Feasibility Study
Coleman Oil Yakima Bulk Fuel

Site Name:	Coleman Oil Yakima Bulk Fuel
Site Address:	1 East I Street, Yakima 98901
Agreed Order:	DE 15639
ERTS ID Nos.:	663825, 670092
Ecology Site Cleanup ID:	13200
Facility/Site ID:	4233

Prepared for:
Mr. Jim Cach
Coleman Oil Company
335 Mill Road
Lewiston, Idaho 83501

PBS Project No. 41392.000

October 6, 2023

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October 4, 2023

John Mefford
Toxics Cleanup Program Site Manager
WA State Department of Ecology – Central Regional Office
1250 W Alder Street
Union Gap, WA 98903

RE: Coleman Oil Yakima Bulk Fuel
Agreed Order: DE 15639
Ecology Site Cleanup ID: 13200
Facility/Site ID: 4233

Dear Mr. Mefford,

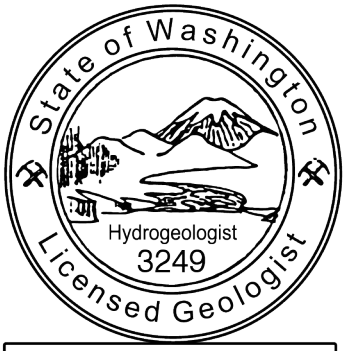
PBS has previously completed Remedial Investigation (RI) and Interim Actions (IA) activities, in general accordance with the Work Plans developed under the Agreed Order, at the property located at 1 East I Street in Yakima, Washington. The RI report, dated June 30, 2023, was submitted to Ecology and was accepted as satisfactory on July 7, 2023.

This Feasibility Study (FS) was prepared in general accordance with WAC 173-340-350(8) and presented in general accordance with the FS Checklist Guidance (Publication No. 16-09-007). It is understood that once the FS is accepted as satisfactory a Draft Cleanup Action Plan will be prepared in general accordance with WAC 173-340-380.

Sincerely,
PBS Engineering and Environmental Inc.

Digitally signed by James Welles
Date: 2023.10.06 14:14:18 -07'00'

James Welles, LHG
Senior Hydrogeologist



cc. Jim Cach, Coleman Oil Company
Tom Mergy, PBS Principal Hydrogeologist

1 INTRODUCTION

PBS Engineering and Environmental (PBS) prepared this Feasibility Study (FS) report, on behalf of the Coleman Oil Company (Coleman Oil), regarding the property located at 1 East I Street in Yakima, Washington. The FS was conducted in accordance with the Washington State Model Toxics Control Act (MTCA) Chapter 173-340-350(8) under Washington Administrative Code (WAC).

1.1 Agreed Order

Coleman Oil entered an Agreed Order (No. DE 15639) with other potentially liable parties (PLPs) and Ecology. The effective date of the Agreed Order is March 29, 2018. The PLPs are currently:

- Coleman Oil Company, LLC (Coleman Oil)
- BNSF Railway Company (BNSF)
- Carol Jean Wondrack
- Wondrack Distributing, Inc.
- Chevron Environmental Management Company (Chevron)

The Agreed Order requires the PLPs to complete a Remedial Investigation (RI), FS, and to prepare Draft Cleanup Action Plan (DCAP) for the site.

1.2 General Site Information

The approximate 1.0-acre property comprises one parcel (181313-14070) in Yakima, Washington at the northeast corner of the intersection of East I Street and the BNSF Railroad (see Vicinity Map - Figure 1). The site is currently developed as a bulk fuel storage and distribution facility.

Site Name:	Coleman Oil Yakima Bulk Fuel Plant
Site Location:	1 East I Street Yakima, Washington 98901 Northeast Quarter of Section 13, Township 13 North, Range 18 East of the Willamette Base and Meridian
Ecology Site Cleanup ID:	13200
Ecology Facility/Site ID:	4233
Agreed Order Number:	DE15639
Site Description:	The site is currently developed as a bulk fuel plant. The site is generally flat.
Current Operator:	Coleman Oil Company 335 Mill Road Lewiston, Idaho 83501
Current Owner:	Carol Jean Wondrack
Previous Owners / Operators:	Chevron U.S.A. / Wondrack Distributing, Inc
Project Consultant Contact Information:	PBS Engineering and Environmental Thomas Mergy, LHG

	214 East Galer Street, Suite 300 Seattle, WA 98102 Office Phone – 206.233.9639 Email – tom.mergy@pbsusa.com
Ecology Site Manager:	John Mefford Toxics Cleanup Program Department of Ecology Central Regional Office 1250 W Alder Street Union Gap, Washington 98903 Phone – 509.731.9613 Email – john.mefford@ecy.wa.gov

1.3 Site Use

The property is currently developed as a petroleum storage, distribution and active fueling facility. Site features include four active ASTs, associated fuel transfer components, a secondary containment structure, an out-of-use fueling canopy and several structures used as office space and equipment storage. There are currently no proposed plans for change of land use or redevelopment for the site. See Site Plan - Figure 2 for layout of the property.

1.4 Summary of Remedial Investigation

1.4.1 *Site Investigation and Interim Action*

A Remedial Investigation (RI) report dated June 30, 2023 was submitted to Ecology for the Site. The RI detailed subsurface investigation and interim actions completed at the Site since release discovery in 2016 including:

- Advancement of 26 soil borings
- Installation of 16 groundwater monitoring wells
- Installation of one recovery well (RW-1)
- Shallow soil sampling to identify sources of contamination
- Underground storage tank (UST) decommissioning by removal and associated UST site assessment
- Excavation and offsite disposal of petroleum contaminated soil
- Ongoing multiphase extraction (MPE) of non-aqueous phase liquid (NAPL) and contaminated water
- Quarterly groundwater monitoring
- Vapor intrusion evaluation of adjacent structures

1.4.2 *Site Activities since RI*

Since issuance of the RI Report, PBS has continued to perform ongoing MPE events for LNAPL removal and routine groundwater monitoring. Methodology for MPE events and groundwater monitoring are summarized in detail in the RI report.

1.4.3 *Conceptual Site Model Summary*

The Site is impacted by two discrete and apparent releases of diesel and gasoline fuels to the subsurface which were identified in March and December of 2016, respectively. There is evidence of more weathered petroleum in both the gasoline and diesel ranges that indicated prior undefined releases at the Site. The locations of both 2016 releases are well understood and are depicted on Figure 2. The exact volumes of the respective releases are currently unknown.

NAPL remains present at the Site following release discovery and performance of interim actions. Analysis and visual assessment of NAPL samples by the laboratory indicate that the NAPL plume contains three distinguishable compositions.

- A mixture of fresh and weathered gasoline and diesel fuels (FWGD NAPL)
- A mixture of fresh and weathered diesel fuel only (FWD NAPL)
- Weathered diesel fuel only (WD NAPL)

The RI identified the following COCs for the Site.

Soil

- TPH in the gasoline range
- TPH in the diesel range
- TPH in the heavy oil range
- Cadmium
- Lead
- Naphthalene

Groundwater

- TPH as gasoline range organics
- TPH as diesel range organics
- BTEX
- Naphthalene

NAPL along with soil and groundwater contaminated with COCs in exceedance of cleanup levels (CULs) remain at the Site. The nature and extent of soil contamination is presented in Figure 3. Extents of NAPL and diesel contamination in groundwater are presented in Figure 4.

2 CLEANUP STANDARDS

This section presents remedial action objectives (RAOs) and preliminary cleanup standards proposed for the Site. The RAOs and cleanup standards proposed for the site are based on an evaluation of the CSM presented in the RI report and summarized in Section 1.4.3. The pathways presented in the CSM form the basis for establishing the RAOs and CULs for groundwater and soil at the site.

2.1.1 *Preliminary Cleanup Levels*

In accordance with MTCA, cleanup levels were developed to include identified potential exposure pathways for human and environmental receptors based on the current and future planned land use. The property is currently zoned for industrial use, and future zoning is not anticipated to change. The current and near-term use of the property is a commercial fueling station, although future uses are unknown and, as such, the proposed cleanup criteria are protective for unrestricted land use.

The proposed cleanup criteria for soil at the Site are the MTCA Method A Soil Cleanup Levels for Unrestricted Land Uses (MTCA Method A) as defined in WAC 173-340-720, 173-340-740, and 173-340-747.

The proposed cleanup criteria for groundwater at the Site are the MTCA Method A Groundwater Cleanup Levels (MTCA Method A) as defined in WAC 173-340-720,173-340-740, and 173-340-747.

Vapor Intrusion Method B Sub-Slab Soil Gas Screening Levels were used as cleanup criteria for soil vapor, as defined in Ecology's Cleanup Levels and Risk Calculations (CLARC) Vapor Intrusion Method B Table updated January 2023. However, the RI, which is pending public comment, determined the vapor intrusion exposure pathway to be incomplete. As such, cleanup criteria are not presented for soil vapor, and vapor intrusion is not further discussed in the FS.

Preliminary cleanup levels are presented in Table 1.

2.1.2 *Proposed Points of Compliance*

The standard point of compliance for soil is defined as throughout the Site from ground surface to 15 feet bgs.

Groundwater standard points of compliance are for protection of drinking water and would extend vertically from the uppermost level of the saturated zone to the lowest depth potentially impacted by the releases. The Site and surrounding area is industrial in use and groundwater is not currently used for beneficial use, nor is it expected to be used for beneficial use in the future. Standard points of compliance for groundwater are tentatively proposed at this time. Conditional points of compliance (CPOCs) may be proposed at a future date if it is not practicable to meet the cleanup level throughout the site based on the criteria established in WAC 173-340-720(8)(c).

2.1.3 *Remedial Action Objectives*

The primary remedial action objective is to meet cleanup and screening levels that are protective of human health and the environment, at the points of compliance.

Achievement of remedial action objectives will serve as a basis for the evaluation of the alternatives and the selection of the preferred cleanup alternative presented in this FS.

2.1.4 *Applicable or Relevant and Appropriate Requirements*

MTCA requires that cleanup actions comply with all legally applicable state and federal laws and regulations, and those requirements identified and determined to be relevant and appropriate (hereafter "ARARs") for the site. This section discusses potential ARARs being considered for the selection of cleanup action alternatives.

"Applicable" requirements under MTCA are those cleanup standards, standards of control, and other human health and environmental protection requirements, criteria, or limitations adopted under state or federal law that specifically address a hazardous substance, cleanup action, location, or other circumstance at a site (WAC 173-340-710(3)).

"Relevant and appropriate" requirements include those cleanup standards, standards of control, and other human health and environmental requirements, criteria, or limitations established under state or federal law that, while not legally applicable to the hazardous substance, cleanup action, location, or other circumstance at a site, address problems or situations sufficiently similar to those encountered at the site that their use is well suited to the particular site (WAC 173-340-710(4)).

Preliminary cleanup levels are discussed in Section 2.1.1. Table 2 provides a summary of potential ARARs considered for selection of cleanup action alternatives.

3 REMEDIAL ACTION ALTERNATIVES

This section presents potential remedial technologies and develops remedial action alternatives to address NAPL, groundwater, and soil contamination at the Site. The identified alternatives are further evaluated in Section 4 in accordance with MTCA criteria under WAC 173-340-360. The preferred remedial action alternative is described in Section 5.

3.1 Identify Reasonable Number and Type of Alternatives

When appropriate, MTCA allows for an initial screening of remedial technologies such that the number of alternatives carried forward to the evaluation is reduced. MTCA stipulates that the following remedial action alternatives or components may be eliminated from further consideration in a Feasibility Study:

- Alternatives or components that clearly do not meet the minimum requirements established for cleanup actions under WAC 173-340-360, including those alternatives for which costs are clearly disproportionate.
- Alternatives or components which are not technically possible.

For the initial screening process, Table 3 summarizes the potential remedial technologies and components. Retained components were assembled into remedial alternatives for further evaluation against MTCA criteria for cleanup actions. The following four remedial alternatives were developed using the technologies retained in the initial screening:

- Alternative 1 – Multiphase Extraction Enhanced Monitored Natural Attenuation (MPE MNA)
- Alternative 2 – Surfactant Enhanced Bioremediation (SEB)
- Alternative 3 – Surfactant Enhanced Dual Phase Extraction (SEDPE)
- Alternative 4 – Targeted Soil Excavation with Passive Reactive Barrier (PRB) and MPE

These alternatives are described in the following sections. Feasibility-level cost estimates, assumed to be accurate to +50%/-30% of the actual costs in 2023 dollars, for each alternative were developed in accordance with U.S. Environmental Protection Agency (EPA) cost estimating guidance (EPA 2000).

3.1.1 *Alternative 1 – Multiphase Extraction Enhanced Monitored Natural Attenuation (MPE MNA)*

Alternative 1 includes periodic performance of multiphase extraction (MPE) events and groundwater monitoring. MPE events performed monthly would be utilized to remove contaminant mass via non-aqueous phase liquid (NAPL) and contaminated groundwater from the subsurface as well as control the migration of contaminants form the Site. Groundwater monitoring would be used to track the attenuation of NAPL and contaminant concentrations in groundwater due to MPE and natural degradation of dissolved phase-contaminants.

MPE events would be performed monthly and include gauging of depth to water (DTW) and depth to product (DTP) in each of the on-site monitoring wells, and removal of approximately 500 gallons of combined NAPL and contaminated groundwater. MPE events would be performed on existing monitoring wells, existing recovery well RW-1, and a newly installed recovery well across I Street in the vicinity of MW-12. MW-12 is the location where the greatest thickness of NAPL has been observed most recently at the Site. Monitoring and recovery wells selected for MPE will be selected uniquely during each event based on field conditions observed during gauging of wells prior to performance of MPE. The goal would be to perform MPE on the wells observed to have the greatest thickness and/or transmissivity of NAPL at the time of the MPE event.

Groundwater monitoring would be conducted twice per year (semiannually) and include gauging of DTW and DTP and sampling of a select network of monitoring wells representative of the source area as well as upgradient and downgradient contaminant concentrations. Preliminarily, sample collection from the following well network of six wells is proposed for long term groundwater monitoring: MW-7, MW-9, MW-3, MW-12, MW14 and MW-15.

A 4-inch diameter recovery well would be installed downgradient from the Site in the vicinity of a MW-12 where the greatest thickness of NAPL has most recently been observed at the Site. MPE events would be conducted using a vacuum truck monthly as long as they continued to have a meaningful impact on the presence of NAPL in on site wells, quantified by a reduction in NAPL thickness measured during semiannual monitoring events and monthly MPE events. Once no significant reduction in NAPL is observed for three consecutive monthly MPE events, MPE events would be scaled back to being performed on a quarterly basis. MPE events would then be performed quarterly until no significant reduction in NAPL is observed for four consecutive quarterly MPE events, at which point MPE events would cease and groundwater monitoring would continue. Groundwater monitoring performed following cessation of MPE events will be used to track the natural degradation of contaminant concentrations in groundwater. This process is referred to as monitored natural attenuation (MNA).

Following completion of implementation of this alternative, performance monitoring of soil would be performed via drilling investigation. Method B CULs would be calculated using fractionation in accordance with WAC 173-340-740(3) for evaluation of soil compliance. Performance monitoring of soil will be further detailed in the Compliance Monitoring Plan (CMP) to be included in the final Cleanup Action Plan (CAP).

It is expected that the Alternative 1 MPE MNA may take approximately 30 years of operation to reach the CULs. A conceptual layout of Alternative 1 is presented in Figure 5.

The present worth cost to implement Alternative 1, assuming a 2.0% interest rate as per Circular A-94 and an operation and maintenance (O&M) period of 30 years, is approximately $2.6 million (M) (OMB 2023). The total costs include capital costs of $257,000 and total O&M costs of approximately $2.3M (accounting for present worth).

3.1.2 *Alternative 2 – Surfactant Enhanced Bioremediation (SEB)*

Alternative 2 would employ surfactant enhanced bioremediation using a designed injection/recovery treatment system. Surfactant technology has the unique ability to selectively desorb contaminants and make NAPL miscible in the aqueous phase for enhanced mass removal. The surfactants will also desorb contamination from the soil surfaces, or from NAPL layers making them more available for in-situ or ex-situ remediation. The liberated contaminated water is then more biologically available for microbial (bacteria) and associated enzymatic degradation.

Once desorbed by the surfactants, the NAPL will be recovered though a set of extraction wells to remove liquids (water and NAPL). This liquid will be processed through an aboveground oil/water separator to capture the free-phase petroleum, then surfactant and biologic solutions will be added, and the enhanced water is reintroduced through injection wells to create a closed loop system to effectively treat the area. Recovered free-phase petroleum would be removed from the Site for disposal. The injection wells will be placed at intervals to saturate areas of contaminated soil as well as the vadose zone areas above the groundwater table.

Alternative 2 utilizes injection of water enhanced with surfactants and microbial amendments into the vadose zone to treat contaminated soil above the water table and within the smear zone. These contaminants would be treated in-situ by microbial amendments and ex-situ in the above ground system following removal from the subsurface by extraction wells. The use of soil vapor extraction is not proposed in Alternative 2.

A pilot study would be performed to determine spacing and placement of injection and recovery wells to ensure an appropriate zone of influence for the wells. The study would include measurement of physical and chemical parameters of NAPL as well as injected surfactant/enzyme at specified wells in proximity to selected injection and extractions wells. Additionally, an improved understanding of localized groundwater flow conditions within the site would aid in system design. This could be achieved via the use of tracer dye studies, passive flow meters, or other means implemented during the pilot test.

In addition to the on-property treatment system, this alternative includes installation of an additional recovery well(s) downgradient of the property near MW-12. MPE events would be performed on the well(s) as described in Alternative 1, with the exception that the events would be performed quarterly rather than monthly.

Following implementation of this alternative, performance monitoring of soil would be performed via drilling investigation. Method B CULs would be calculated using fractionation in accordance with WAC 173-340-740(3) for evaluation of soil compliance. Performance monitoring of soil will be further detailed in the CMP to be included in the final CAP.

It is expected that the Alternative 2 SEB recirculating system NAPL recovery and supplemental biological treatment may take 5 years of operation to reach the CULs. Achievement of CULs would be evaluated and confirmed by groundwater monitoring performed throughout and following remediation. A conceptual layout of Alternative 2 is presented in Figure 6.

The present worth cost to implement Alternative 2, assuming a 1.3% interest rate as per Circular A-94 and an O&M period of 5 years, is approximately $2.2M (OMB 2023). The total costs include capital costs of $1.2M and total O&M costs of $1.0M (accounting for present worth).

3.1.3 *Alternative 3 – Surfactant Enhanced Dual Phase Extraction (SEDPE)*

Alternative 3 includes implementing Surfactant Enhanced Dual Phase Extraction (SEDPE) using a Dual Phase Extraction system (liquid + vapor), ex situ treatment of groundwater, and reinjection of treated water enhanced with surfactant.

The system will involve the installation of injection wells to introduce the surfactant solution into the groundwater zone, and several dual phase recovery wells to recover NAPL, contaminated groundwater, and volatile organic vapors in soil pore space from the vadose zone. Liquids would be processed through an aboveground oil/water separator to capture the free-phase petroleum, then a surfactant solution will be added, and the water would be reintroduced through injection wells to create a closed loop system to effectively treat the area. Recovered free-phase petroleum would be removed from the Site for disposal.

The injection wells will be placed at intervals to saturate areas of contaminated soil as well as the vadose zone areas above the water table. Vapors would be drawn from the extraction wells via a regenerative blower housed in the extraction system area, and forced through a filtration system utilizing granular activated carbon (GAC) to remove contaminant mass from the vapor prior to discharge to the atmosphere in compliance with applicable air discharge permits. GAC in the filtration system would be changed out periodically to ensure effective treatment of vapors prior to discharge.

Alternative 3 utilizes soil vapor extraction and injection of water enhanced with surfactants into the vadose zone to treat contaminated soil above the water table and within the smear zone. These contaminants would be treated ex-situ in the above ground system following removal from the subsurface by dual phase extraction wells. The use of microbial amendments is not proposed in Alternative 2. Alternatives 2 and 3 use a very similar approach, with the primary difference being the use of bioremediation in Alternative 2 and soil vapor extraction in Alternative 3. Based on findings of the RI, the majority of contaminant mass remaining at the Site is located near the bottom of the vadose zone in the smear zone. Based on a lack of significant contaminant mass in the unsaturated

vadose zone, bioremediation is expected to result in a greater reduction in contaminant mass in the vadose zone relative to soil vapor extraction.

A pilot study would be performed to determine spacing and placement of injection and recovery wells to ensure appropriate zone of influence for the wells for liquid and vapor recovery. The study would include measurement of physical and chemical parameters of injected surfactant at specified wells in proximity to selected injection and extractions wells. The vapor extraction will measure air pressures, temperatures, flow rates and concentrations of VOCs in the extracted vapor.

In addition to the on-property treatment system, this alternative includes installation of an additional recovery well(s) downgradient of the property near MW-12. MPE events would be performed on the well(s) as described in Alternative 1, with the exception that the events would be performed quarterly rather than monthly.

Following completion of implementation of this alternative, performance monitoring of soil would be performed via drilling investigation. Method B CULs would be calculated using fractionation in accordance with WAC 173-340-740(3) for evaluation of soil compliance. Performance monitoring of soil will be further detailed in the CMP to be included in the final CAP.
It is expected that the Alternative 3 SEDPE recirculating system NAPL and soil vapor recovery and supplemental surfactant treatment may take 5 years of operation to reach the CULs. A conceptual layout of Alternative 3 is presented in Figure 7.

The present worth cost to implement Alternative 3, assuming a 1.3% interest rate as per Circular A-94 and an O&M period of 5 years, is approximately $2.4M (OMB 2023). The total costs include capital costs of $1.2M and total O&M costs of $1.2M (accounting for present worth).

3.1.4 *Alternative 4 – Targeted Soil Excavation with Passive Reactive Barrier (PRB) and MPE*

Alternative 4 includes demolition of property structures, soil removal to 20-feet below ground surface (bgs) within areas of remaining contaminated soil, installation of a passive reactive barrier (PRB) downgradient of the Site across I Street, and performance of MPE events downgradient of the Site.

Areas and depths for proposed soil excavation are presented in Figure 6. Excavated soil would be removed from the Site for disposal, and excavations would be backfilled with clean imported backfill material. Confirmation soil samples would be collected following excavation. A 4-inch diameter recovery well would be installed downgradient from the Site in the vicinity of a MW-12 where the greatest thickness of NAPL has most recently been observed at the Site. MPE events would be conducted using a vacuum truck quarterly for up to five years, or until MPE events were determined to have no significant reduction in the presence of NAPL at the Site for 4 consecutive quarters.

A passive reactive barrier (PRB) would be installed on site and downgradient from the Site following soil removal by excavation. The PRB would be installed using a remedial injection solution composed of granular activated carbon, a microbial solution of bacteria concentrate, as well as amendments added to serve as an ongoing food and respiratory source for continued biological

degradation of contaminants. The objective of injections within this area is to create a reactive curtain of remedial solution through which groundwater leaving the source area and moving downgradient will flow. Pilot testing utilizing limited remedial injections and use of passive flow meters to determine their effect on the reduction of contaminant flux across the area of pilot injections will be used to determine the effectiveness of a potential PRB on reducing contaminant mass prior to leaving the site in the downgradient direction.

This alternative would require demolition and reconstruction of the structure near the western property boundary to facilitate soil removal by excavation.

It is expected that Alternative 4 may take up to 10 years following completion of excavation to reach the CULs. A conceptual layout of Alternative 4 is presented in Figure 8.

The present worth cost to implement Alternative 4, assuming a 1.5% interest rate as per Circular A-94 and an O&M period of 10 years, is approximately $8.1M (OMB 2023). The total costs include capital costs of $7.7M and total O&M costs of $0.4M (accounting for present worth).

3.1.5 *Additional Considerations Regarding Alternatives*

Land Use Restrictions (LURs) or Engineering Controls (ECs) such as an environmental covenant recorded for the source property may be implemented with any of the above alternatives as appropriate. LURs or ECs would be implemented if CULs are unable to be reached in a reasonable timeframe using proper implementation of the selected alternative, including potential optimization of the treatment system if initial milestones are not met. Milestones and metrics for system performance and triggers for system optimization will be specified at a later date in system design and operations and maintenance (O&M) documents. LURs or ECs would address residual contaminants which are likely to be part of each proposed alternative.

4 DETAILED EVALUATION AND SELECTION OF ALTERNATIVES

This section evaluates and compares the adequacy of each alternative relative to MTCA criteria (WAC 173-340-360), as well as a ranking of criteria by disproportionate cost analysis (DCA), as required by WAC 173-340-350. The comparative analysis of the alternatives is organized by MTCA criteria as listed in Section 4.1.

Additionally, a consideration of public concerns will be addressed following the public comment period. The findings of the comparative evaluation are summarized below for each criterion. Table 4 presents a summary of the MTCA cleanup action alternatives evaluation.

4.1 Threshold and Other Requirements

In accordance with WAC 173-340-360(2), there are minimum requirements that must be met for a selected cleanup action. These minimum requirements are defined in terms of Threshold Requirements and Other Requirements. Threshold Requirements which must be met by the selected cleanup action include the following:

- Protect Human Health and the environment;
- Comply with cleanup standards;

- Comply with applicable state and federal laws; and
- Provide for compliance monitoring.

Selected cleanup actions fulfilling the above threshold requirements must also meet the following other criteria:

- Use permanent solutions to the maximum extent practicable;
- Provide for a reasonable restoration time frame;
- Consider Public Concerns

4.1.1 *Evaluation of Threshold Requirements*

Protection of Human Health and the Environment

The only complete exposure pathway identified for the Site in the RI was direct contact with contaminated soil by site workers during excavation or earthwork. Earthwork in contaminated conditions such as those found at the site is routinely conducted by trained personnel in a manner that protects human health. Alternatives 2, 3 and 4 all include trenching or excavation, while Alternative 1 includes drilling a well in contaminated soil. All of the alternatives would protect human health and the environment by reducing the source of NAPL via excavation or NAPL recovery, groundwater treatment, and monitoring to varying degrees. Based on this evaluation, all alternatives presented in this FS are considered to meet the threshold requirement for protection of human health and the environment.

Comply with Cleanup Standards

All four cleanup alternatives proposed in this FS are expected to achieve cleanup standards in all media within varying restoration time frames. As such, all alternatives presented in this FS are considered to meet the threshold requirement for compliance with cleanup standards.

Comply with Applicable State and Federal Regulations

Cleanup alternatives were developed in consideration of local, state and federal regulations, and no cleanup action was proposed which would not comply with these regulations. As such, all alternatives presented in this FS are considered to meet the threshold requirement for compliance with applicable state and federal regulations.

Provide for Compliance Monitoring

Groundwater monitoring is proposed in all four cleanup alternatives presented in this FS. In the circumstance of Alternative 4, confirmation soil samples would be collected from remedial excavations to document contaminant concentrations left in place in soil following excavation. In the case of Alternatives 1 through 3, site-specific Method B soil CULs would be calculated to evaluate the direct contact exposure pathway. As such, all alternatives presented in this FS are considered to meet the threshold requirement to provide for compliance monitoring.

4.1.2 *Evaluation of Other Requirements*

Because all four proposed cleanup alternatives met the threshold requirements of MTCA, each is evaluated by the other requirements presented in WAC 173-340-360(2).

Permanence

All four proposed alternatives include removal of NAPL from the Site and groundwater monitoring until contaminant concentrations are demonstrated to be below CULs. Following removal of the source of contamination at the Site to varying degrees via the various methodologies presented for the alternatives, the source of contamination would be reduced, which would prevent recontamination of groundwater. As such, all four alternatives presented in this FS are considered to be permanent cleanup actions.

Reasonable Restoration Timeframe

MPE has been conducted periodically at the Site for the past seven years. NAPL remains at the Site and contaminant concentrations in groundwater remain elevated well above preliminary CULs. Based on the performance of past MPE over the last seven years and the current status of environmental conditions at the Site, Alternative 1 is expected to take at least 30 years to reach CULs. MTCA places a preference on remedial alternatives that can be implemented in a shorter period of time. Alternative 1 is not expected to achieve site restoration in a reasonable time frame.

Alternatives 2, 3 and 4 are expected to achieve site restoration in a time frame ranging from approximately 3 to 10 years. All three of these alternatives are considered to meet the requirement for a reasonable restoration timeframe.

Consider Public Concerns

In accordance with WAC 173-340-600(13)(a), Ecology shall provide or require public notice of FS Reports and invite public comments. At this time, no public concerns were identified with any of the four proposed cleanup alternatives. If public concerns are received during the public comment period, they will be addressed, and the alternative revised as needed at that time. As such, Alternatives 2, 3 and 4 consider public concerns, and will continue to do so through public comment period and implementation.

4.1.3 *Conclusions Regarding Evaluation of Threshold and Other Requirements*

Based on evaluation of threshold and other requirements in accordance with WAC 173-340-360(2), Alternatives 1, 2, 3 and 4 meet the threshold requirements and are further evaluated by Disproportionate Cost Analysis (DCA) in this FS.

4.2 Disproportionate Cost Analysis

The MTCA DCA is used to evaluate which of the cleanup action alternatives that meet the threshold requirements are permanent to the maximum extent practicable. This analysis involves comparing the costs and benefits of the alternatives and selecting the most permanent alternative whose incremental costs are not disproportionate to the incremental benefits. Costs are disproportionate to benefits if the incremental cost of the more permanent alternative exceeds the incremental benefits achieved by the lower cost alternative [WAC 173-340-360(3)(e)(i)]. Alternatives that exhibit disproportionate costs are considered "impracticable." Where the benefits of two alternatives are equivalent, MTCA specifies that Ecology select the least costly alternative [WAC 173-340-360(e)(ii)(C)]. The alternatives are first compared to the most permanent cleanup alternative and the benefits of each alternative are ranked under the criteria of the DCA [WAC 173-340-360(f)]. The

costs are then compared to these benefits and cost-benefit ratios are calculated. The cost-benefit ratios are compared among the alternatives to identify which alternative is permanent to the maximum extent practicable.

In accordance with WAC 173-340-360(3)(f), the alternatives meeting the threshold and other requirements must be further evaluated by conducting a DCA to determine whether a cleanup action is permanent to the maximum extent practicable. The following evaluation criteria are used to evaluate each cleanup alternative when conducting a DCA:

- Protectiveness
- Permanence
- Cost
- Effectiveness over the long term
- Management of short term risks
- Technical and administrative implementability

4.2.1 *Disproportionate Cost Analysis Ranking Criteria*

The DCA is presented in Table 6. Environmental benefit is quantified by rating the alternatives with respect to the criteria of WAC 173-340-360(3)(f) as presented above. Rating values are assigned on a scale of 1 to 10, 1 indicating the lowest degree of criteria satisfaction and 10 indicating the highest degree of satisfaction. Each criterion is assigned a weighting factor based on importance. For the purposes of the DCA presented in Table 6, the following weighting factors are assigned:

- Overall protectiveness – 30%
- Permanence – 20%
- Long term effectiveness – 20%
- Short term effectiveness – 10%
- Implementability – 10%
- Consideration of public concerns – 10%

4.2.2 *Conclusions of Disproportionate Cost Analysis*

Table 6 summarizes the results of the DCA using Alternative 4 as the baseline remedy, or most permanent, under the assumptions described in Section 4.2.

The relative benefit ranking of each alternative against the six MTCA evaluation criteria and cost/benefit ratio are presented in Table 6. Note that the last of the six criteria, Consideration of Public Concerns, will be evaluated after the public comment period on the FS Report. The preferred alternative is presented in Section 5 and is assembled from the alternative selected as permanent to the maximum extent practicable for the Site. Consistent with MTCA requirements, starting with the alternatives that meet the threshold requirements, Alternatives 1 through 4, the overall weighted benefit score and cost of Alternatives 1 through 3 are compared to the scores and costs for the most permanent alternative, Alternative 4. Alternative 4 includes the most aggressive means of source reduction by excavating NAPL and contaminated soil and represents the most permanent remedial alternative evaluated in this FS. As such, Alternative 4 represents the benchmark against which the incremental costs and benefits of the other alternatives are evaluated.

The overall weighted score for Alternative 2 was the highest, 6.4 (out of 10). Alternative 3 received an overall weighted score of 6.3 points, while Alternative 4 received an overall weighted score of 6 points. Alternative 1 received an overall weighted score of 4 points. Alternative 2 was determined to be "permanent to the maximum extent practicable" based on having the lowest cost to benefit score in the DCA.

5 REMEDY SELECTION

Based on the evaluations in Section 4, the preferred cleanup action is Alternative 2 Surfactant Enhanced Bioremediation (SEB), which includes the following:

- Groundwater extraction
- Ex situ groundwater treatment
- In situ groundwater treatment via injection of treated groundwater augmented with surfactants and biological amendments

Alternative 2 meets the threshold and other MTCA requirements and is the preferred remedy based on the DCA. Alternative 2 was determined to be the most permanent remedy and had an overall weighted benefit score of 6.4 points in the DCA. Alternatives 3 and 4 has just slightly lower weighted scores, but the costs were higher and disproportionate relative to the incremental benefits.

Alternative 2 would employ surfactant enhanced bioremediation using a designed injection/recovery treatment system. Surfactant technology has the unique ability to selectively desorb contaminants and make NAPL miscible in the aqueous phase for enhanced mass removal. The surfactants will also desorb contamination from the soil surfaces, or from NAPL layers making them more available for in-situ or ex-situ remediation. The liberated contaminated water is then more biologically available for microbial (bacteria) and associated enzymatic degradation.

Once desorbed by the surfactants, the NAPL will be recovered though a set of extraction wells to remove liquids (water and NAPL). This liquid will be processed through an above ground separator to capture the free phase petroleum, then surfactant and biologic solutions will be added, and the water is reintroduced through injection wells to create a closed loop system to effectively treat the area. Recovered free phase petroleum would be removed from the Site for disposal. The injection wells will be placed at intervals to saturate areas of contaminated soil as well as the vadose zone areas above the water table zone.

A pilot study would be performed to determine spacing and placement of injection and recovery wells to ensure an appropriate zone of influence for the wells. The study would include measurement of physical and chemical parameters of injected surfactant/enzyme at specified wells in proximity to selected injection and extractions wells.

It is expected that the Alternative 2 SEB recirculating system NAPL recovery and supplemental biological treatment may take 5 years of operation to reach the CULs. A conceptual layout of the Alternative 2 is presented in Figure 4.

The present worth cost to implement Alternative 2, assuming a 2.0% interest rate as per Circular A-94 and an O&M period of 5 years, is approximately $2.2M (OMB 2023). The total costs include capital costs of $1.2M and total O&M costs of $1.0M (accounting for present worth).

The 5-year O&M period includes O&M of the injection/recovery treatment system, semi-annual groundwater monitoring for the first 3 years, and quarterly groundwater monitoring for the final two years.

6 LIMITATIONS AND CLOSURE

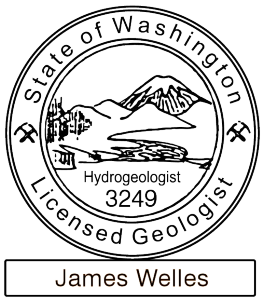
PBS has prepared this report for use by Coleman Oil. The site is managed under a State Agreed Order, and it is understood that this report may become available to the public.

Findings and recommendations contained in this report represent PBS' professional opinions based on the currently available information and are arrived at in accordance with currently accepted professional standards. This Feasibility Study Report will be used to develop the draft Cleanup Action Plan for compliance with MTCA regulations (WAC 173-340).

Sincerely,
PBS Engineering and Environmental Inc.

Digitally signed by James Welles
Date: 2023.10.06 14:14:41 -07'00'

James Welles, LHG Date
Senior Hydrogeologist



Melanie L. Young

Digitally signed by Melanie Young
Date: 2023.10.06 14:19:46 -07'00'

Melanie Young, PE Date
Senior Environmental Engineer

Reviewed by: Thomas Mergy, LHG
Principal Hydrogeologist

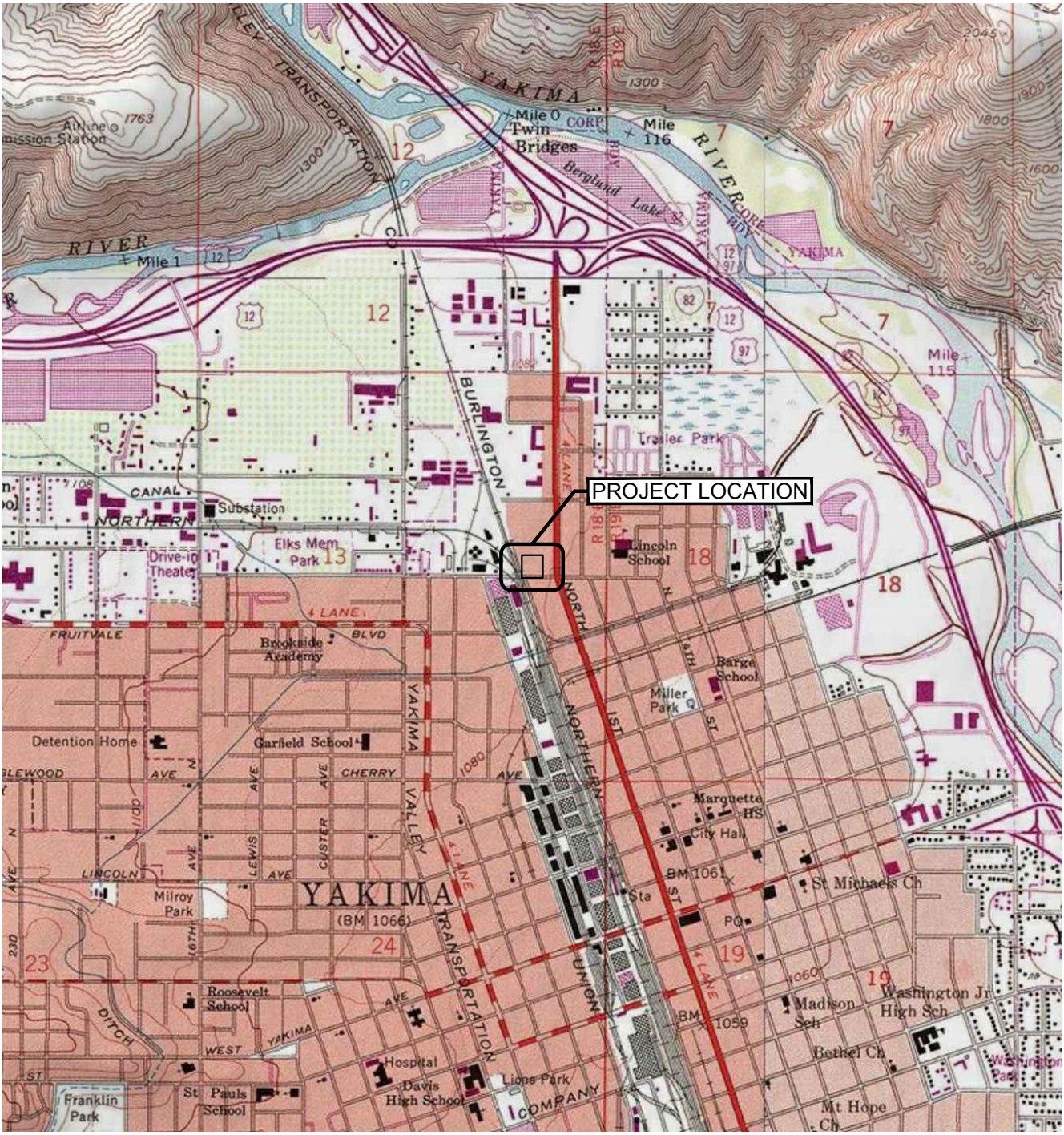
7 REFERENCES

EPA (US Environmental Protection Agency). (2000). A Guide to Developing and Documenting Cost Estimates During the Feasibility Study. Washington, DC: Publication No. EPA 540-R-00-002.

Office of Management and Budget (OMB). (Revised 2023). Circular A-94, Appendix C, Discount Rates for Cost Effectiveness, Lease Purchase, and Related Analyses.

(PBS, 2023) Remedial Investigation and Interim Action Report – Coleman Oil Yakima Bulk Fuel, PBS Engineering and Environmental, June 2023.

Figures



SOURCE: USGS YAKIMA WEST, WA QUADRANGLE 1985

WASHINGTON

Scale 1" = 2,000'

0' 1,000' 2,000' 4,000'

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VICINITY MAP

1 EAST I STREET
YAKIMA, WASHINGTON

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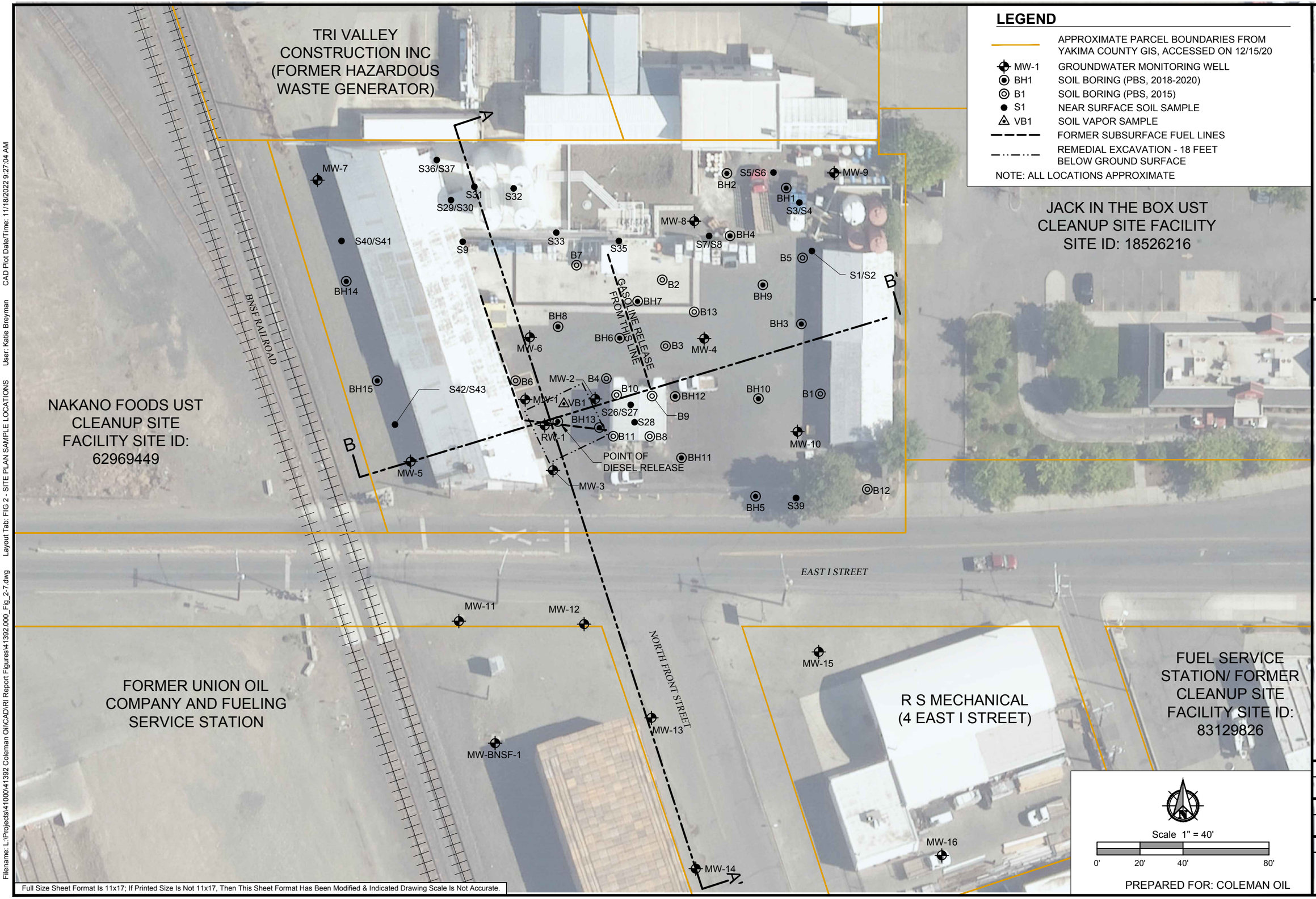
41392.000

FIGURE
1



LEGEND

- APPROXIMATE PARCEL BOUNDARIES FROM YAKIMA COUNTY GIS, ACCESSED ON 12/15/20
- MW-1 GROUNDWATER MONITORING WELL
- BH1 SOIL BORING (PBS, 2018-2020)
- B1 SOIL BORING (PBS, 2015)
- S1 NEAR SURFACE SOIL SAMPLE
- VB1 SOIL VAPOR SAMPLE
- FORMER SUBSURFACE FUEL LINES
- REMEDIAL EXCAVATION - 18 FEET BELOW GROUND SURFACE

NOTE: ALL LOCATIONS APPROXIMATE

Scale 1" = 40'

0' 20' 40' 80'

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SITE PLAN: SAMPLE LOCATIONS
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1 EAST I STREET, YAKIMA, WASHINGTON

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Filename: L:\Projects\41000\41392 Coleman Oil\CAD\RI Report Figures\41392.000_Fig_2-7.dwg Layout Tab: FIG 2 - SITE PLAN SAMPLE LOCATIONS User: Katie Breyman CAD Plot Date/Time: 11/18/2022 9:27:04 AM

LEGEND

- APPROXIMATE PARCEL BOUNDARIES FROM YAKIMA COUNTY GIS, ACCESSED ON 12/15/20
- MW-1 — GROUNDWATER MONITORING WELL
- BH1 — SOIL BORING (PBS, 2018-2020)
- B1 — SOIL BORING (PBS, 2015)
- S1 — NEAR SURFACE SOIL SAMPLE
- VB1 — SOIL VAPOR SAMPLE
- FORMER SUBSURFACE FUEL LINES
- REMEDIAL EXCAVATION - 10 FEET BELOW GROUND SURFACE
- EXTENT OF SOIL CONTAMINATION >MTCA CULS
- MTCA CUL — MODEL TOXICS CONTROL ACT METHOD A GROUNDWATER CLEANUP LEVEL FOR SOIL:
  - LEAD: 250 mg/kg
  - CADMIUM: 2 mg/kg
  - DIESEL: 2,000 mg/kg
  - HEAVY OIL: 2,000 mg/kg
  - GASOLINE: 30 mg/kg
- (mg/kg) — MILLIGRAMS PER KILOGRAM

NOTE: DEPICTED SOIL CONTAMINATION BASED ON 2015 & 2016 INVESTIGATION. CONTAMINANTS HAVE NOT BEEN DETECTED IN EXCEEDANCE OF MTCA CULS IN SITE SOIL SAMPLES FROM 2018-2020

MW-7 S36/S37 S31 S32 S29/S30 S40/S41 S9 S33 S35 B7 BH14 BH15 S42/S43 MW-5 MW-6 BH8 BH6 B3 MW-4 B13 BH7 B2 BH9 BH3 B5 S1/S2 S5/S6 BH2 BH1 S3/S4 MW-9 MW-8 BH4 S7/S8 B6 MW-2 B4 B10 MW-1 VB1 BH12 BH10 B1 S26/S27 S28 B9 BH13 RW-1 B11 B8 BH11 MW-10 MW-3 BH5 S39 B12 MW-11 MW-12 MW-15 MW-13 MW-16 MW-14

BNSF RAILROAD

GASOLINE RELEASE FROM THIS LINE

DIESEL & HEAVY OIL (3-FT DEPTH)

DIESEL (1-FT DEPTH)

POINT OF DIESEL RELEASE

DIESEL & GASOLINE (18-FT DEPTH)

EAST I STREET

NORTH FRONT STREET

Scale 1" = 40'

0' 20' 40' 80'

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EXTENT OF DIESEL AND HEAVY OIL IN SOIL

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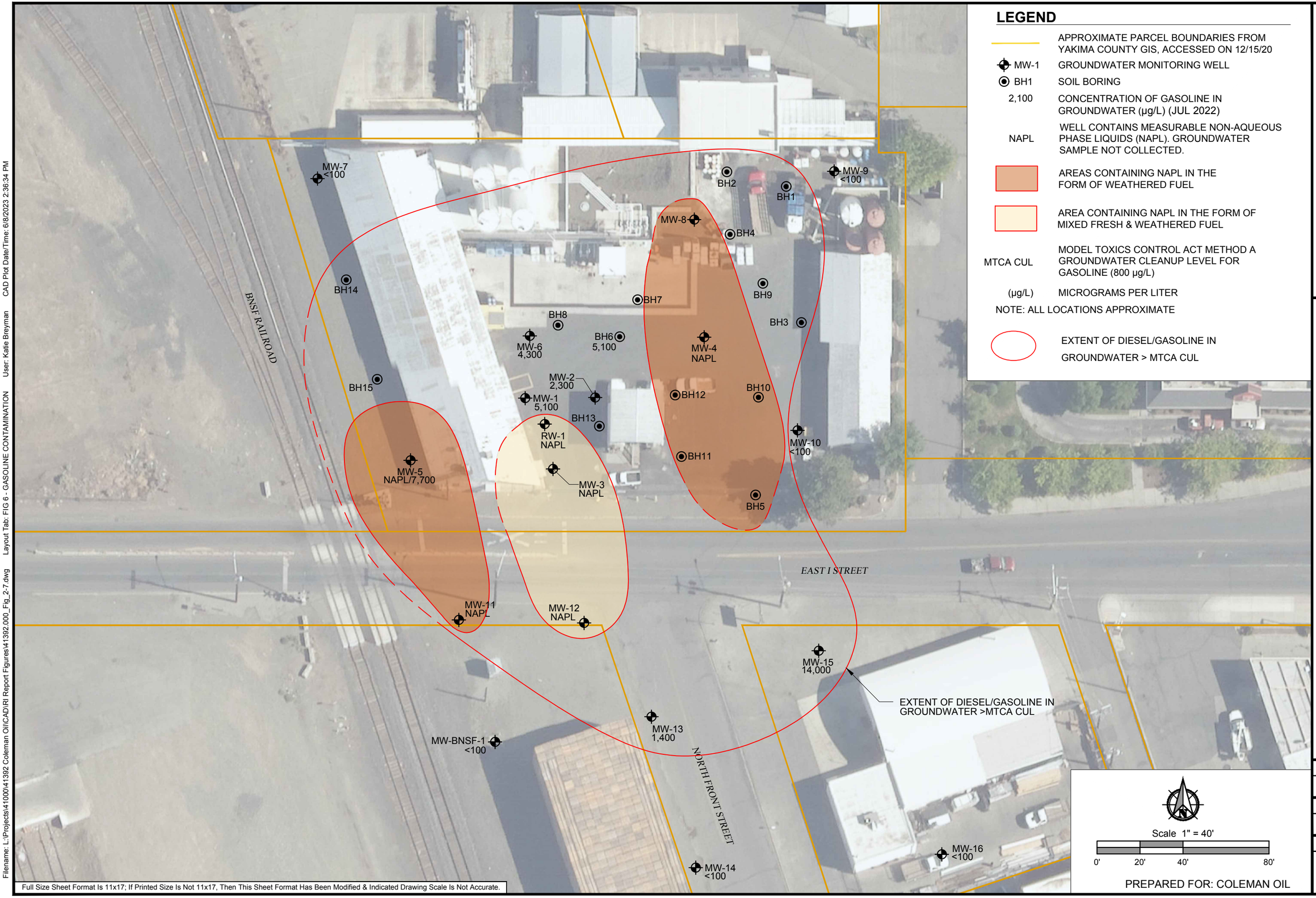

LEGEND

- APPROXIMATE PARCEL BOUNDARIES FROM YAKIMA COUNTY GIS, ACCESSED ON 12/15/20
- MW-1 — GROUNDWATER MONITORING WELL
- BH1 — SOIL BORING
- 2,100 — CONCENTRATION OF GASOLINE IN GROUNDWATER (µg/L) (JUL 2022)
- NAPL — WELL CONTAINS MEASURABLE NON-AQUEOUS PHASE LIQUIDS (NAPL). GROUNDWATER SAMPLE NOT COLLECTED.
- AREAS CONTAINING NAPL IN THE FORM OF WEATHERED FUEL
- AREA CONTAINING NAPL IN THE FORM OF MIXED FRESH & WEATHERED FUEL
- MTCA CUL — MODEL TOXICS CONTROL ACT METHOD A GROUNDWATER CLEANUP LEVEL FOR GASOLINE (800 µg/L)
- (µg/L) — MICROGRAMS PER LITER

NOTE: ALL LOCATIONS APPROXIMATE

EXTENT OF DIESEL/GASOLINE IN GROUNDWATER > MTCA CUL

Scale 1" = 40'

0' 20' 40' 80'

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EXTENT OF TPH AS DIESEL / GASOLINE IN GROUNDWATER
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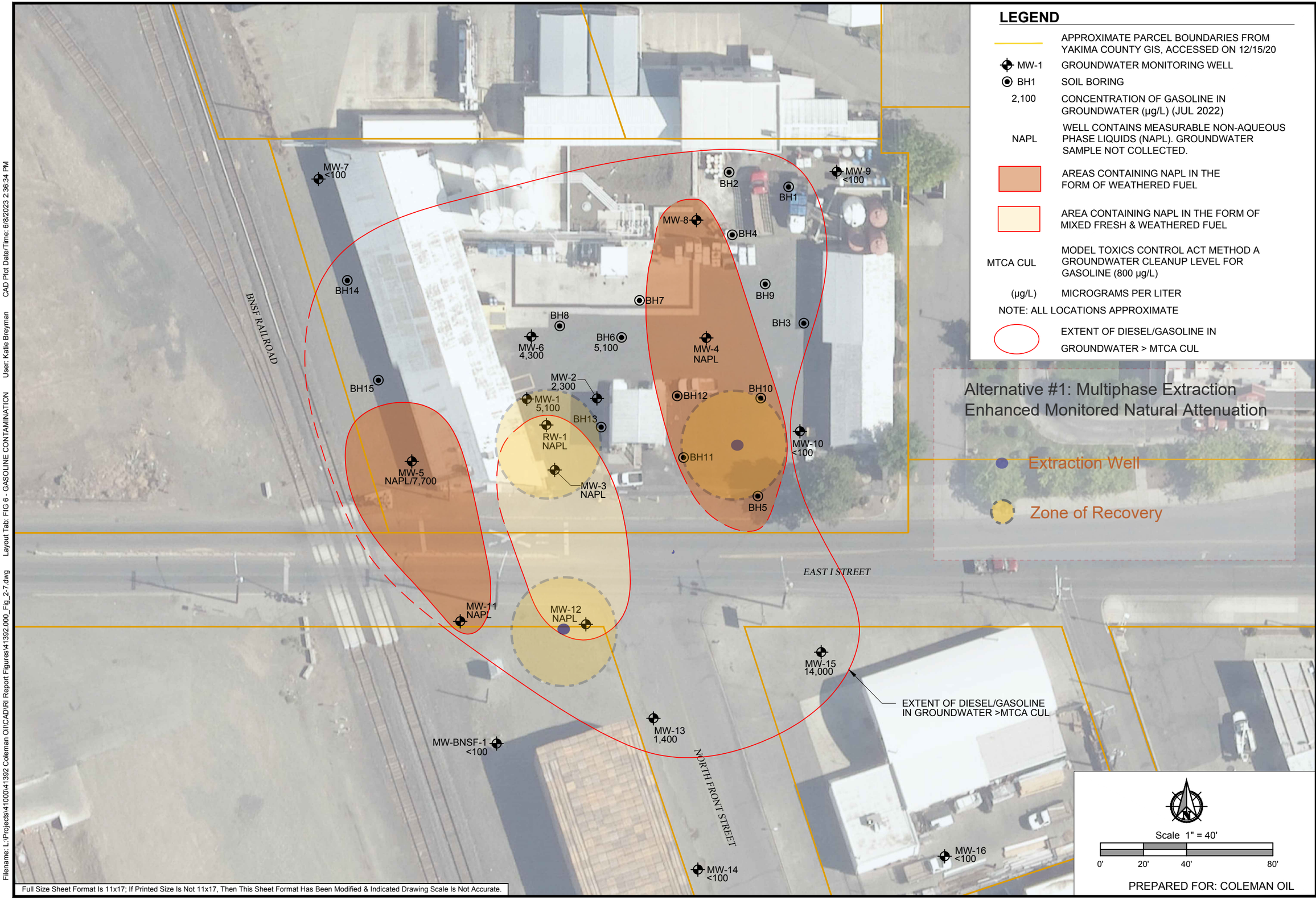

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ALTERNATIVE 1: Multiphase Extraction - Monitored Natural Attenuation

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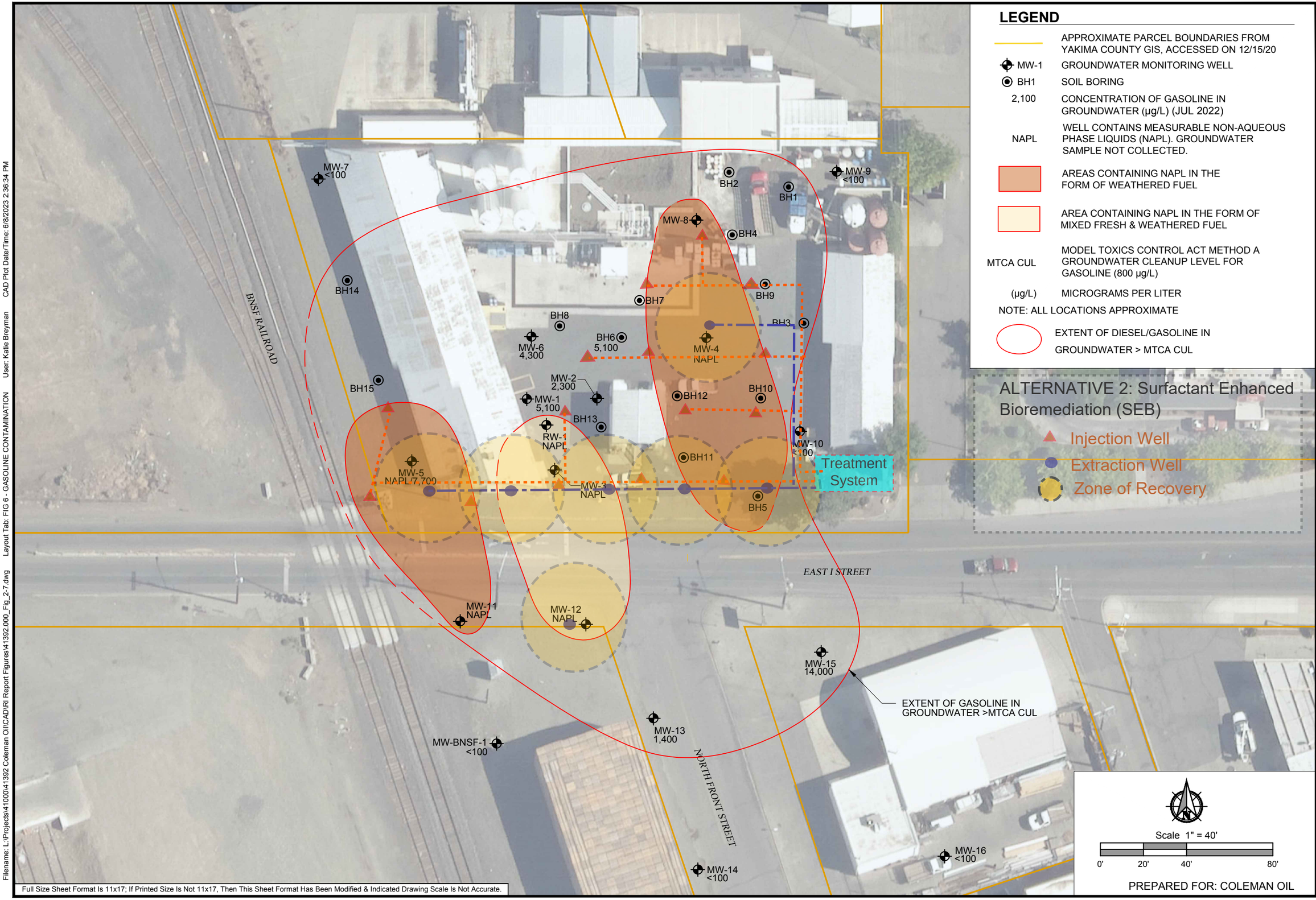

LEGEND

- APPROXIMATE PARCEL BOUNDARIES FROM YAKIMA COUNTY GIS, ACCESSED ON 12/15/20
- MW-1 — GROUNDWATER MONITORING WELL
- BH1 — SOIL BORING
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- NAPL — WELL CONTAINS MEASURABLE NON-AQUEOUS PHASE LIQUIDS (NAPL). GROUNDWATER SAMPLE NOT COLLECTED.
- AREAS CONTAINING NAPL IN THE FORM OF WEATHERED FUEL
- AREA CONTAINING NAPL IN THE FORM OF MIXED FRESH & WEATHERED FUEL
- MTCA CUL — MODEL TOXICS CONTROL ACT METHOD A GROUNDWATER CLEANUP LEVEL FOR GASOLINE (800 µg/L)
- (µg/L) — MICROGRAMS PER LITER

NOTE: ALL LOCATIONS APPROXIMATE

- EXTENT OF DIESEL/GASOLINE IN GROUNDWATER > MTCA CUL

ALTERNATIVE 2: Surfactant Enhanced Bioremediation (SEB)

- Injection Well
- Extraction Well
- Zone of Recovery

Scale 1" = 40'

0' 20' 40' 80'

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ALTERNATIVE 2: Surfactant Enhanced Bioremediation
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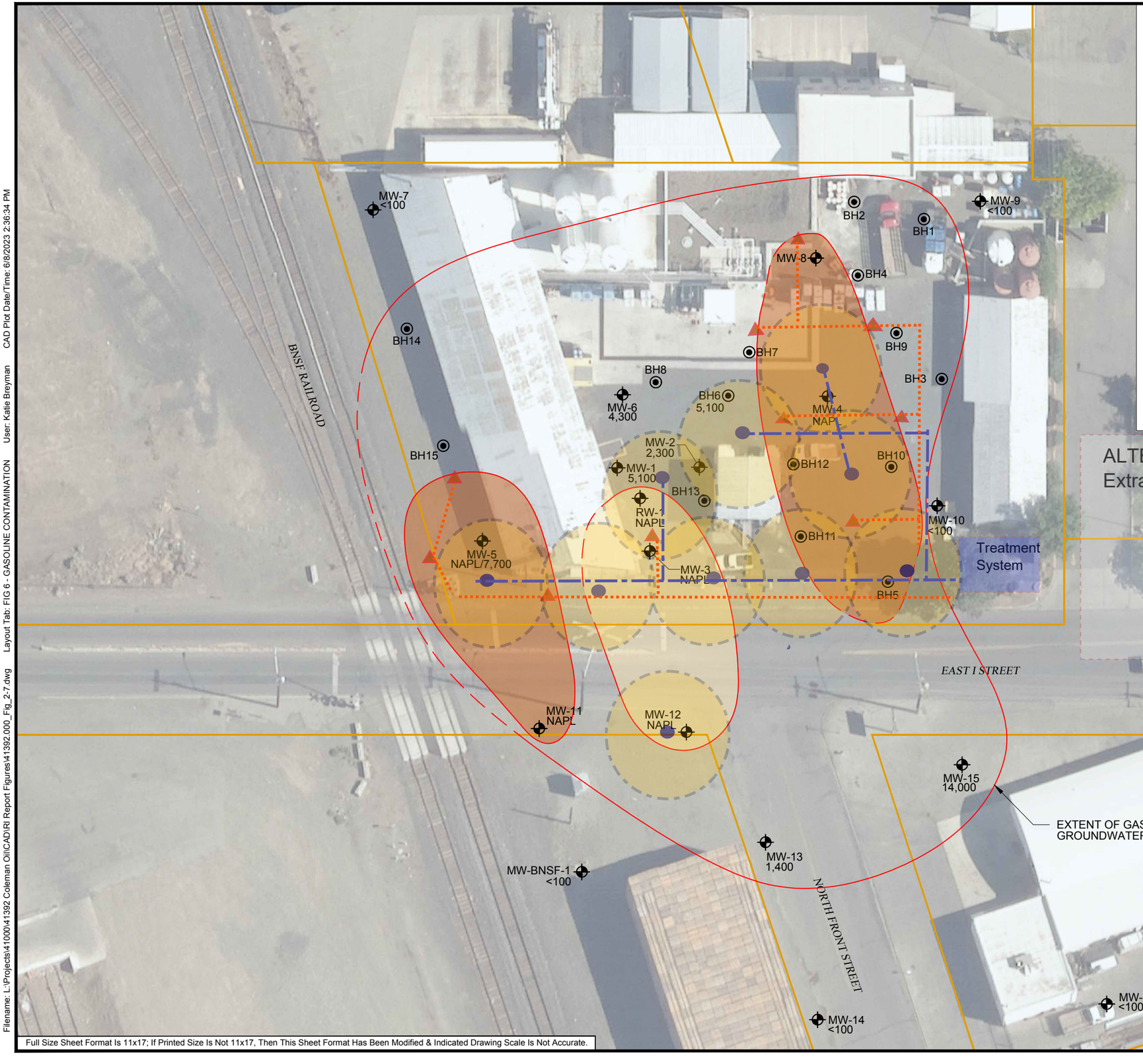

LEGEND

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- MTCA CUL — MODEL TOXICS CONTROL ACT METHOD A GROUNDWATER CLEANUP LEVEL FOR GASOLINE (800 µg/L)
- (µg/L) — MICROGRAMS PER LITER

NOTE: ALL LOCATIONS APPROXIMATE

- EXTENT OF DIESEL/GASOLINE IN GROUNDWATER > MTCA CUL

ALTERNATIVE #3: Surfactant Enhanced Extraction

- Injection Well
- Extraction Well
- Zone of Recovery

Scale 1" = 40'

0' 20' 40' 80'

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ALTERNATIVE 3: Surfactant Enhanced Dual Phase Extraction

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LEGEND

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- MW-1 — GROUNDWATER MONITORING WELL
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- B1 — SOIL BORING (PBS, 2015)
- S1 — NEAR SURFACE SOIL SAMPLE
- VB1 — SOIL VAPOR SAMPLE
- FORMER SUBSURFACE FUEL LINES
- REMEDIAL EXCAVATION - 10 FEET BELOW GROUND SURFACE
- EXTENT OF SOIL CONTAMINATION >MTCA CULS
- MTCA CUL — MODEL TOXICS CONTROL ACT METHOD A GROUNDWATER CLEANUP LEVEL FOR SOIL:
  - LEAD: 250 mg/kg
  - CADMIUM: 2 mg/kg
  - DIESEL: 2,000 mg/kg
  - HEAVY OIL: 2,000 mg/kg
  - GASOLINE: 30 mg/kg
- (mg/kg) — MILLIGRAMS PER KILOGRAM

NOTE: DEPICTED SOIL CONTAMINATION BASED ON 2015 & 2016 INVESTIGATION. CONTAMINANTS HAVE NOT BEEN DETECTED IN EXCEEDANCE OF MTCA CULS IN SITE SOIL SAMPLES FROM 2018-2020

ALTERNATIVE #4: Targeted Excavation, Passive Reactive Barrier (PRB) and Multiphase Extraction (MPE)

- Push Probe Injection Point
- Multiphase Extraction (NAPL+Groundwater+Vapor) Well
- Zone of Recovery
- Proposed Soil Excavation Area

MW-7, S36/S37, S31, S32, S29/S30, S40/S41, S9, S33, S35, B7, BH14, BH15, S42/S43, BH8, BH6, MW-6, B3, MW-4, BH7, B2, BH2, S5/S6, BH1, S3/S4, MW-9, MW-8, BH4, S7/S8, B5, S1/S2, BH9, B13, BH3, MW-2, B4, B10, BH12, MW-1, VB1, B6, S26/S27, S28, BH13, B9, RW-1, B11, B8, BH11, POINT OF DIESEL RELEASE, MW-5, MW-3, BH10, B1, DIESEL (1-FT DEPTH), MW-10, DIESEL & HEAVY OIL (3-FT DEPTH), B12, BH5, S39, Excavate to ~20-ft bgs, Excavate to ~5-ft bgs, DIESEL & GASOLINE (18-FT DEPTH), GASOLINE RELEASE FROM THIS LINE, BNSF RAILROAD, EAST I STREET, NORTH FRONT STREET, MW-11, MW-12, MW-13, MW-14, MW-15, MW-16

Scale 1" = 40'

0' 20' 40' 80'

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ALTERNATIVE 4: Targeted Excavation, PRB, and MPE
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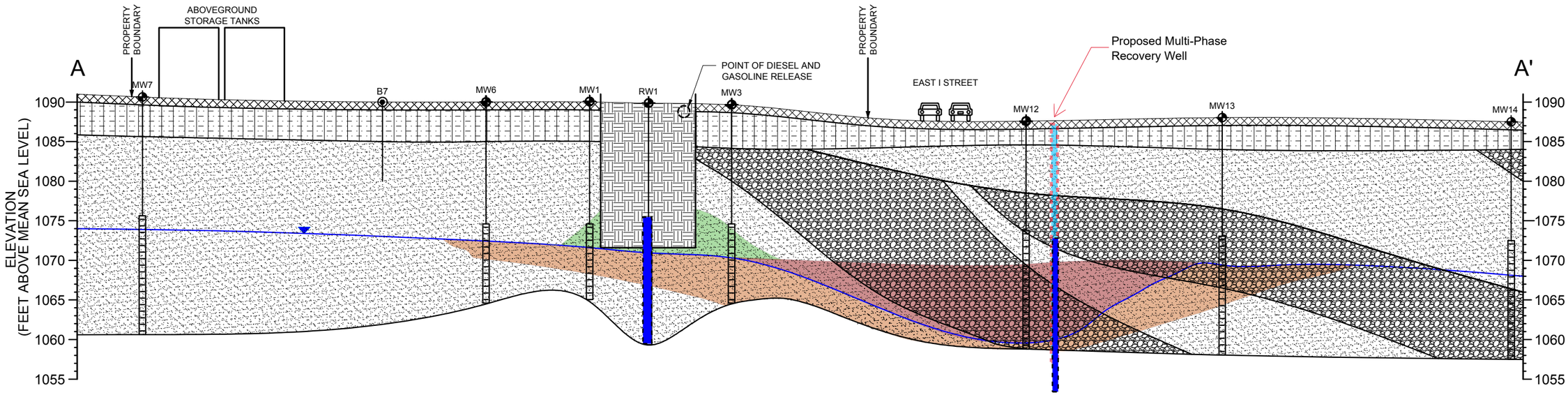


1

CROSS-SECTION A-A'

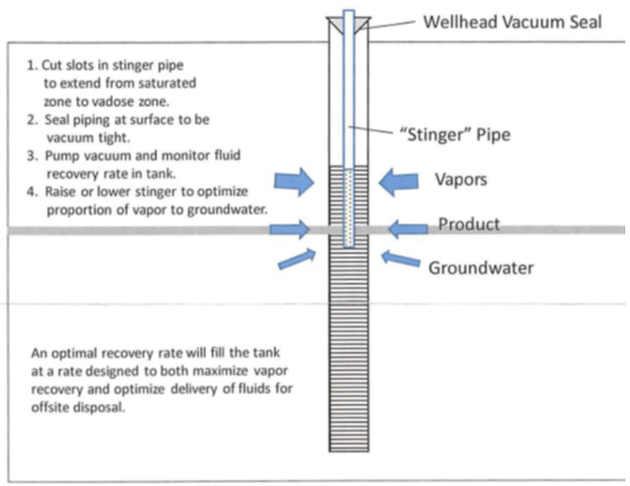
0' 20' 40' 80'

2X VERTICAL EXAGGERATION

LEGEND

BH-1	DIRECT PUSH/SONIC SOIL BORING		ASPHALT/ ARTIFICIAL FILL
MW1/RW1	MONITORING WELL		SILTY SAND WITH GRAVEL (SM)
	WELL SCREEN		WELL GRADED SAND WITH GRAVEL AND SILT (SW)
			WELL GRADED GRAVEL WITH SAND (GW)
	GROUNDWATER (NOV 2020)		AREA OF SOIL EXCAVATION AND CLEAN BACKFILL
	FORMER SUBSURFACE FUEL LINE		NAPL (NOV 2020)
NAPL	NON-AQUEOUS PHASE LIQUID		GROUNDWATER WITH CONCENTRATION OF GASOLINE AND/OR DIESEL >MTCA CUL
MTCA CUL	MODEL TOXINS CONTROL ACT METHOD A CLEANUP LEVEL		SOIL CONTAMINANT CONCENTRATIONS >MTCA CUL

Figure 1: Suggested Multi-Phase Vacuum Extraction



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CONCEPTUAL SITE MODEL - CROSS-SECTION

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Tables

Table 1. Proposed Cleanup Levels and Remediation Levels
Coleman Oil Yakima

Chemicals of Concern	Preliminary Groundwater Cleanup Levels (MTCA Method A[a]) (µg/L)	Preliminary Soil Cleanup Levels (MTCA Method A)[b] (mg/kg)	NAPL Thickness Remediation Levels (feet)
TPH-D	500	2,000	0.05
TPH-G	800	30	
Benzene	5	0.03	
Toluene	1,000	7	
Ethylbenzene	700	6	
Total Xylenes	1,000	9	
Naphthalene	160	5	

Notes:

[a]Groundwater cleanup levels based on MTCA Method A Groundwater cleanup levels
[b]Soil cleanup levels based on MTCA Method A Soil cleanup levels for unrestricted land use

mg/kg – milligrams per kilogram
NAPL – nonaqueous phase liquid
TPH – Total Petroleum Hydrocarbons
TPH-D – Diesel range TPH
TPH-G – Gasoline range TPH
µg/L – micrograms per liter

Table 2. Applicable or Relevant and Appropriate Requirements
Coleman Oil, Yakima, Washington

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate
Chemical-Specific			
Federal National Primary Drinking Water Regulations	40 CFR 141 and 142	Establishes health-based standards, maximum contaminant levels (MCL) and maximum contaminant level goals (MCLG), for public water systems.	Relevant and Appropriate
Federal Regional Screening Levels for soil and water	Source: epa.gov/risk/regional-screening-levels-rsls	Provides risk-based concentrations that are intended to assist risk assessor and others in initial screening-level evaluations of environmental regulations	Applicable
Washington State Model Toxics Control Act (MTCA) Cleanup Levels (CULs) for Groundwater	WAC 173-340	Requires groundwater cleanup levels be based on the estimates of the highest beneficial use and the reasonable maximum potential exposure under current and future site uses	Applicable
MTCA - Selection of Cleanup Actions	WAC 173-340-360(2)(f)	Limits on use of remediation levels	Relevant and Appropriate
Washington State Water Quality Standards for Groundwater	WAC 173-200	Establishes maximum contaminant concentrations for the protection of beneficial uses of groundwater	Potentially Relevant and Appropriate
Washington Dangerous Waste Regulations	WAC 173-303	This regulation implements chapter 70.105 RCW, the Hazardous Waste Management Act as amended, and implements, in part, chapters 70.95E, 70.105D, and 15.54 RCW, and Subtitle C of Public Law 94-580, the Resource Conservation and Recovery Act of 1976, which the legislature has empowered the department to implement.	Potentially Relevant and Appropriate
Action-Specific			
MTCA - Selection of Cleanup Actions	WAC 173-340-360(2)(a)&(b)	Establishes the minimum requirements and procedures for selecting cleanup actions; defines threshold requirements and other requirements	Applicable
MTCA - Selection of Cleanup Actions	WAC 173-340-360(2)(c)	Establishes the minimum requirements for groundwater cleanup actions	Applicable
MTCA - Selection of Cleanup Actions	WAC 173-340-360(2)(e)	Requirements for institutional controls	Applicable
Washington MTCA - Limits on dilution and dispersion	WAC 173-340-360(2)(g)	Addresses reliance on dilution and dispersion overactive remedial measures	Applicable

Table 2. Applicable or Relevant and Appropriate Requirements
Coleman Oil, Yakima, Washington

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate
Washington State Regulation and Licensing for Well Contractors and Operators	RCW 18.104 WAC 173-162	Establishes procedures for examination, licensing, and regulation of well contractors and operators	Relevant and Appropriate
Washington State Standards for Construction and Maintenance of Water Wells	RCW 18.104 WAC 173-160	Establishes minimum standards for construction of water and monitoring wells and for the decommissioning of wells.	Relevant and Appropriate
Washington Underground Injection Control Program	WAC 173-218	Requirements for underground injection control applicable to cleanup alternatives that include injection of materials into subsurface groundwater and soil.	Relevant and Appropriate
Washington Solid Waste Management Handling Standards and Regulations	RCW 70.95WAC 173-350	Solid waste requirements are potentially applicable to the offsite disposal of solid nonhazardous wastes that may be generated as part of well installation or excavation.	Relevant and Appropriate
Location-Specific			
Endangered Species Act	16 USC 1531-1543; 50 CFR 402; 50 CFR 17	Requirements to protect fish, wildlife and plants that are threatened or endangered with extinction. This act requires consultation with resource agencies for projects that may affect threatened or endangered species.	Potentially Relevant and Appropriate
Fish and Wildlife Conservation Act	16 USC 2901; 50 CFR 83	Requirements for federal agencies to use their authority to conserve and promote conservation of non-game fish and wildlife, and evaluated in conjunction with the Endangered Species Act consultation.	Potentially Relevant and Appropriate
Archaeological and Historic Preservation Act	16 USC 469	Establishes procedures for the preservation of historical and archeological data that might be destroyed through alteration of terrain because of a federally licensed activity or program.	Potentially Relevant and Appropriate
Archaeological Resources Protection Act	16 USC 470aa; 43 CFR 7	Specifies the steps that must be taken to protect archaeological resources and sites that are on public and Native American lands and to preserve data uncovered.	Potentially Relevant and Appropriate
City of Yakima Grading Permit	2018 IBC, Appendix J	Grading permits required for clearing/grading land-disturbing activities. https://www.yakimawa.gov/services/codes/files/Grading-Permit-Application_05-2023.pdf	Relevant and Appropriate

Table 2. Applicable or Relevant and Appropriate Requirements
Coleman Oil, Yakima, Washington

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate
City of Yakima Stormwater and Erosion Control	YMC 7.83.130	Requirements for stormwater management and erosion control for clearing/grading of 1 acre or more.	Potentially Relevant and Appropriate
Yakima Regional Clean Air Agency (YRCAA)	Regulation 1 of the YRCAA	Local requirements implementing the Washington Clean Air Act to control air pollution through procedures, standards, permits, and programs.	Relevant and Appropriate
Stormwater Permit Program	RCW 90.48.260; 40 CFR 122.26; WAC 173-226	Requirements of the Federal Clean Water Act for coverage under the general stormwater permit for stormwater discharges associated with construction activities disturbing over 1 acre.	Relevant and Appropriate
State Waste Discharge Permit Program	WAC 173-216	Requirements for discharge of treated water directly to the ground.	Potentially Relevant and Appropriate
State Environmental Policy Act	RCW 43.21C; WAC 197-11; WAC 173-802	State law intended to ensure state and local government officials consider environmental values when making decisions or taking an official action such as approving the Cleanup Action Plan.	Relevant and Appropriate

Notes:
CFR – code of federal regulations
CULs – cleanup levels
IBC – International Building Code
MCL – maximum contaminant level
MCLG – maximum contaminant level goals
MTCA – Model Toxics Control Act
RCW – Revised Code of Washington
WAC – Washington Administrative Code
USC – United States Code
YMC – Yakima Municipal Code
YRCAA - Yakima Regional Clean Air Agency

Table 3. Identification and Screening of Remedial Technologies
Coleman Oil Yakima Site

Technology Category	Remedial Technology Type	Relative Restoration Time	Relative Capital/ O&M Costs	Screening Results
No Action	None	High	None	Not Retained. This will not meet MTCA threshold requirements.
Long-Term Monitoring	• Long-Term Groundwater Monitoring • Monitored Natural Attenuation • Enhanced Monitored Natural Attenuation	Medium to High	Medium	Retained
Groundwater Containment	• Groundwater extraction in source area • In situ injections or trenching to install a permeable reactive barrier on downgradient end of groundwater plume	Medium	Medium	Retained
In situ Groundwater Treatment	• Injection of surfactant enhanced treated groundwater • Injection of biologically enhanced treated groundwater	Low to Medium	Medium	Retained.
Ex situ Groundwater Treatment	• Oil water separator for extracted groundwater prior to enhancement and reinjection • Offsite disposal of extracted groundwater • All treatment requires groundwater extraction	Low to Medium	Medium	Retained
Ex Situ Groundwater / Soil Vapor Treatment	• Soil vapor extraction via extraction wells • Treatment of extracted soil vapor via drums of granular activated carbon	Low	Medium	Retained
Soil Excavation and Offsite Disposal	• Excavation of Residual Soil Contamination • Transportation and Offsite Disposal	Medium	Very High	Not Retained

Notes:
MTCA – Model Toxics Control Act
O&M – Operation and Maintenance

Table 4. Evaluation of Remedial Alternatives
Coleman Oil, Yakima, Washington

MTCA Evaluation Criteria	Alternative 1: MPE Enhanced MNA	Alternative 2: Surfactant Enhanced Bioremediation	Alternative 3: Surfactant Enhanced Dual Phase Extraction	Alternative 4: Targeted Soil Excavation with PRB and MPE
Threshold Requirements				
Protect human health and the environment	This remedy is protective of human health and the environment because it provides capture of nonaqueous phase liquid (NAPL) and contaminated groundwater via multiphase extraction (MPE) to prevent plume migration and ongoing groundwater (GW) monitoring to ensure plume reduction or stability.	This remedy is protective of human health and the environment because it provides recovery of NAPL, treatment of GW and includes GW monitoring to ensure plume reduction or stability.	This remedy is protective of human health and the environment because it provides recovery of NAPL, treatment of GW and includes GW monitoring to ensure plume reduction or stability.	This remedy is protective of human health and the environment because it would remove the source of contamination that has impacted GW, eventually reducing GW concentrations, along with MPE, installation of a passive reactive barrier (PRB) to prevent downgradient plume migration, and GW monitoring.
Comply with cleanup standards	Alternative 1 is expected to eventually result in compliance with GW cleanup standards at standard or conditional points of compliance.	Alternative 2 would comply with GW cleanup standards at standard points of compliance.	Alternative 3 would comply with GW cleanup standards at standard points of compliance.	Alternative 4 would comply with GW cleanup standards at standard or conditional points of compliance.
Comply with applicable state and federal laws	Alternative 1 will comply with applicable state and federal laws by eventually reducing GW concentrations to below cleanup standards.	Alternative 2 will comply with applicable state and federal laws by reducing GW concentrations to below cleanup standards.	Alternative 3 will comply with applicable state and federal laws by reducing GW concentrations to below cleanup standards.	Alternative 4 will comply with applicable state and federal laws by eventually reducing GW concentrations to below cleanup standards.
Provide for compliance monitoring	This option includes compliance monitoring.	This option includes compliance monitoring.	This option includes compliance monitoring.	This option includes compliance monitoring.
Does remedy meet all Threshold Requirements?	*Yes*	*Yes*	*Yes*	*Yes*

Table 4. Evaluation of Remedial Alternatives
Coleman Oil, Yakima, Washington

Other Requirements				
Permanent to the Maximum Extent Practicable	This alternative serves as a permanent remedy removing some NAPL and conducting GW monitoring to confirm that contaminants may be reduced by natural attenuation.	This alternative serves as a permanent remedy by enhancing NAPL recovery and allowing in situ bioremediation to treat GW contamination to concentrations that pose no threat to human health or the environment.	This alternative serves as a permanent remedy by enhancing NAPL recovery, and physically removing and treating GW contamination to concentrations that pose no threat to human health or the environment.	This alternative serves as a permanent remedy by removing the residual source of contamination to groundwater and PRB to treat and prevent downgradient plume migration.
Provide for reasonable restoration timeframe	This remedy does not provide a reasonable restoration time as it would not efficiently remove or treat contamination. The timeframe for this alternative is at least 30 years.	This remedy would provide a restoration time of approximately 5 years with physical and biological treatment of GW.	This remedy would provide a restoration time of approximately 5 years with physical treatment of GW and soil vapor.	This remedy would provide a reasonable restoration time, estimated at 10 years. Although this alternative would remove residual contamination in soil, which is expected to reduce GW concentrations, the remaining restoration timeframe is uncertain, therefore, 10 years is assumed, as that timeframe may be needed for GW monitoring.
Consider public concerns	The public may be concerned that active reduction of contamination in soil and groundwater are not being conducted.	No public concerns are identified with this alternative presuming GW monitoring confirms no downgradient migration of plume.	No public concerns are identified with this alternative presuming GW monitoring confirms no downgradient migration of plume.	The public may be concerned with impacts to adjacent public right of way (ROW) needed to facilitate soil excavation. Additionally, public concerns may exist regarding the environmental/greenhouse gas impacts of hauling contaminated media for offsite disposal rather than the in situ destruction of contamination.

Notes:
GW - groundwater

Table 4. Evaluation of Remedial Alternatives
Coleman Oil, Yakima, Washington

MNA – Monitored Natural Attenuation
MPE – Multiphase extraction
MTCA – Model Toxics Control Act
NAPL – Nonaqueous phase liquid
ROW – right of way
PRB – Passive reactive barrier

Table 5 - Comparison of Remedial Action Alternative Costs
Coleman Oil, Yakima, Washington

Task	Alternatives			
	1	2	3	4
	MPE Enhanced MNA	Surfactant Enhanced Bioremediation	Surfactant Enhanced Dual Phase Extraction	Targeted Soil Excavation with PRB and MPE
Capital Cost Totals				
Capital Direct Costs	$104,000	$735,400	$783,000	$6,399,000
Contractor Contingency Assumed	30%	35%	35%	30%
Capital Indirect Costs	$152,800	$425,353	$444,000	$1,300,000
Total Capital Costs	**$257,000**	**$1,161,000**	**$1,227,000**	**$7,699,000**
O&M Cost Totals				
Total O&M Costs	$2,760,000	$1,076,000	$1,261,000	$420,000
Total Capital and O&M Costs	$3,017,000	$2,237,000	$2,488,000	$8,119,000
Years of O&M	30	5	5	10
Annualized O&M Costs	$92,000	$215,200	$252,200	$42,000
PW O&M Costs	$2,311,000	$1,034,000	$1,212,000	$390,000
Project Totals				
Total Capital and PW O&M Costs	**$2,600,000**	**$2,200,000**	**$2,400,000**	**$8,100,000**
Total Project Cost	**$2.6 M**	**$2.2 M**	**$2.4 M**	**$8.1 M**

Notes:
M - million
MNA - monitored natural attenuation
MPE - multiphase extraction
O&M - operation and maintenance
PRB - Passive Reactive Barrier
PW - Present Worth assumes a 2.0% interest rate for 30 years, 1.3% for 5 years and 1.5% for 10 years per OMB Circular A-94, revised 3/2023

Table 6. Disproportionate Cost Analysis Relative Benefits Ranking Evaluation
Coleman Oil, Yakima, Washington

Evaluation Criteria (Weighting Factor %)	Alternative 1: Multiphase Extraction Enhanced Monitored Natural Attenuation	Alternative 2: Surfactant Enhanced Bioremediation	Alternative 3: Surfactant Enhanced Dual Phase Extraction	Alternative 4: Targeted Soil Excavation with PRB and MPE
	Relative Benefits Ranking for DCA			
Overall Protectiveness 30%	**Fair** This remedy is protective of human health and the environment because reduces contamination by removal of NAPL and provides soil confirmation sampling and ongoing groundwater monitoring during remediation to ensure that the contaminant plume remains stable or is reduced and exposure pathways remain incomplete.	**Excellent** This remedy is protective of human health and the environment because it removes NAPL and reduces contamination in place and provides soil confirmation sampling and ongoing groundwater monitoring during remediation to ensure that the contaminant plume remains stable or is reduced and exposure pathways remain incomplete.	**Excellent** This remedy is protective of human health and the environment because it reduces contamination in place and provides soil confirmation sampling and ongoing groundwater monitoring during remediation to ensure that the contaminant plume remains stable or is reduced and exposure pathways remain incomplete.	**Excellent** This remedy is protective of human health and the environment because it provides removal of the source to groundwater contamination and includes soil confirmation sampling and ongoing groundwater monitoring to ensure the contaminant plume is stable and exposure pathways remain incomplete.
Benefit Score[a]: Raw/(Weighted)	**3/(0.9)**	**7/(2.1)**	**7/(2.1)**	**8/(2.4)**
Permanence 20%	**Fair** Permanent remedy by removing some NAPL and conducting monitoring to confirm that contaminants will be further reduced by natural attenuation. Contaminants will be reduced by MPE although concentrations above cleanup standards may remain.	**Excellent** Permanent remedy by enhancing NAPL recovery and allowing in situ bioremediation to treat GW contamination to concentrations that pose no threat to human health or the environment.	**Excellent** Permanent remedy by enhancing NAPL recovery and physically removing and treating GW contamination to concentrations that pose no threat to human health or the environment.	**Excellent** Permanent remedy by removing the source of contamination to GW and PRB to treat and prevent downgradient plume migration. Contaminants will be further reduced by natural attenuation to concentrations that pose no threat to human health or the environment.
Benefit Score[a]: Raw/(Weighted)	**3/(0.6)**	**8/(1.6)**	**8/(1.6)**	**8/(1.6)**

Table 6. Disproportionate Cost Analysis Relative Benefits Ranking Evaluation
Coleman Oil, Yakima, Washington

Evaluation Criteria (Weighting Factor %)	Alternative 1: Multiphase Extraction Enhanced Monitored Natural Attenuation	Alternative 2: Surfactant Enhanced Bioremediation	Alternative 3: Surfactant Enhanced Dual Phase Extraction	Alternative 4: Targeted Soil Excavation with PRB and MPE
	Relative Benefits Ranking for DCA			
Long-Term Effectiveness 20% Benefit Score[a]: Raw/(Weighted)	**Fair** If MPE is unable to reduce contaminant concentrations to below cleanup standards, long term effectiveness of this remedy would be reduced. **4/(0.8)**	**Excellent** Permanent destruction of contaminants and reduction of concentrations to below cleanup levels will remain very effective in the long term. **8/(1.6)**	**Excellent** Permanent destruction of contaminants and reduction of concentrations to below cleanup levels will remain very effective in the long term. **8/(1.6)**	**Excellent** Removal of source of contamination by excavation and monitoring to ensure groundwater concentrations attenuate to below cleanup levels will remain very effective in the long term. **8/(1.6)**
Management of Short-Term Risks 10% Benefit Score[a]: Raw/(Weighted)	**Excellent** While this remedy may eventually achieve cleanup standards for groundwater, the time frame for contaminant reduction is long, and thus risks of contamination remain in the short-term. However, there is minimal short-term risk for workers during implementation. **7/(0.7)**	**Good** Moderate risk of contact with contaminated soil and groundwater during drilling, installation of injection and extraction wells, and during treatment system operation. **6/(0.6)**	**Good** Moderate risk of contact with contaminated soil and groundwater during drilling, installation of injection and extraction wells, and during treatment system operation. **5/(0.5)**	**Poor** Moderate to high risk of contact with contaminated soil and groundwater during excavation and offsite disposal, but this risk can be managed with proper controls. Following excavation of source, short term risk is greatly reduced. **2/(0.2)**

Table 6. Disproportionate Cost Analysis Relative Benefits Ranking Evaluation
Coleman Oil, Yakima, Washington

Evaluation Criteria (Weighting Factor %)	Alternative 1: Multiphase Extraction Enhanced Monitored Natural Attenuation	Alternative 2: Surfactant Enhanced Bioremediation	Alternative 3: Surfactant Enhanced Dual Phase Extraction	Alternative 4: Targeted Soil Excavation with PRB and MPE
	Relative Benefits Ranking for DCA			
Implementability 10% Benefit Score[a]: Raw/(Weighted)	**Superior** This remedy can be implemented with mobile equipment that visits the Site periodically on an as needed basis. The scope of this remedy is easily expanded or reduced to meet Site needs based on monitoring. **10/(1.0)**	**Good** • Technical implementation moderately complex with significant impacts to current on-site operations. • Administrative implementation challenges include installation of system, particularly injection/extraction wells and horizontal piping, during continued operation of the Site as a bulk fueling facility. **5/(0.5)**	**Good** • Technical implementation moderately complex with significant impacts to current on-site operations. • Administrative implementation challenges include installation of system, particularly injection/extraction wells and horizontal piping, during continued operation of the Site as a bulk fueling facility. **5/(0.5)**	**Poor** • Technical implementation is not complex but very impactful to Site; excavation to depths of 20 feet bgs involves logistical challenges in an area with adjacent structures. • Building demolition and reconstruction is required, presenting a significant impact to Site relative to other alternatives. **2/(0.2)**
Consideration of Public Concerns 10%	This criterion will be evaluated after the public comment period	This criterion will be evaluated after the public comment period	This criterion will be evaluated after the public comment period	This criterion will be evaluated after the public comment period

Table 6. Disproportionate Cost Analysis Relative Benefits Ranking Evaluation
Coleman Oil, Yakima, Washington

Evaluation Criteria	Alternative 1: Multiphase Extraction Enhanced Monitored Natural Attenuation	Alternative 2: Surfactant Enhanced Bioremediation	Alternative 3: Surfactant Enhanced Dual Phase Extraction	Alternative 4: Targeted Soil Excavation with PRB and MPE
	DCA Summary			
Estimated Cost[b]	**$2.6M**	**$2.3M**	**$2.5M**	**$8.1M**
Overall Weighted Benefit Score	**4 Fair**	**6.4 Good**	**6.3 Good**	**6 Good**
Overall Alternative Benefit Ranking	4	1 (Most Beneficial)	2	3
Relative Cost/Benefit Ratio	650K	359K	397K	1,350K
Remedy Permanent to the Maximum Extent Practicable?	No	Yes	No	No
Is the Alternative's Cost Disproportionate to its Incremental Benefits?	Yes	No	Yes	Yes

[a] – Ratings used: Poor (1-2), Fair (3-4), Good (5-6), Excellent (7-8), Superior (9-10).
[b] – Estimated Cost = Total Project Present Worth Cost (see Table 5 Comparison of Remedial Action Alternative Costs and Appendix A Remedial Action Alternative Cost Estimates).

Notes:
DCA – disproportionate cost analysis
GW - groundwater
MNA – monitored natural attenuation
MPE – Multiphase extraction
NAPL – non-aqueous phase liquid
O&M – operation and maintenance
PRB – passive reactive barrier

Appendix A
Remedial Action Alternative Cost Estimates

Table A-1. Cost Estimate for Alternative 1 - Multiphase Extraction (MPE) Enhanced Monitored Natural Attenuation (MNA)

Coleman Oil, Yakima, Washington

ITEM	QUANTITY	UNIT	UNIT PRICE	COST
1. CAPITAL COSTS				
1A. Capital Direct Costs				
Install Additional Recovery Wells	2	EA	$ 15,000	$30,000
Soil Performance Monitoring	1	LS	$ 50,000	$50,000
SUBTOTAL DIRECT CAPITAL COSTS				$80,000
Contingency		%	30	$24,000
TOTAL CAPITAL DIRECT COSTS				$104,000
1B. Indirect Capital Costs				
Design/Engineering		LS	1	$20,000
Permitting and Regulatory Compliance		%	40	$41,600
SEPA Checklist		LS	1	$15,000
Ecology Oversight		%	40	$41,600
Construction QA and Management		%	25	$26,000
Combined Sales Tax Rate for Yakima County		%	8.3	$8,632
TOTAL CAPITAL INDIRECT COSTS				$152,800
TOTAL DIRECT AND INDIRECT CAPITAL COSTS				$256,800
TOTAL CAPITAL COSTS				**$257,000**
2. PERIODIC O&M COSTS				
Multiphase Extraction O&M				
Multiphase Extraction Events (monthly)	12	EA	$ 10,000	$120,000
Subtotal				**$120,000**
Contingency		%	25	$30,000
TOTAL O&M COST PER YEAR				**$150,000**
Cost Projection for 15 Years				**$2,250,000**
15-Year Present Worth Periodic Costs*				**$1,930,000**
Semi-Annual Groundwater Monitoring and O&M				
Project Management/Coordination	2	EA	$1,500	$3,000
Sampling Labor, Supplies, and IDW Disposal	2	EA	$2,000	$4,000
Analytical (NWTPH-Dx, NWTPH-Gx, BTEX by 8021, 6 wells)	2	EA	$1,400	$2,800
Annual Reporting	1	YR	$1,500	$1,500
Periodic Maintenance Allowance for Monitoring Wells	1	YR	$2,000	$2,000
Subtotal				**$13,300**
Contingency		%	25	$3,325
TOTAL O&M COST PER YEAR				**$17,000**
Cost Projection for 30 Years				**$510,000**
30-Year Present Worth Periodic Costs*				**$381,000**
TOTAL CAPITAL COSTS				**$257,000**
TOTAL PERIODIC COSTS (30 YEARS)				**$2,760,000**
TOTAL CAPITAL AND PERIODIC COSTS (2023 DOLLARS)				**$3,017,000**
PRESENT WORTH PERIODIC COSTS*				**$2,311,000**
TOTAL PROJECT PRESENT WORTH*				**$2,600,000**

* = Present worth costs were calculated using a 2.0% discount rate for 30 years based on OMB Circular No. A-94, Rev. 3/2023

Notes:

BTEX - benzene, toluene, ethylbenzene, and xylenes

EA - each

LS - lump sum

YR - year

MPE - multiphase extraction

MNA - monitored natural attenuation

O&M - operation and maintenance

QA - quality assurance

Table A-2. Cost Estimate for Alternative 2 - Surfactant Enhanced Bioremediation
Coleman Oil, Yakima, Washington

ITEM	QUANTITY	UNIT	UNIT PRICE	COST
1. CAPITAL COSTS				
1A. Capital Direct Costs (Installed)				
Mobilization/Demobilization	1	LS	$15,000	$15,000
Pilot Test	1	LS	$45,000	$45,000
Passive Flux Meter Deployment and Sampling	10	EA	$3,500	$35,000
Extraction Well Installation (Six 4-inch diameter wells to 35')	1	LS	$60,000	$60,000
Injection Well Installation (Fifteen 2-inch diameter wells to 15')	1	LS	$75,000	$75,000
Install Additional Recovery Well near MW-12	2	EA	$15,000	$30,000
Pumps for Extraction Wells	9	LS	$500	$4,500
Air Stripper	1	LS	$30,000	$30,000
Oil Water Separator	1	LS	$25,000	$25,000
System Pad and Enclosure	1	LS	$90,000	$90,000
Batch Tank for Mixing Pre-injection	1	LS	$15,000	$15,000
Subsurface Plumbing (4" to extraction wells)	300	LF	$70	$21,000
Subsurface Plumbing (2" to injection wells)	685	LF	$50	$34,250
Injection Pump and Manifold System	1	LS	$30,000	$30,000
Soil Performance Monitoring	1	LS	$50,000	$50,000
SUBTOTAL DIRECT CAPITAL COSTS				$544,750
Contingency		%	35	$190,663
TOTAL CAPITAL DIRECT COSTS				$735,400
1B. Indirect Capital Costs				
Design/Engineering		%	20	$147,080
Permitting and Regulatory Compliance		%	8	$58,832
SEPA Checklist		LS	1	$15,000
Ecology Oversight		%	8	$58,832
Construction QA and Management		%	8	$58,832
Monitoring Well and System Decommissioning		%	3.5	$25,739
Combined Sales Tax Rate for Yakima County		%	8.3	$61,038
TOTAL CAPITAL INDIRECT COSTS				$425,353
TOTAL DIRECT AND INDIRECT CAPITAL COSTS				$1,160,753
TOTAL CAPITAL COSTS				**$1,161,000**

2. O&M COSTS				
Semi-annual Groundwater Monitoring (first 3 years)				
Project Management/Coordination	2	EA	$2,000	$4,000
Sampling Labor, Supplies, and IDW Disposal	2	EA	$6,105	$12,210
Analytical (NWTPH-Dx, NWTPH-Gx, BTEX by 8021, 16 wells)	2	EA	$2,935	$5,870
Semi-annual Reporting	2	EA	$2,200	$4,400
Subtotal				**$26,480**
Contingency		%	25	$6,620
Quarterly Groundwater Monitoring (last 2 years / 8 quarters)				
Project Management/Coordination	4	EA	$2,000	$8,000
Sampling Labor, Supplies, and IDW Disposal	4	EA	$6,105	$24,420
Analytical (NWTPH-Dx, NWTPH-Gx, BTEX by 8021, 16 wells)	4	EA	$2,935	$11,740
Quarterly Reporting	4	EA	$2,200	$8,800
Subtotal				**$52,960**
Contingency		%	25	$13,240
O&M				
Multiphase Extraction Events (quarterly)	4	EA	$ 10,000	$40,000
Periodic Maintenance Allowance for Wells	1	YR	$5,000	$5,000
Surfactant Enhancements	1	YR	$20,000	$20,000
Biological Enhancements	1	YR	$30,000	$30,000
O&M Consulting Fees	1	YR	$40,000	$40,000
Subtotal				**$135,000**
Contingency		%	25	$33,750
TOTAL O&M COST PER YEAR (first 3 years)				**$202,000**
TOTAL O&M COST PER YEAR (last 2 years)				**$235,000**
Cost Projection for 5 Years				**$1,076,000**
1-3 Year Present Worth Periodic Costs* (first 3 years)				**$591,000**
4-5 Year Present Worth Periodic Costs* (last 2 years)				**$443,000**
TOTAL CAPITAL COSTS				**$1,161,000**
TOTAL PERIODIC COSTS (5 YEARS)				**$1,076,000**
TOTAL CAPITAL AND PERIODIC COSTS (2023 DOLLARS)				**$2,237,000**
PRESENT WORTH O&M COSTS*				**$1,034,000**
TOTAL PROJECT PRESENT WORTH*				**$2,200,000**

* = Present worth costs were calculated using a 1.3% discount rate for 5 years based on OMB Circular No. A-94, Rev. 3/2023

Notes:

BTEX - benzene, toluene, ethylbenzene, and xylenes

EA - each

GW - groundwater

IC - institutional control

IDW - investigation derived waste (i.e., soil cuttings, purge water)

LF - linear feet

LS - lump sum

MNA - monitored natural attenuation

YR - year

O&M - operation and maintenance

QA - quality assurance

Table A-3. Cost Estimate for Alternative 3 - Surfactant Enhanced Dual Phase Extraction
Coleman Oil, Yakima, Washington

ITEM	QUANTITY	UNIT	UNIT PRICE	COST
1. CAPITAL COSTS				
1A. Capital Direct Costs (Installed)				
Mobilization/Demobilization				
Pilot Test	1	LS	$45,000	$45,000
Passive Flux Meter Deployment and Sampling	10	EA	$3,500	$35,000
Extraction Well Installation (Nine 4-inch diameter wells to 35')	1	LS	$90,000	$90,000
Injection Well Installation (Nine 2-inch diameter wells to 15')	1	LS	$45,000	$45,000
Install Additional Recovery Well near MW-12	2	EA	$15,000	$30,000
Pumps for Extraction Wells	9	LS	$500	$4,500
Air Stripper	1	LS	$30,000	$30,000
Oil Water Separator	1	LS	$25,000	$25,000
System Pad and Enclosure	1	LS	$90,000	$90,000
Batch Tank for Mixing Pre-injection	1	LS	$15,000	$15,000
Regenerative Blower (for vapor extraction)	1	LS	$25,000	$25,000
Subsurface Plumbing (4" to extraction wells)	460	LF	$70	$32,200
Subsurface Plumbing (2" to injection wells)	570	LF	$50	$28,500
Injection Pump and Manifold System	1	LS	$25,000	$25,000
Installation of Granular Activated Carbon Filtration System (for vapor)	1	LS	$10,000	$10,000
Soil Performance Monitoring	1	LS	$50,000	$50,000
SUBTOTAL DIRECT CAPITAL COSTS				$580,200
Contingency		%	35	$203,070
TOTAL CAPITAL DIRECT COSTS				$783,000
1B. Indirect Capital Costs				
Design/Engineering		%	20	$156,600
Permitting and Regulatory Compliance		%	8	$62,640
SEPA Checklist		LS	1	$15,000
Ecology Oversight		%	7	$54,810
Construction QA and Management		%	8	$62,640
Monitoring Well and System Decommissioning		%	3.5	$27,405
Combined Sales Tax Rate for Yakima County		%	8.3	$64,989
TOTAL CAPITAL INDIRECT COSTS				$444,000
TOTAL DIRECT AND INDIRECT CAPITAL COSTS				$1,227,000
TOTAL CAPITAL COSTS				**$1,227,000**

2. O&M COSTS					
Semi-annual Groundwater Monitoring (first 3 years)					
Project Management/Coordination		2	EA	$2,000	$4,000
Sampling Labor, Supplies, and IDW Disposal		2	EA	$6,105	$12,210
Analytical (NWTPH-Dx, NWTPH-Gx, BTEX by 8021; 16 wells)		2	EA	$2,935	$5,870
Semi-annual Reporting		2	EA	$2,200	$4,400
	Subtotal				**$26,480**
Contingency			%	25	$6,620
Quarterly Groundwater Monitoring (last 2 years)					
Project Management/Coordination		4	EA	$2,000	$8,000
Sampling Labor, Supplies, and IDW Disposal		4	EA	$6,105	$24,420
Analytical (NWTPH-Dx, NWTPH-Gx, BTEX by 8021; 16 wells)		4	EA	$2,935	$11,740
Quarterly Reporting		4	EA	$2,200	$8,800
	Subtotal				**$52,960**
Contingency			%	25	$13,240
Multiphase Extraction O&M					
Multiphase Extraction Events (quarterly)		4	EA	$ 10,000	$40,000
Periodic Maintenance Allowance for Wells		1	YR	$5,000	$5,000
Surfactant Enhancements		1	YR	$20,000	$20,000
Granular Activated Carbon Change Outs		1	YR	$60,000	$60,000
O&M Consulting Fees		1	YR	$40,000	$40,000
	Subtotal				**$165,000**
Contingency			%	25	$41,250
TOTAL O&M COST PER YEAR (first 3 years)					**$239,000**
TOTAL O&M COST PER YEAR (last 2 years)					**$272,000**
Cost Projection for 5 Years					**$1,261,000**
1-3 Year Present Worth Periodic Costs* (first 3 years)					**$699,000**
5-Year Present Worth Periodic Costs* (last 2 years)					**$513,000**
TOTAL CAPITAL COSTS					**$1,227,000**
TOTAL O&M/PERIODIC COSTS (5 YEARS)					**$1,261,000**
TOTAL CAPITAL AND PERIODIC COSTS (2023 DOLLARS)					**$2,488,000**
PRESENT WORTH O&M COSTS*					**$1,212,000**
TOTAL PROJECT PRESENT WORTH*					**$2,400,000**

* = Present worth costs were calculated using a 1.3% discount rate for 5 years based on OMB Circular No. A-94, Rev. 3/2023

Notes:

BTEX - benzene, toluene, ethylbenzene, and xylenes
EA - each
GW - groundwater
IC - institutional control
IDW - investigation derived waste (i.e., soil cuttings, purge water)
LF - linear feet
LS - lump sum
MNA - monitored natural attenuation
YR - year
O&M - operation and maintenance
QA - quality assurance

Table A-4. Cost Estimate for Alternative 4 - Targeted Soil Excavation with Passive Reactive Barrier (PRB) and MPE

Coleman Oil, Yakima, Washington

ITEM	QUANTITY	UNIT	UNIT PRICE	COST
1. CAPITAL COSTS				
1A. Capital Direct Costs (Installed)				
Mobilization/Demobilization	1	LS	$20,000	$20,000
Site Prep (Utility Locating, Erosion Control)	1	LS	$15,000	$15,000
Surveying	1	LS	$15,000	$15,000
Building Demolition	1	LS	$100,000	$100,000
Building Replacement / Reconstruction	1	LS	$500,000	$500,000
Excavation of Contaminated Soil	7,000	CY	$100	$700,000
Transportation and Disposal of Excavated Soil	9,450	TON	$250	$2,362,500
Imported Backfill and Compaction	7000	CY	$90	$630,000
Installation of Additional Recovery Wells near MW-12	2	LS	$15,000	$30,000
Passive Reactive Barrier Pilot Test (includes use of Passive Flux Meters)	1	LS	$60,000	$60,000
Installation of Passive Reactive Barrier	1	LS	$400,000	$400,000
Site Restoration/Paving	6000	SF	$15	$90,000
SUBTOTAL DIRECT CAPITAL COSTS				$4,922,500
Contingency		%	30	$1,476,750
TOTAL CAPITAL DIRECT COSTS				**$6,399,000**
1B. Indirect Capital Costs				
Design/Engineering		%	4	$255,960
Waste Characterization and Confirmation Sampling for Excavated Soil	40	EA	$450	$18,000
Permitting and Regulatory Compliance		%	2	$127,980
SEPA Checklist		LS	1	$15,000
Ecology Oversight		%	1.5	$95,985
Construction QA and Management		%	4	$255,960
Combined Sales Tax Rate for Yakima County		%	8.3	$531,117
TOTAL CAPITAL INDIRECT COSTS				**$1,300,000**
TOTAL DIRECT AND INDIRECT CAPITAL COSTS				**$7,699,000**
2. O&M COSTS				
Multiphase Extraction O&M (Quarterly for 5 years)	4	EA	$ 10,000	$40,000
Subtotal				**$40,000**
Contingency		%	25	$10,000
TOTAL PERIODIC COST PER YEAR (2 events per year for 1 year)				**$50,000**
Cost Projection for 5 Years				**$250,000**
5-Year Present Worth Periodic Costs*				**$236,000**
Semi-Annual Groundwater Monitoring and O&M				
Project Management/Coordination	2	EA	$1,500	$3,000
Sampling Labor, Supplies, and IDW Disposal	2	EA	$2,000	$4,000
Analytical (NWTPH-Dx, NWTPH-Gx, BTEX by 8021, 6 wells)	2	EA	$1,400	$2,800
Annual Reporting	1	YR	$1,500	$1,500
Periodic Maintenance Allowance for Monitoring Wells	1	YR	$2,000	$2,000
Subtotal				**$13,300**
Contingency		%	25	$3,325
TOTAL PERIODIC COST PER YEAR (2 events per year for 1 year)				**$17,000**
Cost Projection for 10 Years				**$170,000**
10-Year Present Worth Periodic Costs*				**$157,000**
TOTAL CAPITAL COSTS				**$7,699,000**
TOTAL O&M/PERIODIC COSTS (10 YEARS)				**$420,000**
TOTAL CAPITAL AND PERIODIC COSTS (2023 DOLLARS)				**$8,119,000**
PRESENT WORTH O&M COSTS*				**$390,000**
TOTAL PROJECT PRESENT WORTH*				**$8,100,000**

* = Present worth costs were calculated using a 1.5% discount rate for 10 years based on OMB Circular No. A-94, Rev. 3/2023

Notes:
BTEX - benzene, toluene, ethylbenzene, and xylenes
EA - each
GW - groundwater
IDW - investigation derived waste (i.e., soil cuttings, purge water)
LS - lump sum
SF - square feet
YR - year
O&M - operation and maintenance
PRB - passive reactive barrier
QA - quality assurance