Draft Mitigation Measures Assessment Report

Saddle Rock Natural Area
Phase 2 IRA Construction Project
Wenatchee, Washington

for
City of Wenatchee

September 28, 2020

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Wenatchee, Washington

File No. 4296-008-02

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EXECUTIVE SUMMARY

This Mitigation Measures Assessment Report (Report) describes mitigation measures to address areas of bare soil with elevated arsenic concentrations identified during Phase 2 of the Interim Remedial Action (IRA) at the Saddle Rock Natural Area (Site). The project is located at 1130 Circle Street in Wenatchee, Washington as shown in Vicinity Map, Figure 1.

The Site is subject to the requirements of the Agreed Order (AO) number DE 15823 dated October 25, 2018, and subsequent Amendment No. AO-1 dated April 9, 2020, between the City of Wenatchee (City) and Ecology. Per the AO and subsequent amendment, the City is responsible for implementing the scope of work (SOW) outlined by Ecology in the AO and amendment. The City has accepted the role as the primary party responsible for compliance with the AO and AO-1.

The Site is comprised of eight Areas of Interest (AOIs), identified as SR-01 through SR-08, where waste rock was generated from historical mine prospecting, mining or road development disturbed by naturally mineralized areas. In 2019, GeoEngineers assessed pile-specific background arsenic concentrations, refined extents of waste rock piles, identified downslope areas requiring cleanup, and established a Site-wide cleanup goal of 95 milligrams per kilogram (mg/kg) for total arsenic. GeoEngineers completed Phase 1 construction activities in late October 2019.

Phase 2 IRA activities began in August 2020 with a Bare Soils Assessment of areas with evidence of human influenced bare soils (e.g., existing trails, lookout points, resting points along trails). Results of the assessment identified a mean total arsenic concentration of 103.4 mg/kg, with a range of concentrations from below the limits of detection (LOD) to 2,103 mg/kg. Exclusion of outlier data (the one sample at a concentration of 2,103 mg/kg) indicated the mean total arsenic concentration was 72.7 mg/kg with a range of concentrations from below the LOD to 344 mg/kg. Based on the investigation, GeoEngineers proposed mitigation measures to address elevated arsenic concentrations in bare soils impacted by human activities.

Alternatives analysis was conducted to determine if potential options would meet evaluation criteria and requirements of the AO-11. A preferred alternative was then selected based on an assessment of effectiveness, implementability, responsibility and cost. Options were identified within the general response actions and were either retained or discarded if the options showed poor results against the evaluation criteria or would be unable to attain the goals and objectives of the project. From the available options, three main alternatives were evaluated. A no action alternative is not included in this analysis. Action alternatives for the site are as follows:

1. Alternative 1 – Cover and Revegetate Bare Soil Areas
2. Alternative 2 – Realign and Decommission Trail System to Avoid Bare Soil Areas
3. Alternative 3 – Institutional Controls with Existing Trail Improvements, Existing Trail Covering and Select Trail Decommissioning

From the results of the comparative analysis, Alternative 3 was selected as the preferred mitigation measure. The total estimated cost for the preferred alternative and contingency will be presented in the forthcoming Preliminary Design Report because certain construction elements are still in development (e.g., the design of the Phase 2 haul road).

This Executive Summary should be used only in the context of the full report for which it is intended.

1.0 INTRODUCTION

This Mitigation Measures Assessment Report (Report) describes potential mitigation measures to address areas of bare soil with elevated total arsenic concentrations identified during Phase 2 of the Interim Remedial Action (IRA) at the Saddle Rock Natural Area (Site). The project area is located at 1130 Circle Street in Wenatchee, Washington as shown in Vicinity Map, Figure 1.

The Site is formally identified by the Washington State Department of Ecology (Ecology) as Facility Site ID (FSID) No. 22496 and Cleanup Site ID No. 11610. The Site is subject to the requirements of the Agreed Order (AO) number DE 15823 dated October 25, 2018 (Ecology 2018b) and subsequent Amendment No. AO-11 dated April 9, 2020 (Ecology 2020a) between the City of Wenatchee (City) and Ecology. Per the AO and subsequent amendment, the City is responsible for implementing the scope of work (SOW) outlined by Ecology in the AO and amendment. The City has accepted the role as the primary party responsible for compliance with the AO and AO-1. The City is retaining ownership of the Site before and after the Phase 1 and 2 IRA are conducted. This Report was completed as part of Task 1b of Amendment A-01, which outlines the following objectives:

- **Task 1b – Assessment and Identification of Appropriate Mitigation Measures to Address Contaminated Soil Influenced by Human Activities (Non-Waste Rock Areas).** Task 1b, presented in this Report, assesses potential mitigation measures to address bare soil (impacted by human activities) with elevated arsenic concentrations. These areas were primarily hiking trails but also included the SR-04 waste rock and overburden area where waste rock arsenic concentrations were found to be consistent with surrounding native soil arsenic concentrations. This task included Phase 1 and Phase 2 areas where bare soil was present and arsenic concentrations were greater than the Method A cleanup level of 20 milligrams per kilogram (mg/kg), and in particular where arsenic concentrations were greater than the site-specific background concentration of 95 mg/kg. Elevated arsenic in areas of outcrop or scree were excluded from this investigation because those areas were anticipated to be considered "naturally occurring," if no evidence of human activities was present.

2.0 SITE DESCRIPTION AND BACKGROUND

The Saddle Rock Natural Area is documented with eight areas of interest (AOIs) originally delineated by others (2013a and 2013b) as part of their Remedial Investigation/Feasibility Study (RI/FS). The AOIs were identified as SR-01 through SR-08, where waste rock and overburden was generated from historical mining or road development disturbed by naturally mineralized areas. Since 2011, the Washington State Department of Ecology (Ecology) and others have performed multiple investigations. Additional field investigation and analysis were completed by Ecology after the RI/FS were completed, which are detailed in the Technical Memorandum, "Gold Knob Prospect (aka Saddle Rock Park), Establishing Site Cleanup Levels and Areas," (Ecology 2018a). The additional data collected by Ecology identified data gaps in the RI/FS documents. GeoEngineers was selected by the City in early January 2019 to complete the next phases of work for the Site and developed a Sampling and Analysis Plan (SAP) to be implemented during the subsequent Ecology-requested data gap assessment, waste rock pile delineations, and confirmation soil sampling during the Phase 1 and 2 IRA construction (GeoEngineers 2019a).

In April 2019, GeoEngineers (2019b) conducted a supplemental data gap field sampling event to address data gaps identified in the Ecology (2018a) Technical Memorandum. The supplemental data gap analysis

identified pile-specific background arsenic concentrations, refined later extents of waste rock piles, identified downslope areas requiring cleanup, and established a Site-wide cleanup goal of 95 mg/kg total arsenic. GeoEngineers (2020a) completed Phase 1 construction activities in late autumn 2019.

Phase 2 IRA activities began in August 2020 with the Bare Soils Assessment (GeoEngineers 2020b). For a comprehensive Site description and background, refer to GeoEngineers' Sampling and Analysis Plan (2019a) and Interim Remedial Action Construction Report (2020a).

2.1. Site-specific Cleanup Criteria

GeoEngineers (2019b) performed an additional evaluation of each identified waste rock pile and background arsenic concentrations associated with mapped hydrothermally altered rocks within the Swauk Formation mapped by Gresens (1983) during the April 2019 supplemental data gaps field sampling event. Background soil sample locations were identified upslope from waste rock piles and screened in the field with a handheld x-ray fluorescence (XRF) instrument to assess metals concentrations. A total of 97 XRF background soil samples from SR-01 through SR-05 and SR-08 were screened in the field by GeoEngineers.

XRF analysis of background total arsenic identified a mean concentration of 45.2 mg/kg, and the calculated 90th percentile was 95 mg/kg for total arsenic. Therefore, 95 mg/kg for total arsenic was established as the cleanup goal for the overall Site (Phase 1 and 2), not the original background concentration of 14.4 mg/kg established during the FS in 2013. Based on the heterogeneous formations and elevated total arsenic concentrations at various locations, 95 mg/kg represents a more reasonable cleanup goal, and better characterizes the varied background mineralization at the Site.

3.0 MITIGATION MEASURES OPTIONS

This section describes potential mitigation measures methods and technologies used to develop mitigation measures alternatives. A summary of mitigation measures and technologies is presented in Screening of Mitigation Measures, Table 1.

3.1. Institutional Controls

Institutional controls (ICs) are non-engineered instruments (e.g., administrative and legal controls) that minimize potential for human exposure to contamination and/or protect the integrity of a remedial activity. The following sections describe potential ICs assessed for the Site.

3.1.1. Restrictive Covenant

Restrictive Covenants (RCs) are a type of Proprietary Control intended to limit future land use in order to control future contact with contaminated soils and ensure maintenance of the selected mitigation measures. A RC would be recorded to impose limitations at the Site to restrict activities or future resource use that may result in unacceptable risk to human health or the environment.

It is anticipated that an RC will not be recorded with Ecology after substantial completion of Phase 2 construction activities are completed because the remaining anthropogenically generated waste rock will be removed (at SR-05). Furthermore, as indicated in the Ecology letter dated October 28, 2011, a Site RC will not be required since Recreation and Conservation Office (RCO) funds have ben utilized on this project (Ecology 2011).

3.1.2. Public Education and Signs

Signs warning the public of elevated arsenic concentrations due to natural background conditions, encouraging use of specified rest areas and/or prohibiting use of certain trails could be placed throughout the Site. Locations for sign placement may include at trailheads, former waste rock pile locations, along trails and at rest areas where elevated arsenic concentrations are present.

3.1.3. Benches

The City and Chelan-Douglas Land Trust (Land Trust) have determined four general locations for the placement of benches at the Site. Two benches have been installed at the viewpoint near the top of the mountain. Benches at the remaining two locations are planned to be installed after a new haul road is constructed during the Phase 2 IRA construction activities.

Placing benches at rest areas would reduce direct contact exposure pathways by allowing hikers to sit above bare soil with elevated arsenic concentrations. Alternatively, the benches could be placed in areas with low arsenic concentrations to encourage hikers to rest in those areas and away from elevated arsenic concentrations. The benches would be maintained in the long term with regular operations and maintenance (O&M) as part of the trail system O&M schedule.

3.1.4. Soil Removal Station

A wash or brush station could be positioned at the main trailhead to encourage hikers to remove potentially contaminated soil from their shoes or their animals' paws to reduce the possibility of exposure and transporting contaminated soil offsite. This measure is generally not effective for controlling on-site exposure to contaminated soil, especially towards upper park area (ridgeline of Saddle Rock proper).

As presented in the Technical Memorandum: Phase 2 Saddle Rock Interim Remedial Action, Bare Soils Investigation Summary (GeoEngineers 2020b), concentrations of arsenic decrease to less than 20 mg/kg along the lower half of the trail system (between Phase 1 and 2 areas) down to the main trailhead. The likelihood of left over soil, greater than 20 mg/kg arsenic, on shoes or animal paws is low based on the recent bare soils assessment data collected on the main trail system. Additionally, arsenic contaminated wash water and/or soil would accumulate at the station location, creating a potential hotspot of elevated arsenic concentrations and additional long term disposal considerations for the City. As such, this alternative was not retained for further consideration.

3.2. Trail Modifications

Trail modifications would include realignment and/or decommissioning to preclude access and limit exposure. Planned stormwater and erosion control improvements will also contribute to the long term sustainability and may assist in preventing the migration of elevated arsenic soil across the Site. The following sections provide a brief discussion of these alternatives.

3.2.1. Realignment

Realignment of existing trails at the Site is an option for avoiding naturally occurring elevated arsenic areas. Realignment of these trails could focus towards the upper elevations of the Phase 1 and 2 areas, where the arsenic has been documented to be the highest in concentrations. As part of the Phase 2 IRA construction activities, portions of the existing trail system could also be modified to allow improved access

for excavating equipment and haul trucks to SR-05. This realignment, if selected, will be presented in the preliminary design report, which is a forthcoming report.

Re-alignment of trails is a method for avoiding potentially hazardous areas in other public spaces, including in the U.S. National Forest. Recent communication between Ecology and the Forest Service indicate this alternative has been used on other public areas in Washington state (Ecology 2020b).

3.2.2. Decommissioning

The City and Land Trust are planning to decommission unsustainable trails (i.e. trails that are not part of the official trail system), and the Land Trust has committed (based on communications with the City) to assist in decommissioning these trails by providing volunteer workers to assist with this effort. Under this alternative, direct contact exposure pathways with bare soils containing elevated arsenic concentrations is reduced after trail decommissioning.

3.3. Barrier Installation over Bare Soils

Bare soil areas with elevated arsenic concentrations could be covered and revegetated to create a barrier over contaminated soil, which would control direct contact with potential human and ecological receptors. Fiber rolls, geotextile fabric and imported clean soil/on-Site-sourced soil or wood chips could be placed in areas with elevated arsenic concentrations and hydroseeded to stabilize them over the long term.

A finishing top-coarse crushed gravel layer placed along the new haul road alignment is anticipated as part of Phase 2 construction. This gravel layer would serve as a barrier and would reduce the direct contact exposure pathways in areas where the trail was not realigned from areas with high arsenic concentrations. Regular O&M would likely be needed to maintain the crushed gravel finish layer and correct erosion features that might develop in the long term.

4.0 EVALUATION CRITERIA

This section presents a description of criteria used in this Report to evaluate mitigation measure alternatives.

4.1. MTCA Disproportionate Cost Analysis

The Model Toxics Control Act (MTCA) disproportionate cost analysis (DCA) is used to evaluate which alternatives meet threshold requirements. Since this project does not fully comply with cleanup standards, it is considered an Interim Action. Nonetheless, the evaluation criteria specified in WAC 173-340-360(2) and (3) (protectiveness, permanence, cost, long-term effectiveness, management of short-term risks, implementability and consideration of public concerns) are used in this evaluation to identify a preferred alternative.

As outlined in WAC 173-340-360(3)(e), MTCA provides a methodology that uses the criteria below to determine whether the costs associated with each cleanup alternative are disproportionate relative to the incremental benefit of the alternative above the next lowest-cost alternative. The comparison of benefits relative to costs may be quantitative but will often be qualitative. Costs are disproportionate to benefits if the incremental costs of the more permanent alternative exceed the incremental degree of benefits

achieved by the other lower-cost alternative [WAC 173-340-360(e)(i)]. Where two or more alternatives are equal in benefits, the less costly alternative is selected [WAC 173-340-360(e)(ii)(c)].

Each of the MTCA criteria used in the DCA is described below.

4.1.1. Protectiveness

The overall protectiveness of a cleanup action alternative is evaluated based on several factors. First, the extent to which human health and the environment are protected and the degree to which overall risk at a site is reduced are considered. Both on-site and off-site reduction in risk resulting from implementing the alternative are considered. Protectiveness also gauges the degree to which the cleanup action may perform above the level of the specific standards presented in MTCA. Finally, it is a measure of the improvement of the overall environmental quality at a site.

4.1.2. Permanence

MTCA specifies that when selecting a cleanup action alternative, preference shall be given to actions that are "permanent solutions to the maximum extent practicable." Evaluation criteria include the degree to which the alternative permanently reduces the toxicity, mobility or mass of hazardous substances, including the effectiveness 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 processes, and the characteristics and quantity of treatment residuals generated.

4.1.3. Cost

The analysis of cleanup action alternative costs under MTCA includes all costs associated with implementing an alternative, including design, construction, long-term monitoring and institutional controls. Costs are intended to be comparable among different alternatives to assist in the overall analysis of relative costs and benefits of the alternatives. The costs to implement an alternative include the cost of construction, the net present value of any long-term costs and agency oversight costs. Long-term costs include operation and maintenance costs, monitoring costs, equipment replacement costs and the cost of maintaining institutional controls. Cost estimates for treatment technologies describe pretreatment, analytical, labor and waste management costs. The design life of the cleanup action is estimated, and the costs of replacement or repair of major elements are included in the cost estimate. Costs are compared against benefits to assess cost effectiveness and practicability of the cleanup action alternatives.

4.1.4. Long-Term Effectiveness

Long-term effectiveness is a parameter that expresses the degree of certainty that the alternative will be successful in maintaining compliance with cleanup standards over the long-term performance of the cleanup action. The MTCA regulations contain a specific preference ranking for different types of technologies that is to be considered as part of the comparative analysis. The ranking places the highest preference on technologies such as reuse/recycling, treatment, immobilization/solidification, and disposal in an engineered, lined and monitored facility.

Lower preference rankings are applied for technologies such as on-site isolation/containment with attendant engineered controls, and institutional controls and monitoring. The regulations recognize that, in most cases, the cleanup alternatives will combine multiple technologies to accomplish the Cleanup Action

Objectives (CAOs). The MTCA preference ranking must be considered along with other site-specific factors in the evaluation of long-term effectiveness.

4.1.5. Management of Short-term Risks

Evaluation of this criterion considers the relative magnitude and complexity of actions required to maintain protection of human health and the environment during implementation of the cleanup action. Cleanup actions carry short-term risks, such as potential mobilization of contaminants during construction, or safety risks typical of construction projects. Some short-term risks can be managed through the use of best practices during project design and construction, while other risks are inherent to project alternatives and can offset the long-term benefits of an alternative.

4.1.6. Implementability

Implementability is an overall metric expressing the relative difficulty and uncertainty of implementing the cleanup action. Evaluation of implementability includes consideration of technical factors such as the availability of mature technologies and experienced contractors to accomplish the cleanup work. It also includes administrative factors associated with permitting and completing the cleanup.

4.1.7. Consideration of Public Concerns

The public involvement process under MTCA is used to identify potential public concerns regarding cleanup action alternatives. The extent to which an alternative addresses those concerns is considered as part of the evaluation process. This includes concerns raised by individuals, community groups, local governments, tribes, federal and state agencies, and other organizations that may have an interest in or knowledge of the site.

5.0 PROPOSED MITIGATION MEASURES ALTERNATIVES

In this section, the technologies and options for mitigation measures are used to develop alternatives to address bare soil areas where arsenic concentrations are greater than the MTCA Method A cleanup level of 20 mg/kg, and in particular where arsenic concentrations are greater than the site-specific background concentration of 95 mg/kg. This section also provides a comparative analysis of the developed mitigation measures alternatives.

The mitigation measures alternatives developed in this section are based on conceptual-level design for the implementation of individual technologies. Design parameters used to develop the alternatives are based on engineering judgment, previous experience and current knowledge of Site conditions. The final design for the selected alternative may require additional analysis to better define the scope and costs associated with the interim action and mitigation measures.

The mitigation measures alternatives were developed to be consistent with the current and future land uses at the Site. A brief description of current and future land use is presented in Section 2 of this Report.

The conceptual plans for the alternatives presented below are based on data obtained during Phase 1 of the IRA (GeoEngineers 2020a) and the bare soils field survey completed in August 2020 (GeoEngineers 2020b). Professional judgment was used to interpolate and extrapolate the extent of contamination during development of the areas anticipated to require mitigation measures. This approach was required to

develop plans that meet the goals of the respective alternatives, with an attempt to account for the known extent of contamination and using consistent methodologies between alternatives. Stormwater and erosion control improvements are also planned for each alternative, but will be confirmed and designed in the forthcoming Phase 2 Preliminary Design Report.

Each alternative leaves soil greater than the MTCA Method A cleanup level in place. The waste rock at SR-05 will be removed as part of Phase 2 construction activities. Institutional controls will be required to control future contact with contaminated soil and to ensure maintenance of soil coverings, trails and signs.

5.1. Alternative 1 – Cover and Revegetate Bare Soil Areas

Alternative 1 relies on physical barriers (covering and revegetation) to isolate contaminated soil at the Site from potential receptors, including humans. Specifically, Alternative 1 includes the following components:

- Cover (with a locally sourced Site material with a concentration less than 20 mg/kg arsenic or clean imported fill) and revegetate all bare soil areas at the Site where humans may encounter soils with elevated arsenic concentrations. This would include viewpoints, rest areas and "illegal" trails, as well as portions of the main trail system.
- Implement O&M procedures (to be determined in future design phases) to ensure revegetated areas remain intact.

Covering and revegetation of areas of bare soil is expected to be accomplished using commonly available techniques. The Interim Removal Action Final Design Report specifies methods for hydroseeding at the Site and the appropriate seed mix (GeoEngineers 2019c) that can be used to cover and revegetate bare soils areas.

The existing main trail (a four wheel drive-type road) to SR-05 may be covered with a top-course gravel. This provides a protective barrier to exposure to bare soil by placing gravel over the road/trail surface. The new gravel layer would be maintained as part of the trail system.

5.2. Alternative 2 – Realign and Decommission Trail System to Avoid Bare Soil Areas

Alternative 2 relies on isolating contaminated soils at the Site from human receptors by controlling access to select areas with elevated concentrations of total arsenic and provide a safe haul road for Phase 2 construction work activities. Specifically, Alternative 2 includes the following components:

- Realign select portions of the existing trail system (currently a four wheel drive-type road) at the Site to provide a lower steepness grade haul road for Phase 2 construction work and avoid, to the extent possible, bare soils areas where arsenic concentrations are greater than 95 mg/kg. This includes a significant area in the western portion of the Site, and a relatively small area in the eastern portion of the Site (Arsenic Iso-contours, Figure 2).
- Decommission select side trails throughout the Site, which may include regrading, revegetating and/or blocking portions of the main trail system to restrict access to these areas.
- Implement O&M procedures (to be determined in future design phases) to ensure trail decommissioning and realignment is intact.

Trail (the main existing four wheel drive road) realignment is expected to be accomplished using commonly available construction techniques. The specific construction methods would be specified during the design of the mitigation measures or by the City selected contractor.

Decommissioning of select side trails (primarily single track trails, emanating off the main existing four wheel drive trail in various places) at the Site will be accomplished by the City and Land Trust using commonly available restoration and construction techniques. A wood fencing barrier is typically used by the Land Trust in nearby other trail systems in the Wenatchee Valley; however, enforcement of the decommissioned trails may be difficult in the long term, as the single track trails often represent a preferred path for some hikers (short cuts).

5.3. Alternative 3 – Institutional Controls with Existing Trail Improvements, Existing Trail Covering and Select Trail Decommissioning

Alternative 3 combines some methods used in Alternatives 1 and 2 to isolate areas with elevated concentrations of total arsenic in soil at the Site from potential receptors including humans. Specifically, Alternative 3 includes the following components:

- Improve the existing main trail system during Phase 2 IRA construction activities by re-grading the current main trail surface, adding a suitable gravel base in select areas (primarily in steep grade areas) and install stormwater/erosion control improvements. The existing main trail system improvements would be accomplished to create a safer driving surface for equipment moving up and down the Site during Phase 2 construction. Other portions of the existing main trail in the Phase 2 area would be widened and improved for construction equipment access.
- Cover the entire Phase 1 and 2 main trail system (formerly used as the haul road during construction work) with a top coarse crushed gravel. The gravel would be placed after Phase 2 construction activities are substantially complete.
- Decommission select side trails throughout the Site as discussed in Section 5.2. These trails are primarily side trails emanating off the main trail.
- Install benches at rest areas away from areas with arsenic concentrations greater than 95 mg/kg.
- Install signs encouraging hikers to stay on established trails and away from revegetated areas.
- Implement O&M procedures (to be determined in future design phases) to maintain benches, signage, revegetated areas and trail modifications.

Areas with naturally-occurring elevated concentrations of total arsenic above the background concentration of 95 mg/kg will be left in place at the Site. The placement and design of signs to prohibit hikers from venturing from established trails would be determined (with the assistance of the Land Trust and Ecology) following final design alignment of the trail system. Installation of new benches at rest areas, to the extent practicable, away from areas with arsenic concentrations greater than 95 mg/kg would also be implemented. Two benches have been installed at the Site ridgetop, near the highest observed background arsenic concentrations, which assists in reducing potential exposure to humans.

As described above, a finishing top course gravel (installed post Phase 2 construction) along the entire Phase 1 and 2 main trail system would create a physical barrier to soils in exceedance of 20 mg/kg.

Therefore, keeping the public on the main trail via signage and education would limit or reduce the possibility of getting contaminated soil on shoes or animal paws.

5.4. Evaluation and Comparison of Alternatives

This section provides an evaluation and comparative analysis of the mitigation measures alternatives developed for the Site. The alternatives are evaluated with respect to the MTCA evaluation criteria described in Section 4.1, and then compared to each other relative to their expected performance under each criterion. The components of the three alternatives are described above in Sections 5.1 through 5.3 and are summarized and evaluated in Evaluation of Alternatives, Table 2. The results of the evaluation are summarized in Preferred Alternative Decision Matrix Summary, Table 3.

5.4.1. MTCA Disproportionate Cost Analysis

As discussed in Section 4.2, the MTCA DCA is used to determine which cleanup alternative is permanent to the maximum extent practicable. The evaluation of the level of achievement for each individual criterion, using a numeric scorings scale of 1 (lowest) to 5 (highest) is presented in Table 2 and 3, and discussed below.

5.4.1.1. *Protectiveness*

Alternative 3 achieves a high level of protectiveness as a result of a combination of methods to control contact pathways between contaminated soil and potential receptors. Alternative 1 achieves a moderate level of protectiveness because it creates a barrier between contaminated soil and potential receptors but does not restrict access to those receptors. Alternative 2 achieves a lower level of protectiveness because, although it restricts access to contaminated soil and receptors, it does not provide a barrier to reduce contact if the access restrictions fail.

5.4.1.2. *Permanence*

Each alternative has a moderate level of permanence since soils with total arsenic concentrations above 95 mg/kg are retained and they rely on varying concentrations of O&M.

5.4.1.3. *Long-term Effectiveness*

All alternatives include potential exposure to contaminated soil over the long-term. However, Alternatives 1 and 3 achieve the highest level for long-term effectiveness because they create a barrier between contaminated soil and potential receptors and restrict access to areas with elevated total arsenic concentrations. Alternative 2 provides a lower level of long-term effectiveness because enforcement of the decommissioned trails may be difficult in the long term, as these trails often represent a preferred path for some hikers (short cuts). Alternative 1 provides a moderate level of long-term effectiveness, as areas with high foot traffic and areas with steep slopes may be susceptible to increased erosion or deterioration of the cover and vegetation.

5.4.1.4. *Management of Short-term Risks*

Alternative 1 includes minimal exposure to areas with elevated arsenic concentrations and generally involves importing cover material. Alternatives 2 and 3 involve higher exposure because they require more involved earthwork and construction activities to re-establish trails and the haul road.

5.4.1.5. *Technical and Administrative Implementability*

Each alternative provides a similarly high level of technical and administrative feasibility. Regardless of the alternative selected, the Site will need similar access and require coordination with the City and Ecology.

5.4.1.6. *Cost*

For each alternative, probable remedy costs (+50/-30 percent) will be developed using a combination of published engineering reference manuals (i.e., RS Means, Heavy Construction Cost Data Manual), construction cost estimates solicited from applicable vendors and contractors, review of actual costs incurred during similar, applicable projects and professional judgment.

Under Alternative 3, the City and Land Trust would plan for the development, installation and maintenance of institutional controls. The City also plans to convert the Phase 2 haul road to a permanent trail and maintenance of the trail will be performed by the Land Trust.

Under Alternative 2, the cost for the initial trail realignment will be included in the Phase 2 construction costs. The City plans to complete trail restorations in cooperation with the Land Trust, closures and O&M tasks.

Under Alternative 1, the cost to cover and revegetate a significant area is high (depending on the material source location) compared to other measures; however, select areas could be covered and revegetated during Phase 2 IRA activities to moderate the cost.

5.4.2. Reasonable Restoration Timeframe

Alternative 2 provides the shortest restoration timeframe since it only involves trail decommissioning and realignment. Alternatives 1 and 3 incorporate revegetation, which will necessitate at least one growing season to implement.

5.4.3. Consideration of Public Concerns

Alternative 3 is expected to have the highest level of public acceptance because it achieves the greatest level of compromise, protection and certainty. All alternatives would likely be somewhat disruptive, but Alternatives 1 and 2 are considered the most disruptive to hikers.

5.5. Selection of a Preferred Alternative

Selection of a preferred alternative under MTCA requires that a preference be given to alternatives that use permanent solutions to the maximum extent practicable, provide for a reasonable restoration time frame and consider public concerns. The analysis below compares the baseline alternative (the alternative that provides the greatest degree of permanence) to the other alternatives based on degree of permanence, reasonable restoration time frame and public concerns. According to MTCA (WAC 173-340-200), a permanent solution or permanent cleanup action means a cleanup action in which cleanup standards can be met without further action being required at the Site other than the approved disposal of any residue resulting from the cleanup action.

5.5.1. Preferred Mitigation Measures Alternative

Alternative 3 is the preferred Mitigation Measures. Alternative 3 utilizes barriers, existing trail improvements/covering/decommissioning and institutional controls as evaluated and shown on Table 3.

6.0 LIMITATIONS

This report has been prepared for the exclusive use of the City of Wenatchee, their authorized agents and regulatory agencies in their evaluation of the Site. No other party may rely on this product of our services unless we agree in advance and in writing to such reliance.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted environmental science practices in this area at the time this report was prepared. No warranty or other conditions, express or implied, should be understood.

7.0 REFERENCES

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Table 1

Screening of Mitigation Measures

Phase 2 Saddle Rock Interim Remedial Action Project

Wenatchee, Washington

Action/ Technology	Process Option	Description	Effectiveness	Implementability	Responsibility	Relative Cost	Summary of Screening
Institutional Controls	Restrictive Covenant	Implement restrictive covenant to limit future use of Site.	Effectiveness for protection of human health would depend on enforcement of and compliance with restrictive covenant.	Technically implementable. Specific legal requirements and authority would need to be met.	City of Wenatchee	Low capital.	Not applicable given expected final Site conditions after Phase 2 IRA activities. Not retained.
	Public Education and Signs	Install and maintain educational and/or instructional signs to inform the public of elevated arsenic in native soils and methods to avoid/reduce exposure.	Generally not effective unless in combination with other measures.	Technically implementable. Locations and language of the signs would be determined after Phase 2 IRA construction activities.	City of Wenatchee/Land Trust	Negligible capital. Low O&M.	Potentially applicable in combination with other measures. Retained.
	Benches	Install and maintain benches to encourage hikers to rest in areas with lower levels of arsenic, thereby reducing or eliminating exposure to bare soils with elevated arsenic in rest areas. Two benches have already been installed at the park ridgetop.	Effective for preventing direct contact exposure.	Technically implementable. The City and Land Trust have determined general areas for placement of benches. Installation of Benches can commence after Phase 2 IRA activities are complete and the final alignment of the haul road is determined.	City of Wenatchee/Land Trust	Negligible capital. Low O&M.	Potentially applicable in combination with other measures. Retained.
	Soil Removal Stations	Install foot wash and/or brush stations at trailheads to encourage hikers to clean boots, animal paws etc. to avoid transporting contaminated soil offsite.	Generally not effective for reducing exposure on Site.	Technically implementable. Water sources are already in place and brush stations could be added at trailheads. Note: Water not available in winter	City of Wenatchee/Land Trust	low capital, moderate to high O&M.	Not applicable due to lack of effectiveness for reducing exposure while onsite. Not retained.
Trail Modifications	Realignment	Modify existing trails so that they no longer pass through areas with elevated arsenic concentrations, thereby reducing potential exposure of the general public to areas with elevated arsenic.	Effective for eliminating direct contact exposure routes. Potential for the public to re-establish routes and create shortcuts through elevated arsenic areas.	Technically implementable. A portion of the trail system will be modified to a haul road during Phase 2 IRA activities and will be converted to a permanent trail and access road at the conclusion of Phase 2 IRA.	Ecology for initial realignment/haul road, City/Land Trust for permanent road and trail maintenance	Very high capital. Low O&M.	Potentially. Retained.
	Decommissioning	Decommission select side trails to restore native conditions for the area. Selected trails would be blocked, revegetated, recontoured and/or covered.	Effective for reducing exposure risk provided restoration is maintained in the long term. Potential for the public to re-establish routes and create shortcuts through elevated arsenic areas.	Technically implementable. The City and Land Trust have expressed interest in closing select trails to protect the native conditions of the Site.	City of Wenatchee/Land Trust	Negligible capital if abandonment is assumed by the Land Trust. Low O&M.	Potentially applicable in combination with other measures. Retained.
Barrier over Bare Soils	Covering and Revegetation	Install and maintain fiber rolls, geotextile fabric, imported or onsite clean soil or wood chips in combination with revegetation methods such as hydroseeding to create a barrier between contaminated soil and the public.	Effective for preventing direct contact exposure (i.e., dermal contact or ingestion) provided coverings are maintained in the long term.	Technically implementable. Coverings may be difficult to maintain especially in areas with steep grade.	City of Wenatchee	High capital, moderate to High O&M.	Potentially applicable in combination with other measures. Retained.
	Covering Haul Road/Main Trail	Cover newly graded and/or realigned haul road to SR-05 with gravel to limit exposure to bare soils.	Effective for preventing direct contact exposure (i.e., dermal contact or ingestion) provided road is maintained in the long term.	Technically implementable. Coverings may be difficult to maintain especially in areas with steep grade.	Ecology for initial realignment/haul road, City of Wenatchee/Land Trust for permanent road and trail maintenance	High capital, moderate to High O&M.	Potentially applicable in combination with other measures. Retained.

Notes:

O&M = Operation and Maintenance

Table 2

Evaluation of Alternatives

Phase 2 Saddle Rock Interim Remedial Action Project

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	Alternative 1 - Cover and Revegetate Bare Soil Areas	Alternative 2 - Realign and Abandon Trail System to Avoid Bare Soil Areas	Alternative 3 - Institutional Controls with Select Trail Realignment, Select Trail Covering and Trail Abandonment
Alternative Description			
Soil	• Cover (with a locally sourced Site material with a concentration less than 20 mg/kg arsenic or clean imported fill) and revegetate all bare soils areas (trails, rest areas, view points, side trails) with elevated arsenic concentrations • Implement future O&M procedures to ensure areas remain intact	• Realign trails to avoid areas with high arsenic concentrations • Abandon select side trails • Implement future O&M procedures to ensure areas remain intact	• Cover the entire Phase 1 and 2 main trail with gravel, after Phase 2 substantial construction is complete, to limit exposure • Close select side trails • Install benches at rest areas away from or over areas with elevated arsenic concentrations • Install signs encouraging public to remain on main trail • Implement future O&M procedures to ensure areas remain intact
Cost	To be presented in the Preliminary Design Report	To be presented in the Preliminary Design Report	To be presented in the Preliminary Design Report
Timeframe	Can be implemented in one field season	Can be implemented in one field season	Can be implemented in one field season
Alternative Ranking Under MTCA			
1. Compliance with MTCA Threshold Criteria			
Protection of Human Health and the Environment	Partial - Alternative provides moderate protection of human health through capping. Relies on O&M.	Partial - Alternative provides moderate protection of human health through trail realignment and abandonment. Relies on compliance.	Yes - Alternative would protect human health through a combination of trail capping, realignment/decommissioning, and institutional controls. Relies on O&M and compliance.
Compliance With Cleanup Standards	No - Alternative would not comply with cleanup standards because total arsenic would remain at concentrations greater than cleanup levels. If a conditional point of compliance was used, the cleanup standards could be met with Alternative 1.	No - Alternative would not comply with cleanup standards because total arsenic would remain at concentrations greater than cleanup levels. If a conditional point of compliance was used, the cleanup standards could be met with Alternative 2.	No - Alternative would not comply with cleanup standards because total arsenic would remain at concentrations greater than cleanup levels. If a conditional point of compliance was used, the cleanup standards could be met with Alternative 3.
Compliance With Applicable State and Federal Regulations	Yes - Alternative complies with applicable state and federal regulations.	Yes - Alternative complies with applicable state and federal regulations.	Yes - Alternative complies with applicable state and federal regulations.
Provision for Compliance Monitoring	Yes - Alternative includes provisions for compliance monitoring.	Yes - Alternative includes provisions for compliance monitoring.	Yes - Alternative includes provisions for compliance monitoring.
2. Restoration Timeframe			
	Restoration timeframe is moderate. Revegetation will necessitate one growing season under this alternative. Because naturally-occurring contamination in soil is not being removed as part of this alternative, it would be present indefinitely.	Restoration timeframe is relatively short. No revegetation is needed. Because naturally-occurring contamination in soil is not being removed as part of this alternative, it would be present indefinitely.	Restoration timeframe is moderate. Revegetation will necessitate one growing season under this alternative. Because naturally-occurring contamination in soil is not being removed as part of this alternative, it would be present indefinitely.

	Alternative 1 - Cover and Revegetate Bare Soil Areas	Alternative 2 - Realign and Abandon Trail System to Avoid Bare Soil Areas	Alternative 3 - Institutional Controls with Select Trail Realignment, Select Trail Covering and Trail Abandonment
3. Disproportionate Cost Analysis Relative Benefits Ranking (Scored from 1-lowest to 5-highest)			
Protectiveness	Score = 4 Achieves a moderate level of overall protectiveness as a result of barrier over arsenic that pose risks to human health and the environment at the Site.	Score = 3 Achieves a moderate level of overall protectiveness as a result of limiting access to areas with arsenic that pose risks to human health and the environment at the Site.	Score = 5 Achieves a moderate level of overall protectiveness as a result covering and/or restricting access to areas with arsenic that pose risks to human health and the environment at the Site.
Permanence	Score = 3 Achieves a moderate level of permanence since soils with total arsenic concentrations above 95 mg/kg are retained and they rely on varying levels of O&M.	Score = 3 Achieves a moderate level of permanence since soils with total arsenic concentrations above 95 mg/kg are retained and they rely on varying levels of O&M.	Score = 3 Achieves a moderate level of permanence since soils with total arsenic concentrations above 95 mg/kg are retained and they rely on varying levels of O&M.
Long-Term Effectiveness	Score = 3 Involves creating a barrier between arsenic that pose risks to human health and the environment, but does not prevent access to those areas.	Score = 1 Involves trail construction and abandonment to limit access to areas with arsenic that pose risks to human health and the environment. However, hikers may ignore signs or return to using abandoned trails without other controls preventing them from doing so.	Score = 4 Involves combination of methods to reduce risk of exposure to arsenic that pose risks to human health and the environment.
Management of Short-Term Risks	Score = 4 Minimal short-term risk associated with covering and revegetating bare soils areas.	Score = 2 Involves trail construction and abandonment with higher short-term risks due to construction and earthwork.	Score = 3 Involves combination of methods to reduce risk of exposure with moderate level of earthwork needed.
Technical and Administrative Implementability	Score = 4 Involves moderate technological and administration considerations.	Score = 4 Involves moderate technological and administration considerations.	Score = 4 Involves moderate technological and administration considerations.
Consideration of Public Concerns	Score = 3 Does not remove arsenic that pose risks to human health and the environment at the Site but reduces contact pathways between arsenic and receptors. Does not restrict access to areas with high arsenic concentrations.	Score = 2 Does not remove arsenic that pose risks to human health and the environment at the Site but restricts access to areas with arsenic that pose risks to human health and the environment. Does not provide barrier between arsenic and receptors.	Score = 5 Does not remove arsenic that pose risks to human health and the environment at the Site but reduces contact pathways between arsenic and receptors and provides highest level of protection.
Total	21	15	24

Notes:

NA = Not applicable

CSZ = Contaminated Soil Zone

COC = Chemicals of Concern

Table 3

Preferred Alternative Decision Matrix Summary

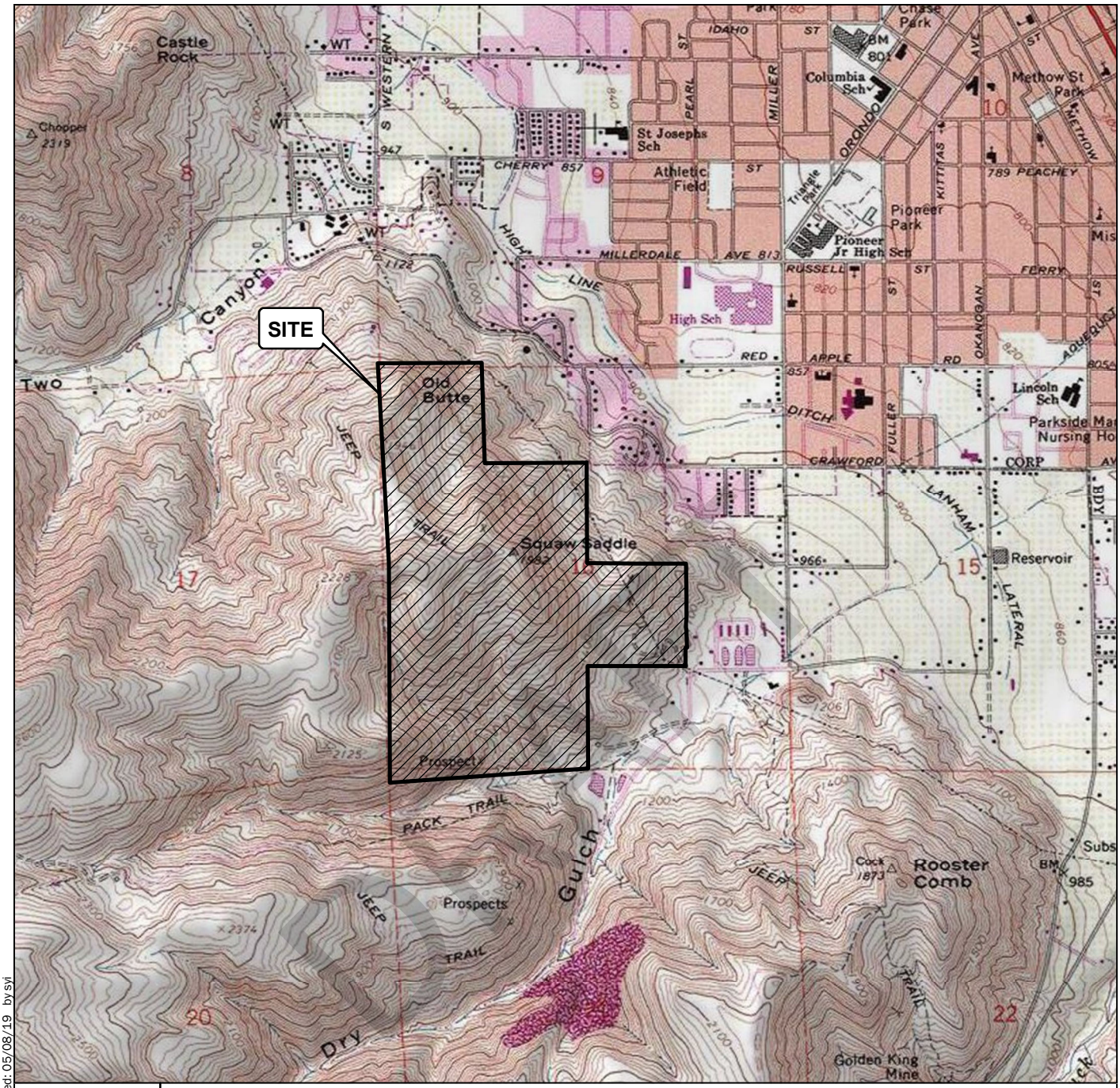
Phase 2 Saddle Rock Interim Remedial Action Project

Wenatchee, Washington

Alternative Number	Alternative 1	Alternative 2	Alternative 3
Alternative Ranking Under MTCA			
1. Compliance with MTCA Threshold Criteria	2nd	3rd	1st
2. Restoration Timeframe	2nd (tied)	1st	2nd (tied)
3. DCA Relative Benefits Ranking	2nd	3rd	1st
Protectiveness	4	3	5
Permanence	3	3	3
Long-Term Effectiveness	3	1	4
Management of Short-Term Risks	4	2	3
Technical and Administrative Implementability	4	4	4
Consideration of Public Concerns	3	2	5
Total of Scores	**21**	**15**	**24**
4. Disproportionate Cost Analysis (DCA)			
Probable Remedy Cost	High	High	Moderate
Costs Disproportionate to Incremental Benefits	Yes	Yes	No
Practicability of Remedy	Practicable	Practicable	Practicable
Remedy Permanent to Maximum Extent Practicable	Yes	Yes	Yes
Overall Alternative Ranking	**2nd**	**3rd**	**1st**

Notes:

MTCA = Model Toxics Control Act



N
W E
S

2,000 0 2,000

Feet

Vicinity Map

Saddle Rock Interim Remedial Action Project
Wenatchee, Washington

GeoEngineers

Figure 1

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Mapbox Open Street Map, 2016

Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

P:\4\4296008\GIS\MXD\429600800_T200_F01_Vicinity Map.mxd Date Exported: 05/08/19 by syi

P:\4\429600B\GIS\MXD\429600B00_FOX_Arsenic_ISOContour.mxd Date Exported: 08/12/20 by ccabrera

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
3. Mean total arsenic concentrations at waste rock piles from confirmation XRF samples during Phase I IRA activities

Data Source: ESRI World Imagery.

Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Legend

- XRF Number, (Arsenic Concentration in mg/kg) and Approximate Location
- Waste Rock Pile Number, (Mean Arsenic Concentration in mg/kg) and Approximate Location
- MTCA Method A Clean Up Level (<20 mg/kg)
- Site Specific Background Concentration (<95 mg/kg)

N W E S

275 0 275

Feet

Total Arsenic Concentrations with Isometric Contours

Saddle Rock Interim Remedial Action Project
Wenatchee, Washington

GeoEngineers

Figure 2