

**Richardson Flat Tailings OU2/3 Assessment Site  
Park City, Summit County, Utah  
Final  
Engineering Evaluation/Cost Analysis**

**TD# 2142-2103-06, DTN# 0266b**



**April 17, 2026**



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Engineering Evaluation/Cost Analysis**

**Superfund Technical Assessment and Response Team V**

**April 17, 2026**

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## CONTENTS

Executive Summary .....	6
Project Background.....	6
Proposed Removal Action and Alternatives .....	7
Alternative Comparison .....	8
Proposed Alternative.....	9
1. Introduction and Site Characterization .....	10
1.1. Project Background.....	10
1.2. Site Background.....	11
1.2.1. Site Location and Description.....	11
1.2.2. Features and Landscape .....	12
1.2.3. Geology and Hydrogeology .....	12
1.2.4. Regional Hydrology.....	13
1.2.5. Land Use and Populations .....	14
1.2.6. Sensitive Ecosystems and Habitat .....	14
1.2.7. Meteorology and Climate .....	15
1.3. Previous Reclamation and Removal Actions.....	15
1.3.1. Previous Site Investigations.....	16
1.4. Source, Nature, and Extent of Contamination .....	17
1.4.1. Regional Background.....	17
1.4.2. Potential Site Contaminants.....	17
1.4.3. Source and Nature of Contamination.....	17
1.5. Streamlined Floodplain and Upland Risk Evaluations .....	19
1.5.1. Purpose.....	20
1.5.2. Exposure Units.....	20
1.5.3. Human Health Risk Assessment.....	22
2. Removal Action Objectives, Scope, and Schedule.....	30
2.1. Removal Action Objectives .....	30
2.2. Statutory Limits on Removal Actions.....	30
2.3. Removal Scope .....	30
2.4. Removal Schedule .....	31
3. Identification and Screening of Removal Action Technologies .....	32
3.1. Development and Screening of Technologies .....	32
3.1.1. Summary of Technology Identification and Screening .....	34
3.1.2. Summary of Alternative Development .....	36
3.1.3. Applicable or Relevant and Appropriate Requirements .....	39
3.2. Description of Alternatives .....	40
3.2.1. Common Elements.....	40
3.2.2. Description of Removal Action Alternatives.....	45



3.3. Detailed Analysis of Alternatives .....	49
3.3.1. Effectiveness Criterion.....	49
3.3.2. Implementability Criterion.....	50
3.3.3. Cost Criterion.....	50
3.3.4. Cost Estimating Process.....	51
3.3.5. Alternative 1: No Action.....	51
3.3.6. Alternative 2: Targeted Physical Removal of Tailings – Five Scenarios .....	52
3.3.7. Alternative 3: <i>In Situ</i> Tailings Nutrient Amendment and Revegetation.....	58
3.3.8. Alternative 4: Removal of Tailings to Pre-Mining Contours and Revegetation ....	62
3.3.9. Alternative 5: Placement of a Topsoil Cover Over Tailings.....	65
4. Comparative Analysis of Alternatives .....	69
4.1. Comparative Analysis Approach .....	69
4.2. Summary of Analysis.....	69
4.2.1. Effectiveness .....	70
4.2.2. Implementability .....	74
4.2.3. Projected Costs.....	75
5. Recommended Removal Action Alternative .....	77
6. References.....	78



**EXHIBITS**

Exhibit 1. Summary of Alternative Ratings..... 8

Exhibit 2. Summary of Conceptual Site Model ..... 18

Exhibit 3. Distinct Tailings Areas and Estimated Associated Tailings Volumes..... 19

Exhibit 4. General Response Actions ..... 32

Exhibit 5. Alternative 2, Scenario A Cost Breakdown Estimate Summary..... 54

Exhibit 6. Alternative 2, Scenario B Cost Breakdown Summary..... 55

Exhibit 7. Alternative 2, Scenario C Cost Breakdown Summary..... 56

Exhibit 8. Alternative 2, Scenario D Cost Breakdown ..... 57

Exhibit 9. Alternative 2, Scenario E Cost Breakdown..... 58

Exhibit 10. Alternative 3 Cost Breakdown ..... 61

Exhibit 11. Alternative 4 Costs Breakdown Estimate Summary ..... 64

Exhibit 12. Alternative 5 Cost Breakdown ..... 67

Exhibit 13. Summary of Alternative Ratings..... 69

Exhibit 14. Construction Completion Time for Alternatives..... 73



## **FIGURES**

- Figure 1. Site Location Map
- Figure 2. OU2/3 Site Map with Operable Unit Boundaries Map
- Figure 3. Site Features Map
- Figure 4. Surface Water Pathways Map
- Figure 5. Test Pit Locations Map

## **TABLES**

- Table 1. Applicable or Relevant and Appropriate Requirements and To Be Considered Criteria for the Richardson Flat OU2/3 Tailings Site

## **APPENDICES**

- Appendix A. Test Pit Photolog
- Appendix B. Cost Estimate Assumptions for Targeted Physical Removal of Tailings, Scenarios A through E
- Appendix C. Cost Estimate Assumptions And Cost Estimate For In Situ Tailings Nutrient Amendment And Revegetation
- Appendix D. Cost Estimate Assumptions And Cost Estimate For Removal Of Tailings To Pre-Mining Contours And Revegetation Through Modification Of Surface Water Flows
- Appendix E. Appendix E. Cost Estimate Assumptions And Cost Estimate For Placement Of Topsoil Cover



## ACRONYMS AND ABBREVIATIONS

3DVA	Three-dimensional data visualization and analysis
µg/L	Microgram per liter
ARAR	Applicable or relevant and appropriate requirement
bgs	Below ground surface
BLM	Bureau of Land Management
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	<i>Code of Federal Regulations</i>
COPC	Contaminants of potential concern
COPEC	Contaminants of potential ecological concern
EE/CA	Engineering evaluation and cost analysis
EPC	Exposure point concentration
ERE	Ecological risk evaluation
EU	Exposure unit
HHRE	Human health risk evaluation
HQ	Hazard quotient
HI	Hazard index
IC	Institutional control
kg/day	Kilogram per day
LOAEL	Lowest observed adverse effect level
NOAEL	No observed adverse effect level
MCL	Maximum contaminant level
mm	Millimeter
NCP	National Oil and Hazardous Substances Contingency Plan
OSWER	Office of Solid Waste and Emergency Response
OU	Operable unit
RAO	Removal action objective
RME	Reasonable maximum exposure
RML	Removal Management Level
SRB	Sulfate-reducing bioreactor
SRC	SRC, Inc.
SLHHRE	Streamlined Human Health Risk Evaluation
SLERE	Streamlined Ecological Risk Evaluation
SU	Standard unit
TBC	To be considered
Tetra Tech	Tetra Tech, Inc.
TRV	Toxicity Reference Value
UDEQ	Utah Department of Environmental Quality
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
Weston	Weston Solutions, Inc.



## EXECUTIVE SUMMARY

This report summarizes the engineering evaluation and cost analysis (EE/CA) for a portion of the Richardson Flat Tailings Site—specifically, a portion of Operable Unit 2 (OU2) and Operable Unit 3 (OU3). These two operable units are intermingled and throughout this document will often be described as OU2/3. The site area includes a 6-mile segment of Silver Creek, and an associated alluvial plain, where mill tailings from local mining activities were deposited during an approximately 140-year period. The purpose of the EE/CA is to assess options to address human and ecological health risks at the site resulting from these mining activities in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

## PROJECT BACKGROUND

The site lies within the Wasatch Mountains between Park City and Interstate 80 in Summit County, Utah. Mining operations in the area produced substantial quantities of sulfide and carbonate ores that primarily produced silver between 1875 and 1982. Silver Creek is the dominant surface water drainage from Park City; it received tailings from several mills along its flow path. Prior investigative activities along Silver Creek revealed tailings inundating an area up to 1,500 feet wide, up to an estimated 5 feet deep, and approximately 6 miles long.

To assess human health and ecological risks from the historical mining operations, OU2/3 were the subject of streamlined risk evaluations (SLREs) for the upland and the floodplain areas. These SLREs included an ecological risk evaluation and a streamlined human health risk evaluation (SRC 2022, 2023). Results from these studies indicate that unacceptable risks are present at the site for human and ecological receptors. Based on the results, the current recommendation is to remove human health contaminants of potential concern (COPCs) and contaminants of potential ecological concern (COEPCs) at the site. Removal actions are focused on a collection of endeavors that include removing tailings as a source of contamination, stabilizing other tailings deposits, redistributing surface water within the alluvial plain, and promoting passive bioremediation applications. This action is intended to be an initial action that will preserve funds to allow for a second phase of cleanup and time to evaluate the removal action described in this document. Specifically, the actions intend to accomplish three removal action objectives (RAO):

- Prevent soil and water exposure to mining COPCs that would pose an unacceptable risk to human health from the perspective of reasonably anticipated future land use
- Minimize soil and water exposure to mining COEPCs that would pose an unacceptable risk to plants, animals, aquatic species, and other ecological receptors
- Reduce the off-site migration of mining COPCs and COEPCs that would pose an unacceptable risk to human or ecological health via soil, surface water, groundwater, or air

Ecological risks were assessed based on the known ecosystems for the region. As a result, the proposed removal action is subject to comparison to alternative approaches. The final proposed action will be based on effectiveness, implementability, and cost criteria.



## PROPOSED REMOVAL ACTION AND ALTERNATIVES

The current recommendation to accomplish the RAOs is to remove the surface and subsurface contaminated tailings rather than treat the soil and water; however, contaminated water still enters OU2/3 via Operable Unit 4, the perennial outflow from Prospector Square (Tetra Tech 2023). This metals-laden water will continue to influence the site area following a tailings removal. EPA and Park City are addressing the outfall from OU4 under a separate EE/CA and Action Memorandum. This EE/CA, specific to OU2/3, evaluated five alternatives:

- **Alternative 1: No Action.** Under Alternative 1, no treatment, containment, or removal action would occur at the site, and all threats would remain unchanged. Mining waste and contaminated soils would continue to threaten human and ecological receptors.
- **Alternative 2: Targeted Physical Removal of Tailings.** Alternative 2 considers targeted tailings removal at the site under five possible scenarios. All scenarios conclude with depositing the tailings in the operable unit 1 (OU1) repository located adjacent to the site between Highway 248 and Highway 40 at 40.678354 latitude and -111.452524 longitude. The reaches described below are depicted on Figure 3.
  - *Scenario A:* The entire site area (Reaches 2–6)
  - *Scenario B:* Three net acid generating tailings areas—Big Four Tailings, Upper Meadow Tailings at River Bend, and Floodplain Tailings (Areas 1–3 within Reaches 2, 3, and 6)
  - *Scenario C:* South of the Big Four Mill (Reaches 2–5) and the net acid generating tailings area at Big Four Tailings (Area 3 within Reach 6)
  - *Scenario D:* Three net acid generating tailings areas—Big Four Tailings, Upper Meadow Tailings at River Bend, and Floodplain Tailings (Areas 1–3 within Reaches 2, 3, and 6)—as well as elevated lead-containing tailings downstream of Prospector Square within Reach 1 (at locations to be determined)
  - *Scenario E:* The region extending from the Floodplain Tailings to the Upper Meadow Tailings (Reaches 2, 3, and 4) as well as tailings spots in Reach 1 below Prospector Square (at locations to be determined)
- **Alternative 3: *In Situ* Tailings Nutrient Amendment and Revegetation.** Alternative 3 intends to amend tailings *in situ* by using a nutrient blend and adding a seed mixture to promote plant growth and stabilize the substrate.
- **Alternative 4: Revegetation via Modification of Surface Water Distribution within Silver Creek Valley.** Alternative 4 promotes vegetative recovery by redistributing surface water via channel reorientations (braiding, meandering, or ponding) to make water more available within the valley.
- **Alternative 5: Placement of a Topsoil Cover Over Tailings.** Alternative 5 transports topsoil to the site and places it as a 6-inch lift over the tailings to act as a barrier to direct contact with the contamination.



## ALTERNATIVE COMPARISON

Removal action alternatives were evaluated individually and in relation to each other according to effectiveness, implementability, and cost. Exhibit 1 presents an overview of the comparative analysis results:

**Exhibit 1. Summary of Alternative Ratings**

Alternative	Attainment of Threshold Criteria	Effectiveness	Implementability	Cost Rating (\$ Million)
Alternative 1: No Action	Fail	Short Term: <b>Very Good</b> Long Term: Very Poor	Technical: <b>Very Good</b> Administrative: <b>Very Good</b>	<b>Very Good</b> (\$0)
Alternative 2: Targeted Physical Removal of Tailings, single area to full site area	Pass	Short Term: Poor Long Term: <b>Very Good</b>	Technical: Good Administrative: Good	Good to Poor (\$7.3–77.7)
Alternative 3: In Situ Tailings Nutrient Amendment and Seeding, dependent on neutralization needs	Pass	Short Term: Average Long Term: Average	Technical: Good Administrative: Good	Good (\$4.8–5.4)
Alternative 4: Revegetation through Modification of Surface Water Distribution	Pass	Short Term: Poor Long Term: Poor	Technical: Average Administrative: Poor	Good (\$6.1)
Alternative 5: Placement of topsoil on top of tailings material in Reaches 6 and 7 (49 percent of site tailings area)	Pass	Short Term: Good Long Term: Average	Technical: Good Administrative: Good	Average (\$11.9)

**Notes:**

1. A rating in **bold** is the highest rating in its category.
2. Threshold criteria are (a) overall protectiveness, and (b) compliance with applicable or relevant and appropriate requirements.
3. Estimated costs are net present value including construction contingencies, project management, annual operation and maintenance based on 30 years, and 5-year reviews.



## PROPOSED ALTERNATIVE

The implementation of removal actions at the site is informed by available funding. The complete removal and disposal of tailings is estimated to cost \$69M in capital costs which exceeds available funds. Contaminants exist through all stretches of the OU2/3 Silver Creek boundary, and metals loading increases nearly linearly throughout the stretch, with an upward inflection at the Big 4 tailings area. This indicates that source removal across any portion of the stretch would benefit ecological receptors, onsite workers, and future potential recreators. The volume of tailings in the Big 4 tailings area encompasses nearly half of the total estimated volume of tailings within OU2/3. Meanwhile the Big 4 tailings area only comprises roughly a quarter of the acreage within OU2/3. The removal of source material is intended to be iterative, meaning that if additional funding becomes available, EPA will re-visit removing additional source material. During this initial removal action, a concurrent investigation will occur in the Silver Maple Claim. A portion of the available funds will be held back to investigate a secondary, smaller removal action that will complement the proposed alternative in this EE/CA.

The proposed alternative is the removal of tailings from Reaches 1 through 4 as budget allows, in combination with revegetation across the entire OU2/3 Silver Creek stretch. These reaches are depicted in Figure 3. This portion of the site area is also the most-traveled portion of the site for recreation. This recommendation is cost effective: tailings in this region are present at a shallow depth, so a larger area per cost can be removed.

The proposed alternative described above is a combination of Alternative 2, specifically Scenario E, and Alternative 3. Per this approach, all tailing influences would be removed along the popular recreational trail (Rail Trail) from Prospector Square to the Upper Meadows area. Within the floodplain, tailings would be removed from approximately 3.3 consecutive miles of the 6-mile site length, and 81 acres of the 313 total acres of tailings coverage would be addressed.

This removal action is part of an iterative process, and future removal work may be conducted at the site as resources allow. EPA is still performing characterization activities within Silver Creek in order to assess the best allocation of remaining resources within the Richardson Flat Site.



## 1. INTRODUCTION AND SITE CHARACTERIZATION

This report summarizes the engineering evaluation and cost analysis (EE/CA) for a portion of the Richardson Flat Tailings Site (Figure 1) specifically, Operable Unit 2 (OU2) and Operable Unit 3 (OU3) (Figure 2). The site area includes a 6-mile segment of Silver Creek, and an associated alluvial plain, where mill tailings from local mining activities were deposited during an approximately 140-year period. The purpose of the EE/CA is to assess options to address human and ecological health risks at the site resulting from these mining activities in accordance with CERCLA.

### 1.1. PROJECT BACKGROUND

The site lies within the Wasatch Mountains between Park City and Interstate 80 (I-80) in Summit County, Utah. Mining operations in the area produced substantial quantities of sulfide and carbonate ores that primarily produced silver between 1875 and 1982 (Weston Solutions, Inc. [Weston] 2018). Silver Creek is the dominant surface water drainage from Park City; it received tailings from several mills along its flow path. Prior investigative activities along Silver Creek revealed tailings inundating an area up to 1,500 feet wide, up to an estimated 5 feet deep, and approximately 6 miles long.

To assess health and ecological risks from the historical mining operations, OU2/3 were subject to a streamlined risk evaluations (SLRE) by SRC, Inc. (SRC) that included an ecological risk evaluation (ERE) and a streamlined human health risk evaluation (HHRE) for both the upland and floodplain portions of the site (USEPA 2022, 2023). Results from these studies indicate that unacceptable risks are present at the site for human and ecological receptors. Based on the results, the current recommendation is to remove human health contaminants of concern (COPC) and contaminants of ecological concern (COPEC) at the site. Removal actions are focused on removing tailings as a source of contamination, stabilizing other tailings deposits, redistributing surface water within the alluvial plain, and covering the tailings material, and promoting passive bioremediation applications. Specifically, the actions intend to accomplish three removal action objectives (RAO):

- Prevent soil and water exposure to mining contaminants that would pose an unacceptable risk to human health from the perspective of reasonably anticipated future land use
- Minimize soil and water exposure to mining contaminants that would pose an unacceptable risk to plants, animals, and other ecological receptors
- Reduce the off-site migration of mining contaminants that would pose an unacceptable risk to human or ecological health via soil, surface water, groundwater, or air

EPA assessed ecological risks based on the known ecosystems for the region. As a result, the proposed removal action is subject to comparison to alternative approaches. The final proposed action is based on the effectiveness, implementability, and cost criteria.



## 1.2. SITE BACKGROUND

Within the Park City Mining District, 12 historical mills consolidated milling activity; they were above the site area, and their remnants are still present. An additional mill, the Big Four Mill (Figure 3), once reprocessed tailings that had accumulated within the site area.

Beginning in 1875, mine tailings were deposited into Silver Creek for transport to two natural low-elevation repositories: Prospector Square above the outfall of the Prospector Drain, which is Operable Unit 4 (OU4) and Richardson Flat in Operable Unit 1 (OU1). Each repository was investigated as a separate entity and is excluded from the EE/CA. Tailings carried downstream within Silver Creek were deposited along the 6-mile flow path from Prospector Square to the intersection of present day I-80, inundating an area on site of up to approximately 1,500 feet wide and as deep as 5 feet. The hydraulic gradient of Silver Creek increases at its downgradient intersection with I-80, where the channel is constricted within a narrow canyon.

The region is currently undergoing significant residential and light industry development. The Town of Park City, Utah, is immediately upstream of the OU2/3 site area; it is expanding toward the Richardson Flat Site.

### 1.2.1. Site Location and Description

The site is in the Wasatch Mountains between Park City, Utah, and I-80 in Summit County, Utah (Figure 1). Specifically, the site is within Township 1 South, Range 4 East, in Sections 10, 11, 14, 15, 22, 23, 26, 27, and 35; it is also within Sections 2 and 3 of Township 2 South, Range 4 East. The site is bisected by Silver Creek, which has headwaters above the Town of Park City and is the primary drainage of the Weber River Basin at 6,575 feet above mean sea level. The area is along an approximately 6-mile segment of Silver Creek, beginning at Prospector Square in Park City. Silver Creek exits eastward from Prospector Square in Park City, transecting south of and parallel to State Highway 248. The creek then turns northward at its intersection with U.S. Highway 40 and parallels the east side of the highway until it intersects I-80.

The site includes approximately 2,300 acres containing tailings from historic mining operations, contaminated water, and contaminated sediment within the Silver Creek flow path. The OU1 tailings impoundment is adjacent to Silver Creek at the site area (Figure 3). The site also includes a floodplain, a riparian habitat, and upland areas adjacent to Silver Creek. Lastly, the Rail Trail (a former Union Pacific railroad bed) runs along the eastern edge of the site and Silver Creek. It begins at Prospector Square in Park City.

For the purposes of this report, the OU2 boundary areas extend approximately 4.5 miles along Silver Creek, beginning near Highway 248 on the southern end and extending to I-80 on the northern end. It ranges in width from 2,100 feet at the southern boundary to 3,800 feet near Pivotal Promontory Road. OU3 includes the Silver Creek floodplain, beginning at Prospector Square. The OU3 creek then passes through the Floodplain Tailing Area—southwest of OU1—and incorporates the Upper Meadow Tailings Area to the north of OU1. Finally, OU3 also includes portions of the site north of Promontory Ranch Road and south of Silver Gate Drive.



Site investigations were not defined or limited by OU2/3 boundaries; instead, other nomenclature distinguished between various working areas within the site. These are “reach” and “area” boundaries:

- Reach 1: From Prospector Drain to Richardson Flat Road (Silver Maple Claims Area)
- Reach 2: From Richardson Flat Road to Highway 248 (Floodplain Tailing Area – Area 1)
- Reach 3: From Highway 248 downstream 2,000 feet to the Geneva Rock cement plant (Upper Meadow and River Bend Tailing Areas – Area 2)
- Reach 4: From the Geneva Rock facility 6,000 feet downstream to the Upper Meadow Tailings Area
- Reach 5: From the Upper Meadows Tailings Area 8,000 feet downstream to Promontory Ranch Road
- Reach 6: From Promontory Ranch Road 4,500 feet downstream to Silver Gate Road (Big Four Tailings Area – Area 3)
- Reach 7: From Silver Gate Road 7,000 feet downstream to I-80 (Big Four Tailings Area)

### 1.2.2. Features and Landscape

The site area that includes the alluvial plain in which Silver Creek resides is relatively flat with gently sloping sides. It ranges in width from approximately 240 to 1,200 feet and has a hydraulic gradient of approximately 0.8 percent (43 feet per mile). Silver Creek varies from 3 to 15 feet in width and flows primarily northward. It is fed by various springs, treated effluent water, and mine tunnel drainage in addition to meteoric precipitation. Portions of the site were flood-irrigated when agricultural considerations were present; there appears to be limited irrigation today. Several irrigation ditches have been constructed in the basin and are presented in Figure 4. The area surrounding the site is arid and dominated by sage brush.

The predominant Silver Creek sediment load during the prior century consisted of mill tailings. This resulted in a swath of metal-laden, sand-size tailings along a 6-mile creek segment that has been observed to contribute contamination to valley waters. The mill tailings are in wide, flat deposition areas. Tailings were once collected into berms and hummocks, where the material was gathered for reprocessing at the Big Four Mill.

A relatively healthy wetland with several beaver ponds, as well as some tailings, dominates the most upgradient stream mile at the site. The remaining 5 miles are dominated by mine tailings, including focused stream-deposited areas, and hummocks and berms of historical tailings that were gathered for reprocessing. There is vegetation within the tailings, although it is sparse in some areas. There are no historical mine relics at the site except for a historical railroad track that was converted to a biking and hiking trail for local recreation.

### 1.2.3. Geology and Hydrogeology

Regional bedrock morphology underlying the Silver Creek valley and surrounding area includes folding and faulting in the forms of anticlines, synclines, and faults. The fracturing and faulting of the bedrock lithology creates a secondary porosity that transmits groundwater in an unknown

manner at the site. This porosity could contribute water to the Silver Creek valley via vertical releases in the form of previously observed subsurface flow and surface springs. These waters possess geochemical signatures based upon the source rock from which they were derived; they may exert an influence upon water acidity, as with limestone-derived water.

The site area is directly underlain by Quaternary and Holocene age (geologically recent) unconsolidated materials, including alluvium, colluvium, and tailings that readily transmit groundwater. These sediments lie atop Keetley volcanic rocks that include fractured andesitic breccias that can yield large volumes of water. The water contacts underlying water-bearing bedrock formations (Tetra Tech 2023).

Underlying bedrock formations at the site area include the Woodside shale, which is considered a confining unit in contact with Keetley volcanics. The Park City limestone also underlies the Keetley volcanics in portions of the site area and may contribute subregional groundwater to the site with an upward groundwater gradient. Additionally, the Park City Formation is an important host rock for the ore bodies of the upland mining district, after which it was named. Another underlying formation is the Park City shale, which is considered a confining unit that underlies the Keetley volcanics at the site area. Lastly, the Weber quartzite underlies the Keetley volcanics near the site area and is a significant subregional aquifer with both fracture and matrix flow (Tetra Tech 2023). Ore bodies were once mined from this quartzite.

Based on these conditions, the Keetley volcanics unit at the site area is recharged by lateral flow from uplands around the site area and by vertical flow from the Park City limestone and Weber quartzite units. The Keetley volcanics unit discharges laterally into the subregional flow system and vertically into the overlying unconsolidated materials—namely, the Silver Creek alluvium, colluvium, and tailings (Tetra Tech 2023).

#### **1.2.4. Regional Hydrology**

Silver Creek drains an area of approximately 26 square miles. It includes Ontario and Empire Canyons as well as Deer Valley. Other basin water is removed (1) for municipal water supplies, (2) via extraction through wells and diversions, (3) via evapotranspiration, and (4) as additions to subsurface aquifer supplies.

Silver Creek obtains its natural base flow from springs in Park Meadows, which is southeast of Quarry Mountain and north of Prospector Square (where Dority Spring is a major contributor) (U.S. Geological Survey (USGS) 1986). The creek also obtains its flow from other observed springs and an unmeasured amount of vertical flow contribution to the Silver Creek alluvial aquifer from underlying bedrock aquifers. Additionally, the creek receives lateral and vertical flow contributions from the Keetley volcanics unit that overlies much of the site area as well as infiltration from precipitation (USGS 1986).

Investigations in 2017 confirmed several springs that contribute surface water to the site area, including Dority Spring via the Pace-Homer Spring Ditch, the OU1 Spring Ditch, the Pace Spring Ditch, Homer Spring, the Northwest Springs Ditch, and the Dairy Springs Area. Additional unidentified springs are present in or near the site area based on mapping observations (Weston 2018).



The Silver Creek basin and associated groundwater system is predominantly recharged at high elevations through meteoric input, primarily snowmelt, which is initially stored within anisotropic, fractured bedrock aquifers. Water percolates to lower elevations through fractures, joints, and faults until it intersects a preferential flow path such as a mine tunnel, high porosity unconsolidated materials (that is, Silver Creek alluvial aquifer), or stream channel. As hydraulic head increases, subsurface and surface flow increase, as affected by seasonal fluctuations and annual variations. The portion of Silver Creek that incorporates the assessment area is a basal portion of the creek as it moves across low-lying terrain. Because of the gently sloping flow path, creek velocity is slowed, and the sediment load in suspension is deposited onto the relatively flat floodplain. This typically results in natural meandering and braided channeling of creeks and rivers and distributes water widely across low-angled floodplains; however, natural meanders are lacking at the site because of tailings deposition and manufactured alterations. Finally, there are several irrigation ditch transects, some unrecognizable today, throughout the creek valley that were placed by landowners during the prior century to irrigate the area for farming and ranching.

### **1.2.5. Land Use and Populations**

The site comprises wetland and upland habitats and plant communities. Currently, there are no residential properties within the site boundary, although homes are currently under construction adjacent to it. The upland portion of the site is used by recreational visitors. Workers have been observed to intermittently enter the floodplain and upland portions of the site. Off-road biking trails, the historical Rail Trail, boardwalks in wetland areas, and paved bike trails are present at the site, with the trails seeing use year-round.

### **1.2.6. Sensitive Ecosystems and Habitat**

The streamlined floodplain risk evaluation noted three general habitat types within the site: aquatic (instream), riparian, and wetlands (USEPA 2023). The “Silver Maple Wetlands” encompasses the area at the upstream end of the site, beginning at Prospector Drain (immediately below OU4) and extending downstream to the Silver Maple Claims. It contains ponds connected by stretches of braided channel flowing through densely vegetated wetlands. These ponded emergent wetland conditions have been created and maintained by beaver activity. Downstream of this point, where the creek flows under State Highway 248 and turns to the north, the stream corridor widens, but the stream becomes more entrenched. The stream is bordered in this area by a narrow floodplain containing a mixture of riparian vegetation, upland vegetation, and wet meadow. There are several tailings areas in the floodplain (“Floodplain Tailings”) on both sides of the creek through this stretch.

Opposite the OU1 tailing repository, the stream widens again into another wetland area that is also created and maintained by beaver activity. A wetland supplied by water from a remediated (clean) diversion ditch surrounding OU1 (the “Embankment Wetland”) is immediately south of Silver Creek in this area, separated from the creek by the berm of the Rail Trail. Water from the Embankment Wetland merges with Silver Creek just upstream of the point where the creek is crossed by Highway 248, and the combined flow goes through a culvert under the road. Downstream of the Highway 248 crossing, Silver Creek enters an area that is characterized by a broad, wet meadow with multiple branching stream channels. This basic habitat type extends downstream to the bottom of OU2/3, where the stream is crossed by I-80. Vegetation within the



floodplain in this area is dominated by dense growths of Baltic rush (*Juncus arcticus*, also known as wiregrass), with other herbaceous species making up less than 5 percent of total vegetative cover. Numerous piles and deposits of bare tailings are scattered across the floodplain through this reach. Tailings deposited throughout OU2/3 include grey piles, reportedly sourced from carbonate rocks, and areas and piles that are stained red, presumably caused by the presence of acid-forming minerals in the tailings.

The aquatic and riparian habitats of the site are presumed to be used by a variety of aquatic ecological receptors (such as aquatic plants, benthic invertebrates, and fish) as well as aquatic-dependent terrestrial receptors that use these habitats for foraging or other activities (namely, herbivorous, insectivorous, and piscivorous birds, mammals, and amphibians). The riparian and wetland habitats at the site are presumed to be used by a variety of terrestrial and riparian receptors, including plants, soil invertebrates, herptiles, and terrestrial and riparian birds and mammals that use the area for foraging and other activities. Aquatic organisms (including plants, benthic invertebrates, and fish), amphibians, and aquatic-feeding birds and mammals are present within the in-stream aquatic habitat areas.

### **1.2.7. Meteorology and Climate**

The site's long-term meteorological observations have not been recorded. The two nearest meteorological data stations are in Park City, Utah (500 feet higher in elevation and 2 miles to the southwest in the Wasatch Mountains), and Kamas, Utah (at a similar elevation to the site and 9 miles to the east). Annual precipitation for the site likely falls between the values recorded at these two meteorological stations. Annual precipitation at Park City is 31 inches of water with an average annual low temperature of 26.8°F and an average annual high temperature of 57.3°F. Annual precipitation at Kamas is 17.21 inches of water per year with an average annual low temperature of 29.8°F and an average annual high temperature of 60.5°F (U.S. Climate Data 2024). Much of the annual precipitation in the Park City area is deposited as snowpack that begins melting in early March and extends into late May, based on elevation.

Similarly, the site's long-term wind data have not been recorded. The prevailing wind direction is from the northwest to the southeast, as concluded during an air monitoring assessment conducted at OU1 in 1986 (United Park City Mines Company 2016). Prevailing wind direction may be useful during monitoring of particulates that may blow off site during removal activities.

## **1.3. PREVIOUS RECLAMATION AND REMOVAL ACTIONS**

Extensive reclamation and removal actions have not been performed at the OU2/3 site area aside from minimal boardwalk installations and asphalt placement onto bike trails near Highway 248, performed by Basin Recreation, Park City. In 2019 and 2021, EPA entered settlements with certain landowners to characterize and address discreet portions of certain parcels within the site. Rail Trail maintenance and vegetation removal from Silver Creek along the Rail Trail is performed by Park City. The Big Four Mill, which operated from 1915 to 1918, re-processed tailings derived from the upper reaches of the OU2/3 site area, including from the Upper Meadow Tailings Area based on observation of remnant tailings berms and hummocks left behind after gathering operations. The mill was reportedly the third largest mill in Utah in 1916



and had the capacity to process 1,800 tons of tailings per day (UDEQ 2002). The mill moved tailings from the Upper Meadow Tailings Area to the Big Four Tailings Area after processing.

### 1.3.1. Previous Site Investigations

Site investigative activities have been on-going for many years by several entities. The list below includes recent reporting that is relevant to OU2/3.

- Argonne National Laboratory. 2004. “QuickSite Investigation for the Upper Silver Creek Watershed.”
- Syracuse Research Corporation. 2003. “Baseline Human Health Risk Assessment for Recreational Visitors at Richardson Flat Tailings.” March.
- Tetra Tech, Inc. 2008a. “Draft Lower Silver Creek Wetland Delineation Report.” March 18.
- Tetra Tech, Inc. 2008b. “Draft Lower Silver Creek Data Summary Report.” March 31.
- Tetra Tech, Inc. 2008c. “Reactive Transport Modeling Under High Flow Conditions for Cd, Zn” March.
- Tetra Tech, Inc. 2017. “Silver Creek OU2/3 Tailing Volume Assessment.” April 24.
- Tetra Tech, Inc. 2023. “Revised Summary Characterization of Silver Creek Surface Water for Richardson Float OU2/3 Assessment Site.” May 31.
- Tetra Tech, Inc. 2024. “Priority Tailings Areas Test Pit Analysis, Richardson Flat OU2/3 Assessment Site.” March 19.
- United Park City Mines Company. 2004. “Volume I Focused Remedial Investigation Report for Richardson Flat Tailings Site.” September 2.
- United Park City Mines Company. 2016. “Engineering Evaluation/Cost Analysis OU2/3, Richardson Flat Tailings Site – Draft Site Characterization.” August 10.
- U.S. Environmental Protection Agency. 2020. “Screening-Level Ecological Risk Assessment for OU2/3, Richardson Flat Site, Summit County, Utah.” October.
- USEPA 2022. Streamlined Upland Risk Evaluation for Operable Units 2 & 3 of the Richardson Flat Site Located in Summit County, Utah. September 2022.
- USEPA 2023. Streamlined Floodplain Risk Evaluation for Operable Units 2 & 3 of the Richardson Flat Site Located in Summit County, Utah. July 2023.
- U.S. Geological Survey. 2007. Scientific Investigations Report 2007-5248. “Principal Locations of Metal Loading from Floodplain Tailings, Lower Silver Creek, Utah, April 2004.”
- U.S. Geological Survey. 2004. Water Resources Investigations Report 03-4296. “Quantification of Metal Loading to Silver Creek Through the Silver Maple Claims Area, Park City, Utah, May 2002.”

- Weston Solutions, Inc. 2020. “Sampling Activities Report for Richardson Flat OU2/3 Upland Soils and Groundwater.” May 29.
- Weston Solutions, Inc. 2018a. “Field Activities Report for Richardson Flat OU2/3 Assessment – Background Soils.” April 13.
- Weston Solutions, Inc. 2018b. “Summary Characterization of Silver Creek Surface Water for Richardson Flat OU2/3 Assessment.” April 27.

## 1.4. SOURCE, NATURE, AND EXTENT OF CONTAMINATION

The source, nature, and extent of waste materials at the Richardson Flat OU2/3 site area were characterized during several investigations at the 2,300-acre site area and included surface water, groundwater, soils, and tailings (Weston 2020, Tetra Tech 2008, Tetra Tech 2023). Recent analytical data are used to assess the contamination within the subsections below.

### 1.4.1. Regional Background

The tailings that were deposited into the Silver Creek flow path and floodplain have accumulated during the past approximately 140 years within the 2,300-acre site area, with the heaviest accumulations occurring within the floodplain. The tailings range in size from clay to coarse-grained sand, and appear to be a predominantly fine-grained, well-sorted sand-sized material based on geologic observations during recent site investigations. The tailings consist of sulfide-bearing, acid-producing quartzite, and carbonaceous acid-neutralizing limestone, dependent on which ore body was mined. Therefore, there are tailings areas on site that are net acid-generating and areas that are net acid-neutralizing. Acid that is generated by the tailings, and which interacts with metals inherent in the site materials, releases heavy metals into the hydrologic regime. Limited plant growth occurs on site indicating the tailings are inhospitable and devoid of nutrients. The tailings are susceptible to wind and water erosion.

### 1.4.2. Potential Site Contaminants

Heavy metals contamination occurs at the site area within waters and tailings. Metals that are considered to possess the most influential effects at the site include arsenic, cadmium, lead, and zinc. They are observed in tailings as high as 2,100, 598, 75,000, and 107,000 milligrams per kilogram (mg/kg) (10.7 percent), respectively (Tetra Tech 2008, 2024). The mean lead concentration for undisturbed soils at the site area is 65.76 ppm (SRC 2023).

Surface water and groundwater possess neutral pH values (groundwater pH averages 7.2 standard units [SU], surface water ranges between 7 and 8 SU) and appear to reflect the neutralizing influence that calcium carbonate-based (limestone) tailings exert on the waters after commingling while flowing through the site. Arsenic, cadmium, lead, and zinc are observed within waters at the site in amounts of 650, 1,900, 1,300, and 18,000 micrograms per liter ( $\mu\text{g/L}$ ), respectively (Tetra Tech 2023).

### 1.4.3. Source and Nature of Contamination

Prior data have shown that historical mining activities have impacted floodplain deposits, surface water, and groundwater in the study area with concentrations of heavy metals. Appreciable

metals contamination within non-tailings soils in areas topographically above the Silver Creek floodplain have not been observed (Tetra Tech 2023).

A summary of the conceptual site model is provided below to illustrate potential media of concern, exposure pathways, and receptors. Photos of in-place sediment profiles obtained during test pit installations are included in Appendix A. They illustrate the contrast of tailings, historical wetland material, and underlying gravels. For reference, Figure 5 includes the physical location of test pits.

**Exhibit 2. Summary of Conceptual Site Model**

Source and Release Mechanisms	Exposure Media	Exposure Routes	Potential Receptors
Mill tailings were washed downstream within Silver Creek and subsequently settled onto the flat-lying floodplain. Tailings are observed to leach into the waters on site.	Waste Material and Creek Bank	Dermal contact, ingestion, and inhalation.	Future residents, recreationists, workers, and trespassers may be exposed or might come into contact with surface materials. Mammals, birds, amphibians and terrestrial plants may also come in contact with or uptake surface material.
	Surface Water and Sediment	Dermal contact and ingestion.	Future residents, recreationalists, mammals, birds, and aquatic life (macroinvertebrates, amphibians, fish, ) may be exposed.
	Groundwater	Dermal contact in areas where shallow groundwater mixes with surface water.	Future residents, recreationalists, mammals, birds, and aquatic life (fish, amphibians, macroinvertebrates) may be exposed.

Analytical results of field collected samples show that tailings possess the potential to leach arsenic, cadmium, lead, and zinc at amounts of 43, 160, 2,900, and 31,000 µg/L, respectively.

The pH of Silver Creek remained within a neutral range of approximately 7 to 8 within the upgradient half of the site area, although an obvious decrease of approximately 1 SU in base pH values is evident beginning in the Lower Meadow tailings and continuing for 2.5 miles through the Big Four tailings.

Analysis of dissolved metals loading to Silver Creek reveals that the arsenic load increases approximately 4-fold across the length of the site area from 0.02 to 0.07 kilogram per day (kg/day); cadmium increases 9-fold from 0.01 to 0.09 kg/day; lead increases 95-fold from 0.002 to 0.19 kg/day; and zinc increases 15-fold from 1.66 to 24.6 kg/day (Tetra Tech 2023).

The potential for the tailings to also produce acid conditions was analyzed. While most of the tailings on-site exhibit neutral pH overall, there are significant differences in their ability to generate acid conditions via natural chemical processes. Three areas of tailings deposition were observed to be net acid-generating, including the Big Four Tailings Area, Floodplain Tailings Area, and the Upper Meadow – River Bend Tailings Area north of the Floodplain Tailings Area (Areas 1, 2, and 3 in Figure 3). The acid generation potential for tailings is 6.5 times greater than

for non-tailings. Likewise, the acid neutralizing potential of non-tailings is significantly greater than for tailings (Tetra Tech 2008, 2024).

A three-dimensional data visualization and analysis (3DVA) effort was performed for the site area using field test pit observations and associated analytical data collected during 2007 and 2022 field investigations (Tetra Tech 2024). The results of the 3DVA effort illustrate mine tailings thickness at the site, including the approximately 5-foot-thick deposit in the northern portion of the site (Big Four Tailings Area, Reaches 6 and 7), and the consistently thinner tailings thickness ranging up to 1.5 feet thick within the rest of the site area (Reaches 1, 2, 3, 4, and 5). Tailings volume calculations were also performed via 3DVA. Distinct tailings areas and estimated associated tailings volumes are included in Exhibit 3.

**Exhibit 3. Distinct Tailings Areas and Estimated Associated Tailings Volumes**

Name of Tailings Area	Location Within Designated Site Reach Area	Volume (cubic yards)
Area 1 (Floodplain)	Reach 2	14,685
Area 2 (Upper Meadow – River Bend)	Reach 3	29,392
Area 3 (Big Four)	Reach 6	35,696
Area 4 (Big Four)	Reach 6	18,860
Area 5 (Upper Meadow)	Reach 4	77,353
Area downstream of Big Four Mill	Minor Reach 5, All of Reach 6, 7	637,672
Area upstream of Big Four Mill	Major of Reach 5, All of Reach 2, 3, 4	507,818
<b>Total Tailings Volume</b>		<b>1,321,476</b>

**Notes:**

Area refers to specific tailings deposits.

Reach refers to specific land intervals along the length of the site.

The grain size distribution of tailings was analyzed in four locations. Results indicated 52 to 76 percent of aggregate orange-, brown-, and grey-colored tailings were observed to be greater than 0.074 millimeters (mm) in diameter. A total of 73 percent of (only) grey tailings (limestone-derived ore material) was observed to be greater than 0.25 mm in diameter. This distinct difference in size is likely related to the type of mined rock material: sulfide-bearing quartzite versus carbonate limestone (Tetra Tech 2024). Color and size distinctions of tailings are included for completeness only, and to assist in on-site identification of tailings.

## 1.5. STREAMLINED FLOODPLAIN AND UPLAND RISK EVALUATIONS

The SLREs for OU2/3 incorporates extensive laboratory sampling data derived from multiple previous site investigations conducted between 2002 and 2021 (USEPA 2022, 2023). All analytical data have been uploaded into a site-specific U.S. Environmental Protection Agency



(USEPA) Scribe database. Data considered in the SLREs were downloaded from the Richardson Flat Tailings Scribe database on April 23, 2023.

### **1.5.1. Purpose**

The purpose of the SLREs were to characterize potential risks to humans and the environment, both now and in the future, from site-related contaminants that are present in floodplain soil, sediment, and surface water, assuming that no steps are taken to remediate the environment or to reduce exposures to contaminated environmental media. A floodplain and upland SLRE were conducted independently for their respective portions of the site and upland. A risk evaluation identifies contaminants of concern in the affected media, assesses contaminant concentrations, and evaluates whether the exposure and toxicity associated with those contaminants can be sufficient to justify taking an action under an EE/CA. In accordance with EE/CA guidance, the SLREs identified contaminants of potential concern (COPC) to human health and contaminants of potential ecological concern (COPEC) to the environment floodplain and upland areas (USEPA 2022, 2023).

### **1.5.2. Exposure Units**

Exposure units (EU), summarized from SLREs, are geographic areas with a particular land use within which an exposed receptor (a person, animal, or plant) may reasonably be assumed to reside or move at random and where contact across the EU is equally likely over the course of an exposure duration.

The upland areas evaluated in this SLRE were divided into four exposure units (EUs), as shown in Figure 2-5. In 2020, USEPA developed a screening level ecological risk assessment (SLERA) for the OU2/3site (USEPA Region 8 2020). As part of the 2020 SLERA, USEPA identified upland EUs to represent areas of similar habitat type. However, since the development of the SLERA, USEPA Region 8 has revised the boundaries for the upland area and refined the approach for evaluating potential risks to support removal action decision-making. Note that some parcels included in the original site boundary have already gone through additional separate investigations pursuant to establishing Administrative Orders on Consent (AOCs) with USEPA. These are not included in this evaluation.

The “Rail Trail”, identified as the section of the Historic Rail Trail State Park located within the OU2/3 site boundary, is also evaluated in this SLRE, both as two separate EUs (north and south of UT-248) and as one EU (Figure 2-5). The Rail Trail is split into north (Rail Trail North EU) and south (Rail Trail South EU) for this risk evaluation at UT-248 where the trail changes from a paved path to an unpaved path. The EU evaluating the full extent of the Rail Trail is herein referred to as “Rail Trail Combined”. Although the south section of the Rail Trail is paved, there are strips of dirt on each side of the pavement that represent areas of potential exposure to soil for recreators and ecological receptors.

The floodplain areas evaluated in the SLRE were divided into seven EUs. These reaches were defined in U.S. Fish and Wildlife Service based on channel morphology, expected water quality, and physical access points (SRC 2023).



- Reach 1: Prospector Park to Richardson Flat Road. Silver Creek enters Prospector Park just to the south of the Prospector Drain, and the creek and the outfall from the drain come together in an impounded beaver pond just south of the property line for the Bureau of Land Management (BLM)-managed Silver Maple Claims area which makes up the upstream portion of Reach 1. Poned conditions are predominant throughout this reach because of a series of beaver ponds connected by stretches of braided channel flowing through dense vegetation. Mine tailings are present throughout this reach but are mostly inundated by the high water levels created by the beaver ponds.
- Reach 2: Richardson Flat Road to Highway 248. Additional water from the Pace Homer Ditch enters Silver Creek just downstream (east) of the Richardson Flat Road crossing. Silver Creek runs through a single channel through most of Reach 2; however, it also runs through several Floodplain Tailings deposits through this reach. The stream broadens out into an impounded area created by beaver dams at the bottom of Reach 2, adjacent to the Richardson Flats Tailing Impoundment Wetlands. Fish (Bonneville cutthroat trout, red shiner, and spotted dace) were observed in the upper portion of the reach, but the stretch from the Highway 40 bridge to the Highway 40 crossing was completely devoid of fish.
- Reach 3: Highway 248 to the Geneva Rock Cement Plant. This is a relatively short reach that begins downstream (east) of the Highway 248 crossing and ends just downstream (north) of the point where much of Silver Creek’s water is diverted into the GM Pace Ditch that runs to the east of the Rail Trail.
- Reach 4: Geneva Rock Cement Plant 6,000 feet downstream to the second Canal Diversion within the Upper Meadow Tailings Area. This reach extends from shortly below the first Silver Creek Canal Diversion about 1.1 miles down-valley to where a second diversion from the creek appears on the map. The stream channel in this area is meandering, and there are several alternative channels that may be branching from the main channel or may be carrying irrigation return flows back from irrigated fields in the southeast sector of the valley. This reach is located where Silver Creek changes direction from a northeast direction to a northwest direction (river bend).
- Reach 5: Second Canal Diversion to Promontory Ranch Road. The stream in Reach 5 is incised 2-3 feet below the level of the floodplain for most of the reach, with many deeper pools located intermittently through the reach. Away from the stream channel, much of the floodplain contained inundated wet meadow with multiple shallow flow paths through the vegetation at the time of the survey. The channel substrate in the surveyed section of this reach consisted more of coarse gravels than the fine sediments noted downstream, with rock structure noted in many of the deeper pools.
- Reach 6: Promontory Ranch Road 4,500 feet to Silver Gate Road and confluence with the Snyderville Basin Water Reclamation facility effluent stream. This reach is characterized by a narrow and deeply incised stream channel, averaging 3 to 6 feet wide and 2 to 3 feet deep. Many deep pool areas were noted during field observations, often in “elbows” where the stream formed tight meanders. Four surface water inflows were noted coming in from the west within this reach. The vegetation community on the floodplain was strongly dominated by wiregrass, with the density of other forb species visually estimated at less than 5 percent. Numerous bare areas of exposed tailings were present, including



some areas that were stained red presumably caused by the presence of acid-forming minerals in the tailings.

- **Reach 7:** Silver Gate Road to I-80. The channel in this reach ranges from 2 to 4 feet wide and 2 to 3 feet deep. Bottom sediments are primarily composed of fine sandy silts with little to no structure. Filamentous algae covered about 50 percent of the bottom substrate, particularly toward the edges of the channel where the flow was slower. Vegetation in the floodplain and adjacent to the creek was heavily dominated by wiregrass, with other forbs making up less than 5 percent cover (visual estimate). Numerous areas of bare tailings were located in the floodplain and adjacent to the creek; most of the tailings in this area that were viewed during the survey are of the grey carbonate type.

Two additional site features included in the SLRE were the Pace Homer Ditch and the Pace Spring Ditch. The Pace Homer Ditch runs along the northwest side of Reach 1 and forks into two branches within Reach 2. The Pace Spring Ditch originates west of Reach 2, crosses under Highway 40, and flows along the southern end of the Park City Business Center property. It flows parallel to the Silver Creek channel in Reach 4 and the southern part of Reach 5. These two ditches were evaluated as separate EUs in the ecological portion of the SLRE.

### **1.5.3. Human Health Risk Assessment**

#### **1.5.3.1 Upland Streamlined Human Health Evaluation**

Streamlined risk evaluations were performed to support risk-based decision making for the upland and floodplain areas of the Richardson Flat OU-2/3 portions of the site [USEPA 2022, 2023]. This section of the document focuses on evaluating human health and ecological risks associated with direct contact exposures to soils within the upland areas of the site and along the Rail Trail. The HHRE evaluated exposures to current recreational visitors who use the site for a variety of activities including biking, hiking, running, horseback riding, and bird watching. Although recreational activities primarily occur along the Rail Trail, there are numerous paths and trails (that are not part of the Site ES-3 Park) that allow access into the upland areas of the site. Similar recreational use of the Rail Trail and any connecting trails is expected to continue in the future. Because Summit County is currently undergoing significant residential, commercial, and light industry development, it is anticipated that future use of the upland areas also will include additional residential, commercial, and light industrial use. Thus, human receptor populations of concern evaluated in the HHRE are current recreational visitors and hypothetical future residents, commercial/industrial workers, construction workers, and recreational visitors. It was assumed that young children represent the most sensitive receptor population and that evaluation of this receptor will be protective of older children and adults who may be exposed under similar scenarios.

Within the upland areas, human exposures are expected to occur primarily via incidental ingestion of and dermal contact with soils. Inhalation of soil particulates may also occur following surface soil disturbance. Residents, commercial/industrial workers and recreational visitors are expected to be exposed only to surface soils (defined for this evaluation as soils within the top six-inch depth below ground surface [0-6" bgs]). Hypothetical future construction



workers would be exposed to both surface and subsurface soils (defined for this evaluation as soils within the 0 to 3-foot depth range).

Not all contaminants that were detected within upland soils were included in the quantitative risk characterization of the HHRE. Instead, the list was focused on those contaminants of potential concern (COPC) present at concentrations in upland soils that exceeded conservative risk-based screening levels [RSLs, USEPA, 2022]. The contaminants that contributed to unacceptable risks [cancer risk and non-cancer hazard index] were antimony, arsenic, chromium, lead, and thallium. Several other constituents were detected in the soils but they were less significant risk contributors to upland risks [USEPA, 2022].

The excess risk of cancer was evaluated in terms of the probability that an exposed individual will develop cancer because of that exposure. Excess cancer risks are summed across all carcinogenic contaminants and all exposure pathways that contribute to exposure of an individual in a given population. Excess cancer risks above one in ten thousand ( $10^{-4}$  or  $1E-04$ ) were considered to represent unacceptable risks. If the excess cancer risk for an individual COPC exceeds  $1E-04$ , some form of remedial action is indicated.

The potential for non-cancer effects was evaluated by comparing the estimated exposure of a receptor over a specified time period to a reference threshold that represents the exposure below which adverse non-cancer effects are not expected, even in sensitive populations. This ratio of site exposures to effect thresholds is called a Hazard Quotient (HQ). The sum of HQ values is referred to as the hazard index (HI). If the HQ or HI for a COPC is greater than one (HQ greater than  $> 1$  or  $HI > 1$ ), there is some possibility that non-cancer effects may occur and were considered to represent unacceptable risks.

For lead, the Integrated Exposure Uptake Biokinetic (IEUBK) model was used to evaluate exposures to lead in soils for children and the Adult Lead Methodology (ALM) was used to evaluate exposure to lead in soils for adults. All inputs in the lead models were central tendency point estimates consistent with United States Environmental Protection Agency (USEPA) guidance (USEPA, 1994c). The IEUBK and ALM models were used to estimate the probability that any random individual might have a blood lead value over 5 micrograms per deciliter ( $\mu\text{g}/\text{dL}$ ) under the user-specified exposure conditions.

Excess lead-related risks were estimated for the following hypothetical receptors:

- Hypothetical, future resident child in exposure unit 1 [EU-1]
- Hypothetical future residential child in EU-1 along the Rail Trail South & combined Rail Trail
- Hypothetical future resident child recreating along the Rail Trail
- Hypothetical future construction worker along Rail Trail South and combined
- Hypothetical future resident recreating along the Rail Trail South

Unacceptable risks for human receptors for the upland areas were summarized as:

- Concentrations of lead in surface soils may pose an unacceptable risk to children recreating in EU1 or along the Rail Trail now or in the future



- Concentrations of lead may pose an unacceptable risk to children who both live within the upland area in the future and recreate along the Rail Trail
- Concentrations of lead along the Rail Trail may pose an unacceptable risk to workers involved in digging/excavation activities
- Concentrations of antimony, arsenic, and thallium in surface soils may pose unacceptable noncancer hazards to hypothetical future children living within the upland areas
- If chromium exists as the carcinogenic hexavalent form in site soils, excess cancer risks likely exceed USEPA's acceptable risk range. Although site data on the form of chromium present in site soils are not available, chromium likely exists primarily as the non-carcinogenic trivalent form.

### 1.5.3.2 Upland Streamlined Ecological Risk Evaluation

The streamlined ecological risk evaluation was conducted for the upland reaches of the Richardson Flat OU2/3 site as a follow on to the Screening Level Ecological Risk Assessment that was conducted to identify data gaps and areas where additional details were required [USEPA, 2020]. Five assessment endpoints were selected to evaluate risk to terrestrial ecological receptors at the site in this ERE: survival, growth and reproduction of terrestrial plants, soil invertebrates, and herbivorous, vermivorous and carnivorous birds and mammals. Although the focus of this SRE was on the upland portion of the site, two additional assessment endpoints were selected to evaluate exposure of ecological receptors to surface water and sediment in the GM Pace Ditch in EU1: survival, growth and reproduction of aquatic organisms, and survival, growth and reproduction of amphibians. Receptors addressed in the upland ecological risk assessment included amphibians and fish [Pace Homer Ditch], plants and terrestrial receptors, vermivorous birds [robin], vermivorous mammals [Vagrant Shrew], carnivorous birds [American kestrel], sage grouse, badger, and mule deer.

An updated Contaminants of Potential Ecological Concern (COPEC) screen was conducted by comparing the maximum measured concentration of each analyte in soil collected on-site with conservative screening benchmarks for plants, invertebrates, birds and mammals. The list of COPECs for the upland site included antimony, arsenic, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, selenium, silver, thallium, and zinc. To evaluate direct contact of terrestrial plants and soil invertebrates with site soil, exposure point concentrations (EPCs) calculated as the 95UCL for each upland EU were compared with conservative soil screening benchmarks to calculate HQs consistent with USEPA ecological risk assessment guidance (Ecological Risk Assessment Guidance for Superfund [ERAGS]; USEPA, 1997).

The line of evidence used to assess the risk to herbivorous, vermivorous and carnivorous birds and mammals was dietary exposure to COPECs present in soil and estimated prey tissue concentrations, and comparison of modeled doses with Toxicity Reference Values (TRVs) to calculate an HQ. For the streamlined ERE, a calculated No Observed Adverse Effect Level (NOAEL)-based HQ less than (<) 1.0 is considered to be indicative of negligible or acceptable risk. If a calculated Lowest Observed Adverse Effect Level (LOAEL)-based HQ is greater than or equal to ( $\geq$ ) 1.0, it was concluded that risk is unacceptable at that exposure concentration.

The risks to ecological receptors were significant and affected several receptor classes in the upland areas. The risks are summarized in the following bullets:

- LOAEL-based HQs  $\geq 1.0$  indicate unacceptable risk to vermivorous birds at the site from estimated dietary exposure to arsenic, cadmium, lead, mercury, and zinc in some upland EUs (Table ES-7).
- The maximum calculated LOAEL-based HQ for these COPECs was for exposure to lead in the Rail Trail South EU. The maximum HQs were calculated for lead (75.8), mercury (35.4), vanadium (25.3), and zinc (71.7). LOAEL-based HQs  $> 1.0$  indicate unacceptable risk to vermivorous mammals from dietary exposure to antimony, arsenic, cadmium, lead and zinc in some upland EUs (Table ES-8).
- The maximum calculated LOAEL-based HQs for vermivorous mammals were for exposure to COPECs in the Rail Trail South EU.
- Model calculations suggest acceptable risk (NOAEL-based HQs  $< 1.0$ ) or indeterminate risk (NOAEL-based HQ  $> 1.0$  and LOAEL-based HQ  $< 1.0$ ) from dietary exposure of carnivorous and herbivorous birds and mammals to all inorganic COPECs at this Site (Tables ES-9 through ES-12).

Overall conclusions for exposure of aquatic receptors to surface water and sediment in the GM Pace Ditch are:

- Concentrations of antimony, arsenic, cadmium, copper, iron, lead, manganese, mercury, silver and in sediment residuals in the ditches may present unacceptable risks to benthic invertebrates.
- Concentrations of aluminum, cadmium, copper, mercury, and zinc in upstream surface water locations may present unacceptable risks to amphibians [HQs  $> 1.0$ ].

### 1.5.3.3 Floodplain Streamlined Human Health Evaluation

The streamlined floodplain HHRE focused on evaluating human health risks associated with direct contact exposures (incidental ingestion and dermal contact) to solid media and surface water by recreational visitors and outdoor maintenance workers. The HHRE evaluated exposures to current and future recreational visitors who use the site for a variety of activities including hiking, running, biking, horseback riding, bird watching, wading, and potentially fishing. It was assumed that young children represent the most sensitive recreational receptor, and that evaluation of the child recreational visitor will be protective of older children and adults who may be exposed under similar recreational scenarios. The HHRE also evaluated current and future adult outdoor maintenance workers who may be involved with soil excavation activities. Within the floodplain areas, human exposures are expected to occur primarily via incidental ingestion of and dermal contact with solid media (surface and subsurface soil and sediment) and surface water. Recreational visitors are expected to be exposed only to surface soil/sediment (defined for this evaluation as soils and sediment collected within the top six-inch depth below ground surface [0-6" bgs]). Outdoor maintenance workers are expected to be exposed to both surface and subsurface soils (defined for this evaluation as soils and sediment collected within the 0- to 3-foot depth range).

Not all contaminants that were detected within the floodplain soils/sediments or surface waters have been included in the quantitative risk characterization. The list of COPCs include aluminum, antimony, arsenic, barium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, selenium, silver, thallium, vanadium, and zinc.

As previously noted, risks from lead exposure was evaluated using the IEUBK model for child receptors and the adult lead model [ALM] to evaluate exposure to adults. The probability for exceeding a 5 µg/dL blood lead level benchmark is the threshold indicating unacceptable risk for exposure. Two child receptor scenarios were considered for a child visiting the flood plain area: 1) a current or future recreational visitor that lives away from the site; and 2) a future recreational visitor that lives within the upland area and recreates in the floodplain area. The adult receptor was an outdoor maintenance worker conducting soil excavations. In all cases, the probability for exceeding 5 µg/dL blood lead benchmark was attained.

Predicted risks from exposures to non-lead COPCs are summarized in Table ES-4. For non-lead COPCs, unacceptable risks were predicted based on non-cancer hazards and cancer risks for the recreational visitor in all floodplain EUs. Unacceptable non-cancer hazards across all floodplain EUs were primarily due to antimony, arsenic, cadmium and thallium; manganese was also a risk driver in Reaches 3 and 4 and mercury was a risk driver in Reach 4. Unacceptable excess lifetime cancer risks for the recreational visitor were primarily due to arsenic in Reaches 4, 6 and 7, and from chromium (evaluated as hexavalent chromium) in Reaches 1 and 2. Without a specified source for hexavalent chromium, chromium is expected to be present in the environment primarily as the less potent non-carcinogenic trivalent form. Additionally, analysis of forage fish tissue for arsenic and lead suggests that consumption of fish from Silver Creek might have a increased risk for human receptors

#### 1.5.3.4 Floodplain Streamlined Ecological Risk Evaluation

The ERE was conducted to refine the list of contaminants of potential ecological concern (COPECs) identified by the 2020 SLERA (USEPA 2020). Survival, growth and reproduction in thirteen assessment endpoints-- terrestrial and aquatic plants, terrestrial and aquatic invertebrates, fish, amphibians, and herbivorous, vermivorous, insectivorous, invertivorous, omnivorous, piscivorous and carnivorous birds and mammals-- were selected to evaluate risk to floodplain ecological receptors at the site in this ERE. Assessment endpoints are explicit expressions of the ecological resources that are to be protected at a site, selected based on their ecological relevance, susceptibility (e.g., sensitivity or high potential for exposure) and relevance to management goals.

Analytes identified as COPECs for further quantitative risk characterization in the ERE varied by medium; an additional list of COPECs was developed for further evaluation in the wildlife dietary exposure models (USEPA 2023, Table ES-5). Potential risk was evaluated by comparing COPEC concentrations measured in site media with risk benchmarks for ecological receptors and calculating an HQ as:  $HQ = \text{Exposure Concentration} / \text{Effect Threshold Concentration}$ . In a streamlined ERE, the decision point for determining potential unacceptable risk is an HQ greater than or equal to ( $\geq$ ) 1.0, when the effect threshold is a lowest observed effect concentration (LOEC) or a lowest observed adverse effect level (LOAEL).



To evaluate risk to aquatic plants, benthic invertebrates, and fish from direct contact with surface water or porewater, EPCs were compared with conservative surface water screening benchmarks including no observed effect concentrations (NOECs) in water and less conservative LOECs. NOECs are ecological benchmarks below which no adverse effects on aquatic organisms are expected, such as chronic Utah Water Quality Standards (UT WQS) or National Recommended Ambient Water Quality Criteria (AWQC) for surface water where values are protective of 95% of aquatic organisms and threshold effect concentrations (TECs) for sediment.

LOECs are ecological benchmarks above which adverse effects on aquatic organisms are expected, such as acute UT WQS or AWQC for surface water which are the highest concentration to which aquatic organisms can be briefly exposed without adverse effects and probable effect concentrations (PECs) for sediment.

LOEC-based HQs calculated for exposure of aquatic organisms to surface water equaled or exceeded 1.0 but were less than 10.0 for cadmium, lead, manganese, mercury and zinc in at least one EU (Table ES-7). LOEC-based HQs equaled or exceeded 10.0 for cadmium in Reaches 5 and 6, mercury in Reach 5 and for zinc in Reaches 3, 5 and 6. The highest calculated LOEC-based HQs were for exposure of aquatic organisms to surface water in Reach 5. LOEC-based HQs calculated for exposure of aquatic organisms to porewater equaled or exceeded 1.0 but were less than 10.0 for cadmium, lead, mercury and zinc in at least one EU (Table ES-8). LOEC-based HQs equaled or exceeded 10.0 for cadmium in Reaches 3 and 4; for lead in Reaches 3, 4, 5 and 7; manganese in Reach 3; mercury in Reaches 3, 5 and 7; and for zinc in Reaches 3, 4, 5 and 6. Pore water and sediment EPCs were compared to conservative screening benchmarks including threshold effect concentrations (TECs, NOECs) and less conservative probable effect concentrations (PECs, LOECs). Aluminum, antimony, arsenic, cadmium, cobalt, copper lead, mercury, selenium, and zinc were risk contributors to aquatic organisms and amphibians.

The line of evidence used to assess the risk to herbivorous (terrestrial and floodplain mammal only), vermivorous, insectivorous (bird only), invertivorous (floodplain bird only), omnivorous (floodplain bird only), piscivorous (floodplain bird only) and carnivorous birds and mammals was modeled dietary exposure to COPECs present in floodplain or wetland soil or sediment, surface water, and estimated or measured prey tissue concentrations and comparison of modeled doses with toxicity reference values (TRVs) to calculate HQs.

Risk findings for birds and mammals are summarized in Table ES-11 and as follows:

#### Terrestrial

- For terrestrial receptors, calculated unacceptable risk was highest for vermivorous birds and mammals.
- There is calculated unacceptable risk for all terrestrial receptors from exposure to some COPECs in some Reaches.
- Calculated LOAEL-based HQs for terrestrial vermivorous birds were highest for dietary exposure to lead in all floodplain Reaches except Reach 3; arsenic in Reach 7; cadmium in Reaches 2, 4, 5, 6 and 7; and mercury in Reaches 2 and 4.



- Calculated LOAEL-based HQs for terrestrial vermivorous mammals were highest for dietary exposure to aluminum and antimony in all floodplain Reaches except Reach 3; arsenic in Reach 7; and cadmium in Reaches 2, 4, 5, 6 and 7.
- LOAEL-based HQs for terrestrial carnivorous birds equaled or exceeded 1.0 for lead (all Reaches except Reaches 1 and 3); mercury (all Reaches except Reach 3) and arsenic (Reach 7). Dietary exposure to mercury in Reaches 2, 4 and 5 resulted in HQs > 10.0.
- LOAEL-based HQs for terrestrial herbivorous mammals exposed to surface soil equaled or exceeded 1.0 for exposure to thallium in all floodplain EUs; aluminum in all Reaches except Reach 3; antimony in all EUs except Reaches 3, 5 and 6; and arsenic in Reach 7.
- LOAEL-based HQs for terrestrial herbivorous mammals exposed to surface and subsurface soil resulted in similar potential risk except that the LOAEL-based HQs for antimony in Reach 1 and Reach 2 are less than (<) 1.0 for exposure to surface and subsurface soil.

#### Terrestrial/Floodplain Receptors:

- For terrestrial/floodplain receptors, calculated unacceptable risk was highest for invertivorous birds.
- Calculated LOAEL-based HQs for terrestrial/floodplain invertivorous birds was highest (> 10.0) for dietary exposure to lead in all floodplain Reaches; arsenic in Reaches 4, 5, 6 and 7; cadmium in Reach 7; mercury in Reaches 2, 4 and 5; and zinc in Reach 7.
- Calculated LOAEL-based HQs for both avian and mammalian carnivores indicate unacceptable risk for exposure on these receptors to mercury in Reaches 2 and 4.
- LOAEL-based HQs for exposure of carnivorous terrestrial/floodplain mammals were highest (>10.0) for dietary exposure to aluminum (all floodplain Reaches except Reach 3) and to antimony in Reach 7.

#### Floodplain Receptors:

- For floodplain receptors, unacceptable risk was highest for invertivorous birds.
- Calculated LOAEL-based HQs for floodplain invertivorous birds were highest (> 10.0) for dietary exposure to lead in all floodplain Reaches.
- For all avian floodplain feeding guilds, unacceptable risk was highest for exposure to lead.
- In addition to lead, there is unacceptable risk to floodplain omnivorous birds from exposure to arsenic (all floodplain Reaches except Reach 1) and from exposure to zinc in Reach 7.
- In addition to lead, there is unacceptable risk to floodplain insectivorous birds from exposure to arsenic and zinc in all floodplain Reaches, and from exposure to mercury in Reach 5.
- Lead is the only COPEC that poses unacceptable risk to piscivorous birds.
- In addition to lead, there is unacceptable risk to floodplain invertivorous birds from dietary exposure to arsenic, mercury and zinc in all floodplain Reaches; cadmium in all floodplain Reaches except Reaches 2 and 3; manganese in Reaches 3 and 4; and selenium in Reach 1.



- No LOAEL-based HQs equal or exceed 1.0 for floodplain herbivorous mammals. Risk for this feeding guild is acceptable for purposes of this EE/CA.
- For dietary exposure models that utilize measured COPEC concentrations in prey species, there is unacceptable risk to all four avian feeding guilds from exposure to lead; to floodplain omnivores, insectivores and invertivores from exposure to arsenic; and to floodplain insectivores and invertivores from exposure to zinc in all floodplain Reaches.



## 2. REMOVAL ACTION OBJECTIVES, SCOPE, AND SCHEDULE

This section presents the RAOs, statutory limits on removal actions, removal scope, and removal schedule.

### 2.1. REMOVAL ACTION OBJECTIVES

An early step in developing removal action alternatives is to establish RAOs. RAOs are a general description of what the removal action will accomplish.

The removal action objectives of this tailings removal action are to:

- Prevent exposure to soil and water with contaminants from mining activities that would pose an unacceptable risk to human health with the reasonably anticipated future land use;
- Reduce exposure to soil and water with contaminants from mining activities that would pose an unacceptable risk to plants, animals, and other ecological receptors;
- Reduce off-site migration of contaminants from mining activities that would pose an unacceptable risk to human or ecological health by soil, surface water, groundwater, or air.

The reasonably anticipated reuse of the OU2/3 site area is generally open space. The intent of the removal action is to address the surface and subsurface contaminated tailings at the Richardson Flat Tailings OU2/3 site. RAOs will be achieved by performing tailings removal from the site area, and not treatment of soil or water.

The RAOs listed above describe prevention of exposure to and migration of contaminants from the site. RAOs can be achieved in the short term with measured success. Mine tailings can reasonably be removed from the site area and placed into adjacent repositories. Re-planting of vegetative cover can also be accomplished to bind and cover tailings left in place. Silver Creek can also be reconfigured to more appropriately distribute water across the site area, particularly in tailings-removal areas. However, surface water and groundwater contamination will likely continue to be present at the site based on upstream sources and untouched source material.

### 2.2. STATUTORY LIMITS ON REMOVAL ACTIONS

The CERCLA section 104(c)(1) limitations on removal actions of \$2 million and 12 months do not apply at the Richardson Flat OU2/3 Tailings site because the selected action will be funded by settlements with potentially responsible parties.

### 2.3. REMOVAL SCOPE

The scope of the removal action will be to address solid media contamination (tailings) at the site. Budget constraints limit a full removal effort at this time. The removal action will also help minimize potential future impacts on groundwater and surface water.



## 2.4. REMOVAL SCHEDULE

The National Oil and Hazardous Substances Contingency Plan (NCP) requires a minimum public comment period of 30 days following release of the proposed draft EE/CA by USEPA. USEPA will respond to comments received during the public comment period and publishes an action memorandum following the response to comments. USEPA will provide public notification of the removal action schedule upon issuance of the action memorandum.

During implementation of the selected removal action alternative(s), several factors may affect the schedule, including planning and design, cultural and biological clearances and mitigation, seasonal weather-related restrictions, and access for construction equipment. Depending on the removal action alternative(s) selected in the final EE/CA, design and implementation of the construction activities will likely require between one and three field seasons, depending on schedule-limiting factors such as cleaning up sites sequentially or concurrently, equipment availability, and weather (especially monsoon rains and snowfall).

Semi-annual inspections and maintenance of any revegetated areas, erosion and stormwater controls, and access roads may be necessary at the site for approximately 5 years after stabilization and restoration because of the timeframe required to reestablish vegetation.



### 3. IDENTIFICATION AND SCREENING OF REMOVAL ACTION TECHNOLOGIES

Per EE/CA guidance, “a limited number of alternatives appropriate for addressing the removal action objectives” should be identified, developed, and carried through the detailed analysis (EPA 1993). The retained technologies and options for the site were combined into removal action alternatives that are expected to meet the RAOs presented in Section 2. The identified removal alternatives rely on proven technologies with a track record of successful implementation. This section identifies and analyzes the removal action technologies for the site.

[Section 3.1](#) summarizes the process of screening potential technologies and identifies the removal action alternatives that may be effective and implementable at the site, [Section 3.2](#) describes in detail the retained removal action alternatives, and [Section 3.3](#) provides a detailed analysis of the removal action alternatives based on the NCP evaluation criteria of effectiveness, implementability, and cost.

#### 3.1. DEVELOPMENT AND SCREENING OF TECHNOLOGIES

This subsection identifies general response actions, identifies and screens technologies, develops and describes potential removal action alternatives, and identifies applicable or relevant and appropriate requirements (ARAR). Exhibit 4 includes a summary of technologies that were investigated for inclusion at the site.

**Exhibit 4. General Response Actions**

Control Type	Technology	Process Option	Retained	Notes
Institutional Controls	Deed Restrictions	Encumber ownership uses.	Yes	Restricted areas to be identified based on completeness of removal action and land uses. Incorporated into final removal as appropriate.
	Environmental Covenants	Encumber land uses.	Yes	Restricted areas to be identified based on completeness of removal action and land uses. Incorporated into final removal as appropriate.



Control Type	Technology	Process Option	Retained	Notes
Engineering Controls	Surface Controls	Consolidation, grading, revegetation, and erosion controls.	Yes	Ultimate tailings removal and resultant site impacts will determine required modifications. Incorporated into final remedy as appropriate.
	Physical Barriers	Fences and gates	Yes	Usage to accommodate final land uses. Incorporated into final remedy as appropriate.
	On-Site Consolidation	Removal of contaminant material from the current natural setting.	Yes	Excavation of tailings and placement into a repository.
	Drainage and Slope Stabilization	Retaining wall features, re-route surface drainage.	Yes	As required on newly exposed land surface after tailings removal. Incorporated into final remedy as appropriate.
	Disposal	Placement into approved landfill.	No	Transport of tailings to remote facilities is too costly and labor-intensive with regard to transportation.
	Hydraulic Isolation of Tailings	Lined / piped surface water flow channels.	No	Deemed to not be practical and not a favorable use of the natural landscape. Unable to eliminate the natural modification of features because of seasonal flows.
	Physical and Chemical Treatment	Soil washing and particle separation	No	Requires much materials handling. Costly, with untested technologies. Limited gains versus the associated cost and effort.
	Passive Bioremediation	Sulfate-reducing bioreactors, zero-valent iron, biochar, other.	No	Costly to install and long-term maintenance of installed technologies is required.
	Phytoremediation	Vegetative treatment	No	Does not eliminate contaminants from the site. Unable to prevent animal consumption of plants.
	Revegetation	Substrate stabilization by additive vegetative cover	Yes	Immobilizes tailings particles and creates a vegetative barrier to contaminants. Incorporated into final remedy as appropriate.
Soil Barriers	Placement of clean topsoil onto tailings surface.	Yes	Clean topsoil to act as a non-engineered cap to act as a barrier to physical contact with tailings.	



### 3.1.1. Summary of Technology Identification and Screening

The removal action alternative development process involves identifying general response actions, technology types, and process options that may satisfy RAOs. The initial screening below eliminates infeasible technologies and process options and retains potentially feasible technologies and process options.

A technology or process option can be eliminated from further consideration if it does not meet the effectiveness threshold criteria (protectiveness and compliance with ARARs) or substantive implementability criteria (technical, administrative, availability, and local acceptance), which are detailed in [Section 3.3](#). In addition, a technology or process option can be eliminated if its cost is substantially higher than other technologies or process options and at least one other technology or process option is retained that offers equal protectiveness.

#### 3.1.1.1. Post Removal Site Controls

ICs include the implementation of access restrictions to control current and future land use. ICs would not reduce waste migration from a site but could be used to protect human health by administratively restricting access to affected areas. In addition, these restrictions may be used in conjunction with other technologies to protect an implemented action. Potentially applicable ICs consist of land use and access restrictions such as environmental covenants, local ordinances, and use of the state's groundwater protection zone program.

#### 3.1.1.2. Engineering Controls

Engineering controls are used primarily to reduce exposure to contaminants by creating a barrier that prevents direct exposure to or transport of waste from the contaminated sources to the surrounding lands. Potentially applicable engineering controls include surface controls, physical barriers, on-site containment and consolidation, drainage and slope stabilization, disposal, hydraulic isolation, and topsoil cover and are described below.

- **Surface controls** – Surface control measures are used primarily to reduce contaminant transport, direct exposure, and the overall exposure area. Surface controls could be appropriate in more remote areas where direct human contact is not a primary concern or as a component of a containment alternative. Surface control process options include consolidation, grading, revegetation, and erosion controls.
- **Physical barriers** – Physical barriers may include site access controls such as fencing. Portions of the site have been gated and fenced by prior property owners to intermittently run livestock on the land. Much of that land has been, or is in the process of being, converted to recreational uses by local government entities.
- **On-site consolidation and containment** – Mine waste can be consolidated and capped to prevent exposure. Waste from areas of the site can be gathered, or consolidated, and then capped. Typically, the cap is designed to minimize water infiltration and leaching of contaminants, control erosion, and limit exposure to contaminants. A 6-acre repository constructed in an adjacent area of the Silver Creek valley is considered for placement south of Promontory Ranch Road at 40.718839° latitude and -111.477379° longitude.

The primary repository option is at OU1, located adjacent to the site between Highway 248 and Highway 40 at 40.678354 latitude and -111.452524 longitude.

- **Drainage and slope stabilization** – Surface water that flows through the site area, and hence tailings, may be re-oriented into channel pathways outside of the tailings deposition areas. This would reduce the amount of surface water to react with tailings *in situ*, thereby reducing contaminant release from the site. Stabilization of the channel banks would be required to control tailings erosion back into the channel.

Also, surface water flow paths at the site may be reconfigured to more widely distribute water throughout the site area by creating meanders, braids, and ponds. Tailings would be pulled back from surface water flow paths and stabilized along the stream banks to control tailings erosion back into the channel. Bank stabilization is typically achieved by adding vegetative cover which will be self-restoring over time as it grows and expands. Nutrients may be required to be added to the substrate to support growth.

- **Disposal** – Tailings can be excavated and disposed of off-site as a potential remedy. Off-site disposal may be applicable if the disposal site is accessible to a large volume of heavy truck traffic. Pretreatment of waste using solidification or stabilization to address potential leachability may be considered where the disposal facility design does not address the potential for leachate generation. A contaminated soil repository is located adjacent to the site between Highway 248 and Highway 40 at 40.678354 latitude and -111.452524 longitude at OU1.
- **Hydraulic isolation of tailings** – This option would leave tailings in place but physically isolate them from interaction with surface water flow. This action would require isolation of the surface water flow by creating a creek barrier via lining the channel with an impervious material, or by placing all surface water flow within a containment structure such as a pipe. If water interaction is removed from tailings, the geochemical process of acid generation is minimized.
- **Topsoil cover over tailings** – Transport topsoil to the site and place as a 6-inch lift over the tailings to act as a barrier to direct tailings contact.

### 3.1.1.3. *In Situ* Treatment

*In situ* treatment involves treating the contaminated medium where it is currently located. *In situ* technologies reduce the mobility and toxicity of the contaminated medium and may reduce exposure to the contaminated materials; however, in general, *in situ* technologies allow a lesser degree of control in comparison to *ex situ* treatment options. A short screening summary of different *in situ* treatment classes is described below.

- **Passive bioremediation** – Initial investigations into *in situ* passive bioremediation revealed that the flow within Silver Creek is, overall, too great, to treat passively without some engineering modifications. Also, the highly alkaline nature of Silver Creek water would render the inclusion of sulfate-reducing bioreactors (SRB) largely ineffectual, except in targeted areas where surface water sulfate observations were observed to increase greatly. Some other possible options to target specific tailing locations include the placement of an adsorptive medium such as zero-valent iron, granular iron, zeolite, or

biochar. These options could be installed as barrier walls, gabion-type structures, or possibly reactor beds and tanks. Water aeration, precipitation, and settling, were also considered based on the elevated iron concentrations and nearly neutral pH observed at the site. The creation of turbulent flow to promote aeration, and placement of settling ponds to allow for the resulting precipitate to drop out of solution are also required. Settling ponds would need to be serviced routinely to remove precipitate.

- **Vegetative treatment** – Vegetative treatment (also known as phytoremediation) is a process that uses plants to remove, transfer, stabilize, or destroy contaminants in soil or sediment. This methodology has been implemented at many heavy metals-contaminated sites throughout the U.S. in recent decades. Prevention of human or animal consumption of the plants would be necessary.
- **Substrate stabilization by addition of vegetative cover** – This process would amend the upper surface media (which includes soils, tailings, and sediments) to help enrich the media to establish a vegetative cover of adapted, hardy, metal-tolerant, and acid-tolerant grasses and forbs. After applying soil amendments and preparing a seedbed, site-specific seed mixtures would be used to establish self-sustaining vegetation.
- **Physical and chemical treatment** – Physical treatment processes use physical separation and the characteristics of materials to concentrate constituents into a relatively smaller volume for disposal or further treatment. Chemical treatment processes act by adding a chemical reagent that either removes contaminants from the material, fixates contaminants within the material matrix, or renders a neutralizing effect on the contaminants. The net result of chemical treatment processes is a reduction of toxicity and mobility of contaminants in the solid media. Different types of physical and chemical treatments screened include soil washing, material separation, and acid neutralization and are described below.
  - **Soil washing and particle separation** – This treatment process involves washing the contaminated material (with water) in a vat, or agitated vessel, to dissolve water-soluble contaminants and create a slurry mixture. The resultant mixture would be managed to separate the fines/slimes from sand-sized particles and placed into appropriate repository locations. This approach would allow for two material factions: (1) a highly water-transmissive material that would reduce water reaction time required for effective metals contamination production, and (2) another mixture consisting of fines and colloidal slimes that would be placed in a dry area of a repository where water would be controlled or eliminated from influencing chemical reactions that could produce metals contamination.

If the treatments discussed above or any other treatment methods are shown to be effective and practicable before selection of a remedy, USEPA will amend this analysis and consider such treatments.

### 3.1.2. Summary of Alternative Development

After an initial screening of general response actions and technologies, and given budget constraints, a combination of proposed alternatives that include removal, containment, and re-



engineering of site conditions that are identified as being protective, effective, and implementable at the site will be identified. ICs, surface controls, and access controls are feasible but not as stand-alone responses and may be combined with removal, containment, and re-engineering of site conditions options.

A list of analyzed but excluded process options for the site is included below and is followed by a list of retained alternatives.

**3.1.2.1. Not Retained Technologies.** The following technologies were removed from consideration as infeasible during development of this EE/CA:

- **Soil washing and particle separation** – This treatment process involves washing the contaminated material (with water) in a vat, or agitated vessel, to dissolve water-soluble contaminants and create a slurry mixture. This treatment option was eliminated from consideration because, by virtue of the parent rock types that were mined, that is, sulfide (acid-producing) and carbonate (acid-neutralizing) tailings were commingled along the deposition path within the Silver Creek valley. Therefore, the tailings are (predominantly) favorably mixed to promote overall acid neutralization effects. The tailings mixture is also observed to be predominantly coarse material with a limited portion of slimes. Soil washing and particle separation would result in limited gains versus the associated cost and effort; this option was not retained.
- **Passive bioremediation** – Initial investigations into in situ passive bioremediation revealed that the flow within Silver Creek is, overall, too great, to treat passively without some engineering modifications. Also, the highly alkaline nature of Silver Creek water would render the inclusion of SRBs largely ineffectual. Some other possible options to target specific tailing locations include the placement of an adsorptive media such as zero-valent iron, granular iron, zeolite, or biochar. These options could be installed as barrier walls, gabion-type structures, or possibly reactor beds and tanks. Water aeration, precipitation, and settling, was also considered based on the elevated iron concentrations and circum-neutral pH observed at the site. It would be helpful to slightly boost the Silver Creek pH, however, to approximately 8. The creation of turbulent flow to promote aeration, and placement of settling ponds to allow for the resulting precipitate to drop out of solution are also required. Settling ponds would need to be serviced on occasion to remove precipitate. The passive bioremediation option was not retained based on the need for inclusion of passive bio-remedial alternatives at multiple targeted locations at the site to be efficient for contaminant removal.
- **Vegetative treatment** – Vegetative treatment uses plants to remove, transfer, stabilize, or destroy contaminants in soil or sediment. Because of the depth of waste, limited depth of root penetration, and harvested material handling requirements, phytoremediation was not retained.
- **Hydraulic isolation of tailings** – This option would leave tailings in place but physically isolate them from interaction with surface water flow. This action would require isolation of the surface water flow by creating a creek barrier via lining the channel with an impervious material, or by placing all surface water flow within a containment structure such as a pipe. Because there is a flux of surface water that enters the Silver Creek flow



path from lateral overland flow, surface springs, and subsurface springs, it is likely that creek flow cannot be controlled in a way that would disallow ancillary channels to form in the valley and, consequently, continue to react with tailings. This action would result in continued contaminant generation that a lined channel is intended to eliminate. Therefore, this alternative was not retained.

**3.1.2.2. Retained Technologies.** The following technologies were retained for further evaluation in this EE/CA, and for composing remedial alternatives. The technologies have been tailored to address specific conditions and other local requirements at the Richardson Flat OU2/3 Tailings site.

- **Post Removal Site Controls, Surface Controls, and Physical Barriers** – These technologies are retained for implementation at the site, although they would be included as part of a larger removal action.
- **On-Site Consolidation** – Tailings would be removed from the site and placed into a local repository. Tailings would be removed by visual identification until the underlying historical wetland surface, or other naturally emplaced material, is encountered. Field confirmation may be employed to ensure removal of tailings. The resultant landscape would be modified as appropriate to enhance the natural environment.
- **Drainage and Slope Stabilization, Revegetation** – These technologies would be implemented as required to maintain the natural setting, revised topography, and surface water drainage, after the tailings removal.
- **Placement of a Topsoil Cover Over Tailings** – Transport clean topsoil to the site and place as a 6-inch lift over the tailings to act as a barrier to direct tailings contact.

### **3.1.2.3. Proposed Alternative Options**

EPA developed and evaluated five alternatives as part of the EE/CA:

- **Alternative 1: No Action.** Under Alternative 1, no treatment, containment, or removal action would occur at the site, and all threats would remain unchanged. Mining waste and contaminated soils would continue to threaten human and ecological receptors.
- **Alternative 2: Targeted Physical Removal of Tailings.** Alternative 2 considers targeted tailings removal at the site under five possible scenarios. All scenarios conclude with depositing the tailings in the OU1 repository located adjacent to the site between Highway 248 and Highway 40 at 40.678354 latitude and -111.452524 longitude.
  - *Scenario A:* The entire site area (Reaches 2–6)
  - *Scenario B:* Three net acid-generating tailings areas—Big Four Tailings, Upper Meadow Tailings at River Bend, and Floodplain Tailings (Areas 1–3 within Reaches 2, 3, and 6)
  - *Scenario C:* South of the Big Four Mill (Reaches 2–5) and the net acid-generating tailings area at Big Four Tailings (Area 3 within Reach 6)

- *Scenario D*: Three net acid-generating tailing areas—Big Four Tailings, Upper Meadow Tailings at River Bend, and Floodplain Tailings (Areas 1–3 within Reaches 2, 3, and 6)—as well as elevated lead-containing tailings downstream of Prospector Square within Reach 1 (at locations to be determined)
- *Scenario E*: The region extending from the Floodplain Tailings to the Upper Meadow Tailings (Reaches 2, 3, and 4) as well as tailings spots in Reach 1 below Prospector Square (at locations to be determined)
- **Alternative 3: *In Situ* Tailings Nutrient Amendment and Revegetation.** Alternative 3 intends to amend tailings *in situ* by using a nutrient blend and adding a seed mixture to promote plant growth and stabilize the substrate.
- **Alternative 4: Revegetation via Modification of Surface Water Distribution within Silver Creek Valley.** Alternative 4 promotes vegetative recovery by redistributing surface water via channel reorientations (braiding, meandering, or ponding) to make water more available within the valley.
- **Alternative 5: Placement of a Topsoil Cover Over Tailings.** Alternative 5 transports topsoil to the site and places it as a 6-inch lift over the tailings to act as a barrier to direct contact with the contamination.

Retained removal action alternatives listed above are fully described in [Section 3.2.2](#) and carried through a detailed analysis in [Section 3.3](#).

### 3.1.3. Applicable or Relevant and Appropriate Requirements

Pursuant to the NCP at 40 Code of Federal Regulations (CFR) § 300.415(j), removal actions must attain federal and state ARARs to the extent practicable considering the exigencies of the situation. The identification of ARARs is an iterative process; therefore, ARARs are referred to as potential until the final determination is made by USEPA in the action memorandum.

NCP at 40 CFR § 300.5 identifies ARARs and “To Be Considered” (TBC) criteria as follows:

- **Applicable requirements** are defined as “those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance found at a CERCLA site.”
- **Relevant and appropriate requirements** are defined as “those cleanup standards, standards of control, and other substantive requirements, criteria, or limitation promulgated under federal or state environmental facility siting laws that, while not ‘applicable’ address problems or situations sufficiently similar to those encountered at the CERCLA site and that is well suited to the particular site.”
- **TBC criteria** consist of advisories, criteria, or guidance that were developed by USEPA, other federal agencies, or states that may be useful in developing CERCLA remedies and include non-promulgated guidance or advisories that are not legally binding and that do not have the status of potential ARARs. TBCs generally fall within three categories:



health effects information with a high degree of credibility, technical information on how to perform or evaluate site investigations or response actions, and policy.

ARARs apply to on-site actions completed as part of a removal action. Compliance with ARARs requires compliance only with the substantive requirements contained within the statute or regulation and, pursuant to CERCLA § 121(e)(1), does not require compliance with procedural requirements, such as permitting or recordkeeping. ARARs do not apply to off-site response actions. Instead, off-site response actions must comply with independently applicable requirements (not relevant and appropriate) and must comply with both substantive and procedural components of the requirements.

USEPA, as the lead agency, is responsible for identifying potential federal ARARs and the Utah Department of Environmental Quality (UDEQ) is responsible for identifying potential State of Utah ARARs. Potential ARARs for the Richardson Flat OU2/3 Tailings site are presented in Table 1.

USEPA has divided ARARs into three categories: chemical specific, location specific, and action specific. The three categories are described below:

- **Chemical-specific ARARs** are usually health- or risk-based numerical values or methodologies that, when applied to site-specific conditions, result in the establishment of numerical values. These values establish the acceptable amount or concentration of a chemical that may be found in, or discharged to, the ambient environment.
- **Location-specific ARARs** apply to the geographical or physical location of a site. These requirements limit where and how the response action can be implemented.
- **Action-specific ARARs** include performance, design, or other controls on the specific activities to be performed as part of the response action for a site.

## 3.2. DESCRIPTION OF ALTERNATIVES

This subsection describes the removal action alternatives for the Richardson Flat OU2/3 Tailings site. [Section 3.2.1](#) provides a summary of common construction, excavation, stabilization and restoration, and maintenance elements applicable to all alternatives, as well as potentially unavoidable impacts. A detailed description of removal action alternatives and associated costs, which focuses on the different waste disposal options, is presented in [Section 3.2.2](#).

### 3.2.1. Common Elements

To reduce repetitive discussion in the detailed alternative analyses, common removal action elements for Alternatives 2 through 5 are provided in the following subsections.

#### 3.2.1.1. *Common Elements for Construction Activities*

**Site Preparation.** Laydown areas would be established within the Richardson Flat OU2/3 Tailings site at an advantageous location after biological and cultural resource clearances. Laydown areas may include portable toilets, wash water, refuse pickup, decontamination station, temporary offices, personal protective equipment and first aid supply storage, temporary Wi-Fi



and radio, and a source of water from a tank stand. The laydown areas would also include security personnel and temporary security fencing and signage for access controls. Laydown areas would remain until completion of the removal action.

Power for the project would be provided by diesel generators within the laydown area. The diesel generators would require bulk fuel storage at the laydown area, as well as daily storage on the project site. All best management practices would be adhered to, including a secondary containment area that would be constructed around generators, storage tanks, and the fueling area. The generators would provide power for various types of construction equipment, lighting systems, and pumps. A water storage tank for the water trucks would also be required. A local source of potable water would be used.

**Cultural and Biological Exclusion and Timing.** Cultural resource investigations have not been performed at the site. However, compliance requirements for cultural resources would be specified by USEPA. For this EE/CA and consistent with other CERCLA actions taken in this area, cultural resources would be avoided or protected during site work activities.

Natural resource surveys for special status, threatened, or endangered species would be required to verify the current land use at the site area, mapped habitat and vegetation cover types, and recorded locations of potential special status species resources.

The removal actions may involve creating truck paths and widening access roads for haul roads and establishing an overall work area. Therefore, additional field surveys and reports of both natural and cultural resources in the proposed work areas may be required. The surveys must conclude that the proposed removal action project area would not affect natural and cultural resources before design and construction can proceed.

**Site Access.** During the response and restoration activities, access to the Richardson Flat OU2/3 Tailings site would be restricted by signage, temporary fencing at access points, and security as deemed appropriate. The laydown areas would be completely fenced. The site foreperson and the health and safety officer would be responsible for personnel and visitors while they are on site. USEPA and its authorized representatives, including its contractors, and representatives would have access to the site at all times. A site access and security plan would describe the activities used to monitor and control access to the site during implementation of the response actions and the period of work performance.

The alternatives being considered would require an extensive amount of construction materials and water hauling over approximately two field seasons. Construction of some haul roads would be required at strategic locations at the site in an effort to minimize the number of haul roads.

During transport of materials on or off site, traffic controls would be necessary. A traffic control plan would be developed and followed throughout operations. Even with precautions, nearby roads may require maintenance to protect the roadway and road users. To maintain road load limits, scales may be used to weigh haul trucks to remain within those limits. Observing road load limits would help reduce roadway wear and maintain the local roadways in a safe operating condition. Equipment and materials would be available to restore the roadways as needed.



**Air Monitoring.** A sampling and analysis plan would be prepared to describe the methods and procedures for collecting, analyzing, and evaluating air samples within and at the perimeter of work zones and within near-by residential areas. Air monitoring stations may be positioned and operated to monitor dust and airborne contaminant concentrations during grubbing, excavation, stockpiling, loading of trucks, hauling, waste transfer, and site restoration. Air monitoring and dust suppression measures would be used to document that off-site migration of contaminants at unacceptable concentrations does not occur, maintain compliant air quality conditions and a safe working environment, and protect the health of nearby residents, workers, the general public, and the environment. Water spraying would be used during soil-moving activities at all work zones for dust suppression. Alternate engineering controls may be used on haul roads to limit water application needs. Water would be sourced as described under site preparation.

**Dust Control.** Off-road haul routes and site excavation, waste transfer, and restoration areas would be wetted so that dust generation is minimized. Water spraying would be used during soil-moving activities for dust suppression. Rock fields and grating would also be used to reduce the track-out of dirt onto paved surfaces. To maintain the haul routes as laid out, signs and barriers would be provided, as necessary, to contain traffic along the designated route. Water used for dust control and cleaning of paved surfaces would be imported as described under site preparation. Dust control would be used to maintain compliant air quality conditions and a safe working environment and to protect the health of nearby residents, workers, the general public, and the environment in accordance with a site-specific Fugitive Dust Plan

### ***3.2.1.2. Common Elements for Excavation Activities***

Common excavation elements for implementation of Alternatives 2, 4, and 5 at the Richardson Flat OU2/3 Tailings site, including excavation approach, tailings handling and transfer, soil cover design, stream channel design and restoration, CERCLA combined actions, and the CERCLA Off-Site Rule, are described below.

**Excavation Approach.** Removal of tailings deposits within the Silver Creek flow path is the removal action of primary concern at the site. Excavation would require removal of tailings thicknesses ranging from a few inches to approximately 5 feet. Final status surveying or sampling would be conducted to verify attainment of RAOs. Tailings would be temporarily stockpiled for load out in work areas. Surface restoration would be applied in areas where tailings are removed.

Alternatives 2 and 4 require excavation of tailings. Specific excavation approaches are listed below.

- ***Fluvially deposited contaminated tailings and tailings piles.*** Because tailings were deposited within the Silver Creek valley by streamflow, the tailings were laid down predominantly as a 6- to 18-inch-thick veneer along the Silver Creek flow path. Tailings were also collected into hummocks and berms for later transportation to the Big Four Mill to be re-processed. Many hummocks and berms remain on site today within the Upper Meadow area. Tailings that were re-processed at the Big Four Mill were replaced into Silver Creek, accumulating into a layer approximately 5 feet thick below the mill. The purpose of reclamation activities is to remove tailings and restore Silver Creek, to the



extent possible, for this action. Removal alternatives will consider interacting components that will augment the creek by tailings removal, stream restoration, and revegetation. Tailings would be moved to a repository.

- **Dust suppression.** Dust suppression measures during excavation will include a 6,000-gallon water truck. Heavy equipment access mats will be used to provide structural stability for heavy equipment and trucks in soft and muddy work areas. Dump trucks assumed for transport on the site include 16.7-cubic-yard dump trucks. Dry brushing of the truck bed and wheels would occur before each truck leaves the site or transfer station.
- **Repository options.** OU1 is a remnant of prior removal activities performed at the site and is located adjacent to the site between Highway 248 and Highway 40 at 40.678354 latitude and -111.452524 longitude. The OU1 repository is approximately 50 acres in size and is considered the primary option for tailings placement for these removal activities. OU1 was constructed to accept wastes related to the site, as well as other locally derived wastes. An additional repository is considered for construction at a location south of Promontory Ranch Road at 40.718839° latitude and -111.477379° longitude on the slope above the Silver Creek floodplain. This potential repository location is 6 acres in size, situated within a dry ravine, and would be unlined.

### **3.2.1.3. Common Elements for Stabilization and Restoration Activities**

Common stabilization and restoration elements for implementation of Alternatives 2 through 5 at the Richardson Flat OU2/3 Tailings site, including stabilization in place, and site restoration, are described below.

**Stabilize-in-Place Approaches.** Tailings may be left in place dependent on access, steep banks, and possibly a narrowed scope based on funding. Additional factors considered when identifying areas of contamination to be managed through stabilizing in place are:

- **Mature vegetation** – Removal of contamination would damage the existing vegetation, which is unlikely to regenerate to the level of existing stability and ecological value for watershed protection. This vegetation stabilizes the existing area and reduces transport of contaminants.
- **Established ecosystem** – Areas where a surviving ecosystem is established, despite contaminant exposures, such as beaver-ponded and wetland areas, may be left undisturbed.
- **Difficult access** – Risk of interaction with human receptors at the location is low based on the terrain and land use.

Stabilization may include revegetation by adding nutrients and a seed mixture, terracing, and re-establishing stream channels. Stabilization would require monitoring of improvements in vegetative cover and density.

**Site Restoration Activities.** Site restoration and the corresponding typical restoration approaches require common needs. Details regarding restoration features are described below:



- **Tailings Excavation Areas** - Excavated areas would be backfilled as necessary, graded to pre-tailings deposition contours when possible, and oriented to reduce erosion with drainage pathways integrated with the topography and existing drainage patterns to the extent possible. Channel widths would be designed to accept high flow run-off while not deteriorating the channel design.
- **Main Haul Roads** - Haul road options at the site include existing dirt, gravel, and paved roads. The roads would be used to transport tailings from the site to a repository, transport materials (topsoil, nutrients, seed, etc.) to the site, and for placing heavy equipment at site locations to perform operations in specific areas.

The roads would be improved to facilitate construction access and removal of waste. Water control bars and rolling dips would be used on portions of the road that have an extended length and a slope greater than 5 percent. Rock weirs and drop structures would be constructed in drainage swales to reduce erosion.

#### **3.2.1.4. Common Elements for Maintenance**

Common elements for the maintenance of surficial restoration and stabilization features at the site under Alternatives 2 through 5 are described below. In addition, a site-wide inspection of the stability of all features should be conducted each year for five years.

**Inspection, Maintenance, and Monitoring of Stabilized-in-Place and Surficial Restoration Features.** Inspections and maintenance may be performed for at least the first 5 years after stabilization and restoration outlined in [Section 3.2.1.3](#). A long-term inspection and monitoring plan, including periodic vegetation surveys and drainage sediment and surface water sampling, is recommended.

Semi-annual inspection, maintenance, and repair would include:

- Vegetation surveys (monitoring) of stabilized and restored features in late spring to assess cover density, type, and height and plant success
- Vegetation maintenance of stabilized and restored features, including reseeded and replanting
- Erosion control inspection and maintenance surveys of stabilized and restored features and roads after snowmelt and the monsoon season
- Maintenance and repair of erosional activities on stabilized and restored features until vegetation is holding soil in place and erosional activities have diminished
- Maintenance and repair of erosional activities along haul roads and reclaimed access roads unless road use is no longer required
- Inspection and maintenance and repair of stormwater controls and in-channel sediment detention structures and reseeded, replanting, and removing weeds in drainage pathways

Land use controls may be required for waste stabilized in place. The form of the land use controls would likely be a land withdrawal or an environmental covenant, such as an easement to



restrict future residential use or activities that would disturb waste at the site. Further, a resource management plan would be prepared to guide agencies responsible for various use of the lands.

### ***3.2.1.5. Potential Unavoidable Impacts***

Except for Alternative 1 (no action), each of the removal action alternatives would result in an overall improvement to the local environment. However, for Alternatives 2 through 5, unavoidable impacts are expected and may include:

- Local populations using common roads associated with the site would be inconvenienced, including general disturbance to local residents from heavy equipment activity during the approximately two field seasons of construction and increased truck traffic. Generation of dust on access and haul roads would be minimized by water spraying or other engineering controls during construction and hauling activities. Noise would be limited to normal work hours to avoid disturbing local residents.
- Disruption of sensitive species and habitat during construction activities may occur at the Richardson Flat OU2/3 Tailings site. Conservation measures would be implemented to protect the continued existence of any identified sensitive species during the proposed action. The timing and location of construction activities would be adjusted to limit disturbance, and biological monitoring would be conducted during construction activities.
- Cultural resources have not been identified at the Richardson Flat OU2/3 Tailings site.
- No disruption of wildlife access to the Richardson Flat OU2/3 Tailings site would occur after construction. Access to any repository covers would be restricted with temporary range fencing depending on cap design to limit damage to the cap.
- Risk of traffic accidents, fatalities, and greenhouse gas emissions would increase from the trucking of cover material and waste. The potential risks increase with the off-site haul distances. Trucking mileage, greenhouse gas emissions, traffic accidents and traffic- and emission-related fatalities are discussed for each removal action alternative in [Section 3.3](#).
- Water and other engineering controls would be used for dust control during excavation and restoration, and on roads during waste hauling. Water use is discussed for each removal action alternative in [Section 3.3](#).

## **3.2.2. Description of Removal Action Alternatives**

The following subsections present descriptions of the five removal action alternatives identified in [Section 3.1.2](#) for the Richardson Flat OU2/3 Tailings site.

### ***3.2.2.1. Alternative 1: No Action***

Under Alternative 1, no treatment, containment, or removal action would occur at the site. In this case, all threats would remain unchanged. Mine waste and contaminated soils would continue to threaten human and ecological receptors.



### ***3.2.2.2. Alternative 2: Targeted Physical Removal of Tailings***

Under Alternative 2, RAOs would be accomplished through excavation of accessible mine tailings, hauling, and consolidation of waste in the OU1 repository. Site excavation and stabilization and restoration elements common to removal action alternatives are described in [Section 3.2.1.2](#) and [Section 3.2.1.3](#).

Addressing all tailings within the Richardson Flat OU2/3 Tailings Site, as outlined in Alternative 2, Scenario A, would equate to approximately 1,321,476 cubic yards of tailings being removed from the Site area. Scenarios B through E propose targeting specific tailing areas within the larger site area. Tailings removal for on-site consolidation will use 16.7-cubic-yard dump trucks for waste transport on existing haul roads to the extent possible. Limited on-site access roads will be required to access some tailing areas.

All tailings areas may be reclaimed in some fashion including possible soil amendment, revegetation, and modification of historical surface water flow paths. The inclusion of historical wetland organic material observed under the tailings deposits during test pit excavation activities would be incorporated into the remedy as an organic substrate.

Revegetation would include using native plants to blend in with the landscape. Cattle grazing would be restricted in tailings removal areas. Because the site area use is predominantly limited to open space, except for current limited cattle grazing, and incorporates relatively flat-lying topography, other site restoration activity needs such as securing high walls, additional mine debris and features, and excessive surface water run-on paths are not expected.

A geomorphic design approach would blend the erosion controls and surface water flow paths in a fashion to mimic topography and historical flow paths as observed during removal activities.

#### **On-site Conceptual Design**

The conceptual design for the Alternative 2 tailings removal may include restoration of the original surface topography, including historical surface water flow paths, ponds, and floodplains. Some re-engineering of surface water flow may be required to distribute water in a beneficial way to enhance vegetation health. The conceptual design assumes tailings placement into the already established OU1 repository.

#### **Removal Action Components**

Additional information regarding common excavation and restoration elements is provided in [Section 3.2.1.2](#) and [Section 3.2.1.3](#). The removal action components for Alternative 2 are:

- Excavation and stockpiling of non-impacted organic wetland material, and on-site gravels, for site restoration uses
- Construction of access and haul roads within the tailings area to move tailings to a repository
- Hauling mill tailings to one or more repositories for final disposal



- Grading of the newly exposed historical wetland surface, construction of erosion and stormwater controls, and revegetation as needed
- Contour grading and revegetation of excavated areas
- Construction of sediment detention structures, as appropriate, pending observation of the resultant historical wetland surface
- Implementation of access controls, such as temporary range fencing to allow for successful revegetation
- Maintenance and monitoring of the stabilization and restoration areas for up to 5 years

### **3.2.2.3. Alternative 3: *In Situ* Tailings Nutrient Amendment and Revegetation**

Under Alternative 3, RAOs would be accomplished through leaving tailings in place and amending *in situ* with a nutrient blend, and adding a seed mixture, to promote plant growth and stabilize the tailings substrate. Implementation and maintenance of site restoration measures and land use and access controls to protect the site restoration process would be required. Site excavation and restoration elements common to removal action alternatives are described in [Section 3.2.1.2](#) and [Section 3.2.1.3](#).

Under Alternative 3, an estimated 300 acres of land area would be revitalized by amending the tailings with nutrients to promote healthy plant growth, and the placement of seed mixtures that would act to vegetate the tailing areas and reduce wind and water erosion. This revegetation plan is designed to amend the upper surface media (which includes soils, tailings, and sediments) to help enrich the media to establish a vegetative cover of adapted, hardy, metal-tolerant, and acid-tolerant grasses and forbs. After applying soil amendments and preparing a seedbed, site-specific seed mixtures will be used to establish self-sustaining vegetation. Once vegetation begins to establish (estimate two to three growing seasons), the root/soil/microorganism interactions within the upper few inches of surface media will help to provide nutrient cycling, fertility, plant-available water, and other important aspects to transform the upper surface media into a viable plant-growth medium.

### **Removal Action Components**

Additional information regarding common excavation and restoration elements is provided in [Section 3.2.1.2](#) and [Section 3.2.1.3](#). The removal action components for Alternative 3 are:

- This alternative is not a removal action but is designed to reduce physical access to the mine tailings, as well as minimize erosive effects.
- The alternative will enrich the surface media to establish a vegetative cover of adapted, hardy, metal-tolerant, and acid-tolerant grasses and forbs.
- Once vegetation begins to establish (estimate two to three growing seasons), the root/soil/microorganisms interactions within the upper few inches of surface media will help to provide nutrient cycling, fertility, plant-available water, and other important aspects to transform the upper surface media into a viable plant-growth medium.



- Seed drills or broadcast spreaders will require access to the site area, likely pulled by a low surface impact tractor. Construction of access roads would be minimal.
- Inspection and maintenance of the seeded areas would be recommended for 2 to 5 years.

#### ***3.2.2.4. Alternative 4: Removal of Tailings and Revegetation through Modification of Surface Water Flows within the Silver Creek Valley***

Under Alternative 4, RAOs would be accomplished by the re-establishment of historical Silver Creek flow paths through the valley to revitalize natural flora. Prior to the valley being inundated with tailings, a well-established riparian zone was present, as evidenced by observations within test pit stratigraphy as an organic-rich zone, observed to range in thickness from 2 to 46 inches.

Under Alternative 4, some volume of tailings may be removed from the site area, depending on the areas that are proposed for this alternative. The total volume of tailings at the site has been calculated to be approximately 1,321,476 cubic yards. The tailing areas south of the former Big Four Mill are observed to be 0.5 to 1.5 feet thick. Tailings north of the former Big Four Mill are as thick as approximately 5 feet.

Access road construction within the tailings areas and improvement and maintenance of existing haul routes would be required, as well as excavators, haul trucks, and surface water re-routing in work areas. Because the historical wetland zone would be unearthed, there may be ample dormant seeds within the material to establish a healthy vegetative cover without reseeded or allow limited reseeded. The removal of tailings will be a restorative benefit for the site area.

#### **Removal Action Components**

Additional information regarding common excavation and restoration elements is provided in [Section 3.2.1.2](#) and [Section 3.2.1.3](#). The removal action components for Alternative 4 are:

- Physical removal of mine tailings in selected areas
- Construction of access and haul roads within the tailings area to move tailings to a repository
- Re-alignment of historical Silver Creek channels that become exposed after tailings removal to distribute surface water in the most beneficial manner
- Excavation and stockpiling of organic wetland material, and on-site gravels, for site restoration uses
- Grading of the newly exposed historical wetland surface, construction of erosion and stormwater controls, and revegetation as needed
- Contour grading and revegetation of excavated areas
- Construction of sediment detention structures as appropriate pending observation of the resultant historical wetland surface
- Implementation of access controls, such as temporary range fencing to allow for successful revegetation



- Maintenance and monitoring of the stabilization and restoration areas for up to 5 years

### ***3.2.2.5. Alternative 5: Placement of a Topsoil Cover Over Tailings***

Under Alternative 5, RAOs would be accomplished by eliminating physical contact to tailings. A 6-inch-thick layer of clean topsoil would be placed onto the tailings surface, thereby insulating the tailings from direct physical contact.

Any variation of topsoil placement may be added to specific site areas, depending on site access control needs, and topsoil cover needs in areas where tailings may not have been removed. The total volume of topsoil required to cover the site area with a 0.5-foot-thick layer is estimated to be 242,000 cubic yards.

Access road construction within the tailings areas and improvement and maintenance of existing haul routes would be required, as well as excavators, haul trucks, and surface water re-routing in work areas.

### **Removal Action Components**

Additional information regarding common excavation and restoration elements is provided in [Section 3.2.1.2](#) and [Section 3.2.1.3](#). The removal action components for Alternative 5 are:

- Construction of access and haul roads within the tailings area to move and place topsoil
- Contour grading to promote even placement of topsoil
- Implementation of access controls, such as temporary range fencing
- Maintenance and monitoring of the stabilization and restoration areas for up to 5 years

## **3.3. DETAILED ANALYSIS OF ALTERNATIVES**

As required by the NCP and described in the “Guidance on Conducting Non-Time Critical Removal Actions under CERCLA” (USEPA 1993), retained removal action alternatives are evaluated individually against three broad criteria: effectiveness, implementability, and cost.

The following subsections describe the NCP evaluation criteria and how these criteria are addressed under each alternative considered for the Richardson Flat OU2/3 Tailings site.

### **3.3.1. Effectiveness Criterion**

This criterion evaluates protectiveness and compliance with ARARs, along with short- and long-term effectiveness and permanence, and reduction in toxicity, mobility, or volume of waste.

- **Overall Protection of Human Health and the Environment** – This threshold criterion evaluates whether each alternative provides adequate protection of human health and the environment. The assessment of overall protection focuses on whether a specific alternative achieves adequate protection and how site risks posed through each pathway addressed by the EE/CA are eliminated, reduced, or controlled through treatment,



engineering, or land use controls. Based on effectiveness and ARAR compliance, alternatives are either considered protective or not protective.

- **Compliance with ARARs** – This threshold criterion evaluates whether each alternative would meet the identified ARARs.
- **Short-Term Effectiveness (during removal action)** – This criterion evaluates the effects that the alternative would have on human health and the environment under current conditions prior to the action and during its construction and implementation phase. The evaluation includes risks to the workers and communities under current conditions and from construction work, fuel consumption, greenhouse gas emissions, water use, waste and materials management, ecosystem protection, and traffic accident and traffic-fatality risk during implementation, and particulate matter of 2.5 microns or less in diameter (PM<sub>2.5</sub>) emissions, and also takes into account the time necessary to complete the action.
- **Long-Term Effectiveness and Permanence (after removal action)** – This criterion evaluates the results of the removal action in terms of the risk remaining at the site after response objectives have been met. The primary focus of this evaluation is on the extent and effectiveness of the controls used to manage the risk posed by wastes remaining at the site.

### 3.3.2. Implementability Criterion

This criterion evaluates the technical and administrative feasibility of implementing an alternative and the availability of required services and materials.

- **Technical Feasibility** – This criterion takes into account construction considerations, demonstrated performance, adaptability to environmental conditions, and timing.
- **Availability of Required Services and Materials** – This criterion evaluates whether staff, equipment, services, disposal locations, and any other required services and materials are available in the necessary timeframes for construction and maintenance activities. This criterion was combined with technical feasibility for this EE/CA.
- **Administrative Feasibility** – This criterion considers regulatory approval and scheduling constraints.
- **Community Acceptance** – Community acceptance will be addressed in the action memorandum after the public review and comment period on the draft EE/CA.

### 3.3.3. Cost Criterion

The types of costs assessed include the following:

- Capital costs, including both direct and indirect costs
- Annual maintenance costs
- Net present value of capital and maintenance costs



The level of accuracy is suitable for the screening of alternatives in an EE/CA as described in USEPA's "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study" (USEPA 2000). Engineering costs are based on current year (2024) dollars and are estimates within plus 100 to minus 50 percent of the actual project cost. Cost details for each cost category and cost estimate assumptions are presented in Appendix B.

### 3.3.4. Cost Estimating Process

Cost estimates were prepared in accordance with USEPA (2000) guidelines using engineer's estimates, unit costs (for example, cubic yard, linear foot, and square foot quantities) from RSMMeans 2024 cost estimating software, and professional experience based on vendor quotes and prior implementation. The accuracy of the cost estimates will be refined with further data, including the detailed analysis of alternatives and conceptual design and the remedial design.

Other construction-related costs were identified and included in the cost approach, including mobilization and demobilization, site preparation, dewatering, and site restoration. Non-construction-related costs required before and during construction activities were also identified and included in the cost approach, including design and planning costs.

### 3.3.5. Alternative 1: No Action

Alternative 1 (no action) is included as a baseline for evaluating the effects of no action and comparing no action to the removal action alternatives.

#### 3.3.5.1. Effectiveness

**Overall Protection of Public Health and the Environment** – Alternative 1 would not be protective and would not achieve RAOs. This alternative would not minimize potential exposure to or transport of COCs or COECs from the site. This alternative would not reduce risk to human health or the environment.

**Compliance with ARARs** – Under Alternative 1, there are no ARARs with which to comply per CERCLA § 121(d). ARARs are triggered by an action and are, therefore, not pertinent if no cleanup occurs.

**Short-Term Effectiveness** – Alternative 1 has no action, so no short-term risks would exist for the community or workers from construction activities. However, threats to human and ecological receptors would persist in the short term. Because no construction activities would occur, no additional energy use, greenhouse gas emissions, water use, waste and materials management, and ecosystem protection requirements would be triggered. No additional traffic volume or potential traffic accident injuries and traffic- and emission-related fatalities associated with construction or waste hauling would occur.

**Long-Term Effectiveness and Permanence** – Alternative 1 does not offer any long-term effectiveness and permanence in reducing potential risks to human and ecological receptors. No controls or long-term measures would be implemented to control COCs or COECs at the site.



**Reduction of Toxicity, Mobility, or Volume through Treatment** – Alternative 1 employs no treatment, so no reductions in toxicity, mobility, or volume through active treatment would occur.

### ***3.3.5.2. Implementability***

**Technical Feasibility and Availability of Services and Materials** – Alternative 1 would be readily implementable because no construction would be involved. This alternative would not impact the ability to conduct removal or remedial actions in the future. No services or materials would be needed to implement Alternative 1.

**Administrative Feasibility** – Alternative 1 would be administratively feasible as no action is taken.

### ***3.3.5.3. Costs***

No costs would be incurred for Alternative 1 as it involves no removal activities and no legal or administrative activities.

## **3.3.6. Alternative 2: Targeted Physical Removal of Tailings – Five Scenarios**

Alternative 2 involves the excavation of accessible mine tailings and placement into the OU1 repository.

- Scenario A: Remove all tailings from the site area and place at OU1 repository.
- Scenario B: Remove net acid-generating tailings within Areas 1, 2, and 3 (within Floodplain Tailings, Upper Meadow Tailings at River Bend, and Big Four Tailings). Place at OU1 repository.
- Scenario C: Remove all tailings south of the Big Four Mill location (Reaches 2, 3, 4, and 5), and the net acid-generating tailings at the Big Four Tailings location (Area 3 within Reach 6), place at OU1 repository.
- Scenario D: Remove the three net acid-generating tailing areas at the Big Four Mill, Upper Meadow Tailings at River Bend, and Floodplain Tailings locations (Areas 1, 2, and 3 within Reaches 2, 3, and 6). Also remove tailings spots in Reach 1 downstream of Prospector Square. Place at OU1 repository.
- Scenario E: Remove all tailings extending from the Floodplain Tailings to the Upper Meadow (Reaches 2, 3, and 4), and tailings spots in Reach 1 below Prospector Square. Place at OU1 repository.

### ***3.3.6.1. Effectiveness***

**Overall Protection of Public Health and the Environment** – Under Alternative 2, overall protectiveness would be considered good for achieving RAOs because mine waste that contains metal COCs and COECs would be excavated and consolidated at OU1. However, four of the five scenarios that are proposed do not remove all tailings. Because some of the tailings may be left



intact, the potential for direct contact, ingestion, and inhalation of contaminants by human and ecological receptors would not be fully eliminated. Alternative 2 would not be fully protective of public health and the environment; the effectiveness is dependent upon the particular scenario that would be employed at the site.

**Compliance with ARARs** – Federal and state ARARs identified in Table 1 would be met for the site under Alternative 2.

**Short-Term Effectiveness** – The short-term impacts to the community, workers, and the environment under Alternative 2 are described below.

- **Protection of the Community during Removal Action** – The site area is located within a mostly rural area with commercial and limited close-by residential areas. Dust control measures, such as water spraying, would be used during excavation, waste consolidation, waste compaction, and any capping of the waste. Trucks hauling equipment and supplies would also add noise. However, the trucks would be routed and operated under a transportation plan during times that would minimize impact to the surrounding area. Emergency spill containment and cleanup contingencies would also be included in the transportation plan.

- **Protection of Workers** – Short-term risks of physical injury would exist for site workers under Alternative 2 during construction, primarily related to operating equipment during road construction, tailings excavation, site restoration, and tailings consolidation.

Short-term impacts to air quality in the surrounding environment may occur during excavation and loading of waste for transfer to the on-site consolidation area. Air monitors would be placed around the construction zone at the site and waste consolidation areas to measure dust concentrations. Engineering controls would be implemented to reduce dust levels to protect site workers. Water for dust suppression and enclosed cabs on equipment would be required to limit worker exposure to or inhalation of particulates. Water would be obtained from local municipal supplies for dust control.

- **Environmental Impacts** – Moderate short-term environmental impacts could occur from the excavation and on-site consolidation of waste. Environmental impacts would include a moderate increase in construction noise and traffic on roadways, water import and use for dust control and compaction, the potential for nuisance soil spills during on-site waste hauling, and additional greenhouse gas emissions within the region.
- **Time Until Removal Action Objectives Are Achieved** – Excavation, consolidation, and containment of waste on site would meet preliminary RAOs in the short term.

**Long-Term Effectiveness and Permanence (after removal action)** – Alternative 2 would be effective over the long term. Depending on the scenario, tailings would be removed to some degree from the site and eliminated from the human and environmental exposure pathway.

**Reduction of Toxicity, Mobility, or Volume through Treatment** – Alternative 2 employs no treatment, so no reductions in toxicity, mobility, or volume through active treatment would occur.

### 3.3.6.2. Implementability

**Technical Feasibility and Availability of Services and Materials** – Alternative 2 consists of earthwork and material consolidation and capping at an on-site repository. The equipment required for the work is readily available and consists of conventional excavators, loaders, and articulated haul trucks.

Construction and environmental monitoring equipment and services would be readily available. Labor would be available in the regional market. A sufficient volume of water for on-site dust suppression and waste and cap compaction may be obtained through municipal sources. No future removal actions would be anticipated at the site under Alternative 2. Long-term maintenance of the on-site repository would be required.

**Administrative Feasibility** – Alternative 2 would be administratively implementable and require coordination between USEPA, UDEQ, local, and regional entities that are participants in the site remedial effort. Permits for on-site actions would not be required under CERCLA.

### 3.3.6.3. Costs

A summary costs for Alternative 2 scenarios are presented in Exhibits 5–9. A more focused cost approach for each scenario is included in Appendix E. The scenarios include:

- **Scenario A:** Remove all tailings from the site area and place at OU1 repository.
- **Scenario B:** Remove three net acid-generating tailings areas at Big Four Tailings, Upper Meadow Tailings at River Bend, and Floodplain Tailings locations (Areas 1, 2, and 3 within Reaches 2, 3, and 6). Place at OU1 repository.
- **Scenario C:** Remove all tailings south of the Big Four Mill location (Reaches 2, 3, 4, and 5), and the net acid-generating tailings at the Big Four Tailings location (Area 3 within Reach 6), place at OU1 repository.
- **Scenario D:** Remove the three net acid-generating tailing areas at Big Four Tailings, Upper Meadow Tailings at River Bend, and Floodplain Tailings locations (Areas 1, 2, and 3 within Reaches 2, 3, and 6). Also remove tailings spots in Reach 1 downstream of Prospector Square. Place at OU1 repository.
- **Scenario E:** Remove all tailings extending from the Floodplain Tailings to the Upper Meadow Tailings (Reaches 2, 3, and 4), and tailings spots in Reach 1 below Prospector Square (locations to be determined). Place at OU1 repository.

**Exhibit 5. Alternative 2, Scenario A Cost Breakdown Estimate Summary**

Parameter	Costs (rounding errors are present)	
Planning Documents	\$1,521,000	
Site Preparation and Mobilization	\$636,000	
Sitewide Soil Excavation, Reaches 1 to 7	\$4,992,000	



Parameter	Costs (rounding errors are present)	
Tailings Dewatering Area	\$19,527,000	
Disposal at On-Site Repository	\$15,987,000	
Grading and Site Restoration	\$9,446,000	
Demobilization	\$474,000	
<b>Subtotal Construction Costs</b>	<b>\$52,583,000</b>	
Project Management: 12% Construction Cost	\$6,310,000	
Construction Contingencies: 20% of Construction Cost	\$10,517,000	
<b>Subtotal Capital Costs</b>		<b>\$69,410,000</b>
Annual Operation and Maintenance (O&M) Costs	\$290,000	
O&M Contingencies: 30% Annual O&M Cost	\$87,000	
<b>Subtotal Annual O&amp;M Costs</b>		<b>\$377,000</b>
Present Worth of Annual O&M Costs Based on 30 Year Life @ 2.50% P/A (present from annual) Factor = 20.93	\$7,891,000	
Five-year reviews, \$50,000 each for 6 reviews Present Worth of Future Costs Based on 30 Year Life @ 2.50%	\$398,000	
<b>Subtotal Present Worth 30 Year Life Costs</b>		<b>\$8,289,000</b>
<b>Total Present Worth</b>		<b>78,076,000</b>

#### Exhibit 6. Alternative 2, Scenario B Cost Breakdown Summary

Parameter	Costs (rounding errors are present)	
Planning Documents	\$474,000	
Site Preparation and Mobilization	\$229,000	
Area 3 Excavation and Loading	\$145,000	
Area 2 Excavation and Loading	\$124,000	
Area 1 Excavation and Loading	\$59,000	
Tailings Dewatering Area	\$836,000	
Disposal at On-Site Repository	\$1,505,000	
Grading and Site Restoration	\$646,000	
Demobilization	\$161,000	



Parameter	Costs (rounding errors are present)	
<b>Subtotal Construction Costs</b>	<b>\$4,180,000</b>	
Project Management: 12% Construction Cost	\$502,000	
Construction Contingencies: 20% of Construction Cost	\$836,000	
<b>Subtotal Capital Costs</b>		<b>\$5,517,000</b>
Annual Operation and Maintenance (O&M) Costs	\$95,000	
O&M Contingencies: 30% Annual O&M Cost	\$29,000	
<b>Subtotal Annual O&amp;M Costs</b>		<b>\$124,000</b>
Present Worth of Annual O&M Costs Based on 30 Year Life @ 2.50% P/A (present from annual) Factor = 20.93	\$2,585,000	
Five-year reviews, \$50,000 each for 6 reviews Present Worth of Future Costs Based on 30 Year Life @ 2.50%	\$203,000	
<b>Subtotal Present Worth 30 Year Life Costs</b>		<b>\$2,788,000</b>
<b>Total Present Worth</b>		<b>\$8,429,000</b>

#### Exhibit 7. Alternative 2, Scenario C Cost Breakdown Summary

Parameter	Cost (rounding errors are present)	
Planning Documents	\$783,000	
Site Preparation and Mobilization	\$813,000	
Reaches 1 – 5 Excavation and Loading	\$2,134,000	
Area 3 Excavation and Loading	\$205,000	
Tailings Dewatering Area	\$5,612,000	
Disposal at On-Site Repository	\$6,312,000	
Grading and Site Restoration	\$3,734,000	
Demobilization	\$332,000	
<b>Subtotal Construction Costs</b>	<b>\$19,992,000</b>	
Project Management: 12% Construction Cost	\$2,391,000	
Construction Contingencies: 20% of Construction Cost	\$3,984,000	
<b>Subtotal Capital Costs</b>		<b>\$26,300,000</b>
Annual Operation and Maintenance (O&M) Costs	\$240,000	
O&M Contingencies: 30% Annual O&M Cost	\$72,000	
<b>Subtotal Annual O&amp;M Costs</b>		<b>\$312,000</b>



Parameter	Cost (rounding errors are present)	
Present Worth of Annual O&M Costs Based on 30 Year Life @ 2.50% P/A (present from annual) Factor = 20.93	\$6,530,000	
Five-year reviews, \$50,000 each for 6 reviews Present Worth of Future Costs Based on 30 Year Life @ 2.50%	\$298,000	
<b>Subtotal Present Worth 30 Year Life Costs</b>		<b>\$6,828,000</b>
<b>Total Present Worth</b>		<b>33,440,000</b>

### Exhibit 8. Alternative 2, Scenario D Cost Breakdown

Parameter	Cost (rounding errors are present)	
Planning Documents	\$459,000	
Site Preparation and Mobilization	\$214,000	
Reaches 1 Excavation and Loading	\$18,000	
Area 3 Excavation and Loading	\$205,000	
Area 2 Excavation and Loading	\$178,000	
Area 1 Excavation and Loading	\$83,000	
Tailings Dewatering Area	\$853,000	
Disposal at On-Site Repository	\$1,023,000	
Grading and Site Restoration	\$219,000	
Demobilization	\$190,000	
<b>Subtotal Construction Costs</b>	<b>\$3,442,000</b>	
Project Management: 12% Construction Cost	\$413,000	
Construction Contingencies: 20% of Construction Cost	\$688,000	
<b>Subtotal Capital Costs</b>		<b>4,543,000</b>
Annual Operation and Maintenance (O&M) Costs	\$95,000	
O&M Contingencies: 30% Annual O&M Cost	\$29,000	
<b>Subtotal Annual O&amp;M Costs</b>		<b>\$124,000</b>
Present Worth of Annual O&M Costs Based on 30 Year Life @ 2.50% P/A (present from annual) Factor = 20.93	\$2,585,000	
Five-year reviews, \$50,000 each for 6 reviews Present Worth of Future Costs Based on 30 Year Life @ 2.50%	\$203,000	
<b>Subtotal Present Worth 30 Year Life Costs</b>		<b>\$2,788,000</b>
<b>Total Present Worth</b>		<b>\$7,455,000</b>

### Exhibit 9. Alternative 2, Scenario E Cost Breakdown

Parameter	Cost (rounding errors are present)	
Planning Documents	\$541,000	
Site Preparation and Mobilization	\$622,000	
Reaches 1 – 4 Excavation and Loading	\$1,111,000	
Tailings Dewatering Area	\$1,662,000	
Disposal at On-Site Repository	\$1,989,000	
Grading and Site Restoration	\$1,451,000	
Demobilization	\$239,000	
<b>Subtotal Construction Costs</b>	<b>\$7,615,000</b>	
Project Management: 12% Construction Cost	\$914,000	
Construction Contingencies: 20% of Construction Cost	\$1,523,000	
<b>Subtotal Capital Costs</b>		<b>\$10,052,000</b>
Annual Operation and Maintenance (O&M) Costs	\$150,000	
O&M Contingencies: 30% Annual O&M Cost	\$45,000	
<b>Subtotal Annual O&amp;M Costs</b>		<b>\$195,000</b>
Present Worth of Annual O&M Costs Based on 30 Year Life @ 2.50% P/A (present from annual) Factor = 20.93	\$4,081,000	
Five-year reviews, \$50,000 each for 6 reviews Present Worth of Future Costs Based on 30 Year Life @ 2.50%	\$203,000	
<b>Subtotal Present Worth 30 Year Life Costs</b>		<b>\$4,284,000</b>
<b>Total Present Worth</b>		<b>14,531,000</b>

#### 3.3.6.4. Cost Assumptions

The level of detail in developing these estimates is considered appropriate for the screening of alternatives, but the cost estimates are not intended for use in detailed budgetary planning. The accuracy of the cost estimates will be refined with further data, including the detailed analysis of alternatives and conceptual design and the remedial design.

#### 3.3.7. Alternative 3: *In Situ* Tailings Nutrient Amendment and Revegetation

Alternative 3 would amend tailings in situ with a nutrient blend, and add a seed mixture, to promote plant growth and stabilize the substrate.



Under Alternative 3, an estimated 300 acres of land area would be revitalized by amending the tailings with nutrients to promote healthy plant growth, and the placement of seed mixtures that would act to vegetate the tailings areas and reduce wind and water erosion. This revegetation plan is designed to amend the upper surface media (which includes soils, tailings, and sediments) to help enrich the media to establish a vegetative cover of adapted, hardy, metal-tolerant, and acid-tolerant grasses and forbs. After applying soil amendments and preparing a seedbed, site-specific seed mixtures will be used to establish self-sustaining vegetation. Once vegetation begins to establish (estimate two to three growing seasons), the root/soil/microorganism interactions within the upper few inches of surface media will help to provide the nutrient cycling, fertility, plant-available water, and other important aspects to transform the upper surface medium into a viable plant-growth medium. Process details for this alternative are included in Appendix C.

### ***3.3.7.1. Effectiveness***

**Overall Protection of Public Health and the Environment** – Under Alternative 3, overall protectiveness would be considered reasonable for achieving RAOs because tailings would be bound within a vegetative cover. Tailings in all areas would be stabilized in place. The potential for direct contact, ingestion, and inhalation, would be substantially reduced where tailings have been bound within a vegetative cover. Tailings mobility and loading to and within drainages would be reduced. Alternative 3 would be protective of public health and the environment.

**Compliance with ARARs** – Federal and state ARARs identified in Table 1 would be met for the site under Alternative 3.

**Short-Term Effectiveness (during removal action)** – The short-term impacts to the community, workers, and environment under Alternative 3 are described below.

- **Protection of the Community** – Construction activities under Alternative 3 are minimal because tailings removal procedures will not be pursued. However, tailings may be disturbed by the act of pulling seeders or broadcast spreaders along the land surface. Therefore, air monitors would be placed around the site area to measure dust concentrations. Actions such as water suppression may be performed to reduce dust release if warranted to protect the community.
- **Protection of Workers** – Short-term risks of physical injury would exist for site workers under Alternative 3 primarily related to operating equipment during seed and nutrient addition to the tailings areas. However, additional risk of accidents is possible during the hauling of supplies to the site area. Mitigation of additional worker risk would require truck driver training and equipment inspections.

Air quality monitoring, water for dust suppression, enclosed cabs on equipment, and worker and equipment decontamination would be similar to Alternative 2. Work areas would be secured (for example, marked or fenced) to limit access to authorized personnel only.

- **Environmental Impacts** – Short-term environmental impacts could occur from the impact of driving equipment on the tailings surface. However, Alternative 3 would stabilize in place a substantial amount of surface tailings. Environmental impacts would



include a slight increase in associated equipment noise, traffic on highways and unpaved roads, water import volume and use for dust control (if deemed necessary via air monitoring).

Revegetation would expedite the return of native flora at the site and stabilize-in-place areas once cleanup actions are complete.

- **Time Until Removal Action Objectives Are Achieved** – Revegetation success is challenging to measure and monitor and can take several years to fully materialize. Native and introduced grass and forb seeds selected for reseeding this site may not germinate during the first growing season for several reasons, including the timing of precipitation, soil conditions (fertility and temperature) and poor soil contact.

**Long-Term Effectiveness and Permanence (after removal action)** – Tailings would be left in place and bound by or covered with vegetation. The stabilize-in-place areas would reduce solids and contaminant loading to local drainages and reduce erosive effects by wind and water. Physical access and potential exposure to the tailings would be greatly reduced by the vegetation.

Land use controls would be necessary to limit access to and disturbance of the stabilize-in-place areas. A long-term surveillance and maintenance plan would be implemented after construction to monitor erosion reduction and vegetative recovery at stabilize-in-place areas.

**Reduction of Toxicity, Mobility, or Volume through Treatment** – Alternative 3 employs no treatment, so no reductions in toxicity, mobility, or volume through active treatment would occur.

### ***3.3.7.2. Implementability***

**Technical Feasibility and Availability of Services and Materials** – Alternative 3 would use simple machinery to distribute seeds and nutrients to the site area. Equipment needs and personnel requirements are minimal and are widely available in the region. Labor market availability would be favorable. Water volume requirements for dust control at the site would be substantially less than for Alternatives 2 and 4, haul road access would be minimal. Long-term inspection and possible vegetation maintenance would be required as all tailings would remain.

**Administrative Feasibility** – Similar to Alternatives 2 and 4, Alternative 3 would be administratively implementable and require coordination between USEPA, UDEQ, and Park City.

### ***3.3.7.3. Costs***

Revegetation costs can be estimated but are quite variable because of the many non-standard factors and practices used by contractors. For example, one contractor may have revegetation construction equipment readily available and located nearby, while another contractor may have to lease the equipment or transport it from some distance to the project. Additionally, estimated costs per unit (acre, ton, cubic yard) are realistic, but would likely decrease with a larger project.



Estimated revegetation costs were determined using product and detailed information obtained on the internet, bid tabulations from similar revegetation projects over the last two years, and experiential knowledge of mine reclamation and construction.

The construction cost for Alternative 3 (assuming a soils pH of 5.5 to 7, and revegetation with 2 tons of lime addition and a drill seed operation) is estimated to be \$1,410,000. Other lime mixture and seed distribution options are possible depending on site needs that would be vetted at the time of application, and do change the cost. A summary of the major cost categories associated with implementing Alternative 3 is presented in Exhibit 10. A more focused cost approach is included in Appendix C.

**Exhibit 10. Alternative 3 Cost Breakdown**

Revegetation Item	Cost Estimate per 300 Acres (all figures are rounded)	
Clearing and Site Prep. (included flagging ecotype areas)	\$30,000	
Agricultural Lime (delivered)	\$180,000	
Bulk Compost (delivered)	150,000	
Fertilizer (N-P-K) (delivered)	30,000	
Seedbed Preparation (Equipment and Labor)	\$240,000	
Drill Seed and Cultipack (Equipment and Labor)	\$180,000	
Revegetation Seed Mixtures Standard Rates (average for three mixtures)	\$360,000	
2 T lime	\$ 180,000	
Mobilization and Demobilization	\$60,000	
<b>Subtotal Construction Costs</b>	<b>\$1,410,000</b>	
Project Management: 12% Construction Cost	\$295,000	
Construction Contingencies: 20% of Construction Cost	\$492,000	
<b>Subtotal Capital Costs</b>		<b>\$2,197,000</b>
Annual Operation and Maintenance (O&M) Costs	\$95,000	
O&M Contingencies: 30% Annual O&M Cost	\$29,000	
<b>Subtotal Annual O&amp;M Costs</b>		<b>\$124,000</b>
Present Worth of Annual O&M Costs Based on 30 Year Life @ 2.50% P/A (present from annual) Factor = 20.93	2,585,000	
Five-year reviews, \$50,000 each for 6 reviews Present Worth of Future Costs Based on 30 Year Life @ 2.50%	\$203,000	
<b>Subtotal Present Worth 30 Year Life Cost</b>		<b>\$2,788,000</b>
<b>Total Present Worth</b>		<b>\$5,109,000</b>



#### **3.3.7.4. Cost Assumptions**

The level of detail in developing these estimates is considered appropriate for the screening of alternatives, but the cost estimates are not intended for use in detailed budgetary planning. The accuracy of the cost estimates will be refined with further data, including the detailed analysis of alternatives and conceptual design and the remedial design.

#### **3.3.8. Alternative 4: Removal of Tailings to Pre-Mining Contours and Revegetation**

Alternative 4 is accomplished through the modification of surface water flows within the Silver Creek Valley. It is intended to promote vegetative recovery by redistributing surface water via channel reorientations (braiding, meandering, or ponding) to make water more available within the valley.

Typical channel restoration projects involve the raising of the water surface profile to reconnect the streamflow with the topsoil layers in the soil profile of incised channels. Incised channels are typically found in areas where ranchers removed willows and stream-side vegetation to expand areas for hay production and to ease the movement of cattle or sheep between pastures. As a result of the vegetation removal, the channels incise and the stream is disconnected from the topsoil layer.

For Silver Creek, instead of the channel becoming incised, the channel and riparian area was filled with tailings from the mills. Observations of soil layers in test pits show that the tailings are located on top of the organic layer created by the original wetland/riparian area adjacent to the historical stream channel. Under the organic layer is a layer of coarse alluvium deposited by the stream channel over a long period of time.

Therefore, instead of raising the water surface profile of Silver Creek, the water surface profile of the proposed new channel would be lowered into the coarse alluvium under the organic layer observed in the test pits. The organic layer would become the new stream banks along the new channel and would be the ideal growth medium to jump start the growth of vegetation in the restored wetland/riparian area adjacent to the new channel. Process details for this alternative are included in Appendix D.

##### **3.3.8.1. Effectiveness**

**Overall Protection of Public Health and the Environment** – Under Alternative 4, overall protectiveness would be considered good for achieving RAOs because tailings would be removed from the site and a riparian zone re-established. The potential for direct contact, ingestion, and inhalation, by human and ecological receptors would be reduced. Maintenance of this remedy would be minimal as natural conditions would be achieved.

**Compliance with ARARs** – Federal and state ARARs identified in Table 1 would be met under Alternative 4.

**Short-Term Effectiveness** – The short-term impacts to the community, workers, and environment under Alternative 4 are described below.



- **Protection of the Community** – Construction activities under Alternative 4 would occur throughout the site area and include excavating within tailings and historical wetland material with loaders or tracked equipment. Tailings will be transported by haul trucks approximately 4 miles to the existing OU1 repository. Because the immediate site area is largely rural with some commercial, and limited residential areas, air monitoring for particulates will be performed to guide actions to protect human health and the environment from dust emissions. Water suppression will also be needed. Surface water controls will also be employed at the site.
- **Protection of Workers** – Short-term risks of physical injury would exist for site workers under Alternative 4 during construction, primarily related to operating equipment during road construction, waste excavation, site restoration, loading waste into off-road articulated haul trucks, and waste hauling to the repository.

Air quality monitoring, water for dust suppression, enclosed cabs on equipment, and workers and equipment decontamination would be performed.

- **Environmental Impacts** – Even with erosion control measures, large short-term environmental impacts could occur from the excavation, hauling, and placement of materials at the OU1 repository. Environmental impacts would include an increase in construction noise, traffic, waste truck hauling on local roads, water import volume and use for dust control, the potential for nuisance material spills, and potential dust emissions.

Other environmental impacts under Alternative 4 include fuel consumption and emissions from waste hauling. Revegetation would expedite the return of native flora in excavation areas once cleanup actions are complete.

- **Time Until Removal Action Objectives Are Achieved** - Revegetation and biodiversity through modification of surface water flows is challenging to measure and monitor and can take several years to fully materialize. Native and introduced grass and forb seeds selected for reseeding this site may not germinate during the first growing season for several reasons, including the timing of precipitation, soil conditions (fertility and temperature) and poor soil contact.

**Long-Term Effectiveness and Permanence (after removal action)** – Alternative 4 would have poor effectiveness over the long term. Excavated tailings would be limited to the areas the surface water is redistributed to but does not address bulk tailings. The excavated tailings would be placed in the OU1 repository adjacent to the site area. Re-establishment of historical riparian conditions with the reduction of tailings from the site will allow promote long-term effectiveness but would be hampered by lingering source material in other areas. Alternative 4 would mitigate the long-term effects on potential human and ecological receptors.

**Reduction of Toxicity, Mobility, or Volume through Treatment** Alternative 4 employs no treatment, so no reductions in toxicity, mobility, or volume through active treatment would occur.



### 3.3.8.2. Implementability

**Technical Feasibility and Availability of Services and Materials** – Similar to Alternative 2, Alternative 4 consists of earthwork, water management, and waste transport to the OU1 repository. Equipment, services, and labor market availability would be similar to Alternative 2. No future removal actions would be required. Once established, long-term inspection and maintenance would be reduced; however, short-term inspection, monitoring, and maintenance of flow channels, stabilized banks or ponds, and revegetation efforts at the site would be required.

**Administrative Feasibility** – Similar to Alternative 2, Alternative 4 would be administratively implementable and require coordination between USEPA, UDEQ, and local entities. No land use controls would be required.

### 3.3.8.3. Costs

Cost estimates are presented below according to Silver Creek segments that are defined by physical constrictions at the site. Cost assumptions and construction logistics are summarized below. A more focused cost approach is included in Appendix D.

**Exhibit 11. Alternative 4 Costs Breakdown Estimate Summary**

Organic Layer Removal, Channel Gravel Grading, Bypass Channel Construction	Costs (all figures are rounded)	
Stream Reach: Richardson Flat Road to Highway 189 Crossing	\$82,000	
Stream Reach: Highway 189 Crossing to Highway 248 Crossing	\$107,000	
Stream Reach: Highway 248 Crossing to Park City Towing Access Road	\$130,000	
Stream Reach: Park City Towing Access Road to Promontory Ranch Road	\$1,251,000	
Design and Construction	\$458,000	
Mobilization And Demobilization	\$25,000	
<b>Subtotal Construction Cost</b>	<b>\$2,053,000</b>	
Project Management: 12% Construction Cost	\$254,000	
Construction Contingencies: 40% of Construction Cost	\$846,000	
<b>Subtotal Capital Costs</b>		<b>\$3,153,000</b>
Annual Operation and Maintenance (O&M) Costs	\$95,000	
O&M Contingencies: 30% Annual O&M Cost	\$29,000	
<b>Subtotal Annual O&amp;M Costs</b>		<b>\$124,000</b>
Present Worth of Annual O&M Costs Based on 30 Year Life @ 2.50% P/A (present from annual) Factor = 20.93	2,585,000	



Organic Layer Removal, Channel Gravel Grading, Bypass Channel Construction	Costs (all figures are rounded)	
Five-year reviews, \$50,000 each for 6 reviews Present Worth of Future Costs Based on 30 Year Life @ 2.50%	\$203,000	
<b>Subtotal Present Worth 30 Year Life Cost</b>		<b>\$2,788,000</b>
<b>Total Present Worth</b>		<b>\$5,941,000</b>

#### **3.3.8.4. Cost Assumptions**

The level of detail in developing these estimates is considered appropriate for the screening of alternatives, but the cost estimates are not intended for use in detailed budgetary planning. The accuracy of the cost estimates will be refined with further data, including the detailed analysis of alternatives and conceptual design and the remedial design. A presentation of site actions and assumptions related to this alternative are included in Appendix D.

#### **3.3.9. Alternative 5: Placement of a Topsoil Cover Over Tailings**

Alternative 5 involves the transportation of topsoil to the site for placement over the tailings to act as a barrier to direct tailings contact.

Locally derived topsoil would be transported to the site and placed onto the tailings surface in a 6-inch lift. Topsoil will be a medium grade. The tailings surface will require smoothing and contouring in areas where the tailings surface is irregular and not conducive to accepting and maintaining a consistent 6-inch topsoil cover. Topsoil will be screened to eliminate particles smaller than 1 inch in diameter.

##### **3.3.9.1. Effectiveness**

**Overall Protection of Public Health and the Environment** – Under Alternative 5, overall protectiveness would be considered reasonable for achieving RAOs because tailings would be contained underneath a 6-inch layer of clean topsoil. The potential for direct contact, ingestion, and inhalation, would be eliminated. Alternative 5 would be protective of public health and the environment.

**Compliance with ARARs** – Federal and state ARARs identified in Table 1 would be met for the site under Alternative 5.

**Short-Term Effectiveness (during Removal Action)** – The short-term impacts to the community, workers, and the environment under Alternative 5 are described below.

- **Protection of the Community** – Construction activities under Alternative 5 are minimal because tailings will not be removed. However, tailings may be disturbed by the act of moving heavy equipment on the land surface. Therefore, air monitors would be placed around the site area to measure dust concentrations. Actions such as water suppression may be performed to reduce dust release if warranted to protect the community.



- **Protection of Workers** – Short-term risks of physical injury would exist for site workers under Alternative 5 primarily related to operating equipment during site preparation and topsoil addition on top of the tailings areas. Mitigation of additional worker risk would require truck driver training and equipment inspections.

Air quality monitoring, water for dust suppression, enclosed cabs on equipment, and worker and equipment decontamination would be similar to Alternative 2. Work areas would be secured (for example, marked or fenced) to limit access to authorized personnel only.

- **Environmental Impacts** – Short-term environmental impacts could occur from the impact of driving equipment on the tailings surface. However, Alternative 5 would eliminate contact to the tailings. Environmental impacts would include a slight increase in associated equipment noise, traffic on highways and unpaved roads, and water import volume and use for dust control (if deemed necessary via air monitoring).
- **Time Until Removal Action Objectives Are Achieved** – Objectives would be achieved at the time of topsoil placement.

**Long-Term Effectiveness and Permanence (after removal action)** – Although tailings would be left in place, they would be protected from access by a 6-inch soil cover. Erosive effects exerted onto the tailings by wind and water would be reduced. Physical access and potential exposure to tailings would be eliminated by the top-soil placement.

Land use controls would be recommended to reduce impacts to the topsoil layer and to encourage natural re-vegetation processes. A long-term surveillance and maintenance plan would be implemented after construction to monitor erosion reduction and vegetative recovery.

**Reduction of Toxicity, Mobility, or Volume through Treatment** – Alternative 5 employs no treatment, so no reductions in toxicity, mobility, or volume through active treatment would occur.

### ***3.3.9.2. Implementability***

**Technical Feasibility and Availability of Services and Materials** – Alternative 5 includes trucks to transport topsoil material to the site from a local source, as well as grading equipment to smooth the land surface and to spread the topsoil. Equipment needs and personnel requirements are minimal and are widely available in the region. Labor market availability would be favorable. Water volume requirements for dust control at the site would be less than for Alternatives 2 and 4; haul road access is minimal. Long-term inspection and possible vegetation maintenance would be required.

**Administrative Feasibility** – Alternative 5 would be administratively implementable and require coordination between USEPA, UDEQ, and Park City.

### ***3.3.9.3. Costs***

Transportation costs can be managed by employing differently sized trucks to haul topsoil from the off-site soil preparation/mixing location as some trucks are larger than others and the project



may achieve an economy of scale as the cost per unit yard is reduced with larger trucks. Although topsoil is obtained locally, it does require amending and screening and will likely be sourced from multiple local locations. Disposal of coarse material that is screened from top-soil fines is an additional cost that may be minimal if a local need for the coarse material is identified. Estimated top-soil costs and truck hauling expenses were obtained from a local vendor.

The cost for topsoil and transport to the site, excluding site preparation and topsoil spreading, within Reaches 6 and 7 is estimated to be \$5,304,000. Total cost for application of topsoil into Reaches 6 and 7 is estimated to be \$8,981,000. A summary of the major cost categories associated with implementing Alternative 5 is presented in Exhibit 12. A more focused cost approach is included in Appendix D. The cost presented for Alternative 5 is based on placing topsoil into Reaches 6 and 7 only (Big Four Tailings Area) and can be amended to include the site as a whole, if desired.

**Exhibit 12. Alternative 5 Cost Breakdown**

Parameter	Costs (all figures are rounded)	
Permits	\$133,000	
Assessments/Reports	\$40,000	
Site Preparation and Mobilization	\$386,000	
Water Diversion	\$45,000	
Soil Spreading, grading, Compaction in Reach 6, 7	\$896,000	
Topsoil Material	\$5,304,000	
<b>Subtotal Construction Costs</b>	<b>\$6,804,000</b>	
Project Management: 12% Construction Cost	\$816,000	
Construction Contingencies: 20% of Construction Cost	\$1,361,000	
<b>Subtotal Capital Costs</b>		<b>\$8,981,000</b>
Annual Operation and Maintenance (O&M) Costs	\$95,000	
O&M Contingencies: 30% Annual O&M Cost	\$29,000	
<b>Subtotal Annual O&amp;M Costs</b>		<b>\$124,000</b>
Present Worth of Annual O&M Costs Based on 30 Year Life @ 2.50% P/A (present from annual) Factor = 20.93	\$2,585,000	
Five-year reviews, \$50,000 each for 6 reviews Present Worth of Future Costs Based on 30 Year Life @ 2.50%	\$203,000	
<b>Subtotal Present Worth 30 Year Life Costs</b>		<b>\$2,788,000</b>
<b>Total Present Worth</b>		<b>\$11,893,000</b>



#### ***3.3.9.4. Cost Assumptions***

The level of detail in developing these estimates is considered appropriate for the screening of alternatives, but the cost estimates are not intended for use in detailed budgetary planning. The accuracy of the cost estimates will be refined with further data, including the detailed analysis of alternatives and conceptual design and the remedial design.



## 4. COMPARATIVE ANALYSIS OF ALTERNATIVES

This section presents the approach for the comparative analysis of alternatives and a summary of the analysis. Comparative analysis includes evaluation of the relative effectiveness, implementability, and cost between alternatives. The comparative analysis ranks the three criteria for each alternative qualitatively as very poor, poor, average, good, or very good.

### 4.1. COMPARATIVE ANALYSIS APPROACH

The final step of this EE/CA is to conduct a comparative analysis of alternatives and discuss each alternative's strengths and weaknesses relative to the other alternatives in achieving RAOs. An explanation of the evaluation and ranking criteria is presented in [Section 3.3](#).

### 4.2. SUMMARY OF ANALYSIS

All alternatives except Alternative 1 meet the threshold criterion of protectiveness of public health and the environment. Exhibit 13 presents a comparative rating of alternatives.

**Exhibit 13. Summary of Alternative Ratings**

Alternative	Attainment of Threshold Criteria	Effectiveness	Implementability	Cost Rating (\$ Million)
Alternative 1: No Action	Fail	Short Term: <b>Very Good</b> Long Term: Very Poor	Technical: <b>Very Good</b> Administrative: <b>Very Good</b>	<b>Very Good</b> (\$0)
Alternative 2: Targeted Physical Removal of Tailings, single area to full site area	Pass	Short Term: Poor Long Term: <b>Very Good</b>	Technical: Good Administrative: Good	Good to Poor (\$7.3–77.7)
Alternative 3: In Situ Tailings Nutrient Amendment and Seeding, dependent on neutralization needs	Pass	Short Term: Average Long Term: Average	Technical: Good Administrative: Good	Good (\$4.8–5.4)
Alternative 4: Revegetation through Modification of Surface Water Distribution	Pass	Short Term: Poor Long Term: Poor	Technical: Average Administrative: Poor	Good (\$6.1)



Alternative	Attainment of Threshold Criteria	Effectiveness	Implementability	Cost Rating (\$ Million)
Alternative 5: Placement of topsoil on top of tailings material in Reaches 6 and 7 (49 percent of site tailings area)	Pass	Short Term: Good Long Term: Average	Technical: Good Administrative: Good	Average (\$11.9)

**Notes:**

1. A rating in **bold** is the highest rating in its category.
2. Threshold criteria are (a) overall protectiveness, and (b) compliance with applicable or relevant and appropriate requirements.
3. Estimated costs are net present value including construction contingencies, project management, annual operation and maintenance based on 30 years, and 5-year reviews.

#### 4.2.1. Effectiveness

Effectiveness comprises two threshold criteria (protectiveness and compliance with ARARs) and includes short-term effectiveness (during the removal action) and long-term effectiveness and permanence of the remedy (after the removal action).

##### 4.2.1.1. Overall Protectiveness of Human Health and the Environment

All alternatives except Alternative 1 (no action) would be protective of public health and the environment. Contamination would also be stabilized with vegetation and left in place in some areas (Alternative 3) or modified to accommodate more favorable stream water distribution (Alternative 4). Stabilize-in-place areas would reduce contaminated tailings mobility to and within drainages, thereby reducing exposure to human and ecological receptors over the long term. Placement of a 6-inch-thick layer of topsoil (in selected areas as costs allow) would also reduce contaminated tailings mobility and loading to and within drainages, promote vegetation growth, and reduce exposure to human and ecological receptors over the long term (Alternative 5).

##### 4.2.1.2. Compliance with Applicable or Relevant and Appropriate Requirements

All removal action alternatives except Alternative 1 would meet the federal and state ARARs identified in Table 1.

##### 4.2.1.3. Short-Term Effectiveness (during removal action)

Short-term effectiveness comprises four criteria: protection of the community, protection of workers, environmental impacts, and time to meet RAOs. Overall short-term effectiveness is rated Very Good for Alternative 1, Poor for Alternative 2, Average for Alternative 3, Poor for Alternative 4, and Good for Alternative 5.



## Protection of the Community during Removal Action

Alternative 1 is rated Very Good as no removal activities would be conducted to impact the community and limited exposure to contaminants at the site is expected under current land use conditions.

Alternatives 2 and 4 (removing tailings to the repository or re-distributing tailings on site to expose historical and create new stream flow channels) would create the most traffic and dust impacts to the community based on truck traffic on access roads to transport tailings, equipment, and construction materials for excavation and repository construction; therefore, Alternatives 2 and 4 are rated Average. No excavated waste would be hauled through the residential community. Dust impacts would be limited to site construction and the dirt haul road to the adjacent OU1 repository with no impacts to the community. Best management practices in the form of dust suppression and air monitoring will be conducted to ensure that site contaminants are not migrating off-site.

Alternative 5 employs haul trucks moving from top-soil screening areas off site to on-site locations where material would be staged and spread onto tailings. Although contaminated tailings would not be transported, other soils would be transported, creating potential dust releases and haul truck traffic. Also, dust and noise impacts would be encountered at the off-site top-soil screening areas. This alternative is rated Average.

Because materials, other than seed and nutrients, are not excavated or transported to the site, Alternative 3 is rated Good. Fewer haul miles through the community would also result in fewer potential traffic accident injuries than Alternatives 2, 4, and 5.

Truck haul routes on site will include a combination of on-site gravel roads and asphalt frontage roads. Because the project site is approximately 6 miles long, the haul distance to the OU1 repository will vary depending on truck placement along the 6-mile length. Alternatives 3 and 4 (predominantly on-site work activities) would be the safest for the community from a haul truck traffic perspective and would be followed by Alternative 2 (targeted physical removal of tailings and placement into the OU1 repository), and Alternative 5 (trucking topsoil from various locations off site and dispersing on site). Based on estimated miles travelled, Alternative 5 would have the highest probability of a traffic-related fatality.

## Protection of Workers

Worker protection for removal activities primarily involves practices to mitigate negative effects caused by mine tailings during removal actions including dust inhalation hazards, physical injury, traffic accidents, and traffic-related fatalities. The contractors performing the removal actions would be prequalified to perform work with tailings and be required to have the training and experience to mitigate risks associated with the action.

Alternatives 2 and 4 each require some degree of excavation work; therefore, each possesses potential dust inhalation hazards from tailings, as well as potential for injury to workers via the acts of excavation and handling of materials. Alternatives 3 and 5 require the use of machinery on the tailings surface, thereby introducing the potential for dust emissions from tailings, even though excavation of tailings is not projected. Risks to workers could be mitigated using



engineering controls and respiratory protection if needed. Haul truck drivers could also be protected from dust emissions through engineering controls such as closed cabs.

Quantification of additional threat can be conducted; however, safe work practices and engineering controls, dust monitoring, and respiratory protection, would be used to mitigate the additional threat. Mitigation and monitoring practices would be used to limit threats to workers.

The rate of traffic accidents and fatalities is proportional to the amount of hauling for a particular alternative. The haul distance for Alternative 2 (targeted physical removal and placement into a repository) averages 4 miles, or less. Alternative 3, 4, and 5 do not include the hauling of tailings to a repository, however, Alternatives 3 and 5 do require off-site truck mobilizations in the form of materials delivery to the project area. Those mileages cannot be determined at this time as materials suppliers and localities are unknown.

Alternative 2 includes haul distances from excavation zones averaging 4 miles. This short distance greatly reduces potential for mishaps and exposure during transportation of tailings. Even though Alternative 5 does not include hauling of tailings, it does represent the greatest potential truck-hauling risk as all top-soil material has to be obtained, processed, and hauled to the site from various locations in the region. Local top-soil source locations have not been identified.

### **Environmental Impacts**

Alternatives 2 and 4 each require some degree of excavation work; therefore, each possesses potential dust release hazards to the environment from tailings. These alternatives are rated as **Poor**. Alternatives 3 and 5 require the use of machinery on the tailings surface, thereby also introducing the potential for dust emissions from tailings. These alternatives are rated as **Average**. However, all removal action alternatives would remove from the environment, or stabilize in place, a substantial amount of tailings contamination.

Alternatives 2 and 5 would also require installation of on-site haul roads, as well as limited use of local roadways to transport materials. Additional impacts may include residual track-out effects of soil and mud, increased traffic noise, increased water use for dust control on haul roads, nuisance spills during waste hauling, and increased greenhouse gas emissions.

Water pumping or water import would also have an environmental impact, depending on the water source, import distance, and volume required for dust control. Alternative 2 would require the most water resources because of excavation, hauling, and placement of tailings. Alternative 5 would require less but still substantial water supplies to mitigate dust releases. Alternatives 3 and 4 would require the least amount of dust suppression water supplies based on the limited truck traffic and minor site disturbance.

### **Time Until Removal Action Objectives Are Achieved**

A summary of the construction completion time for each alternative is presented in [Exhibit](#) . All action alternatives would be completed in one to three field seasons, depending on schedule-limiting factors such as monsoon rains, snowfall, and the number of excavating and materials hauling machines (excavators and dump trucks). Nutrient and seed placement activities



in Alternative 3 would be the shortest completion time based on a lack of tailings handling needs and limited materials needs. Alternative 2 completion time would be the longest because of excavation and hauling requirements and would likely be limited by availability of haul trucks. The Alternative 4 timeframe depends on the footage of Silver Creek channel reconstruction that is ultimately selected, although time to complete is expected to be less than Alternative 2. Alternative 5 timeframe to completion is more unpredictable because of currently undetermined topsoil sources and haul distances. Topsoil material would also require double handling: delivery and stockpiling on site and then handling for the distribution on site.

**Exhibit 14. Construction Completion Time for Alternatives**

Alternative	Estimated Construction Completion Time
Alternative 1: No Action	0 days (baseline)
Alternative 2: Targeted Physical Removal of Tailings	Up to 518 days, depending on the scenario and number of haul trucks used (2 to 3 field seasons)
Alternative 3: <i>In Situ</i> Tailings Nutrient Amendment and Seeding	140 days (1 field season)
Alternative 4: Revegetation through Modification of Surface Water Distribution	194 days, dependent on the number of haul trucks used (2 field seasons)
Alternative 5: Placement of topsoil on top of tailings in Reaches 6 and 7 (49 percent of site tailings area)	326 days, dependent on the number of haul trucks used (2 field seasons)

#### ***4.2.1.4. Long-Term Effectiveness and Permanence (after removal action)***

For all removal action alternatives, waste removal or sequestering on site would reduce the magnitude of tailings impacts to the environment. Non-cancer hazards and risk to ecological receptors would be reduced or removed. Removal of tailings contamination would result in a long-term elimination of environmental impacts.

Because some areas of tailings contamination could be stabilized in place under Alternatives 3, 4, and 5, the differences between the alternatives rest with the methods employed to reduce any tailings impacts. Areas with tailings contamination stabilized in place would have restrictions on future land use.

Alternative 1 is rated **Very Poor** because no removal action would be performed. Human health risk may be partially reduced through increased awareness of risks, but no reduction in risk to the ecosystem would occur. Uncontrolled waste would remain and continue to be accessible by humans, animals, birds, amphibians, macroinvertebrates, and fish and subject to potential migration to uncontaminated or less-contaminated areas.



Alternative 2 is rated **Very Good** as the sources of risk at the site would be excavated. Alternative 2 may also allow for unrestricted future use of those portions of the site where waste has been removed. Consolidated and capped waste under Alternatives 3, 4, and 5, require long-term monitoring, and are each rated as **Average to Poor**.

To reduce exposure, Alternative 2 would consolidate waste in a controlled repository. Permanence of risk reduction would rely on the cap and repository design standards that have already been defined for OU1. Although long-term maintenance would be required.

#### 4.2.2. Implementability

Implementability comprises two criteria: (1) technical feasibility and availability of services and materials, and (2) administrative feasibility.

##### 4.2.2.1. *Technical Feasibility and Availability of Services and Materials*

Removal action alternatives consist mainly of earthwork and material hauling. The action alternatives would be technically feasible with labor available through the local and regional markets, as well as equipment and materials.

Completion of the removal action is limited by available funding, which does not allow for all tailings to be removed from the site area unless additional funds become available. Some tailings will, therefore, likely remain on site, although tailings presence may be greatly reduced, and environmental impacts will be reduced.

The removal action will therefore be completed in multiple phases or, if additional funds are made available in the short term, may be fully completed in a single phase. Short-term monitoring of site restoration features (possibly 5 years) would occur under all removal action alternatives, while long-term monitoring and maintenance (approximately 30 years), particularly the inspection and repair of erosional features and controls and revegetation, would be required for the stabilize-in-place areas and consolidation areas and repository caps. Experienced contractors, construction equipment, and materials would be available within the region.

Alternative 1 would be readily implementable with no construction involved and is rated **Very Good**. Alternative 1 would not impact the ability to conduct removal or remedial actions in the future. No services or materials would be needed because no removal action would be performed.

Among the action alternatives, Alternative 2 would be technically feasible to implement as all excavated waste would be removed from the site. Design methods, construction practices, and engineering requirements are well documented and understood. However, additional design and construction would be required to improve the haul road route to the repository. Bridge and road rating deficiencies, as well as road damage and repair, would also be technical concerns that would require evaluation, design, and construction. Therefore, Alternative 2 is rated **Good**.

Alternatives 3, 4, and 5 would be technically feasible to implement as excavated waste would be consolidated on site, environmental impacts reduced by over-planting, or covering with topsoil. Design methods, construction practices, and engineering requirements are well documented and



understood. Alternative 3 is rated **Good** as all tailings would be bound with vegetation with a relatively small effort, while Alternative 5 is rated **Good** as all tailings would be covered with topsoil, although an additional effort would be required. Alternative 4 is rated **Average** because tailings that would be removed from water pathways, requiring excavation, and will remain on site although bound with added vegetation. Technical difficulties in building stream channels are also realized.

#### 4.2.2.2. *Administrative Feasibility*

Administratively, Alternative 1 is rated **Very Good** as there is no action.

Alternative 3 is also rated as **Good** based on its ease of implementation, relatively low cost, and minimal management. Alternatives 2 and 5 are each rated as **Good** because of their straightforward approaches: excavate tailings and place into a repository, or cover with topsoil material. These alternatives are also uncomplicated in design and easy to understand for permitting and approvals.

Alternative 4 is rated **Poor** because additional coordination is required for re-routing water flow paths, as well as storing re-vegetated tailings near the creek banks. This alternative is considered more complicated because of design and effectiveness considerations.

#### 4.2.2.3. *Supporting Agency Acceptance*

Acceptance by supporting agencies is an additional criterion that will be addressed in an action memorandum after stakeholder comments have been received on the draft EE/CA.

#### 4.2.2.4. *Community Acceptance*

Acceptance by the Park City community is an additional criterion that will be addressed in an action memorandum after public comments have been received on the draft EE/CA.

### 4.2.3. Projected Costs

A summary of the cost for each alternative is presented in Exhibit 15 which summarizes the present values for each action alternative using a baseline 30-year project duration for stabilize-in-place inspection, environmental monitoring, and maintenance under all action alternatives and a 30-year inspection and maintenance for caps at a 2.5 percent discount rate.

**Exhibit 15. Alternative Costs and Ratings**  
(millions of dollars)

Alternative	Capital Cost	Maintenance Present Value (2.5% Discount Rate)	Total Present Value Cost	Cost Rating
Alternative 1: No Action	\$0	\$0	\$0	<b>Very Good</b>



Alternative	Capital Cost	Maintenance Present Value (2.5% Discount Rate)	Total Present Value Cost	Cost Rating
Alternative 2: Targeted Physical Removal of Tailings, single area to full site area	\$4.5 to \$69.4	\$2.9 to 8.7 (30 years)	\$7.3 to \$77.7	Good to Poor
Alternative 3: In Situ Tailings Nutrient Amendment and Seeding, dependent on neutralization needs	\$1.9 to \$2.5	\$2.9 (30 years)	\$4.8 to \$5.4	<b>Very Good</b>
Alternative 4: Revegetation through Modification of Surface Water Distribution	\$3.2	\$2.9 (30 years)	\$6.1	Good
Alternative 5: Placement of topsoil on top of tailings in Reaches 6 and 7 (49 percent of site tailing area)	\$8.9	\$2.9 (30 years)	\$11.9	Average

Alternative 1 would be the least expensive because no construction and maintenance costs would be incurred and is rated **Very Good**. Alternative 3 is also rated **Very Good** as costs are low, although all tailings remain on the site. Alternative 4 is rated **Good**, however, as with alternative 3, the tailings contamination is not removed from the site. Alternative 2 is rated Good to Poor as this alternative includes the costliest scenarios, but achieves removal of tailings from the site area. Alternative 5 is rated **Average** because, although physical contact with the tailings is eliminated, it is a costly endeavor while not removing any tailings material.



## 5. RECOMMENDED REMOVAL ACTION ALTERNATIVE

Implementation of removal options is limited by currently available funding, therefore total removal of tailings from the site is not possible at this time without additional funds. Removal of tailings from the apparent most-travelled portion of the site in the upgradient areas of Silver Creek does achieve the greatest cost efficiency as tailings in that area occur in, physically, the thinnest deposition interval at the site area. Therefore, more site square footage can be remediated, versus removal of the thick tailings deposit within a smaller area downstream of the Big Four Mill. The alternative presented below is considered the most beneficial approach to achieve RAOs.

Alternative 2, Scenario E: Remove all tailings extending from the Floodplain Tailings to the Upper Meadow Tailings (Reaches 2, 3, and 4), and tailings spots in Reach 1 below Prospector Square. Additional tailings may also be removed from Area 5, depending on work efficiencies and actual tailings accumulation encountered during upgradient removal operations. Place tailings at the OU1 repository.

Tailings influences would be removed along the popular Rail Trail beginning at Prospector Drain and ending in the Upper Meadows area. Tailings may be removed from approximately 3.3 consecutive miles of the 6-mile site length, and 81 acres of the 313 total acres of tailings coverage.



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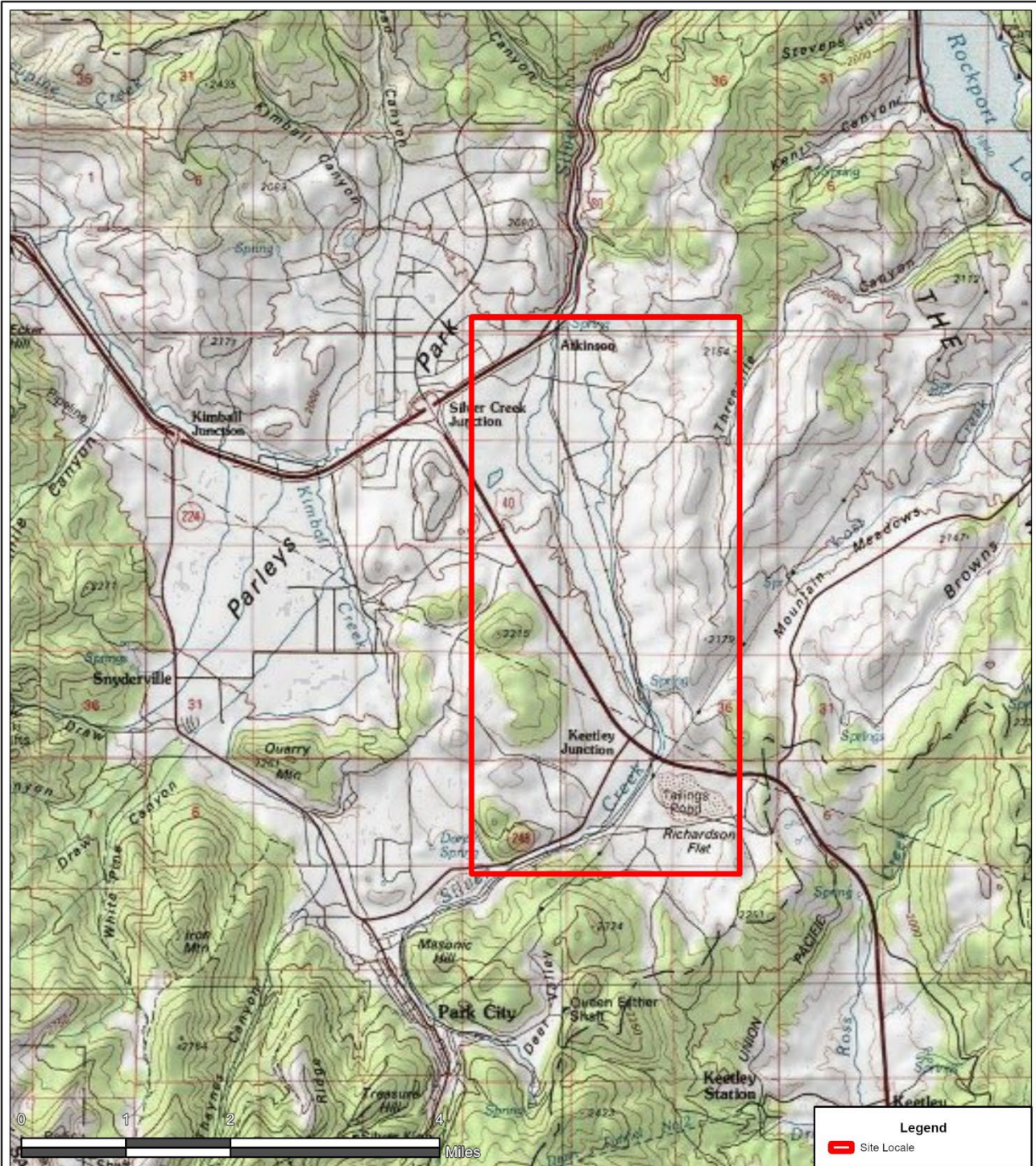
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## **FIGURES**

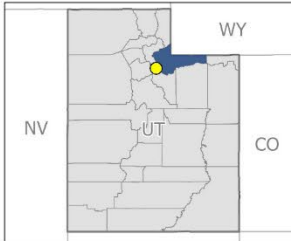
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**Figure 1. Site Location Map**



Notes:

Source:  
 Background: ESRI World Topographic  
 Spatial Reference:  
 WGS 1984 Web Mercator Auxiliary Sphere  
 Coordinate System



United States  
 Environmental  
 Protection Agency

Region 8 START V  
 TD: 2142-2103-06

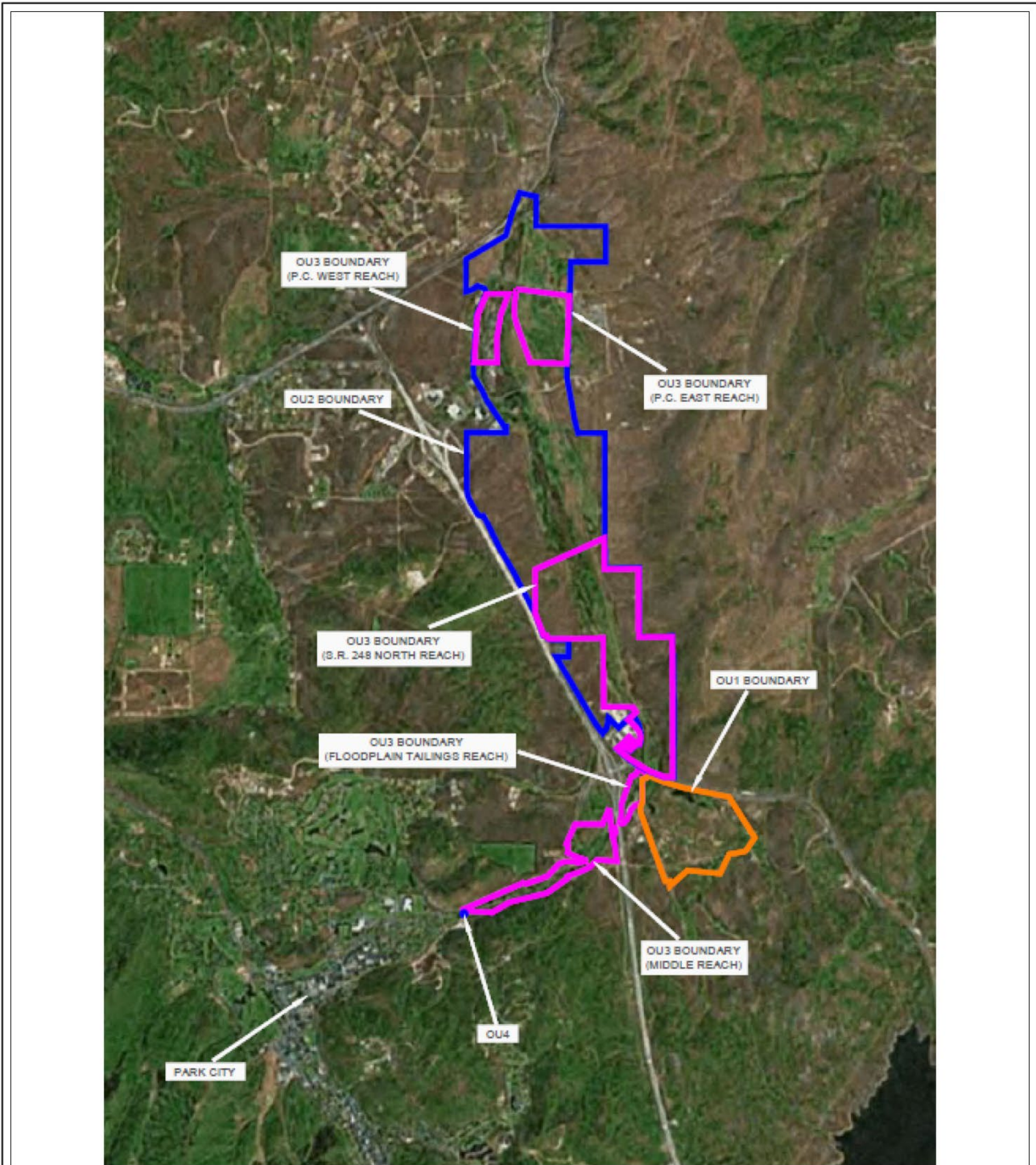


**TETRA TECH**

Analyst: S. DeNeice  
 Date: 3/26/2024

**FIGURE 1**  
**RICHARDSON FLAT OU 2/3**  
**SITE LOCATION**  
**SUMMIT COUNTY, UTAH**

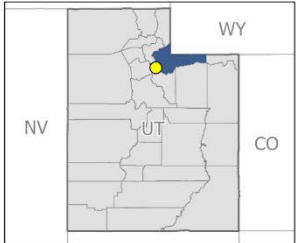
**Figure 2. OU2/3 Site Map with Operable Unit Boundaries Map**



Notes:  
 OU - USEPA Operable Unit

Source:  
 OU Boundaries provided by  
 Resource and Environmental Management Consultants

Spatial Reference:  
 GCS WGS 1984  
 Coordinate System



United States  
 Environmental  
 Protection Agency

Region 8 START V  
 TD: 2142-2103-06

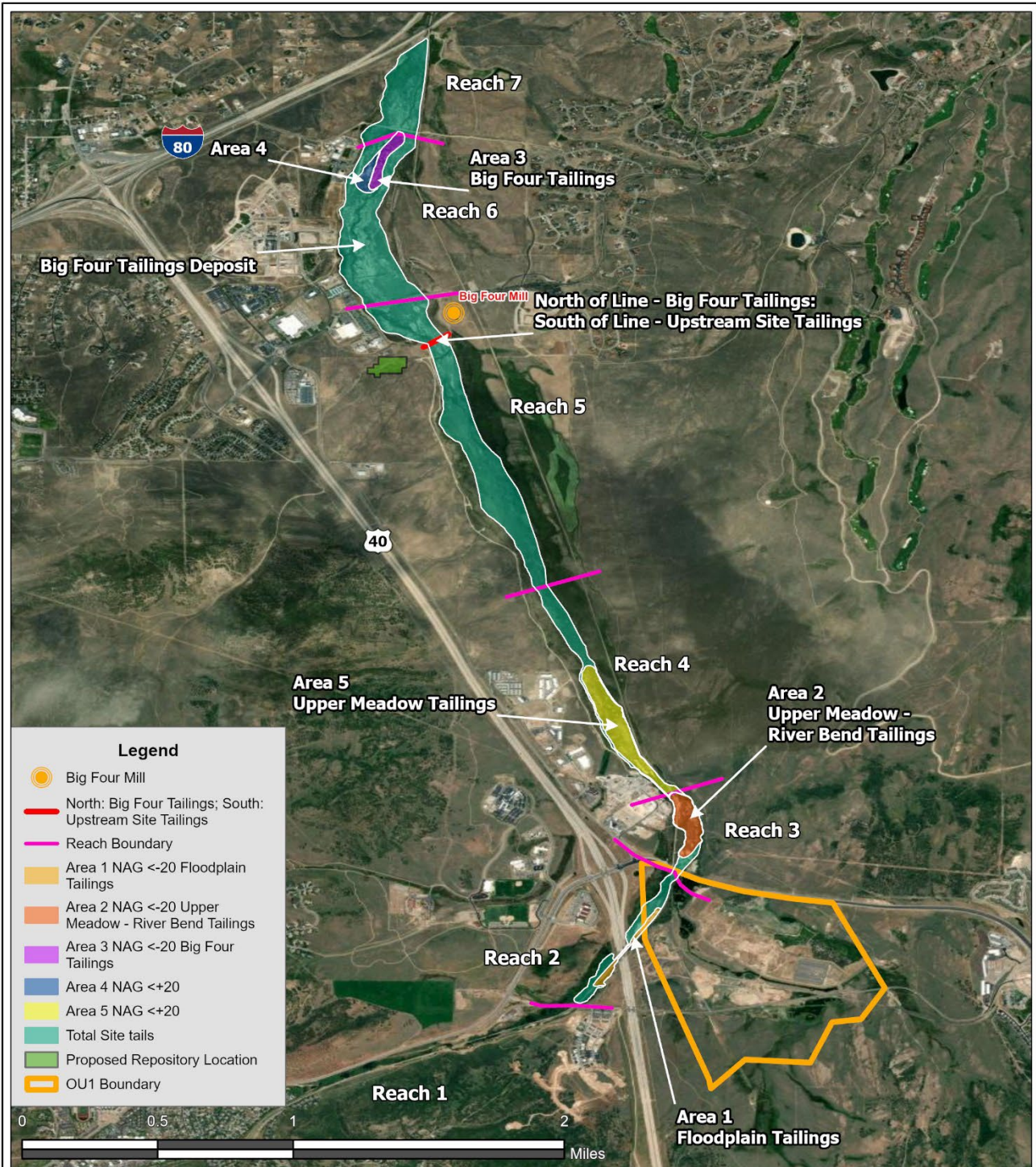
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Analyst: S. DeNeice  
 Date: 3/26/2024

**FIGURE 2  
 RICHARDSON FLAT OU 2/3  
 SITE MAP WITH  
 OU BOUNDARIES  
 SUMMIT COUNTY, UTAH**

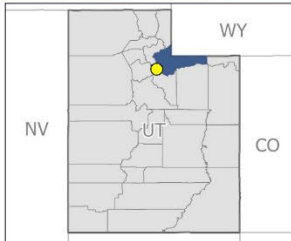
Path: V:\R08\_STARTV\Richardson Flat OU\_23\ArcGISPro\RichardsonFlat\_OU23\RichardsonFlat\_OU23.aprx\Figure 2 Site Map w OU Boundaries

**Figure 3. Site Features Map**



**Notes:**  
 NAG - Net Acid Generating  
 NAG Units - Tons of calcium carbonate per 1,000 tons of ore material  
 OU1 - Operable Unit 1 Repository

**Source:**  
 Background: ESRI World Imagery Hybrid  
 Spatial Reference: GCS WGS 1984 Coordinate System



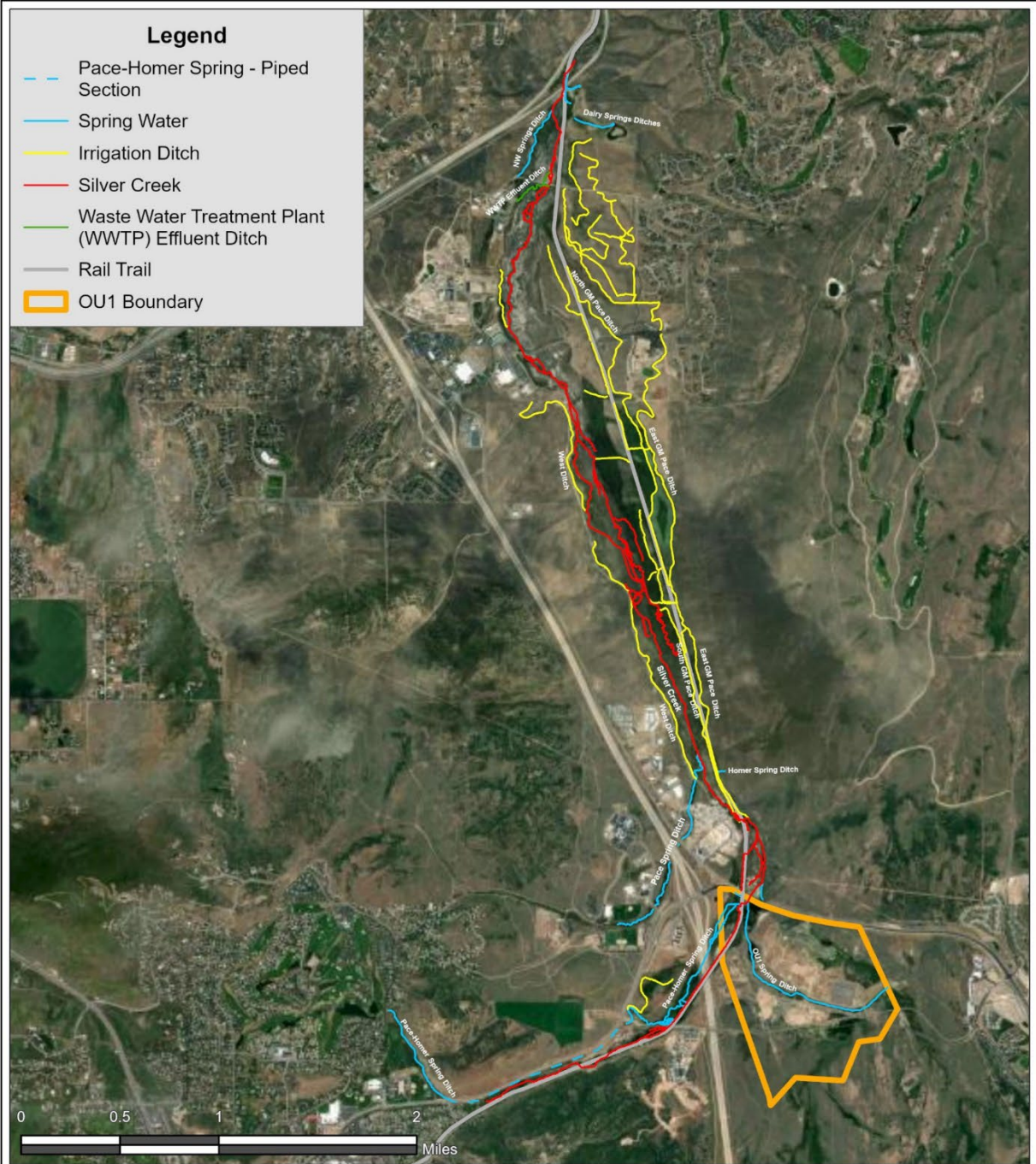
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 TD: 2142-2103-06



Analyst: S. DeNeice  
 Date: 3/26/2024

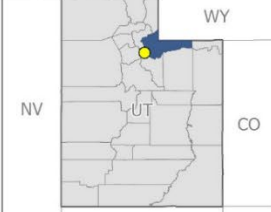
**FIGURE 3  
 RICHARDSON FLAT OU 2/3  
 SITE FEATURES  
 SUMMIT COUNTY, UTAH**

**Figure 4. Surface Water Pathways Map**



Notes:  
 OU1 - Operable Unit 1 Repository

Source:  
 Background: ESRI World Imagery Hybrid  
 Spatial Reference:  
 WGS 1984 Web Mercator Auxiliary Sphere  
 Coordinate System



United States Environmental Protection Agency  
 Region 8 START V  
 TD: 2142-2103-06

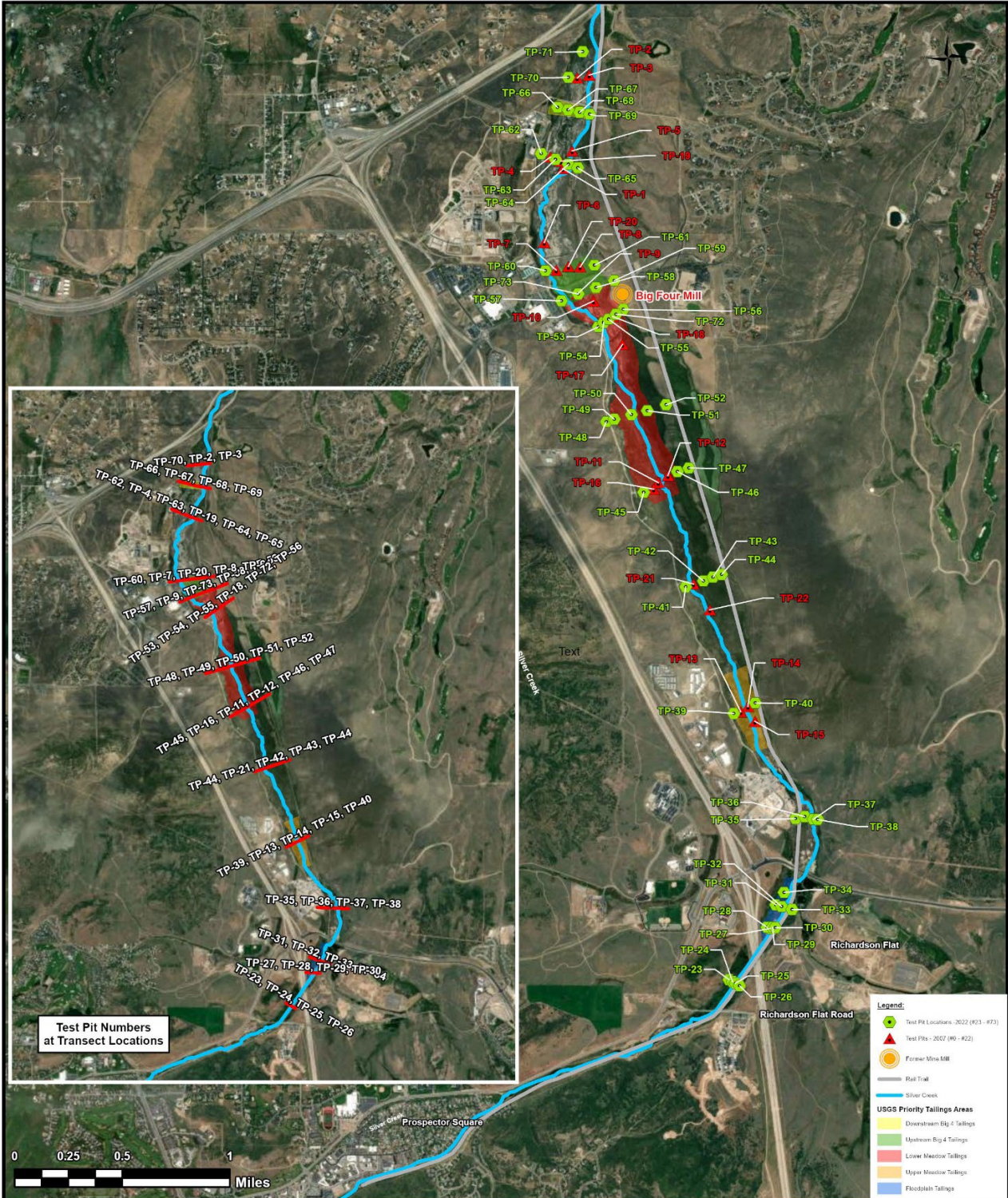
**TETRA TECH**

Analyst: S. DeNeice  
 Date: 3/26/2024

**FIGURE 4**  
**RICHARDSON FLAT OU 2/3**  
**SURFACE WATER PATHWAYS**  
**SUMMIT COUNTY, UTAH**

Path: V:\R08\_STARTV\Richardson Flat OU\_23\ArcGISPro\RichardsonFlat\_0U23\RichardsonFlat\_0U23.aprx\Figure 4 Surface Water Pathways

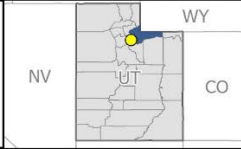
**Figure 5. Test Pit Locations Map**



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Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere  
 Projection: Mercator Auxiliary Sphere  
 Datum: WGS 1984

Source:  
 Background: ESRI World Imagery  
 Test Pits 2022 - Tetra Tech  
 Rail Trail: Tetra Tech (2022)



Prepared for:  
 U.S. EPA - Region 8  
 Contract: 68HE030D0001  
 TD: 2142-2103-06

Prepared By:  
 Tetra Tech, Inc.  
 START V  
 Suite 1400  
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 Denver, CO

**FIGURE 5  
 RICHARDSON FLAT OU 2/3  
 TEST PIT LOCATIONS  
 SUMMIT COUNTY, UTAH**

Date: 5/15/2024

## **TABLES**

**APPENDIX A. TABLE 1. APPLICABLE OR RELEVANT AND  
APPROPRIATE REQUIREMENTS AND TO BE CONSIDERED  
CRITERIA FOR THE RICHARDSON FLAT OU2/3 TAILINGS SITE**

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## RICHARDSON FLAT ARARS

Requirement	Citation	Alternative	Description	Comment
<b>Federal ARARs</b>				
<b>Endangered Species Act</b>	16 U.S.C. § 1536, 50 C.F.R. §§ 17.21(a), (c), 17.31, 17.61, 17.71, 17.82  Applicable, location and action-specific	2, 3, 4, 5	Potential habitat for federally endangered or threatened species in Summit County, taking actions that may impact the species and their habitat	This statute and implementing regulations provide that federal activities not jeopardizedo not jeopardize the continued existence of any threatened or endangered species. Substantive compliance with the ESA means that EPA must identify whether a threatened or endangered species, or its critical habitat, will be affected by a proposed response action. If so, EPA must avoid the action or take appropriate mitigation measures so that the action does not affect the species or its critical habitat.
<b>Migratory Bird Treaty Act</b>	16 U.S.C. § 703(a)  Applicable, location-specific	2, 3, 4, 5	Potential habitat for migratory birds, taking actions that may negatively impact the migratory birds and their habitat	The statute makes it unlawful for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts, nests, or eggs of such bird except under the terms of a valid permit issued pursuant to the regulations.

## RICHARDSON FLAT ARARS

<p style="text-align: center;"><b>National Historic Preservation Act</b></p>	<p>16 U.S.C. § 470, 36 C.F.R. §§ 60, 63, 800.4, 800.5, 800.6, and 188.10(a)</p> <p style="text-align: center;">Applicable, action-specific</p>	<p style="text-align: center;">2, 3, 4, 5</p>	<p style="text-align: center;">Presence of cultural resources within removal work areas</p>	<p>Federal agencies required to take into account the effect of response actions upon any district, site, building, structure, or object that is included in or eligible for the National Register of Historic Places. Federal agencies are required to take into account their undertakings on historic properties and must determine whether there will be an adverse effect, and if so, how the effect may be minimized or mitigated.</p>
<b>State ARARs*</b>				
<p style="text-align: center;"><b>Air Quality</b></p>				
<p style="text-align: center;"><b>Air Pollution Prohibited</b></p>	<p style="text-align: center;">UAC R307-102-1(1)  UAC R307-101-2</p> <p style="text-align: center;">Applicable, Action-specific</p>	<p style="text-align: center;">2, 3, 4, 5</p>	<p>Emission of air pollutants in sufficient quantities to cause air pollution defined in R307-101-2 as “the presence of an air pollutant in the ambient air in such quantities and duration and under conditions and circumstances, that are injurious to human health or welfare, animal or plant life, or property...” is prohibited.</p>	<p>This regulation functions as a blanket prohibition on the creation of air pollution and is intended to address circumstances not addressed elsewhere in the rules. For example, controls should be implemented to prevent air pollution from exposed soil following removal, wind-blown dust from staging piles, etc.</p>

## RICHARDSON FLAT ARARS

<p><b>Visible Emission Standards</b></p>	<p>UAC R307-201-3(4), (5) and (6)</p> <p>Applicable, Action-specific</p>	<p>2, 3, 4, 5</p>	<p>Establishes visible emission standards: no visible emissions from gasoline powered engines, 20% opacity limit for diesel engines manufactured after January 1, 1973, and 40% opacity limit for diesel engines manufactured before January 1, 1973.</p>	<p>Emissions from remedial operations must meet the visible emission standards.</p>
<p><b>Automobile Emission Control Devices</b></p>	<p>UAC R307-201-4</p> <p>Applicable, Action-specific</p>	<p>2, 3, 4, 5</p>	<p>Requires motor vehicles on which a system or device for the control of crankcase emissions or exhaust emissions is installed or incorporated, shall maintain the system or device in operable condition and shall use it at all times that the motor vehicle or motor vehicle engine is operated.</p>	<p>Motor vehicles used in remedial actions shall use appropriate systems or devices to prevent crankcase or exhaust emissions at all times.</p>
<p><b>Fugitive Dust</b></p>	<p>UAC R307-205-5(2)(a) and (b)</p> <p>Applicable, Action-specific</p>	<p>2, 3, 4, 5</p>	<p>(a) Any person engaging in clearing or leveling of land greater than one-quarter acre in size, earthmoving, excavation, or movement of trucks or construction equipment over cleared land greater than one-quarter acre in size or access haul roads shall take steps to minimize fugitive dust from such activities, including watering, chemical stabilization of potential fugitive dust sources or other equivalent techniques.</p> <p>(b) the owner or operator of any land area greater than one-quarter acre in size that has been cleared or excavated shall take measures to prevent fugitive particulate matter from becoming airborne, including planting vegetative cover, providing synthetic cover, watering, chemical</p>	<p>Applicable to the clearing, leveling, or excavating dirt, which should be conducted in a manner that minimizes fugitive dust.</p>

## RICHARDSON FLAT ARARS

			stabilization, wind breaks or other equivalent methods.	
<b>Tailings Piles and Ponds</b>	UAC R307-205-8(2)(a) through (g)  Relevant and Appropriate, Action-specific	2, 4, 5	Where fugitive dust results from the excavation and disposal operations of tailings, steps must be taken to minimize fugitive dust by using controls such as: watering, chemical stabilization, synthetic covers, vegetative covers, wind breaks, minimizing the area of disturbed tailings, restricting the speed of vehicles in and around the tailings operation, or other equivalent methods of techniques.	Remedial actions of tailings shall meet the fugitive dust standards of R307-205-8 and implement the controls prescribed by R307-205-8(2).
<b>Waste Management and Radiation Control</b>				
<b>Stabilization of Releases</b>	First sentence of UAC R315-101-2(a)  Applicable, Action-specific	2, 3, 4, 5	Appropriate action should be taken to stabilize a release site either through source removal or source control.	Applies where a site is not cleaned up to background. The work plan requirement after the first sentence is inapplicable.
<b>Principle of non-degradation</b>	UAC R315-101-3(a)	2, 3, 4, 5	Prohibits increasing the mass of contaminants in the source area. Levels of contaminants in groundwater shall not increase beyond existing levels of contamination at a site.	Applies where a site is not cleaned up to background

## RICHARDSON FLAT ARARS

	Applicable, Action-specific			
<b>Human Health and Ecological Risk Evaluation Criteria and Risk Assessment</b>	UAC R315-101-5  Applicable, Action-specific	2, 3, 4, 5	Establishes standards for conducting a risk assessment using a conceptual site model, evaluating the following: identification, concentration and distributed or any hazardous constituents; fate of contaminants of interest and any pathways of transport of contaminants of interest; any potential exposure routes; human receptors, and ecological receptors.	Applies where a site is not cleaned up to background
<b>Corrective Action</b>	UAC R315-101-6(a)(1)  Applicable, Chemical-specific	2, 3, 4, 5	Corrective action is required at a site when the level of risk present is greater than $1 \times 10^{-4}$ for carcinogens or hazard index greater than one for non-carcinogens; ecological effects are significant; or groundwater contamination is exceeded on or off-site or residual contamination poses a potential threat to groundwater.	Applies where a site is not cleaned up to background
<b>Contents of Site Management Plan, Land Use Controls, Environmental Covenants,</b>	UAC R315-101-8(f)  An Environmental Covenant.	2, 3, 4, 5	Requires an environmental covenant for any site contaminated with hazardous constituents not cleaned up to or below background levels.	Applies where a site is not cleaned up to background

**RICHARDSON FLAT ARARS**

<b>Restrictions, Controls and Conditions</b>	Applicable, Action-specific			
<p style="text-align: center;"><b>Manifest Requirements Applicable to Small and Large Quantity Generators</b></p>	<p>UAC R315-262-20(1)</p> <p>UAC R315-262-22</p> <p>UAC R315-262-23(a)</p> <p>UAC R315-262-24(a)</p> <p>UAC R315-262-25</p> <p>UAC R315-262-27</p> <p>Relevant and Appropriate, Action-specific</p>	2	<p>Requires a generator who transports a hazardous waste for offsite treatment, storage, or disposal to prepare a manifest with enough copies (R315-252-22) for generator, transporter, owner/operator of facility, and another to be returned to generator); R315-262-23 (generator to sign manifest by hand, obtain handwritten signature of initial transporter and date of acceptance, and retain one copy); R315-262-24 (electronic manifests may be used if enforceable electronic signatures under R315-262-25 are obtained and may be transmitted electronically); R315-262-27 (certification statements required as to being a large or small quantity generator).</p>	<p>Applies if hazardous wastes are transported off-site, taking into consideration the August 30, 2004 “Request for Concurrence on the Applicability of the Off-site Rule in Park City, Utah.”</p>
<p style="text-align: center;"><b>Pre-Transport Requirements – Packaging</b></p>	<p>UAC R315-262-30</p> <p>Applicable, Action-specific</p>	2	<p>Establishes standards for generators transporting hazardous waste or offering hazardous waste for transportation off-site, including packaging the waste in accordance with the applicable DOT regulations on packaging under 49 CFR parts 173, 178, and 179</p>	<p>Applies if hazardous waste is taken off-site.</p>

## RICHARDSON FLAT ARARS

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<p><b>Pre-Transport Requirements – Labeling</b></p>	<p>UAC R315-262-31</p> <p>Applicable, Action-specific</p>	<p>2</p>	<p>Requires generators to label each package in accordance with the applicable DOT regulations on packaging under 49 CFR part 172 before transporting hazardous waste or offering hazardous waste for transportation off-site</p>	<p>Applies if hazardous waste is taken off-site.</p>
<p><b>Pre-Transport Requirements – Marking</b></p>	<p>UAC R315-262-32(a)</p> <p>Applicable, Action-specific</p>	<p>2</p>	<p>Requires a generator to mark each package of hazardous waste in accordance with the applicable DOT regulations on hazardous materials under 49 CFR part 172 before transporting or offering hazardous waste for transportation off-site</p>	<p>Applies if hazardous waste is taken off-site.</p>
<p><b>Pre-Transport Requirements – Placarding</b></p>	<p>UAC R315-262-33</p> <p>Applicable, Action-specific</p>	<p>2</p>	<p>Requires a generator to placard or offer the initial transporter the appropriate placards according to DOT regulations for hazardous materials under 49 CFR part 172, subpart F before transporting hazardous waste or offering hazardous waste for transportation off-site</p>	<p>Applies if waste is taken off-site.</p>

## RICHARDSON FLAT ARARS

<p><b>The Manifest System</b></p>	<p>UAC R315-263-20(1)</p> <p>Applicable, Action-specific</p>	<p>2</p>	<p>Prohibits a transporter from accepting hazardous waste from a generator unless the transporter is also provided with a manifest form; EPA Form 8700-22, and if necessary, EPA Form 8700-22A; signed in accordance with the requirement of Section R315-262-23, or is provided with an electronic manifest that is gotten, completed, and transmitted in accordance with Subsection R315-262-20(a)(3), and signed with a valid and enforceable electronic signature as described in 40 CFR 262.25.</p>	<p>Applies if waste is transported off-site.</p>
<p><b>Compliance with the Manifest</b></p>	<p>UAC R315-263-21(a)</p> <p>Applicable, Action-specific</p>	<p>2</p>	<p>Requires a transporter to deliver the entire quantity of hazardous waste which the transporter has accepted from a generator or transporter to the designated facility, alternate designated facility, or the next designated transporter.</p>	<p>Applies if waste is transported off-site.</p>
<p><b>Immediate Action</b></p>	<p>UAC R315-263-30(a)</p> <p>Relevant and Appropriate, Action-Specific</p>	<p>2, 3, 4</p>	<p>In the event of a spill of hazardous waste, the person responsible must immediately take appropriate action to minimize the threat to human health and the environment.</p>	<p>Applicable in the event hazardous waste or material is spilled.</p>

## RICHARDSON FLAT ARARS

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<p><b>Spill Clean Up</b></p>	<p>UAC R315-263-31</p> <p>Relevant and Appropriate, Action-Specific</p>	<p>2, 3, 4</p>	<p>Requires the person responsible for the material at the time of the spill to clean up the spilled material and any residue or contaminated media or other material result from the spill so that the spill material, residue, or contaminated media no longer presents a hazard to human health or the environment.</p>	<p>Applicable in the event hazardous waste or material is spilled.</p>
<p><b>Compliance with Department of Transportation Regulations</b></p>	<p>UAC R315-263-34</p> <p>Applicable, Action-specific</p>	<p>2</p>	<p>Requires transporters of hazardous waste to comply with the pertinent regulations of the U.S. DOT governing the transportation of hazardous materials for both interstate and intrastate shipments included in Subsection R315-263-34(a)-(i).</p>	<p>Applicable if waste is transported.</p>
<p><b>General Waste Analysis</b></p>	<p>UAC R315-264-13</p> <p>Relevant and Appropriate, Action-Specific</p>	<p>2</p>	<p>If any hazardous waste is treated, stored, or disposed, a detailed chemical and physical analysis of a representative sample of the wastes should be obtained so that such waste may be disposed of appropriately.</p>	<p>Applicable if hazardous waste is treated, stored, or disposed of on site.</p>

**RICHARDSON FLAT ARARS**

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<p style="text-align: center;"><b>Security</b></p>	<p style="text-align: center;">UAC R315-264-14(a)</p> <p style="text-align: center;">Relevant and Appropriate, Action-Specific</p>	<p style="text-align: center;">2</p>	<p>Unknowing and unauthorized entry of persons or livestock to a disposal facility should be prevented unless (1) contact with the facility will not injure persons or livestock; and (2) disturbance of the waste or equipment will not cause a violation of the requirements of R315-264.</p>	<p>Relevant and Appropriate to hazardous waste disposal.</p>
<p style="text-align: center;"><b>Staging Piles</b></p>	<p style="text-align: center;">UAC R315-264-554(d), (h), (k)</p> <p style="text-align: center;">Applicable, Action-Specific</p>	<p style="text-align: center;">2, 4</p>	<p>The standards and design criteria of staging piles shall comply with the following:</p> <p>(i) The staging pile shall facilitate a reliable, effective and protective remedy;</p> <p>(ii) The staging pile shall be designed so as to prevent or minimize releases of hazardous wastes and hazardous constituents into the environment, and minimize or adequately control cross-media transfer, as necessary to protect human health and the environment, for example, through the use of liners, covers, run-off/run-on controls, as appropriate.</p> <p>A staging pile may operate for up to two years after hazardous remediation waste is first placed into a staging pile.</p> <p>A staging pile must be closed within 180 days of the operating term expiring by (1) removing and decontaminating all remediation waste,</p>	<p>Should be observed when excavated soil is staged prior to being deposited in OU1.</p>

## RICHARDSON FLAT ARARS

			contaminated system components, and structures and equipment contaminated with waste and leachate; and (2) decontaminating subsoils.	
<b>Water Quality</b>				
<b>General Requirements</b>	UAC R317-1-2-2.1  Applicable, Action-Specific	2, 3, 4, 5	Prohibits any person from discharging wastewater or depositing wastes or other substances in violation of the requirements of the water quality rules. (R317-1 <i>et seq.</i> )	Applicable to removal action and should be observed to the extent practicable.
<b>TMDLs</b>	UAC R317-1-7-7.36  Applicable, Chemical-Specific	2, 3, 4, 5	Incorporates the total maximum daily loads (TMDL) for waters of the state, including the Silver Creek TMDL for dissolved Zinc and Cadmium, the contaminants of concern, approved by EPA on August 4, 2004. The beneficial uses impaired: Class 3A – cold water species of game fish and aquatic life. TMDL defined targets/endpoints are .39 mg/l for zinc and .0008 mg/l for cadmium.	TMDLs shall be observed during removal activities.
<b>Antidegradation Policy</b>	UAC R317-2-3-3.1  Applicable, Action-Specific	2, 3, 4, 5	Existing instream water uses shall be maintained and protected, and no water quality degradation is allowable which would interfere with or become injurious to existing instream water uses.	To be observed during removal action.

## RICHARDSON FLAT ARARS

<b>Use Designations</b>	<p style="text-align: center;">UAC R317-2-6 UAC R317-2-13-13.4</p> <p style="text-align: center;">Applicable, Action-Specific</p>	2, 3, 4, 5	<p>Authorizes the Water Quality Board to group waters of the state into classes to protect against controllable pollution the beneficial uses designated within each class as set forth in this section. Silver Creek and its tributaries from the confluence of Tollgate Creek to headwaters is classified in R317-2-13 a 1C, 2B, 3A, 4* water.</p>	To be observed during removal action.
<b>Water Quality Standards</b>	<p style="text-align: center;">UAC R317-2-7-7.1 and 7.2</p> <p style="text-align: center;">Applicable, Action, Chemical-Specific</p>	2, 3, 4, 5	<p>7.1 Establishes the applicability of numeric criteria in R317-2-14 to each of the classes assigned to waters of the state as specified in Section R317-2-6. It shall be unlawful for any person to discharge or place any waste or other substances in such a manner as may interfere with designated uses protected by assigned classes or to cause any of the applicable standards to be violated unless an exception applies.</p> <p>7.2 It is unlawful for any person to discharge or place any waste or other substance in such a way as will be or may become offensive such as unnatural deposits, floating debris, oil, scum or other nuisances such as color, odor or taste; or cause conditions which produce undesirable aquatic life or which product objectional tastes in edible aquatic organisms or result in concentrations or combinations of substances which produce undesirable physiological responses in desirable resident fish, or other</p>	To be observed during removal action.

## RICHARDSON FLAT ARARS

			desirable aquatic life or undesirable human health effects.	
<b>Protection of Downstream Uses</b>	UAC R317-2-8  Applicable, Action-Specific	2, 3, 4, 5	All actions to control waste discharges under shall be modified as necessary to protect downstream designated uses.	To be observed during removal action.
<b>Numeric Criteria</b>	UAC R317-2-14  Applicable, Chemical-Specific	2, 3, 4, 5	Establishes the numeric criteria for maximum concentrations of pollutants in waters. This section includes maximum contaminant levels for arsenic, cadmium, lead, mercury, and silver. This section also limits TDS for Silver Creek and tributaries to 1,900 mg/l.	To be observed during removal actions.
<b>Construction Storm Water Discharges</b>	UAC R317-8-11.3(2)(a)(2)(c), (d), and (f)  Applicable, Action-Specific	2, 3, 4, 5	Use best management practices to control pollutants in storm water discharges during construction or construction activities (clearing, grading or excavating) resulting in disturbance of more than one acre. Also propose stabilization, erosion control, and sediment control measures to control pollutants in storm water discharges that will occur after construction operations have been completed. Inspect to verify that storm water controls and best management practices are operating effectively.	To be observed to control pollutants in storm water discharges during construction; Obtaining a permit or undertaking administrative tasks not required.

## RICHARDSON FLAT ARARS

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<p><b>Relocation of Natural Streams</b></p>	<p>Utah Code § 73-3-29(4)(a)</p> <p>Relevant and Appropriate, Action-specific</p>	<p style="text-align: center;">4</p>	<p>The relocation of a stream shall not impair vested water rights; unreasonably or unnecessarily adversely affect a public recreational use or the natural stream environment; unreasonably or unnecessarily endanger aquatic wildlife; or unreasonably or unnecessarily diminish the natural channel's ability to conduct high flows.</p>	<p>To be observed during removal actions requiring relocation of Silver Creek.</p>
<p>T</p> <p><b>Specific Stream Alteration Activities</b></p>	<p>UAC R655-13-7(c)</p> <p>Specific Stream Alteration Activities</p> <p>Relevant and Appropriate, Action-specific</p>	<p style="text-align: center;">4</p>	<p>Requires an installed culvert or similar structure to contain natural bed material, bedding and backfill placed around the culvert to be no more free-draining than the adjacent bed and bank materials and shall be compacted to in-place densities at least as great as those of similar adjacent materials, and the design to include energy dissipation structure or devices as necessary.</p>	<p>To be observed if the removal actions require the installation of culverts or similar structures.</p>

## RICHARDSON FLAT ARARS

<b>To-Be Considered for Alternatives 2-5</b>			
<b>Requirement</b>	<b>Citation</b>	<b>Description</b>	<b>Comment</b>
<b>Utah Pesticide Control Rule</b>			
<b>Responsibilities of Pesticide Applicator Businesses and Pesticide Applicators</b>	UAC R68-7-16(1)-(4)	Requires pesticide applicators to receive the training required under state law, receive certification in the appropriate pesticide categories, affix to each pesticide service vehicle complete, appropriate, legible, and up-to-date labels for each pesticide. Requires pesticide applicators to notify before the time of each application of a restricted use pesticide with a Danger or Danger-Poison signal word, and such notification should include the information required by Utah Admin. Code R68-7-16(4).	Pesticides applied through response action shall be applied by a trained and certified applicator, the applicator shall affix appropriate labels to the pesticide service vehicle and notify prior to application of pesticides.
<b>Transportation, Storage, Handling, Usage, and Disposal</b>	UAC R68-7-19(1), (7)	Requires pesticide applicators to provide a secure pesticide and device storage area, which may include any area on a service vehicle. Also requires pesticide applying entities to have, at a minimum, a pesticide spill kit in each pesticide service vehicle, pesticide service trailer, and each pesticide storage. Prohibits the disposal of pesticides or pesticide containers in a manner that may cause injury to humans, other non-target species, or the environment, and prohibits the	Pesticides applied through response action shall be stored in a secure area and applicators shall maintain a readily-available spill kit, dispose of pesticides and pesticide containers in a manner that is protective of human health and the environment, and prevent the pollution of streams, lakes, or other water supplies.

## RICHARDSON FLAT ARARS

<b>of Pesticides and Pesticide Containers</b>		pollution of streams, lakes, or other water supplies during pesticide loading, mixing, and application and requires the use of appropriately functioning devices and procedures to prevent back siphoning.	
<b>Utah Seed Rule</b>			
<b>Prohibited Noxious Weed Seeds and Restricted Weed Seeds</b>	UAC R68-8-2(1)(a)(i)-(ii)	Prohibits any person, firm, or corporation, to sell, offer, or expose for sale, or distribute in Utah any agricultural, vegetable, flower, tree, and shrub seeds or seeds for sprouting for seeding purposes that contain any prohibited noxious weeds, including but not limited to those listed under Utah Admin. Code R68-8-2.	Seeds applied through response action, including revegetation, shall not contain noxious weeds, including but not limited to those listed under Utah Admin. Code R68-8-2.
<b>Utah Noxious Weed Act</b>			
<b>Designation and Publication of State Noxious Weeds</b>	UAC R68-9-3(1), (7)	Designates certain vegetation as noxious and invasive and classifies such vegetation based upon the priority of removing the noxious weeds.	Revegetation response actions shall account for Utah’s designated noxious weeds and refrain from planting or promoting the growth of such vegetation.
<b>Designations, Publications, and Prescribed Treatment for Articles Capable of Disseminating Noxious Weeds</b>	UAC R68-9-4(1)(a), (1)(c), (1)(g).	Designates certain articles, including but not limited to machinery and equipment, seed, and soil as articles capable of disseminating noxious weeds. Establishes treatment requirements for such articles to prevent dissemination of noxious weed seeds or parts of noxious weed plants that could cause new growth of noxious weeds.	Articles used in response actions shall be treated to prevent dissemination of noxious weed seeds or parts of noxious weed plants that could cause new growth of noxious weeds.

## RICHARDSON FLAT ARARS

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<b>Archaeological and Historical Preservation</b>			
<b>Report of Discovery on State or Private Lands</b>	Utah Code 9-8a-307(1), (2)	Any person who discovers archaeological resources on state- or privately-owned land shall promptly report the discovery to the State Historical Preservation Office.	If archaeological resources are discovered during response actions, their discovery should be promptly reported to the State Historical Preservation Office.

\*The State has identified Utah Administrative Code R311-211 et seq. as ARARs. EPA has determined that Utah Administrative Code R311-211 et seq. is outside the scope of this removal action, but the State has demonstrated a consistent intent to apply these ARARs and has not waived their ability to identify them as ARARS in future removal or remedial actions.


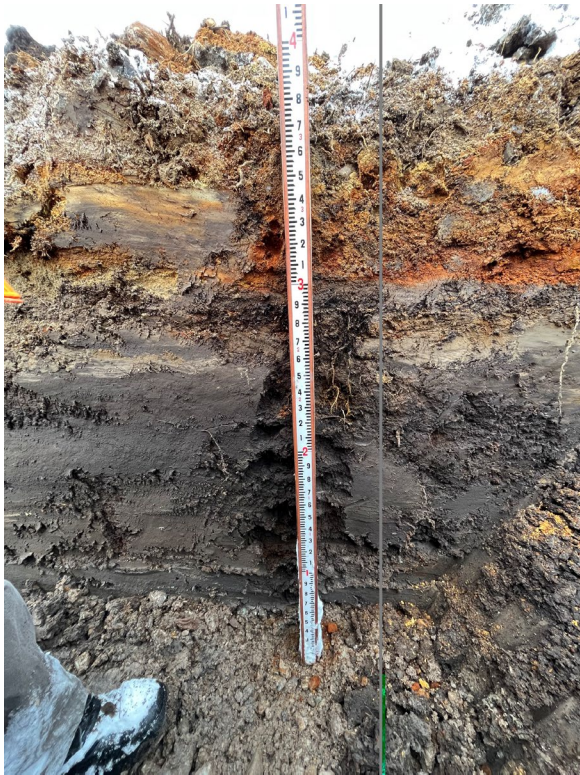
## **APPENDIX B. TEST PIT PHOTOLOG**

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**Project Name:**  
Richardson Flat EE/CA

**Site Location:**  
Park City, Utah



**Project No.**  
2142-2103-06

<b>Date/Time Taken:</b>	2022:12:09 12:15:20	
<b>Photographer:</b>	Schmidt, Cordel	
<b>Latitude:</b>	40.675983	
<b>Longitude:</b>	-111.463409	
<b>Photo Direction:</b>	SW	
<b>Photo Name:</b>	IMG_4569.JPG	
<b>Photo Description:</b>	Test Pit 23. Wetland material, gravel at base.	
<b>Date/Time Taken:</b>	2022:12:09 11:22:15	
<b>Photographer:</b>	Schmidt, Cordel	
<b>Latitude:</b>	40.675911	
<b>Longitude:</b>	-111.462593	
<b>Photo Direction:</b>	NW	
<b>Photo Name:</b>	IMG_4563.JPG	
<b>Photo Description:</b>	Test Pit 25. Tailings 0-1 foot.	

**Project Name:**  
Richardson Flat EE/CA

**Site Location:**  
Park City, Utah


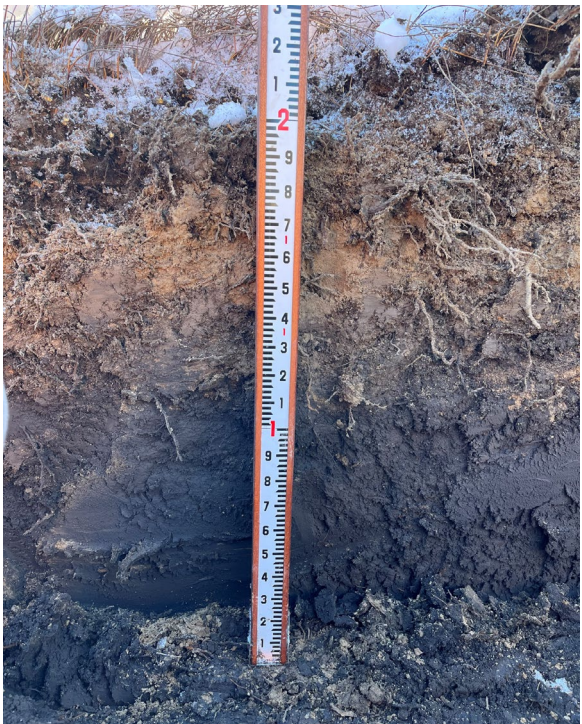
**Project No.**  
2142-2103-06

<b>Date/Time Taken:</b>	2022:12:08 16:01:05	
<b>Photographer:</b>	Schmidt, Cordel	
<b>Latitude:</b>	40.679527	
<b>Longitude:</b>	-111.460083	
<b>Photo Direction:</b>	SSW	
<b>Photo Name:</b>	IMG_4555.JPG	
<b>Photo Description:</b>	Test Pit 27. Tailings 0-2 feet, wetland material underneath.	
<b>Date/Time Taken:</b>	2022:12:08 14:14:05	
<b>Photographer:</b>	Schmidt, Cordel	
<b>Latitude:</b>	40.679489	
<b>Longitude:</b>	-111.459389	
<b>Photo Direction:</b>	SSW	
<b>Photo Name:</b>	IMG_4548.JPG	
<b>Photo Description:</b>	Test Pit 30. Tailings 0-2.2 feet. Thin wetland material with underlying gravel zone.	

**Project Name:**  
Richardson Flat EE/CA

**Site Location:**  
Park City, Utah



**Project No.**  
2142-2103-06

<b>Date/Time Taken:</b>	2022:11:15 13:05:07	
<b>Photographer:</b>	Schmidt, Cordel	
<b>Latitude:</b>	40.686825	
<b>Longitude:</b>	-111.455971	
<b>Photo Direction:</b>	E	
<b>Photo Name:</b>	IMG_4414.JPG	
<b>Photo Description:</b>	Test Pit 37. Tailings 0-1.7 feet overlying wetland material.	
<b>Date/Time Taken:</b>	2022:11:15 15:37:59	
<b>Photographer:</b>	Schmidt, Cordel	
<b>Latitude:</b>	40.694752	
<b>Longitude:</b>	-111.461121	
<b>Photo Direction:</b>	WSW	
<b>Photo Name:</b>	IMG_4422.JPG	
<b>Photo Description:</b>	Test Pit 40. Tailings 0-0.5 foot overlying wetland material.	

**Project Name:**  
Richardson Flat EE/CA

**Site Location:**  
Park City, Utah



**Project No.**  
2142-2103-06

<b>Date/Time Taken:</b>	2022:11:16 09:54:44	
<b>Photographer:</b>	Schmidt, Cordel	
<b>Latitude:</b>	40.703442	
<b>Longitude:</b>	-111.464088	
<b>Photo Direction:</b>	NW	
<b>Photo Name:</b>	IMG_4435.JPG	
<b>Photo Description:</b>	Test Pit 44. Silty clay.	
<b>Date/Time Taken:</b>	2022:11:16 10:43:11	
<b>Photographer:</b>	Schmidt, Cordel	
<b>Latitude:</b>	40.709	
<b>Longitude:</b>	-111.470993	
<b>Photo Direction:</b>	N	
<b>Photo Name:</b>	IMG_4437.JPG	
<b>Photo Description:</b>	Test Pit 45. Thin tailings at ground surface, overlies clayey wetland zone.	

**Project Name:**  
Richardson Flat EE/CA

**Site Location:**  
Park City, Utah



**Project No.**  
2142-2103-06

<b>Date/Time Taken:</b>	2022:11:16 10:56:13	
<b>Photographer:</b>	Schmidt, Cordel	
<b>Latitude:</b>	40.708992	
<b>Longitude:</b>	-111.471001	
<b>Photo Direction:</b>	N	
<b>Photo Name:</b>	IMG_4439.JPG	
<b>Photo Description:</b>	Test Pit 45. Clayey wetland zone overlying coarse gravel.	
<b>Date/Time Taken:</b>	2022:11:16 11:17:59	
<b>Photographer:</b>	Schmidt, Cordel	
<b>Latitude:</b>	40.710384	
<b>Longitude:</b>	-111.46801	
<b>Photo Direction:</b>	NW	
<b>Photo Name:</b>	IMG_4442.JPG	
<b>Photo Description:</b>	Test Pit 46. Wetland material.	

**Project Name:**  
Richardson Flat EE/CA

**Site Location:**  
Park City, Utah



**Project No.**  
2142-2103-06

<b>Date/Time Taken:</b>	2022:11:16 16:27:37	
<b>Photographer:</b>	Schmidt, Cordel	
<b>Latitude:</b>	40.720787	
<b>Longitude:</b>	-111.474083	
<b>Photo Direction:</b>	NE	
<b>Photo Name:</b>	IMG_4458.JPG	
<b>Photo Description:</b>	Test Pit 55. Recent soil material overlying tailings, 0.6-1.4 feet. Underlying wetland material.	
<b>Date/Time Taken:</b>	2022:11:17 09:16:38	
<b>Photographer:</b>	Schmidt, Cordel	
<b>Latitude:</b>	40.722939	
<b>Longitude:</b>	-111.475182	
<b>Photo Direction:</b>	NW	
<b>Photo Name:</b>	IMG_4463.JPG	
<b>Photo Description:</b>	Test Pit 58. Tailings 0-1.4 feet, overlying wetland material.	

**Project Name:**  
Richardson Flat EE/CA

**Site Location:**  
Park City, Utah

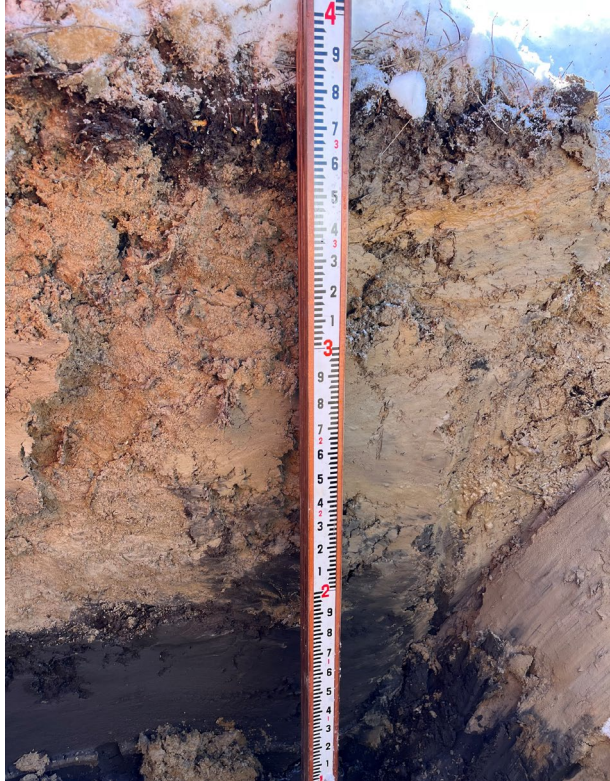
**Project No.**  
2142-2103-06

<b>Date/Time Taken:</b>	2022:11:17 13:25:01	
<b>Photographer:</b>	Schmidt, Cordel	
<b>Latitude:</b>	40.724079	
<b>Longitude:</b>	-111.479645	
<b>Photo Direction:</b>	NNW	
<b>Photo Name:</b>	IMG_4477.JPG	
<b>Photo Description:</b>	Test Pit 60. Typical example of fibrous wetland material at the site.	
<b>Date/Time Taken:</b>	2022:11:17 14:41:29	
<b>Photographer:</b>	Schmidt, Cordel	
<b>Latitude:</b>	40.731602	
<b>Longitude:</b>	-111.478653	
<b>Photo Direction:</b>	NW	
<b>Photo Name:</b>	IMG_4482.JPG	
<b>Photo Description:</b>	Test Pit 63. Groundwater inflow from contact of tailings and historical wetland material.	

**Project Name:**  
Richardson Flat EE/CA

**Site Location:**  
Park City, Utah

**Project No.**  
2142-2103-06

<b>Date/Time Taken:</b>	2022:11:18 13:05:54	
<b>Photographer:</b>	Schmidt, Cordel	
<b>Latitude:</b>	40.735138	
<b>Longitude:</b>	-111.4786	
<b>Photo Direction:</b>	SSW	
<b>Photo Name:</b>	IMG_4501.JPG	
<b>Photo Description:</b>	Test Pit 66. Tailings 0-2 feet overlying wetland material.	

**APPENDIX C. COST ESTIMATE ASSUMPTIONS AND COST ESTIMATE FOR TARGETED PHYSICAL REMOVAL OF TAILINGS, ALTERNATIVE TWO, SCENARIOS A THROUGH E**

## **Cost Assumptions listed below for Alternative Two scenarios.**

Accuracy, General Assumptions, Planning Documents, and Site Preparation and Mobilization items presented below also apply to Alternatives three, four, and five, as appropriate. Cost estimates are a best estimate and may not include all items. They are developed to guide site activities and associated costs. The cost analysis consists of:

- Capital (direct and indirect) and annual O&M costs over 30 years
- Present value (capital and O&M costs) of the alternative by discounting to a base year or current year using a discount rate according to the White House Office of Management and Budget (OMB) Circular A-94 (OMB 2018).

(Source: EPA 2000)

### **General Assumptions**

- Costs were estimated using RS Means Data Online cost estimating software, vendor quotes, or professional judgement.
- Costs are for the 2024 Base Year.
- Assume 1.25 bulking factor.
- Assume 1 cubic yard (CY) of soil is 1.5 tons.
- Project Management costs are assumed to be 12% of construction costs.
- A construction contingency of 20% was applied to construction costs.
- Unless otherwise noted, quantities were estimated based on the assumed locations of excavated areas, site features, laydown areas, and disposal repositories. Quantities may vary significantly from those assumed in this cost estimate as the design of the alternatives is further refined.
- The cost for coordination of site access and necessary permissions from landowners for placement of the waste tailings, construction of temporary roads, waterway diversion, and traffic/pedestrian diversion is not included in this cost estimate.
- It is assumed that ecological or biological assessment, monitoring, remediation, and wetland restoration is outside the scope of this cost estimate.
- Water collected or diverted during the removal action does not require treatment before discharge to Silver Creek.
- No in-excavation dewatering activities were accounted for in this cost estimate.
- It is assumed that soil beneath the mine tailings is not contaminated and would not be removed.
- Mine tailings are assumed to be consistently graded and do not contain a substantial volume of cobbles, debris, metal, or trash that will need to be removed or segregated before placement and compaction in the repository.
- The repository at Operable Unit 1 (OU01) or a new repository constructed for the purpose of disposal of waste tailings will not require a liner or leachate collection and treatment system.

- The mine tailings will be covered with topsoil and an impermeable layer. The repository (at OU01 or newly constructed) will not be constructed to conform to Subtitle C or D requirements.
- Waste characterization samples will not be collected.
- It is assumed that a source of potable water is readily available for sanitary facilities, decontamination, and dust suppression. However, this cost estimate does not include the cost of water because of the uncertainty in the source of water at the site.
- Only 20% of the excavated area will be backfilled with an onsite borrow source. The remaining area will be graded for drainage and seeded.

### **Planning Documents**

- Costs for permits is assumed to be 2% based on RSMeans default values.
- The planning documents are assumed to include a removal action workplan, community involvement plan, engineering drawings, specifications, a basis of design report, construction schedule and cost estimate, site management plan, communications plan, a stormwater management plan, dust suppression plan, health and safety plan, sampling and analysis plan, quality assurance project plan, traffic and pedestrian plan, haul route plan, dust control plan, and a waste disposal plan.
- Costs for assessments/reports were estimated using professional judgment, based on experience with similar plans of similar scope and complexity.

### **Site Preparation and Mobilization**

- Topographic surveys will be performed before the start of mobilization at the laydown area, excavation and work areas, and the designated tailings repository located at OU01 or the location of the new repository.
- The laydown area is approximately 1 acre and will be fenced in for security. The location of the laydown area will be determined in the design but is assumed to be near the excavation area(s) and accessible by existing, paved roads.
- Current vegetation at the site is not dense and covers only approximately 50% of the site surface area. Clearing and grubbing activities will include removal of light brush.
- Temporary roads of approximately 4-inch gravel fill will be made at the site to allow equipment and truck access to excavation areas.
- Rented heavy equipment access mats will be used to provide structural stability for heavy equipment and trucks in soft and muddy work areas.
- Dust suppression measures during excavation will include a 6,000-gallon water truck.
- Rented heavy equipment access mats will be used to provide structural stability for heavy equipment and trucks in soft and muddy work areas.
- An onsite field technician will collect lateral extent confirmation samples at the excavation perimeter with an occurrence of one sample every 500 linear ft. Samples will not be collected from the excavation bottom or from the excavated material.

### **For Scenario A: Sitewide Excavation in Reaches 2, 3, 4, 5, 6**

- Dust suppression activities will continue for 95 weeks.

- Approximately 1,321,476 CY (“in-place volume”) will be removed sitewide.
- The excavation depth will be visually determined by an onsite technician and is approximately 2 feet below ground surface (bgs), except for three locations: Reach 2, Reach 3, and Reach 6. Field confirmation may be employed to ensure removal of tailings.
  - Reach 2 and reach 3 will require an excavation depth of approximately 1.5 ft bgs.
  - Reach 6 will require an excavation depth of approximately 4 ft bgs.

**For Scenarios B: Excavation in NAG Areas 1, 2, 3 within Reaches 2, 3, 6**

- Dust suppression activities will continue for 25 weeks.
- Approximately 79,773 CY (“in-place volume”) will be removed sitewide.

**For Scenario C: Removal of all tailings south of Big 4 and NAG Area 3**

- Dust suppression activities will continue for 95 weeks.
- Approximately 543,514 CY (“in-place volume”) will be removed sitewide.

**For Scenario D: Excavation of NAG Areas 1, 2, 3, and Reach 1**

- Dust suppression activities will continue for 25 weeks.
- Approximately 14,685 CY (“in-place volume”) will be removed sitewide.

**For Scenario E: Excavation of tailings from Richardson Flat Road through Reach 5 and Reach 1**

- Dust suppression activities will continue for 49 weeks.
- Approximately 159,885 CY (“in-place volume”) will be removed sitewide.

**Tailings Dewatering Area**

- The excavated tailings are expected to be wet and will be temporary stockpiled adjacent to excavation for dewatering via gravity drainage (it is assumed that no dewatering amendments, such as lime or quicklime will be necessary). Excess water from the stockpile will be allowed to drain back into the excavated area.
- No liner is anticipated to be used for the temporary tailings’ stockpiles.
- The dewatering stockpiles are anticipated to cover a total area of approximately 1.8 acres.
- Clearing and grubbing activities will include removal of light brush and small trees as determined during excavation and stockpiling activities.
- Silt fencing will be placed around the stockpiles of excavated tailings.
- Once dry, the tailings will be loaded and hauled to the OU01 repository.

**Disposal at OU01 Repository**

- OU01 will be used as the repository for excavated materials.
- Dust suppression measures will be implemented at the repository and may include a water truck or a stationary water tank.

- It is assumed topsoil for the cover will be brought from an offsite source. Additionally, it is expected the cover design may change once study and model is performed.
- It is assumed that the repository does not require a liner or leachate collection and treatment system, based on current uses.
- It is assumed that trucks will use a portion of the recreational trails, and surrounding highways and local streets and will require regular maintenance/repairs and traffic control.

### Grading and Site Restoration

- It is assumed that 20% of excavated areas will require backfill.
- It is assumed that backfill will be available from onsite sources.
- The site will be reseeded to support vegetative growth as follows through the process of mechanical seeding, mulching, and crimping.
- It is assumed the repository does not require seeding.

### Demobilization

- A topographic survey will be performed at areas disturbed during the site work. Inspections of the repository, roadways, and site conditions will also be performed.
- A closeout report will be issued after the removal action to document site activities. Costs for the closeout report are based on professional judgement for similar reports.

Alternative 2, Scenario A: Sitewide Excavation in Reaches 2, 3, 4, 5, 6, 7 with Disposal at OU1		Cost Estimate Summary			
<b>Site:</b> Richardson Flat Tailings <b>Location:</b> Park City, Utah <b>Base Year:</b> 2024 <b>Date:</b> May 2024	<b>Description:</b> Alternative 2, Scenario A consists of removal of all currently observed tailings material across the entire site (not including Reach 1); Excavation and on-site disposal at the OU01 repository; and hydroseeding restoration activities.				
Capital Costs					
Description	Quantity	Unit	Unit Cost	RSMeans Index	Total Cost
<b>Planning Documents</b>					
Permits	1	Lump Sum	\$1,021,257.00	014126500010	\$1,021,257.00
Assessments/Reports	1	Lump Sum	\$500,000.00	Professional Judgement	\$500,000.00
<b>SUBTOTAL</b>					<b>\$1,521,257.00</b>
<b>Site Preparation and Mobilization</b>					
Topographic Surveys	346	Acre	\$976.12	022113090050	\$337,737.52
Clearing and Grubbing (Laydown and Work Areas)	151	Acre	\$1,689.75	311313100400	\$255,152.25
Temporary Fencing (Laydown Area)	800	LF	\$5.60	015626500200	\$4,480.00
Signage	15	EA	\$25.34	015623103010	\$380.10
Mobilization/Delivery of Large Equipment	3	EA	\$914.38	015436501500	\$2,743.14
Temporary Roads	5,000	SY	\$7.19	015523500050	\$35,950.00
<b>SUBTOTAL</b>					<b>\$636,443.01</b>
<b>Sitewide Soil Excavation</b>					
Water Diversion	5,280	CY	\$10.44	312319200100	\$55,123.20
Dust Suppression	96	Wk	\$7,264.51	015433406950	\$697,392.96
Mats/Padding for Work Area	1	Lump Sum	\$1,041,323.09	310660141600	\$1,041,323.09

Excavation of Tailings	1,321,476	BCY	\$1.97	312316420260	\$2,603,307.72
Excavation Inspector	480	Day	\$1,200.00	Professional Judgement	\$576,000.00
Confirmation Sampling Lab Costs	114	EA	\$165.00	ALS	\$18,810.00
<b>SUBTOTAL</b>					<b>\$4,991,956.97</b>
<b>Tailings Dewatering Area</b>					
Clearing and Grubbing	7	Acre	\$1,689.75	312316435320	\$11,936.87
Silt Fence	8,792	LF	\$3.50	312514161000	\$30,772.00
Loading	1,651,845	LCY	\$2.27	312316420260	\$3,742,254.85
Haul to Repository	1,651,845	LCY	\$9.53	312323200022	\$15,742,082.85
<b>SUBTOTAL</b>					<b>\$19,527,046.56</b>
<b>Disposal at Onsite Repository</b>					
Removal of Current Repository Cover	80,017	BCY	\$1.97	312323156045	\$157,633.65
Dust Suppression	95	Wk	\$7,264.51	015433406950	\$690,128.45
Rough Grading of Tailings	1,916,640	SF	\$0.06	312213200280	\$118,180.98
Compaction of Tailings	1,321,476	BCY	\$0.31	312323235050	\$11,439,175.68
Repository Cover material (Topsoil)	70,987	BCY	\$42.77	Vendor	\$3,036,099.73
Spreading of Repository Cover	70,987	BCY	\$2.31	312323156045	\$163,979.20
Compaction of Repository Cover	70,987	BCY	\$0.31	312323235050	\$66,017.60
Rough Grading of Repository Cover	1,916,640	SF	\$0.06	312213200280	\$118,180.98
Finish grading of Repository Cover	1,917	MSF	\$34.63	312216103312	\$66,373.24
Roadways Maintenance	95	Mi	\$222.52	340113100220	\$21,139.40
Recreational Trails and Roadways Traffic Control	95	Day	\$1,160.80	RSMeans Crews	\$110,276.00
<b>SUBTOTAL</b>					<b>\$15,987,184.92</b>
<b>Grading and Site Restoration</b>					
Clean Fill Excavation and Loading	264,295	CY	\$32.85	310513100200	\$8,682,097.32
Rough Grading	6,885,280	SF	\$0.06	312213200280	\$4.25
Mechanical Seeding	158	Acre	\$1,203.00	329219130020	\$190,151.33
Soil Mulching	6,885		\$69.53	329113160700	\$478,733.52
Soil Crimping	158	MSF	\$604.15	329219130020	\$95,494.53
<b>SUBTOTAL</b>		Acre			<b>\$9,446,480.95</b>
<b>Demobilization</b>					
Topographic Surveys	346	Acre	\$976.12	022113090050	\$337,737.52
Inspections	30	Days	\$1,200.00	Professional Judgement	\$36,000.00
Closeout Report	1	Lump Sum	\$100,000.00	Professional Judgement	\$100,000.00
<b>SUBTOTAL</b>					<b>\$473,737.52</b>
<b>Subtotal Construction Costs</b>					<b>\$52,584,106.92</b>
Project Management		12% Construction Cost		\$6,310,092.83	
Construction Contingencies		20% of Construction Cost		\$10,516,821.38	
<b>Total Capital Costs</b>					<b>\$69,411,021.14</b>
<b>Operation and Maintenance (O&amp;M) Costs</b>					
Vegetation Surveys	1	EA	\$40,000.00	Professional Judgement	\$40,000.00
Drainage Sediment and Surface Water Sampling	1	EA	\$50,000.00	Professional Judgement	\$50,000.00
Biannual Inspection/Maintenance/Repair of Onsite Cap and Repository	1	EA	\$100,000.00	Professional Judgement	\$100,000.00
<b>Subtotal Annual O&amp;M Costs</b>					<b>\$290,000.00</b>

<i>O&amp;M Contingencies</i>	<i>30% Annual O&amp;M Cost</i>	<i>87,000.00</i>
<b>Total Annual O&amp;M Costs</b>		<b>\$377,000.00</b>
<i>Present Worth of Annual O&amp;M Costs Based on 30 Year Life @ 2.50%</i>	<i>P/A (present from annual) Factor = 20.93</i>	<b>\$7,890,720.31</b>
<i>Five-Year Reviews</i>	<i>\$100,000 each for 6 reviews</i>	
<b>Present Worth of Future Costs Based on 30 Year Life @ 2.50%</b>		<b>\$398,192.25</b>
<b>Total Present Worth</b>		<b>\$77,699,933.69</b>

Notes:

x1.25 Expansion Factor Used for all LCY quantities

x0.9 Compaction Factor Used for all CCY quantities

Alternative 2, Scenario B: NAG Areas 1, 2, 3  
within Reaches 2, 3, 6. Excavation and Disposal  
at OU1

## Cost Estimate Summary

Site: Richardson Flat Tailings  
Location: Park City, Utah  
Base Year: 2024  
Date: May 2024

Description: Alternative 2, Scenario B consists of removal of Net-Acid-Generating tailings material located at three delineated areas at the site; Excavation and on-site disposal at the OU01 repository; and restoration of the site.

Capital Costs					
Description	Quantity	Unit	Unit Cost	RS Means Index	Total Cost
<b>Planning Documents</b>					
Permits	1	Lump Sum	\$74,117.62	014126500010	\$74,117.62
Assessments/Reports	1	Lump Sum	\$400,000.00	Professional Judgement	\$400,000.00
<b>SUBTOTAL</b>					<b>\$474,117.62</b>
<b>Site Preparation and Mobilization</b>					
Topographic Surveys	44	Acre	\$976.12	022113090050	\$42,864.33
Clearing and Grubbing (Laydown and Work Areas)	14	Acre	\$1,689.75	311313100400	\$24,427.85
Temporary Fencing (Laydown Area)	800	LF	\$5.60	015626500200	\$4,480.00
Signage	15	EA	\$25.34	015623103010	\$380.10
Mobilization/Delivery of Large Equipment	3	EA	\$914.38	015436501500	\$2,743.14
Temporary Roads	5,000	SY	\$7.19	015523500050	\$35,950.00
Mats/Padding for Work Area	1	Lump Sum	\$62,861.12	310660141600	\$62,861.12
Water Diversion	5,280	CY	\$10.44	312319200100	\$55,123.20
<b>SUBTOTAL</b>					<b>\$228,829.74</b>
<b>Area 3 Excavation and Loading</b>					
Dust Suppression	10	Wk	\$7,264.51	015433406950	\$72,645.10
Excavation of Tailings	35,696	BCY	\$1.97	312316420260	\$70,321.12
Confirmation Sampling Lab Costs	10	EA	\$165.00	ALS	\$1,636.14
<b>SUBTOTAL</b>					<b>\$144,602.36</b>
<b>Area 2 Excavation and Loading</b>					
Dust Suppression	9	Wk	\$7,264.51	015433406950	\$65,380.59
Excavation of Tailings	29,392	BCY	\$1.97	312316420260	\$57,902.24
Confirmation Sampling Lab Costs	7	EA	\$165.00	ALS	\$1,145.76
<b>SUBTOTAL</b>					<b>\$124,428.59</b>
<b>Area 1 Excavation and Loading</b>					
Dust Suppression	4	Wk	\$7,264.51	015433406950	\$29,058.04
Excavation of Tailings	14,685	BCY	\$1.97	312316420260	\$28,929.45
Confirmation Sampling Lab Costs	8	EA	\$165.00	ALS	\$1,360.59
<b>SUBTOTAL</b>					<b>\$59,348.08</b>
<b>Tailings Dewatering Area</b>					
Clearing and Grubbing	2	Acre	\$1,689.75	312316435320	\$3,045.12
Silt Fence	3,140	LF	\$3.50	312514161000	\$10,990.00
Loading	99,716	LCY	\$2.27	312316420260	\$225,907.16
Haul to Repository	99,716	LCY	\$5.98	312323203220	\$596,303.18
<b>SUBTOTAL</b>					<b>\$836,245.46</b>
<b>Disposal at On-site Repository</b>					
Dust Suppression	24	Wk	\$7,264.51	015433406950	\$174,348.24
Rough Grading of Tailings	653,400	SF	\$0.06	312213200280	\$40,288.97
Compaction of Tailings	79,773	BCY	\$0.31	312323235050	\$122,278.31
Repository Cover material (topsoil)	24,200	BCY	\$42.77	Vendor	\$1,035,034.00

Compaction of Repository Cover	24,200	BCY	\$0.31	312323235050	\$37,094.45
Rough Grading of Repository Cover	653,400	SF	\$0.06	312213200280	\$40,288.97
Finish grading of Repository Cover	653	MSF	\$34.63	312216103312	\$22,627.24
Roadways Maintenance	24	Mi	\$222.52	340113100220	\$5,340.48
Recreational Trails and Roadways Traffic Control	24	Day	\$1,160.80	RSMeans Crews	\$27,859.20
<b>SUBTOTAL</b>					<b>\$1,505,159.86</b>
<b>Grading and Site Restoration</b>					
Clean Fill Excavation and Loading	15,955	CY	\$32.85	310513100200	\$524,108.61
Rough Grading	708,225	SF	\$0.06	312213200280	\$43,669.48
Mechanical Seeding	16	Acre	\$1,203.00	329219130020	\$19,559.09
Soil Mulching	708		\$69.53	329113160700	\$49,242.85
Soil Crimping	16	MSF Acre	\$604.15	329219130020	\$9,822.63
<b>SUBTOTAL</b>					<b>\$646,402.66</b>
<b>Demobilization</b>					
Topographic Surveys	44	Acre	\$976.12	022113090050	\$42,864.33
Inspections	15	Days	\$1,200.00	Professional Judgement	\$18,000.00
Closeout Report	1	Lump Sum	\$100,000.00	Professional Judgement	\$100,000.00
<b>SUBTOTAL</b>					<b>\$160,864.33</b>
<b>Subtotal Construction Costs</b>					<b>4,179,998.70</b>
<i>Project Management</i>		<i>12% Construction Cost</i>			<i>501,599.84</i>
<i>Construction Contingencies</i>		<i>20% of Construction Cost</i>			<i>835,999.74</i>
<b>Total Capital Costs</b>					<b>\$5,517,598.28</b>
<b>Operation and Maintenance (O&amp;M) Costs</b>					
Vegetation Surveys	1	EA	\$5,000.00	Professional Judgement	\$5,000.00
Drainage Sediment and Surface Water Sampling	1	EA	\$10,000.00	Professional Judgement	\$10,000.00
Biannual Inspection/Maintenance/Repair of Onsite Cap and Repository and Site Maintenance	1	EA	\$40,000.00	Professional Judgement	\$40,000.00
<b>Subtotal Annual O&amp;M Costs</b>					<b>\$95,000.00</b>
<i>O&amp;M Contingencies</i>		<i>30% Annual O&amp;M Cost</i>			<i>28,500.00</i>
<b>Total Annual O&amp;M Costs</b>					<b>\$123,500.00</b>
<i>Present Worth of Annual O&amp;M Costs Based on 30 Year Life @ 2.50%</i>		<i>P/A (present from annual) Factor = 20/93</i>			<b>\$2,584,891.14</b>
<i>Five-Year Reviews</i>		<i>\$50,000 each for 6 reviews</i>			
<i>Present Worth of Future Costs Based on 30 Year Life @ 2.50%</i>		<i>P/F (present from future) Factor</i>			<b>\$202,968.71</b>
<b>Total Present Worth</b>					<b>\$8,305,458.13</b>

Notes:

x1.25 Expansion Factor Used for all LCY quantities

x0.9 Compaction Factor Used for all CCY quantities

Alternative 2, Scenario C: Removal of all tailings south of Big 4, also NAG Area 3. Disposal at OU1.

## Cost Estimate Summary

**Site:** Richardson Flat Tailings  
**Location:** Park City, Utah  
**Base Year:** 2024  
**Date:** February 2024

**Description:** Alternative 2, Scenario C consists of removal of all tailings material south of Big 4 mill, also NAG Area 3. Excavation and on-site disposal at the OU01 repository, restoration of the site.

Capital Costs					
Description	Quantity	Unit	Unit Cost	RSMeans Index	Total Cost
<b>Planning Documents</b>					
Permits	1	Lump Sum	\$382,793.86	014126500010	\$382,793.86
Assessments/Reports	1	Lump Sum	\$400,000.00	Professional Judgement	\$400,000.00
<b>SUBTOTAL</b>					<b>\$782,793.86</b>
<b>Site Preparation and Mobilization</b>					
Topographic Surveys	207	Acre	\$976.12	022113090050	\$201,599.44
Clearing and Grubbing (Laydown and Work Areas)	81	Acre	\$1,689.75	311313100400	\$137,318.72
Temporary Fencing (Laydown Area)	800	LF	\$5.60	015626500200	\$4,480.00
Signage	15	EA	\$25.34	015623103010	\$380.10
Mobilization/Delivery of Large Equipment	3	EA	\$914.38	015436501500	\$2,743.14
Temporary Roads	5,000	SY	\$7.19	015523500050	\$35,950.00
Mats/Padding for Work Area	1	Lump Sum	\$400,160.58	310660141600	\$400,160.58
Water Diversion	2,913	CY	\$10.44	312319200100	\$30,408.24
<b>SUBTOTAL</b>					<b>\$813,040.22</b>
<b>Area 7 Excavation and Loading</b>					
Dust Suppression	85	Wk	\$7,264.51	015433406950	\$617,483.35
Excavation of Tailings	507,818	BCY	\$1.97	312316420260	\$1,000,401.46
Excavation Inspector	425	Day	\$1,200.00	Professional Judgement	\$510,000.00
Confirmation Sampling Lab Costs	36	EA	\$165.00	ALS	\$5,973.00
<b>SUBTOTAL</b>					<b>\$2,133,857.81</b>
<b>Area 3 Excavation and Loading</b>					
Dust Suppression	10	Wk	\$7,264.51	015433406950	\$72,645.10
Excavation of Tailings	35,696	BCY	\$1.97	312316420260	\$70,321.12
Excavation Inspector	50	Day	\$1,200.00	Professional Judgement	\$60,000.00
Confirmation Sampling Lab Costs	10	EA	\$165.00	ALS	\$1,636.14
<b>SUBTOTAL</b>					<b>\$204,602.36</b>
<b>Tailings Dewatering Area</b>					
Clearing and Grubbing	2.00	Acre	\$1,689.75	312316435320	\$3,379.50
Silt Fence	1,884	LF	\$3.50	312514161000	\$6,594.00
Loading	679,393	LCY	\$2.27	312316420260	\$1,539,163.71
Haul to Repository	679,393	LCY	\$5.98	312323203220	\$4,062,767.15
<b>SUBTOTAL</b>					<b>\$5,611,904.36</b>
<b>Disposal at On-site Repository</b>					
Dust Suppression	95	Wk	\$7,264.51	015433406950	\$690,128.45
Rough Grading of Tailings	1,916,640	SF	\$0.06	312213200280	\$114,998.40
Compaction of Tailings	543,514	BCY	\$0.31	312323235050	\$2,092,001.73

Repository Cover material (topsoil)	70,987	BCY	\$42.77	Vendor	\$3,036,099.73
Compaction of Repository Cover	70,987	BCY	\$0.31	312323235050	\$66,017.60
Rough Grading of Repository Cover	1,916,640	SF	\$0.06	312213200280	\$114,998.40
Finish grading of Repository Cover	1,917	MSF	\$34.63	312216103312	\$66,373.24
Roadways Maintenance	95	Mi	\$222.52	340113100220	\$21,139.40
Recreational Trails and Roadways Traffic Control	95	Day	\$1,160.80	RSMMeans Crews	\$110,276.00
<b>SUBTOTAL</b>					<b>\$6,312,032.96</b>
<b>Grading and Site Restoration</b>					
Clean Fill Excavation and Loading	108,703	CY	\$32.85	310513100200	\$3,570,886.98
Rough Grading	87,201	SF	\$0.06	312213200280	\$5,232.08
Mechanical Seeding	83	Acre	\$1,203.00	329219130020	\$100,168.64
Soil Mulching	87		\$69.53	329113160700	\$6,063.10
Soil Crimping	83	MSF Acre	\$604.15	329219130020	\$50,304.97
<b>SUBTOTAL</b>					<b>\$3,732,655.77</b>
<b>Demobilization</b>					
Topographic Surveys	207	Acre	\$976.12	022113090050	\$201,599.44
Inspections	25	Days	\$1,200.00	Professional Judgement	\$30,000.00
Closeout Report	1	Lump Sum	\$100,000.00	Professional Judgement	\$100,000.00
<b>SUBTOTAL</b>					<b>\$331,599.44</b>
<b>Subtotal Construction Costs</b>					<b>19,922,486.78</b>
Project Management		12% Construction Cost			2,390,698.41
Construction Contingencies		20% of Construction Cost			3,984,497.36
<b>Total Capital Costs</b>					<b>\$26,297,682.54</b>
<b>Operation and Maintenance (O&amp;M) Costs</b>					
Vegetation Surveys	1	EA	\$30,000.00	Professional Judgement	\$30,000.00
Drainage Sediment and Surface Water Sampling	1	EA	\$50,000.00	Professional Judgement	\$50,000.00
Biannual Inspection/Maintenance/Repair of Onsite Cap and Repository and Site Maintenance	1	EA	\$80,000.00	Professional Judgement	\$80,000.00
<b>Subtotal Annual O&amp;M Costs</b>					<b>\$240,000.00</b>
O&M Contingencies		30% Annual O&M Cost			72,000.00
<b>Total Annual O&amp;M Costs</b>					<b>\$312,000.00</b>
Present Worth of Annual O&M Costs Based on 30 Year Life @ 2.50%		P/A (present from annual) Factor = 20/93			<b>\$6,530,251.29</b>
Five-Year Reviews		\$75,000 each for 6 reviews			
Present Worth of Future Costs Based on 30 Year Life @ 2.50%		P/F (present from future) Factor			<b>\$298,644.18</b>
<b>Total Present Worth</b>					<b>\$33,126,578.02</b>

## Notes:

x1.25 Expansion Factor Used for all LCY quantities  
x0.9 Compaction Factor Used for all CCY quantities

Alternative 2, Scenario D: Hotspots and Reach 1  
Excavation. Disposal at OU1.

## Cost Estimate Summary

**Site:** Richardson Flat Tailings  
**Location:** Park City, Utah  
**Base Year:** 2024  
**Date:** March 2024

**Description:** Alternative 2, Scenario D consists of removal of Net-Acid-Generating tailings material located at Areas 1, 2, and 3, also remove tailings spots in Reach 1; excavation and on-site disposal at the OU01 repository; and restoration of the site.

Capital Costs					
Description	Quantity	Unit	Unit Cost	RSMeans Index	Total Cost
<b>Planning Documents</b>					
Permits	1	Lump Sum	\$59,307.54	014126500010	\$59,307.54
Assessments/Reports	1	Lump Sum	\$400,000.00	Professional Judgement	\$400,000.00
<b>SUBTOTAL</b>					<b>\$459,307.54</b>
<b>Site Preparation and Mobilization</b>					
Topographic Surveys	74	Acre	\$976.12	022113090050	\$72,232.41
Clearing and Grubbing (Laydown and Work Areas)	14	Acre	\$1,689.75	311313100400	\$24,427.85
Temporary Fencing (Laydown Area)	800	LF	\$5.60	015626500200	\$4,480.00
Signage	15	EA	\$25.34	015623103010	\$380.10
Mobilization/Delivery of Large Equipment	3	EA	\$914.38	015436501500	\$2,743.14
Temporary Roads	5,100	SY	\$7.19	015523500050	\$36,669.00
Mats/Padding for Work Area	1	Lump Sum	\$62,861.12	310660141600	\$62,861.12
Water Diversion	1,000	CY	\$10.44	312319200100	\$10,440.00
<b>SUBTOTAL</b>					<b>\$214,233.62</b>
<b>Reach 1 Excavation and Loading</b>					
Dust Suppression	1	Wk	\$7,264.51	015433406950	\$7,264.51
Excavation of Tailings	1,600	BCY	\$1.97	312316420260	\$3,152.00
Excavation Inspector	5	Day	\$1,200.00	Professional Judgement	\$6,000.00
Confirmation Sampling Lab Costs	8	EA	\$165.00	ALS	\$1,320.00
<b>SUBTOTAL</b>					<b>\$17,736.51</b>
<b>Area 3 Excavation and Loading</b>					
Dust Suppression	10	Wk	\$7,264.51	015433406950	\$72,645.10
Excavation of Tailings	35,696	BCY	\$1.97	312316420260	\$70,321.12
Excavation Inspector	50	Day	\$1,200.00	Professional Judgement	\$60,000.00
Confirmation Sampling Lab Costs	10	EA	\$165.00	ALS	\$1,636.14
<b>SUBTOTAL</b>					<b>\$204,602.36</b>
<b>Area 2 Excavation and Loading</b>					
Dust Suppression	9	Wk	\$7,264.51	015433406950	\$65,380.59
Excavation of Tailings	29,392	BCY	\$1.97	312316420260	\$57,902.24
Excavation Inspector	45	Day	\$1,200.00	Professional Judgement	\$54,000.00
Confirmation Sampling Lab Costs	7	EA	\$165.00	ALS	\$1,145.76
<b>SUBTOTAL</b>					<b>\$178,428.59</b>
<b>Area 1 Excavation and Loading</b>					
Dust Suppression	4	Wk	\$7,264.51	015433406950	\$29,058.04
Excavation of Tailings	14,685	BCY	\$1.97	312316420260	\$28,929.45
Excavation Inspector	20	Day	\$1,200.00	Professional Judgement	\$24,000.00
Confirmation Sampling Lab Costs	8	EA	\$165.00	ALS	\$1,360.59
<b>SUBTOTAL</b>					<b>\$83,348.08</b>
<b>Tailings Dewatering Area</b>					
Clearing and Grubbing	2	Acre	\$1,689.75	312316435320	\$3,045.12

Silt Fence	3,140	LF	\$3.50	312514161000	\$10,990.00
Loading	101,716	LCY	\$2.27	312316420260	\$230,438.16
Haul to Repository	101,716	LCY	\$5.98	312323203220	\$608,263.18
<b>SUBTOTAL</b>					<b>\$852,736.46</b>
<b>Disposal at On-site Repository</b>					
Dust Suppression	25	Wk	\$7,264.51	015433406950	\$181,612.75
Rough Grading of Tailings	435,600	SF	\$0.06	312213200280	\$26,136.00
Compaction of Tailings	14,685	BCY	\$0.31	312323235050	\$34,441.58
Repository Cover material (topsoil)	16,133	BCY	\$42.77	Vendor	\$690,022.67
Compaction of Repository Cover	16,133	BCY	\$0.31	312323235050	\$15,004.00
Rough Grading of Repository Cover	435,600	SF	\$0.06	312213200280	\$26,136.00
Finish grading of Repository Cover	436	MSF	\$34.63	312216103312	\$15,084.83
Roadways Maintenance	25	Mi	\$222.52	340113100220	\$5,563.00
Recreational Trails and Roadways Traffic Control	25	Day	\$1,160.80	RSMMeans Crews	\$29,020.00
<b>SUBTOTAL</b>					<b>\$1,023,020.83</b>
<b>Grading and Site Restoration</b>					
Clean Fill Excavation and Loading	2,937	CY	\$32.85	310513100200	\$96,480.45
Rough Grading	708,225	SF	\$0.06	312213200280	\$43,669.48
Mechanical Seeding	16	Acre	\$1,203.00	329219130020	\$19,559.09
Soil Mulching	708		\$69.53	329113160700	\$49,242.85
Soil Crimping	16	MSF Acre	\$604.15	329219130020	\$9,822.63
<b>SUBTOTAL</b>					<b>\$218,774.50</b>
<b>Demobilization</b>					
Topographic Surveys	74	Acre	\$976.12	022113090050	\$72,232.41
Inspections	15	Days	\$1,200.00	Professional Judgement	\$18,000.00
Closeout Report	1	Lump Sum	\$100,000.00	Professional Judgement	\$100,000.00
<b>SUBTOTAL</b>					<b>\$190,232.41</b>
<b>Subtotal Construction Costs</b>					<b>3,442,420.89</b>
<i>Project Management</i>		<i>12% Construction Cost</i>			<i>413,090.51</i>
<i>Construction Contingencies</i>		<i>20% of Construction Cost</i>			<i>688,484.18</i>
<b>Total Capital Costs</b>					<b>\$4,543,995.58</b>
<b>Operation and Maintenance (O&amp;M) Costs</b>					
Vegetation Surveys	1	EA	\$5,000.00	Professional Judgement	\$5,000.00
Drainage Sediment and Surface Water Sampling	1	EA	\$10,000.00	Professional Judgement	\$10,000.00
Biannual Inspection/Maintenance/Repair of Onsite Cap and Repository and Site Maintenance	1	EA	\$40,000.00	Professional Judgement	\$40,000.00
<b>Subtotal Annual O&amp;M Costs</b>					<b>\$95,000.00</b>
<i>O&amp;M Contingencies</i>		<i>30% Annual O&amp;M Cost</i>			<i>28,500.00</i>
<b>Total Annual O&amp;M Costs</b>					<b>\$123,500.00</b>
<i>Present Worth of Annual O&amp;M Costs Based on 30 Year Life @ 2.50% P/A (present from annual) Factor = 20.93</i>					<b>\$2,584,891.14</b>
<i>Five-Year Reviews</i>		<i>\$50,000 each for 6 reviews</i>			
<i>Present Worth of Future Costs Based on 30 Year Life @ 2.50% P/F (present from future) Factor</i>					<b>\$202,968.71</b>
<b>Total Present Worth</b>					<b>\$7,331,855.42</b>

Notes:

x1.25 Expansion Factor Used for all LCY quantities

x0.9 Compaction Factor Used for all CCY quantities

Alternative 2, Scenario E: Richardson Flat Road through Reach 5 and Reach 1 Excavation. Disposal at OU1		Cost Estimate Summary			
<b>Site: Richardson Flat Tailings</b> <b>Location: Park City, Utah</b> <b>Base Year: 2024</b> <b>Date: May 2024</b>		<b>Description:</b> Alternative 2, Scenario E, consists of removal of tailings material from area bound by Richardson Flat Road and extending through Reach 5, also tailings located in Reach 1; excavation and on-site disposal at the OU01 repository; and restoration of the site.			
Capital Costs					
Description	Quantity	Unit	Unit Cost	RSMMeans Index	Total Cost
<b>Planning Documents</b>					
Permits	1	Lump Sum	\$141,469.98	014126500010	\$141,469.98
Assessments/Reports	1	Lump Sum	\$400,000.00	Professional Judgement	\$400,000.00
<b>SUBTOTAL</b>					<b>\$541,469.98</b>
<b>Site Preparation and Mobilization</b>					
Topographic Surveys	106	Acre	\$976.12	022113090050	\$103,468.72
Clearing and Grubbing (Laydown and Work Areas)	52	Acre	\$1,689.75	311313100400	\$87,867.00
Temporary Fencing (Laydown Area)	800	LF	\$5.60	015626500200	\$4,480.00
Signage	15	EA	\$25.34	015623103010	\$380.10
Mobilization/Delivery of Large Equipment	3	EA	\$914.38	015436501500	\$2,743.14
Temporary Roads	34,000	SY	\$7.19	015523500050	\$244,460.00
Mats/Padding for Work Area	1	Lump Sum	\$125,989.38	310660141600	\$125,989.38
Water Diversion	5,000	CY	\$10.44	312319200100	\$52,200.00
<b>SUBTOTAL</b>					<b>\$621,588.34</b>
<b>Excavation and Loading</b>					
Dust Suppression	48	Wk	\$7,264.51	015433406950	\$348,696.48
Excavation of Tailings	159,885	BCY	\$1.97	312316420260	\$314,973.45
Excavation Inspector	240	Day	\$1,200.00	Professional Judgement	\$288,000.00
Confirmation Sampling Lab Costs	963	EA	\$165.00	ALS	\$158,921.84
<b>SUBTOTAL</b>					<b>\$1,110,591.77</b>
<b>Tailings Dewatering Area</b>					
Clearing and Grubbing	2	Acre	\$1,689.75	312316435320	\$3,045.12
Silt Fence	3,140	LF	\$3.50	312514161000	\$10,990.00
Loading	199,856	LCY	\$2.27	312316420260	\$452,774.33
Haul to Repository	199,856	LCY	\$5.98	312323203220	\$1,195,140.38
<b>SUBTOTAL</b>					<b>\$1,661,949.83</b>
<b>Disposal at On-site Repository</b>					
Dust Suppression	49	Wk	\$7,264.51	015433406950	\$355,960.99
Rough Grading of Tailings	566,280	SF	\$0.06	312213200280	\$33,976.80
Compaction	159,885	BCY	\$0.31	312323235050	\$566,762.28
Repository Cover material (topsoil)	20,973	BCY	\$42.77	Vendor	\$897,029.47
Compaction of Repository Cover	20,973	BCY	\$0.31	312323235050	\$13,003.47
Rough Grading of Repository Cover	566,280	MSF	\$0.06	312213200280	\$33,976.80
Finish grading of Repository Cover	566	MSF	\$34.63	312216103312	\$19,610.28
Roadways Maintenance	49	Mi	\$222.52	340113100220	\$11,458.84
Recreational Trails and Roadways Traffic Control	49	Day	\$1,160.80	RSMMeans Crews	\$56,879.20
<b>SUBTOTAL</b>					<b>\$1,988,658.12</b>
<b>Grading and Site Restoration</b>					
Clean Fill Excavation and Loading	31,977	CY	\$32.85	310513100200	\$1,050,444.45
Rough Grading	2,343,620	SF	\$0.06	312213200280	\$140,617.20
Mechanical Seeding	54	Acre	\$1,203.00	329219130020	\$64,723.94

Soil Mulching	2,344	MSF	\$69.53	329113160700	\$162,951.90
Soil Crimping	54	Acre	\$604.15	329219130020	\$32,504.55
<b>SUBTOTAL</b>					<b>\$1,451,242.04</b>
<b>Demobilization</b>					
Topographic Surveys	106	Acre	\$976.12	022113090050	\$103,468.72
Inspections	30	Days	\$1,200.00	Professional Judgement	\$36,000.00
Closeout Report	1	Lump Sum	\$100,000.00	Professional Judgement	\$100,000.00
<b>SUBTOTAL</b>					<b>\$239,468.72</b>
<b>Subtotal Construction Costs</b>					<b>7,614,968.78</b>
<i>Project Management</i>		<i>12% Construction Cost</i>			<i>913,796.25</i>
<i>Construction Contingencies</i>		<i>20% of Construction Cost</i>			<i>1,522,993.76</i>
<b>Total Capital Costs</b>					<b>\$10,051,758.79</b>
<b>Operation and Maintenance (O&amp;M) Costs</b>					
Vegetation Surveys	1	EA	\$10,000.00	Professional Judgement	\$10,000.00
Drainage Sediment and Surface Water Sampling	1	EA	\$20,000.00	Professional Judgement	\$20,000.00
Biannual Inspection/Maintenance/Repair of Onsite Cap and Repository and Site Maintenance	1	EA	\$60,000.00	Professional Judgement	\$60,000.00
<b>Subtotal Annual O&amp;M Costs</b>					<b>\$150,000.00</b>
<i>O&amp;M Contingencies</i>		<i>30% Annual O&amp;M Cost</i>			<i>45,000.00</i>
<b>Total Annual O&amp;M Costs</b>					<b>\$195,000.00</b>
<i>Present Worth of Annual O&amp;M Costs Based on 30 Year Life @ 2.50%</i>		<i>P/A (present from annual) Factor = 20.93</i>			<b>\$4,081,407.06</b>
<i>Five-Year Reviews</i>		<i>\$50,000 each for 6 reviews</i>			
<b>Present Worth of Future Costs Based on 30 Year Life @ 2.50%</b>					<b>\$202,968.71</b>
<b>Total Present Worth</b>					<b>\$14,336,134.56</b>

Notes:

x1.25 Expansion Factor Used for all LCY quantities  
x0.9 Compaction Factor Used for all CCY quantities

**APPENDIX D. COST ESTIMATE ASSUMPTIONS AND COST  
ESTIMATE FOR *IN SITU* TAILINGS NUTRIENT AMENDMENT  
AND REVEGETATION, ALTERNATIVE THREE**

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### **Alternative 3 *In Situ* Tailings Nutrient Amendment And Revegetation, And Cost Estimate Assumptions**

Accuracy, General Assumptions, Planning Documents, and Site Preparation and Mobilization items presented in Appendix B also apply to Alternatives three, four, and five, as appropriate. Cost estimates are a best estimate and may not include all items. They are developed to guide site activities and associated costs. The cost analysis consists of:

- Capital (direct and indirect) and annual O&M costs over 30 years
- Present value (capital and O&M costs) of the alternative by discounting to a base year or current year using a discount rate according the White House Office of Management and Budget (OMB) Circular A-94 (OMB 2018).

The recommended time of year to complete the Silver Creek revegetation efforts is the fall dormant season (September 15 to October 30) or early spring (April) in order to have the seed in the ground prior to the first growing season with dependable precipitation. Spring revegetation seeding will allow the seeds to germinate and immediately begin growing that spring; fall seeding allows the grass and forb seeds to remain dormant throughout the winter (which can increase germination of some native seeds) and be ready to sprout and grow as early in the spring as possible.

Seedbed preparation will involve delivering the required soil amendments, applying the agricultural lime and compost to the surface of the designated areas, and incorporating or tilling the amendments into the upper 6 inches of surface medium using an offset disk pulled behind a 4-wheel drive farm tractor. Some areas will only have compost applied because no lime will be applied to areas with pH above 7.0. The seedbed tillage operation should be accomplished in one pass across the area to simply turn over the surface medium and incorporate the amendments, but not pulverize or overly mix the seedbed.

Three revegetation seed mixtures have been formulated for seeding three different soil/media ecotypes with differing soil pH levels in the upper 6 inches. The first is the highly acidic tailings ecotype which will be used to seed areas with soil pH levels below 5.5. The second seed mixture is the moderately acidic tailings ecotype which will be used for areas with soil pH levels between 5.5 and 7.0. The third seed mixture is the common streambank ecotype which will be used to seed areas with soil pH levels above 7.0.

Revegetation success is challenging to measure and monitor and can take several years to fully materialize. Native and introduced grass and forb seeds selected for reseeding this site may not germinate during the first growing season for several reasons including the timing of precipitation, soil conditions (fertility and temperature) and poor soil contact. The revegetation seed mix seeds may germinate and become established at a later time when weather and soil conditions are more favorable.

Revegetated areas should not be grazed by domestic livestock during the first growing season at a minimum, and may benefit from deferred grazing for a second year. Additional weeds and weedy-plant growth in the revegetated areas are common and not too detrimental for long-term revegetation success. In fact, the growth of weeds may demonstrate the surface medium is transitioning to a more desirable plant growth medium.

If larger spots or areas fail to support the reseeded grasses and forbs after two growing seasons, it is common to collect soil samples from those areas, add soil amendments to help rectify the plant-inhibitory conditions, and reseed those areas with an appropriate seed mix.

An estimated 300 acres will be included in tailings amendment and revegetation efforts. Agricultural lime will be placed at a rate of 2 to 5 tons per acre; bulk compost will be placed at a rate of 20 cubic yards per acre; a fertilizer mix (nitrogen-phosphorus-potassium) will be placed at rates of 140 pounds per acre, 20 pounds per acre, and 20 pounds per acre, respectively.

Three vegetation seed mixtures are proposed depending on the acidity of the substrate: highly acidic (pH below 5.5); moderately acidic (pH between 5.5 and 7.0); and a common streambank mixture that will be used to seed areas with soil pH levels above 7.0. Application rates are estimated to be: highly acidic = 12.25 pounds per acre, moderately acidic = 12 pounds per acre, and common streambank mixture = 14.75 pounds per acre.

**Exhibit C-1. Highly Acidic Tailings Seed Mixture and Application Rates**

Common Name	Scientific Name	Cultivar (if designated)	Pure Live Seed (PLS) Rate Pounds PLS/Acre
Slender wheatgrass	<i>Elymus trachycaulum</i>	Revenue	3 lbs.
Streambank wheatgrass	<i>Elymus lanceolatus</i>	Sodar	2 lbs.
Canada wildrye	<i>Elymus canadensis</i>	Mandan	2 lbs.
Alpine timothy	<i>Phleum alpinum</i>	none	0.5 lbs.
Tufted hairgrass	<i>Deschampsia caespitosa</i>	none	0.25 lbs.
Alpine bluegrass	<i>Poa alpine</i>	none	0.25 lbs.
Redtop	<i>Agrostis gigantea</i>	Streaker	0.25 lbs.
Common yarrow	<i>Achillea millefolium</i>	Eagle	0.25 lbs.
Blue flax	<i>Linum lewisii</i>	Maple Grove	0.5 lbs.
Cudweed sagewort	<i>Artemisia ludoviciana</i>	none	0.25 lbs.
Birdsfoot trefoil	<i>Lotus corniculatus</i>	Empire (Inoculated)	1 lbs.
ReGreen	Not applicable (wheat and wheatgrass hybrid)	Cover crop	2 lbs.
<b>Seed Totals</b>			<b>12.25 lbs.</b>

**Notes:**

Inoculated      Legumes must be inoculated with Rhizoba before adding to seed mix  
 lbs.                Pounds  
 PLS                Pure live seed

**Exhibit C-2. Moderately Acidic Tailings Seed Mixture and Application Rates**

Common Name	Scientific Name	Cultivar (if designated)	Pure Live Seed (PLS) Rate Pounds PLS/Acre
Slender wheatgrass	<i>Elymus trachycaulum</i>	Revenue	2 lbs.
Streambank wheatgrass	<i>Elymus lanceolatus</i>	Sodar	2 lbs.
Nevada bluegrass	<i>Poa nevadensis</i>	Opportunity	1 lbs.
Hard fescue	<i>Festuca trachyphylla</i>	Serra	0.5 lbs.
Switchgrass	<i>Panicum virgatum</i>	Trailblazer	1 lbs.
Tufted hairgrass	<i>Deschampsia caespitosa</i>	none	0.25 lbs.
Redtop	<i>Agrostis gigantea</i>	Streaker	0.25 lbs.
Common yarrow	<i>Achillea millefolium</i>	Eagle	0.25 lbs.
Blue flax	<i>Linum lewisii</i>	Maple Grove	0.5 lbs.
Cudweed sagewort	<i>Artemisia ludoviciana</i>	none	0.25 lbs.
Birdsfoot trefoil	<i>Lotus corniculatus</i>	Empire (Inoculated)	1 lbs.
Cicer milkvetch	<i>Astragalus cicer</i>	Monarch (Inoculated)	1 lbs.
ReGreen	Not applicable (wheat and wheatgrass hybrid)	Cover crop	2 lbs.
<b>Seed totals</b>			<b>12 lbs.</b>

**Notes:**

Inoculated            Legumes must be inoculated with Rhizoba before adding to seed mix  
lbs.                        Pounds  
PLS                        Pure live seed

**Exhibit C-3. Common Streambank Seed Mixture and Application Rates**

Common Name	Scientific Name	Cultivar (if designated)	Pure Live Seed (PLS) Rate Pounds PLS/Acre
Slender wheatgrass	<i>Elymus trachycaulum</i>	Revenue	2 lbs.
Streambank wheatgrass	<i>Elymus lanceolatus</i>	Sodar	2 lbs.
Great Basin wildrye	<i>Leymus cinereus</i>	Continental	2 lbs.
Nevada bluegrass	<i>Poa nevadensis</i>	Opportunity	1 lbs.
Hard fescue	<i>Festuca trachyphylla</i>	Serra	0.5 lbs.
Alkali grass	<i>Puccinellia distans</i>	Fults	0.5 lbs.
Inland saltgrass	<i>Distichlis spicata stricta</i>	none	0.5 lbs.
Western wheatgrass	<i>Pascopyrum smithii</i>	Recovery	1 lbs.

Common Name	Scientific Name	Cultivar (if designated)	Pure Live Seed (PLS) Rate Pounds PLS/Acre
Common yarrow	<i>Achillea millefolium</i>	Eagle	0.25 lbs.
Blue flax	<i>Linum lewisii</i>	Maple Grove	0.5 lbs.
Cudweed sagewort	<i>Artemisia ludoviciana</i>	none	0.25 lbs.
Basin big sagebrush	<i>Artemisia tridentata</i> spp. <i>tridentata</i>	none	0.25 lbs.
Birdsfoot trefoil	<i>Lotus corniculatus</i>	Empire (Inoculated)	1 lbs.
Cicer milkvetch	<i>Astragalus cicer</i>	Monarch (Inoculated)	1 lbs.
ReGreen	Not applicable (wheat and wheatgrass hybrid)	Cover crop	2 lbs.
<b>Seed totals</b>			<b>14.75 lbs.</b>

**Notes:**

Inoculated            Legumes must be inoculated with Rhizoba before adding to seed mix  
lbs.                        Pounds  
PLS                        Pure live seed

## SEEDING OPERATIONS

Revegetation seeding is recommended to be completed during the fall dormant season (September 15 to October 30), immediately after the seedbed has been prepared. If fall dormant season does not meet the project schedule, the revegetation can be completed in the spring (April). Drill seeding is recommended over broadcast seeding because drill seeding provides better seed coverage and contact with the soil.

A rangeland grass-seed drill with precision seed placement and multiple seed boxes would be preferred. The ideal seeding depth for most of the grass species in the seed mixtures is 1/8 to 1/4 inch deep. Higher quality rangeland grass drills have separate seed boxes for small seed, fluffy seed, and larger seeds, like legumes, to provide more uniform and accurate planting rates. Seed should be lightly covered and have good contact with the surface medium which may involve pulling a cultipacker. Small areas can be covered by driving a track-mounted dozer or tractor over the seeded area. The surface medium (soil) should not be wet or saturated during revegetation work to minimize soil compaction from the tractor and implement wheels.

Broadcast seeding can be used if drill seeding is not practical. The recommended seeding rates for all vegetation species should be increased by 1.5 times for broadcast seeding to allow for the seed that fails to contact the ground surface and become established. If possible, completing a cultipack operation across the seeded area after broadcast seeding will help ensure the seed is in contact with the soil surface.

Mulching or covering the seeded areas with an erosion control mat is not recommended for this revegetation project. A live cover crop (ReGreen) is recommended because it will quickly germinate during the first growing season and provide some protection against wind and water

erosion. ReGreen resembles standard wheat but is a sterile hybrid that only survives one growing season year. Any kernels produced in the ReGreen seed heads are sterile and will not germinate.

## POST REVEGETATION PRACTICES

Revegetation success is challenging to measure and monitor and can take several years to fully materialize. Native and introduced grass and forb seeds selected for reseeding this site may not germinate during the first growing season for several reasons including the timing of precipitation, soil conditions (fertility and temperature) and poor soil contact. The revegetation seed mix seeds may germinate and become established at a later time when weather and soil conditions are more favorable.

Revegetated areas should not be grazed by domestic livestock during the first growing season at a minimum, and may benefit from deferred grazing for a second year. Additional weeds and weedy-plant growth in the revegetated areas are common and not too detrimental for long-term revegetation success. In fact, the growth of weeds may demonstrate the surface medium is transitioning to a more desirable plant growth medium.

If larger spots or areas fail to support the reseeded grasses and forbs after two growing seasons, it is common to collect soils samples from those areas, add soil amendments to help rectify the plant-inhibitory conditions, and reseed those areas with an appropriate seed mix.

## ESTIMATED REVEGETATION COSTS

Revegetation costs can be estimated but are quite variable due to the many non-standard factors and practices used by Contractors when they submit their costs for revegetation. For example, one Contractor may have revegetation construction equipment readily available and located nearby, while another Contractor has to lease the equipment or transport it from some distance to the project. Additionally, costs per unit (acre, ton, cubic yard) are realistic, but would likely decrease with a larger project.

Estimated revegetation costs were determined using product and detailed information on the web, bid tabulations from similar revegetation projects over the last two years, and personal knowledge of mine reclamation and construction. Table 7 provides the itemized breakdown of estimated revegetation costs on a unit basis, and as a combined cost to completely revegetate one acre.

Revegetation Item	Units	Unit Costs (US\$)	Totals (per acre)
Clearing and Site Prep. (included flagging ecotype areas)	Acre	100	250
Agricultural Lime (delivered)	Ton	300	600 (2 T/Acre)
			1,500 (5 T/Acre)
Bulk Compost (delivered)	Cubic Yard	25	500 (20 T/Acre)
Fertilizer (N-P-K) (delivered)	180 pounds – one Acre	100	100 (180 lbs/Acre)
Seedbed Preparation (Equipment and Labor)	Acre	800	800
Drill Seed and Cultipack (Equipment and Labor)	Acre	600	600
Broadcast Seed and Cultipack	Acre	400	400

(Equipment and Labor)			
Revegetation Seed Mixtures Standard Rates (average for 3 mixtures)	Acre	1,200	1,200
Revegetation Seed Mixtures 1.5-X Standard Rates (average for 3 mixtures)	Acre	1,800	1,800
Mobilization and Demobilization	Acre	200	200
<b>Revegetation Scenarios</b>			
Reveg (no lime, broadcast seed)			4,050
Reveg (2 T lime, broadcast seed)			4,650
Reveg (5 T lime, broadcast seed)			5,550
Reveg (no lime, drill seed)			3,650
Reveg (2 T lime, drill seed)			4,250
Reveg (5 T lime, drill seed)			5,150

**APPENDIX E. COST ESTIMATE ASSUMPTIONS AND COST  
ESTIMATE FOR REMOVAL OF TAILINGS TO PRE-MINING  
CONTOURS AND REVEGETATION THROUGH  
MODIFICATION OF SURFACE WATER FLOWS,  
ALTERNATIVE FOUR**

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## **Alternative 4 Cost Estimate Assumptions For Removal Of Tailings To Pre-Mining Contours And Revegetation Through Modification Of Surface Water Flows.**

Accuracy, General Assumptions, Planning Documents, and Site Preparation and Mobilization items presented in Appendix B also apply to Alternatives three, four, and five, as appropriate. Cost estimates are a best estimate and may not include all items. They are developed to guide site activities and associated costs. The cost analysis consists of:

- Capital (direct and indirect) and annual O&M costs over 30 years
- Present value (capital and O&M costs) of the alternative by discounting to a base year or current year using a discount rate according the White House Office of Management and Budget (OMB) Circular A-94 (OMB 2018).

### ***ASSUMPTIONS***

1. Depth of the organic layer to be excavated to form the new stream channel equals 2 ft
2. Width of the excavate will equal 20 feet to allow the construction of the different cross section shapes in different sections of the new channel
3. Slope of the new stream channel will be dictated by the overall slope of the organic layer and the length of the new stream channel
4. Channel cross section shapes will be excavated into the coarse gravel layer below the organic layer
5. None of the excavated coarse gravel will be removed from the excavated channel
6. All excavated coarse gravel will be moved to other channel reaches to create gravel bars, floodplain terraces or other channel features
7. All excavated organic material will be dumped within the boundaries of the excavated tailings to create upland areas for riparian vegetation diversity
8. Bases of all utility transmission towers will have mounds of the organic material placed around them for protection
9. Excavate of the organic layer will be completed beginning at the downstream end and proceeding upstream
10. Excavate of the organic layer will be completed with the active stream channel diverted into a temporary channel to convey the stream around the active work area
11. Excavate of the new stream channel will be completed concurrent to the excavate of the organic layer
12. Once the organic layer and new stream channel have been excavated, the active stream channel will be diverted out of the temporary channel and into the new channel
13. Equipment crossings will be installed across the temporary channel to allow construction equipment access to the entire riparian area.
14. New stream channel transitions to and from existing infrastructure will be ripped to maintain these structures.

### ***CONSTRUCTION LOGISTICS***

1. Removal of the tailings, removal of the organic layer and construction of the new stream channel will have to be completed concurrently
2. Existing tailings over the organic layer will provide a protective operating surface for the heavy equipment needed to complete the project
3. This protective layer of tailings over the organic layer will prevent the equipment from sinking in the organic layer and destroying the integrity of the material for future revegetation work
4. For maximum operating efficiency, the existing stream channel should be diverted against the toe of the natural hillslope or against the historic railroad grade during construction periods
5. In the upstream 3 reaches identified in this cost estimate, the existing channel is located close to or next to one of these features requiring little work to implement this construction task
6. In the downstream stream reach, the existing channel location varies and will require relocation during implementation of the restoration activities within each work area
7. When working in the downstream reach, as work is completed in each stream reach, the stream flow will be diverted into the new stream channel before moving into the next work area upstream
8. It is anticipated that the larger equipment will be used to excavate the tailings above the proposed bypass channel and the proposed bypass channel keeping the spoils separate
9. As the tailings removal is completed along the bypass channel, the tailing spoils from the bypass channel EXCAVATE will be removed with the other tailings for placement in the repositories
10. Once all work in the stream reach is completed, the smaller equipment will be used to backfill the organic material into the bypass channel and prepare it for revegetation
11. Work on the tailings removal and organic layer removal will be completed using mid-sized construction equipment to prevent compacting the tailings into the organic layer
12. Once the tailings and organic layers have been excavated, no heavy machine access will be allowed onto the organic layer
13. Construction of the stream channel will be completed using the smaller machines, i.e. a mini excavator and skid steer loader
14. These machines will work inside the 20 foot wide channel footprint where the organic layer has been removed and not have to disturb the organic layer adjacent to the channel
15. All of the channel forming work in the coarse gravels will consist of shaping and moving the gravels to create the needed cross section shapes and channel features.

Alternative 4 incorporates re-establishment of the historical Silver Creek flows through the valley to revitalize natural flora. Prior to the valley being inundated with tailings, a well-established riparian zone was present, as observed within test pit stratigraphy as an organic-rich zone, observed to range in thickness from 2 to 46 inches. Alternative 4 includes removal of the veneer of tailings that currently overlies the organic-rich historical wetland zone. The historical wetland zone would then be modified by establishing surface water flow paths within the wetland zone by removing wetland material in proposed channels to expose an underlying gravel zone (also observed in test pit strata), that serves to distribute surface waters across the site area.

Using the concept of removing the tailings and then rebuilding the stream channel in the organic and coarse alluvium layers below would involve several critical steps:

- The removal of the tailings in a corridor from the upstream end of the project near Richardson Flat Road continuously downstream to the downstream end of the project where the creek passes under the eastbound lane of Interstate 80 would occur. The overall width of the corridor would have to consider the cost to remove the included volume of tailings, the minimum width of the restored wetland/riparian corridor, and the proposed channel configuration within the corridor.
- Determination of the width of the combined floodplain, riparian area, and wetlands adjacent to the new stream channel would have to be made to reestablish a vibrant, self-sustaining riparian corridor.
- Determination of the type of new stream channel configuration that would be installed in the excavated corridor. Historically, high elevation meadow streams have been low gradient streams with highly sinuous stream channels often dictated by numerous beaver dams.

### ***HYDROLOGIC CHARACTERISTICS OF CONCEPTUAL DESIGN***

Beginning in October 2001, the U.S. Geological Survey (USGS) has operated a stream gage on Silver Creek near Silver Creek Junction, Utah. Drainage area upstream of the stream gage equals approximately 17.4 square miles. Location of the stream gage is approximately 300 feet downstream of the channel crossing on Silver Gate Drive.

Discharge data at the Silver Creek gage is available for Water Years 2002 through the present date. Raw data collected at the gage includes a water level measurement every 15 minutes which is then averaged for each day. This average water surface value is then converted to discharge using the latest rating curve for the gage. These average daily discharges are then published by USGS.

Analysis of the streamflow records for Silver Creek uses these average daily flows to establish characteristic, monthly, and flood flows at the gage site using a specialized spreadsheet for the analysis.

Characteristic flows estimated included average annual flow, one-day average low flow, seven-day average low flow and one day average flood flow. The seven-day average low flow provides a better estimate of low flow conditions as it is calculated over a week period instead of just a one-day low flow determined from the data. These flows are shown in Exhibit D-1.

**Exhibit D-1. Average Silver Creek Flow Rates**

Average Annual Flow	One-Day Low Flow	Seven-Day Average Low Flow	Average Flood Flow
6.58	1.4	1.54	44.9

**Notes:**

All flows in cubic feet per second, cfs

Estimated characteristic flows for USGS gage on Silver Creek near Silver Creek Junction, Utah for Water Years 2002 to 2023.

Monthly flows estimated included monthly minimum, monthly mean, and monthly maximum. These flows are shown in Exhibit D-2.

**Exhibit D-2. Monthly Mean and Maximum Silver Creek Flow Rates**

FLOW	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
<b>Mon Max</b>	9.3	7.7	6.4	6.6	11.3	31.0	33.1	22.7	15.8	6.3	4.8	7.2
<b>Mon Mean</b>	4.1	4.3	4.2	4.5	6.2	11.7	15.4	11.5	7.9	3.5	2.7	3.1
<b>Mon Min</b>	2.5	3.3	3.2	3.7	4.2	5.5	7.6	6.7	4.2	2.2	1.7	1.9

**Notes:**

All flows in cubic feet per second, cfs

USGS gage on Silver Creek near Silver Creek Junction, Utah for Water Years 2002 to 2023

Average daily flood flows and instantaneous peak flood flows were analyzed using probability plots similar to the Log Pearson plots used prior to computer data analysis. Flow data were plotted with plus and minus probability on the x-axis and discharge on the y-axis using a logarithmic scale. By determining the equation of the best fit line through the data points, estimates of numerous return interval flows can be calculated. These flows are shown in Exhibit D-3.

**Exhibit D-3. Estimated Average Silver Creek Daily Flood Flows and Instantaneous Peak Flows**

Return Interval	Average Daily Flood	Instantaneous Peak Flood
5-Year	63	80
10-Year	83	100
25-Year	109	128
50-Year	131	150
75 Year	144	164
100-Year	154	173

**Notes:**

All flows in cubic feet per second, cfs

USGS gage on Silver Creek near Silver Creek Junction, Utah for Water Years 2002 to 2023

Based on the small watershed upstream of the gage that contributes water to Silver Creek, the low discharge values shown in the above exhibits are not unusual. It is unknown at this time if any of the flow in Silver Creek is lost into the tailings as it flows through these unconsolidated materials. By restoring the channel into the historical alluvium and surrounding wetland/riparian areas, there is a possibility that the volume of water in the downstream sections of Silver Creek may increase.

***HYDRAULIC CHARACTERISTICS OF CONCEPTUAL DESIGN***

An important aspect of the development of the conceptual channel restoration design will be the constraints placed on the overall channel gradient. Construction of the channel crossing over the existing stream channel has likely been completed using the current channel configuration and

water surface profile. Any changes proposed to the channel configuration and water surface will be required to pass through the existing channel crossing structures.

At the Richardson Flat Road crossing, the invert elevation of the culvert or bridge controls the water surface elevation in the stream channel and ponds upstream of the road. This bridge, located adjacent to the Union Pacific Rail Trail, will be the upstream control elevation of the new channel conceptual design.

In the channel reach between Richardson Flat Road and the Highway 189 bridge, the channel appears to flow along the toe of the Rail Trail and then under the Highway 189 bridge. Width of the channel corridor under the bridge cannot be changed because of the existing bridge abutments. This channel reach will be another channel hydraulic control point.

Between the Highway 189 bridge and the Highway 248 crossing, the existing channel remains along the toe of the Rail Trail and then crosses under the Rail Trail approximately 200 feet upstream of the Highway 248 crossing. The crossing under Highway 248 will be another hydraulic control point.

Approximately 1,800 feet downstream of the Highway 248 crossing along the Rail Trail, Silver Creek passes under the trail through an existing bridge or trestle. This bridge or trestle will remain in place as a historical component of the old railroad grade and will be another hydraulic control point.

Downstream of the Rail Trail historical bridge or trestle, Silver Creek crosses under the access road off East Atkinson Road through Park City Towing company property. It is likely that this channel crossing will be replaced during the construction of the new channel and will not be a hydraulic control point in the channel profile.

The next channel crossing is under the road/trail off Promontory Ranch Road that connects with the trail system along the western edge of the riparian area/tailings deposition area. It is likely that this channel crossing will be replaced during the construction of the new channel and will not be a hydraulic control point in the channel profile.

As discussed previously, it is anticipated that a new stream channel crossing will be required to convey the new Silver Creek stream channel under Promontory Ranch Road. This new channel crossing will be designed to not be a hydraulic control in the new channel profile.

Similarly, it is anticipated that a new stream channel crossing will be required to convey the new Silver Creek stream channel under Silver Gate Drive. This new channel crossing will be designed to not be a hydraulic control in the new channel profile.

It is also anticipated that a new stream channel crossing will be required to convey the new Silver Creek stream channel under the Pace Frontage Road. This new channel crossing will be designed to not be a hydraulic control in the new channel profile.

At the downstream end of the project reach, Silver Creek passes under the east bound lane of Interstate 80. This bridge and channel elevation will serve as the downstream hydraulic control for the project.

## ***STREAM CHANNEL CHARACTERISTICS OF CONCEPTUAL DESIGN***

Based on the hydrologic analysis presented above, the channel cross section will likely be 4 to 6 feet wide for the low flow channel and 12 to 16 feet wide for the high flow channel. It is anticipated that all flows above an average flood flow (approximately 45 cubic feet per second) will inundate the wetland/riparian areas adjacent to the new stream channel. This inundation and storage of flood water will reduce the volume of water in the new stream channel and significantly reduce the potential for erosion of the new stream banks.

A hydraulic geometry analysis will be completed to define the typical cross section shape of the new channel. Different channel shapes will be developed for riffle sections, transition sections, mild bend sections, and severe bend sections. Each section will incorporate low flow, high flow, and floodplain/riparian components. Cross sections will be designed so that flow will begin to flow out onto the floodplain/riparian areas at the same discharge.

Plan view layout of the new channel pattern will be determined by the overall and local channel gradients. Channel patterns can range from a single channel with large radius bends to a channel with multiple small radius bends repeating continuously downstream. Incorporation of ponds may be included in the design if sufficient gradient is present to install a hydraulic control to pond the water upstream. Installation of any ponds will have to ensure aquatic organism upstream and downstream passage into and out of the pond.

## ***REVEGETATION POTENTIAL OF CONCEPTUAL DESIGN***

Exposure of the organic layer below the tailings will provide an excellent medium for any revegetation efforts. In addition to the rich, organic soil present, the presence of the stream channel adjacent to the wetland/riparian area will provide a continuous source of moisture to the soil. Historically, this combination of soil and moisture is what created the highly vegetated riparian areas along these high elevation meadow stream channels.

Existing riparian areas along stream channels create large numbers of seeds and roots to propagate the next generations of plants. With the exposed organic layer being covered with tailings for the last 80 to 100 years, it is uncertain if any viable seeds or roots are present in the soil. If there are seeds and roots present, they will likely generate new vegetation within the first few years after project completion.

If a revegetation plan is developed for the project site, the plan should include native plants acclimated to the region around Park City. Native plants within this region are able to grow in the shortened growing season during the summer and able to survive the long dormant periods during the winter. Included in the revegetation plan should be typical riparian trees, shrubs, and wild flowers to create a mosaic of plants in the new wetland/riparian corridor.

## ***WATER LOSS AND GAIN OF CONCEPTUAL DESIGN***

Historically, irrigation diversion canals removed water for agricultural irrigation and stock watering for ranchers in the lower sections of the valley. With all of the development in the

lower valley over the last several years, it is assumed that these water withdrawals will no longer be occurring and are not incorporated into the conceptual design.

At several locations along the project reach, additional water is added to the base flow in Silver Creek as it enters the project reach at the upstream end. Homer Spring and the outfall from the wastewater treatment plant both add to the flow in Silver Creek. Volume of the flow from each of these sources will need to be quantified to evaluate whether changes to the channel design need to be made.

**UNIT COST  
CALCULATIONS  
ESTIMATES**

EQUIPMENT DESCRIPTION	MONTHLY RENTAL	HOURLY RENTAL	OPERATOR HOURLY WAGE	FUEL CONSUMPTION	OFF ROAD DIESEL FUEL COST	FUEL COST	MACHINE LUBRICANTS	MACHINE MAINTENANCE	RAW MACHINE COST	OVERHEAD & PROFIT	LOADED MACHINE COST	HOURLY PRODUCTION	UNIT COST (CALCULATED)	UNIT COST (ROUNDED)
	(\$/mon)	(monthly/160)	(\$)	(gal/hr)	(\$/gal)	(\$/hr)	(\$/hr)	(\$/hr)	(\$/hr)	25%	(\$/hr)	(cu yd/hr)	(\$/cu yd)	(\$/cu yd)
CAT 323 Excavator	\$12,000.00	\$ 75.00	\$ 50.00	6	\$ 4.00	\$ 24.00	\$ 10.00	\$ 20.00	\$179.00	\$ 44.75	\$ 223.75	100	\$ 2.24	\$ 3.00
CAT 730 Haul Truck	\$20,000.00	\$ 125.00	\$ 50.00	8	\$ 4.00	\$ 32.00	\$ 12.00	\$ 24.00	\$243.00	\$ 60.75	\$ 303.75	50	\$ 6.08	\$ 6.50
CAT D4 Dozer	\$12,000.00	\$ 75.00	\$ 50.00	6	\$ 4.00	\$ 24.00	\$ 10.00	\$ 20.00	\$179.00	\$ 44.75	\$ 223.75	100	\$ 2.24	\$ 3.00
CAT 310 Excavator	\$10,000.00	\$ 62.50	\$ 50.00	4	\$ 4.00	\$ 16.00	\$ 8.00	\$ 16.00	\$ 152.50	\$ 38.13	\$ 190.63	50	\$ 3.81	\$ 4.00
CAT 299 Skid Steer Loader	\$ 8,000.00	\$ 50.00	\$ 50.00	4	\$ 4.00	\$ 16.00	\$ 8.00	\$ 16.00	\$140.00	\$ 35.00	\$ 175.00	50	\$ 3.50	\$ 4.00

**RICHARDSON FLAT  
ROAD TO HIGHWAY  
189 CROSSING**

**ORGANIC LAYER  
REMOVAL**

REACH LENGTH	SINUOSITY RATIO	CHANNEL LENGTH	CHANNEL WIDTH	CHANNEL DEPTH	EXCAVATE VOLUME	EXCAVATE VOLUME	EXCAVATE UNIT COST	EXCAVATE COST	HAULING UNIT COST	HAULING COST	GRADING UNIT COST	GRADING COST	TOTAL REMOVAL COST
(ft)		(ft)	(ft)	(ft)	(cu ft)	(cu yd)	(\$/cu yd)	(\$)	(\$/cu yd)	(\$)	(\$/cu yd)	(\$)	(\$)
1600	1.0	1600	20	2	64000	2370	\$ 3.00	\$ 7,111.11	\$ 6.50	\$15,407.41	\$ 3.00	\$7,111.11	\$ 29,629.63
1600	1.1	1760	20	2	70400	2607	\$ 3.00	\$ 7,822.22	\$ 6.50	\$ 16,948.15	\$ 3.00	\$ 7,822.22	\$ 32,592.59
1600	1.2	1920	20	2	76800	2844	\$ 3.00	\$ 8,533.33	\$ 6.50	\$ 18,488.89	\$ 3.00	\$ 8,533.33	\$ 35,555.56
1600	1.3	2080	20	2	83200	3081	\$ 3.00	\$ 9,244.44	\$ 6.50	\$ 20,029.63	\$ 3.00	\$ 9,244.44	\$ 38,518.52
1600	1.4	2240	20	2	89600	3319	\$ 3.00	\$ 9,955.56	\$ 6.50	\$21,570.37	\$ 3.00	\$ 9,955.56	\$ 41,481.48
1600	1.5	2400	20	2	96000	3556	\$ 3.00	\$ 10,666.67	\$ 6.50	\$ 23,111.11	\$ 3.00	\$ 10,666.67	\$ 44,444.44
1600	1.6	2560	20	2	102400	3793	\$ 3.00	\$ 11,377.78	\$ 6.50	\$24,651.85	\$ 3.00	\$ 11,377.78	\$ 47,407.41

**CHANNEL GRAVEL  
GRADING**

REACH LENGTH	SINUOSITY RATIO	OVERALL CHANNEL LENGTH	RIFFLE CHANNEL PERCENTAGE	RIFFLE CHANNEL LENGTH	RIFFLE CHANNEL WIDTH	RIFFLE CHANNEL DEPTH	RIFFLE EXCAVATE VOLUME	TRANSITION CHANNEL PERCENTAGE	TRANSITION CHANNEL LENGTH	TRANSITION CHANNEL WIDTH	TRANSITION CHANNEL DEPTH	TRANSITION EXCAVATE VOLUME	POOL CHANNEL PERCENTAGE	POOL CHANNEL LENGTH	POOL CHANNEL WIDTH	POOL CHANNEL DEPTH	POOL EXCAVATE VOLUME	TOTAL EXCAVATE VOLUME	CL G EXCA
(ft)		(ft)	(%)	(ft)	(ft)	(ft)	(cu yd)	(%)	(ft)	(ft)	(ft)	(cu yd)	(%)	(ft)	(ft)	(ft)	(cu yd)	(cu yd)	(\$)
1600	1.0	1600	90	1440	8	0.5	213	5	80	10	1	30	5	80	12	2	71	314	\$

1600	1.1	1760	80	1408	8	0.5	209	10	176	10	1	65	10	176	12	2	156	430	\$
1600	1.2	1920	70	1344	8	0.5	199	15	288	10	1	107	15	288	12	2	256	562	\$
1600	1.3	2080	60	1248	8	0.5	185	20	416	10	1	154	20	416	12	2	370	709	\$
1600	1.4	2240	50	1120	8	0.5	166	20	448	10	1	166	30	672	12	2	597	929	\$
1600	1.5	2400	40	960	8	0.5	142	20	480	10	1	178	40	960	12	2	853	1173	\$
1600	1.6	2560	30	768	8	0.5	114	20	512	10	1	190	50	1280	12	2	1138	1441	\$

**STREAM BYPASS CHANNEL**

COMPONENT	REACH LENGTH	EXCAVATE LENGTH	EXCAVATE WIDTH	EXCAVATE DEPTH	EXCAVATE VOLUME	EXCAVATE VOLUME	EXCAVATE UNIT COST	EXCAVATE COST	HAULING UNIT COST	HAULING COST	TOTAL REMOVAL COST
	(ft)	(ft)	(ft)	(ft)	(cu ft)	(cu yd)	(\$/cu yd)	(\$)	(\$/cu yd)	(\$)	(\$)
Tailings	1600	1600	20	3	96000	3556	\$ 3.00	\$ 10,666.67	\$ 6.50	\$23,111.11	\$ 33,777.78
Organics	1600	1600	8	2	25600	948	\$ 3.00	\$ 2,844.44			\$ 2,844.44

**HIGHWAY 189 CROSSING TO HIGHWAY 248 CROSSING**

**ORGANIC LAYER REMOVAL**

REACH LENGTH	SINUOSITY RATIO	CHANNEL LENGTH	CHANNEL WIDTH	CHANNEL DEPTH	EXCAVATE VOLUME	EXCAVATE VOLUME	EXCAVATE UNIT COST	EXCAVATE COST	HAULING UNIT COST	HAULING COST	GRADING UNIT COST	GRADING COST	TOTAL REMOVAL COST
(ft)		(ft)	(ft)	(ft)	(cu ft)	(cu yd)	(\$/cu yd)	(\$)	(\$/cu yd)	(\$)	(\$/cu yd)	(\$)	(\$)
2000	1.0	2000	20	2	80000	2963	\$ 3.00	\$ 8,888.89	\$ 6.50	\$ 19,259.26	\$ 3.00	\$ 8,888.89	\$ 37,037.04
2000	1.1	2200	20	2	88000	3259	\$ 3.00	\$ 9,777.78	\$ 6.50	\$ 21,185.19	\$ 3.00	\$ 9,777.78	\$ 40,740.74
2000	1.2	2400	20	2	96000	3556	\$ 3.00	\$ 10,666.67	\$ 6.50	\$23,111.11	\$ 3.00	\$ 10,666.67	\$ 44,444.44
2000	1.3	2600	20	2	104000	3852	\$ 3.00	\$ 11,555.56	\$ 6.50	\$ 25,037.04	\$ 3.00	\$11,555.56	\$ 48,148.15
2000	1.4	2800	20	2	112000	4148	\$ 3.00	\$ 12,444.44	\$ 6.50	\$26,962.96	\$ 3.00	\$ 12,444.44	\$ 51,851.85
2000	1.5	3000	20	2	120000	4444	\$ 3.00	\$ 13,333.33	\$ 6.50	\$ 28,888.89	\$ 3.00	\$ 13,333.33	\$ 55,555.56
2000	1.6	3200	20	2	128000	4741	\$ 3.00	\$ 14,222.22	\$ 6.50	\$30,814.81	\$ 3.00	\$ 14,222.22	\$ 59,259.26

**CHANNEL GRAVEL GRADING**

REACH LENGTH	SINUOSITY RATIO	OVERALL CHANNEL LENGTH	RIFFLE CHANNEL PERCENTAGE	RIFFLE CHANNEL LENGTH	RIFFLE CHANNEL WIDTH	RIFFLE CHANNEL DEPTH	RIFFLE EXCAVATE VOLUME	TRANSITION CHANNEL PERCENTAGE	TRANSITION CHANNEL LENGTH	TRANSITION CHANNEL WIDTH	TRANSITION CHANNEL DEPTH	TRANSITION EXCAVATE VOLUME	POOL CHANNEL PERCENTAGE	POOL CHANNEL LENGTH	POOL CHANNEL WIDTH	POOL CHANNEL DEPTH	POOL EXCAVATE VOLUME	TOTAL EXCAVATE VOLUME	CH G EXCA
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(ft)	(ft)	(%)	(ft)	(ft)	(ft)	(cu yd)	(%)	(ft)	(ft)	(ft)	(cu yd)	(%)	(ft)	(ft)	(ft)	(cu yd)	(cu yd)	(%)	
2000	1.0	2000	90	1800	8	0.5	267	5	100	10	1	37	5	100	12	2	89	393	\$
2000	1.1	2200	80	1760	8	0.5	261	10	220	10	1	81	10	220	12	2	196	538	\$
2000	1.2	2400	70	1680	8	0.5	249	15	360	10	1	133	15	360	12	2	320	702	\$
2000	1.3	2600	60	1560	8	0.5	231	20	520	10	1	193	20	520	12	2	462	886	\$
2000	1.4	2800	50	1400	8	0.5	207	20	560	10	1	207	30	840	12	2	747	1161	\$
2000	1.5	3000	40	1200	8	0.5	178	20	600	10	1	222	40	1200	12	2	1067	1467	\$
2000	1.6	3200	30	960	8	0.5	142	20	640	10	1	237	50	1600	12	2	1422	1801	\$

**STREAM BYPASS CHANNEL**

COMPONENT	REACH LENGTH (ft)	EXCAVATE LENGTH (ft)	EXCAVATE WIDTH (ft)	EXCAVATE DEPTH (ft)	EXCAVATE VOLUME (cu ft)	EXCAVATE VOLUME (cu yd)	EXCAVATE UNIT COST (\$/cu yd)	EXCAVATE COST (\$)	HAULING UNIT COST (\$/cu yd)	HAULING COST (\$)	TOTAL REMOVAL COST (\$)
Tailings	2000	2000	20	3	120000	4444	\$ 3.00	\$ 13,333.33	\$ 6.50	\$ 28,888.89	\$ 42,222.22
Organics	2000	2000	8	2	32000	1185	\$ 3.00	\$ 3,555.56			\$ 3,555.56

**HIGHWAY 248 CROSSING TO PARK CITY TOWING ACCESS ROAD**

**ORGANIC LAYER REMOVAL**

REACH LENGTH (ft)	SINUOSITY RATIO	CHANNEL LENGTH (ft)	CHANNEL WIDTH (ft)	CHANNEL DEPTH (ft)	EXCAVATE VOLUME (cu ft)	EXCAVATE VOLUME (cu yd)	EXCAVATE UNIT COST (\$/cu yd)	EXCAVATE COST (\$)	HAULING UNIT COST (\$/cu yd)	HAULING COST (\$)	GRADING UNIT COST (\$/cu yd)	GRADING COST (\$)	TOTAL REMOVAL COST (\$)
2300	1.0	2300	20	2	92000	3407	\$ 3.00	\$ 10,222.22	\$ 6.50	\$ 22,148.15	\$ 3.00	\$ 10,222.22	\$ 42,592.59
2300	1.1	2530	20	2	101200	3748	\$ 3.00	\$ 11,244.44	\$ 6.50	\$ 24,362.96	\$ 3.00	\$ 11,244.44	\$ 46,851.85
2300	1.2	2760	20	2	110400	4089	\$ 3.00	\$ 12,266.67	\$ 6.50	\$ 26,577.78	\$ 3.00	\$ 12,266.67	\$ 51,111.11
2300	1.3	2990	20	2	119600	4430	\$ 3.00	\$ 13,288.89	\$ 6.50	\$ 28,792.59	\$ 3.00	\$ 13,288.89	\$ 55,370.37
2300	1.4	3220	20	2	128800	4770	\$ 3.00	\$ 14,311.11	\$ 6.50	\$ 31,007.41	\$ 3.00	\$ 14,311.11	\$ 59,629.63
2300	1.5	3450	20	2	138000	5111	\$ 3.00	\$ 15,333.33	\$ 6.50	\$ 33,222.22	\$ 3.00	\$ 15,333.33	\$ 63,888.89
2300	1.6	3680	20	2	147200	5452	\$ 3.00	\$ 16,355.56	\$ 6.50	\$ 35,437.04	\$ 3.00	\$ 16,355.56	\$ 68,148.15

**CHANNEL GRAVEL GRADING**

REACH LENGTH	SINUOSITY RATIO	OVERALL CHANNEL LENGTH	RIFFLE CHANNEL PERCENTAGE	RIFFLE CHANNEL LENGTH	RIFFLE CHANNEL WIDTH	RIFFLE CHANNEL DEPTH	RIFFLE EXCAVATE VOLUME	TRANSITION CHANNEL PERCENTAGE	TRANSITION CHANNEL LENGTH	TRANSITION CHANNEL WIDTH	TRANSITION CHANNEL DEPTH	TRANSITION EXCAVATE VOLUME	POOL CHANNEL PERCENTAGE	POOL CHANNEL LENGTH	POOL CHANNEL WIDTH	POOL CHANNEL DEPTH	POOL EXCAVATE VOLUME	TOTAL EXCAVATE VOLUME	CH G EX UN
(ft)		(ft)	(%)	(ft)	(ft)	(ft)	(cu yd)	(%)	(ft)	(ft)	(ft)	(cu yd)	(%)	(ft)	(ft)	(ft)	(cu yd)	(cu yd)	(%)
2300	1.0	2300	90	2070	8	0.5	307	5	115	10	1	43	5	115	12	2	102	451	\$
2300	1.1	2530	80	2024	8	0.5	300	10	253	10	1	94	10	253	12	2	225	618	\$
2300	1.2	2760	70	1932	8	0.5	286	15	414	10	1	153	15	414	12	2	368	808	\$
2300	1.3	2990	60	1794	8	0.5	266	20	598	10	1	221	20	598	12	2	532	1019	\$
2300	1.4	3220	50	1610	8	0.5	239	20	644	10	1	239	30	966	12	2	859	1336	\$
2300	1.5	3450	40	1380	8	0.5	204	20	690	10	1	256	40	1380	12	2	1227	1687	\$
2300	1.6	3680	30	1104	8	0.5	164	20	736	10	1	273	50	1840	12	2	1636	2072	\$

**STREAM BYPASS CHANNEL**

COMPONENT	REACH LENGTH	EXCAVATE LENGTH	EXCAVATE WIDTH	EXCAVATE DEPTH	EXCAVATE VOLUME	EXCAVATE VOLUME	EXCAVATE UNIT COST	EXCAVATE COST	HAULING UNIT COST	HAULING COST	TOTAL REMOVAL COST
	(ft)	(ft)	(ft)	(ft)	(cu ft)	(cu yd)	(\$/cu yd)	(\$)	(\$/cu yd)	(\$)	(\$)
Tailings	2300	2300	20	3	138000	5111	\$ 3.00	\$ 15,333.33	\$ 6.50	\$ 33,222.22	\$ 48,555.56
Organics	2300	2300	8	2	36800	1363	\$ 3.00	\$ 4,088.89			\$ 4,088.89

**PARK CITY TOWING ACCESS ROAD TO PROMONTORY RANCH ROAD**

**ORGANIC LAYER REMOVAL**

REACH LENGTH	SINUOSITY RATIO	CHANNEL LENGTH	CHANNEL WIDTH	CHANNEL DEPTH	EXCAVATE VOLUME	EXCAVATE VOLUME	EXCAVATE UNIT COST	EXCAVATE COST	HAULING UNIT COST	HAULING COST	GRADING UNIT COST	GRADING COST	TOTAL REMOVAL COST
(ft)		(ft)	(ft)	(ft)	(cu ft)	(cu yd)	(\$/cu yd)	(\$)	(\$/cu yd)	(\$)	(\$/cu yd)	(\$)	(\$)
13500	1.0	13500	20	2	540000	20000	\$3.00	\$ 60,000.00	\$ 6.50	\$ 30,000.00	\$ 3.00	\$ 60,000.00	\$ 250,000.00
13500	1.1	14850	20	2	594000	22000	\$ 3.00	\$ 66,000.00	\$ 6.50	\$ 43,000.00	\$ 3.00	\$ 66,000.00	\$ 275,000.00
13500	1.2	16200	20	2	648000	24000	\$ 3.00	\$ 72,000.00	\$ 6.50	\$ 56,000.00	\$ 3.00	\$ 72,000.00	\$ 300,000.00
13500	1.3	17550	20	2	702000	26000	\$ 3.00	\$ 78,000.00	\$ 6.50	\$ 69,000.00	\$ 3.00	\$ 78,000.00	\$ 325,000.00
13500	1.4	18900	20	2	756000	28000	\$ 3.00	\$ 84,000.00	\$ 6.50	\$ 82,000.00	\$ 3.00	\$ 84,000.00	\$ 350,000.00
13500	1.5	20250	20	2	810000	30000	\$ 3.00	\$ 90,000.00	\$ 6.50	\$ 95,000.00	\$ 3.00	\$ 90,000.00	\$ 375,000.00
13500	1.6	21600	20	2	864000	32000	\$ 3.00	\$ 96,000.00	\$ 6.50	\$ 208,000.00	\$ 3.00	\$ 96,000.00	\$ 400,000.00
13500	1.7	22950	20	2	918000	34000	\$ 3.00	\$ 102,000.00	\$ 6.50	\$ 221,000.00	\$ 3.00	\$ 102,000.00	\$ 425,000.00
13500	1.8	24300	20	2	972000	36000	\$ 3.00	\$ 108,000.00	\$ 6.50	\$ 234,000.00	\$ 3.00	\$ 108,000.00	\$ 450,000.00
13500	1.9	25650	20	2	1026000	38000	\$ 3.00	\$ 114,000.00	\$ 6.50	\$ 247,000.00	\$ 3.00	\$ 114,000.00	\$ 475,000.00

13500 2.0 27000 20 2 1080000 40000 \$ 3.00 \$ 120,000.00 \$ 6.50 \$260,000.00 \$ 3.00 \$120,000.00 \$ 500,000.00

**CHANNEL GRAVEL GRADING**

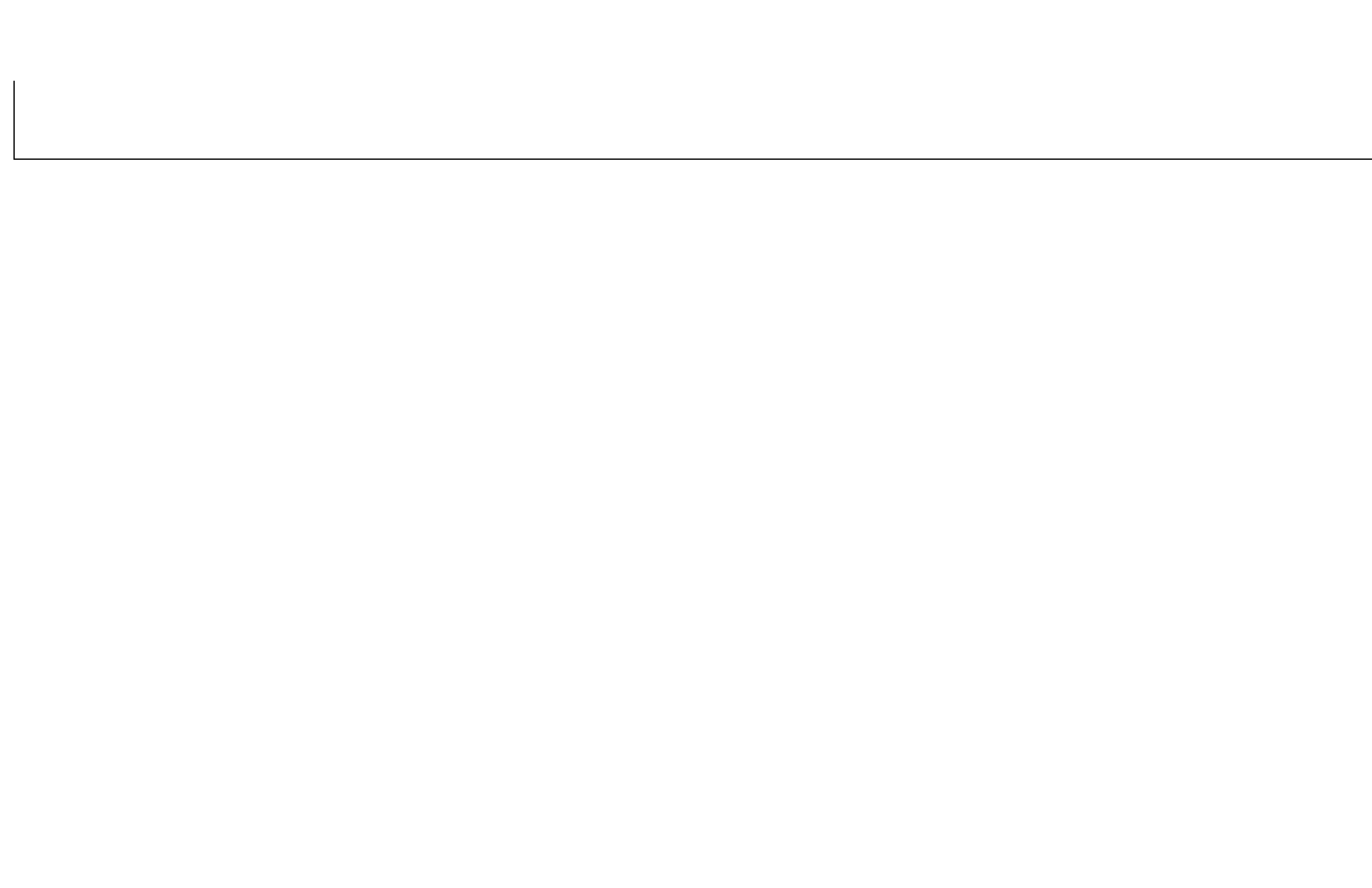
REACH LENGTH	SINUOSITY RATIO	OVERALL CHANNEL LENGTH	RIFFLE CHANNEL PERCENTAGE	RIFFLE CHANNEL LENGTH	RIFFLE CHANNEL WIDTH	RIFFLE CHANNEL DEPTH	RIFFLE EXCAVATE VOLUME	TRANSITION CHANNEL PERCENTAGE	TRANSITION CHANNEL LENGTH	TRANSITION CHANNEL WIDTH	TRANSITION CHANNEL DEPTH	TRANSITION EXCAVATE VOLUME	POOL CHANNEL PERCENTAGE	POOL CHANNEL LENGTH	POOL CHANNEL WIDTH	POOL CHANNEL DEPTH	POOL EXCAVATE VOLUME	TOTAL EXCAVATE VOLUME	CH G EXCA
(ft)		(ft)	(%)	(ft)	(ft)	(ft)	(cu yd)	(%)	(ft)	(ft)	(ft)	(cu yd)	(%)	(ft)	(ft)	(ft)	(cu yd)	(cu yd)	(%)
13500	1.0	13500	90	12150	8	0.5	1800	5	675	10	1	250	5	675	12	2	600	2650	\$
13500	1.1	14850	80	11880	8	0.5	1760	10	1485	10	1	550	10	1485	12	2	1320	3630	\$
13500	1.2	16200	70	11340	8	0.5	1680	15	2430	10	1	900	15	2430	12	2	2160	4740	\$
13500	1.3	17550	60	10530	8	0.5	1560	20	3510	10	1	1300	20	3510	12	2	3120	5980	\$
13500	1.4	18900	50	9450	8	0.5	1400	20	3780	10	1	1400	30	5670	12	2	5040	7840	\$
13500	1.5	20250	40	8100	8	0.5	1200	20	4050	10	1	1500	40	8100	12	2	7200	9900	\$
13500	1.6	21600	30	6480	8	0.5	960	20	4320	10	1	1600	50	10800	12	2	9600	12160	\$
13500	1.7	22950	20	4590	8	0.5	680	20	4590	10	1	1700	60	13770	12	2	12240	14620	\$
13500	1.8	24300	15	3645	8	0.5	540	15	3645	10	1	1350	70	17010	12	2	15120	17010	\$
13500	1.9	25650	10	2565	8	0.5	380	10	2565	10	1	950	80	20520	12	2	18240	19570	\$
13500	2.0	27000	5	1350	8	0.5	200	5	1350	10	1	500	90	24300	12	2	21600	22300	\$

**STREAM BYPASS CHANNEL**

COMPONENT	REACH LENGTH	EXCAVATE LENGTH	EXCAVATE WIDTH	EXCAVATE DEPTH	EXCAVATE VOLUME	EXCAVATE VOLUME	EXCAVATE UNIT COST	EXCAVATE COST	HAULING UNIT COST	HAULING COST	TOTAL REMOVAL COST
	(ft)	(ft)	(ft)	(ft)	(cu ft)	(cu yd)	(\$/cu yd)	(\$)	(\$/cu yd)	(\$)	(\$)
Tailings	13500	13500	20	3	810000	30000	\$ 3.00	\$ 90,000.00	\$ 6.50	\$195,000.00	\$ 85,000.00
Organics	13500	13500	8	2	216000	8000	\$ 3.00	\$ 24,000.00			\$ 24,000.00

**RIPARIAN POND EXCAVATE**

COMPONENT	EXCAVATE LENGTH	EXCAVATE WIDTH	EXCAVATE DEPTH	EXCAVATE VOLUME	EXCAVATE VOLUME	EXCAVATE UNIT COST	EXCAVATE COST	HAULING UNIT COST	HAULING COST	TOTAL EXCAVATE COST	NUMBER OF PONDS	TOTAL CONSTRUCTION COST
	(ft)	(ft)	(ft)	(cu ft)	(cu yd)	(\$/cu yd)	(\$)	(\$/cu yd)	(\$)	(\$)	(ea)	(\$)
In-Channel Ponds (1/4 acre)		105	105	2	22050	817	\$ 3.00	\$ 2,450.00	\$ 6.50	\$ 5,308.33	10	\$ 7,583.33
Off-Channel Ponds (1 acre)		210	210	3	132300	4900	\$ 3.00	\$ 14,700.00	\$ 6.50	\$ 31,850.00	4	\$ 86,200.00



**CHANNEL  
RESTORATION  
COST SUMMARY**

<b>STREAM REACH</b>	<b>CONSTRUCTION COMPONENT</b>	<b>SELECTED CHANNEL CONFIGURATION</b>	<b>JUSTIFICATION</b>	
<b>RICHARDSON FLAT ROAD TO HIGHWAY 189 CROSSING</b>	<i>ORGANIC LAYER REMOVAL</i>	<i>Channel Sinuosity Ratio = 1.3</i>	<i>Narrow riparian area between RR grade and toe of hillslope</i>	\$ 38,518.52
	<i>CHANNEL GRAVEL GRADING</i>			\$ 5,669.93
	<i>STREAM BYPASS CHANNEL</i>			\$ 36,622.22
<b>HIGHWAY 189 CROSSING TO HIGHWAY 248 CROSSING</b>	<i>ORGANIC LAYER REMOVAL</i>	<i>Channel Sinuosity Ratio = 1.4</i>	<i>Riparian area between RR grade and toe of hillslope slightly wider than previous reach</i>	\$ 51,851.85
	<i>CHANNEL GRAVEL GRADING</i>			\$ 9,291.85
	<i>STREAM BYPASS CHANNEL</i>			\$ 45,777.78
<b>HIGHWAY 248 CROSSING TO PARK CITY TOWING ACCESS ROAD</b>	<i>ORGANIC LAYER REMOVAL</i>	<i>Channel Sinuosity Ratio = 1.5</i>	<i>Riparian area between RR grade and toe of hillslope slightly wider than previous reach</i>	\$ 63,888.89
	<i>CHANNEL GRAVEL GRADING</i>			\$ 13,493.33
	<i>STREAM BYPASS CHANNEL</i>			\$ 52,644.44
<b>PARK CITY TOWING ACCESS ROAD TO PROMONTORY RANCH ROAD</b>	<i>ORGANIC LAYER REMOVAL</i>	<i>Channel Sinuosity Ratio = 2.0</i>	<i>Riparian area between RR grade and toe of hillslope very wide</i>	\$ 500,000.00
	<i>CHANNEL GRAVEL GRADING</i>		<i>and will allow the restoration of a diverse riparian corridor that</i>	\$ 178,400.00
	<i>STREAM BYPASS CHANNEL</i>		<i>includes a meandering stream channel and dense vegetation</i>	\$ 309,000.00
	<i>RIPARIAN POND EXCAVATE</i>			\$ 263,783.33
			Estimated Construction Costs	\$ 1,568,942.15
			Mobilization and Demobilization	\$ 25,000.00
			Contractor Overhead 15%	\$ 239,091.32

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	Final Design and Construction Oversight 25%	\$ 458,258.37
	Contingency 40%	\$ 733,213.39
	<b>ESTIMATED CONSTRUCT COST</b>	\$ 3,024,505.23

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**APPENDIX F. COST ESTIMATE ASSUMPTIONS AND COST  
ESTIMATE FOR PLACEMEMNT OF TOPSOIL COVER,  
ALTERNATIVE FIVE**

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Accuracy, General Assumptions, Planning Documents, and Site Preparation and Mobilization items presented in Appendix B also apply to Alternatives three, four, and five, as appropriate. Cost estimates are a best estimate and may not include all items. They are developed to guide site activities and associated costs. The cost analysis consists of:

- Capital (direct and indirect) and annual O&M costs over 30 years
- Present value (capital and O&M costs) of the alternative by discounting to a base year or current year using a discount rate according the White House Office of Management and Budget (OMB) Circular A-94 (OMB 2018).

Alternative 5. Smooth ground surface and place topsoil onto Reaches 6 and 7.		Cost Estimate Summary			
<b>Site:</b> Richardson Flat Tailings <b>Location:</b> Park City, Utah <b>Base Year:</b> 2024 <b>Date:</b> May 2024		<b>Description:</b>		Alternative 5 consists of smoothing and recontouring Reaches 6 and 7, and placing locally-derived topsoil onto the ground over the tailings; and hydroseeding restoration activities.	
Capital Costs					
Parameter	Quantity	Unit	Unit Cost	RS Means Index	Total Cost
Planning Documents					
Permits	1	Lump Sum	\$132,609.45	14126500010	\$132,609
Assessments/Reports	1	Lump Sum	\$40,000.00	Professional Judgment	\$40,000
<b>Subtotal</b>					<b>\$172,609</b>
Site Preparation and Mobilization					
Topographic Surveys	150	Acre	\$976.12	22113090050	\$146,418
Clearing and Grubbing (Laydown and Work Areas)	75	Acre	\$1,689.75	3.11313E+11	\$126,731
Temporary Fencing (Laydown Area)	800	LF	\$5.60	15626500200	\$4,480
Signage	5	EA	\$25.34	15623103010	\$127
Mobilization/Delivery of Large Equipment	2	EA	\$914.38	15436501500	\$1,829
Temporary Roads	2,000	SY	\$7.19	15523500050	\$14,380
Mats/Padding for Work Area	1	Lump Sum	\$91,660.80	3.1066E+11	\$91,661
Water Diversion	4,306	CY	\$10.44	3.12319E+11	\$44,950
<b>Subtotal</b>					<b>\$430,576</b>
Reaches 6 and 7 Spreading and Compaction					
Dust Suppression	3	Wk	\$7,264.51	15433406950	\$21,794
Mid-Grade Topsoil (includes delivery to site)	124,000	LCY	\$42.77	Private vendor	\$5,303,480
Spreading	99,200	BCY	\$2.31	3.12323E+11	\$229,152
Rough Grading	6,534,000	SF	\$0.06	3.12213E+11	\$402,890

Compaction	99,200	BCY	\$0.31	3.12323E+11	\$30,752
Recreational Trails and Roadways					
Traffic Control	15	Day	\$1,160.80	RS Means Crews	\$17,412
Topographic Surveys	150	Acre	\$976.12	22113090050	\$146,418
				Professional	
Inspections	15	Days	\$1,200.00	Judgement	\$18,000
		Lump		Professional	
Closeout Report	1	Sum	\$30,000.00	Judgement	\$30,000
<b>Subtotal</b>					<b>\$6,199,897</b>
Project Management: 12% Construction Cost					<b>\$795,657</b>
Construction Contingencies: 20% of Construction Cost					<b>\$1,326,095</b>
<b>Total Capital Costs</b>					<b>\$8,752,224</b>
<b>Operation and Maintenance (O&amp;M) Costs</b>					
Annual Operation and Maintenance (O&M) Costs					\$95,000
O&M Contingencies: 30% Annual O&M Cost					\$29,000
<b>Total Annual O&amp;M Costs</b>					<b>\$124,000</b>
<i>Present Worth of Annual O&amp;M Costs Based on 30 Year Life @ 2.50% P/A (present from annual) Factor = 20.93</i>					<b>\$2,585,000</b>
<i>Five-year reviews, \$50,000 each for 6 reviews. Present Worth of Future Costs Based on 30 Year Life @ 2.50%</i>					<b>\$203,000</b>
<b>Total Present Worth</b>					<b>\$11,837,000</b>