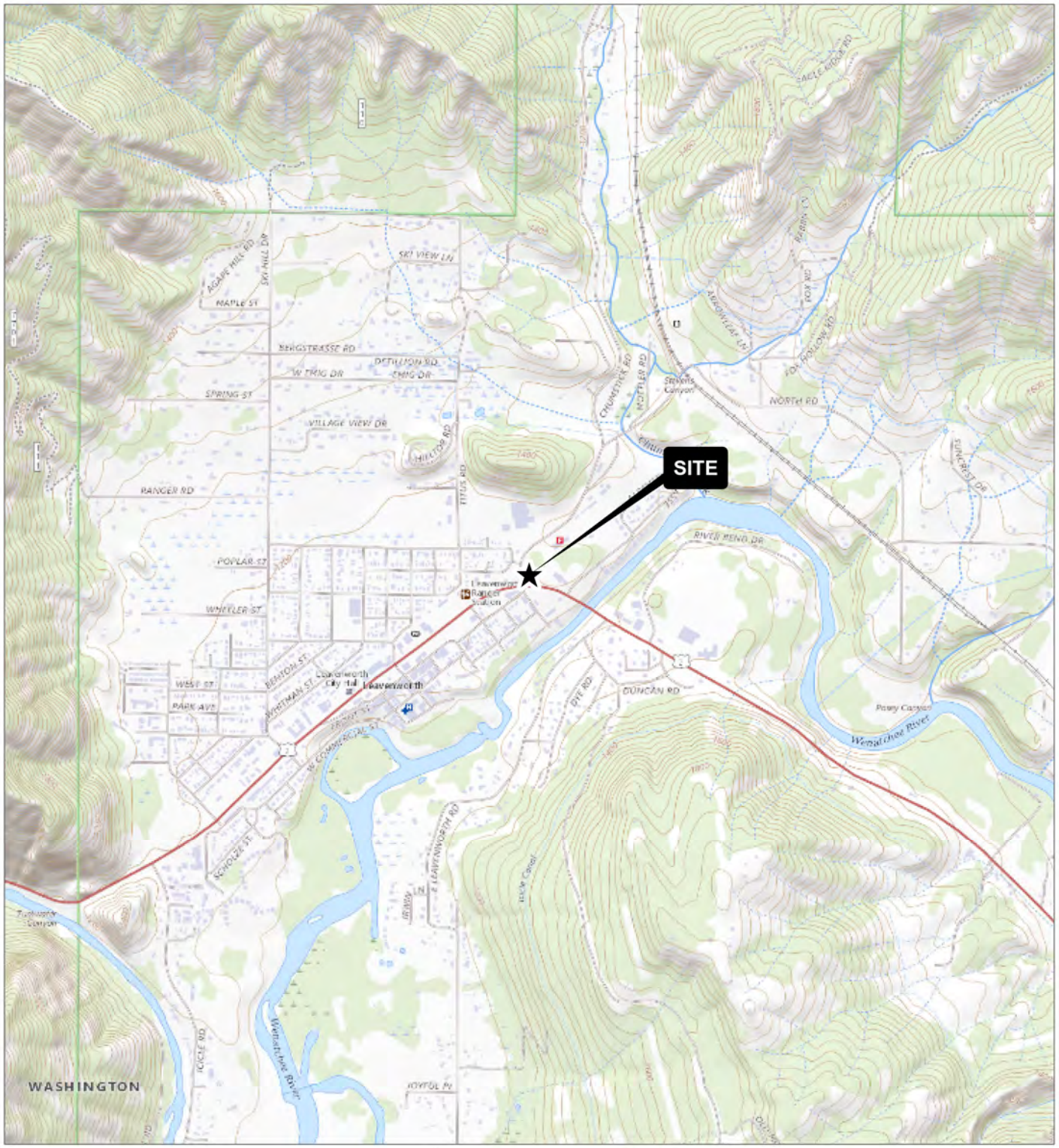
Table 5
Benefit/Cost Analysis
Draft Cleanup Action Plan
Glacier Park East Site
Chumstick Highway and U.S. Highway 2, Leavenworth, WA

Factor	Alternative 1		Alternative 2		Alternative 3		Alternative 4	
	Rank	Value	Rank	Value	Rank	Value	Rank	Value
Protectiveness (0.3)	1.0	0.30	3.3	1.00	4.0	1.20	2.2	0.65
Permanence (0.2)	2.3	0.47	4.3	0.87	4.0	0.80	3.0	0.60
Long-Term Effectiveness (0.2)	1.0	0.20	4.0	0.80	4.0	0.80	1.8	0.35
Short-Term Risk (0.1)	5.0	0.50	3.5	0.35	3.0	0.30	2.5	0.25
Implementability (0.1)	4.8	0.48	3.8	0.38	3.5	0.35	3.5	0.35
Public Concerns (0.1)	2.0	0.20	3.0	0.30	3.0	0.30	1.0	0.1
Benefit Value	**2.2**		**3.7**		**3.8**		**2.3**	



Figures

DRAFT



0 1,000 2,000
FEET
1:24,000 1" = 2,000'

BASE MAP: USGS COLOR ORTHO IMAGERY
DATA SOURCES: TRC

PROJECT:
GLACIER PARK EAST SITE
CHUMSTICK HIGHWAY AND U.S. HIGHWAY 2
LEAVENWORTH, WASHINGTON

TITLE:
GENERAL VICINITY MAP
DRAFT CLEANUP ACTION PLAN

DRAWN BY:	S. RAY	PROJ. NO.:	551929.0000.0000
CHECKED BY:	R. CLAIR		
APPROVED BY:	R. CLAIR		**FIGURE 1**
DATE:	JULY 2023		

TRC
1180 NW MAPLE STREET, SUITE 310
ISSAQUAH, WA 98027
PHONE: 425.395.0010

FILE: CLEANUP ACTION PLAN

DRAFT

- CATCH BASIN
- GROUNDWATER-BEARING ZONE MONITORING WELL
- SOIL BORING
- SHALLOW TRANSIENT WATER PIEZOMETER
- INDICATES SAMPLE WHERE ONE OR MORE CONSTITUENT CONCENTRATIONS EXCEED THE DLS, BUT LESS THAN THE CULS
- INDICATES SAMPLE HAS NO CONSTITUENT CONCENTRATIONS EXCEEDING THE CULS OR DLS
- INDICATES SAMPLE WHERE ONE OR MORE CONSTITUENT CONCENTRATIONS EXCEED CULS
- APPROXIMATE SITE BOUNDARY (INCLUDES IMPACT OF COCS EXCEEDING THEIR CULS)
- EXISTING ASPHALT CAP
- APPROXIMATE SUBJECT PROPERTY BOUNDARY

NOTES:
AST = ABOVEGROUND STORAGE TANK.
COCs = CHEMICALS OF CONCERN.
CUL = CLEANUP LEVEL.
DL = LABORATORY DETECTION LIMIT.
PROPERTY BOUNDARY EXTENDS FARTHER TO THE NORTHEAST.
WELLS AND PIEZOMETERS SURVEYED IN JUNE 2021 BY ERIANDSEN & ASSOCIATES, EAST WENATCHEE, WASHINGTON.

BASE MAP: GOOGLE EARTH AND THEIR DATA PARTNERS (2020).
DATA SOURCES: TRC, KENNEDY/JENKS CONSULTANTS (2013), GEO ENGINEERS (2002).

N

1:360
1" = 30'
0 30 60 FEET

PROJECT:
GLACIER PARK EAST SITE
CHUMSTICK HIGHWAY AND U.S. HIGHWAY 2
LEAVENWORTH, WASHINGTON

TITLE:
SITE REPRESENTATION
DRAFT CLEANUP ACTION PLAN

DRAWN BY:	S. RAY	PROJ. NO.:	551929.0000.0000
CHECKED BY:	R. CLAIR		
APPROVED BY:	R. CLAIR		**FIGURE 2**
DATE:	JULY 2023		

TRC
1180 NW MAPLE STREET, SUITE 310
ISSAQUAH, WA 98027
PHONE: 425.395.0010

FILE: Cleanup Action Plan.aprx

Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet; Map Rotation: 0
Saved By: SRAY on 7/26/2023, 7:56:00 PM; File Path: T:\GIS\551929_GPE_CAP\2-APRX\Cleanup Action Plan.aprx; Layout Name: Fig 2 - Site Representation

DRAFT

- CATCH BASIN
- GROUNDWATER-BEARING ZONE MONITORING WELL
- SOIL BORING
- SHALLOW TRANSIENT WATER PIEZOMETER
- INDICATES SAMPLE WHERE ONE OR MORE CONSTITUENT CONCENTRATIONS EXCEED THE DLS, BUT LESS THAN THE CULS
- INDICATES SAMPLE HAS NO CONSTITUENT CONCENTRATIONS EXCEEDING THE CULS OR DLS
- INDICATES SAMPLE WHERE ONE OR MORE CONSTITUENT CONCENTRATIONS EXCEED CULS
- PROPOSED BIOVENTING WELL
- APPROXIMATE PIPING RUN
- APPROXIMATE SITE BOUNDARY (INCLUDES IMPACT OF COCS EXCEEDING THEIR CULS)
- EXISTING ASPHALT CAP
- APPROXIMATE SUBJECT PROPERTY BOUNDARY
- EQUIPMENT COMPOUND

NOTES:
AST = ABOVEGROUND STORAGE TANK.
COCs = CHEMICALS OF CONCERN.
CUL = CLEANUP LEVEL.
DL = LABORATORY DETECTION LIMIT.
PROPERTY BOUNDARY EXTENDS FARTHER TO THE NORTHEAST.
WELLS AND PIEZOMETERS SURVEYED IN JUNE 2021 BY ERIANDSEN & ASSOCIATES, EAST WENATCHEE, WASHINGTON.

BASE MAP: GOOGLE EARTH AND THEIR DATA PARTNERS (2020).
DATA SOURCES: TRC, KENNEDY/JENKS CONSULTANTS (2013), GEO ENGINEERS (2002).

1:360
1" = 30'
0 30 60 FEET

PROJECT:
GLACIER PARK EAST SITE
CHUMSTICK HIGHWAY AND U.S. HIGHWAY 2
LEAVENWORTH, WASHINGTON

TITLE:
PROPOSED BIOVENTING WELLS
DRAFT CLEANUP ACTION PLAN

DRAWN BY:	S. RAY / R. COLLINS	PROJ. NO.:	551929.0000.0000
CHECKED BY:	R. CLAIR		**FIGURE 3**
APPROVED BY:	R. CLAIR		
DATE:	AUGUST 2023		

TRC
1180 NW MAPLE STREET, SUITE 310
ISSAQUAH, WA 98027
PHONE: 425.395.0010

FILE: Cleanup Action Plan.aprx

Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet; Map Rotation: 0
Saved By: RCOLLINS on 8/25/2023, 9:35:32 AM; File Path: T:\PROJECTS\SEA\551929.0.CPE_CAP\2-APRX\Cleanup Action Plan.aprx; Layout Name: Fig 3 - Proposed Bioventing Wells

DRAFT

Primary Sources	Chemicals of Potential Concern	Media of Concern	Transport Mechanisms
On-Site sources of Chemicals of Concern - Former ASTs and Fuel Transloading Operations	Gasoline-Range Organics (GRO), Diesel-Range Organics (DRO), Oil-Range Organics (ORO), Benzene, Toluene, Ethylbenzene, and Total Xylenes (BTEX), and Naphthalenes	☐ Surface Soil (0–2 feet bgs)	☐ Direct release to soil ☐ Migration to subsurface soil ☐ Migration to groundwater ☐ Volatilization ☐ Runoff or erosion ☐ Uptake by plant or animal ☐ Other (list) _____
		☒ Soil (> 2 feet bgs)	☒ Direct release to soil ☒ Migration to groundwater ☒ Volatilization ☐ Other (list) _____
		☒ Groundwater	☒ Release to groundwater ☒ Volatilization ☐ Future migration to surface water ☐ Future migration to sediment ☐ Uptake by plant or animal ☐ Other (list) _____
	☒ Adsorbed onto soil ☒ Dissolved in water ☐ Non-aqueous phase	☐ Surface Water	☐ Release to surface water ☐ Volatilization ☐ Sedimentation ☐ Uptake by plant or animal ☐ Other (list) _____
		☐ Sediment	☐ Release to surface water ☐ Resuspension or erosion ☐ Uptake by plant or animal ☐ Other (list) _____

Exposure Media	Exposure Pathway	Current (C) and Potential Future (F) Receptors: Commercial Industrial	Construction Worker	Residential/ Recreational	TEE Receptors
☒ Soil	☒ Ingestion		F		
	☒ Dermal Exposure		F		
☒ Groundwater	☒ Ingestion		F		
	☒ Dermal Exposure		F		
☒ Air	☒ Inhalation		F		
☐ Surface Water	☐ Ingestion				
	☐ Dermal Contact				
☐ Sediment	☐ Ingestion				
	☐ Dermal Contact				
☐ Indoor Air	☐ Inhalation				

NOTES:
bgs = Below ground surface.
ASTs = Aboveground storage tanks.

PROJECT:
GLACIER PARK EAST SITE
CHUMSTICK HIGHWAY AND U.S. HIGHWAY 2
LEAVENWORTH, WASHINGTON

TITLE:
CONCEPTUAL SITE MODEL
DRAFT CLEANUP ACTION PLAN

DRAWN BY:	S. RAY / R. COLLINS	PROJ. NO.:	551929.0000.0000
CHECKED BY:	R. CLAIR		
APPROVED BY:	R. CLAIR		**FIGURE 4**
DATE:	SEPTEMBER 2023		

TRC
1180 NW MAPLE STREET, SUITE 310
ISSAQUAH, WA 98027
PHONE: 425.395.0010

FILE: Cleanup Action Plan.aprx