UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
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OFFICE OF
ENVIRONMENTAL CLEANUP

January 31, 2013

Ms. Susan Lee
U.S. Bureau of Land Management-Medford District Office
3040 Biddle Rd.
Medford, OR 97504

Mr. Timothy L. Barnes
Bureau of Land Management
3050 N.E. Third Street
Prineville, Oregon 97754

Mr. Greg Aiken
Environmental Cleanup Program
Oregon Department of Environmental Quality
165 East 7th Street #100
Eugene, OR 97401

Mr. Stephen R. Hinkle
USGS Oregon Water Science Center
2130 SW 5th Avenue
Portland, OR 97201

Re: Formosa Mine Superfund Site, Final Operable Unit One Feasibility Study

Dear Ms. Lee, Mr. Barnes, Mr. Aiken and Mr. Hinkle:

The U.S. Environmental Protection Agency (EPA) is pleased to submit the Final Operable Unit 1 Feasibility Study for the Formosa Mine Site near Riddle, Oregon. EPA appreciates the input and support your agencies have provided in completing this phase of the project and we look forward to a continued collaborative effort at the Site.

If you have any questions, please contact me at 206-553-1478 or via e-mail at: cora.christopher@epa.gov.

Sincerely,

Christopher Cora
Project Manager

Enclosure

FINAL
OU1 Feasibility Study Report
Formosa Mine Superfund Site
Douglas County, Oregon

Prepared for:
U.S. Environmental Protection Agency
Region 10
1200 Sixth Avenue, Suite 900
Seattle, Washington 98101

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January 31, 2013

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Parametrix ENGINEERING . PLANNING . ENVIRONMENTAL SCIENCES

CDM Smith

A Report Prepared For:

U.S. Environmental Protection Agency, Region 10
1200 Sixth Avenue, Suite 900
Seattle, Washington 98101

FINAL
OU1 FEASIBILITY STUDY REPORT
FORMOSA MINE SUPERFUND SITE
DOUGLAS COUNTY, OREGON

January 31, 2013

Prepared By: ____________ Date: 1/31/2013
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Parametrix ENGINEERING . PLANNING . ENVIRONMENTAL SCIENCES

CDM Smith

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Acronyms

1E-06	one per one million
ABA	acid base accounting
AES10	Architectural and Engineering Services
amsl	above mean sea level
ARARs	applicable or relevant and appropriate requirements
ARD	acid-rock drainage
BCY	bank cubic yards
BLM	U.S. Bureau of Land Management
$CaCo_3$	agricultural lime
$Ca(oh)_2$	hydrated lime
CCR	Covenants, Conditions, and Restrictions
CDM Smith	CDM Federal Programs Corporation
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COCs	contaminants of concern
COPCs	contaminants of potential concern
CSM	conceptual site model
CTE	central tendency exposure
$CuFeS_2$	chalcopyrite
CY	cubic yards
DOGAMI	Oregon Department of Geology and Mineral Industries
DOT	U.S. Department of Transportation
Dynamic	Dynamac Corp.
EA	exposure areas
EES	Easement and Equitable Servitude
EM	encapsulation mound
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentrations
ERA	ecological risk assessment
ESL	exposure screening levels
FEI	Formosa Exploration Inc.
FFRRO	Federal Facilities Restoration and Reuse Office
FPXRF	field-portable x-ray fluorescence
FS	feasibility study
FRTR	Federal Remediation Technologies Roundtable
GAL	gallons
GCL	geosynthetic clay liner
gpm	gallons per minute
GRAs	general response actions
H	horizontal
Hart Crowser	Hart Crowser Inc.
HDPE	high-density polyethylene
HHEBRA	Human Health and Ecological Baseline Risk Assessment
HHRA	human health risk assessment
HQs	hazard quotients
ITRC	Interstate Technology Regulatory Council

LiDAR	Light Detection and Ranging
LDR	land disposal restrictions
mg/kg	milligrams per kilogram
MA	Middle Creek A
MB	Middle Creek B
MIW	mining-influenced water
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NOV	notice of violation
NPL	National Priorities List
O&M	operation and maintenance
OAR	Oregon Administrative Rule
ODEQ	Oregon Department of Environmental Quality
ORS	Oregon Revised Statues
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response
OU	Operable Unit
PMDA	primary mine disturbance area
PRAO	preliminary remedial action objectives
PRG	preliminary remediation goals
PRP	potentially responsible party
RAO	remedial action objectives
RCRA	Resource Conservation and Recovery Act
RGs	remedial goals
RI	remedial investigation
RME	reasonable maximum exposure
ROD	record of decision
site	Formosa Mine Superfund Site
SITE	Superfund Innovative Technology Evaluation
SAP	sampling and analysis plan
SFA	South Fork Middle Creek A
SPLP	synthetic precipitation leaching procedure
START-3	Superfund Technical Assistance & Response Contract 3
TAL	target analyte list
TBC	to be considered
U.S.C.	United States Code
USFWS	U.S. Fish and Wildlife Service
V	vertical
WRDs	waste rock dumps
ZnS	sphalerite

Executive Summary

This feasibility study (FS) report for the Formosa Mine Superfund Site (site) Operable Unit (OU) 1 was prepared for the U.S. Environmental Protection Agency (EPA) Region 10 by CDM Federal Programs Corporation (CDM Smith) as Task Order 047 for Architectural and Engineering Services (AES10) Contract Number 68-S7-03-04.

This report presents the results of the development, screening, and detailed evaluation of remedial alternatives to address the contaminated medium for OU1 (mine materials). The work performed during the FS was in accordance with guidance developed by EPA for conducting remedial investigation (RI)/FS under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 Code of Federal Regulations [CFR] 300.430(e)). In addition, the cost estimates for each alternative were developed in accordance with EPA's guidance for developing cost estimates during the FS.

The site is an abandoned mine located in southwest Oregon in Douglas County, approximately 25 miles south of Roseburg, Oregon, and 7 miles south of Riddle, Oregon. Specifically, the site is located within Sections 23, 26, and 27, Township 31 South, Range 6 West Willamette Meridian. Locally, it is situated in the Coast Range Klamath Mountains at elevations between 3,200 and 3,700 feet above mean sea level (amsl) near Silver Butte Peak (3,973 feet amsl). The site is divided into two OUs:

- **OU1** includes all surface and subsurface mine materials deposited outside of the underground mine workings. These mine materials are defined as OU1 mine materials and include materials that were excavated during construction and operation of the mine, such as waste rock, ore, tailings, construction rock, road surfaces, and contaminated soils that are co-mingled with waste rock, affected by dispersion of contaminants from mine materials, and/or affected by mining-influenced water (MIW) discharges.

- **OU2** includes all remaining media and site contamination areas, including surface water, stream sediment, groundwater, underground workings, and adit water drainage. Mine materials present within the underground workings are defined as OU2 mine materials.

At a minimum, OU1 includes the primary mine disturbance area (PMDA), which is the portion of the site that has been impacted by surface deposition of mine materials as a result of mining-related activities. The OU1 RI investigated the nature and extent of OU1 mine material contamination and prepared human health and ecological risk assessments. Nature and extent of contamination in surface water and groundwater (OU2) were also investigated as part of the OU1 RI to evaluate impacts from OU1 and OU2 mine materials and develop a conceptual site model (CSM).

The primary contaminant sources at the site are mine materials that contain sulfide minerals. Exposure of these mine materials to precipitation and oxygen, results in sulfide oxidation and subsequent release of dissolved metals and metalloids to the environment. This process is referred to as acid-rock drainage (ARD) and is the dominant contaminant release mechanism at the site. The general term mine impacted water (MIW) is used to describe ARD once it transports from the generation source. Contaminants generated and transported include sulfur present in various forms that generate ARD, dissolved sulfate present in MIW, and several inorganic and metalloids, such as arsenic, cadmium, copper, and zinc, which are present in rocks and in MIW. These four elements are the primary indicators of ARD generation and MIW impacts for the site.

During the FS, preliminary remedial action objectives (PRAOs) were identified and remedial technologies and process options were developed and screened for the mine materials. Six remedial alternatives were assembled from the retained technologies to address mine materials. These alternatives were screened based on effectiveness, implementability, and cost to reduce the number of alternatives for detailed analysis.

Five of the six alternatives were retained after screening. These alternatives were analyzed in detail and compared based on the first seven of the nine NCP alternative evaluation criteria. The NCP alternative evaluation criteria comprise nine factors described below grouped as threshold, balancing, and modifying criteria. Two threshold criteria are overall protection of human health and the environment and compliance with applicable or relevant and appropriate requirements (ARARs). Five balancing criteria are long-term effectiveness and permanence, reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost. Two modifying criteria are state acceptance and community acceptance. Evaluation of state and community acceptance will be conducted after comments are received on the proposed plan and are not evaluated at this stage of the CERCLA process.

Preliminary Remedial Action Objectives: The PRAOs were developed to be protective of human health and the environment and are based on the current and anticipated future recreational and commercial land uses:

1. Manage mine materials to minimize chemical migration and the generation of acid rock drainage to protect habitat and ecological receptor populations and communities, including individuals of threatened and endangered species.

2. Minimize human exposure to mine material at concentrations that could result in unacceptable cancer risks or adverse non-cancer effects.

General Response Actions (GRAs): GRAs considered for remediation of mine materials are:

- No Action/No Further Action
- Monitoring
- Administrative Controls
- Containment
- Removal, Transport, Disposal
- Treatment
- Reuse, Reclamation, Recovery

Only those remedial technologies and process options identified as feasible, with respect to overall technical implementability and suitability of the technology for treatment of mine materials were evaluated or screened within each GRA. Remedial technologies and process options that are retained from the first step were then further evaluated for effectiveness, implementability, and relative cost.

The retained remedial technologies and process options were used to assemble remedial alternatives for OU1 mine materials, as presented in Exhibit ES-1 below.

Exhibit ES-1. Retained Remedial Technologies and Process Options for Development of Remedial Alternatives

Remedial Technology	Process Option
Physical and/or chemical monitoring	Non-intrusive visual inspection Intrusive visual inspection Sample collection and analysis
Institutional controls	Governmental controls, proprietary controls, and informational devices
Community awareness	Informational and educational programs
Access controls	Fencing and posted warnings
Surface source controls	Grading Revegetation Exposure barrier Geosynthetic multi-Layer cover Pavement cover
Subsurface source controls	Liner system Submergence
Barriers	Retaining structures
Removal	Mechanical removal (excavation)
Transport	Mechanical transport (hauling/conveying) Hydraulic transport (slurry pumping)
Disposal	Disposal at proposed facility within PMDA Disposal at proposed facility outside PMDA Disposal at existing facility
Biological Treatment	Chemically reduced submergence
Chemical/physical treatment	Neutralization/pozzolan- or cement-based stabilization/solidification

Development and Screening of Alternatives: Remedial action alternatives were developed by combining the retained remedial technologies and process options. The following are the remedial alternatives developed, screened, and evaluated in this study:

Alternative 1: No Further Action

Alternative 2: In-Place Containment, Continued Submergence of Tailings within EM, and Limited Excavation/Disposal of Mine Materials at Proposed Facility within PMDA

Alternative 3: Limited In-Place Containment, Chemically Reduced Submergence of Tailings within EM, and Excavation/Disposal of Mine Materials at Proposed Facilities within and outside PMDA

Alternative 4: Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facilities within and outside PMDA

Alternative 5: Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Existing and Proposed Facilities within and outside PMDA

Alternative 6: Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facility outside PMDA

These remedial action alternatives were screened and evaluated for effectiveness, implementability, and cost to facilitate a focus on the most feasible alternatives retained for detailed analysis. Based upon the screening process, Alternative 5 was screened out because it would pose additional short-term risks, would be complex to implement, and would have excessive costs relative to the other screened alternatives.

Detailed Analysis of Retained Alternatives: Remedial alternatives retained after the initial screening and evaluation undergo detailed analysis. During detailed analysis, each alternative is assessed using the NCP alternative evaluation criteria. The following alternatives were retained for detailed analysis:

Alternative 1: No Further Action

Alternative 2: In-Place Containment, Continued Submergence of Tailings within EM, and Limited Excavation/Disposal of Mine Materials at Proposed Facility within PMDA

Alternative 3: Limited In-Place Containment, Chemically Reduced Submergence of Tailings within EM, and Excavation/Disposal of Mine Materials at Proposed Facilities within and outside PMDA

Alternative 4: Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facilities within and outside PMDA

Alternative 6: Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facility outside PMDA

Comparative Analysis: Each remedial alternative undergoing comparative analysis is presented in Exhibit ES-2.

There were fundamental and secondary assumptions made in the development, screening, individual analysis, and comparative analysis of alternatives that can affect the ability of the alternatives to meet threshold and balancing criteria. This is especially true given that all alternatives involve disposal and containment of mine materials in a facility within the Cow Creek watershed for perpetuity.

For example, some alternatives include the use of a proposed disposal facility located within the PMDA. Even with routine maintenance and monitoring, long-term effectiveness and permanence of disposal facility within the PMDA cannot be entirely ensured due to the location of the facility at a higher elevation within the watershed. At this location, the facility is exposed to harsh weather conditions that can lead to higher erosion potential relative to a location lower within the watershed. Another example is the existence of submerged tailings within the former water and tailings storage pond located in the encapsulation mound (EM). Some alternatives assume the in situ containment (submergence) or in situ treatment (chemically reduced submergence) of tailings rather than excavation and disposal. Continued effectiveness of in situ containment or treatment of tailings would be dependent on maintaining consistent water levels and reducing conditions for the submerged tailings within the former water and tailings storage pond, underneath a newly-constructed multilayer geosynthetic cover. Regular monitoring of submerged tailings would be needed to verify those conditions. Continued effectiveness also requires that the former pond liner beneath the EM remains intact and holds water to create the required saturated conditions.

These examples illustrate the importance of considering the fundamental and secondary assumptions and issues identified in the screening and analysis of alternatives during selection of a preferred alternative. Critical consideration of these issues in relation to balancing criteria, including but not limited to long term effectiveness and permanence and implementability, will be required to ensure adherence with threshold criteria given the potential locations of disposal facilities and the requirement for monitoring and maintenance in perpetuity.

When the FS is finalized, a preferred alternative for OU1 will be presented to the public in the proposed plan. The proposed plan briefly summarizes the RI and FS, alternatives studied in the detailed analysis phase of the FS, and highlights the key factors that led to identifying the preferred alternative. The proposed plan allows the State of Oregon, represented by Oregon Department of Environmental Quality (ODEQ), the U.S. Bureau of Land Management (BLM), and the community to comment on the preferred alternative. The agencies have the ability to combine elements of alternatives to address a subset of the mine materials for a preferred alternative in the proposed plan, including elements of alternatives screened out in the FS.

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Exhibit ES-2. Summary of Comparative Analysis for OU1 Remedial Alternatives

Remedial Alternative	Description	Threshold Criteria		Balancing Criteria					
		Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume through Treatment	Short-Term Effectiveness	Implementability	Present Value Cost (Dollars)	
1	No Further Action	—	—	⓿	⓿	⓿	⓿	$	$115,000
2	In-Place Containment, Continued Submergence of Tailings within EM, and Limited Excavation/Disposal of Mine Materials at Proposed Facility within PMDA	+	+	❷	❶	❸	❹	$$	$5,553,000
3	Limited In-Place Containment, Chemically Reduced Submergence of Tailings within EM, and Excavation/Disposal of Mine Materials at Proposed Facilities within and outside PMDA	+	+	❸	❷	❸	❸	$$$	$9,275,000
4	Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facilities within and outside PMDA	+	+	❸	❸	❸	❸	$$$	$10,407,000
6	Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facility outside PMDA	+	+	❹	❸	❷	❸	$$$	$10,489,000

Notes:

1. The numerical designations for the qualitative ratings system used in this table are not used to quantitatively assess remedial alternatives (for instance, individual rankings for an alternative are not additive).

2. Detailed cost spreadsheets (cost summaries, present value analyses, and cost worksheets) for each alternative are presented in Appendix F.

Legend for Qualitative Ratings System:

Threshold Criteria		Balancing Criteria (Excluding Cost)		Balancing Criteria (Present Value Cost in Dollars)	
—	**Unacceptable**	⓿	**None**	⓿	**None**
+	**Acceptable**	❶	**Low**	$	**Low ($0 through $4M)**
+*	**Acceptable with ARAR Waiver(s)**	❷	**Low to Moderate**	$$	**Low to Moderate ($4M through $8M)**
		❸	**Moderate**	$$$	**Moderate ($8M through $12M)**
		❹	**Moderate to High**	$$$$	**Moderate to High ($12M through $16M)**
		❺	**High**	$$$$$	**High (Greater than $16M)**

Section 1
Introduction

1.1 Purpose

This feasibility study (FS) report for the Formosa Mine Superfund Site (site) Operable Unit (OU) 1 was prepared for the U.S. Environmental Protection Agency (EPA) Region 10 by CDM Federal Programs Corporation (CDM Smith) as Task Order 047 for Architectural and Engineering Services (AES10) Contract Number 68-S7-03-04. The purpose of the FS is to identify, develop, screen, and conduct detailed evaluation of remedial alternatives for OU1 that are capable of addressing risks to human health and the environment from the contaminated medium (mine materials). The OU1 remedial investigation (RI) report was completed in January 2012 (CDM Smith 2012) and details the information used to characterize conditions at OU1, determines the nature and extent of contamination, and summarizes risks to human health and the environment.

This FS report presents the results of the development, screening, and detailed evaluation of remedial alternatives to address the contaminated medium for OU1. The work performed during the FS was in accordance with guidance developed by EPA for *Conducting RI/FS under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)* (EPA 1988) and in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 Code of Federal Regulations [CFR] 300.430(e)). In addition, the cost estimates for each alternative were developed in accordance with *A Guide to Developing and Documenting Cost Estimates during the Feasibility Study* (EPA 2000a).

After the FS is completed, EPA will issue a proposed plan that summarizes the RI and FS and describes EPA's preferred remedy to mitigate risk in OU1. The administrative record, including the proposed plan with comment forms, will be available at the information repository in Riddle, Oregon. When the proposed plan is issued, there will be a public comment period of at least 30 days, during which EPA will hold a public meeting to introduce the EPA's preferred alternative and allow the public to comment on the proposed plan. Public comments may also be provided to EPA in writing via mail or email. This process is designed to allow the public adequate opportunity to provide formal input to EPA before a final decision is made. EPA will consider all public comments. These comments and EPA's associated responses will be compiled into a responsiveness summary. EPA will then make its final risk management and cleanup decisions and publish those decisions in a record of decision (ROD). The responsiveness summary will be an attachment to the ROD.

1.2 Organization

The progress between major process steps of the FS is graphically illustrated on the header at the beginning of each section. This report is organized as follows:

- Section 1 discusses the purpose of the report, the report organization, and summarizes the site location, description, background, and history.
- Section 2 describes the characteristics of the site, including the conceptual site model (CSM), features and physical characteristics, a summary of the nature and extent of contamination, and a summary of human health and ecological risks posed by contamination.

- Section 3 describes the process for identifying preliminary remedial action objectives (PRAOs) and preliminary remediation goals (PRGs). This section also identifies potential applicable or relevant and appropriate requirements (ARARs) and "to be considered" (TBC) information.
- Section 4 describes the options for general response actions (GRAs) and the screening and evaluation of different remedial technologies and process options used to develop remedial alternatives.
- Section 5 identifies and describes the remedial alternatives and the screening process followed to reduce the remedial alternatives considered to be most suitable for further analysis.
- Section 6 describes the criteria used to evaluate the retained alternatives for further analysis in Section 7.
- Section 7 presents a detailed analysis of the remedial alternatives retained after screening in Section 5 and summarizes the comparative analysis conducted to compare and contrast the remedial alternatives.
- Section 8 lists the references and documents referred to in this FS.
- Appendix A provides a summary of federal and state ARARs and TBCs.
- Appendix B provides quantity calculations for the screening and detailed analysis of remedial alternatives.
- Appendix C documents the alternative screening evaluation.
- Appendix D documents the alternative screening cost information. Screening cost estimates have an expected accuracy range between +100 percent and -50 percent of the actual costs.
- Appendix E provides the detailed analysis of alternatives.
- Appendix F provides the detailed alternative analysis cost information. Detailed analysis cost estimates have an expected accuracy range between +50 percent and -30 percent of the actual costs.

1.3 Site Location and Description

The site is an abandoned mine located in southwest Oregon in Douglas County, approximately 25 miles south of Roseburg, Oregon, and 7 miles south of Riddle, Oregon (Figure 1-1). Specifically, the site is located within Sections 23, 26, and 27, Township 31 South, Range 6 West Willamette Meridian. Locally, it is situated in the Coast Range Klamath Mountains at elevations between 3,200 and 3,700 feet above mean sea level (amsl) near Silver Butte Peak (3,973 feet amsl). The site is divided into two OUs:

- **OU1** includes all surface and subsurface mine materials deposited outside of the underground mine workings, referred to in this FS as "mine materials." These include materials that were excavated during construction and operation of the mine, such as waste rock, ore, tailings, construction rock, road surfaces, and contaminated soils that are co-mingled with waste rock, affected by dispersion of contaminants from mine materials, and/or affected by mining-influenced water (MIW) discharges.

- **OU2** includes all remaining media and site contamination areas, including surface water, stream sediment, groundwater, underground workings, and adit water drainage. Mine materials present within the underground workings are defined as OU2 mine materials and are not evaluated in this FS.

Figure 1-2 presents the general site features, including historic facilities from mining activities and existing features such as waste rock dumps (WRDs) and roads. The primary mine disturbance area (PMDA) for OU1 is the portion of the site that has been impacted by surface deposition of mine materials as a result of mining-related activities. As shown on Figure 1-2, the PMDA encompasses approximately 24.4 acres. This area was slightly refined from the RI area (25.7 acres) because of exclusion of unaffected areas in the area calculation (e.g., forest areas and bedrock outcrops).

Surface terrain is characterized by steep mountains, narrow ridges, and deep canyons. The upland area surrounding the PMDA is heavily forested, consisting of predominantly Douglas fir. The site is situated near the top of a mountain ridge (Silver Butte ridge) that divides several sub-watersheds and drainages. Russell Creek drainage lies to the north of the site, Upper West Fork Canyon Creek drainage lies to the east, South Fork Middle Creek drainage lies to the south, and Upper Middle Creek drainage lies to the west.

1.4 Site Background and History

This section presents an overview of the site background and history. Additional details can be found in the OU1 RI report (CDM Smith 2012).

Mining was conducted intermittently by several operators over approximately 80 years. Early exploration activities began in 1910, with historic underground mining occurring during the 1920s and 1930s. Copper was the primary payable metal obtained from chalcopyrite ($CuFeS_2$) ore; with some gold and silver produced as a byproduct of copper production. Zinc was also present in the same ore body as sphalerite (ZnS), although zinc was not considered a marketable metal at the time. Historic mining resulted in drainage of MIW from underground adit portals and creation of WRDs adjacent to the portals that contained acid-rock drainage (ARD)-generating materials (CDM Smith 2012).

Exploration activities occurred intermittently after historic mining, with the most expansive conducted in the 1980s. Modern mining was conducted by Formosa Exploration Inc. (FEI) from 1990 to 1993. FEI significantly expanded the extent of underground workings from the historic mining era as well as the extent of WRD areas at the surface. Modern mining operations generally included removal of ore from underground, onsite crushing of ore, and production of copper and zinc concentrates within a flotation mill. Copper concentrates were shipped offsite for smelting; however, zinc concentrates were never shipped because of low zinc prices. Waste tailings from the flotation process were disposed of within the underground mine and within a lined water and tailings storage pond adjacent to the onsite mill. Waste rock and other comingled ARD-generating mine materials were disposed of within the underground mine, as well as within WRD areas adjacent to the mill and pond area and along several onsite roads (CDM Smith 2012).

Onsite inspections by the Oregon Department of Geology and Mineral Industries (DOGAMI) in 1993 revealed several violations of FEI's permit conditions, and a subsequent notice of violation (NOV) was issued. By August 1993, DOGAMI had issued a closure notice for failing to correct the problems identified in the NOV. After mine closure, reclamation was conducted. From 1993 to 1994, the majority of reclamation work was conducted by FEI. DOGAMI provided inspection of the reclamation work and funding from bonding. The U.S. Bureau of Land Management (BLM) provided permission to construct the adit water diversion system on property managed by BLM. Reclamation by FEI during 1993 through 1994 involved the following activities (CDM Smith 2012):

- Excavation and disposal of dry-stacked tailings within the underground workings
- Excavation and disposal of stockpiled ore within the underground workings, the former water and tailings storage pond, and the ore storage area
- Excavation of zinc concentrate dump site and disposal within the underground workings
- Excavation, stockpiling, and biological treatment of diesel fuel contaminated soils
- Excavation of sulfide tailings from Upper Middle Creek and disposal within the underground workings
- Backfill and covering of mine portals
- Excavation and disposal of crib wall fill materials on side slopes adjacent to the former mill and pond area and as cover for the encapsulation mound (EM)
- Demolition of crib wall structures and disposal onsite
- Removal and offsite disposal crusher facility, shop facility, mill building and all processing equipment, and million-gallon water storage tank

In addition to the reclamation activities described above, the following reclamation activities are significant to the analysis of OU1 in this FS:

1. *Excavation and disposal of dry-stacked tailings and capping of materials disposed in the former water and tailings storage pond (now referred to as the EM)*

    - The former water and tailings storage pond was originally used for process water to feed the milling operations. The pond was excavated mostly into bedrock and blasted/excavated material was used as fill to expand the flat area at the top of the ridge. The southeast and northwest side berms were stabilized with the construction of the wood and steel rebar retaining walls (i.e., crib walls) on both sides of the pond area. The pond liner was constructed of two layers of high-density polyethylene (HDPE) (60 mil upper and 40 mil lower) with an internal drainage net between the layers and a leak detection system. Three sample ports were installed to test for leakage of the upper liner and a sump was installed to collect leakage in the drainage net if it occurred. The upper liner was reportedly punctured at some point during mining operations, although the location of the tear is unknown. The pond was originally constructed at a depth of 25.5 feet with 3 feet of freeboard below the crest of the liner system. In 1992, the pond was expanded by embanking additional fill and adding additional liner along the crest, which raised the crest elevation by 2.5 feet to a total pond depth of 28 feet.
    - During mining, the volume of underground mine workings available for backfilling was consistently smaller than the volume of tailings generated. As a result, a significant amount of tailings was stored in the water storage pond (now referred to as the EM). During reclamation, the majority of tailings were hydraulically transported in the underground mine workings; however, some tailings remained in the pond. These remaining tailings

were spread on the pond liner to protect the liner from damage during rock backfilling. During excavation of the tailings material on the south portion of the pond, both the upper and lower pond liners were reportedly ripped, but no documentation was provided if the rip was repaired. Seventeen thousand tons of low-grade ore was backfilled onto the remaining tailings followed by a Bentomat™ cover, and a 5- to 7-foot thick soil/rock cover. The top layer of soil was amended with limestone, biosolids, and mulch, and the area was seeded. Attempts at revegetation with Douglas fir and blackberry cuttings were also reported. The EM cover was completed in August 1994.

- Current observations of the EM suggest that the cover material contains some amount of ARD-generating mine materials as well as dispersed rebar from crib wall demolition. The west side of the mound area contains a poorly established vegetative cover; however, the east side of the mound is devoid of vegetation and has undergone significant erosion over the years. A fabric geotextile material is exposed on the southern corner of the EM, possibly from erosion that has resulted in complete loss of the cover system.

2. *Construction of adit water diversion systems to drain MIW from covered mine portals*

    - The adit water diversion system is intended to capture MIW draining from the Formosa 1 and Silver Butte 1 adits and divert it away from the headwaters of Upper Middle Creek and into a dispersion drainfield. The Silver Butte 1 adit rarely flows, but the Formosa 1 adit has recorded flows as high as 190 gallons per minute (gpm) (Hart Crowser Inc. [Hart Crowser] 2002). This approach was part of the original reclamation plan implemented by FEI in 1994. Over the years, clogging of the pipes by iron precipitate has required ongoing maintenance and reconfiguration of the system.

    - The current adit water diversion system was installed in 2000 and is shown on Figure 1-2. The original Formosa 1 system was installed in 1994 at a shallower drain slope than the existing, and the original drainfield was located approximately 120 vertical feet above the existing drainfield. A second configuration was constructed around 1996, which steepened the drain slope and discharged approximately 15 feet downslope and 60 feet north of the original drainfield. Over the years, these changing diversion system configurations have resulted in soil contamination over a wide area as a result of the acidic and metal-bearing MIW discharge (See Figure 1-2. Further delineation of the area comprising adit drainage affected soils would be evaluated before implementation of the selected remedy).

Despite the efforts described above, the reclamation was not successful in mitigating ARD generation of the surface (OU1) mine materials. Ongoing maintenance and repair of adit water diversion systems have also been conducted since 1993 to present day.

1.5 Investigations and Current Site Status

Details of investigations and site status are provided in the OU1 RI report (CDM Smith 2012). The following briefly lists the regulatory and other associated activities that have occurred at the site:

- **1999 – State-Led RI.** The Oregon Department of Environmental Quality (ODEQ), in cooperation with BLM, began a state-led RI at the site in June 1999. An RI report was prepared in June 2000 (BLM/ODEQ 2000), herein referred to as the "2000 RI."

- **1999 – Site Assessment.** BLM hired Dynamac Corp. (Dynamac) to conduct a site assessment in October 1999. The site assessment report was prepared by Dynamac in February 2000 (Dynamac 2000).
- **2000 – Removal Assessment Report.** Hart Crowser Inc. (Hart Crowser) was hired by Oregon DEQ in 2000 to conduct an investigation at the site. A removal assessment report was prepared by Hart Crowser in September 2000 (Hart Crowser 2000).
- **2000 – Adit Collection System Construction.** Also in 2000, Hart Crowser was hired by Oregon DEQ to build a new adit water diversion and treatment system. Construction of the adit collection system began in the fall of 2000 and was completed by November.
- **2001 – Data Evaluation Report.** Hart Crowser conducted data evaluation and prepared a report in September 2001. (Hart Crowser 2001)
- **2002 – Supplemental RI.** Hart Crowser conducted a supplemental RI and prepared a report in December 2002 (Hart Crowser 2002).
- **2004 – Human Health and Ecological Baseline Risk Assessment (HHEBRA).** Hart Crowser completed a HHEBRA in 2004 (Hart Crowser 2004a).
- **2004 – State-Led FS.** Hart Crowser completed a state-led FS (herein referred to as the "2004 FS") in 2004 (Hart Crowser 2004b).
- **2005 – National Priorities List (NPL) Petition.** Citizens petitioned the EPA to consider adding the site to the NPL.
- **2006 – NPL Proposal.** The site was proposed for listing on the NPL.
- **2006 – Removal Assessment.** In the summer of 2006, the EPA Superfund Technical Assistance & Response Contract 3 (START-3) Team conducted a removal assessment at the site. The START-3 removal assessment report was prepared in March 2007 (START-3 2007).
- **2007 – NPL Listing.** The site was added to the NPL.
- **2008 – EPA Emergency Response Action.** In June of 2008, EPA performed emergency repairs and replacements of piping, and also removed iron precipitates from piping at the adit water diversion system.
- **2009 – EPA Emergency Response Action.** In March of 2009, EPA performed a removal of an iron precipitate obstruction within the concrete vault, repaired pipe, and completed an overall inspection of the adit water diversion system.
- **2009 – Data Summary Report.** Before the EPA-led RI report, a data summary report of previous investigations began with background data collection, assessment of historic data and information, and development of recommendations for the EPA-led RI/FS and risk assessment. These findings were presented in the data summary report (CDM Smith 2009a). Although a state-led RI/FS and risk assessment was conducted, the data summary report concluded that additional data collection and assessment was necessary to sufficiently characterize site contamination to conduct remedial action under CERCLA.

- **2009 – EPA-Led RI.** Characterization of the nature and extent of mine materials and soils for the OU1 RI began in October 2009 and was completed in November 2010. CDM Smith prepared the first sampling and analysis plan (SAP) in 2009 (CDM Smith 2009b) and the second SAP in 2010 (CDM Smith 2010). Both SAPs include components of OU1 and OU2. The OU1 RI included definition of the horizontal and vertical extent of OU1 mine materials and soil, the potential for the mine materials to generate ARD and contaminants of potential concern (COPCs), and human health and ecological risk assessment. Surface water and groundwater sampling are being conducted as part of ongoing efforts for characterization of OU2 and understanding the affects of OU1 mine materials on surface water and groundwater.

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Section 2
Site Characteristics

This section summarizes the CSM, site characteristics, nature and extent of contamination, and risk assessments as presented in the OU1 RI report (CDM Smith 2012). Complete details of the site characteristics and the nature and extent of contamination are presented in the OU1 RI report (CDM Smith 2012).

2.1 Conceptual Model

The CSM as presented in Figure 2-1 incorporates the primary mechanisms that lead to release of contaminants from source materials, migration routes of contaminants in the environment, exposure pathways, and human/ecological receptors. Figure 2-1 is a diagrammatic figure illustrating these components for both OU1 and OU2. In addition, Figures 2-2 and 2-3 present a graphic representation of the contaminant generation, transport, and fate mechanisms for two representative locations of the site. These figures present the CSM components before the potential exposure route or receptor endpoints shown as on Figure 2-1 and provide site-specific illustrations of the Formosa 1 adit area and Upper Middle Creek (Figure 2-2) and the EM area and South Fork Middle Creek (Figure 2-3).

2.1.1 Contaminant Sources

The Formosa Mine exploited an ore body called a volcanogenic massive sulfide, a natural deposit of rock that is strongly enriched in metals, metalloids, and sulfide minerals. The mining process exposed these rocks to surface weathering through construction of tunnels and haulage of broken rock to the surface, crushing and grinding rocks to separate payable metals, and deposition of waste materials at the surface. The primary contaminant sources at the site are mine materials that contain sulfide minerals (e.g., pyrite), which generate ARD when exposed to precipitation and oxygen. The process of sulfide oxidation and subsequent release of dissolved metals and metalloids is the dominant contaminant release mechanism at the site.

OU1 mine materials such as waste rock, tailings, and mixtures of waste rock with soils are source materials for ARD generation. Mine materials containing sulfide minerals within the underground mine are also ARD-generating (OU2 mine materials); however, mitigation of the OU1 mine material sources is the focus of this FS.

Pyrite oxidation is catalyzed by microorganisms and control by a number of factors including concentration of pyrite in the rock, grain size and crystal habit of pyrite, particle size of the rock, and presence of other minerals that can buffer reduction in pH. For OU1 mine materials, particle size factors are particularly important with respect to fine-grained tailings and the widespread waste rock materials that have undergone weathering processes at the surface. The finer the particle size, the higher the surface area of potential exposed pyrite, and the higher the potential rate of oxidation of pyrite.

Contaminants of concern (COCs) include sulfur present in various forms that generate ARD, dissolved sulfate present in MIW, and several toxic metals and metalloids present in rocks and in MIW, such as arsenic, cadmium, copper, and zinc. The term COCs as used in this FS report is intended to generally represent this group of contaminants as a whole. The OU1 RI nature and extent evaluation identified

COPCs, followed by the risk assessment, which narrowed the list of contaminants to only COCs. Other metals are included in the COCs list; however, these four metals/metalloids (arsenic, cadmium, copper, and zinc) are the primary indicators of ARD generation and MIW impacts for the site.

2.1.2 Migration Routes

Contaminants can be transported from the site via surface water, groundwater, and by physical dispersion. Figures 2-2 and 2-3 illustrate these migration routes for both OU1 and OU2. This FS is intended to address mitigation of COC migration from OU1 mine materials. As ARD is generated and transported through the environment via surface water and groundwater pathways, the pH generally increases through interactions with soils and mixing with neutral-pH waters. The general term MIW is used to describe ARD once it transports from the generation source.

2.1.2.1 Surface Water

Releases of COCs from OU1 mine materials to surface water occur from MIW runoff from exposed mine materials and from groundwater seeps discharging to surface water. Release of COCs also occurs from leakage of the adit water diversion system at the Formosa 1 adit (from OU2 mine materials). Runoff includes overland flow (over the land surface) and interflow (within the subsoil/near-surface fractured bedrock zone). In the upper reaches of Upper Middle Creek subdrainages Middle Creek A (MA) and Middle Creek B (MB) and South Fork Middle Creek subdrainage South Fork Middle Creek A (SFA) (see Figure 1-2), interflow conveys runoff into the alluvial groundwater systems and can discharge as seeps to surface water. The seep discharges may also be affected by movement of MIW from bedrock groundwater into the alluvial groundwater systems within the subdrainages.

2.1.2.2 Groundwater

Releases of COCs from OU1 mine materials to alluvial and/or bedrock groundwater occur from infiltration of rain and snowmelt through OU1 mine materials, ARD generation, and transport of MIW through the alluvial and/or bedrock groundwater systems. As described above, MIW transports through the alluvial groundwater systems of the main subdrainages near the site and discharges to surface water. MIW also transports from OU1 mine materials in the EM area to the bedrock groundwater system, and subsequently to the alluvial groundwater system in the SFA subdrainage. For the Upper Middle Creek subdrainages MA and MB, discharge of MIW from underground workings is possible, but has not been adequately characterized.

2.1.2.3 Physical Dispersion

Physical dispersion of mine materials also contributes to pollutant migration. Numerous areas of large-scale downslope movement of mine materials are present as a result of very steep topography and relatively high precipitation rates during some periods of the year. Erosion rills of up to approximately 5 feet deep are present in some WRDs, and downslope transport by erosion has displaced mine materials tens to hundreds of feet downslope in several areas. Physical dispersion by wind and traffic may occur, in particular along road areas. Wind dispersion of road materials has likely occurred onto road side ditches and embankments, causing migration of COCs. Wind dispersion of road materials is facilitated by vehicle traffic and has been observed during field events. However, it is not considered a significant transport mechanism at the site.

2.1.3 Exposure Pathways

Human exposure pathways include dermal contact, incidental ingestion, and inhalation of OU1 mine materials. Exposure pathways for terrestrial ecological receptors include direct contact/dermal exposure, direct contact/uptake, inhalation, and dietary. Exposure pathways for aquatic/riparian ecological receptors include direct contact/dermal exposure and direct contact/uptake.

2.1.4 Potential Receptors

Potential human populations most likely to be exposed include current workers, visitors, and possible offsite residents. Hypothetical future receptors include construction workers, workers, visitors, and offsite residents. Visitors include hikers, campers, all-terrain vehicle riders, and hunters. Ecological receptors include terrestrial vegetation and wildlife (including salamanders, anurans [frogs and toads], lizards, snakes, birds, and mammals, including bats) and aquatic/riparian vegetation and wildlife (including aquatic plants, water column invertebrates, fish, and larval amphibians).

2.2 Site Setting and General Features

The site is located in the Coast Range Klamath Mountains at elevations between 3,200 and 3,700 feet amsl in Douglas County, Oregon, approximately 25 miles south of Roseburg, Oregon, and 7 miles south of Riddle, Oregon (see Figure 1-1). The PMDA area that contains OU1 mine materials (approximately 24.4 acres) is surrounded by heavily forested and steep mountainous areas and several watershed drainages.

The site is accessible by improved gravel and natural surface roads, which are maintained by BLM and private timber companies. The majority of the site (e.g., PMDA) can be accessed off of Shoestring Road using either Silver Butte Road (Road 30-6-35.1) or Road 30-6-35.0 followed by Road 31-6-13.1. These roads are readily accessible by vehicle throughout the year, with the exception of winter months when snow may hinder vehicular travel.

General site features include (see Figure 1-2):

Surface piles of OU1 mine materials are predominantly waste rock and construction rock, which have been comingled in many areas. OU1 mine materials are present at all adit portals, on the east and west sides of the EM, on road surfaces, and in other areas disturbed by mining such as the former ore storage area, illegal dump area, million gallon tank area, shop facility, and crusher facility.

The **underground mine and associated mine portals** were constructed over various periods of operation. Currently, all underground mine workings are inaccessible, because attempts were made to seal the portals as part of early reclamation activities in the early 1990s. However, MIW discharges from the Formosa 1 adit on a perennial basis. Four additional reclaimed portals formerly accessed the underground mine, but do not generally discharge ARD. Two small isolated adits (404 and K1G) are also present south of the site (see Figure 1-2).

The **adit water diversion system** has been reconstructed several times since mine reclamation. This facility is designed to collect MIW discharging from the Formosa 1 and Silver Butte 1 adits and divert this water in a pipeline to a discharge point located just north of the Silver Butte WRD. Adit drainage affected soils are included as part of OU1 mine materials.

The **historic mining features** were present during modern mining and later removed or reclaimed such as the former crusher, shop, milling, water and tailings storage areas, and the EM. The EM was constructed from a former water and tailings storage pond during mine reclamation activities. The EM contains tailings and low grade ore within the pond, and mounded low-grade ore above the pond liner elevation. As part of the reclamation activities, a geosynthetic clay cover and vegetated cover soil was constructed over the mounded low-grade ore. Additional details for the EM are provided in Section 1.4.

2.3 Summary of Physical Characteristics

This section presents a summary of the physical characteristics of the site.

2.3.1 Climate

The climate of the Klamath Mountains is characterized by hot dry summers followed by wet winters of low to moderate temperatures. Precipitation varies between 15 and 70 inches per year. November through March are the wettest months of the year, with median precipitation of 4.48, 5.75, 5.02, 3.58, and 3.35 inches, respectively. The higher precipitation during these months causes high surface water flow in area streams that generally peaks in March and declines during spring, summer, and fall. Precipitation during winter may fall as snow in higher elevations, especially above 3,200 feet amsl. The warmest months are July and August, when the high temperatures average around 76 degrees Fahrenheit. The coldest month is January, when the high averages around 41 degrees Fahrenheit and a low of 31 degrees Fahrenheit.

2.3.2 Geology

The geology of the site is characterized by weakly metamorphosed mafic volcanic rocks, which lie within an accommodation zone between two regional thrust faults, the Silver Butte Thrust and the Coast Range Thrust. The rocks strike generally northeast and dip towards the east. The volcanic rock units include a variety of basaltic to dacitic flows and tuffs. A thin veneer of unconsolidated colluvial and alluvial sediments overlies the metavolcanic bedrock, which are mixtures of rock fragments and soil that are transported downslope by gravity from parent bedrock. In areas of vegetation, the top surface of colluvial material contains a higher fraction of organic matter and rootlets.

A series of massive sulfide lenses are present within the metavolcanic rocks. These massive sulfide lenses are concordant with bedding of the metavolcanic rocks and crop out along a northeastern trend extending from the EM area towards the Formosa 2 and 3 adits. Natural enrichment of metals and metalloids including arsenic, cadmium, copper, lead, and zinc are associated with these massive sulfide deposits. Massive sulfide deposits containing economic concentrations of copper and zinc were the target of mining activities at Formosa. The massive sulfide deposits and surrounding rocks contain high concentrations of pyrite, an ARD-generating mineral, and other sulfide, sulfosalt, and sulfate minerals.

2.3.3 Surface Water

The site is located near the top of Silver Butte at the drainage divide among four major drainages (see Figure 1-1). The west and south east portions of the site are drained by Upper Middle Creek and South Fork Middle Creek, perennial streams that are tributaries to Middle Creek. These streams are severely affected by MIW. The north and northeast portions of Silver Butte are drained by Russell Creek and Upper West Fork Canyon Creek respectively.

Russell Creek, West Fork Canyon Creek, and Middle Creek all drain into Cow Creek, a major regional watershed which supplies municipal drinking water to the town of Riddle, as well as several private drinking and irrigation water intakes. Flow in Cow Creek is significantly higher than the tributary drainages of Russell Creek, Canyon Creek, and Middle Creek.

2.3.4 Groundwater

The groundwater system at the site is differentiated into two groundwater systems: the alluvial system and the bedrock system.

Direct evidence collected from MIW discharges from seeps and springs show that MIW is discharging from the alluvial groundwater system into surface water. This alluvial groundwater system is recharged by leachate from OU1 mine materials, leakage at the Formosa 1 adit portal, and discharge from the bedrock aquifer depending on the location within the tributary drainages. Recharge from leachate released from OU1 mine materials is likely ephemeral in nature, occurring in response to major precipitation events or snowmelt. Recharge from leakage at the Formosa 1 adit is likely perennial, but the recharge rate is expected to vary seasonally on a similar magnitude to seasonal variations in MIW measured at the adit portal. Recharge from the bedrock aquifer is likely perennial, but the locations where this recharge occurs within the tributary drainages likely varies seasonally in relation to variations in the water level of the bedrock aquifer. Alluvial aquifers are present within unconsolidated alluvial and colluvial sediments located within tributary drainages. The thickness of the alluvium/colluvium range from less than 1 feet to up to 10 feet and soil types range from silt to gravel. These aquifers coalesce in the downstream direction and convey water to the major drainages of Upper Middle Creek, South Fork Middle Creek, Russell Creek, and West Fork Canyon Creek. Five alluvial groundwater monitoring wells were installed in August 2010, and automated water level sensors were placed in these wells and monitored from November 2010 through September 2011 to further assess the alluvial groundwater system for the Formosa OU1 RI report. Water level data showed that these wells respond quickly to precipitation events. One alluvial well always has water present (MW-15A), one well has water present on a perennial basis (MW-7A), and the remaining three wells have very little to no water except during precipitation events (MW-13A, MW-16A, and MW-21). These last three wells may not have been installed in the deepest portion of the tributary drainages or the well was not installed at the base of the alluvial system as a result of drill bit refusal during installation. Because of the limited aquifer thickness and steep slopes at the Site, the alluvial groundwater system has limited storage capacity.

The bedrock aquifer is located within metavolcanic rocks, which exhibit relatively lower permeability as compared to unconsolidated sediments that host the alluvial groundwater system. Observation of bedrock outcrops and water movement through those outcrops during spring and seep surveys shows that the primary porosity of the bedrock rock units is low, and that groundwater is conveyed predominantly through fractures and other discontinuities. Historical groundwater data show water elevation decreased by values ranging from 26 to 84 feet between March and September 1989. These data were gathered from four monitoring wells constructed near the area of the current EM. Water levels in these wells, which were located within a relatively small area, also ranged from approximately 3,200 feet to 3,320 feet amsl in March of 1989. The large seasonal fluctuation in water levels suggests that the storage coefficient of the bedrock aquifer may be low, resulting in large increases in water level in relation to seasonal recharge by precipitation. The wide range in water table elevations measured during March 1989 at bedrock wells located close to each other suggests that the fracture systems intersected by the monitoring wells may not be well connected. Automated water level sensors were placed in operable bedrock monitoring wells at the site, MW-2 and MW-5, and were monitored during the period of November 2010 through September 2011 for the Formosa

OU1 RI report. MW-2 and MW-5 showed water elevation decreased by 4 feet and 35 feet, respectively, over the period of record. This suggests that the fractures intersected by the screened interval of MW-2 are relatively less connected with the surface as compared to MW-5. The overall permeability of the bedrock aquifer and the degree of inter-connectedness of individual fracture zones within the bedrock aquifer is unknown.

2.3.5 Encapsulation Mound Water

As discussed in Section 1.4 of this FS, because of a lack of available storage in the underground mine workings during operation of the mine, tailings from the mill were placed into the former water and tailings storage pond (now referred to as the EM) and on the south end of the pond. During reclamation of the mine, the majority of tailings were placed into the underground mine workings, but some tailings remained and were spread on the liner to protect it from damage during low grade ore backfilling. Low grade ore was then backfilled over these tailings. During excavation of the tailings material on the south portion of the pond, both the upper and lower pond liners were reportedly ripped, but no documentation was provided if the rip was repaired. During OU1 RI investigations, it was noted that materials backfilled into the EM are saturated for nearly the entire depth of the repository. Additional information regarding construction and contents of the EM can be found in Sections 3.1.2.2 and 4.1 and Tables 4.1-5 and 4.1-6 of the Final Formosa OU1 RI Report.

As a result, MIW is also present within the EM. This water is defined as a subsurface or vadose zone water, rather than groundwater. Piezometers within the EM indicate increases in water level during the wet season and decreases in water level during the dry season. The increase in water level indicates that infiltration through the clay cover and mounded low-grade ore occurs in response to increased precipitation, while the decrease in water level indicates leakage of water from the existing repository liner. These observations document leaking water from the liner, which can have affects on both bedrock groundwater and alluvial groundwater in the EM and South Fork Middle Creek area.

2.3.6 Surface Water-Groundwater Interactions

Discharge of groundwater to surface water was observed in many tributary drainages during the wet season seep and spring survey. Most of the observed locations were areas where groundwater discharges to surface water from alluvial aquifers. Discharge areas were commonly located at intersections of roads with the tributary drainages, where the road cut excavation truncated the alluvial aquifer forcing groundwater to the surface. Often this water flowed over the surface for a short distance downstream of the road before re-infiltrating into the alluvial groundwater system within undisturbed portions of the tributary drainages.

Discharge of MIW to surface water was observed within both the Upper Middle Creek and South Fork Middle Creek drainages. Within Upper Middle Creek, discharge of MIW from groundwater to surface water is extensive in a tributary located approximately 300 feet downgradient from the Formosa 1 adit. This discharge causes severe effects to surface water quality, and was observed during both the wet season and dry season spring and seep surveys suggesting that MIW discharge in this area is perennial. Discharge from the alluvial aquifer system is thought to be a major contributor to MIW discharge from groundwater to surface water in the Upper Middle Creek drainage; however, discharges from the bedrock aquifer to surface water may also occur. MIW was also observed to be discharging from the alluvial aquifer to the South Fork Middle Creek drainage. These discharges occur where road cuts truncate the alluvial groundwater system, and MIW re-infiltrated downstream of the road cuts. The observed discharges were intermittent and may be associated with both the alluvial and/or bedrock groundwater systems.

2.3.7 Ecology

The PMDA is largely devoid of vegetation in many areas; however, thick vegetative cover is located in surrounding areas. Upland vegetation in and around the site consists primarily of coniferous forest dominated by Douglas fir. Golden chinkapin and Pacific madrone also commonly occur in drier areas, while western red cedar and western hemlock occur in wetter areas or on north aspects. Canyon live oak is occasionally found in open, drier areas on rocky soils. Forest age in and around the site varies from old-growth stands to younger successional forest and areas of recent timber harvest. Old-growth forest is present on BLM managed land located near the Formosa adits.

The areas surrounding the mine provide habitat for a variety of wildlife including Roosevelt elk, black tailed deer, coyote, western grey squirrel, black bear, and numerous bird species. Winter steelhead and resident rainbow trout, fall and spring chinook salmon, coho salmon, and cutthroat trout have been documented by the Oregon Department of Fish and Wildlife using the Lower Cow Creek Watershed Analysis Unit (BLM 2002), which includes unaffected portions of the watershed.

There are 11 federally threatened or endangered species with the potential to occur in Douglas County (U.S. Fish and Wildlife Service [USFWS] 2011a). Of these, seven are marine species or associated with coastal habitats not found close to the site. The remaining four species include the Northern spotted owl (*Strix occidentalis caurina*) and three plants: Gentner's fritillary (*Fritillaria gentneri*), Kincaid's lupine (*Lupinus sulphureus ssp. kincaidii*), and rough popcornflower (*Plagiobothrys hirtus*). In addition, two species, the fisher (Martes pennant) and North American wolverine (*Gulo gulo luscus*) are candidates for listing. Only the Northern spotted owl (federally threatened) has a high likelihood of occurrence near the site and also has critical habitat areas identified. Forest areas within Connectivity/Diversity Block and General Forest Management Area designated BLM managed lands and private lands adjacent to the PMDA are potential habitat for the Northern spotted owl. All other species have a low likelihood or are unlikely to occur near the site, because of lack of habitat or range characteristics. Upper Middle Creek and South Fork Middle Creek are adversely affected by MIW discharge from the site.

2.3.8 Land Use

The former mine area of the site is mostly located on private land owned by FEI, with some public land areas managed by BLM. Timber harvest is the predominant current and expected future land use in the area. The majority of land surrounding the OU1 site area is either owned by private timber companies, chiefly Silver Butte Timber Company and Roseburg Resources, or is Oregon and California revested grant land managed by BLM. Private lands are designated as Timberland Resource based on county zoning classifications which are based on requirements under state law. The BLM land in the area is designated as one of the two Matrix land use allocations, either as a General Forest Management Area or Connectivity/Diversity Block. The Formosa 1 Adit and the northern extent of the PMDA are near or within BLM managed lands which fall under the Connectivity/Diversity Block land use allocation. The eastern portion of the PMDA which includes the illegal dump area, the upper South Fork Middle Creek drainage, and the southern portion of the PMDA including the 404 Adit are either within or are in close proximity to lands designated General Forest Management Area. In both cases the land is available for timber harvest at varying frequencies, with the Connectivity/Diversity Block being more restrictive in terms of potential land use. In addition to timber and other forest commodities, the two Matrix land use allocations provide connectivity between Late Successional Reserves, habitat, and ecologically valuable structural components such as down logs or large trees.

OU1 and adjacent areas are also used by recreational hikers, campers, hunters, and all-terrain vehicle riders. An active weather station and fire-lookout tower is located at the top of Silver Butte Peak, which is accessed via roads through the PMDA. There are also mining claims in the area, although no mining is being conducted under a Notice or Plan of Operations.

Roads in the area and at the PMDA are open for public use, with exception to a locked gate on Road 31-6-26.1 that accesses the weather station/lookout tower. While timber harvest does not currently occur adjacent to the site, the area is being managed as harvest and is part of a rotation, and harvest will occur within the life history of the selected remedy. Private timber companies have access agreements on roads within the PMDA area. Workers at the weather station and fire-lookout tower also have access agreements for these onsite roads.

No residential use occurs at or adjacent to the site. The nearest residents are approximately 3 miles to the north of the PMDA.

2.4 Summary of Nature and Extent of Contamination

Evaluation of nature and extent of contamination considered in the OU1 RI report included:

- OU1 mine materials and soil
- Surface water
- Groundwater

The OU1 RI report focused on examination of the geochemical characteristics, geographic extent, and depth and volume of OU1 mine materials. The RI work to date has also evaluated nature and extent of contamination in surface water and groundwater, components of OU2, but these media have not yet been fully characterized. Data collected from surface water and groundwater were presented in the OU1 RI at the time of publication, although additional evaluation of these data will be conducted for the OU2 RI.

2.4.1 OU1 Mine Materials and Soil

This section presents a summary of the nature and extent of contamination of OU1 mine materials and soil at the site. Soils located downslope from mine materials (potentially affected soils), or in areas that are affected by MIW discharge (adit drainage affected soils) or groundwater seeps are potential secondary sources of contamination. In the OU1 RI report, these soils were described separately from mine materials. For the purposes of simplifying evaluations in the FS, adit drainage affected soils are grouped within the term mine materials, although these soils are discussed in Section 2.4.1.2 below to be consistent with the OU1 RI. Potentially affected soils are excluded from the definition of mine materials and are discussed in Section 2.4.1.2.

2.4.1.1 OU1 Mine Materials

OU1 mine materials are primary source materials, which are deleteriously affecting surface water and groundwater. OU1 mine materials consist of waste rock, ore, tailings, construction rock, road construction material, exposed bedrock surfaces, contaminated soils, and adit drainage affected soils. Adit drainage affected soils are further discussed in Section 2.4.1.2 below. Waste rock, ore, and tailings are the primary source materials that contain natural enrichments of various metals and metalloids that have the potential to generate ARD. Tailings are present in the EM and within the underground mine, but are generally not observed on the surface. Waste rock is common within OU1 mine materials, and waste rock management practices during mining and reclamation resulted in extensive comingling of waste rock with construction rock, road surfaces, and other soils. As a result of this extensive comingling of these materials, they are evaluated together and referred to as "OU1 mine materials."

OU1 mine materials were characterized using a weight of evidence approach by comparing data to several different screening criteria. The screening criteria include:

- Target analyte list (TAL) metals screening criteria based on background incremental soil sample data
- Synthetic precipitation leaching procedure (SPLP) screening criteria based on State of Oregon groundwater and surface water standards
- Acid base accounting (ABA) screening criteria based on the metrics defined by the laboratory method
- Lithology screening criteria indicating ARD-generating materials
- Field paste pH screening criteria based on paired comparison of field paste pH and SPLP data
- Field-portable x-ray fluorescence (FPXRF) screening criteria based on statistical evaluation of the FPXRF data populations

OU1 mine materials were evaluated for these criteria to identify materials that may require mitigation based on the presence of COCs that exceed the screening criteria (TAL metals, SPLP metals, and FPXRF metals), the potential to generate ARD, and the potential to leach COCs to surface water and groundwater.

Mine materials are commonly strongly ARD-generating, as shown by field paste pH data, laboratory ABA data, and lithological data. Modified SPLP data show that dissolved metals and acidity leaches from mine materials at concentrations exceeding screening criteria. The SPLP extract solutions contain high concentrations of cadmium, copper, and zinc, which are indicators for MIW-affected waters. These indicators are also found in surface water and groundwater in close proximity to the mine materials. Evaluations of the maturity of the OU1 mine materials indicates that these materials are not yet mature, and that the materials would be expected to generate ARD with lower pH and higher concentrations of COCs in the future. This indicates that the downstream extent of affects to Upper Middle Creek and South Fork Middle Creek would be expected to increase in the future if the OU1 mine materials located at the headwaters of these creek subdrainage areas are not remediated.

It is estimated that the process of infiltration of precipitation into OU1 mine materials, ARD generation as the water percolates through the mine materials, and subsequent MIW discharge produces 4 to 13 million gallons of MIW in an average year. During particularly high-precipitation years, this volume is estimated to be between 9 and 15 million gallons per year. ARD produced by OU1 mine materials discharges to both groundwater and surface water. The dominant COC transport pathway is discharge of ARD to groundwater, COC migration in groundwater, and subsequent discharge of MIW from groundwater to surface water in Upper Middle Creek and South Fork Middle Creek.

OU1 mine materials are present in WRDs located at the portals of all former openings into the underground mine, and in piles on the east and west side of the EM. The depth of OU1 mine materials was delineated based on surface borings and excavator trenches. The areal extent and depth of mine materials are shown on Figure 2-4. This figure presents a refined version of the isopach model originally presented in the OU1 RI report (CDM Smith 2012). The RI isopach provided a rough estimate of mine material depth to the bedrock interface utilizing the depth of borings and trenches where available and surface light detection and ranging (LiDAR) contour data. Five-foot contour intervals were developed based on this data (isopach contours). Together, the isopach contours, boring and trench depth, and surface contours were incorporated into an ArcGIS spatial analyst model to compute a three-dimensional volume. The mine material volume based on this process was estimated at 280,000 cubic yards (CY), excluding the materials beneath the geosynthetic clay cover (35,000 CY based on literature values) and at the 404 adit area (2,000 CY estimated).

As part of the FS process, these volumes were refined to support development and assessment of remedial alternatives. For the FS, RI boring and trench depth and location data were further reviewed and the isopach contours were revised to reflect the depth of known or observed ARD-generating mine materials, rather than to the full depth of bedrock. In some instances, native soils present below ARD-generating mine materials do have a reduced or affected pH and elevated concentrations of COPCs, reflecting leaching and infiltration from overlying ARD-generating mine materials. However, many borings and trenches indicate the presence of native soils with paste pH values above the screening criteria (4.6 standard units) and either low COC concentrations or no sample data to indicate an exposure issue or that the soils are ARD-generating. For OU1 remediation, to the extent practicable these soils should remain in place for full removal alternatives to provide a surface to incorporate reclamation components such as placement of topsoil, seeding, tree planting, and other erosion control features.

In addition to the depth refinement, historic data and as-built information for the former water and tailings storage pond and EM structure were digitized and incorporated into the isopach, along with creation of isopach contours for the 404 adit WRD. After refinement of the 5-foot isopach contours and incorporation of the EM data, interpolated 2.5-foot contours were generated between the 5-foot contours, and the ArcGIS spatial analyst model calculation was re-run. Generation of 2.5-foot contours provides a more accurate estimate of volume. All of these refinements indicate a significant reduction in mine material volume from the RI report values, as shown in Exhibit 2-1.

Exhibit 2-1. Estimated Volume of Mine Materials in OU1

Area	Estimated Volume from RI (CY)	Estimated Volume from FS (CY)
OU1 mine materials in PMDA	280,000	202,000[1]
Mine materials below geosynthetic clay cover in EM	35,000	31,000
Mine materials located at 404 adit	2,000	1,000
Total	317,000	234,000

[1] Includes estimated 3,000 CY of adit drainage affected soils which is an estimate based on opportunity samples and visibly affected soil. Further delineation of the area comprising adit drainage affected soils would be evaluated before implementation of the selected remedy. Original RI mine materials volume did not include these soils.

2.4.1.2 OU1 Soils

Soils located downslope from the mine materials are subject to both physical and hydrogeochemical dispersion of COPCs from the mine materials. Soils in these areas were evaluated using several methods to: 1) further define the downslope boundary of the OU1 mine materials, and 2) characterize soils downslope from that boundary, which may be affected by COC dispersion. The downslope boundary of mine materials was delineated using a weight of evidence approach that incorporated visual observation, lithological logging, field paste pH/conductivity, and FPXRF. The downslope boundary of mine materials includes the visual extent of the mine materials, and a narrow band of affected soils that was delineated based on paste pH/conductivity and FPXRF data.

Potentially affected soils downslope from the delineated PMDA material boundary may be affected by either physical dispersion or hydrogeochemical dispersion of contaminants. Hydrogeochemical dispersion is a broad term that relates to leaching of metals and acidity from mine materials through ARD generation, and sequestration of dissolved metals and acidity in soils as the ARD migrates downslope. These soils are located within vegetated areas including timber within Connectivity/Diversity Block designated BLM managed lands. COC concentrations in these soils were evaluated by incremental sampling methods. Two areas of background soils were also sampled by incremental sampling to provide screening criteria to compare with the downslope soils. Comparison of the background data with the downslope data shows that the downslope soils are enriched in numerous COCs as compared to background. However, it is unknown if the relatively higher metal concentrations in the downslope soils reflect natural variability in background in this strongly mineralized area, or if these relatively higher values result from downslope dispersion from mining–related contamination.

Several areas were identified in the downslope soils where hydrogeochemical dispersion would result in metals enrichment. The most pronounced effects are present within the discharge areas for the adit water diversion system. Although delineation of contamination associated with the adit water diversion system discharge was not a data quality objective for the RI, opportunity samples of adit drainage affected soils and general observations were completed in the area visibly affected by adit water discharge. Thick accumulations of iron precipitates and anomalous arsenic concentrations are present in the direct vicinity discharge area. As stated above, these soils are included with the total mine material volume and are shown on Figure 2-1. The visibly impacted area is based on the presence of iron precipitates and includes the current drainfield area, historic drainfield areas, and a small leakage area along the pipe path. Although not delineated to date, it is suspected that effects of contaminant dispersion for COCs such as cadmium, copper, and zinc, which precipitate and/or adsorb at higher pH, may be present downgradient from the adit diversion discharge point within the subsoil and groundwater. Further delineation of the area comprising adit drainage affected soils would be evaluated before implementation of the selected remedy.

Several relatively small areas were also identified where MIW was discharging to soils from groundwater as seeps. These seep-affected soils exhibit high copper and zinc concentrations, which may be caused by adsorption of dissolved copper and zinc by organic matter in the soil. The sources for the seeps have not been identified and may relate to discharge of MIW from OU1 mine materials and from the alluvial and/or bedrock groundwater systems. The main MIW discharge areas to soils are within the MB subdrainage on Upper Middle Creek and on the south side of the Silver Butte 1 WRD. These affected soils are included within the OU1 mine materials delineation.

2.4.2 Surface Water

The nature and extent of contamination in surface water have not been fully characterized to date. Available data regarding surface water are described to support analysis of the effects of OU1 mine materials on surface water, document effects of MIW discharge in the Middle Creek watershed, monitor for potential effects to Russell Creek and West Fork Canyon Creek, and evaluate water quality downstream in Cow Creek where water is withdrawn for uses including irrigation and municipal drinking water. Wet and dry season seep and spring surveys were also conducted to evaluate the effect of groundwater discharge on surface water quality.

Surface water quality data collected from the upper reaches of Upper Middle Creek and South Fork Middle Creek is strongly affected by MIW. The water is calcium–sulfate type water, with high total dissolved solids and high concentrations of cadmium, copper, and zinc, indicator parameters for ARD generation. The water is strongly acidic near the primary mine disturbance area, and the pH gradually increases as the surface water flows downstream. COC concentrations also decrease as the water flows downstream as a result of various attenuation processes including precipitation, adsorption, and dilution.

Surface water in Upper Middle Creek is thought to be affected by MIW discharge from OU1 mine materials, and groundwater from both mine workings and leakage of the adit water diversion system at the portal of the Formosa 1 adit (from OU2 mine materials). Discharge from the adit water diversion system near the Silver Butte WRD may also affect Upper Middle Creek surface water. MIW contamination in South Fork Middle Creek is thought to be caused primarily by ARD generation from OU1 mine materials. It is possible that some unknown hydraulic connection is present between the underground mine and South Fork Middle Creek. These assumptions will potentially undergo further evaluation during development of the OU2 RI and OU2 FS. However, available data indicate that OU1 mine materials are the dominant contributor to MIW water in South Fork Middle Creek including: 1) the lack of any underground workings within the South Fork Middle Creek watershed; 2) the presence of MIW seeps in South Fork Middle Creek at elevations above the Formosa 1 adit (i.e., the discharge point for the underground mine); 3) the presence of severe groundwater contamination in the headwaters area of South Fork Middle Creek measured at MW-5; and 4) the presence of strongly ARD-generating OU1 mine materials in the South Fork Middle Creek watershed.

Surface water quality within Russell Creek and West Fork Canyon Creek is not affected by the site, based on samples collected during a wet season and dry season seep and spring survey. This water is neutral pH, calcium-bicarbonate type water with low total dissolved solids, and low concentrations of indicator parameters for MIW.

MIW that discharges from Middle Creek enters Cow Creek, where significant dilution occurs. Water within Cow Creek was sampled to evaluate if the dilution resulted in attenuation of dissolved contaminant loads to a point that would not present risks to either human or ecological receptors. Surface water in Cow Creek was sampled above the confluence with Middle Creek and at three locations downstream from the confluence where surface water is used. Comparison of the surface water quality data from upstream of Middle Creek to the three downstream locations indicate that the site is not causing adverse effects to surface water quality within Cow Creek, and that drinking water intakes are not affected by the mine discharge.

2.4.3 Groundwater

Preliminary evaluation of nature and extent of contamination in the bedrock and alluvial groundwater systems has been conducted. Two existing bedrock wells were sampled in the wet and dry seasons between October 2009 and January 2011. MW-2 is a bedrock monitoring well located near the Formosa 1 adit. MW-5 is an existing bedrock monitoring well located on the east side of the EM. In addition, five alluvial monitoring wells were installed and sampled during 2010 and 2011. Additional characterization of groundwater may be necessary as components of future work focused on OU2.

Water quality in the bedrock aquifer near the Formosa 1 adit is circumneutral pH calcium-sulfate type water with low concentrations of cadmium, copper, and zinc (indicator parameters for MIW). The presence of sulfate as the predominant anion suggests that this water may be slightly affected by either the underground mine or OU1 mine materials. However, the circumneutral pH and relatively low concentration of indicator parameters for MIW suggest that effects to bedrock groundwater quality at this location are not severe. The bedrock groundwater system is fracture controlled, and the possible presence of unknown fracture-controlled connections between the underground mine and Upper Middle Creek cannot be entirely ruled out. Future evaluations during the OU2 RI will include the groundwater to surface water pathway. Water quality data from seeps, springs, wells, and surface water measurements will be assessed.

Alluvial monitoring well MW-7A is located close to the Formosa 1 adit, in a perched alluvial aquifer that extends downgradient to major areas of MIW discharge from groundwater to surface water in Upper Middle Creek. Field and laboratory data collected from this well indicates this perched aquifer is strongly acidic with high conductivity, which indicates that the aquifer is affected by MIW. These data support the current hypothesis that some portion of the MIW discharged from the Formosa 1 adit bypasses the collection facility and leaks into the perched alluvial aquifer at this location. This may be a significant source of metals loading to Upper Middle Creek.

Water quality within the bedrock aquifer on the east side of the EM is monitored at MW-5. In contrast to the relatively good water quality at MW-2, water quality at MW-5 is severely affected by MIW. This water is strongly acidic calcium-sulfate type water, with high concentrations of cadmium, copper, and zinc. It is unknown if this water has been contaminated by ARD generated in surface mine materials piles and/or by leakage from the EM. Numerous seeps and springs located in South Fork Middle Creek watershed show similar water chemistry and may be related to discharge of MIW from this bedrock aquifer to surface water from the possible presence of the previously discussed fracture-controlled connections.

Water quality within the EM has also been evaluated based on data collected from piezometers MW-22 and MW-23 installed in August 2010. The data collected indicate that the former pond is saturated for nearly the entire depth with severally affected MIW. Over the 11 month monitoring period (during the OU1 RI), transducer data show an increase and decrease in water level of approximately 1.5 feet following the seasonal changes in precipitation. These data indicate that the EM cover system is leaking and that the former pond liner is leaking at some point. Based on this data and historical information regarding pond construction, the estimated leakage of MIW during 2011 is approximately 103,000 gallons.

2.5 Summary of Risk Assessment

A risk assessment was prepared for the OU1 RI report. This section provides a summary of human health and ecologic risk as presented in the summary section for the OU1 RI report (CDM Smith 2012). An evaluation of potential human health and ecological risks associated with exposure to materials in OU1 has been conducted. OU1 was divided into the following three exposure areas (EAs):

- EA-1 – This exposure area represents the PMDA of the site, as shown on Figure 1-2. These materials are classified as OU1 mine materials within this FS.

- EA-2 – this exposure area represents the area of potentially affected soils located immediately downslope of mine materials defined as EA-1. The area was characterized to determine whether impacts are present beyond the mine materials boundary, and was sampled using an incremental sampling approach. The areas sampled were generally located below the Formosa 1 adit WRD, Silver Butte 1 adit WRD, west EM WRD, east EM WRD and illegal dump area, and two drainage areas west EM WRD. These materials are excluded as OU1 mine materials within this FS.

- EA-3 – This exposure area represents the visibly affected areas resulting from the adit water diversion system pipeline and drainfields. This EA includes discharge areas associated with both the current pipeline and previous pipelines that discharged MIW in a drainfield further upgradient from the current pipeline. These materials are classified as OU1 mine materials within this FS. Further delineation of the area comprising adit drainage affected soils would be evaluated before implementation of the selected remedy.

Human and ecological populations may additionally be exposed to contaminants migrating from mine materials and soils to groundwater and surface water. Exposures to these media were assessed based on a screening-level comparitive evaluation. The screening-level comparative assessment was risk-based and contaminant levels detected in migrating mine materials and soil did not exceed human health risk benchmarks. Detailed evaluations of risks to receptors from surface water and groundwater contamination will be addressed in the risk assessment for OU2.

2.5.1 Human Health Risk Assessment

Current workers, visitors, and possible offsite residents were quantitatively evaluated for exposure to surface soils. Future construction workers, workers, visitors, and offsite residents were quantitatively evaluated for risks to surface as well as subsurface soils. Visitors included hikers, campers, all-terrain vehicle riders, and hunters. Estimated cancer risks for all populations both current and future, fall within or below the EPA acceptable risk range of 1E-04 to 1E-06. Estimated noncancer hazards segregated by target organ are below the acceptable hazard benchmark of 1.0.

- EA-1. Estimated cancer risks for current and future onsite workers and construction workers in EA-1 are equal to 1E-05 or less. Estimated cancer risks for current and future visitors (adult and child) in EA-1 are equal to 4E-06 or less. Estimated risks for offsite residents exposed via inhalation to windblown dusts from EA-1 are below the risk benchmark of 1E-06. In all cases, the risks greater than 1E-06 were due to arsenic.

  Estimated noncancer hazards for current and future onsite workers, visitors, and offsite residents are below the acceptable hazard benchmark of 1.0. Estimated noncancer hazard for future construction workers in the reasonable maximum exposure (RME) case is 2; however, when segregated by target organ, the individual hazard indices for each organ are below 1. In the central tendency exposure (CTE) case, the hazard is below the acceptable hazard benchmark of 1.0.

- EA-2. Estimated cancer risks for current visitors (adult and child) in EA-2 and offsite residents exposed via inhalation to windblown dusts from EA-2 are below the risk benchmark of 1E-06. In all cases, the risks were due to arsenic. Estimated noncancer hazards for these populations are below the acceptable hazard benchmark of 1.0

- EA-3. Estimated cancer risks for onsite workers in EA-3 are equal to 6E-05 or less. Estimated cancer risks for visitors (adult and child) in EA-3 are equal to 2E-05 or less. Estimated risks for offsite residents exposed via inhalation to windblown dust from EA-3 are 2E-06 or less. In all cases, the risks were due to arsenic. Estimated noncancer hazards for these populations are below the acceptable hazard benchmark of 1.0.

In summary, human health risks greater than 1E-06 due to exposure to mine materials and soils are likely site-related, but limited to arsenic. All estimated excess cancer risks fall within EPA's acceptable risk range of 1E-04 to 1E-06. All estimated noncancer hazards segregated by target organ fall below EPA's benchmark of 1.0.

Groundwater and surface water exposures may also contribute to human health risk, but will be examined quantitatively in the risk assessment conducted for OU2 and thus are not evaluated in this FS.

2.5.2 Ecological Risk Assessment

The ecological risk assessment (ERA) identified several COPCs (metals and metalloids) in surface soil and mine materials occurring at elevated concentrations potentially linked to adverse effects in exposed terrestrial receptors. A subset of these contaminants are identified as final COCs based on measured concentrations in surface soils and mine materials, the form of these contaminants likely occurring in these media, the potential for toxicity, and the confidence in the quantitative risk estimates (reflecting the confidence in the exposure point concentrations [EPCs] and ecological screening levels [ESLs] underlying these estimates). Final COCs for OU1 by EA are presented below:

- EA-1 – Arsenic, cadmium, copper, lead, mercury, nickel, selenium, and zinc
- EA -2 – Cadmium, copper, manganese, and zinc (location-specific)
- EA-3 – Arsenic, copper, vanadium, and zinc

In addition, the ERA concluded that OU1 mine materials are adversely affecting downgradient aquatic resources, based on migration routes identified in the CSM and concentrations of COCs measured in surface water. Contributing to these surface water-related risks are concentrations of cadmium, copper, lead (marginally), and zinc in surface water. The source of elevated concentrations of these COCs in surface water includes solid materials and runoff transported from OU1 via overland flow and MIW seeps.

Screening level hazard quotients (HQs) for selected metals (cadmium, copper, lead, nickel, and zinc) were developed based on comparisons of dissolved concentrations in surface water to chronic hardness-adjusted (where applicable) EPA *National Recommended Water Quality Criteria* (EPA 2009c). Surface water locations evaluated were within the Upper Middle Creek and South Fork Middle Creek subdrainages near OU1 mine materials, as well at adit discharges. The screening level assessment indicated significantly high HQs, as summarized below for surface water:

- Upper Middle Creek subdrainage from near PMDA to within 0.75 mile downstream:
  - HQs range from cadmium (219), copper (427), and zinc (104) upstream to cadmium (41), copper (38), and zinc (18) downstream
- South Fork Middle Creek subdrainage from near PMDA to within 1 mile downstream:
  - HQs range from cadmium (286), copper (648), and zinc (120) upstream to cadmium (35), copper (36), and zinc (21) downstream

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Section 3

Remedial Action Objectives

Section 300.430(e) of the NCP requires that the remedial alternative development process be initiated by developing PRAOs, identifying GRAs that address these PRAOs, and performing an initial screening of applicable remedial technologies. The goal of the remedy selection process is to select remedies that are protective of human health and the environment, maintain protection over time, and minimize untreated waste.

PRAOs are media-specific and source-specific goals achieved through completion of a remedial action that is protective of human health and the environment. These objectives are typically expressed in terms of the contaminant, the concentration of the contaminant, and the exposure route and receptor. PRAOs are typically developed by evaluating several sources of information including results of the human health risk assessment (HHRA), ERA, and tentatively identified ARARs. These inputs provide the basis for determination of whether protection of human health and the environment is achieved for a remedial alternative.

This section presents the ARARs, PRAOs, and the PRGs that are tentatively identified for the site. Final ARARs, remedial action objectives (RAOs), and remedial goals (RGs) will be developed from evaluations presented within this FS and set forth in the ROD for consideration in remedial design and subsequent remedial actions.

3.1 Applicable or Relevant and Appropriate Requirements

Identification and evaluation of ARARs are integral components of the FS process to determine whether remedial alternatives can protect human health and the environment. The following paragraphs were developed from EPA's *Introduction to Applicable or Relevant and Appropriate Requirements* (EPA 1998); they give an overview of why ARARs must be identified and evaluated as part of the CERCLA process.

CERCLA and the NCP establish a standardized process through which EPA must respond to spills and clean up the nation's most dangerous hazardous waste sites. The CERCLA response process, while it sets acceptable risk-based goals for cleanups, does not impose specific restrictions on the various activities (such as treatment, storage and disposal of wastes, construction and use of remediation equipment, and release of contaminants into air, soil, and water) that may occur during a response. EPA instead relies on other eligible federal and state environmental laws and regulations to govern response activities through the ARARs selection process.

A site-specific risk assessment is the foundation on which the selection of a CERCLA remedy is based. ARARs fill in the substantive gaps in CERCLA's risk-based response framework, ensuring protection of human health and the environment. Appendix A constitutes the initial identification and detailed description of ARARs for the remedial alternatives under evaluation in this FS.

3.1.1 ARAR Identification Process

Determining exactly which laws and regulations will affect a CERCLA response is somewhat different than determining the effect of laws and regulations on activities that take place outside the boundaries of a site remediated under CERCLA. For onsite activities, CERCLA requires compliance with both applicable requirements (i.e., those that would apply to a given circumstance at any site or facility) and those that EPA deems to be relevant and appropriate (even though they do not apply directly), based on the unique conditions at a site.

ARARs are designated as either "applicable" or "relevant and appropriate," according to EPA guidance, and may stem either from federal or state law. ARARs must be identified on a site-specific basis and involve a two-part analysis. A determination must first be made on whether a given requirement is applicable. If it is not applicable, then a second determination must be made on whether it is both relevant and appropriate. When the analysis determines that a requirement is both relevant and appropriate, such a requirement must be complied with to the same degree as if it were applicable (EPA 1988). Compliance with ARARs is a threshold criterion that any selected remedy must meet unless a legal waiver as provided by CERCLA Section 121(d)(4) is invoked.

3.1.1.1 Consideration of State Requirements as ARARs

State requirements are potential ARARs for CERCLA response actions as long as they meet the following eligibility criteria:

- State law or regulation
- Environmental or facility siting law or regulation
- Promulgated (of general applicability and legally enforceable)
- Substantive (not procedural or administrative)
- More stringent than federal requirements
- Identified in a timely manner
- Consistently applied

Many state requirements listed as ARARs are promulgated with identical or nearly identical requirements to federal law pursuant to delegated environmental programs administered by federal agencies and the state. The preamble to the NCP provides that such a situation results in citation to the state provision and treatment of the provision as a federal requirement.

3.1.1.2 Information to be Considered

In addition to ARARs, the NCP states that where ARARs do not exist, agency advisories, criteria, or guidance are to be considered useful "in helping to determine what is protective at a site or how to carry out certain actions or requirements" (55 Federal Register 8745). These sources of information are referred to as TBCs.

The NCP preamble states, however, that provisions in the TBC category "should not be required as cleanup standards, because they are, by definition, generally neither promulgated nor enforceable, so they do not have the same status under CERCLA as do ARARs." Although not enforceable requirements, these documents are important sources of information that EPA and the state may consider during selection of the remedy, especially regarding the evaluation of public health and environmental risks, or which will be referred to, as appropriate, in selecting and developing cleanup actions [40 CFR (Code of Federal Regulations) § 300.400(g)(3), 40 CFR § 300.415(I)].

Appendix A also contains initial identification and detailed description of TBCs for the remedial alternatives under evaluation in this FS.

3.1.1.3 Other Regulatory Requirements Not Considered ARARs

There are other laws and regulations that do not constitute ARARs for the site, because they are not specifically related to environmental cleanup or facility siting. One example would be the U.S. Department of Transportation (DOT) regulations for transport of hazardous and nonhazardous materials or wastes; another would be Occupational Safety and Health Administration (OSHA) general construction safety regulations.

3.1.2 Categories of ARARs

Environmental laws and regulations fit (more or less) into three categories: 1) those that pertain to the management of certain chemicals; 2) those that restrict activities at a given location; and 3) those that control specific actions. Thus, there are three primary types of ARARs: chemical-, location-, and action-specific. An ARAR can be one or a combination of all three types of ARARs.

Chemical-specific requirements address chemical or physical characteristics of compounds or substances on sites. These values establish acceptable amounts or concentrations of contaminants that may be found in, or discharged to, the ambient environment.

Location-specific requirements are restrictions placed on the concentrations of hazardous substances or the conduct of cleanup activities, because they are in specific locations. Location-specific ARARs relate to the geographical or physical positions of sites rather than the nature of contaminants at sites.

Action-specific requirements are usually technology-based or activity-based requirements, or limitations on actions taken with respect to hazardous substances, pollutants, or contaminants. A given cleanup activity will trigger an action-specific requirement. Such requirements do not themselves determine the cleanup alternative but define how chosen cleanup methods should be performed.

3.1.3 Waivers of Specific ARARs

CERCLA Section 121(d)(4) authorizes that any ARAR may be waived per one of the following six conditions if the protection of human health and the environment is ensured:

- It is part of a total remedial action that will attain such level or standard of control when completed (i.e., interim action waiver).
- Compliance with the ARAR at a given site will result in greater risk to human health and the environment than alternative options that do not comply with the ARAR.
- Compliance with such a requirement is technically impracticable from an engineering perspective.
- The remedial action will attain a standard or performance equivalent to that required by the ARARs through use of another method or approach.

- The ARAR in question is a state standard and the state has not consistently applied (or demonstrated the intention to consistently apply) the ARAR in similar circumstances at other sites.
- In meeting the ARAR, the selected remedial action will not ensure a balance between the need for protection of public health and welfare and the environment at the site and the availability of Superfund monies to respond to other facilities.

It is not anticipated that ARAR waivers will be required for selecting or implementing a remedy at the site.

3.1.4 CERCLA Permit Exemption

CERCLA Section 121(e)(1), 42 United States Code (U.S.C). § 9621(e)(1), states, "No Federal, State, or local permit shall be required for the portion of any removal or remedial action conducted entirely onsite, where such remedial action is selected and carried out in compliance with this section." The onsite activities must, however, comply with substantive permit requirements. The term "onsite" is defined in the NCP as "*the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementation of the response action*" (40 CFR § 300.5).

For purposes of the FS, it is assumed that the PMDA would be considered onsite. Other areas of the site in very close proximity of the mine or where contamination such as mine materials, contaminated surface water, or contaminated groundwater has come to be located are also considered onsite for purposes of the permit exemption. While no permits will be obtained for any OU1 response actions conducted onsite, EPA will evaluate the substantive requirements that would otherwise be included in any such permit and determine which substantive provisions must be complied with.

3.1.5 Identification of Potential ARARs for Remedial Alternatives

Appendix A lists potential ARARs and TBCs, along with a brief description of ARARs for the implementation of a remedial action at OU1. The ARARs are organized by whether they are federal or Oregon ARARs or TBCs. The ARARs or group of related ARARs included in Appendix A are identified by a statutory or regulatory citation, followed by a brief explanation of the ARAR and how, and to what extent, the ARAR is expected to apply to potential activities to be conducted. The tables in Appendix A also identify whether the ARAR or TBC is chemical-, location-, and/or action-specific.

Appendix A identifies potential ARARs for the purpose of evaluating remedial alternatives in this FS. The potential ARARs in this FS are not binding; final ARARs will be determined in the ROD as performance standards for remedial design and subsequent remedial actions.

3.1.6 ARARs Affecting Waste Classifications for Mine Materials

ARARs identified in Appendix A address waste classifications for mine materials generated during remedial action. Thus, these ARARs warrant further discussion here since they potentially affect remedial alternatives identified in this FS.

The primary regulatory driver for waste classifications is the Resource Conservation and Recovery Act (RCRA), and specifically RCRA Subtitle C which address identification of hazardous wastes. The Bevill Amendment excludes from regulation under Subtitle C "solid wastes from the extraction, beneficiation, and processing of ores and minerals." The mine materials at the site, having been derived from mining activities, meet the criteria of the Bevill exclusion and therefore, could be exempted for regulation as an environmental medium containing hazardous waste.

This determination would be significant as RCRA Subtitle C disposal requirements would not be applicable for the mine materials generated from OU1, and could be disposed in a Subtitle D facility.

However, based on research conducted as part of the FS, local Subtitle D facilities would likely not accept mine materials without implementation of testing protocols defined under RCRA for identification of characteristic hazardous waste (i.e., toxicity characteristic leaching procedure to determine toxicity). If it were determined that the mine materials exhibited toxicity characteristics, these facilities would likely require pre-treatment of mine materials to meet RCRA land disposal restrictions (LDRs). Based on SPLP data from the RI it is likely that the mine materials will be considered toxic and would require pre-treatment such as stabilization/solidification prior to disposal to meet LDRs.

3.1.7 State of Oregon ARARs Affecting Determination of Acceptable Risk

The provisions of the following potential ARARs were identified as significant to affecting the determination of acceptable risk for remedial alternatives identified in this FS as defined by Oregon law and regulations.

The Oregon Environmental Cleanup Law (Oregon Revised Statutes [ORS] 465.200 through ORS 465.900) and the Oregon Hazardous Substance Remedial Action Rules (Oregon Administrative Rule [OAR] 340-122) provide the state's regulatory framework for the determination of removal and remedial action necessary to assure protection of the present and future public health, safety and welfare, and the environment in the event of a release or threat of a release of a hazardous substance. These state laws and regulations have been identified as "applicable" ARARs and thus compliance with the substantive requirements of these laws and regulations is required.

Generally the substantive portions of the Oregon Environmental Cleanup Law and Oregon Hazardous Substance Remedial Action Rules provide standards similar to those within CERCLA and the NCP. However there are a few major differences that fundamentally affect the determination of protectiveness.

Specifically, the Oregon Hazardous Substance Remedial Action Rules indicate the following:

"Acceptable risk level for human exposure to individual carcinogens" means for deterministic risk assessments, a lifetime excess cancer risk of less than or equal to one per one million (1E-06) for an individual at an upper-bound exposure (OAR 340-122-0115(2)(a)).

"Acceptable risk level for individual ecological receptors" (per OAR 340-122-0015(5)(a) through (c)) applies only to species listed as threatened or endangered pursuant to 16 USC 1531 et seq. or ORS 465.172, and means:

For deterministic risk assessments, a toxicity index less than or equal to one for an individual ecological receptor at an upper-bound exposure, where the toxicity index is the sum of the toxicity quotients attributable to systemic toxicants with similar endpoints for similarly responding species and the toxicity quotient is the ratio of the exposure point value to the ecological benchmark value.

For probabilistic risk assessments, a toxicity index less than or equal to one at the 90th percentile and less than or equal to 10 at the 95th percentile, each based on the same distribution of toxicity index numbers for an exposed individual ecological receptor.

The probability of important changes in such factors as growth, survival, fecundity, or reproduction related to the health and viability of an individual ecological receptor that are reasonably likely to occur as a consequence of exposure to hazardous substances is *de minimis*.

"Acceptable risk level for populations of ecological receptors" (per OAR 340-122-0115(6)) means a 10 percent chance, or less, that more than 20 percent of the total local population will be exposed to an exposure point value greater than the ecological benchmark value for each COC and no other observed significant adverse effects on the health or viability of the local population.

The issue of background concentrations of COPCs that are naturally occurring is another aspect of the Oregon Hazardous Substance Remedial Action Rules that affects the development of a PRG. Specifically the "Standards" section within OAR 340-122-0040(2)(a) through (c) states:

"In the event of a release of a hazardous substance, remedial actions shall be implemented to achieve:

(a) Acceptable risk levels defined in OAR 340-122-0115, as demonstrated by a residual risk assessment;

(b) Numeric cleanup standards developed as part of an approved generic remedy identified or developed by the Department (Oregon DEQ) under OAR 340-122-0047, if applicable; or

(c) For areas where hazardous substances occur naturally, the background level of the hazardous substances, if higher than those levels specified in subsections (2)(a) through (2)(b) of this rule."

Arsenic is a COC, but is also naturally-occurring element within soils near the site. Thus, the determination of a PRG for arsenic is not solely based on the determination of risk, but also whether that risk represents concentrations of arsenic above background concentrations for the site. This issue is discussed further in Section 3.4.3.

3.2 Anticipated Land Uses

The current and anticipated future land uses for the site are an important consideration for the development of PRAOs and PRGs to ensure remedial alternatives are protective of human health and the environment. The final condition of the site after remediation must be considered in evaluating future land uses or activities and the related protection to human health that is provided.

As discussed in Section 2.3.8, the expectation and assumption in this FS is that areas that are remediated in OU1 will remain predominantly as recreational and commercial land use (based on the zoning classification of Timberland Resource for privately-owned lands and General Forest Management Area and Connectivity/Diversity Block land use allocations for BLM-managed lands).

3.3 Preliminary Remedial Action Objectives

PRAOs are media-specific and source-specific goals to be achieved through completion of a remedy that is protective of human health and the environment. These objectives are typically expressed in terms of the chemicals, the concentration of the chemicals, and the exposure routes and receptors.

PRAOs are typically developed by evaluating several sources of information, including results of the RI report, the risk assessments, and tentatively identified ARARs presented in Appendix A. These inputs are the basis for determining whether protection of human health and the environment is achieved for a particular remedial alternative. In accordance with EPA RI/FS guidance (EPA 1988), recommended

PRAOs for OU1 were developed in the OU1 RI report (CDM 2012), based on the RI nature and extent conclusions and risk assessment. The recommended PRAOs developed in the RI report were as follows:

1. Manage OU1 mine materials to prevent COPC migration into surface or groundwater, and to protect aquatic and riparian ecosystems downgradient of OU1
2. Implement land use controls to provide for land uses that will be protective of the remedy
3. Ensure that users of private or BLM lands have no more than a 1E-06 chance of contracting cancer from ingestion of mine materials or contaminated soils
4. Reduce risks to ecological receptors at the population or community level through management of mine materials and contaminated soils

Based on subsequent discussions with the lead and support agencies, the PRAOs have been revised and simplified. The revised PRAOs presented in this FS are based on anticipated future use of OU1 by people for primarily recreational and commercial purposes under the zoning classifications for Timberland Resource for privately-owned lands and for the objectives of General Forest Management Area and Connectivity/Diversity Block land use allocations for BLM managed lands:

1. Manage mine materials to minimize chemical migration and the generation of acid rock drainage to protect habitat and ecological receptor populations and communities, including individuals of threatened and endangered species.
2. Minimize human exposure to mine material at concentrations that could result in unacceptable cancer risks or adverse non-cancer effects.

These PRAOs are described further below:

Manage mine materials to minimize chemical migration and the generation of acid rock drainage to protect habitat and ecological receptor populations and communities, including individuals of threatened and endangered species.

As discussed in the OU1 RI report (CDM Smith 2012), identification of mine materials is based on a weight of evidence approach, because there is no test than can fully define the propensity for a rock to generate ARD. Using this weight of evidence approach, mine materials in OU1 have been characterized and delineated. Mine materials are primary source materials and the process of ARD generation and MIW migration causes ongoing releases of COPCs from mine materials into the environment. These COPCs are subsequently transported via groundwater and surface water pathways to downstream ecosystems, where they cause adverse effects to aquatic biota and potentially to other upper trophic level consumers (e.g., piscivorous [fish eating] birds and mammals). Managing mine materials in a manner that prevents ARD generation and subsequent transport of the COPCs via groundwater and surface water, will prevent ongoing releases of COCs from mine materials, and the associated deleterious effects to downstream ecosystems from MIW.

The ERA also identified several inorganic contaminants in mine materials occurring at concentrations that have potential to adversely affect exposed terrestrial receptors. These include mine materials in EA-1, potentially contaminated soils in EA-2, and contaminated soils in EA-3 have the potential to cause risks to these receptors.

The potential for ecological receptors exposed to mining-related chemicals to suffer adverse effects related to survival, growth, or reproduction is based only partly on chemical concentration. Protection of receptors from potential effects must consider the presence of receptors, suitability of habitat, and availability of the chemicals. Foraging opportunities for avian and mammalian receptors are limited within OU1 and suitable habitat is minimal. In addition, threatened or endangered species may be present in the vicinity of the site, but are not likely present within the PMDA of OU1.

This recommended PRAO is expected to guide the selection of remedial alternatives that can provide protection of ecological receptors at the population or community level and individual threatened and endangered species (if present) from potential adverse effects through appropriate management or mitigation of mine materials.

Minimize human exposure to mine material at concentrations that could result in unacceptable cancer risks or adverse non-cancer effects.

Evaluation of human health risks indicate the cancer risk exceeds 1E-06 for current and future workers related to incidental ingestion and inhalation of arsenic. The exposure areas that pose potential cancer risks to current and future workers of greater than 1E-06 are EA-1 and EA-3. OU1 mine materials that pose cancer risks in EA-1 and EA-3 are those materials that have been determined to also be sources of ARD generation and/or associated deleterious effects to downstream ecosystems from MIW. It is expected that management or mitigation of mine materials to meet the objectives set forth in PRAO 1 would also address the requirements of this PRAO (PRAO 2).

3.4 Preliminary Remediation Goals

PRGs are defined as the average concentration of a chemical in an exposure unit associated with a target risk level such that concentrations at or below the PRG do not pose an unacceptable risk. As stated in Section 3.3, the PRAOs for the site include protection of human and ecological receptors from contaminated mine materials distributed across the site.

The development of PRGs is a requirement of the NCP (40 CFR 300.430(e)(2)(i)). Identification and selection of the PRGs are typically based on PRAOs, the current and anticipated future land uses, and the tentatively identified ARARs. The PRGs are typically presented as chemical- and media-specific values that directly address the PRAOs. These values are typically used as a preliminary value in the FS to guide evaluations of remedial alternatives.

3.4.1 Identification of PRGs

The OU1 PRG is specific to human exposure to mine waste and is not applicable to the aquatic environment of OU2. Only arsenic resulted in low risk to human receptors. Because pH does not directly correlate to human health risk, it is not an appropriate PRG. However, pH could be used as an indicator for aquatic conditions within the evaluation of an OU2 remediation action.

A PRG of 10.5 milligrams per kilogram (mg/kg) was calculated for arsenic in mine materials. The PRG equates to a human health risk level of 1E-06 using exposure assumptions for current and future workers at EA-1 and EA-3. Development of the PRG was not based on risks to ecological receptors, because the ERA determined that risks to terrestrial ecological receptors were acceptable for the reasons discussed in Section 3.3.

PRGs based on ecological risk or other COCs as related to the aqueous environment of OU2 have not been developed. The PRAOs developed for OU1 focus on source control and given that a "release" from the Site would occur or be measured in the aqueous environment of OU2, chemical specific criteria (PRGs) for surface water and/or groundwater will be developed as part of the OU2 RI.

The purpose of PRG development for the OU1 FS is not to provide a benchmark value for delineation of mine materials nor as post-construction basis for confirmation. The primary means of delineation of mine materials both pre- and post-construction will be based on geochemical properties regarding the propensity to generate ARD which can be evaluated by inspections and visual observations which are not metal or metalloid specific. If needed, paste pH of materials may be used as field screening to determine degree of ARD generation for these purposes based on correlation between paste pH and leaching of COCs presented in the OU1 RI report (CDM Smith 2012).

3.4.2 Intended Use of PRG for Arsenic

The PRG was developed to document that arsenic in mine materials exceeding the acceptable risk level for human exposure to individual carcinogens established by OAR 340-122 (1E-06) is present at OU1. The PRG also provides a basis for determining that a remedial alternative, through mitigation of mine materials to address ARD and MIW generation, is likely in compliance with this State of Oregon ARAR.

3.4.3 Impact of Naturally Occurring Arsenic on PRGs

The presence of naturally occurring arsenic at the site is a complicating factor in the application of the arsenic PRG to OU1. Arsenic is a metalloid that also occurs naturally in soils developed over volcanic rocks, such as those that underlie and outcrop near the site. Pursuant to EPA guidance, Role of Background in the CERCLA Cleanup Program, Office of Solid Waste and Emergency Response (OSWER) 9285.6-07P, acceptable exposure levels are not set below natural background levels. Similarly, OAR 340-122-0040(2)(c) does not require remediation of hazardous substances that occur naturally and have background levels above acceptable risk levels or numerical cleanup standards.

A discussed in Section 2.4.1.1, collection of soil samples for inorganic analysis was performed during the OU1 RI from two locations outside of the PMDA that may be representative of background. The mean concentration of arsenic from those locations ranged from 0.537 mg/kg to 3.47 mg/kg, which are lower than the PRG of 10.5 mg/kg. However, it was inconclusive whether these samples are representative of site specific background due to the presence of ARD-generating bedrock within the PMDA that can cause natural enrichments of metals and metalloids in soils. If future background studies are conducted that demonstrate that arsenic background concentrations are higher than 10.5 mg/kg, the lead and support agencies may revise the PRG for arsenic to site-specific background.

After mine materials are addressed by an OU1 remedial approach, the remaining soils (potentially affected soils) may have residual arsenic concentrations, but is questionable how they compare to background concentrations of naturally occurring arsenic. Thus, potentially affected soils are excluded from evaluation in the FS.

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Section 4

Identification and Screening of General Response Actions, Remedial Technologies, and Process Options

4.1 Overview

This section identifies GRAs, remedial technologies, and process options that are potentially useful to address the PRAOs identified in Section 3 for the contaminated media that pose a potential threat to human health and the environment. This section presents the screening of GRAs, remedial technologies, and process options in accordance with the NCP to retain representative technologies and process options that can be assembled into remedial alternatives, which are discussed in Section 5.

The identification and screening process consists of the following general steps:

- Identify the contaminants and affected media that pose risks to human health and the environment and group these into a category or categories of contaminated media for FS evaluation.
- Develop GRAs for the contaminated media that will satisfy the PRAOs identified in Section 3.
- Compile remedial technologies and process options for each GRA that are potentially viable for remediation of the contaminated media.
- Screen the remedial technologies and process options with respect to technical implementability for the contaminated media at the site. Technologies and process options that are not technically implementable relative to the contaminated media are eliminated from further consideration in this FS.
- Evaluate and screen the retained remedial technologies and process options with respect to effectiveness, ease of implementability, and relative cost. Technologies and process options that have low effectiveness, low implementability, or high cost to address the contaminated media are eliminated from further consideration in this FS.
- Combine and assemble the retained technologies and process options for the contaminated media into remedial alternatives as presented in Section 5.

The remainder of this section describes the contaminated media and evaluates GRAs, technologies, and process options that are potentially viable for addressing them to meet the PRAOs and ARARs discussed in Section 3.

4.2 Contaminants and Affected Media

The purpose of this subsection is to identify the contaminants and affected media that exhibit a potential risk to human health and the environment, and group these into categories of contaminated media. Creating categories of contaminated media facilitates identification of GRAs, remedial technologies, and process options that can be used to address the PRAOs.

The nature and extent of contamination within media at the Site and the human health risks posed by the contaminated media are summarized in Section 2 and fully discussed in the RI report (CDM Smith 2012). The contaminated media included as part of OU1 are ARD-generating waste rock, tailings, construction rock, and various mixtures of these materials with native soils, as well as adit drainage affected soils as described in Section 2.4.1.1. To simplify FS evaluations and alternative descriptions, the media described in Section 2.4.1.1 are grouped together and herein defined as "mine materials." This grouping was based on the assumption that the various materials can generally be addressed using many of the same remedial technologies and process options.

One other major focus of the study area investigation for the OU1 RI are potentially affected soils located downslope of mine material WRDs as described in Section 2.4.1.2. These soils are excluded from FS evaluation because of several factors. These factors include uncertainties related to background concentrations of COCs, the non-acid-generating nature of the soils, and low cancer risks identified in the OU1 RI (CDM Smith 2012). Moreover, these soils are located in densely vegetated areas that currently provide quality habitat, and disturbance of these soils may result in adverse impacts to habitat in comparison to the current condition.

4.3 General Response Actions

GRAs are initial broad response actions considered to address the PRAOs for the mine materials identified at OU1. GRAs include several remedial categories, such as containment, removal, disposal, and treatment of mine materials. Site-specific GRAs are first developed to satisfy the PRAOs and/or ARARs, and then are evaluated as part of the identification and screening of remedial technologies and process options for the mine materials.

The GRAs considered for remediation of mine materials include the following:

- No action/no further action
- Administrative controls
- Removal, transport, disposal
- Reuse, reclamation, recovery
- Monitoring
- Containment
- Treatment

No action/no further action leaves mine materials in their existing condition with no control or cleanup planned. In accordance with the NCP, this GRA must be considered to provide a baseline against which other options can be compared.

Monitoring involves physical and/or chemical measures used at OU1 to determine if there is contaminant migration. Monitoring is not intended to substitute any engineering aspect of a selected remedy and does not physically address contaminants.

Administrative controls involve administrative, legal, and/or informational, or physical measures intended to control or prevent present and future use or access to mine materials, and inform and warn of dangers associated with these materials. These controls are not intended to substitute for engineering aspects of a selected remedy and do not physically address contaminants.

Containment involves physical measures applied to mine materials to control the release of contaminants and/or prevent direct contact or exposure to the contaminants.

Removal, transport, disposal involve a complete or partial removal (i.e., excavation) of mine materials followed by transportation and disposal at an onsite/offsite location.

Treatment involves biological, chemical, thermal, and/or physical measures applied to the mine materials that reduce toxicity, mobility, and/or volume of the contaminants present.

Reuse, reclamation, recovery involves processes that can remove or treat mine materials while recovering usable or saleable materials.

4.4 Identification of Remedial Technologies and Process Options

In this step of the FS process, remedial technology types and process options that are capable of addressing mine materials are identified and organized under each GRA listed in Section 4.3. This section provides potentially viable remedial technologies and process options for the mine materials.

Remedial technologies and process options were assembled using the Federal Remediation Technologies Roundtable (FRTR) *Remediation Technologies Screening Matrix and Reference Guide*, Version 4.0 (EPA 2007), the *Abandoned Mine Site Characterization and Cleanup Handbook* (EPA 2000b), the *Presumptive Remedy Guidance for Metals-in-Soil Sites* (EPA 1999), the *Abandoned Mine Land Program Policy Handbook* (BLM 2007), the *Abandoned Mine Waste Repositories – Site Selection, Design, and Cost* (BLM 2003), published literature and vendor information, and engineering judgment based on experience from other mine remediation projects.

Potentially viable remedial technologies and associated process options identified for remediation of mine materials are presented in Table 4-1.

4.5 Screening of Remedial Technologies and Process Options for Technical Implementability

The remedial technologies and process options presented on Table 4-1 were first evaluated and screened based on technical implementability. A wide range of potential remedial technologies and process options for OU1 were reviewed to evaluate the suitability of a technology for addressing the mine materials. The sources of information discussed in Section 4.4 were also used to perform screening.

A given technology or process option was eliminated from further consideration on the basis of technical implementability if site conditions or site characterization data indicated that the technology or process option is incompatible with the contaminants or cannot be implemented effectively because of physical limitations or constraints at OU1. Factors that commonly influence this step of the screening process include but are not limited to type of contaminants and extent of contaminated materials. The primary COCs at the Site are inorganics, which limits the applicability of many types of treatment processes. Technologies and process options that are not applicable to treatment of inorganic compounds in mine materials were eliminated from further evaluation. The extent and volume of the mine materials relative to the method of implementing the remedial technologies and process options were also taken into consideration (for instance the use of offsite disposal process options to address large volumes of mine materials).

Some of the eliminated process options may be technically implementable on a small scale for a specific location; however, the technical implementability screening and elimination were performed by evaluating use of the process options on a large-scale, site-wide basis.

The process options eliminated from further consideration in this FS (with the rationale for elimination) are indicated on Table 4-1 using blue shading. Retained technologies and process options were then carried forward to the second step of the evaluation process as discussed in Section 4.6. The screening for technical implementability has resulted in the following general conclusions:

- Remedial technologies/process options exist that should be eliminated and have no further consideration, because they are unable to remediate the mine materials due to site conditions or the lack of compatibility with the mine materials.
- Remedial technologies/process options that have substantial potential and applicability as a stand-alone remedy for mine materials.
- Remedial technologies/process options that could provide remedial benefits in combination with other remedial technologies, but would likely only have cost-effective application for specific site elements and particular conditions and will likely be retained for further evaluation.

4.6 Evaluation of Remedial Technologies and Process Options for Effectiveness, Implementability, and Relative Cost

Each of the technically implementable remedial technologies and process options retained from the preliminary screening process presented in Section 4.5 were further evaluated in the second step of the screening process to determine whether they should be eliminated from further consideration in the FS or retained for assembly into remedial alternatives.

4.6.1 Evaluation Criteria

Each remedial technology or process option was qualitatively evaluated for effectiveness, implementability, and relative cost. The criteria used, as defined in this step of the FS process, are as follows:

Effectiveness

The evaluation of the effectiveness of a remedial technology or process option focuses on:

- Potential effectiveness in handling the estimated volumes of mine materials and meeting the objectives identified in the PRAOs
- Potential impacts to human health and the environment during construction and implementation
- How proven the remedial technology or process option is with respect to the contaminants and conditions at OU1

Implementability

Technically implementable technologies and process options retained from the screening step described in Section 4.5 are evaluated with respect to both the technical and administrative feasibility of implementing a remedial technology or process option. Technical implementability was used as an initial screening step in Section 4.5 to eliminate remedial technologies and process options that were clearly ineffective or unworkable at OU1. This subsequent screening criterion places greater emphasis on the institutional aspects of implementability. This criterion focuses on:

- Ability to obtain permits for offsite actions
- Administrative and institutional feasibility
- Availability and capacity of treatment, storage, materials, and disposal services
- Availability of necessary equipment and skilled workers

Relative Cost

Cost plays a limited role in the screening of remedial technologies and process options. Relative capital and operation and maintenance (O&M) costs are used rather than detailed estimates. The cost analysis is evaluated based on engineering judgment and is ranked relative to other process options in the same technology type. Since remedial alternatives and associated quantities are not defined during technology and process option screening, relative cost is presented qualitatively as a range rather than quantitatively.

4.6.2 Screening Evaluation

Each of the remedial technologies and process options retained from the first screening step for the mine materials were evaluated against the three criteria identified in Section 4.6.1 to determine whether they should be eliminated from further consideration in the FS or retained for assembly into remedial alternatives. The results of this second screening step are presented on Table 4-2. Exhibit 4-1 presents the qualitative rating system used in conjunction with the stated rationale to justify the ratings with respect to each criterion.

Exhibit 4-1. Qualitative Rating System for Screening of Remedial Technologies and Process Options

Effectiveness and Implementability		Relative Cost	
⓿	None	⓿	None
❶	Low	$	Low
❷	Low to moderate	$$	Low to moderate
❸	Moderate	$$$	Moderate
❹	Moderate to high	$$$$	Moderate to high
❺	High	$$$$$	High

This evaluation and screening process is inherently qualitative. The evaluation criteria described in Section 4.6.1 are specified by EPA RI/FS guidance (EPA 1988); however, the degree to which the criteria are weighted against each other is not specified. Determination of how the individual evaluation criterion should influence the overall rankings is subjective and based on site-specific considerations and professional judgment. The factors considered for each of the three criteria that justify retention or elimination are rated using the qualitative rating system. For the effectiveness and implementability criteria, a “low” rating was the least preferable and a “high” rating was the most preferable. For relative cost criteria, a “low” rating indicated a relatively low cost (most preferable) while a “high” rating indicated a relatively high cost (least preferable).

Remedial technologies or process options deemed to have low effectiveness, low implementability, and/or high relative cost for mine materials are eliminated from further consideration in the FS for development of remedial alternatives, and are indicated on Table 4-2 using blue shading. The factors considered for each of the three criteria that provide justification for retention or elimination are also summarized. The applicable locations for implementation of a retained process option (either for site-wide application or for particular remediation subareas on the site) is also considered during screening of process options, and as appropriate, the site-specific applicability is clarified in the process option description.

4.7 Retained GRAs, Remedial Technologies, and Process Options

Based on the results of the two-step screening process described in Sections 4.5 and 4.6, a reduced number of remedial technologies and process options for mine materials were retained for further evaluation and the development of remedial action alternatives as discussed further in Section 5. These retained remedial technologies and process options are presented on Exhibit 4-2.

Exhibit 4-2. Retained Remedial Technologies and Process Options for Development of Remedial Alternatives

Remedial Technology	Process Option
Physical and/or chemical monitoring	Non-intrusive visual inspection Intrusive visual inspection Sample collection and analysis
Institutional controls	Governmental controls, proprietary controls, and informational devices
Community awareness	Informational and educational programs
Access controls	Fencing and posted warnings
Surface source controls	Grading Revegetation Exposure barrier Geosynthetic multi-layer cover Pavement cover
Subsurface source controls	Liner system Submergence
Barriers	Retaining structures
Removal	Mechanical removal (excavation)
Transport	Mechanical transport (hauling/conveying) Hydraulic transport (slurry pumping)
Disposal	Disposal at proposed facility within PMDA Disposal at proposed facility outside PMDA Disposal at existing facility
Biological treatment	Chemically reduced submergence
Chemical/physical treatment	Neutralization/pozzolan- or cement-based stabilization/solidification

Remedial technologies and process options identified to address mine materials are retained, because they either have substantial potential and applicability as a stand-alone remedy, or have remedial benefits in combination with other remedial technologies, but would only have cost-effective application for specific site elements and particular conditions.

It is unlikely that using or applying a single remedial technology/process option to the mine materials will solely be able to achieve the PRAOs or comply with ARARs. Thus, using various remedial technologies/process options in combination is likely to be necessary. Remedial technologies/process options for mine materials are used in various combinations for assembly of remedial alternatives as discussed in Section 5.

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Section 5

Development and Screening of Alternatives

5.1 Overview

In this section, remedial action alternatives (herein referred to as remedial alternatives) are assembled by combining the retained remedial technologies and process options for contaminated soils presented in Section 4. Remedial alternatives are developed from either stand-alone process options or combinations of the retained process options.

These remedial alternatives are then screened using a qualitative process with standard evaluation to determine overall effectiveness, implementability, and cost. The purpose of alternative screening presented in this section is to reduce the number of remedial alternatives retained for detailed analysis in Section 7.

The remedial alternatives for the site span a range of categories defined by the NCP as follows:

- No action/no further action alternative.
- Alternatives that address the principal threats, but involve little or no treatment; protection would be by prevention or control of exposure through actions such as containment and/or administrative controls.
- Alternatives that, as their principal element, employ treatment that reduces the toxicity, mobility, or volume of the contaminants.

5.2 Assumptions Affecting Development of Remedial Alternatives

Several fundamental assumptions affect the development of remedial alternatives evaluated in this FS (other than a "no further action alternative"). These assumptions are driven by requirements of the PRAOs and ARARs identified in Section 3 and site limitations and constraints that cannot be overcome by using one or more remedial technology/process options as described in Section 4. These fundamental assumptions were taken into consideration during development of remedial alternatives for this FS and include the items listed in Exhibit 5-1:

Exhibit 5-1. Assumptions Affecting Development of Remedial Alternatives

Fundamental Assumption	Rationale
Exclusion of contaminated water (i.e., surface water and groundwater) and OU2 components in remedial alternative development and evaluation, except for future access.	The focus of this FS is to address the remediation of site contamination associated with OU1 mine materials. The RI for OU2 is in the initial stages and the FS process for OU2 has not begun. Thus the potential remedial alternatives to address OU2 contamination are unknown. However, remedial alternatives for OU1 are developed in anticipation of maintaining access to OU2 site components such as adits and other underground workings.

Exhibit 5-1. Assumptions Affecting Development of Remedial Alternatives (continued)

Fundamental Assumption	Rationale
Exclusion of potentially affected soils located downslope of mine materials.	Potentially affected soils located downslope of OU1 mine materials (downslope of PMDA boundary) are considered to be below the risk level to necessitate action, and are not acid-generating or causing adverse affects to surface water. In addition, it is uncertain if metals concentrations in these soils are associated with background from the mineralized mine area or from dispersion from the mine materials, as discussed in Section 2. Moreover, these soils are located in densely vegetated areas that currently provide quality habitat, and removal/disturbance of these soils may result in adverse impacts to habitat in comparison to the current condition. Thus, potentially affected soils located downslope of OU1 mine materials are excluded from remedial alternative development and evaluation.
Land use at OU1 is generally considered to be commercial or recreational purposes or for General Forest Management Area and Connectivity/Diversity Block objectives.	Timber harvest, recreation, General Forest Management Area, and Connectivity/Diversity Block objectives are the predominant current and expected future land uses in the area. Active logging is conducted near OU1 on private land parcels. OU1 and adjacent areas are used by hikers, campers, hunters, and all-terrain vehicle riders.
Road access disturbed during implementation of alternatives will be restored.	It is assumed that repair of existing roads or replacement/installation of new roads will be required to maintain access to the area. Access roads crossing from the east to west side of the PMDA, may be interrupted during implementation of alternatives. It is assumed that access roads will be repaired or replaced to restore access to the site.
Administrative controls are essential GRA component of all alternatives (except the no further action alternative).	It is assumed that administrative controls are essential GRA components of all remedial alternatives except the no further action alternative required by the NCP. Administrative controls will only be applied to the proposed facility outside of the PMDA in Alternative 6. It is assumed that these activities will be implemented at disposal facilities and containment areas to restrict use and access of these areas to the public.
Monitoring is essential GRA component of all alternatives.	It is assumed that monitoring (visual inspection and/or sampling/analysis) are essential GRA components of all remedial alternatives since mine materials will be either capped in place or disposed of within a constructed facility except for the no further action alternative required by the NCP. For Alternative 6, monitoring will only take place at the proposed facility outside of the PMDA as it is assumed that upon completion of the remedy (i.e. complete removal of mine materials), there will be no risk within the PMDA. It is assumed that these activities must be performed to determine protectiveness of the remedy after implementation and the need for any future additional remedial measures.
30-year period of analysis for all remedial alternatives.	It is likely that all remedial alternatives would require an indefinite duration of O&M. However, evaluation of long durations of O&M is cumbersome and is generally not necessary for comparative evaluation between alternatives, because of the effects of cost discounting in later years under present value analysis. The period of analysis for the FS is assumed to be 30 years, because the increase of present value cost due to small periodic expenditures for maintenance and monitoring after 30 years is minimal relative to the accuracy range of the estimates. Additional information about period of analysis is discussed in Section 6.7.
Evaluation of rail and truck transport options.	For preparation of screening level costs, evaluation of rail versus truck transport costs was conducted. Costs for each option were similar; however, transport via rail is not as easily implementable due to restrictions and requirements at rail loading and unloading facilities. Therefore, the representative transport process option for FS evaluations is mechanical transport via trucks for alternatives that include disposal at an existing permitted facility.
Mine materials are exempt from regulation as RCRA hazardous waste, but require treatment before disposal at an existing facility.	As discussed in Section 3.1.6, it is assumed for purposes of this FS that OU1 mine materials are exempt from regulation as RCRA hazardous waste, because they are derived from mineral processing (i.e., Bevill Amendment wastes). However, because of the acid-generating nature of the mine materials, existing facilities will likely request analysis and/or treatment of waste before disposal. Thus, additional treatment of mine materials such as stabilization/solidification is assumed to be required before disposal at existing facilities.

Secondary factors and considerations have also been tentatively identified to aid development of remedial alternatives (such as use of onsite beneficial remediation materials to the extent possible) but are not fundamental controlling considerations. Since these considerations vary depending on the remedial approach used in each alternative, they are discussed in Section 7 for retained remedial alternatives.

5.3 Description of Remedial Alternatives

Remedial alternatives were assembled by combining the retained remedial technologies and process options that are capable of addressing the contaminated medium (mine materials). Table 5-1 provides a comprehensive list of the tentatively-retained remedial technologies/process options that were used to develop each remedial alternative. The fundamental site assumptions and factors described in Sections 5.2 were also considered during development of the remedial alternatives.

The remedial alternatives evaluated for OU1 include:

- Alternative 1: No Further Action
- Alternative 2: In-Place Containment, Continued Submergence of Tailings within EM, and Limited Excavation/Disposal of Mine Materials at Proposed Facility within PMDA
- Alternative 3: Limited In-Place Containment, Chemically Reduced Submergence of Tailings within EM, and Excavation/Disposal of Mine Materials at Proposed Facilities within and outside PMDA
- Alternative 4: Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facilities within and outside PMDA
- Alternative 5: Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Existing and Proposed Facilities within and outside PMDA
- Alternative 6: Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facility outside PMDA

The following subsections provide generalized descriptions of the remedy components for remedial alternatives to be evaluated during the screening process presented in this section. Detailed information for remedy components, including but not limited to specific quantities of mine materials and frequency and types of samples collected for analysis, are discussed in Section 7 for the alternatives retained after screening.

5.3.1 Alternative 1: No Further Action

Alternative 1 (No Further Action) is required by the NCP as a baseline for comparison against other remedial alternatives. This alternative would leave the site in its current state with no additional removal and/or remedial actions being implemented.

As required by the NCP, 5-year site reviews would be performed since mine materials would remain at the PMDA with contaminant concentrations above PRGs. The contaminant concentrations above PRGs do not allow for unlimited use and unrestricted exposure under the current and potential future land uses. Site monitoring (i.e., non-intrusive visual inspections) would also be conducted only as necessary to complete the 5-year site reviews.

5.3.2 Alternative 2: In-Place Containment, Continued Submergence of Tailings within EM, and Limited Excavation/Disposal of Mine Materials at Proposed Facility within PMDA

Alternative 2 includes in-place containment of mine materials as the predominant approach with limited excavation and disposal of targeted mine materials at a proposed facility within the PMDA.

Limited excavation would be conducted to address highly acid-generating mine materials at headwaters of creek areas and other targeted areas. Targeted mine materials directly impact the headwaters of the South Fork Middle Creek and Upper Middle Creek and/or affecting stability of the EM. These areas include the east EM WRD, illegal dump area, the Formosa 1 adit and Formosa 3 adit WRDs, mine materials along the upper side slopes of the EM, and adit drainage affected soils. The total targeted volume of mine materials to be excavated for Alternative 2 is approximately 72,000 CY.

All excavated materials would be disposed of within a proposed facility located within the PMDA. The proposed facility within the PMDA would span primarily from the EM to the ore storage area and would have an approximate capacity of 60,000 to 80,000 CY, depending on the degree of potential development of onsite overburden and rock borrow source to the southwest of the EM area. Development of this area to obtain uncontaminated soil and rock for cover construction and reclamation would expand the available volume for consolidation of mine materials. The facility would include a geosynthetic multi-layer cover system placed over consolidated mine materials.

The proposed facility within the PMDA would contain the EM in place, including the former water and tailings storage pond. Tailings currently stored in the pond would continue to remain submerged under the newly-constructed geosynthetic multi-layer cover system. Submergence of tailings would continue to mitigate ARD generation, assuming the existing liner remains intact and holds water. Additional information on submergence is provided in Tables 4-1 and 4-2.

A combination of multi-layer geosynthetic covers, pavement covers, and exposure barriers would be implemented for remaining mine materials not targeted for excavation to mitigate unacceptable exposure risks to humans and reduce generation of ARD. Pavement covers would be constructed over mine materials within existing road alignments. Multi-layer geosynthetic covers would be constructed in areas of mine materials outside of the proposed facility and road alignments on level areas and shallow slopes (less than 3 horizontal to 1 vertical [3H:1V]). Both types of covers are capable of mitigating ARD generation as well as addressing human exposure to contaminants.

Exposure barriers would only be used on remaining mine materials with slopes steeper than 3H:1V. The mine material surface would be regraded, neutralized as needed to successfully establish exposure barriers to underlying mine materials, and covered with a vegetated or rock surface layer. The specific type of exposure barriers to be determined during the remedial design based on slopes and availability of sufficient quantities of suitable fill materials. Evaluation of geotechnical stability of regraded areas would be evaluated during the remedial design, which may indicate the need for retaining structures to stabilize mine materials left in place. These types of covers would address human exposure to contaminants but would have a minimal impact on mitigating ARD.

Excavated areas or areas disturbed during construction that do not have mine materials would be regraded and reclaimed with a rock armor or a vegetative layer, depending on the steepness of resulting slopes. Roads within the PMDA impacted by excavations would be reconstructed as necessary to restore access.

Administrative controls involve administrative, legal and/or informational, or physical measures intended to control or prevent present and future use or access to mine materials, and inform and warn of dangers associated with these materials. These controls would be implemented as needed to maintain integrity of the proposed disposal facility and containment areas and provide the public with community awareness tools to enhance awareness of potential hazards and the remedy for OU1. Monitoring would consist of visual inspections to document degree of protectiveness to human health and the environment and determine maintenance needs for the proposed facility and containment areas. Maintenance of the proposed disposal facility and containment areas would be performed as necessary to maintain protectiveness and integrity of the covers systems.

Five-year site reviews would be performed since mine materials under covers would remain at the PMDA with contaminant concentrations above PRGs. The contaminant concentrations above PRGs do not allow for unlimited use and unrestricted exposure under the current and potential future land uses.

5.3.3 Alternative 3: Limited In-Place Containment, Chemically Reduced Submergence of Tailings within EM, and Excavation/Disposal of Mine Materials at Proposed Facilities within and outside PMDA

Alternative 3 includes limited in-place containment of mine materials at the EM area, excavation of all other mine materials, and disposal of mine materials at proposed facilities within and outside the PMDA. Disposal of all excavated materials would take place at two proposed facilities: one within the PMDA as described in Alternative 2 and one outside of the PMDA at a location to be determined.

The proposed facility within the PMDA would contain the EM in place, including the former water and tailings storage pond. Chemically reduced submergence would be implemented for tailings within the former water and tailings storage pond by adding liquid organic reagents to enhance in situ biological treatment. Additional information on chemically reduced submergence is provided in Tables 4-1 and 4-2.

The proposed facility outside of the PMDA would be sized to contain the remainder of excavated mine materials (approximately 125,000 CY) and constructed to meet pertinent ARARs for the selected location.

Excavated areas or areas disturbed during completion of the remedy (including roads within the PMDA) would be restored or regraded and reclaimed, as described for Alternative 2.

Administrative controls, maintenance, and monitoring for the proposed disposal facilities would be performed as described for Alternative 2. However, additional maintenance requirements, such as leachate collection and treatment, may be needed for the proposed facility outside of the PMDA depending on the selected location and configuration. It is assumed that the collection and storage facilities for leachate are included under OU1. The FS does not include evaluation of subsequent leachate water management (i.e., treatment). It is assumed that subsequent management and disposal of leachate will take place under OU2 operations as it is difficult to make a facility-specific determination of leachate characteristics (i.e. quantity and quality).

Five-year site reviews would be performed since mine materials under covers would remain at the PMDA with contaminant concentrations above PRGs. The contaminant concentrations above PRGs do not allow for unlimited use and unrestricted exposure under the current and potential future land uses.

5.3.4 Alternative 4: Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facilities within and outside PMDA

Alternative 4 includes excavation and disposal of mine materials, including EM tailings, at proposed facilities within and outside the PMDA. Disposal of all excavated materials would take place at two proposed facilities: one within the PMDA and one outside of the PMDA as described for Alternative 3.

The tailings within the former water and tailings storage pond (approximately 19,000 CY) would be dewatered and treated by pozzolan- or cement-based stabilization /solidification before disposal. A treatment additive such as Portland cement or other types of stabilization agents would be added to bind the contaminants in the tailings and reduce their mobility from leaching.

Since the EM area will be excavated and disposed of rather than contained in place, the targeted disposal volume for the proposed facility within the PMDA would increase to 109,000 CY.

Excavated areas or areas disturbed during completion of the remedy (including roads within the PMDA) would be restored or regraded and reclaimed as described for Alternatives 2 and 3.

Administrative controls, maintenance, monitoring, and 5-year site reviews would be implemented as described for Alternative 3.

5.3.5 Alternative 5: Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Existing and Proposed Facilities within and outside PMDA

Alternative 5 includes excavation and disposal of all mine materials, including EM tailings, similar to Alternative 4. However, a portion of mine materials would be disposed of at an existing permitted facility located outside of the PMDA. Disposal of the majority of excavated materials would take place at two proposed facilities as described in Alternative 4, except that the size of the facility outside the PMDA would be smaller than for Alternative 4 (approximately 95,000 CY).

A portion of the mine materials (approximately 30,000 CY) would be transported and disposed of at one or more existing, permitted disposal facilities. The closest Subtitle D facility that will accept mine materials from OU1 is approximately 83 miles away. The closest Subtitle C facility that will accept mine materials from OU1 is approximately 350 miles away. Disposal at the Subtitle D facility is assumed for this alternative; however, as discussed in Section 3.1.6, it is assumed for the purpose of this FS that mine materials addressed under this alternative at a Subtitle D facility will require treatment before disposal.

Excavated areas or areas disturbed during completion of the remedy (including roads within the PMDA) would be restored or regraded and reclaimed as described for Alternative 2.

Administrative controls, maintenance, monitoring, and 5-year site reviews would be implemented as described for Alternative 4, except that maintenance and monitoring would not be required for the existing permitted disposal facilities that self-perform those activities.

5.3.6 Alternative 6: Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facility outside PMDA

Alternative 6 includes excavation of mine materials, including EM tailings, as described for Alternative 3 and disposal of all excavated material at a proposed facility outside the PMDA.

The tailings within the former water and tailings storage pond (approximately 19,000 CY) would be dewatered and treated as described for Alternative 4. Since the EM area will be excavated and disposed of rather than contained in place, the targeted disposal volume for the proposed facility outside of the PMDA would increase to 234,000 CY.

Excavated areas or areas disturbed during completion of the remedy (including roads within the PMDA) would be restored or regraded and reclaimed as described for Alternatives 2 and 3.

Administrative controls, maintenance, monitoring, and 5-year site reviews would be implemented as described for Alternative 3, except that 5-year site reviews would not be required for OU1 within the PMDA once mine materials with contaminant concentrations above PRGs are no longer present.

5.4 Screening Evaluation of Alternatives

The purpose of this screening evaluation is to evaluate whether a proposed remedial alternative will undergo the more thorough and extensive analysis presented in Section 7. The screening evaluation uses a smaller set of screening evaluation criteria than what is used for detailed analysis of retained alternatives after screening. Each of these proposed alternatives is screened using the short- and long-term aspects (where applicable) of three broad criteria: effectiveness, implementability, and cost.

5.4.1 Screening Criteria

This section presents a summary of the screening criteria utilized for the screening evaluation of alternatives.

5.4.1.1 Effectiveness

Effectiveness relates to the ability of the remedial alternative to satisfy screening evaluation criteria detailed in Exhibit 5-2.

Exhibit 5-2. Effectiveness Criteria

Effectiveness Criteria
Overall protection of human health and the environment[1]
Compliance with ARARs[1]
Short-term effectiveness (during the remedial construction and implementation period)
Long-term effectiveness and permanence (following remedial construction)
Reduction of toxicity, mobility, or volume through treatment

[1] These criteria are referred to as threshold criteria that an alternative must meet to be viable (except the no further action alternative); threshold criteria are described further in Section 6.

Effectiveness of each of the proposed alternatives is judged against the five effectiveness screening criteria using the qualitative ratings system in Exhibit 5-3.

Exhibit 5-3. Effectiveness Qualitative Ratings System

Effectiveness Ratings Categories	
⓿	None
❶	Low
❷	Low to moderate
❸	Moderate
❹	Moderate to high
❺	High

5.4.1.2 Implementability

Implementability relates to the ability of the remedial alternative to satisfy screening evaluation criteria detailed in Exhibit 5-4.

Exhibit 5-4. Implementability Criteria

Implementability Criteria	
Technical feasibility	Ability to construct, reliably operate, and meet technology-specific regulations for process options until a remedial action is complete
	Ability to operate, maintain, replace, and monitor technical components after the remedial action is complete
Administrative feasibility	Ability to obtain approvals from other agencies
	Availability and capacity of treatment, storage, and disposal services
	Availability of property, specific materials and equipment, and technical specialists required for a remedial action

Implementability of each of the proposed alternatives is judged against the screening criteria using the qualitative ratings system presented in Exhibit 5-5.

Exhibit 5-5. Implementability Qualitative Ratings System

Implementability Ratings Categories	
⓿	None
❶	Low
❷	Low to moderate
❸	Moderate
❹	Moderate to high
❺	High

A determination that an alternative is not technically feasible will usually preclude it from further consideration. Negative factors affecting administrative feasibility will normally involve coordination steps to lessen the negative aspects of the alternative but will not necessarily eliminate an alternative from consideration.

5.4.1.3 Cost

Cost estimates prepared for screening alternatives are typically comparative estimates with relative accuracy so that cost decisions among alternatives are sustained as the accuracy of cost estimates improves in the detailed analysis of alternatives. The procedures used to develop cost estimates for alternative screening are similar to those used for detailed analysis; the differences are in the degree of alternative refinement and cost component development.

The focus of comparative screening estimates is to identify and include items that are essential to the alternatives that control the magnitude of the overall cost. Cost estimates at this step of the FS process are generally determined using cost curves, generic unit costs, vendor information, conventional cost-estimating guides, and prior similar estimates modified by site-specific information rather than detailed cost estimates. Both capital and O&M costs are considered in these estimates. Present value analyses are performed to discount all costs to a common base year. This is performed to fairly evaluate expenditures occurring over different time frames.

The development of alternatives during the screening process is incomplete, because a detailed analysis of the alternative components (such as development of detailed quantities, detailed scoping of remedy components, etc.) has not been performed. Thus, the costs developed for the screening analysis of these proposed alternatives are not held to the accuracy required for the detailed analysis of alternatives (i.e., +50 percent to -30 percent of actual costs). Typical cost accuracy ranges for alternative screening are +100 percent to -50 percent of actual costs.

A simplified approach was developed for determining alternative screening costs; a more detailed evaluation of alternative costs is presented in conjunction with detailed analysis of alternatives (Section 7). The simplified approach for determining alternative screening costs involves identifying specific GRAs for mine materials that are fundamental cost drivers for the alternative in question and providing costs for these GRA remedy components. If these fundamental GRAs are included in the screening cost estimates, they should be within the accuracy range acceptable for these estimates without development of the secondary remedy components.

The specific GRAs identified as fundamental cost drivers for each alternative are listed below:

Alternative 1: Monitoring

Alternatives 2 through 6: Monitoring; administrative controls; containment; removal, transport, disposal; and treatment

It should be noted that GRA components identified for screening cost development purposes pertain only to mine materials. For instance, the GRA of transport is specifically for mine materials; transport of backfill required to construct covers or place excavation backfill are inherent to the GRAs of containment or removal rather than transport. Unit quantities (areas and volumes) required to develop costs for these items are presented in Appendix B.

The cost of each proposed alternative is rated on a comparative basis with other alternatives using a scale determined from the range of costs for the screened alternatives. Because of the likely alternative costs for the site, the cost ranges for the ratings categories are large. The cost rating categories are as follows in Exhibit 5-6.

Exhibit 5-6. Cost Qualitative Ratings System

Cost Ratings Categories		Cost Ranges (Present Value Dollars)
$	Low	Less than 4 million dollars
$$	Low to moderate	Between 4 million and 8 million dollars
$$$	Moderate	Between 8 million and 12 million dollars
$$$$	Moderate to high	Between 12 million and 16 million dollars
$$$$$	High	Greater than 16 million dollars

5.5 Summary of Alternatives Screening

Appendix C presents the evaluation and screening of each remedial alternative using the three screening criteria. This evaluation and screening process is inherently qualitative in nature (with the exception of approximate cost). The evaluation criteria described in Section 5.4 are specified by the NCP and EPA CERCLA guidance; however, the degree to which the criteria are weighted against each other is not specified. A determination of how the individual evaluation criteria influence the overall rankings is based on site-specific considerations and requires engineering judgment.

Remedial alternatives with similar scope and essential components would have overall rankings that are similar, unless other considerations such as large differences in waste volumes or differing construction durations exist between them. Factors that affect the threshold criteria (overall protection of human health and the environment and compliance with ARARs) are given considerable weight in the overall ranking for effectiveness since alternatives must meet these criteria to be selected as a remedy. Section 6 describes the threshold criteria in further detail.

Each alternative developed and described in Section 5.3 was evaluated to determine its overall effectiveness, implementability, and cost in Appendix C using the qualitative ratings system discussed in Section 5.4.

Exhibit 5-7 summarizes the results for the screening of alternatives for the site. The only remedial alternative eliminated from further consideration in this FS (indicated with blue shading) on Exhibit 5-7 is Alternative 5.

The remedial alternatives that were retained for detailed analysis are identified in Section 5.6. Alternative 5 was eliminated from further consideration, because it would pose additional short-term risks, would be complex to implement, and would have excessive costs relative to the other screened alternatives.

Exhibit 5-7. Summary of Alternatives Screening

Alt.	Description	Effectiveness	Implementability	Approximate Cost (Present Value Dollars)	
1	No Further Action	⓿	⓿	$	$100,000
2	In-Place Containment, Continued Submergence of Tailings within EM, and Limited Excavation/Disposal of Mine Materials at Proposed Facility within PMDA	❷	❹	$$	$5,640,000
3	Limited In-Place Containment, Chemically Reduced Submergence of Tailings within EM, and Excavation/Disposal of Mine Materials at Proposed Facilities within and outside PMDA	❸	❸	$$	$7,600,000
4	Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facilities within and outside PMDA	❹	❸	$$$$	$12,360,000
5	Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Existing and Proposed Facilities within and outside PMDA	❹	❷	$$$$$	$25,950,000
6	Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facility outside PMDA	❹	❸	$$$$	$13,280,000

Notes:

1. The alternatives screening process involves a qualitative assessment of the degree to which remedial alternatives meet the evaluation criteria presented in Appendix C. The numerical designations for the qualitative ratings system used in this table are not used to quantitatively assess remedial alternatives (for instance, rankings for a remedial alternative are not additive).
2. All remedial alternatives have been retained for detailed analysis in Section 7.
3. Screening cost backup information (screening cost estimate summaries and present value analyses) for each alternative are presented in Appendix D.

Legend for Qualitative Ratings System:

Effectiveness and Implementability

- ⓿ None
- ❶ Low
- ❷ Low to moderate
- ❸ Moderate
- ❹ Moderate to high
- ❺ High

Cost (Present Value Dollars)

- ⓿ None ($0)
- $ Low ($0 through $4M)
- $$ Low to moderate ($4M through $8M)
- $$$ Moderate ($8M through $12M)
- $$$$ Moderate to high ($12M through $16M)
- $$$$$ High (Greater than $16M)

5.6 Alternatives Retained for Detailed Analysis

Based on the screening of the alternatives, the following alternatives were retained for detailed analysis in Section 7:

- Alternative 1: No Further Action
- Alternative 2: In-Place Containment, Continued Submergence of Tailings within EM, and Limited Excavation/Disposal of Mine Materials at Proposed Facility within PMDA
- Alternative 3: Limited In-Place Containment, Chemically Reduced Submergence of Tailings within EM, and Excavation/Disposal of Mine Materials at Proposed Facilities within and outside PMDA
- Alternative 4: Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facilities within and outside PMDA
- Alternative 6: Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facility outside PMDA

Section 6

Definition of Criteria Used in the Detailed Analysis of Retained Alternatives

The remedial alternatives retained after completion of the alternative screening step of the FS process (summarized in Section 5) are further evaluated in Section 7 using the nine NCP alternative evaluation criteria. These criteria were developed to address statutory requirements and considerations for remedial actions in accordance with the NCP and additional technical and policy considerations that have proven to be important for selecting among remedial alternatives (EPA 1988). The following subsections describe the nine alternative evaluation criteria used in the detailed analysis of remedial alternatives and the priority in which the criteria are considered.

6.1 Overall Protection of Human Health and the Environment

Each alternative is assessed to determine whether it can provide appropriate protection of human health and the environment (short- and long-term) from unacceptable risks posed by hazardous substances, pollutants, or contaminants present at the site. Evaluation of this criterion focuses on how site risks are eliminated, reduced, or controlled through treatment, engineered controls, or institutional controls and whether an alternative poses any unacceptable cross-media impacts.

6.2 Compliance with ARARs

For this criterion, we evaluate each alternative to determine how ARARs identified in Appendix A of this document will be met.

If the assessment indicates an ARAR will not be met, then the basis for justifying one of the six ARAR waivers allowed under CERCLA is required to be discussed. These ARAR waivers are detailed in Exhibit 6-1.

Criteria Used to Evaluate Remedial Alternatives

- Protection of Human Health and Environment
- Compliance with ARARs
- Long-Term Effectiveness and Permanence
- Reduction of Toxicity, Mobility, or Volume through Treatment
- Short-Term Effectiveness
- Implementability
- Cost
- State Acceptance
- Community Acceptance

Exhibit 6-1. ARAR Waivers

Waiver	Description
Interim measures	The remedial action selected is only part of a total remedial action that will attain such level or standard of control when completed. (CERCLA §121(d)(4)(A))
Greater risk to health and the environment	Compliance with such requirement at the facility will result in greater risk to human health and the environment than alternative options. (CERCLA §121(d)(4)(B))
Technical impracticability	Compliance with such requirement is technically impracticable from an engineering perspective. (CERCLA §121(d)(4)(C))
Equivalent standard of performance	The remedial action selected will attain a standard of performance that is equivalent to that required under the otherwise applicable standard, requirement, criteria, or limitation through use of another method or approach. (CERCLA §121(d)(4)(D))
Inconsistent application of state requirements	With respect to a state standard, requirement, criteria, or limitation, the state has not consistently applied (or demonstrated the intention to consistently apply) the standard, requirement, criteria, or limitation in similar circumstances at other remedial actions. (CERCLA §121(d)(4)(E))
Fund balancing	In the case of a remedial action to be undertaken solely under Section 104 using the fund, selection of a remedial action that attains such level or standard of control will not provide a balance between the need for protection of public health and welfare and the environment at the facility under consideration and the availability of amounts from the fund to respond to other sites which present or may present a threat to public health or welfare or the environment, taking into consideration the relative immediacy of such threats. (CERCLA §121(d)(4)(F))

6.3 Long-Term Effectiveness and Permanence

Long-term effectiveness evaluates the likelihood that the remedy will be successful and the permanence that it affords. Factors to be considered, as appropriate, include the following:

- Magnitude of residual risk remaining from untreated waste or treatment residuals remaining at the conclusion of the remedial activities. The characteristics of the residuals are considered to the degree that they remain hazardous, taking into account their toxicity, mobility, or volume and propensity to bioaccumulate.

- Adequacy and reliability of controls that are used to manage treatment residuals and untreated waste remaining at the site. This factor includes an assessment of containment systems and institutional controls to determine if they are sufficient to ensure that any exposure to human and ecological receptors is within protective levels. This factor also addresses the long-term reliability of management controls for providing continued protection from residuals, the assessment of the potential need to replace technical components of the alternative, and the potential exposure pathways and risks posed should the remedial action need replacement.

6.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Each alternative is assessed for the degree to which it employs technology to permanently and significantly reduce toxicity, mobility, or volume, including how treatment is used to address the principal threats posed by the site. Factors to be considered, as appropriate, include the following:

- The treatment processes the alternatives use and materials they will treat

- The amount of hazardous substances, pollutants, or contaminants that will be destroyed or treated, including how the principal threat(s) will be addressed
- The degree of expected reduction in toxicity, mobility, or volume of the waste due to treatment
- The degree to which the treatment is irreversible
- The type and quantity of residuals that will remain following treatment, considering the persistence, toxicity, mobility, and propensity to bioaccumulate such hazardous substances and their constituents
- Whether the alternative would satisfy the statutory preference for treatment as a principal element of the remedial action

6.5 Short-Term Effectiveness

This criterion reviews the effects of each alternative during the construction and implementation phase of the remedial action until remedial response objectives are met. The short-term impacts of each alternative are assessed, considering the following factors, as appropriate:

- Short-term risks that might be posed to the community during implementation of an alternative
- Potential impacts on workers during remedial action and the effectiveness and reliability of protective measures
- Potential adverse environmental impacts resulting from construction and implementation of an alternative and the reliability of the available mitigation measures during implementation in preventing or reducing the potential impacts
- Time until protection is achieved

6.6 Implementability

The technical and administrative feasibility of implementing an alternative and the availability of various services and materials required during its implementation is evaluated under this criterion. The ease or difficulty of implementing each alternative will be assessed by considering the following factors detailed in Exhibit 6-2.

Exhibit 6-2. Implementability Factors to be Considered during Alternative Evaluation

Criterion	Factors to be Considered
Technical feasibility	▪ Technical difficulties and unknowns associated with the construction and operation of a technology ▪ Reliability of the technology, focusing on technical problems that will lead to schedule delays ▪ Ease of undertaking additional remedial actions, including what, if any, future remedial actions would be needed and the difficulty to implement additional remedial actions ▪ Ability to monitor the effectiveness of the remedy, including an evaluation of risks of exposure should monitoring be insufficient to detect a system failure
Administrative feasibility	▪ Activities needed to coordinate with other offices and agencies and the ability and time required to obtain any necessary approvals and permits from other agencies (for offsite actions)

Exhibit 6-2. Implementability Factors to be Considered during Alternative Evaluation (continued)

Criterion	Factors to be Considered
Availability of services and materials	▪ Availability of adequate offsite treatment, storage capacity, and disposal capacity and services ▪ Availability of necessary equipment and specialists and provisions to ensure any necessary additional resources ▪ Availability of services and materials plus the potential for obtaining competitive bids, which is particularly important for innovative technologies ▪ Availability of prospective technologies

6.7 Cost

Types of costs that are assessed during detailed analysis of each retained alternative include the following:

- Capital costs
- Annual O&M costs
- Periodic costs
- Present value of capital and annual O&M costs

Cost estimates are developed according to *A Guide to Developing and Documenting Cost Estimates during the Feasibility Study* (EPA 2000a). Flexibility is incorporated into each alternative for the location of remedial facilities, the selection of cleanup levels, and the period in which remedial action will be completed. Assumptions of the project scope and duration are defined for each alternative to provide cost estimates for the various remedial alternatives. Important assumptions specific to each alternative are summarized in the description of the alternative. Additional assumptions are included in the detailed cost estimates in Appendix F.

The levels of detail employed in making these estimates are conceptual but are considered appropriate for making choices between alternatives. The information provided in the cost estimate is based on the best available information regarding the anticipated scope of the remedial alternatives.

The costs are evaluated with respect to the following categories:

- Capital costs are expenditures that are required to construct a remedial action. They are exclusive of costs required to operate or maintain the action throughout its lifetime. Capital costs consist primarily of expenditures initially incurred to build or install the remedial action. Capital costs include all labor, equipment, and material costs (including contractor markups, such as overhead and profit) associated with activities, such as mobilization/demobilization, site work, installation of containment (cover) systems, and disposal facilities. Capital costs also include expenditures for professional/technical services that are necessary to support construction of the remedial action.

- Annual O&M costs are post-construction costs necessary to ensure or verify the continued effectiveness of a remedial action. These costs are estimated mostly on an annual basis. Annual O&M costs include all labor, equipment, and material costs (including contractor markups, such as overhead and profit) associated with activities, such as monitoring, operating and maintaining containment (cover) systems, and disposal facilities. Annual O&M costs also include expenditures for professional/technical services necessary to support O&M activities.

- Periodic costs are costs that occur only once every few years (e.g., 5-year site reviews and equipment replacement) or expenditures that occur only once during the entire O&M period or remedial time frame (e.g., site closeout and remedy failure/replacement). These costs may be either capital or O&M costs, but because of their periodic nature, it is more practical to consider them separately from other capital or O&M costs in the estimating process.

- The present value of each alternative provides the basis for the cost comparison. The present value cost represents the amount of money that, if invested in the initial year of the remedial action at a given rate, would provide the funds required to make future payments to cover all costs associated with the remedial action over its planned life. Future O&M and periodic costs are included and discounted (reduced) by the appropriate present value discount rate over the period of analysis selected for each alternative. Per guidance, inflation and depreciation are not considered in preparing the present value costs.

  As discussed in *A Guide to Developing and Documenting Cost Estimates during the Feasibility Study* (EPA 2000a), the real discount (interest) rate used for present value analysis in the FS depends on whether the site is classified as a Federal facility site. Federal facility sites are former or current installations operated or controlled by a Federal government agency and identified by EPA's Federal Facilities Restoration and Reuse Office (FFRRO). The Formosa Mine Superfund Site is not a Federal facility identified within FFRRO's site inventory. In addition, the guidance specifically mentions that although a Federal-lead site cleaned up by EPA using the Superfund trust fund (i.e. Fund-lead sites) may be an analogous situation to a Federal facility site being cleaned up using Superfund authority, there is always a chance that a potentially responsible party (PRP) could remediate the site. Thus, per guidance a real discount rate of 7 percent should be used in calculating present value costs for all non-Federal facility sites such as the Formosa Mine Superfund Site. A 7 percent real discount rate was used to develop present value costs for each retained alternative as presented in Appendix F.

  The alternatives retained for detailed analysis are primarily containment remedies and thus have indefinite project durations and likely require perpetual maintenance. The assumed period of analysis used to develop estimates of present value costs for each alternative is 30 years. The guidance indicates that site-specific justification should be provided when the project duration exceeds the selected period of present value analysis. Those justifications were provided in Exhibit 5-1 of Section 5.

  A "no-discounting" scenario is also included for the present value analysis of each alternative in Appendix F as recommended by the guidance for long-term projects (e.g., project duration exceeding 30 years). A non-discounted constant dollar cash flow over time demonstrates the impact of a discount rate on the total present value cost and the relative amounts of future annual expenditures. Non-discounted constant dollar costs are presented for comparison purposes only and should not be used in place of present value costs in the Superfund remedy selection process.

  A sensitivity analysis were performed and included in Appendix F for select retained alternatives analyzed in Section 7. A sensitivity analysis is recommended by the guidance to illustrate the impacts of changes to factors that have a relatively-high degree of uncertainty and that, with only a small change in their value, could significantly affect the overall cost of the alternative. Factors with inherent uncertainty for this project include lifespan of remedy components, project durations, and future economic conditions. Those factors are addressed in the sensitivity analysis (Appendix F) by varying the period of analyses and including large future year expenditures (e.g. remedy component replacement).

6.8 State Acceptance

This criterion evaluates the technical and administrative issues and concerns the state may have regarding each of the alternatives. Assessment of state concerns will be completed after comments on the FS and proposed plan are received by EPA and addressed in the ROD. Thus, state acceptance is not considered in the detailed analysis of alternatives presented in this FS.

6.9 Community Acceptance

Assessment of concerns from the public will be completed after comments on the FS and proposed plan are received by EPA and addressed in the ROD. Thus, community acceptance is not considered in the detailed analysis of alternatives presented in this FS.

6.10 Criteria Priorities

The nine NCP alternative evaluation criteria are separated into three groups to establish priority among these criteria during detailed analysis of the remedial alternatives as detailed in Exhibit 6-3.

Exhibit 6-3. Criteria Priorities

Group	Criteria	Definition
Threshold criteria	▪ Overall protection of human health and the environment ▪ Compliance with ARARs	Must be satisfied by the remedial alternative being considered as the preferred remedy
Balancing criteria	▪ Long-term effectiveness and permanence ▪ Reduction of toxicity, mobility, or volume through treatment ▪ Short-term effectiveness ▪ Implementability ▪ Cost	Technical criteria evaluated among those alternatives satisfying the threshold criteria
Modifying criteria	▪ State acceptance ▪ Community acceptance	Not evaluated in this FS; evaluated after comments received on the FS and PP

Section 7

Detailed Analyses of Retained Alternatives

7.1 Overview

This section presents the detailed analysis of the remedial alternatives retained in Section 5. During detailed analysis, each alternative is assessed using the two threshold criteria and five balancing criteria presented in Section 6. Analysis of each alternative against the threshold and balancing criteria is presented on tables within Appendix E. The results of the detailed analysis for each remedial alternative are then arrayed to perform a comparative analysis of the alternatives and identify the key tradeoffs between them.

The following alternatives were retained for detailed analysis in Section 7:

Alternative 1: No Further Action

Alternative 2: In-Place Containment, Continued Submergence of Tailings within EM, and Limited Excavation/Disposal of Mine Materials at Proposed Facility within PMDA

Alternative 3: Limited In-Place Containment, Chemically Reduced Submergence of Tailings within EM, and Excavation/Disposal of Mine Materials at Proposed Facilities within and outside PMDA

Alternative 4: Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facilities within and outside PMDA

Alternative 6: Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facility outside PMDA

7.2 Secondary Assumptions Affecting Detailed Analysis of Remedial Alternatives

Section 5 presents the fundamental assumptions for all remedial alternatives used during alternative development and screening. In addition, there are numerous secondary assumptions that affect the detailed analysis of alternatives, but are not fundamental controlling considerations and can vary between alternatives. Some of these secondary assumptions are grouped into distinct categories and include the items listed in Exhibit 7-1. Additional assumptions are provided as part of the detailed descriptions of alternatives provided in the remaining sections below. These detailed descriptions are provided as the basis for cost estimating as presented in this FS.

Exhibit 7-1. Secondary Assumptions Affecting Refinement and Detailed Analysis of Remedial Alternatives

Secondary Assumption Category	Secondary Assumption Description	Rationale
Transportation	Hydraulic Transport	Hydraulic transport will be retained for development of remedial alternatives specifically for transport of tailings materials, but not included with the cost estimates. Representative process option for the transport remedial technology is mechanical transport.
	Hauling Distance	The haul distance to proposed facility outside of PMDA is no more than 5 miles. Specific facility location(s) are not identified for the FS.
Treatment of Materials	Stabilization/Solidification	For alternatives that include excavation of the EM, tailings will be dewatered to the extent possible or necessary and treated with cement-based stabilization/solidification to provide geochemical stability and geotechnical stability (for compaction during consolidation). It is assumed that extracted water from tailings will be stored and disposed of as part of OU2 actions. Treatment of water is not evaluated in the FS or included in the cost estimates.
	Pre-treatment of Mine Materials	Based on the discussion in Section 3, mine materials are Bevill exempt and are excluded from pre-treatment prior to disposal (to meet LDRs). However, tailings will be pre-treated due to anticipated requirements of commercial facilities and the costs are included in Appendix F.
Geological Materials for Reclamation	Uncontaminated Overburden and Rock Borrow Sources	It is assumed that during expansion of the proposed facility site within PMDA, onsite overburden and rock borrow will be developed adjacent to the EM. The rock borrow source would provide the necessary rock for implementation of the alternatives; however, additional overburden sources would be required.
	Uncontaminated Subsoil and Topsoil Borrow Sources	Additional overburden resource will be developed near the site, at a haul distance of no more than 5 miles. Additional facilities other than the onsite source mentioned above are not identified specifically in the FS.
	Commercial Rock, Subsoil, and Topsoil Borrow Sources	It is assumed no commercial rock or soil sources will be required, except commercial sources of gravel for road areas may be required for road reconstruction.
	Organic Materials, Lime, and Fertilizer Amendment Materials	It is assumed that commercial sources of lime, organic matter, and fertilizer are locally available.
Proposed Facility Construction Assumptions	Proposed Facility Siting and Construction Requirements	The substantive requirements of OAR 340-095 are considered the minimum requirements for siting a disposal location and for the construction assumptions used for proposed facilities within or outside of the PMDA. The proposed facilities within and outside the PMDA are assumed to be considered "onsite" and are therefore not subject to the administrative requirements of OAR 340-095.
	Consolidation Volume at Proposed Facility within PMDA	The proposed consolidation volume at the facility within the PMDA is limited to the current available space; however, consolidation volume would be expanded based on development of overburden rock and borrow sources adjacent to the EM.

Exhibit 7-1. Secondary Assumptions Affecting Refinement and Detailed Analysis of Remedial Alternatives (continued)

Secondary Assumption Category	Secondary Assumption Description	Rationale
Proposed Facility Construction Assumptions (continued)	Maintenance of Proposed Facilities	Maintenance requirements for proposed facilities would be performed as necessary to maintain protectiveness and integrity of the covers systems and to manage leachate water. It is assumed that cover replacements will not be required, because preventative O&M of the covers will take place. It is assumed that the collection and storage facilities for leachate are included under OU1. The FS does not include evaluation of subsequent leachate water management (i.e., treatment). It is assumed that subsequent management and disposal of leachate will take place under OU2 operations as it is difficult to make a facility-specific determination of leachate characteristics (i.e. quantity and quality).
Cover and Reclamation Types Used for site Remediation	Neutralization	Neutralization may also be a component of reclamation activities and for vegetative cover systems in order to create soils that have adequate pH to sustain vegetation and to prevent wicking of contaminants from ARD-impacted surfaces into the overlying uncontaminated cover materials. This type of neutralization is not considered treatment, but as a component of other applicable process options.
	Modified ARD Generating Bedrock Outcrops	ARD-generating bedrock exists beneath mine materials that was previously altered by mining activities on the southeast side of the ore storage area. For alternatives that include full excavation, it is assumed that these modified ARD-generating bedrock surfaces will be covered with a combination of rock and soil cover exposure barriers. Blasting of rock surfaces (particularly at outcrops) may be necessary to provide adequate slope for cover and mitigate potential long-term erosion issues. Water diversions (i.e. riprap lined ditches) would be installed around bedrock outcrops to the degree technically implementable to mitigate exposure of runoff to modified ARD-generating bedrock surfaces.
Miscellaneous Assumptions	Former Water and Tailings Pond Use After Excavation	The former water and tailings storage pond was excavated mostly in bedrock. Alternative 6 includes a full removal of mine materials and disposal in proposed facility outside PMDA. This previously excavated bedrock surface will not be backfilled in anticipation that this area could be utilized as part of OU2 water management activities. Specific modifications to the excavated pond to enhance geotechnical stability and human protection would be evaluated during remedial design
	Retaining Structures	Retaining structures are included as part of remedial alternatives, but not included with the cost estimates. Geotechnical investigations would be conducted during the remedial design to determine if retaining structures along steep embankments are necessary to implement the remedy.

7.3 Alternative 1: No Further Action

7.3.1 Detailed Remedy Component Descriptions

Alternative 1 (No Further Action) is required by the NCP to provide an environmental baseline against which impacts of the various remedial alternatives can be compared. A summary of the remedial components of Alternative 1 is provided in Section 5.3.1. The following text provides additional detail about the remedial components of this alternative.

Alternative 1 would leave removal action activities previously performed in their current conditions. No new removal or remedial action activities would be initiated at OU1 to address migration of contaminants and MIW from mine materials or otherwise mitigate the associated risks to human health and the environment.

Mine materials within the PMDA would remain exposed to the environment with the propensity to generate ARD. Acid-generating mine materials on steep slopes adjacent to the headwaters of South Fork and Middle Creek would continue to allow migration of contaminants and MIW to those drainages. Adit diversion soils would continue to allow migration of MIW to surface water and groundwater.

The cover constructed over the EM would continue to erode and expose mine materials and allow infiltration of precipitation into the EM. Mine materials could become exposed at the surface and allow migration of MIW to surface water and groundwater. Tailings within the former water and tailings storage pond would continue to remain submerged in the short term, but changes in conditions within the EM could result in further discharge of contaminants and MIW to groundwater in the future.

The only actions that would be implemented for Alternative 1 are completion of 5-year site reviews as required by the NCP and monitoring (specifically non-intrusive visual inspections) only as required to support conclusions made in the 5-year site reviews.

7.3.2 Overall Protection of Human Health and the Environment

Evaluation of overall protection of human health and the environment for Alternative 1 is provided in Table E-1 (Appendix E) using the evaluation criteria considerations along with the qualitative rating for each and the justification for the rating. The overall rating on this criterion for Alternative 1 is "unacceptable." **-**

7.3.3 Compliance with ARARs

Evaluation of compliance with ARARs for Alternative 1 is provided in Table E-2 (Appendix E) using the evaluation criteria considerations along with the qualitative rating for each and the justification for the rating. ARARs evaluated for this alternative are included in Appendix A. The overall rating on this criterion for Alternative 1 is "unacceptable." **-**

7.3.4 Long-Term Effectiveness and Permanence

Evaluation of long-term effectiveness and permanence for Alternative 1 is provided in Table E-3 (Appendix E) using the evaluation criteria considerations along with the qualitative rating for each and the justification for the rating. The overall rating on this criterion for Alternative 1 is "none." ⓿

7.3.5 Reduction of Toxicity, Mobility, or Volume through Treatment

Evaluation of reduction of toxicity, mobility, or volume through treatment for Alternative 1 is provided in Table E-4 (Appendix E) using the evaluation criteria considerations along with the qualitative rating for each and the justification for the rating. The overall rating on this criterion for Alternative 1 is "none." ⓿

7.3.6 Short-Term Effectiveness

Evaluation of short-term effectiveness for Alternative 1 is provided in Table E-5 (Appendix E) using the evaluation criteria considerations along with the qualitative rating for each and the justification for the rating. The overall rating on this criterion for Alternative 1 is "none." ⓿

7.3.7 Implementability

Evaluation of implementability for Alternative 1 is provided in Table E-6 (Appendix E) using the evaluation criteria considerations along with the qualitative rating for each and the justification for the rating. The overall rating on this criterion for Alternative 1 is "none." ⓿

7.3.8 Cost

Evaluation of cost for Alternative 1 is provided in Table E-7 (Appendix E) using the evaluation criteria considerations along with the cost rating for each and the justification for the rating. Detailed cost estimates for this alternative are included in Appendix F. The overall rating on this criterion for Alternative 1 is "low." $

7.4 Alternative 2: In-Place Containment, Continued Submergence of Tailings within EM, and Limited Excavation/Disposal of Mine Materials at Proposed Facility within PMDA

7.4.1 Detailed Remedy Component Descriptions

A summary of the remedial components of Alternative 2 is provided in Section 5.3.2. The location of targeted areas for excavation and the location of the proposed repository within the PMDA for Alternative 2 are illustrated on Figure 7-1. The following text provides additional detail about the remedial components of this alternative.

Multi-layer Geosynthetic Covers, Exposure Barriers, and Pavement Covers

Alternative 2 includes regrading and covering in-place a large area of the mine materials using multi-layer geosynthetic covers, exposure barriers, and pavement covers to limit direct exposure of mine materials to potential receptors and provide a varying degree of mitigation of ARD. This alternative assumes multi- layer geosynthetic covers would be installed over mine materials to remain in place on level areas and shallow slopes (less than 3H:1V). A typical multi-layer geosynthetic cover is assumed to consist of a low permeability layer, drainage layer, barrier layer, and vegetative layer. The vegetative layer would be amended with organics, lime, and fertilizer and then seeded. Erosion control would be provided as necessary.

Where multi-layer geosynthetic covers may not be implementable, soil or rock exposure barriers may be used. Placement of different types of exposure barriers is dependent on site conditions and cover objectives. For soil barriers, the upper layer (growth media) would be amended with organics, lime, and fertilizer and then seeded. Rock barriers are assumed to be constructed of coarse rock generated from nearby borrow sources. Additional erosion control features would be provided as necessary to stabilize covered areas. Multi-layer geosynthetic covers or exposure barriers would cover approximately 11.8 acres of the PMDA. It is estimated that multi-layer geosynthetic covers can be installed on approximately 10 percent of the 11.8 acres. The remaining acreage would be covered with an appropriate exposure barrier.

The remedial design would include evaluation of topography and other factors within exposure barrier areas and determine the appropriate exposure barrier type. Soil barriers are common for mine site reclamation, but may have limited applicability on steep slopes of WRD areas to be covered because of geotechnical instability. However, innovative approaches may be considered during remedial design that can improve stability of a soil barrier, such as geonet or similar geotextiles. For these steeper WRDs, a rock exposure barrier may have better stability and permanence. In contrast, rock covers provide little mitigation of infiltration and subsequent reduction of ARD generation. Vegetative soil exposure barriers provide some degree of mitigation of ARD generation through evapotranspiration processes, as long as adequate measures are taken to ensure successful vegetative growth (e.g., lime amendment of subgrade mine materials and adequate nutrient amendment to growth media soils). However, the predominant factor that would limit ARD generation on vegetative soil exposure barriers on steep slopes is the propensity for runoff rather than infiltration. Within the slope toe areas of WRDs, vegetated soil exposure barriers would be preferred since many of these areas are currently heavily forested and may only contain a thin layer (e.g., 1 to 2 feet) of mine materials.

Borrow sources for exposure barrier materials, either rock or soil, are assumed to be available within nearby resources. For example, several potentially suitable areas along the Upper Middle Creek watershed could be developed for use as soil and rock materials. Additionally several areas of bedrock outcrops exist near the EM area, in particular a large area on the south side of the EM. This area could be developed by further cutting into the rock unit, while also expanding the flat area for consolidation of mine materials. This approach is discussed further below in relation to the proposed facility within the PMDA.

Existing roads in areas not targeted for excavation and outside of the proposed facility area within the PMDA would be covered with a pavement cover (approximately 2-acre area). These areas are assumed to be excavated to a depth of 1-foot below grade and then regraded as necessary to accommodate the thickness of a pavement cover. An aggregate gravel base is assumed to be installed, followed by an asphalt cover. Management of runoff from pavement cover areas would also be necessary and incorporated into the cover system. A combination of drainage channels/ditches and culverts may be implemented to route runoff from the paved areas and into runoff channels at selected areas along the road.

Excavation of Targeted Mine Materials

In addition to limited excavation along road areas to accommodate pavement cover, highly acid-generating mine materials at the headwaters of creek areas and other targeted areas would be excavated under Alternative 2. These areas include the east EM WRD, illegal dump area, the Formosa 1 and Formosa 3 adit WRDs, mine materials along the upper side slopes of the EM, and the adit drainage affected soils. These areas are targeted to remove the ARD generating mine materials that are causing direct runoff and/or seep-affected discharges to the creeks and to provide stabilization of the EM area to accommodate a proposed disposal facility for excavated mine materials. The targeted areas would be excavated to the depths of mine materials as shown on Figure 7-1.

The ARD-generating bedrock beneath mine materials that was previously altered by mining activities on the southeast side of the ore storage area and within a portion of the illegal dump area would be reshaped using blasting or other means, covered with rock or vegetative soil layer to the extent possible, and water diversions would be installed around these areas to mitigate exposure to stormwater.

Other excavated areas or areas disturbed during completion of the remedy would be regraded and covered with growth media layer or rock layer to stabilize steep slopes. Areas with growth media would be amended with organic matter, lime, and fertilizer as necessary and then seeded. Erosion control features such as silt fences, straw bales, erosion control blankets, and down logs/slash from clearing and grubbing would be installed. A tree planting program would be implemented in areas that have adequate soil materials (some areas would be excavated to bedrock); however, tree planting costs are not included in this FS.

Roads removed during excavation would be re-constructed using primarily native overburden and clean road gravel cover, except for areas of road where the pavement cover has been applied. Because native overburden is comprised of mine materials and these materials would be removed, the road may need to be installed above or below the existing grade. For Alternative 2, the only road areas that would be removed would be at the Formosa 1 adit WRD and along the EM area.

Continued Submergence of Tailings within EM

The proposed facility within the PMDA would contain the EM in place, including the former water and tailings storage pond. Tailings currently contained within the pond would continue to remain submerged under the newly-constructed geosynthetic multi-layer cover system to mitigate ARD generation, assuming the existing liner remains intact and holds water. However, during construction of the proposed facility within the PMDA, partial removal of the EM sides (including the upper portion of the pond liner) would be removed, because the ARD-generating fill used to create the berm would be unstable for construction of the proposed disposal facility within the PMDA. This would reduce the volume of contaminated waste rock/soil and mine tailings within the pond from approximately 25,000 CY to treatment of mine tailings between 12,000 and 18,000 CY. After excavation of these fill materials that support the upper portion of the pond liner, excavated mine materials from other areas can be disposed of within this area.

Proposed Facility within PMDA

The proposed facility within the PMDA would span primarily from the EM to the ore storage area and would have an approximate capacity of 60,000 to 80,000 CY, depending on the degree of potential development of onsite overburden and rock borrow source to the southwest of the EM area. The lower range of the approximate capacity of the proposed facility within the PMDA was calculated using an AutoCAD Civil 3D model, which calculates excavation cut and fill volumes of a regraded surface, given existing surface topography and horizontal boundary conditions. Potential grading of this facility is shown in Figure 7-2. The upper range of the approximate capacity includes the AutoCAD Civil 3D model and an estimate of available space should the area southwest of the EM be utilized as a rock borrow source. The additional 20,000 CY is assumed to be the approximate volume of material that could be placed at a 3H:1V side slope if the rock borrow source were excavated to the proposed base of the facility at the southwest side of the EM.

The proposed facility within the PMDA would be constructed with 3H:1V side slopes, contain a geosynthetic multi-layer cover system (including low permeability layer, drainage layer, barrier layer, and vegetative layer) over consolidated mine materials, and would include surface water run-on/runoff controls. Existing site roads would be removed in the EM and ore storage area to accommodate the disposal facility. Roads would be reclaimed to maintain current access routes in conjunction with the disposal facility construction, although alignments of new road areas may differ from the current alignments.

In addition, treatment approaches for stabilization of mine materials within the proposed facility could be evaluated during the remedial design to inhibit ARD generation within the consolidated material. An example is amendment of consolidated mine materials in bulk or in sections of the facility with organic materials such as biosolids or wood chips. These materials provide a food source for bacteria to help create a reduced environment and thereby minimize potential for ARD generation. However, these types of stabilization treatment approaches for mine materials are not evaluated in the FS.

Administrative Controls

Administrative controls would consist of institutional controls (governmental controls, proprietary controls, and informational devices), community awareness activities (information and educational programs), and access controls (fences and posted warnings). Administrative controls are administrative, legal, and/or informational, or physical measures intended to control or prevent present and future use or access to mine materials, inform, and warn of dangers associated with these materials, and to maintain integrity of the proposed disposal facility and containment areas. Administrative controls would be tailored for different components of the site. For example, fencing would be implemented around the proposed facility to restrict access to this area, whereas fencing may not be required at the top of reclaimed steep WRD slopes.

Institutional controls would consist of combination of governmental controls, proprietary controls, and/or informational devices that would be selected on an aerial basis depending on the ownership status and the degree of contamination present within an area. "Layering" of institutional controls may be required to enhance the overall protectiveness of institutional controls. Issuance and periodic review and update of a comprehensive institutional control plan likely would be required to keep track of the various institutional control measures taken within the site.

Community awareness activities include informational and educational programs to inform the public about site risks and the activities being performed to reduce these risks. Dissemination of this information could use electronic communication (e-mails and web site updates), printed communication (flyers, facts sheets, newspaper articles, or signs), and/or personal communication (public meetings or personal visits). Community awareness activities would be put in place throughout the remedial process, especially during implementation of remedial action and subsequent 5-year site reviews.

Access controls (specifically posted warnings) would be implemented primarily at the proposed facility within the PMDA. O&M would be required to maintain access controls damaged by weather or vandalism.

Monitoring

Five-year site reviews would be performed since mine materials under covers would remain at the PMDA with contaminant concentrations above PRGs. The contaminant concentrations above PRGs do not allow for unlimited use and unrestricted exposure under the current and potential future land uses. Non-intrusive visual inspections (i.e., surface inspections) would be performed in support of the 5-year site review. Monitoring would be performed at all locations with contamination above PRGs left in place within PMDA.

Remedial Component Quantity Summary

Exhibit 7-2 provides a summary of the major remedial components for Alternative 2 requiring construction and the estimated quantities for these components.

Exhibit 7-2. Summary of Remedial Components for Alternative 2

Remedial Component	Unit	Estimated Quantity
Mine materials to remain in-place	BCY	162,000
Mine materials to be excavated and consolidated at proposed facility within the PMDA	BCY	72,000
Surface area of excavations	Acres	6.80
Surface area of proposed repository within the PMDA	Acres	4.4
Surface area of exposure barriers	Acres	10.6
Surface area of multi-layer geosynthetic covers	Acres	1.2
Surface area of pavement covers	Acres	2.0

Notes: BCY = bank cubic yards PMDA = primary mine disturbance area

7.4.2 Overall Protection of Human Health and the Environment

Evaluation of overall protection of human health and the environment for Alternative 2 is provided in Table E-8 (Appendix E) using the evaluation criteria along with the qualitative rating for each and the justification for the rating. The overall rating on this criterion for Alternative 2 is "acceptable." **+**

7.4.3 Compliance with ARARs

Evaluation of compliance with ARARs for Alternative 2 is provided in Table E-9 (Appendix E) using the evaluation criteria considerations along with the qualitative rating for each and the justification for the rating. ARARs evaluated for this alternative are included in Appendix A. The overall rating on this criterion for Alternative 2 is "acceptable." **+**

7.4.4 Long-Term Effectiveness and Permanence

Evaluation of long-term effectiveness and permanence for Alternative 2 is provided in Table E-10 (Appendix E) using the evaluation criteria considerations along with the qualitative rating for each and the justification for the rating. The overall rating on this criterion for Alternative 2 is "low to moderate." ❷

7.4.5 Reduction of Toxicity, Mobility, or Volume through Treatment

Evaluation of reduction of toxicity, mobility, or volume through treatment for Alternative 2 is provided in Table E-11 (Appendix E) using the evaluation criteria considerations along with the qualitative rating for each and the justification for the rating. The overall rating on this criterion for Alternative 2 is "low." ❶

7.4.6 Short-Term Effectiveness

Evaluation of short-term effectiveness for Alternative 2 is provided in Table E-12 (Appendix E) using the evaluation criteria considerations along with the qualitative rating for each and the justification for the rating. The overall rating on this criterion for Alternative 2 is "moderate to high." ❸

7.4.7 Implementability

Evaluation of implementability for Alternative 2 is provided in Table E-13 (Appendix E) using the evaluation criteria considerations along with the qualitative rating for each and the justification for the rating. The overall rating on this criterion for Alternative 2 is "moderate to high." ❹

7.4.8 Cost

Evaluation of cost for Alternative 2 is provided in Table E-14 (Appendix E) using the evaluation criteria considerations along with the cost rating for each and the justification for the rating. Detailed cost estimates for this alternative are included in Appendix F. The overall rating on this criterion for Alternative 2 is "low to moderate." $$

7.5 Alternative 3: Limited In-Place Containment, Chemically Reduced Submergence of Tailings within EM, and Excavation/Disposal of Mine Materials at Proposed Facilities within and outside PMDA

7.5.1 Detailed Remedy Component Descriptions

A summary of the remedial components of Alternative 3 is provided in Section 5.3.3. The location of targeted areas for excavation and the location of the proposed repository within the PMDA for Alternative 3 are illustrated on Figure 7-3. The following text provides additional detail about the remedial components of this alternative.

Excavation of Mine Materials

All mine materials within the PMDA, including adit drainage affected soil, would be excavated and disposed except for those materials within the EM as part of Alternative 3. These areas would be excavated to the depths of mine materials as shown on Figure 7-3 and disposed of within a proposed facility located within the PMDA and a proposed facility outside of the PMDA. Mine materials along the upper side slopes of the EM and material within the east EM WRD would be placed within the proposed facility within the PMDA due to proximity to the proposed facility site. Other mine materials within the surrounding area of the EM would be placed within the proposed facility within the PMDA (approximately 29,000 CY) until the capacity of the facility within the PMDA is reached. All remaining materials, including material from the Silver Butte 1 adit WRD, Formosa 1 and Formosa 3 adit WRDs, and the adit drainage affected soil, would be placed in the proposed facility outside of the PMDA.

ARD-generating bedrock beneath mine materials that was previously altered by mining activities on the southeast side of the ore storage area on the southeast side of the ore storage area and within a portion of the illegal dump area would be excavated and restored as described for Alternative 2.

Similar to Alternative 2, excavated areas or areas disturbed during completion of the remedy would be regraded and covered with growth media layer or rock layer to stabilize steep slopes. Areas with growth media would be amended with organic matter, lime, and fertilizer as necessary and then seeded. Erosion control features such as silt fences, straw bales, erosion control blankets, and down logs/slash from clearing and grubbing would be installed. A tree planting program would be implemented in areas that have adequate soil materials (some areas would be excavated to bedrock); however, tree planting costs are not included in this FS.

Roads removed during excavation would be reconstructed using primarily clean road gravel cover. For Alternative 3, roads would be removed across the site during excavation and restored or regraded upon restoration completion. The roads would be reclaimed at new alignments which would not impact reclaimed areas.

Treatment of Tailings

Chemically reduced submergence would be applied to the tailings currently contained within the former water and tailings storage pond by adding liquid organic reagents to enhance in situ biological treatment within the existing cover system. This approach would mitigate ARD generation, assuming the existing liner remains intact and holds water. Chemically reduce submergence within the EM would promote the precipitation of dissolved COPCs as solid-phase sulfide minerals as long as saturated conditions are maintained within the EM. Excavation of the sides of the EM and upper portion of the pond liner would be conducted as described for Alternative 2.

Proposed Facility within PMDA

The proposed facility within the PMDA would be constructed as described for Alternative 2.

Proposed Facility outside PMDA

The proposed facility outside the PMDA would be located between approximately 1 to 5 miles (haul distance) from the PMDA and would have an approximate capacity of 125,000 CY. Preliminary evaluation of potential disposal facilities has been conducted for the FS in order to provide a basis for the assumed haulage distance. Several possible areas have been identified based on position outside of stream areas, accessibility from existing roads, and moderate sloped areas (3H:1V or less) in which mine materials can be adequately backfilled and graded to provide stable slopes and cover system. During ROD preparation and/or during the remedial design, full evaluation of repository sites would be conducted. This process would be conducted in accordance with the siting requirements (substantive) in OAR 340-095. In addition, pending determination of whether the facility is constructed onsite or offsite, the administrative requirements of OAR 340-095 would also apply.

The repository area would be cleared and grubbed as necessary and existing overburden removed to bedrock for mine material consolidation. Overburden would be processed (screened and amended) to create materials for the cover system construction. Additional soil and rock materials may be required from other near-site borrow areas.

Although the location and configuration of the repository is unknown at this time, it was assumed that a liner and leachate collection system would be installed at the bottom of the repository to protect groundwater and surface water by collecting leachate from the overlying mine materials. The liner and leachate collection system construction would be determined during remedial design in accordance with OAR 340-095. The leachate collection system would drain to a central leachate collection point such as a detention basin or treatment system. The remedial design would evaluate the necessity and approach for leachate collection treatment; however, treatment approaches for leachate are not included in this FS. It was assumed that subsequent management and disposal of leachate will take place under OU2 operations as it is difficult to make a facility-specific determination of Leachate characteristics (i.e. quantity and quality).

As discussed in Section 7.4.1, treatment approaches for stabilization of mine materials such as organic material amendment may be evaluated during the remedial design for the proposed facility outside the PMDA. However, these types of treatment approaches are not evaluated in the FS. Consolidation of excavated mine materials would be conducted to create stable side slopes and geomorphic shapes that promote runoff. The facility would be constructed with 3H:1V side slopes, contain a geosynthetic multi-layer cover system (including low permeability layer, drainage layer, barrier layer, and vegetative layer) over consolidated mine materials, and would include surface water run-on/runoff controls. Since this facility would be constructed on an existing sloped area, runon channels at the upper end of the facility would be necessary which would route stormwater around the repository. Runoff channels would also be constructed at the slope toe of the repository area, along with potential for bench/runoff channels space along the long axis of the repository slope. Exact configurations of runon and runoff controls would be evaluated during the remedial design.

Administrative Controls

In addition to administrative controls described for Alternative 2, access controls such as fencing would be applied to the proposed facility outside of the PMDA.

Monitoring

Monitoring would be performed as described for Alternative 2, as well as the addition of monitoring of covers and leachate collection systems at the proposed facility.

Remedial Component Quantity Summary

Exhibit 7-3 provides a summary of the major remedial components for Alternative 3 requiring construction and the estimated quantities for these components.

Exhibit 7-3. Summary of Remedial Components for Alternative 3

Remedial Component	Unit	Estimated Quantity
Mine materials to remain in-place	BCY	40,000
Mine materials to be excavated and consolidated at proposed facility within the PMDA	BCY	69,000
Mine materials to be excavated and consolidated at proposed facility outside the PMDA	BCY	125,000
Volume of tailings to be treated with chemical submergence	BCY	19,000
Surface area of proposed repository within the PMDA	Acres	4.4
Surface area of proposed repository outside of the PMDA	Acres	3.5
Surface area of excavations	Acres	24.9

Notes: BCY = bank cubic yards PMDA = primary mine disturbance area

7.5.2 Overall Protection of Human Health and the Environment

Evaluation of overall protection of human health and the environment for Alternative 3 is provided in Table E-15 (Appendix E) using the evaluation criteria along with the qualitative rating for each and the justification for the rating. The overall rating on this criterion for Alternative 3 is “acceptable.” **+**

7.5.3 Compliance with ARARs

Evaluation of compliance with ARARs for Alternative 3 is provided in Table E-16 (Appendix E) using the evaluation criteria considerations along with the qualitative rating for each and the justification for the rating. ARARs evaluated for this alternative are included in Appendix A. The overall rating on this criterion for Alternative 3 is “acceptable.” **+**

7.5.4 Long-Term Effectiveness and Permanence

Evaluation of long-term effectiveness and permanence for Alternative 3 is provided in Table E-17 (Appendix E) using the evaluation criteria considerations along with the qualitative rating for each and the justification for the rating. The overall rating on this criterion for Alternative 3 is “moderate.” ❸

7.5.5 Reduction of Toxicity, Mobility, or Volume through Treatment

Evaluation of reduction of toxicity, mobility, or volume through treatment for Alternative 3 is provided in Table E-18 (Appendix E) using the evaluation criteria considerations along with the qualitative rating for each and the justification for the rating. The overall rating on this criterion for Alternative 3 is “low to moderate.” ❷

7.5.6 Short-Term Effectiveness

Evaluation of short-term effectiveness for Alternative 3 is provided in Table E-19 (Appendix E) using the evaluation criteria considerations along with the qualitative rating for each and the justification for the rating. The overall rating on this criterion for Alternative 3 is “moderate.” ❸

7.5.7 Implementability

Evaluation of implementability for Alternative 3 is provided in Table E-20 (Appendix E) using the evaluation criteria considerations along with the qualitative rating for each and the justification for the rating. The overall rating on this criterion for Alternative 3 is “moderate.” ❸

7.5.8 Cost

Evaluation of cost for Alternative 3 is provided in Table E-21 (Appendix E) using the evaluation criteria considerations along with the cost rating for each and the justification for the rating. Detailed cost estimates for this alternative are included in Appendix F. The overall rating on this criterion for Alternative 3 is “low to moderate.” $$

7.6 Alternative 4: Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facilities within and outside PMDA

7.6.1 Detailed Remedy Component Descriptions

A summary of the remedial components of Alternative 4 is provided in Section 5.3.4. The location of targeted areas for excavation and the location of the proposed repository within the PMDA for Alternative 4 are illustrated on Figure 7-4. The following text provides additional detail about the remedial components of this alternative.

Treatment of Tailings

The tailings within the EM, approximately 19,000 CY, would be removed and treated by pozzolan- or cement-based stabilization/solidification. This approach would reduce the ARD generating potential and improve transportation and compaction of tailings. However, treatment of tailings with cement would increase the volume of materials necessary for disposal, thereby increasing the size requirement for disposal facilities. Treated tailings material would be disposed within the proposed facility within the PMDA. Prior to treatment of tailings, the pore water present within the EM will be removed to the extent possible via extraction or other methods. Water would be disposed as part of OU2 actions.

Excavation of Contaminated Materials

All mine materials within the PMDA, including the materials within the EM, would be removed as part of Alternative 4. These areas would be excavated to the depths of mine materials as shown on Figure 7-4. Excavated materials would then be disposed of within a proposed facility located within the PMDA and a proposed facility outside of the PMDA. Mine materials would be distributed between the proposed facilities within and outside of the PMDA as described for Alternative 3, with the addition that excavated and treated materials from the EM would be disposed within the proposed facility within the PMDA.

Reclamation of modified ARD-generating bedrock areas on the southeast side of the ore storage area, other excavated areas, and road areas would be completed as described for Alternative 3.

Proposed Facility within PMDA

The proposed facility within the PMDA would be performed as described for Alternative 3, but since the EM area would also be removed and disposed rather than contained in-place, the targeted disposal volume within the PMDA would increase to 109,000 CY versus Alternatives 2 and 3 (only targeted at 69,000 CY).

Proposed Facility outside PMDA

The proposed facility outside the PMDA would be performed as described for Alternative 3.

Administrative Controls

Administrative controls would be performed as described for Alternative 3.

Monitoring

Monitoring would be performed as described for Alternative 3.

Remedial Component Quantity Summary

Exhibit 7-4 provides a summary of the major remedial components for Alternative 4 requiring construction and the estimated quantities for these components.

Exhibit 7-4. Summary of Remedial Components for Alternative 4

Remedial Component	Unit	Estimated Quantity
Mine materials to be excavated and consolidated at proposed facility within the PMDA	BCY	109,000
Mine materials to be excavated and consolidated at proposed facility outside the PMDA	BCY	125,000
Volume of tailings to be treated with pozzolan- or cement-based solidification/stabilization	BCY	19,000
Estimated volume of water to be removed from EM during tailings removal	GAL	632,000
Surface area of proposed repository within the PMDA	Acres	4.4
Surface area of proposed repository outside of the PMDA	Acres	3.5
Surface area of excavations	Acres	24.9

Notes: BCY = bank cubic yards PMDA = primary mine disturbance area GAL = gallons

7.6.2 Overall Protection of Human Health and the Environment

Evaluation of overall protection of human health and the environment for Alternative 4 is provided in Table E-22 (Appendix E) using the evaluation criteria along with the qualitative rating for each and the justification for the rating. The overall rating on this criterion for Alternative 4 is "acceptable." **+**

7.6.3 Compliance with ARARs

Evaluation of compliance with ARARs for Alternative 4 is provided in Table E-23 (Appendix E) using the evaluation criteria considerations along with the qualitative rating for each and the justification for the rating. ARARs evaluated for this alternative are included in Appendix A. The overall rating on this criterion for Alternative 4 is "acceptable." **+**

7.6.4 Long-Term Effectiveness and Permanence

Evaluation of long-term effectiveness and permanence for Alternative 4 is provided in Table E-24 (Appendix E) using the evaluation criteria considerations along with the qualitative rating for each and the justification for the rating. The overall rating on this criterion for Alternative 4 is "moderate." ❸

7.6.5 Reduction of Toxicity, Mobility, or Volume through Treatment

Evaluation of reduction of toxicity, mobility, or volume through treatment for Alternative 4 is provided in Table E-25 (Appendix E) using the evaluation criteria considerations along with the qualitative rating for each and the justification for the rating. The overall rating on this criterion for Alternative 4 is "moderate." ❸

7.6.6 Short-Term Effectiveness

Evaluation of short-term effectiveness for Alternative 4 is provided in Table E-26 (Appendix E) using the evaluation criteria considerations along with the qualitative rating for each and the justification for the rating. The overall rating on this criterion for Alternative 4 is "moderate." ❸

7.6.7 Implementability

Evaluation of implementability for Alternative 4 is provided in Table E-27 (Appendix E) using the evaluation criteria considerations along with the qualitative rating for each and the justification for the rating. The overall rating on this criterion for Alternative 4 is "moderate." ❸

7.6.8 Cost

Evaluation of cost for Alternative 4 is provided in Table E-28 (Appendix E) using the evaluation criteria considerations along with the cost rating for each and the justification for the rating. Detailed cost estimates for this alternative are included in Appendix F. The overall rating on this criterion for Alternative 4 is "moderate." $$$

7.7 Alternative 6: Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facility outside PMDA

7.7.1 Detailed Remedy Component Descriptions

A summary of the remedial components of Alternative 6 is provided in Section 5.3.6. The location of targeted areas for excavation and the location of the proposed repository within the PMDA for Alternative 6 are illustrated on Figure 7-5. The following text provides additional detail about the remedial components of this alternative.

Treatment of Contaminated Tailings

Treatment of contaminated tailings would be performed as described for Alternative 4.

Excavation of Contaminated Materials

Excavation of mine materials would be performed as described for Alternative 4, except that all excavated materials would be disposed of in the proposed facility outside of the PMDA. The excavation areas would be excavated to the depths of contaminated mine materials as shown on Figure 7-5.

Reclamation of modified ARD-generating bedrock areas on the southeast side of the ore storage area, other excavated areas, and road areas would be completed as described for Alternative 4.

Proposed Facility outside PMDA

The proposed facility outside the PMDA would be constructed as described for Alternatives 3 and 4, except that the size of the facility would be increased to accommodate all of the excavated mine materials (234,000 CY).

Administrative Controls

Administrative controls would be performed as described for Alternative 4.

Monitoring

Monitoring of covers and leachate collection system would be performed at the proposed facility; however, 5-year site review would not be required for OU1 within the PMDA once mine materials with contaminant concentrations above PRGs are no longer present.

Remedial Component Quantity Summary

Exhibit 7-5 provides a summary of the major remedial components for Alternative 6 requiring construction and the estimated quantities for these components.

Exhibit 7-5. Summary of Remedial Components for Alternative 6

Remedial Component	Unit	Estimated Quantity
Mine materials to be excavated and consolidated at proposed facility outside the PMDA	BCY	234,000
Volume of tailings to be treated with pozzolan- or cement-based solidification/stabilization	BCY	19,000
Estimated volume of water to be removed from EM during tailings removal	GAL	632,000
Surface area of proposed repository outside of the PMDA	Acres	5.4
Surface area of excavations	Acres	24.9

Notes: BCY = bank cubic yards PMDA = primary mine disturbance area GAL = gallons

7.7.2 Overall Protection of Human Health and the Environment

Evaluation of overall protection of human health and the environment for Alternative 6 is provided in Table E-29 (Appendix E) using the evaluation criteria along with the qualitative rating for each and the justification for the rating. The overall rating on this criterion for Alternative 6 is “acceptable.” **+**

7.7.3 Compliance with ARARs

Evaluation of compliance with ARARs for Alternative 6 is provided in Table E-30 (Appendix E) using the evaluation criteria considerations along with the qualitative rating for each and the justification for the rating. ARARs evaluated for this alternative are included in Appendix A. The overall rating on this criterion for Alternative 6 is “acceptable.” **+**

7.7.4 Long-Term Effectiveness and Permanence

Evaluation of long-term effectiveness and permanence for Alternative 6 is provided in Table E-31 (Appendix E) using the evaluation criteria considerations along with the qualitative rating for each and the justification for the rating. The overall rating on this criterion for Alternative 6 is “moderate to high.” ❹

7.7.5 Reduction of Toxicity, Mobility, or Volume through Treatment

Evaluation of reduction of toxicity, mobility, or volume through treatment for Alternative 6 is provided in Table E-32 (Appendix E) using the evaluation criteria considerations along with the qualitative rating for each and the justification for the rating. The overall rating on this criterion for Alternative 6 is “moderate.” ❸

7.7.6 Short-Term Effectiveness

Evaluation of short-term effectiveness for Alternative 6 is provided in Table E-33 (Appendix E) using the evaluation criteria considerations along with the qualitative rating for each and the justification for the rating. The overall rating on this criterion for Alternative 6 is “low to moderate.” ❷

7.7.7 Implementability

Evaluation of implementability for Alternative 6 is provided in Table E-34 (Appendix E) using the evaluation criteria considerations along with the qualitative rating for each and the justification for the rating. The overall rating on this criterion for Alternative 6 is "moderate." ❸

7.7.8 Cost

Evaluation of cost for Alternative 6 is provided in Table E-35 (Appendix E) using the evaluation criteria considerations along with the cost rating for each and the justification for the rating. Detailed cost estimates for this alternative are included in Appendix F. The overall rating on this criterion for Alternative 6 is "moderate." $$$

7.8 State (Support Agency) Acceptance

State (support agency) acceptance is a modifying criterion under the NCP. Assessment of the state acceptance will not be completed until comments on the final FS report are submitted to EPA. Thus, state acceptance is not considered in the detailed analysis of alternatives presented in the FS.

7.9 Community Acceptance

Community acceptance is also a modifying criterion under the NCP. Assessment of community acceptance will include responses to questions that any interested person in the community may have regarding any component of the remedial alternatives presented in the proposed plan. This assessment will be completed after EPA receives public comments on the proposed plan during the public commenting period. Thus, community acceptance is not considered in the detailed analysis of alternatives presented in the FS.

7.10 Comparative Analysis of Alternatives

This FS evaluated the five retained remedial alternatives discussed in this section against the two threshold criteria and five balancing criteria. The results of the detailed analysis for each remedial alternative are presented in Exhibit 7-6 to allow a comparative analysis of the alternatives and identify the key tradeoffs between them. Comparative analysis for the remedial alternatives using the threshold and balancing criteria has been put into narrative form in the following subsections. Only significant comparative differences between alternatives are presented; the full set of rationale for the qualitative ratings is provided in Appendix E.

7.10.1 Overall Protection of Human Health and the Environment

Of the five retained alternatives, only the no further action alternative (i.e., Alternative 1) would fail to provide protection for human health and the environment and would not address the PRAOs for OU1. Thus, Alternative 1 was given a rating of unacceptable. Alternatives 2, 3, 4, and 6 were giving a rating of acceptable.

Alternative 2 addresses the PRAOs primarily through in place containment of mine materials as the predominant approach with limited excavation and disposal of targeted mine materials at a proposed facility within the PMDA. Tailings stored in the EM remain submerged in the former water and tailings storage pond under a newly-constructed geosynthetic multi-layer cover system. In-place containment using covers would provide a barrier that eliminates exposure of human receptors to arsenic in mine materials posing unacceptable cancer risks and reduce generation of ARD. However, mine materials still remain beneath covers across a large extent of the site and could pose risks and generate ARD if the covers are compromised.

Alternative 3 addresses the PRAOs primarily through excavation of mine materials and disposal of mine materials at proposed facilities within and outside the PMDA, limited in place containment of mine materials at the EM area, and implementation of chemically reduced submergence for tailings within the former water and tailings storage pond. Excavation of mine materials and disposal in proposed disposal facilities within and outside the PMDA would provide a barrier that eliminates exposure of human receptors to arsenic in mine materials in the EM posing unacceptable cancer risks and reduces generation of ARD. Tailings stored in the EM would be contained in-place under a newly-constructed geosynthetic multi-layer cover system, and chemically reduced submergence of the tailings in the former water and tailings storage pond would provide further protection from generation of ARD and MIW migration to groundwater. Although mine materials would be managed beneath covers, they could pose risks and generate ARD if the covers are compromised.

Alternative 4 addresses the PRAOs primarily through excavation of mine materials, stabilization/solidification of tailings, and disposal at proposed facilities within and outside the PMDA. Excavation of mine materials and disposal in proposed disposal facilities within and outside the PMDA would provide a barrier that eliminates exposure of human receptors to arsenic in mine materials in the EM posing unacceptable cancer risks and reduces generation of ARD. Tailings stored in the EM would be excavated and treated using stabilization/solidification prior to disposal which would provide further protection from generation of ARD and MIW migration to groundwater. Although mine materials would be managed beneath covers, they could pose risks and generate ARD if the covers are compromised.

Alternative 6 addresses the PRAOs primarily through excavation of mine materials, stabilization/solidification of tailings, and disposal at proposed facility outside the PMDA. Alternative 6 would provide similar protection of human health and the environment as Alternative 4 except that mine materials would be completely excavated at OU1 and placed at a proposed facility outside of the PMDA.

7.10.2 Compliance with ARARs

Alternative 1 fails to be compliant with the chemical-specific ARARs identified for the site (specifically OAR 340-122) since no further action is taken and unacceptable cancer risk levels for arsenic would remain in mine materials. Thus, this alternative was given a rating of unacceptable.

Alternatives 2, 3, 4, and 6 were given acceptable ratings under the assumption that in-place containment or excavation and disposal of mine materials in proposed facilities would be in compliance with chemical-specific ARARs such as OAR 340-122. Location- and action-specific ARARs would be addressed during excavation and transport of mine materials and in selection and construction of proposed facilities for disposal of mine materials.

7.10.3 Long-Term Effectiveness and Permanence

Alternative 1 fails to provide long-term effectiveness and permanence since no further action is taken and the previously performed reclamation activities were inadequate to address the PRAOs identified for OU1. Thus, this alternative was given a rating of "none."

Alternative 2 provides long-term effectiveness and permanence primarily through in place containment of mine materials with limited excavation and disposal of targeted mine materials at a proposed facility within the PMDA. With proper construction the covers would limit direct exposure to mine materials by humans, provide a reduction in infiltration, and mitigate ARD generation and MIW migration. However, mine materials still remain beneath covers across a large extent of OU1 and could pose risks if the covers are compromised. Because mine materials would remain in place on steep slopes, long-term effectiveness and permanence is not as certain as for alternatives that excavate contaminated mine materials and dispose of them in proposed facilities constructed with shallower slopes. Thus, this alternative was given a rating of "low to moderate."

Alternative 3 provides long-term effectiveness and permanence primarily through excavation and disposal at proposed facilities within and outside PMDA. Excavation and disposal outside of PMDA increases the long-term effectiveness and permanence of the alternative because mine materials are relocated and placed within proposed disposal facilities constructed with shallower slopes than are currently present. The proposed facility outside of the PMDA include bottom liners as well as cover liners which would increase the isolation of the mine materials. Although mine materials are left in place at the EM area under Alternative 3, exposure to these materials would be addressed through in place containment. The proposed facility within the PMDA would contain the EM in place, including the former water and tailings storage pond. Chemically reduced submergence would be implemented for tailings within the former water and tailings storage pond to enhance biological treatment and reduce generation of ARD and migration of MIW. Thus, Alternative 3 was given a rating of "moderate."

Alternatives 4 and 6 provide long-term effectiveness and permanence primarily through excavation and disposal of all mine materials at proposed facilities within and outside PMDA as described for Alternative 3. The tailings within the former water and tailings storage pond would be dewatered and treated by pozzolan- or cement-based stabilization/solidification prior to disposal. Excavation and disposal of mine materials in the EM area along with additional treatment of tailings increases the long term effectiveness and permanence of the remedy compared to remedies without additional treatment due to which would provide further protection from generation of ARD and MIW migration to groundwater when treated tailings are disposed of at the proposed facilities. Administrative controls are included in each alternative to further limit future human receptor exposure to mine materials.

Excavated mine materials would be disposed at the proposed facilities within and outside of PMDA under Alternative 4. Thus, Alternative 4 was given a rating of "moderate." Alternative 6 has a greater potential for long-term effectiveness and permanence than Alternatives 2, 3, and 4, because all mine materials would be disposed of at a proposed facility outside the PMDA. The proposed facility outside the PMDA could be designed to be fully contained and capable of collecting leachate for treatment, and sited at a more environmentally-favorable location than the PMDA to enhance permanence. The use of one disposal facility outside of the PMDA, coupled with the removal of all mine materials from the PMDA, would also increase long-term effectiveness by decreasing the environmental footprint (measured by surface area) of mine materials as compared to Alternative 4. Thus, Alternative 6 was given a rating of "moderate to high."

7.10.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative 1 fails to provide a reduction of toxicity, mobility, or volume through treatment since additional treatment of mine materials is not a component of this alternative. Thus, Alternative 1 was given a rating of "none."

Alternatives 2, 3, 4, and 6 provide reduction in toxicity, mobility, and volume through treatment of tailings. Under Alternative 2, tailings currently contained within the former water and tailings storage pond would continue to be submerged under the newly-constructed cover system to mitigate ARD generation, assuming the existing liner remains intact and holds water. However, the tailings are a relatively small percentage of the volume of mine materials existing at OU1. Thus, Alternative 2 was giving a rating "low".

Under Alternative 3, tailings currently contained within the former water and tailings storage pond would continue to be submerged under the newly-constructed cover system to mitigate ARD generation, assuming the existing liner remains intact and holds water. Chemically reduced submergence may provide a further reduction of toxicity and mobility of contaminants from the tailings. However, the tailings are a relatively small percentage of the volume of mine materials existing at OU1. Thus, Alternative 3 was giving a rating "low to moderate".

Under Alternatives 4 and 6, tailings would by treated by stabilization/solidification prior to disposal. Treatment would provide additional protection to groundwater from generation of ARD and migration of MIW from pyrite-rich tailings. However, the tailings are a relatively small percentage of the volume of mine materials existing at OU1. Thus, this alternative was given a rating of "moderate."

7.10.5 Short-Term Effectiveness

Alternative 1 fails to provide short-term effectiveness since no further action is taken. Thus, this alternative was given a rating of "none".

Potential additional risks to workers, the community, and the environment would occur during the implementation of the targeted excavation of mine materials in Alternative 2, and the more comprehensive excavation of mine materials in Alternatives 3, 4, and 6.

Alternative 2 limits short-term risks to workers, the community, and the environment primarily through in-place containment of mine materials. Administrative controls could be quickly implemented to address potential exposure to mine materials. Trucks used to haul materials for covers as well as for reclamation within the PMDA slightly increase short-term risks to the community. Transportation and placement of borrow materials have potential environmental impacts from equipment emissions and disturbance of borrow location outside of PMDA. Limited excavation of mine materials and disposal at the proposed facility within PMDA would require disturbance of mine materials. While limited excavation of mine materials and construction of covers would involve surface disturbance of mine materials, short-term risks to workers would be mitigated through the use of safety measures such as personal protective equipment (PPE). Short-term risks to workers, the community, and the environment could be mitigated through measures such as water-based dust suppression and use of fuel efficient vehicles. Thus, Alternative 2 was given a rating of "moderate to high."

Alternative 3 requires disturbance of a larger amount of mine materials across OU1 and a longer duration of construction than Alternative 2, which poses increased short-term risks to workers and the community than the predominately surface disturbance activities under Alternative 2. Construction of a new proposed facility outside of PMDA would increase extent of the impacted areas as compared to Alternative 2. Hauling of mine materials to proposed facility outside of PMDA as well as transport of materials for covers as well as for reclamation to the PMDA increases truck traffic and related risks workers and to the community as compared to Alternative 2. Excavation and transport of mine materials to proposed facility outside of PMDA as well as transport and placement of borrow materials have potential environmental impacts from equipment emissions and disturbance of borrow location outside of PMDA. While limited excavation of mine materials and construction of covers would involve surface disturbance of mine materials, short-term risks to workers would be mitigated through the use of safety measures such as PPE. Short-term risks to workers, the community, and the environment could be mitigated through measures such as water-based dust suppression and use of fuel efficient vehicles. Thus, this alternative was given a rating of "moderate."

Alternative 4 poses similar short-term risks to workers and the community as Alternative 3. Alternative 4 requires disturbance of all mine materials across OU1 and a longer duration of construction than Alternative 3, which poses increased short-term risks to workers and the community than the less robust excavation activities under Alternative 2. However, there is an additional step of treating tailings by stabilization/solidification. This step involves additional contact by workers to mine materials during treatment as well as additional truck traffic to deliver the stabilization agent. Thus, this alternative was given a rating of "moderate".

Alternative 6 is similar to Alternative 4, except that all mine materials would be disposed at a proposed facility outside the PMDA. Construction of a new proposed facility outside of PMDA would increase truck traffic in the community due to the increased volume of mine materials to be disposed at the proposed facility outside the PMDA. The additional hauling of mine materials to a proposed facility outside of the PMDA would result in additional environmental impacts from equipment emissions. Thus this alternative was given a rating of "low to moderate".

7.10.6 Implementability

Alternative 1 has no further action taken other than 5-year site reviews. Since no new remedial action is taken, this alternative was given a rating of "none."

Alternative 2 includes limited excavation and disposal of targeted mine materials at a proposed facility within the PMDA. Alternatives 3 and 4 include excavation, transport, and disposal of larger volumes of mine materials, which is a common construction practice, but results in longer construction period and use more construction equipment to complete than Alternative 2. Alternative 6 includes transport of the largest quantities of mine materials for disposal at the proposed facility outside of PMDA. Alternatives 3 and 4 include disposal of mine materials at two locations (proposed facilities within and outside of PMDA). Alternative 2 includes transport of mine materials a shorter distance to a proposed facility within PMDA.

Alternatives 2, 3, 4, and 6 include import of construction resources, such as asphalt (Alternative 2), pozzolan or cement (Alternatives 4 and 6) lime, organic materials, and geosynthetic materials. Uncontaminated borrow sources within or outside of PMDA would need to be developed for these alternatives. Excavation of mine materials and placement of covers on steep slopes may require use of specialty equipment and practices to ensure worker safety. Inspection, monitoring and maintenance of the proposed facilities, cover systems, and access controls across OU1 would be relatively easy to implements. Maintenance of institutional controls may be more difficult due to various types of ownership and land use. Maintaining institutional controls would require agency coordination.

Materials, equipment, and technical specialists needed for the chemically-reduced submergence of tailings in Alternative 3 are specialized but available. Treatment of tailings using stabilization/solidification for Alternatives 4 and 6 is relatively straightforward, but may be difficult due to high concentrations of contaminants in the tailings, degree of saturation, and limited space for performing stabilization/solidification. Treatability testing would be required to assess and optimize performance of stabilization/solidification of tailings.

Overall, Alternative 2 was given a rating of "moderate to high" and Alternatives 3, 4, and 6 were given a rating of "moderate".

7.10.7 Cost

Present value costs for all alternatives were evaluated over a 30-year period (Years 0 through 29).

The present value cost for Alternative 1 was given a rating of "low." The present value cost for this alternative is approximately $115,000.

The present value cost for Alternative 2 was given a rating of "low to moderate." The present value cost for this alternative is approximately $5,553,000.

The present value cost for Alternatives 3, 4 and 6 were given a rating of "moderate." The present value costs for these alternatives are approximately $9,275,000, $10,407,000 and $10,489,000 respectively.

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Exhibit 7-6. Summary of Comparative Analysis for OU1 Remedial Alternatives

Remedial Alternative	Description	Threshold Criteria		Balancing Criteria					
		Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume through Treatment	Short-Term Effectiveness	Implementability	Present Value Cost (Dollars)	
1	No Further Action	—	—	⓿	⓿	⓿	⓿	$	$115,000
2	In-Place Containment, Continued Submergence of Tailings within EM, and Limited Excavation/Disposal of Mine Materials at Proposed Facility within PMDA	+	+	❷	❶	❸	❹	$$	$5,553,000
3	Limited In-Place Containment, Chemically Reduced Submergence of Tailings within EM, and Excavation/Disposal of Mine Materials at Proposed Facilities within and outside PMDA	+	+	❸	❷	❸	❸	$$$	$9,275,000
4	Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facilities within and outside PMDA	+	+	❸	❸	❸	❸	$$$	$10,407,000
6	Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facility outside PMDA	+	+	❹	❸	❷	❸	$$$	$10,489,000

Notes:

1. The numerical designations for the qualitative ratings system used in this table are not used to quantitatively assess remedial alternatives (for instance, individual rankings for an alternative are not additive).

2. Detailed cost spreadsheets (cost summaries, present value analyses, and cost worksheets) for each alternative are presented in Appendix F.

Legend for Qualitative Ratings System:

Threshold Criteria		Balancing Criteria (Excluding Cost)		Balancing Criteria (Present Value Cost in Dollars)	
—	**Unacceptable**	⓿	**None**	⓿	**None**
+	**Acceptable**	❶	**Low**	$	**Low ($0 through $4M)**
+*	**Acceptable with ARAR Waiver(s)**	❷	**Low to Moderate**	$$	**Low to Moderate ($4M through $8M)**
		❸	**Moderate**	$$$	**Moderate ($8M through $12M)**
		❹	**Moderate to High**	$$$$	**Moderate to High ($12M through $16M)**
		❺	**High**	$$$$$	**High (Greater than $16M)**

Section 8

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Tables

Table 4-1 Preliminary Identification and Technical Implementability Screening of Potentially Applicable Remedial Technologies/Process Options , Mine Materials, Formosa Mine Superfund Site OU1

General Response Action	Remedial Technology	Process Option	Description of Option	Screening Comments	Retained
No Action	None	None	No action would be taken. The mine materials remain in their existing condition.	Required by NCP as baseline for comparison.	Yes
Monitoring	Physical and/or Chemical Monitoring	Non-Intrusive Visual Inspection	A non-intrusive (surficial) visual inspection of the immediate ground surface to determine the presence or absence of mine materials.	Potentially implementable process option.	Yes
		Intrusive Visual Inspection	An intrusive visual inspection of the subsurface (using excavations or boreholes) to determine the presence or absence of mine materials.	Potentially implementable process option.	Yes
		Sample Collection and Analysis	Mine material samples would be collected for chemical analysis.	Potentially implementable process option.	Yes
Administrative Controls	Institutional Controls	Governmental Controls, Proprietary Controls, and Informational Devices	Contact with mine materials would be controlled through legal instruments. Examples of governmental controls include but are not limited to local zoning, permits, codes, or regulations. Examples of proprietary controls include but are not limited to instruments such as Easement and Equitable Servitude (EES) and Covenants, Conditions and Restrictions (CCRs). Examples of informational devices include but are not limited to Notices of Environmental Contamination.	Potentially implementable process option.	Yes
	Community Awareness Activities	Informational and Educational Programs	Community informational and educational programs would be undertaken to enhance awareness of potential hazards and remedies for mine materials.	Potentially implementable process option.	Yes
	Access Controls	Fencing and Posted Warnings	Mine materials would be enclosed by fences and warning signs to control access and warn people of dangers posed by the mine materials.	Potentially implementable process option.	Yes
Containment	Surface Source Controls	In Situ Mixing	Mine materials with high contaminant concentrations are mixed with underlying uncontaminated soil or fill materials.	Not technically implementable for site application since bedrock generally underlies mine materials. Even if uncontaminated soil is present within localized areas, the acid-generating potential of mine materials would still exist after in situ mixing.	No
		Grading	Mine materials would be contoured to promote drainage and facilitate other technologies and process options.	Potentially implementable process option.	Yes
		Revegetation	Uncovered areas of mine materials, the soil layer of cover systems, and excavated/reclaimed areas would be planted with vegetation. Technology used in conjunction with several other technologies and process options.	Potentially implementable process option.	Yes
		Exposure Barrier	Mine materials would be covered with a simple layer of soil and vegetation or rock with sufficient thickness to eliminate surface exposure of mine materials.	Potentially implementable process option.	Yes
		Evapotranspiration Cover	Mine materials would be covered with engineered layers of soil or rock combined with select plant species to maximize evapotranspiration and eliminate surface exposure of mine materials.	Not technically implementable for site application due to the relatively large amount of overall precipitation and the percentage of that precipitation that occurs during the winter which is a period of low evapotranspiration potential.	No
		Organic cover	Mine materials would be covered with a thick layer (i.e., several feet) of organic materials such as wood waste in order to create a reduced environment and mitigate ARD generation.	Potentially implementable process option.	Yes
		Bentonite-Amended Soil Cover	Mine materials would be covered with bentonite-amended soil along with drainage and vegetative layers to reduce infiltration of precipitation and eliminate surface exposure of mine materials.	Potentially implementable process option.	Yes
		Geosynthetic Multi-Layer Cover	Mine materials would be covered with geosynthetic material, such as geomembrane or geosynthetic clay liner (GCL), along with drainage and vegetative layers to reduce infiltration of precipitation and eliminate surface exposure of mine materials.	Potentially implementable process option.	Yes
		Pavement Cover	Mine materials would be covered with relatively impervious layers of manufactured paving materials such as asphalt or concrete to reduce infiltration of precipitation and eliminate surface exposure of mine materials.	Potentially implementable process option.	Yes

Table 4-1 Preliminary Identification and Technical Implementability Screening of Potentially Applicable Remedial Technologies/Process Options , Mine Materials, Formosa Mine Superfund Site OU1 (continued)

General Response Action	Remedial Technology	Process Option	Description of Option	Screening Comments	Retained
Containment (Continued)	Subsurface Source Controls	Liner System	A liner system would be placed at the bottom of a constructed facility for disposal of mine materials to prevent leaking of MIW that may form in the consolidated materials.	Potentially implementable process option.	Yes
		Submergence	Mine materials would be submerged in a constructed impoundment to prevent further oxidation of sulfide minerals and ARD generation.	Potentially implementable process option.	Yes
	Barriers	Retaining Structures	Mine materials surfaces would be stabilized using retaining structures.	Potentially implementable process option.	Yes
Removal, Transport, Disposal	Removal	Mechanical Excavation	Mine materials would be excavated using mechanical methods.	Potentially implementable process option.	Yes
		Hydraulic Excavation (Slurry Pumping)	Mine materials, typically fine grained materials such as tailings, would be excavated in slurry form using a pipeline or other hydraulic conveyance systems.	Potentially implementable process option.	Yes
		Pneumatic Excavation (Vacuum Extraction)	Mine materials, typically fine grained materials such as tailings, would be excavated using vacuum hoses, vacuum trucks, or other pneumatic conveyance system.	Not technically feasible because of high density of saturated tailings, and size and coarse texture of other mine materials and soils.	No
	Transport	Mechanical Transport (Hauling/Conveying)	Excavated mine materials would be transported by truck or other mechanical conveyance method to disposal site.	Potentially implementable process option.	Yes
		Hydraulic Transport (Slurry Pumping)	Excavated mine materials, typically fine grained materials such as tailings, would be mixed with water and be piped in slurry form to disposal site.	Potentially implementable process option.	Yes
		Pneumatic Transport (Vacuum Extraction)	Excavated mine materials, typically fine grained materials such as tailings, would be piped using a vacuum system to disposal site.	Not technically feasible because of high density of saturated tailings and size and coarse texture of other mine materials and soils.	No
	Disposal	Disposal at Proposed Facility within PMDA	Excavated mine materials would be disposed of at a proposed facility constructed within the PMDA (i.e., EM area).	Potentially implementable process option.	Yes
		Disposal at Proposed Facility outside PMDA	Excavated mine materials would be disposed of at a proposed facility to be constructed outside of the PMDA.	Potentially implementable process option.	Yes
		Disposal at Existing Facility	Excavated mine materials would be disposed of in an existing (currently permitted) facility that is designed or authorized to accept the mine materials.	Potentially implementable process option.	Yes
Treatment	Biological Treatment	Chemically Reduced Submergence	Mine materials would be placed in a chemically reduced environment constructed using anaerobic microorganisms to immobilize soluble metals as metal-sulfide precipitates.	Potentially implementable process option.	Yes
		Phytoremediation	Contaminants would be removed from mine materials using select plant species.	Not technically feasible for site application because of high contaminant concentrations, large extent and volume of mine materials and soils, excessive depth of contamination, and the heterogeneous nature of the mine materials matrix.	No
	Chemical/Physical Treatment	Neutralization	ARD generating mine materials would be mixed with an alkaline material such as agricultural lime ($CaCO_3$) or hydrated lime ($Ca(OH)_2$) to neutralize acidity and increase pH. Technology used in conjunction with several other technologies and process options such as removal and disposal.	Potentially implementable process option.	Yes
		Chemical Immobilization	Mine materials would be excavated and treated with chemicals to inhibit sulfide oxidation. Technology used in conjunction with several other technologies and process options, such as removal and disposal. Process option may be particularly applicable to ARD generating bedrock outcrops.	Potentially implementable process option.	Yes
		Pozzolan- or Cement-Based Stabilization/Solidification	Mine materials would be excavated and mixed with a pozzolan- or cement-based binding agent before disposal. Technology used in conjunction with several other technologies and process options such as removal and disposal. Process option may be particular applicable mine materials such as saturated tailings.	Potentially implementable process option.	Yes
		Hydrometallurgical Processing (Flotation)	Mine materials would be excavated, crushed, and ground, and flotation (addition of chemicals to mine materials and soils-water slurry) would be used to remove sulfide minerals, producing a sulfide concentrate and non-acid-generating tailings (remove all sulfide minerals from tailings).	Potentially implementable process option.	Yes
		Solvent/Chemical Extraction (Leaching)	Mine materials would be excavated, crushed, ground, and placed into a leaching facility. A solvent/chemical is then dispersed through the mine materials to remove specific contaminants.	Potentially implementable process option.	Yes

Table 4-1 Preliminary Identification and Technical Implementability Screening of Potentially Applicable Remedial Technologies/Process Options , Mine Materials, Formosa Mine Superfund Site OU1 (continued)

General Response Action	Remedial Technology	Process Option	Description of Option	Screening Comments	Retained
Treatment (Continued)	Chemical/Physical Treatment (Continued)	Soil Washing	Mine materials would be excavated, screened, and introduced into a washing process that uses a washing solution and mechanical agitation to remove surficial contaminants.	Not technically feasible for site application because technology does not remove contaminants such as metals and metalloids or sulfide minerals from mine materials. Technology is typically used for removal of organic contaminants from soils.	No
		In Situ Electrokinetic Separation	In situ mine materials are electrically charged with direct current, causing the transport/removal of ions, particles, and water.	Not technically feasible for site application because of high contaminant concentrations, large extent and volume of mine materials, low moisture content of the mine materials other than tailings, and the high electrical conductivity of the minerals within the mine materials matrix.	No
		In Situ Pozzolan- or Cement-Based Stabilization/Solidification	Mine materials would be mixed in situ with a pozzolan- or cement-based binding agent using a deep soil auger mixing/injection technique.	Not technically feasible for site application because of high contaminant concentrations, large extent and volume of mine materials, excessive depth of contamination, and the heterogeneous nature of the mine materials matrix.	No
		In Situ Soil Flushing	A washing solution (as with soil washing) would be circulated through the mine materials with the use of injection and extraction wells or trenches.	Not technically feasible for site application because of high contaminant concentrations, large extent and volume of mine materials, and the heterogeneous nature of the mine materials matrix.	No
	Thermal Treatment	In Situ Vitrification	An electrical current would be passed between electrodes inserted into mine materials to cause melting. The melted matrix is then allowed to cool into solid vitrified glass mass.	Not technically feasible for site application because of large extent and volume of mine materials, excessive depth of contamination, and the heterogeneous nature of the rock/fill matrix.	No
		Thermal Plasma Technology	An electrical current would be passed between electrodes to form plasma. Excavated mine materials placed in the plasma arc forms a molten bath; metals are separated from the impurities that form slag.	Not technically feasible for site application because of large extent and volume of mine materials, low concentrations of commercially usable minerals in previously processed mine materials, and higher concentrations of leachable contaminants in slag requiring disposal.	No
		Pyrometallurgical Processing (Smelting)	Smelting (application of heat to a charge of mine materials and flux in a furnace) would be used to separate molten streams of metals, slag, and dust. Mine materials would be excavated, crushed, ground, and then smelted. Additional process options such as hydrometallurgical processing (flotation) may be required prior to smelting.	Potentially implementable process option.	Yes
Reuse, Reclamation, Recovery	Remining/Reprocessing	Flotation, Leaching, and Smelting	Mine materials would be excavated and processed using methods such as flotation and smelting to separate valuable metals from the mine materials and soils. These processes are described in greater detail under chemical/physical treatment remedial technologies. This technology is intended to represent the potential for generation of materials that could be sold for a positive cost benefit, whereas treatment technologies are intended to treat and dispose of the waste with no potential for positive cost benefit.	Potentially implementable process option.	Yes

Note: Shading indicates remedial technologies/process options have been tentatively eliminated from further consideration based on lack of technical implementability. Remaining (unshaded) remedial technologies/process options have been retained for additional screening in Table 4-2.

Table 4-2 Screening of Potentially Applicable Remedial Technologies/Process Options Based on Effectiveness, Implementability, and Relative Cost, Mine Materials, Formosa Mine Superfund Site OU1

General Response Actions	Remedial Technology	Process Option	Description of Option	Effectiveness	Implementability	Relative Cost: Capital Cost	Relative Cost: O&M Cost	Reason for Elimination of Process Option from Consideration
No Action	None	None	No action would be taken. The mine materials remain in their existing condition.	(0) No protection of human health or the environment and no compliance with ARARs.	(1) Easily implemented but is not acceptable to regulatory agencies and does not meet ARARs.	(0)	(0)	Retained (Required by NCP as a standalone alternative)
Monitoring	Physical and/or Chemical Monitoring	Non-Intrusive Visual Inspection	A non-intrusive (surficial) visual inspection of the immediate ground surface to determine the presence or absence of mine materials.	(1) Protects human receptors by enhancing awareness of potential site hazards from presence of mine waste. Does not directly affect receptors and does not physically address contamination.	(5) Easily implemented using available technical and labor resources.	$	(0)	Retained
		Intrusive Visual Inspection	An intrusive visual inspection of the subsurface (using excavations or boreholes) to determine the presence or absence of mine materials.	(2) Protects human receptors by enhancing awareness of potential site hazards from presence of mine waste. Does not directly affect receptors and does not physically address contamination.	(5) Easily implemented using available technical and labor resources.	$	(0)	Retained
		Sample Collection and Analysis	Mine material samples would be collected for chemical analysis.	(2) Protects human receptors by enhancing awareness of potential site hazards from presence of mine waste. Does not directly affect receptors and does not physically address contamination.	(5) Easily implemented using available technical and labor resources.	$	(0)	Retained
Administrative Controls	Institutional Controls	Governmental Controls, Proprietary Controls, and Informational Devices	Contact with mine materials would be controlled through legal instruments. Examples of governmental controls include but are not limited to local zoning, permits, codes, or regulations. Examples of proprietary controls include but are not limited to instruments such as EES and CCRs. Examples of informational devices include but are not limited to Notices of Environmental Contamination.	(2) Enhances awareness of potential site hazards and remedies and restricts future uses of the site that are not protective of human health and the environment. Does not directly affect ecological receptors and does not physically address contamination.	(3) Implemented using legal instruments and labor resources; potential public resistance, especially for disposal locations outside of the PMDA.	$	(0)	Retained
	Community Awareness Activities	Informational and Educational Programs	Community informational and educational programs would be undertaken to enhance awareness of potential hazards and remedies for mine materials.	(2) Protects human receptors by enhancing awareness of potential site hazards and remedies. Does not directly affect ecological receptors and does not physically address contamination.	(5) Easily implemented using available technical and labor resources.	$	(0)	Retained
	Access Controls	Fencing and Posted Warnings	Mine materials would be enclosed by fences and warning signs to control access and warn people of dangers posed by the mine materials.	(2) Protects human receptors by enhancing awareness of potential site hazards and remedies through warnings and restricted access through fencing, though human receptors may choose to ignore warnings and circumvent fencing. Lesser degree of protection to ecological receptors that are capable of circumventing fencing.	(5) Easily implemented and resources readily available.	$	$	Retained
Containment	Surface Source Controls	Grading	Mine materials would be contoured to promote drainage and facilitate other technologies and process options.	(2) Enhances stability and partially mitigates erosion and infiltration. The grading reduces wind and water erosion transport and leaching of soluble contaminants. It does not protect receptors from direct exposure to contaminants by itself.	(4) Easily implemented using available construction resources. Requires some maintenance for long-term protectiveness.	$$	$$	Retained
		Revegetation	Uncovered areas of mine materials, the soil layer of cover systems, and excavated/reclaimed areas would be planted with vegetation. Technology used in conjunction with several other technologies and process options.	(2) Reduces erosion of fill surfaces, potentially reduces exposure of contaminants to receptors, and facilitates other containment technologies. It does not protect receptors or reduce ARD generation and MIW migration by itself.	(4) Easily implemented using available construction resources. Requires suitable soil conditions for initial establishment and minor maintenance for long-term protectiveness.	$$	$	Retained
		Exposure Barrier	Mine materials would be covered with a simple layer of soil and vegetation or rock with sufficient thickness to eliminate surface exposure of mine materials.	(3) Protects receptors by eliminating surface exposure of contaminants. It does not significantly reduce ARD generation and MIW migration.	(4) Easily implemented using available construction resources. Requires minor maintenance for long-term protectiveness, especially on steep slopes.	$$$	$$$	Retained

Table 4-2 Screening of Potentially Applicable Remedial Technologies/Process Options Based on Effectiveness, Implementability, and Relative Cost, Mine Materials, Formosa Mine Superfund Site OU1 (continued)

General Response Actions	Remedial Technology	Process Option	Description of Option	Effectiveness	Implementability	Relative Cost		Reason for Elimination of Process Option from Consideration
						Capital Cost	O&M Cost	
Containment (Continued)	Surface Source Controls (Continued)	Organic Cover	Mine materials would be covered with a thick layer (i.e., several feet) of organic materials such as wood waste in order to create a reduced environment and mitigate ARD generation.	❷ This technology would eliminate surface exposure of contaminants, and initially provide a reduction of ARD generation and MIW migration in the areas where it can be applied. However, effectiveness of an organic cover may decrease over time due to longevity (organic materials will become resistant to decomposition with time). Desiccation of the cover during the dry season would also be expected to reduce the effectiveness.	❸ Implemented using available construction resources. Potential difficulty obtaining and transporting large quantities of suitable organic materials needed to cover all of the mine materials at OU1. Requires increased maintenance for long-term protectiveness, especially on steep slopes.	$$$$	$$$	Effectiveness, Cost
		Bentonite-Amended Soil Cover	Mine materials would be covered with bentonite-amended soil along with drainage and vegetative layers to reduce infiltration of precipitation and eliminate surface exposure of mine materials.	❸ Protects receptors by eliminating surface exposure of contaminants. Provides moderate to large reduction of ARD generation and MIW migration initially; effectiveness of clay covers may decrease over time due to development of desiccation cracking or penetration of woody vegetation if not maintained. In addition, effectiveness may decrease over time due to ion exchange of metals from mine materials into the clay matrix, thereby increasing permeability of the clay.	❷ Implemented using available construction resources. Difficult to obtain and transport large quantities of bentonite and homogenize bentonite with soil. Requires increased maintenance for long-term protectiveness, especially on steep slopes.	$$$$	$$$	Implementability, Cost
		Geosynthetic Multi-Layer Cover	Mine materials would be covered with geosynthetic material, such as geomembrane or GCL, along with drainage and vegetative layers to reduce infiltration of precipitation and eliminate surface exposure of mine materials.	❹ Protects receptors by eliminating surface exposure of contaminants. Provides large reduction of ARD generation and MIW migration. Effectiveness of geosynthetic multi-layer covers may decrease over time due to penetration of woody vegetation if not maintained.	❸ Implemented using available construction resources from nearby borrow areas and geosynthetic materials. Some fill sources outside of the PMDA and specialized synthetic materials may be required. Requires increased maintenance for long-term protectiveness, especially on steep slopes.	$$$	$$	Retained
		Pavement Cover	Mine materials would be covered with relatively impervious layers of manufactured paving materials such as asphalt or concrete to reduce infiltration of precipitation and eliminate surface exposure of mine materials.	❹ Protects receptors by eliminating surface exposure of contaminants. Provides large reduction of ARD generation and MIW migration initially; effectiveness of asphalt or concrete covers may decrease over time due to development of freeze-thaw cracking.	❸ Implemented using available construction resources. Potentially difficult to obtain and transport large quantities of asphalt or concrete. Requires some maintenance for long-term protectiveness.	$$$$	$$$	Retained
	Subsurface Source Controls	Liner System	A liner system would be placed at the bottom of a constructed facility for disposal of mine materials to prevent leaking of MIW that may form in the consolidated materials.	❹ Effective at subsurface isolation of reactive mine materials and subsequent MIW migration to underlying surfaces. Effectiveness is dependent on proactive management of collected leachate. The interface between the liner and underlying soil/bedrock may cause geotechnical stability issues.	❸ Implemented using available construction resources. Specialized synthetic materials may be required. The interface between the liner and underlying soil/bedrock may cause installation issues.	$$$	$$	Retained
		Submergence	Mine materials would be submerged in a constructed impoundment to prevent further oxidation of sulfide minerals and ARD generation. The saturated tailings within the EM are currently addressed through submergence.	❸ Does not directly protect receptors from exposure to contaminants. Provides moderate reduction of ARD generation and migration; effectiveness of anoxic submergence may decrease over time if anoxic conditions are not maintained. Mine materials above submerged zone may not be in anoxic. Effectiveness not ensured if submerged mine materials and groundwater are not neutralized. At a small scale, submergence of stored pyrite-rich tailings within the EM is helping to mitigate ARD generation.	❸ Implemented using available construction resources. Maintenance required to maintain consistent water levels within submerged mine materials and monitor subsurface conditions to maintain an anoxic environment. Large scale submergence of mine materials is not feasible at OU1 because of topographic limitations. However, saturated tailings within the EM could continue to be submerged.	$$	$	Retained
	Barriers	Retaining Structures	Mine materials surfaces would be stabilized using retaining structures.	❸ Does not directly protect receptors from contaminants or provide reduction of ARD generation by itself. May provide slight reduction in MIW migration by retaining mine materials behind structures depending on the type of structure. Effective if used to stabilize mine materials present at steep slopes at OU1, and potentially for proposed disposal facilities.	❸ Implemented using available construction resources, but could be difficult to install on steep slopes. Requires some maintenance for long-term protectiveness.	$$$	$	Retained

Table 4-2 Screening of Potentially Applicable Remedial Technologies/Process Options Based on Effectiveness, Implementability, and Relative Cost, Mine Materials, Formosa Mine Superfund Site OU1 (continued)

General Response Actions	Remedial Technology	Process Option	Description of Option	Effectiveness	Implementability	Relative Cost: Capital Cost	Relative Cost: O&M Cost	Reason for Elimination of Process Option from Consideration
Removal, Transport, Disposal	Removal	Mechanical Removal (Excavation)	Mine materials would be excavated using mechanical methods.	❹ Protects receptors by eliminating exposure to contaminants and provides reduction of ARD generation and MIW migration at original location. Must be combined with transport, disposal, and/or treatment technologies.	❹ Easily implemented using available construction resources. Excavation may be more difficult on steep slopes.	$$$	⓿	Retained
		Hydraulic Excavation (Slurry Pumping)	Mine materials, typically fine grained materials such as tailings, would be excavated in slurry form using a pipeline or other hydraulic conveyance systems.	❹ Protects receptors by eliminating exposure to contaminants and provides reduction of ARD generation and MIW migration at original location. Must be combined with transport, disposal, and/or treatment technologies.	❸ Efficient for tailings materials only. Not feasible for wastes containing large cobbles or boulders. Requires construction of infrastructure for implementation and safeguards to prevent spilling of materials.	$$$	⓿	Retained
	Transport	Mechanical Transport (Hauling/ Conveying)	Excavated mine materials would be transported by truck or other mechanical conveyance method to disposal site.	❹ Protects receptors by eliminating exposure to contaminants and provides reduction of ARD generation and MIW migration at original location. Transport of mine materials on roads may cause adverse impacts to the public. Must be combined with removal, disposal, and/or treatment technologies.	❹ Easily implemented using available construction resources; efficient for all sizes of materials. Suitable road access or travel corridor required for mechanical transport.	$$$	⓿	Retained
		Hydraulic Transport (Slurry Pumping)	Mine materials, typically fine grained materials such as tailings, would be excavated in slurry form using a pipeline or other hydraulic conveyance systems.	❹ Protects receptors by eliminating exposure to contaminants and provides reduction of ARD generation and MIW migration at original location. Must be combined with removal, disposal, and/or treatment technologies.	❸ Efficient for tailings materials only. Not feasible for wastes containing large cobbles or boulders. Requires construction of infrastructure for implementation and safeguards to prevent spilling of materials.	$$$	⓿	Retained
	Disposal	Disposal at Proposed Facility within PMDA	Excavated mine materials would be disposed of at a proposed facility constructed within the PMDA (i.e., EM area).	❹ Protects receptors by eliminating exposure to contaminants and provides reduction of ARD generation and MIW migration at original location. Must be combined with removal, transport, containment, and/or treatment technologies.	❸ Implemented using available construction resources. Property to construct disposal facility is available. A potentially suitable area for disposal within the PMDA has limited capacity for construction due to the steep side slopes present. Requires some maintenance for long-term protectiveness.	$$$	⓿	Retained
		Disposal at Proposed Facility outside PMDA	Excavated mine materials would be disposed of at a proposed facility to be constructed outside of the PMDA.	❹ Protects receptors by eliminating exposure to contaminants and eliminates onsite ARD generation and MIW migration from the disposed materials. Transport of mine materials on roads may cause adverse impacts to the public. Must be combined with removal, transport, containment, and/or treatment technologies.	❸ Implemented using available construction resources, but property to construct disposal facility must be obtained. Large quantities of mine materials are difficult to transport to locations outside of the PMDA. Land use and other restrictions such as existence of floodplains, wetlands, and fault zones may affect the administrative implementability of this process option. Requires some maintenance for long-term protectiveness.	$$$$	⓿	Retained
		Disposal at Existing Facility	Excavated mine materials would be disposed of in an existing (currently permitted) facility that is designed or authorized to accept the mine materials.	❹ Protects receptors by eliminating exposure to contaminants and eliminates onsite ARD generation and MIW migration from the disposed materials. Transport of mine materials on roads or rail may cause adverse impacts to the public. Must be combined with removal, transport, containment, and/or treatment technologies.	❹ Existing facilities are currently permitted to accept wastes; however, may require treatment of mine materials to allow disposal. Future maintenance is performed by the facility. Large quantities of mine materials are difficult to transport outside the PMDA.	$$$$$	⓿	Retained
Treatment	Biological Treatment	Chemically Reduced Submergence	Mine materials would be placed in a chemically reduced environment constructed using anaerobic microorganisms to immobilize soluble metals as metal-sulfide precipitates. The saturated tailings within the EM could potentially be mitigated using chemically-reduced submergence.	❸ Protects receptors from contaminants by submerging tailings below the water surface. Provides reduction of ARD generation and migration; effectiveness of chemically reduced submergence may decrease over time if saturated and reducing conditions are not maintained. Occasional maintenance, monitoring, and addition of organic reagent may be required.	❸ Implemented using available construction resources; however, technology may be proprietary and subject to patents. Boreholes would be drilled for introduction of liquid organic reagents within the existing submerged zone. Large scale submergence of mine materials is not feasible at OU1 because of topographic limitations. However, saturated tailings within the EM could be submerged in a chemically reducing environment.	$$	$$	Retained

Table 4-2 Screening of Potentially Applicable Remedial Technologies/Process Options Based on Effectiveness, Implementability, and Relative Cost, Mine Materials, Formosa Mine Superfund Site OU1 (continued)

General Response Actions	Remedial Technology	Process Option	Description of Option	Effectiveness	Implementability	Relative Cost		Reason for Elimination of Process Option from Consideration
						Capital Cost	O&M Cost	
Treatment (Continued)	Chemical/ Physical Treatment	Neutralization	ARD generating mine materials would be mixed with an alkaline material such as agricultural lime ($CaCO_3$) or hydrated lime ($Ca(OH)_2$) to neutralize acidity and increase pH. Technology used in conjunction with several other technologies and process options such as surface and subsurface source controls and disposal.	❸ Does not protect receptors from exposure to contaminants if inhaled or ingested. Provides some reduction of ARD generation and MIW migration initially if the amendment is applied correctly; however, effectiveness of neutralization may decrease over time if sufficient quantities are not used initially to address future acid-generating potential. Neutralization is more effective on a small-scale basis for less acid-generating materials that are contained in place. Neutralization could help to facilitate revegetation and support development of a self-sustaining vegetative cover in reclaimed areas.	❸ Implemented using available construction resources. Potential difficulty obtaining and transporting large quantities of suitable neutralization materials needed from sources outside of the PMDA.	$$$$	⓿	Retained
		Chemical Immobilization	Mine materials would be excavated and treated with chemicals to inhibit sulfide oxidation. Technology used in conjunction with several other technologies and process options, such as removal and disposal. Process option may be particularly applicable to ARD generating bedrock outcrops.	❸ Does not protect receptors from exposure to contaminants if inhaled or ingested. Provides moderate to high reduction of ARD generation and MIW migration initially; effectiveness of chemical immobilization may decrease over time due to degradation of chemical coating or amendment material.	❷ Implemented using available construction resources; however, technology is proprietary and subject to patents. Potential difficulty obtaining and transporting large quantities of suitable immobilization materials needed from sources outside of the PMDA. Requires periodic reapplications for long-term effectiveness.	$$$$	$$$$	Implementability, Cost
		Pozzolan- or Cement-Based Stabilization/ Solidification	Mine materials would be excavated and mixed with a pozzolan- or cement-based binding agent before disposal. Technology used in conjunction with several other technologies and process options such as removal and disposal. Process option may be particular applicable mine materials such as saturated tailings.	❸ Protects receptors by eliminating exposure of contaminants. Provides large reduction of ARD generation and MIW migration initially; effectiveness of stabilization may decrease over time due to development of freeze-thaw cracking.	❸ Implemented using available construction resources. Difficult to obtain and transport large quantities of binding agent and homogenize binding agent with soil. Requires some maintenance for long-term protectiveness. This process option will be most applicable on a smaller scale and for more homogeneous materials, such as tailings. Saturated mine materials may require dewatering prior to stabilization/solidification.	$$$$	$$$	Retained
		Hydrometallurgical Processing (Flotation)	Mine materials would be excavated, crushed, and ground (if necessary), and flotation would be used to remove sulfide minerals, producing a sulfide concentrate and non-acid-generating tailings (remove all sulfide minerals from mine materials).	❸ Protects receptors by treating source materials to remove ARD generating minerals. May not be effective unless treated tailings are also neutralized with limestone to address residual pyrite not removed by treatment process. May facilitate additional recovery of metals. A pyrite concentrate would be produced, which would require appropriate disposal. When coupled with neutralization, process option may generate materials that could be used in OU1 reclamation.	❷ Implemented using available equipment and construction resources. However, the process option would require construction of a new mineral processing facility at OU1, electrical power and other infrastructure, and removal/reclamation of these facilities after mine materials are treated. Treatability testing would be required to assess performance of hydrometallurgical processing in removing pyrite from tailings.	$$$$$	⓿	Implementability, Cost
		Solvent/Chemical Extraction (Leaching)	Mine materials would be excavated, crushed, ground and placed into a leaching facility. A solvent/chemical is then dispersed through the mine materials to remove specific contaminants.	❶ Although treatment technology could reduce contaminants in mine materials, the process would not remove sulfide minerals or reduce the ARD potential of mine materials.	❷ Implemented using available equipment and construction resources. However, the process option would require construction of leaching facilities such as leach vats or leach pads, construction of electrowinning facilities, and subsequent removal/reclamation of these facilities after treatment.	$$$$$	⓿	Effectiveness, Implementability, Cost

Table 4-2 Screening of Potentially Applicable Remedial Technologies/Process Options Based on Effectiveness, Implementability, and Relative Cost, Mine Materials, Formosa Mine Superfund Site OU1 (continued)

General Response Actions	Remedial Technology	Process Option	Description of Option	Effectiveness	Implementability	Relative Cost: Capital Cost	Relative Cost: O&M Cost	Reason for Elimination of Process Option from Consideration
Treatment (Continued)	Thermal Treatment	Pyrometallurgical Processing (Smelting)	Smelting (application of heat to a charge of mine materials and flux in a furnace) would be used to separate molten streams of metals, slag, and dust. Mine materials would be excavated, crushed, ground, and then smelted. Additional process options such as hydrometallurgical processing (flotation) may be required prior to smelting.	❸ Protects receptors by recovering metals from sulfide concentrates. In the smelting process, the sulfide minerals would be destroyed and the concentrates would not be acid-generating. Waste products produced during smelting would be disposed in accordance with site specific requirements at an existing smelter.	❷ Potentially implementable at an existing smelter, but technical and administrative feasibility would be low for a proposed smelter. Treatability testing would be necessary to evaluate recoverable metals in the concentrate and infrastructure would be required as described for hydrometallurgical processing. In the event that hydrometallurgical processing (flotation) is utilized for treatment of mine materials, the concentrate produced may be suitable for shipment to an existing operating smelter in Arizona, Utah, or Tennessee for metals recovery. Treatability testing would be required to assess potentially recoverable metals in the sulfa concentrate. This process option would only be implemented if the hydrometallurgical processing treatment option were implemented.	$$$$$	⓿	Implementability, Cost
Reuse, Reclamation, Recovery	Remining/ Reprocessing	Flotation, Leaching, and Smelting	Mine materials would be excavated and processed using methods such as flotation and smelting to separate valuable metals from the mine materials and soils. These processes are described in greater detail under chemical/physical treatment remedial technologies. This technology is intended to represent the potential for generation of materials that could be sold for a positive cost benefit, whereas treatment technologies are intended to treat and dispose of the waste with no potential for positive cost benefit.	❸ Protects receptors by recovering metals from sulfide concentrates. In the smelting process, the sulfide minerals would be destroyed and the concentrates would not be acid-generating. Waste products produced during smelting would be disposed in accordance with site specific requirements at an existing smelter.	❷ Potentially implementable at an existing facility but would be low for a proposed facility. Treatability testing would be necessary to evaluate recoverable metals in the concentrate and infrastructure would be required as described for hydrometallurgical processing. Since hydrometallurgical processing (flotation) is utilized for treatment of mine materials, the concentrate produced may be suitable for shipment to an existing operating smelter in Arizona, Utah, or Tennessee for metals recovery. Treatability testing would be required to assess potentially recoverable metals in the sulfa concentrate.	$$$$$	$$$	Implementability, Cost

Notes:

1. The screening process for effectiveness, implementability, and relative cost involves a qualitative assessment of the degree to which process options address evaluation criteria presented in Section 4.6. The numerical designations for the qualitative ratings system used in this table are not used to quantitatively assess process options (for instance, rankings for a process option are not additive).
2. Shading indicates remedial technologies/process options have been eliminated from further consideration based on lack of effectiveness, implementability, and/or disproportionate cost relative to other process options within the same GRA. Remaining (unshaded) remedial technologies/process options have been retained for assembly into remedial action alternatives as discussed in Section 5.
3. The following sources of technical information were used to identify and screen remedial technologies and process options:

   FRTR. 2007. Remediation Technologies Screening Matrix and Reference Guide, Version 4.0.

   Interstate Technology Regulatory Council (ITRC). Mining Waste Treatment Technology Selection. <http://www.itrcweb.org/miningwaste-guidance/technology_overviews.htm>

   EPA. 1994. Superfund Innovative Technology Evaluation (SITE) Technology Capsule, Geosafe Corporation, In Situ Vitrification Technology. November.

   EPA. 1999. Presumptive Remedy for Metals-in-Soil Sites. September.

   EPA. 2000. Introduction to Phytoremediation. February.

   EPA. 2000. Abandoned Mine Site Characterization and Cleanup Handbook. August.

Legend for Qualitative Ratings System: The following ratings were used for evaluation and presentation of effectiveness, implementability, and relative cost:

Effectiveness and Implementability		Relative Cost	
⓿	**None**	$	**Low**
❶	**Low**	$$	**Low to Moderate**
❷	**Low to Moderate**	$$$	**Moderate**
❸	**Moderate**	$$$$	**Moderate to High**
❹	**Moderate to High**	$$$$$	**High**
❺	**High**		

Table 5-1 Remedial Technologies/Process Options Evaluated for Implementation of Remedial Alternatives, Mine Materials, Formosa Mine Superfund Site OU1

General Response Action	Remedial Technology	Process Option	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
No Further Action	None	None	X					
Monitoring	Physical and/or Chemical Monitoring	Non-Intrusive Visual Inspection	X	X	X	X	X	X
		Intrusive Visual Inspection		X	X	X	X	X
		Sample Collection and Analysis		X	X	X	X	X
Administrative Controls	Institutional Controls	Governmental Controls, Proprietary Controls, and Informational Devices		X	X	X	X	X
	Community Awareness Activities	Informational and Educational Programs		X	X	X	X	X
	Access Controls	Fencing and Posted Warnings		X	X	X	X	X
Containment	Surface Source Controls	Grading		X	X	X	X	X
		Revegetation		X	X	X	X	X
		Exposure Barrier		X				
		Geosynthetic Multi-Layer Cover		X	X	X	X	X
		Pavement Cover		X				
	Subsurface Source Controls	Liner system			X	X	X	X
		Submergence		X				
	Barriers	Retaining Structures		X	X	X	X	X
Removal, Transport, Disposal	Removal	Mechanical Removal (Excavation)		X	X	X	X	X
		Hydraulic Excavation (Slurry Pumping)				X	X	X
	Transport	Mechanical Transport (Hauling/ Conveying)		X	X	X	X	X
		Hydraulic Transport (Slurry Pumping)				X	X	X
	Disposal	Disposal in Proposed Facility within PMDA		X	X	X	X	
		Disposal in Proposed Facility outside of PMDA			X	X	X	X
		Disposal at Existing Facility					X	
Treatment	Biological Treatment	Chemically Reduced Submergence			X			
	Chemical/ Physical Treatment	Neutralization		X	X	X	X	X
		Pozzolan- or Cement-Based Stabilization/ Solidification				X	X	X

Table 5-1 Remedial Technologies/Process Options Evaluated for Implementation of Remedial Alternatives, Mine Materials, Formosa Mine Superfund Site OU1 (continued)

Notes:

1. "X" designations indicate that remedial technology/process options are evaluated as a potential component of the indicated remedial alternative. Where similar process options have been indicated for the same remedial alternative (such as mechanical transport versus hydraulic transport), the most representative process has been selected for evaluation and costing. However, that does not preclude use of the similar alternate processes during implementation of the selected remedy.
2. Shaded boxes indicate the process options are not considered for the remedial alternative(s) in question.
3. Descriptions of remedial technologies/process options are provided in Table 4-2. Descriptions of remedial alternatives are provided in Section 5.3.

Alternative 1: No Further Action

Alternative 2: In-Place Containment, Continued Submergence of Tailings within EM, and Limited Excavation/Disposal of Mine Materials at Proposed Facility within PMDA

Alternative 3: Limited In-Place Containment, Chemically Reduced Submergence of Tailings within EM, and Excavation/Disposal of Mine Materials at Proposed Facilities within and outside PMDA

Alternative 4: Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facilities within and outside PMDA

Alternative 5: Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Existing and Proposed Facilities within and outside PMDA

Alternative 6: Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facility outside PMDA

Figures

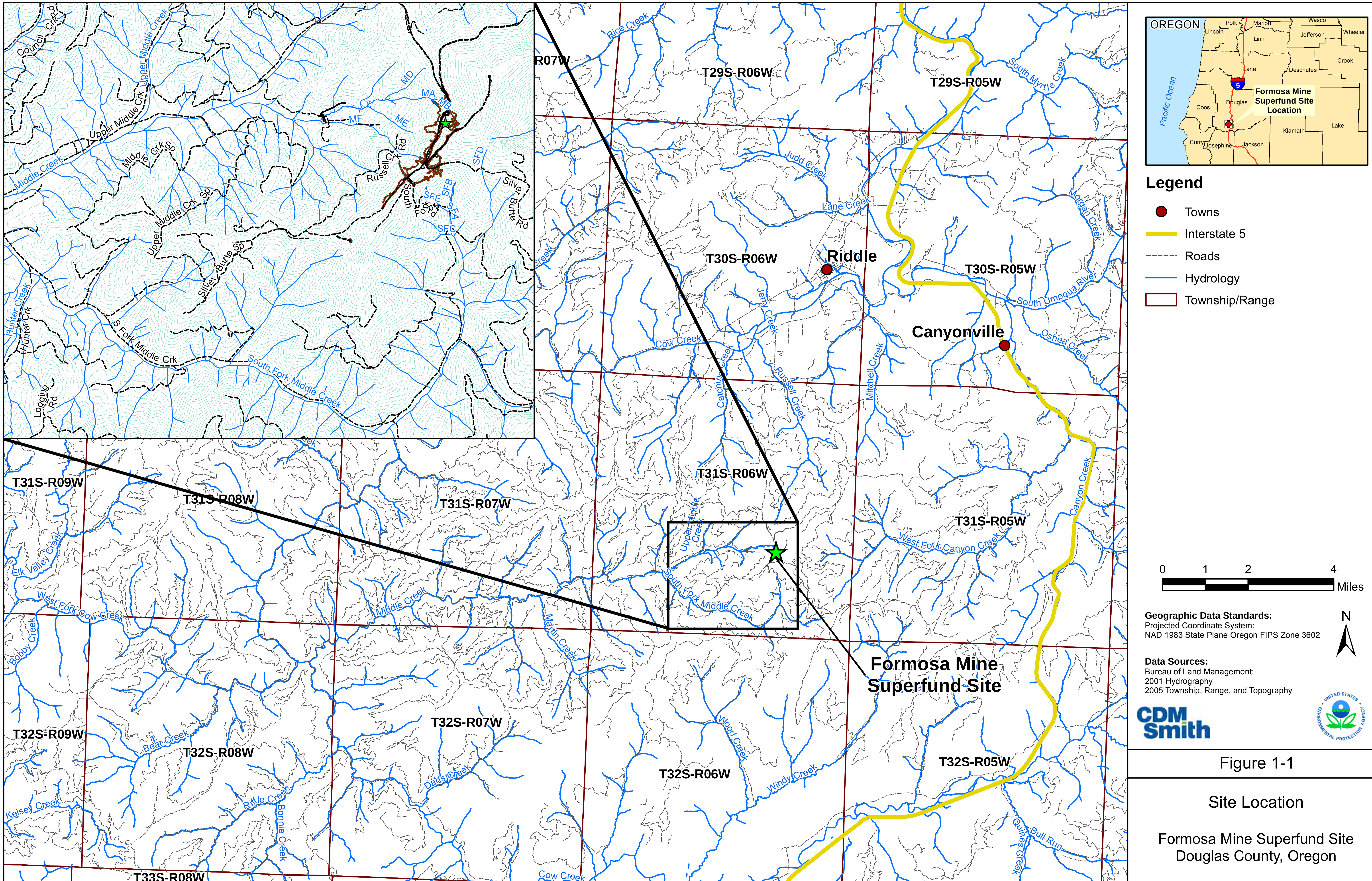
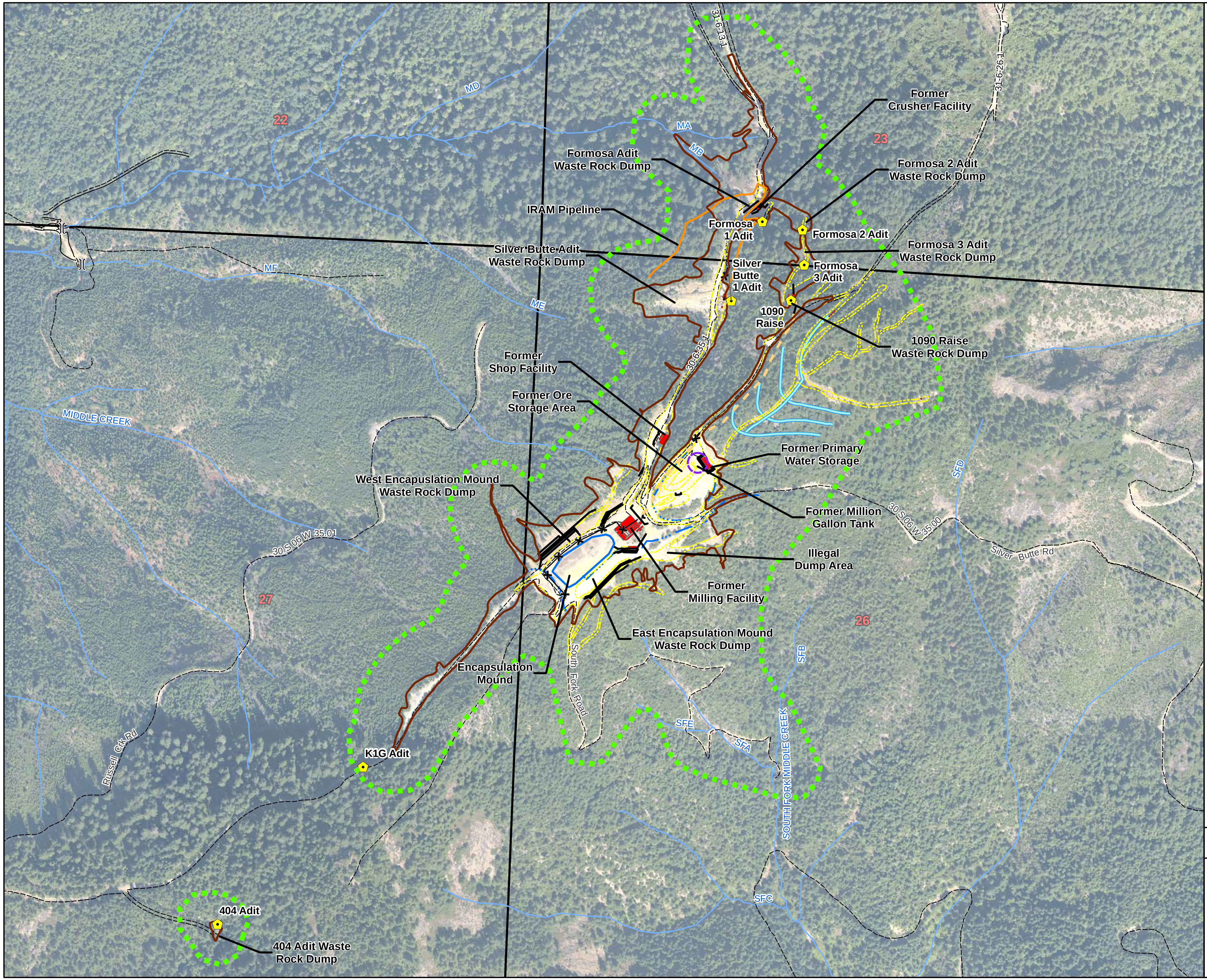


Figure 1-1

Site Location

Formosa Mine Superfund Site
Douglas County, Oregon



Legend

Current Site Features

- Adit
- Primary Mine Disturbance Area
- Site Investigation Area
- Culverts
- Fence
- Adit Water Diversion System
- Roads
- Hydrology
- Sections

Historic Facilities

- Former Runoff Water Diversion
- Former Water Dispersion System
- Historic Roads
- Historic Crib Walls
- Former MainTailings Line From Mill
- Historic Facilities
- Former Million Gallon Tank
- Former Water and Tailings Storage Pond

0 250 500 1,000 Feet

N

Geographic Data Standards:
Projected Coordinate System:
NAD 1983 State Plane Oregon FIPS Zone 3602

Data Sources:
Bureau of Land Management:
2001 Hydrography
2005 Township, Range, and Topography

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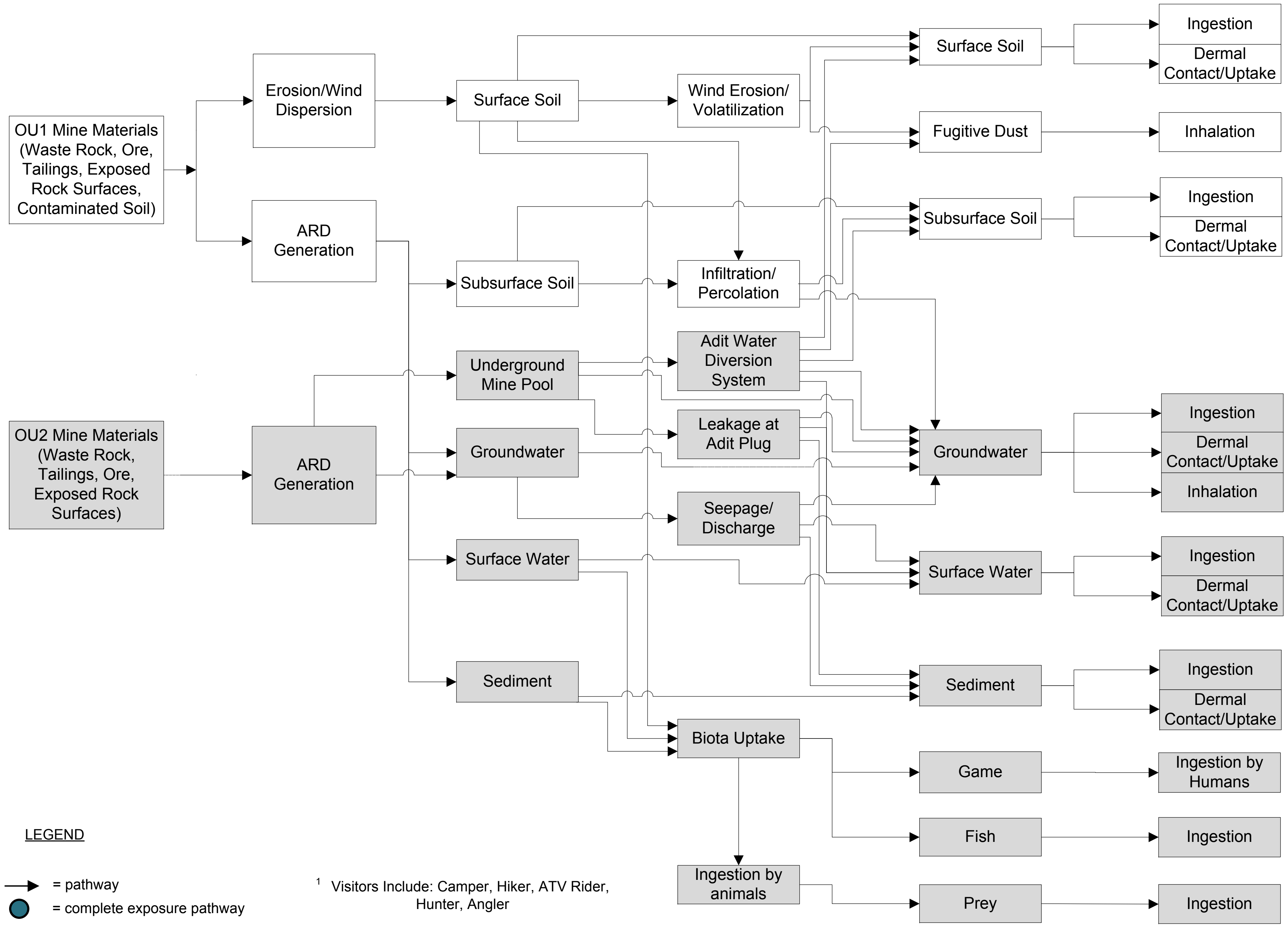
Figure 1-2

Site Features and Historic Facilities

Formosa Mine Superfund Site
Douglas County, Oregon

PRIMARY SOURCES | PRIMARY RELEASE MECHANISMS | SECONDARY SOURCES | SECONDARY RELEASE MECHANISMS | EXPOSURE MEDIUM | POTENTIAL EXPOSURE ROUTE



POTENTIAL RECEPTORS

Exposure Medium	Potential Exposure Route	Human Receptors: Visitors[1]	Human Receptors: Workers	Human Receptors: Workers	Ecological Receptors: Invertebrates	Ecological Receptors: Vegetation	Ecological Receptors: Mammals	Ecological Receptors: Birds	Ecological Receptors: Fish
Surface Soil	Ingestion	●	●	○	●	NA	●	●	○
Surface Soil	Dermal Contact/Uptake	●	●	○	●	●	▲	▲	○
Fugitive Dust	Inhalation	●	●	●	▲	NA	▲	▲	○
Subsurface Soil	Ingestion	○	▲	○	○	NA	▲	○	○
Subsurface Soil	Dermal Contact/Uptake	○	▲	○	○	▲	▲	○	○
Groundwater	Ingestion	○	○	○	○	NA	○	○	○
Groundwater	Dermal Contact/Uptake	○	○	○	○	○	○	○	○
Groundwater	Inhalation	○	○	○	○	NA	○	○	○
Surface Water	Ingestion	●	●	●	●	NA	●	●	●
Surface Water	Dermal Contact/Uptake	●	●	●	●	●	●	●	●
Sediment	Ingestion	●	○	●	●	NA	●	●	▲
Sediment	Dermal Contact/Uptake	●	○	○	●	▲	●	●	▲
Game	Ingestion by Humans	▲	○	▲	NA	NA	NA	NA	NA
Fish	Ingestion	●	○	●	○	NA	●	●	●
Prey	Ingestion	○	○	○	▲	NA	●	●	●

LEGEND

→ = pathway
● = complete exposure pathway
○ = incomplete exposure pathway
▲ = complete exposure pathway, qualitatively evaluated
= shading indicates OU2
NA = not applicable

[1] Visitors Include: Camper, Hiker, ATV Rider, Hunter, Angler

Note: Surface soil is defined as 0 to 6 inches below ground surface (bgs), greater than 6 inches bgs is considered subsurface soil.

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CONCEPTUAL SITE MODEL FOR HUMAN AND ECOLOGICAL EXPOSURES
Formosa Mine Superfund Site
Douglas County, Oregon

FIGURE 2-1

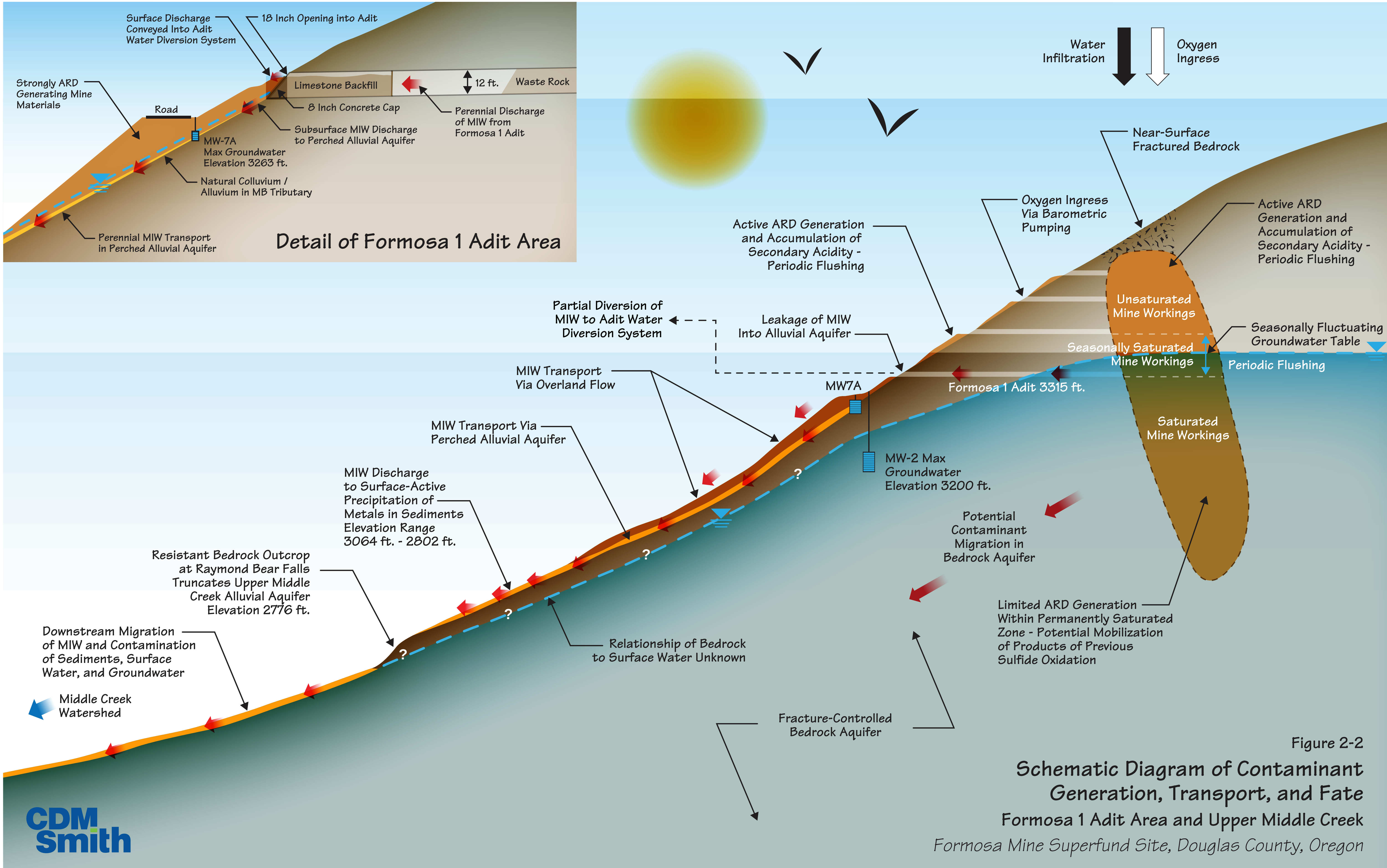


Figure 2-2

Schematic Diagram of Contaminant Generation, Transport, and Fate

Formosa 1 Adit Area and Upper Middle Creek

Formosa Mine Superfund Site, Douglas County, Oregon

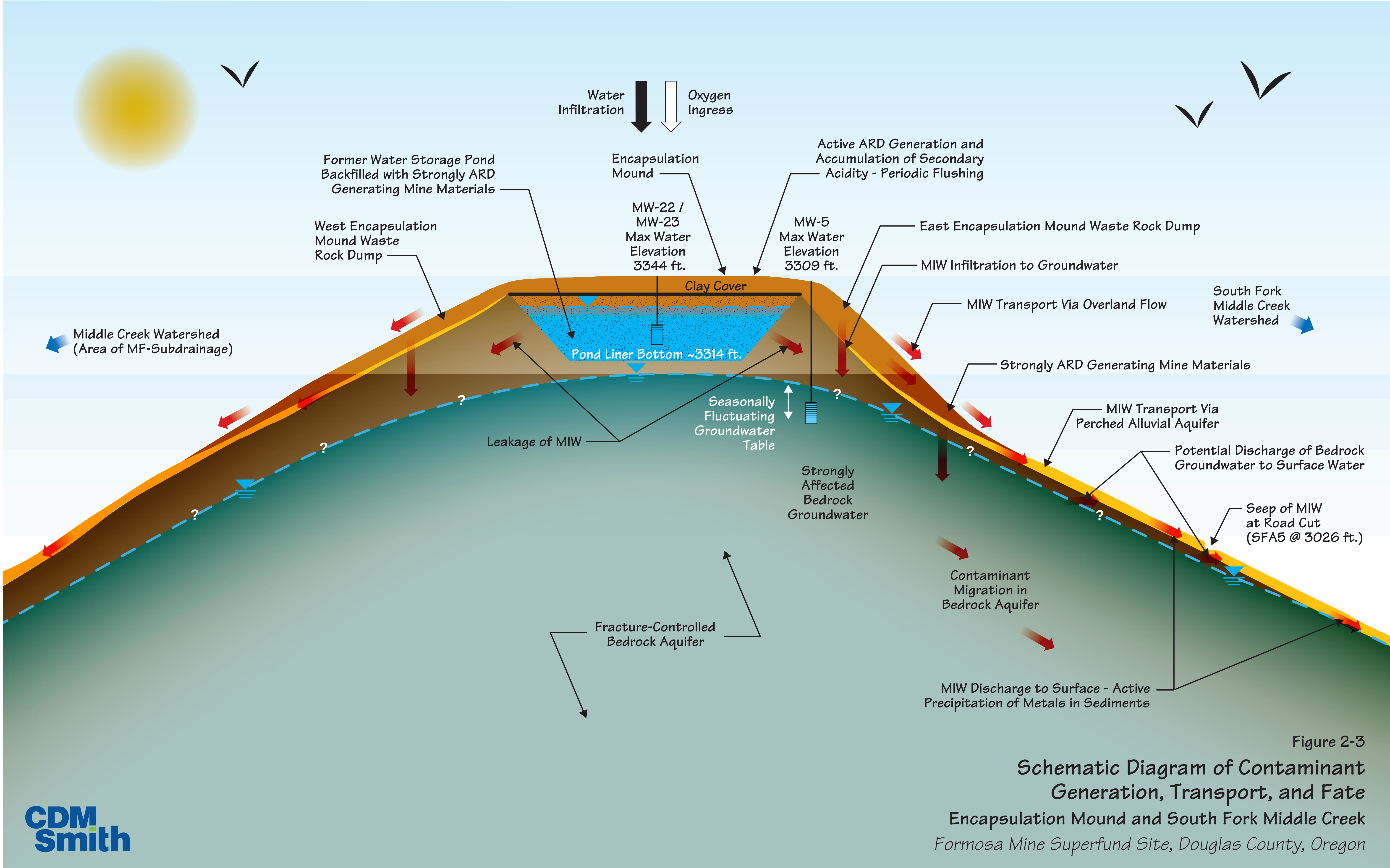


Figure 2-3

Schematic Diagram of Contaminant Generation, Transport, and Fate

Encapsulation Mound and South Fork Middle Creek

Formosa Mine Superfund Site, Douglas County, Oregon

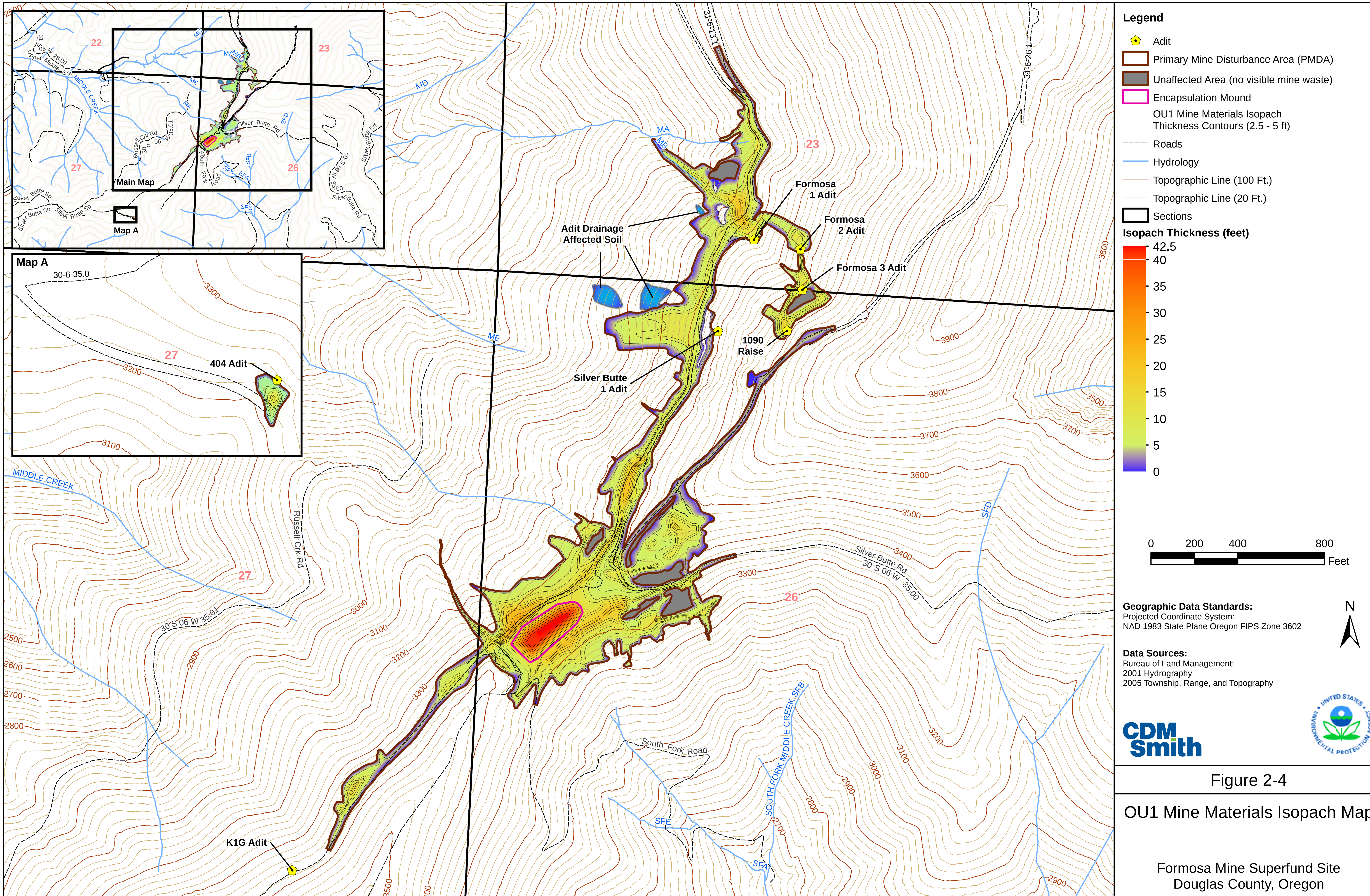
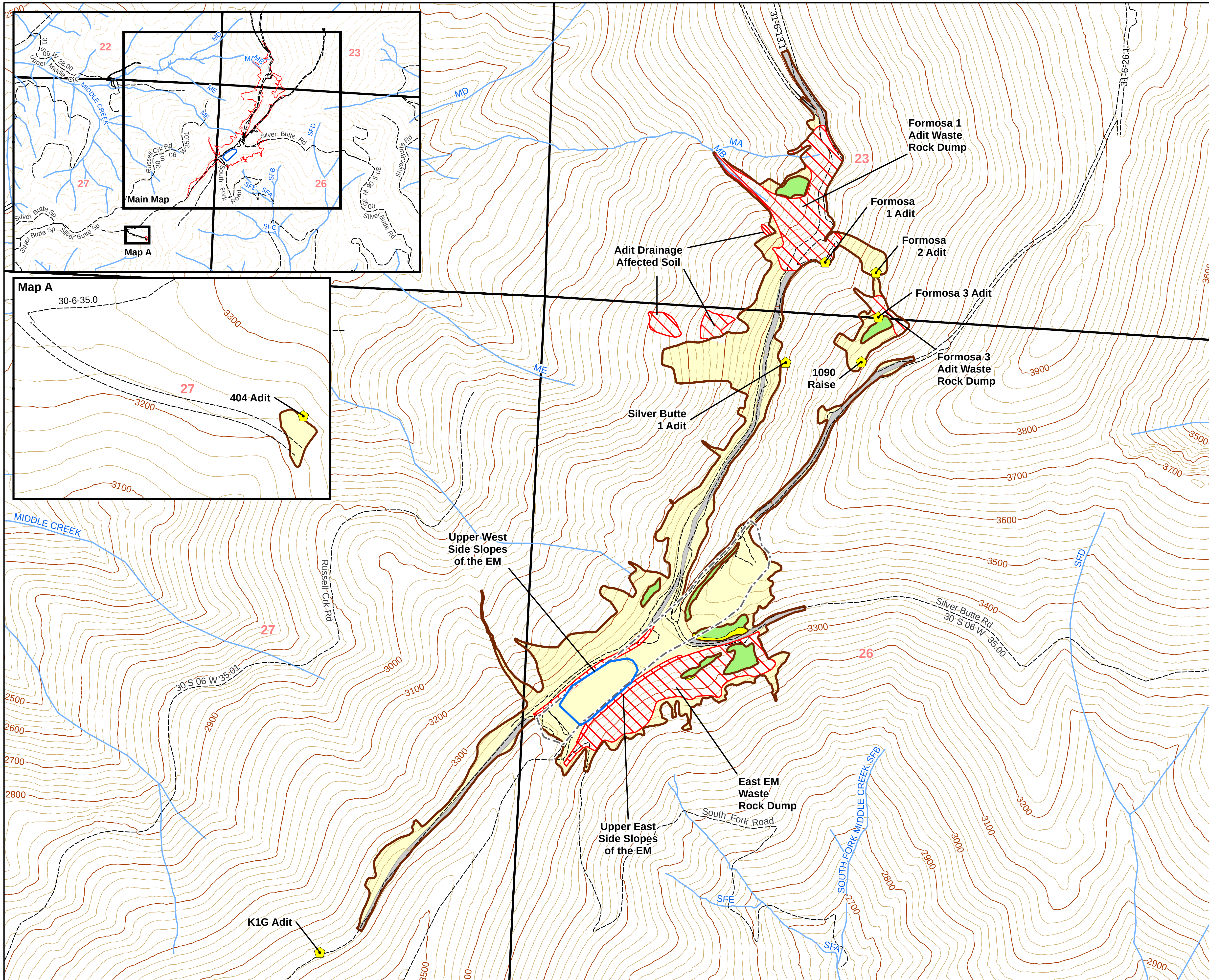


Figure 2-4

OU1 Mine Materials Isopach Map

Formosa Mine Superfund Site
Douglas County, Oregon



Legend

- Adit
- ARD Generating Bedrock Outcrops
- Primary Mine Disturbance Area (PMDA)
- Unaffected Area (no visible mine waste)
- Approximate Extent of Exposure Barriers
- Approximate Extent of Excavations
- Encapsulation Mound
- Approximate Extent of Pavement Cover
- Approximate Extent of Proposed Facility within PMDA
- Roads
- Hydrology
- Topographic Line (100 Ft.)
- Topographic Line (20 Ft.)
- Sections

0 200 400 800 Feet

N

Geographic Data Standards:
Projected Coordinate System:
NAD 1983 State Plane Oregon FIPS Zone 3602

Data Sources:
Bureau of Land Management:
2001 Hydrography
2005 Township, Range, and Topography

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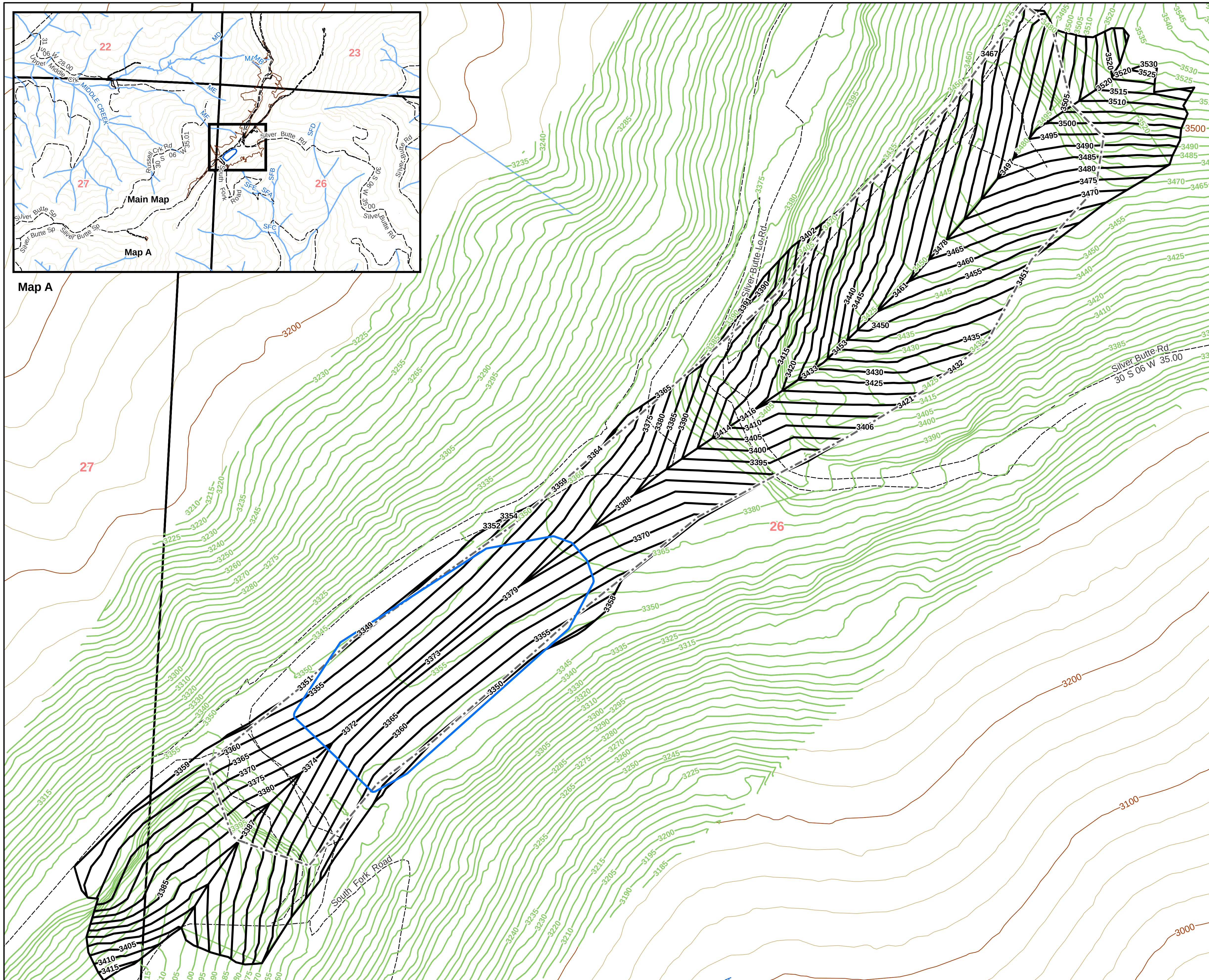
Figure 7-1

Conceptual Surface Configuration
Alternative 2

Formosa Mine Superfund Site
Douglas County, Oregon



Legend

- Encapsulation Mound
- Approximate Extent of Proposed Facility within PMDA
- Modeled Mine Material Consolidation Contours of Proposed Facility within PMDA
- Existing Contours (5 ft)
- Roads
- Hydrology
- Topographic Line (100 Ft.)
- Topographic Line (20 Ft.)
- Sections

0 50 100 200 Feet

N

Geographic Data Standards:
Projected Coordinate System:
NAD 1983 State Plane Oregon FIPS Zone 3602

Data Sources:
Bureau of Land Management:
2001 Hydrography
2005 Township, Range, and Topography

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Figure 7-2

Proposed Facility within Primary Mine Disturbance Area

Formosa Mine Superfund Site
Douglas County, Oregon

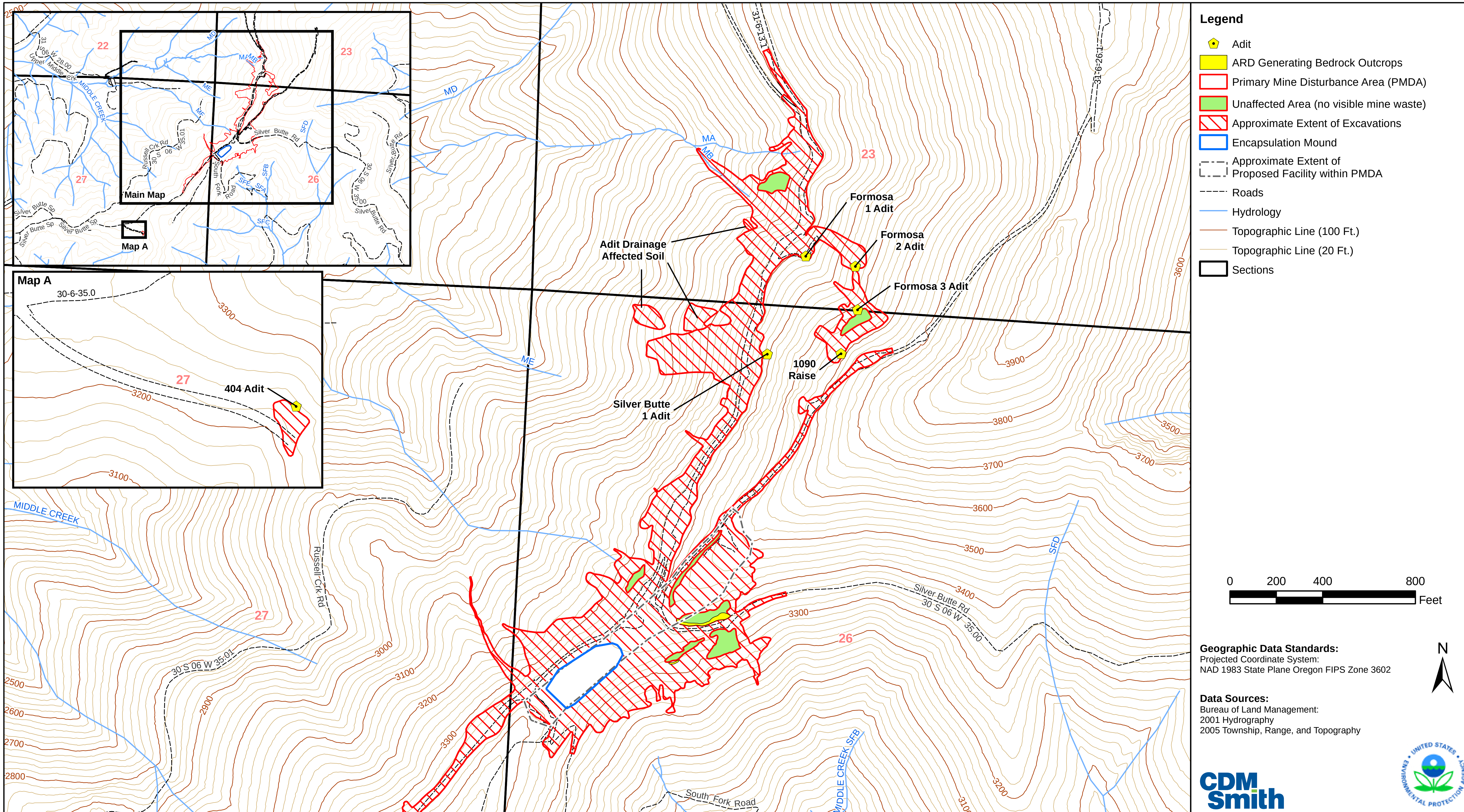

Figure 7-3

Conceptual Surface Configuration
Alternative 3

Formosa Mine Superfund Site
Douglas County, Oregon

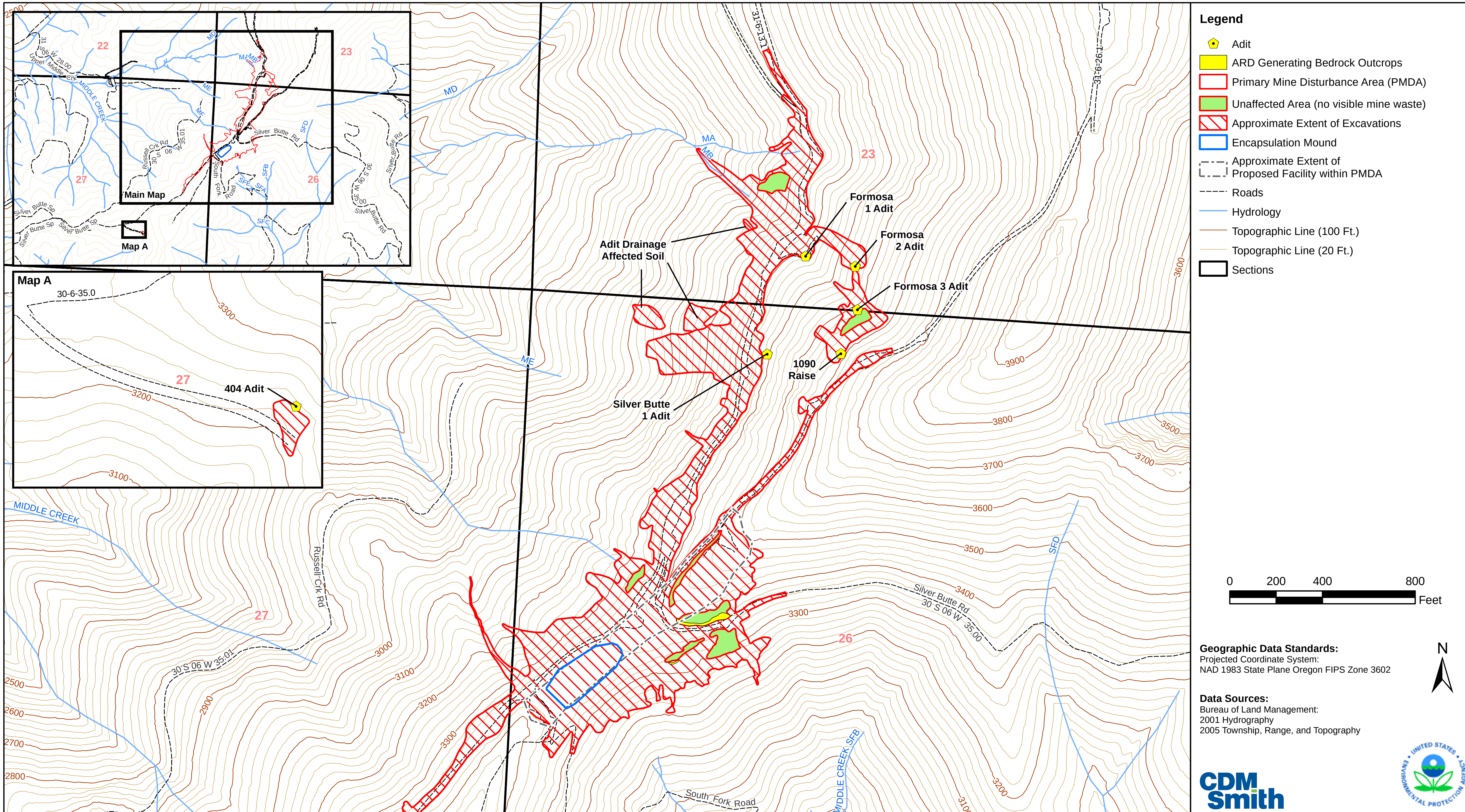

Figure 7-4

Conceptual Surface Configuration
Alternative 4

Formosa Mine Superfund Site
Douglas County, Oregon

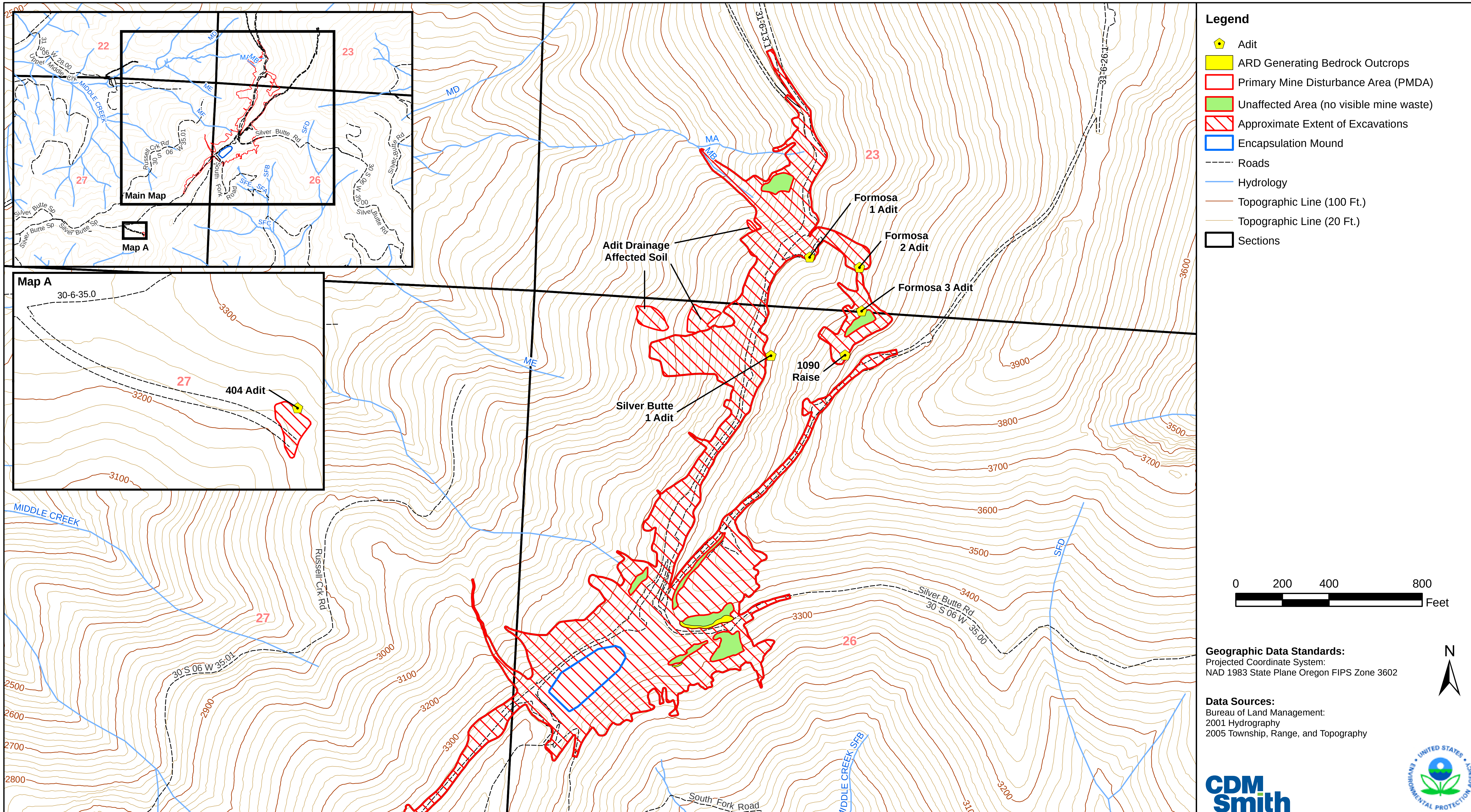

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Figure 7-5

Conceptual Surface Configuration
Alternative 6

Formosa Mine Superfund Site
Douglas County, Oregon

Appendix A
Summary of Federal and State ARARs and TBCs

Summary of Potential Federal and State Applicable or Relevant and Appropriate Requirements (ARARs) and To Be Considered Information (TBCs)
Formosa Mine Superfund Site

Statutes, Regulations, Standards, or Requirements [a]	Citations or References [b]	Preliminary ARAR Determination	Description	Comment	Chemical-Specific	Location-Specific	Action-Specific
Federal ARARs and TBCs							
National Historic Preservation Act	16 U.S.C. 470 36 CFR Part. 800 40 CFR 6.301(b)	Applicable	A requirement for a property included in or eligible for the National Register of Historic Places. The NHPA requires federally funded projects to identify and mitigate impacts of project activities on properties included in or eligible for the National Register. This statute and implementing regulations require federal agencies to take into account the effect of this response action upon any district, site, building, structure, or object that is included in or eligible for the National Register of Historic Places (generally, 50 years old or older). If cultural resources on or eligible for the national register are present, it will be necessary to determine if there will be an adverse effect and, if so, how the effect may be minimized or mitigated, in consultation with the appropriate State Historic Preservation Office.	No property or resources at the site are included in the National Registry; however, substantive portions of the NHPA would be applicable if EPA determines that response actions may impact property and/or resources eligible for listing in the National Registry.		✓	
Archaeological and Historic Preservation Act	16 U.S.C. 469 40 CFR 6.301(c)	Applicable	The AHPA requires that for federally approved projects that may cause irreparable loss to significant scientific, prehistoric, historic, or archaeological data, the data must be preserved by the agency undertaking the project or the agency undertaking the project may request DOI to do so. This statute and implementing regulations establish requirements for the evaluation and preservation of historical and archaeological data, which may be destroyed through alteration of terrain as a result of a federal construction project or a federally licensed activity or program.	No prehistoric or historic sites were identified in existing data for the area that potentially could be impacted by the remedial action. However, because much of the area has not been previously surveyed, Phase I archaeological surveys will be conducted if any remedy components are to be located in a previously undisturbed area. If response activities impact archaeological resources at the Site, substantive portions of this law would be applicable.		✓	

Statutes, Regulations, Standards, or Requirements [a]	Citations or References [b]	Preliminary ARAR Determination	Description	Comment	Chemical-Specific	Location-Specific	Action-Specific
Federal ARARs and TBCs							
Historic Sites, Buildings, and Antiquities Act of 1935	16 U.S.C. 461–467	Applicable	For areas designated as historic sites, the action should avoid undesirable impacts on landmarks and encourage the long-term preservation of nationally significant properties that illustrate or commemorate the history and prehistory of the United States. In conducting an environmental review of a proposed action, the responsible official shall consider the existence and location of natural landmarks using information provided by the National Park Service pursuant to 36 CFR § 62.6(d) to avoid undesirable impacts on such landmarks	Substantive portions of this law would be applicable if EPA determines that response activities will impact areas eligible for listing on the Historic Site, Building, Objects, and Antiquities Register.		✓	
Archaeological Resources Protection Act of 1979, as Amended 1988	16 U.S.C. 470aa–470mm	Applicable	Archaeological Resources Protection Act provides for the preservation of archeological and historic data that might be destroyed through alternation of terrain during a federal construction project or federally licensed activity.	The site has undergone extensive excavations and disturbances therefore, is unlikely to contain potential archaeological resources; however, substantive portions of this law would be applicable if EPA determines that remedial activities would cause loss or adverse impacts to significant scientific, prehistoric, historic, or archaeological data.		✓	
Resource Conservation and Recovery Act: Location Standards for Hazardous Waste Facilities-100 Year Floodplains	42 U.S.C. 6901 40 CFR 264.18(b)	Relevant and Appropriate	Hazardous waste TSDFs located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout of any 100-year floodplain	Relevant and appropriate provisions will be identified for waste repositories constructed on site.		✓	✓
Resource Conservation and Recovery Act: Subtitle C— Exemption for Extraction, Beneficiation and Processing Mining Waste	40 CFR 261.4(b)(7)	Applicable	EPA exempts mining wastes from the extraction, beneficiation, and some processing of ores and minerals, in accordance with the Bevill amendment to RCRA.	OU1 mine materials may meet this exemption.	✓		✓

Statutes, Regulations, Standards, or Requirements [a]	Citations or References [b]	Preliminary ARAR Determination	Description	Comment	Chemical-Specific	Location-Specific	Action-Specific
Federal ARARs and TBCs							
Resource Conservation and Recovery Act: Subtitle C—Hazardous Waste Characteristics	40 CFR 261.20 Characteristics of Hazardous Waste	Applicable	Generators of solid waste must determine whether the waste is hazardous. A solid waste is hazardous if it exhibits the toxicity characteristic (based on extraction procedure Method 1311).	Applicable to solid waste generated during remediation.	✓		
Resource Conservation and Recovery Act: Subtitle C—Hazardous Remediation Waste Management Requirements (HWIR Media)	40 CFR 264.554 Staging Piles	Relevant and Appropriate	The use of staging piles facilitates short-term storage of remediation wastes for shipment offsite or onsite treatment. The regulations contain performance standards for these piles but piles are not subject to LDRs.	Relevant and appropriate provisions will be identified if hazardous waste is managed in a staging pile.	✓		✓
Resource Conservation and Recovery Act Subtitle C—Hazardous Waste Treatment and Storage	40 CFR 264 Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities	Relevant and Appropriate	Requirements for storing or treating hazardous wastes in tanks, containers, or surface impoundments. Subpart F addresses groundwater monitoring at hazardous waste TSDFs. Closure requirements for hazardous waste repositories are covered under Subpart G. Hazardous waste landfills must meet minimum design standards under Subpart N.	Relevant and appropriate provisions will be identified after a preferred alternative is identified and further details are available during siting and pre-design phases. Relevant and appropriate, because an on-site mine waste disposal facility could be relatively similar to hazardous waste facility. Therefore, aspects of Subpart G and the design standards in Subpart N may be appropriate standards to use for design and construction of a disposal facility.			✓
Resource Conservation and Recovery Act: Subtitle D—Criteria for Classification of Solid Waste Disposal Facilities and Practices	42 U.S.C. 6901 et seq. 40 CFR 257	Relevant and Appropriate	Certain criteria are required to be met by solid waste disposal facilities and disposal practices. Relevant criteria such as not restricting the base flow of the floodplain, not taking threatened or endangered species, and not causing a discharge to navigable waters, may be useful for siting and design of a disposal facility.	After selection of the preferred alternative, relevant provisions will be identified.			✓

Statutes, Regulations, Standards, or Requirements [a]	Citations or References [b]	Preliminary ARAR Determination	Description	Comment	Chemical-Specific	Location-Specific	Action-Specific
Federal ARARs and TBCs							
Resource Conservation and Recovery Act Subtitle D—Disposal of Nonhazardous Solid Waste	42 U.S.C. 6901 et. seq. 40 CFR Part 258	Relevant and Appropriate	Provides criteria for cover material, run-on/runoff control systems, access control, restrictions on disposal of liquid wastes.	After selection of the preferred alternative, relevant provisions will be identified during siting and pre-design activity.			✓
Mineral Lands and Regulations in General (General Mining Act of 1872)	17 STAT.91; amended 30 U.S.C. 22.28 36 CFR 228.8-10	Not an ARAR	Authorizes and governs prospecting and mining for economic minerals, such as gold, platinum, and silver, on federal public lands.	This is not an environmental siting statute.			
Surface Mining Control and Reclamation Act of 1977	30 U.S.C. 120 et seq. 30 CFR 816	Not an ARAR	Provides for the cooperation between the Secretary of the Interior and the states with respect to the regulation of surface coal mining operations, and the acquisition and reclamation of abandoned mines.	No surface mining activity is ongoing therefore not a regulatory requirement. Although this statute provides performance criteria for surface mines such as coals mining, it is not appropriate for an underground hardrock mine.			
Resource Conservation and Recovery Act -Land Disposal Restrictions	40 CFR 260 268	Applicable	This part identifies hazardous wastes that are restricted from land disposal. The temporary or permanent placement of restricted hazardous wastes on the land at a CERCLA site may trigger RCRA land disposal restrictions as applicable requirements.		✓		✓
Fish and Wildlife Coordination Act Responsible official requirements Rules implementing the Fish and Wildlife Conservation Act of 1980	16 U.S.C 661 et seq., 40 CFR 6.302(g) 50 CFR 83	Applicable	This statute and implementing regulations require coordination with federal and state agencies for federally funded projects to ensure that any modification of any stream or other water body affected by any action authorized or funded by the federal agency provides for adequate protection of fish and wildlife resources.	If the remedial action involves activities that affect wildlife and/or non-game fish, federal agencies must first consult with the USFWS and the relevant state agency with jurisdiction over wildlife resources.		✓	

Statutes, Regulations, Standards, or Requirements [a]	Citations or References [b]	Preliminary ARAR Determination	Description	Comment	Chemical-Specific	Location-Specific	Action-Specific
Federal ARARs and TBCs							
Endangered Species Act Responsible official requirements Endangered and threatened wildlife and plants Interagency cooperation-Endangered Species Act of 1973, as amended	16 USC 1531 40 CFR 6.302(h) 50 CFR 17 50 CFR 402	Applicable	This statute and implementing regulations provide that federal activities not jeopardize the continued existence of any threatened or endangered species. ESA Section 7 requires consultation with the USFWS to identify the possible presence of protected species and mitigate potential impacts on such species.	If threatened or endangered species are identified within tareas for remedial action, activities must be designed to conserve the species and their habitat. To date no threatened or endangered species have been identified in the PMDA area of the site.		✓	
Migratory Bird Treaty Act List of Migratory Birds	16 USC. 703, et seq. 50 CFR 10.13	Relevant and Appropriate	Makes it unlawful to "hunt, take, capture, kill," or take other various actions adversely affected a broad range of migratory birds, without the prior approval of the Department of the Interior.	The selected remedial actions will be carried out in a manner to avoid adversely affecting migratory bird species, including individual birds or their nests.		✓	
Clean Air Act	42 U.S.C. 7401, et seq.	Not an ARAR	The Clean Air Act establishes NAAQS for pollutants considered to be harmful to public health and the environment. The NAAQSs are not enforceable themselves, but the state translates these ambient standards into specific emission limitation in the SIP).	The selected remedial actions will be carried out in a manner that will comply with NAAQS. Although this is not an ARAR, the state requirements, in portions of the SIP, will be applicable.	✓	✓	✓

Statutes, Regulations, Standards, or Requirements [a]	Citations or References [b]	Preliminary ARAR Determination	Description	Comment	Chemical-Specific	Location-Specific	Action-Specific
Federal ARARs and TBCs							
Clean Water Act/Water Pollution Control Act	33 U.S.C. 1251 Section 307 – Toxic and Pre-Treatment Standards Section 401—Water Quality Certification Section 402 – National Pollutant Discharge Elimination System Sections 301-302 – Effluent Limitations Setion 303 – Water Quality Standards Section 304 – Federal Water Quality Criteria Section 306 – National Performance Standards	Relevant and Appropriate	These regulations govern water quality, including water discharged as part of a remedial process. Section 307—Pretreatment regulations under 40 CFR Part 403 provide for limits on discharge to a sanitary sewer system, protecting the municipal system from accepting wastewater that would cause it to exceed its NPDES permit discharge limits. Section 401—Water Quality Certification requires that EPA receive a water quality certification from a state that a given project requiring a federal permit that may result in a discharge to navigable water will comply with the state's water quality standards. Section 402—The NPDES program establishes a comprehensive framework for addressing processing water and stormwater discharges under the program. Requires that point-source discharges not cause the exceedance of surface water quality standards outside the mixing zone. Specifies requirements under 40 CFR 122.26 for point-source discharge of stormwater from construction sites to surface water and provides for Best Management Practices such as erosion control for removal and management of sediment to prevent run-on and runoff.	The remedial alternatives for OU1 address only mine materials. The substantive provisions are relevant and appropriate to OU1 remedial alternatives. These regulations include standards of control and other substantive environmental protection requirements that address situations similar to the circumstances of the proposed response action and are well suited to the conditions of the site. The remedial actions will be protective of surface water.			✓
Hazardous Waste Operations and Emergency Response	29 CFR 1910.120 and 40 CFR 311	Applicable	Worker protection during hazardous waste cleanup and CERCLA removal actions		✓		✓
Executive Order 11593 Protection and Enhancement of the Cultural Environment	16 U.S.C. 470	Applicable	Requires federal agencies to consider the existence and location of potential and existing National Natural Landmarks to avoid undesirable impacts on them			✓	

Statutes, Regulations, Standards, or Requirements [a]	Citations or References [b]	Preliminary ARAR Determination	Description	Comment	Chemical-Specific	Location-Specific	Action-Specific
Federal ARARs and TBCs							
Bald Eagle Protection Act	16 U.S.C. 668 et seq.	Applicable	Requires continued consultation with the USFWS during remedial design and remedial construction to ensure that any cleanup of the site does not unnecessarily adversely affect the bald or golden eagle.			✓	
Federal Land Policy and Management Act of 1976	43 U.S.C. 1701	Not an ARAR	Provides for multiple use and inventory, protection, and planning for cultural resources on public lands.	This statute provides administrative framework for managing and protecting resources on federal land. Substantive provisions are included in other federal action and location specific ARARs.			
Resource Management Plan	Northwest Forest Plan FSEIS, 1994 and ROD, 1994	To Be Considered-Not an ARAR	This is the current applicable approved Resource Management Plan for the area of BLM Managed Lands.	If BLM land is considered for a disposal facility or borrow source, this plan may provide useful guidance. Non-promulgated advisories, plans, or guidance issued by federal or state governments are not legally binding and do not have the status of ARARs. However, such requirements may be useful and are "to be considered". TBC requirements (40 C.F.R. § 300.400[g][3]) complement ARARs but do not override them. They are useful for guiding decisions regarding cleanup levels or methods when regulatory standards are not available.			

Statutes, Regulations, Standards, or Requirements [a]	Citations or References [b]	Preliminary ARAR Determination	Description	Comment	Chemical-Specific	Location-Specific	Action-Specific
Federal ARARs and TBCs							
Survey and Manage Settlement Agreement of 2011		To Be Considered-Not an ARAR	EPA is a signator to this agreement – we have put a question into our solicitor to see if it applies to CERCLA – The 2011 Settlement Agreement relates to the Northwest Forest Plan Implementation – Survey and Manage Mitigation Measure. The Agreement provides direction regarding Survey and Manage species and the 2007 ROD removing the Survey and Manage Mitigation Measure. The specific species list is expanded, from the previous 2001 listing, for actions after 30 September 2012. Other criteria and exemptions are established for projects within the range of the northern spotted owl.	This agreement is not applicable, or relevant and appropriate, because it is not a cleanup standard, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address circumstances at a CERCLA site and does not address problems or situations similar to the circumstances of the proposed response action. EPA and BLM are both a party to this agreement, and CERCLA is not exempted. The agreement will provide useful guidance for cleanup decisions, but may not have substantive provisions that are more stringent than other federal ARARs.			
Disposal of Solid Waste Criteria for Classification of Solid Waste Disposal Facilities and Practices	42 U.S.C. 6901 et seq. 40 CFR 257	Relevant and Appropriate	Facility or disposal practices in floodplains will not restrict flow of basic floods, reduce the temporary water-storage capacity of the floodplain, or otherwise result in a washout of solid waste. Establishes criteria for determining which solid waste disposal practices pose threats to human health and the environment.	May be considered relevant and appropriate for a disposal facility or repository located "onsite."			✓
BLM AML Handbook		To Be Considered	BLM Policies Management of Abandoned Mine Lands including, but not limited to, Section 9.4.7.2. Repositories	The handbook may provide useful guidance for cleanup decisions or methods. After selection of a preferred alternative, the handbook can be used during the siting and design of a disposal facility.			

Statutes, Regulations, Standards, or Requirements	Citations or References	Preliminary ARAR Determination	Description	Comment	Chemical-Specific	Location-Specific	Action-Specific
State of Oregon ARARs and TBCs							
Indian Graves And Protected Objects Historic Property Historic Preservation Plan Preservation Of Property Of Historic Significance Oregon Property Management Program For Historic Sites And Properties Archaeological Objects And Sites Archaeological Sites and Historical Material	ORS 97.740-97.750 Protection of Indian Graves ORS 358.475 Policy Special Assessment of Historic Property ORS 358.612 Authorities of State Historic Preservation Officer ORS 358.622 (State Advisory Committee on Historic Preservation) ORS 358.635 (Preservation of state-owned historic property) ORS 358.680-690 (Oregon Property Management Program) ORS 358.905 (General Archaeology) ORS 390.235 (Issuance of Archeological Permits	Not an ARAR	Governs Oregon Historical Preservation. Analogous to Federal Historic Preservation Act (36 CFR; Parts 60 and 61), and NHPA.	Not a potential ARAR. The Formosa Mine Superfund Site is not included in or eligible for the National Register. The Oregon statutes are no more stringent that the Federal requirements of the NHPA. The NHPA is not a potential ARAR. The NHPA requires federally funded projects to identify and mitigate impacts of project activities on properties included in or eligible for the National Register. No historic building or landmark is present at the Formosa Mine Superfund Site that could be impacted by the remedial action. In addition, no building in the project area was constructed prior to 1950, a date typically used as an initial screen for determining eligibility for the National Register. Therefore, the NHPA is not a potential ARAR.			

Statutes, Regulations, Standards, or Requirements	Citations or References	Preliminary ARAR Determination	Description	Comment	Chemical-Specific	Location-Specific	Action-Specific
State of Oregon ARARs and TBCs							
Oregon Threatened or Endangered Wildlife Species, ORS 496.171-192	ORS 496.171-192	Not an ARAR	Sets forth standards for the Oregon Fish and Wildlife Commission to list species as threatened or endangered; authorizes the Commission to enact regulations necessary to ensure survival of listed species, such as protecting habitat; expressly provides that this regulation does not, by itself, require an owner of private land to take action to protect an endangered or threatened species.	The statute does not contain substantive requirements and is not more stringent than the federal ESA. The listed species might be different from the federal ESA. After the FS, both lists will be checked relative to the preferred alternative and in preparation of the ROD.			
General Emission Standards and Air Quality [c]	ORS 468A OAR 340-226-0100 Policy and application	Relevant and Appropriate	Provides general emission standards for fugitive emissions of air contaminants and requires highest and best practicable treatment or control of such emissions. EPA has established NAAQS for several pollutants. NAAQS may be applicable for conditions at a site that results in emissions to air of criteria pollutants. If a remedial activity may exceed regulatory criteria, the activity may be subject to preconstruction review in designated attainment areas. The source may qualify for emission exemption under OAR 340-020-0245. If a preconstruction permit is required, Oregon DEQ has statutory authority to waive it under ORS 465.315.	The Formosa Mine Superfund Site, in Douglas County, is not within a designated non-attainment or air quality maintenance area. Therefore, emission criteria and rules for Special Control Areas (defined in OAR-340-204) are not applicable. OAR 340-226-0100 are potential relevant and appropriate requirements for remedial alternatives being considered, because the EPA delegated them into SIP per the CAA, 42 U.S.C. §§ 7401–7671.	✓	✓	✓

Statutes, Regulations, Standards, or Requirements	Citations or References	Preliminary ARAR Determination	Description	Comment	Chemical-Specific	Location-Specific	Action-Specific
State of Oregon ARARs and TBCs							
Visible Emissions and Nuisance Requirements	OAR 340-208-0200-0210 - Fugitive Emission Requirements	Relevant and Appropriate	Prohibits any handling, transporting, or storage of materials, or use of a road, or any equipment to be operated, without taking reasonable precautions to prevent particulate matter from becoming airborne. These rules include areas other than "special control areas" where fugitive emissions may cause a nuisance and control measures are practicable.	Potentially relevant and appropriate as applicable parts pertain to areas and sources outside Special Control Areas defined in OAR-340-204. Substantive provisions of OAR 340-208-0200 are potentially applicable state requirements because they are not included in the SIP.			✓
Noise Control Regulations	OAR 340-035-0035	Relevant and Appropriate	Sets noise standards for equipment, facilities, operations, or activities including the production, storage, handling, sale, purchase, exchange, or maintenance of a product, commodity, or service, including the storage or disposal of waste products.	Potentially relevant to remedial activities and equipment that may generate noise.			✓
Removal or Remedial Action	ORS 465.200- 465.900 Oregon Hazardous Substance Remedial Action Rules [c] OAR 340-122 *et seq.*	Relevant and Appropriate	Sets standards for degree of cleanup required. Establishes acceptable risk levels for human health at 1 x 10^{-6} for individual carcinogens, 1 x 10^{-5} for multiple carcinogens; and Hazard Index of 1.0 for non-carcinogens; and protection of ecological receptors at the individual level for threatened or endangered species and the population levels for all others.	May be relevant and appropriate if substantive cleanup standards are more stringent than federal requirements.	✓		✓

Statutes, Regulations, Standards, or Requirements	Citations or References	Preliminary ARAR Determination	Description	Comment	Chemical-Specific	Location-Specific	Action-Specific
State of Oregon ARARs and TBCs							
Oregon Hazardous Waste Management Act	ORS 466.005 – 466.225 Hazardous Waste Management Rules; OAR 340-100 *et. seq.*	Relevant and Appropriate	Establish a regulatory structure for the generation, transportation, treatment, storage, and disposal of hazardous wastes. OAR Chapter 340, Divisions 100 to 106, 109, 111, 113, 120, 124, and 142 incorporate, by reference, hazardous waste management regulations of the federal program, included in 40 CFR Parts 260 to 266, 268, 270, 273, and Subpart A and Subpart B of Part 124, into OAR.	May be relevant and appropriate if substantive cleanup standards are more stringent than federal requirements for remedial actions that generate listed or characteristic hazardous wastes including environmental media such as contaminated soil and/or groundwater. OAR Chapter 340, Divisions 100 to 106, 109, 111, 113, 120, 124, and 142 incorporate, by reference, hazardous waste management regulations of the federal program, included in 40 CFR Parts 260 to 266, 268, 270, 273 ,and Subpart A and Subpart B of Part 124, into OAR.	✓		✓
Solid Waste Management Solid Waste: General Provisions	ORS 459.005 - 418 OAR 340-093 - 097	Relevant and Appropriate	Regulations under this statute establish a regulatory structure for the collection, transportation, treatment, storage, and disposal of solid wastes.	May be relevant and appropriate if substantive cleanup standards are more stringent than federal requirements for on-site management and disposal of contaminated soil, groundwater, and mine materials.			✓
Solid Waste Management - Municipal	ORS 459.046- OAR 340-094	Not an ARAR	Regulations under this statute establish a regulatory structure for the collection, transportation, treatment, storage, and disposal of solid wastes at municipal solid waste landfills.	May be relevant and appropriate if substantive cleanup standards are more stringent that federal requirements for onsite management and disposal of contaminated soil, groundwater, and mine materials.			✓

Statutes, Regulations, Standards, or Requirements	Citations or References	Preliminary ARAR Determination	Description	Comment	Chemical-Specific	Location-Specific	Action-Specific
State of Oregon ARARs and TBCs							
Solid Waste Management	ORS 459 OAR 340-095 Land Disposal Sites Other than Municipal Solid Waste Landfills	Not an ARAR	Governs the management of solid wastes, and land disposal sites, other than municipal solid waste landfills.	May be relevant and appropriate if substantive cleanup standards are more stringent than federal requirements for on-site management or disposal of mine-impacted material.			✓

Statues, Regulations, Standards, or Requirements	Citations or References	Preliminary ARAR Determination	Description	Comment	Chemical-Specific	Location-Specific	Action-Specific
State of Oregon To Be Considered (TBCs)							
Final Guidance Consideration of Land Use In Environmental Remedial Actions	OAR 340-122 Oregon DEQ, July 1998	To Be Considered	Describes how to make a land use determination for use in a risk assessment and in the remedy selection process.	No Comments.		✓	✓
Guidance for identification of Hot Spots	OAR 340-122 Oregon DEQ, April 1998	To Be Considered	Describes procedures for delineating "hot spots" in water and other environmental media.	Guidance for hot spot determination for non-CERCLA state sites. For Superfund sites, this TBC may be relevant to the selection of remedial alternatives but only where consistent with overall EPA guidance and policy		✓	✓
Final Guidance for Use of Institutional Controls	OAR 340-122 Oregon DEQ, April 1998	To Be Considered	Guidance for selection or approval of institutional controls as part or all of a remedy.	For Superfund sites, this TBC may be relevant to the selection of remedial alternatives but only where consistent with overall EPA guidance and policy.			✓
Guidance for Assessing Bioaccumulative Chemicals of Concern in Sediment, DEQ, 2007	OAR 340-122	To Be Considered	Describes a process to evaluate chemical found in sediment for their potential contribution to risk as a result of bioaccumulation. Provides alternative methods for developing sediment screening levels and bioaccumulation bioassay data.	Does not pertain to remedial actions considered for Formosa OU1. All remedial actions for OU1 address soil only. However, this guidance may have information pertinent to remedial actions adjacent to and within surface water bodies near Formosa OU1.			
Human Health Risk Assessment Guidance, DEQ, 2010	OAR 340-122	To Be Considered	Describes methods that may be used to perform human health risk assessments at cleanup sites in Oregon.	Does not pertain to remedial actions considered for Formosa OU1 because the risk assessment evaluations were completed in the remedial investigation phase. All remedial actions for OU1 have completed the risk assessment phase.			

Statues, Regulations, Standards, or Requirements	Citations or References	Preliminary ARAR Determination	Description	Comment	Chemical-Specific	Location-Specific	Action-Specific
State of Oregon To Be Considered (TBCs)							
Guidance for Ecological Risk Assessment: Levels I, II, III, IV DEQ 1998 and 2001	OAR 340-122	To Be Considered	Describes methods to be used in evaluating ecological risk at cleanup sites in Oregon and provides a Screening Benchmark Table for contaminants.	Does not pertain to remedial actions considered for Formosa OU1, because the risk assessment evaluations were completed in the remedial investigation phase. All remedial actions for OU1 have completed the risk assessment phase.			

[a] Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader. Listing the statutes and policies does not indicate acceptance of the entire statutes or policies as potential ARARs; specific potential ARARs are addressed in the table below each general heading. Only substantive requirements of the specific citations are considered potential ARARs.

[b] Only the substantive provisions of the requirements cited in this table are potential ARARs.

[c] The preamble to the NCP indicates that state regulations that are components of a federally authorized or delegated state program are generally considered federal requirements and potential federal ARARs for the purposes of ARARs analysis (55 Fed. Reg. 8666, 8742 [1990]). The Oregon DEQ received final authorization for the regulation of hazardous wastes on August 15, 1995 (Federal Register Volume 60, Number 116 (Friday, June 16, 1995) and established rules in OAR 340-100 et. seq. For the CAA, EPA approved Oregon's SIP and the air statutes were promulgated as ORS 468 and 468A.

Substantive RCRA requirements are applicable to response actions on CERCLA sites if the waste is a RCRA hazardous waste, and either: the waste was initially treated, stored, or disposed after the effective date of the particular RCRA requirement (1976 for RCRA, and 1984 for the amendments including land disposal restrictions); or the activity at the CERCLA site constitutes treatment, storage, or disposal as defined by RCRA (EPA 1988a CERCLA Compliance With Other Laws Manual, Draft Guidance (Part I). Interim Final EPA/540/G 89/006, Office of Emergency and Remedial Response, Washington, D.C. August.

EPA 1989a. CERCLA Compliance With Other Laws Manual: Part II – Clean Air Act and Other Environmental Statutes and State Requirements, EPA/540/G-89/009, OSWER Directive 9234.1-02, Office of Solid Waste and Emergency Response, Washington, D.C. August.

Acronyms

AHPA	Archaeological and Historic Preservation Act
AML	Abandoned Mine Lands
ARAR	Applicable or Relevant and Appropriate Requirement
BLM	Bureau of Land Management
CAA	Clean Air Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
DOI	United States Department of Interior
EPA	United States Environmental Protection Agency
ESA	Endangered Species Act
FSEIS	Final Supplemental Environmental Impact Statement
LDR	Land Disposal Restrictions
NAAQS	National Ambient Air Quality Standards
NHPA	National Historic Preservation Act
NPDES	National Pollutant Discharge Elimination System
OAR	Oregon Administrative Rules
Oregon DEQ	State of Oregon Department of Environmental Quality
ORS	Oregon Revised Statutes
OSWER	Office of Solid Waste and Emergency Response
OU1	Operable Unit 1
ROD	Record of Decision
RCRA	Resource Conservation and Recovery Act
SMCRA	Surface Mining Control and Reclamation Act
SIP	State Implementation Plan
TBCs	To Be Considered Information
TSDF	Treatment, Storage, and Disposal Facility
U.S.C.	United States Code
USFWS	United States Fish and Wildlife Service

Appendix B

Quantity Calculations for the Screening and Detailed Analysis of Remedial Alternatives

Table B-1
Contaminant Source Material Volume Balances for Alternative Screening and Detailed Analysis
Alternative 2

Remediation Area	Area (acres)	Contaminant Sources (Mine Materials): Volume Contained In-Place (BCY)	Volume Removed, Transported, and Consolidated (BCY): Proposed Facility Within PMDA (4.38 acres)	Volume Removed, Transported, and Consolidated (BCY): Proposed Facility Outside PMDA (0 acres)	Volume Removed, Transported, and Consolidated (BCY): Existing Facility
Encapsulation mound (EM) waste rock/soil	1.05	21,000	0	0	0
EM tailings		19,000	0	0	0
East EM waste rock dump (WRD)	2.98	0	32,000	0	0
Formosa 1 and Formosa 3 adit WRDs	2.86	0	25,000	0	0
Mine materials along the upper side slopes of the EM	0.45	0	8,000	0	0
Road areas to accommodate pavement cover	1.98	0	4,000	0	0
Adit drainage afftected soil	0.51	0	3,000	0	0
All other mine materials	15.10	122,000	0	0	0
Subtotal	24.93	162,000	72,000	0	0
Total	24.93	234,000			

Notes:
BCY = bank cubic yards
PMDA = primary mine disturbance area
Estimated in-place volume (bcy) is rounded up to the nearest 1,000 cubic yards.

Table B-2
Contaminant Source Material Volume Balances for Alternative Screening and Detailed Analysis
Alternative 3

Remediation Area	Area (acres)	Volume Contained In-Place (BCY)	Contaminant Sources (Mine Materials) — Volume Removed, Transported, and Consolidated (BCY): Proposed Facility Within PMDA (4.38 acres)	Proposed Facility Outside PMDA (3.52 acres)	Existing Facility
Encapsulation mound (EM) waste rock/soil	1.05	21,000	0	0	0
EM tailings		19,000	0	0	0
East EM waste rock dump (WRD)	2.98	0	32,000	0	0
Formosa 1 and Formosa 3 adit WRDs	2.86	0	0	25,000	0
Mine materials along the upper side slopes of the EM	0.45	0	8,000	0	0
Road areas to accommodate pavement cover	1.98	0	0	0	0
Adit drainage afftected soil	0.51	0	0	3,000	0
All other mine materials	15.10	0	29,000	97,000	0
Subtotal	24.93	40,000	69,000	125,000	0
Total	24.93	234,000			

Notes:

BCY = bank cubic yards

PMDA = primary mine disturbance area

Estimated in-place volume (bcy) is rounded up to the nearest 1,000 cubic yards.

Table B-3
Contaminant Source Material Volume Balances for Alternative Screening and Detailed Analysis
Alternative 4

Remediation Area	Area (acres)	Contaminant Sources (Mine Materials)			
		Volume Contained In-Place (BCY)	Volume Removed, Transported, and Consolidated (BCY)		
			Proposed Facility Within PMDA (4.38 acres)	Proposed Facility Outside PMDA (3.52 acres)	Existing Facility
Encapsulation mound (EM) waste rock/soil	1.05	0	21,000	0	0
EM tailings		0	19,000	0	0
East EM waste rock dump (WRD)	2.98	0	32,000	0	0
Formosa 1 and Formosa 3 adit WRDs	2.86	0	0	25,000	0
Mine materials along the upper side slopes of the EM	0.45	0	8,000	0	0
Road areas to accommodate pavement cover	1.98	0	0	0	0
Adit drainage afftected soil	0.51	0	0	3,000	0
All other mine materials	15.10	0	29,000	97,000	0
Subtotal	24.93	0	109,000	125,000	0
Total	24.93	234,000			

Notes:

BCY = bank cubic yards

PMDA = primary mine disturbance area

Estimated in-place volume (bcy) is rounded up to the nearest 1,000 cubic yards.

Table B-4
Contaminant Source Material Volume Balances for Alternative Screening and Detailed Analysis
Alternative 5

Remediation Area	Area (acres)	Contaminant Sources (Mine Materials): Volume Contained In-Place (BCY)	Volume Removed, Transported, and Consolidated (BCY): Proposed Facility Within PMDA (4.38 acres)	Proposed Facility Outside PMDA (2.93 acres)	Existing Facility
Encapsulation mound (EM) waste rock/soil	1.05	0	21,000	0	0
EM tailings		0	19,000	0	0
East EM waste rock dump (WRD)	2.98	0	32,000	0	0
Formosa 1 and Formosa 3 adit WRDs	2.86	0	0	0	25,000
Mine materials along the upper side slopes of the EM	0.45	0	8,000	0	0
Road areas to accommodate pavement cover	1.98	0	0	0	0
Adit drainage afftected soil	0.51	0	0	3,000	0
All other mine materials	15.10	0	29,000	92,000	5,000
Subtotal	24.93	0	109,000	95,000	30,000
Total	24.93	234,000			

Notes:

BCY = bank cubic yards

PMDA = primary mine disturbance area

Estimated in-place volume (bcy) is rounded up to the nearest 1,000 cubic yards.

Table B-5
Contaminant Source Material Volume Balances for Alternative Screening and Detailed Analysis
Alternative 6

Remediation Area	Area (acres)	Contaminant Sources (Mine Materials) Volume Contained In-Place (BCY)	Volume Removed, Transported, and Consolidated (BCY) Proposed Facility Within PMDA (0 acres)	Proposed Facility Outside PMDA (5.35 acres)	Existing Facility
Encapsulation mound (EM) waste rock/soil	1.05	0	0	21,000	0
EM tailings		0	0	19,000	0
East EM waste rock dump (WRD)	2.98	0	32,000	32,000	0
Formosa 1 and Formosa 3 adit WRDs	2.86	0	0	25,000	0
Mine materials along the upper side slopes of the EM	0.45	0	0	8,000	0
Road areas to accommodate pavement cover	1.98	0	0	0	0
Adit drainage afftected soil	0.51	0	0	3,000	0
All other mine materials	15.10	0	0	94,000	0
Subtotal	24.93	0	32,000	202,000	0
Total	24.93	234,000			

Notes:

BCY = bank cubic yards

PMDA = primary mine disturbance area

Estimated in-place volume (bcy) is rounded up to the nearest 1,000 cubic yards.

Appendix C

Screening of Alternatives

Alternative 1
No Further Action

Table C-1. Effectiveness Screening - Alternative 1

Effectiveness Criteria	Evaluation Summary
Overall protection of human health and the environment	▪ Selected mine materials at OU1 were partially addressed during previous reclamation activities as discussed in Section 1.4. ▪ The remainder of mine materials at OU1 were left unaddressed. ▪ Unaddressed mine materials potentially generate ARD and leach contaminants to surface water and groundwater, especially during periods of precipitation and snowmelt. ▪ Unaddressed mine materials within portions of the PMDA may have contaminants above PRGs which could pose a direct exposure risk to human and ecological receptors. ▪ Partially addressed mine materials are not fully exposed at the surface, but potentially generate ARD and leach contaminants to surface water and groundwater, especially during periods of precipitation and snowmelt.
Compliance with ARARs	▪ No further remedial action would be taken to address mine materials; thus, this criterion is not met.
Short-term effectiveness (during the remedial construction and implementation period)	▪ No further remedial action would be undertaken to address mine materials; thus, none of these criteria are met.
Long-term effectiveness and permanence (following remedial construction)	
Reduction of toxicity, mobility, or volume through treatment	
Overall Rating	⓿

Table C-2. Implementability Screening - Alternative 1

Implementability Criteria	Evaluation Summary
Ability to construct, reliably operate, and meet technology-specific regulations for process options until a remedial action is complete	▪ No further remedial action would be undertaken to address mine materials; thus, this criterion is not applicable. ▪ No further remedial action would be undertaken to address mine materials; thus, no need to obtain approvals from regulatory agencies. ▪ No further remedial action would be undertaken to address mine materials; thus, this criterion is not applicable. ▪ Technical equipment and specialists are available for inspections that would be required under 5-year site reviews.
Ability to operate, maintain, replace, and monitor technical components after the remedial action is complete	
Ability to obtain approvals from other agencies	
Availability and capacity of treatment, storage, and disposal services	
Availability of property, specific materials and equipment, and technical specialists required for a remedial action	
Overall Rating	⓿

Table C-3. Cost Screening – Alternative 1

Evaluation Factors for Cost	Overall Rating	Approximate Cost (Present Value Dollars)
Present value cost	$	$100,000

Alternative 2

In-Place Containment, Continued Submergence of Tailings within EM, and Limited Excavation/Disposal of Mine Materials at Proposed Facility within PMDA

Table C-4. Effectiveness Screening - Alternative 2

Effectiveness Criteria	Evaluation Summary
Overall protection of human health and the environment	▪ Mine materials would be primarily addressed through in-place containment (covering). ▪ Highly acid-generating mine materials at headwaters of creek areas and other targeted areas would be excavated and disposed of at proposed facility within PMDA. ▪ Excavation and disposal of highly acid-generating mine materials at proposed facility within PMDA would eliminate exposure of mine materials with contaminant concentrations above PRGs to humans and provide significant reduction of ARD generation and migration. ▪ Tailings stored within the former water and tailings storage pond would continue to remain submerged under the cover system at the EM. Submergence would continue to mitigate ARD generation, assuming existing liner remains intact and holds water. ▪ With proper construction and maintenance, the covers would eliminate exposure of mine materials to humans. Migration of contamination to air would be eliminated and migration of contamination to groundwater and surface water would be reduced. ▪ A reduction of exposure risks to humans and ecological receptors from contaminants above PRGs would occur from excavation and disposal of highly acid-generating mine materials and in-place containment of other mine materials. ▪ Monitoring and maintenance would be performed during and after construction to ensure protectiveness of the remedy.
Compliance with ARARs	▪ Mine materials excavated and disposed of in proposed facility within PMDA coupled with in-place containment would physically address exposure to contaminants above PRGs; thus, meeting chemical-specific ARARs. ▪ Location-specific ARARs for the remedy would be addressed during implementation, but impacts are expected to be minimal, because disposal of mine materials is conducted primarily within the PMDA. ▪ Action-specific ARARs for the remedy would be addressed during implementation.
Short-term effectiveness (during the remedial construction and imple-mentation period)	▪ Excavation and disposal of mine materials could pose short-term risks to workers. ▪ Surface disturbance of mine materials could pose short-term risks to workers installing covers. ▪ Safety measures such as dust suppression, use of PPE, and establishment of work zones would protect workers and the community during implementation. ▪ There would be minor impacts to the community under this alternative, as truck traffic would only be required to transport materials for covers as well as for reclamation to the PMDA. ▪ There could also be impacts to the environment during the implementation of the remedial action due to the use of heavy construction and hauling equipment and import of borrow and cover materials from outside the PMDA. Use of fuel efficient and low emission equipment as well as careful selection and reclamation of borrow areas could reduce environmental impacts.

Table C-4. Effectiveness Screening - Alternative 2 (Continued)

Effectiveness Criteria	Evaluation Summary
Long-term effectiveness and permanence (following remedial construction)	▪ Mine materials would be primarily addressed through in-place containment (covering). ▪ Highly acid-generating mine materials at headwaters of creek areas and other targeted areas would be excavated and disposed of at proposed facility within PMDA. ▪ Long-term effectiveness and permanence of covers is dependent on continued integrity of the covers and adherence to administrative controls. ▪ O&M activities would be periodically required to repair damage or erosion to the covers. Monitoring and maintenance of covers would need to be performed in perpetuity. ▪ Regular monitoring of submerged tailings would be required to maintain consistent water levels and reducing conditions for the submerged tailings within the former water and tailings storage pond. ▪ Due to in-place containment of mine materials on existing steep slopes, use of stability measures such as geocells or retaining walls may need to be incorporated to maintain stability. Geotechnical monitoring may also need to be conducted after construction. ▪ Long-term effectiveness of vegetated multi-layer geosynthetics covers may decrease over time if woody vegetation became established and penetrated the covers. Preventative maintenance to address woody vegetation would be required to maintain integrity. ▪ Long-term effectiveness of pavement cover may decrease over time due to development of freeze-thaw cracking and would require regular maintenance to maintain integrity. ▪ Administrative controls implemented for the proposed disposal facility and other cover areas would require monitoring and maintenance in perpetuity. Even with maintenance and monitoring, long-term effectiveness of administrative controls cannot be ensured since people could ignore them. ▪ Monitoring would be performed to evaluate long-term effectiveness and permanence of the remedy.
Reduction of toxicity, mobility, or volume through treatment	▪ There is no reduction of toxicity, mobility, or volume through treatment for most mine materials, because the primary remedy approaches are in-place containment and excavation/disposal at a proposed facility within the PMDA. ▪ Tailings stored within the former water and tailings storage pond would continue to remain submerged under the cover system at the EM. Submergence would continue to mitigate ARD generation, assuming existing liner remains intact and holds water and would result in some reduction of toxicity and mobility of contaminants from the tailings.
Overall Rating	❸

Table C-5. Implementability Screening - Alternative 2

Implementability Criteria	Evaluation Summary
Ability to construct, reliably operate, and meet technology-specific regulations for process options until a remedial action is complete	▪ Excavation and disposal, construction of covers, and implementation of monitoring is relatively straight forward and can be implemented using available equipment and labor resources. ▪ Excavation of mine materials and placement of covers on steep slopes may require use of specialty equipment and practices to ensure worker safety. ▪ Uncontaminated borrow sources within or outside of PMDA would need to be developed. ▪ Other materials such as pavement material, lime, organic material, and geosynthetic materials, would need to be imported to OU1. ▪ Monitoring would be performed during construction to ensure protectiveness of the remedy.
Ability to operate, maintain, replace, and monitor technical components after the remedial action is complete	▪ Inspection, monitoring and maintenance of the proposed facility, cover systems, and access controls across OU1 is relatively straightforward and can be easily implemented using available materials, equipment, and labor resources. ▪ Maintenance of institutional controls may be more difficult due to various types of ownership and land use. Maintaining institutional controls would require agency coordination.
Ability to obtain approvals from other agencies	▪ Regulatory approval for in-place containment of mine materials using covers should be obtainable. ▪ Development of borrow sources outside of PMDA for proposed facility construction, cover, and reclamation materials would require coordination and approval from the affected agency or property owner. ▪ Regulatory approvals for monitoring and maintenance should be obtainable. ▪ Regulatory approvals for institutional controls and access controls should be obtainable. However, some difficulties may be encountered with regard to types of restrictions.
Availability and capacity of treatment, storage, and disposal services	▪ The proposed disposal facility within PMDA would extend from the EM to the ore storage area along the Silver Butte ridge, and have sufficient capacity to consolidate excavated mine materials. ▪ Offsite treatment, storage, and disposal services would not be required.
Availability of property, specific materials and equipment, and technical specialists required for a remedial action	▪ Labor, equipment, and materials for excavation, proposed facility construction, and cover construction are available. ▪ Suitable rock and soil materials for proposed facility construction, cover construction, and reclamation would be required from within and outside the PMDA. ▪ Pavement cover construction materials would be required from offsite sources. ▪ Materials, equipment, and technical specialists needed for the geosynthetic portions of cover construction are more specialized, but readily available. ▪ Technical equipment and specialists are available for implementation of institutional controls and monitoring.
Overall Rating	❹

Table C-6. Cost Screening – Alternative 2

Evaluation Factors for Cost	Overall Rating	Approximate Cost (Present Value Dollars)
Present value cost	$$	$5,640,000

Alternative 3

Limited In-Place Containment, Chemically Reduced Submergence of Tailings within EM, and Excavation/Disposal of Mine Materials at Proposed Facilities within and outside PMDA

Table C-7. Effectiveness Screening - Alternative 3

Effectiveness Criteria	Evaluation Summary
Overall protection of human health and the environment	▪ Mine materials would be primarily addressed through excavation and disposal at proposed facilities within and outside of PMDA. ▪ Remaining mine materials would be addressed on a limited basis through in-place containment (covering). ▪ Excavation and disposal of mine materials at proposed facilities within and outside PMDA would eliminate exposure of mine materials with contaminant concentrations above PRGs to humans and provide significant reduction of ARD generation and migration. ▪ Tailings stored within the former water and tailings storage pond would continue to remain submerged under cover system at the EM. Submergence would continue to mitigate ARD generation, assuming existing liner remains intact and holds water. ▪ Addition of a carbon source to tailings may support biological treatment through bacterially catalyzed sulfate reduction. This type of treatment has the potential to precipitate dissolved contaminants within the pore water as solid-phase sulfide minerals; thus, further limiting their ability to leach to surface water and groundwater. ▪ With proper construction and maintenance, the covers would eliminate exposure of mine materials to humans. Migration of contamination to air would be eliminated and migration of contamination to groundwater and surface water would be reduced. ▪ A reduction of exposure risks to humans and ecological receptors from contaminants above PRGs would occur from excavation and disposal of highly acid-generating mine materials in proposed facilities and limited in-place containment of other mine materials. ▪ Monitoring would be performed during and after construction to ensure protectiveness of the remedy.
Compliance with ARARs	▪ Mine materials excavated and disposed of in proposed facilities within and outside of PMDA coupled with limited in-place containment would physically address exposure to contaminants above PRGs; thus, meeting chemical-specific ARARs. ▪ Mine materials are likely exempted from RCRA Subtitle C regulation by the Bevill amendment to RCRA, so chemical-specific ARARs related to hazardous waste characterization and disposal are likely not applicable. Location-specific ARARs for the remedy would be addressed during implementation. It is expected that additional location-specific ARARs would need to be addressed, because disposal of mine materials is conducted outside as well as inside the PMDA. Action-specific ARARs for the remedy would be addressed during implementation. It is expected that additional action-specific ARARs would need to be addressed, because disposal of mine materials is conducted outside as well as inside the PMDA.
Short-term effectiveness (during the remedial construction and imple-mentation period)	▪ Excavation and disposal of mine materials could pose short-term risks to workers. ▪ Surface disturbance of mine materials could pose short-term risks to workers installing covers. ▪ Safety measures such as dust suppression, use of PPE, and establishment of work zones would protect workers and the community during implementation. ▪ There would be additional impacts to the community under this alternative, as truck traffic would be required for disposal of mine materials at the proposed facility outside of PMDA as well as transport of treatment additives for chemically-reduced submergence of tailings. Truck traffic would also be required to transport materials for covers as well as for reclamation within and outside the PMDA.

Table C-7. Effectiveness Screening - Alternative 3 (Continued)

Effectiveness Criteria	Evaluation Summary
Short-term effectiveness (during the remedial construction and imple-mentation period) (Continued)	▪ There could also be impacts to the environment during the implementation of the remedial action due to the use of heavy construction and hauling equipment and import of borrow and cover materials from outside the PMDA. Use of fuel efficient and low emission equipment as well as careful selection and reclamation of borrow areas could reduce environmental impacts. ▪ Construction of a new proposed facility outside of PMDA would increase extent of the impacted areas as compared to Alternative 2. ▪ Duration of remedial construction and implementation would increase over Alternative 2 due to additional mine material excavation and disposal both within and outside of the PMDA.
Long-term effectiveness and permanence (following remedial construction)	▪ Mine materials would be primarily addressed through excavation and disposal at proposed facilities within and outside of PMDA. ▪ Remaining mine materials would be addressed on a limited basis through in-place containment (covering). ▪ Excavation and disposal of mine materials at proposed facilities within and outside PMDA would eliminate exposure of mine materials with contaminant concentrations above PRGs to humans and provide significant reduction of ARD generation and migration. ▪ Long-term effectiveness and permanence of covers is dependent on continued integrity of the covers and adherence to administrative controls. ▪ O&M activities would be periodically required to repair damage or erosion to the covers. Monitoring and maintenance of covers would need to be performed in perpetuity. ▪ Long-term effectiveness of vegetated multi-layer geosynthetic covers may decrease over time if woody vegetation became established and penetrated the covers. Preventative maintenance to address woody vegetation would be required to maintain integrity. ▪ Regular monitoring would be required to maintain consistent water levels and reducing conditions for the submerged tailings within the former water and tailings storage pond. ▪ Management of hydrogen sulfide gas emission generated from sulfate reduction during chemically-reduced submergence of the tailings may also be required. ▪ Administrative controls implemented for the proposed disposal facilities and other cover areas would require monitoring and maintenance in perpetuity. Even with maintenance and monitoring, long-term effectiveness of administrative controls cannot be ensured since people could ignore them. ▪ Monitoring would be performed to evaluate long-term effectiveness and permanence of the remedy.
Reduction of toxicity, mobility, or volume through treatment	▪ There is no reduction of toxicity, mobility, or volume through treatment for most mine materials, because the primary remedy approaches are excavation/disposal at proposed facilities within and outside the PMDA and limited in-place containment. ▪ Tailings stored within the former water and tailings storage pond would continue to remain submerged under the cover system at the EM. Submergence would continue to mitigate ARD generation, assuming existing liner remains intact and holds water and would result in some reduction of toxicity and mobility of contaminants from the tailings. ▪ Chemically reduced submergence may provide a further reduction of toxicity and mobility of contaminants from the tailings.
Overall Rating	❸

Table C-8. Implementability Screening - Alternative 3

Implementability Criteria	Evaluation Summary
Ability to construct, reliably operate, and meet technology-specific regulations for process options until a remedial action is complete	▪ Excavation, construction of the proposed disposal facilities, construction of the covers, and implementation of monitoring is relatively straight forward and can be implemented using available equipment and labor resources. ▪ Excavation of mine materials and placement of covers on steep slopes may require use of specialty equipment and practices to ensure worker safety. ▪ Uncontaminated borrow sources within or outside of PMDA would need to be developed. ▪ Other materials, such as carbon source, lime, organic material, and geosynthetic materials, would need to be imported to OU1. ▪ Treatability testing would be required to assess and optimize performance of chemically reduced submergence for tailings in the former water and tailings storage pond. ▪ Construction of a new proposed facility outside of PMDA may be affected by land uses, other restrictions such as existence of floodplains, wetlands, and fault zones, or historical or culturally significant artifacts. ▪ Excavated mine materials may require transportation to the proposed facility outside of PMDA in specialized enclosed trucks. ▪ Monitoring would be performed during construction to ensure protectiveness of the remedy.
Ability to operate, maintain, replace, and monitor technical components after the remedial action is complete	▪ Inspection, monitoring and maintenance of the proposed facilities, cover systems, and access controls across OU1 is relatively straightforward and can be easily implemented using available materials, equipment, and labor resources. ▪ Maintenance of institutional controls may be more difficult due to various types of ownership and land use. Maintaining institutional controls would require agency coordination.
Ability to obtain approvals from other agencies	▪ Regulatory approval needed to excavate and transport mine materials should be obtainable. ▪ Regulatory approval for in-place containment of mine materials using covers should be obtainable. ▪ Development of borrow sources outside of PMDA for proposed facility construction, cover, and reclamation materials would require coordination and approval from the affected agency or property owner. ▪ Construction of repository outside of PMDA would require coordination and approval from the affected agency or property owner. ▪ Regulatory approvals for monitoring and maintenance should be obtainable. ▪ Regulatory approvals for institutional and engineering controls should be obtainable. However, some difficulties may be encountered with regard to types of restrictions. ▪ New proposed facilities constructed offsite would require approval by Oregon DEQ.
Availability and capacity of treatment, storage, and disposal services	▪ The proposed disposal facility within PMDA would extend from the EM to the ore storage area along the Silver Butte ridge, and have sufficient capacity to consolidate excavated mine materials. ▪ The proposed facility outside PMDA would be constructed to meet pertinent ARARs for the selected location and have sufficient capacity to consolidate excavated mine materials.

Table C-8. Implementability Screening - Alternative 3 (Continued)

Implementability Criteria	Evaluation Summary
Availability of property, specific materials and equipment, and technical specialists required for a remedial action	▪ Property would need to be acquired for construction of a proposed facility outside of the PMDA. ▪ Labor, equipment, and materials for excavation and proposed facility construction are available. ▪ Suitable rock and soil materials for proposed facility construction, cover construction, and reclamation would be required from within and outside the PMDA. ▪ Materials, equipment, and technical specialists needed for the geosynthetic portions of cover construction at the proposed facilities are more specialized but readily available. ▪ Materials, equipment, and technical specialists needed for the chemically-reduced submergence of tailings are more specialized but available. ▪ Technical equipment and specialists are available for implementation of institutional controls and monitoring.
Overall Rating	❸

Table C-9. Cost Screening – Alternative 3

Evaluation Factors for Cost	Overall Rating	Approximate Cost (Present Value Dollars)
Present value cost	$$	$7,600,000

Alternative 4

Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facilities within and outside PMDA

Table C-10. Effectiveness Screening - Alternative 4

Effectiveness Criteria	Evaluation Summary
Overall protection of human health and the environment	▪ Mine materials would be primarily addressed through excavation and disposal at proposed facilities within and outside of PMDA. ▪ Excavation and disposal of mine materials at proposed facilities within and outside PMDA would eliminate exposure of mine materials with contaminant concentrations above PRGs to humans and provide significant reduction of ARD generation and migration. ▪ Tailings stored within the former water and tailings storage pond would be treated by stabilization/solidification. Stabilization/solidification would minimize or eliminate leaching of contaminants to surrounding soils and groundwater when treated tailings are disposed of at the proposed facility ▪ With proper construction and maintenance, the covers at the proposed facilities would eliminate exposure of mine materials to humans. Migration of contamination to air would be eliminated and migration of contamination to groundwater and surface water would be reduced. ▪ A reduction of exposure risks to humans and ecological receptors from contaminants above PRGs would occur from excavation and disposal of mine materials in proposed facilities. ▪ Monitoring would be performed during and after construction to ensure protectiveness of the remedy.
Compliance with ARARs	▪ Mine materials excavated and disposed of in proposed facilities within and outside of PMDA coupled with limited in-place containment would physically address exposure to contaminants above PRGs; thus, meeting chemical-specific ARARs. ▪ Mine materials are likely exempted from RCRA Subtitle C regulation by the Bevill amendment to RCRA, so chemical-specific ARARs related to hazardous waste characterization and disposal are likely not applicable. Location-specific ARARs for the remedy would be addressed during implementation. It is expected that additional location-specific ARARs would need to be addressed, because disposal of mine materials is conducted outside as well as inside the PMDA. Action-specific ARARs for the remedy would be addressed during implementation. It is expected that additional action-specific ARARs would need to be addressed, because disposal of mine materials is conducted outside as well as inside the PMDA
Short-term effectiveness (during the remedial construction and imple-mentation period)	▪ Excavation and disposal of mine materials could pose short-term risks to workers. ▪ Surface disturbance of mine materials could pose short-term risks to workers installing covers. ▪ Safety measures such as dust suppression, use of PPE, and establishment of work zones would protect workers and the community during implementation. ▪ There would be additional impacts to the community under this alternative, as truck traffic would be required for disposal of mine materials at the proposed facility outside of PMDA as well as transport of treatment additives such as pozzolan or cement for stabilization/solidification of tailings. Truck traffic would also be required to transport materials for covers as well as for reclamation within and outside the PMDA. ▪ There could also be impacts to the environment during the implementation of the remedial action due to the use of heavy construction and hauling equipment and import of borrow and cover materials from outside the PMDA. Use of fuel efficient and low emission equipment as well as careful selection and reclamation of borrow areas could reduce environmental impacts. ▪ Construction of a new proposed facility outside of PMDA would increase extent of the impacted areas as compared to Alternative 2. ▪ Duration of remedial construction and implementation would increase over Alternative 2 due to additional mine material excavation and disposal both within and outside of the PMDA.

Table C-10. Effectiveness Screening - Alternative 4 (Continued)

Effectiveness Criteria	Evaluation Summary
Long-term effectiveness and permanence (following remedial construction)	▪ Mine materials would be primarily addressed through excavation and disposal at proposed facilities within and outside of PMDA. ▪ Excavation and disposal of mine materials at proposed facilities within and outside PMDA would eliminate exposure of mine materials with contaminant concentrations above PRGs to humans and provide significant reduction of ARD generation and migration. ▪ Stabilization/solidification of tailings would prevent leaching of contamination to surrounding soils and groundwater when treated tailings are disposed of at the proposed facility; thus, providing greater long-term effectiveness and permanence at the proposed facility. ▪ Long-term effectiveness and permanence of proposed facilities is dependent on continued integrity of the covers and adherence to administrative controls. ▪ O&M activities would be periodically required to repair damage or erosion to the covers at the proposed facilities. Monitoring and maintenance of covers would need to be performed in perpetuity. ▪ Long-term effectiveness of vegetated multi-layer geosynthetic covers at the proposed facilities may decrease over time if woody vegetation became established and penetrated the covers. Preventative maintenance to address woody vegetation would be required to maintain integrity. ▪ Administrative controls implemented for the proposed disposal facilities would require monitoring and maintenance in perpetuity. Even with maintenance and monitoring, long-term effectiveness of administrative controls cannot be ensured since people could ignore them. ▪ Monitoring would be performed to evaluate long-term effectiveness and permanence of the remedy.
Reduction of toxicity, mobility, or volume through treatment	▪ There is no reduction of toxicity, mobility, or volume through treatment for most mine materials, because the primary remedy approach is excavation/disposal at proposed facilities within and outside the PMDA. ▪ Tailings stored within the former water and tailings storage pond would be dewatered and treated by stabilization /solidification prior to disposal; thus, reducing toxicity and mobility of contaminants from the tailings.
Overall Rating	❹

Table C-11. Implementability Screening - Alternative 4

Implementability Criteria	Evaluation Summary
Ability to construct, reliably operate, and meet technology-specific regulations for process options until a remedial action is complete	▪ Excavation and disposal, construction of the proposed disposal facilities, and implementation of monitoring is relatively straightforward and can be implemented using available equipment, and labor resources. ▪ Excavation of mine materials and placement of covers on steep slopes may require use of specialty equipment and practices to ensure worker safety. ▪ Uncontaminated borrow sources within or outside of PMDA would need to be developed. ▪ Other materials, such as pozzolan- or cement, lime, organic material, and geosynthetic materials, would need to be imported to OU1. ▪ Treatment of tailings using stabilization/solidification is relatively straightforward, but may be difficult due to high concentrations of contaminants in the tailings, degree of saturation, and limited space for performing stabilization/solidification. ▪ Treatability testing would be required to assess and optimize performance of stabilization/solidification of tailings.

Table C-11. Implementability Screening - Alternative 4 (Continued)

Implementability Criteria	Evaluation Summary
Ability to construct, reliably operate, and meet technology-specific regulations for process options until a remedial action is complete	▪ Treatment will solidify the tailings and provide the ability to adequately transport, dispose, and compact tailings within a proposed facility. ▪ Construction of a new proposed facility outside of PMDA may be affected by land uses, other restrictions such as existence of floodplains, wetlands, and fault zones, or historical or culturally significant artifacts. ▪ Excavated mine materials may require transportation to the proposed facility outside of PMDA in specialized enclosed trucks. ▪ Monitoring would be performed during construction to ensure protectiveness of the remedy. ▪ Leachate collection and treatment may be needed for the proposed facility outside of the PMDA, depending on selected location and configuration. Leachate treatment would be performed as part of OU2 operations.
Ability to operate, maintain, replace, and monitor technical components after the remedial action is complete	▪ Inspection, monitoring and maintenance of cover systems and access controls at the proposed facilities is relatively straightforward and can be easily implemented using available materials, equipment, and labor resources. ▪ Maintenance of institutional controls may be more difficult due to various types of ownership and land use. Maintaining institutional controls would require agency coordination.
Ability to obtain approvals from other agencies	▪ Regulatory approval needed to excavate and transport mine materials should be obtainable. ▪ Development of borrow sources outside of PMDA for proposed facility construction and reclamation materials would require coordination and approval from the affected agency or property owner. ▪ Construction of repository outside of PMDA would require coordination and approval from the affected agency or property owner. ▪ Regulatory approvals for monitoring and maintenance should be obtainable. ▪ Regulatory approvals for institutional and engineering controls should be obtainable. However, some difficulties may be encountered with regard to types of restrictions. ▪ New proposed facilities constructed offsite would require approval by Oregon DEQ. ▪ Regulatory approvals for leachate collection system at the proposed facility outside of PMDA (if needed) should be obtainable.
Availability and capacity of treatment, storage, and disposal services	▪ The proposed disposal facility within PMDA would extend from the EM to the ore storage area along the Silver Butte ridge, and have sufficient capacity to consolidate excavated mine materials. ▪ The proposed facility outside PMDA would be constructed to meet pertinent ARARs for the selected location and have sufficient capacity to consolidate excavated mine materials.
Availability of property, specific materials and equipment, and technical specialists required for a remedial action	▪ Property would need to be acquired for construction of a proposed facility outside of the PMDA. ▪ Labor, equipment, and materials for excavation and proposed facility construction are available. ▪ Suitable rock and soil materials for cover construction would be required from within and outside the PMDA. ▪ Materials, equipment, and technical specialists needed for the geosynthetic portions of cover construction at the proposed facilities are more specialized but readily available. ▪ Materials, equipment, and technical specialists needed for the stabilization/solidification of tailings are more specialized but available. ▪ Technical equipment and specialists are available for implementation of institutional controls and monitoring. ▪ Material, equipment and technical specialist needed for leachate collection for the proposed facility outside of PMDA (if needed) are readily available.
Overall Rating	❸

Table C-12. Cost Screening – Alternative 4

Evaluation Factors for Cost	Overall Rating	Approximate Cost (Present Value Dollars)
Present value cost	$$$$	$12,360,000

Alternative 5

Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Existing and Proposed Facilities within and outside PMDA

Table C-13. Effectiveness Screening - Alternative 5

Effectiveness Criteria	Evaluation Summary
Overall protection of human health and the environment	▪ Mine materials would be primarily addressed through excavation and disposal at proposed facilities within and outside of PMDA and an existing facility. ▪ Excavation and disposal of mine materials at proposed facilities within and outside PMDA and at an existing facility would eliminate exposure of mine materials with contaminant concentrations above PRGs to humans and provide significant reduction of ARD generation and migration. ▪ Tailings stored within the former water and tailings storage pond would be treated by stabilization/solidification. Stabilization/solidification would minimize or eliminate leaching of contaminants to surrounding soils and groundwater when treated tailings are disposed of at the proposed facility ▪ With proper construction and maintenance, the covers at the proposed facilities would eliminate exposure of mine materials to humans. Migration of contamination to air would be eliminated and migration of contamination to groundwater and surface water would be reduced. ▪ A reduction of exposure risks to humans and ecological receptors from contaminants above PRGs would occur from excavation and disposal of mine materials in proposed facilities and an existing facility. ▪ Monitoring would be performed during and after construction to ensure protectiveness of the remedy.
Compliance with ARARs	▪ Mine materials excavated and disposed of in proposed facilities within and outside of PMDA coupled with limited in-place containment would physically address exposure to contaminants above PRGs; thus, meeting chemical-specific ARARs. ▪ Mine materials are likely exempted from RCRA Subtitle C regulation by the Bevill amendment to RCRA, so chemical-specific ARARs related to hazardous waste characterization and disposal are likely not applicable. Location-specific ARARs for the remedy would be addressed during implementation. It is expected that additional location-specific ARARs would need to be addressed, because disposal of mine materials is conducted outside as well as inside the PMDA. Action-specific ARARs for the remedy would be addressed during implementation. It is expected that additional action-specific ARARs would need to be addressed ,because disposal of mine materials is conducted outside as well as inside the PMDA.
Short-term effectiveness (during the remedial construction and implementation period)	▪ Excavation and disposal of mine materials could pose short-term risks to workers. ▪ Surface disturbance of mine materials could pose short-term risks to workers installing covers. ▪ Safety measures such as dust suppression, use of PPE, and establishment of work zones would protect workers and the community during implementation. ▪ There would be additional impacts to the community under this alternative, as truck traffic would be required for disposal of mine materials at the proposed facility outside of PMDA as well as transport of treatment additives such as pozzolan or cement for stabilization/solidification of tailings. Truck traffic would also be required to transport materials for covers as well as for reclamation within and outside the PMDA. ▪ Truck and/or rail haulage of mine materials to existing disposal facility would increase the potential for traffic hazards on public roads. ▪ There could also be impacts to the environment during the implementation of the remedial action due to the use of heavy construction and hauling equipment and import of borrow and cover materials from outside the PMDA. Use of fuel efficient and low emission equipment, mixed modes of transport (truck and rail) to the existing disposal facility, as well as careful selection and reclamation of borrow areas could reduce environmental impacts. ▪ Construction of a new proposed facility outside of PMDA would increase extent of the impacted areas as compared to Alternative 2. ▪ Duration of remedial construction and implementation would be similar or slightly increase over Alternative 4 due to disposal at an existing facility as well as both within and outside of the PMDA.

Table C-13. Effectiveness Screening - Alternative 5 (Continued)

Effectiveness Criteria	Evaluation Summary
Long-term effectiveness and permanence (following remedial construction)	▪ Mine materials would be primarily addressed through excavation and disposal at proposed facilities within and outside of PMDA and at an existing facility. ▪ Excavation and disposal of mine materials at proposed facilities within and outside PMDA and at an existing facility would eliminate exposure of mine materials with contaminant concentrations above PRGs to humans and provide significant reduction of ARD generation and migration. ▪ Stabilization/solidification of tailings would prevent leaching of contamination to surrounding soils and groundwater when treated tailings are disposed of at the proposed facility; thus, providing greater long-term effectiveness and permanence at the proposed facility. ▪ Long-term effectiveness and permanence of proposed facilities is dependent on continued integrity of the covers and adherence to administrative controls. ▪ Disposal of mine materials at an existing facility would provide long-term effectiveness and permanence, assuming the facility receive adequate O&M. Long-term effectiveness and permanence of an existing facility is generally more ensured, because they are operated and maintained by a third party on a continuous basis. ▪ O&M activities would be periodically required to repair damage or erosion to the covers at the proposed facilities. Monitoring and maintenance of covers would need to be performed in perpetuity. ▪ Long-term effectiveness of vegetated multi-layer geosynthetic covers at the proposed facilities may decrease over time if woody vegetation became established and penetrated the covers. Preventative maintenance to address woody vegetation would be required to maintain integrity. ▪ Administrative controls implemented for the proposed disposal facilities would require monitoring and maintenance in perpetuity. Even with maintenance and monitoring, long-term effectiveness of administrative controls cannot be ensured since people could ignore them. ▪ Monitoring would be performed to evaluate long-term effectiveness and permanence of the remedy.
Reduction of toxicity, mobility, or volume through treatment	▪ There is no reduction of toxicity, mobility, or volume through treatment for most mine materials, because the primary remedy approach is excavation/disposal at proposed facilities within and outside the PMDA. ▪ Tailings stored within the former water and tailings storage pond would be dewatered and treated by stabilization /solidification prior to disposal; thus, reducing toxicity and mobility of contaminants from the tailings. ▪ Generally, Bevill exempt mining waste could be accepted at an existing facility without prior treatment. However, final acceptance of the mine materials is determined by the individual facility and thus, some of the mine materials may require pre-treatment prior to disposal to meet LDRs. Subtitle D facilities would likely require pre-treatment of mine materials to LDRs prior to acceptance and disposal. ▪ Pre-treatment to LDRs may provide a slight reduction in toxicity and mobility of the contaminants.
Overall Rating	❹

Table C-14. Implementability Screening - Alternative 5

Implementability Criteria	Evaluation Summary
Ability to construct, reliably operate, and meet technology-specific regulations for process options until a remedial action is complete	▪ Excavation and disposal, construction of the proposed disposal facilities, and implementation of monitoring is relatively straightforward and can be implemented using available equipment, and labor resources. ▪ Special management procedures may be required for disposal at the existing facility. ▪ Excavation of mine materials and placement of covers on steep slopes may require use of specialty equipment and practices to ensure worker safety. ▪ Uncontaminated borrow sources within or outside of PMDA would need to be developed. ▪ Other materials, such as pozzolan- or cement, lime, organic material, and geosynthetic materials, would need to be imported to OU1. ▪ Treatment of tailings using stabilization/solidification is relatively straightforward, , but may be difficult due to high concentrations of contaminants in the tailings, degree of saturation, and limited space for performing stabilization/solidification. ▪ Treatability testing would be required to assess and optimize performance of stabilization/solidification of tailings. ▪ Treatment will solidify the tailings and provide the ability to adequately transport, dispose, and compact tailings within a proposed facility. ▪ Construction of a new proposed facility outside of PMDA may be affected by land uses, other restrictions such as existence of floodplains, wetlands, and fault zones, or historical or culturally significant artifacts. ▪ Excavated mine materials may require transportation to the proposed facility outside of PMDA and the existing facility in specialized enclosed trucks. ▪ If rail is used to transport mine materials to the existing facility, coordination with the pertinent railroad would be required. ▪ Monitoring would be performed during construction to ensure protectiveness of the remedy. ▪ Leachate collection and treatment may be needed for the proposed facility outside of the PMDA, depending on selected location and configuration. Leachate treatment would be performed as part of OU2 operations.
Ability to operate, maintain, replace, and monitor technical components after the remedial action is complete	▪ Inspection, monitoring and maintenance of cover systems and access controls at the proposed facilities is relatively straightforward and can be easily implemented using available materials, equipment, and labor resources. ▪ Maintenance of institutional controls may be more difficult due to various types of ownership and land use. Maintaining institutional controls would require agency coordination.
Ability to obtain approvals from other agencies	▪ Regulatory approval needed to excavate and transport mine materials should be obtainable. ▪ Development of borrow sources outside of PMDA for proposed facility construction and reclamation materials would require coordination and approval from the affected agency or property owner. ▪ Construction of repository outside of PMDA would require coordination and approval from the affected agency or property owner. ▪ Regulatory approvals for monitoring and maintenance should be obtainable. ▪ Regulatory approvals for institutional and engineering controls should be obtainable. However, some difficulties may be encountered with regard to types of restrictions. ▪ New proposed facilities constructed offsite would require approval by Oregon DEQ. ▪ Use of an existing facility for disposal of mine materials would require approval from that facility. ▪ If rail is used to transport mine materials to the existing facility, approval from the pertinent railroad would be required. ▪ Regulatory approvals for leachate collection system at the proposed facility outside of PMDA (if needed) should be obtainable.

Table C-14. Implementability Screening - Alternative 5 (Continued)

Implementability Criteria	Evaluation Summary
Availability and capacity of treatment, storage, and disposal services	▪ The proposed disposal facility within PMDA would extend from the EM to ore storage area and have sufficient capacity to consolidate excavated mine materials. ▪ The proposed facility outside PMDA would be constructed to meet pertinent ARARs for the selected location and have sufficient capacity to consolidate excavated mine materials. ▪ Existing disposal facilities (Subtitle C and Subtitle D facilities) authorized to accept mine materials are available within the State of Oregon. The closest Subtitle C facility potentially willing to accept mine materials is located approximately 400 miles from the site and can perform pre-treatment if necessary. The closest Subtitle D facility potentially willing to accept mine materials is located approximately 90 miles from the site; however, this facility would require pre-treatment of the mine materials prior to acceptance and disposal.
Availability of property, specific materials and equipment, and technical specialists required for a remedial action	▪ Property would need to be acquired for construction of a proposed facility outside of the PMDA. ▪ If rail is used for transport of mine materials to an existing facility, a truck to rail transfer location would need to be obtained. ▪ Labor, equipment, and materials for excavation and proposed facility construction are available. ▪ Suitable rock and soil materials for cover construction would be required from within and outside the PMDA. ▪ Materials, equipment, and technical specialists needed for the geosynthetic portions of cover construction at the proposed facilities are more specialized but readily available. ▪ Materials, equipment, and technical specialists needed for the stabilization/solidification of tailings are more specialized but available. ▪ Technical equipment and specialists are available for implementation of institutional controls and monitoring. ▪ Material, equipment and technical specialist needed for leachate collection for the proposed facility outside of PMDA (if needed) are readily available.
Overall Rating	❷

Table C-15. Cost Screening – Alternative 5

Evaluation Factors for Cost	Overall Rating	Approximate Cost (Present Value Dollars)
Present value cost	$$$$$	$25,950,000

Alternative 6

Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facility outside PMDA

Table C-16. Effectiveness Screening - Alternative 6

Effectiveness Criteria	Evaluation Summary
Overall protection of human health and the environment	▪ Mine materials would be primarily addressed through excavation and disposal at proposed facility outside of PMDA. ▪ Excavation and disposal of highly acid-generating mine materials at proposed facility outside PMDA would eliminate exposure of mine materials with contaminant concentrations above PRGs to humans and provide significant reduction of ARD generation and migration. ▪ Tailings stored within the former water and tailings storage pond would be treated by stabilization /solidification. Stabilization/solidification would minimize or eliminate leaching of contaminants to surrounding soils and groundwater when treated tailings are disposed of at the proposed facility ▪ With proper construction and maintenance, the cover at the proposed facility would eliminate exposure of mine materials to humans. Migration of contamination to air would be eliminated and migration of contamination to groundwater and surface water would be reduced. ▪ A reduction of exposure risks to humans and ecological receptors from contaminants above PRGs would occur from excavation and disposal of mine materials in the proposed facility. ▪ Monitoring would be performed during and after construction to ensure protectiveness of the remedy.
Compliance with ARARs	▪ Mine materials excavated and disposed of in the proposed facility outside of PMDA would physically address exposure to contaminants above PRGs; thus, meeting chemical-specific ARARs. ▪ Additional chemical-specific ARARs such as LDRs may be relevant for disposal at a proposed facility outside of the PMDA. However, mine materials are Bevill exempt wastes so appropriateness of applying LDRs is not clear. ▪ Location-specific ARARs for the remedy would be addressed during implementation. It is expected that additional location-specific ARARs would need to be addressed, because disposal of mine materials is conducted outside the PMDA. ▪ Action-specific ARARs for the remedy would be addressed during implementation. It is expected that additional action-specific ARARs would need to be addressed, because disposal of mine materials is conducted outside the PMDA.
Short-term effectiveness (during the remedial construction and imple-mentation period)	▪ Excavation and disposal of mine materials could pose short-term risks to workers. ▪ Surface disturbance of mine materials could pose short-term risks to workers installing covers. ▪ Safety measures such as dust suppression, use of PPE, and establishment of work zones would protect workers and the community during implementation. ▪ There would be additional impacts to the community under this alternative, as truck traffic would be required for disposal of mine materials at the proposed facility outside of PMDA as well as transport of treatment additives such as pozzolan or cement for stabilization/solidification of tailings. Truck traffic would also be required to transport materials for construction of the proposed facility as well as for reclamation within and outside the PMDA. ▪ There could also be impacts to the environment during the implementation of the remedial action due to the use of heavy construction and hauling equipment and import of borrow and cover materials from outside the PMDA. Use of fuel efficient and low emission equipment as well as careful selection and reclamation of borrow areas could reduce environmental impacts. ▪ Duration of remedial construction and implementation would increase over Alternative 4 due to all disposals occurring outside of the PMDA.

Table C-16. Effectiveness Screening - Alternative 6 (Continued)

Effectiveness Criteria	Evaluation Summary
Long-term effectiveness and permanence (following remedial construction)	▪ Mine materials would be primarily addressed through excavation and disposal at proposed facility outside of PMDA. ▪ Excavation and disposal of mine materials at proposed facility outside PMDA would eliminate exposure of mine materials with contaminant concentrations above PRGs to humans and provide significant reduction of ARD generation and migration. ▪ Stabilization/solidification of tailings would prevent leaching of contamination to surrounding soils and groundwater when treated tailings are disposed of at the proposed facility; thus, providing greater long-term effectiveness and permanence at the proposed facility. ▪ Construction of a new proposed facility outside of PMDA would decrease extent of the impacted areas as compared to Alternative 4. ▪ Construction of a new proposed facility outside of PMDA would decrease extent of the impacted areas as compared to Alternative 4. ▪ Long-term effectiveness and permanence of proposed facility is dependent on continued integrity of the covers and adherence to administrative controls. ▪ O&M activities would be periodically required to repair damage or erosion to the cover at the proposed facility. Monitoring and maintenance of cover would need to be performed in perpetuity. ▪ Long-term effectiveness of vegetated multi-layer geosynthetic cover at the proposed facility may decrease over time if woody vegetation became established and penetrated the covers. Preventative maintenance to address woody vegetation would be required to maintain integrity. ▪ Administrative controls implemented for the proposed disposal facility and would require monitoring and maintenance in perpetuity. Even with maintenance and monitoring, long-term effectiveness of administrative controls cannot be ensured since people could ignore them. ▪ Monitoring would be performed to evaluate long-term effectiveness and permanence of the remedy.
Reduction of toxicity, mobility, or volume through treatment	▪ There is no reduction of toxicity, mobility, or volume through treatment for most mine materials, because the primary remedy approach is excavation/disposal at proposed facility outside the PMDA. ▪ Tailings stored within the former water and tailings storage pond would be dewatered and treated by stabilization /solidification prior to disposal; thus, reducing toxicity and mobility of contaminants from the tailings.
Overall Rating	❹

Table C-17. Implementability Screening - Alternative 6

Implementability Criteria	Evaluation Summary
Ability to construct, reliably operate, and meet technology-specific regulations for process options until a remedial action is complete	▪ Excavation and disposal, construction of the proposed disposal facility, and implementation of monitoring is relatively straightforward and can be implemented using available equipment, and labor resources. ▪ Excavation of mine materials and placement of covers on steep slopes may require use of specialty equipment and practices to ensure worker safety. ▪ Uncontaminated borrow sources within or outside of PMDA would need to be developed. ▪ Other materials, such as pozzolan- or cement, lime, organic material, and geosynthetic materials, would need to be imported to OU1. ▪ Treatment of tailings using stabilization/solidification is relatively straightforward, but may be difficult due to high concentrations of contaminants in the tailings, degree of saturation, and limited space for performing stabilization/solidification. ▪ Treatability testing would be required to assess and optimize performance of stabilization/solidification of tailings.

Table C-17. Implementability Screening - Alternative 6 (Continued)

Implementability Criteria	Evaluation Summary
Ability to construct, reliably operate, and meet technology-specific regulations for process options until a remedial action is complete (Continued)	▪ Treatment will solidify the tailings and provide the ability to adequately transport, dispose, and compact tailings within a proposed facility. ▪ Construction of a new proposed facility outside of PMDA may be affected by land uses, other restrictions such as existence of floodplains, wetlands, and fault zones, or historical or culturally significant artifacts. ▪ Excavated mine materials may require transportation to the proposed facility outside of PMDA in specialized enclosed trucks. ▪ Monitoring would be performed during construction to ensure protectiveness of the remedy. ▪ Leachate collection and treatment may be needed for the proposed facility outside of the PMDA, depending on selected location and configuration. Leachate treatment would be performed as part of OU2 operations.
Ability to operate, maintain, replace, and monitor technical components after the remedial action is complete	▪ Inspection, monitoring and maintenance of cover system, leachate collection system (if needed) and access controls at the proposed facility is relatively straightforward and can be easily implemented using available materials, equipment, and labor resources. ▪ Maintenance of institutional controls may be more difficult due to various types of ownership and land use. Maintaining institutional controls would require agency coordination.
Ability to obtain approvals from other agencies	▪ Regulatory approval needed to excavate and transport contaminated soils should be obtainable. ▪ Development of borrow sources outside of PMDA for proposed facility construction and reclamation materials would require coordination and approval from the affected agency or property owner. ▪ Construction of repository outside of PMDA would require coordination and approval from the affected agency or property owner. ▪ Regulatory approvals for leachate collection system at the proposed facility outside of PMDA (if needed) should be obtainable. ▪ Regulatory approvals for monitoring and maintenance should be obtainable. ▪ Regulatory approvals for institutional and engineering controls should be obtainable. However, some difficulties may be encountered with regard to types of restrictions. ▪ New proposed facilities constructed offsite would require approval by Oregon DEQ.
Availability and capacity of treatment, storage, and disposal services	▪ The proposed facility outside PMDA would be constructed to meet pertinent ARARs for the selected location and have sufficient capacity to consolidate excavated mine materials.
Availability of property, specific materials and equipment, and technical specialists required for a remedial action	▪ Property would need to be acquired for construction of a proposed facility outside of the PMDA. ▪ Labor, equipment, and materials for excavation and proposed facility construction are available. ▪ Suitable rock and soil materials for cover construction would be required from within and outside the PMDA. ▪ Materials, equipment, and technical specialists needed for the geosynthetic portions of cover construction at the proposed facilities are more specialized but readily available. ▪ Materials, equipment, and technical specialists needed for the stabilization/solidification of tailings are more specialized but available. ▪ Technical equipment and specialists are available for implementation of institutional controls and monitoring.
Overall Rating	❸

Table C-18. Cost Screening – Alternative 6

Evaluation Factors for Cost	Overall Rating	Approximate Cost (Present Value Dollars)
Present value cost	$$$$	$13,280,000

Appendix D

Alternative Screening Cost Information

The cost spreadsheets included in this appendix were developed in accordance with EPA 540-R-00-002 (OSWER 9355.0-75) July 2000.

These costs should be used to compare alternative relative costs. Costs for project management, remedial design, and construction management were determined as percentages of capital cost per the guidance. Costs for these work items may not reflect costs for implementation. These costs are determined based on specific client requirements during implementation.

Present Value Analyses

TABLE SPV-ADRFT

PRESENT VALUE ANALYSIS

Annual Discount Rate Factors Table

Site: Formosa Mine Superfund Site OU1
Location: Douglas County, OR
Phase: Feasibility Study
Base Year: 2013

Discount Rate (Percent): 7.0

Year	Discount Factor [1,2]	Year	Discount Factor [1,2]
0	1.0000	26	0.1722
1	0.9346	27	0.1609
2	0.8734	28	0.1504
3	0.8163	29	0.1406
4	0.7629	30	0.1314
5	0.7130	31	0.1228
6	0.6663	32	0.1147
7	0.6227	33	0.1072
8	0.5820	34	0.1002
9	0.5439	35	0.0937
10	0.5083	36	0.0875
11	0.4751	37	0.0818
12	0.4440	38	0.0765
13	0.4150	39	0.0715
14	0.3878	40	0.0668
15	0.3624	41	0.0624
16	0.3387	42	0.0583
17	0.3166	43	0.0545
18	0.2959	44	0.0509
19	0.2765	45	0.0476
20	0.2584	46	0.0445
21	0.2415	47	0.0416
22	0.2257	48	0.0389
23	0.2109	49	0.0363
24	0.1971		
25	0.1842		

Notes:

[1] Annual discount factors were calculated using the formulas and guidance presented in Section 4.0 o "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.

[2] The real discount rate of 7.0% was obtained from "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000, Page 4-5.

TABLE SPV-1

PRESENT VALUE ANALYSIS

Alternative 1
No Further Action

Site:	**Formosa Mine Superfund Site OU1**
Location:	**Douglas County, OR**
Phase:	**Feasibility Study**
Base Year:	**2013**

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Earthwork)[2]	Annual O&M Costs	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$0	$0	$0	$0	$0	1.0000	$0
1	$0	$0	$0	$0	$0	0.9346	$0
2	$0	$0	$0	$0	$0	0.8734	$0
3	$0	$0	$0	$0	$0	0.8163	$0
4	$0	$0	$0	$45,000	$45,000	0.7629	$34,331
5	$0	$0	$0	$0	$0	0.7130	$0
6	$0	$0	$0	$0	$0	0.6663	$0
7	$0	$0	$0	$0	$0	0.6227	$0
8	$0	$0	$0	$0	$0	0.5820	$0
9	$0	$0	$0	$45,000	$45,000	0.5439	$24,476
10	$0	$0	$0	$0	$0	0.5083	$0
11	$0	$0	$0	$0	$0	0.4751	$0
12	$0	$0	$0	$0	$0	0.4440	$0
13	$0	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$0	$45,000	$45,000	0.3878	$17,451
15	$0	$0	$0	$0	$0	0.3624	$0
16	$0	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	$0	0.2959	$0
19	$0	$0	$0	$45,000	$45,000	0.2765	$12,443
20	$0	$0	$0	$0	$0	0.2584	$0
21	$0	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	$0	0.2257	$0
23	$0	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$0	$45,000	$45,000	0.1971	$8,870
25	$0	$0	$0	$0	$0	0.1842	$0
26	$0	$0	$0	$0	$0	0.1722	$0
27	$0	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$0	$45,000	$45,000	0.1406	$6,327
TOTALS:	$0	$0	$0	$270,000	$270,000		$103,898
TOTAL PRESENT VALUE OF ALTERNATIVE 1 [5]							**$100,000**

Notes:

1 The alternative is expected to require cost expenditures for perpetuity since soils would have contaminant concentrations above RGs that would allow for unlimited use and unrestricted exposure under the current and potential future land uses. However the period of analysis was assumed to be 30 years (Years 0 through 29).

2 Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table SCS-1.

3 Total annual expenditure is the total cost per year with no discounting.

4 Present value is the total cost per year including a 7.0% discount factor for that year. See Table SPV-ADRFT for details.

5 Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -50% to +100% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE SPV-2

PRESENT VALUE ANALYSIS

Alternative 2

In-Place Containment, Submergence of Tailings, and Limited Excavation/Disposal of Mine Materials at Proposed Facility within PMDA

Site: Formosa Mine Superfund Site OU1
Location: Douglas County, OR
Phase: Feasibility Study
Base Year: 2013

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Earthwork)[2]	Annual O&M Costs (Site Maintenance and Inspection)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$159,000	$4,958,000	$0	$0	$5,117,000	1.0000	$5,117,000
1	$0	$0	$27,000	$0	$27,000	0.9346	$25,234
2	$0	$0	$27,000	$0	$27,000	0.8734	$23,582
3	$0	$0	$27,000	$0	$27,000	0.8163	$22,040
4	$0	$0	$27,000	$81,000	$108,000	0.7629	$82,393
5	$0	$0	$27,000	$0	$27,000	0.7130	$19,251
6	$0	$0	$27,000	$0	$27,000	0.6663	$17,990
7	$0	$0	$27,000	$0	$27,000	0.6227	$16,813
8	$0	$0	$27,000	$0	$27,000	0.5820	$15,714
9	$0	$0	$27,000	$81,000	$108,000	0.5439	$58,741
10	$0	$0	$27,000	$0	$27,000	0.5083	$13,724
11	$0	$0	$27,000	$0	$27,000	0.4751	$12,828
12	$0	$0	$27,000	$0	$27,000	0.4440	$11,988
13	$0	$0	$27,000	$0	$27,000	0.4150	$11,205
14	$0	$0	$27,000	$81,000	$108,000	0.3878	$41,882
15	$0	$0	$27,000	$0	$27,000	0.3624	$9,785
16	$0	$0	$27,000	$0	$27,000	0.3387	$9,145
17	$0	$0	$27,000	$0	$27,000	0.3166	$8,548
18	$0	$0	$27,000	$0	$27,000	0.2959	$7,989
19	$0	$0	$27,000	$81,000	$108,000	0.2765	$29,862
20	$0	$0	$27,000	$0	$27,000	0.2584	$6,977
21	$0	$0	$27,000	$0	$27,000	0.2415	$6,521
22	$0	$0	$27,000	$0	$27,000	0.2257	$6,094
23	$0	$0	$27,000	$0	$27,000	0.2109	$5,694
24	$0	$0	$27,000	$81,000	$108,000	0.1971	$21,287
25	$0	$0	$27,000	$0	$27,000	0.1842	$4,973
26	$0	$0	$27,000	$0	$27,000	0.1722	$4,649
27	$0	$0	$27,000	$0	$27,000	0.1609	$4,344
28	$0	$0	$27,000	$0	$27,000	0.1504	$4,061
29	$0	$0	$27,000	$81,000	$108,000	0.1406	$15,185
TOTALS:	$159,000	$4,958,000	$783,000	$486,000	$6,386,000		$5,635,499
TOTAL PRESENT VALUE OF ALTERNATIVE 2 [5]							**$5,640,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpituity since soils under covers and structures would have contaminant concentrations above RGs that would allow for unlimited use and unrestricted exposure under the current and potential future land uses. However the period of analysis was assumed to be 30 years (Years 0 through 29).

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table SCS-2.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table SPV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -50% to +100% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE SPV-3

PRESENT VALUE ANALYSIS

Alternative 3

Limited In-Place Containment, Chemically Reduced Submergence of Tailings, and Excavation/Disposal of Mine Materials a Proposed Facilities within and outside PMDA

Site:	**Formosa Mine Superfund Site OU1**
Location:	**Douglas County, OR**
Phase:	**Feasibility Study**
Base Year:	**2013**

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Earthwork)[2]	Annual O&M Costs	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$159,000	$6,920,000	$0	$0	$7,079,000	1.0000	$7,079,000
1	$0	$0	$27,000	$0	$27,000	0.9346	$25,234
2	$0	$0	$27,000	$0	$27,000	0.8734	$23,582
3	$0	$0	$27,000	$0	$27,000	0.8163	$22,040
4	$0	$0	$27,000	$81,000	$108,000	0.7629	$82,393
5	$0	$0	$27,000	$0	$27,000	0.7130	$19,251
6	$0	$0	$27,000	$0	$27,000	0.6663	$17,990
7	$0	$0	$27,000	$0	$27,000	0.6227	$16,813
8	$0	$0	$27,000	$0	$27,000	0.5820	$15,714
9	$0	$0	$27,000	$81,000	$108,000	0.5439	$58,741
10	$0	$0	$27,000	$0	$27,000	0.5083	$13,724
11	$0	$0	$27,000	$0	$27,000	0.4751	$12,828
12	$0	$0	$27,000	$0	$27,000	0.4440	$11,988
13	$0	$0	$27,000	$0	$27,000	0.4150	$11,205
14	$0	$0	$27,000	$81,000	$108,000	0.3878	$41,882
15	$0	$0	$27,000	$0	$27,000	0.3624	$9,785
16	$0	$0	$27,000	$0	$27,000	0.3387	$9,145
17	$0	$0	$27,000	$0	$27,000	0.3166	$8,548
18	$0	$0	$27,000	$0	$27,000	0.2959	$7,989
19	$0	$0	$27,000	$81,000	$108,000	0.2765	$29,862
20	$0	$0	$27,000	$0	$27,000	0.2584	$6,977
21	$0	$0	$27,000	$0	$27,000	0.2415	$6,521
22	$0	$0	$27,000	$0	$27,000	0.2257	$6,094
23	$0	$0	$27,000	$0	$27,000	0.2109	$5,694
24	$0	$0	$27,000	$81,000	$108,000	0.1971	$21,287
25	$0	$0	$27,000	$0	$27,000	0.1842	$4,973
26	$0	$0	$27,000	$0	$27,000	0.1722	$4,649
27	$0	$0	$27,000	$0	$27,000	0.1609	$4,344
28	$0	$0	$27,000	$0	$27,000	0.1504	$4,061
29	$0	$0	$27,000	$81,000	$108,000	0.1406	$15,185
TOTALS:	$159,000	$6,920,000	$783,000	$486,000	$8,348,000		$7,597,499
TOTAL PRESENT VALUE OF ALTERNATIVE 3 [5]							**$7,600,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpituity since soils left beneath structures could have contaminant concentrations above RGs that would not allow for unlimited use and unrestricted exposure under the current and potential future land uses. However the period of analysis was assumed to be 30 years (Years 0 through 29).

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table SCS-3.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table SPV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -50% to +100% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE SPV-4

PRESENT VALUE ANALYSIS

Alternative 4
Excavation, Stabilization/Solidfication of Tailings, and Disposal of Mine Materials at Proposed Facilities within and outside PMDA

Site:	**Formosa Mine Superfund Site OU1**
Location:	**Douglas County, OR**
Phase:	**Feasibility Study**
Base Year:	**2013**

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Earthwork)[2]	Annual O&M Costs	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$159,000	$11,353,000	$0	$0	$11,512,000	1.0000	$11,512,000
1	$0	$0	$54,000	$0	$54,000	0.9346	$50,468
2	$0	$0	$54,000	$0	$54,000	0.8734	$47,164
3	$0	$0	$54,000	$0	$54,000	0.8163	$44,080
4	$0	$0	$54,000	$81,000	$135,000	0.7629	$102,992
5	$0	$0	$54,000	$0	$54,000	0.7130	$38,502
6	$0	$0	$54,000	$0	$54,000	0.6663	$35,980
7	$0	$0	$54,000	$0	$54,000	0.6227	$33,626
8	$0	$0	$54,000	$0	$54,000	0.5820	$31,428
9	$0	$0	$54,000	$81,000	$135,000	0.5439	$73,427
10	$0	$0	$54,000	$0	$54,000	0.5083	$27,448
11	$0	$0	$54,000	$0	$54,000	0.4751	$25,655
12	$0	$0	$54,000	$0	$54,000	0.4440	$23,976
13	$0	$0	$54,000	$0	$54,000	0.4150	$22,410
14	$0	$0	$54,000	$81,000	$135,000	0.3878	$52,353
15	$0	$0	$54,000	$0	$54,000	0.3624	$19,570
16	$0	$0	$54,000	$0	$54,000	0.3387	$18,290
17	$0	$0	$54,000	$0	$54,000	0.3166	$17,096
18	$0	$0	$54,000	$0	$54,000	0.2959	$15,979
19	$0	$0	$54,000	$81,000	$135,000	0.2765	$37,328
20	$0	$0	$54,000	$0	$54,000	0.2584	$13,954
21	$0	$0	$54,000	$0	$54,000	0.2415	$13,041
22	$0	$0	$54,000	$0	$54,000	0.2257	$12,188
23	$0	$0	$54,000	$0	$54,000	0.2109	$11,389
24	$0	$0	$54,000	$81,000	$135,000	0.1971	$26,609
25	$0	$0	$54,000	$0	$54,000	0.1842	$9,947
26	$0	$0	$54,000	$0	$54,000	0.1722	$9,299
27	$0	$0	$54,000	$0	$54,000	0.1609	$8,689
28	$0	$0	$54,000	$0	$54,000	0.1504	$8,122
29	$0	$0	$54,000	$81,000	$135,000	0.1406	$18,981
TOTALS:	$159,000	$11,353,000	$1,566,000	$486,000	$13,564,000		$12,361,991
TOTAL PRESENT VALUE OF ALTERNATIVE 4 [5]							**$12,360,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpituity since soils left beneath structures could have contaminant concentrations above RGs that would not allow for unlimited use and unrestricted exposure under the current and potential future land uses. However the period of analysis was assumed to be 30 years (Years 0 through 29).

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table SCS-4.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table SPV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -50% to +100% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE SPV-5

PRESENT VALUE ANALYSIS

Alternative 5
Excavation, Stabilization/Solidfication of Tailings, and Disposal of Mine Materials at Existing and Proposed Facilities within and outside PMDA

Site:	**Formosa Mine Superfund Site OU1**
Location:	**Douglas County, OR**
Phase:	**Feasibility Study**
Base Year:	**2013**

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Earthwork)[2]	Annual O&M Costs	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$159,000	$24,938,000	$0	$0	$25,097,000	1.0000	$25,097,000
1	$0	$0	$54,000	$0	$54,000	0.9346	$50,468
2	$0	$0	$54,000	$0	$54,000	0.8734	$47,164
3	$0	$0	$54,000	$0	$54,000	0.8163	$44,080
4	$0	$0	$54,000	$81,000	$135,000	0.7629	$102,992
5	$0	$0	$54,000	$0	$54,000	0.7130	$38,502
6	$0	$0	$54,000	$0	$54,000	0.6663	$35,980
7	$0	$0	$54,000	$0	$54,000	0.6227	$33,626
8	$0	$0	$54,000	$0	$54,000	0.5820	$31,428
9	$0	$0	$54,000	$81,000	$135,000	0.5439	$73,427
10	$0	$0	$54,000	$0	$54,000	0.5083	$27,448
11	$0	$0	$54,000	$0	$54,000	0.4751	$25,655
12	$0	$0	$54,000	$0	$54,000	0.4440	$23,976
13	$0	$0	$54,000	$0	$54,000	0.4150	$22,410
14	$0	$0	$54,000	$81,000	$135,000	0.3878	$52,353
15	$0	$0	$54,000	$0	$54,000	0.3624	$19,570
16	$0	$0	$54,000	$0	$54,000	0.3387	$18,290
17	$0	$0	$54,000	$0	$54,000	0.3166	$17,096
18	$0	$0	$54,000	$0	$54,000	0.2959	$15,979
19	$0	$0	$54,000	$81,000	$135,000	0.2765	$37,328
20	$0	$0	$54,000	$0	$54,000	0.2584	$13,954
21	$0	$0	$54,000	$0	$54,000	0.2415	$13,041
22	$0	$0	$54,000	$0	$54,000	0.2257	$12,188
23	$0	$0	$54,000	$0	$54,000	0.2109	$11,389
24	$0	$0	$54,000	$81,000	$135,000	0.1971	$26,609
25	$0	$0	$54,000	$0	$54,000	0.1842	$9,947
26	$0	$0	$54,000	$0	$54,000	0.1722	$9,299
27	$0	$0	$54,000	$0	$54,000	0.1609	$8,689
28	$0	$0	$54,000	$0	$54,000	0.1504	$8,122
29	$0	$0	$54,000	$81,000	$135,000	0.1406	$18,981
TOTALS:	$159,000	$24,938,000	$1,566,000	$486,000	$27,149,000		$25,946,991
TOTAL PRESENT VALUE OF ALTERNATIVE 5[5]							**$25,950,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpituity since soils left beneath structures could have contaminant concentrations above RGs that would not allow for unlimited use and unrestricted exposure under the current and potential future land uses. However the period of analysis was assumed to be 30 years (Years 0 through 29).

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table SCS-5.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table SPV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -50% to +100% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE SPV-6

PRESENT VALUE ANALYSIS

Alternative 6

Excavation, Stabilization/Solidfication of Tailings, and Disposal of Mine Materials at Proposed Facility outside PMDA

Site: Formosa Mine Superfund Site OU1
Location: Douglas County, OR
Phase: Feasibility Study
Base Year: 2013

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Earthwork)[2]	Annual O&M Costs	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$159,000	$12,601,000	$0	$0	$12,760,000	1.0000	$12,760,000
1	$0	$0	$27,000	$0	$27,000	0.9346	$25,234
2	$0	$0	$27,000	$0	$27,000	0.8734	$23,582
3	$0	$0	$27,000	$0	$27,000	0.8163	$22,040
4	$0	$0	$27,000	$81,000	$108,000	0.7629	$82,393
5	$0	$0	$27,000	$0	$27,000	0.7130	$19,251
6	$0	$0	$27,000	$0	$27,000	0.6663	$17,990
7	$0	$0	$27,000	$0	$27,000	0.6227	$16,813
8	$0	$0	$27,000	$0	$27,000	0.5820	$15,714
9	$0	$0	$27,000	$81,000	$108,000	0.5439	$58,741
10	$0	$0	$27,000	$0	$27,000	0.5083	$13,724
11	$0	$0	$27,000	$0	$27,000	0.4751	$12,828
12	$0	$0	$27,000	$0	$27,000	0.4440	$11,988
13	$0	$0	$27,000	$0	$27,000	0.4150	$11,205
14	$0	$0	$27,000	$81,000	$108,000	0.3878	$41,882
15	$0	$0	$27,000	$0	$27,000	0.3624	$9,785
16	$0	$0	$27,000	$0	$27,000	0.3387	$9,145
17	$0	$0	$27,000	$0	$27,000	0.3166	$8,548
18	$0	$0	$27,000	$0	$27,000	0.2959	$7,989
19	$0	$0	$27,000	$81,000	$108,000	0.2765	$29,862
20	$0	$0	$27,000	$0	$27,000	0.2584	$6,977
21	$0	$0	$27,000	$0	$27,000	0.2415	$6,521
22	$0	$0	$27,000	$0	$27,000	0.2257	$6,094
23	$0	$0	$27,000	$0	$27,000	0.2109	$5,694
24	$0	$0	$27,000	$81,000	$108,000	0.1971	$21,287
25	$0	$0	$27,000	$0	$27,000	0.1842	$4,973
26	$0	$0	$27,000	$0	$27,000	0.1722	$4,649
27	$0	$0	$27,000	$0	$27,000	0.1609	$4,344
28	$0	$0	$27,000	$0	$27,000	0.1504	$4,061
29	$0	$0	$27,000	$81,000	$108,000	0.1406	$15,185
TOTALS:	$159,000	$12,601,000	$783,000	$486,000	$14,029,000		$13,278,499
TOTAL PRESENT VALUE OF ALTERNATIVE 5 [5]							**$13,280,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpituity since soils left beneath structures could have contaminant concentrations above RGs that would not allow for unlimited use and unrestricted exposure under the current and potential future land uses. However the period of analysis was assumed to be 30 years (Years 0 through 29).

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table SCS-6.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table SPV-ADRFT for details.

[5] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -50% to +100% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

Screening Cost Estimate Summaries

TABLE SCS-1

Alternative **1**
No Further Action

SCREENING COST ESTIMATE SUMMARY

Site:	Formosa Mine Superfund Site OU1
Location:	Douglas County, OR
Phase:	Feasibility Study
Base Year:	2013
Date:	January 31, 2013

Description: Alternative 1 (No Further Action) is required by the NCP as a baseline for comparison against other remedial alternatives. This alternative would leave the site in its current state with no additional removal and/or remedial actions being implemented. As required by the NCP, five-year site reviews would be performed since mine materials would remain at the PMDA with contaminant concentrations above PRGs. The contaminant concentrations above PRGs do not allow for unlimited use and unrestricted exposure under the current and potential future land uses.. Site monitoring (i.e., non-intrusive visual inspections) would also be conducted only as necessary to complete the 5-year reviews.

5-YEAR SITE REVIEW PERIODIC COSTS (Years 4, 9, 14, 19, 24, and 29)

DESCRIPTION	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Review & Community Awareness	1	LS	$30,000	$30,000	Includes site inspection and 5-year review report
SUBTOTAL				$30,000	
Contingency (Scope and Bid)	20%			$6,000	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL				$36,000	
Project Management	10%			$3,600	The high end of the recommended range in EPA 540-R-00-002 was used.
Technical Support	15%			$5,400	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL				$45,000	
TOTAL PERIODIC COST				**$45,000**	Total capital cost is rounded to the nearest $1,000.

Notes:
Refer to Table SCS-Notes for cost sources and explanation for various unit costs.
Percentages used for indirect costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.
Costs presented for this alternative are expected to have an accuracy between -50% to +100% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

Abbreviations:

LS	Lump Sum
QTY	Quantity

TABLE SCS-2

Alternative 2

In-Place Containment, Continued Submergence of Tailings within EM, and Limited Excavation/Disposal of Mine Materials at Proposed Facility within PMDA

SCREENING COST ESTIMATE SUMMARY

Site: Formosa Mine Superfund Site OU1
Location: Douglas County, OR
Phase: Feasibility Study
Base Year: 2013
Date: January 31, 2013

Description: Alternative 2 includes in-place containment of mine materials as the predominant approach with limited excavation and disposal of targeted mine materials at a proposed facility within the PMDA. Limited excavation would be conducted to address highly acid-generating mine materials at headwaters of creek areas and other targeted areas. All excavated materials would be disposed of within a proposed facility located within the PMDA. Development of this area to obtain uncontaminated soil and rock for cover construction and reclamation would expand the available volume for consolidation of mine materials. The facility would use a geosynthetic multi-layer cover system over consolidated mine materials. The proposed facility within the PMDA would contain the EM in place, including the former water and tailings storage pond. Tailings currently stored in the EM pond would continue to remain submerged under the newly-constructed geosynthetic multi-layer cover system. Submergence of tailings which would continue to mitigate ARD generation , assuming the existing liner remains intact and holds water. A combination of multi layer geosynthetic covers, pavement covers, and exposure barriers would be implemented for remaining mine materials not targeted for excavation to mitigate unacceptable exposure risks to humans and reduce generation of ARD. Exposure barriers would only be used on remaining mine materials with slopes steeper than 3H:1V. Excavated areas or areas disturbed during construction that do not have mine materials would be regraded and reclaimed with a rock armor or a vegetative layer, depending on the steepness of resulting slopes. Administrative controls involve administrative, legal, and/or informational, or physical measures intended to control or prevent present and future use or access to mine materials, and inform and warn of dangers associated with these materials. Monitoring would consist of visual inspections to document degree of protectiveness to human health and the environment and determine maintenance needs for the proposed facility and containment areas. Maintenance of the proposed disposal facility and containment areas would be performed as necessary to maintain protectiveness and integrity of the covers systems. Five-year site reviews would be performed since mine materials under covers would remain at the PMDA with contaminant concentrations above PRGs. The contaminant concentrations above PRGs do not allow for unlimited use and unrestricted exposure under the current and potential future land uses.

INSTITUTIONAL CONTROLS CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Institutional Controls for Containment Alternatives	1	LS	$123,000	$123,000	
SUBTOTAL				$123,000	
Contingency (Scope and Bid)	20%			$24,600	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL				$147,600	
Project Management	8%			$11,808	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL				$159,408	
TOTAL CAPITAL COST				**$159,000**	Total capital cost is rounded to the nearest $1,000.

EARTHWORK CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
In-Place Capping of Contaminated Soils (Exposure Barrier)	12	ACR	$35,000	$420,000	
In-Place Capping of Contaminated Soils (Pavement Cover)	5,700	TON	$95	$541,500	Assumed density of gravel to be 1.4 tons/CY and asphalt to be 145 lbs/ cubic ft
Geosynthetic Multi-Layer Cover	5	ACR	$86,000	$430,000	(from Means Estimating Handbook).
Liner System	22,000	SY	$23	$506,000	
Contaminated Soils Excavation, Transport, and Disposal to Proposed Facility within Primary Mine Disturbance Area (PMDA)	69,000	CY	$8	$552,000	
Backfilling and Restoration of Excavated Areas	5100	CY	$15	$76,500	
Neutralization - Lime Delivery	6,900	TON	$135	$931,500	
Neutralization - Lime Amendment and Processing	12	ACR	$1,200	$14,400	
Organic Delivery	4,000	TON	$42	$168,000	
Organic Soil Amendment and Processing	4,000	TON	$36	$144,000	
SUBTOTAL				$3,471,900	
Contingency (Scope and Bid)	20%			$694,380	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL				$4,166,280	
Project Management	5%			$208,314	The low end of the recommended range in EPA 540-R-00-002 was used.
Remedial Design	8%			$333,302	The low end of the recommended range in EPA 540-R-00-002 was used.
Construction Management	6%			$249,977	The low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL				$4,957,873	
TOTAL CAPITAL COST				**$4,958,000**	Total capital cost is rounded to the nearest $1,000.

TABLE SCS-2

Alternative 2
In-Place Containment, Continued Submergence of Tailings within EM, and Limited Excavation/Disposal of Mine Materials at Proposed Facility within PMDA

SCREENING COST ESTIMATE SUMMARY

Site: Formosa Mine Superfund Site OU1
Location: Douglas County, OR
Phase: Feasibility Study
Base Year: 2013
Date: January 31, 2013

Description: Alternative 2 includes in-place containment of mine materials as the predominant approach with limited excavation and disposal of targeted mine materials at a proposed facility within the PMDA. Limited excavation would be conducted to address highly acid-generating mine materials at headwaters of creek areas and other targeted areas. All excavated materials would be disposed of within a proposed facility located within the PMDA. Development of this area to obtain uncontaminated soil and rock for cover construction and reclamation would expand the available volume for consolidation of mine materials. The facility would use a geosynthetic multi-layer cover system over consolidated mine materials. The proposed facility within the PMDA would contain the EM in place, including the former water and tailings storage pond. Tailings currently stored in the EM pond would continue to remain submerged under the newly-constructed geosynthetic multi-layer cover system. Submergence of tailings which would continue to mitigate ARD generation , assuming the existing liner remains intact and holds water. A combination of multi layer geosynthetic covers, pavement covers, and exposure barriers would be implemented for remaining mine materials not targeted for excavation to mitigate unacceptable exposure risks to humans and reduce generation of ARD. Exposure barriers would only be used on remaining mine materials with slopes steeper than 3H:1V. Excavated areas or areas disturbed during construction that do not have mine materials would be regraded and reclaimed with a rock armor or a vegetative layer, depending on the steepness of resulting slopes. Administrative controls involve administrative, legal, and/or informational, or physical measures intended to control or prevent present and future use or access to mine materials, and inform and warn of dangers associated with these materials. Monitoring would consist of visual inspections to document degree of protectiveness to human health and the environment and determine maintenance needs for the proposed facility and containment areas. Maintenance of the proposed disposal facility and containment areas would be performed as necessary to maintain protectiveness and integrity of the covers systems. Five-year site reviews would be performed since mine materials under covers would remain at the PMDA with contaminant concentrations above PRGs. The contaminant concentrations above PRGs do not allow for unlimited use and unrestricted exposure under the current and potential future land uses.

SITE MAINTENANCE AND INSPECTION ANNUAL OPERATIONS AND MAINTENANCE (O&M) COSTS (Years 1 through 29)

DESCRIPTION	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Annual Inspection and Maintenance of Covers	1	YR	$18,000	$18,000	Includes inspection and maintenance of the remedy put in place
SUBTOTAL				$18,000	
Contingency (Scope and Bid)	20%			$3,600	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL				$21,600	
Project Management	10%			$2,160	The high end of the recommended range in EPA 540-R-00-002 was used.
Technical Support	15%			$3,240	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL				$27,000	
TOTAL ANNUAL O&M COST				**$27,000**	Total capital cost is rounded to the nearest $1,000.

5-YEAR SITE REVIEW PERIODIC COSTS (Years 4, 9, 14, 19, 24, and 29)

DESCRIPTION	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Review, Community Awareness Activities, & ICs Maintenanc	1	LS	$54,000	$54,000	Includes site inspection and 5-year review report
SUBTOTAL				$54,000	
Contingency (Scope and Bid)	20%			$10,800	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL				$64,800	
Project Management	10%			$6,480	The high end of the recommended range in EPA 540-R-00-002 was used.
Technical Support	15%			$9,720	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL				$81,000	
TOTAL PERIODIC COST				**$81,000**	Total capital cost is rounded to the nearest $1,000.

Notes:
Percentages used for indirect costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.
Costs presented for this alternative are expected to have an accuracy between -50% to +100% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

Abbreviations:

CY	Cubic Yard
LS	Lump Sum
QTY	Quantity
YR	Year
ACR	Acre
SY	Square Yard

TABLE SCS-3

Alternative **3**

Limited In-Place Containment, Chemically Reduced Submergence of Tailings within EM, and Excavation/Disposal of Mine Materials at Proposed Facilities within and outside PMDA

SCREENING COST ESTIMATE SUMMARY

Site: Formosa Mine Superfund Site OU1
Location: Douglas County, OR
Phase: Feasibility Study
Base Year: 2013
Date: January 31, 2013

Description: Alternative 3 includes limited in-place containment of mine materials at the EM area, excavation of all other mine materials, and disposal of mine materials at proposed facilities within and outside the PMDA. Disposal of all excavated materials would take place at two proposed facilities: one within the PMDA and one outside of the PMDA at a location to be determined. The proposed facility within the PMDA would contain the EM in place, including the former water and tailings storage pond. Chemically reduced submergence would be implemented for tailings within the former water and tailings storage pond by adding liquid organic reagents to enhance in situ biological treatment. The proposed facility outside of the PMDA would be sized to contain the remainder of excavated mine materials (approximately 125,000 CY) and constructed to meet pertinent ARARs for the selected location. Excavated areas or areas disturbed during construction that do not have mine materials would be regraded and reclaimed with a rock armor or a vegetative layer, depending on the steepness of resulting slopes. Administrative controls involve administrative, legal, and/or informational, or physical measures intended to control or prevent present and future use or access to mine materials, and inform and warn of dangers associated with these materials. Monitoring would consist of visual inspections to document degree of protectiveness to human health and the environment and determine maintenance needs for the proposed facility and containment areas. Maintenance of the proposed disposal facility and containment areas would be performed as necessary to maintain protectiveness and integrity of the covers systems. However additional maintenance requirements, such as leachate collection and treatment, may be needed for the proposed facility outside of the PMDA depending on the selected location and configuration. Five-year site reviews would be performed since mine materials under covers would remain at the PMDA with contaminant concentrations above PRGs. The contaminant concentrations above PRGs do not allow for unlimited use and unrestricted exposure under the current and potential future land uses.

INSTITUTIONAL CONTROLS CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Institutional Controls for Containment Alternatives	1	LS	$123,000	$123,000	
SUBTOTAL				$123,000	
Contingency (Scope and Bid)	20%			$24,600	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL				$147,600	
Project Management	8%			$11,808	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL				$159,408	
TOTAL CAPITAL COST				**$159,000**	Total capital cost is rounded to the nearest $1,000.

EARTHWORK CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Geosynthetic Multi-Layer Cover	8	ACR	$86,000	$688,000	
Liner System	39,000	SY	$23	$897,000	
Contaminated Soils Excavation, Transport, and Disposal to Proposed Facility within Primary Mine Disturbance Area (PMDA)	69,000	CY	$8	$552,000	
Contaminated Soils Excavation, Transport, and Disposal to Proposed Facility outside PMDA	125,000	CY	$13	$1,625,000	
Backfilling and Restoration of Excavated Areas	20,000	CY	$15	$300,000	
Neutralization - Lime Delivery	5,700	TON	$135	$769,500	
Neutralization - Lime Amendment and Processing	12	ACR	$1,200	$14,400	
Organic Delivery	3,300	TON	$42	$138,600	
Organic Soil Amendment and Processing	3,300	TON	$36	$118,800	
SUBTOTAL				$4,845,900	
Contingency (Scope and Bid)	20%			$969,180	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL				$5,815,080	
Project Management	5%			$290,754	The low end of the recommended range in EPA 540-R-00-002 was used.
Remedial Design	8%			$465,206	The low end of the recommended range in EPA 540-R-00-002 was used.
Construction Management	6%			$348,905	The low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL				$6,919,945	
TOTAL CAPITAL COST				**$6,920,000**	Total capital cost is rounded to the nearest $1,000.

TABLE SCS-3

Alternative **3**

Limited In-Place Containment, Chemically Reduced Submergence of Tailings within EM, and Excavation/Disposal of Mine Materials at Proposed Facilities within and outside PMDA

SCREENING COST ESTIMATE SUMMARY

Site: Formosa Mine Superfund Site OU1
Location: Douglas County, OR
Phase: Feasibility Study
Base Year: 2013
Date: January 31, 2013

Description: Alternative 3 includes limited in-place containment of mine materials at the EM area, excavation of all other mine materials, and disposal of mine materials at proposed facilities within and outside the PMDA. Disposal of all excavated materials would take place at two proposed facilities: one within the PMDA and one outside of the PMDA at a location to be determined. The proposed facility within the PMDA would contain the EM in place, including the former water and tailings storage pond. Chemically reduced submergence would be implemented for tailings within the former water and tailings storage pond by adding liquid organic reagents to enhance in situ biological treatment. The proposed facility outside of the PMDA would be sized to contain the remainder of excavated mine materials (approximately 125,000 CY) and constructed to meet pertinent ARARs for the selected location. Excavated areas or areas disturbed during construction that do not have mine materials would be regraded and reclaimed with a rock armor or a vegetative layer, depending on the steepness of resulting slopes. Administrative controls involve administrative, legal, and/or informational, or physical measures intended to control or prevent present and future use or access to mine materials, and inform and warn of dangers associated with these materials. Monitoring would consist of visual inspections to document degree of protectiveness to human health and the environment and determine maintenance needs for the proposed facility and containment areas. Maintenance of the proposed disposal facility and containment areas would be performed as necessary to maintain protectiveness and integrity of the covers systems. However additional maintenance requirements, such as leachate collection and treatment, may be needed for the proposed facility outside of the PMDA depending on the selected location and configuration. Five-year site reviews would be performed since mine materials under covers would remain at the PMDA with contaminant concentrations above PRGs. The contaminant concentrations above PRGs do not allow for unlimited use and unrestricted exposure under the current and potential future land uses.

SITE MAINTENANCE AND INSPECTION ANNUAL OPERATIONS AND MAINTENANCE (O&M) COSTS (Years 1 through 29)

DESCRIPTION	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Annual Inspection and Maintenance of Covers	1	YR	$18,000	$18,000	Includes inspection and maintenance of the remedy put in place
SUBTOTAL				$18,000	
Contingency (Scope and Bid)	20%			$3,600	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL				$21,600	
Project Management	10%			$2,160	The high end of the recommended range in EPA 540-R-00-002 was used.
Technical Support	15%			$3,240	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL				$27,000	
TOTAL ANNUAL O&M COST				**$27,000**	Total capital cost is rounded to the nearest $1,000.

5-YEAR SITE REVIEW PERIODIC COSTS (Years 4, 9, 14, 19, 24, and 29)

DESCRIPTION	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Review, Community Awareness Activities, & ICs Maintenance	1	LS	$54,000	$54,000	Includes site inspection and 5-year review report
SUBTOTAL				$54,000	
Contingency (Scope and Bid)	20%			$10,800	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL				$64,800	
Project Management	10%			$6,480	The high end of the recommended range in EPA 540-R-00-002 was used.
Technical Support	15%			$9,720	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL				$81,000	
TOTAL PERIODIC COST				**$81,000**	Total capital cost is rounded to the nearest $1,000.

Notes:

Percentages used for indirect costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.
Costs presented for this alternative are expected to have an accuracy between -50% to +100% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

Abbreviations:

CY	Cubic Yard
LS	Lump Sum
QTY	Quantity
YR	Year
ACR	Acre
SY	Square Yard

TABLE SCS-4

Alternative 4

Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facilities within and Outside PMDA

SCREENING COST ESTIMATE SUMMARY

Site: Formosa Mine Superfund Site OU1
Location: Douglas County, OR
Phase: Feasibility Study
Base Year: 2013
Date: January 31, 2013

Description: Alternative 4 includes excavation and disposal of mine materials, including EM tailings, at proposed facilities within and outside the PMDA. Disposal of all excavated materials would take place at two proposed facilities: one within the PMDA and one outside of the PMDA. The tailings within the former water and tailings storage pond (approximately 19,000 CY) would be dewatered and treated by pozzolan- or cement-based stabilization/solidification before disposal. A treatment additive such as Portland cement or other types of stabilization agents would be added to bind the contaminants in the tailings and reduce their mobility from leaching. Since the EM area will be excavated and disposed of rather than contained in place, the targeted disposal volume for the proposed facility within the PMDA would increase to 109,000 CY. Excavated areas or areas disturbed during construction that do not have mine materials would be restored or regraded and reclaimed with a rock armor or a vegetative layer, depending on the steepness of resulting slopes. Administrative controls involve administrative, legal, and/or informational, or physical measures intended to control or prevent present and future use or access to mine materials, and inform and warn of dangers associated with these materials. Monitoring would consist of visual inspections to document degree of protectiveness to human health and the environment and determine maintenance needs for the proposed facility and containment areas. Maintenance of the proposed disposal facility and containment areas would be performed as necessary to maintain protectiveness and integrity of the covers systems. Five-year site reviews would be performed since mine materials under covers would remain at the PMDA with contaminant concentrations above PRGs. The contaminant concentrations above PRGs do not allow for unlimited use and unrestricted exposure under the current and potential future land uses.

INSTITUTIONAL CONTROLS CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Institutional Controls for Excavation/Transport/Disposal Alternatives	1	LS	$123,000	$123,000	
SUBTOTAL				$123,000	
Contingency (Scope and Bid)	20%			$24,600	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL				$147,600	
Project Management	8%			$11,808	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL				$159,408	
TOTAL CAPITAL COST				**$159,000**	Total capital cost is rounded to the nearest $1,000.

EARTHWORK CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Geosynthetic Multi-Layer Cover	8	ACR	$86,000	$688,000	
Liner System	39,000	SY	$23	$897,000	
Contaminated Soils Excavation, Transport, and Disposal to Proposed Facility within Primary Mine Disturbance Area (PMDA)	109,000	CY	$8	$872,000	
Contaminated Soils Excavation, Transport, and Disposal to Proposed Facility outside PMDA	125,000	CY	$13	$1,625,000	
Backfilling and Restoration of Excavated Areas	20,000	CY	$15	$300,000	
Neutralization - Lime Delivery	5,700	TON	$135	$769,500	
Neutralization - Lime Amendment and Processing	12	ACR	$1,200	$14,400	
Organic Delivery	3,300	TON	$42	$138,600	
Organic Soil Amendment and Processing	3,300	TON	$36	$118,800	
Pozzolan- or Cement-Based Stabilization/solidification of Tailings from EM	19,000	CY	$133	$2,527,000	
SUBTOTAL				$7,950,300	
Contingency (Scope and Bid)	20%			$1,590,060	
SUBTOTAL				$9,540,360	
Project Management	5%			$477,018	The low end of the recommended range in EPA 540-R-00-002 was used.
Remedial Design	8%			$763,229	The low end of the recommended range in EPA 540-R-00-002 was used.
Construction Management	6%			$572,422	The low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL				$11,353,029	
TOTAL CAPITAL COST				**$11,353,000**	Total capital cost is rounded to the nearest $1,000.

TABLE SCS-4

Alternative **4**
Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facilities within and Outside PMDA

SCREENING COST ESTIMATE SUMMARY

Site: Formosa Mine Superfund Site OU1
Location: Douglas County, OR
Phase: Feasibility Study
Base Year: 2013
Date: January 31, 2013

Description: Alternative 4 includes excavation and disposal of mine materials, including EM tailings, at proposed facilities within and outside the PMDA. Disposal of all excavated materials would take place at two proposed facilities: one within the PMDA and one outside of the PMDA. The tailings within the former water and tailings storage pond (approximately 19,000 CY) would be dewatered and treated by pozzolan- or cement-based stabilization/solidification before disposal. A treatment additive such as Portland cement or other types of stabilization agents would be added to bind the contaminants in the tailings and reduce their mobility from leaching. Since the EM area will be excavated and disposed of rather than contained in place, the targeted disposal volume for the proposed facility within the PMDA would increase to 109,000 CY. Excavated areas or areas disturbed during construction that do not have mine materials would be restored or regraded and reclaimed with a rock armor or a vegetative layer, depending on the steepness of resulting slopes. Administrative controls involve administrative, legal, and/or informational, or physical measures intended to control or prevent present and future use or access to mine materials, and inform and warn of dangers associated with these materials. Monitoring would consist of visual inspections to document degree of protectiveness to human health and the environment and determine maintenance needs for the proposed facility and containment areas. Maintenance of the proposed disposal facility and containment areas would be performed as necessary to maintain protectiveness and integrity of the covers systems. Five-year site reviews would be performed since mine materials under covers would remain at the PMDA with contaminant concentrations above PRGs. The contaminant concentrations above PRGs do not allow for unlimited use and unrestricted exposure under the current and potential future land uses.

SITE MAINTENANCE AND INSPECTION ANNUAL OPERATIONS AND MAINTENANCE (O&M) COSTS (Years 1 through 29)

DESCRIPTION	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Annual Inspection and Maintenance of Covers	2	YR	$18,000	$36,000	Includes inspection and maintenance of the remedy put in place
SUBTOTAL				$36,000	
Contingency (Scope and Bid)	20%			$7,200	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL				$43,200	
Project Management	10%			$4,320	The high end of the recommended range in EPA 540-R-00-002 was used.
Technical Support	15%			$6,480	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL				$54,000	
TOTAL ANNUAL O&M COST				**$54,000**	Total capital cost is rounded to the nearest $1,000.

5-YEAR SITE REVIEW PERIODIC COSTS (Years 4, 9, 14, 19, 24, and 29)

DESCRIPTION	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Review, Community Awareness Activities, & ICs Maintenance	1	LS	$54,000	$54,000	Includes site inspection and 5-year review report
SUBTOTAL				$54,000	
Contingency (Scope and Bid)	20%			$10,800	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL				$64,800	
Project Management	10%			$6,480	The high end of the recommended range in EPA 540-R-00-002 was used.
Technical Support	15%			$9,720	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL				$81,000	
TOTAL PERIODIC COST				**$81,000**	Total capital cost is rounded to the nearest $1,000.

Notes:
Percentages used for indirect costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.
Costs presented for this alternative are expected to have an accuracy between -50% to +100% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS

Abbreviations:

CY	Cubic Yard
LS	Lump Sum
QTY	Quantity
YR	Year
ACR	Acre
SY	Square Yard

TABLE SCS-5

Alternative 5
Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Existing and Proposed Facilities within and outside PMDA

SCREENING COST ESTIMATE SUMMARY

Site: Formosa Mine Superfund Site OU1
Location: Douglas County, OR
Phase: Feasibility Study
Base Year: 2013
Date: January 31, 2013

Description: Alternative 5 includes excavation and disposal of all mine materials, including EM tailings, similar to Alternative 4. However a portion of mine materials would be disposed of at an existing permitted facility located outside of the PMDA. Disposal of the majority of excavated materials would take place at two proposed facilities as described in Alternative 4, except that the size of the facility outside the PMDA would be smaller than for Alternative 4 (approximately 95,000 CY). A portion of the mine materials (approximately 30,000 CY) would be transported and disposed of at one or more existing, permitted disposal facilities. The closest Subtitle D facility that will accept mine materials from OU1 is approximately 83 miles away. The closest Subtitle C facility that will accept mine materials from OU1 is approximately 350 miles away. Disposal at the Subtitle D facility is assumed for this alternative; however, as discussed in Section 3.1.6, it is assumed for the purpose of this FS that mine materials addressed under this alternative at a Subtitle D facility will require treatment before disposal. Excavated areas or areas disturbed during construction that do not have mine materials would be restored or regraded and reclaimed with a rock armor or a vegetative layer, depending on the steepness of resulting slopes. Administrative controls involve administrative, legal, and/or informational, or physical measures intended to control or prevent present and future use or access to mine materials, and inform and warn of dangers associated with these materials. Monitoring would consist of visual inspections to document degree of protectiveness to human health and the environment and determine maintenance needs for the proposed facility and containment areas. Maintenance of the proposed disposal facility and containment areas would be performed as necessary to maintain protectiveness and integrity of the covers systems. Five-year site reviews would be performed since mine materials under covers would remain at the PMDA with contaminant concentrations above PRGs. The contaminant concentrations above PRGs do not allow for unlimited use and unrestricted exposure under the current and potential future land uses.

INSTITUTIONAL CONTROLS CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Institutional Controls for Excavation/Transport/Disposal Alternatives	1	LS	$123,000	$123,000	
SUBTOTAL				$123,000	
Contingency (Scope and Bid)	20%			$24,600	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL				$147,600	
Project Management	8%			$11,808	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL				$159,408	
TOTAL CAPITAL COST				**$159,000**	Total capital cost is rounded to the nearest $1,000.

EARTHWORK CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Geosynthetic Multi-Layer Cover	7.5	ACR	$86,000	$645,000	
Liner System	36,000	SY	$23	$828,000	
Contaminated Soils Excavation, Transport, and Disposal to Proposed Facility within Primary Mine Disturbance Area (PMDA)	109,000	CY	$8	$872,000	
Contaminated Soils Excavation, Transport, and Disposal to Proposed Facility outside PMDA	95,000	CY	$13	$1,235,000	
Contaminated Soils Excavation, Transport, and Disposal to Existing Facility outside PMDA	30,000	CY	$342	$10,260,000	
Backfilling and Restoration of Excavated Areas	20,000	CY	$15	$300,000	
Neutralization - Lime Delivery	6,100	TON	$135	$823,500	
Neutralization - Lime Amendment and Processing	12	ACR	$1,200	$14,400	
Organic Delivery	3,300	TON	$42	$138,600	
Organic Soil Amendment and Processing	3,300	TON	$36	$118,800	
Pozzolan- or Cement-Based Stabilization/solidification of Tailings from EM	19,000	CY	$133	$2,527,000	
SUBTOTAL				$17,762,300	
Contingency (Scope and Bid)	20%			$3,552,460	
SUBTOTAL				$21,314,760	
Project Management	5%			$1,065,738	The low end of the recommended range in EPA 540-R-00-002 was used.
Remedial Design	6%			$1,278,886	The low end of the recommended range in EPA 540-R-00-002 was used.
Construction Management	6%			$1,278,886	The low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL				$24,938,270	
TOTAL CAPITAL COST				**$24,938,000**	Total capital cost is rounded to the nearest $1,000.

TABLE SCS-5

Alternative 5
Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Existing and Proposed Facilities within and outside PMDA

SCREENING COST ESTIMATE SUMMARY

Site: Formosa Mine Superfund Site OU1
Location: Douglas County, OR
Phase: Feasibility Study
Base Year: 2013
Date: January 31, 2013

Description: Alternative 5 includes excavation and disposal of all mine materials, including EM tailings, similar to Alternative 4. However a portion of mine materials would be disposed of at an existing permitted facility located outside of the PMDA. Disposal of the majority of excavated materials would take place at two proposed facilities as described in Alternative 4, except that the size of the facility outside the PMDA would be smaller than for Alternative 4 (approximately 95,000 CY). A portion of the mine materials (approximately 30,000 CY) would be transported and disposed of at one or more existing, permitted disposal facilities. The closest Subtitle D facility that will accept mine materials from OU1 is approximately 83 miles away. The closest Subtitle C facility that will accept mine materials from OU1 is approximately 350 miles away. Disposal at the Subtitle D facility is assumed for this alternative; however, as discussed in Section 3.1.6, it is assumed for the purpose of this FS that mine materials addressed under this alternative at a Subtitle D facility will require treatment before disposal. Excavated areas or areas disturbed during construction that do not have mine materials would be restored or regraded and reclaimed with a rock armor or a vegetative layer, depending on the steepness of resulting slopes. Administrative controls involve administrative, legal, and/or informational, or physical measures intended to control or prevent present and future use or access to mine materials, and inform and warn of dangers associated with these materials. Monitoring would consist of visual inspections to document degree of protectiveness to human health and the environment and determine maintenance needs for the proposed facility and containment areas. Maintenance of the proposed disposal facility and containment areas would be performed as necessary to maintain protectiveness and integrity of the covers systems. Five-year site reviews would be performed since mine materials under covers would remain at the PMDA with contaminant concentrations above PRGs. The contaminant concentrations above PRGs do not allow for unlimited use and unrestricted exposure under the current and potential future land uses.

SITE MAINTENANCE AND INSPECTION ANNUAL OPERATIONS AND MAINTENANCE (O&M) COSTS (Years 1 through 29)

DESCRIPTION	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Annual Inspection and Maintenance of Covers	2	YR	$18,000	$36,000	Includes inspection and maintenance of the remedy put in place
SUBTOTAL				$36,000	
Contingency (Scope and Bid)	20%			$7,200	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL				$43,200	
Project Management	10%			$4,320	The high end of the recommended range in EPA 540-R-00-002 was used.
Technical Support	15%			$6,480	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL				$54,000	
TOTAL ANNUAL O&M COST				**$54,000**	Total capital cost is rounded to the nearest $1,000.

5-YEAR SITE REVIEW PERIODIC COSTS (Years 4, 9, 14, 19, 24, and 29)

DESCRIPTION	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Review, Community Awareness Activities, & ICs Maintenance	1	LS	$54,000	$54,000	Includes site inspection and 5-year review report
SUBTOTAL				$54,000	
Contingency (Scope and Bid)	20%			$10,800	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL				$64,800	
Project Management	10%			$6,480	The high end of the recommended range in EPA 540-R-00-002 was used.
Technical Support	15%			$9,720	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL				$81,000	
TOTAL PERIODIC COST				**$81,000**	Total capital cost is rounded to the nearest $1,000.

Notes:
Percentages used for indirect costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.
Costs presented for this alternative are expected to have an accuracy between -50% to +100% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

Abbreviations:

CY	Cubic Yard
LS	Lump Sum
QTY	Quantity
YR	Year
ACR	Acre
SY	Square Yard

TABLE SCS-6

Alternative **6**

Excavation, Stabilization/Solidfication of Tailings, and Disposal of Mine Materials at Proposed Facility outside PMDA

SCREENING COST ESTIMATE SUMMARY

Site: Formosa Mine Superfund Site OU1
Location: Douglas County, OR
Phase: Feasibility Study
Base Year: 2013
Date: January 31, 2013

Description: Alternative 6 includes excavation and disposal of mine materials, including EM tailings, at a proposed facility outside the PMDA. The tailings within the former water and tailings storage pond (approximately 19,000 CY) would be dewatered and treated as described for Alternative 4. Since the EM area will be excavated and disposed of rather than contained in place, the targeted disposal volume for the proposed facility outside of the PMDA would increase to 234,000 CY. Excavated areas or areas disturbed during construction that do not have mine materials would be restored or regraded and reclaimed with a rock armor or a vegetative layer, depending on the steepness of resulting slopes. Administrative controls involve administrative, legal, and/or informational, or physical measures intended to control or prevent present and future use or access to mine materials, and inform and warn of dangers associated with these materials. Monitoring would consist of visual inspections to document degree of protectiveness to human health and the environment and determine maintenance needs for the proposed facility and containment areas. Maintenance of the proposed disposal facility and containment areas would be performed as necessary to maintain protectiveness and integrity of the covers systems. Five-year site reviews would be performed since mine materials under covers would remain, however, the 5-year site reviews would not be required for OU1 within the PMDA once mine materials with contaminant concentrations above PRGs are no longer present.

INSTITUTIONAL CONTROLS CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Institutional Controls for Excavation/Transport/Disposal Alternatives	1	LS	$123,000	$123,000	
SUBTOTAL				$123,000	
Contingency (Scope and Bid)	20%			$24,600	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL				$147,600	
Project Management	8%			$11,808	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL				$159,408	
TOTAL CAPITAL COST				**$159,000**	Total capital cost is rounded to the nearest $1,000.

EARTHWORK CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Geosynthetic Multi-Layer Cover	10	ACR	$86,000	$860,000	
Liner System	47,000	SY	$23	$1,081,000	
Contaminated Soils Excavation, Transport, and Disposal to Proposed Facility outside PMDA	234,000	CY	$13	$3,042,000	
Backfilling and Restoration of Excavated Areas	20,000	CY	$15	$300,000	
Neutralization - Lime Delivery	6,500	TON	$135	$877,500	
Neutralization - Lime Amendment and Processing	12	ACR	$1,200	$14,400	
Organic Delivery	3,500	TON	$42	$147,000	
Organic Soil Amendment and Processing	3,500	TON	$36	$126,000	
Pozzolan- or Cement-Based Stabilization/solidification of Tailings from EM	19,000	CY	$133	$2,527,000	
SUBTOTAL				$8,974,900	
Contingency (Scope and Bid)	20%			$1,794,980	
SUBTOTAL				$10,769,880	
Project Management	5%			$538,494	The low end of the recommended range in EPA 540-R-00-002 was used.
Remedial Design	6%			$646,193	The low end of the recommended range in EPA 540-R-00-002 was used.
Construction Management	6%			$646,193	The low end of the recommended range in EPA 540-R-00-002 was used.
TOTAL				$12,600,760	
TOTAL CAPITAL COST				**$12,601,000**	Total capital cost is rounded to the nearest $1,000.

TABLE SCS-6

Alternative **6**

Excavation, Stabilization/Solidfication of Tailings, and Disposal of Mine Materials at Proposed Facility outside PMDA

SCREENING COST ESTIMATE SUMMARY

Site: Formosa Mine Superfund Site OU1
Location: Douglas County, OR
Phase: Feasibility Study
Base Year: 2013
Date: January 31, 2013

Description: Alternative 6 includes excavation and disposal of mine materials, including EM tailings, at a proposed facility outside the PMDA. The tailings within the former water and tailings storage pond (approximately 19,000 CY) would be dewatered and treated as described for Alternative 4. Since the EM area will be excavated and disposed of rather than contained in place, the targeted disposal volume for the proposed facility outside of the PMDA would increase to 234,000 CY. Excavated areas or areas disturbed during construction that do not have mine materials would be restored or regraded and reclaimed with a rock armor or a vegetative layer, depending on the steepness of resulting slopes. Administrative controls involve administrative, legal, and/or informational, or physical measures intended to control or prevent present and future use or access to mine materials, and inform and warn of dangers associated with these materials. Monitoring would consist of visual inspections to document degree of protectiveness to human health and the environment and determine maintenance needs for the proposed facility and containment areas. Maintenance of the proposed disposal facility and containment areas would be performed as necessary to maintain protectiveness and integrity of the covers systems. Five-year site reviews would be performed since mine materials under covers would remain, however, the 5-year site reviews would not be required for OU1 within the PMDA once mine materials with contaminant concentrations above PRGs are no longer present.

SITE MAINTENANCE AND INSPECTION ANNUAL OPERATIONS AND MAINTENANCE (O&M) COSTS (Years 1 through 29)

DESCRIPTION	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Annual Inspection and Maintenance of Covers	1	YR	$18,000	$18,000	Includes inspection and maintenance of the remedy put in place
SUBTOTAL				$18,000	
Contingency (Scope and Bid)	20%			$3,600	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL				$21,600	
Project Management	10%			$2,160	The high end of the recommended range in EPA 540-R-00-002 was used.
Technical Support	15%			$3,240	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL				$27,000	
TOTAL ANNUAL O&M COST				**$27,000**	Total capital cost is rounded to the nearest $1,000.

5-YEAR SITE REVIEW PERIODIC COSTS (Years 4, 9, 14, 19, 24, and 29)

DESCRIPTION	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Review, Community Awareness Activities, & ICs Maintenanc	1	LS	$54,000	$54,000	Includes site inspection and 5-year review report
SUBTOTAL				$54,000	
Contingency (Scope and Bid)	20%			$10,800	10% Scope, 10% Bid (Low end of the recommended range in EPA 540-R-00-002).
SUBTOTAL				$64,800	
Project Management	10%			$6,480	The high end of the recommended range in EPA 540-R-00-002 was used.
Technical Support	15%			$9,720	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL				$81,000	
TOTAL PERIODIC COST				**$81,000**	Total capital cost is rounded to the nearest $1,000.

Notes:
Percentages used for indirect costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.
Costs presented for this alternative are expected to have an accuracy between -50% to +100% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

Abbreviations:

CY	Cubic Yard
LS	Lump Sum
QTY	Quantity
YR	Year
ACR	Acre
SY	Square Yard

TABLE SCS - NOTES

SCREENING COST ESTIMATE SUMMARY

Unit Cost Basis for Various Work Elements/Activities Under Alternative 1, 2, 3, 4, 5, and 6

Site:	**Formosa OU1**
Location:	**Douglas County, OR**
Phase:	**Feasibility Study**
Base Year:	**2013**

WORK ELEMENT DESCRIPTION	GENERAL RESPONSE ACTION(S) REPRESNTED	ALTERNATIVE(S)	UNIT COST	UNIT(S)	COST SOURCE	COST DATE	NOTES
5-Year Site Review & Community Awareness	Monitoring, Land Use Controls	1	$40,000	LS	Gilt Edge OU1 & Flat Creek OU1	2012	Refer to Appendix H, Table CW1-2 Refer to Appendix F, Table CW1-2
5-Year Site Review, Community Awareness Activities, & ICs Maintenance	Monitoring, Land Use Controls	2 and 3	$54,000	LS	Gilt Edge OU1 & Flat Creek OU2	2012	Refer to Appendix H, Table CW3-3 Refer to Appendix F, Table CW2-11 and -12
5-Year Site Review, Community Awareness Activities, & ICs Maintenance	Monitoring, Land Use Controls	4, 5, & 6	$54,000	LS	Gilt Edge OU1 & Flat Creek OU3	2012	Refer to Appendix H, Table CW5-3 Refer to Appendix F, Table CW2-11 and -12
Institutional Controls for Containment Alternatives	Land Use Controls	2 and 3	$123,000	LS	Gilt Edge OU1	2012	Refer to Appendix H, Table CW3-1
Institutional Controls for Excavation/Transport/Disposal Alternatives	Land Use Controls	4,5 & 6	$123,000	LS	Gilt Edge OU1	2012	Refer to Appendix H, Table CW5-1
Annual Inspection and Maintenance of Covers	Controls, Containment	2, 3, 4, 5, & 6	$18,000	YR	Gilt Edge OU1	2012	Refer to Appendix H, Table CW3-31 and -34
In-Place Capping of Contaminated Soils (Exposure Barrier)	Containment	2	$35,000	ACR	Flat Creek OU1 See Note 1, 3,& 4	2012	Average between Flat Creek, Frohner Mine, Dunka Mine, and California Gulch
In-Place Capping of Contaminated Soils (Pavement Cover)	Containment	2	$95	TON	Vendor Quote	2012	Carson Paving & Sealing Inc, quote for asphalt including hauling and mixing
Repository Excavation and Preparation	Containment	2, 3, 4, 5, & 6	$4	CY	See Note 3 & 5	2012	Average between California Gulch and BLM
Geosynthetic Multi-Layer Cover	Containment	2, 3, 4, 5, & 6	$86,000	ACR	Gilt Edge OU1 See Notes 2 & 3	2012	Average between Gilt Edge, Toston Smelter, and Frohner Mine
Liner System	Removal/Transport/Disposal	2, 3, 4, 5, & 6	$23	SY	See Notes 3 & 6	2012	Average between Frohner Mine and New World Mining District
Contaminated Soils Excavation, Transport, and Disposal to Proposed Facility within Primary Mine Disturbance Area (PMDA)	Removal/Transport/Disposal	2, 3, 4, & 5	$8	CY	Flat Creek OU1	2012	Refer to Appendix F, Table CW4-4 and -5, MII Assembly used for hauling
Contaminated Soils Excavation, Transport, and Disposal to Proposed Facility outside PMDA	Removal/Transport/Disposal	3, 4, 5, & 6	$13	CY	Flat Creek OU1	2012	Refer to Appendix F, Table CW4-4 and -5
Contaminated Soils Excavation, Transport, and Disposal to Existing Facility outside PMDA	Removal/Transport/Disposal	5	$342	CY	Vendor Quote & Flat Creek OU1	2012	Vendor quote for RCRA facility with Flat Creek used for excavation and loading.
Backfilling and Restoration of Excavated Areas	Removal/Transport/Disposal	2, 3, 4, 5, & 6	$15	CY	Flat Creek OU1	2011	Refer to Appendix F, Table CW5-6
Neutralization - Lime Delivery	Treatment	2, 3, 4, 5, & 6	$135	TON	Gilt Edge OU1	2012	Vendor quote for material, MII Assembly used for hauling
Neutralization - Lime Amendment and Processing	Treatment	2, 3, 4, 5, & 6	$1,200	ACR	Gilt Edge OU1	2012	Refer to Appendix H, Table CW4-31
Organic Delivery	Treatment	2, 3, 4, 5, & 6	$42	TON	Gilt Edge OU1	2012	Vendor quote for material, MII Assembly used for hauling
Organic Soil Amendment and Processing	Treatment	2, 3, 4, 5, & 6	$36	TON	Gilt Edge OU1	2012	Refer to Appendix H, Table CW4-31
Pozzolan- or Cement-Based Stabilization/solidification of Tailings from EM	Treatment	4, 5, & 6	$133	CY	Flat Creek OU1	2012	Refer to Appendix F, Table CW5-12

Notes: Unit costs in this table are rounded to the nearest $5,000 (large unit costs) or nearest $5 (small unit costs)

Abbreviations:

ACR Acre
CY Cubic Yard
LS Lump Sum
YR Year

Note

1 - Case Study, Big River Mine Tailings Site, St. Francois County, Missouri
2 - Final Draft Construction Report for the Toston Smelter Reclamation Project, Toston, Montana, 2009
3 - Addendum No.1 to the Expanded Engineering Evaluation and Cost Analysis for the Frohner Mine and Mill Site, Clancy-Lump Gulch Mining District, Jefferson County, Montana;
4 - Final Phase I Removal Action Completion Report for the California Gulch Superfund Site, Lake County, CO OU6
5 - Abandoned Mine Waste Repositories: Site Selection, Design, and Cost, Technical Note 410, April 2002, Bureau of Land Management
6 - Construction Report, Selective Source Response Action, New World Mining District Response and Restoration Project, Bozeman, Montana, 2006

Appendix E

Detailed Analysis of Retained Alternatives

Alternative 1
No Further Action

Table E-1. Evaluation Summary for Overall Protection of Human Health and the Environment – Alternative 1

Evaluation Factors for Overall Protection of Human Health and the Environment	Evaluation Summary
Adequate protection of human health and the environment (short- and long-term) from unacceptable risks posed by hazardous substances, pollutants, or contaminants present at the site	▪ Selected mine materials at OU1 were partially addressed during previous reclamation activities as discussed in Section 1.4. The remainder of mine materials at OU1 were left unaddressed. ▪ Unaddressed mine materials within portions of the PMDA may have contaminants above PRGs which could pose a direct exposure risk to human and ecological receptors. ▪ Partially addressed mine materials are not fully exposed at the surface, but potentially generate ARD and leach contaminants to surface water and groundwater, especially during periods of precipitation and snowmelt.

Table E-2. Evaluation Summary for Compliance with ARARs – Alternative 1

Evaluation Factors for Compliance with ARARs	Evaluation Summary
Compliance with chemical-specific ARARs	▪ Alternative 1 fails to be compliant with the chemical-specific ARARs identified for the site (specifically OAR 340-122) since no further action is taken and unacceptable cancer risk levels for arsenic would remain in mine materials. Thus, this criterion is not met.
Compliance with location-specific ARARs	▪ Location-specific ARARs would not be triggered since no new remedial measures would be undertaken.
Compliance with action-specific ARARs	▪ Action-specific ARARs would not be triggered since no new remedial measures would be undertaken.

Table E-3. Evaluation Summary for Long-Term Effectiveness and Permanence – Alternative 1

Evaluation Factors for Long-Term Effectiveness and Permanence	Evaluation Summary
Magnitude of residual risk remaining from untreated waste or treatment residuals remaining at the conclusion of the remedial activities	▪ No new remedial actions would be undertaken to address mine materials. ▪ Unaddressed mine materials within portions of the PMDA may have contaminants above PRGs which could pose a direct exposure risk to human and ecological receptors. ▪ Partially addressed mine materials are not fully exposed at the surface, but potentially generate ARD and leach contaminants to surface water and groundwater, especially during periods of precipitation and snowmelt.
Adequacy and reliability of controls that are used to manage treatment residuals and untreated waste remaining at the site	▪ No controls are put in place under the no further action alternative. Thus, mine materials would be left uncontrolled except as partially mitigated during previous reclamation activities. ▪ Mine materials could migrate to other media and could pose unacceptable risks to humans and ecological receptors.

Table E-4. Evaluation Summary for Reduction of Toxicity, Mobility, or Volume through Treatment – Alternative 1

Evaluation Factors for Reduction of Toxicity, Mobility, or Volume through Treatment	Evaluation Summary
The treatment processes, the alternative uses, and materials they will treat	▪ No further remedial action would be undertaken to address mine materials. Thus, there would be no reduction of toxicity, mobility, or volume of contamination through treatment. ▪ The statutory preference for treatment as a principal element of the remedial action would not be met.
The amount of hazardous substances, pollutants, or contaminants that will be destroyed or treated, including how the principal threat(s) will be addressed	
The degree of expected reduction in toxicity, mobility, or volume of the waste due to treatment	
The degree to which the treatment is irreversible	
The type and quantity of residuals that will remain following treatment, considering the persistence, toxicity, mobility, and propensity to bioaccumulate such hazardous substances and their constituents	
Whether the alternative would satisfy the statutory preference for treatment as a principal element of the remedial action	

Table E-5. Short-Term Effectiveness Evaluation Summary – Alternative 1

Evaluation Factors for Short-Term Effectiveness	Evaluation Summary
Short-term risks that might be posed to the community during implementation of an alternative	▪ No further remedial action would be undertaken for mine materials; thus, there are no short-term risks posed to the community during implementation of the alternative.
Potential impacts on workers during remedial action and the effectiveness and reliability of protective measures	▪ Workers performing site inspections during 5-year site reviews would potentially be exposed to mine materials that pose unacceptable risks. ▪ These risks could be mitigated through the use of monitoring and personal protective equipment.
Potential adverse environmental impacts resulting from construction and implementation of an alternative and the reliability of the available mitigation measures during implementation in preventing or reducing the potential impacts	▪ No further remedial action would be undertaken. Thus, there would be no potential adverse environmental impacts resulting from implementation of the alternative.
Time until protection is achieved	▪ No further remedial action would be undertaken to address mine materials. Thus, protection would not be achieved under this alternative.

Table E-6. Implementability Evaluation Summary – Alternative 1

Evaluation Factors for Implementability		Evaluation Summary
Technical feasibility	Technical difficulties and unknowns associated with the construction and operation of a technology	▪ No further remedial action would be undertaken for mine materials. ▪ Inspections for 5-year site reviews are simple and routine activities. However, these activities do nothing to address mine materials, which potentially generate ARD and could pose a direct exposure risk to human and ecological receptors
	Reliability of the technology, focusing on technical problems that will lead to schedule delays	
	Ease of undertaking additional remedial actions including what, if any, future remedial actions would be needed and the difficulty to implement additional remedial actions	
	Ability to monitor the effectiveness of the remedy, including an evaluation of risks of exposure should monitoring be insufficient to detect a system failure	
Administrative feasibility	Activities needed to coordinate with other offices and agencies	▪ No further remedial actions would be undertaken to address mine materials; thus, no need to obtain approvals from regulatory agencies.
	The ability and time required to obtain any necessary approvals and permits from other agencies (for offsite actions)	
Availability of services and materials	Availability of adequate offsite treatment, storage capacity, and disposal capacity and services	▪ No offsite remedial activities would be conducted under this alternative.
	Availability of necessary equipment and specialists and provisions to ensure any necessary additional resources	▪ Technical equipment and specialists are available for inspections that would be required under 5-year site reviews.
	Availability of services and materials plus the potential for obtaining competitive bids, which is particularly important for innovative technologies	
	Availability of prospective technologies	

Table E-7. Cost Evaluation Summary – Alternative 1

Evaluation Factors for Cost	Approximate Cost (Dollars)
Total capital cost	None
Total O&M cost	None
Total periodic cost	$300,000
Total cost (excluding present value discounting)	$300,000
Total present value cost	$115,000

Note: Total costs are for the assumed period of evaluation (Years 0 through 29). Costs are rounded to the nearest $1,000.

Alternative 2

In-Place Containment, Continued Submergence of Tailings within EM, and Limited Excavation/Disposal of Mine Materials at Proposed Facility within PMDA

Table E-8. Evaluation Summary for Overall Protection of Human Health and the Environment – Alternative 2

Evaluation Factors for Overall Protection of Human Health and the Environment	Evaluation Summary
Adequate protection of human health and the environment (short- and long-term) from unacceptable risks posed by hazardous substances, pollutants, or contaminants present at the site	▪ Mine materials would be primarily addressed through in-place containment (covering). ▪ Highly acid-generating mine materials at headwaters of creek areas and other targeted areas would be excavated and disposed of at proposed facility within PMDA. ▪ Excavation and disposal of highly acid-generating mine materials at proposed facility within PMDA would eliminate exposure of mine materials with contaminant concentrations above PRGs to humans and provide significant reduction of ARD generation and migration. ▪ Tailings stored within the former water and tailings storage pond would continue to remain submerged under the newly-constructed multi-layer geosynthetic cover system at the EM. Submergence of tailings would continue to mitigate ARD generation, assuming existing liner remains intact, and holds water. ▪ With proper construction and maintenance, the covers would eliminate exposure of mine materials to humans. Migration of contamination to air would be eliminated and migration of contamination to groundwater and surface water would be reduced. ▪ A reduction of exposure risks to humans and ecological receptors from contaminants above PRGs would occur from excavation and disposal of highly acid-generating mine materials and in-place containment of other mine materials. ▪ Monitoring and maintenance would be performed during and after construction to ensure protectiveness of the remedy. ▪ PRAOs for mine materials are addressed through in-place containment, removal, transport, disposal, and administrative controls.

Table E-9. Evaluation Summary for Compliance with ARARs – Alternative 2

Evaluation Factors for Compliance with ARARs	Evaluation Summary
Compliance with chemical-specific ARARs	▪ Mine materials excavated and disposed of in proposed facility within PMDA coupled with in-place containment would physically address exposure to contaminants above PRGs; thus, meeting chemical-specific ARARs such as OAR 340-122.
Compliance with location-specific ARARs	▪ Location-specific ARARs for the remedy would be addressed during implementation, but impacts are expected to be minimal because disposal of mine materials is conducted primarily within the PMDA.
Compliance with action-specific ARARs	▪ Action-specific ARARs for the remedy would be addressed during implementation of the remedial action.

Table E-10. Evaluation Summary for Long-Term Effectiveness and Permanence – Alternative 2

Evaluation Factors for Long-Term Effectiveness and Permanence	Evaluation Summary
Magnitude of residual risk remaining from untreated waste or treatment residuals remaining at the conclusion of the remedial activities	▪ Mine materials would be primarily addressed through in-place containment (covering). The horizontal extent of the covering is approximately 16.2 acres and would address approximately 65 percent of the mine materials. ▪ Highly acid-generating mine materials at headwaters of creek areas and other targeted areas would be excavated and disposed of at proposed facility within PMDA. These areas include the east EM waste rock dump (32,000 CY), the Formosa 1 and Formosa 3adit waste rock dumps (25,000 CY), mine materials along the upper side slopes of the EM (8,000 CY), adit drainage affected soil (3,000 CY), and within road areas to accommodate pavement cover (4,000 CY). These include approximately 31 percent of mine materials. ▪ Tailings stored within the former water and tailings storage pond would continue to remain submerged under the newly-constructed multi-layer geosynthetic cover system at the EM. Submergence of tailings would continue to mitigate ARD generation, assuming existing liner remains intact and holds water. ▪ With proper construction and maintenance, the covers would eliminate exposure of mine materials to humans. Migration of contamination to air would be eliminated and migration of contamination to groundwater and surface water would be reduced. ▪ A reduction of exposure risks to humans and ecological receptors from contaminants above PRGs would occur from excavation and disposal of highly acid-generating mine materials and in-place containment of other mine materials. ▪ Due to in-place containment of mine materials on existing steep slopes, use of stability measures such as geocells or retaining walls may need to be incorporated to maintain stability. ▪ Long-term effectiveness would not be entirely ensured since mine materials potentially posing a risk are left on site (although covered). Protection to human health and the environment is partially dependent on administrative controls. ▪ Administrative controls implemented for the proposed disposal facility and other cover areas would require monitoring and maintenance in perpetuity. Even with maintenance and monitoring, long-term effectiveness of administrative controls cannot be ensured since people could ignore them. ▪ Monitoring would be performed to evaluate long-term effectiveness and permanence of the remedy.
Adequacy and reliability of controls that are used to manage treatment residuals and untreated waste remaining at the site	▪ Long-term effectiveness and permanence of covers is dependent on continued integrity of the covers and adherence to administrative controls. ▪ O&M activities would be periodically required to repair damage or erosion to the covers. Monitoring and maintenance of covers would need to be performed in perpetuity. ▪ Regular monitoring of submerged tailings would be required to maintain consistent water levels and reducing conditions for the submerged tailings within the former water and tailings storage pond. ▪ Geotechnical monitoring may also need to be conducted after construction to ensure the stability of covers on existing steep slopes. ▪ Long-term effectiveness of vegetated multi-layer geosynthetic covers may decrease over time if woody vegetation became established and penetrated the covers. Preventative maintenance to address woody vegetation would be required to maintain integrity. ▪ Long-term effectiveness of pavement cover may decrease over time due to development of freeze-thaw cracking and would require regular maintenance to maintain integrity.

Table E-11. Evaluation Summary for Reduction of Toxicity, Mobility, or Volume through Treatment – Alternative 2

<table>
<tr><th>Evaluation Factors for Reduction of Toxicity, Mobility, or Volume through Treatment</th><th>Evaluation Summary</th></tr>
<tr><td>The treatment processes, the alternative uses, and materials they will treat</td><td rowspan="6">▪ There is no reduction of toxicity, mobility, or volume through treatment for most mine materials, because the primary remedy approaches are in-place containment and excavation/disposal at a proposed facility within the PMDA.
▪ Tailings stored within the former water and tailings storage pond would continue to remain submerged under the newly-constructed multi-layer geosynthetic cover system at the EM. Submergence would continue to mitigate ARD generation, assuming existing liner remains intact and holds water and would result in some reduction of toxicity and mobility of contaminants from the tailings.
▪ The statutory preference for treatment as a principal element of the remedial action would not be met.</td></tr>
<tr><td>The amount of hazardous substances, pollutants, or contaminants that will be destroyed or treated, including how the principal threat(s) will be addressed</td></tr>
<tr><td>The degree of expected reduction in toxicity, mobility, or volume of the waste due to treatment</td></tr>
<tr><td>The degree to which the treatment is irreversible</td></tr>
<tr><td>The type and quantity of residuals that will remain following treatment, considering the persistence, toxicity, mobility, and propensity to bioaccumulate such hazardous substances and their constituents</td></tr>
<tr><td>Whether the alternative would satisfy the statutory preference for treatment as a principal element of the remedial action</td></tr>
</table>

Table E-12. Short-Term Effectiveness Evaluation Summary – Alternative 2

Evaluation Factors for Short-Term Effectiveness	Evaluation Summary
Short-term risks that might be posed to the community during implementation of an alternative	▪ There would be minor impacts to the community under this alternative, as truck traffic would only be required to transport materials for covers as well as for reclamation to the PMDA. ▪ Short-term risks posed to the community during implementation of the alternative also relate to trespassers within the mine disturbance area. ▪ Administrative control could be quickly implemented to limit exposure risks to human receptors.
Potential impacts on workers during remedial action and the effectiveness and reliability of protective measures	▪ Excavation and disposal of mine materials could pose short-term risks to workers. ▪ Surface disturbance of mine materials could pose short-term risks to workers installing covers. ▪ Safety measures such as dust suppression, use of PPE, and establishment of work zones would protect workers and the community during implementation. ▪ Transport of materials for construction of covers as well as for reclamation to the PMDA would pose short-term risks to workers from increased traffic. ▪ Other potential impacts could be from safety hazards during remedial implementation, such as falls, electrical hazards, and mechanical hazards.
Potential adverse environmental impacts resulting from construction and implementation of an alternative and the reliability of the available mitigation measures during implementation in preventing or reducing the potential impacts	▪ There could also be impacts to the environment during the implementation of the remedial action due to the use of heavy construction and hauling equipment and import of borrow and cover materials from outside the PMDA. Use of fuel efficient and low emission equipment as well as careful selection and reclamation of borrow areas could reduce environmental impacts. ▪ The alternative would involve surface disturbance of contaminated soils which could pose potential adverse impacts through dispersion of dust. Water- or chemical- based suppression would be used for controlling mine materials and dust during construction. ▪ Development of borrow outside of PMDA borrow areas could adversely impact the environment. Mitigation measures could include selection of easily accessible borrow locations and reclamation of borrow areas after use.
Time until protection is achieved	▪ The proposed remedial action and administrative controls could be implemented in approximately 1 year.

Table E-13. Implementability Evaluation Summary – Alternative 2

Evaluation Factors for Implementability		Evaluation Summary
Technical feasibility	Technical difficulties and unknowns associated with the construction and operation of a technology	▪ Logistics for working with large number of heavy equipment and trucks within the PMDA could be difficult to manage. ▪ Roads and utilities within the PMDA would be affected. Roads will be restored upon construction completion. Legal agreements for the new roads might need to be obtained from affected property owners. ▪ Excavation of mine materials and placement of covers on steep slopes may require use of specialty equipment and practices to ensure worker safety. ▪ Maintenance of institutional controls may be more difficult due to various types of ownership and land use. Maintaining institutional controls would require agency coordination. ▪ Monitoring would be performed during construction to ensure protectiveness of the remedy.
	Reliability of the technology, focusing on technical problems that will lead to schedule delays	▪ Excavation and disposal, construction of covers, and implementation of monitoring is relatively straight forward and can be implemented using available equipment and labor resources. ▪ Uncontaminated borrow sources within or outside of PMDA would need to be developed. ▪ Other materials such as pavement material, lime, organic material, and geosynthetic materials, would need to be imported to OU1 that could result in schedule delay. ▪ Monitoring, implementation, and enforcement of institutional controls may be more difficult, especially for properties due to various types of ownership, types of land use, and levels of occupancy.
	Ease of undertaking additional remedial actions, including what, if any, future remedial actions would be needed and the difficulty to implement additional remedial actions	▪ Future excavation and disposal of mine materials could be implemented. ▪ Additional in situ treatment measures could be applied to submerged tailings.
	Ability to monitor the effectiveness of the remedy, including an evaluation of risks of exposure should monitoring be insufficient to detect a system failure	▪ Inspection, monitoring and maintenance of the proposed facility, cover systems, and access controls across OU1 is relatively straightforward and can be easily implemented using available materials, equipment, and labor resources. ▪ Maintenance of institutional controls may be more difficult due to various types of ownership and land use. Maintaining institutional controls would require agency coordination.
Administrative feasibility	Activities needed to coordinate with other offices and agencies	▪ Regulatory approval for in-place containment of mine materials using covers should be obtainable. ▪ Development of borrow sources outside of PMDA for proposed facility construction, cover, and reclamation materials would require coordination and approval from the affected agency or property owner. ▪ Regulatory approvals for monitoring and maintenance should be obtainable. ▪ Regulatory approvals for institutional controls and access controls should be obtainable. However some difficulties may be encountered with regard to types of restrictions. ▪ Site inspections for 5-year site reviews would be coordinated with EPA and Oregon DEQ.

Table E-13. Implementability Evaluation Summary – Alternative 2 (continued)

Evaluation Factors for Implementability		Evaluation Summary
Administrative feasibility (continued)	The ability and time required to obtain any necessary approvals and permits from other agencies (for offsite actions)	▪ Development of borrow sources outside of PMDA for cover materials would require coordination and approval from the affected agency.
Availability of services and materials	Availability of adequate offsite treatment, storage capacity, and disposal capacity and services	▪ The proposed disposal facility within PMDA would extend from the EM to the ore storage area along the Silver Butte ridge, and have sufficient capacity to consolidate excavated mine materials. ▪ Total volume of mine materials to be excavated and transported for disposal within PMDA would be approximately 72,000 CY. ▪ Offsite treatment, storage, and disposal services would not be required.
	Availability of necessary equipment and specialists and provisions to ensure any necessary additional resources	▪ Labor, equipment, and materials for excavation, proposed facility construction, and cover construction are available. ▪ Suitable rock and soil materials for proposed facility construction cover construction, and reclamation would be required from within and outside the PMDA. ▪ Pavement cover construction materials would be required from offsite sources. ▪ Materials, equipment, and technical specialists needed for the geosynthetic portions of cover construction are more specialized but readily available. ▪ Technical equipment and specialists are available for implementation of institutional controls and monitoring. ▪ Technical equipment and specialists are available for site inspections that would be required under 5-year site reviews.
	Availability of services and materials plus the potential for obtaining competitive bids, which is particularly important for innovative technologies	
	Availability of prospective technologies	

Table E-14. Cost Evaluation Summary – Alternative 2

Evaluation Factors for Cost	Approximate Cost (Dollars)
Total capital cost	$5,075,000
Total O&M cost	$750,000
Total periodic cost	$330,000
Total cost (excluding present value discounting)	$6,155,000
Total present value cost	$555,3000

Note: Total costs are for the assumed period of evaluation (Years 0 through 29). Costs are rounded to the nearest $1,000.

Alternative 3

Limited In-Place Containment, Chemically Reduced Submergence of Tailings within EM, and Excavation/Disposal of Mine Materials at Proposed Facilities within and outside PMDA

Table E-15. Evaluation Summary for Overall Protection of Human Health and the Environment – Alternative 3

Evaluation Factors for Overall Protection of Human Health and the Environment	Evaluation Summary
Adequate protection of human health and the environment (short- and long-term) from unacceptable risks posed by hazardous substances, pollutants, or contaminants present at the site	▪ Mine materials would be primarily addressed through excavation and disposal at proposed facilities within and outside of PMDA. ▪ Remaining mine materials would be addressed on a limited basis through in-place containment (covering). ▪ Excavation and disposal of mine materials at proposed facilities within and outside PMDA would eliminate exposure of mine materials with contaminant concentrations above PRGs to humans and provide significant reduction of ARD generation and migration. ▪ Tailings currently stored within the former water and tailings storage pond would continue to remain submerged under the newly-constructed multi-layer geosynthetic cover system at the EM. Submergence of tailings would continue to mitigate ARD generation, assuming existing liner remains intact and holds water. ▪ Addition of a carbon source to tailings may support in situ biological treatment through bacterially catalyzed sulfate reduction. This type of treatment has the potential to precipitate dissolved contaminants within the pore water as solid-phase sulfide minerals; thus, further limiting their ability to leach to surface water and groundwater. ▪ With proper construction and maintenance, the covers would eliminate exposure of mine materials to humans. Migration of contamination to air would be eliminated and migration of contamination to groundwater and surface water would be reduced. ▪ A reduction of exposure risks to humans and ecological receptors from contaminants above PRGs would occur from excavation and disposal of highly acid-generating mine materials in proposed facilities and limited in-place containment of other mine materials. ▪ Monitoring would be performed during and after construction to ensure protectiveness of the remedy. ▪ PRAOs would be addressed through removal, transportation, and disposal at proposed facilities within and outside of PMDA coupled with in-place containment and administrative controls.

Table E-16. Evaluation Summary for Compliance with ARARs – Alternative 3

Evaluation Factors for Compliance with ARARs	Evaluation Summary
Compliance with chemical-specific ARARs	▪ Mine materials excavated and disposed of in proposed facilities within and outside of PMDA coupled with limited in-place containment would physically address exposure to contaminants above PRGs; thus, meeting chemical-specific ARARs such as OAR 340-122. ▪ Mine materials are likely exempted from RCRA Subtitle C regulation by the Bevill amendment to RCRA, so chemical-specific ARARs related to hazardous waste characterization and disposal are likely not applicable.
Compliance with location-specific ARARs	▪ Location-specific ARARs for the remedy would be addressed during implementation. It is expected that additional location-specific ARARs would need to be addressed because disposal of mine materials is conducted outside as well as inside the PMDA.
Compliance with action-specific ARARs	▪ Action-specific ARARs for the remedy would be addressed during implementation. It is expected that additional action-specific ARARs would need to be addressed because disposal of mine materials is conducted outside as well as inside the PMDA.

Table E-17. Evaluation Summary for Long-Term Effectiveness and Permanence – Alternative 3

Evaluation Factors for Long-Term Effectiveness and Permanence	Evaluation Summary
Magnitude of residual risk remaining from untreated waste or treatment residuals remaining at the conclusion of the remedial activities	▪ Mine materials would be primarily addressed through excavation and disposal at proposed facilities within and outside of PMDA. These include approximately 83 percent of mine materials (194,000 CY). ▪ Remaining mine materials would be addressed on a limited basis through in-place containment (covering). The horizontal extent of the in-place covers is approximately 1.1 acre and would address approximately 4 percent of the mine materials. ▪ Excavation and disposal of mine materials at proposed facilities within (69,000 CY) and outside PMDA (125,000 CY) would eliminate exposure of mine materials with contaminant concentrations above PRGs to humans and provide significant reduction of ARD generation and migration. ▪ Tailings stored within the former water and tailings storage pond would continue to remain submerged under the newly-constructed multi-layer geosynthetic cover system at the EM. Submergence of tailings would continue to mitigate ARD generation, assuming existing liner remains intact and holds water. ▪ Addition of a carbon source to tailings may support in situ biological treatment through bacterially catalyzed sulfate reduction. This type of treatment has the potential to precipitate dissolved contaminants within the pore water as solid-phase sulfide minerals; thus, further limiting their ability to leach to surface water and groundwater. ▪ With proper construction and maintenance, the covers would eliminate exposure of mine materials to humans. Migration of contamination to air would be eliminated and migration of contamination to groundwater and surface water would be reduced. ▪ A reduction of exposure risks to humans and ecological receptors from contaminants above PRGs would occur from excavation and disposal of highly acid-generating mine materials in proposed facilities and limited in-place containment of other mine materials. ▪ Long-term effectiveness would not be entirely ensured since approximately 40,000 CY of mine materials potentially posing a risk are left within the PMDA (although covered). Protection to human health and the environment is partially dependent on administrative controls. ▪ Administrative controls implemented for the proposed disposal facilities and the EM cover area would require monitoring and maintenance in perpetuity. Even with maintenance and monitoring, long-term effectiveness of administrative controls cannot be ensured since people could ignore them. ▪ Monitoring would be performed to evaluate long-term effectiveness and permanence of the remedy.
Adequacy and reliability of controls that are used to manage treatment residuals and untreated waste remaining at the site	▪ Long-term effectiveness and permanence of covers is dependent on continued integrity of the covers and adherence to administrative controls. ▪ O&M activities would be periodically required to repair damage or erosion to the covers. Monitoring and maintenance of covers would need to be performed in perpetuity. ▪ Long-term effectiveness of vegetated multi-layer geosynthetic covers may decrease over time if woody vegetation became established and penetrated the covers. Preventative maintenance to address woody vegetation would be required to maintain integrity. ▪ Regular monitoring of submerged tailings would be required to maintain consistent water levels and reducing conditions for the submerged tailings within the former water and tailings storage pond. ▪ Management of hydrogen sulfide gas emission generated from sulfate reduction during chemically-reduced submergence of the tailings may also be required. ▪ Administrative controls implemented for the proposed disposal facilities and other cover areas would require monitoring and maintenance in perpetuity. Even with maintenance and monitoring, long-term effectiveness of administrative controls cannot be ensured since people could ignore them. ▪ Monitoring would be performed to evaluate long-term effectiveness and permanence of the remedy. ▪ Disposal of mine waste at proposed facilities outside of PMDA would provide long-term effectiveness and permanence, assuming the facility receives adequate O&M.

Table E-18. Evaluation Summary for Reduction of Toxicity, Mobility, or Volume through Treatment – Alternative 3

<table>
<tr><th>Evaluation Factors for Reduction of Toxicity, Mobility, or Volume through Treatment</th><th>Evaluation Summary</th></tr>
<tr><td>The treatment processes, the alternative uses, and materials they will treat</td><td rowspan="6">There is no reduction of toxicity, mobility, or volume through treatment for most mine materials because the primary remedy approaches are excavation/disposal at proposed facilities within and outside the PMDA and limited in-place containment.
Tailings stored within the former water and tailings storage pond would continue to remain submerged under the cover system at the EM. Submergence would continue to mitigate ARD generation, assuming existing liner remains intact and holds water and would result in some reduction of toxicity and mobility of contaminants from the tailings.
Chemically reduced submergence may provide a further reduction of toxicity and mobility of contaminants from the tailings.
Although treatment of tailings is included for this alternative, the volume of tailings is small relative to the overall volume of mine materials. Thus, the statutory preference for treatment as a principal element of the remedial action may not be met.</td></tr>
<tr><td>The amount of hazardous substances, pollutants, or contaminants that will be destroyed or treated, including how the principal threat(s) will be addressed</td></tr>
<tr><td>The degree of expected reduction in toxicity, mobility, or volume of the waste due to treatment</td></tr>
<tr><td>The degree to which the treatment is irreversible</td></tr>
<tr><td>The type and quantity of residuals that will remain following treatment, considering the persistence, toxicity, mobility, and propensity to bioaccumulate such hazardous substances and their constituents</td></tr>
<tr><td>Whether the alternative would satisfy the statutory preference for treatment as a principal element of the remedial action</td></tr>
</table>

Table E-19. Short-Term Effectiveness Evaluation Summary – Alternative 3

Evaluation Factors for Short-Term Effectiveness	Evaluation Summary
Short-term risks that might be posed to the community during implementation of an alternative	▪ There would be additional impacts to the community under this alternative, as truck traffic would be required for disposal of mine materials at the proposed facility outside of PMDA as well as transport of treatment additives for chemically-reduced submergence of tailings. Truck traffic would also be required to transport materials for covers as well as for reclamation within and outside the PMDA. ▪ Short-term risks posed to the community during implementation of the alternative also relate to trespassers within the mine disturbance area. ▪ Administrative control could be quickly implemented to limit exposure risks to human receptors.
Potential impacts on workers during remedial action and the effectiveness and reliability of protective measures	▪ Excavation and disposal of mine materials could pose short-term risks to workers. ▪ Surface disturbance of mine materials could pose short-term risks to workers installing covers. ▪ Safety measures such as dust suppression, use of PPE, and establishment of work zones would protect workers and the community during implementation. ▪ Transport of materials for construction of covers as well as for reclamation to the PMDA and proposed facility outside of PMDA would pose short-term risks to workers from increased traffic. ▪ Other potential impacts could be from safety hazards during remedial implementation, such as falls, electrical hazards, and mechanical hazards.

Table E-19. Short-Term Effectiveness Evaluation Summary –Alternative 3 (continued)

Evaluation Factors for Short-Term Effectiveness	Evaluation Summary
Potential adverse environmental impacts resulting from construction and implementation of an alternative and the reliability of the available mitigation measures during implementation in preventing or reducing the potential impacts	▪ There could also be impacts to the environment during the implementation of the remedial action due to the use of heavy construction and hauling equipment and import of borrow and cover materials from outside the PMDA. Use of fuel efficient and low emission equipment as well as careful selection and reclamation of borrow areas could reduce environmental impacts. ▪ Construction of a new proposed facility outside of PMDA would increase extent of the impacted areas as compared to Alternative 2. ▪ Water- or chemical- based suppression would be used for controlling mine materials and dust during construction. ▪ Development of outside of PMDA borrow areas could adversely impact the environment. Mitigation measures could include selection of easily accessible borrow locations and reclamation of borrow areas after use.
Time until protection is achieved	▪ Duration of remedial construction and implementation would increase over Alternative 2 due to additional mine material excavation and disposal both within and outside of the PMDA. ▪ The proposed remedial action and administrative controls could be implemented in approximately 2 years.

Table E-20. Implementability Evaluation Summary – Alternative 3

Evaluation Factors for Implementability		Evaluation Summary
Technical feasibility	Technical difficulties and unknowns associated with the construction and operation of a technology	▪ Logistics for working with large number of heavy equipment and trucks at the site could be difficult to manage. ▪ Roads and utilities within the OU1 would be affected, roads will be restored upon construction completion. Legal agreements for the new roads might need to be obtained from affected property owners. ▪ Excavation of mine materials and placement of covers on steep slopes may require use of specialty equipment and practices to ensure worker safety. ▪ Maintenance of institutional controls may be more difficult due to various types of ownership and land use. Maintaining institutional controls would require agency coordination. ▪ Monitoring would be performed during construction to ensure protectiveness of the remedy. ▪ Total volume of mine materials to be excavated and transported for disposal outside of PMDA would be approximately 125,000 CY ▪ Excavated mine materials may require transportation to the proposed facility outside of PMDA in specialized enclosed trucks. ▪ Approximately 5,342 truck loads would be required to haul the mine materials to the proposed facility outside of PMDA.
	Reliability of the technology, focusing on technical problems that will lead to schedule delays	▪ Excavation, construction of the proposed disposal facilities, construction of the covers, and implementation of monitoring is relatively straight forward and can be implemented using available equipment and labor resources. ▪ Uncontaminated borrow sources within or outside of PMDA would need to be developed. ▪ Other materials such as carbon source, lime, organic material, and geosynthetic materials, would need to be imported to OU1 that could result in schedule delay. ▪ Treatability testing would be required to assess and optimize performance of chemically reduced submergence for tailings in the former water and tailings storage pond.

Table E-20. Implementability Evaluation Summary – Alternative 3 (continued)

Evaluation Factors for Implementability		Evaluation Summary
Technical feasibility (continued)	Reliability of the technology, focusing on technical problems that will lead to schedule delays (continued)	▪ Construction of a new proposed facility outside of PMDA may be affected by land uses, other restrictions such as existence of floodplains, wetlands, and fault zones, or historical or culturally significant artifacts. ▪ Monitoring, implementation, and enforcement of institutional controls may be more difficult, especially for properties due to various types of ownership, types of land use, and levels of occupancy. ▪ Leachate collection and treatment may be needed for the proposed facility outside of the PMDA, depending on selected location and configuration. Leachate treatment would be performed as part of OU2 operations.
	Ease of undertaking additional remedial actions, including what, if any, future remedial actions would be needed and the difficulty to implement additional remedial actions	▪ Future excavation and disposal of remaining mine materials could be implemented. ▪ Additional in situ treatment measures could be applied to submerged tailings. ▪ Covers over mine materials disposed of in proposed facilities could be upgraded. ▪ Additional in situ treatment of disposed mine materials could be performed within the proposed facilities, but would be difficult to effectively implement at a later date.
	Ability to monitor the effectiveness of the remedy, including an evaluation of risks of exposure should monitoring be insufficient to detect a system failure	▪ Inspection, monitoring and maintenance of the proposed facilities, cover systems, leachate collection system (if needed), and access controls across OU1 is relatively straightforward and can be easily implemented using available materials, equipment, and labor resources. ▪ Maintenance of institutional controls may be more difficult due to various types of ownership and land use. Maintaining institutional controls would require agency coordination.
Administrative feasibility	Activities needed to coordinate with other offices and agencies	▪ Regulatory approval needed to excavate and transport mine materials should be obtainable. ▪ Regulatory approval for in-place containment of mine materials using covers should be obtainable. ▪ Construction of repository outside of PMDA would require coordination and approval from the affected agency or property owner. ▪ Regulatory approvals for leachate collection system at the proposed facility outside of PMDA (if needed) should be obtainable. ▪ Regulatory approvals for monitoring and maintenance should be obtainable. ▪ Regulatory approvals for institutional and access controls should be obtainable. However, some difficulties may be encountered with regard to types of restrictions. ▪ Site inspections for 5-year site reviews would be coordinated with EPA and Oregon DEQ.
	The ability and time required to obtain any necessary approvals and permits from other agencies (for offsite actions)	▪ Development of borrow sources outside of PMDA for proposed facility construction, cover, and reclamation materials would require coordination and approval from the affected agency or property owner. ▪ New proposed facilities constructed outside of PMDA would require approval by Oregon DEQ.

Table E-20. Implementability Evaluation Summary – Alternative 3 (continued)

Evaluation Factors for Implementability		Evaluation Summary
Availability of services and materials	Availability of adequate offsite treatment, storage capacity, and disposal capacity and services	▪ The proposed disposal facility within PMDA would extend from the EM to the ore storage area along the Silver Butte ridge, and have sufficient capacity to consolidate excavated mine materials. ▪ Property would need to be acquired for construction of a proposed facility outside of the PMDA. ▪ The proposed facility outside PMDA would be constructed to meet pertinent ARARs for the selected location and have sufficient capacity to consolidate excavated mine materials. ▪ Total volume of mine materials to be excavated and transported for disposal within PMDA would be approximately 69,000 CY. ▪ Total volume of mine materials to be excavated and transported for disposal outside of PMDA would be approximately 125,000 CY.
		▪ Total volume of mine materials to be excavated and transported for disposal outside of PMDA would be approximately 125,000 CY. ▪ Approximately 5,342 truck loads would be required to haul the mine materials to the proposed facility outside of PMDA.
	Availability of necessary equipment and specialists and provisions to ensure any necessary additional resources	▪ Labor, equipment, and materials for excavation and proposed facility construction are available. ▪ Suitable rock and soil materials for proposed facility construction, cover construction, and reclamation would be required from within and outside the PMDA. ▪ Materials, equipment, and technical specialists needed for the geosynthetic portions of cover construction at the proposed facilities are more specialized but readily available. ▪ Materials, equipment, and technical specialists needed for the chemically-reduced submergence of tailings are more specialized but available. ▪ Material, equipment and technical specialist needed for leachate collection for the proposed facility outside of PMDA (if needed) are readily available. ▪ Technical equipment and specialists are available for implementation of institutional controls and monitoring. ▪ Technical equipment and specialists are available for site inspections that would be required under 5-year site reviews.
	Availability of services and materials plus the potential for obtaining competitive bids, which is particularly important for innovative technologies	
	Availability of prospective technologies	

Table E-21. Cost Evaluation Summary – Alternative 3

Evaluation Factors for Cost	Approximate Cost (Dollars)
Total capital cost	$8,878,000
Total O&M cost	$553,000
Total periodic cost	$330,000
Total cost (excluding present value discounting)	$9,761,000
Total present value cost	$9,275,000

Note: Total costs are for the assumed period of evaluation (Years 0 through 29). Costs are rounded to the nearest $1,000.

Alternative 4

Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facilities within and outside PMDA

Table E-22. Evaluation Summary for Overall Protection of Human Health and the Environment – Alternative 4

Evaluation Factors for Overall Protection of Human Health and the Environment	Evaluation Summary
Adequate protection of human health and the environment (short- and long-term) from unacceptable risks posed by hazardous substances, pollutants, or contaminants present at the site	▪ Mine materials would be primarily addressed through excavation and disposal at proposed facilities within and outside of PMDA. ▪ Excavation and disposal of mine materials at proposed facilities within and outside PMDA would eliminate exposure of mine materials with contaminant concentrations above PRGs to humans and provide significant reduction of ARD generation and migration. ▪ Tailings stored within the former water and tailings storage pond would be dewatered and treated by pozzolan- or cement- based stabilization/solidification. ▪ Stabilization/solidification would minimize or eliminate leaching of contaminants to surrounding soils and groundwater when treated tailings are disposed of at the proposed facility ▪ With proper construction and maintenance, the covers at the proposed facilities would eliminate exposure of mine materials to humans. Migration of contamination to air would be eliminated and migration of contamination to groundwater and surface water would be reduced. ▪ A reduction of exposure risks to humans and ecological receptors from contaminants above PRGs would occur from excavation and disposal of mine materials in proposed facilities. ▪ Monitoring would be performed during and after construction to ensure protectiveness of the remedy. ▪ PRAOs would be addressed through excavation and disposal at proposed facilities within and outside of PMDA coupled with administrative controls.

Table E-23. Evaluation Summary for Compliance with ARARs – Alternative 4

Evaluation Factors for Compliance with ARARs	Evaluation Summary
Compliance with chemical-specific ARARs	▪ Mine materials excavated and disposed of in proposed facilities within and outside of PMDA would physically address exposure to contaminants above PRGs; thus, meeting chemical-specific ARARs such as OAR 340-122. ▪ Additional chemical-specific ARARs such as LDRs may be relevant for disposal at a proposed facility outside of the PMDA. However, mine materials are Bevill exempt wastes so appropriateness of applying LDRs is not clear.
Compliance with location-specific ARARs	▪ Location-specific ARARs for the remedy would be addressed during implementation. It is expected that additional location-specific ARARs would need to be addressed, because disposal of mine materials is conducted outside as well as inside the PMDA.
Compliance with action-specific ARARs	▪ Action-specific ARARs for the remedy would be addressed during implementation. It is expected that additional action-specific ARARs would need to be addressed, because disposal of mine materials is conducted outside as well as inside the PMDA.

Table E-24. Evaluation Summary for Long-Term Effectiveness and Permanence – Alternative 4

Evaluation Factors for Long-Term Effectiveness and Permanence	Evaluation Summary
Magnitude of residual risk remaining from untreated waste or treatment residuals remaining at the conclusion of the remedial activities	▪ Mine materials would be primarily addressed through excavation and disposal at proposed facilities within and outside of PMDA. These include all mine materials within PMDA, including materials within EM (234,000 CY). ▪ Excavation and disposal of mine materials at proposed facilities within (109,000 CY) and outside PMDA (125,000 CY) would eliminate exposure of mine materials with contaminant concentrations above PRGs to humans and provide significant reduction of ARD generation and migration. ▪ Stabilization/solidification of tailings (19,000 CY) would prevent leaching of contamination to surrounding soils and groundwater when treated tailings are disposed of at the proposed facility, thus providing greater long-term effectiveness and permanence at the proposed facility.
Adequacy and reliability of controls that are used to manage treatment residuals and untreated waste remaining at the site	▪ Long-term effectiveness and permanence of proposed facilities is dependent on continued integrity of the covers and adherence to administrative controls. ▪ O&M activities would be periodically required to repair damage or erosion to the covers at the proposed facilities. Monitoring and maintenance of covers would need to be performed in perpetuity. ▪ Long-term effectiveness of vegetated multi-layer geosynthetic covers at the proposed facilities may decrease over time if woody vegetation became established and penetrated the covers. Preventative maintenance to address woody vegetation would be required to maintain integrity. ▪ Administrative controls implemented for the proposed disposal facilities would require monitoring and maintenance in perpetuity. Even with maintenance and monitoring, long-term effectiveness of administrative controls cannot be ensured since people could ignore them. ▪ Monitoring would be performed to evaluate long-term effectiveness and permanence of the remedy. ▪ Disposal of mine waste at proposed facilities outside of PMDA would provide long-term effectiveness and permanence, assuming the facility receives adequate O&M.

Table E-25. Evaluation Summary for Reduction of Toxicity, Mobility, or Volume through Treatment – Alternative 4

Evaluation Factors for Reduction of Toxicity, Mobility, or Volume through Treatment	Evaluation Summary
The treatment processes, the alternative uses, and materials they will treat	▪ There is no reduction of toxicity, mobility, or volume through treatment for most mine materials because the primary remedy approach is excavation/disposal at proposed facilities within and outside the PMDA. ▪ Tailings stored within the former water and tailings storage pond would be dewatered and treated by stabilization/solidification prior to disposal, thus reducing toxicity and mobility of contaminants from the tailings. ▪ Although treatment of tailings is included for this alternative, the volume of tailings is small relative to the overall volume of mine materials. Thus, the statutory preference for treatment as a principal element of the remedial action may not be met.
The amount of hazardous substances, pollutants, or contaminants that will be destroyed or treated, including how the principal threat(s) will be addressed	
The degree of expected reduction in toxicity, mobility, or volume of the waste due to treatment	
The degree to which the treatment is irreversible	
The type and quantity of residuals that will remain following treatment, considering the persistence, toxicity, mobility, and propensity to bioaccumulate such hazardous substances and their constituents	
Whether the alternative would satisfy the statutory preference for treatment as a principal element of the remedial action	

Table E-26. Short-Term Effectiveness Evaluation Summary – Alternative 4

Evaluation Factors for Short-Term Effectiveness	Evaluation Summary
Short-term risks that might be posed to the community during implementation of an alternative	▪ There would be additional impacts to the community under this alternative, as truck traffic would be required for disposal of mine materials at the proposed facility outside of PMDA as well as transport of treatment additives such as pozzolan or cement for stabilization/solidification of tailings. Truck traffic would also be required to transport materials for construction of the proposed facility as well as for reclamation within and outside the PMDA. ▪ Short-term risks posed to the community during implementation of the alternative also relate to trespassers within the mine disturbance area. ▪ Administrative control could be quickly implemented to limit exposure risks to human receptors.
Potential impacts on workers during remedial action and the effectiveness and reliability of protective measures	▪ Excavation and disposal of mine materials could pose short-term risks to workers. ▪ Surface disturbance of mine materials could pose short-term risks to workers installing covers. ▪ Safety measures such as dust suppression, use of PPE, and establishment of work zones would protect workers and the community during implementation. ▪ Transport of materials for construction of covers as well as for reclamation to the PMDA and proposed facility outside of PMDA would pose short-term risks to workers from increased traffic. ▪ Other potential impacts could be from safety hazards during remedial implementation, such as falls, electrical hazards, and mechanical hazards.
Potential adverse environmental impacts resulting from construction and implementation of an alternative and the reliability of the available mitigation measures during implementation in preventing or reducing the potential impacts	▪ There could also be impacts to the environment during the implementation of the remedial action due to the use of heavy construction and hauling equipment and import of borrow and cover materials from outside the PMDA. Use of fuel efficient and low emission equipment as well as careful selection and reclamation of borrow areas could reduce environmental impacts. ▪ Construction of a new proposed facility outside of PMDA would increase extent of the impacted areas as compared to Alternative 2. ▪ Water- or chemical- based suppression would be used for controlling mine materials and dust during construction. ▪ Development of outside of PMDA borrow areas could adversely impact the environment. Mitigation measures could include selection of easily accessible borrow locations and reclamation of borrow areas after use.
Time until protection is achieved	▪ Duration of remedial construction and implementation would increase over Alternative 2 due to additional mine material excavation and disposal both within and outside of the PMDA. ▪ The proposed remedial action and administrative controls could be implemented in approximately 2 years.

Table E-27. Implementability Evaluation Summary – Alternative 4

Evaluation Factors for Implementability		Evaluation Summary
Technical feasibility	Technical difficulties and unknowns associated with the construction and operation of a technology	▪ Logistics for working with large number of heavy equipment and trucks at the PMDA could be difficult to manage. ▪ Roads and utilities within the OU1 would be affected, roads would be restored upon construction completion. Legal agreements for the new roads might need to be obtained from affected property owners. ▪ Excavation of mine materials and placement of covers on steep slopes may require use of specialty equipment and practices to ensure worker safety. ▪ Maintenance of institutional controls may be more difficult due to various types of ownership and land use. Maintaining institutional controls would require agency coordination. ▪ Monitoring would be performed during construction to ensure protectiveness of the remedy. ▪ Total volume of mine materials to be excavated and transported for disposal within PMDA would be approximately 109,000 CY. ▪ Total volume of mine materials to be excavated and transported for disposal outside of PMDA would be approximately 125,000 CY. ▪ Excavated mine materials may require transportation to the proposed facility outside of PMDA in specialized enclosed trucks. ▪ Approximately 5,342 truck loads would be required to haul the mine materials to the proposed facility outside of PMDA.
	Reliability of the technology, focusing on technical problems that will lead to schedule delays	▪ Excavation and disposal, construction of the proposed disposal facilities, and implementation of monitoring is relatively straightforward and can be implemented using available equipment, and labor resources. ▪ Uncontaminated borrow sources within or outside of PMDA would need to be developed. ▪ Other materials such as pozzolan- or cement-, lime, organic material, and geosynthetic materials, would need to be imported to OU1 that could result in schedule delay. ▪ Treatment of tailings using stabilization/solidification is relatively straightforward, but may be difficult due to high concentrations of contaminants in the tailings, degree of saturation, and limited space for performing stabilization/solidification. ▪ Treatability testing would be required to assess and optimize performance of stabilization/solidification of tailings. ▪ Treatment will solidify the tailings and provide the ability to adequately transport, dispose, and compact tailings within a proposed facility. ▪ Construction of a new proposed facility outside of PMDA may be affected by land uses, other restrictions such as existence of floodplains, wetlands, and fault zones, or historical or culturally significant artifacts. ▪ Monitoring, implementation, and enforcement of institutional controls may be more difficult, especially for properties due to various types of ownership, types of land use, and levels of occupancy. ▪ Leachate collection and treatment may be needed for the proposed facility outside of the PMDA, depending on selected location and configuration. Leachate treatment would be performed as part of OU2 operations.
	Ease of undertaking additional remedial actions, including what, if any, future remedial actions would be needed and the difficulty to implement additional remedial actions	▪ Covers over mine materials disposed of in proposed facilities could be upgraded. ▪ Additional in situ treatment of disposed mine materials could be performed within the proposed facilities, but would be difficult to effectively implement at a later date.

Table E-27. Implementability Evaluation Summary – Alternative 4 (continued)

Evaluation Factors for Implementability		Evaluation Summary
Technical feasibility (continued)	Ability to monitor the effectiveness of the remedy, including an evaluation of risks of exposure should monitoring be insufficient to detect a system failure	▪ Inspection, monitoring and maintenance of the proposed facilities, cover systems, leachate collection system (if needed), and access controls across OU1 is relatively straightforward and can be easily implemented using available materials, equipment, and labor resources. ▪ Maintenance of institutional controls may be more difficult due to various types of ownership and land use. Maintaining institutional controls would require agency coordination.
Administrative feasibility	Activities needed to coordinate with other offices and agencies	▪ Regulatory approval needed to excavate and transport mine materials should be obtainable. ▪ Construction of repository outside of PMDA would require coordination and approval from the affected agency or property owner. ▪ Regulatory approvals for leachate collection system at the proposed facility outside of PMDA (if needed) should be obtainable. ▪ Regulatory approvals for monitoring and maintenance should be obtainable. ▪ Regulatory approvals for institutional and access controls should be obtainable. However, some difficulties may be encountered with regard to types of restrictions.
	The ability and time required to obtain any necessary approvals and permits from other agencies (for offsite actions)	▪ Development of borrow sources outside of PMDA for proposed facility construction, cover, and reclamation materials would require coordination and approval from the affected agency or property owner. ▪ New proposed facilities constructed outside of PMDA would require approval by Oregon DEQ. ▪ Site inspections for 5-year site reviews would be coordinated with EPA and Oregon DEQ.
Availability of services and materials	Availability of adequate offsite treatment, storage capacity, and disposal capacity and services	▪ The proposed disposal facility within PMDA would extend from the EM to the ore storage area along the Silver Butte ridge, and have sufficient capacity to consolidate excavated mine materials. ▪ Property would need to be acquired for construction of a proposed facility outside of the PMDA. ▪ The proposed facility outside PMDA would be constructed to meet pertinent ARARs for the selected location and have sufficient capacity to consolidate excavated mine materials. ▪ Total volume of mine materials to be excavated and transported for disposal within PMDA would be approximately 109,000 CY. ▪ Total volume of mine materials to be excavated and transported for disposal outside of PMDA would be approximately 125,000 CY. ▪ Approximately 5,342 truck loads would be required to haul the mine materials to the proposed facility outside of PMDA.

Table E-27. Implementability Evaluation Summary – Alternative 4 (continued)

Evaluation Factors for Implementability		Evaluation Summary
Availability of services and materials (continued)	Availability of necessary equipment and specialists and provisions to ensure any necessary additional resources	▪ Labor, equipment, and materials for excavation and proposed facility construction are available. ▪ Suitable rock and soil materials for proposed facility construction cover construction, and reclamation would be required from within and outside the PMDA. ▪ Materials, equipment, and technical specialists needed for the geosynthetic portions of cover construction at the proposed facilities are more specialized but readily available. ▪ Materials, equipment, and technical specialists needed for the stabilization/solidification of tailings are more specialized but available. ▪ Material, equipment and technical specialist needed for leachate collection for the proposed facility outside of PMDA (if needed) are readily available. ▪ Technical equipment and specialists are available for implementation of institutional controls and monitoring. ▪ Technical equipment and specialists are available for site inspections that would be required under 5-year site reviews.
	Availability of services and materials plus the potential for obtaining competitive bids, which is particularly important for innovative technologies	
	Availability of prospective technologies	

Table E-28. Cost Evaluation Summary – Alternative 4

Evaluation Factors for Cost	Approximate Cost (Dollars)
Total capital cost	$10,010,000
Total O&M cost	$553,000
Total periodic cost	$330,000
Total cost (excluding present value discounting)	$10,893,000
Total present value cost	$10,407,000

Note: Total costs are for the assumed period of evaluation (Years 0 through 29). Costs are rounded to the nearest $1,000.

Alternative 6

Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facility outside PMDA

Table E-29. Evaluation Summary for Overall Protection of Human Health and the Environment – Alternative 6

Evaluation Factors for Overall Protection of Human Health and the Environment	Evaluation Summary
Adequate protection of human health and the environment (short- and long-term) from unacceptable risks posed by hazardous substances, pollutants, or contaminants present at the site	▪ Mine materials would be primarily addressed through excavation and disposal at proposed facility outside of PMDA. ▪ Excavation and disposal of highly acid-generating mine materials at proposed facility outside PMDA would eliminate exposure of mine materials with contaminant concentrations above PRGs to humans and provide significant reduction of ARD generation and migration. ▪ Tailings stored within the former water and tailings storage pond would be dewatered and treated by stabilization/solidification. Stabilization/solidification would minimize or eliminate leaching of contaminants to surrounding soils and groundwater when treated tailings are disposed of at the proposed facility. ▪ With proper construction and maintenance, the cover at the proposed facility would eliminate exposure of mine materials to humans. Migration of contamination to air would be eliminated and migration of contamination to groundwater and surface water would be reduced. ▪ A reduction of exposure risks to humans and ecological receptors from contaminants above PRGs would occur from excavation and disposal of mine materials in the proposed facility. ▪ Monitoring would be performed during and after construction to ensure protectiveness of the remedy. ▪ PRAOs would be addressed through excavation and disposal at proposed facilities outside of PMDA coupled with administrative controls.

Table E-30. Evaluation Summary for Compliance with ARARs – Alternative 6

Evaluation Factors for Compliance with ARARs	Evaluation Summary
Compliance with chemical-specific ARARs	▪ Mine materials excavated and disposed of in the proposed facility outside of PMDA would physically address exposure to contaminants above PRGs; thus, meeting chemical-specific ARARs such as OAR 340-122. ▪ Additional chemical-specific ARARs such as LDRs may be relevant for disposal at a proposed facility outside of the PMDA. However, mine materials are Bevill exempt wastes so appropriateness of applying LDRs is not clear.
Compliance with location-specific ARARs	▪ Location-specific ARARs for the remedy would be addressed during implementation. It is expected that additional location-specific ARARs would need to be addressed because disposal of mine materials is conducted outside the PMDA.
Compliance with action-specific ARARs	▪ Action-specific ARARs for the remedy would be addressed during implementation. It is expected that additional action-specific ARARs would need to be addressed because disposal of mine materials is conducted outside the PMDA.

Table E-31. Evaluation Summary for Long-Term Effectiveness and Permanence – Alternative 6

Evaluation Factors for Long-Term Effectiveness and Permanence	Evaluation Summary
Magnitude of residual risk remaining from untreated waste or treatment residuals remaining at the conclusion of the remedial activities	▪ Mine materials would be primarily addressed through excavation and disposal at proposed facility outside of PMDA. These includes all mine materials within PMDA , including materials within EM (234,000 CY). ▪ Excavation and disposal of mine materials at proposed facility outside PMDA would eliminate exposure of mine materials with contaminant concentrations above PRGs to humans and provide significant reduction of ARD generation and migration. ▪ Stabilization/solidification of tailings would prevent leaching of contamination to surrounding soils and groundwater when treated tailings are disposed of at the proposed facility, thus providing greater long-term effectiveness and permanence at the proposed facility. ▪ Construction of a new proposed facility outside of PMDA would decrease extent of the impacted areas within PMDA as compared to Alternative 4.
Adequacy and reliability of controls that are used to manage treatment residuals and untreated waste remaining at the site	▪ Long-term effectiveness and permanence of proposed facilities is dependent on continued integrity of the covers and adherence to administrative controls. ▪ O&M activities would be periodically required to repair damage or erosion to the covers at the proposed facilities. Monitoring and maintenance of covers would need to be performed in perpetuity. ▪ Long-term effectiveness of vegetated multi-layer geosynthetic covers at the proposed facilities may decrease over time if woody vegetation became established and penetrated the covers. Preventative maintenance to address woody vegetation would be required to maintain integrity. ▪ Administrative controls implemented for the proposed disposal facilities would require monitoring and maintenance in perpetuity. Even with maintenance and monitoring, long-term effectiveness of administrative controls cannot be ensured since people could ignore them. ▪ Monitoring would be performed to evaluate long-term effectiveness and permanence of the remedy. ▪ Disposal of mine waste at proposed facilities outside of PMDA would provide long-term effectiveness and permanence, assuming the facility receives adequate O&M.

Table E-32. Evaluation Summary for Reduction of Toxicity, Mobility, or Volume through Treatment – Alternative 6

Evaluation Factors for Reduction of Toxicity, Mobility, or Volume through Treatment	Evaluation Summary
The treatment processes, the alternative uses, and materials they will treat	▪ There is no reduction of toxicity, mobility, or volume through treatment for most mine materials because the primary remedy approach is excavation/disposal at proposed facilities within and outside the PMDA. ▪ Tailings stored within the former water and tailings storage pond would be dewatered and treated by stabilization/ solidification prior to disposal; thus, reducing toxicity and mobility of contaminants from the tailings. ▪ Although treatment of tailings is included for this alternative, the volume of tailings is small relative to the overall volume of mine materials. Thus, the statutory preference for treatment as a principal element of the remedial action may not be met.
The amount of hazardous substances, pollutants, or contaminants that will be destroyed or treated, including how the principal threat(s) will be addressed	
The degree of expected reduction in toxicity, mobility, or volume of the waste due to treatment	
The degree to which the treatment is irreversible	
The type and quantity of residuals that will remain following treatment, considering the persistence, toxicity, mobility, and propensity to bioaccumulate such hazardous substances and their constituents	
Whether the alternative would satisfy the statutory preference for treatment as a principal element of the remedial action	

Table E-33. Short-Term Effectiveness Evaluation Summary – Alternative 6

Evaluation Factors for Short-Term Effectiveness	Evaluation Summary
Short-term risks that might be posed to the community during implementation of an alternative	▪ There would be additional impacts to the community under this alternative, as truck traffic would be required for disposal of mine materials at the proposed facility outside of PMDA as well as transport of treatment additives such as pozzolan or cement for stabilization/solidification of tailings. Truck traffic would also be required to transport materials for construction of the proposed facility as well as for reclamation within and outside the PMDA. ▪ Short-term risks posed to the community during implementation of the alternative also relate to trespassers within the mine disturbance area. ▪ Administrative controls could be quickly implemented to limit exposure risks to human receptors. ▪ Duration of remedial construction and implementation would increase over Alternative 4 due to disposal of mine material occurring outside of the PMDA.
Potential impacts on workers during remedial action and the effectiveness and reliability of protective measures	▪ Excavation and disposal of mine materials could pose short-term risks to workers. ▪ Surface disturbance of mine materials could pose short-term risks to workers installing covers. ▪ Safety measures such as dust suppression, use of PPE, and establishment of work zones would protect workers and the community during implementation. ▪ Transport of materials for construction of covers as well as for reclamation to the PMDA and proposed facility outside of PMDA would pose short-term risks to workers from increased traffic. ▪ Other potential impacts could be from safety hazards during remedial implementation, such as falls, electrical hazards, and mechanical hazards.
Potential adverse environmental impacts resulting from construction and implementation of an alternative and the reliability of the available mitigation measures during implementation in preventing or reducing the potential impacts	▪ There could also be impacts to the environment during the implementation of the remedial action due to the use of heavy construction and hauling equipment and import of borrow and cover materials from outside the PMDA. Use of fuel efficient and low emission equipment as well as careful selection and reclamation of borrow areas could reduce environmental impacts. ▪ Construction of a new proposed facility outside of PMDA would increase extent of the impacted areas as compared to Alternative 4. ▪ Water- or chemical- based suppression would be used for controlling mine materials and dust during construction. ▪ Development of outside of PMDA borrow areas could adversely impact the environment. Mitigation measures could include selection of easily accessible borrow locations and reclamation of borrow areas after use.
Time until protection is achieved	▪ Duration of remedial construction and implementation would increase over Alternative 4 due to disposal of all mine material occurring outside of the PMDA. ▪ The proposed remedial action and administrative controls could be implemented in approximately 3 years.

Table E-34. Implementability Evaluation Summary – Alternative 6

Evaluation Factors for Implementability		Evaluation Summary
Technical feasibility	Technical difficulties and unknowns associated with the construction and operation of a technology	▪ Logistics for working with large number of heavy equipment and trucks at the within and outside the PMDA could be difficult to manage. ▪ Roads and utilities within the OU1 would be affected; roads would be restored upon construction restoration completion. Legal agreements for the new roads might need to be obtained from affected property owners. ▪ Excavation of mine materials and placement of covers on steep slopes may require use of specialty equipment and practices to ensure worker safety. ▪ Maintenance of institutional controls may be more difficult due to various types of ownership and land use. Maintaining institutional controls would require agency coordination. ▪ Monitoring would be performed during construction to ensure protectiveness of the remedy. ▪ Total volume of mine materials to be excavated and transported for disposal outside of PMDA would be approximately 234,000 CY ▪ Excavated mine materials may require transportation to the proposed facility outside of PMDA in specialized enclosed trucks. ▪ Approximately 10,000 truck loads would be required to haul the mine materials to the proposed facility outside of PMDA.
	Reliability of the technology, focusing on technical problems that will lead to schedule delays	▪ Excavation and disposal, construction of the proposed disposal facilities, and implementation of monitoring is relatively straightforward and can be implemented using available equipment, and labor resources. ▪ Uncontaminated borrow sources within or outside of PMDA would need to be developed. ▪ Other materials such as pozzolan- or cement-, lime, organic material, and geosynthetic materials, would need to be imported to OU1 that could result in schedule delay. ▪ Treatment of tailings using stabilization/solidification is relatively straightforward but may be difficult due to high concentrations of contaminants in the tailings, degree of saturation, and limited space for performing stabilization/solidification. ▪ Treatability testing would be required to assess and optimize performance of stabilization/solidification of tailings. ▪ Treatment will solidify the tailings and provide the ability to adequately transport, dispose, and compact tailings within a proposed facility. ▪ Construction of a new proposed facility outside of PMDA may be affected by land uses, other restrictions such as existence of floodplains, wetlands, and fault zones, or historical or culturally significant artifacts. ▪ Monitoring, implementation, and enforcement of institutional controls may be more difficult, especially for properties due to various types of ownership, types of land use, and levels of occupancy. ▪ Leachate collection and treatment may be needed for the proposed facility outside of the PMDA, depending on selected location and configuration. Leachate treatment would be performed as part of OU2 operations.
	Ease of undertaking additional remedial actions, including what, if any, future remedial actions would be needed and the difficulty to implement additional remedial actions	▪ Covers over mine materials disposed of in proposed facilities could be upgraded. ▪ Additional in situ treatment of disposed mine materials could be performed within the proposed facilities, but would be difficult to effectively implement at a later date.

Table E-34. Implementability Evaluation Summary – Alternative 6 (continued)

Evaluation Factors for Implementability		Evaluation Summary
Technical feasibility (continued)	Ability to monitor the effectiveness of the remedy, including an evaluation of risks of exposure should monitoring be insufficient to detect a system failure	▪ Inspection, monitoring and maintenance of the proposed facilities, cover systems, leachate collection system (if needed), and access controls across OU1 is relatively straightforward and can be easily implemented using available materials, equipment, and labor resources. ▪ Maintenance of institutional controls may be more difficult due to various types of ownership and land use. Maintaining institutional controls would require agency coordination.
Administrative feasibility	Activities needed to coordinate with other offices and agencies	▪ Regulatory approval needed to excavate and transport mine materials should be obtainable. ▪ Construction of repository outside of PMDA would require coordination and approval from the affected agency or property owner. ▪ Regulatory approvals for leachate collection system at the proposed facility outside of PMDA (if needed) should be obtainable. ▪ Regulatory approvals for monitoring and maintenance should be obtainable. ▪ Regulatory approvals for institutional and access controls should be obtainable. However, some difficulties may be encountered with regard to types of restrictions.
	The ability and time required to obtain any necessary approvals and permits from other agencies (for offsite actions)	▪ Development of borrow sources outside of PMDA for proposed facility construction, cover, and reclamation materials would require coordination and approval from the affected agency or property owner. ▪ New proposed facilities constructed outside of PMDA would require approval by Oregon DEQ. ▪ Site inspections for 5-year site reviews would be coordinated with EPA and Oregon DEQ.
Availability of services and materials	Availability of adequate offsite treatment, storage capacity, and disposal capacity and services	▪ Property would need to be acquired for construction of a proposed facility outside of the PMDA. ▪ The proposed facility outside PMDA would be constructed to meet pertinent ARARs for the selected location and have sufficient capacity to consolidate excavated mine materials. ▪ Total volume of mine materials to be excavated and transported for disposal outside of PMDA would be approximately 234,000 CY. ▪ Approximately 10,000 truck loads would be required to haul the mine materials to the proposed facility outside of PMDA.
	Availability of necessary equipment and specialists and provisions to ensure any necessary additional resources	▪ Labor, equipment, and materials for excavation and proposed facility construction are available. ▪ Suitable rock and soil materials for proposed facility construction cover construction, and reclamation would be required from within and outside the PMDA. ▪ Materials, equipment, and technical specialists needed for the geosynthetic portions of cover construction at the proposed facilities are more specialized but readily available. ▪ Materials, equipment, and technical specialists needed for the stabilization/solidification of tailings are more specialized but available. ▪ Material, equipment and technical specialist needed for leachate collection for the proposed facility outside of PMDA (if needed) are readily available. ▪ Technical equipment and specialists are available for implementation of institutional controls and monitoring. ▪ Technical equipment and specialists are available for site inspections that would be required under 5-year site reviews.
	Availability of services and materials plus the potential for obtaining competitive bids, which is particularly important for innovative technologies	
	Availability of prospective technologies	

Table E-35. Cost Evaluation Summary – Alternative 6

Evaluation Factors for Cost	Approximate Cost (Dollars)
Total capital cost	$10,092,000
Total O&M cost	$553,000
Total periodic cost	$330,000
Total cost (excluding present value discounting)	$10,975,000
Total present value cost	$10,489,000

Note: Total costs are for the assumed period of evaluation (Years 0 through 29). Costs are rounded to the nearest $1,000.

Appendix F

Detailed Alternative Screening Cost Information

Appendix F

Detailed Alternative Screening Cost Information

The cost spreadsheets included in this appendix were developed in accordance with EPA 540-R-00-002 (OSWER 9355.0-75) July 2000.

These costs should be used to compare alternative relative costs. Costs for project management, remedial design, and construction management were determined as percentages of capital cost per the guidance. Costs for these work items may not reflect costs for implementation. These costs are determined based on specific client requirements during implementation.

Present Value and Cost Estimate Summary
Alternative 1

TABLE PV-1

PRESENT VALUE ANALYSIS

Alternative 1
No Further Action

Site:	**Formosa OU1**
Location:	**Douglas County, Oregon**
Phase:	**Feasibility Study**
Base Year:	**2013**

Year[1]	Capital Costs[2]	Annual O&M Costs	Periodic Costs	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$0	$0	$0	$0	1.0000	$0
1	$0	$0	$0	$0	0.9346	$0
2	$0	$0	$0	$0	0.8734	$0
3	$0	$0	$0	$0	0.8163	$0
4	$0	$0	$50,000	$50,000	0.7629	$38,145
5	$0	$0	$0	$0	0.7130	$0
6	$0	$0	$0	$0	0.6663	$0
7	$0	$0	$0	$0	0.6227	$0
8	$0	$0	$0	$0	0.5820	$0
9	$0	$0	$50,000	$50,000	0.5439	$27,195
10	$0	$0	$0	$0	0.5083	$0
11	$0	$0	$0	$0	0.4751	$0
12	$0	$0	$0	$0	0.4440	$0
13	$0	$0	$0	$0	0.4150	$0
14	$0	$0	$50,000	$50,000	0.3878	$19,390
15	$0	$0	$0	$0	0.3624	$0
16	$0	$0	$0	$0	0.3387	$0
17	$0	$0	$0	$0	0.3166	$0
18	$0	$0	$0	$0	0.2959	$0
19	$0	$0	$50,000	$50,000	0.2765	$13,825
20	$0	$0	$0	$0	0.2584	$0
21	$0	$0	$0	$0	0.2415	$0
22	$0	$0	$0	$0	0.2257	$0
23	$0	$0	$0	$0	0.2109	$0
24	$0	$0	$50,000	$50,000	0.1971	$9,855
25	$0	$0	$0	$0	0.1842	$0
26	$0	$0	$0	$0	0.1722	$0
27	$0	$0	$0	$0	0.1609	$0
28	$0	$0	$0	$0	0.1504	$0
29	$0	$0	$50,000	$50,000	0.1406	$7,030
TOTALS:	$0	$0	$300,000	**$300,000**		$115,440
TOTAL PRESENT VALUE OF ALTERNATIVE 1[5]						**$115,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since soils would have contaminant concentrations above RGs that would allow for unlimited use and unrestricted exposure under the current and potential future land uses. However the period of analysis was assumed to be 30 years (Years 0 through 29).

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-1.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table PV-ADRFT for details.

[5] Total present value is rounded to the nearest $1,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE CS-1

Alternative 1 **No Further Action**	**COST ESTIMATE SUMMARY**

Site:	Formosa OU1
Location:	Douglas County, Oregon
Phase:	Feasibility Study
Base Year:	2013
Date:	January 31, 2013

Description: Alternative 1 (No Further Action) is required by the NCP as a baseline for comparison against other remedial alternatives. This alternative would leave the site in its current state with no additional removal and/or remedial actions being implemented. As required by the NCP, five-year site reviews would be performed since mine materials would remain at the PMDA with contaminant concentrations above PRGs. The contaminant concentrations above PRGs do not allow for unlimited use and unrestricted exposure under the current and potential future land uses.. Site monitoring (i.e., non-intrusive visual inspections) would also be conducted only as necessary to complete the 5-year reviews.

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
CAPITAL COSTS						
TOTAL CAPITAL COST					**$0**	No capital costs are assumed.
ANNUAL OPERATION AND MAINTENANCE (O&M) COSTS						
TOTAL ANNUAL O&M COST					**$0**	No annual O&M costs are assumed.
PERIODIC COSTS (Years 4, 9, 14, 19, 24, and 29)						
5-Year Site Reviews	CW1-1	1	LS	$33,024	$33,024	Includes five-year site inspection and report; assumed to be statutory review that occurs every five years after initiation of remedial action (Year 0).
SUBTOTAL					$33,024	
Contingency (Scope and Bid)		20%			$6,605	10% Scope, 10% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$39,629	
Project Management		10%			$3,963	Percentage from Exhibit 5-8 was used.
Technical Support		15%			$5,944	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$49,536	
TOTAL PERIODIC COST					**$50,000**	Total capital cost is rounded to the nearest $1,000.

Notes:

Percentages used for indirect costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 540-R-00-002 (July 2000).

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation

Abbreviations:

EA	Each
QTY	Quantity
LS	Lump Sum

Present Value and Cost Estimate Summary
Alternative 2

TABLE PV-2

PRESENT VALUE ANALYSIS

Alternative 2

In-Place Containment, Continued Submergence of Tailings within EM, and Limited Excavation/Disposal of Mine Materials at Proposed Facility within PMDA

Site:	**Formosa OU1**
Location:	**Douglas County, Oregon**
Phase:	**Feasibility Study**
Base Year:	**2013**

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Earthwork)[2]	Annual O&M Costs	Periodic Costs	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$178,000	$4,897,000	$0	$0	$5,075,000	1.0000	$5,075,000
1	$0	$0	$41,000	$0	$41,000	0.9346	$38,319
2	$0	$0	$40,000	$0	$40,000	0.8734	$34,936
3	$0	$0	$39,000	$0	$39,000	0.8163	$31,836
4	$0	$0	$39,000	$55,000	$94,000	0.7629	$71,713
5	$0	$0	$39,000	$0	$39,000	0.7130	$27,807
6	$0	$0	$23,000	$0	$23,000	0.6663	$15,325
7	$0	$0	$23,000	$0	$23,000	0.6227	$14,322
8	$0	$0	$23,000	$0	$23,000	0.5820	$13,386
9	$0	$0	$23,000	$55,000	$78,000	0.5439	$42,424
10	$0	$0	$23,000	$0	$23,000	0.5083	$11,691
11	$0	$0	$23,000	$0	$23,000	0.4751	$10,927
12	$0	$0	$23,000	$0	$23,000	0.4440	$10,212
13	$0	$0	$23,000	$0	$23,000	0.4150	$9,545
14	$0	$0	$23,000	$55,000	$78,000	0.3878	$30,248
15	$0	$0	$23,000	$0	$23,000	0.3624	$8,335
16	$0	$0	$23,000	$0	$23,000	0.3387	$7,790
17	$0	$0	$23,000	$0	$23,000	0.3166	$7,282
18	$0	$0	$23,000	$0	$23,000	0.2959	$6,806
19	$0	$0	$23,000	$55,000	$78,000	0.2765	$21,567
20	$0	$0	$23,000	$0	$23,000	0.2584	$5,943
21	$0	$0	$23,000	$0	$23,000	0.2415	$5,555
22	$0	$0	$23,000	$0	$23,000	0.2257	$5,191
23	$0	$0	$23,000	$0	$23,000	0.2109	$4,851
24	$0	$0	$23,000	$55,000	$78,000	0.1971	$15,374
25	$0	$0	$23,000	$0	$23,000	0.1842	$4,237
26	$0	$0	$23,000	$0	$23,000	0.1722	$3,961
27	$0	$0	$23,000	$0	$23,000	0.1609	$3,701
28	$0	$0	$23,000	$0	$23,000	0.1504	$3,459
29	$0	$0	$23,000	$55,000	$78,000	0.1406	$10,967
TOTALS:	$178,000	$4,897,000	$750,000	$330,000	$6,155,000		$5,552,710
TOTAL PRESENT VALUE OF ALTERNATIVE 2[5]							**$5,553,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since soils under covers and structures would have contaminant concentrations above RGs that would allow for unlimited use and unrestricted exposure under the current and potential future land uses. However the period of analysis was assumed to be 30 years (Years 0 through 29).

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-2.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table PV-ADRFT for details.

[5] Total present value is rounded to the nearest $1,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They ai prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE CS-2

Alternative 2

In-Place Containment, Continued Submergence of Tailings within EM, and Limited Excavation/Disposal of Mine Materials at Proposed Facility within PMDA

COST ESTIMATE SUMMARY

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013
Date: January 31, 2013

Description: Alternative 2 includes in-place containment of mine materials as the predominant approach with limited excavation and disposal of targeted mine materials at a proposed facility within the PMDA. Limited excavation would be conducted to address highly acid-generating mine materials at headwaters of creek areas and other targeted areas. All excavated materials would be disposed of within a proposed facility located within the PMDA. Development of this area to obtain uncontaminated soil and rock for cover construction and reclamation would expand the available volume for consolidation of mine materials. The facility would use a geosynthetic multi-layer cover system over consolidated mine materials. The proposed facility within the PMDA would contain the EM in place, including the former water and tailings storage pond. Tailings currently stored in the EM pond would continue to remain submerged under the newly-constructed geosynthetic multi-layer cover system. Submergence of tailings which would continue to mitigate ARD generation , assuming the existing liner remains intact and holds water. A combination of multi layer geosynthetic covers, pavement covers, and exposure barriers would be implemented for remaining mine materials not targeted for excavation to mitigate unacceptable exposure risks to humans and reduce generation of ARD. Exposure barriers would only be used on remaining mine materials with slopes steeper than 3H:1V. Excavated areas or areas disturbed during construction that do not have mine materials would be regraded and reclaimed with a rock armor or a vegetative layer, depending on the steepness of resulting slopes. Administrative controls involve administrative, legal, and/or informational, or physical measures intended to control or prevent present and future use or access to mine materials, and inform and warn of dangers associated with these materials. Monitoring would consist of visual inspections to document degree of protectiveness to human health and the environment and determine maintenance needs for the proposed facility and containment areas. Maintenance of the proposed disposal facility and containment areas would be performed as necessary to maintain protectiveness and integrity of the covers systems. Five-year site reviews would be performed since mine materials under covers would remain at the PMDA with contaminant concentrations above PRGs. The contaminant concentrations above PRGs do not allow for unlimited use and unrestricted exposure under the current and potential future land uses.

INSTITUTIONAL CONTROLS CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Institutional Controls	CW2-1	1	LS	$111,491	$111,491	
Engineered Controls	CW2-2	1	LS	$172	$172	
SUBTOTAL					$111,663	
Contingency (Scope and Bid)		20%			$22,333	10% Scope, 10% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$133,996	
Project Management		8%			$10,720	Percentage from Exhibit 5-8 was used.
Remedial Design		15%			$20,099	Percentage from Exhibit 5-8 was used.
Construction Management		10%			$13,400	Percentage from Exhibit 5-8 was used.
TOTAL					$178,215	
TOTAL CAPITAL COST					**$178,000**	Total capital cost is rounded to the nearest $1,000.

EARTHWORK CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Excavation of Mine Materials	CW2-4	1	LS	$134,257	$134,257	
Excavation of Borrow Areas	CW2-5	1	LS	$632,194	$632,194	
Transportation of Mine Materials	CW2-6	1	LS	$290,467	$290,467	
Transportation of Borrow Material	CW2-7	1	LS	$222,920	$222,920	
Lime and Organic Material for Topsoil and Subsoil Amendment	CW2-8	1	LS	$453,901	$453,901	
Dust Control	CW2-9	1	LS	$152,682	$152,682	
Excavation Area Reclamation	CW2-10	1	LS	$31,272	$31,272	
Revegetation of Reclamation Areas	CW2-11	1	LS	$97,479	$97,479	
Surveying for Construction Control	CW2-12	1	LS	$60,355	$60,355	
Permanent Access Road	CW2-13	1	LS	$105,431	$105,431	
Erosion Control	CW2-14	1	LS	$177,401	$177,401	
Mobilization/Demobilization and Preparatory Work	CW2-15	1	LS	$69,284	$69,284	
Construction of Repository within PMDA	CW2-16	1	LS	$617,025	$617,025	
Construction of Exposure Barrier	CW2-17	1	LS	$285,182	$285,182	
Asphalt Cover Construction	CW2-22	1	LS	$89,515	$89,515	
Revegetation of Covers	CW2-23	1	LS	$9,846	$9,846	
SUBTOTAL					$3,429,211	
Contingency (Scope and Bid)		20%			$685,842	10% Scope, 10% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$4,115,053	
Project Management		5%			$205,753	Percentage from Exhibit 5-8 was used.
Remedial Design		8%			$329,204	Percentage from Exhibit 5-8 was used.
Construction Management		6%			$246,903	Percentage from Exhibit 5-8 was used.
TOTAL					$4,896,913	
TOTAL CAPITAL COST					**$4,897,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-2

Alternative **2**

In-Place Containment, Continued Submergence of Tailings within EM, and Limited Excavation/Disposal of Mine Materials at Proposed Facility within PMDA

COST ESTIMATE SUMMARY

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013
Date: January 31, 2013

Description: Alternative 2 includes in-place containment of mine materials as the predominant approach with limited excavation and disposal of targeted mine materials at a proposed facility within the PMDA. Limited excavation would be conducted to address highly acid-generating mine materials at headwaters of creek areas and other targeted areas. All excavated materials would be disposed of within a proposed facility located within the PMDA. Development of this area to obtain uncontaminated soil and rock for cover construction and reclamation would expand the available volume for consolidation of mine materials. The facility would use a geosynthetic multi-layer cover system over consolidated mine materials. The proposed facility within the PMDA would contain the EM in place, including the former water and tailings storage pond. Tailings currently stored in the EM pond would continue to remain submerged under the newly-constructed geosynthetic multi-layer cover system. Submergence of tailings which would continue to mitigate ARD generation , assuming the existing liner remains intact and holds water. A combination of multi layer geosynthetic covers, pavement covers, and exposure barriers would be implemented for remaining mine materials not targeted for excavation to mitigate unacceptable exposure risks to humans and reduce generation of ARD. Exposure barriers would only be used on remaining mine materials with slopes steeper than 3H:1V. Excavated areas or areas disturbed during construction that do not have mine materials would be regraded and reclaimed with a rock armor or a vegetative layer, depending on the steepness of resulting slopes. Administrative controls involve administrative, legal, and/or informational, or physical measures intended to control or prevent present and future use or access to mine materials, and inform and warn of dangers associated with these materials. Monitoring would consist of visual inspections to document degree of protectiveness to human health and the environment and determine maintenance needs for the proposed facility and containment areas. Maintenance of the proposed disposal facility and containment areas would be performed as necessary to maintain protectiveness and integrity of the covers systems. Five-year site reviews would be performed since mine materials under covers would remain at the PMDA with contaminant concentrations above PRGs. The contaminant concentrations above PRGs do not allow for unlimited use and unrestricted exposure under the current and potential future land uses.

ANNUAL OPERATIONS AND MAINTENANCE (O&M) COSTS - Year 1

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Cover and Reclamation Maintenance (Year 1)	CW2-18	1	LS	$27,545	$27,545	
SUBTOTAL					$27,545	
Contingency (Scope and Bid)		20%			$5,509	10% Scope, 10% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$33,054	
Project Management		10%			$3,305	Percentage from Exhibit 5-8 was used.
Technical Support		15%			$4,958	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$41,317	
TOTAL ANNUAL O&M COST					**$41,000**	Total O&M cost is rounded to the nearest $1,000.

ANNUAL OPERATIONS AND MAINTENANCE (O&M) COSTS - Year 2

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Cover and Reclamation Maintenance (Year 2)	CW2-19	1	LS	$26,951	$26,951	
SUBTOTAL					$26,951	
Contingency (Scope and Bid)		20%			$5,390	10% Scope, 10% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$32,341	
Project Management		10%			$3,234	Percentage from Exhibit 5-8 was used.
Technical Support		15%			$4,851	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$40,426	
TOTAL ANNUAL O&M COST					**$40,000**	Total O&M cost is rounded to the nearest $1,000.

ANNUAL OPERATIONS AND MAINTENANCE (O&M) COSTS - Years 3 through 5

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Cover and Reclamation Maintenance (Years 3 through 5)	CW2-20	1	LS	$26,113	$26,113	
SUBTOTAL					$26,113	
Contingency (Scope and Bid)		20%			$5,223	10% Scope, 10% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$31,336	
Project Management		10%			$3,134	Percentage from Exhibit 5-8 was used.
Technical Support		15%			$4,700	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$39,170	
TOTAL ANNUAL O&M COST					**$39,000**	Total O&M cost is rounded to the nearest $1,000.

TABLE CS-2

Alternative **2**

In-Place Containment, Continued Submergence of Tailings within EM, and Limited Excavation/Disposal of Mine Materials at Proposed Facility within PMDA

COST ESTIMATE SUMMARY

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013
Date: January 31, 2013

Description: Alternative 2 includes in-place containment of mine materials as the predominant approach with limited excavation and disposal of targeted mine materials at a proposed facility within the PMDA. Limited excavation would be conducted to address highly acid-generating mine materials at headwaters of creek areas and other targeted areas. All excavated materials would be disposed of within a proposed facility located within the PMDA. Development of this area to obtain uncontaminated soil and rock for cover construction and reclamation would expand the available volume for consolidation of mine materials. The facility would use a geosynthetic multi-layer cover system over consolidated mine materials. The proposed facility within the PMDA would contain the EM in place, including the former water and tailings storage pond. Tailings currently stored in the EM pond would continue to remain submerged under the newly-constructed geosynthetic multi-layer cover system. Submergence of tailings which would continue to mitigate ARD generation , assuming the existing liner remains intact and holds water. A combination of multi layer geosynthetic covers, pavement covers, and exposure barriers would be implemented for remaining mine materials not targeted for excavation to mitigate unacceptable exposure risks to humans and reduce generation of ARD. Exposure barriers would only be used on remaining mine materials with slopes steeper than 3H:1V. Excavated areas or areas disturbed during construction that do not have mine materials would be regraded and reclaimed with a rock armor or a vegetative layer, depending on the steepness of resulting slopes. Administrative controls involve administrative, legal, and/or informational, or physical measures intended to control or prevent present and future use or access to mine materials, and inform and warn of dangers associated with these materials. Monitoring would consist of visual inspections to document degree of protectiveness to human health and the environment and determine maintenance needs for the proposed facility and containment areas. Maintenance of the proposed disposal facility and containment areas would be performed as necessary to maintain protectiveness and integrity of the covers systems. Five-year site reviews would be performed since mine materials under covers would remain at the PMDA with contaminant concentrations above PRGs. The contaminant concentrations above PRGs do not allow for unlimited use and unrestricted exposure under the current and potential future land uses.

ANNUAL OPERATIONS AND MAINTENANCE (O&M) COSTS - Years 6 through 29

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Cover and Reclamation Maintenance (Years 6 through 29)	CW2-21	1	LS	$15,146	$15,146	
SUBTOTAL					$15,146	
Contingency (Scope and Bid)		20%			$3,029	10% Scope, 10% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$18,175	
Project Management		10%			$1,818	Percentage from Exhibit 5-8 was used.
Technical Support		15%			$2,726	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$22,719	
TOTAL ANNUAL O&M COST					**$23,000**	Total O&M cost is rounded to the nearest $1,000.

PERIODIC COSTS (Years 4, 9, 14, 19, 24, and 29)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Reviews	CW2-3	1	LS	$36,360	$36,360	Includes five-year site inspection and report; assumed to be statutory review that occurs every five years after initiation of remedial action (Year 0).
SUBTOTAL					$36,360	
Contingency (Scope and Bid)		20%			$7,272	10% Scope, 10% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$43,632	
Project Management		10%			$4,363	Percentage from Exhibit 5-8 was used.
Technical Support		15%			$6,545	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$54,540	
TOTAL PERIODIC COST					**$55,000**	Total capital cost is rounded to the nearest $1,000.

Notes:

Percentages used for indirect costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

Abbreviations:

EA	Each
LS	Lump Sum
QTY	Quantity
YR	Year

Present Value and Cost Estimate Summary
Alternative 3

TABLE PV-3

PRESENT VALUE ANALYSIS

Alternative 3

Limited In-Place Containment, Chemically Reduced Submergence of Tailings within EM, and Excavation/Disposal of Mine Materials at Proposed Facilities within and outside PMDA

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Earthwork)[2]	Annual O&M Costs	Periodic Costs	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$301,000	$8,577,000	$0	$0	$8,878,000	1.0000	$8,878,000
1	$0	$0	$35,000	$0	$35,000	0.9346	$32,711
2	$0	$0	$35,000	$0	$35,000	0.8734	$30,569
3	$0	$0	$33,000	$0	$33,000	0.8163	$26,938
4	$0	$0	$33,000	$55,000	$88,000	0.7629	$67,135
5	$0	$0	$33,000	$0	$33,000	0.7130	$23,529
6	$0	$0	$16,000	$0	$16,000	0.6663	$10,661
7	$0	$0	$16,000	$0	$16,000	0.6227	$9,963
8	$0	$0	$16,000	$0	$16,000	0.5820	$9,312
9	$0	$0	$16,000	$55,000	$71,000	0.5439	$38,617
10	$0	$0	$16,000	$0	$16,000	0.5083	$8,133
11	$0	$0	$16,000	$0	$16,000	0.4751	$7,602
12	$0	$0	$16,000	$0	$16,000	0.4440	$7,104
13	$0	$0	$16,000	$0	$16,000	0.4150	$6,640
14	$0	$0	$16,000	$55,000	$71,000	0.3878	$27,534
15	$0	$0	$16,000	$0	$16,000	0.3624	$5,798
16	$0	$0	$16,000	$0	$16,000	0.3387	$5,419
17	$0	$0	$16,000	$0	$16,000	0.3166	$5,066
18	$0	$0	$16,000	$0	$16,000	0.2959	$4,734
19	$0	$0	$16,000	$55,000	$71,000	0.2765	$19,632
20	$0	$0	$16,000	$0	$16,000	0.2584	$4,134
21	$0	$0	$16,000	$0	$16,000	0.2415	$3,864
22	$0	$0	$16,000	$0	$16,000	0.2257	$3,611
23	$0	$0	$16,000	$0	$16,000	0.2109	$3,374
24	$0	$0	$16,000	$55,000	$71,000	0.1971	$13,994
25	$0	$0	$16,000	$0	$16,000	0.1842	$2,947
26	$0	$0	$16,000	$0	$16,000	0.1722	$2,755
27	$0	$0	$16,000	$0	$16,000	0.1609	$2,574
28	$0	$0	$16,000	$0	$16,000	0.1504	$2,406
29	$0	$0	$16,000	$55,000	$71,000	0.1406	$9,983
TOTALS:	$301,000	$8,577,000	$553,000	$330,000	$9,761,000		$9,274,739
TOTAL PRESENT VALUE OF ALTERNATIVE 3[5]							**$9,275,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since soils left beneath structures could have contaminant concentrations above RGs that would not allow for unlimited use and unrestricted exposure under the current and potential future land uses. However the period of analysis was assumed to be 30 years (Years 0 through 29).

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-3.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table PV-ADRFT for details.

[5] Total present value is rounded to the nearest $1,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE CS-3

Alternative **3**
Limited In-Place Containment, Chemically Reduced Submergence of Tailings within EM, and Excavation/Disposal of Mine Materials at Proposed Facilities within and outside PMDA

COST ESTIMATE SUMMARY

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013
Date: January 31, 2013

Description: Alternative 3 includes limited in-place containment of mine materials at the EM area, excavation of all other mine materials, and disposal of mine materials at proposed facilities within and outside the PMDA. Disposal of all excavated materials would take place at two proposed facilities: one within the PMDA and one outside of the PMDA at a location to be determined. The proposed facility within the PMDA would contain the EM in place, including the former water and tailings storage pond. Chemically reduced submergence would be implemented for tailings within the former water and tailings storage pond by adding liquid organic reagents to enhance in situ biological treatment. The proposed facility outside of the PMDA would be sized to contain the remainder of excavated mine materials (approximately 125,000 CY) and constructed to meet pertinent ARARs for the selected location. Excavated areas or areas disturbed during construction that do not have mine materials would be regraded and reclaimed with a rock armor or a vegetative layer, depending on the steepness of resulting slopes. Administrative controls involve administrative, legal, and/or informational, or physical measures intended to control or prevent present and future use or access to mine materials, and inform and warn of dangers associated with these materials. Monitoring would consist of visual inspections to document degree of protectiveness to human health and the environment and determine maintenance needs for the proposed facility and containment areas. Maintenance of the proposed disposal facility and containment areas would be performed as necessary to maintain protectiveness and integrity of the covers systems. However additional maintenance requirements, such as leachate collection and treatment, may be needed for the proposed facility outside of the PMDA depending on the selected location and configuration. Five-year site reviews would be performed since mine materials under covers would remain at the PMDA with contaminant concentrations above PRGs. The contaminant concentrations above PRGs do not allow for unlimited use and unrestricted exposure under the current and potential future land uses.

INSTITUTIONAL CONTROLS CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Institutional Controls	CW3-1	1	LS	$111,491	$111,491	
Engineered Controls	CW3-2	1	LS	$77,059	$77,059	
SUBTOTAL					$188,550	
Contingency (Scope and Bid)		20%			$37,710	10% Scope, 10% Bid (Low end of the recommended range).
SUBTOTAL					$226,260	
Project Management		8%			$18,101	Percentage from Exhibit 5-8 was used.
Remedial Design		15%			$33,939	Percentage from Exhibit 5-8 was used.
Construction Management		10%			$22,626	Percentage from Exhibit 5-8 was used.
TOTAL					$300,926	
TOTAL CAPITAL COST					**$301,000**	Total capital cost is rounded to the nearest $1,000.

EARTHWORK CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Excavation of Mine Materials	CW3-4	1	LS	$361,749	$361,749	
Excavation of Borrow Areas	CW3-5	1	LS	$853,886	$853,886	
Transportation of Mine Materials	CW3-6	1	LS	$1,063,557	$1,063,557	
Transportation of Borrow Material	CW3-7	1	LS	$216,586	$216,586	
Lime and Organic Material for Topsoil and Subsoil Amendment	CW3-8	1	LS	$405,199	$405,199	
Dust Control	CW3-9	1	LS	$274,827	$274,827	
Excavation Area Reclamation	CW3-10	1	LS	$94,386	$94,386	
Revegetation of Reclamation Areas	CW3-11	1	LS	$308,746	$308,746	
Surveying for Construction Control	CW3-12	1	LS	$71,406	$71,406	
Permanent Access Road	CW3-13	1	LS	$146,353	$146,353	
Erosion Control	CW3-14	1	LS	$439,880	$439,880	
Mobilization/Demobilization and Preparatory Work	CW3-15	1	LS	$69,284	$69,284	
Construction of Repository within PMDA	CW3-16	1	LS	$617,025	$617,025	
Construction of Repository outside PMDA	CW3-17	1	LS	$1,068,279	$1,068,279	
Chemical Submergence of Tailings	CW3-22	1	LS	$10,000	$10,000	
Revegetation of Covers	CW3-23	1	LS	$4,941	$4,941	
SUBTOTAL					$6,006,104	
Contingency (Scope and Bid)		20%			$1,201,221	10% Scope, 10% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$7,207,325	
Project Management		5%			$360,366	Percentage from Exhibit 5-8 was used.
Remedial Design		8%			$576,586	Percentage from Exhibit 5-8 was used.
Construction Management		6%			$432,440	Percentage from Exhibit 5-8 was used.
TOTAL					$8,576,717	
TOTAL CAPITAL COST					**$8,577,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-3

Alternative 3
Limited In-Place Containment, Chemically Reduced Submergence of Tailings within EM, and Excavation/Disposal of Mine Materials at Proposed Facilities within and outside PMDA

COST ESTIMATE SUMMARY

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013
Date: January 31, 2013

Description: Alternative 3 includes limited in-place containment of mine materials at the EM area, excavation of all other mine materials, and disposal of mine materials at proposed facilities within and outside the PMDA. Disposal of all excavated materials would take place at two proposed facilities: one within the PMDA and one outside of the PMDA at a location to be determined. The proposed facility within the PMDA would contain the EM in place, including the former water and tailings storage pond. Chemically reduced submergence would be implemented for tailings within the former water and tailings storage pond by adding liquid organic reagents to enhance in situ biological treatment. The proposed facility outside of the PMDA would be sized to contain the remainder of excavated mine materials (approximately 125,000 CY) and constructed to meet pertinent ARARs for the selected location. Excavated areas or areas disturbed during construction that do not have mine materials would be regraded and reclaimed with a rock armor or a vegetative layer, depending on the steepness of resulting slopes. Administrative controls involve administrative, legal, and/or informational, or physical measures intended to control or prevent present and future use or access to mine materials, and inform and warn of dangers associated with these materials. Monitoring would consist of visual inspections to document degree of protectiveness to human health and the environment and determine maintenance needs for the proposed facility and containment areas. Maintenance of the proposed disposal facility and containment areas would be performed as necessary to maintain protectiveness and integrity of the covers systems. However additional maintenance requirements, such as leachate collection and treatment, may be needed for the proposed facility outside of the PMDA depending on the selected location and configuration. Five-year site reviews would be performed since mine materials under covers would remain at the PMDA with contaminant concentrations above PRGs. The contaminant concentrations above PRGs do not allow for unlimited use and unrestricted exposure under the current and potential future land uses.

ANNUAL OPERATIONS AND MAINTENANCE (O&M) COSTS - Year 1

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Cover and Reclamation Maintenance (Year 1)	CW3-18	1	LS	$23,664	$23,664	
SUBTOTAL					$23,664	
Contingency (Scope and Bid)		20%			$4,733	10% Scope, 10% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$28,397	
Project Management		10%			$2,840	Percentage from Exhibit 5-8 was used.
Technical Support		15%			$4,260	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$35,497	
TOTAL ANNUAL O&M COST					**$35,000**	

ANNUAL OPERATIONS AND MAINTENANCE (O&M) COSTS - Year 2

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Cover and Reclamation Maintenance (Year 2)	CW3-19	1	LS	$23,068	$23,068	
SUBTOTAL					$23,068	
Contingency (Scope and Bid)		20%			$4,614	10% Scope, 10% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$27,682	
Project Management		10%			$2,768	Percentage from Exhibit 5-8 was used.
Technical Support		15%			$4,152	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$34,602	
TOTAL ANNUAL O&M COST					**$35,000**	

ANNUAL OPERATIONS AND MAINTENANCE (O&M) COSTS - Years 3 through 5

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Cover and Reclamation Maintenance (Years 3 through 5)	CW3-20	1	LS	$21,934	$21,934	
SUBTOTAL					$21,934	
Contingency (Scope and Bid)		20%			$4,387	10% Scope, 10% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$26,321	
Project Management		10%			$2,632	Percentage from Exhibit 5-8 was used.
Technical Support		15%			$3,948	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$32,901	
TOTAL ANNUAL O&M COST					**$33,000**	

TABLE CS-3

Alternative 3
Limited In-Place Containment, Chemically Reduced Submergence of Tailings within EM, and Excavation/Disposal of Mine Materials at Proposed Facilities within and outside PMDA

COST ESTIMATE SUMMARY

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013
Date: January 31, 2013

Description: Alternative 3 includes limited in-place containment of mine materials at the EM area, excavation of all other mine materials, and disposal of mine materials at proposed facilities within and outside the PMDA. Disposal of all excavated materials would take place at two proposed facilities: one within the PMDA and one outside of the PMDA at a location to be determined. The proposed facility within the PMDA would contain the EM in place, including the former water and tailings storage pond. Chemically reduced submergence would be implemented for tailings within the former water and tailings storage pond by adding liquid organic reagents to enhance in situ biological treatment. The proposed facility outside of the PMDA would be sized to contain the remainder of excavated mine materials (approximately 125,000 CY) and constructed to meet pertinent ARARs for the selected location. Excavated areas or areas disturbed during construction that do not have mine materials would be regraded and reclaimed with a rock armor or a vegetative layer, depending on the steepness of resulting slopes. Administrative controls involve administrative, legal, and/or informational, or physical measures intended to control or prevent present and future use or access to mine materials, and inform and warn of dangers associated with these materials. Monitoring would consist of visual inspections to document degree of protectiveness to human health and the environment and determine maintenance needs for the proposed facility and containment areas. Maintenance of the proposed disposal facility and containment areas would be performed as necessary to maintain protectiveness and integrity of the covers systems. However additional maintenance requirements, such as leachate collection and treatment, may be needed for the proposed facility outside of the PMDA depending on the selected location and configuration. Five-year site reviews would be performed since mine materials under covers would remain at the PMDA with contaminant concentrations above PRGs. The contaminant concentrations above PRGs do not allow for unlimited use and unrestricted exposure under the current and potential future land uses.

ANNUAL OPERATIONS AND MAINTENANCE (O&M) COSTS - Years 6 through 29

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Cover and Reclamation Maintenance (Years 6 through 29)	CW3-21	1	LS	$10,967	$10,967	
SUBTOTAL					$10,967	
Contingency (Scope and Bid)		20%			$2,193	10% Scope, 10% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$13,160	
Project Management		10%			$1,316	Percentage from Exhibit 5-8 was used.
Technical Support		15%			$1,974	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$16,450	
TOTAL ANNUAL O&M COST					**$16,000**	

PERIODIC COSTS (Years 4, 9, 14, 19, 24, and 29)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Reviews	CW3-3	1	LS	$36,360	$36,360	Includes five-year site inspection and report; assumed to be statutory review that occurs every five years after initiation of remedial action (Year 0).
SUBTOTAL					$36,360	
Contingency (Scope and Bid)		20%			$7,272	10% Scope, 10% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$43,632	
Project Management		10%			$4,363	Percentage from Exhibit 5-8 was used.
Technical Support		15%			$6,545	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$54,540	
TOTAL PERIODIC COST					**$55,000**	Total capital cost is rounded to the nearest $1,000.

Notes:
Percentages used for indirect costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.
Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation

Abbreviations:

EA	Each
LS	Lump Sum
QTY	Quantity
YR	Year

Present Value and Cost Estimate Summary
Alternative 4

TABLE PV-4

PRESENT VALUE ANALYSIS

Alternative 4

Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facilities within and Outside PMDA

Site:	**Formosa OU1**
Location:	**Douglas County, Oregon**
Phase:	**Feasibility Study**
Base Year:	**2013**

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Earthwork)[2]	Annual O&M Costs	Periodic Costs	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$301,000	$9,709,000	$0	$0	$10,010,000	1.0000	$10,010,000
1	$0	$0	$35,000	$0	$35,000	0.9346	$32,711
2	$0	$0	$35,000	$0	$35,000	0.8734	$30,569
3	$0	$0	$33,000	$0	$33,000	0.8163	$26,938
4	$0	$0	$33,000	$55,000	$88,000	0.7629	$67,135
5	$0	$0	$33,000	$0	$33,000	0.7130	$23,529
6	$0	$0	$16,000	$0	$16,000	0.6663	$10,661
7	$0	$0	$16,000	$0	$16,000	0.6227	$9,963
8	$0	$0	$16,000	$0	$16,000	0.5820	$9,312
9	$0	$0	$16,000	$55,000	$71,000	0.5439	$38,617
10	$0	$0	$16,000	$0	$16,000	0.5083	$8,133
11	$0	$0	$16,000	$0	$16,000	0.4751	$7,602
12	$0	$0	$16,000	$0	$16,000	0.4440	$7,104
13	$0	$0	$16,000	$0	$16,000	0.4150	$6,640
14	$0	$0	$16,000	$55,000	$71,000	0.3878	$27,534
15	$0	$0	$16,000	$0	$16,000	0.3624	$5,798
16	$0	$0	$16,000	$0	$16,000	0.3387	$5,419
17	$0	$0	$16,000	$0	$16,000	0.3166	$5,066
18	$0	$0	$16,000	$0	$16,000	0.2959	$4,734
19	$0	$0	$16,000	$55,000	$71,000	0.2765	$19,632
20	$0	$0	$16,000	$0	$16,000	0.2584	$4,134
21	$0	$0	$16,000	$0	$16,000	0.2415	$3,864
22	$0	$0	$16,000	$0	$16,000	0.2257	$3,611
23	$0	$0	$16,000	$0	$16,000	0.2109	$3,374
24	$0	$0	$16,000	$55,000	$71,000	0.1971	$13,994
25	$0	$0	$16,000	$0	$16,000	0.1842	$2,947
26	$0	$0	$16,000	$0	$16,000	0.1722	$2,755
27	$0	$0	$16,000	$0	$16,000	0.1609	$2,574
28	$0	$0	$16,000	$0	$16,000	0.1504	$2,406
29	$0	$0	$16,000	$55,000	$71,000	0.1406	$9,983
TOTALS:	$301,000	$9,709,000	$553,000	$330,000	$10,893,000		$10,406,739
TOTAL PRESENT VALUE OF ALTERNATIVE 4[5]							**$10,407,000**

Notes:

1 The alternative is expected to require cost expenditures for perpetuity since soils left beneath structures could have contaminant concentrations above RGs that would not allow for unlimited use and unrestricted exposure under the current and potential future land uses. However the period of analysis was assumed to be 30 years (Years 0 through 29).

2 Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-4.

3 Total annual expenditure is the total cost per year with no discounting.

4 Present value is the total cost per year including a 7.0% discount factor for that year. See Table PV-ADRFT for details.

5 Total present value is rounded to the nearest $1,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE CS-4

Alternative **4**
Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facilities within and Outside PMDA

COST ESTIMATE SUMMARY

Excavation, Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013
Date: January 31, 2013

Description: Alternative 4 includes excavation and disposal of mine materials, including EM tailings, at proposed facilities within and outside the PMDA. Disposal of all excavated materials would take place at two proposed facilities: one within the PMDA and one outside of the PMDA. The tailings within the former water and tailings storage pond (approximately 19,000 CY) would be dewatered and treated by pozzolan- or cement-based stabilization/solidification before disposal. A treatment additive such as Portland cement or other types of stabilization agents would be added to bind the contaminants in the tailings and reduce their mobility from leaching. Since the EM area will be excavated and disposed of rather than contained in place, the targeted disposal volume for the proposed facility within the PMDA would increase to 109,000 CY. Excavated areas or areas disturbed during construction that do not have mine materials would be restored or regraded and reclaimed with a rock armor or a vegetative layer, depending on the steepness of resulting slopes. Administrative controls involve administrative, legal, and/or informational, or physical measures intended to control or prevent present and future use or access to mine materials, and inform and warn of dangers associated with these materials. Monitoring would consist of visual inspections to document degree of protectiveness to human health and the environment and determine maintenance needs for the proposed facility and containment areas. Maintenance of the proposed disposal facility and containment areas would be performed as necessary to maintain protectiveness and integrity of the covers systems. Five-year site reviews would be performed since mine materials under covers would remain at the PMDA with contaminant concentrations above PRGs. The contaminant concentrations above PRGs do not allow for unlimited use and unrestricted exposure under the current and potential future land uses.

INSTITUTIONAL CONTROLS CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Institutional Controls	CW4-1	1	LS	$111,491	$111,491	
Engineered Controls	CW4-2	1	LS	$77,059	$77,059	
SUBTOTAL					$188,550	
Contingency (Scope and Bid)		20%			$37,710	10% Scope, 10% Bid (Low end of the recommended range).
SUBTOTAL					$226,260	
Project Management		8%			$18,101	Percentage from Exhibit 5-8 was used.
Remedial Design		15%			$33,939	Percentage from Exhibit 5-8 was used.
Construction Management		10%			$22,626	Percentage from Exhibit 5-8 was used.
TOTAL					$300,926	
TOTAL CAPITAL COST					**$301,000**	Total capital cost is rounded to the nearest $1,000.

EARTHWORK CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Excavation of Mine Materials	CW4-4	1	LS	$436,336	$436,336	
Excavation of Borrow Areas	CW4-5	1	LS	$853,886	$853,886	
Transportation of Mine Materials	CW4-6	1	LS	$1,224,927	$1,224,927	
Transportation of Borrow Material	CW4-7	1	LS	$216,586	$216,586	
Lime and Organic Material for Topsoil and Subsoil Amendment	CW4-8	1	LS	$405,199	$405,199	
Cement Stabilization of Mine Wastes	CW4-9	1	LS	$478,893	$478,893	
Excavation Area Reclamation	CW4-10	1	LS	$94,386	$94,386	
Revegetation of Reclamation Areas	CW4-11	1	LS	$308,746	$308,746	
Surveying for Construction Control	CW4-12	1	LS	$71,406	$71,406	
Permanent Access Road	CW4-13	1	LS	$146,353	$146,353	
Mobilization/Demobilization and Preparatory Work	CW4-14	1	LS	$69,284	$69,284	
Construction of Repository outside PMDA	CW4-15	1	LS	$1,068,279	$1,068,279	
Erosion Control	CW4-16	1	LS	$379,174	$379,174	
Construction of Repository within PMDA	CW4-17	1	LS	$481,449	$481,449	
Dewatering of Encapsulation Mound	CW4-18	1	LS	$284,154	$284,154	
Dust Control	CW4-23	1	LS	$274,827	$274,827	
Revegetation of Covers	CW4-24	1	LS	$4,941	$4,941	
SUBTOTAL					$6,798,826	
Contingency (Scope and Bid)		20%			$1,359,765	10% Scope, 10% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$8,158,591	
Project Management		5%			$407,930	Percentage from Exhibit 5-8 was used.
Remedial Design		8%			$652,687	Percentage from Exhibit 5-8 was used.
Construction Management		6%			$489,515	Percentage from Exhibit 5-8 was used.
TOTAL					$9,708,723	
TOTAL CAPITAL COST					**$9,709,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-4

Alternative 4
Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facilities within and Outside PMDA

COST ESTIMATE SUMMARY

Excavation, Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013
Date: January 31, 2013

Description: Alternative 4 includes excavation and disposal of mine materials, including EM tailings, at proposed facilities within and outside the PMDA. Disposal of all excavated materials would take place at two proposed facilities: one within the PMDA and one outside of the PMDA. The tailings within the former water and tailings storage pond (approximately 19,000 CY) would be dewatered and treated by pozzolan- or cement-based stabilization/solidification before disposal. A treatment additive such as Portland cement or other types of stabilization agents would be added to bind the contaminants in the tailings and reduce their mobility from leaching. Since the EM area will be excavated and disposed of rather than contained in place, the targeted disposal volume for the proposed facility within the PMDA would increase to 109,000 CY. Excavated areas or areas disturbed during construction that do not have mine materials would be restored or regraded and reclaimed with a rock armor or a vegetative layer, depending on the steepness of resulting slopes. Administrative controls involve administrative, legal, and/or informational, or physical measures intended to control or prevent present and future use or access to mine materials, and inform and warn of dangers associated with these materials. Monitoring would consist of visual inspections to document degree of protectiveness to human health and the environment and determine maintenance needs for the proposed facility and containment areas. Maintenance of the proposed disposal facility and containment areas would be performed as necessary to maintain protectiveness and integrity of the covers systems. Five-year site reviews would be performed since mine materials under covers would remain at the PMDA with contaminant concentrations above PRGs. The contaminant concentrations above PRGs do not allow for unlimited use and unrestricted exposure under the current and potential future land uses.

ANNUAL OPERATION AND MAINTENANCE (O&M) COSTS - Year 1

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Cover and Reclamation Maintenance (Year 1)	CW4-19	1	LS	$23,664	$23,664	
SUBTOTAL					$23,664	
Contingency (Scope and Bid)		20%			$4,733	10% Scope, 10% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$28,397	
Project Management		10%			$2,840	Percentage from Exhibit 5-8 was used.
Technical Support		15%			$4,260	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$35,497	
TOTAL ANNUAL O&M COST					**$35,000**	

ANNUAL OPERATION AND MAINTENANCE (O&M) COSTS - Year 2

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Cover and Reclamation Maintenance (Year 2)	CW4-20	1	LS	$23,068	$23,068	
SUBTOTAL					$23,068	
Contingency (Scope and Bid)		20%			$4,614	10% Scope, 10% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$27,682	
Project Management		10%			$2,768	Percentage from Exhibit 5-8 was used.
Technical Support		15%			$4,152	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$34,602	
TOTAL ANNUAL O&M COST					**$35,000**	

ANNUAL OPERATION AND MAINTENANCE (O&M) COSTS - Years 3 through 5

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Cover and Reclamation Maintenance (Years 3 through 5)	CW4-21	1	LS	$21,934	$21,934	
SUBTOTAL					$21,934	
Contingency (Scope and Bid)		20%			$4,387	10% Scope, 10% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$26,321	
Project Management		10%			$2,632	Percentage from Exhibit 5-8 was used.
Technical Support		15%			$3,948	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$32,901	
TOTAL ANNUAL O&M COST					**$33,000**	

TABLE CS-4

Alternative 4
Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facilities within and Outside PMDA

COST ESTIMATE SUMMARY

Excavation, Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013
Date: January 31, 2013

Description: Alternative 4 includes excavation and disposal of mine materials, including EM tailings, at proposed facilities within and outside the PMDA. Disposal of all excavated materials would take place at two proposed facilities: one within the PMDA and one outside of the PMDA. The tailings within the former water and tailings storage pond (approximately 19,000 CY) would be dewatered and treated by pozzolan- or cement-based stabilization/solidification before disposal. A treatment additive such as Portland cement or other types of stabilization agents would be added to bind the contaminants in the tailings and reduce their mobility from leaching. Since the EM area will be excavated and disposed of rather than contained in place, the targeted disposal volume for the proposed facility within the PMDA would increase to 109,000 CY. Excavated areas or areas disturbed during construction that do not have mine materials would be restored or regraded and reclaimed with a rock armor or a vegetative layer, depending on the steepness of resulting slopes. Administrative controls involve administrative, legal, and/or informational, or physical measures intended to control or prevent present and future use or access to mine materials, and inform and warn of dangers associated with these materials. Monitoring would consist of visual inspections to document degree of protectiveness to human health and the environment and determine maintenance needs for the proposed facility and containment areas. Maintenance of the proposed disposal facility and containment areas would be performed as necessary to maintain protectiveness and integrity of the covers systems. Five-year site reviews would be performed since mine materials under covers would remain at the PMDA with contaminant concentrations above PRGs. The contaminant concentrations above PRGs do not allow for unlimited use and unrestricted exposure under the current and potential future land uses.

ANNUAL OPERATION AND MAINTENANCE (O&M) COSTS - Years 6 through 29

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Cover and Reclamation Maintenance (Years 6 through 29)	CW4-22	1	LS	$10,967	$10,967	
SUBTOTAL					$10,967	
Contingency (Scope and Bid)		20%			$2,193	10% Scope, 10% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$13,160	
Project Management		10%			$1,316	Percentage from Exhibit 5-8 was used.
Technical Support		15%			$1,974	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$16,450	
TOTAL ANNUAL O&M COST					**$16,000**	

PERIODIC COSTS (Years 4, 9, 14, 19, 24, and 29)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Reviews	CW4-3	1	LS	$36,360	$36,360	Includes five-year site inspection and report; assumed to be statutory review that occurs every five years after initiation of remedial action (Year 0).
SUBTOTAL					$36,360	
Contingency (Scope and Bid)		20%			$7,272	10% Scope, 10% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$43,632	
Project Management		10%			$4,363	Percentage from Exhibit 5-8 was used.
Technical Support		15%			$6,545	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$54,540	
TOTAL PERIODIC COST					**$55,000**	Total capital cost is rounded to the nearest $1,000.

Notes:
Percentages used for indirect costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.
Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

Abbreviations:

EA	Each
LS	Lump Sum
QTY	Quantity
YR	Year

Present Value and Cost Estimate Summary
Alternative 6

TABLE PV-6

PRESENT VALUE ANALYSIS

Alternative 6

Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facility outside PMDA

Site:	**Formosa OU1**
Location:	**Douglas County, Oregon**
Phase:	**Feasibility Study**
Base Year:	**2013**

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Earthwork)[2]	Annual O&M Costs	Periodic Costs	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$305,000	$9,787,000	$0	$0	$10,092,000	1.0000	$10,092,000
1	$0	$0	$35,000	$0	$35,000	0.9346	$32,711
2	$0	$0	$35,000	$0	$35,000	0.8734	$30,569
3	$0	$0	$33,000	$0	$33,000	0.8163	$26,938
4	$0	$0	$33,000	$55,000	$88,000	0.7629	$67,135
5	$0	$0	$33,000	$0	$33,000	0.7130	$23,529
6	$0	$0	$16,000	$0	$16,000	0.6663	$10,661
7	$0	$0	$16,000	$0	$16,000	0.6227	$9,963
8	$0	$0	$16,000	$0	$16,000	0.5820	$9,312
9	$0	$0	$16,000	$55,000	$71,000	0.5439	$38,617
10	$0	$0	$16,000	$0	$16,000	0.5083	$8,133
11	$0	$0	$16,000	$0	$16,000	0.4751	$7,602
12	$0	$0	$16,000	$0	$16,000	0.4440	$7,104
13	$0	$0	$16,000	$0	$16,000	0.4150	$6,640
14	$0	$0	$16,000	$55,000	$71,000	0.3878	$27,534
15	$0	$0	$16,000	$0	$16,000	0.3624	$5,798
16	$0	$0	$16,000	$0	$16,000	0.3387	$5,419
17	$0	$0	$16,000	$0	$16,000	0.3166	$5,066
18	$0	$0	$16,000	$0	$16,000	0.2959	$4,734
19	$0	$0	$16,000	$55,000	$71,000	0.2765	$19,632
20	$0	$0	$16,000	$0	$16,000	0.2584	$4,134
21	$0	$0	$16,000	$0	$16,000	0.2415	$3,864
22	$0	$0	$16,000	$0	$16,000	0.2257	$3,611
23	$0	$0	$16,000	$0	$16,000	0.2109	$3,374
24	$0	$0	$16,000	$55,000	$71,000	0.1971	$13,994
25	$0	$0	$16,000	$0	$16,000	0.1842	$2,947
26	$0	$0	$16,000	$0	$16,000	0.1722	$2,755
27	$0	$0	$16,000	$0	$16,000	0.1609	$2,574
28	$0	$0	$16,000	$0	$16,000	0.1504	$2,406
29	$0	$0	$16,000	$55,000	$71,000	0.1406	$9,983
TOTALS:	$305,000	$9,787,000	$553,000	$330,000	**$10,975,000**		$10,488,739
TOTAL PRESENT VALUE OF ALTERNATIVE 6[5]							**$10,489,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since soils under covers and structures would have contaminant concentrations above RGs that would allow for unlimited use and unrestricted exposure under the current and potential future land uses. However the period of analysis was assumed to be 30 years (Years 0 through 29).

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-6.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table PV-ADRFT for details.

[5] Total present value is rounded to the nearest $1,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They ar prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE CS-6

Alternative **6**

Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facility outside PMDA

COST ESTIMATE SUMMARY

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013
Date: January 31, 2013

Description: Alternative 6 includes excavation and disposal of mine materials, including EM tailings, at a proposed facility outside the PMDA. The tailings within the former water and tailings storage pond (approximately 19,000 CY) would be dewatered and treated as described for Alternative 4. Since the EM area will be excavated and disposed of rather than contained in place, the targeted disposal volume for the proposed facility outside of the PMDA would increase to 234,000 CY. Excavated areas or areas disturbed during construction that do not have mine materials would be restored or regraded and reclaimed with a rock armor or a vegetative layer, depending on the steepness of resulting slopes. Administrative controls involve administrative, legal, and/or informational, or physical measures intended to control or prevent present and future use or access to mine materials, and inform and warn of dangers associated with these materials. Monitoring would consist of visual inspections to document degree of protectiveness to human health and the environment and determine maintenance needs for the proposed facility and containment areas. Maintenance of the proposed disposal facility and containment areas would be performed as necessary to maintain protectiveness and integrity of the covers systems. Five-year site reviews would be performed since mine materials under covers would remain, however, the 5-year site reviews would not be required for OU1 within the PMDA once mine materials with contaminant concentrations above PRGs are no longer present.

INSTITUTIONAL AND ENGINEERED CONTROLS CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Institutional Controls	CW6-1	1	LS	$111,491	$111,491	
Engineered Controls	CW6-2	1	LS	$79,513	$79,513	
SUBTOTAL					$191,004	
Contingency (Scope and Bid)		20%			$38,201	10% Scope, 10% Bid (Low end of the recommended range).
SUBTOTAL					$229,205	
Project Management		8%			$18,336	Percentage from Exhibit 5-8 was used.
Remedial Design		15%			$34,381	Percentage from Exhibit 5-8 was used.
Construction Management		10%			$22,921	Percentage from Exhibit 5-8 was used.
TOTAL					$304,843	
TOTAL CAPITAL COST					**$305,000**	Total capital cost is rounded to the nearest $1,000.

EARTHWORK CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Excavation of Mine Materials	CW6-4	1	LS	$436,336	$436,336	
Excavation of Borrow Areas	CW6-5	1	LS	$744,677	$744,677	
Transportation of Mine Materials	CW6-6	1	LS	$1,469,880	$1,469,880	
Transportation of Borrow Material	CW6-7	1	LS	$186,206	$186,206	
Revegetation of Reclamation Areas	CW6-8	1	LS	$369,187	$369,187	
Cement Stabilization of Mine Wastes	CW6-9	1	LS	$447,658	$447,658	
Excavation Area Reclamation	CW6-10	1	LS	$114,286	$114,286	
Lime and Organic Material for Topsoil and Subsoil Amendment	CW6-11	1	LS	$435,200	$435,200	
Surveying for Construction Control	CW6-12	1	LS	$71,406	$71,406	
Permanent Access Road	CW6-13	1	LS	$148,963	$148,963	
Construction of Repository outside PMDA	CW6-14	1	LS	$1,423,859	$1,423,859	
Erosion Control	CW6-15	1	LS	$373,580	$373,580	
Mobilization/Demobilization and Preparatory Work	CW6-16	1	LS	$69,284	$69,284	
Dewatering of Encapsulation Mound	CW6-21	1	LS	$284,619	$284,619	
Dust Control	CW6-22	1	LS	$274,827	$274,827	
Revegetation of Covers	CW6-23	1	LS	$3,424	$3,424	
SUBTOTAL					$6,853,392	
Contingency (Scope and Bid)		20%			$1,370,678	10% Scope, 10% Bid (Low end of the recommended range).
SUBTOTAL					$8,224,070	
Project Management		5%			$411,204	Percentage from Exhibit 5-8 was used.
Remedial Design		8%			$657,926	Percentage from Exhibit 5-8 was used.
Construction Management		6%			$493,444	Percentage from Exhibit 5-8 was used.
TOTAL					$9,786,644	
TOTAL CAPITAL COST					**$9,787,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-6

Alternative 6
Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facility outside PMDA

COST ESTIMATE SUMMARY

Site:	Formosa OU1
Location:	Douglas County, Oregon
Phase:	Feasibility Study
Base Year:	2013
Date:	January 31, 2013

Description: Alternative 6 includes excavation and disposal of mine materials, including EM tailings, at a proposed facility outside the PMDA. The tailings within the former water and tailings storage pond (approximately 19,000 CY) would be dewatered and treated as described for Alternative 4. Since the EM area will be excavated and disposed of rather than contained in place, the targeted disposal volume for the proposed facility outside of the PMDA would increase to 234,000 CY. Excavated areas or areas disturbed during construction that do not have mine materials would be restored or regraded and reclaimed with a rock armor or a vegetative layer, depending on the steepness of resulting slopes. Administrative controls involve administrative, legal, and/or informational, or physical measures intended to control or prevent present and future use or access to mine materials, and inform and warn of dangers associated with these materials. Monitoring would consist of visual inspections to document degree of protectiveness to human health and the environment and determine maintenance needs for the proposed facility and containment areas. Maintenance of the proposed disposal facility and containment areas would be performed as necessary to maintain protectiveness and integrity of the covers systems. Five-year site reviews would be performed since mine materials under covers would remain, however, the 5-year site reviews would not be required for OU1 within the PMDA once mine materials with contaminant concentrations above PRGs are no longer present.

ANNUAL OPERATIONS AND MAINTENANCE (O&M) COSTS - Year 1

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Cover and Reclamation Maintenance (Year 1)	CW6-17	1	LS	$23,664	$23,664	
SUBTOTAL					$23,664	
Contingency (Scope and Bid)		20%			$4,733	10% Scope, 10% Bid (Low end of the recommended range).
SUBTOTAL					$28,397	
Project Management		10%			$2,840	Percentage from Exhibit 5-8 was used.
Technical Support		15%			$4,260	Middle value of the recommended range was used.
TOTAL					$35,497	
TOTAL ANNUAL COST					**$35,000**	Periodic cost is rounded to the nearest $1,000.

ANNUAL OPERATIONS AND MAINTENANCE (O&M) COSTS - Year 2

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Cover and Reclamation Maintenance (Year 2)	CW6-18	1	LS	$23,068	$23,068	
SUBTOTAL					$23,068	
Contingency (Scope and Bid)		20%			$4,614	10% Scope, 10% Bid (Low end of the recommended range).
SUBTOTAL					$27,682	
Project Management		10%			$2,768	Percentage from Exhibit 5-8 was used.
Technical Support		15%			$4,152	Middle value of the recommended range was used.
TOTAL					$34,602	
TOTAL ANNUAL COST					**$35,000**	Periodic cost is rounded to the nearest $1,000.

ANNUAL OPERATIONS AND MAINTENANCE (O&M) COSTS - Years 3 through 5

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Cover and Reclamation Maintenance (Years 3 through 5)	CW6-19	1	LS	$21,934	$21,934	
SUBTOTAL					$21,934	
Contingency (Scope and Bid)		20%			$4,387	10% Scope, 10% Bid (Low end of the recommended range).
SUBTOTAL					$26,321	
Project Management		10%			$2,632	Percentage from Exhibit 5-8 was used.
Technical Support		15%			$3,948	Middle value of the recommended range was used.
TOTAL					$32,901	
TOTAL ANNUAL COST					**$33,000**	Periodic cost is rounded to the nearest $1,000.

TABLE CS-6

Alternative **6**
Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facility outside PMDA

COST ESTIMATE SUMMARY

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013
Date: January 31, 2013

Description: Alternative 6 includes excavation and disposal of mine materials, including EM tailings, at a proposed facility outside the PMDA. The tailings within the former water and tailings storage pond (approximately 19,000 CY) would be dewatered and treated as described for Alternative 4. Since the EM area will be excavated and disposed of rather than contained in place, the targeted disposal volume for the proposed facility outside of the PMDA would increase to 234,000 CY. Excavated areas or areas disturbed during construction that do not have mine materials would be restored or regraded and reclaimed with a rock armor or a vegetative layer, depending on the steepness of resulting slopes. Administrative controls involve administrative, legal, and/or informational, or physical measures intended to control or prevent present and future use or access to mine materials, and inform and warn of dangers associated with these materials. Monitoring would consist of visual inspections to document degree of protectiveness to human health and the environment and determine maintenance needs for the proposed facility and containment areas. Maintenance of the proposed disposal facility and containment areas would be performed as necessary to maintain protectiveness and integrity of the covers systems. Five-year site reviews would be performed since mine materials under covers would remain, however, the 5-year site reviews would not be required for OU1 within the PMDA once mine materials with contaminant concentrations above PRGs are no longer present.

ANNUAL OPERATIONS AND MAINTENANCE (O&M) COSTS - Years 6 through 29

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Cover and Reclamation Maintenance (Years 6 through 29)	CW6-20	1	LS	$10,967	$10,967	
SUBTOTAL					$10,967	
Contingency (Scope and Bid)		20%			$2,193	10% Scope, 10% Bid (Low end of the recommended range).
SUBTOTAL					$13,160	
Project Management		10%			$1,316	Percentage from Exhibit 5-8 was used.
Technical Support		15%			$1,974	Middle value of the recommended range was used.
TOTAL					$16,450	
TOTAL ANNUAL COST					**$16,000**	Periodic cost is rounded to the nearest $1,000.

5-YEAR SITE REVIEW PERIODIC COSTS (Years 4, 9, 14, 19, 24, and 29)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Reviews	CW6-3	1	LS	$36,360	$36,360	
SUBTOTAL					$36,360	
Contingency (Scope and Bid)		20%			$7,272	10% Scope, 10% Bid (Low end of the recommended range).
SUBTOTAL					$43,632	
Project Management		10%			$4,363	The high end of the recommended range was used.
Technical Support		15%			$6,545	Middle value of the recommended range was used.
TOTAL					$54,540	
TOTAL PERIODIC COST					**$55,000**	Periodic cost is rounded to the nearest $1,000.

Notes:
Percentages used for indirect costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.

Abbreviations:
EA Each
QTY Quantity
LS Lump Sum

Cost Worksheets
Alternative 1

TABLE CW1-1

Alternative 1
Capital Cost Sub-Element
5-Year Site Reviews

Cost Worksheet: **CW1-1**

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the 5-year site review report. The following includes labor, material and shipping costs for 5-year site review reports.

Cost Analysis:
Cost for 5-Year Site Reviews (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
L16	Project Manager	40	HR	1.00	$39.48	$39.48	$0.00	$0.00	$0.00	$0.00	$39.48	$1,579.20	100%	9%	$3,443	SE SalaryExpert.com	
L6	Environmental Engineer	120	HR	1.00	$33.51	$33.51	$0.00	$0.00	$0.00	$0.00	$33.51	$4,021.20	100%	9%	$8,766	SE SalaryExpert.com	
L8	Environmental Scientist	160	HR	1.00	$30.92	$30.92	$0.00	$0.00	$0.00	$0.00	$30.92	$4,947.20	100%	9%	$10,785	SE SalaryExpert.com	
L17	Quality Control Engineer	24	HR	1.00	$44.10	$44.10	$0.00	$0.00	$0.00	$0.00	$44.10	$1,058.40	100%	9%	$2,307	SE SalaryExpert.com	
L2	Project Engineer	40	HR	1.00	$42.74	$42.74	$0.00	$0.00	$0.00	$0.00	$42.74	$1,709.60	100%	9%	$3,727	SE SalaryExpert.com	
L4	Clerks, Typist, Bookkeeper & Receptionist	40	HR	1.00	$19.22	$19.22	$0.00	$0.00	$0.00	$0.00	$19.22	$768.80	100%	9%	$1,676	SE SalaryExpert.com	
M27	Copy and Shipping Allowance	1	LS	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2,320.00	$2,320.00	$2,320.00	0%	0%	$2,320	A Allowance	
												TOTAL UNIT COST:			$33,024		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

Cost Worksheets
Alternative 2

TABLE CW2-1

Alternative 2 | **Cost Worksheet:** **CW2-1**
Capital Cost Sub-Element
Institutional Controls

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves implementation of institutional control for the site. The following cost includes hours for a legal procedures and cost for document submission.

Cost Analysis:
Cost for Institutional Controls (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
L7	Environmental Lawyer	500	HR	1.00	$44.67	$44.67	$0.00	$0.00	$0.00	$0.00	$44.67	$22,335.00	100%	9%	$48,690	SE SalaryExpert.com	
L18	Surveyors	250	HR	1.00	$31.69	$31.69	$0.00	$0.00	$0.00	$0.00	$31.69	$7,922.50	100%	9%	$17,271	SE SalaryExpert.com	
L4	Clerks, Typist, Bookkeeper & Receptionist	250	HR	1.00	$19.22	$19.22	$0.00	$0.00	$0.00	$0.00	$19.22	$4,805.00	100%	9%	$10,475	SE SalaryExpert.com	
M36	Supplies, Copying and Shipping Allowance	1	LS	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$34,800.00	$34,800.00	$34,800.00	0%	0%	$34,800	A Allowance	
M131	Document Submission and Recording Allowance	5	EA	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$51.00	$51.00	$255.00	0%	0%	$255	A Allowance	
												TOTAL UNIT COST:			$111,491		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW2-2

Alternative 2
Capital Cost Sub-Element
Engineered Controls

Cost Worksheet: **CW2-2**

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the cost associated with engineered controls on the site. Engineered controls include installation of warning signs along the perimeter of the disturbed mine area.

Cost Analysis:
Cost for Engineered Controls (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
M37A	Signs	6	EA	1.00	$0.00	$0.00	$0.00	$0.00	$24.30	$0.00	$24.30	$145.80	8%	9%	$172	V Vendor Quote	Assume 150 FT apart
												TOTAL UNIT COST:			$172		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW2-3

Alternative 2
Capital Cost Sub-Element
5-Year Site Reviews

Cost Worksheet: **CW2-3**

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the 5-year site visits and 5-year site review report. The following cost includes labor, material and shipping costs for site visits and 5-year site review reports.

Cost Analysis:
Cost for 5-Year Site Reviews (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A44A	Site Inspection Crew	20	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$70.47	$70.47	$1,409.40	100%	9%	$3,072	MII MII Assemblies	
A44AA	Pickup Truck, 1/2 Ton	20	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$11.22	$11.22	$224.40	8%	9%	$264	MII MII Assemblies	
L16	Project Manager	40	HR	1.00	$39.48	$39.48	$0.00	$0.00	$0.00	$0.00	$39.48	$1,579.20	100%	9%	$3,443	SE SalaryExpert.com	
L6	Environmental Engineer	120	HR	1.00	$33.51	$33.51	$0.00	$0.00	$0.00	$0.00	$33.51	$4,021.20	100%	9%	$8,766	SE SalaryExpert.com	
L8	Environmental Scientist	160	HR	1.00	$30.92	$30.92	$0.00	$0.00	$0.00	$0.00	$30.92	$4,947.20	100%	9%	$10,785	SE SalaryExpert.com	
L17	Quality Control Engineer	24	HR	1.00	$44.10	$44.10	$0.00	$0.00	$0.00	$0.00	$44.10	$1,058.40	100%	9%	$2,307	SE SalaryExpert.com	
L2	Project Engineer	40	HR	1.00	$42.74	$42.74	$0.00	$0.00	$0.00	$0.00	$42.74	$1,709.60	100%	9%	$3,727	SE SalaryExpert.com	
L4	Clerks, Typist, Bookkeeper & Receptionist	40	HR	1.00	$19.22	$19.22	$0.00	$0.00	$0.00	$0.00	$19.22	$768.80	100%	9%	$1,676	SE SalaryExpert.com	
M27	Copy and Shipping Allowance	1	LS	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2,320.00	$2,320.00	$2,320.00	0%	0%	$2,320	A Allowance	
												TOTAL UNIT COST:			$36,360		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW2-4

Alternative 2
Capital Cost Sub-Element
Excavation of Mine Materials

Cost Worksheet: CW2-4

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the excavation of mine materials. It includes costs for labor, material, and equipment.

Cost Analysis:
Cost for Mine Material Excavation (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A9A	Excavation	72,000	BCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1.17	$1.17	$84,240.00	8%	9%	$99,167	MII MII Assemblies	
A12A	Material Loading	82,800	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.36	$0.36	$29,808.00	8%	9%	$35,090	MII MII Assemblies	
												TOTAL UNIT COST:			$134,257		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW2-5

Alternative 2
Capital Cost Sub-Element
Excavation of Borrow Areas

Cost Worksheet: **CW2-5**

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the excavation of rock and soil from borrow areas. It includes costs for labor, material, and equipment.

Cost Analysis:
Cost for Borrow Material Excavation (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
	Rock Borrow																
A51A	Clearing and Grubbing	0.37	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2,771.62	$2,771.62	$1,025.50	8%	9%	$1,207	MII MII Assemblies	
A8A	Rock Quarrying	12,500	BCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$12.71	$12.71	$158,875.00	8%	9%	$187,028	MII MII Assemblies	
A7AA	Rock Ripping using Dozer	11,871	BCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.34	$2.34	$27,778.14	8%	9%	$32,700	MII MII Assemblies	
A12A	Material Loading	16,687	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.36	$0.36	$6,007.32	8%	9%	$7,072	MII MII Assemblies	
A7A	Jaw Crusher	16,687	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$10.38	$10.38	$173,211.06	8%	9%	$203,904	MII MII Assemblies	
A12A	Material Loading	16,687	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.36	$0.36	$6,007.32	8%	9%	$7,072	MII MII Assemblies	
	Soil Borrow			1.00													
A51A	Clearing and Grubbing	2.26	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2,771.62	$2,771.62	$6,263.86	8%	9%	$7,374	MII MII Assemblies	
A9A	Excavation	54,100	BCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1.17	$1.17	$63,297.00	8%	9%	$74,513	MII MII Assemblies	
A12A	Material Loading	62,215	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.36	$0.36	$22,397.40	8%	9%	$26,366	MII MII Assemblies	
A78A	Screening	62,215	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.80	$0.80	$49,772.00	8%	9%	$58,592	MII MII Assemblies	
A12A	Material Loading	62,215	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.36	$0.36	$22,397.40	8%	9%	$26,366	MII MII Assemblies	
												TOTAL UNIT COST:			$632,194		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW2-6

Alternative 2 **Cost Worksheet: CW2-6**
Capital Cost Sub-Element
Transportation of Mine Materials

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves hauling, handling, and disposal of contaminated mine materials. It includes costs for labor, material, and equipment.

Cost Analysis:
Cost for Transportation and Disposal of Mine Material (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A28A	Short Haul	82,800	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.74	$0.74	$61,272.00	8%	9%	$72,129	MII MII Assemblies	Assume 0.5 mile haul
A17B	Excavated Material Placement	82,800	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.24	$2.24	$185,472.00	8%	9%	$218,338	MII MII Assemblies	Placement of excavated materials within the repository
												TOTAL UNIT COST:			$290,467		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW2-7

Alternative 2
Capital Cost Sub-Element
Transportation of Borrow Material

Cost Worksheet: **CW2-7**

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves hauling and handling of excavated materials from borrow areas. It includes costs for labor, material, and equipment.

Cost Analysis:
Cost for Transportation of Borrow Material (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A29A	Repository Haul/Overburden Haul	78,902	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.40	$2.40	$189,364.80	8%	9%	$222,920	MII MII Assemblies	To facility outside of PMDA
												TOTAL UNIT COST:			$222,920		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW2-8

Alternative 2 **Cost Worksheet: CW2-8**
Capital Cost Sub-Element
Lime and Organic Material for Topsoil and Subsoil Amendment

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the required lime and organic material for topsoil and subsoil amendment. Lime (Ag lime) and organic material (yard waste/compost) would be imported to the site.

Cost Analysis:
Cost for Lime and Organic Material for Soil Amendment (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
	Lime for Soil Amendment																
M33	Lime, Material and Delivery	1,079	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$155.76	$10.31	$166.07	$179,189.53	8%	9%	$210,942	V Vendor Quote	1.95 hourcycle time for one truck and that truck holds 20 LCY of lime.
A25A	Lime Amendment and Processing	22.95	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1,740.20	$1,740.20	$39,937.59	8%	9%	$47,015	MII MII Assemblies	
	Organic Material for Topsoil Amendment																
M33A	Organic Material, Material and Delivery	3,798	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$23.00	$10.31	$33.31	$126,511.38	8%	9%	$148,929	V Vendor Quote	1.95 hourcycle time for one truck and that truck holds 20 LCY of organic material.
A27A	Organic Amendment and Processing	22.95	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1,740.20	$1,740.20	$39,937.59	8%	9%	$47,015	MII MII Assemblies	
												TOTAL UNIT COST:			$453,901		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW2-9

Alternative 2 **Cost Worksheet: CW2-9**
Capital Cost Sub-Element
Dust Control

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves dust control during implementation of remedial activities at the site.

Cost Analysis:
Cost for Dust Control (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A5A	Dust Control	900	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$144.11	$144.11	$129,699.00	8%	9%	$152,682	MII MII Assemblies	
												TOTAL UNIT COST:			$152,682		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW2-10

Alternative 2
Capital Cost Sub-Element
Excavation Area Reclamation

Cost Worksheet: **CW2-10**

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the reclamation of excavation areas. The reclamation would include a 6" growth media layer.

Cost Analysis:
Cost for Reclamation of Excavated Areas (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
	Topsoil Placement																
A15A	Subsoil/Topsoil Placement	6,325	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$4.20	$4.20	$26,565.00	8%	9%	$31,272	MII MII Assemblies	
												TOTAL UNIT COST:			$31,272		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW2-11

Alternative 2 **Cost Worksheet: CW2-11**
Capital Cost Sub-Element
Revegetation of Reclamation Areas

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the revegetation of all reclamation areas on the site. It includes hydro-seeding with fertilizer and hydromulch.

Cost Analysis:
Cost for Revegetation of Reclamation Areas (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A42A	Hydro-Seeding Crew	7.80	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$123.52	$123.52	$963.46	8%	9%	$1,134	MII MII Assemblies	
M8	Seed Mix	7.80	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$144.00	$0.00	$144.00	$1,123.20	8%	9%	$1,322	P Previous Work	Materials only, 32 lbs/acre
M10	Hydromulch	7.80	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$187.50	$0.00	$187.50	$1,462.50	8%	9%	$1,722	P Previous Work	Materials only, 3000 lbs/acre
M9	Fertilizer (N2 and P2O5)	7.80	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$50.07	$0.00	$50.07	$390.55	8%	9%	$460	P Previous Work	Materials only, 135 lbs/acre
A31A	Lime/Fertilizer- Haul	20	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$10.31	$10.31	$206.20	8%	9%	$243	MII MII Assemblies	1.95 hourcycle time for one truck and that truck holds 20 LCY of lime/fertilizer material.
A68A	Tree Planting	2,380	EA	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.92	$9.92	$23,609.60	8%	9%	$27,793	MII MII Assemblies	
M44	Cedar Tree	452	EA	1.00	$0.00	$0.00	$0.00	$0.00	$25.00	$0.00	$25.00	$11,300.00	8%	9%	$13,302	P Previous Work	
M45	Pine Tree	750	EA	1.00	$0.00	$0.00	$0.00	$0.00	$25.00	$0.00	$25.00	$18,750.00	8%	9%	$22,073	P Previous Work	
M46	Spruce Tree	1,000	EA	1.00	$0.00	$0.00	$0.00	$0.00	$25.00	$0.00	$25.00	$25,000.00	8%	9%	$29,430	P Previous Work	
												TOTAL UNIT COST:			$97,479		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW2-12

Alternative 2 **Cost Worksheet: CW2-12**
Capital Cost Sub-Element
Surveying for Construction Control

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves cost for site surveying before and after the remedial alternative is constructed.

Cost Analysis:
Cost for Site Surveying (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A63A	Survey	100	DAY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$469.38	$469.38	$46,938.00	8%	9%	$55,255	MII MII Assemblies	
M133	Surveying Report Allowance	1	LS	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5,100.00	$5,100.00	$5,100.00	0%	0%	$5,100	A Allowance	
												TOTAL UNIT COST:			$60,355		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW2-13

Alternative 2
Capital Cost Sub-Element
Permanent Access Road

Cost Worksheet: CW2-13

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the permanent access road construction. It is assumed that the permanent access road to the site from the north would take approximately 2 weeks of dozer time. The gravel road base would be imported from offsite sources. Some rock excavation and clearing of forested areas will be required.

Cost Analysis:
Cost for Permanent Access Road (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A51A	Clearing and Grubbing	1.5	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2,771.62	$2,771.62	$4,157.43	8%	9%	$4,894	MII MII Assemblies	
M5A	Road Mix, Gravel	2,653	TN	1.00	$0.00	$0.00	$0.00	$0.00	$12.13	$0.00	$12.13	$32,180.80	8%	9%	$37,883	V Vendor Quote	Includes material purchase only
A45AA	Gravel Delivery	3,055	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.69	$5.69	$17,380.96	8%	9%	$20,461	MII MII Assemblies	
A21A	Compaction - Fill	300	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1.15	$1.15	$345.00	8%	9%	$406	MII MII Assemblies	Compacting embankment and subgrade
A45A	Permanent Gravel Access Road Installation	80	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$443.71	$443.71	$35,496.80	8%	9%	$41,787	MII MII Assemblies	
												TOTAL UNIT COST:			$105,431		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW2-14

Alternative 2
Capital Cost Sub-Element
Erosion Control

Cost Worksheet: CW2-14

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the installation of erosion control at the site.

Cost Analysis:
Cost for Installation of Erosion Control (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A9AA	Excavation	40	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$135.38	$135.38	$5,415.20	8%	9%	$6,375	MII MII Assemblies	Placement of Logs as Erosion Control
	Erosion Control at Facilities																
M41	Silt Fence	2,800	LF	1.00	$1.06	$1.06	$0.00	$0.00	$0.33	$0.00	$1.39	$3,892.00	8%	9%	$4,582	CW RS Means	
M42	Hay Bales	56	LF	1.00	$0.53	$0.53	$0.00	$0.00	$10.72	$0.00	$11.25	$630.00	8%	9%	$742	CW RS Means	
M43	Erosion Control Blankets	21,200	SY	1.00	$1.95	$1.95	$0.00	$0.00	$1.05	$0.00	$3.00	$63,600.00	8%	9%	$74,870	CW RS Means	
	Erosion Control at Excavated Areas																
M41	Silt Fence	3,400	LF	1.00	$1.06	$1.06	$0.00	$0.00	$0.33	$0.00	$1.39	$4,726.00	8%	9%	$5,563	CW RS Means	
M42	Hay Bales	68	LF	1.00	$0.53	$0.53	$0.00	$0.00	$10.72	$0.00	$11.25	$765.00	8%	9%	$901	CW RS Means	
M43	Erosion Control Blankets	10,695	SY	1.00	$1.95	$1.95	$0.00	$0.00	$1.05	$0.00	$3.00	$32,085.00	8%	9%	$37,770	CW RS Means	
	Erosion Control at Borrow Areas																
M41	Silt Fence	5,000	LF	1.00	$1.06	$1.06	$0.00	$0.00	$0.33	$0.00	$1.39	$6,950.00	8%	9%	$8,182	CW RS Means	
M42	Hay Bales	100	LF	1.00	$0.53	$0.53	$0.00	$0.00	$10.72	$0.00	$11.25	$1,125.00	8%	9%	$1,324	CW RS Means	
M43	Erosion Control Blankets	10,503	SY	1.00	$1.95	$1.95	$0.00	$0.00	$1.05	$0.00	$3.00	$31,509.00	8%	9%	$37,092	CW RS Means	
												TOTAL UNIT COST:			$177,401		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW2-15

Alternative 2 **Cost Worksheet: CW2-15**
Capital Cost Sub-Element
Mobilization/Demobilization and Preparatory Work

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves mobilization and demobilization of all the required equipment to and from the site respectively. It also includes preparatory work like equipment setup, working pad/area, storage area setup, erosion control and barrier setup etc. It is assumed that mobilization and demobilization would be required only once, i.e. all equipment would be left onsite during the construction off season.

Cost Analysis:
Cost for Mobilization/Demobilization and Preparatory Work (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A58A	Tractor - Heavy Equipment	192	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$110.61	$110.61	$21,237.12	8%	9%	$25,000	MII MII Assemblies	Per heavy equipment per hour
A59A	Tractor - Large Equipment	224	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.68	$105.68	$23,672.32	8%	9%	$27,867	MII MII Assemblies	Per large equipment per hour
A60A	Self-Propelled Equipment	112	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$51.27	$51.27	$5,742.24	8%	9%	$6,760	MII MII Assemblies	Per equipment per hour
A61A	Pilot Car w/Driver	160	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$51.27	$51.27	$8,203.20	8%	9%	$9,657	MII MII Assemblies	Per equipment per hour
												TOTAL UNIT COST:			$69,284		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW2-16

Alternative 2
Capital Cost Sub-Element
Construction of Repository within PMDA

Cost Worksheet: CW2-16

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the construction of a repository within the PMDA to contain excavated mine wastes. The proposed facility within the PMDA would be constructed with 3H:1V side slopes, contain a geosynthetic multi-layer cover system (including low permeability layer, drainage layer, barrier layer, and vegetative layer) over consolidated mine materials, and would include surface water run-on/runoff controls.

Cost Analysis:
Cost of Construction of Repository within PMDA (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A9A	Excavation	17,000	BCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1.17	$1.17	$19,890.00	8%	9%	$23,415	MII MII Assemblies	
A49A	Rough Grading	4,250	BCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.64	$2.64	$11,220.00	8%	9%	$13,208	MII MII Assemblies	Assume 25% of surface area
	Multi-Layer Cover																
M88	Geomembrane	4.38	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$19,602.00	$28,568.24	$48,170.24	$210,985.65	8%	9%	$248,372	V Vendor Quote	Delivered cost
M89	Geotextile	4.38	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$5,227.20	$5,305.57	$10,532.77	$46,133.53	8%	9%	$54,308	V Vendor Quote	Delivered cost
A14A	Drain Layer/Bedding/Layer Placement	12,190	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$4.21	$4.21	$51,319.90	8%	9%	$60,414	MII MII Assemblies	
A23A	Compaction - Bedding Layer	12,190	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1.92	$1.92	$23,404.80	8%	9%	$27,552	MII MII Assemblies	
A17A	Fill Placement - Mass Fill Areas	8,165	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.24	$2.24	$18,289.60	8%	9%	$21,531	MII MII Assemblies	
A21A	Compaction - Fill	8,165	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1.15	$1.15	$9,389.75	8%	9%	$11,054	MII MII Assemblies	Compacting embankment and subgrade
A17AA	Fill Placement - Top Soil	4,025	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.24	$2.24	$9,016.00	8%	9%	$10,614	MII MII Assemblies	
A67A	Fine Grading	21,200	SY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.44	$0.44	$9,328.00	8%	9%	$10,981	MII MII Assemblies	
	Riprap Placement																
A16A	Riprap Placement	4,497	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$25.61	$25.61	$115,168.17	8%	9%	$135,576	MII MII Assemblies	
												TOTAL UNIT COST:			$617,025		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW2-17

Alternative 2 **Cost Worksheet: CW2-17**
Capital Cost Sub-Element
Construction of Exposure Barrier

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the construction of the exposure barrier within PMDA. The exposure barrier will vary in construction between all soil and all gravel. The barrier will be 2 ft thick.

Cost Analysis:
Construction of Exposure Barrier (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
	Geomembrane																
M88	Geomembrane	1.18	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$19,602.00	$28,568.24	$48,170.24	$56,696.37	8%	9%	$66,743	V Vendor Quote	Delivered cost
M89	Geotextile	1.18	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$5,227.20	$5,305.57	$10,532.77	$12,397.07	8%	9%	$14,594	V Vendor Quote	
	Subsoil Placement Over Contaminated Soil																
A49A	Rough Grading	9,500	BCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.64	$2.64	$25,080.00	8%	9%	$29,524	MII MII Assemblies	
A17A	Fill Placement - Mass Fill Areas	21,850	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.24	$2.24	$48,944.00	8%	9%	$57,617	MII MII Assemblies	
A21A	Compaction - Fill	21,850	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1.15	$1.15	$25,127.50	8%	9%	$29,580	MII MII Assemblies	Compacting embankment and subgrade
	Topsoil Placement for Cover																
A17AA	Fill Placement - Top Soil	21,850	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.24	$2.24	$48,944.00	8%	9%	$57,617	MII MII Assemblies	
A67A	Fine Grading	56,967	SY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.44	$0.44	$25,065.48	8%	9%	$29,507	MII MII Assemblies	
												TOTAL UNIT COST:			$285,182		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW2-18

Alternative 2
Annual O&M Cost Sub-Element
Cover and Reclamation Maintenance (Year 1)

Cost Worksheet: **CW2-18**

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves operations and maintenance pertaining to the upkeep of the cover systems and reclamation areas for Year 1. It includes costs for site inspection, weed control, and reseeding.

Cost Analysis:
Cost for Cover and Reclamation Maintenance - Year 1 (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A44A	Site Inspection Crew	64	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$70.47	$70.47	$4,510.08	100%	9%	$9,832	MII MII Assemblies	
A44AA	Pickup Truck, 1/2 Ton	64	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$11.22	$11.22	$718.08	8%	9%	$845	MII MII Assemblies	
A62A	Cap O&M	20	DAY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$478.12	$478.12	$9,562.40	8%	9%	$11,257	MII MII Assemblies	
A42A	Hydro-Seeding Crew	2.0	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$123.52	$123.52	$247.04	8%	9%	$291	MII MII Assemblies	
M8	Seed Mix	2.0	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$144.00	$0.00	$144.00	$288.00	8%	9%	$339	P Previous Work	Materials only, 32 lbs/acre
M10	Hydromulch	2.0	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$187.50	$0.00	$187.50	$375.00	8%	9%	$441	P Previous Work	Materials only, 3000 lbs/acre
M9	Fertilizer (N2 and P2O5)	2.0	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$50.07	$0.00	$50.07	$100.14	8%	9%	$118	P Previous Work	Materials only, 135 lbs/acre
A31A	Lime/Fertilizer- Haul	20	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$10.31	$10.31	$206.20	8%	9%	$243	MII MII Assemblies	1.95 hourcycle time for one truck and that truck holds 20 LCY of lime/fertilizer material.
A46A	Road Improvement/Reconstruction	8	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$443.71	$443.71	$3,549.68	8%	9%	$4,179	MII MII Assemblies	Includes grading and compaction
												TOTAL UNIT COST:			$27,545		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW2-19

Alternative 2
Annual O&M Cost Sub-Element
Cover and Reclamation Maintenance (Year 2)

Cost Worksheet: CW2-19

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves operations and maintenance pertaining to the upkeep of the cover systems and reclamation areas for Year 2. It includes costs for site inspection, weed control, and reseeding.

Cost Analysis:
Cost for Cover and Reclamation Maintenance - Year 2 (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A44A	Site Inspection Crew	64	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$70.47	$70.47	$4,510.08	100%	9%	$9,832	MII MII Assemblies	
A44AA	Pickup Truck, 1/2 Ton	64	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$11.22	$11.22	$718.08	8%	9%	$845	MII MII Assemblies	
A62A	Cap O&M	20	DAY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$478.12	$478.12	$9,562.40	8%	9%	$11,257	MII MII Assemblies	
A42A	Hydro-Seeding Crew	1.0	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$123.52	$123.52	$123.52	8%	9%	$145	MII MII Assemblies	
M8	Seed Mix	1.0	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$144.00	$0.00	$144.00	$144.00	8%	9%	$170	P Previous Work	Materials only, 32 lbs/acre
M10	Hydromulch	1.0	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$187.50	$0.00	$187.50	$187.50	8%	9%	$221	P Previous Work	Materials only, 3000 lbs/acre
M9	Fertilizer (N2 and P2O5)	1.0	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$50.07	$0.00	$50.07	$50.07	8%	9%	$59	P Previous Work	Materials only, 135 lbs/acre
A31A	Lime/Fertilizer- Haul	20	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$10.31	$10.31	$206.20	8%	9%	$243	MII MII Assemblies	1.95 hourcycle time for one truck and that truck holds 20 LCY of lime/fertilizer material.
A46A	Road Improvement/Reconstruction	8	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$443.71	$443.71	$3,549.68	8%	9%	$4,179	MII MII Assemblies	Includes grading and compaction
												TOTAL UNIT COST:			$26,951		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW2-20

Alternative 2 **Cost Worksheet: CW2-20**
Annual O&M Cost Sub-Element
Cover and Reclamation Maintenance (Years 3 through 5)

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves operations and maintenance pertaining to the upkeep of the cover systems and reclamation areas for Years 3 through 5. It includes costs for site inspection, weed control, and reseeding.

Cost Analysis:
Cost for Cover and Reclamation Maintenance - Years 3 through 5 (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A44A	Site Inspection Crew	64	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$70.47	$70.47	$4,510.08	100%	9%	$9,832	MII MII Assemblies	
A44AA	Pickup Truck, 1/2 Ton	64	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$11.22	$11.22	$718.08	8%	9%	$845	MII MII Assemblies	
A62A	Cap O&M	20	DAY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$478.12	$478.12	$9,562.40	8%	9%	$11,257	MII MII Assemblies	
A46A	Road Improvement/Reconstruction	8	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$443.71	$443.71	$3,549.68	8%	9%	$4,179	MII MII Assemblies	Includes grading and compaction
												TOTAL UNIT COST:			$26,113		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW2-21

Alternative 2 | **Cost Worksheet: CW2-21**
Annual O&M Cost Sub-Element
Cover and Reclamation Maintenance (Years 6 through 29)

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves operations and maintenance pertaining to the upkeep of the cover systems and reclamation areas for Years 6 through 29. It includes costs for site inspection, weed control, and reseeding.

Cost Analysis:
Cost for Cover and Reclamation Maintenance - Years 6 through 29 (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A44A	Site Inspection Crew	32	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$70.47	$70.47	$2,255.04	100%	9%	$4,916	MII MII Assemblies	
A44AA	Pickup Truck, 1/2 Ton	32	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$11.22	$11.22	$359.04	8%	9%	$423	MII MII Assemblies	
A62A	Cap O&M	10	DAY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$478.12	$478.12	$4,781.20	8%	9%	$5,628	MII MII Assemblies	
A46A	Road Improvement/Reconstruction	8	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$443.71	$443.71	$3,549.68	8%	9%	$4,179	MII MII Assemblies	Includes grading and compaction
												TOTAL UNIT COST:			$15,146		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW2-22

Alternative 2
Capital Cost Sub-Element
Asphalt Cover Construction

Cost Worksheet: **CW2-22**

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the construction of the asphalt cover. It is assumed that an aggregate gravel base would be installed, followed by an asphalt cover.

Cost Analysis:
Cost for Asphalt Cover Construction (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A51A	Clearing and Grubbing	2.0	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2,771.62	$2,771.62	$5,487.81	8%	9%	$6,460	MII MII Assemblies	
A9A	Excavation	3,195	BCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1.17	$1.17	$3,738.15	8%	9%	$4,401	MII MII Assemblies	
M5A	Road Mix, Gravel	1,777	TN	1.00	$0.00	$0.00	$0.00	$0.00	$12.13	$0.00	$12.13	$21,555.01	8%	9%	$25,375	V Vendor Quote	Includes material purchase only
A45AA	Gravel Delivery	1,225	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.69	$5.69	$6,970.25	8%	9%	$8,205	MII MII Assemblies	
A21A	Compaction - Fill	1,225	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1.15	$1.15	$1,408.75	8%	9%	$1,658	MII MII Assemblies	Compacting embankment and subgrade
M17	Asphalt	2,130	BCY	1.00	$0.00	$0.00	$0.00	$0.00	$6.33	$0.00	$6.33	$13,482.90	8%	9%	$15,872	CW RS Means	Includes material purchase only
A82AA	Asphalt Delivery	2,450	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.69	$5.69	$13,940.50	8%	9%	$16,411	MII MII Assemblies	
A82A	Asphalt Cover Construction	2,130	BCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$4.44	$4.44	$9,457.20	8%	9%	$11,133	MII MII Assemblies	
												TOTAL UNIT COST:			$89,515		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW2-23

Alternative 2 **Cost Worksheet: CW2-23**
Capital Cost Sub-Element
Revegetation of Covers

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the revegetation of the cover systems. It includes hydro-seeding with fertilizer and hydromulch.

Cost Analysis:
Cost for Revegetation of Covers (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A42A	Hydro-Seeding Crew	16.15	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$123.52	$123.52	$1,994.85	8%	9%	$2,348	MII MII Assemblies	
M8	Seed Mix	16.15	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$144.00	$0.00	$144.00	$2,325.60	8%	9%	$2,738	P Previous Work	Materials only, 32 lbs/acre
M10	Hydromulch	16.15	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$187.50	$0.00	$187.50	$3,028.13	8%	9%	$3,565	P Previous Work	Materials only, 3000 lbs/acre
M9	Fertilizer (N2 and P2O5)	16.15	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$50.07	$0.00	$50.07	$808.63	8%	9%	$952	P Previous Work	Materials only, 135 lbs/acre
A31A	Lime/Fertilizer- Haul	20	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$10.31	$10.31	$206.20	8%	9%	$243	MII MII Assemblies	1.95 hourcycle time for one truck and that truck holds 20 LCY of lime/fertilizer material.
												TOTAL UNIT COST:			$9,846		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

Cost Worksheets

Alternative 3

TABLE CW3-1

Alternative 3
Capital Cost Sub-Element
Institutional Controls

Cost Worksheet: **CW3-1**

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves implementation of institutional control for the site. The following cost includes hours for a legal procedures and cost for document submission.

Cost Analysis:
Cost for Institutional Controls (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
L7	Environmental Lawyer	500	HR	1.00	$44.67	$44.67	$0.00	$0.00	$0.00	$0.00	$44.67	$22,335.00	100%	9%	$48,690	SE SalaryExpert.com	
L18	Surveyors	250	HR	1.00	$31.69	$31.69	$0.00	$0.00	$0.00	$0.00	$31.69	$7,922.50	100%	9%	$17,271	SE SalaryExpert.com	
L4	Clerks, Typist, Bookkeeper & Receptionist	250	HR	1.00	$19.22	$19.22	$0.00	$0.00	$0.00	$0.00	$19.22	$4,805.00	100%	9%	$10,475	SE SalaryExpert.com	
M36	Supplies, Copying and Shipping Allowance	1	LS	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$34,800.00	$34,800.00	$34,800.00	0%	0%	$34,800	A Allowance	
M131	Document Submission and Recording Allowance	5	EA	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$51.00	$51.00	$255.00	0%	0%	$255	A Allowance	
												TOTAL UNIT COST:			$111,491		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW3-2

Alternative 3 **Cost Worksheet: CW3-2**
Capital Cost Sub-Element
Engineered Controls

COST WORKSHEET

Site: Formosa OU1 **Prepared By:** JN **Date:** 7/13/2012
Location: Douglas County, Oregon
Phase: Feasibility Study **Checked By:** EB **Date:** 7/16/2012
Base Year: 2013

Work Statement:
This sub-element involves the cost associated with engineered controls on the site. Engineered controls include installation of fencing and warning signs along the perimeter of the disturbed mine area. Access gates are also included.

Cost Analysis:
Cost for Engineered Controls (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
M34	Chain Link Fence	4,455	LF	1.00	$7.63	$7.63	$0.00	$0.00	$6.75	$0.00	$14.38	$64,062.90	8%	9%	$75,415	V Vendor Quote	Assume braces set 150 FT apart
M29	Gate, Latch and Fittings, Double Swing	1	EA	1.00	$572.18	$572.18	$0.00	$0.00	$678.02	$0.00	$1,250.20	$1,250.20	8%	9%	$1,472	V Vendor Quote	
M37A	Signs	6	EA	1.00	$0.00	$0.00	$0.00	$0.00	$24.30	$0.00	$24.30	$145.80	8%	9%	$172	V Vendor Quote	Assume 150 FT apart
												TOTAL UNIT COST:			$77,059		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW3-3

Alternative 3 | **Cost Worksheet:** **CW3-3**
Capital Cost Sub-Element
5-Year Site Reviews

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the 5-year site visits and 5-year site review report. The following cost includes labor, material and shipping costs for site visits and 5-year site review reports.

Cost Analysis:
Cost for 5-Year Site Reviews (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A44A	Site Inspection Crew	20	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$70.47	$70.47	$1,409.40	100%	9%	$3,072	MII MII Assemblies	
A44AA	Pickup Truck, 1/2 Ton	20	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$11.22	$11.22	$224.40	8%	9%	$264	MII MII Assemblies	
L16	Project Manager	40	HR	1.00	$39.48	$39.48	$0.00	$0.00	$0.00	$0.00	$39.48	$1,579.20	100%	9%	$3,443	SE SalaryExpert.com	
L6	Environmental Engineer	120	HR	1.00	$33.51	$33.51	$0.00	$0.00	$0.00	$0.00	$33.51	$4,021.20	100%	9%	$8,766	SE SalaryExpert.com	
L8	Environmental Scientist	160	HR	1.00	$30.92	$30.92	$0.00	$0.00	$0.00	$0.00	$30.92	$4,947.20	100%	9%	$10,785	SE SalaryExpert.com	
L17	Quality Control Engineer	24	HR	1.00	$44.10	$44.10	$0.00	$0.00	$0.00	$0.00	$44.10	$1,058.40	100%	9%	$2,307	SE SalaryExpert.com	
L2	Project Engineer	40	HR	1.00	$42.74	$42.74	$0.00	$0.00	$0.00	$0.00	$42.74	$1,709.60	100%	9%	$3,727	SE SalaryExpert.com	
L4	Clerks, Typist, Bookkeeper & Receptionist	40	HR	1.00	$19.22	$19.22	$0.00	$0.00	$0.00	$0.00	$19.22	$768.80	100%	9%	$1,676	SE SalaryExpert.com	
M27	Copy and Shipping Allowance	1	LS	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2,320.00	$2,320.00	$2,320.00	0%	0%	$2,320	A Allowance	
												TOTAL UNIT COST:			$36,360		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW3-4

Alternative 3
Capital Cost Sub-Element
Excavation of Mine Materials

Cost Worksheet: **CW3-4**

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the excavation of mine materials. It includes costs for labor, material, and equipment.

Cost Analysis:
Cost for Mine Material Excavation (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A9A	Excavation	194,000	BCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1.17	$1.17	$226,980.00	8%	9%	$267,201	MII MII Assemblies	
A12A	Material Loading	223,100	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.36	$0.36	$80,316.00	8%	9%	$94,548	MII MII Assemblies	
												TOTAL UNIT COST:			$361,749		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW3-5

Alternative 3
Capital Cost Sub-Element
Excavation of Borrow Areas

Cost Worksheet: **CW3-5**

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the excavation of rock and soil from borrow areas. It includes costs for labor, material, and equipment.

Cost Analysis:
Cost for Borrow Material Excavation (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
	Rock Borrow																
A51A	Clearing and Grubbing	0.37	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2,771.62	$2,771.62	$1,025.50	8%	9%	$1,207	MII MII Assemblies	
A8A	Rock Quarrying	12,500	BCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$12.71	$12.71	$158,875.00	8%	9%	$187,028	MII MII Assemblies	
A7AA	Rock Ripping using Dozer	25,556	BCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.34	$2.34	$59,801.04	8%	9%	$70,398	MII MII Assemblies	
A12A	Material Loading	35,605	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.36	$0.36	$12,817.80	8%	9%	$15,089	MII MII Assemblies	
A7A	Jaw Crusher	35,605	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$10.38	$10.38	$369,579.90	8%	9%	$435,069	MII MII Assemblies	
A12A	Material Loading	35,605	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.36	$0.36	$12,817.80	8%	9%	$15,089	MII MII Assemblies	
	Soil Borrow			1.00													
A51A	Clearing and Grubbing	2.26	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2,771.62	$2,771.62	$6,263.86	8%	9%	$7,374	MII MII Assemblies	
A9A	Excavation	35,700	BCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1.17	$1.17	$41,769.00	8%	9%	$49,170	MII MII Assemblies	
A12A	Material Loading	41,055	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.36	$0.36	$14,779.80	8%	9%	$17,399	MII MII Assemblies	
A78A	Screening	41,055	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.80	$0.80	$32,844.00	8%	9%	$38,664	MII MII Assemblies	
A12A	Material Loading	41,055	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.36	$0.36	$14,779.80	8%	9%	$17,399	MII MII Assemblies	
												TOTAL UNIT COST:			$853,886		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW3-6

Alternative 3 | **Cost Worksheet:** **CW3-6**
Capital Cost Sub-Element
Transportation of Mine Materials

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves hauling, handling, and disposal of contaminated mine materials. It includes costs for labor, material, and equipment.

Cost Analysis:
Cost for Transportation and Disposal of Mine Material (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A28A	Short Haul	79,350	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.74	$0.74	$58,719.00	8%	9%	$69,124	MII MII Assemblies	Assume 0.5 mile haul
A29A	Repository Haul/Overburden Haul	143,750	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.40	$2.40	$345,000.00	8%	9%	$406,134	MII MII Assemblies	To facility outside of PMDA
A17B	Excavated Material Placement	223,100	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.24	$2.24	$499,744.00	8%	9%	$588,299	MII MII Assemblies	Placement of excavated materials within the repository
												TOTAL UNIT COST:			$1,063,557		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW3-7

Alternative 3
Capital Cost Sub-Element
Transportation of Borrow Material

Cost Worksheet: **CW3-7**

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves hauling and handling of excavated materials from borrow areas. It includes costs for labor, material, and equipment.

Cost Analysis:
Cost for Transportation of Borrow Material (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A29A	Repository Haul/Overburden Haul	76,660	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.40	$2.40	$183,984.00	8%	9%	$216,586	MII MII Assemblies	To facility outside of PMDA
												TOTAL UNIT COST:			$216,586		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW3-8

Alternative 3 **Cost Worksheet: CW3-8**
Capital Cost Sub-Element
Lime and Organic Material for Topsoil and Subsoil Amendment

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the required lime and organic material for topsoil and subsoil amendment. Lime (Ag lime) and organic material (yard waste/compost) would be imported to the site.

Cost Analysis:
Cost for Lime and Organic Material for Soil Amendment (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
	Lime for Soil Amendment																
M33	Lime, Material and Delivery	848	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$155.76	$10.31	$166.07	$140,827.36	8%	9%	$165,782	V Vendor Quote	1.95 hourcycle time for one truck and that truck holds 20 LCY of lime.
A25A	Lime Amendment and Processing	28.45	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1,740.20	$1,740.20	$49,508.69	8%	9%	$58,282	MII MII Assemblies	
	Organic Material for Topsoil Amendment																
M33A	Organic Material, Material and Delivery	3,133	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$23.00	$10.31	$33.31	$104,360.23	8%	9%	$122,853	V Vendor Quote	1.95 hourcycle time for one truck and that truck holds 20 LCY of organic material.
A27A	Organic Amendment and Processing	28.45	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1,740.20	$1,740.20	$49,508.69	8%	9%	$58,282	MII MII Assemblies	
												TOTAL UNIT COST:			$405,199		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW3-9

Alternative 3
Capital Cost Sub-Element
Dust Control

Cost Worksheet: **CW3-9**

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves dust control during implementation of remedial activities at the site.

Cost Analysis:
Cost for Dust Control (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A5A	Dust Control	1,620	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$144.11	$144.11	$233,458.20	8%	9%	$274,827	MII MII Assemblies	
												TOTAL UNIT COST:			$274,827		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW3-10

Alternative 3
Capital Cost Sub-Element
Excavation Area Reclamation

Cost Worksheet: **CW3-10**

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the reclamation of excavation areas. The reclamation would include a 6" growth media layer.

Cost Analysis:
Cost for Reclamation of Excavated Areas (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
	Topsoil Placement																
A15A	Subsoil/Topsoil Placement	19,090	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$4.20	$4.20	$80,178.00	8%	9%	$94,386	MII MII Assemblies	
												TOTAL UNIT COST:			$94,386		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW3-11

Alternative 3
Capital Cost Sub-Element
Revegetation of Reclamation Areas

Cost Worksheet: **CW3-11**

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the revegetation of all the reclamation areas on the site. It includes hydro-seeding with fertilizer and hydromulch.

Cost Analysis:
Cost for Revegetation of Reclamation Areas (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A42A	Hydro-Seeding Crew	21.55	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$123.52	$123.52	$2,661.86	8%	9%	$3,134	MII MII Assemblies	
M8	Seed Mix	21.55	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$144.00	$0.00	$144.00	$3,103.20	8%	9%	$3,653	P Previous Work	Materials only, 32 lbs/acre
M10	Hydromulch	21.55	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$187.50	$0.00	$187.50	$4,040.63	8%	9%	$4,757	P Previous Work	Materials only, 3000 lbs/acre
M9	Fertilizer (N2 and P2O5)	21.55	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$50.07	$0.00	$50.07	$1,079.01	8%	9%	$1,270	P Previous Work	Materials only, 135 lbs/acre
A31A	Lime/Fertilizer- Haul	20	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$10.31	$10.31	$206.20	8%	9%	$243	MII MII Assemblies	1.95 hourcycle time for one truck and that truck holds 20 LCY of lime/fertilizer material.
A68A	Tree Planting	7,193	EA	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.92	$9.92	$71,354.56	8%	9%	$83,999	MII MII Assemblies	
M44	Cedar Tree	1,193	EA	1.00	$0.00	$0.00	$0.00	$0.00	$25.00	$0.00	$25.00	$29,825.00	8%	9%	$35,110	P Previous Work	
M45	Pine Tree	4,000	EA	1.00	$0.00	$0.00	$0.00	$0.00	$25.00	$0.00	$25.00	$100,000.00	8%	9%	$117,720	P Previous Work	
M46	Spruce Tree	2,000	EA	1.00	$0.00	$0.00	$0.00	$0.00	$25.00	$0.00	$25.00	$50,000.00	8%	9%	$58,860	P Previous Work	
												TOTAL UNIT COST:			$308,746		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW3-12

Alternative 3 **Cost Worksheet: CW3-12**
Capital Cost Sub-Element
Surveying for Construction Control

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves cost for site surveying before and after the remedial alternative is constructed.

Cost Analysis:
Cost for Site Surveying (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A63A	Survey	120	DAY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$469.38	$469.38	$56,325.60	8%	9%	$66,306	MII MII Assemblies	
M133	Surveying Report Allowance	1	LS	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5,100.00	$5,100.00	$5,100.00	0%	0%	$5,100	A Allowance	
												TOTAL UNIT COST:			$71,406		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW3-13

Alternative 3
Capital Cost Sub-Element
Permanent Access Road

Cost Worksheet: CW3-13

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the permanent access road construction. Some rock excavation and clearing of forested areas will be required.

Cost Analysis:
Cost for Permanent Access Road (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A51A	Clearing and Grubbing	3	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2,771.62	$2,771.62	$8,869.18	8%	9%	$10,441	MII MII Assemblies	
A45A	Permanent Gravel Access Road Installation	80	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$443.71	$443.71	$35,496.80	8%	9%	$41,787	MII MII Assemblies	
A45AA	Gravel Delivery	3,405	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.69	$5.69	$19,375.30	8%	9%	$22,809	MII MII Assemblies	
M5A	Road Mix, Gravel	4,937	TN	1.00	$0.00	$0.00	$0.00	$0.00	$12.13	$0.00	$12.13	$59,891.48	8%	9%	$70,504	V Vendor Quote	Includes material purchase only
A21A	Compaction - Fill	600	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1.15	$1.15	$690.00	8%	9%	$812	MII MII Assemblies	Compacting embankment and subgrade
												TOTAL UNIT COST:			$146,353		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW3-14

Alternative 3
Capital Cost Sub-Element
Erosion Control

Cost Worksheet: **CW3-14**

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the installation of erosion control at the site.

Cost Analysis:
Cost for Installation of Erosion Control (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A9AA	Excavation	40	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$135.38	$135.38	$5,415.20	8%	9%	$6,375	MII MII Assemblies	Placement of Logs as Erosion Control
	Erosion Control at Facilities																
M41	Silt Fence	4,400	LF	1.00	$1.06	$1.06	$0.00	$0.00	$0.33	$0.00	$1.39	$6,116.00	8%	9%	$7,200	CW RS Means	
M42	Hay Bales	88	LF	1.00	$0.53	$0.53	$0.00	$0.00	$10.72	$0.00	$11.25	$990.00	8%	9%	$1,165	CW RS Means	
M43	Erosion Control Blankets	38,237	SY	1.00	$1.95	$1.95	$0.00	$0.00	$1.05	$0.00	$3.00	$114,711.00	8%	9%	$135,038	CW RS Means	
	Erosion Control at Excavated Areas																
M41	Silt Fence	10,250	LF	1.00	$1.06	$1.06	$0.00	$0.00	$0.33	$0.00	$1.39	$14,247.50	8%	9%	$16,772	CW RS Means	
M42	Hay Bales	205	LF	1.00	$0.53	$0.53	$0.00	$0.00	$10.72	$0.00	$11.25	$2,306.25	8%	9%	$2,715	CW RS Means	
M43	Erosion Control Blankets	39,668	SY	1.00	$1.95	$1.95	$0.00	$0.00	$1.05	$0.00	$3.00	$119,004.00	8%	9%	$140,092	CW RS Means	
	Erosion Control at Borrow Areas																
M41	Silt Fence	5,000	LF	1.00	$1.06	$1.06	$0.00	$0.00	$0.33	$0.00	$1.39	$6,950.00	8%	9%	$8,182	CW RS Means	
M42	Hay Bales	100	LF	1.00	$0.53	$0.53	$0.00	$0.00	$10.72	$0.00	$11.25	$1,125.00	8%	9%	$1,324	CW RS Means	
M43	Erosion Control Blankets	34,267	SY	1.00	$1.95	$1.95	$0.00	$0.00	$1.05	$0.00	$3.00	$102,801.00	8%	9%	$121,017	CW RS Means	
												TOTAL UNIT COST:			$439,880		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW3-15

Alternative 3 **Cost Worksheet:** **CW3-15**
Capital Cost Sub-Element
Mobilization/Demobilization and Preparatory Work

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves mobilization and demobilization of all the required equipment to and from the site respectively. It also includes preparatory work like equipment setup, working pad/area, storage area setup, erosion control and barrier setup etc. It is assumed that mobilization and demobilization would be required only once, i.e. all equipment would be left onsite during the construction off season.

Cost Analysis:
Cost for Mobilization/Demobilization and Preparatory Work (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A58A	Tractor - Heavy Equipment	192	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$110.61	$110.61	$21,237.12	8%	9%	$25,000	MII MII Assemblies	Per heavy equipment per hour
A59A	Tractor - Large Equipment	224	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.68	$105.68	$23,672.32	8%	9%	$27,867	MII MII Assemblies	Per large equipment per hour
A60A	Self-Propelled Equipment	112	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$51.27	$51.27	$5,742.24	8%	9%	$6,760	MII MII Assemblies	Per equipment per hour
A61A	Pilot Car w/Driver	160	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$51.27	$51.27	$8,203.20	8%	9%	$9,657	MII MII Assemblies	Per equipment per hour
												TOTAL UNIT COST:			$69,284		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW3-16

Alternative 3
Capital Cost Sub-Element
Construction of Repository within PMDA

Cost Worksheet: CW3-16

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the construction of a repository within the PMDA to contain excavated mine wastes. The proposed facility within the PMDA would be constructed with 3H:1V side slopes, contain a geosynthetic multi-layer cover system (including low permeability layer, drainage layer, barrier layer, and vegetative layer) over consolidated mine materials, and would include surface water run-on/runoff controls.

Cost Analysis:
Cost of Construction of Repository within PMDA (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A9A	Excavation	17,000	BCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1.17	$1.17	$19,890.00	8%	9%	$23,415	MII MII Assemblies	
A49A	Rough Grading	4,250	BCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.64	$2.64	$11,220.00	8%	9%	$13,208	MII MII Assemblies	Assume 25% of surface area
	Multi-Layer Cover																
M88	Geomembrane	4.4	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$19,602.00	$28,568.24	$48,170.24	$210,985.65	8%	9%	$248,372	V Vendor Quote	Delivered cost
M89	Geotextile	4.4	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$5,227.20	$5,305.57	$10,532.77	$46,133.53	8%	9%	$54,308	V Vendor Quote	Delivered cost
A14A	Drain Layer/Bedding/Layer Placement	12,190	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$4.21	$4.21	$51,319.90	8%	9%	$60,414	MII MII Assemblies	
A23A	Compaction - Bedding Layer	12,190	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1.92	$1.92	$23,404.80	8%	9%	$27,552	MII MII Assemblies	
A17A	Fill Placement - Mass Fill Areas	8,165	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.24	$2.24	$18,289.60	8%	9%	$21,531	MII MII Assemblies	
A21A	Compaction - Fill	8,165	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1.15	$1.15	$9,389.75	8%	9%	$11,054	MII MII Assemblies	Compacting embankment and subgrade
A17AA	Fill Placement - Top Soil	4,025	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.24	$2.24	$9,016.00	8%	9%	$10,614	MII MII Assemblies	
A67A	Fine Grading	21,200	SY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.44	$0.44	$9,328.00	8%	9%	$10,981	MII MII Assemblies	
	Riprap Placement																
A16A	Riprap Placement	4,497	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$25.61	$25.61	$115,168.17	8%	9%	$135,576	MII MII Assemblies	
												TOTAL UNIT COST:			$617,025		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

TABLE CW3-17

Alternative 3 **Cost Worksheet: CW3-17**
Capital Cost Sub-Element
Construction of Repository outside PMDA

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the construction of a repository outside the PMDA to contain excavated mine wastes. The facility would be constructed with 3H:1V side slopes, contain a geosynthetic multi-layer cover system (including low permeability layer, drainage layer, barrier layer, and vegetative layer) over consolidated mine materials, and would include surface water run-on/runoff controls. Additionally, a liner and leachate collection system would be installed at the bottom of the repository to collect leachate from the overlying mine materials.

Cost Analysis:
Cost of Construction of Repository outside PMDA (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A49A	Rough Grading	8,925	BCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.64	$2.64	$23,562.00	8%	9%	$27,737	MII MII Assemblies	Assume 25% of excavated material
	Liner System																
M88	Geomembrane	3.52	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$19,602.00	$28,568.24	$48,170.24	$169,559.24	8%	9%	$199,605	V Vendor Quote	Delivered cost
M89	Geotextile	3.52	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$5,227.20	$5,305.57	$10,532.77	$37,075.35	8%	9%	$43,645	V Vendor Quote	Delivered cost
A14A	Drain Layer/Bedding/Layer Placement	6,555	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$4.21	$4.21	$27,596.55	8%	9%	$32,487	MII MII Assemblies	
A23A	Compaction - Bedding Layer	6,555	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1.92	$1.92	$12,585.60	8%	9%	$14,816	MII MII Assemblies	
A79A	4" HDPE Pipe	825	LF	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$6.43	$6.43	$5,304.75	8%	9%	$6,245	MII MII Assemblies	
M90	4" HDPE Pipe, DR 11	25	LF	1.00	$0.00	$0.00	$0.00	$0.00	$3.05	$0.00	$3.05	$76.25	8%	9%	$90	CW RS Means	
M95	4" HDPE Perf. Pipe	800	LF	1.00	$0.00	$0.00	$0.00	$0.00	$3.05	$0.00	$3.05	$2,440.00	8%	9%	$2,872	CW RS Means	
M91	4" HDPE 90 Deg Elbow	4	EA	1.00	$0.00	$0.00	$0.00	$0.00	$18.70	$0.00	$18.70	$74.80	8%	9%	$88	CW RS Means	
M92	4" HDPE Tee	1	EA	1.00	$0.00	$0.00	$0.00	$0.00	$22.50	$0.00	$22.50	$22.50	8%	9%	$26	CW RS Means	
M93	Welding plastic Labor	2.5	HR	1.00	$0.00	$0.00	$0.00	$0.00	$45.40	$0.00	$45.40	$113.50	8%	9%	$134	CW RS Means	
M94	Plastic Welder Rental	0.5	DY	1.00	$0.00	$0.00	$0.00	$0.00	$45.50	$0.00	$45.50	$22.75	8%	9%	$27	CW RS Means	
M46A	Sump Pump	1	EA	1.00	$0.00	$0.00	$0.00	$0.00	$363.00	$245.00	$608.00	$608.00	8%	9%	$716	CW RS Means	
M46B	100,000 Tank	1	EA	1.00	$0.00	$0.00	$0.00	$0.00	$258,000	$668.00	$258,668.00	$258,668.00	8%	9%	$304,504	CW RS Means	
	Cover System																
M88	Geomembrane	3.52	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$19,602.00	$28,568.24	$48,170.24	$169,559.24	8%	9%	$199,605	V Vendor Quote	Delivered cost
M89	Geotextile	3.52	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$5,227.20	$5,305.57	$10,532.77	$37,075.35	8%	9%	$43,645	V Vendor Quote	Delivered cost
A14A	Drain Layer/Bedding/Layer Placement	9,775	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$4.21	$4.21	$41,152.75	8%	9%	$48,445	MII MII Assemblies	
A23A	Compaction - Bedding Layer	9,775	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1.92	$1.92	$18,768.00	8%	9%	$22,094	MII MII Assemblies	
A17A	Fill Placement - Mass Fill Areas	6,555	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.24	$2.24	$14,683.20	8%	9%	$17,285	MII MII Assemblies	
A21A	Compaction - Fill	6,555	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1.15	$1.15	$7,538.25	8%	9%	$8,874	MII MII Assemblies	Compacting embankment and subgrade
A17AA	Fill Placement - Top Soil	3,220	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.24	$2.24	$7,212.80	8%	9%	$8,491	MII MII Assemblies	
A67A	Fine Grading	17,037	SY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.44	$0.44	$7,496.28	8%	9%	$8,825	MII MII Assemblies	
	Riprap Placement																
A16A	Riprap Placement	2,588	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$25.61	$25.61	$66,278.68	8%	9%	$78,023	MII MII Assemblies	
												TOTAL UNIT COST:			$1,068,279		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

TABLE CW3-18

Alternative 3 **Cost Worksheet: CW3-18**
Annual O&M Cost Sub-Element
Cover and Reclamation Maintenance (Year 1)

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves operations and maintenance pertaining to the upkeep of the cover systems and reclamation areas for Year 1. It includes costs for site inspection, weed control, and reseeding.

Cost Analysis:
Cost for Cover and Reclamation Maintenance - Year 1 (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A44A	Site Inspection Crew	64	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$70.47	$70.47	$4,510.08	100%	9%	$9,832	MII MII Assemblies	
A44AA	Pickup Truck, 1/2 Ton	64	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$11.22	$11.22	$718.08	8%	9%	$845	MII MII Assemblies	
A62A	Cap O&M	20	DAY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$478.12	$478.12	$9,562.40	8%	9%	$11,257	MII MII Assemblies	
A42A	Hydro-Seeding Crew	2.5	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$123.52	$123.52	$308.80	8%	9%	$364	MII MII Assemblies	
M8	Seed Mix	2.5	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$144.00	$0.00	$144.00	$360.00	8%	9%	$424	P Previous Work	Materials only, 32 lbs/acre
M10	Hydromulch	2.5	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$187.50	$0.00	$187.50	$468.75	8%	9%	$552	P Previous Work	Materials only, 3000 lbs/acre
M9	Fertilizer (N2 and P2O5)	2.5	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$50.07	$0.00	$50.07	$125.18	8%	9%	$147	P Previous Work	Materials only, 135 lbs/acre
A31A	Lime/Fertilizer- Haul	20	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$10.31	$10.31	$206.20	8%	9%	$243	MII MII Assemblies	1.95 hourcycle time for one truck and that truck holds 20 LCY of lime/fertilizer material.
												TOTAL UNIT COST:			$23,664		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW3-19

Alternative 3 **Cost Worksheet: CW3-19**
Annual O&M Cost Sub-Element
Cover and Reclamation Maintenance (Year 2)

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves operations and maintenance pertaining to the upkeep of the cover systems and reclamation areas for Year 2. It includes costs for site inspection, weed control, and reseeding.

Cost Analysis:
Cost for Cover and Reclamation Maintenance - Year 2 (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A44A	Site Inspection Crew	64	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$70.47	$70.47	$4,510.08	100%	9%	$9,832	MII MII Assemblies	
A44AA	Pickup Truck, 1/2 Ton	64	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$11.22	$11.22	$718.08	8%	9%	$845	MII MII Assemblies	
A62A	Cap O&M	20	DAY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$478.12	$478.12	$9,562.40	8%	9%	$11,257	MII MII Assemblies	
A42A	Hydro-Seeding Crew	1.5	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$123.52	$123.52	$185.28	8%	9%	$218	MII MII Assemblies	
M8	Seed Mix	1.5	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$144.00	$0.00	$144.00	$216.00	8%	9%	$254	P Previous Work	Materials only, 32 lbs/acre
M10	Hydromulch	1.5	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$187.50	$0.00	$187.50	$281.25	8%	9%	$331	P Previous Work	Materials only, 3000 lbs/acre
M9	Fertilizer (N2 and P2O5)	1.5	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$50.07	$0.00	$50.07	$75.11	8%	9%	$88	P Previous Work	Materials only, 135 lbs/acre
A31A	Lime/Fertilizer- Haul	20	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$10.31	$10.31	$206.20	8%	9%	$243	MII MII Assemblies	1.95 hourcycle time for one truck and that truck holds 20 LCY of lime/fertilizer material.
												TOTAL UNIT COST:			$23,068		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW3-20

Alternative 3 **Cost Worksheet: CW3-20**
Annual O&M Cost Sub-Element
Cover and Reclamation Maintenance (Years 3 through 5)

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves operations and maintenance pertaining to the upkeep of the cover systems and reclamation areas for Years 3 through 5. It includes costs for site inspection and cap maintenance.

Cost Analysis:
Cost for Cover and Reclamation Maintenance - Years 3 through 5 (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A44A	Site Inspection Crew	64	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$70.47	$70.47	$4,510.08	100%	9%	$9,832	MII MII Assemblies	
A44AA	Pickup Truck, 1/2 Ton	64	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$11.22	$11.22	$718.08	8%	9%	$845	MII MII Assemblies	
A62A	Cap O&M	20	DAY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$478.12	$478.12	$9,562.40	8%	9%	$11,257	MII MII Assemblies	
												TOTAL UNIT COST:			$21,934		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW3-21

Alternative 3 | **Cost Worksheet:** **CW3-21**

Annual O&M Cost Sub-Element

Cover and Reclamation Maintenance (Years 6 through 29)

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves operations and maintenance pertaining to the upkeep of the cover systems and reclamation areas for Years 6 through 29. It includes costs for site inspection and cap maintenance.

Cost Analysis:
Cost for Cover and Reclamation Maintenance - Years 6 through 29 (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A44A	Site Inspection Crew	32	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$70.47	$70.47	$2,255.04	100%	9%	$4,916	MII MII Assemblies	
A44AA	Pickup Truck, 1/2 Ton	32	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$11.22	$11.22	$359.04	8%	9%	$423	MII MII Assemblies	
A62A	Cap O&M	10	DAY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$478.12	$478.12	$4,781.20	8%	9%	$5,628	MII MII Assemblies	
												TOTAL UNIT COST:			$10,967		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW3-22		
Alternative 3 **Capital Cost Sub-Element** **Chemical Submergence of Tailings**	**Cost Worksheet: CW3-22**	**COST WORKSHEET**

Site:	Formosa OU1	**Prepared By:**	JN	**Date:**	7/13/2012
Location:	Douglas County, Oregon				
Phase:	Feasibility Study	**Checked By:**	EB	**Date:**	7/16/2012
Base Year:	2013				

Work Statement:
This sub-element involves the chemical submergence of tailings.

Cost Analysis:
Cost for Chemical Submergence of Tailings (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
M135	Chemical Submergance Allowance	1	LS	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$10,000.00	$10,000.00	$10,000.00	0%	0%	$10,000	A Allowance	
												TOTAL UNIT COST:			$10,000		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW3-23

Alternative 3 **Cost Worksheet: CW3-23**
Capital Cost Sub-Element
Revegetation of Covers

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the revegetation of the cover systems. It includes hydro-seeding with fertilizer and hydromulch.

Cost Analysis:
Cost for Revegetation of Covers (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A42A	Hydro-Seeding Crew	7.90	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$123.52	$123.52	$975.81	8%	9%	$1,149	MII MII Assemblies	
M8	Seed Mix	7.90	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$144.00	$0.00	$144.00	$1,137.60	8%	9%	$1,339	P Previous Work	Materials only, 32 lbs/acre
M10	Hydromulch	7.90	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$187.50	$0.00	$187.50	$1,481.25	8%	9%	$1,744	P Previous Work	Materials only, 3000 lbs/acre
M9	Fertilizer (N2 and P2O5)	7.90	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$50.07	$0.00	$50.07	$395.55	8%	9%	$466	P Previous Work	Materials only, 135 lbs/acre
A31A	Lime/Fertilizer- Haul	20	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$10.31	$10.31	$206.20	8%	9%	$243	MII MII Assemblies	1.95 hourcycle time for one truck and that truck holds 20 LCY of lime/fertilizer material.
												TOTAL UNIT COST:			$4,941		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

Cost Worksheets
Alternative 4

TABLE CW4-1

Alternative 4
Capital Cost Sub-Element
Institutional Controls

Cost Worksheet: **CW4-1**

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves implementation of institutional control for the site. The following cost includes hours for a legal procedures and cost for document submission.

Cost Analysis:
Cost for Institutional Controls (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
L7	Environmental Lawyer	500	HR	1.00	$44.67	$44.67	$0.00	$0.00	$0.00	$0.00	$44.67	$22,335.00	100%	9%	$48,690	SE SalaryExpert.com	
L18	Surveyors	250	HR	1.00	$31.69	$31.69	$0.00	$0.00	$0.00	$0.00	$31.69	$7,922.50	100%	9%	$17,271	SE SalaryExpert.com	
L4	Clerks, Typist, Bookkeeper & Receptionist	250	HR	1.00	$19.22	$19.22	$0.00	$0.00	$0.00	$0.00	$19.22	$4,805.00	100%	9%	$10,475	SE SalaryExpert.com	
M36	Supplies, Copying and Shipping Allowance	1	LS	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$34,800.00	$34,800.00	$34,800.00	0%	0%	$34,800	A Allowance	
M131	Document Submission and Recording Allowance	5	EA	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$51.00	$51.00	$255.00	0%	0%	$255	A Allowance	
												TOTAL UNIT COST:			$111,491		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW4-2

Alternative 4
Capital Cost Sub-Element
Engineered Controls

Cost Worksheet: **CW4-2**

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the cost associated with engineered controls on the site. Engineered controls include installation of 3-strand barbed wire fencing (with T-posts and bracing) and warning signs along the perimeter of the disturbed mine area. Access gates are also included.

Cost Analysis:
Cost for Engineered Controls (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
M34	Chain Link Fence	4,455	LF	1.00	$7.63	$7.63	$0.00	$0.00	$6.75	$0.00	$14.38	$64,062.90	8%	9%	$75,415	V Vendor Quote	Assume braces set 150 FT apart
M29	Gate, Latch and Fittings, Double Swing	1	EA	1.00	$572.18	$572.18	$0.00	$0.00	$678.02	$0.00	$1,250.20	$1,250.20	8%	9%	$1,472	V Vendor Quote	
M37A	Signs	6	EA	1.00	$0.00	$0.00	$0.00	$0.00	$24.30	$0.00	$24.30	$145.80	8%	9%	$172	V Vendor Quote	Assume 150 FT apart
												TOTAL UNIT COST:			$77,059		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW4-3

Alternative 4
Capital Cost Sub-Element
5-Year Site Reviews

Cost Worksheet: **CW4-3**

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the 5-year site visits and 5-year site review report. The following cost includes labor, material and shipping costs for site visits and 5-year site review reports.

Cost Analysis:
Cost for 5-Year Site Reviews (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A44A	Site Inspection Crew	20	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$70.47	$70.47	$1,409.40	100%	9%	$3,072	MII MII Assemblies	
A44AA	Pickup Truck, 1/2 Ton	20	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$11.22	$11.22	$224.40	8%	9%	$264	MII MII Assemblies	
L16	Project Manager	40	HR	1.00	$39.48	$39.48	$0.00	$0.00	$0.00	$0.00	$39.48	$1,579.20	100%	9%	$3,443	SE SalaryExpert.com	
L6	Environmental Engineer	120	HR	1.00	$33.51	$33.51	$0.00	$0.00	$0.00	$0.00	$33.51	$4,021.20	100%	9%	$8,766	SE SalaryExpert.com	
L8	Environmental Scientist	160	HR	1.00	$30.92	$30.92	$0.00	$0.00	$0.00	$0.00	$30.92	$4,947.20	100%	9%	$10,785	SE SalaryExpert.com	
L17	Quality Control Engineer	24	HR	1.00	$44.10	$44.10	$0.00	$0.00	$0.00	$0.00	$44.10	$1,058.40	100%	9%	$2,307	SE SalaryExpert.com	
L2	Project Engineer	40	HR	1.00	$42.74	$42.74	$0.00	$0.00	$0.00	$0.00	$42.74	$1,709.60	100%	9%	$3,727	SE SalaryExpert.com	
L4	Clerks, Typist, Bookkeeper & Receptionist	40	HR	1.00	$19.22	$19.22	$0.00	$0.00	$0.00	$0.00	$19.22	$768.80	100%	9%	$1,676	SE SalaryExpert.com	
M27	Copy and Shipping Allowance	1	LS	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2,320.00	$2,320.00	$2,320.00	0%	0%	$2,320	A Allowance	
												TOTAL UNIT COST:			$36,360		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW4-4

Alternative 4
Capital Cost Sub-Element
Excavation of Mine Materials

Cost Worksheet: **CW4-4**

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the excavation of mine materials. It includes costs for labor, material, and equipment.

Cost Analysis:
Cost for Mine Material Excavation (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A9A	Excavation	234,000	BCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1.17	$1.17	$273,780.00	8%	9%	$322,294	MII MII Assemblies	
A12A	Material Loading	269,100	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.36	$0.36	$96,876.00	8%	9%	$114,042	MII MII Assemblies	
												TOTAL UNIT COST:			$436,336		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW4-5

Alternative 4
Capital Cost Sub-Element
Excavation of Borrow Areas

Cost Worksheet: CW4-5

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the excavation of rock and soil from borrow areas. It includes costs for labor, material, and equipment.

Cost Analysis:
Cost for Borrow Material Excavation (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
	Rock Borrow																
A51A	Clearing and Grubbing	0.37	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2,771.62	$2,771.62	$1,025.50	8%	9%	$1,207	MII MII Assemblies	
A8A	Rock Quarrying	12,500	BCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$12.71	$12.71	$158,875.00	8%	9%	$187,028	MII MII Assemblies	
A7AA	Rock Ripping using Dozer	25,556	BCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.34	$2.34	$59,801.04	8%	9%	$70,398	MII MII Assemblies	
A12A	Material Loading	35,605	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.36	$0.36	$12,817.80	8%	9%	$15,089	MII MII Assemblies	
A7A	Jaw Crusher	35,605	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$10.38	$10.38	$369,579.90	8%	9%	$435,069	MII MII Assemblies	
A12A	Material Loading	35,605	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.36	$0.36	$12,817.80	8%	9%	$15,089	MII MII Assemblies	
	Soil Borrow																
A51A	Clearing and Grubbing	2.26	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2,771.62	$2,771.62	$6,263.86	8%	9%	$7,374	MII MII Assemblies	
A9A	Excavation	35,700	BCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1.17	$1.17	$41,769.00	8%	9%	$49,170	MII MII Assemblies	
A12A	Material Loading	41,055	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.36	$0.36	$14,779.80	8%	9%	$17,399	MII MII Assemblies	
A78A	Screening	41,055	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.80	$0.80	$32,844.00	8%	9%	$38,664	MII MII Assemblies	
A12A	Material Loading	41,055	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.36	$0.36	$14,779.80	8%	9%	$17,399	MII MII Assemblies	
												TOTAL UNIT COST:			$853,886		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW4-6

Alternative 4 **Cost Worksheet: CW4-6**
Capital Cost Sub-Element
Transportation of Mine Materials

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves hauling, handling, and disposal of contaminated mine materials. It includes costs for labor, material, and equipment.

Cost Analysis:
Cost for Transportation and Disposal of Mine Material (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A28A	Short Haul	125,350	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.74	$0.74	$92,759.00	8%	9%	$109,196	MII MII Assemblies	Assume 0.5 mile haul
A29A	Repository Haul/Overburden Haul	143,750	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.40	$2.40	$345,000.00	8%	9%	$406,134	MII MII Assemblies	To facility outside of PMDA
A17B	Excavated Material Placement	269,100	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.24	$2.24	$602,784.00	8%	9%	$709,597	MII MII Assemblies	Placement of excavated materials within the repository
												TOTAL UNIT COST:			$1,224,927		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW4-7

Alternative 4
Capital Cost Sub-Element
Transportation of Borrow Material

Cost Worksheet: **CW4-7**

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves hauling and handling of excavated materials from borrow areas. It includes costs for labor, material, and equipment.

Cost Analysis:
Cost for Transportation of Borrow Material (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A29A	Repository Haul/Overburden Haul	76,660	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.40	$2.40	$183,984.00	8%	9%	$216,586	MII MII Assemblies	To facility outside of PMDA
												TOTAL UNIT COST:			$216,586		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW4-8

Alternative 4 **Cost Worksheet:** **CW4-8**
Capital Cost Sub-Element
Lime and Organic Material for Topsoil and Subsoil Amendment

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the required lime and organic material for topsoil and subsoil amendment. Lime (Ag lime) and organic material (yard waste/compost) would be imported to the site.

Cost Analysis:
Cost for Lime and Organic Material for Soil Amendment (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
	Lime for Soil Amendment																
M33	Lime, Material and Delivery	848	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$155.76	$10.31	$166.07	$140,827.36	8%	9%	$165,782	V Vendor Quote	1.95 hourcycle time for one truck and that truck holds 20 LCY of lime.
A25A	Lime Amendment and Processing	28.45	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1,740.20	$1,740.20	$49,508.69	8%	9%	$58,282	MII MII Assemblies	
	Organic Material for Topsoil Amendment																
M33A	Organic Material, Material and Delivery	3,133	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$23.00	$10.31	$33.31	$104,360.23	8%	9%	$122,853	V Vendor Quote	1.95 hourcycle time for one truck and that truck holds 20 LCY of organic material.
A27A	Organic Amendment and Processing	28.45	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1,740.20	$1,740.20	$49,508.69	8%	9%	$58,282	MII MII Assemblies	
												TOTAL UNIT COST:			$405,199		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW4-9

Alternative 4 **Cost Worksheet:** **CW4-9**
Capital Cost Sub-Element
Cement Stabilization of Mine Wastes

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the stabilization of mine wastes using cement.

Cost Analysis:
Cost for Cement Stabilization (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A12A	Material Loading	21,850	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.36	$0.36	$7,866.00	8%	9%	$9,260	MII MII Assemblies	
M87	Portland Cement, Delivered	1,530	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$116.39	$0.00	$116.39	$178,018.51	8%	9%	$209,563	P Previous Work	
A65A	Cement Stabilization	21,850	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.31	$9.31	$203,423.50	8%	9%	$239,470	MII MII Assemblies	
M129	Mobilization/Demobilization of Pugmill Batch Plant	1	EA	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$20,600.00	$20,600.00	$20,600.00	0%	0%	$20,600	A Allowance	
												TOTAL UNIT COST:			$478,893		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW4-10

Alternative 4 **Cost Worksheet: CW4-10**
Capital Cost Sub-Element
Excavation Area Reclamation

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the reclamation of excavation areas. The reclamation would include a 6" growth media layer.

Cost Analysis:
Cost for Reclamation of Excavated Areas (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
	Topsoil Placement																
A15A	Subsoil/Topsoil Placement	19,090	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$4.20	$4.20	$80,178.00	8%	9%	$94,386	MII MII Assemblies	
												TOTAL UNIT COST:			$94,386		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW4-11

Alternative 4 **Cost Worksheet: CW4-11**
Capital Cost Sub-Element
Revegetation of Reclamation Areas

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the revegetation of all reclamation areas on the site. It includes hydro-seeding with fertilizer and hydomulch.

Cost Analysis:
Cost for Revegetation of Reclamation Areas (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A42A	Hydro-Seeding Crew	21.55	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$123.52	$123.52	$2,661.86	8%	9%	$3,134	MII MII Assemblies	
M8	Seed Mix	21.55	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$144.00	$0.00	$144.00	$3,103.20	8%	9%	$3,653	P Previous Work	Materials only, 32 lbs/acre
M10	Hydromulch	21.55	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$187.50	$0.00	$187.50	$4,040.63	8%	9%	$4,757	P Previous Work	Materials only, 3000 lbs/acre
M9	Fertilizer (N2 and P2O5)	21.55	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$50.07	$0.00	$50.07	$1,079.01	8%	9%	$1,270	P Previous Work	Materials only, 135 lbs/acre
A31A	Lime/Fertilizer- Haul	20	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$10.31	$10.31	$206.20	8%	9%	$243	MII MII Assemblies	1.95 hourcycle time for one truck and that truck holds 20 LCY of lime/fertilizer material.
A68A	Tree Planting	7,193	EA	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.92	$9.92	$71,354.56	8%	9%	$83,999	MII MII Assemblies	
M44	Cedar Tree	1,193	EA	1.00	$0.00	$0.00	$0.00	$0.00	$25.00	$0.00	$25.00	$29,825.00	8%	9%	$35,110	P Previous Work	
M45	Pine Tree	4,000	EA	1.00	$0.00	$0.00	$0.00	$0.00	$25.00	$0.00	$25.00	$100,000.00	8%	9%	$117,720	P Previous Work	
M46	Spruce Tree	2,000	EA	1.00	$0.00	$0.00	$0.00	$0.00	$25.00	$0.00	$25.00	$50,000.00	8%	9%	$58,860	P Previous Work	
												TOTAL UNIT COST:			$308,746		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW4-12

Alternative 4
Capital Cost Sub-Element
Surveying for Construction Control

Cost Worksheet: **CW4-12**

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves cost for site surveying before and after the remedial alternative is constructed.

Cost Analysis:
Cost for Site Surveying (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A63A	Survey	120	DAY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$469.38	$469.38	$56,325.60	8%	9%	$66,306	MII MII Assemblies	
M133	Surveying Report Allowance	1	LS	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5,100.00	$5,100.00	$5,100.00	0%	0%	$5,100	A Allowance	
												TOTAL UNIT COST:			$71,406		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW4-13

Alternative 4
Capital Cost Sub-Element
Permanent Access Road

Cost Worksheet: **CW4-13**

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the permanent access road construction. It is assumed that the permanent access road to the site from the north would take approximately 2 weeks of dozer time. The to gravel road base would be imported from offsite sources. Some rock excavation and clearing of forested areas will be required.

Cost Analysis:
Cost for Permanent Access Road (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A51A	Clearing and Grubbing	3	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2,771.62	$2,771.62	$8,869.18	8%	9%	$10,441	MII MII Assemblies	
A45A	Permanent Gravel Access Road Installation	80	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$443.71	$443.71	$35,496.80	8%	9%	$41,787	MII MII Assemblies	
A45AA	Gravel Delivery	3,405	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.69	$5.69	$19,375.30	8%	9%	$22,809	MII MII Assemblies	
M5A	Road Mix, Gravel	4,937	TN	1.00	$0.00	$0.00	$0.00	$0.00	$12.13	$0.00	$12.13	$59,891.48	8%	9%	$70,504	V Vendor Quote	Includes material purchase only
A21A	Compaction - Fill	600	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1.15	$1.15	$690.00	8%	9%	$812	MII MII Assemblies	Compacting embankment and subgrade
												TOTAL UNIT COST:			$146,353		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW4-14

Alternative 4 **Cost Worksheet: CW4-14**
Capital Cost Sub-Element
Mobilization/Demobilization and Preparatory Work

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves mobilization and demobilization of all the required equipment to and from the site respectively. It also includes preparatory work like equipment setup, working pad/area, storage area setup, erosion control and barrier setup etc. It is assumed that mobilization and demobilization would be required only once, i.e. all equipment would be left onsite during the construction off season.

Cost Analysis:
Cost for Mobilization/Demobilization and Preparatory Work (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A58A	Tractor - Heavy Equipment	192	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$110.61	$110.61	$21,237.12	8%	9%	$25,000	MII MII Assemblies	Per heavy equipment per hour
A59A	Tractor - Large Equipment	224	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.68	$105.68	$23,672.32	8%	9%	$27,867	MII MII Assemblies	Per large equipment per hour
A60A	Self-Propelled Equipment	112	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$51.27	$51.27	$5,742.24	8%	9%	$6,760	MII MII Assemblies	Per equipment per hour
A61A	Pilot Car w/Driver	160	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$51.27	$51.27	$8,203.20	8%	9%	$9,657	MII MII Assemblies	Per equipment per hour
												TOTAL UNIT COST:			$69,284		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW4-15

Alternative 4 **Cost Worksheet: CW4-15**
Capital Cost Sub-Element
Construction of Repository outside PMDA

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the construction of a repository outside the PMDA to contain excavated mine wastes. The facility would be constructed with 3H:1V side slopes, contain a geosynthetic multi-layer cover system (including low permeability layer, drainage layer, barrier layer, and vegetative layer) over consolidated mine materials, and would include surface water run-on/runoff controls. Additionally, a liner and leachate collection system would be installed at the bottom of the repository to collect leachate from the overlying mine materials.

Cost Analysis:
Cost for Construction of Repository outside PMDA (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A49A	Rough Grading	8,925	BCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.64	$2.64	$23,562.00	8%	9%	$27,737	MII MII Assemblies	Assume 25% of excavated material
	Liner System																
M88	Geomembrane	3.52	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$19,602.00	$28,568.24	$48,170.24	$169,559.24	8%	9%	$199,605	V Vendor Quote	Delivered cost
M89	Geotextile	3.52	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$5,227.20	$5,305.57	$10,532.77	$37,075.35	8%	9%	$43,645	V Vendor Quote	Delivered cost
A14A	Drain Layer/Bedding/Layer Placement	6,555	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$4.21	$4.21	$27,596.55	8%	9%	$32,487	MII MII Assemblies	
A23A	Compaction - Bedding Layer	6,555	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1.92	$1.92	$12,585.60	8%	9%	$14,816	MII MII Assemblies	
A79A	4" HDPE Pipe	825	LF	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$6.43	$6.43	$5,304.75	8%	9%	$6,245	MII MII Assemblies	
M90	4" HDPE Pipe, DR 11	25	LF	1.00	$0.00	$0.00	$0.00	$0.00	$3.05	$0.00	$3.05	$76.25	8%	9%	$90	CW RS Means	
M95	4" HDPE Perf. Pipe	800	LF	1.00	$0.00	$0.00	$0.00	$0.00	$3.05	$0.00	$3.05	$2,440.00	8%	9%	$2,872	CW RS Means	
M91	4" HDPE 90 Deg Elbow	4	EA	1.00	$0.00	$0.00	$0.00	$0.00	$18.70	$0.00	$18.70	$74.80	8%	9%	$88	CW RS Means	
M92	4" HDPE Tee	1.0	EA	1.00	$0.00	$0.00	$0.00	$0.00	$22.50	$0.00	$22.50	$22.50	8%	9%	$26	CW RS Means	
M93	Welding plastic Labor	2.5	HR	1.00	$0.00	$0.00	$0.00	$0.00	$45.40	$0.00	$45.40	$113.50	8%	9%	$134	CW RS Means	
M94	Plastic Welder Rental	1	DY	1.00	$0.00	$0.00	$0.00	$0.00	$45.50	$0.00	$45.50	$22.75	8%	9%	$27	CW RS Means	
M46A	Sump Pump	1	EA	1.00	$0.00	$0.00	$0.00	$0.00	$363.00	$245.00	$608.00	$608.00	8%	9%	$716	CW RS Means	
M46B	100,000 Tank	1	EA	1.00	$0.00	$0.00	$0.00	$0.00	$258,000	$668.00	$258,668.00	$258,668.00	8%	9%	$304,504	CW RS Means	
	Cover System																
M88	Geomembrane	3.52	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$19,602.00	$28,568.24	$48,170.24	$169,559.24	8%	9%	$199,605	V Vendor Quote	Delivered cost
M89	Geotextile	3.52	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$5,227.20	$5,305.57	$10,532.77	$37,075.35	8%	9%	$43,645	V Vendor Quote	Delivered cost
A14A	Drain Layer/Bedding/Layer Placement	9,775	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$4.21	$4.21	$41,152.75	8%	9%	$48,445	MII MII Assemblies	
A23A	Compaction - Bedding Layer	9,775	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1.92	$1.92	$18,768.00	8%	9%	$22,094	MII MII Assemblies	
A17A	Fill Placement - Mass Fill Areas	6,555	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.24	$2.24	$14,683.20	8%	9%	$17,285	MII MII Assemblies	
A21A	Compaction - Fill	6,555	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1.15	$1.15	$7,538.25	8%	9%	$8,874	MII MII Assemblies	Compacting embankment and subgrade
A17A	Fill Placement - Mass Fill Areas	3,220	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.24	$2.24	$7,212.80	8%	9%	$8,491	MII MII Assemblies	
A67A	Fine Grading	17,037	SY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.44	$0.44	$7,496.28	8%	9%	$8,825	MII MII Assemblies	
	Riprap Placement																
A16A	Riprap Placement	2,588	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$25.61	$25.61	$66,278.68	8%	9%	$78,023	MII MII Assemblies	
												TOTAL UNIT COST:			$1,068,279		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW4-16

Alternative 4 **Cost Worksheet:** **CW4-16**
Capital Cost Sub-Element
Erosion Control

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the installation of erosion control at the site.

Cost Analysis:
Cost for Installation of Erosion Control (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A9AA	Excavation	40	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$135.38	$135.38	$5,415.20	8%	9%	$6,375	MII MII Assemblies	Placement of Logs as Erosion Control
	Erosion Control at Facilities																
M41	Silt Fence	4,400	LF	1.00	$1.06	$1.06	$0.00	$0.00	$0.33	$0.00	$1.39	$6,116.00	8%	9%	$7,200	CW RS Means	
M42	Hay Bales	88	LF	1.00	$0.53	$0.53	$0.00	$0.00	$10.72	$0.00	$11.25	$990.00	8%	9%	$1,165	CW RS Means	
M43	Erosion Control Blankets	38,237	SY	1.00	$1.95	$1.95	$0.00	$0.00	$1.05	$0.00	$3.00	$114,711.00	8%	9%	$135,038	CW RS Means	
	Erosion Control at Excavated Areas																
M41	Silt Fence	10,250	LF	1.00	$1.06	$1.06	$0.00	$0.00	$0.33	$0.00	$1.39	$14,247.50	8%	9%	$16,772	CW RS Means	
M42	Hay Bales	205	LF	1.00	$0.53	$0.53	$0.00	$0.00	$10.72	$0.00	$11.25	$2,306.25	8%	9%	$2,715	CW RS Means	
M43	Erosion Control Blankets	41,611	SY	1.00	$1.95	$1.95	$0.00	$0.00	$1.05	$0.00	$3.00	$124,833.00	8%	9%	$146,953	CW RS Means	
	Erosion Control at Borrow Areas																
M41	Silt Fence	5,000	LF	1.00	$1.06	$1.06	$0.00	$0.00	$0.33	$0.00	$1.39	$6,950.00	8%	9%	$8,182	CW RS Means	
M42	Hay Bales	100	LF	1.00	$0.53	$0.53	$0.00	$0.00	$10.72	$0.00	$11.25	$1,125.00	8%	9%	$1,324	CW RS Means	
M43	Erosion Control Blankets	16,940	SY	1.00	$1.95	$1.95	$0.00	$0.00	$1.05	$0.00	$3.00	$50,820.00	8%	9%	$59,825	CW RS Means	
												TOTAL UNIT COST:			$379,174		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW4-17

Alternative 4
Capital Cost Sub-Element
Construction of Repository within PMDA

Cost Worksheet: **CW4-17**

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the construction of a repository within the PMDA to contain excavated mine wastes. The proposed facility within the PMDA would be constructed with 3H:1V side slopes, contain a geosynthetic multi-layer cover system (including low permeability layer, drainage layer, barrier layer, and vegetative layer) over consolidated mine materials, and would include surface water run-on/runoff controls.

Cost Analysis:
Cost for Construction of Repository within PMDA (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A9A	Excavation	17,000	BCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1.17	$1.17	$19,890.00	8%	9%	$23,415	MII MII Assemblies	
A49A	Rough Grading	4,250	BCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.64	$2.64	$11,220.00	8%	9%	$13,208	MII MII Assemblies	Assume 25% of excavated material
	Multi-Layer Cover																
M88	Geomembrane	4.38	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$19,602.00	$28,568.24	$48,170.24	$210,985.65	8%	9%	$248,372	V Vendor Quote	Delivered cost
M89	Geotextile	4.38	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$5,227.20	$5,305.57	$10,532.77	$46,133.53	8%	9%	$54,308	V Vendor Quote	Delivered cost
A14A	Drain Layer/Bedding/Layer Placement	12,190	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$4.21	$4.21	$51,319.90	8%	9%	$60,414	MII MII Assemblies	
A23A	Compaction - Bedding Layer	12,190	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1.92	$1.92	$23,404.80	8%	9%	$27,552	MII MII Assemblies	
A17A	Fill Placement - Mass Fill Areas	8,165	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.24	$2.24	$18,289.60	8%	9%	$21,531	MII MII Assemblies	
A21A	Compaction - Fill	8,165	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1.15	$1.15	$9,389.75	8%	9%	$11,054	MII MII Assemblies	Compacting embankment and subgrade
A17A	Fill Placement - Mass Fill Areas	4,025	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.24	$2.24	$9,016.00	8%	9%	$10,614	MII MII Assemblies	
A67A	Fine Grading	21,200	SY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.44	$0.44	$9,328.00	8%	9%	$10,981	MII MII Assemblies	
	Riprap Placement																
A16A	Riprap Placement	4,497	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$25.61	$25.61	$115,168.17	8%	9%	$135,576	MII MII Assemblies	
												TOTAL UNIT COST:			$481,449		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW4-18

Alternative 4
Capital Cost Sub-Element
Dewatering of Encapsulation Mound

Cost Worksheet: **CW4-18**

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the dewatering process of the encapsulation mound.

Cost Analysis:
Cost for Dewatering of Encapsulation Mound (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A71A	Dewatering	24	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$61.25	$61.25	$1,470.00	8%	9%	$1,730	MII MII Assemblies	Assumed 3 Days
M89	Geotextile	3	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$5,227.20	$5,305.57	$10,532.77	$31,598.31	8%	9%	$37,198	V Vendor Quote	Delivered cost
M47	Goulds JCU Sludge Pump	1	EA	1.00	$0.00	$0.00	$0.00	$0.00	$47,075.12	$0.00	$47,075.12	$47,075.12	8%	9%	$55,417	V Vendor Quote	3 conductor armored and ground GGC electrical cable
M48A	Pump Barge	1	LS	1.00	$0.00	$0.00	$0.00	$0.00	$19,360.00	$0.00	$19,360.00	$19,360.00	8%	9%	$22,791	P Previous Work	Includes wiring, elbows, piping, deck, and rails
A72A	Dewatering Tank	4.0	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$167.07	$167.07	$668.28	8%	9%	$787	MII MII Assemblies	
M48	50000 Gal Tank	1	LS	1.00	$0.00	$0.00	$0.00	$0.00	$128,000	$0.00	$128,000.00	$128,000.00	8%	9%	$150,682	V Vendor Quote	HDPE pipes, elbows and tees
A73A	Dewatering Bag Filter	4	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$98.88	$98.88	$395.52	8%	9%	$466	MII MII Assemblies	
M53A	Fuel Diesel	55	GAL	1.00	$0.00	$0.00	$0.00	$0.00	$3.13	$0.00	$3.13	$172.15	8%	9%	$203	P Previous Work	Assume 25% of excavated material
A66AA	Liquid Transportation	632,000	GAL	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.02	$0.02	$12,640.00	8%	9%	$14,880	MII MII Assemblies	Assume 25% of excavated material
												TOTAL UNIT COST:			$284,154		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW4-19

Alternative 4
Annual O&M Cost Sub-Element
Cover and Reclamation Maintenance (Year 1)

Cost Worksheet: CW4-19

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves operations and maintenance pertaining to the upkeep of the cover systems and reclamation areas for Year 1. It includes costs for site inspection, weed control, and reseeding.

Cost Analysis:
Cost for Cover and Reclamation Maintenance - Year 1 (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A44A	Site Inspection Crew	64	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$70.47	$70.47	$4,510.08	100%	9%	$9,832	MII MII Assemblies	
A44AA	Pickup Truck, 1/2 Ton	64	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$11.22	$11.22	$718.08	8%	9%	$845	MII MII Assemblies	
A62A	Cap O&M	20	DAY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$478.12	$478.12	$9,562.40	8%	9%	$11,257	MII MII Assemblies	
A42A	Hydro-Seeding Crew	2.5	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$123.52	$123.52	$308.80	8%	9%	$364	MII MII Assemblies	
M8	Seed Mix	2.5	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$144.00	$0.00	$144.00	$360.00	8%	9%	$424	P Previous Work	Materials only, 32 lbs/acre
M10	Hydromulch	2.5	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$187.50	$0.00	$187.50	$468.75	8%	9%	$552	P Previous Work	Materials only, 3000 lbs/acre
M9	Fertilizer (N2 and P2O5)	2.5	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$50.07	$0.00	$50.07	$125.18	8%	9%	$147	P Previous Work	Materials only, 135 lbs/acre
A31A	Lime/Fertilizer- Haul	20	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$10.31	$10.31	$206.20	8%	9%	$243	MII MII Assemblies	1.95 hourcycle time for one truck and that truck holds 20 LCY of lime/fertilizer material.
												TOTAL UNIT COST:			$23,664		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW4-20

Alternative 4 **Cost Worksheet:** **CW4-20**
Annual O&M Cost Sub-Element
Cover and Reclamation Maintenance (Year 2)

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves operations and maintenance pertaining to the upkeep of the cover systems and reclamation areas for Year 2. It includes costs for site inspection, weed control, and reseeding.

Cost Analysis:
Cost for Cover and Reclamation Maintenance - Year 2 (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A44A	Site Inspection Crew	64	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$70.47	$70.47	$4,510.08	100%	9%	$9,832	MII MII Assemblies	
A44AA	Pickup Truck, 1/2 Ton	64	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$11.22	$11.22	$718.08	8%	9%	$845	MII MII Assemblies	
A62A	Cap O&M	20	DAY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$478.12	$478.12	$9,562.40	8%	9%	$11,257	MII MII Assemblies	
A42A	Hydro-Seeding Crew	1.5	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$123.52	$123.52	$185.28	8%	9%	$218	MII MII Assemblies	
M8	Seed Mix	1.5	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$144.00	$0.00	$144.00	$216.00	8%	9%	$254	P Previous Work	Materials only, 32 lbs/acre
M10	Hydromulch	1.5	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$187.50	$0.00	$187.50	$281.25	8%	9%	$331	P Previous Work	Materials only, 3000 lbs/acre
M9	Fertilizer (N2 and P2O5)	1.5	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$50.07	$0.00	$50.07	$75.11	8%	9%	$88	P Previous Work	Materials only, 135 lbs/acre
A31A	Lime/Fertilizer- Haul	20	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$10.31	$10.31	$206.20	8%	9%	$243	MII MII Assemblies	1.95 hourcycle time for one truck and that truck holds 20 LCY of lime/fertilizer material.
												TOTAL UNIT COST:			$23,068		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW4-21

Alternative 4 **Cost Worksheet: CW4-21**
Annual O&M Cost Sub-Element
Cover and Reclamation Maintenance (Years 3 through 5)

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves operations and maintenance pertaining to the upkeep of the cover systems and reclamation areas for Years 3 through 5. It includes costs for site inspection and cap maintenance.

Cost Analysis:
Cost for Cover and Reclamation Maintenance - Year 3 through 5 (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A44A	Site Inspection Crew	64	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$70.47	$70.47	$4,510.08	100%	9%	$9,832	MII MII Assemblies	
A44AA	Pickup Truck, 1/2 Ton	64	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$11.22	$11.22	$718.08	8%	9%	$845	MII MII Assemblies	
A62A	Cap O&M	20	DAY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$478.12	$478.12	$9,562.40	8%	9%	$11,257	MII MII Assemblies	
												TOTAL UNIT COST:			$21,934		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW4-22

Alternative 4 **Cost Worksheet: CW4-22**
Annual O&M Cost Sub-Element
Cover and Reclamation Maintenance (Years 6 through 29)

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves operations and maintenance pertaining to the upkeep of the cover systems and reclamation areas for Years 6 through 29. It includes costs for site inspection and cap maintenance.

Cost Analysis:
Cost for Cover and Reclamation Maintenance - Year 6 through 29 (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A44A	Site Inspection Crew	32	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$70.47	$70.47	$2,255.04	100%	9%	$4,916	MII MII Assemblies	
A44AA	Pickup Truck, 1/2 Ton	32	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$11.22	$11.22	$359.04	8%	9%	$423	MII MII Assemblies	
A62A	Cap O&M	10	DAY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$478.12	$478.12	$4,781.20	8%	9%	$5,628	MII MII Assemblies	
												TOTAL UNIT COST:			$10,967		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW4-23

Alternative 4
Capital Cost Sub-Element
Dust Control

Cost Worksheet: **CW4-23**

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves dust control during implementation of remedial activities at the site.

Cost Analysis:
Cost for Dust Control (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A5A	Dust Control	1,620	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$144.11	$144.11	$233,458.20	8%	9%	$274,827	MII MII Assemblies	
												TOTAL UNIT COST:			$274,827		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW4-24

Alternative 4 **Cost Worksheet:** **CW4-24**
Capital Cost Sub-Element
Revegetation of Covers

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the revegetation of the cover systems. It includes hydro-seeding with fertilizer and hydomulch.

Cost Analysis:
Cost for Revegetation of Covers (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A42A	Hydro-Seeding Crew	7.90	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$123.52	$123.52	$975.81	8%	9%	$1,149	MII MII Assemblies	
M8	Seed Mix	7.90	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$144.00	$0.00	$144.00	$1,137.60	8%	9%	$1,339	P Previous Work	Materials only, 32 lbs/acre
M10	Hydromulch	7.90	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$187.50	$0.00	$187.50	$1,481.25	8%	9%	$1,744	P Previous Work	Materials only, 3000 lbs/acre
M9	Fertilizer (N2 and P2O5)	7.90	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$50.07	$0.00	$50.07	$395.55	8%	9%	$466	P Previous Work	Materials only, 135 lbs/acre
A31A	Lime/Fertilizer- Haul	20	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$10.31	$10.31	$206.20	8%	9%	$243	MII MII Assemblies	1.95 hourcycle time for one truck and that truck holds 20 LCY of lime/fertilizer material.
												TOTAL UNIT COST:			$4,941		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

Cost Worksheets
Alternative 6

TABLE CW6-1

Alternative 6 **Cost Worksheet: CW6-1**
Capital Cost Sub-Element
Institutional Controls

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves implementation of institutional control for the site. The following cost includes hours for a legal procedures and cost for document submission.

Cost Analysis:
Cost for Institutional Controls (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
L7	Environmental Lawyer	500	HR	1.00	$44.67	$44.67	$0.00	$0.00	$0.00	$0.00	$44.67	$22,335.00	100%	9%	$48,690	SE SalaryExpert.com	
L18	Surveyors	250	HR	1.00	$31.69	$31.69	$0.00	$0.00	$0.00	$0.00	$31.69	$7,922.50	100%	9%	$17,271	SE SalaryExpert.com	
L4	Clerks, Typist, Bookkeeper & Receptionist	250	HR	1.00	$19.22	$19.22	$0.00	$0.00	$0.00	$0.00	$19.22	$4,805.00	100%	9%	$10,475	SE SalaryExpert.com	
M36	Supplies, Copying and Shipping Allowance	1	LS	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$34,800.00	$34,800.00	$34,800.00	0%	0%	$34,800	A Allowance	
M131	Document Submission and Recording Allowance	5	EA	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$51.00	$51.00	$255.00	0%	0%	$255	A Allowance	
												TOTAL UNIT COST:			$111,491		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW6-2

Alternative 6 **Cost Worksheet: CW6-2**
Capital Cost Sub-Element
Engineered Controls

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the cost associated with engineered controls on the site. Engineered controls include installation of 3-strand barbed wire fencing (with T-posts and bracing) and warning signs along the perimeter of the disturbed mine area. Access gates are also included.

Cost Analysis:
Cost for Engineered Controls (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
M34	Chain Link Fence	4,600	LF	1.00	$7.63	$7.63	$0.00	$0.00	$6.75	$0.00	$14.38	$66,148.00	8%	9%	$77,869	V Vendor Quote	Assume braces set 150 FT apart
M29	Gate, Latch and Fittings, Double Swing	1	EA	1.00	$572.18	$572.18	$0.00	$0.00	$678.02	$0.00	$1,250.20	$1,250.20	8%	9%	$1,472	V Vendor Quote	
M37A	Signs	6	EA	1.00	$0.00	$0.00	$0.00	$0.00	$24.30	$0.00	$24.30	$145.80	8%	9%	$172	V Vendor Quote	Assume 150 FT apart
												TOTAL UNIT COST:			$79,513		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW6-3

Alternative 6
Capital Cost Sub-Element
5-Year Site Reviews

Cost Worksheet: **CW6-3**

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the 5-year site visits and 5-year site review report. The following cost includes labor, material and shipping costs for site visits and 5-year site review reports.

Cost Analysis:
Cost for 5-Year Site Reviews (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A44A	Site Inspection Crew	20	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$70.47	$70.47	$1,409.40	100%	9%	$3,072	MII MII Assemblies	
A44AA	Pickup Truck, 1/2 Ton	20	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$11.22	$11.22	$224.40	8%	9%	$264	MII MII Assemblies	
L16	Project Manager	40	HR	1.00	$39.48	$39.48	$0.00	$0.00	$0.00	$0.00	$39.48	$1,579.20	100%	9%	$3,443	SE SalaryExpert.com	
L6	Environmental Engineer	120	HR	1.00	$33.51	$33.51	$0.00	$0.00	$0.00	$0.00	$33.51	$4,021.20	100%	9%	$8,766	SE SalaryExpert.com	
L8	Environmental Scientist	160	HR	1.00	$30.92	$30.92	$0.00	$0.00	$0.00	$0.00	$30.92	$4,947.20	100%	9%	$10,785	SE SalaryExpert.com	
L17	Quality Control Engineer	24	HR	1.00	$44.10	$44.10	$0.00	$0.00	$0.00	$0.00	$44.10	$1,058.40	100%	9%	$2,307	SE SalaryExpert.com	
L2	Project Engineer	40	HR	1.00	$42.74	$42.74	$0.00	$0.00	$0.00	$0.00	$42.74	$1,709.60	100%	9%	$3,727	SE SalaryExpert.com	
L4	Clerks, Typist, Bookkeeper & Receptionist	40	HR	1.00	$19.22	$19.22	$0.00	$0.00	$0.00	$0.00	$19.22	$768.80	100%	9%	$1,676	SE SalaryExpert.com	
M27	Copy and Shipping Allowance	1	LS	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2,320.00	$2,320.00	$2,320.00	0%	0%	$2,320	A Allowance	
												TOTAL UNIT COST:			$36,360		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW6-4

Alternative 6
Capital Cost Sub-Element
Excavation of Mine Materials

Cost Worksheet: **CW6-4**

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the excavation of mine materials. It includes costs for labor, material, and equipment.

Cost Analysis:
Cost for Mine Material Excavation (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A9A	Excavation	234,000	BCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1.17	$1.17	$273,780.00	8%	9%	$322,294	MII MII Assemblies	
A12A	Material Loading	269,100	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.36	$0.36	$96,876.00	8%	9%	$114,042	MII MII Assemblies	
												TOTAL UNIT COST:			$436,336		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW6-5

Alternative 6
Capital Cost Sub-Element
Excavation of Borrow Areas

Cost Worksheet: **CW6-5**

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the excavation of rock and soil from borrow areas. It includes costs for labor, material, and equipment.

Cost Analysis:
Cost for Borrow Material Excavation (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
	Rock Borrow																
A51A	Clearing and Grubbing	0.37	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2,771.62	$2,771.62	$1,025.50	8%	9%	$1,207	MII MII Assemblies	
A8A	Rock Quarrying	12,500	BCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$12.71	$12.71	$158,875.00	8%	9%	$187,028	MII MII Assemblies	
A7AA	Rock Ripping using Dozer	25,556	BCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.34	$2.34	$59,801.04	8%	9%	$70,398	MII MII Assemblies	
A12A	Material Loading	27,957	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.36	$0.36	$10,064.52	8%	9%	$11,848	MII MII Assemblies	
A7A	Jaw Crusher	27,957	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$10.38	$10.38	$290,193.66	8%	9%	$341,616	MII MII Assemblies	
A12A	Material Loading	27,957	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.36	$0.36	$10,064.52	8%	9%	$11,848	MII MII Assemblies	
	Soil Borrow																
A51A	Clearing and Grubbing	2.26	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2,771.62	$2,771.62	$6,263.86	8%	9%	$7,374	MII MII Assemblies	
A9A	Excavation	33,000	BCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1.17	$1.17	$38,610.00	8%	9%	$45,452	MII MII Assemblies	
A12A	Material Loading	37,950	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.36	$0.36	$13,662.00	8%	9%	$16,083	MII MII Assemblies	
A78A	Screening	37,950	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.80	$0.80	$30,360.00	8%	9%	$35,740	MII MII Assemblies	
A12A	Material Loading	37,950	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.36	$0.36	$13,662.00	8%	9%	$16,083	MII MII Assemblies	
												TOTAL UNIT COST:			$744,677		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW6-6

Alternative 6 **Cost Worksheet: CW6-6**
Capital Cost Sub-Element
Transportation of Mine Materials

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves hauling, handling, and disposal of contaminated mine materials. It includes costs for labor, material, and equipment.

Cost Analysis:
Cost for Transportation and Disposal of Mine Material (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A29A	Repository Haul/Overburden Haul	269,100	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.40	$2.40	$645,840.00	8%	9%	$760,283	MII MII Assemblies	To facility outside of PMDA
A17B	Excavated Material Placement	269,100	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.24	$2.24	$602,784.00	8%	9%	$709,597	MII MII Assemblies	Placement of excavated materials within the repository
												TOTAL UNIT COST:			$1,469,880		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW6-7

Alternative 6 **Cost Worksheet:** **CW6-7**
Capital Cost Sub-Element
Transportation of Borrow Material

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves hauling and handling of excavated materials from borrow areas. It includes costs for labor, material, and equipment.

Cost Analysis:
Cost for Transportation of Borrow Material (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A29A	Repository Haul/Overburden Haul	65,907	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.40	$2.40	$158,176.80	8%	9%	$186,206	MII MII Assemblies	To facility outside of PMDA
												TOTAL UNIT COST:			$186,206		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW6-8

Alternative 6
Capital Cost Sub-Element
Revegetation of Reclamation Areas

Cost Worksheet: **CW6-8**

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the revegetation of all reclamation areas on the site. It includes hydro-seeding with fertilizer and hydromulch.

Cost Analysis:
Cost for Revegetation of Reclamation Areas (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A42A	Hydro-Seeding Crew	25.93	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$123.52	$123.52	$3,202.87	8%	9%	$3,770	MII MII Assemblies	
M8	Seed Mix	25.93	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$144.00	$0.00	$144.00	$3,733.92	8%	9%	$4,396	P Previous Work	Materials only, 32 lbs/acre
M10	Hydromulch	25.93	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$187.50	$0.00	$187.50	$4,861.88	8%	9%	$5,723	P Previous Work	Materials only, 3000 lbs/acre
M9	Fertilizer (N2 and P2O5)	25.93	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$50.07	$0.00	$50.07	$1,298.32	8%	9%	$1,528	P Previous Work	Materials only, 135 lbs/acre
A31A	Lime/Fertilizer- Haul	20	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$10.31	$10.31	$206.20	8%	9%	$243	MII MII Assemblies	1.95 hourcycle time for one truck and that truck holds 20 LCY of lime/fertilizer material.
A68A	Tree Planting	8,600	EA	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.92	$9.92	$85,312.00	8%	9%	$100,429	MII MII Assemblies	
M44	Cedar Tree	2,700	EA	1.00	$0.00	$0.00	$0.00	$0.00	$25.00	$0.00	$25.00	$67,500.00	8%	9%	$79,461	P Previous Work	
M45	Pine Tree	2,700	EA	1.00	$0.00	$0.00	$0.00	$0.00	$25.00	$0.00	$25.00	$67,500.00	8%	9%	$79,461	P Previous Work	
M46	Spruce Tree	3,200	EA	1.00	$0.00	$0.00	$0.00	$0.00	$25.00	$0.00	$25.00	$80,000.00	8%	9%	$94,176	P Previous Work	
												TOTAL UNIT COST:			$369,187		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

TABLE CW6-9

Alternative 6 **Cost Worksheet: CW6-9**
Capital Cost Sub-Element
Cement Stabilization of Mine Wastes

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the stabilization of mine wastes using cement.

Cost Analysis:
Cost for Cement Stabilization (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A12A	Material Loading	21,850	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.36	$0.36	$7,866.00	8%	9%	$9,260	MII MII Assemblies	
M87	Portland Cement, Delivered	1,530	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$116.39	$0.00	$116.39	$178,018.51	8%	9%	$209,563	P Previous Work	
A65A	Cement Stabilization	21,850	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.31	$9.31	$176,890.00	8%	9%	$208,235	MII MII Assemblies	
M129	Mobilization/Demobilization of Pugmill Batch Plant	1	EA	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$20,600.00	$20,600.00	$20,600.00	0%	0%	$20,600	A Allowance	
												TOTAL UNIT COST:			$447,658		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW6-10

Alternative 6 | **Cost Worksheet: CW6-10**
Capital Cost Sub-Element
Excavation Area Reclamation

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the reclamation of excavation areas. The reclamation would include a 6" growth media layer.

Cost Analysis:
Cost for Reclamation of Excavated Areas (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
	Topsoil Placement																
A15A	Subsoil/Topsoil Placement	23,115	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$4.20	$4.20	$97,083.00	8%	9%	$114,286	MII MII Assemblies	
												TOTAL UNIT COST:			$114,286		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW6-11

Alternative 6 **Cost Worksheet: CW6-11**
Capital Cost Sub-Element
Lime and Organic Material for Topsoil and Subsoil Amendment

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the required lime and organic material for topsoil and subsoil amendment. Lime (Ag lime) and organic material (yard waste/compost) would be imported to the site.

Cost Analysis:
Cost for Lime and Organic Material for Soil Amendment (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
	Lime for Soil Amendment																
M33	Lime, Material and Delivery	925	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$155.76	$10.31	$166.07	$153,614.75	8%	9%	$180,835	V Vendor Quote	1.95 hourcycle time for one truck and that truck holds 20 LCY of lime.
A25A	Lime Amendment and Processing	30.28	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1,740.20	$1,740.20	$52,693.26	8%	9%	$62,031	MII MII Assemblies	
	Organic Material for Topsoil Amendment																
M33A	Organic Material, Material and Delivery	3,323	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$23.00	$10.31	$33.31	$110,689.13	8%	9%	$130,303	V Vendor Quote	1.95 hourcycle time for one truck and that truck holds 20 LCY of organic material.
A27A	Organic Amendment and Processing	30.28	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1,740.20	$1,740.20	$52,693.26	8%	9%	$62,031	MII MII Assemblies	
												TOTAL UNIT COST:			$435,200		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW6-12

Alternative 6
Capital Cost Sub-Element
Surveying for Construction Control

Cost Worksheet: CW6-12

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves cost for site surveying before and after the remedial alternative is constructed.

Cost Analysis:
Cost for Site Surveying (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A63A	Survey	120	DAY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$469.38	$469.38	$56,325.60	8%	9%	$66,306	MII MII Assemblies	
M133	Surveying Report Allowance	1	LS	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5,100.00	$5,100.00	$5,100.00	0%	0%	$5,100	A Allowance	
												TOTAL UNIT COST:			$71,406		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW6-13

Alternative 6
Capital Cost Sub-Element
Permanent Access Road

Cost Worksheet: **CW6-13**

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the permanent access road construction. It is assumed that the permanent access road to the site from the north would take approximately 2 weeks of dozer time. The to gravel road base would be imported from offsite sources. Some rock excavation and clearing of forested areas will be required.

Cost Analysis:
Cost for Permanent Access Road (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A51A	Clearing and Grubbing	4	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2,771.62	$2,771.62	$11,086.48	8%	9%	$13,051	MII MII Assemblies	
A45A	Permanent Gravel Access Road Installation	80	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$443.71	$443.71	$35,496.80	8%	9%	$41,787	MII MII Assemblies	
A45AA	Gravel Delivery	3,405	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5.69	$5.69	$19,375.30	8%	9%	$22,809	MII MII Assemblies	
M5A	Road Mix, Gravel	4,937	TN	1.00	$0.00	$0.00	$0.00	$0.00	$12.13	$0.00	$12.13	$59,891.48	8%	9%	$70,504	V Vendor Quote	Includes material purchase only
A21A	Compaction - Fill	600	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1.15	$1.15	$690.00	8%	9%	$812	MII MII Assemblies	Compacting embankment and subgrade
												TOTAL UNIT COST:			$148,963		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW6-14

Alternative 6 **Cost Worksheet: CW6-14**
Capital Cost Sub-Element
Construction of Repository outside PMDA

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the construction of a repository outside the PMDA to contain excavated mine wastes. The facility would be constructed with 3H:1V side slopes, contain a geosynthetic multi-layer cover system (including low permeability layer, drainage layer, barrier layer, and vegetative layer) over consolidated mine materials, and would include surface water run-on/runoff controls. Additionally, a liner and leachate collection system would be installed at the bottom of the repository to collect leachate from the overlying mine materials.

Cost Analysis:
Cost for Construction of Repository outside PMDA (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A49A	Rough Grading	8,250	BCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.64	$2.64	$21,780.00	8%	9%	$25,639	MII MII Assemblies	Assume 25% of excavated material
	Liner System																
M88	Geomembrane	5.35	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$19,602.00	$28,568.24	$48,170.24	$257,710.78	8%	9%	$303,377	V Vendor Quote	Delivered cost
M89	Geotextile	5.35	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$5,227.20	$5,305.57	$10,532.77	$56,350.32	8%	9%	$66,336	V Vendor Quote	Delivered cost
A14A	Drain Layer/Bedding/Layer Placement	9,890	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$4.21	$4.21	$41,636.90	8%	9%	$49,015	MII MII Assemblies	
A23A	Compaction - Bedding Layer	9,890	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1.92	$1.92	$18,988.80	8%	9%	$22,354	MII MII Assemblies	
A79A	4" HDPE Pipe	1,025	LF	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$6.43	$6.43	$6,590.75	8%	9%	$7,759	MII MII Assemblies	
M90	4" HDPE Pipe, DR 11	25	LF	1.00	$0.00	$0.00	$0.00	$0.00	$3.05	$0.00	$3.05	$76.25	8%	9%	$90	CW RS Means	
M95	4" HDPE Perf. Pipe	1,000	LF	1.00	$0.00	$0.00	$0.00	$0.00	$3.05	$0.00	$3.05	$3,050.00	8%	9%	$3,590	CW RS Means	
M91	4" HDPE 90 Deg Elbow	4	EA	1.00	$0.00	$0.00	$0.00	$0.00	$18.70	$0.00	$18.70	$74.80	8%	9%	$88	CW RS Means	
M92	4" HDPE Tee	1	EA	1.00	$0.00	$0.00	$0.00	$0.00	$22.50	$0.00	$22.50	$22.50	8%	9%	$26	CW RS Means	
M93	Welding plastic Labor	3.5	HR	1.00	$0.00	$0.00	$0.00	$0.00	$45.40	$0.00	$45.40	$158.90	8%	9%	$187	CW RS Means	
M94	Plastic Welder Rental	1	DY	1.00	$0.00	$0.00	$0.00	$0.00	$45.50	$0.00	$45.50	$45.50	8%	9%	$54	CW RS Means	
M46A	Sump Pump	1	EA	1.00	$0.00	$0.00	$0.00	$0.00	$363.00	$245.00	$608.00	$608.00	8%	9%	$716	CW RS Means	
M46B	100,000 Tank	1	EA	1.00	$0.00	$0.00	$0.00	$0.00	$258,000	$668.00	$258,668.00	$258,668.00	8%	9%	$304,504	CW RS Means	
	Cover System																
M88	Geomembrane	5.35	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$19,602.00	$28,568.24	$48,170.24	$257,710.78	8%	9%	$303,377	V Vendor Quote	Delivered cost
M89	Geotextile	5.35	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$5,227.20	$5,305.57	$10,532.77	$56,350.32	8%	9%	$66,336	V Vendor Quote	Delivered cost
A14A	Drain Layer/Bedding/Layer Placement	14,835	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$4.21	$4.21	$62,455.35	8%	9%	$73,522	MII MII Assemblies	
A23A	Compaction - Bedding Layer	14,835	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1.92	$1.92	$28,483.20	8%	9%	$33,530	MII MII Assemblies	
A17A	Fill Placement - Mass Fill Areas	9,890	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.24	$2.24	$22,153.60	8%	9%	$26,079	MII MII Assemblies	
A21A	Compaction - Fill	9,890	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1.15	$1.15	$11,373.50	8%	9%	$13,389	MII MII Assemblies	Compacting embankment and subgrade
A17A	Fill Placement - Mass Fill Areas	4,945	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.24	$2.24	$11,076.80	8%	9%	$13,040	MII MII Assemblies	
A67A	Fine Grading	25,894	SY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.44	$0.44	$11,393.36	8%	9%	$13,412	MII MII Assemblies	
	Riprap Placement																
A16A	Riprap Placement	3,232	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$25.61	$25.61	$82,771.52	8%	9%	$97,439	MII MII Assemblies	
												TOTAL UNIT COST:			$1,423,859		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:

FACTOR:	NOTES:
H&S Productivity (labor and equipment only)	Field work will be in Level "D" PPE. MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW6-15

Alternative 6
Capital Cost Sub-Element
Erosion Control

Cost Worksheet: **CW6-15**

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the installation of erosion control at the site.

Cost Analysis:
Cost for Erosion Control (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A9AA	Excavation	40	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$135.38	$135.38	$5,415.20	8%	9%	$6,375	MII MII Assemblies	Placement of Logs as Erosion Control
	Erosion Control at Facilities																
M41	Silt Fence	4,400	LF	1.00	$1.06	$1.06	$0.00	$0.00	$0.33	$0.00	$1.39	$6,116.00	8%	9%	$7,200	CW RS Means	
M42	Hay Bales	88	LF	1.00	$0.53	$0.53	$0.00	$0.00	$10.72	$0.00	$11.25	$990.00	8%	9%	$1,165	CW RS Means	
M43	Erosion Control Blankets	25,894	SY	1.00	$1.95	$1.95	$0.00	$0.00	$1.05	$0.00	$3.00	$77,682.00	8%	9%	$91,447	CW RS Means	
	Erosion Control at Excavated Areas																
M41	Silt Fence	10,250	LF	1.00	$1.06	$1.06	$0.00	$0.00	$0.33	$0.00	$1.39	$14,247.50	8%	9%	$16,772	CW RS Means	
M42	Hay Bales	205	LF	1.00	$0.53	$0.53	$0.00	$0.00	$10.72	$0.00	$11.25	$2,306.25	8%	9%	$2,715	CW RS Means	
M43	Erosion Control Blankets	41,611	SY	1.00	$1.95	$1.95	$0.00	$0.00	$1.05	$0.00	$3.00	$124,833.00	8%	9%	$146,953	CW RS Means	
	Erosion Control at Borrow Areas																
M41	Silt Fence	5,000	LF	1.00	$1.06	$1.06	$0.00	$0.00	$0.33	$0.00	$1.39	$6,950.00	8%	9%	$8,182	CW RS Means	
M42	Hay Bales	100	LF	1.00	$0.53	$0.53	$0.00	$0.00	$10.72	$0.00	$11.25	$1,125.00	8%	9%	$1,324	CW RS Means	
M43	Erosion Control Blankets	25,894	SY	1.00	$1.95	$1.95	$0.00	$0.00	$1.05	$0.00	$3.00	$77,682.00	8%	9%	$91,447	CW RS Means	
												TOTAL UNIT COST:			$373,580		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW6-16

Alternative 6 **Cost Worksheet: CW6-16**
Capital Cost Sub-Element
Mobilization/Demobilization and Preparatory Work

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves mobilization and demobilization of all the required equipment to and from the site respectively. It also includes preparatory work like equipment setup, working pad/area, storage area setup, erosion control and barrier setup etc. It is assumed that mobilization and demobilization would be required only once, i.e. all equipment would be left onsite during the construction off season.

Cost Analysis:
Cost for Mobilization/Demobilization and Preparatory Work (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A58A	Tractor - Heavy Equipment	192	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$110.61	$110.61	$21,237.12	8%	9%	$25,000	MII MII Assemblies	Per heavy equipment per hour
A59A	Tractor - Large Equipment	224	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$105.68	$105.68	$23,672.32	8%	9%	$27,867	MII MII Assemblies	Per large equipment per hour
A60A	Self-Propelled Equipment	112	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$51.27	$51.27	$5,742.24	8%	9%	$6,760	MII MII Assemblies	Per equipment per hour
A61A	Pilot Car w/Driver	160	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$51.27	$51.27	$8,203.20	8%	9%	$9,657	MII MII Assemblies	Per equipment per hour
												TOTAL UNIT COST:			$69,284		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW6-17

Alternative 6 **Cost Worksheet: CW6-17**
Annual O&M Cost Sub-Element
Cover and Reclamation Maintenance (Year 1)

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves operations and maintenance pertaining to the upkeep of the cover systems and reclamation areas for Year 1. It includes costs for site inspection, weed control, and reseeding.

Cost Analysis:
Cost for Cover and Reclamation Maintenance - Year 1 (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A44A	Site Inspection Crew	64	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$70.47	$70.47	$4,510.08	100%	9%	$9,832	MII MII Assemblies	
A44AA	Pickup Truck, 1/2 Ton	64	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$11.22	$11.22	$718.08	8%	9%	$845	MII MII Assemblies	
A62A	Cap O&M	20	DAY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$478.12	$478.12	$9,562.40	8%	9%	$11,257	MII MII Assemblies	
A42A	Hydro-Seeding Crew	2.5	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$123.52	$123.52	$308.80	8%	9%	$364	MII MII Assemblies	
M8	Seed Mix	2.5	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$144.00	$0.00	$144.00	$360.00	8%	9%	$424	P Previous Work	Materials only, 32 lbs/acre
M10	Hydromulch	2.5	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$187.50	$0.00	$187.50	$468.75	8%	9%	$552	P Previous Work	Materials only, 3000 lbs/acre
M9	Fertilizer (N2 and P2O5)	2.5	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$50.07	$0.00	$50.07	$125.18	8%	9%	$147	P Previous Work	Materials only, 135 lbs/acre
A31A	Lime/Fertilizer- Haul	20	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$10.31	$10.31	$206.20	8%	9%	$243	MII MII Assemblies	1.95 hourcycle time for one truck and that truck holds 20 LCY of lime/fertilizer material.
												TOTAL UNIT COST:			$23,664		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW6-18		
Alternative 6 **Annual O&M Cost Sub-Element** **Cover and Reclamation Maintenance (Year 2)**	**Cost Worksheet: CW6-18**	**COST WORKSHEET**

Site:	Formosa OU1	**Prepared By:** JN	**Date:** 7/13/2012
Location:	Douglas County, Oregon		
Phase:	Feasibility Study	**Checked By:** EB	**Date:** 7/16/2012
Base Year:	2013		

Work Statement:
This sub-element involves operations and maintenance pertaining to the upkeep of the cover systems and reclamation areas for Year 2. It includes costs for site inspection, weed control, and reseeding.

Cost Analysis:
Cost for Cover and Reclamation Maintenance - Year 2 (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A44A	Site Inspection Crew	64	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$70.47	$70.47	$4,510.08	100%	9%	$9,832	MII MII Assemblies	
A44AA	Pickup Truck, 1/2 Ton	64	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$11.22	$11.22	$718.08	8%	9%	$845	MII MII Assemblies	
A62A	Cap O&M	20	DAY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$478.12	$478.12	$9,562.40	8%	9%	$11,257	MII MII Assemblies	
A42A	Hydro-Seeding Crew	1.5	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$123.52	$123.52	$185.28	8%	9%	$218	MII MII Assemblies	
M8	Seed Mix	1.5	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$144.00	$0.00	$144.00	$216.00	8%	9%	$254	P Previous Work	Materials only, 32 lbs/acre
M10	Hydromulch	1.5	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$187.50	$0.00	$187.50	$281.25	8%	9%	$331	P Previous Work	Materials only, 3000 lbs/acre
M9	Fertilizer (N2 and P2O5)	1.5	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$50.07	$0.00	$50.07	$75.11	8%	9%	$88	P Previous Work	Materials only, 135 lbs/acre
A31A	Lime/Fertilizer- Haul	20	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$10.31	$10.31	$206.20	8%	9%	$243	MII MII Assemblies	1.95 hourcycle time for one truck and that truck holds 20 LCY of lime/fertilizer material.
												TOTAL UNIT COST:			$23,068		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW6-19

Alternative 6 | **Cost Worksheet:** **CW6-19**
Annual O&M Cost Sub-Element
Cover and Reclamation Maintenance (Years 3 through 5)

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves operations and maintenance pertaining to the upkeep of the cover systems and reclamation areas for Years 3 through 5. It includes costs for site inspection and cap maintenance.

Cost Analysis:
Cost for Cover and Reclamation Maintenance - Years 3 through 5 (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A44A	Site Inspection Crew	64	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$70.47	$70.47	$4,510.08	100%	9%	$9,832	MII MII Assemblies	
A44AA	Pickup Truck, 1/2 Ton	64	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$11.22	$11.22	$718.08	8%	9%	$845	MII MII Assemblies	
A62A	Cap O&M	20	DAY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$478.12	$478.12	$9,562.40	8%	9%	$11,257	MII MII Assemblies	
												TOTAL UNIT COST:			$21,934		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW6-20

Alternative 6 **Cost Worksheet: CW6-20**
Annual O&M Cost Sub-Element
Cover and Reclamation Maintenance (Years 6 through 29)

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves operations and maintenance pertaining to the upkeep of the cover systems and reclamation areas for Years 6 through 29. It includes costs for site inspection and cap maintenance.

Cost Analysis:
Cost for Cover and Reclamation Maintenance - Years 6 through 29 (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A44A	Site Inspection Crew	32	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$70.47	$70.47	$2,255.04	100%	9%	$4,916	MII MII Assemblies	
A44AA	Pickup Truck, 1/2 Ton	32	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$11.22	$11.22	$359.04	8%	9%	$423	MII MII Assemblies	
A62A	Cap O&M	10	DAY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$478.12	$478.12	$4,781.20	8%	9%	$5,628	MII MII Assemblies	
												TOTAL UNIT COST:			$10,967		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW6-21

Alternative 6
Annual O&M Cost Sub-Element
Dewatering of Encapsulation Mound

Cost Worksheet: **CW6-21**

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the dewatering of the encapsulation mound.

Cost Analysis:
Cost for Dewatering of Encapsulation Mound (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A71A	Dewatering	24	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$61.25	$61.25	$1,470.00	8%	9%	$1,730	MII MII Assemblies	Assumed 3 Days
M89	Geotextile	3	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$5,227.20	$5,305.57	$10,532.77	$31,598.31	8%	9%	$37,198	V Vendor Quote	Delivered cost
M47	Goulds JCU Sludge Pump	1	EA	1.00	$0.00	$0.00	$0.00	$0.00	$47,075.12	$0.00	$47,075.12	$47,075.12	8%	9%	$55,417	V Vendor Quote	3 conductor armored and ground GGC electrical cable
M48A	Pump Barge	1	LS	1.00	$0.00	$0.00	$0.00	$0.00	$19,360.00	$0.00	$19,360.00	$19,360.00	8%	9%	$22,791	P Previous Work	Includes wiring, elbows, piping, deck, and rails
A72A	Dewatering Tank	4	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$167.07	$167.07	$668.28	8%	9%	$787	MII MII Assemblies	
M48	50000 Gal Tank	1	LS	1.00	$0.00	$0.00	$0.00	$0.00	$128,000	$0.00	$128,000.00	$128,000.00	8%	9%	$150,682	V Vendor Quote	HDPE pipes, elbows and tees
A73A	Dewatering Bag Filter	8	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$98.88	$98.88	$791.04	8%	9%	$931	MII MII Assemblies	
M53A	Fuel Diesel	55	GAL	1.00	$0.00	$0.00	$0.00	$0.00	$3.13	$0.00	$3.13	$172.15	8%	9%	$203	P Previous Work	Diesel for pumps, generators
A66AA	Liquid Transportation	632,000	GAL	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.02	$0.02	$12,640.00	8%	9%	$14,880	MII MII Assemblies	Based off of 650,000 GAL
												TOTAL UNIT COST:			$284,619		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW6-22

Alternative 6
Capital Cost Sub-Element
Dust Control

Cost Worksheet: **CW6-22**

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves dust control during implementation of remedial activities at the site.

Cost Analysis:
Cost for Dust Control (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A5A	Dust Control	1,620	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$144.11	$144.11	$233,458.20	8%	9%	$274,827	MII MII Assemblies	
												TOTAL UNIT COST:			$274,827		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	NOTES:
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

TABLE CW6-23

Alternative 6 | **Cost Worksheet: CW6-23**
Capital Cost Sub-Element
Revegetation of Covers

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This sub-element involves the revegetation of the cover systems. It includes hydro-seeding with fertilizer and hydromulch.

Cost Analysis:
Cost for Revegetation of Covers (Lump Sum)

COST DATABASE CODE	DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	PC OH	PC PF	BUR LIC	COST SOURCE CITATION	COMMENTS
A42A	Hydro-Seeding Crew	5.35	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$123.52	$123.52	$660.83	8%	9%	$778	MII MII Assemblies	
M8	Seed Mix	5.35	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$144.00	$0.00	$144.00	$770.40	8%	9%	$907	P Previous Work	Materials only, 32 lbs/acre
M10	Hydromulch	5.35	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$187.50	$0.00	$187.50	$1,003.13	8%	9%	$1,181	P Previous Work	Materials only, 3000 lbs/acre
M9	Fertilizer (N2 and P2O5)	5.35	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$50.07	$0.00	$50.07	$267.87	8%	9%	$315	P Previous Work	Materials only, 135 lbs/acre
A31A	Lime/Fertilizer- Haul	20	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$10.31	$10.31	$206.20	8%	9%	$243	MII MII Assemblies	1.95 hourcycle time for one truck and that truck holds 20 LCY of lime/fertilizer material.
												TOTAL UNIT COST:			$3,424		

Notes:
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
The Cost Database Code is a reference code for linking with line item cost information with the cost source database and is not otherwise used within these cost worksheets.

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
MII (MII Assemblies), GSA (www.gsa.gov), SE (www.salaryexpert.com), A (Allowance), V (Vendor Quote), CW (Means CostWorks 2012), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:	**NOTES:**
FACTOR:	Field work will be in Level "D" PPE.
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	2012 cost sources are not escalated (EF=1.00). All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Mar 2012
Area Cost Factor	An AF of 1.05 is used for Oregon, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 8% and profit is 9% for the Prime Contractor. Professional labor overhead is 100%. Allowances and items with mandated costs such as per diem do not have overhead and profit applied.

Abbreviations:

QTY	Quantity	ACR	Acres
EQUIP	Equipment	BCY	Bank Cubic Yard
MATL	Material	CLF	100 Linear Foot
HPF	HTRW Productivity Factor	DY	Days
ADJ LABOR	Adjusted Labor for HFP	EA	Each
ADJ EQUIP	Adjusted Equipment for HFP	LF	Linear Foot
UNMOD UC	Unmodified Unit Cost	HR	Hours
UNMOD LIC	Unmodified Line Item Cost	LB	Pounds
UNBUR LIC	Unburdened Line Item Cost	LCY	Loose Cubic Yard
PC OH	Prime Contractor Overhead	LS	Lump Sum
PC PF	Prime Contractor Profit	RL	Roll
BUR LIC	Burdened Line Item Cost	SY	Square Yard
		TN	Tons

Calculations

TABLE CA-1

Alternative 2
Calculation Worksheet
Contaminated Fill Material Balances

COST WORKSHEET

Site:	Formosa OU1	**Prepared By:** JN	**Date:** 7/13/2012
Location:	Douglas County, Oregon		
Phase:	Feasibility Study	**Checked By:** EB	**Date:** 7/16/2012
Base Year:	2013		

Work Statement:
This calculation sheet allows the user to define the volume of contaminated fill removed from various subareas. Changes to the input fields on this calculation sheet will also change the quantities and types of materials for amendment of soils and the resulting capital costs.

Contaminated Fill Material Balances

Remediation Subarea Name	Estimated In-Place Volume (BCY)	Expansion Factor	Estimated In-Place Lose Volume (LCY)	Relocated Within PMDA (BCY)	Volume Relocated Within PMDA (LCY)	Volume Relocated Outside PMDA (BCY)	Volume Relocated to Existing Facility (BCY)
Encapsulation Mound (EM) Waste Rock/Soil	21,000	1.15	24,200	0	0	0	0
EM Tailings	19,000	1.15	21,900	0	0	0	0
East EM Waste Rock Dump	0	1.15	0	32,000	36,800	0	0
Formosa 1 and Formosa 3 Adit Waste Rock Dump	0	1.15	0	25,000	28,750	0	0
Mine Materials Along the Upper Side slopes of the EM	0	1.15	0	8,000	9,200	0	0
Road Areas to Accommodate Pavement cover	0	1.15	0	4,000	4,600	0	0
Adit Drainage Affected Soil	0	1.15	0	3,000	3,450	0	0
All other Mine materials	122,000	1.15	140,300	0	0	0	0
TOTALS:	**162,000**		**186,400**	**72,000**	**82,800**	**0**	**0**

Notes:
Input fields are denoted by a dashed line. Do not overwrite information not contained within the dashed lines.

TABLE CA-2

Alternative 2
Calculation Worksheet
Beneficial Fill Material Balances

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This calculation sheet allows the user to define the volume of beneficial fill (subsoil and topsoil) and the volume of riprap generated. Changes to the input fields on this calculation sheet will also change the quantities and types of materials for amendment of soils and cover construction, reclamation, and the resulting capital costs.

Beneficial Fill Material Balances

Remediation Subarea Name	Waste Rock, Fill, or Stockpile Name	Estimated In-Place Volume (BCY)	Expansion Factor	Estimated In-Place Volume (LCY)	Estimated Available Onsite Neutralization Material (BCY)	Estimated Available Onsite Subsoil Volume (BCY)	Estimated Available Onsite Topsoil Volume (BCY)	Estimated Available Onsite Drain Layer Material Volume (BCY)	Estimated Available Onsite Riprap Volume (BCY)	Beneficial Soil Resources Left In-Place (BCY)
Expansion of Proposed Facility within PMDA	Rock Borrow	12,500	1.15	14,375	0	0	0	8,590	3,910	0
Access Road Construction	Rock Borrow	11,871	1.15	13,652	0	0	0	13,652	0	0
Middle Creek Borrow Area	Gravelly, Gravelly Clay Loam	200,000	1.15	230,000	0	172,000	28,000	0	0	0
Proposed Facility Outside PMDA	Gravelly, Gravelly Clay Loam	28,500	1.15	32,775	0	28,500	0	0	0	0
TOTALS:		**252,871**		**290,802**	**0**	**200,500**	**28,000**	**22,242**	**3,910**	**0**

Notes:
Input fields are denoted by a dashed line. Do not overwrite information not contained within the dashed lines.

TABLE CA-3

Alternative 2
Calculation Worksheet
Required Materials Input Calculations

COST WORKSHEET

Site:	Formosa OU1	**Prepared By:** JN	**Date:** 7/13/2012
Location:	Douglas County, Oregon		
Phase:	Feasibility Study	**Checked By:** EB	**Date:** 7/16/2012
Base Year:	2013		

Work Statement:
This calculation sheet allows the user to define the thicknesses of covers and reclamation, and amendment rates of the soil materials. The spreadsheet also allow the user to change the quantities of earthwork, road building, and drainage system components. Changes to the input fields on this calculation sheet will also change the quantities and types of materials for amendment of soils and cover construction and reclamation and the resulting capital costs.

Input Fields- Required Materials

Cover-Cap Components	Surface Area (AC)	Drain Layer Thickness (IN)	Subsoil Thickness (IN)	Growth Media Thickness (IN)
Geosynthetic Multi-Layer Cover - Within PMDA	**4.38**	**18**	**12**	**6**
Exposure Barriers	**11.77**		**12**	**12**
Excavation Areas Reclamation	**6.80**		**0**	**6**
TOTAL	22.95			

Drainage System Components on Cover	Width/Length (FT)	Area (SF)
Riprap for Drop Shutes - Within PMDA	30	
Riprap Sectional Area (10' x 1.5')		15.0
Riprap for Perimeter Drainage Channel - Within PMDA	2,800	
Riprap Sectional Area (25' x 1.5')		37.5

Amendment Components	Amendment Rate (TON/AC-FT)	Application Rate (LB/AC)
Lime for Parent Surface Amendment by Ripping	80	
Compost for Topsoil Amendment	230	
Fertilizer Amendment for Topsoil		135
Hydromulching		3,000
Seed Mix for Topsoil Areas		32

Area for Asphalt Cover	Area (AC)	Volume (BCY)	Volume (LCY)	Weight (TON)
Existing Access Road to Remain	1.98			
Volume of Excavation for Asphalt Cover		3,195	3,675	
Volume of 3/4" Road Base (4" Thick)		1,065	1,225	1,777
Volume of Asphalt (8" Thick)		2,130	2,450	

Restoration Components	Amendment Rate (trees/AC)
Reforestation	350

Access Road Construction Preparation		
Width of Road	FT	20
Excavation Cut Area (Assume 2:1 Hillside)	SF	100
Length of Road	FT	3,205
Area to be Cleared and Grubbed	SF	64,100
Amount of Cut and Fill Material to be Removed by Dozer	%	100%
Volume of Cut and Fill Material	BCF	320,500
	BCY	**11,871**

Rough grading		
Length of Road	FT	3,205
Width of Road	FT	20
Cut and Fill	FT	1
Volume of Material to Graded	BCF	64,100
	BCY	**2,375**

Access Road Construction Components	Length (FT)	Width (FT)	Thickness (IN)	Percentage of Loose Gravel Compacted	Quantity	Volume of Gravel/Fill (BCY)
Gravel Road Base	3,205	20	6.0	20.0%		1,190
Ditch	6,900	2	8.0			350
Class 6 Bedding Material for Culvert (24" Diameter)	30.0	5	3.0		8	12
Fill for Culvert (24" Diameter)	30.0	5	48.0		8	39

Subsoil and Topsoil Material From Borrow Sources	Area (AC)	Area (SY)	Depth (IN)	Clearing and Grubbing (%)
Surface Area Required to be Disturbed - Potential Repository Outside PMDA	3.52	17,037		50%
Surface Area Required to be Disturbed - Borrow Source	1.00	4,840		50%
Assume Topsoil Overburden:			60	
Expansion of Proposed Facility within PMDA	0.37	1,791		100%

Notes:
Input fields are denoted by a dashed line. Do not overwrite information not contained within the dashed lines.

It is assumed that the Subcontractor shall be able to necessary construction materials through screening of onsite borrow sources.

TABLE CA-4

Alternative 2
Calculation Worksheet
Required Materials Output Calculations

COST WORKSHEET

Site:	Formosa OU1	**Prepared By:** JN	**Date:** 7/13/2012
Location:	Douglas County, Oregon		
Phase:	Feasibility Study	**Checked By:** EB	**Date:** 7/16/2012
Base Year:	2013		

Work Statement:
This calculation output sheet allows the user to calculate the volume of various material required for cover construction and reclamation. Changes to the input fields on this calculation sheet will also change the quantities and types of materials for amendment of soils and cover construction, reclamation, and the resulting capital costs.

Output Fields-Required Materials

Remedy Components	Estimated Required Subsoil Volume (BCY)	Estimated Required Subsoil Volume (LCY)	Estimated Required Topsoil Volume (BCY)	Estimated Required Topsoil Volume (LCY)	Estimated Required Drain Layer Volume (BCY)	Estimated Required Drain Layer Volume (LCY)	Surface Area (AC)	Surface Area (SY)	Surface Area (SF)
Geosynthetic Multi-Layer Cover - Within PMDA	7,100	8,165	3,500	4,025	10,600	12,190	4.4	21,200	190,793
Exposure Barriers	19,000	21,850	19,000	21,850	0	0	11.8	56,967	512,701
Excavation Areas Reclamation	0	0	5,500	6,325			6.8	32,912	296,208
Total	**26,100**	**30,015**	**28,000**	**32,200**	**10,600**	**12,190**	**23.0**	**111,079**	**999,702**

Restoration Component	Quantity (Trees)
Reforestation	2,380

TABLE CA-5

Alternative 2
Calculation Worksheet
Required Materials Output Calculations

COST WORKSHEET

Site:	Formosa OU1	**Prepared By:** JN	**Date:** 7/13/2012
Location:	Douglas County, Oregon		
Phase:	Feasibility Study	**Checked By:** EB	**Date:** 7/16/2012
Base Year:	2013		

Work Statement:
This calculation output sheet allows the user to calculate the volumes of various material required for cover construction, benches, access road and beneficial material balance. Changes to the input fields on this calculation sheet will also change the quantities and types of materials for amendment of soils and cover construction, reclamation, and the resulting capital costs.

Output Fields-Required Materials

Remedy Components	Seed Mix for Topsoil Areas (LB)	Drain Layer Volume (BCY)	Drain Layer Volume for Crushing (LCY)	Fertilizer for Topsoil Areas (LB)	Hydromulching for Topsoil Areas (LB)
Geosynthetic Multi-Layer Cover - Within PMDA	200	10,600	12,190	600	13,100
Exposure Barriers	400	0	0	1,600	35,300
Excavation Areas Reclamation	300			900	20,400
TOTALS:	**900**	**10,600**	**12,190**	**3,100**	**68,800**

Remedy Components	Required Weight (TON)	Volume Required (LCY)
Available Onsite Neutralization Material (assume 53 lb/cf density)	**0**	**0**
Lime for Parent Surface Amendment by Ripping	1,400	1,079
Compost for Topsoil Amendment	4,000	3,798
Compost for Deficit Topsoil Requiring Amendment	0	0
Total Crushed Limestone Required for Neutralization	**1,400**	**1,079**
Subtotal for Organic Matter	**4,000**	**3,798**

Drainage System Components On Cover	Area (SY)	Volume (BCY)	Volume (LCY)
Riprap for Drop Shutes - Within PMDA		20	23
Riprap for Perimeter Drainage Channel - Within PMDA		3,890	4,474

Access Road Construction Components	Surface Area (AC)	Volume of Gravel (BCY)	Volume of Gravel (LCY)	Weight of Gravel (TON)	Grading Volume (BCY)	Compaction Volume (LCY)
Clearing and Grubbing	1.5					
Gravel Road Base		1,190	1,369	**1,984**	**2,375**	**300**
Ditch		350	403	**584**		
Class 6 Bedding Material for Culvert (24" Diameter)		12	14	**20**		
Fill for Culvert (24" Diameter)		39	45	**65**		

Beneficial Material Summary- Onsite and Offsite Fill

	Subsoil Volume (BCY)	Topsoil Volume (BCY)	Riprap Volume (BCY)	Drain Layer/Gravel (BCY)	Organic Matter-Compost (TON)
Required Beneficial Fill Source Material Volume	26,100	28,000	3,910	10,600	4,000
Available Onsite Beneficial Fill Sources	200,500	28,000	3,910	22,242	0
Excess Beneficial Fill Source Balance- Material	174,400	0	0	11,642	0
Deficit Beneficial Fill Source Balance - Material	0	0	0	0	4,000

Blasting	**Required Volume (BCY)**	**Volume for Hauling (LCY)**	**Percentage**
Volume Required from Blasting	**0**	**0**	
Assume 10% Rippable	**0**		10%
Assume 90% Blasted	**0**		90%

TABLE CA-6

ALTERNATIVE 2 (YEAR 1)
Calculation Worksheet
Required Materials Output Calculations

COST WORKSHEET

Site:	Formosa OU1	**Prepared By:** JN	**Date:** 7/13/2012
Location:	Douglas County, Oregon		
Phase:	Feasibility Study	**Checked By:** EB	**Date:** 7/16/2012
Base Year:	2013		

Description: Determine the quantity of materials and labor required for maintenance of the cover systems and reclamation areas for Alternative 2 for Year 1.

ALTERNATIVE 2 (YEARS 1 THROUGH 3)

Input Fields

Cover and Reclamation Areas	Location	Surface Area (AC)	Surface Area Subtotals (AC)	Annual Percentage of Surface Requiring Reseeding	Annual Percentage of Surface Requiring Weed Control
Geosynthetic Multi-Layer Cover	Within PMDA	4.4	16.2	7%	100%
	Exposure Barriers	11.8			
Excavation Areas Reclamation	Excavated Areas	6.8	6.8	7%	100%

Amendment Components	Application Rate (LB/AC)
Fertilizer for Topsoil Amendment	135
Hydromulching	3,000
Seed Mix for Topsoil Areas	32

Output Fields-Required Materials

Remedy Components	Reseeding for Topsoil Areas (AC)	Seed Mix for Topsoil Areas (LB)	Fertilizer for Topsoil Areas (LB)	Hydromulching for Topsoil Areas (LB)	Weed Control for Seeded Areas (AC)
Geosynthetic Multi-Layer Cover	1.5	100	200	3,400	17
Excavation Areas	0.5	100	100	1,500	7
TOTALS:	**2.0**	**200**	**300**	**4,900**	**24**

TABLE CA-7

ALTERNATIVE 2 (YEAR 2)
Calculation Worksheet
Required Materials Output Calculations

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012

Checked By: EB **Date:** 7/16/2012

Description: Determine the quantity of materials and labor required for maintenance of the cover systems and reclamation areas for Alternative 2 for Year 2

ALTERNATIVE 2 (YEAR 2)

Input Fields

Cover and Reclamation Areas	Location	Surface Area (AC)	Surface Area Subtotals (AC)	Annual Percentage of Surface Requiring Reseeding	Annual Percentage of Surface Requiring Weed Control
Geosynthetic Multi-Layer Cover	Within PMDA	4.4	16.2	3%	100%
	Exposure Barriers	11.8			
Excavation Areas Reclamation	Excavated Areas	6.8	6.8	3%	100%

Amendment Components	Application Rate (LB/AC)
Fertilizer for Topsoil Amendment	135
Hydromulching	3,000
Seed Mix for Topsoil Areas	32

Output Fields-Required Materials

Remedy Components	Reseeding for Topsoil Areas (AC)	Seed Mix for Topsoil Areas (LB)	Fertilizer for Topsoil Areas (LB)	Hydromulching for Topsoil Areas (LB)	Weed Control for Seeded Areas (AC)
Geosynthetic Multi-Layer Cover	0.5	100	100	1,500	17
Excavation Areas	0.5	100	100	700	7
TOTALS:	**1.0**	**200**	**200**	**2,200**	**24**

TABLE CA-1

Alternative 3
Calculation Worksheet
Contaminated Fill Material Balances

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This calculation sheet allows the user to define the volume of contaminated fill removed from various subareas. Changes to the input fields on this calculation sheet will also change the quantities and types of materials for amendment of soils and the resulting capital costs.

Contaminated Fill Material Balances

Remediation Subarea Name	Estimated In-Place Volume (BCY)	Expansion Factor	Estimated In-Place Lose Volume (LCY)	Relocated Within PMDA (BCY)	Relocated Within PMDA (LCY)	Volume Relocated Outside PMDA (BCY)	Volume Relocated Outside PMDA (LCY)	Volume Relocated to Existing Facility (BCY)
Encapsulation Mound (EM) Waste Rock/Soil	21,000	1.15	24,200	0	0	0	0	0
EM Tailings	19,000	1.15	21,900	0	0	0	0	0
East EM Waste Rock Dump	0	1.15	0	32,000	36,800	0	0	0
Formosa 1 and Formosa 3 Adit Waste Rock Dump	0	1.15	0	0	0	25,000	28,750	0
Mine Materials Along the Upper Side slopes of the EM	0	1.15	0	8,000	9,200	0	0	0
Road Areas to Accommodate Pavement cover	0	1.15	0	0	0	0	0	0
Adit Drainage Affected Soil	0	1.15	0	0	0	3,000	3,450	0
All other Mine materials	0	1.15	0	29,000	33,350	97,000	111,550	0
TOTALS:	**40,000**		**46,100**	**69,000**	**79,350**	**125,000**	**143,750**	**0**

Notes:
Input fields are denoted by a dashed line. Do not overwrite information not contained within the dashed lines.

TABLE CA-2

Alternative 3
Calculation Worksheet
Beneficial Fill Material Balances

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This calculation sheet allows the user to define the volume of beneficial fill (subsoil and topsoil) and the volume of riprap generated. Changes to the input fields on this calculation sheet will also change the quantities and types of materials for amendment of soils and cover construction, reclamation, and the resulting capital costs.

Beneficial Fill Material Balances

Remediation Subarea Name	Waste Rock, Fill, or Stockpile Name	Estimated In-Place Volume (BCY)	Expansion Factor	Estimated In-Place Volume (LCY)	Estimated Available Onsite Neutralization Material (LCY)	Estimated Available Onsite Subsoil Volume (BCY)	Estimated Available Onsite Topsoil Volume (BCY)	Estimated Available Onsite Drain Layer Material Volume (BCY)	Estimated Available Onsite Riprap Volume (BCY)	Beneficial Soil Resources Left In-Place (BCY)
Expansion of Proposed Facility within PMDA	Rock Borrow	12,500	1.15	14,375	0	0	0	6,340	6,160	0
Access Road Construction	Rock Borrow	25,556	1.15	29,389	0	0	0	25,556	0	0
Middle Creek Borrow Area	Gravelly, Gravelly Clay Loam	200,000	1.15	230,000	0	177,100	22,900	0	0	0
Proposed Facility Outside PMDA	Gravelly, Gravelly Clay Loam	28,500	1.15	32,775	0	28,500	0	0	0	0
TOTALS:		**266,556**		**306,539**	**0**	**205,600**	**22,900**	**31,896**	**6,160**	**0**

Notes:
Input fields are denoted by a dashed line. Do not overwrite information not contained within the dashed lines.

TABLE CA-3

Alternative 3
Calculation Worksheet
Required Materials Input Calculations

COST WORKSHEET

Site:	Formosa OU1	**Prepared By:** JN	**Date:** 7/13/2012
Location:	Douglas County, Oregon		
Phase:	Feasibility Study	**Checked By:** EB	**Date:** 7/16/2012
Base Year:	2013		

Work Statement:
This calculation sheet allows the user to define the thicknesses of covers and reclamation, and amendment rates of the soil materials. The spreadsheet also allow the user to change the quantities of earthwork, road building, and drainage system components. Changes to the input fields on this calculation sheet will also change the quantities and types of materials for amendment of soils and cover construction and reclamation and the resulting capital costs.

Input Fields- Required Materials

Cover-Cap Components	Surface Area (AC)	Drain Layer Thickness (IN)	Subsoil Thickness (IN)	Growth Media Thickness (IN)
Geosynthetic Multi-Layer Cover - Within PMDA	**4.38**	**18**	**12**	**6**
Geosynthetic Multi-Layer Cover - Outside PMDA	**3.52**	**18**	**12**	**6**
Excavation Areas Reclamation	**20.55**		**0**	**6**
TOTAL	28.45			

Drainage System Components on Cover	Width/Length (FT)	Area (SF)
Riprap for Drop Shutes - Within PMDA	30	
Riprap for Drop Shutes - Outside PMDA	50	
Riprap Sectional Area (10' x 1.5')		15.0
Riprap for Perimeter Drainage Channel - Within PMDA	2,800	
Riprap for Perimeter Drainage Channel - Outside PMDA	1,600	
Riprap Sectional Area (25' x 1.5')		37.5

Repository Liner Components	Surface Area (AC)	QTY	Drain Layer Thickness (IN)
Geosynthetic Clay Liner - Outside PMDA	**3.52**	1	
Geotextile - Outside PMDA	**3.52**	1	
Drainage Layer - Outside PMDA	**3.52**		12
4" Perf. HDPE Pipe for Drainage Layer - Outside PMDA (FT)		800	
4" Solid HDPE Pipe for Drainage Layer - Outside PMDA (FT)		25	
4" 90 Degree HDPE Elbows for Drainage Layer - Outside PMDA		4	
4" HDPE Tee for Drainage Layer - Outside PMDA		1	
Geotextile - Outside PMDA	**3.52**	1	

Amendment Components	Amendment Rate (TON/AC-FT)	Application Rate (LB/AC)
Lime for Surface Amendment	80	
Compost for Topsoil Amendment	230	
Fertilizer Amendment for Topsoil		135
Hydromulching		3,000
Seed Mix for Topsoil Areas		32

Restoration Components	Amendment Rate (tons/AC)
Reforestation	350

Access Road Construction Preparation		
Width of Road	FT	20
Excavation Cut Area (Assume 2:1 Hillside)	SF	100
Length of Road	FT	6,900
Area to be Cleared and Grubbed	SF	138,000
Amount of Cut and Fill Material to be Removed by Dozer	%	100%
Volume of Cut and Fill Material	BCF	690,000
	BCY	**25,556**

Rough grading		
Length of Road	FT	6,900
Width of Road	FT	20
Cut and Fill	FT	1
Volume of Material to Graded	BCF	138,000
	BCY	**5,112**

Access Road Construction Components	Length (FT)	Width (FT)	Thickness (IN)	Percentage of Loose Gravel Compacted	Quantity	Volume of Gravel/Fill (BCY)
Gravel Road Base	6,900	20	6.0	20.0%		2,560
Ditch	6,900	2	8.0			350
Class 6 Bedding Material for Culvert (24" Diameter)	30.0	5	3.0		8	12
Fill for Culvert (24" Diameter)	30.0	5	48.0		8	39

Subsoil and Topsoil Material From Borrow Sources	Area (AC)	Area (SY)	Depth (IN)	Clearing and Grubbing (%)
Surface Area Required to be Disturbed - Potential Repository Outside PMDA	3.52	17,037		50%
Surface Area Required to be Disturbed - Borrow Source	1.00	4,840		50%
Assume Topsoil Overburden:			60	
Expansion of Proposed Facility within PMDA	0.37	1,791		100%

Notes:

Input fields are denoted by a dashed line. Do not overwrite information not contained within the dashed lines.

It is assumed that the Subcontractor shall be able to necessary construction materials through screening of onsite borrow sources.

TABLE CA-4

Alternative 3
Calculation Worksheet
Required Materials Output Calculations

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This calculation output sheet allows the user to calculate the volume of various material required for cover construction and reclamation. Changes to the input fields on this calculation sheet will also change the quantities and types of materials for amendment of soils and cover construction, reclamation, and the resulting capital costs.

Output Fields-Required Materials

Remedy Components	Estimated Required Subsoil Volume (BCY)	Estimated Required Subsoil Volume (LCY)	Estimated Required Topsoil Volume (BCY)	Estimated Required Topsoil Volume (LCY)	Estimated Required Drain Layer Volume for Cover (BCY)	Estimated Required Drain Layer Volume for Cover (LCY)	Estimated Required Drain Layer Volume for Liner (BCY)	Estimated Required Drain Layer Volume for Liner (LCY)	Surface Area (AC)	Surface Area (SY)	Surface Area (SF)
Geosynthetic Multi-Layer Cover - Within PMDA	7,100	8,165	3,500	4,025	10,600	12,190			4.4	21,200	190,793
Geosynthetic Multi-Layer Cover - Outside PMDA	5,700	6,555	2,800	3,220	8,500	9,775	5,700	6,555	3.5	17,037	153,331
Excavation Areas Reclamation	0	0	16,600	19,090					20.6	99,462	895,158
Total	**12,800**	**14,720**	**22,900**	**26,335**	**19,100**	**21,965**	**5,700**	**6,555**	**28.5**	**137,699**	**1,239,282**

Restoration Component	Quantity (Trees)
Reforestation	7,193

TABLE CA-5

Alternative 3
Calculation Worksheet
Required Materials Output Calculations

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This calculation output sheet allows the user to calculate the volumes of various material required for cover construction, benches, access road and beneficial material balance. Changes to the input fields on this calculation sheet will also change the quantities and types of materials for amendment of soils and cover construction, reclamation, and the resulting capital costs.

Output Fields-Required Materials

Remedy Components	Seed Mix for Topsoil Areas (LB)	Drain Layer Volume (BCY)	Drain Layer Volume for Crushing (LCY)	Fertilizer for Topsoil Areas (LB)	Hydromulching for Topsoil Areas (LB)
Geosynthetic Multi-Layer Cover - Within PMDA	200	10,600	12,190	600	13,100
Geosynthetic Multi-Layer Cover - Outside PMDA	200	14,200	16,330	500	10,600
Excavation Areas Reclamation	700			2,800	61,700
TOTALS:	**1,100**	**24,800**	**28,520**	**3,900**	**85,400**

Remedy Components	Required Weight (TON)	Volume Required (LCY)
Available Onsite Neutralization Material (assume 53 lb/cf density)	**0**	**0**
Lime for Parent Surface Amendment	1,100	848
Compost for Topsoil Amendment	3,300	3,133
Compost for Deficit Topsoil Requiring Amendment	0	0
Total Crushed Limestone Required for Neutralization	**1,100**	**848**
Subtotal for Organic Matter	**3,300**	**3,133**

Drainage System Components On Cover	Area (SY)	Volume (BCY)	Volume (LCY)
Riprap for Perimeter Drainage Channel - Within PMDA		3,890	4,474
Riprap for Perimeter Drainage Channel - Outside PMDA		2,220	2,553
Riprap for Drop Shutes - Within PMDA		20	23
Riprap for Drop Shutes - Outside PMDA		30	35

Access Road Construction Components	Surface Area (AC)	Volume of Gravel (BCY)	Volume of Gravel (LCY)	Weight of Gravel (TON)	Grading Volume (BCY)	Compaction Volume (LCY)
Clearing and Grubbing	3.2					
Gravel Road Base		2,560	2,944	**4,269**	**5,112**	**600**
Ditch		350	403	**584**		
Class 6 Bedding Material for Culvert (24" Diameter)		12	14	**20**		
Fill for Culvert (24" Diameter)		39	45	**65**		

Beneficial Material Summary- Onsite and Offsite Fill

	Subsoil Volume (BCY)	Topsoil Volume (BCY)	Riprap Volume (BCY)	Drain Layer/Gravel (BCY)	Organic Matter-Compost (TON)
Required Beneficial Fill Source Material Volume	12,800	22,900	6,160	24,800	3,300
Available Onsite Beneficial Fill Sources	205,600	22,900	6,160	31,896	0
Excess Beneficial Fill Source Balance- Material	192,800	0	0	7,096	0
Deficit Beneficial Fill Source Balance - Material	0	0	0	0	3,300

Blasting	**Required Volume (BCY)**	**Volume for Hauling (LCY)**	**Percentage**
Volume Required from Blasting	**0**	**0**	
Assume 10% Rippable	**0**		10%
Assume 90% Blasted	**0**		90%

TABLE CA-6

ALTERNATIVE 3 (YEAR 1)
Calculation Worksheet
Required Materials Output Calculations

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Description: Determine the quantity of materials and labor required for maintenance of the cover systems and reclamation areas for Alternative 3 for Year 1

ALTERNATIVE 3 (YEAR 1)

Input Fields

Cover and Reclamation Areas	Location	Surface Area (AC)	Surface Area Subtotals (AC)	Annual Percentage of Surface Requiring Reseeding	Annual Percentage of Surface Requiring Weed Control
Geosynthetic Multi-Layer Cover	Within PMDA	4.4	7.9	7%	100%
	Outside PMDA	3.5			
Excavation Areas Reclamation	Excavated Areas	20.6	20.6	7%	100%

Amendment Components	Application Rate (LB/AC)
Fertilizer for Topsoil Amendment	135
Hydromulching	3,000
Seed Mix for Topsoil Areas	32

Output Fields-Required Materials

Remedy Components	Reseeding for Topsoil Areas (AC)	Seed Mix for Topsoil Areas (LB)	Fertilizer for Topsoil Areas (LB)	Hydromulching for Topsoil Areas (LB)	Weed Control for Seeded Areas (AC)
Geosynthetic Multi-Layer Cover	1.0	100	100	1,700	8
Excavation Areas	1.5	100	200	4,400	21
TOTALS:	**2.5**	**200**	**300**	**6,100**	**29**

TABLE CA-7

ALTERNATIVE 3 (YEAR 2)
Calculation Worksheet
Required Materials Output Calculations

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Description: Determine the quantity of materials and labor required for maintenance of the cover systems and reclamation areas for Alternative 3 for Year 2

ALTERNATIVE 3 (YEAR 2)

Input Fields

Cover and Reclamation Areas	Location	Surface Area (AC)	Surface Area Subtotals (AC)	Annual Percentage of Surface Requiring Reseeding	Annual Percentage of Surface Requiring Weed Control
Geosynthetic Multi-Layer Cover	Within PMDA	4.4	7.9	3%	100%
	Outside PMDA	3.5			
Excavation Areas Reclamation	Excavated Areas	20.6	20.6	3%	100%

Amendment Components	Application Rate (LB/AC)
Fertilizer for Topsoil Amendment	135
Hydromulching	3,000
Seed Mix for Topsoil Areas	32

Output Fields-Required Materials

Remedy Components	Reseeding for Topsoil Areas (AC)	Seed Mix for Topsoil Areas (LB)	Fertilizer for Topsoil Areas (LB)	Hydromulching for Topsoil Areas (LB)	Weed Control for Seeded Areas (AC)
Geosynthetic Multi-Layer Cover	0.5	100	100	800	8
Excavation Areas	1.0	100	100	1,900	21
TOTALS:	**1.5**	**200**	**200**	**2,700**	**29**

TABLE CA-1

Alternative 4
Calculation Worksheet
Contaminated Fill Material Balances

COST WORKSHEET

Site:	Formosa OU1	**Prepared By:** JN	**Date:** 7/13/2012
Location:	Douglas County, Oregon		
Phase:	Feasibility Study	**Checked By:** EB	**Date:** 7/16/2012
Base Year:	2013		

Work Statement:
This calculation sheet allows the user to define the volume of contaminated fill removed from various subareas. Changes to the input fields on this calculation sheet will also change the quantities and types of materials for amendment of soils and the resulting capital costs.

Contaminated Fill Material Balances

Remediation Subarea Name	Estimated In-Place Volume (BCY)	Expansion Factor	Estimated In-Place Lose Volume (LCY)	Volume Relocated Within PMDA (BCY)	Volume Relocated Within PMDA (LCY)	Volume Relocated Outside PMDA (BCY)	Volume Relocated Outside PMDA (LCY)	Volume Relocated to Existing Facility (BCY)
Encapsulation Mound (EM) Waste Rock/Soil	0	1.15	0	21,000	24,150	0	0	0
EM Tailings	0	1.15	0	19,000	21,850	0	0	0
East EM Waste Rock Dump	0	1.15	0	32,000	36,800	0	0	0
Formosa 1 and Formosa 3 Adit Waste Rock Dump	0	1.15	0	0	0	25,000	28,750	0
Mine Materials Along the Upper Side slopes of the EM	0	1.15	0	8,000	9,200	0	0	0
Road Areas to Accommodate Pavement cover	0	1.15	0	0	0	0	0	0
Adit Drainage Affected Soil	0	1.15	0	0	0	3,000	3,450	0
All other Mine materials	0	1.15	0	29,000	33,350	97,000	111,550	0
TOTALS:	**0**		**0**	**109,000**	**125,350**	**125,000**	**143,750**	**0**

Notes:
Input fields are denoted by a dashed line. Do not overwrite information not contained within the dashed lines.

TABLE CA-2

Alternative 4
Calculation Worksheet
Beneficial Fill Material Balances

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This calculation sheet allows the user to define the volume of beneficial fill (subsoil and topsoil) and the volume of riprap generated. Changes to the input fields on this calculation sheet will also change the quantities and types of materials for amendment of soils and cover construction, reclamation, and the resulting capital costs.

Beneficial Fill Material Balances

Remediation Subarea Name	Waste Rock, Fill, or Stockpile Name	Estimated In-Place Volume (BCY)	Expansion Factor	Estimated In-Place Volume (LCY)	Estimated Available Onsite Neutralization Material (BCY)	Estimated Available Onsite Subsoil Volume (BCY)	Estimated Available Onsite Topsoil Volume (BCY)	Estimated Available Onsite Drain Layer Material Volume (BCY)	Estimated Available Onsite Riprap Volume (BCY)	Beneficial Soil Resources Left In-Place (BCY)
Expansion of Proposed Facility within PMDA	Rock Borrow	12,500	1.15	14,375	0	0	0	6,340	6,160	0
Access Road Construction	Rock Borrow	25,556	1.15	29,389	0	0	0	25,556	0	0
Middle Creek Borrow Area	Gravelly, Gravelly Clay Loam	200,000	1.15	230,000	0	177,100	22,900	0	0	0
Proposed Facility Outside PMDA	Gravelly, Gravelly Clay Loam	28,500	1.15	32,775	0	28,500	0	0	0	0
TOTALS:		**266,556**		**306,539**	**0**	**205,600**	**22,900**	**31,896**	**6,160**	**0**

Notes:
Input fields are denoted by a dashed line. Do not overwrite information not contained within the dashed lines.

TABLE CA-3

Alternative 4
Calculation Worksheet
Required Materials Input Calculations

COST WORKSHEET

Site: Formosa OU1		**Prepared By:** JN	**Date:** 7/13/2012
Location: Douglas County, Oregon			
Phase: Feasibility Study		**Checked By:** EB	**Date:** 7/16/2012
Base Year: 2013			

Work Statement:
This calculation sheet allows the user to define the thicknesses of covers and reclamation, and amendment rates of the soil materials. The spreadsheet also allow the user to change the quantities of earthwork, road building, and drainage system components. Changes to the input fields on this calculation sheet will also change the quantities and types of materials for amendment of soils and cover construction and reclamation and the resulting capital costs.

Input Fields- Required Materials

Cover-Cap Components	Surface Area (AC)	Drain Layer Thickness (IN)	Subsoil Thickness (IN)	Growth Media Thickness (IN)
Geosynthetic Multi-Layer Cover - Within PMDA	**4.38**	**18**	**12**	**6**
Geosynthetic Multi-Layer Cover - Outside PMDA	**3.52**	**18**	**12**	**6**
Excavation Areas Reclamation	**20.55**		**0**	**6**
TOTAL	28.45			

Drainage System Components on Cover	Width/Length (FT)	Area (SF)
Riprap for Drop Shutes - Within PMDA	30	
Riprap for Drop Shutes - Outside PMDA	50	
Riprap Sectional Area (10' x 1.5')		15.0
Riprap for Perimeter Drainage Channel - Within PMDA	2,800	
Riprap for Perimeter Drainage Channel - Outside PMDA	1,600	
Riprap Sectional Area (25' x 1.5')		37.5

Repository Liner Components	Surface Area (AC)	QTY	Drain Layer Thickness (IN)
Geosynthetic Clay Liner - Outside PMDA	**3.52**	1	
Geotextile - Outside PMDA	**3.52**	1	
Drainage Layer - Outside PMDA	**3.52**		12
4" Perf. HDPE Pipe for Drainage Layer - Outside PMDA (FT)		800	
4" Solid HDPE Pipe for Drainage Layer - Outside PMDA (FT)		25	
4" 90 Degree HDPE Elbows for Drainage Layer - Outside PMDA		4	
4" HDPE Tee for Drainage Layer - Outside PMDA		1	
Geotextile - Outside PMDA	**3.52**	1	

Amendment Components	Amendment Rate (TON/AC-FT)	Application Rate (LB/AC)
Lime for Parent Surface Amendment	80	
Compost for Topsoil Amendment	230	
Fertilizer Amendment for Topsoil		135
Hydromulching		3,000
Seed Mix for Topsoil Areas		32

Restoration Components	Amendment Rate (trees/AC)
Reforestation	350

Access Road Construction		
Width of Road	FT	20
Excavation Cut Area (Assume 2:1 Hillside)	SF	100
Length of Road	FT	6,900
Area to be Cleared and Grubbed	SF	138,000
Amount of Cut and Fill Material to be Removed by Dozer	%	100%
Volume of Cut and Fill Material	BCF	690,000
	BCY	**25,556**

Rough grading		
Length of Road	FT	6,900
Width of Road	FT	20
Cut and Fill	FT	1
Volume of Material to Graded	BCF	138,000
	BCY	**5,112**

Access Road Construction Components	Length (FT)	Width (FT)	Thickness (IN)	Percentage of Loose Gravel	Quantity	Volume of Gravel/Fill (BCY)
Gravel Road Base - Permanent Access Road	6,900	20	6.0	20.0%		2,560
Ditch	6,900	2	8.0			350
Class 6 Bedding Material for Culvert (24" Diameter)	30.0	5	3.0		8	12
Fill for Culvert (24" Diameter)	30.0	5	48.0		8	39

Subsoil and Topsoil Material From Borrow Sources	Area (AC)	Area (SY)	Depth (IN)	Clearing and Grubbing (%)
Surface Area Required to be Disturbed - Potential Repository Outside PMDA	3.52	17,037		50%
Surface Area Required to be Disturbed - Borrow Source	1.00	4,840		50%
Assume Topsoil Overburden:			60	
Expansion of Proposed Facility within PMDA	0.37	1,791		100%

Encapsulation Mound Removal		
Waste Rock/Soil to be Removed	CY	6,000
Tailings to be Treated and Removed	CY	19,000
Assumed Porosity of Waste Rock/Soil	%	25%
Assumed Porosity of Tailings	%	50%
Assumed Actual Recovery of Waste Rock/Soil	%	50%
Assumed Actual Recover of Tailings	%	25%
Water to be Removed from Encapsulation Mound	GAL	632,000
Haul Distance to Tank	MI	3.37

Notes:

Input fields are denoted by a dashed line. Do not overwrite information not contained within the dashed lines.

It is assumed that the Subcontractor shall be able to necessary construction materials through screening of onsite borrow sources.

TABLE CA-4

Alternative 4
Calculation Worksheet
Required Materials Output Calculations

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This calculation output sheet allows the user to calculate the volume of various material required for cover construction and reclamation. Changes to the input fields on this calculation sheet will also change the quantities and types of materials for amendment of soils and cover construction, reclamation, and the resulting capital costs.

Output Fields-Required Materials

Remedy Components	Estimated Required Subsoil Volume (BCY)	Estimated Required Subsoil Volume (LCY)	Estimated Required Topsoil Volume (BCY)	Estimated Required Topsoil Volume (LCY)	Estimated Required Drain Layer Volume for Cover (BCY)	Estimated Required Drain Layer Volume for Cover (LCY)	Estimated Required Drain Layer Volume for Liner (BCY)	Estimated Required Drain Layer Volume for Liner (LCY)	Surface Area (AC)	Surface Area (SY)	Surface Area (SF)
Geosynthetic Multi-Layer Cover - Within PMDA	7,100	8,165	3,500	4,025	10,600	12,190			4.4	21,200	190,793
Geosynthetic Multi-Layer Cover - Outside PMDA	5,700	6,555	2,800	3,220	8,500	9,775	5,700	6,555	3.5	17,037	153,331
Excavation Areas Reclamation	0	0	16,600	19,090					20.6	99,462	895,158
Total	**12,800**	**14,720**	**22,900**	**26,335**	**19,100**	**21,965**	**5,700**	**6,555**	**28.5**	**137,699**	**1,239,282**

Remedy Component	Quantity (Trees)
Tree Planting	7,193

TABLE CA-5

Alternative 4
Calculation Worksheet
Required Materials Output Calculations

COST WORKSHEET

Site:	Formosa OU1	**Prepared By:** JN	**Date:** 7/13/2012
Location:	Douglas County, Oregon		
Phase:	Feasibility Study	**Checked By:** EB	**Date:** 7/16/2012
Base Year:	2013		

Work Statement:
This calculation output sheet allows the user to calculate the volumes of various material required for cover construction, benches, access road and beneficial material balance. Changes to the input fields on this calculation sheet will also change the quantities and types of materials for amendment of soils and cover construction, reclamation, and the resulting capital costs.

Output Fields-Required Materials

Remedy Components	Seed Mix for Topsoil Areas (LB)	Drain Layer Volume (BCY)	Drain Layer Volume (LCY)	Fertilizer for Topsoil Areas (LB)	Hydromulching for Topsoil Areas (LB)
Geosynthetic Multi-Layer Cover - Within PMDA	200	10,600	12,190	600	13,100
Geosynthetic Multi-Layer Cover - Outside PMDA	200	14,200	16,330	500	10,600
Excavation Areas Reclamation	700			2,800	61,700
TOTALS:	**1,100**	**24,800**	**28,520**	**3,900**	**85,400**

Remedy Components	Required Weight (TON)	Volume Required (LCY)
Available Onsite Neutralization Material (assume 53 lb/cf density)	**0**	**0**
Lime for Surface Amendment	1,100	848
Compost for Topsoil Amendment	3,300	3,133
Compost for Deficit Topsoil Requiring Amendment	0	0
Total Crushed Limestone Required for Neutralization	**1,100**	**848**
Subtotal for Organic Matter	**3,300**	**3,133**

Drainage System Components On Cover	Area (SY)	Volume (BCY)	Volume (LCY)
Riprap for Perimeter Drainage Channel - Within PMDA		3,890	4,474
Riprap for Perimeter Drainage Channel - Outside PMDA		2,220	2,553
Riprap for Drop Shutes - Within PMDA		20	23
Riprap for Drop Shutes - Outside PMDA		30	35

Access Road Construction Components	Surface Area (AC)	Volume of Gravel (BCY)	Volume of Gravel (LCY)	Weight of Gravel (TON)	Grading Volume (BCY)	Compaction Volume (LCY)
Clearing and Grubbing	3.2					
Gravel Road Base - Permanent Access Road		2,560	2,944	**4,269**	**5,112**	**600**
Ditch		350	403	**584**		
Class 6 Bedding Material for Culvert (24" Diameter)		12	14	**20**		
Fill for Culvert (24" Diameter)		39	45	**65**		

Beneficial Material Summary- Onsite and Offsite Fill

	Subsoil Volume (BCY)	Topsoil Volume (BCY)	Riprap Volume (BCY)	Drain Layer/Gravel (BCY)	Organic Matter-Compost (TON)
Required Beneficial Fill Source Material Volume	12,800	22,900	6,160	24,800	3,300
Available Onsite Beneficial Fill Sources	205,600	22,900	6,160	31,896	0
<u>Excess</u> Beneficial Fill Source Balance- Material	192,800	0	0	7,096	0
<u>Deficit</u> Beneficial Fill Source Balance - Material	0	0	0	0	3,300

<u>Blasting</u>	Required Volume (BCY)	Volume for Hauling (LCY)	Percentage
Volume Required from Blasting (Assume 15% Extra)	**0**	**0**	
Assume 10% Rippable	**0**		10%
Assume 90% Blasted	**0**		90%

TABLE CA-6

ALTERNATIVE 4 (YEAR 1)
Calculation Worksheet
Required Materials Output Calculations

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Description: Determine the quantity of materials and labor required for maintenance of the cover systems and reclamation areas for Alternative 4 for Year 1

ALTERNATIVE 4 (YEAR 1)

Input Fields

Cover and Reclamation Areas	Location	Surface Area (AC)	Surface Area Subtotals (AC)	Annual Percentage of Surface Requiring Reseeding	Annual Percentage of Surface Requiring Weed Control
Geosynthetic Multi-Layer Cover	Within PMDA	4.4	7.9	7%	100%
	Outside PMDA	3.5			
Excavation Areas Reclamation	Excavated Areas	20.6	20.6	7%	100%

Amendment Components	Application Rate (LB/AC)
Fertilizer for Topsoil Amendment	135
Hydromulching	3,000
Seed Mix for Topsoil Areas	32

Output Fields-Required Materials

Remedy Components	Reseeding for Topsoil Areas (AC)	Seed Mix for Topsoil Areas (LB)	Nitrogen Fertilizer for Topsoil Areas (LB)	Hydromulching for Topsoil Areas (LB)	Weed Control for Seeded Areas (AC)
Geosynthetic Multi-Layer Cover	1.0	100	100	1,700	8
Excavation Areas	1.5	100	200	4,400	21
TOTALS:	**2.5**	**200**	**300**	**6,100**	**29**

TABLE CA-7

ALTERNATIVE 4 (YEAR 2)
Calculation Worksheet
Required Materials Output Calculations

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012

Checked By: EB **Date:** 7/16/2012

Description: Determine the quantity of materials and labor required for maintenance of the cover systems and reclamation areas for Alternative 4 for Year 2

ALTERNATIVE 4 (YEAR 2)

Input Fields

Cover and Reclamation Areas	Location	Surface Area (AC)	Surface Area Subtotals (AC)	Annual Percentage of Surface Requiring Reseeding	Annual Percentage of Surface Requiring Weed Control
Geosynthetic Multi-Layer Cover	Within PMDA	4.4	7.9	3%	100%
	Outside PMDA	3.5			
Excavation Areas Reclamation	Excavated Areas	20.6	20.6	3%	100%

Amendment Components	Application Rate (LB/AC)
Fertilizer for Topsoil Amendment	135
Hydromulching	3,000
Seed Mix for Topsoil Areas	32

Output Fields-Required Materials

Remedy Components	Reseeding for Topsoil Areas (AC)	Seed Mix for Topsoil Areas (LB)	Nitrogen Fertilizer for Topsoil Areas (LB)	Hydromulching for Topsoil Areas (LB)	Weed Control for Seeded Areas (LB)
Geosynthetic Multi-Layer Cover	0.5	100	100	800	8
Excavation Areas	1.0	100	100	1,900	21
TOTALS:	**1.5**	**200**	**200**	**2,700**	**29**

TABLE CA-1

Alternative 6
Calculation Worksheet
Contaminated Fill Material Balances

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This calculation sheet allows the user to define the volume of contaminated fill removed from various subareas. Changes to the input fields on this calculation sheet will also change the quantities and types of materials for amendment of soils and the resulting capital costs.

Contaminated Fill Material Balances

Remediation Subarea Name	Estimated In-Place Volume (BCY)	Expansion Factor	Estimated In-Place Lose Volume (LCY)	Relocated Within PMDA (BCY)	Relocated Within PMDA (LCY)	Volume Relocated Outside PMDA (BCY)	Volume Relocated Outside PMDA (LCY)	Volume Relocated to Existing Facility (BCY)
Encapsulation Mound (EM) Waste Rock/Soil	0	1.15	0	0	0	21,000	24,150	0
EM Tailings	0	1.15	0	0	0	19,000	21,850	0
East EM Waste Rock Dump	0	1.15	0	0	0	32,000	36,800	0
Formosa 1 and Formosa 3 Adit Waste Rock Dump	0	1.15	0	0	0	25,000	28,750	0
Mine Materials Along the Upper Side slopes of the EM	0	1.15	0	0	0	8,000	9,200	0
Road Areas to Accommodate Pavement cover	0	1.15	0	0	0	0	0	0
Adit Drainage Affected Soil	0	1.15	0	0	0	3,000	3,450	0
All other Mine materials	0	1.15	0	0	0	126,000	144,900	0
TOTALS:	**0**		**0**	**0**	**0**	**234,000**	**269,100**	**0**

Notes:
Input fields are denoted by a dashed line. Do not overwrite information not contained within the dashed lines.

TABLE CA-2

Alternative 6
Calculation Worksheet
Beneficial Fill Material Balances

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This calculation sheet allows the user to define the volume of beneficial fill (subsoil and topsoil) and the volume of riprap generated. Changes to the input fields on this calculation sheet will also change the quantities and types of materials for amendment of soils and cover construction, reclamation, and the resulting capital costs.

Beneficial Fill Material Balances

Remediation Subarea Name	Waste Rock, Fill, or Stockpile Name	Estimated In-Place Volume (BCY)	Expansion Factor	Estimated In-Place Volume (LCY)	Estimated Available Onsite Neutralization Material (BCY)	Estimated Available Onsite Subsoil Volume (BCY)	Estimated Available Onsite Topsoil Volume (BCY)	Estimated Available Onsite Drain Layer Material Volume (BCY)	Estimated Available Onsite Riprap Volume (BCY)	Beneficial Soil Resources Left In-Place (BCY)
Expansion of Proposed Facility within PMDA	Rock Borrow	12,500	1.15	14,375	0	0	0	9,690	2,810	0
Access Road Construction	Rock Borrow	25,556	1.15	29,389	0	0	0	25,556	0	0
Middle Creek Borrow Area	Gravelly, Gravelly Clay Loam	200,000	1.15	230,000	0	175,600	24,400	0	0	0
Proposed Facility Outside PMDA	Gravelly, Gravelly Clay Loam	28,500	1.15	32,775	0	28,500	0	0	0	0
TOTALS:		**266,556**		**306,539**	**0**	**204,100**	**24,400**	**35,246**	**2,810**	**0**

Notes:
Input fields are denoted by a dashed line. Do not overwrite information not contained within the dashed lines.

TABLE CA-3

Alternative 6
Calculation Worksheet
Required Materials Input Calculations

COST WORKSHEET

Site:	Formosa OU1	**Prepared By:**	JN	**Date:**	7/13/2012
Location:	Douglas County, Oregon				
Phase:	Feasibility Study	**Checked By:**	EB	**Date:**	7/16/2012
Base Year:	2013				

Work Statement:
This calculation sheet allows the user to define the thicknesses of covers and reclamation, and amendment rates of the soil materials. The spreadsheet also allow the user to change the quantities of earthwork, road building, and drainage system components. Changes to the input fields on this calculation sheet will also change the quantities and types of materials for amendment of soils and cover construction and reclamation and the resulting capital costs.

Input Fields- Required Materials

Cover-Cap Components	Surface Area (AC)	Drain Layer Thickness (IN)	Subsoil Thickness (IN)	Growth Media Thickness (IN)
Geosynthetic Multi-Layer Cover - Outside PMDA	**5.35**	**18**	**12**	**6**
Excavation Areas Reclamation	**24.93**		**0**	**6**
TOTAL	30.28			

Drainage System Components on Cover	Width/Length (FT)	Area (SF)
Riprap for Drop Shutes - Outside PMDA	60	
Riprap Sectional Area (10' x 1.5')		15.0
Riprap for Perimeter Drainage Channel - Outside PMDA	2,000	
Riprap Sectional Area (25' x 1.5')		37.5

Repository Liner Components	Surface Area (AC)	QTY	Drain Layer Thickness (IN)
Geosynthetic Clay Liner - Outside PMDA	**5.35**	1	
Geotextile - Outside PMDA	**5.35**	1	
Drainage Layer - Outside PMDA	**5.35**		12
4" Perf. HDPE Pipe for Drainage Layer - Outside PMDA (FT)		1000	
4" Solid HDPE Pipe for Drainage Layer - Outside PMDA (FT)		25	
4" 90 Degree HDPE Elbows for Drainage Layer - Outside PMDA		4	
4" HDPE Tee for Drainage Layer - Outside PMDA		1	
Geotextile - Outside PMDA	**5.35**	1	

Amendment Components	Amendment Rate (TON/AC-FT)	Application Rate (LB/AC)
Lime for Surface Amendment	80	
Compost for Topsoil Amendment	230	
Fertilizer Amendment for Topsoil		135
Hydromulching		3,000
Seed Mix for Topsoil Areas		32

Restoration Components	Amendment Rate (trees/AC)
Reforestation	350

Access Road Construction		
Width of Road	FT	20
Excavation Cut Area (Assume 2:1 Hillside)	SF	100
Length of Road	FT	6,900
Area to be Cleared and Grubbed	SF	138,000
Amount of Cut and Fill Material to be Removed by Dozer	%	100%
Volume of Cut and Fill Material	BCF	690,000
	BCY	**25,556**

Rough grading		
Length of Road	FT	6,900
Width of Road	FT	20
Cut and Fill	FT	1
Volume of Material to Graded	BCF	138,000
	BCY	**5,112**

Access Road Construction Components	Length (FT)	Width (FT)	Thickness (IN)	Percentage of Loose Gravel	Quantity	Volume of Gravel/Fill (BCY)
Gravel Road Base - Permanent Access Road	6,900	20	6.0	20.0%		2,560
Ditch	6,900	2	8.0			350
Class 6 Bedding Material for Culvert (24" Diameter)	30.0	5	3.0		8	12
Fill for Culvert (24" Diameter)	30.0	5	48.0		8	39

Subsoil and Topsoil Material From Borrow Sources	Area (AC)	Area (SY)	Depth (IN)	Clearing and Grubbing (%)
Surface Area Required to be Disturbed - Potential Repository Outside PMDA	3.52	17,037		50%
Surface Area Required to be Disturbed - Borrow Source	1.00	4,840		50%
Assume Topsoil Overburden:			60.0	
Expansion of Proposed Facility within PMDA	0.37	1,791		100%

Encapsulation Mound Removal		
Waste Rock/Soil to be Removed	CY	6,000
Tailings to be Treated and Removed	CY	19,000
Assumed Porosity of Waste Rock/Soil	%	25%
Assumed Porosity of Tailings	%	50%
Assumed Actual Recovery of Waste Rock/Soil	%	50%
Assumed Actual Recover of Tailings	%	25%
Water to be Removed from Encapsulation Mound	GAL	632,000
Haul Distance to Tank	MI	3.37

Notes:
Input fields are denoted by a dashed line. Do not overwrite information not contained within the dashed lines.

It is assumed that the Subcontractor shall be able to necessary construction materials through screening of onsite borrow sources.

TABLE CA-4

Alternative 6
Calculation Worksheet
Required Materials Output Calculations

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Work Statement:
This calculation output sheet allows the user to calculate the volume of various material required for cover construction and reclamation. Changes to the input fields on this calculation sheet will also change the quantities and types of materials for amendment of soils and cover construction, reclamation, and the resulting capital costs.

Output Fields-Required Materials

Remedy Components	Estimated Required Subsoil Volume (BCY)	Estimated Required Subsoil Volume (LCY)	Estimated Required Topsoil Volume (BCY)	Estimated Required Topsoil Volume (LCY)	Estimated Required Drain Layer Volume for Cover (BCY)	Estimated Required Drain Layer Volume for Cover (LCY)	Estimated Required Drain Layer Volume for Liner (BCY)	Estimated Required Drain Layer Volume for Liner (LCY)	Surface Area (AC)	Surface Area (SY)	Surface Area (SF)
Geosynthetic Multi-Layer Cover - Outside PMDA	8,600	9,890	4,300	4,945	12,900	14,835	8,600	9,890	5.35	25,894	233,046
Excavation Areas Reclamation	0	0	20,100	23,115					24.93	120,662	1,085,951
Total	**8,600**	**9,890**	**24,400**	**28,060**	**12,900**	**14,835**	**8,600**	**9,890**	**30.3**	**146,556**	**1,318,997**

Restoration Component	Quantity (Trees)
Reforestation	8,726

TABLE CA-5

Alternative 6
Calculation Worksheet
Required Materials Output Calculations

COST WORKSHEET

Site:	Formosa OU1	**Prepared By:** JN	**Date:** 7/13/2012
Location:	Douglas County, Oregon		
Phase:	Feasibility Study	**Checked By:** EB	**Date:** 7/16/2012
Base Year:	2013		

Work Statement:
This calculation output sheet allows the user to calculate the volumes of various material required for cover construction, benches, access road and beneficial material balance. Changes to the input fields on this calculation sheet will also change the quantities and types of materials for amendment of soils and cover construction, reclamation, and the resulting capital costs.

Output Fields-Required Materials

Remedy Components	Seed Mix for Topsoil Areas (LB)	Drain Layer Volume (BCY)	Drain Layer Volume (LCY)	Fertilizer for Topsoil Areas (LB)	Hydromulching for Topsoil Areas (LB)
Geosynthetic Multi-Layer Cover - Outside PMDA	200	21,500	24,725	700	16,100
Excavation Areas Reclamation	800	0	0	3,400	74,800
TOTALS:	**1,000**	**21,500**	**24,725**	**4,100**	**90,900**

Remedy Components	Required Weight (TON)	Volume Required (LCY)
Available Onsite Neutralization Material (assume 53 lb/cf density)	**0**	**0**
Lime for Parent Surface Amendment by Ripping	1,200	925
Compost for Topsoil Amendment	3,500	3,323
Compost for Deficit Topsoil Requiring Amendment	0	0
Total Crushed Limestone Required for Neutralization	**1,200**	**925**
Subtotal for Organic Matter	**3,500**	**3,323**

Drainage System Components On Cover	Area (SY)	Volume (BCY)	Volume (LCY)
Riprap for Drop Shutes - Outside PMDA		30	35
Riprap for Perimeter Drainage Channel - Outside PMDA		2,780	3,197

Access Road Construction Components	Surface Area (AC)	Volume of Gravel (BCY)	Volume of Gravel (LCY)	Weight of Gravel (TON)	Grading Volume (BCY)	Compaction Volume (LCY)
Clearing and Grubbing	4.0					
Gravel Road Base - Permanent Access Road		2,560	2,944	**4,269**	**5,112**	**600**
Ditch		350	403	**584**		
Class 6 Bedding Material for Culvert (24" Diameter)		12	14	**20**		
Fill for Culvert (24" Diameter)		39	45	**65**		

Beneficial Material Summary- Onsite and Offsite Fill

	Subsoil Volume (BCY)	Topsoil Volume (BCY)	Riprap Volume (BCY)	Drain Layer/Gravel (BCY)	Organic Matter-Compost (TON)
Required Beneficial Fill Source Material Volume	8,600	24,400	2,810	21,500	3,500
Available Onsite Beneficial Fill Sources	204,100	24,400	2,810	35,246	0
Excess Beneficial Fill Source Balance- Material	195,500	0	0	13,746	0
Deficit Beneficial Fill Source Balance - Material	0	0	0	0	3,500

Blasting	Required Volume (BCY)	Volume for Hauling (LCY)	Percentage
Volume Required from Blasting (Assume 15% Extra)	**0**	**0**	
Assume 10% Rippable	**0**		10%
Assume 90% Blasted	**0**		90%

TABLE CA-6

ALTERNATIVE 6 (YEAR 1)
Calculation Worksheet
Required Materials Output Calculations

COST WORKSHEET

Site:	Formosa OU1	**Prepared By:** JN	**Date:** 7/13/2012
Location:	Douglas County, Oregon		
Phase:	Feasibility Study	**Checked By:** EB	**Date:** 7/16/2012
Base Year:	2013		

Description: Determine the quantity of materials and labor required for maintenance of the cover systems and reclamation areas for Alternative 6 for Year 1

ALTERNATIVE 6 (YEAR 1)

Input Fields

Cover and Reclamation Areas	Location	Surface Area (AC)	Surface Area Subtotals (AC)	Annual Percentage of Surface Requiring Reseeding	Annual Percentage of Surface Requiring Weed Control
Geosynthetic Multi-Layer Cover	Within PMDA	5.4	5.4	7%	100%
Excavation Areas Reclamation	Excavated Areas	24.9	24.9	7%	100%

Amendment Components	Application Rate (LB/AC)
Fertilizer for Topsoil Amendment	135
Hydromulching	3,000
Seed Mix for Topsoil Areas	32

Output Fields-Required Materials

Remedy Components	Reseeding for Topsoil Areas (AC)	Seed Mix for Topsoil Areas (LB)	Fertilizer for Topsoil Areas (LB)	Hydromulching for Topsoil Areas (LB)	Weed Control for Seeded Areas (AC)
Geosynthetic Multi-Layer Cover	0.5	100	100	1,200	6
Excavation Areas Reclamation	2.0	100	300	5,300	25
TOTALS:	**2.5**	**200**	**400**	**6,500**	**31**

TABLE CA-7

ALTERNATIVE 6 (YEAR 2)
Calculation Worksheet
Required Materials Output Calculations

COST WORKSHEET

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Prepared By: JN **Date:** 7/13/2012
Checked By: EB **Date:** 7/16/2012

Description: Determine the quantity of materials and labor required for maintenance of the cover systems and reclamation areas for Alternative 6 for Year 2

ALTERNATIVE 6 (YEAR 2)

Input Fields

Cover and Reclamation Areas	Location	Surface Area (AC)	Surface Area Subtotals (AC)	Annual Percentage of Surface Requiring Reseeding	Annual Percentage of Surface Requiring Weed Control
Geosynthetic Multi-Layer Cover	Within PMDA	5.4	5.4	3%	100%
Excavation Areas Reclamation	Excavated Areas	24.9	24.9	3%	100%

Amendment Components	Application Rate (LB/AC)
Fertilizer for Topsoil Amendment	135
Hydromulching	3,000
Seed Mix for Topsoil Areas	32

Output Fields-Required Materials

Remedy Components	Reseeding for Topsoil Areas (AC)	Seed Mix for Topsoil Areas (LB)	Fertilizer for Topsoil Areas (LB)	Hydromulching for Topsoil Areas (LB)	Weed Control for Seeded Areas (AC)
Geosynthetic Multi-Layer Cover	0.5	100	100	500	6
Excavation Areas Reclamation	1.0	100	200	2,300	25
TOTALS:	**1.5**	**200**	**300**	**2,800**	**31**

Cost Estimate Backup

COST INDICES FOR ESCALATION

Base Year for Work: **2012**

Year	Cost Index[1]
1990	398.34
1991	406.78
1992	415.22
1993	427.83
1994	439.45
1995	452.31
1996	462.16
1997	472.17
1998	478.10
1999	486.21
2000	497.07
2001	503.52
2002	517.46
2003	529.95
2004	571.29
2005	608.36
2006	641.91
2007	673.52
2008	716.54
2009	703.00
2010	724.17
2011	756.48
2012	776.35
2013	789.71
2014	802.35
2015	816.79
2016	831.49
2017	846.46
2018	861.69
2019	877.20
2020	892.99
2021	909.07
2022	925.43
2023	942.09
2024	959.05
2025	976.31

1 Yearly composite cost index (weighted average) from the U.S. Army Corps of Engineers Civil Works Construction Cost Index System (CWCCIS), EM 1110-2-1304, 31 March 2000. Revised as of 31 March 2012.

SalaryExpert Cost Sources

Base Year: 2012

COST CODES FOR LABOR AND UNIT COSTS

Cost Code	Description	Units	Unit Labor Cost	Unit Equipment Cost	Unit Material Cost	Unit Other Cost	Year of Cost Source	Escalation Factor	Area Factor	Adjusted Labor Cost	Adjusted Equipment Cost	Adjusted Material Cost	Adjusted Other Cost	PC OH	PC PF	Cost Source: Source	Cost Source: Source ID	Comments
L1	Blast Foreman	HR	$26.71	$0.00	$0.00	$0.00	2012	1	1	$26.71	$0.00	$0.00	$0.00	100%	9%	SE	SalaryExpert.com	
L2	Project Engineer	HR	$42.74	$0.00	$0.00	$0.00	2012	1	1	$42.74	$0.00	$0.00	$0.00	100%	9%	SE	SalaryExpert.com	
L3	Civil Engineer	HR	$43.42	$0.00	$0.00	$0.00	2012	1	1	$43.42	$0.00	$0.00	$0.00	100%	9%	SE	SalaryExpert.com	
L4	Clerks, Typist, Bookkeeper & Receptionist	HR	$19.22	$0.00	$0.00	$0.00	2012	1	1	$19.22	$0.00	$0.00	$0.00	100%	9%	SE	SalaryExpert.com	
L5	Safety Engineer	HR	$41.90	$0.00	$0.00	$0.00	2012	1	1	$41.90	$0.00	$0.00	$0.00	100%	9%	SE	SalaryExpert.com	
L6	Environmental Engineer	HR	$33.51	$0.00	$0.00	$0.00	2012	1	1	$33.51	$0.00	$0.00	$0.00	100%	9%	SE	SalaryExpert.com	
L7	Environmental Lawyer	HR	$44.67	$0.00	$0.00	$0.00	2012	1	1	$44.67	$0.00	$0.00	$0.00	100%	9%	SE	SalaryExpert.com	
L8	Environmental Scientist	HR	$30.92	$0.00	$0.00	$0.00	2012	1	1	$30.92	$0.00	$0.00	$0.00	100%	9%	SE	SalaryExpert.com	
L9	Field Engineer	HR	$27.05	$0.00	$0.00	$0.00	2012	1	1	$27.05	$0.00	$0.00	$0.00	100%	9%	SE	SalaryExpert.com	
L10	Field Draftsmen	HR	$26.06	$0.00	$0.00	$0.00	2012	1	1	$26.06	$0.00	$0.00	$0.00	100%	9%	SE	SalaryExpert.com	
L11	Field Technician	HR	$53.52	$0.00	$0.00	$0.00	2012	1	1	$53.52	$0.00	$0.00	$0.00	100%	9%	SE	Hotjobs.salary.com	
L12	Geologist	HR	$42.77	$0.00	$0.00	$0.00	2012	1	1	$42.77	$0.00	$0.00	$0.00	100%	9%	SE	SalaryExpert.com	
L13	General Superintendent (P.M.)	HR	$50.68	$0.00	$0.00	$0.00	2012	1	1	$50.68	$0.00	$0.00	$0.00	100%	9%	SE	SalaryExpert.com	
L14	Hydrogeologist	HR	$34.76	$0.00	$0.00	$0.00	2012	1	1	$34.76	$0.00	$0.00	$0.00	100%	9%	SE	SalaryExpert.com	
L15	Mechanical Engineer	HR	$0.00	$0.00	$0.00	$0.00	2012	1	1	$0.00	$0.00	$0.00	$0.00	100%	9%	SE	SalaryExpert.com	
L16	Project Manager	HR	$39.48	$0.00	$0.00	$0.00	2012	1	1	$39.48	$0.00	$0.00	$0.00	100%	9%	SE	SalaryExpert.com	
L17	Quality Control Engineer	HR	$44.10	$0.00	$0.00	$0.00	2012	1	1	$44.10	$0.00	$0.00	$0.00	100%	9%	SE	SalaryExpert.com	
L18	Surveyors	HR	$31.69	$0.00	$0.00	$0.00	2012	1	1	$31.69	$0.00	$0.00	$0.00	100%	9%	SE	SalaryExpert.com	
L19	Paralegal	HR	$27.58	$0.00	$0.00	$0.00	2012	1	2	$55.16	$0.00	$0.00	$0.00	100%	9%	SE	SalaryExpert.com	
L20	Electrician	HR	$25.87	$0.00	$0.00	$0.00	2012	1	1	$25.87	$0.00	$0.00	$0.00	100%	9%	SE	SalaryExpert.com	
L21	Plumber	HR	$22.27	$0.00	$0.00	$0.00	2012	1	1	$22.27	$0.00	$0.00	$0.00	100%	9%	SE	SalaryExpert.com	
L22	Site Manager/Operator	HR	$35.30	$0.00	$0.00	$0.00	2012	1	1	$35.30	$0.00	$0.00	$0.00	0%	0%	SD	SD BOP	
L23	General Operator/Technician	HR	$18.64	$0.00	$0.00	$0.00	2012	1	1	$18.64	$0.00	$0.00	$0.00	0%	0%	SD	SD BOP	

Base Year: 2012

COST CODES FOR MATERIAL AND UNIT COSTS

Cost Code	Description	Units	Unit Labor Cost	Unit Equipment Cost	Unit Material Cost	Unit Other Cost	Year of Cost Source	Escalation Factor	Area Factor	Adjusted Labor Cost	Adjusted Equipment Cost	Adjusted Material Cost	Adjusted Other Cost	PC OH	PC PF	Cost Source: Source	Cost Source: Source ID	Comments
M1	Crushed Limestone, Delivered from Offsite	TN	$0.00	$0.00	$9.25	$3.33	2000	1.57	1	$0.00	$0.00	$14.52	$5.23	0%	0%	V	OU3	Includes purchase and delivery to the Site.
M2	HDPE Drainage Net	SY	$0.27	$0.09	$1.44	$0.00	2003	1.47	0.95	$0.38	$0.13	$2.04	$0.00	8%	9%	E	33-08-0511	Includes purchase and installation.
M3	Subsoil, Delivered from Offsite	BCY	$0.00	$0.00	$17.55	$0.00	2003	1.47	0.95	$0.00	$0.00	$24.92	$0.00	8%	9%	E	18-05-0301	Includes purchase and delivery from offsite source, short distance.
M4	General Fill, Delivered from Offsite	BCY	$0.00	$0.00	$7.95	$0.00	2003	1.47	0.95	$0.00	$0.00	$11.29	$0.00	8%	9%	E	17-03-0426	Includes purchase and delivery from offsite source, short distance.
M6	Riprap, Delivered from Offsite	BCY	$0.00	$0.00	$24.04	$0.00	2000	1.57	0.95	$0.00	$0.00	$36.54	$0.00	8%	9%	E	17-03-0418	Includes purchase and delivery to the Site.
M7	Rough Grading with Medium Size Dozer	BCY	$0.51	$0.80	$0.00	$0.00	2003	1.47	0.95	$0.72	$1.14	$0.00	$0.00	8%	9%	E	17-03-0109	For grading new and existing access road alignments.
M8	Seed Mix	ACR	$0.00	$0.00	$144.00	$0.00	2012	1	1	$0.00	$0.00	$144.00	$0.00	8%	9%	P	Previous Work	Materials only, 32 lbs/acre
M8A	Seed Mix	LB	$0.00	$0.00	$5.25	$0.00	2007	1.16	1	$0.00	$0.00	$6.09	$0.00	8%	9%	V	Vendor Quote	
M9	Fertilizer (N2 and P2O5)	ACR	$0.00	$0.00	$50.07	$0.00	2012	1	1	$0.00	$0.00	$50.07	$0.00	8%	9%	P	Previous Work	Materials only, 135 lbs/acre
M9A	Fertilizer (N2 and P2O5)	LB	$0.00	$0.00	$0.61	$0.00	2007	1.16	1	$0.00	$0.00	$0.71	$0.00	8%	9%	V	Vendor Quote	
M10	Hydromulch	ACR	$0.00	$0.00	$187.50	$0.00	2012	1	1	$0.00	$0.00	$187.50	$0.00	8%	9%	P	Previous Work	Materials only, 3000 lbs/acre
M10A	Hydromulching	LB	$0.03	$0.00	$0.27	$0.00	2007	1.16	1	$0.03	$0.00	$0.31	$0.00	8%	9%	V	Vendor Quote	
M11	Crushed Limestone for Neutralization of SWP1 Topsoil	TN	$0.00	$0.00	$9.25	$3.33	2000	1.57	1	$0.00	$0.00	$14.52	$5.23	0%	0%	V	OU3	Includes purchase and delivery to the Site.
M12	Per Diem for 2 Person	DY	$0.00	$0.00	$0.00	$246.00	2012	1	1	$0.00	$0.00	$0.00	$246.00	0%	0%	GSA	www.gsa.gov	
M13	Community Awareness Activities Allowance	EA	$0.00	$0.00	$0.00	$2,000.00	2012	1	1	$0.00	$0.00	$0.00	$2,000.00	0%	0%	A	Allowance	1 meeting per 5-yr review.
M14	Bulk Mixing/Blending of SWP1 Subsoil and Amendments	BCY	$0.76	$2.01	$0.00	$0.00	2003	1.47	0.95	$1.08	$2.85	$0.00	$0.00	8%	9%	E	33-06-0311	Includes mixing of all required amendments with large loader and dozer.
M15	Bulk Mixing/Blending of SWP1 Topsoil and Amendments	BCY	$0.76	$2.01	$0.00	$0.00	2003	1.47	0.95	$1.08	$2.85	$0.00	$0.00	8%	9%	E	33-06-0311	Includes mixing of all required amendments with large loader and dozer.
M16	Rough Grading with Medium Size Dozer	BCY	$0.51	$0.80	$0.00	$0.00	2003	1.47	0.95	$0.72	$1.14	$0.00	$0.00	8%	9%	E	17-03-0109	For pushing of spent ore from HLP to toe of slope.
M18	Bulk Bentonite	TN	$0.00	$0.00	$85.00	$0.00	2003	1.47	1	$0.00	$0.00	$124.95	$0.00	8%	9%	V	OU3	Includes purchase and delivery to the Site.
M19	Bulk Bentonite	TN	$0.00	$0.00	$100.00	$0.00	2003	1.47	1	$0.00	$0.00	$147.00	$0.00	8%	9%	V	OU3	Includes purchase and delivery to the Site.
M20	Clear Large Trees, Grub, and Haul	ACR	$4,320.00	$3,811.00	$0.00	$0.00	2003	1.47	0.95	$6,134.40	$5,411.62	$0.00	$0.00	8%	9%	E	17-01-0108	Includes removal and cutting of trees to 16-inch diameter, grubbing, and hauling.
M22	Bulk Mixing/Blending of Contaminated Fills and Amendments	BCY	$0.76	$2.01	$0.00	$0.00	2003	1.47	0.95	$1.08	$2.85	$0.00	$0.00	8%	9%	E	33-06-0311	Includes mixing of all required amendments with large loader and dozer.
M23	Drain Gravel, From within PMDA	BCY	$0.00	$0.00	$21.91	$0.00	2003	1.47	1	$0.00	$0.00	$32.21	$0.00	8%	9%	E	33-06-1042	Includes purchase and delivery to the Site.
M24	Filter Sand, Delivered from Offsite	BCY	$0.00	$0.00	$17.23	$0.00	2003	1.47	1	$0.00	$0.00	$25.33	$0.00	8%	9%	E	17-03-0405	Includes purchase and delivery to the Site.
M25	Bulk Mixing/Blending of Drain Gravel for Dam Core and Bentonite	BCY	$0.76	$2.01	$0.00	$0.00	2003	1.47	0.95	$1.08	$2.85	$0.00	$0.00	8%	9%	E	33-06-0311	Includes mixing of all required amendments with large loader and dozer.
M27	Copy and Shipping Allowance	LS	$0.00	$0.00	$0.00	$2,000	2007	1.16	1	$0.00	$0.00	$0.00	$2,320.00	0%	0%	A	Allowance	
M27A	Copy and Shipping Allowance	LS	$0.00	$0.00	$0.00	$1,000	2007	1.16	1	$0.00	$0.00	$0.00	$1,160.00	0%	0%	A	Allowance	
M33	Lime, Material and Delivery	LCY	$0.00	$0.00	$155.76	$10.31	2012	1	1	$0.00	$0.00	$155.76	$10.31	8%	9%	V	Vendor Quote	1.95 hourcycle time for one truck and that truck holds 20 LCY of lime.
M33A	Organic Material, Material and Delivery	LCY	$0.00	$0.00	$23.00	$10.31	2012	1	1	$0.00	$0.00	$23.00	$10.31	8%	9%	V	Vendor Quote	1.95 hourcycle time for one truck and that truck holds 20 LCY of organic material.
M21	Crushed Limestone for Soil Neutralization	TN	$0.00	$0.00	$10.35	$0.00	2007	1.16	1	$0.00	$0.00	$10.08	$3.63	8%	9%	V	Vendor Quote	Includes material purchase only
M5	Lime, Road Mix	TN	$0.00	$0.00	$7.25	$0.00	2007	1.16	1	$0.00	$0.00	$8.41	$0.00	8%	9%	V	Vendor Quote	Includes material purchase only
M5A	Road Mix, Gravel	TN	$0.00	$0.00	$12.13	$0.00	2012	1	1	$0.00	$0.00	$12.13	$0.00	8%	9%	V	Vendor Quote	Includes material purchase only
M17	Asphalt	BCY	$0.00	$0.00	$6.33	$0.00	2012	1	1	$0.00	$0.00	$6.33	$0.00	8%	9%	CW	RS Means	Includes material purchase only
M28		EA	$0.00	$0.00	$119.99	$0.00	2007	1.16	1	$0.00	$0.00	$139.19	$0.00	8%	9%	V	Vendor Quote	
M28A	Gate, 2" Tubular Farm Type, Single Swing, 18' Wide, 52" High	EA	$0.00	$0.00	$174.94	$0.00	2007	1.16	1	$0.00	$0.00	$202.93	$0.00	8%	9%	V	Vendor Quote	
M29	Gate, Latch and Fittings, Double Swing	EA	$493.26	$0.00	$584.50	$0.00	2007	1.16	1	$572.18	$0.00	$678.02	$0.00	8%	9%	V	Vendor Quote	
M29A	Gate, Latch and Fittings, Single Swing	EA	$0.00	$0.00	$63.68	$0.00	2007	1.16	1	$0.00	$0.00	$73.87	$0.00	8%	9%	V	Vendor Quote	
M30	Barbed Wire Fencing, 3 Strands,12.5 Ga Galvanized with Fencing Sta	LF	$0.00	$0.00	$0.14	$0.00	2007	1.16	1	$0.00	$0.00	$0.16	$0.00	8%	9%	V	Vendor Quote	
M31	Pipe, Galvanized Pipe, 2 1/2" Dia, 8' High	EA	$0.00	$0.00	$24.32	$0.00	2007	1.16	1	$0.00	$0.00	$28.21	$0.00	8%	9%	V	Vendor Quote	Assume use as corner posts every 500 FT
M32	6.5' T-Posts and Post Clips	EA	$0.00	$0.00	$3.90	$0.00	2007	1.16	1	$0.00	$0.00	$4.52	$0.00	8%	9%	V	Vendor Quote	Assume 10 FT apart
M34	Chain Link Fence	LF	$6.58	$0.00	$5.82	$0.00	2007	1.16	1	$7.63	$0.00	$6.75	$0.00	8%	9%	V	Vendor Quote	Assume braces set 150 FT apart
M35	Barb Wire, Galvanized, Class 3, 3 Strands/LF	LF	$0.00	$0.00	$0.22	$0.00	2007	1.16	1	$0.00	$0.00	$0.26	$0.00	8%	9%	V	Vendor Quote	
M36	Supplies, Copying and Shipping Allowance	LS	$0.00	$0.00	$0.00	$30,000.00	2007	1.16	1	$0.00	$0.00	$0.00	$34,800.00	0%	0%	A	Allowance	
M37	Signs, Sign Post	EA	$0.00	$0.00	$65.20	$0.00	2007	1.16	1	$0.00	$0.00	$75.63	$0.00	8%	9%	V	Vendor Quote	Assume 300 FT apart
M37A	Signs	EA	$0.00	$0.00	$20.95	$0.00	2007	1.16	1	$0.00	$0.00	$24.30	$0.00	8%	9%	V	Vendor Quote	Assume 150 FT apart
M37B	Portable Diesel Pump, Godwin HL80M, 310 GPM, 300 FT Head	EA	$0.00	$0.00	$49,800.00	$0.00	2007	1.16	1	$0.00	$0.00	$57,768.00	$0.00	8%	9%	V	Vendor Quote	
M38	Portable Diesel Pump, Godwin HL5M, 960 GPM, 450 FT Head	EA	$0.00	$0.00	$85,500.00	$0.00	2007	1.16	1	$0.00	$0.00	$99,200.00	$0.00	8%	9%	V	Vendor Quote	
M39	Centrifugal Pump	EA	$0.00	$0.00	$42,000.00	$0.00	2005	1.28	1	$0.00	$0.00	$53,800.00	$0.00	8%	9%	P	Previous Work	Cost includes pumps with variable speed sets
M39B	Underground Storage Tank, FRP, 6' by 16'	EA	$0.00	$0.00	$14,000.00	$0.00	2005	1.28	1	$0.00	$0.00	$18,000.00	$0.00	8%	9%	P	Previous Work	Used for storage of ARD collected from perimeter trenches.
M39A	Diesel Generator Set With Trailer	EA	$0.00	$0.00	$115,000.00	$0.00	2007	1.16	1	$0.00	$0.00	$133,400.00	$0.00	8%	9%	V	Vendor Quote	
M40	Installation Charges	EA	$0.00	$0.00	$5,000.00	$0.00	2005	1.28	1	$0.00	$0.00	$6,400.00	$0.00	8%	9%	P	Previous Work	
M41	Silt Fence	LF	$1.06	$0.00	$0.33	$0.00	2012	1	1	$1.06	$0.00	$0.33	$0.00	8%	9%	CW	RS Means	
M42	Hay Bales	LF	$0.53	$0.00	$10.72	$0.00	2012	1	1	$0.53	$0.00	$10.72	$0.00	8%	9%	CW	RS Means	
M43	Erosion Control Blankets	SY	$1.95	$0.00	$1.05	$0.00	2012	1	1	$1.95	$0.00	$1.05	$0.00	8%	9%	CW	RS Means	
M44	Cedar Tree	EA	$0.00	$0.00	$25.00	$0.00	2012	1	1	$0.00	$0.00	$25.00	$0.00	8%	9%	P	Previous Work	
M45	Pine Tree	EA	$0.00	$0.00	$25.00	$0.00	2012	1	1	$0.00	$0.00	$25.00	$0.00	8%	9%	P	Previous Work	
M46	Spruce Tree	EA	$0.00	$0.00	$25.00	$0.00	2012	1	1	$0.00	$0.00	$25.00	$0.00	8%	9%	P	Previous Work	
M46A	Sump Pump	EA	$0.00	$0.00	$363.00	$245.00	2012	1	1	$0.00	$0.00	$363.00	$245.00	8%	9%	CW	RS Means	
M46B	100,000 Tank	EA	$0.00	$0.00	$258,000.00	$668.00	2012	1	1	$0.00	$0.00	$258,000.00	$668.00	8%	9%	CW	RS Means	
M47	Goulds JCU Sludge Pump	EA	$0.00	$0.00	$40,582.00	$0.00	2007	1.16	1	$0.00	$0.00	$47,075.12	$0.00	8%	9%	V	Vendor Quote	3 conductor armored and ground GGC electrical cable
M48	50000 Gal Tank	LS	$0.00	$0.00	$100,000.00	$0.00	2005	1.28	1	$0.00	$0.00	$128,000.00	$0.00	8%	9%	V	Vendor Quote	HDPE pipes, elbows and tees
M48A	Pump Barge	LS	$0.00	$0.00	$16,000.00	$0.00	2006	1.21	1	$0.00	$0.00	$19,360.00	$0.00	8%	9%	P	Previous Work	Includes wiring, elbows, piping, deck, and rails
M49	Freight Charges	LS	$0.00	$0.00	$0.00	$2,000.00	2007	1.16	1	$0.00	$0.00	$0.00	$2,320.00	8%	9%	V	Vendor Quote	

Base Year: 2012

COST CODES FOR MATERIAL AND UNIT COSTS

Cost Code	Description	Units	Unit Labor Cost	Unit Equipment Cost	Unit Material Cost	Unit Other Cost	Year of Cost Source	Escalation Factor	Area Factor	Adjusted Labor Cost	Adjusted Equipment Cost	Adjusted Material Cost	Adjusted Other Cost	PC OH	PC PF	Cost Source Source	Cost Source Source ID	Comments
M50	Treated Lumber for Barge Construction and Railings	LS	$0.00	$0.00	$1,500.00	$0.00	2007	1.16	1	$0.00	$0.00	$1,740.00	$0.00	8%	9%	V	Vendor Quote	
M51	Miscellaneous Costs	LS	$0.00	$0.00	$0.00	$3,400.00	2007	1.16	1	$0.00	$0.00	$0.00	$3,944.00	8%	9%	V	Vendor Quote	Cost includes specialized labor and miscellaneous charges
M52	General Site Supplies	LS	$0.00	$0.00	$77,000.00	$0.00	2006	1.21	1	$0.00	$0.00	$93,170.00	$0.00	8%	9%	P	Previous Work	Small tools, welding supplies, small pumps, auto and tires, replacement probes, filters, AccuVacs, reagent, etc,.
M52 2AB	General Site Supplies	LS	$0.00	$0.00	$77,000.00	$0.00	2006	1.21	1	$0.00	$0.00	$93,170.00	$0.00	8%	9%	P	Previous Work	Small tools, welding supplies, small pumps, auto and tires, replacement probes, filters, AccuVacs, reagent, etc,.
M52 3E	General Site Supplies	LS	$0.00	$0.00	$77,000.00	$0.00	2006	1.21	1	$0.00	$0.00	$93,170.00	$0.00	8%	9%	P	Previous Work	Small tools, welding supplies, small pumps, auto and tires, replacement probes, filters, AccuVacs, reagent, etc,.
M52 3L	General Site Supplies	LS	$0.00	$0.00	$77,000.00	$0.00	2006	1.21	1	$0.00	$0.00	$93,170.00	$0.00	8%	9%	P	Previous Work	Small tools, welding supplies, small pumps, auto and tires, replacement probes, filters, AccuVacs, reagent, etc,.
M52 4E	General Site Supplies	LS	$0.00	$0.00	$77,000.00	$0.00	2006	1.21	1	$0.00	$0.00	$93,170.00	$0.00	8%	9%	P	Previous Work	Small tools, welding supplies, small pumps, auto and tires, replacement probes, filters, AccuVacs, reagent, etc,.
M52 4L	General Site Supplies	LS	$0.00	$0.00	$77,000.00	$0.00	2006	1.21	1	$0.00	$0.00	$93,170.00	$0.00	8%	9%	P	Previous Work	Small tools, welding supplies, small pumps, auto and tires, replacement probes, filters, AccuVacs, reagent, etc,.
M52 5E	General Site Supplies	LS	$0.00	$0.00	$69,500.00	$0.00	2006	1.21	1	$0.00	$0.00	$84,095.00	$0.00	8%	9%	P	Previous Work	Small tools, welding supplies, small pumps, auto and tires, replacement probes, filters, AccuVacs, reagent, etc,.
M52 5L	General Site Supplies	LS	$0.00	$0.00	$58,000.00	$0.00	2006	1.21	1	$0.00	$0.00	$70,180.00	$0.00	8%	9%	P	Previous Work	Small tools, welding supplies, small pumps, auto and tires, replacement probes, filters, AccuVacs, reagent, etc,.
M53	Fuel Diesel	KGAL	$0.00	$0.00	$0.61	$0.00	2007	1.16	1	$0.00	$0.00	$0.71	$0.00	8%	9%	P	Previous Work	Diesel for pumps
M53A	Fuel Diesel	GAL	$0.00	$0.00	$2.70	$0.00	2007	1.16	1	$0.00	$0.00	$3.13	$0.00	8%	9%	P	Previous Work	Diesel for pumps, generators
M53 2AB	Fuel (Diesel and Gasoline)	LS	$0.00	$0.00	$89,300.00	$0.00	2007	1.16	1	$0.00	$0.00	$103,588.00	$0.00	8%	9%	P	Previous Work	Diesel for pumps and gas for vehicles
M53 3E	Fuel (Diesel and Gasoline)	LS	$0.00	$0.00	$72,100.00	$0.00	2007	1.16	1	$0.00	$0.00	$83,636.00	$0.00	8%	9%	P	Previous Work	Diesel for pumps and gas for vehicles
M53 3L	Fuel (Diesel and Gasoline)	LS	$0.00	$0.00	$50,800.00	$0.00	2007	1.16	1	$0.00	$0.00	$58,928.00	$0.00	8%	9%	P	Previous Work	Diesel for pumps and gas for vehicles
M53 4E	Fuel (Diesel and Gasoline)	LS	$0.00	$0.00	$61,400.00	$0.00	2007	1.16	1	$0.00	$0.00	$71,224.00	$0.00	8%	9%	P	Previous Work	Diesel for pumps and gas for vehicles
M53 4L	Fuel (Diesel and Gasoline)	LS	$0.00	$0.00	$36,800.00	$0.00	2007	1.16	1	$0.00	$0.00	$42,688.00	$0.00	8%	9%	P	Previous Work	Diesel for pumps and gas for vehicles
M53 5E	Fuel (Diesel and Gasoline)	LS	$0.00	$0.00	$61,400.00	$0.00	2006	1.21	1	$0.00	$0.00	$74,294.00	$0.00	8%	9%	P	Previous Work	Diesel for pumps and gas for vehicles
M53 5L	Fuel (Diesel and Gasoline)	LS	$0.00	$0.00	$36,800.00	$0.00	2006	1.21	1	$0.00	$0.00	$44,528.00	$0.00	8%	9%	P	Previous Work	Diesel for pumps and gas for vehicles
M54 2AB	Electricity	LS	$0.00	$0.00	$108,400.00	$0.00	2006	1.21	1	$0.00	$0.00	$131,164.00	$0.00	8%	9%	P	Previous Work	Electricity required by pumps and other site activities
M54 3E	Electricity	LS	$0.00	$0.00	$111,600.00	$0.00	2006	1.21	1	$0.00	$0.00	$135,036.00	$0.00	8%	9%	P	Previous Work	Electricity required by pumps and other site activities
M54 3L	Electricity	LS	$0.00	$0.00	$63,600.00	$0.00	2006	1.21	1	$0.00	$0.00	$76,956.00	$0.00	8%	9%	P	Previous Work	Electricity required by pumps and other site activities
M54 4E	Electricity	LS	$0.00	$0.00	$98,500.00	$0.00	2006	1.21	1	$0.00	$0.00	$119,185.00	$0.00	8%	9%	P	Previous Work	Electricity required by pumps and other site activities
M54 4L	Electricity	LS	$0.00	$0.00	$57,500.00	$0.00	2006	1.21	1	$0.00	$0.00	$69,575.00	$0.00	8%	9%	P	Previous Work	Electricity required by pumps and other site activities
M54 5E	Electricity	LS	$0.00	$0.00	$70,000.00	$0.00	2006	1.21	1	$0.00	$0.00	$84,700.00	$0.00	8%	9%	P	Previous Work	Electricity required by pumps and other site activities
M54 5L	Electricity	LS	$0.00	$0.00	$29,000.00	$0.00	2006	1.21	1	$0.00	$0.00	$35,090.00	$0.00	8%	9%	P	Previous Work	Electricity required by pumps and other site activities
M55	Rental Equipment (Lease)	LS	$0.00	$0.00	$0.00	$163,000.00	2006	1.21	1	$0.00	$0.00	$0.00	$197,230.00	8%	9%	P	Previous Work	Site security radio, pickup trucks, forklift and backhoe
M55 2AB	Rental Equipment (Lease)	LS	$0.00	$0.00	$0.00	$0.00	2006	1.21	1	$0.00	$0.00	$0.00	$0.00	8%	9%	P	Previous Work	Site security radio, pickup trucks, forklift and backhoe
M55 3E	Rental Equipment (Lease)	LS	$0.00	$0.00	$0.00	$0.00	2006	1.21	1	$0.00	$0.00	$0.00	$0.00	8%	9%	P	Previous Work	Site security radio, pickup trucks, forklift and backhoe
M55 4E	Rental Equipment (Lease)	LS	$0.00	$0.00	$0.00	$0.00	2006	1.21	1	$0.00	$0.00	$0.00	$0.00	8%	9%	P	Previous Work	Site security radio, pickup trucks, forklift and backhoe
M55 5E	Rental Equipment (Lease)	LS	$0.00	$0.00	$0.00	$130,000.00	2006	1.21	1	$0.00	$0.00	$0.00	$157,300.00	8%	9%	P	Previous Work	Site security radio, pickup trucks, forklift and backhoe
M56	Onsite Utilities	LS	$0.00	$0.00	$0.00	$37,000.00	2006	1.21	1	$0.00	$0.00	$0.00	$44,770.00	8%	9%	P	Previous Work	Includes telephone, pager, internet, propane, potable water and septic services.
M56 2AB	Onsite Utilities	LS	$0.00	$0.00	$0.00	$0.00	2006	1.21	1	$0.00	$0.00	$0.00	$0.00	8%	9%	P	Previous Work	Includes telephone, pager, internet, propane, potable water and septic services.
M56 3E	Onsite Utilities	LS	$0.00	$0.00	$0.00	$0.00	2006	1.21	1	$0.00	$0.00	$0.00	$0.00	8%	9%	P	Previous Work	Includes telephone, pager, internet, propane, potable water and septic services.
M56 3L	Onsite Utilities	LS	$0.00	$0.00	$0.00	$0.00	2006	1.21	1	$0.00	$0.00	$0.00	$0.00	8%	9%	P	Previous Work	Includes telephone, pager, internet, propane, potable water and septic services.
M56 4E	Onsite Utilities	LS	$0.00	$0.00	$0.00	$0.00	2006	1.21	1	$0.00	$0.00	$0.00	$0.00	8%	9%	P	Previous Work	Includes telephone, pager, internet, propane, potable water and septic services.
M56 4L	Onsite Utilities	LS	$0.00	$0.00	$0.00	$0.00	2006	1.21	1	$0.00	$0.00	$0.00	$0.00	8%	9%	P	Previous Work	Includes telephone, pager, internet, propane, potable water and septic services.
M56 5E	Onsite Utilities	LS	$0.00	$0.00	$0.00	$58,800.00	2006	1.21	1	$0.00	$0.00	$0.00	$71,148.00	8%	9%	P	Previous Work	Includes telephone, pager, internet, propane, potable water and septic services.
M56 5L	Onsite Utilities	LS	$0.00	$0.00	$0.00	$44,100.00	2006	1.21	1	$0.00	$0.00	$0.00	$53,361.00	8%	9%	P	Previous Work	Includes telephone, pager, internet, propane, potable water and septic services.
M57	Monitoring Equipment Rental	LS	$0.00	$0.00	$0.00	$2,500.00	2006	1.21	1	$0.00	$0.00	$0.00	$3,025.00	8%	9%	P	Previous Work	Includes hydrolab rental and 4-way gas monitor

Base Year: 2012

COST CODES FOR MATERIAL AND UNIT COSTS

Cost Code	Description	Units	Unit Labor Cost	Unit Equipment Cost	Unit Material Cost	Unit Other Cost	Year of Cost Source	Escalation Factor	Area Factor	Adjusted Labor Cost	Adjusted Equipment Cost	Adjusted Material Cost	Adjusted Other Cost	PC OH	PC PF	Cost Source: Source	Cost Source: Source ID	Comments
M57 2AB	Monitoring Equipment Rental	LS	$0.00	$0.00	$0.00	$0.00	2006	1.21	1	$0.00	$0.00	$0.00	$0.00	8%	9%	P	Previous Work	Includes hydrolab rental and 4-way gas monitor
M57 3E	Monitoring Equipment Rental	LS	$0.00	$0.00	$0.00	$0.00	2006	1.21	1	$0.00	$0.00	$0.00	$0.00	8%	9%	P	Previous Work	Includes hydrolab rental and 4-way gas monitor
M57 3L	Monitoring Equipment Rental	LS	$0.00	$0.00	$0.00	$0.00	2006	1.21	1	$0.00	$0.00	$0.00	$0.00	8%	9%	P	Previous Work	Includes hydrolab rental and 4-way gas monitor
M57 4E	Monitoring Equipment Rental	LS	$0.00	$0.00	$0.00	$0.00	2006	1.21	1	$0.00	$0.00	$0.00	$0.00	8%	9%	P	Previous Work	Includes hydrolab rental and 4-way gas monitor
M57 4L	Monitoring Equipment Rental	LS	$0.00	$0.00	$0.00	$0.00	2006	1.21	1	$0.00	$0.00	$0.00	$0.00	8%	9%	P	Previous Work	Includes hydrolab rental and 4-way gas monitor
M57 5E	Monitoring Equipment Rental	LS	$0.00	$0.00	$0.00	$1,950.00	2006	1.21	1	$0.00	$0.00	$0.00	$2,359.50	8%	9%	P	Previous Work	Includes hydrolab rental and 4-way gas monitor
M57 5L	Monitoring Equipment Rental	LS	$0.00	$0.00	$0.00	$1,450.00	2006	1.21	1	$0.00	$0.00	$0.00	$1,754.50	8%	9%	P	Previous Work	Includes hydrolab rental and 4-way gas monitor
M58 2A	Electricity for WTP	KGAL	$0.00	$0.00	$0.00	$0.20	2007	1.16	1	$0.00	$0.00	$0.00	$0.23	8%	9%	WTR	WTP Report	
M58 2B	Electricity for WTP	KGAL	$0.00	$0.00	$0.00	$0.26	2007	1.16	1	$0.00	$0.00	$0.00	$0.30	8%	9%	WTR	WTP Report	
M58 345	Electricity for WTP	KGAL	$0.00	$0.00	$0.00	$0.29	2007	1.16	1	$0.00	$0.00	$0.00	$0.34	8%	9%	WTR	WTP Report	
M59 2A	Chemicals and Reagents	KGAL	$0.00	$0.00	$0.42	$0.00	2006	1.21	1	$0.00	$0.00	$0.51	$0.00	8%	9%	WTR	WTP Report	Quicklime, flocculant and CO2 (pH adjust)
M59 2B	Chemicals and Reagents	KGAL	$0.00	$0.00	$0.77	$0.00	2007	1.16	1	$0.00	$0.00	$0.89	$0.00	8%	9%	WTR	WTP Report	Quicklime, flocculant and CO2 (pH adjust)
M59 345	Chemicals and Reagents	KGAL	$0.00	$0.00	$1.10	$0.00	2007	1.16	1	$0.00	$0.00	$1.28	$0.00	8%	9%	WTR	WTP Report	Quicklime, flocculant and CO2 (pH adjust)
M60	Equipment Maintenance	KGAL	$0.00	$0.00	$0.00	$0.69	2007	1.16	1	$0.00	$0.00	$0.00	$0.80	8%	9%	WTR	WTP Report	
M61	WTP Replacement (without Gypsum Scaling Prevention)	LS	$0.00	$0.00	$0.00	$3,510,000.00	2003	1.47	1	$0.00	$0.00	$0.00	$5,159,700.00	8%	9%	P	Previous Work	Includes installation, material, equipment, instrumentation and labor costs
M61A	WTP Upgrade - Gypsum Scaling Prevention	LS	$0.00	$0.00	$0.00	$11.05	2007	1.16	1	$0.00	$0.00	$0.00	$12.82	8%	9%	WTR	WTP Report	Includes installation, material, equipment, instrumentation and labor costs
M62	WTP Building Replacement (without Gypsum Scaling Prevention)	SF	$0.00	$0.00	$0.00	$90.98	2007	1.16	1	$0.00	$0.00	$0.00	$105.54	8%	9%	P	Previous Work	50 FT x 100 FT. Includes installed cost for electrical, HVAC and foundation.
M63	WTP Building Replacement for Gypsum Scaling Prevention	SF	$0.00	$0.00	$0.00	$90.98	2007	1.16	1	$0.00	$0.00	$0.00	$105.54	8%	9%	P	Previous Work	40 FT x 40 FT. Includes installed cost for electrical, HVAC and foundation.
M63A	Constructing New Maintenance Building	SF	$0.00	$0.00	$0.00	$90.98	2007	1.16	1	$0.00	$0.00	$0.00	$105.54	8%	9%	P	Previous Work	50 FT x 100 FT. Includes installed cost for electrical, HVAC, foundation and other utilities.
M64	Lab Analysis - Dissolved Metals	EA	$0.00	$0.00	$0.00	$15.00	2007	1.16	1	$0.00	$0.00	$0.00	$17.40	8%	9%	P	Previous Work	Lab analysis method - EPA 200.8
M65	Lab Analysis - Total Metals	EA	$0.00	$0.00	$0.00	$10.00	2007	1.16	1	$0.00	$0.00	$0.00	$11.60	8%	9%	P	Previous Work	EPA (200.8, 245.1), SM 3111B
M66	Lab Analysis - Routine Parameters	EA	$0.00	$0.00	$0.00	$11.00	2007	1.16	1	$0.00	$0.00	$0.00	$12.76	8%	9%	P	Previous Work	SM 2320B, SM 19(2340), EPA (353.2, 150.1, 375.2, 160.2)
M67	Lab Analysis - Whole Effluent Toxicity (WET)	EA	$0.00	$0.00	$0.00	$550.00	2007	1.16	1	$0.00	$0.00	$0.00	$638.00	8%	9%	P	Previous Work	EPA 160.2
M68	Lab Analysis, WTP Influent - Dissolved Metals	EA	$0.00	$0.00	$0.00	$15.00	2007	1.16	1	$0.00	$0.00	$0.00	$17.40	8%	9%	P	Previous Work	Lab analysis method - EPA 200.8
M69	Lab Analysis, WTP Influent - Total Metals	EA	$0.00	$0.00	$0.00	$10.00	2007	1.16	1	$0.00	$0.00	$0.00	$11.60	8%	9%	P	Previous Work	EPA (200.8, 245.1), SM 3111B
M70	Lab Analysis, WTP Influent - Routine Parameters	EA	$0.00	$0.00	$0.00	$11.00	2007	1.16	1	$0.00	$0.00	$0.00	$12.76	8%	9%	P	Previous Work	SM 2320B, SM 19(2340), EPA (353.2, 150.1, 375.2, 160.2)
M71	Lab Analysis, WTP Effluent - Dissolved Metals	EA	$0.00	$0.00	$0.00	$15.00	2007	1.16	1	$0.00	$0.00	$0.00	$17.40	8%	9%	P	Previous Work	Lab analysis method - EPA 200.8
M72	Lab Analysis, WTP Effluent - Total Metals	EA	$0.00	$0.00	$0.00	$10.00	2007	1.16	1	$0.00	$0.00	$0.00	$11.60	8%	9%	P	Previous Work	EPA (200.8, 245.1), SM 3111B
M73	Lab Analysis, WTP Effluent - Routine Parameters	EA	$0.00	$0.00	$0.00	$11.00	2007	1.16	1	$0.00	$0.00	$0.00	$12.76	8%	9%	P	Previous Work	SM 2320B, SM 19(2340), EPA (353.2, 150.1, 375.2, 160.2)
M74	Coolers	EA	$0.00	$0.00	$10.00	$0.00	2007	1.16	1	$0.00	$0.00	$11.60	$0.00	8%	9%	P	Previous Work	
M75	Ice Bags	EA	$0.00	$0.00	$2.00	$0.00	2007	1.16	1	$0.00	$0.00	$2.32	$0.00	8%	9%	P	Previous Work	
M76	Packing Supplies	EA	$0.00	$0.00	$3.00	$0.00	2007	1.16	1	$0.00	$0.00	$3.48	$0.00	8%	9%	P	Previous Work	
M77	PPE and Gloves	EA	$0.00	$0.00	$10.00	$0.00	2007	1.16	1	$0.00	$0.00	$11.60	$0.00	8%	9%	P	Previous Work	
M78	Generator Fuel	EA	$0.00	$0.00	$15.00	$0.00	2007	1.16	1	$0.00	$0.00	$17.40	$0.00	8%	9%	P	Previous Work	
M79	Disposable Bailer	EA	$0.00	$0.00	$4.00	$0.00	2007	1.16	1	$0.00	$0.00	$4.64	$0.00	8%	9%	P	Previous Work	
M80	YSI Hydrolab	EA	$0.00	$0.00	$500.00	$0.00	2007	1.16	1	$0.00	$0.00	$580.00	$0.00	8%	9%	P	Previous Work	
M81	U10 Water Checker	EA	$0.00	$0.00	$550.00	$0.00	2007	1.16	1	$0.00	$0.00	$638.00	$0.00	8%	9%	P	Previous Work	
M82	Peristaltic Pump	EA	$0.00	$0.00	$300.00	$0.00	2007	1.16	1	$0.00	$0.00	$348.00	$0.00	8%	9%	P	Previous Work	
M83	4-way Gas Monitor	EA	$0.00	$0.00	$300.00	$0.00	2007	1.16	1	$0.00	$0.00	$348.00	$0.00	8%	9%	P	Previous Work	
M84	Water Level indicator	EA	$0.00	$0.00	$100.00	$0.00	2007	1.16	1	$0.00	$0.00	$116.00	$0.00	8%	9%	P	Previous Work	
M85	Generator	EA	$0.00	$0.00	$250.00	$0.00	2007	1.16	1	$0.00	$0.00	$290.00	$0.00	8%	9%	P	Previous Work	
M86	Mobilization/Demobilization of Pugmill Batch Plant	EA	$0.00	$0.00	$100.00	$0.00	2007	1.16	1	$0.00	$0.00	$116.00	$0.00	8%	9%	P	Previous Work	
M87	Portland Cement, Delivered	LCY	$0.00	$0.00	$113.00	$0.00	2011	1.03	1	$0.00	$0.00	$116.39	$0.00	8%	9%	P	Previous Work	
M88	Geomembrane	ACR	$0.00	$0.00	$19,602.00	$28,568.24	2012	1	1	$0.00	$0.00	$19,602.00	$28,568.24	8%	9%	V	Vendor Quote	Delivered cost
M89	Geotextile	ACR	$0.00	$0.00	$5,227.20	$5,305.57	2012	1	1	$0.00	$0.00	$5,227.20	$5,305.57	8%	9%	V	Vendor Quote	Delivered cost
M90	4" HDPE Pipe, DR 11	LF	$0.00	$0.00	$3.05	$0.00	2012	1	1	$0.00	$0.00	$3.05	$0.00	8%	9%	CW	RS Means	
M91	4" HDPE 90 Deg Elbow	EA	$0.00	$0.00	$18.70	$0.00	2012	1	1	$0.00	$0.00	$18.70	$0.00	8%	9%	CW	RS Means	
M92	4" HDPE Tee	EA	$0.00	$0.00	$22.50	$0.00	2012	1	1	$0.00	$0.00	$22.50	$0.00	8%	9%	CW	RS Means	
M93	Welding plastic Labor	HR	$0.00	$0.00	$45.40	$0.00	2012	1	1	$0.00	$0.00	$45.40	$0.00	8%	9%	CW	RS Means	
M94	Plastic Welder Rental	DY	$0.00	$0.00	$45.50	$0.00	2012	1	1	$0.00	$0.00	$45.50	$0.00	8%	9%	CW	RS Means	
M95	4" HDPE Perf. Pipe	LF	$0.00	$0.00	$3.05	$0.00	2012	1	1	$0.00	$0.00	$3.05	$0.00	8%	9%	CW	RS Means	
M96	Goulds Pump 3196	EA	$0.00	$0.00	$11,590.00	$0.00	2007	1.16	1	$0.00	$0.00	$13,444.40	$0.00	8%	9%	V	Vendor Quote	
M97	Grundfos Pump, 4" 10HP	EA	$0.00	$0.00	$6,269.00	$0.00	2007	1.16	1	$0.00	$0.00	$7,272.04	$0.00	8%	9%	V	Vendor Quote	
M98	Weed Control Services	ACR	$0.00	$0.00	$0.00	$62.64	2006	1.21	1	$0.00	$0.00	$0.00	$75.79	8%	9%	P	Previous Work	application of weed control chemicals.
M99	Seed and Fertilizer	ACR	$0.00	$0.00	$8.07	$0.00	2006	1.21	1	$0.00	$0.00	$9.76	$0.00	8%	9%	P	Previous Work	Does not include labor for installation.
M100	ATV Usage and Maintenance	MO	$0.00	$0.00	$0.00	$210.00	2006	1.21	1	$0.00	$0.00	$0.00	$254.10	8%	9%	P	Previous Work	Includes rental and maintenance costs.
M101	Erosion Repair Material Allowance	LS	$0.00	$0.00	$0.00	$1,250.00	2007	1.16	1	$0.00	$0.00	$0.00	$1,450.00	0%	0%	A	Allowance	Includes costs for materials to repair diversion ditches and soil cover materials.
M102	Erosion Repair Material Allowance	LS	$0.00	$0.00	$0.00	$2,500.00	2007	1.16	1	$0.00	$0.00	$0.00	$2,900.00	0%	0%	A	Allowance	Includes costs for materials to repair diversion ditches and soil cover materials.
M103	Erosion Repair Material Allowance	LS	$0.00	$0.00	$0.00	$5,000.00	2007	1.16	1	$0.00	$0.00	$0.00	$5,800.00	0%	0%	A	Allowance	Includes costs for materials to repair diversion ditches and soil cover materials.
M104	Erosion Repair Material Allowance	LS	$0.00	$0.00	$0.00	$7,500.00	2007	1.16	1	$0.00	$0.00	$0.00	$8,700.00	0%	0%	A	Allowance	Includes costs for materials to repair diversion ditches and soil cover materials.
M105	Road Maintenance Services	LS	$0.00	$0.00	$0.00	$3,700.00	2006	1.21	1	$0.00	$0.00	$0.00	$4,477.00	8%	9%	P	Previous Work	Includes road grading services.
M106	Sand Bags for Anchoring Geotextile, 50 LB	EA	$0.00	$0.00	$4.78	$0.00	2007	1.16	1	$0.00	$0.00	$5.54	$0.00	8%	9%	V	Vendor Quote	
M107	Soil Sample Analysis (PLM-VE)	EA	$0.00	$0.00	$0.00	$25.00	2008	1.09	1	$0.00	$0.00	$0.00	$27.25	8%	9%	P	Previous Work	
M108	Soil Sample Analysis (Stereomicroscopy)	EA	$0.00	$0.00	$0.00	$25.00	2008	1.09	1	$0.00	$0.00	$0.00	$27.25	8%	9%	P	Previous Work	

Base Year: 2012

COST CODES FOR MATERIAL AND UNIT COSTS

Cost Code	Description	Units	Unit Labor Cost	Unit Equipment Cost	Unit Material Cost	Unit Other Cost	Year of Cost Source	Escalation Factor	Area Factor	Adjusted Labor Cost	Adjusted Equipment Cost	Adjusted Material Cost	Adjusted Other Cost	PC OH	PC PF	Cost Source: Source	Cost Source: Source ID	Comments
M109	ABS, Sample and Analysis	EA	$0.00	$0.00	$0.00	$940.00	2008	1.09	1	$0.00	$0.00	$0.00	$1,024.60	8%	9%	P	Previous Work	
M110	Equipment/ABS Area/ABS Event	EA	$0.00	$0.00	$0.00	$500.00	2008	1.09	1	$0.00	$0.00	$0.00	$545.00	8%	9%	P	Previous Work	
M111	Sampling and Other Supplies/ABS Area/ABS Event	EA	$0.00	$0.00	$0.00	$250.00	2008	1.09	1	$0.00	$0.00	$0.00	$272.50	8%	9%	P	Previous Work	
M112	Sampling/Other Supplies	LS	$0.00	$0.00	$0.00	$1,500.00	2011	1.03	1	$0.00	$0.00	$0.00	$1,545.00	8%	9%	P	Previous Work	
M113	Sampling/Other Supplies	LS	$0.00	$0.00	$0.00	$150.00	2011	1.03	1	$0.00	$0.00	$0.00	$154.50	8%	9%	P	Previous Work	
M114	Sample Shipping Allowance	LS	$0.00	$0.00	$0.00	$3,000.00	2008	1.09	1	$0.00	$0.00	$0.00	$3,270.00	0%	0%	A	Allowance	For 2 Events
M115	Sample Shipping Allowance	LS	$0.00	$0.00	$0.00	$2,000.00	2011	1.03	1	$0.00	$0.00	$0.00	$2,060.00	0%	0%	A	Allowance	For 1 Event
M116	Sample Shipping Allowance	EA	$0.00	$0.00	$0.00	$100.00	2011	1.03	1	$0.00	$0.00	$0.00	$103.00	8%	9%	P	Previous Work	15 Samples per shipment.
M117	Sample Shipping Allowance	LS	$0.00	$0.00	$0.00	$500.00	2011	1.03	1	$0.00	$0.00	$0.00	$515.00	8%	9%	A	Allowance	
M118	Per Diem for 3 Person	DY	$0.00	$0.00	$0.00	$369.00	2011	1.03	1	$0.00	$0.00	$0.00	$380.07	0%	0%	GSA	www.gsa.gov	
M119	Per Diem for 2 Person	DY	$0.00	$0.00	$0.00	$246.00	2011	1.03	1	$0.00	$0.00	$0.00	$253.38	0%	0%	GSA	www.gsa.gov	
M120	Per Diem for 1 Person	DY	$0.00	$0.00	$0.00	$123.00	2011	1.03	1	$0.00	$0.00	$0.00	$126.69	0%	0%	GSA	www.gsa.gov	
M121	Soil Sample Analysis (TAL Metals/Metalloids)	EA	$0.00	$0.00	$0.00	$94.30	2011	1.03	1	$0.00	$0.00	$0.00	$97.13	8%	9%	V	Vendor Quote	Analytical Method: CLP ILM05.4
M122	Ambient Air Sample Analysis	EA	$0.00	$0.00	$0.00	$400.00	2008	1.09	1	$0.00	$0.00	$0.00	$436.00	8%	9%	P	Previous Work	Analyzed by TEM ISO Method 10312
M123	Sampling Setup (Equipment and Utility)	LS	$0.00	$0.00	$0.00	$4,200.00	2008	1.09	2	$0.00	$0.00	$0.00	$8,778.00	8%	9%	P	Previous Work	Includes sampling equipments and electrical hook-up
M124	Equipment/Ambient Air Sampling Event	EA	$0.00	$0.00	$0.00	$150.00	2008	1.09	3	$0.00	$0.00	$0.00	$463.50	8%	9%	P	Previous Work	
M125	Sampling/Other Supplies/Ambient Air Sampling Event	LS	$0.00	$0.00	$0.00	$1,500.00	2008	1.09	4	$0.00	$0.00	$0.00	$6,135.00	8%	9%	P	Previous Work	
M126	TCLP Metals	EA	$0.00	$0.00	$0.00	$76.17	2011	1.03	1	$0.00	$0.00	$0.00	$78.46	8%	9%	V	Vendor Quote	
M127	Community Awareness Activities Allowance	EA	$0.00	$0.00	$0.00	$2,000.00	2011	1.03	1	$0.00	$0.00	$0.00	$2,060.00	0%	0%	A	Allowance	1 meeting per 5-yr review.
M128	Landfill Disposal Fee	TN	$0.00	$0.00	$0.00	$21.00	2011	1.03	1	$0.00	$0.00	$0.00	$21.63	0%	0%	V	Vendor Quote	
M129	Mobilization/Demobilization of Pugmill Batch Plant	EA	$0.00	$0.00	$0.00	$20,000.00	2011	1.03	1	$0.00	$0.00	$0.00	$20,600.00	0%	0%	A	Allowance	
M130	Site Inspection Report Allowance	LS	$0.00	$0.00	$0.00	$1,500	2011	1.02	1	$0.00	$0.00	$0.00	$1,530.00	0%	0%	A	Allowance	
M131	Document Submission and Recording Allowance	EA	$0.00	$0.00	$0.00	$50	2011	1.02	1	$0.00	$0.00	$0.00	$51.00	0%	0%	A	Allowance	
M132	Surveying Report Allowance	LS	$0.00	$0.00	$0.00	$15,000.00	2011	1.02	1	$0.00	$0.00	$0.00	$15,300.00	0%	0%	A	Allowance	
M133	Surveying Report Allowance	LS	$0.00	$0.00	$0.00	$5,000.00	2011	1.02	1	$0.00	$0.00	$0.00	$5,100.00	0%	0%	A	Allowance	
M134	Orange Fence	SF	$0.00	$0.00	$0.10	$0.00	2011	1.02	1	$0.00	$0.00	$0.10	$0.00	8%	9%	V	Vendor Quote	Includes purchase and delivery to the Site.
M135	Chemical Submergance Allowance	LS	$0.00	$0.00	$0.00	$10,000.00	2012	1	1	$0.00	$0.00	$0.00	$10,000.00	0%	0%	A	Allowance	
M136	Community Awareness Activities Allowance	EA	$0.00	$0.00	$0.00	$2,000.00	2012	1	1	$0.00	$0.00	$0.00	$2,000.00	0%	0%	A	Allowance	1 meeting per 5-yr review.

Base Year: 2012

COST CODES FOR SUBCONTRACTORS AND UNIT COSTS

Cost Code	Work or Material Description	Description for Cost Worksheets	Units	Unit Cost	Year of Cost Source	Escalation Factor	Area Factor	Adjusted Unit Cost	PC OH	PC PF	Cost Source		Comments
											Source	Source ID	
S1A	Blasting Rock	Blasting Rock- Deadwood Formation	BCY	$9.00	2007	1.16	1	$10.44	8%	9%	P	Previous Work	Includes blasting equipment, material and labor
S1B	Blasting Rock	Blasting Rock- Rock Borrow Area	BCY	$13.00	2007	1.16	1	$15.08	8%	9%	P	Previous Work	Includes blasting equipment, material and labor
S2A	ARD Collection - Vault and Manhole Installation	ARD Collection - Vault and Manhole Installation	LS	$526,500.00	2006	1.21	1	$637,065.00	0%	0%	P	Previous Work	Includes all material and installation costs
S3A	ARD Pump House Construction	ARD Pump House Construction	LS	$469,200.00	2006	1.21	1	$567,732.00	0%	0%	P	Previous Work	Includes all material and installation costs for building, pump control, monitoring, electrical system, foundation, HVAC, lightning protection and pipes and fittings.
S4A	Installation of Power Line	Power Line Installation	LF	$26.95	2005	1.28	1	$34.50	0%	0%	P	Previous Work	Power line; 3-phase 7200/12470 Volts. Includes costs for material, equipment and labor.
S5A	Mobilization and Preparatory Work	Mobilization/Demobilization and Preparatory Work	EA	$623,727.34	2002	1.51	1	$941,828.28	0%	0%	P	Previous Work	Assumes remobilization for each construction season

Base Year: 2012

COST CODES FOR MII ASSEMBLIES AND UNIT COSTS

Cost Code	Work or Material Description	Description for Cost Worksheets	Units	MII Unit Cost	Year of Cost Source	Escalation Factor	Area Factor	Adjusted MII Unit Cost	PC OH	PC PF	Cost Source: Source	Cost Source: Source ID	Comments
A1A	Site Operations and Maintenance	Site Operations and Maintenance	HR	$74.35	2012	1.00	1	$74.35	8%	9%	MII	MII Assemblies	
A2A	General Site Work	General Site Work	HR	$127.72	2012	1.00	1	$127.72	8%	9%	MII	MII Assemblies	
A4A	Equipment Maintenance	Equipment Maintenance	HR	$94.29	2012	1.00	1	$94.29	8%	9%	MII	MII Assemblies	Service truck and a fuel truck
A5A	Dust Control	Dust Control	HR	$144.11	2012	1.00	1	$144.11	8%	9%	MII	MII Assemblies	
A6A	Equipment Fueling	Equipment Fueling	HR	$74.17	2012	1.00	1	$74.17	8%	9%	MII	MII Assemblies	
A7A	Jaw Crusher	Jaw Crusher	LCY	**$10.38**	2012	1.00	1	$10.38	8%	9%	MII	MII Assemblies	
A7AA	Rock Ripping using Dozer	Rock Ripping using Dozer	BCY	**$2.34**	2012	1.00	1	$2.34	8%	9%	MII	MII Assemblies	
A8A	Rock Quarrying	Rock Quarrying	BCY	**$12.71**	2012	1.00	1	$12.71	8%	9%	MII	MII Assemblies	
A9A	Excavation	Excavation	BCY	**$1.17**	2012	1.00	1	$1.17	8%	9%	MII	MII Assemblies	
A9AA	Excavation	Excavation	HR	**$135.38**	2012	1.00	1	$135.38	8%	9%	MII	MII Assemblies	
A10A	Blasting - Rock Quarry	Blasting - Rock Quarry	BCY	**$5.35**	2012	1.00	1	$5.35	8%	9%	MII	MII Assemblies	
A12A	Material Loading	Material Loading	LCY	**$0.36**	2012	1.00	1	$0.36	8%	9%	MII	MII Assemblies	
A12AA	Material Loading	Material Loading	HR	**$176.37**	2012	1.00	1	$176.37	8%	9%	MII	MII Assemblies	
A14A	Drain Layer/Bedding/Layer Placement	Drain Layer/Bedding/Layer Placement	LCY	**$4.21**	2012	1.00	1	$4.21	8%	9%	MII	MII Assemblies	
A15A	Subsoil/Topsoil Placement	Subsoil/Topsoil Placement	LCY	**$4.20**	2012	1.00	1	$4.20	8%	9%	MII	MII Assemblies	
A16A	Riprap Placement	Riprap Placement	LCY	**$25.61**	2012	1.00	1	$25.61	8%	9%	MII	MII Assemblies	
A17A	Fill Placement - Mass Fill Areas	Fill Placement - Mass Fill Areas	LCY	**$2.24**	2012	1.00	1	$2.24	8%	9%	MII	MII Assemblies	
A17AA	Fill Placement - Mass Fill Areas	Fill Placement - Top Soil	LCY	**$2.24**	2012	1.00	1	$2.24	8%	9%	MII	MII Assemblies	
A17B	Excavated Material Placement - Mass Fill Areas	Excavated Material Placement	LCY	**$2.24**	2012	1.00	1	$2.24	8%	9%	MII	MII Assemblies	Placement of excavated materials within the repository
A18A	Fill Placement - Constrained Areas	Fill Placement - Constrained Areas	LCY	**$11.64**	2012	1.00	1	$11.64	8%	9%	MII	MII Assemblies	
A19A	Geomembrane Cover System Installation	Geomembrane Cover Installation	ACR	**$28,568.24**	2012	1.00	1	$28,568.24	8%	9%	MII	MII Assemblies	Installation only, no material cost
A19AA	Geotextile Cover System Installation	Geotextile Cover Installation	ACR	**$5,305.57**	2012	1.00	1	$5,305.57	8%	9%	MII	MII Assemblies	Installation only, no material cost
A20A	Geomembrane Removal	Geomembrane Removal	SF	**$0.04**	2012	1.00	1	$0.04	8%	9%	MII	MII Assemblies	
A21A	Compaction - Fill	Compaction - Fill	LCY	**$1.15**	2012	1.00	1	$1.15	8%	9%	MII	MII Assemblies	Compacting embankment and subgrade
A22A	Compaction - Small Areas	Compaction - Small Areas	LCY	**$14.74**	2012	1.00	1	$14.74	8%	9%	MII	MII Assemblies	
A23A	Compaction - Bedding Layer	Compaction - Bedding Layer	LCY	**$1.92**	2012	1.00	1	$1.92	8%	9%	MII	MII Assemblies	
A24A	Lime Delivery	Lime Delivery	LCY	**$10.31**	2012	1.00	1	$10.31	8%	9%	MII	MII Assemblies	
A25A	Lime Amendment and Processing	Lime Amendment and Processing	ACR	**$1,740.20**	2012	1.00	1	$1,740.20	8%	9%	MII	MII Assemblies	
A26A	Organic Delivery	Organic Material Delivery	LCY	**$10.31**	2012	1.00	1	$10.31	8%	9%	MII	MII Assemblies	
A27A	Organic Amendment and Processing	Organic Amendment and Processing	ACR	**$1,740.20**	2012	1.00	1	$1,740.20	8%	9%	MII	MII Assemblies	
A28A	Short Haul	Short Haul	LCY	**$0.74**	2012	1.00	1	$0.74	8%	9%	MII	MII Assemblies	Assume 0.5 mile haul
A29A	Repository Haul/Overburden Haul	Repository Haul/Overburden Haul	LCY	**$2.40**	2012	1.00	1	$2.40	8%	9%	MII	MII Assemblies	To facility outside of PMDA
A30A	Gravel - Haul	Gravel - Haul	LCY	**$5.89**	2012	1.00	1	$5.89	8%	9%	MII	MII Assemblies	1.15 hour cycle time for one truck and that truck holds 20 LCY of gravel material
A31A	Lime/Fertilizer- Haul	Lime/Fertilizer- Haul	LCY	**$10.31**	2012	1.00	1	$10.31	8%	9%	MII	MII Assemblies	1.95 hourcycle time for one truck and that truck holds 20 LCY of lime/fertilizer material.
A31AA	Fill/Cobbles, Hauling and Dumping, Articulated Frame - Long Haul	Fill/Cobbles, Hauling and Dumping - Long Haul	HR	**$133.83**	2012	1.00	1	$133.83	8%	9%	MII	MII Assemblies	
A32A	Boulders/Riprap, Hauling and Dumping, Rigid Frame - Short Haul	Boulders/Riprap, Hauling and Dumping - Short Haul	LCY	**$0.93**	2012	1.00	1	$0.93	8%	9%	MII	MII Assemblies	
A33A	Boulders/Riprap, Hauling and Dumping, Rigid Frame - Long Haul	Boulders/Riprap, Hauling and Dumping - Long Haul	LCY	**$1.07**	2012	1.00	1	$1.07	8%	9%	MII	MII Assemblies	
A34A	Boulders/Riprap, Hauling and Dumping, Articulated Frame - Short Haul	Boulders/Riprap, Hauling and Dumping - Short Haul	LCY	**$1.11**	2012	1.00	1	$1.11	8%	9%	MII	MII Assemblies	
A35A	Boulders/Riprap, Hauling and Dumping, Articulated Frame - Long Haul	Boulders/Riprap, Hauling and Dumping - Long Haul	LCY	**$1.33**	2012	1.00	1	$1.33	8%	9%	MII	MII Assemblies	
A37A	Debris Onsite Disposal - Hauling	Onsite Disposal - Hauling	LCY	**$1.22**	2012	1.00	1	$1.22	8%	9%	MII	MII Assemblies	
A37AA	Debris Onsite Disposal - Hauling	Onsite Debris Disposal - Hauling	HR	$152.55	2012	1.00	1	$152.55	8%	9%	MII	MII Assemblies	
A39A	Structure Demolition	Structure Demolition	HR	$516.44	2012	1.00	1	$516.44	8%	9%	MII	MII Assemblies	
A40A	Pipe/Culvert Demolition	Pipe/Culvert Demolition	HR	$277.66	2012	1.00	1	$277.66	8%	9%	MII	MII Assemblies	
A41A	Power Infrastructure Demolition	Power Infrastructure Demolition	HR	$305.45	2012	1.00	1	$305.45	8%	9%	MII	MII Assemblies	
A42A	Hydro-Seeding	Hydro-Seeding Crew	ACR	$123.52	2012	1.00	1	$123.52	8%	9%	MII	MII Assemblies	
A43A	Sampling Crew w/ 2 Technicians	Sampling Crew - 2 Technicians	HR	$134.09	2012	1.00	1	$134.09	100%	9%	MII	MII Assemblies	
A43AA	Sampling Crew w/ 1 Technician	Sampling Crew - 1 Technician	HR	$0.00	2012	1.00	1	$0.00	100%	9%	MII	MII Assemblies	
A44A	Site Inspection Crew	Site Inspection Crew	HR	$70.47	2012	1.00	1	$70.47	100%	9%	MII	MII Assemblies	
A44AA	Pickup Truck, 1/2 Ton	Pickup Truck, 1/2 Ton	HR	$11.22	2012	1.00	1	$11.22	8%	9%	MII	MII Assemblies	
A45A	Gravel Road	Permanent Gravel Access Road Installation	HR	$443.71	2012	1.00	1	$443.71	8%	9%	MII	MII Assemblies	
A45AA	Gravel Delivery	Gravel Delivery	LCY	$5.69	2012	1.00	1	$5.69	8%	9%	MII	MII Assemblies	
A46A	Road Improvement/Reconstruction	Road Improvement/Reconstruction	HR	$443.71	2012	1.00	1	$443.71	8%	9%	MII	MII Assemblies	Includes grading and compaction
A46AA	Road Improvement/Reconstruction	Road Improvement/Reconstruction	BCY	$4.44	2012	1.00	1	$4.44	8%	9%	MII	MII Assemblies	Includes grading and compaction
A49A	Rough Grading	Rough Grading	BCY	$2.64	2012	1.00	1	$2.64	8%	9%	MII	MII Assemblies	
A50A	Fence Installation	Fence Installation Crew	LF	$2.38	2012	1.00	1	$2.38	8%	9%	MII	MII Assemblies	
A51A	Clearing and Grubbing	Clearing and Grubbing	ACR	$2,771.62	2012	1.00	1	$2,771.62	8%	9%	MII	MII Assemblies	

Base Year: 2012

COST CODES FOR MII ASSEMBLIES AND UNIT COSTS

Cost Code	Work or Material Description	Description for Cost Worksheets	Units	MII Unit Cost	Year of Cost Source	Escalation Factor	Area Factor	Adjusted MII Unit Cost	PC OH	PC PF	Cost Source: Source	Cost Source: Source ID	Comments
A52A	Pipe Laying/Installation	6" HDPE Pipe Laying/Installation	LF	$6.98	2012	1.00	1	$6.98	8%	9%	MII	MII Assemblies	
A53A	Pipe Laying/Installation	10" HDPE Pipe Laying/Installation	LF	$7.40	2012	1.00	1	$7.40	8%	9%	MII	MII Assemblies	
A54A	Pipe Laying/Installation	12" HDPE Pipe Laying/Installation	LF	$8.15	2012	1.00	1	$8.15	8%	9%	MII	MII Assemblies	
A55A	Silt Fence Installation	Silt Fence Installation	HR	$125.33	2012	1.00	1	$125.33	8%	9%	MII	MII Assemblies	
A55AA	Silt Fence Installation	Silt Fence Installation	LF	$1.06	2012	1.00	1	$1.06	8%	9%	MII	MII Assemblies	
A56A	Hay Bale	Hay Bale	HR	$166.38	2012	1.00	1	$166.38	8%	9%	MII	MII Assemblies	
A56AA	Hay Bale	Hay Bale	LF	$0.53	2012	1.00	1	$0.53	8%	9%	MII	MII Assemblies	
A57A	Rolled Erosion Control	Rolled Erosion Control	HR	$125.33	2012	1.00	1	$125.33	8%	9%	MII	MII Assemblies	
A57AA	Rolled Erosion Control	Rolled Erosion Control	SY	$1.95	2012	1.00	1	$1.95	8%	9%	MII	MII Assemblies	
A58A	Tractor w/Low Bed Trailer	Tractor - Heavy Equipment	HR	$110.61	2012	1.00	1	$110.61	8%	9%	MII	MII Assemblies	Per heavy equipment per hour
A59A	Tractor w/Low Bed Trailer	Tractor - Large Equipment	HR	$105.68	2012	1.00	1	$105.68	8%	9%	MII	MII Assemblies	Per large equipment per hour
A60A	Self-Propelled Equipment	Self-Propelled Equipment	HR	$51.27	2012	1.00	1	$51.27	8%	9%	MII	MII Assemblies	Per equipment per hour
A61A	Pilot Car w/Driver	Pilot Car w/Driver	HR	$51.27	2012	1.00	1	$51.27	8%	9%	MII	MII Assemblies	Per equipment per hour
A62A	Cap O&M	Cap O&M	DAY	$478.12	2012	1.00	1	$478.12	8%	9%	MII	MII Assemblies	
A63A	Survey	Survey	DAY	$469.38	2012	1.00	1	$469.38	8%	9%	MII	MII Assemblies	
A64A	Water Truck Operation	Water Truck Operation	DAY	$1,152.86	2012	1.00	1	$1,152.86	8%	9%	MII	MII Assemblies	
A65A	Cement Stabilization	Cement Stabilization	LCY	$9.31	2012	1.00	1	$9.31	8%	9%	MII	MII Assemblies	
A66A	Liquid Transportation	Liquid Transportation	HR	$106.21	2012	1.00	1	$106.21	8%	9%	MII	MII Assemblies	
A66AA	Liquid Transportation	Liquid Transportation	GAL	$0.02	2012	1.00	1	$0.02	8%	9%	MII	MII Assemblies	Based off of 650,000 GAL
A67A	Fine Grading	Fine Grading	SY	$0.44	2012	1.00	1	$0.44	8%	9%	MII	MII Assemblies	
A68A	Tree Planting	Tree Planting	EA	$9.92	2012	1.00	1	$9.92	8%	9%	MII	MII Assemblies	
A69A	Storage Tank	100,000 GAL Tank	EA	$668.00	2012	1.00	1	$668.00	8%	9%	MII	MII Assemblies	
A70A	Sump Pump	Sump Pump	EA	$245.00	2012	1.00	1	$245.00	8%	9%	MII	MII Assemblies	
A71A	Dewatering	Dewatering	HR	$61.25	2012	1.00	1	$61.25	8%	9%	MII	MII Assemblies	Assumed 3 Days
A72A	Dewatering Tank	Dewatering Tank	HR	$167.07	2012	1.00	1	$167.07	8%	9%	MII	MII Assemblies	
A73A	Dewatering Bag Filter	Dewatering Bag Filter	HR	$98.88	2012	1.00	1	$98.88	8%	9%	MII	MII Assemblies	
A74A	Runon Berm	Runon Berm	LCY	$12.06	2012	1.00	1	$12.06	8%	9%	MII	MII Assemblies	
A75A	Culvert	Culvert	LF	$22.53	2012	1.00	1	$22.53	8%	9%	MII	MII Assemblies	
A76A	Gate Installation	Gate Installation	EA	$493.26	2012	1.00	1	$493.26	8%	9%	MII	MII Assemblies	Includes Gate and resultant components
A77A	Chain Link Fence	Chain Link Fence	LF	$6.58	2012	1.00	1	$6.58	8%	9%	MII	MII Assemblies	
A78A	Screening	Screening	LCY	$0.80	2012	1.00	1	0.8	8%	9%	MII	MII Assemblies	
A79A	Pipe Laying/Installation	4" HDPE Pipe	LF	$6.43	2012	1.00	1	6.43	8%	9%	MII	MII Assemblies	
A80A	Chemicals	Chemicals for Encapsulation Mound	LS	$10,000.00	2012	1.00	1	10000	8%	9%	MII	MII Assemblies	
A81A	Compaction - Soil Layer	Compaction - Soil Layer	LCY	$1.15	2012	1.00	1	$1.15	8%	9%	MII	MII Assemblies	
A82A	Asphalt Cover Construction	Asphalt Cover Construction	BCY	$4.44	2012	1.00	1	$4.44	8%	9%	MII	MII Assemblies	
A82AA	Asphalt Delivery	Asphalt Delivery	LCY	$5.69	2012	1.00	1	$5.69	8%	9%	MII	MII Assemblies	

TABLE PV-ADRFT

PRESENT VALUE ANALYSIS

Annual Discount Rate Factors Table

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Discount Rate (Percent): 7.0

Year	Discount Factor[1,2]	Year	Discount Factor[1,2]
0	1.0000	26	0.1722
1	0.9346	27	0.1609
2	0.8734	28	0.1504
3	0.8163	29	0.1406
4	0.7629	30	0.1314
5	0.7130	31	0.1228
6	0.6663	32	0.1147
7	0.6227	33	0.1072
8	0.5820	34	0.1002
9	0.5439	35	0.0937
10	0.5083	36	0.0875
11	0.4751	37	0.0818
12	0.4440	38	0.0765
13	0.4150	39	0.0715
14	0.3878	40	0.0668
15	0.3624	41	0.0624
16	0.3387	42	0.0583
17	0.3166	43	0.0545
18	0.2959	44	0.0509
19	0.2765	45	0.0476
20	0.2584	46	0.0445
21	0.2415	47	0.0416
22	0.2257	48	0.0389
23	0.2109	49	0.0363
24	0.1971		
25	0.1842		

Notes:

1 Annual discount factors were calculated using the formulas and guidance presented in Section 4.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.

2 The real discount rate of 7.0% was obtained from "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000, Page 4-5.

Sensitivity Analysis

Formosa OU1 Final FS Report
Remedial Alternative Cost Estimate Evaluation
Impact of Period of Analysis and Future Periodic Costs on Present Value Cost

CDM Federal Programs Corporation (CDM Smith) prepared feasibility study (FS) screening and evaluation costs for remedial alternatives presented in the Formosa OU1 Final FS Report. Subsequent to FS report submittal, EPA provided questions and comments regarding the remedial alternative cost estimates. EPA requested a sensitivity analysis be performed to obtain a better understanding of the long-term impacts of annual operation and maintenance costs and periodic costs on the total costs (both constant dollar (non-discounted) costs and present value dollar (discounted) costs) for retained alternatives beyond the stated period of analysis (30 years). The real discount rate used for the evaluation is 7.0%, as directed by EPA and indicated in "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study" (EPA 2000), Page 4-5.

Based on the comments/questions posed by EPA, CDM Smith performed the following cost estimate evaluations and comparisons:

1) Comparison of constant dollar (non-discounted) costs and present value (discounted) costs for Alternatives 2, 3, 4, and 6 as presented in the Formosa OU1 Final FS during two periods of analysis (30 years and 100 years). These evaluations include the initial earthwork and institutional control (IC) establishment capital costs. They also include annual operation and maintenance (O&M) costs such as maintenance and monitoring of cover systems, and periodic preparation of five year site reviews. However they do not include periodic costs for potential comprehensive replacement of cover systems. These costs are presented with a tabular format in Exhibit 1.

2) Comparison of constant dollar (non-discounted) costs and present value (discounted) costs for Alternatives 2, 3, 4, and 6 as presented in the Formosa OU1 Final FS during one period of analysis (100 years). These evaluations include the initial capital costs, annual O&M and periodic costs described for the first evaluation. In addition, they include periodic costs for one event of potential comprehensive replacement of cover systems occurring on an assumed 100 year frequency (Year 99). These costs are presented with a tabular format in Exhibit 2.

Additional information on cost comparisons for each remedial alternative is provided as an attachment to this evaluation. The information for each alternative includes a graph comparing constant dollar and present value costs, the present value cost tables for each period of analysis, and the cost summary used to generate the present value cost tables. As illustrated in Exhibits 1 and 2, the constant dollar costs for each alternative increase as the periods of analyses increase. However the constant dollar expenditures after year 30 have minimal effects on the present value costs. Thus a 30-year period of analysis was included in the Formosa OU1 Final FS Report for screening and detailed analysis of alternatives.

Exhibit 1

Comparison of Constant Dollar Costs and Present Value Costs

Alternatives 2, 3, 4, and 6 as Presented in the Formosa OU1 Final FS (Excluding Cover Replacement)

Two Periods of Analyses (30 Years and 100 Years)

Scenario	Alternative 2		Alternative 3		Alternative 4		Alternative 6	
	Constant Dollar Cost	Present Value Cost	Constant Dollar Cost	Present Value Cost	Constant Dollar Cost	Present Value Cost	Constant Dollar Cost	Present Value Cost
30 Year Period of Analysis (Excluding Cover Replacement)	$6,155,000	$5,553,000	$9,761,000	$9,275,000	$10,893,00 0	$10,407,000	$10,975,000	$10,489,000
100 Year Period of Analysis (Excluding Cover Replacement)	$8,540,000	$5,622,000	$11,651,000	$9,326,000	$12,783,00 0	$10,458,000	$12,865,000	$10,539,000

Note: A 7.0% real discount rate was used for present value cost analysis at- non-federal facility sites as specified in EPA 540-R-00-002 (EPA 2000).

Exhibit 2

Comparison of Constant Dollar Costs and Present Value Costs

Alternatives 2, 3, 4, and 6

Two Periodic Cost Scenarios (One Excluding Cover Replacement; One Including Cover Replacement at 100 Year Frequency)

One Period of Analysis (100 Years)

Scenario	Alternative 2		Alternative 3		Alternative 4		Alternative 6	
	Constant Dollar Cost	Present Value Cost	Constant Dollar Cost	Present Value Cost	Constant Dollar Cost	Present Value Cost	Constant Dollar Cost	Present Value Cost
100 Year Period of Analysis (Excluding Cover Replacement)	$8,540,000	$5,622,000	$11,651,000	$9,326,000	$12,783,000	$10,458,000	$12,865,000	$10,539,000
100 Year Period of Analysis (Including Cover Replacement)	$10,190,000	$5,624,000	$13,039,000	$9,327,000	$14,171,000	$10,459,000	$13,803,000	$10,540,000

Note: A 7.0% real discount rate was used for present value cost analysis at non-federal facility sites as specified in EPA 540-R-00-002 (EPA 2000).

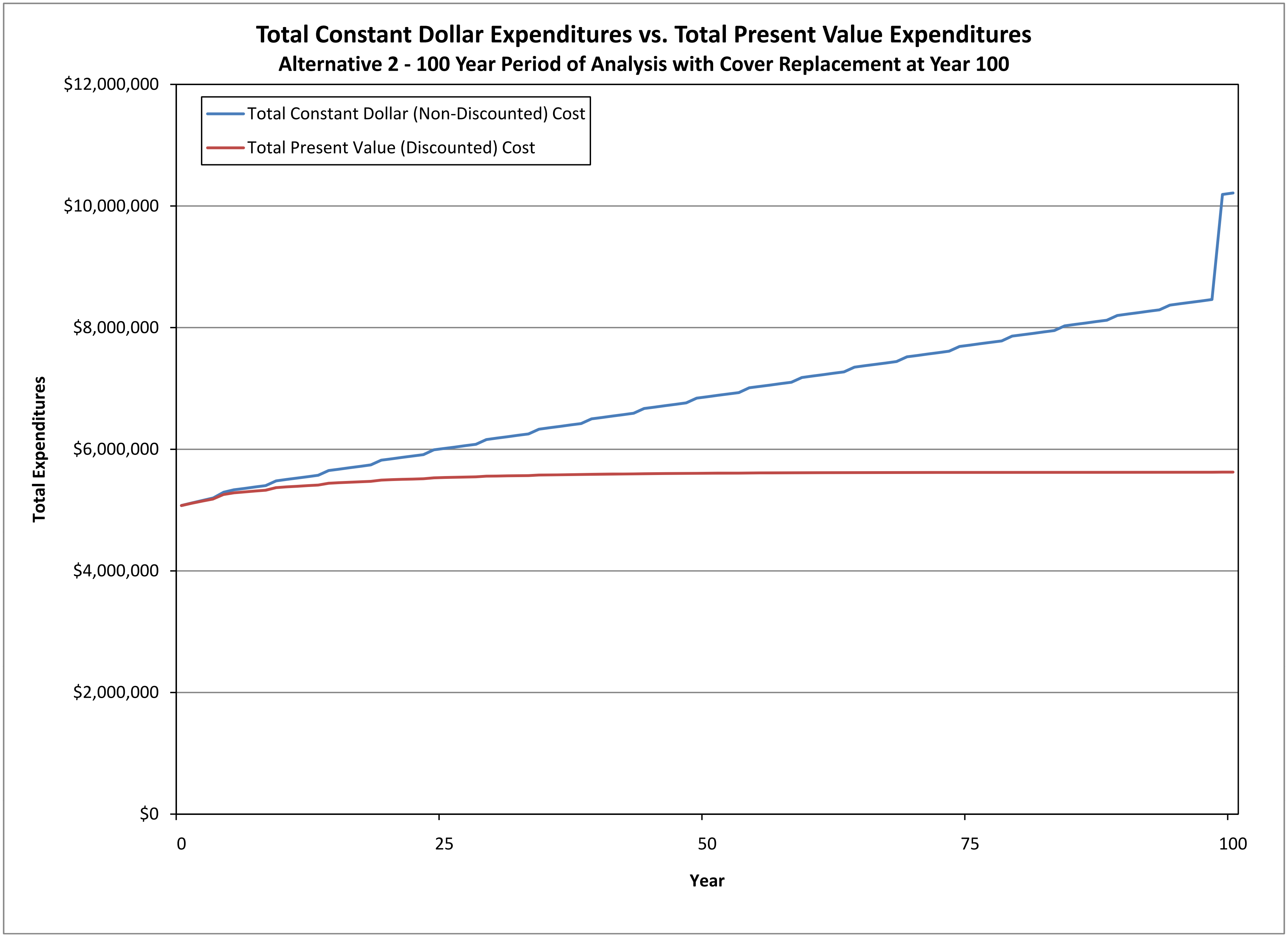

Total Constant Dollar Expenditures vs. Total Present Value Expenditures
Alternative 2 - 100 Year Period of Analysis with Cover Replacement at Year 100
Total Constant Dollar (Non-Discounted) Cost
Total Present Value (Discounted) Cost
$12,000,000
$10,000,000
$8,000,000
$6,000,000
$4,000,000
$2,000,000
$0
Total Expenditures
0
25
50
75
100
Year

TABLE CSS-2

ALTERNATIVE COST SUMMARY

Site:	Formosa OU1
Location:	Douglas County, Oregon
Phase:	Feasibility Study
Base Year:	2012

Alternative 2	**Total Constant Dollar (Non-Discounted) Cost**	**Total Present Value (Discounted) Cost**
30 Year Analysis Period without Cover Replacement	$6,155,000	$5,553,000
100 Year Analysis Period without Cover Replacement	$8,540,000	$5,622,000
100 Year Analysis Period with Cover Replacement	$10,190,000	$5,624,000

Notes:

1 - Capital costs, annual costs, and periodic costs are presented on Table CS-2.

2 - Estimated remedial timeframes and associated present value analysis for each remedial alternative are provided on tables PV-2 (30yr) through PV-2 (100yr).

3 - The non-discounted total cost demonstrates the impact of a discount rate on the total present value cost and the relative amount of future annual expenditures. Non-discounted costs are presented for comparison purposes only and should not be used in place of present value costs in the CERCLA remedy selection process.

4 - Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for feasibility study level evaluation purposes.

5 - Present value is the total cost per year including a 7.0% discount factor for that year.

6 - Costs for replacement of cover includes the installation of a geosynthetic multi-layer cover system (including low permeability layer, drainage layer, barrier layer, and vegetative layer), amending topsoils, and hydro-seeding with fertilizer and hydromulch. It does not include replacement of surface drainage features such as riprap for drop chutes and perimeter drainage channel.

TABLE CS-2

Alternative **2**

In-Place Containment, Continued Submergence of Tailings within EM, and Limited Excavation/Disposal of Mine Materials at Proposed Facility within PMDA

COST ESTIMATE SUMMARY

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013
Date: January 31, 2013

Description: Alternative 2 includes in-place containment of mine materials as the predominant approach with limited excavation and disposal of targeted mine materials at a proposed facility within the PMDA. Limited excavation would be conducted to address highly acid-generating mine materials at headwaters of creek areas and other targeted areas. All excavated materials would be disposed of within a proposed facility located within the PMDA. Development of this area to obtain uncontaminated soil and rock for cover construction and reclamation would expand the available volume for consolidation of mine materials. The facility would use a geosynthetic multi-layer cover system over consolidated mine materials. The proposed facility within the PMDA would contain the EM in place, including the former water and tailings storage pond. Tailings currently stored in the EM pond would continue to remain submerged under the newly-constructed geosynthetic multi-layer cover system. Submergence of tailings which would continue to mitigate ARD generation , assuming the existing liner remains intact and holds water. A combination of multi layer geosynthetic covers, pavement covers, and exposure barriers would be implemented for remaining mine materials not targeted for excavation to mitigate unacceptable exposure risks to humans and reduce generation of ARD. Exposure barriers would only be used on remaining mine materials with slopes steeper than 3H:1V. Excavated areas or areas disturbed during construction that do not have mine materials would be regraded and reclaimed with a rock armor or a vegetative layer, depending on the steepness of resulting slopes. Administrative controls involve administrative, legal, and/or informational, or physical measures intended to control or prevent present and future use or access to mine materials, and inform and warn of dangers associated with these materials. Monitoring would consist of visual inspections to document degree of protectiveness to human health and the environment and determine maintenance needs for the proposed facility and containment areas. Maintenance of the proposed disposal facility and containment areas would be performed as necessary to maintain protectiveness and integrity of the covers systems. Five-year site reviews would be performed since mine materials under covers would remain at the PMDA with contaminant concentrations above PRGs. The contaminant concentrations above PRGs do not allow for unlimited use and unrestricted exposure under the current and potential future land uses.

INSTITUTIONAL CONTROLS CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Institutional Controls	CW2-1	1	LS	$111,491	$111,491	
Engineered Controls	CW2-2	1	LS	$172	$172	
SUBTOTAL					$111,663	
Contingency (Scope and Bid)		20%			$22,333	10% Scope, 10% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$133,996	
Project Management		8%			$10,720	Percentage from Exhibit 5-8 was used.
Remedial Design		15%			$20,099	Percentage from Exhibit 5-8 was used.
Construction Management		10%			$13,400	Percentage from Exhibit 5-8 was used.
TOTAL					$178,215	
TOTAL CAPITAL COST					**$178,000**	Total capital cost is rounded to the nearest $1,000.

EARTHWORK CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Excavation of Mine Materials	CW2-4	1	LS	$134,257	$134,257	
Excavation of Borrow Areas	CW2-5	1	LS	$632,194	$632,194	
Transportation of Mine Materials	CW2-6	1	LS	$290,467	$290,467	
Transportation of Borrow Material	CW2-7	1	LS	$222,920	$222,920	
Lime and Organic Material for Topsoil and Subsoil Amendment	CW2-8	1	LS	$453,901	$453,901	
Dust Control	CW2-9	1	LS	$152,682	$152,682	
Excavation Area Reclamation	CW2-10	1	LS	$31,272	$31,272	
Revegetation of Reclamation Areas	CW2-11	1	LS	$97,479	$97,479	
Surveying for Construction Control	CW2-12	1	LS	$60,355	$60,355	
Permanent Access Road	CW2-13	1	LS	$105,431	$105,431	
Erosion Control	CW2-14	1	LS	$177,401	$177,401	
Mobilization/Demobilization and Preparatory Work	CW2-15	1	LS	$69,284	$69,284	
Construction of Repository within PMDA	CW2-16	1	LS	$617,025	$617,025	
Construction of Exposure Barrier	CW2-17	1	LS	$285,182	$285,182	
Asphalt Cover Construction	CW2-22	1	LS	$89,515	$89,515	
Revegetation of Covers	CW2-23	1	LS	$9,846	$9,846	
SUBTOTAL					$3,429,211	
Contingency (Scope and Bid)		20%			$685,842	10% Scope, 10% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$4,115,053	
Project Management		5%			$205,753	Percentage from Exhibit 5-8 was used.
Remedial Design		8%			$329,204	Percentage from Exhibit 5-8 was used.
Construction Management		6%			$246,903	Percentage from Exhibit 5-8 was used.
TOTAL					$4,896,913	
TOTAL CAPITAL COST					**$4,897,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-2

Alternative 2

In-Place Containment, Continued Submergence of Tailings within EM, and Limited Excavation/Disposal of Mine Materials at Proposed Facility within PMDA

COST ESTIMATE SUMMARY

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013
Date: January 31, 2013

Description: Alternative 2 includes in-place containment of mine materials as the predominant approach with limited excavation and disposal of targeted mine materials at a proposed facility within the PMDA. Limited excavation would be conducted to address highly acid-generating mine materials at headwaters of creek areas and other targeted areas. All excavated materials would be disposed of within a proposed facility located within the PMDA. Development of this area to obtain uncontaminated soil and rock for cover construction and reclamation would expand the available volume for consolidation of mine materials. The facility would use a geosynthetic multi-layer cover system over consolidated mine materials. The proposed facility within the PMDA would contain the EM in place, including the former water and tailings storage pond. Tailings currently stored in the EM pond would continue to remain submerged under the newly-constructed geosynthetic multi-layer cover system. Submergence of tailings which would continue to mitigate ARD generation , assuming the existing liner remains intact and holds water. A combination of multi layer geosynthetic covers, pavement covers, and exposure barriers would be implemented for remaining mine materials not targeted for excavation to mitigate unacceptable exposure risks to humans and reduce generation of ARD. Exposure barriers would only be used on remaining mine materials with slopes steeper than 3H:1V. Excavated areas or areas disturbed during construction that do not have mine materials would be regraded and reclaimed with a rock armor or a vegetative layer, depending on the steepness of resulting slopes. Administrative controls involve administrative, legal, and/or informational, or physical measures intended to control or prevent present and future use or access to mine materials, and inform and warn of dangers associated with these materials. Monitoring would consist of visual inspections to document degree of protectiveness to human health and the environment and determine maintenance needs for the proposed facility and containment areas. Maintenance of the proposed disposal facility and containment areas would be performed as necessary to maintain protectiveness and integrity of the covers systems. Five-year site reviews would be performed since mine materials under covers would remain at the PMDA with contaminant concentrations above PRGs. The contaminant concentrations above PRGs do not allow for unlimited use and unrestricted exposure under the current and potential future land uses.

REPLACEMENT OF COVER FUTURE COSTS (Year 99)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Replacement of Covers	CW2-24	1	LS	$514,547	$514,547	
Replacement of Exposure Barrier	CW2-25	1	LS	$577,031	$577,031	
SUBTOTAL					$1,091,578	
Contingency (Scope and Bid)		20%			$218,316	10% Scope, 10% Bid (Low end of the recommended range).
SUBTOTAL					$1,309,894	
Project Management		6%			$78,594	Percentage from Exhibit 5-8 was used.
Remedial Design		12%			$157,187	Percentage from Exhibit 5-8 was used.
Construction Management		8%			$104,792	Percentage from Exhibit 5-8 was used.
TOTAL					$1,650,467	
TOTAL ANNUAL COST					**$1,650,000**	Future cost is rounded to the nearest $1,000.

ANNUAL OPERATIONS AND MAINTENANCE (O&M) COSTS - Year 1

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Cover and Reclamation Maintenance (Year 1)	CW2-18	1	LS	$27,545	$27,545	
SUBTOTAL					$27,545	
Contingency (Scope and Bid)		20%			$5,509	10% Scope, 10% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$33,054	
Project Management		10%			$3,305	Percentage from Exhibit 5-8 was used.
Technical Support		15%			$4,958	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$41,317	
TOTAL ANNUAL O&M COST					**$41,000**	Total O&M cost is rounded to the nearest $1,000.

TABLE CS-2

Alternative **2**

In-Place Containment, Continued Submergence of Tailings within EM, and Limited Excavation/Disposal of Mine Materials at Proposed Facility within PMDA

COST ESTIMATE SUMMARY

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013
Date: January 31, 2013

Description: Alternative 2 includes in-place containment of mine materials as the predominant approach with limited excavation and disposal of targeted mine materials at a proposed facility within the PMDA. Limited excavation would be conducted to address highly acid-generating mine materials at headwaters of creek areas and other targeted areas. All excavated materials would be disposed of within a proposed facility located within the PMDA. Development of this area to obtain uncontaminated soil and rock for cover construction and reclamation would expand the available volume for consolidation of mine materials. The facility would use a geosynthetic multi-layer cover system over consolidated mine materials. The proposed facility within the PMDA would contain the EM in place, including the former water and tailings storage pond. Tailings currently stored in the EM pond would continue to remain submerged under the newly-constructed geosynthetic multi-layer cover system. Submergence of tailings which would continue to mitigate ARD generation , assuming the existing liner remains intact and holds water. A combination of multi layer geosynthetic covers, pavement covers, and exposure barriers would be implemented for remaining mine materials not targeted for excavation to mitigate unacceptable exposure risks to humans and reduce generation of ARD. Exposure barriers would only be used on remaining mine materials with slopes steeper than 3H:1V. Excavated areas or areas disturbed during construction that do not have mine materials would be regraded and reclaimed with a rock armor or a vegetative layer, depending on the steepness of resulting slopes. Administrative controls involve administrative, legal, and/or informational, or physical measures intended to control or prevent present and future use or access to mine materials, and inform and warn of dangers associated with these materials. Monitoring would consist of visual inspections to document degree of protectiveness to human health and the environment and determine maintenance needs for the proposed facility and containment areas. Maintenance of the proposed disposal facility and containment areas would be performed as necessary to maintain protectiveness and integrity of the covers systems. Five-year site reviews would be performed since mine materials under covers would remain at the PMDA with contaminant concentrations above PRGs. The contaminant concentrations above PRGs do not allow for unlimited use and unrestricted exposure under the current and potential future land uses.

ANNUAL OPERATIONS AND MAINTENANCE (O&M) COSTS - Year 2

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Cover and Reclamation Maintenance (Year 2)	CW2-19	1	LS	$26,951	$26,951	
SUBTOTAL					$26,951	
Contingency (Scope and Bid)		20%			$5,390	10% Scope, 10% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$32,341	
Project Management		10%			$3,234	Percentage from Exhibit 5-8 was used.
Technical Support		15%			$4,851	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$40,426	
TOTAL ANNUAL O&M COST					**$40,000**	Total O&M cost is rounded to the nearest $1,000.

ANNUAL OPERATIONS AND MAINTENANCE (O&M) COSTS - Years 3 through 5

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Cover and Reclamation Maintenance (Years 3 through 5)	CW2-20	1	LS	$26,113	$26,113	
SUBTOTAL					$26,113	
Contingency (Scope and Bid)		20%			$5,223	10% Scope, 10% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$31,336	
Project Management		10%			$3,134	Percentage from Exhibit 5-8 was used.
Technical Support		15%			$4,700	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$39,170	
TOTAL ANNUAL O&M COST					**$39,000**	Total O&M cost is rounded to the nearest $1,000.

ANNUAL OPERATIONS AND MAINTENANCE (O&M) COSTS - Years 6 through Final Year of Evaluation Period

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Cover and Reclamation Maintenance (Years 6 through 29)	CW2-21	1	LS	$15,146	$15,146	
SUBTOTAL					$15,146	
Contingency (Scope and Bid)		20%			$3,029	10% Scope, 10% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$18,175	
Project Management		10%			$1,818	Percentage from Exhibit 5-8 was used.
Technical Support		15%			$2,726	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$22,719	
TOTAL ANNUAL O&M COST					**$23,000**	Total O&M cost is rounded to the nearest $1,000.

TABLE CS-2

Alternative **2**

In-Place Containment, Continued Submergence of Tailings within EM, and Limited Excavation/Disposal of Mine Materials at Proposed Facility within PMDA

COST ESTIMATE SUMMARY

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013
Date: January 31, 2013

Description: Alternative 2 includes in-place containment of mine materials as the predominant approach with limited excavation and disposal of targeted mine materials at a proposed facility within the PMDA. Limited excavation would be conducted to address highly acid-generating mine materials at headwaters of creek areas and other targeted areas. All excavated materials would be disposed of within a proposed facility located within the PMDA. Development of this area to obtain uncontaminated soil and rock for cover construction and reclamation would expand the available volume for consolidation of mine materials. The facility would use a geosynthetic multi-layer cover system over consolidated mine materials. The proposed facility within the PMDA would contain the EM in place, including the former water and tailings storage pond. Tailings currently stored in the EM pond would continue to remain submerged under the newly-constructed geosynthetic multi-layer cover system. Submergence of tailings which would continue to mitigate ARD generation , assuming the existing liner remains intact and holds water. A combination of multi layer geosynthetic covers, pavement covers, and exposure barriers would be implemented for remaining mine materials not targeted for excavation to mitigate unacceptable exposure risks to humans and reduce generation of ARD. Exposure barriers would only be used on remaining mine materials with slopes steeper than 3H:1V. Excavated areas or areas disturbed during construction that do not have mine materials would be regraded and reclaimed with a rock armor or a vegetative layer, depending on the steepness of resulting slopes. Administrative controls involve administrative, legal, and/or informational, or physical measures intended to control or prevent present and future use or access to mine materials, and inform and warn of dangers associated with these materials. Monitoring would consist of visual inspections to document degree of protectiveness to human health and the environment and determine maintenance needs for the proposed facility and containment areas. Maintenance of the proposed disposal facility and containment areas would be performed as necessary to maintain protectiveness and integrity of the covers systems. Five-year site reviews would be performed since mine materials under covers would remain at the PMDA with contaminant concentrations above PRGs. The contaminant concentrations above PRGs do not allow for unlimited use and unrestricted exposure under the current and potential future land uses.

5-YEAR SITE REVIEW PERIODIC COSTS (Every 5 years after initiation of remedial action (Year 0))

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Reviews	CW2-3	1	LS	$36,360	$36,360	Includes five-year site inspection and report; assumed to be statutory review that occurs every five years after initiation of remedial action (Year 0).
SUBTOTAL					$36,360	
Contingency (Scope and Bid)		20%			$7,272	10% Scope, 10% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$43,632	
Project Management		10%			$4,363	Percentage from Exhibit 5-8 was used.
Technical Support		15%			$6,545	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$54,540	
TOTAL PERIODIC COST					**$55,000**	Total capital cost is rounded to the nearest $1,000.

Notes:

Percentages used for indirect costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.
Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

Abbreviations:

EA Each
LS Lump Sum
QTY Quantity
YR Year

TABLE PV-2 (30yr)

PRESENT VALUE ANALYSIS

Alternative 2 (30 Year Analysis Period without Cover Replacement)

In-Place Containment, Continued Submergence of Tailings within EM, and Limited Excavation/Disposal of Mine Materials at Proposed Facility within PMDA

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Earthwork)[2]	Annual O&M Costs	Periodic Costs	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$178,000	$4,897,000	$0	$0	$5,075,000	1.0000	$5,075,000
1	$0	$0	$41,000	$0	$41,000	0.9346	$38,319
2	$0	$0	$40,000	$0	$40,000	0.8734	$34,936
3	$0	$0	$39,000	$0	$39,000	0.8163	$31,836
4	$0	$0	$39,000	$55,000	$94,000	0.7629	$71,713
5	$0	$0	$39,000	$0	$39,000	0.7130	$27,807
6	$0	$0	$23,000	$0	$23,000	0.6663	$15,325
7	$0	$0	$23,000	$0	$23,000	0.6227	$14,322
8	$0	$0	$23,000	$0	$23,000	0.5820	$13,386
9	$0	$0	$23,000	$55,000	$78,000	0.5439	$42,424
10	$0	$0	$23,000	$0	$23,000	0.5083	$11,691
11	$0	$0	$23,000	$0	$23,000	0.4751	$10,927
12	$0	$0	$23,000	$0	$23,000	0.4440	$10,212
13	$0	$0	$23,000	$0	$23,000	0.4150	$9,545
14	$0	$0	$23,000	$55,000	$78,000	0.3878	$30,248
15	$0	$0	$23,000	$0	$23,000	0.3624	$8,335
16	$0	$0	$23,000	$0	$23,000	0.3387	$7,790
17	$0	$0	$23,000	$0	$23,000	0.3166	$7,282
18	$0	$0	$23,000	$0	$23,000	0.2959	$6,806
19	$0	$0	$23,000	$55,000	$78,000	0.2765	$21,567
20	$0	$0	$23,000	$0	$23,000	0.2584	$5,943
21	$0	$0	$23,000	$0	$23,000	0.2415	$5,555
22	$0	$0	$23,000	$0	$23,000	0.2257	$5,191
23	$0	$0	$23,000	$0	$23,000	0.2109	$4,851
24	$0	$0	$23,000	$55,000	$78,000	0.1971	$15,374
25	$0	$0	$23,000	$0	$23,000	0.1842	$4,237
26	$0	$0	$23,000	$0	$23,000	0.1722	$3,961
27	$0	$0	$23,000	$0	$23,000	0.1609	$3,701
28	$0	$0	$23,000	$0	$23,000	0.1504	$3,459
29	$0	$0	$23,000	$55,000	$78,000	0.1406	$10,967
TOTALS:	$178,000	$4,897,000	$750,000	$330,000	**$6,155,000**		$5,552,710
TOTAL PRESENT VALUE OF ALTERNATIVE 2[5]							**$5,553,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since soils under covers and structures would have contaminant concentrations above RGs that would allow for unlimited use and unrestricted exposure under the current and potential future land uses. However the period of analysis was assumed to be 30 years (Years 0 through 29).

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-2.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table PV-ADRFT for details.

[5] Total present value is rounded to the nearest $1,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE PV-2 (100yr)

PRESENT VALUE ANALYSIS

Alternative 2 (100 Year Analysis Period without Cover Replacement)

In-Place Containment, Continued Submergence of Tailings within EM, and Limited Excavation/Disposal of Mine Materials at Proposed Facility within PMDA

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Earthwork)[2]	Annual O&M Costs	Periodic Costs	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$178,000	$4,897,000	$0	$0	$5,075,000	1.0000	$5,075,000
1	$0	$0	$41,000	$0	$41,000	0.9346	$38,319
2	$0	$0	$41,000	$0	$41,000	0.8734	$35,809
3	$0	$0	$41,000	$0	$41,000	0.8163	$33,468
4	$0	$0	$40,000	$55,000	$95,000	0.7629	$72,476
5	$0	$0	$40,000	$0	$40,000	0.7130	$28,520
6	$0	$0	$23,000	$0	$23,000	0.6663	$15,325
7	$0	$0	$23,000	$0	$23,000	0.6227	$14,322
8	$0	$0	$23,000	$0	$23,000	0.5820	$13,386
9	$0	$0	$23,000	$55,000	$78,000	0.5439	$42,424
10	$0	$0	$23,000	$0	$23,000	0.5083	$11,691
11	$0	$0	$23,000	$0	$23,000	0.4751	$10,927
12	$0	$0	$23,000	$0	$23,000	0.4440	$10,212
13	$0	$0	$23,000	$0	$23,000	0.4150	$9,545
14	$0	$0	$23,000	$55,000	$78,000	0.3878	$30,248
15	$0	$0	$23,000	$0	$23,000	0.3624	$8,335
16	$0	$0	$23,000	$0	$23,000	0.3387	$7,790
17	$0	$0	$23,000	$0	$23,000	0.3166	$7,282
18	$0	$0	$23,000	$0	$23,000	0.2959	$6,806
19	$0	$0	$23,000	$55,000	$78,000	0.2765	$21,567
20	$0	$0	$23,000	$0	$23,000	0.2584	$5,943
21	$0	$0	$23,000	$0	$23,000	0.2415	$5,555
22	$0	$0	$23,000	$0	$23,000	0.2257	$5,191
23	$0	$0	$23,000	$0	$23,000	0.2109	$4,851
24	$0	$0	$23,000	$55,000	$78,000	0.1971	$15,374
25	$0	$0	$23,000	$0	$23,000	0.1842	$4,237
26	$0	$0	$23,000	$0	$23,000	0.1722	$3,961
27	$0	$0	$23,000	$0	$23,000	0.1609	$3,701
28	$0	$0	$23,000	$0	$23,000	0.1504	$3,459
29	$0	$0	$23,000	$55,000	$78,000	0.1406	$10,967
30	$0	$0	$23,000	$0	$23,000	0.1314	$3,022
31	$0	$0	$23,000	$0	$23,000	0.1228	$2,824
32	$0	$0	$23,000	$0	$23,000	0.1147	$2,638
33	$0	$0	$23,000	$0	$23,000	0.1072	$2,466
34	$0	$0	$23,000	$55,000	$78,000	0.1002	$7,816
35	$0	$0	$23,000	$0	$23,000	0.0937	$2,155
36	$0	$0	$23,000	$0	$23,000	0.0875	$2,013
37	$0	$0	$23,000	$0	$23,000	0.0818	$1,881
38	$0	$0	$23,000	$0	$23,000	0.0765	$1,760
39	$0	$0	$23,000	$55,000	$78,000	0.0715	$5,577
40	$0	$0	$23,000	$0	$23,000	0.0668	$1,536
41	$0	$0	$23,000	$0	$23,000	0.0624	$1,435
42	$0	$0	$23,000	$0	$23,000	0.0583	$1,341
43	$0	$0	$23,000	$0	$23,000	0.0545	$1,254
44	$0	$0	$23,000	$55,000	$78,000	0.0509	$3,970

TABLE PV-2 (100yr)							
PRESENT VALUE ANALYSIS							
Alternative	**2 (100 Year Analysis Period without Cover Replacement)**						
In-Place Containment, Continued Submergence of Tailings within EM, and Limited Excavation/Disposal of Mine Materials at Proposed Facility within PMDA							
Site:	**Formosa OU1**						
Location:	**Douglas County, Oregon**						
Phase:	**Feasibility Study**						
Base Year:	**2013**						
Year[1]	**Capital Costs (Institutional Controls)[2]**	**Capital Costs (Earthwork)[2]**	**Annual O&M Costs**	**Periodic Costs**	**Total Annual Expenditure[3]**	**Discount Factor (7.0%)**	**Present Value[4]**
45	$0	$0	$23,000	$0	$23,000	0.0476	$1,095
46	$0	$0	$23,000	$0	$23,000	0.0445	$1,024
47	$0	$0	$23,000	$0	$23,000	0.0416	$957
48	$0	$0	$23,000	$0	$23,000	0.0389	$895
49	$0	$0	$23,000	$55,000	$78,000	0.0363	$2,831
50	$0	$0	$23,000	$0	$23,000	0.0339	$780
51	$0	$0	$23,000	$0	$23,000	0.0317	$730
52	$0	$0	$23,000	$0	$23,000	0.0297	$682
53	$0	$0	$23,000	$0	$23,000	0.0277	$637
54	$0	$0	$23,000	$55,000	$78,000	0.0259	$2,020
55	$0	$0	$23,000	$0	$23,000	0.0242	$557
56	$0	$0	$23,000	$0	$23,000	0.0226	$520
57	$0	$0	$23,000	$0	$23,000	0.0211	$486
58	$0	$0	$23,000	$0	$23,000	0.0198	$454
59	$0	$0	$23,000	$55,000	$78,000	0.0185	$1,440
60	$0	$0	$23,000	$0	$23,000	0.0173	$397
61	$0	$0	$23,000	$0	$23,000	0.0161	$371
62	$0	$0	$23,000	$0	$23,000	0.0151	$347
63	$0	$0	$23,000	$0	$23,000	0.0141	$324
64	$0	$0	$23,000	$55,000	$78,000	0.0132	$1,027
65	$0	$0	$23,000	$0	$23,000	0.0123	$283
66	$0	$0	$23,000	$0	$23,000	0.0115	$264
67	$0	$0	$23,000	$0	$23,000	0.0107	$247
68	$0	$0	$23,000	$0	$23,000	0.0100	$231
69	$0	$0	$23,000	$55,000	$78,000	0.0094	$732
70	$0	$0	$23,000	$0	$23,000	0.0088	$202
71	$0	$0	$23,000	$0	$23,000	0.0082	$189
72	$0	$0	$23,000	$0	$23,000	0.0077	$176
73	$0	$0	$23,000	$0	$23,000	0.0072	$165
74	$0	$0	$23,000	$55,000	$78,000	0.0067	$522
75	$0	$0	$23,000	$0	$23,000	0.0063	$144
76	$0	$0	$23,000	$0	$23,000	0.0058	$134
77	$0	$0	$23,000	$0	$23,000	0.0055	$126
78	$0	$0	$23,000	$0	$23,000	0.0051	$117
79	$0	$0	$23,000	$55,000	$78,000	0.0048	$372
80	$0	$0	$23,000	$0	$23,000	0.0045	$103
81	$0	$0	$23,000	$0	$23,000	0.0042	$96
82	$0	$0	$23,000	$0	$23,000	0.0039	$90
83	$0	$0	$23,000	$0	$23,000	0.0036	$84
84	$0	$0	$23,000	$55,000	$78,000	0.0034	$265
85	$0	$0	$23,000	$0	$23,000	0.0032	$73
86	$0	$0	$23,000	$0	$23,000	0.0030	$68
87	$0	$0	$23,000	$0	$23,000	0.0028	$64
88	$0	$0	$23,000	$0	$23,000	0.0026	$60
89	$0	$0	$23,000	$55,000	$78,000	0.0024	$189

TABLE PV-2 (100yr)

PRESENT VALUE ANALYSIS

Alternative **2 (100 Year Analysis Period without Cover Replacement)**

In-Place Containment, Continued Submergence of Tailings within EM, and Limited Excavation/Disposal of Mine Materials at Proposed Facility within PMDA

Site: **Formosa OU1**
Location: **Douglas County, Oregon**
Phase: **Feasibility Study**
Base Year: **2013**

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Earthwork)[2]	Annual O&M Costs	Periodic Costs	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
90	$0	$0	$23,000	$0	$23,000	0.0023	$52
91	$0	$0	$23,000	$0	$23,000	0.0021	$49
92	$0	$0	$23,000	$0	$23,000	0.0020	$46
93	$0	$0	$23,000	$0	$23,000	0.0019	$43
94	$0	$0	$23,000	$55,000	$78,000	0.0017	$135
95	$0	$0	$23,000	$0	$23,000	0.0016	$37
96	$0	$0	$23,000	$0	$23,000	0.0015	$35
97	$0	$0	$23,000	$0	$23,000	0.0014	$32
98	$0	$0	$23,000	$0	$23,000	0.0013	$30
99	$0	$0	$23,000	$55,000	$78,000	0.0012	$96
TOTALS:	$178,000	$4,897,000	$2,365,000	$1,100,000	**$8,540,000**		$5,621,504
TOTAL PRESENT VALUE OF ALTERNATIVE 2[5]							**$5,622,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since soils under covers and structures would have contaminant concentrations above RGs that would allow for unlimited use and unrestricted exposure under the current and potential future land uses. However the period of analysis was assumed to be 100 years (Years 0 through 99).

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-2.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table PV-ADRFT for details.

[5] Total present value is rounded to the nearest $1,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.
They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE PV-2 (100yr with Cover Replacement)

PRESENT VALUE ANALYSIS

Alternative 2 (100 Year Analysis Period with Cover Replacement)

In-Place Containment, Continued Submergence of Tailings within EM, and Limited Excavation/Disposal of Mine Materials at Proposed Facility within PMDA

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Earthwork)[2]	Annual O&M Costs	Periodic Costs	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$178,000	$4,897,000	$0	$0	$5,075,000	1.0000	$5,075,000
1	$0	$0	$41,000	$0	$41,000	0.9346	$38,319
2	$0	$0	$41,000	$0	$41,000	0.8734	$35,809
3	$0	$0	$41,000	$0	$41,000	0.8163	$33,468
4	$0	$0	$40,000	$55,000	$95,000	0.7629	$72,476
5	$0	$0	$40,000	$0	$40,000	0.7130	$28,520
6	$0	$0	$23,000	$0	$23,000	0.6663	$15,325
7	$0	$0	$23,000	$0	$23,000	0.6227	$14,322
8	$0	$0	$23,000	$0	$23,000	0.5820	$13,386
9	$0	$0	$23,000	$55,000	$78,000	0.5439	$42,424
10	$0	$0	$23,000	$0	$23,000	0.5083	$11,691
11	$0	$0	$23,000	$0	$23,000	0.4751	$10,927
12	$0	$0	$23,000	$0	$23,000	0.4440	$10,212
13	$0	$0	$23,000	$0	$23,000	0.4150	$9,545
14	$0	$0	$23,000	$55,000	$78,000	0.3878	$30,248
15	$0	$0	$23,000	$0	$23,000	0.3624	$8,335
16	$0	$0	$23,000	$0	$23,000	0.3387	$7,790
17	$0	$0	$23,000	$0	$23,000	0.3166	$7,282
18	$0	$0	$23,000	$0	$23,000	0.2959	$6,806
19	$0	$0	$23,000	$55,000	$78,000	0.2765	$21,567
20	$0	$0	$23,000	$0	$23,000	0.2584	$5,943
21	$0	$0	$23,000	$0	$23,000	0.2415	$5,555
22	$0	$0	$23,000	$0	$23,000	0.2257	$5,191
23	$0	$0	$23,000	$0	$23,000	0.2109	$4,851
24	$0	$0	$23,000	$55,000	$78,000	0.1971	$15,374
25	$0	$0	$23,000	$0	$23,000	0.1842	$4,237
26	$0	$0	$23,000	$0	$23,000	0.1722	$3,961
27	$0	$0	$23,000	$0	$23,000	0.1609	$3,701
28	$0	$0	$23,000	$0	$23,000	0.1504	$3,459
29	$0	$0	$23,000	$55,000	$78,000	0.1406	$10,967
30	$0	$0	$23,000	$0	$23,000	0.1314	$3,022
31	$0	$0	$23,000	$0	$23,000	0.1228	$2,824
32	$0	$0	$23,000	$0	$23,000	0.1147	$2,638
33	$0	$0	$23,000	$0	$23,000	0.1072	$2,466
34	$0	$0	$23,000	$55,000	$78,000	0.1002	$7,816
35	$0	$0	$23,000	$0	$23,000	0.0937	$2,155
36	$0	$0	$23,000	$0	$23,000	0.0875	$2,013
37	$0	$0	$23,000	$0	$23,000	0.0818	$1,881
38	$0	$0	$23,000	$0	$23,000	0.0765	$1,760
39	$0	$0	$23,000	$55,000	$78,000	0.0715	$5,577
40	$0	$0	$23,000	$0	$23,000	0.0668	$1,536
41	$0	$0	$23,000	$0	$23,000	0.0624	$1,435
42	$0	$0	$23,000	$0	$23,000	0.0583	$1,341
43	$0	$0	$23,000	$0	$23,000	0.0545	$1,254
44	$0	$0	$23,000	$55,000	$78,000	0.0509	$3,970

TABLE PV-2 (100yr with Cover Replacement)

PRESENT VALUE ANALYSIS

Alternative **2 (100 Year Analysis Period with Cover Replacement)**

In-Place Containment, Continued Submergence of Tailings within EM, and Limited Excavation/Disposal of Mine Materials at Proposed Facility within PMDA

Site: **Formosa OU1**
Location: **Douglas County, Oregon**
Phase: **Feasibility Study**
Base Year: **2013**

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Earthwork)[2]	Annual O&M Costs	Periodic Costs	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
45	$0	$0	$23,000	$0	$23,000	0.0476	$1,095
46	$0	$0	$23,000	$0	$23,000	0.0445	$1,024
47	$0	$0	$23,000	$0	$23,000	0.0416	$957
48	$0	$0	$23,000	$0	$23,000	0.0389	$895
49	$0	$0	$23,000	$55,000	$78,000	0.0363	$2,831
50	$0	$0	$23,000	$0	$23,000	0.0339	$780
51	$0	$0	$23,000	$0	$23,000	0.0317	$730
52	$0	$0	$23,000	$0	$23,000	0.0297	$682
53	$0	$0	$23,000	$0	$23,000	0.0277	$637
54	$0	$0	$23,000	$55,000	$78,000	0.0259	$2,020
55	$0	$0	$23,000	$0	$23,000	0.0242	$557
56	$0	$0	$23,000	$0	$23,000	0.0226	$520
57	$0	$0	$23,000	$0	$23,000	0.0211	$486
58	$0	$0	$23,000	$0	$23,000	0.0198	$454
59	$0	$0	$23,000	$55,000	$78,000	0.0185	$1,440
60	$0	$0	$23,000	$0	$23,000	0.0173	$397
61	$0	$0	$23,000	$0	$23,000	0.0161	$371
62	$0	$0	$23,000	$0	$23,000	0.0151	$347
63	$0	$0	$23,000	$0	$23,000	0.0141	$324
64	$0	$0	$23,000	$55,000	$78,000	0.0132	$1,027
65	$0	$0	$23,000	$0	$23,000	0.0123	$283
66	$0	$0	$23,000	$0	$23,000	0.0115	$264
67	$0	$0	$23,000	$0	$23,000	0.0107	$247
68	$0	$0	$23,000	$0	$23,000	0.0100	$231
69	$0	$0	$23,000	$55,000	$78,000	0.0094	$732
70	$0	$0	$23,000	$0	$23,000	0.0088	$202
71	$0	$0	$23,000	$0	$23,000	0.0082	$189
72	$0	$0	$23,000	$0	$23,000	0.0077	$176
73	$0	$0	$23,000	$0	$23,000	0.0072	$165
74	$0	$0	$23,000	$55,000	$78,000	0.0067	$522
75	$0	$0	$23,000	$0	$23,000	0.0063	$144
76	$0	$0	$23,000	$0	$23,000	0.0058	$134
77	$0	$0	$23,000	$0	$23,000	0.0055	$126
78	$0	$0	$23,000	$0	$23,000	0.0051	$117
79	$0	$0	$23,000	$55,000	$78,000	0.0048	$372
80	$0	$0	$23,000	$0	$23,000	0.0045	$103
81	$0	$0	$23,000	$0	$23,000	0.0042	$96
82	$0	$0	$23,000	$0	$23,000	0.0039	$90
83	$0	$0	$23,000	$0	$23,000	0.0036	$84
84	$0	$0	$23,000	$55,000	$78,000	0.0034	$265
85	$0	$0	$23,000	$0	$23,000	0.0032	$73
86	$0	$0	$23,000	$0	$23,000	0.0030	$68
87	$0	$0	$23,000	$0	$23,000	0.0028	$64
88	$0	$0	$23,000	$0	$23,000	0.0026	$60
89	$0	$0	$23,000	$55,000	$78,000	0.0024	$189

TABLE PV-2 (100yr with Cover Replacement)

PRESENT VALUE ANALYSIS

Alternative **2 (100 Year Analysis Period with Cover Replacement)**

In-Place Containment, Continued Submergence of Tailings within EM, and Limited Excavation/Disposal of Mine Materials at Proposed Facility within PMDA

Site: **Formosa OU1**
Location: **Douglas County, Oregon**
Phase: **Feasibility Study**
Base Year: **2013**

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Earthwork)[2]	Annual O&M Costs	Periodic Costs	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
90	$0	$0	$23,000	$0	$23,000	0.0023	$52
91	$0	$0	$23,000	$0	$23,000	0.0021	$49
92	$0	$0	$23,000	$0	$23,000	0.0020	$46
93	$0	$0	$23,000	$0	$23,000	0.0019	$43
94	$0	$0	$23,000	$55,000	$78,000	0.0017	$135
95	$0	$0	$23,000	$0	$23,000	0.0016	$37
96	$0	$0	$23,000	$0	$23,000	0.0015	$35
97	$0	$0	$23,000	$0	$23,000	0.0014	$32
98	$0	$0	$23,000	$0	$23,000	0.0013	$30
99	$0	$1,650,000	$23,000	$55,000	$1,728,000	0.0012	$2,131
TOTALS:	$178,000	$6,547,000	$2,365,000	$1,100,000	**$10,190,000**		$5,623,539
TOTAL PRESENT VALUE OF ALTERNATIVE 2[5]							**$5,624,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since soils under covers and structures would have contaminant concentrations above RGs that would allow for unlimited use and unrestricted exposure under the current and potential future land uses. However the period of analysis was assumed to be 100 years (Years 0 through 99).

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-2.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table PV-ADRFT for details.

[5] Total present value is rounded to the nearest $1,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.
They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

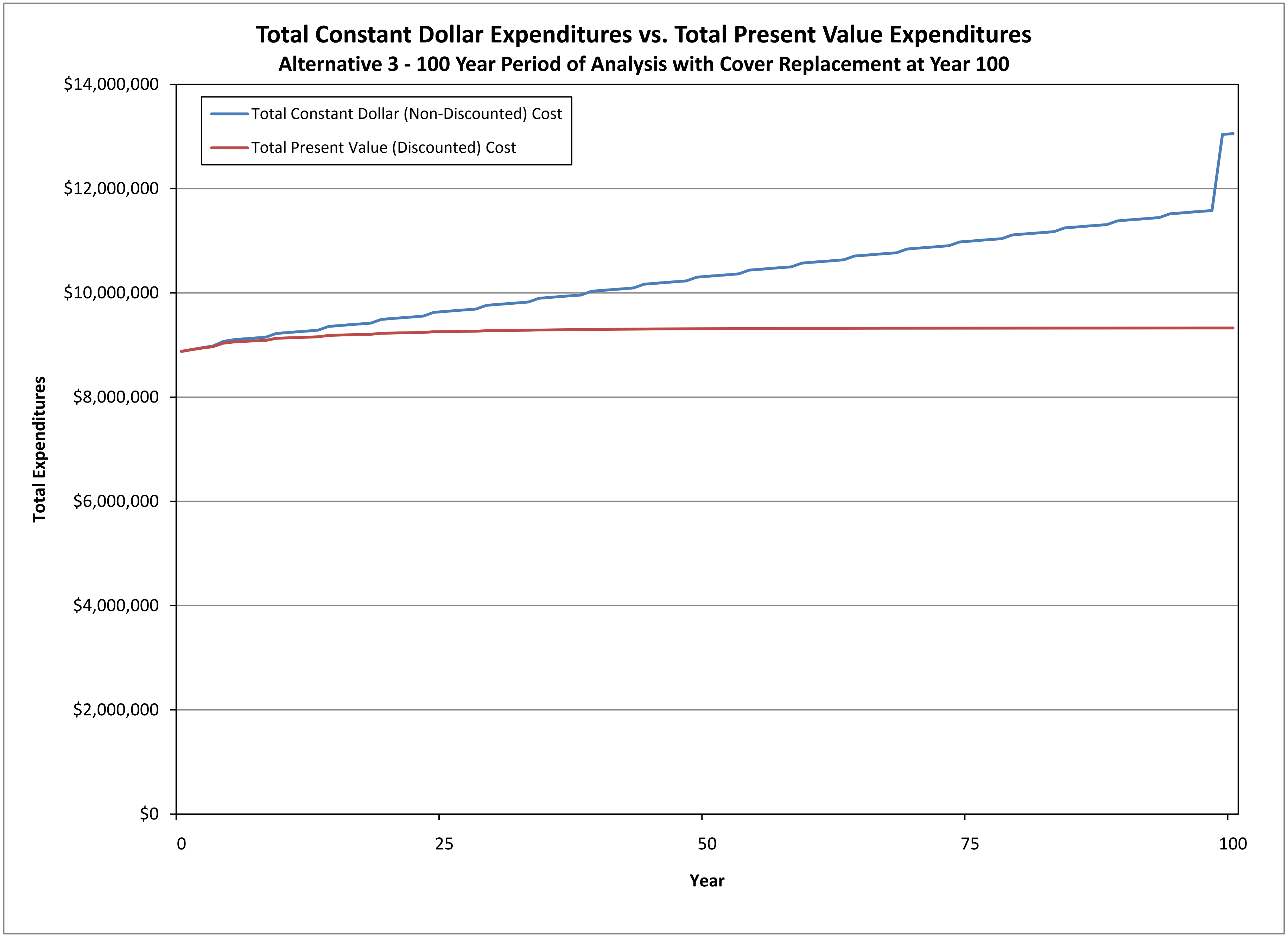

Total Constant Dollar Expenditures vs. Total Present Value Expenditures
Alternative 3 - 100 Year Period of Analysis with Cover Replacement at Year 100
Total Constant Dollar (Non-Discounted) Cost
Total Present Value (Discounted) Cost
Total Expenditures
$14,000,000
$12,000,000
$10,000,000
$8,000,000
$6,000,000
$4,000,000
$2,000,000
$0
0
25
50
75
100
Year

TABLE CSS-3

ALTERNATIVE COST SUMMARY

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Alternative 3	Total Constant Dollar (Non-Discounted) Cost	Total Present Value (Discounted) Cost
30 Year Analysis Period without Cover Replacement	$9,761,000	$9,275,000
100 Year Analysis Period without Cover Replacement	$11,651,000	$9,326,000
100 Year Analysis Period with Cover Replacement	$13,039,000	$9,327,000

Notes:

1 - Capital costs, annual costs, and periodic costs are presented on Table CS-3.

2 - Estimated remedial timeframes and associated present value analysis for each remedial alternative are provided on tables PV-3 (30yr) through PV-3 (100yr).

3 - The non-discounted total cost demonstrates the impact of a discount rate on the total present value cost and the relative amount of future annual expenditures. Non-discounted costs are presented for comparison purposes only and should not be used in place of present value costs in the CERCLA remedy selection process.

4 - Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for feasibility study level evaluation purposes.

5 - Present value is the total cost per year including a 7.0% discount factor for that year.

6 - Costs for replacement of cover includes the installation of a geosynthetic multi-layer cover system (including low permeability layer, drainage layer, barrier layer, and vegetative layer), amending topsoils, and hydro-seeding with fertilizer and hydromulch. It does not include replacement of surface drainage features such as riprap for drop chutes and perimeter drainage channel.

TABLE CS-3

Alternative **3**
Limited In-Place Containment, Chemically Reduced Submergence of Tailings within EM, and Excavation/Disposal of Mine Materials at Proposed Facilities within and outside PMDA

COST ESTIMATE SUMMARY

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013
Date: January 31, 2013

Description: Alternative 3 includes limited in-place containment of mine materials at the EM area, excavation of all other mine materials, and disposal of mine materials at proposed facilities within and outside the PMDA. Disposal of all excavated materials would take place at two proposed facilities: one within the PMDA and one outside of the PMDA at a location to be determined. The proposed facility within the PMDA would contain the EM in place, including the former water and tailings storage pond. Chemically reduced submergence would be implemented for tailings within the former water and tailings storage pond by adding liquid organic reagents to enhance in situ biological treatment. The proposed facility outside of the PMDA would be sized to contain the remainder of excavated mine materials (approximately 125,000 CY) and constructed to meet pertinent ARARs for the selected location. Excavated areas or areas disturbed during construction that do not have mine materials would be regraded and reclaimed with a rock armor or a vegetative layer, depending on the steepness of resulting slopes. Administrative controls involve administrative, legal, and/or informational, or physical measures intended to control or prevent present and future use or access to mine materials, and inform and warn of dangers associated with these materials. Monitoring would consist of visual inspections to document degree of protectiveness to human health and the environment and determine maintenance needs for the proposed facility and containment areas. Maintenance of the proposed disposal facility and containment areas would be performed as necessary to maintain protectiveness and integrity of the covers systems. However additional maintenance requirements, such as leachate collection and treatment, may be needed for the proposed facility outside of the PMDA depending on the selected location and configuration. Five-year site reviews would be performed since mine materials under covers would remain at the PMDA with contaminant concentrations above PRGs. The contaminant concentrations above PRGs do not allow for unlimited use and unrestricted exposure under the current and potential future land uses.

INSTITUTIONAL CONTROLS CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Institutional Controls	CW3-1	1	LS	$111,491	$111,491	
Engineered Controls	CW3-2	1	LS	$77,059	$77,059	
SUBTOTAL					$188,550	
Contingency (Scope and Bid)		20%			$37,710	10% Scope, 10% Bid (Low end of the recommended range).
SUBTOTAL					$226,260	
Project Management		8%			$18,101	Percentage from Exhibit 5-8 was used.
Remedial Design		15%			$33,939	Percentage from Exhibit 5-8 was used.
Construction Management		10%			$22,626	Percentage from Exhibit 5-8 was used.
TOTAL					$300,926	
TOTAL CAPITAL COST					**$301,000**	Total capital cost is rounded to the nearest $1,000.

EARTHWORK CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Excavation of Mine Materials	CW3-4	1	LS	$361,749	$361,749	
Excavation of Borrow Areas	CW3-5	1	LS	$853,886	$853,886	
Transportation of Mine Materials	CW3-6	1	LS	$1,063,557	$1,063,557	
Transportation of Borrow Material	CW3-7	1	LS	$216,586	$216,586	
Lime and Organic Material for Topsoil and Subsoil Amendment	CW3-8	1	LS	$405,199	$405,199	
Dust Control	CW3-9	1	LS	$274,827	$274,827	
Excavation Area Reclamation	CW3-10	1	LS	$94,386	$94,386	
Revegetation of Reclamation Areas	CW3-11	1	LS	$308,746	$308,746	
Surveying for Construction Control	CW3-12	1	LS	$71,406	$71,406	
Permanent Access Road	CW3-13	1	LS	$146,353	$146,353	
Erosion Control	CW3-14	1	LS	$439,880	$439,880	
Mobilization/Demobilization and Preparatory Work	CW3-15	1	LS	$69,284	$69,284	
Construction of Repository within PMDA	CW3-16	1	LS	$617,025	$617,025	
Construction of Repository outside PMDA	CW3-17	1	LS	$1,068,279	$1,068,279	
Chemical Submergence of Tailings	CW3-22	1	LS	$10,000	$10,000	
Revegetation of Covers	CW3-23	1	LS	$4,941	$4,941	
SUBTOTAL					$6,006,104	
Contingency (Scope and Bid)		20%			$1,201,221	10% Scope, 10% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$7,207,325	
Project Management		5%			$360,366	Percentage from Exhibit 5-8 was used.
Remedial Design		8%			$576,586	Percentage from Exhibit 5-8 was used.
Construction Management		6%			$432,440	Percentage from Exhibit 5-8 was used.
TOTAL					$8,576,717	
TOTAL CAPITAL COST					**$8,577,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-3

Alternative 3
Limited In-Place Containment, Chemically Reduced Submergence of Tailings within EM, and Excavation/Disposal of Mine Materials at Proposed Facilities within and outside PMDA

COST ESTIMATE SUMMARY

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013
Date: January 31, 2013

Description: Alternative 3 includes limited in-place containment of mine materials at the EM area, excavation of all other mine materials, and disposal of mine materials at proposed facilities within and outside the PMDA. Disposal of all excavated materials would take place at two proposed facilities: one within the PMDA and one outside of the PMDA at a location to be determined. The proposed facility within the PMDA would contain the EM in place, including the former water and tailings storage pond. Chemically reduced submergence would be implemented for tailings within the former water and tailings storage pond by adding liquid organic reagents to enhance in situ biological treatment. The proposed facility outside of the PMDA would be sized to contain the remainder of excavated mine materials (approximately 125,000 CY) and constructed to meet pertinent ARARs for the selected location. Excavated areas or areas disturbed during construction that do not have mine materials would be regraded and reclaimed with a rock armor or a vegetative layer, depending on the steepness of resulting slopes. Administrative controls involve administrative, legal, and/or informational, or physical measures intended to control or prevent present and future use or access to mine materials, and inform and warn of dangers associated with these materials. Monitoring would consist of visual inspections to document degree of protectiveness to human health and the environment and determine maintenance needs for the proposed facility and containment areas. Maintenance of the proposed disposal facility and containment areas would be performed as necessary to maintain protectiveness and integrity of the covers systems. However additional maintenance requirements, such as leachate collection and treatment, may be needed for the proposed facility outside of the PMDA depending on the selected location and configuration. Five-year site reviews would be performed since mine materials under covers would remain at the PMDA with contaminant concentrations above PRGs. The contaminant concentrations above PRGs do not allow for unlimited use and unrestricted exposure under the current and potential future land uses.

REPLACEMENT OF COVER FUTURE COSTS (Year 99)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Replacement of Covers	CW3-24	1	LS	$918,281	$918,281	
SUBTOTAL					$918,281	
Contingency (Scope and Bid)		20%			$183,656	10% Scope, 10% Bid (Low end of the recommended range).
SUBTOTAL					$1,101,937	
Project Management		6%			$66,116	Percentage from Exhibit 5-8 was used.
Remedial Design		12%			$132,232	Percentage from Exhibit 5-8 was used.
Construction Management		8%			$88,155	Percentage from Exhibit 5-8 was used.
TOTAL					$1,388,440	
TOTAL ANNUAL COST					**$1,388,000**	Future cost is rounded to the nearest $1,000.

ANNUAL OPERATIONS AND MAINTENANCE (O&M) COSTS - Year 1

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Cover and Reclamation Maintenance (Year 1)	CW3-18	1	LS	$23,664	$23,664	
SUBTOTAL					$23,664	
Contingency (Scope and Bid)		20%			$4,733	10% Scope, 10% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$28,397	
Project Management		10%			$2,840	Percentage from Exhibit 5-8 was used.
Technical Support		15%			$4,260	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$35,497	
TOTAL ANNUAL O&M COST					**$35,000**	

ANNUAL OPERATIONS AND MAINTENANCE (O&M) COSTS - Year 2

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Cover and Reclamation Maintenance (Year 2)	CW3-19	1	LS	$23,068	$23,068	
SUBTOTAL					$23,068	
Contingency (Scope and Bid)		20%			$4,614	10% Scope, 10% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$27,682	
Project Management		10%			$2,768	Percentage from Exhibit 5-8 was used.
Technical Support		15%			$4,152	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$34,602	
TOTAL ANNUAL O&M COST					**$35,000**	

TABLE CS-3

Alternative 3
Limited In-Place Containment, Chemically Reduced Submergence of Tailings within EM, and Excavation/Disposal of Mine Materials at Proposed Facilities within and outside PMDA

COST ESTIMATE SUMMARY

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013
Date: January 31, 2013

Description: Alternative 3 includes limited in-place containment of mine materials at the EM area, excavation of all other mine materials, and disposal of mine materials at proposed facilities within and outside the PMDA. Disposal of all excavated materials would take place at two proposed facilities: one within the PMDA and one outside of the PMDA at a location to be determined. The proposed facility within the PMDA would contain the EM in place, including the former water and tailings storage pond. Chemically reduced submergence would be implemented for tailings within the former water and tailings storage pond by adding liquid organic reagents to enhance in situ biological treatment. The proposed facility outside of the PMDA would be sized to contain the remainder of excavated mine materials (approximately 125,000 CY) and constructed to meet pertinent ARARs for the selected location. Excavated areas or areas disturbed during construction that do not have mine materials would be regraded and reclaimed with a rock armor or a vegetative layer, depending on the steepness of resulting slopes. Administrative controls involve administrative, legal, and/or informational, or physical measures intended to control or prevent present and future use or access to mine materials, and inform and warn of dangers associated with these materials. Monitoring would consist of visual inspections to document degree of protectiveness to human health and the environment and determine maintenance needs for the proposed facility and containment areas. Maintenance of the proposed disposal facility and containment areas would be performed as necessary to maintain protectiveness and integrity of the covers systems. However additional maintenance requirements, such as leachate collection and treatment, may be needed for the proposed facility outside of the PMDA depending on the selected location and configuration. Five-year site reviews would be performed since mine materials under covers would remain at the PMDA with contaminant concentrations above PRGs. The contaminant concentrations above PRGs do not allow for unlimited use and unrestricted exposure under the current and potential future land uses.

ANNUAL OPERATIONS AND MAINTENANCE (O&M) COSTS - Years 3 through 5

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Cover and Reclamation Maintenance (Years 3 through 5)	CW3-20	1	LS	$21,934	$21,934	
SUBTOTAL					$21,934	
Contingency (Scope and Bid)		20%			$4,387	10% Scope, 10% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$26,321	
Project Management		10%			$2,632	Percentage from Exhibit 5-8 was used.
Technical Support		15%			$3,948	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$32,901	
TOTAL ANNUAL O&M COST					**$33,000**	

ANNUAL OPERATIONS AND MAINTENANCE (O&M) COSTS - Years 6 through Final Year of Evaluation Period

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Cover and Reclamation Maintenance (Years 6 through 29)	CW3-21	1	LS	$10,967	$10,967	
SUBTOTAL					$10,967	
Contingency (Scope and Bid)		20%			$2,193	10% Scope, 10% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$13,160	
Project Management		10%			$1,316	Percentage from Exhibit 5-8 was used.
Technical Support		15%			$1,974	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$16,450	
TOTAL ANNUAL O&M COST					**$16,000**	

5-YEAR SITE REVIEW PERIODIC COSTS (Every 5 years after initiation of remedial action (Year 0))

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Reviews	CW3-3	1	LS	$36,360	$36,360	Includes five-year site inspection and report; assumed to be statutory review that occurs every five years after initiation of remedial action (Year 0).
SUBTOTAL					$36,360	
Contingency (Scope and Bid)		20%			$7,272	10% Scope, 10% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$43,632	
Project Management		10%			$4,363	Percentage from Exhibit 5-8 was used.
Technical Support		15%			$6,545	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$54,540	
TOTAL PERIODIC COST					**$55,000**	Total capital cost is rounded to the nearest $1,000.

Notes:
Percentages used for indirect costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.
Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation

Abbreviations:
EA Each
LS Lump Sum
QTY Quantity
YR Year

TABLE PV-3 (30yr)							

PRESENT VALUE ANALYSIS

Alternative 3 (30 Year Analysis Period without Cover Replacement)

Limited In-Place Containment, Chemically Reduced Submergence of Tailings within EM, and Excavation/Disposal of Mine Materials at Proposed Facilities within and outside PMDA

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Earthwork)[2]	Annual O&M Costs	Periodic Costs	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$301,000	$8,577,000	$0	$0	$8,878,000	1.0000	$8,878,000
1	$0	$0	$35,000	$0	$35,000	0.9346	$32,711
2	$0	$0	$35,000	$0	$35,000	0.8734	$30,569
3	$0	$0	$33,000	$0	$33,000	0.8163	$26,938
4	$0	$0	$33,000	$55,000	$88,000	0.7629	$67,135
5	$0	$0	$33,000	$0	$33,000	0.7130	$23,529
6	$0	$0	$16,000	$0	$16,000	0.6663	$10,661
7	$0	$0	$16,000	$0	$16,000	0.6227	$9,963
8	$0	$0	$16,000	$0	$16,000	0.5820	$9,312
9	$0	$0	$16,000	$55,000	$71,000	0.5439	$38,617
10	$0	$0	$16,000	$0	$16,000	0.5083	$8,133
11	$0	$0	$16,000	$0	$16,000	0.4751	$7,602
12	$0	$0	$16,000	$0	$16,000	0.4440	$7,104
13	$0	$0	$16,000	$0	$16,000	0.4150	$6,640
14	$0	$0	$16,000	$55,000	$71,000	0.3878	$27,534
15	$0	$0	$16,000	$0	$16,000	0.3624	$5,798
16	$0	$0	$16,000	$0	$16,000	0.3387	$5,419
17	$0	$0	$16,000	$0	$16,000	0.3166	$5,066
18	$0	$0	$16,000	$0	$16,000	0.2959	$4,734
19	$0	$0	$16,000	$55,000	$71,000	0.2765	$19,632
20	$0	$0	$16,000	$0	$16,000	0.2584	$4,134
21	$0	$0	$16,000	$0	$16,000	0.2415	$3,864
22	$0	$0	$16,000	$0	$16,000	0.2257	$3,611
23	$0	$0	$16,000	$0	$16,000	0.2109	$3,374
24	$0	$0	$16,000	$55,000	$71,000	0.1971	$13,994
25	$0	$0	$16,000	$0	$16,000	0.1842	$2,947
26	$0	$0	$16,000	$0	$16,000	0.1722	$2,755
27	$0	$0	$16,000	$0	$16,000	0.1609	$2,574
28	$0	$0	$16,000	$0	$16,000	0.1504	$2,406
29	$0	$0	$16,000	$55,000	$71,000	0.1406	$9,983
TOTALS:	$301,000	$8,577,000	$553,000	$330,000	**$9,761,000**		$9,274,739
TOTAL PRESENT VALUE OF ALTERNATIVE 3[5]							**$9,275,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since soils left beneath structures could have contaminant concentrations above RGs that would not allow for unlimited use and unrestricted exposure under the current and potential future land uses. However the period of analysis was assumed to be 30 years (Years 0 through 29).

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-3.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table PV-ADRFT for details.

[5] Total present value is rounded to the nearest $1,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE PV-3 (100yr)

PRESENT VALUE ANALYSIS

Alternative **3 (100 Year Analysis Period without Cover Replacement)**

Limited In-Place Containment, Chemically Reduced Submergence of Tailings within EM, and Excavation/Disposal of Mine Materials at Proposed Facilities within and outside PMDA

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Earthwork)[2]	Annual O&M Costs	Periodic Costs	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$301,000	$8,577,000	$0	$0	$8,878,000	1.0000	$8,878,000
1	$0	$0	$35,000	$0	$35,000	0.9346	$32,711
2	$0	$0	$35,000	$0	$35,000	0.8734	$30,569
3	$0	$0	$33,000	$0	$33,000	0.8163	$26,938
4	$0	$0	$33,000	$55,000	$88,000	0.7629	$67,135
5	$0	$0	$33,000	$0	$33,000	0.7130	$23,529
6	$0	$0	$16,000	$0	$16,000	0.6663	$10,661
7	$0	$0	$16,000	$0	$16,000	0.6227	$9,963
8	$0	$0	$16,000	$0	$16,000	0.5820	$9,312
9	$0	$0	$16,000	$55,000	$71,000	0.5439	$38,617
10	$0	$0	$16,000	$0	$16,000	0.5083	$8,133
11	$0	$0	$16,000	$0	$16,000	0.4751	$7,602
12	$0	$0	$16,000	$0	$16,000	0.4440	$7,104
13	$0	$0	$16,000	$0	$16,000	0.4150	$6,640
14	$0	$0	$16,000	$55,000	$71,000	0.3878	$27,534
15	$0	$0	$16,000	$0	$16,000	0.3624	$5,798
16	$0	$0	$16,000	$0	$16,000	0.3387	$5,419
17	$0	$0	$16,000	$0	$16,000	0.3166	$5,066
18	$0	$0	$16,000	$0	$16,000	0.2959	$4,734
19	$0	$0	$16,000	$55,000	$71,000	0.2765	$19,632
20	$0	$0	$16,000	$0	$16,000	0.2584	$4,134
21	$0	$0	$16,000	$0	$16,000	0.2415	$3,864
22	$0	$0	$16,000	$0	$16,000	0.2257	$3,611
23	$0	$0	$16,000	$0	$16,000	0.2109	$3,374
24	$0	$0	$16,000	$55,000	$71,000	0.1971	$13,994
25	$0	$0	$16,000	$0	$16,000	0.1842	$2,947
26	$0	$0	$16,000	$0	$16,000	0.1722	$2,755
27	$0	$0	$16,000	$0	$16,000	0.1609	$2,574
28	$0	$0	$16,000	$0	$16,000	0.1504	$2,406
29	$0	$0	$16,000	$55,000	$71,000	0.1406	$9,983
30	$0	$0	$16,000	$0	$16,000	0.1314	$2,102
31	$0	$0	$16,000	$0	$16,000	0.1228	$1,965
32	$0	$0	$16,000	$0	$16,000	0.1147	$1,835
33	$0	$0	$16,000	$0	$16,000	0.1072	$1,715
34	$0	$0	$16,000	$55,000	$71,000	0.1002	$7,114
35	$0	$0	$16,000	$0	$16,000	0.0937	$1,499
36	$0	$0	$16,000	$0	$16,000	0.0875	$1,400
37	$0	$0	$16,000	$0	$16,000	0.0818	$1,309
38	$0	$0	$16,000	$0	$16,000	0.0765	$1,224
39	$0	$0	$16,000	$55,000	$71,000	0.0715	$5,077
40	$0	$0	$16,000	$0	$16,000	0.0668	$1,069
41	$0	$0	$16,000	$0	$16,000	0.0624	$998
42	$0	$0	$16,000	$0	$16,000	0.0583	$933
43	$0	$0	$16,000	$0	$16,000	0.0545	$872
44	$0	$0	$16,000	$55,000	$71,000	0.0509	$3,614

TABLE PV-3 (100yr)

PRESENT VALUE ANALYSIS

Alternative **3 (100 Year Analysis Period without Cover Replacement)**

Limited In-Place Containment, Chemically Reduced Submergence of Tailings within EM, and Excavation/Disposal of Mine Materials at Proposed Facilities within and outside PMDA

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Earthwork)[2]	Annual O&M Costs	Periodic Costs	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
45	$0	$0	$16,000	$0	$16,000	0.0476	$762
46	$0	$0	$16,000	$0	$16,000	0.0445	$712
47	$0	$0	$16,000	$0	$16,000	0.0416	$666
48	$0	$0	$16,000	$0	$16,000	0.0389	$622
49	$0	$0	$16,000	$55,000	$71,000	0.0363	$2,577
50	$0	$0	$16,000	$0	$16,000	0.0339	$542
51	$0	$0	$16,000	$0	$16,000	0.0317	$508
52	$0	$0	$16,000	$0	$16,000	0.0297	$474
53	$0	$0	$16,000	$0	$16,000	0.0277	$443
54	$0	$0	$16,000	$55,000	$71,000	0.0259	$1,839
55	$0	$0	$16,000	$0	$16,000	0.0242	$387
56	$0	$0	$16,000	$0	$16,000	0.0226	$362
57	$0	$0	$16,000	$0	$16,000	0.0211	$338
58	$0	$0	$16,000	$0	$16,000	0.0198	$316
59	$0	$0	$16,000	$55,000	$71,000	0.0185	$1,311
60	$0	$0	$16,000	$0	$16,000	0.0173	$276
61	$0	$0	$16,000	$0	$16,000	0.0161	$258
62	$0	$0	$16,000	$0	$16,000	0.0151	$241
63	$0	$0	$16,000	$0	$16,000	0.0141	$225
64	$0	$0	$16,000	$55,000	$71,000	0.0132	$935
65	$0	$0	$16,000	$0	$16,000	0.0123	$197
66	$0	$0	$16,000	$0	$16,000	0.0115	$184
67	$0	$0	$16,000	$0	$16,000	0.0107	$172
68	$0	$0	$16,000	$0	$16,000	0.0100	$161
69	$0	$0	$16,000	$55,000	$71,000	0.0094	$666
70	$0	$0	$16,000	$0	$16,000	0.0088	$140
71	$0	$0	$16,000	$0	$16,000	0.0082	$131
72	$0	$0	$16,000	$0	$16,000	0.0077	$123
73	$0	$0	$16,000	$0	$16,000	0.0072	$115
74	$0	$0	$16,000	$55,000	$71,000	0.0067	$475
75	$0	$0	$16,000	$0	$16,000	0.0063	$100
76	$0	$0	$16,000	$0	$16,000	0.0058	$94
77	$0	$0	$16,000	$0	$16,000	0.0055	$87
78	$0	$0	$16,000	$0	$16,000	0.0051	$82
79	$0	$0	$16,000	$55,000	$71,000	0.0048	$339
80	$0	$0	$16,000	$0	$16,000	0.0045	$71
81	$0	$0	$16,000	$0	$16,000	0.0042	$67
82	$0	$0	$16,000	$0	$16,000	0.0039	$62
83	$0	$0	$16,000	$0	$16,000	0.0036	$58
84	$0	$0	$16,000	$55,000	$71,000	0.0034	$242
85	$0	$0	$16,000	$0	$16,000	0.0032	$51
86	$0	$0	$16,000	$0	$16,000	0.0030	$48
87	$0	$0	$16,000	$0	$16,000	0.0028	$44
88	$0	$0	$16,000	$0	$16,000	0.0026	$42
89	$0	$0	$16,000	$55,000	$71,000	0.0024	$172

TABLE PV-3 (100yr)

PRESENT VALUE ANALYSIS

Alternative **3 (100 Year Analysis Period without Cover Replacement)**

Limited In-Place Containment, Chemically Reduced Submergence of Tailings within EM, and Excavation/Disposal of Mine Materials at Proposed Facilities within and outside PMDA

Site: **Formosa OU1**
Location: **Douglas County, Oregon**
Phase: **Feasibility Study**
Base Year: **2013**

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Earthwork)[2]	Annual O&M Costs	Periodic Costs	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
90	$0	$0	$16,000	$0	$16,000	0.0023	$36
91	$0	$0	$16,000	$0	$16,000	0.0021	$34
92	$0	$0	$16,000	$0	$16,000	0.0020	$32
93	$0	$0	$16,000	$0	$16,000	0.0019	$30
94	$0	$0	$16,000	$55,000	$71,000	0.0017	$123
95	$0	$0	$16,000	$0	$16,000	0.0016	$26
96	$0	$0	$16,000	$0	$16,000	0.0015	$24
97	$0	$0	$16,000	$0	$16,000	0.0014	$23
98	$0	$0	$16,000	$0	$16,000	0.0013	$21
99	$0	$0	$16,000	$55,000	$71,000	0.0012	$88
TOTALS:	$301,000	$8,577,000	$1,673,000	$1,100,000	**$11,651,000**		$9,325,619
TOTAL PRESENT VALUE OF ALTERNATIVE 3[5]							**$9,326,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since soils left beneath structures could have contaminant concentrations above RGs that would not allow for unlimited use and unrestricted exposure under the current and potential future land uses. However the period of analysis was assumed to be 100 years (Years 0 through 99).

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-3.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table PV-ADRFT for details.

[5] Total present value is rounded to the nearest $1,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE PV-3 (100yr with Cover Replacement)

PRESENT VALUE ANALYSIS

Alternative **3 (100 Year Analysis Period with Cover Replacement)**

Limited In-Place Containment, Chemically Reduced Submergence of Tailings within EM, and Excavation/Disposal of Mine Materials at Proposed Facilities within and outside PMDA

Site: **Formosa OU1**
Location: **Douglas County, Oregon**
Phase: **Feasibility Study**
Base Year: **2013**

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Earthwork)[2]	Annual O&M Costs	Periodic Costs	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$301,000	$8,577,000	$0	$0	$8,878,000	1.0000	$8,878,000
1	$0	$0	$35,000	$0	$35,000	0.9346	$32,711
2	$0	$0	$35,000	$0	$35,000	0.8734	$30,569
3	$0	$0	$33,000	$0	$33,000	0.8163	$26,938
4	$0	$0	$33,000	$55,000	$88,000	0.7629	$67,135
5	$0	$0	$33,000	$0	$33,000	0.7130	$23,529
6	$0	$0	$16,000	$0	$16,000	0.6663	$10,661
7	$0	$0	$16,000	$0	$16,000	0.6227	$9,963
8	$0	$0	$16,000	$0	$16,000	0.5820	$9,312
9	$0	$0	$16,000	$55,000	$71,000	0.5439	$38,617
10	$0	$0	$16,000	$0	$16,000	0.5083	$8,133
11	$0	$0	$16,000	$0	$16,000	0.4751	$7,602
12	$0	$0	$16,000	$0	$16,000	0.4440	$7,104
13	$0	$0	$16,000	$0	$16,000	0.4150	$6,640
14	$0	$0	$16,000	$55,000	$71,000	0.3878	$27,534
15	$0	$0	$16,000	$0	$16,000	0.3624	$5,798
16	$0	$0	$16,000	$0	$16,000	0.3387	$5,419
17	$0	$0	$16,000	$0	$16,000	0.3166	$5,066
18	$0	$0	$16,000	$0	$16,000	0.2959	$4,734
19	$0	$0	$16,000	$55,000	$71,000	0.2765	$19,632
20	$0	$0	$16,000	$0	$16,000	0.2584	$4,134
21	$0	$0	$16,000	$0	$16,000	0.2415	$3,864
22	$0	$0	$16,000	$0	$16,000	0.2257	$3,611
23	$0	$0	$16,000	$0	$16,000	0.2109	$3,374
24	$0	$0	$16,000	$55,000	$71,000	0.1971	$13,994
25	$0	$0	$16,000	$0	$16,000	0.1842	$2,947
26	$0	$0	$16,000	$0	$16,000	0.1722	$2,755
27	$0	$0	$16,000	$0	$16,000	0.1609	$2,574
28	$0	$0	$16,000	$0	$16,000	0.1504	$2,406
29	$0	$0	$16,000	$55,000	$71,000	0.1406	$9,983
30	$0	$0	$16,000	$0	$16,000	0.1314	$2,102
31	$0	$0	$16,000	$0	$16,000	0.1228	$1,965
32	$0	$0	$16,000	$0	$16,000	0.1147	$1,835
33	$0	$0	$16,000	$0	$16,000	0.1072	$1,715
34	$0	$0	$16,000	$55,000	$71,000	0.1002	$7,114
35	$0	$0	$16,000	$0	$16,000	0.0937	$1,499
36	$0	$0	$16,000	$0	$16,000	0.0875	$1,400
37	$0	$0	$16,000	$0	$16,000	0.0818	$1,309
38	$0	$0	$16,000	$0	$16,000	0.0765	$1,224
39	$0	$0	$16,000	$55,000	$71,000	0.0715	$5,077
40	$0	$0	$16,000	$0	$16,000	0.0668	$1,069
41	$0	$0	$16,000	$0	$16,000	0.0624	$998
42	$0	$0	$16,000	$0	$16,000	0.0583	$933
43	$0	$0	$16,000	$0	$16,000	0.0545	$872
44	$0	$0	$16,000	$55,000	$71,000	0.0509	$3,614

TABLE PV-3 (100yr with Cover Replacement)

PRESENT VALUE ANALYSIS

Alternative **3 (100 Year Analysis Period with Cover Replacement)**

Limited In-Place Containment, Chemically Reduced Submergence of Tailings within EM, and Excavation/Disposal of Mine Materials at Proposed Facilities within and outside PMDA

Site: **Formosa OU1**
Location: **Douglas County, Oregon**
Phase: **Feasibility Study**
Base Year: **2013**

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Earthwork)[2]	Annual O&M Costs	Periodic Costs	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
45	$0	$0	$16,000	$0	$16,000	0.0476	$762
46	$0	$0	$16,000	$0	$16,000	0.0445	$712
47	$0	$0	$16,000	$0	$16,000	0.0416	$666
48	$0	$0	$16,000	$0	$16,000	0.0389	$622
49	$0	$0	$16,000	$55,000	$71,000	0.0363	$2,577
50	$0	$0	$16,000	$0	$16,000	0.0339	$542
51	$0	$0	$16,000	$0	$16,000	0.0317	$508
52	$0	$0	$16,000	$0	$16,000	0.0297	$474
53	$0	$0	$16,000	$0	$16,000	0.0277	$443
54	$0	$0	$16,000	$55,000	$71,000	0.0259	$1,839
55	$0	$0	$16,000	$0	$16,000	0.0242	$387
56	$0	$0	$16,000	$0	$16,000	0.0226	$362
57	$0	$0	$16,000	$0	$16,000	0.0211	$338
58	$0	$0	$16,000	$0	$16,000	0.0198	$316
59	$0	$0	$16,000	$55,000	$71,000	0.0185	$1,311
60	$0	$0	$16,000	$0	$16,000	0.0173	$276
61	$0	$0	$16,000	$0	$16,000	0.0161	$258
62	$0	$0	$16,000	$0	$16,000	0.0151	$241
63	$0	$0	$16,000	$0	$16,000	0.0141	$225
64	$0	$0	$16,000	$55,000	$71,000	0.0132	$935
65	$0	$0	$16,000	$0	$16,000	0.0123	$197
66	$0	$0	$16,000	$0	$16,000	0.0115	$184
67	$0	$0	$16,000	$0	$16,000	0.0107	$172
68	$0	$0	$16,000	$0	$16,000	0.0100	$161
69	$0	$0	$16,000	$55,000	$71,000	0.0094	$666
70	$0	$0	$16,000	$0	$16,000	0.0088	$140
71	$0	$0	$16,000	$0	$16,000	0.0082	$131
72	$0	$0	$16,000	$0	$16,000	0.0077	$123
73	$0	$0	$16,000	$0	$16,000	0.0072	$115
74	$0	$0	$16,000	$55,000	$71,000	0.0067	$475
75	$0	$0	$16,000	$0	$16,000	0.0063	$100
76	$0	$0	$16,000	$0	$16,000	0.0058	$94
77	$0	$0	$16,000	$0	$16,000	0.0055	$87
78	$0	$0	$16,000	$0	$16,000	0.0051	$82
79	$0	$0	$16,000	$55,000	$71,000	0.0048	$339
80	$0	$0	$16,000	$0	$16,000	0.0045	$71
81	$0	$0	$16,000	$0	$16,000	0.0042	$67
82	$0	$0	$16,000	$0	$16,000	0.0039	$62
83	$0	$0	$16,000	$0	$16,000	0.0036	$58
84	$0	$0	$16,000	$55,000	$71,000	0.0034	$242
85	$0	$0	$16,000	$0	$16,000	0.0032	$51
86	$0	$0	$16,000	$0	$16,000	0.0030	$48
87	$0	$0	$16,000	$0	$16,000	0.0028	$44
88	$0	$0	$16,000	$0	$16,000	0.0026	$42
89	$0	$0	$16,000	$55,000	$71,000	0.0024	$172

TABLE PV-3 (100yr with Cover Replacement)

PRESENT VALUE ANALYSIS

Alternative **3 (100 Year Analysis Period with Cover Replacement)**

Limited In-Place Containment, Chemically Reduced Submergence of Tailings within EM, and Excavation/Disposal of Mine Materials at Proposed Facilities within and outside PMDA

Site: **Formosa OU1**
Location: **Douglas County, Oregon**
Phase: **Feasibility Study**
Base Year: **2013**

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Earthwork)[2]	Annual O&M Costs	Periodic Costs	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
90	$0	$0	$16,000	$0	$16,000	0.0023	$36
91	$0	$0	$16,000	$0	$16,000	0.0021	$34
92	$0	$0	$16,000	$0	$16,000	0.0020	$32
93	$0	$0	$16,000	$0	$16,000	0.0019	$30
94	$0	$0	$16,000	$55,000	$71,000	0.0017	$123
95	$0	$0	$16,000	$0	$16,000	0.0016	$26
96	$0	$0	$16,000	$0	$16,000	0.0015	$24
97	$0	$0	$16,000	$0	$16,000	0.0014	$23
98	$0	$0	$16,000	$0	$16,000	0.0013	$21
99	$0	$1,388,000	$16,000	$55,000	$1,459,000	0.0012	$1,799
TOTALS:	$301,000	$9,965,000	$1,673,000	$1,100,000	**$13,039,000**		$9,327,330
TOTAL PRESENT VALUE OF ALTERNATIVE 3[5]							**$9,327,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since soils left beneath structures could have contaminant concentrations above RGs that would not allow for unlimited use and unrestricted exposure under the current and potential future land uses. However the period of analysis was assumed to be 100 years (Years 0 through 99).

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-3.

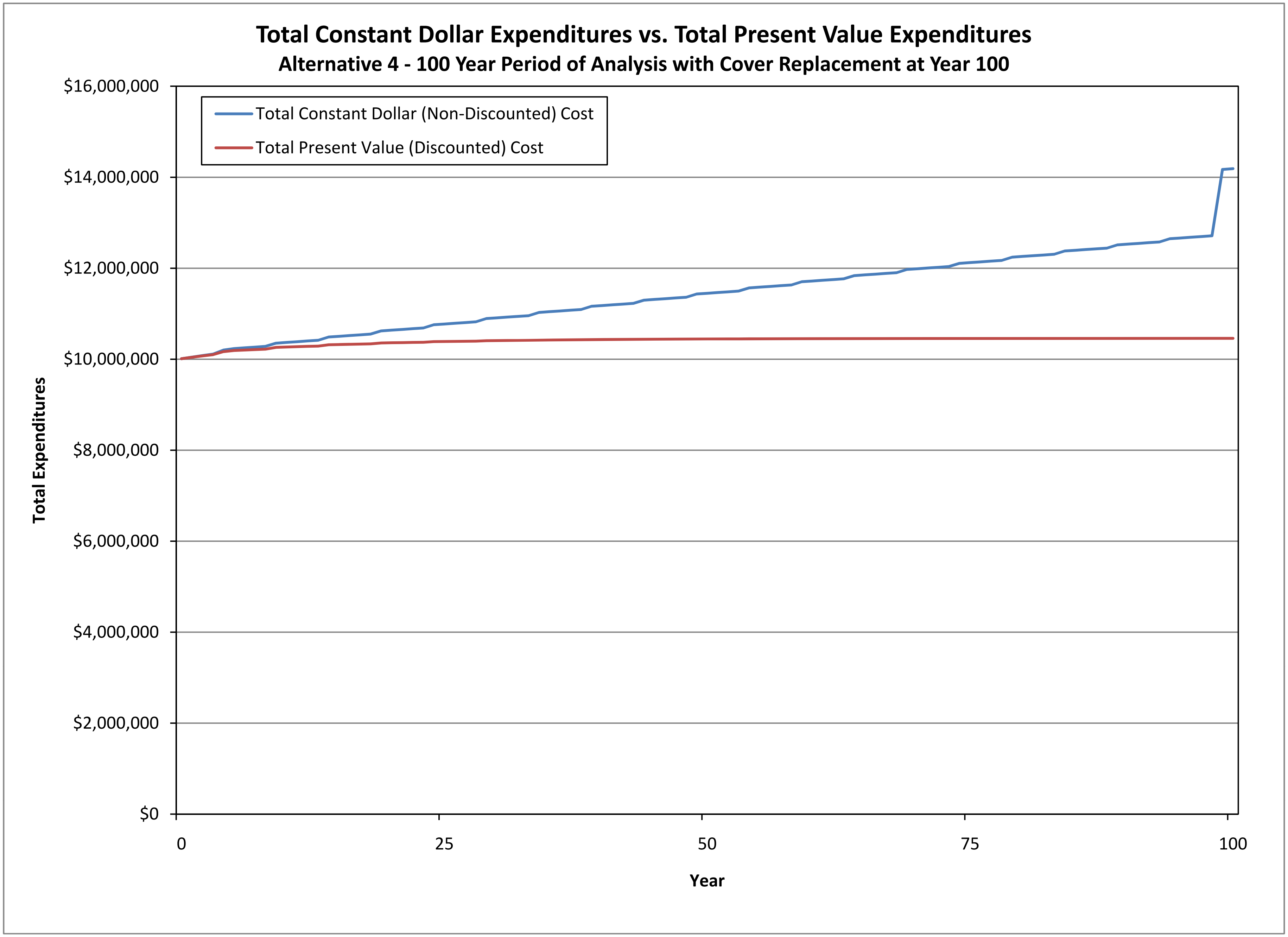
[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table PV-ADRFT for details.

[5] Total present value is rounded to the nearest $1,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.



Total Constant Dollar Expenditures vs. Total Present Value Expenditures
Alternative 4 - 100 Year Period of Analysis with Cover Replacement at Year 100
Total Constant Dollar (Non-Discounted) Cost
Total Present Value (Discounted) Cost
$16,000,000
$14,000,000
$12,000,000
$10,000,000
$8,000,000
$6,000,000
$4,000,000
$2,000,000
$0
Total Expenditures
0
25
50
75
100
Year

TABLE CSS-4

ALTERNATIVE COST SUMMARY

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Alternative 4	**Total Constant Dollar (Non-Discounted) Cost**	**Total Present Value (Discounted) Cost**
30 Year Analysis Period without Cover Replacement	$10,893,000	$10,407,000
100 Year Analysis Period without Cover Replacement	$12,783,000	$10,458,000
100 Year Analysis Period with Cover Replacement	$14,171,000	$10,459,000

Notes:

1 - Capital costs, annual costs, and periodic costs are presented on Table CS-4.

2 - Estimated remedial timeframes and associated present value analysis for each remedial alternative are provided on tables PV-4 (30yr) through PV-4 (100yr).

3 - The non-discounted total cost demonstrates the impact of a discount rate on the total present value cost and the relative amount of future annual expenditures. Non-discounted costs are presented for comparison purposes only and should not be used in place of present value costs in the CERCLA remedy selection process.

4 - Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for feasibility study level evaluation purposes.

5 - Present value is the total cost per year including a 7.0% discount factor for that year.

6 - Costs for replacement of cover includes the installation of a geosynthetic multi-layer cover system (including low permeability layer, drainage layer, barrier layer, and vegetative layer), amending topsoils, and hydro-seeding with fertilizer and hydromulch. It does not include replacement of surface drainage features such as riprap for drop chutes and perimeter drainage channel.

TABLE CS-4

Alternative 4
Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facilities within and Outside PMDA

COST ESTIMATE SUMMARY

Excavation, Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013
Date: January 31, 2013

Description: Alternative 4 includes excavation and disposal of mine materials, including EM tailings, at proposed facilities within and outside the PMDA. Disposal of all excavated materials would take place at two proposed facilities: one within the PMDA and one outside of the PMDA. The tailings within the former water and tailings storage pond (approximately 19,000 CY) would be dewatered and treated by pozzolan- or cement-based stabilization/solidification before disposal. A treatment additive such as Portland cement or other types of stabilization agents would be added to bind the contaminants in the tailings and reduce their mobility from leaching. Since the EM area will be excavated and disposed of rather than contained in place, the targeted disposal volume for the proposed facility within the PMDA would increase to 109,000 CY. Excavated areas or areas disturbed during construction that do not have mine materials would be restored or regraded and reclaimed with a rock armor or a vegetative layer, depending on the steepness of resulting slopes. Administrative controls involve administrative, legal, and/or informational, or physical measures intended to control or prevent present and future use or access to mine materials, and inform and warn of dangers associated with these materials. Monitoring would consist of visual inspections to document degree of protectiveness to human health and the environment and determine maintenance needs for the proposed facility and containment areas. Maintenance of the proposed disposal facility and containment areas would be performed as necessary to maintain protectiveness and integrity of the covers systems. Five-year site reviews would be performed since mine materials under covers would remain at the PMDA with contaminant concentrations above PRGs. The contaminant concentrations above PRGs do not allow for unlimited use and unrestricted exposure under the current and potential future land uses.

INSTITUTIONAL CONTROLS CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Institutional Controls	CW4-1	1	LS	$111,491	$111,491	
Engineered Controls	CW4-2	1	LS	$77,059	$77,059	
SUBTOTAL					$188,550	
Contingency (Scope and Bid)		20%			$37,710	10% Scope, 10% Bid (Low end of the recommended range).
SUBTOTAL					$226,260	
Project Management		8%			$18,101	Percentage from Exhibit 5-8 was used.
Remedial Design		15%			$33,939	Percentage from Exhibit 5-8 was used.
Construction Management		10%			$22,626	Percentage from Exhibit 5-8 was used.
TOTAL					$300,926	
TOTAL CAPITAL COST					**$301,000**	Total capital cost is rounded to the nearest $1,000.

EARTHWORK CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Excavation of Mine Materials	CW4-4	1	LS	$436,336	$436,336	
Excavation of Borrow Areas	CW4-5	1	LS	$853,886	$853,886	
Transportation of Mine Materials	CW4-6	1	LS	$1,224,927	$1,224,927	
Transportation of Borrow Material	CW4-7	1	LS	$216,586	$216,586	
Lime and Organic Material for Topsoil and Subsoil Amendment	CW4-8	1	LS	$405,199	$405,199	
Cement Stabilization of Mine Wastes	CW4-9	1	LS	$478,893	$478,893	
Excavation Area Reclamation	CW4-10	1	LS	$94,386	$94,386	
Revegetation of Reclamation Areas	CW4-11	1	LS	$308,746	$308,746	
Surveying for Construction Control	CW4-12	1	LS	$71,406	$71,406	
Permanent Access Road	CW4-13	1	LS	$146,353	$146,353	
Mobilization/Demobilization and Preparatory Work	CW4-14	1	LS	$69,284	$69,284	
Construction of Repository outside PMDA	CW4-15	1	LS	$1,068,279	$1,068,279	
Erosion Control	CW4-16	1	LS	$379,174	$379,174	
Construction of Repository within PMDA	CW4-17	1	LS	$481,449	$481,449	
Dewatering of Encapsulation Mound	CW4-18	1	LS	$284,154	$284,154	
Dust Control	CW4-23	1	LS	$274,827	$274,827	
Revegetation of Covers	CW4-24	1	LS	$4,941	$4,941	
SUBTOTAL					$6,798,826	
Contingency (Scope and Bid)		20%			$1,359,765	10% Scope, 10% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$8,158,591	
Project Management		5%			$407,930	Percentage from Exhibit 5-8 was used.
Remedial Design		8%			$652,687	Percentage from Exhibit 5-8 was used.
Construction Management		6%			$489,515	Percentage from Exhibit 5-8 was used.
TOTAL					$9,708,723	
TOTAL CAPITAL COST					**$9,709,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-4

Alternative **4**
Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facilities within and Outside PMDA

COST ESTIMATE SUMMARY

Excavation, Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013
Date: January 31, 2013

Description: Alternative 4 includes excavation and disposal of mine materials, including EM tailings, at proposed facilities within and outside the PMDA. Disposal of all excavated materials would take place at two proposed facilities: one within the PMDA and one outside of the PMDA. The tailings within the former water and tailings storage pond (approximately 19,000 CY) would be dewatered and treated by pozzolan- or cement-based stabilization/solidification before disposal. A treatment additive such as Portland cement or other types of stabilization agents would be added to bind the contaminants in the tailings and reduce their mobility from leaching. Since the EM area will be excavated and disposed of rather than contained in place, the targeted disposal volume for the proposed facility within the PMDA would increase to 109,000 CY. Excavated areas or areas disturbed during construction that do not have mine materials would be restored or regraded and reclaimed with a rock armor or a vegetative layer, depending on the steepness of resulting slopes. Administrative controls involve administrative, legal, and/or informational, or physical measures intended to control or prevent present and future use or access to mine materials, and inform and warn of dangers associated with these materials. Monitoring would consist of visual inspections to document degree of protectiveness to human health and the environment and determine maintenance needs for the proposed facility and containment areas. Maintenance of the proposed disposal facility and containment areas would be performed as necessary to maintain protectiveness and integrity of the covers systems. Five-year site reviews would be performed since mine materials under covers would remain at the PMDA with contaminant concentrations above PRGs. The contaminant concentrations above PRGs do not allow for unlimited use and unrestricted exposure under the current and potential future land uses.

REPLACEMENT OF COVER FUTURE COSTS (Year 99)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Replacement of Covers	CW4-25	1	LS	$918,281	$918,281	
SUBTOTAL					$918,281	
Contingency (Scope and Bid)		20%			$183,656	10% Scope, 10% Bid (Low end of the recommended range).
SUBTOTAL					$1,101,937	
Project Management		6%			$66,116	Percentage from Exhibit 5-8 was used.
Remedial Design		12%			$132,232	Percentage from Exhibit 5-8 was used.
Construction Management		8%			$88,155	Percentage from Exhibit 5-8 was used.
TOTAL					$1,388,440	
TOTAL ANNUAL COST					**$1,388,000**	Future cost is rounded to the nearest $1,000.

ANNUAL OPERATION AND MAINTENANCE (O&M) COSTS - Year 1

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Cover and Reclamation Maintenance (Year 1)	CW4-19	1	LS	$23,664	$23,664	
SUBTOTAL					$23,664	
Contingency (Scope and Bid)		20%			$4,733	10% Scope, 10% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$28,397	
Project Management		10%			$2,840	Percentage from Exhibit 5-8 was used.
Technical Support		15%			$4,260	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$35,497	
TOTAL ANNUAL O&M COST					**$35,000**	

ANNUAL OPERATION AND MAINTENANCE (O&M) COSTS - Year 2

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Cover and Reclamation Maintenance (Year 2)	CW4-20	1	LS	$23,068	$23,068	
SUBTOTAL					$23,068	
Contingency (Scope and Bid)		20%			$4,614	10% Scope, 10% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$27,682	
Project Management		10%			$2,768	Percentage from Exhibit 5-8 was used.
Technical Support		15%			$4,152	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$34,602	
TOTAL ANNUAL O&M COST					**$35,000**	

TABLE CS-4

Alternative **4**
Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facilities within and Outside PMDA

COST ESTIMATE SUMMARY

Excavation,	Formosa OU1
Location:	Douglas County, Oregon
Phase:	Feasibility Study
Base Year:	2013
Date:	January 31, 2013

Description: Alternative 4 includes excavation and disposal of mine materials, including EM tailings, at proposed facilities within and outside the PMDA. Disposal of all excavated materials would take place at two proposed facilities: one within the PMDA and one outside of the PMDA. The tailings within the former water and tailings storage pond (approximately 19,000 CY) would be dewatered and treated by pozzolan- or cement-based stabilization/solidification before disposal. A treatment additive such as Portland cement or other types of stabilization agents would be added to bind the contaminants in the tailings and reduce their mobility from leaching. Since the EM area will be excavated and disposed of rather than contained in place, the targeted disposal volume for the proposed facility within the PMDA would increase to 109,000 CY. Excavated areas or areas disturbed during construction that do not have mine materials would be restored or regraded and reclaimed with a rock armor or a vegetative layer, depending on the steepness of resulting slopes. Administrative controls involve administrative, legal, and/or informational, or physical measures intended to control or prevent present and future use or access to mine materials, and inform and warn of dangers associated with these materials. Monitoring would consist of visual inspections to document degree of protectiveness to human health and the environment and determine maintenance needs for the proposed facility and containment areas. Maintenance of the proposed disposal facility and containment areas would be performed as necessary to maintain protectiveness and integrity of the covers systems. Five-year site reviews would be performed since mine materials under covers would remain at the PMDA with contaminant concentrations above PRGs. The contaminant concentrations above PRGs do not allow for unlimited use and unrestricted exposure under the current and potential future land uses.

ANNUAL OPERATION AND MAINTENANCE (O&M) COSTS - Years 3 through 5

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Cover and Reclamation Maintenance (Years 3 through 5)	CW4-21	1	LS	$21,934	$21,934	
SUBTOTAL					$21,934	
Contingency (Scope and Bid)		20%			$4,387	10% Scope, 10% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$26,321	
Project Management		10%			$2,632	Percentage from Exhibit 5-8 was used.
Technical Support		15%			$3,948	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$32,901	
TOTAL ANNUAL O&M COST					**$33,000**	

ANNUAL OPERATIONS AND MAINTENANCE (O&M) COSTS - Years 6 through Final Year of Evaluation Period

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Cover and Reclamation Maintenance (Years 6 through 29)	CW4-22	1	LS	$10,967	$10,967	
SUBTOTAL					$10,967	
Contingency (Scope and Bid)		20%			$2,193	10% Scope, 10% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$13,160	
Project Management		10%			$1,316	Percentage from Exhibit 5-8 was used.
Technical Support		15%			$1,974	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$16,450	
TOTAL ANNUAL O&M COST					**$16,000**	

5-YEAR SITE REVIEW PERIODIC COSTS (Every 5 years after initiation of remedial action (Year 0))

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Reviews	CW4-3	1	LS	$36,360	$36,360	Includes five-year site inspection and report; assumed to be statutory review that occurs every five years after initiation of remedial action (Year 0).
SUBTOTAL					$36,360	
Contingency (Scope and Bid)		20%			$7,272	10% Scope, 10% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$43,632	
Project Management		10%			$4,363	Percentage from Exhibit 5-8 was used.
Technical Support		15%			$6,545	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$54,540	
TOTAL PERIODIC COST					**$55,000**	Total capital cost is rounded to the nearest $1,000.

Notes:

Percentages used for indirect costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

Abbreviations:

EA	Each
LS	Lump Sum
QTY	Quantity
YR	Year

TABLE PV-4 (30yr)

PRESENT VALUE ANALYSIS

Alternative 4 (30 Year Analysis Period without Cover Replacement)

Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facilities within and Outside PMDA

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Earthwork)[2]	Annual O&M Costs	Periodic Costs	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$301,000	$9,709,000	$0	$0	$10,010,000	1.0000	$10,010,000
1	$0	$0	$35,000	$0	$35,000	0.9346	$32,711
2	$0	$0	$35,000	$0	$35,000	0.8734	$30,569
3	$0	$0	$33,000	$0	$33,000	0.8163	$26,938
4	$0	$0	$33,000	$55,000	$88,000	0.7629	$67,135
5	$0	$0	$33,000	$0	$33,000	0.7130	$23,529
6	$0	$0	$16,000	$0	$16,000	0.6663	$10,661
7	$0	$0	$16,000	$0	$16,000	0.6227	$9,963
8	$0	$0	$16,000	$0	$16,000	0.5820	$9,312
9	$0	$0	$16,000	$55,000	$71,000	0.5439	$38,617
10	$0	$0	$16,000	$0	$16,000	0.5083	$8,133
11	$0	$0	$16,000	$0	$16,000	0.4751	$7,602
12	$0	$0	$16,000	$0	$16,000	0.4440	$7,104
13	$0	$0	$16,000	$0	$16,000	0.4150	$6,640
14	$0	$0	$16,000	$55,000	$71,000	0.3878	$27,534
15	$0	$0	$16,000	$0	$16,000	0.3624	$5,798
16	$0	$0	$16,000	$0	$16,000	0.3387	$5,419
17	$0	$0	$16,000	$0	$16,000	0.3166	$5,066
18	$0	$0	$16,000	$0	$16,000	0.2959	$4,734
19	$0	$0	$16,000	$55,000	$71,000	0.2765	$19,632
20	$0	$0	$16,000	$0	$16,000	0.2584	$4,134
21	$0	$0	$16,000	$0	$16,000	0.2415	$3,864
22	$0	$0	$16,000	$0	$16,000	0.2257	$3,611
23	$0	$0	$16,000	$0	$16,000	0.2109	$3,374
24	$0	$0	$16,000	$55,000	$71,000	0.1971	$13,994
25	$0	$0	$16,000	$0	$16,000	0.1842	$2,947
26	$0	$0	$16,000	$0	$16,000	0.1722	$2,755
27	$0	$0	$16,000	$0	$16,000	0.1609	$2,574
28	$0	$0	$16,000	$0	$16,000	0.1504	$2,406
29	$0	$0	$16,000	$55,000	$71,000	0.1406	$9,983
TOTALS:	$301,000	$9,709,000	$553,000	$330,000	**$10,893,000**		$10,406,739
TOTAL PRESENT VALUE OF ALTERNATIVE 4[5]							**$10,407,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since soils left beneath structures could have contaminant concentrations above RGs that would not allow for unlimited use and unrestricted exposure under the current and potential future land uses. However the period of analysis was assumed to be 30 years (Years 0 through 29).

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-4.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table PV-ADRFT for details.

[5] Total present value is rounded to the nearest $1,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE PV-4 (100yr)

PRESENT VALUE ANALYSIS

Alternative **4 (100 Year Analysis Period without Cover Replacement)**

Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facilities within and Outside PMDA

Site: **Formosa OU1**
Location: **Douglas County, Oregon**
Phase: **Feasibility Study**
Base Year: **2013**

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Earthwork)[2]	Annual O&M Costs	Periodic Costs	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$301,000	$9,709,000	$0	$0	$10,010,000	1.0000	$10,010,000
1	$0	$0	$35,000	$0	$35,000	0.9346	$32,711
2	$0	$0	$35,000	$0	$35,000	0.8734	$30,569
3	$0	$0	$33,000	$0	$33,000	0.8163	$26,938
4	$0	$0	$33,000	$55,000	$88,000	0.7629	$67,135
5	$0	$0	$33,000	$0	$33,000	0.7130	$23,529
6	$0	$0	$16,000	$0	$16,000	0.6663	$10,661
7	$0	$0	$16,000	$0	$16,000	0.6227	$9,963
8	$0	$0	$16,000	$0	$16,000	0.5820	$9,312
9	$0	$0	$16,000	$55,000	$71,000	0.5439	$38,617
10	$0	$0	$16,000	$0	$16,000	0.5083	$8,133
11	$0	$0	$16,000	$0	$16,000	0.4751	$7,602
12	$0	$0	$16,000	$0	$16,000	0.4440	$7,104
13	$0	$0	$16,000	$0	$16,000	0.4150	$6,640
14	$0	$0	$16,000	$55,000	$71,000	0.3878	$27,534
15	$0	$0	$16,000	$0	$16,000	0.3624	$5,798
16	$0	$0	$16,000	$0	$16,000	0.3387	$5,419
17	$0	$0	$16,000	$0	$16,000	0.3166	$5,066
18	$0	$0	$16,000	$0	$16,000	0.2959	$4,734
19	$0	$0	$16,000	$55,000	$71,000	0.2765	$19,632
20	$0	$0	$16,000	$0	$16,000	0.2584	$4,134
21	$0	$0	$16,000	$0	$16,000	0.2415	$3,864
22	$0	$0	$16,000	$0	$16,000	0.2257	$3,611
23	$0	$0	$16,000	$0	$16,000	0.2109	$3,374
24	$0	$0	$16,000	$55,000	$71,000	0.1971	$13,994
25	$0	$0	$16,000	$0	$16,000	0.1842	$2,947
26	$0	$0	$16,000	$0	$16,000	0.1722	$2,755
27	$0	$0	$16,000	$0	$16,000	0.1609	$2,574
28	$0	$0	$16,000	$0	$16,000	0.1504	$2,406
29	$0	$0	$16,000	$55,000	$71,000	0.1406	$9,983
30	$0	$0	$16,000	$0	$16,000	0.1314	$2,102
31	$0	$0	$16,000	$0	$16,000	0.1228	$1,965
32	$0	$0	$16,000	$0	$16,000	0.1147	$1,835
33	$0	$0	$16,000	$0	$16,000	0.1072	$1,715
34	$0	$0	$16,000	$55,000	$71,000	0.1002	$7,114
35	$0	$0	$16,000	$0	$16,000	0.0937	$1,499
36	$0	$0	$16,000	$0	$16,000	0.0875	$1,400
37	$0	$0	$16,000	$0	$16,000	0.0818	$1,309
38	$0	$0	$16,000	$0	$16,000	0.0765	$1,224
39	$0	$0	$16,000	$55,000	$71,000	0.0715	$5,077
40	$0	$0	$16,000	$0	$16,000	0.0668	$1,069
41	$0	$0	$16,000	$0	$16,000	0.0624	$998
42	$0	$0	$16,000	$0	$16,000	0.0583	$933
43	$0	$0	$16,000	$0	$16,000	0.0545	$872
44	$0	$0	$16,000	$55,000	$71,000	0.0509	$3,614
45	$0	$0	$16,000	$0	$16,000	0.0476	$762

TABLE PV-4 (100yr)

PRESENT VALUE ANALYSIS

Alternative **4 (100 Year Analysis Period without Cover Replacement)**

Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facilities within and Outside PMDA

Site: **Formosa OU1**
Location: **Douglas County, Oregon**
Phase: **Feasibility Study**
Base Year: **2013**

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Earthwork)[2]	Annual O&M Costs	Periodic Costs	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
46	$0	$0	$16,000	$0	$16,000	0.0445	$712
47	$0	$0	$16,000	$0	$16,000	0.0416	$666
48	$0	$0	$16,000	$0	$16,000	0.0389	$622
49	$0	$0	$16,000	$55,000	$71,000	0.0363	$2,577
50	$0	$0	$16,000	$0	$16,000	0.0339	$542
51	$0	$0	$16,000	$0	$16,000	0.0317	$508
52	$0	$0	$16,000	$0	$16,000	0.0297	$474
53	$0	$0	$16,000	$0	$16,000	0.0277	$443
54	$0	$0	$16,000	$55,000	$71,000	0.0259	$1,839
55	$0	$0	$16,000	$0	$16,000	0.0242	$387
56	$0	$0	$16,000	$0	$16,000	0.0226	$362
57	$0	$0	$16,000	$0	$16,000	0.0211	$338
58	$0	$0	$16,000	$0	$16,000	0.0198	$316
59	$0	$0	$16,000	$55,000	$71,000	0.0185	$1,311
60	$0	$0	$16,000	$0	$16,000	0.0173	$276
61	$0	$0	$16,000	$0	$16,000	0.0161	$258
62	$0	$0	$16,000	$0	$16,000	0.0151	$241
63	$0	$0	$16,000	$0	$16,000	0.0141	$225
64	$0	$0	$16,000	$55,000	$71,000	0.0132	$935
65	$0	$0	$16,000	$0	$16,000	0.0123	$197
66	$0	$0	$16,000	$0	$16,000	0.0115	$184
67	$0	$0	$16,000	$0	$16,000	0.0107	$172
68	$0	$0	$16,000	$0	$16,000	0.0100	$161
69	$0	$0	$16,000	$55,000	$71,000	0.0094	$666
70	$0	$0	$16,000	$0	$16,000	0.0088	$140
71	$0	$0	$16,000	$0	$16,000	0.0082	$131
72	$0	$0	$16,000	$0	$16,000	0.0077	$123
73	$0	$0	$16,000	$0	$16,000	0.0072	$115
74	$0	$0	$16,000	$55,000	$71,000	0.0067	$475
75	$0	$0	$16,000	$0	$16,000	0.0063	$100
76	$0	$0	$16,000	$0	$16,000	0.0058	$94
77	$0	$0	$16,000	$0	$16,000	0.0055	$87
78	$0	$0	$16,000	$0	$16,000	0.0051	$82
79	$0	$0	$16,000	$55,000	$71,000	0.0048	$339
80	$0	$0	$16,000	$0	$16,000	0.0045	$71
81	$0	$0	$16,000	$0	$16,000	0.0042	$67
82	$0	$0	$16,000	$0	$16,000	0.0039	$62
83	$0	$0	$16,000	$0	$16,000	0.0036	$58
84	$0	$0	$16,000	$55,000	$71,000	0.0034	$242
85	$0	$0	$16,000	$0	$16,000	0.0032	$51
86	$0	$0	$16,000	$0	$16,000	0.0030	$48
87	$0	$0	$16,000	$0	$16,000	0.0028	$44
88	$0	$0	$16,000	$0	$16,000	0.0026	$42
89	$0	$0	$16,000	$55,000	$71,000	0.0024	$172
90	$0	$0	$16,000	$0	$16,000	0.0023	$36

TABLE PV-4 (100yr)							
PRESENT VALUE ANALYSIS							
Alternative	**4 (100 Year Analysis Period without Cover Replacement)**						
Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facilities within and Outside PMDA							
Site:	**Formosa OU1**						
Location:	**Douglas County, Oregon**						
Phase:	**Feasibility Study**						
Base Year:	**2013**						
Year[1]	**Capital Costs (Institutional Controls)[2]**	**Capital Costs (Earthwork)[2]**	**Annual O&M Costs**	**Periodic Costs**	**Total Annual Expenditure[3]**	**Discount Factor (7.0%)**	**Present Value[4]**
91	$0	$0	$16,000	$0	$16,000	0.0021	$34
92	$0	$0	$16,000	$0	$16,000	0.0020	$32
93	$0	$0	$16,000	$0	$16,000	0.0019	$30
94	$0	$0	$16,000	$55,000	$71,000	0.0017	$123
95	$0	$0	$16,000	$0	$16,000	0.0016	$26
96	$0	$0	$16,000	$0	$16,000	0.0015	$24
97	$0	$0	$16,000	$0	$16,000	0.0014	$23
98	$0	$0	$16,000	$0	$16,000	0.0013	$21
99	$0	$0	$16,000	$55,000	$71,000	0.0012	$88
TOTALS:	$301,000	$9,709,000	$1,673,000	$1,100,000	**$12,783,000**		$10,457,619
TOTAL PRESENT VALUE OF ALTERNATIVE 4[5]							**$10,458,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since soils left beneath structures could have contaminant concentrations above RGs that would not allow for unlimited use and unrestricted exposure under the current and potential future land uses. However the period of analysis was assumed to be 100 years (Years 0 through 99).

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-4.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table PV-ADRFT for details.

[5] Total present value is rounded to the nearest $1,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE PV-4 (100yr with Cover Replacement)							
PRESENT VALUE ANALYSIS							
Alternative	**4 (100 Year Analysis Period with Cover Replacement)**						
Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facilities within and Outside PMDA							
Site:	**Formosa OU1**						
Location:	**Douglas County, Oregon**						
Phase:	**Feasibility Study**						
Base Year:	**2013**						
Year[1]	**Capital Costs (Institutional Controls)[2]**	**Capital Costs (Earthwork)[2]**	**Annual O&M Costs**	**Periodic Costs**	**Total Annual Expenditure[3]**	**Discount Factor (7.0%)**	**Present Value[4]**
0	$301,000	$9,709,000	$0	$0	$10,010,000	1.0000	$10,010,000
1	$0	$0	$35,000	$0	$35,000	0.9346	$32,711
2	$0	$0	$35,000	$0	$35,000	0.8734	$30,569
3	$0	$0	$33,000	$0	$33,000	0.8163	$26,938
4	$0	$0	$33,000	$55,000	$88,000	0.7629	$67,135
5	$0	$0	$33,000	$0	$33,000	0.7130	$23,529
6	$0	$0	$16,000	$0	$16,000	0.6663	$10,661
7	$0	$0	$16,000	$0	$16,000	0.6227	$9,963
8	$0	$0	$16,000	$0	$16,000	0.5820	$9,312
9	$0	$0	$16,000	$55,000	$71,000	0.5439	$38,617
10	$0	$0	$16,000	$0	$16,000	0.5083	$8,133
11	$0	$0	$16,000	$0	$16,000	0.4751	$7,602
12	$0	$0	$16,000	$0	$16,000	0.4440	$7,104
13	$0	$0	$16,000	$0	$16,000	0.4150	$6,640
14	$0	$0	$16,000	$55,000	$71,000	0.3878	$27,534
15	$0	$0	$16,000	$0	$16,000	0.3624	$5,798
16	$0	$0	$16,000	$0	$16,000	0.3387	$5,419
17	$0	$0	$16,000	$0	$16,000	0.3166	$5,066
18	$0	$0	$16,000	$0	$16,000	0.2959	$4,734
19	$0	$0	$16,000	$55,000	$71,000	0.2765	$19,632
20	$0	$0	$16,000	$0	$16,000	0.2584	$4,134
21	$0	$0	$16,000	$0	$16,000	0.2415	$3,864
22	$0	$0	$16,000	$0	$16,000	0.2257	$3,611
23	$0	$0	$16,000	$0	$16,000	0.2109	$3,374
24	$0	$0	$16,000	$55,000	$71,000	0.1971	$13,994
25	$0	$0	$16,000	$0	$16,000	0.1842	$2,947
26	$0	$0	$16,000	$0	$16,000	0.1722	$2,755
27	$0	$0	$16,000	$0	$16,000	0.1609	$2,574
28	$0	$0	$16,000	$0	$16,000	0.1504	$2,406
29	$0	$0	$16,000	$55,000	$71,000	0.1406	$9,983
30	$0	$0	$16,000	$0	$16,000	0.1314	$2,102
31	$0	$0	$16,000	$0	$16,000	0.1228	$1,965
32	$0	$0	$16,000	$0	$16,000	0.1147	$1,835
33	$0	$0	$16,000	$0	$16,000	0.1072	$1,715
34	$0	$0	$16,000	$55,000	$71,000	0.1002	$7,114
35	$0	$0	$16,000	$0	$16,000	0.0937	$1,499
36	$0	$0	$16,000	$0	$16,000	0.0875	$1,400
37	$0	$0	$16,000	$0	$16,000	0.0818	$1,309
38	$0	$0	$16,000	$0	$16,000	0.0765	$1,224
39	$0	$0	$16,000	$55,000	$71,000	0.0715	$5,077
40	$0	$0	$16,000	$0	$16,000	0.0668	$1,069
41	$0	$0	$16,000	$0	$16,000	0.0624	$998
42	$0	$0	$16,000	$0	$16,000	0.0583	$933
43	$0	$0	$16,000	$0	$16,000	0.0545	$872
44	$0	$0	$16,000	$55,000	$71,000	0.0509	$3,614
45	$0	$0	$16,000	$0	$16,000	0.0476	$762

TABLE PV-4 (100yr with Cover Replacement)

PRESENT VALUE ANALYSIS

Alternative **4 (100 Year Analysis Period with Cover Replacement)**

Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facilities within and Outside PMDA

Site: **Formosa OU1**
Location: **Douglas County, Oregon**
Phase: **Feasibility Study**
Base Year: **2013**

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Earthwork)[2]	Annual O&M Costs	Periodic Costs	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
46	$0	$0	$16,000	$0	$16,000	0.0445	$712
47	$0	$0	$16,000	$0	$16,000	0.0416	$666
48	$0	$0	$16,000	$0	$16,000	0.0389	$622
49	$0	$0	$16,000	$55,000	$71,000	0.0363	$2,577
50	$0	$0	$16,000	$0	$16,000	0.0339	$542
51	$0	$0	$16,000	$0	$16,000	0.0317	$508
52	$0	$0	$16,000	$0	$16,000	0.0297	$474
53	$0	$0	$16,000	$0	$16,000	0.0277	$443
54	$0	$0	$16,000	$55,000	$71,000	0.0259	$1,839
55	$0	$0	$16,000	$0	$16,000	0.0242	$387
56	$0	$0	$16,000	$0	$16,000	0.0226	$362
57	$0	$0	$16,000	$0	$16,000	0.0211	$338
58	$0	$0	$16,000	$0	$16,000	0.0198	$316
59	$0	$0	$16,000	$55,000	$71,000	0.0185	$1,311
60	$0	$0	$16,000	$0	$16,000	0.0173	$276
61	$0	$0	$16,000	$0	$16,000	0.0161	$258
62	$0	$0	$16,000	$0	$16,000	0.0151	$241
63	$0	$0	$16,000	$0	$16,000	0.0141	$225
64	$0	$0	$16,000	$55,000	$71,000	0.0132	$935
65	$0	$0	$16,000	$0	$16,000	0.0123	$197
66	$0	$0	$16,000	$0	$16,000	0.0115	$184
67	$0	$0	$16,000	$0	$16,000	0.0107	$172
68	$0	$0	$16,000	$0	$16,000	0.0100	$161
69	$0	$0	$16,000	$55,000	$71,000	0.0094	$666
70	$0	$0	$16,000	$0	$16,000	0.0088	$140
71	$0	$0	$16,000	$0	$16,000	0.0082	$131
72	$0	$0	$16,000	$0	$16,000	0.0077	$123
73	$0	$0	$16,000	$0	$16,000	0.0072	$115
74	$0	$0	$16,000	$55,000	$71,000	0.0067	$475
75	$0	$0	$16,000	$0	$16,000	0.0063	$100
76	$0	$0	$16,000	$0	$16,000	0.0058	$94
77	$0	$0	$16,000	$0	$16,000	0.0055	$87
78	$0	$0	$16,000	$0	$16,000	0.0051	$82
79	$0	$0	$16,000	$55,000	$71,000	0.0048	$339
80	$0	$0	$16,000	$0	$16,000	0.0045	$71
81	$0	$0	$16,000	$0	$16,000	0.0042	$67
82	$0	$0	$16,000	$0	$16,000	0.0039	$62
83	$0	$0	$16,000	$0	$16,000	0.0036	$58
84	$0	$0	$16,000	$55,000	$71,000	0.0034	$242
85	$0	$0	$16,000	$0	$16,000	0.0032	$51
86	$0	$0	$16,000	$0	$16,000	0.0030	$48
87	$0	$0	$16,000	$0	$16,000	0.0028	$44
88	$0	$0	$16,000	$0	$16,000	0.0026	$42
89	$0	$0	$16,000	$55,000	$71,000	0.0024	$172
90	$0	$0	$16,000	$0	$16,000	0.0023	$36

TABLE PV-4 (100yr with Cover Replacement)

PRESENT VALUE ANALYSIS

Alternative **4 (100 Year Analysis Period with Cover Replacement)**

Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facilities within and Outside PMDA

Site: **Formosa OU1**
Location: **Douglas County, Oregon**
Phase: **Feasibility Study**
Base Year: **2013**

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Earthwork)[2]	Annual O&M Costs	Periodic Costs	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
91	$0	$0	$16,000	$0	$16,000	0.0021	$34
92	$0	$0	$16,000	$0	$16,000	0.0020	$32
93	$0	$0	$16,000	$0	$16,000	0.0019	$30
94	$0	$0	$16,000	$55,000	$71,000	0.0017	$123
95	$0	$0	$16,000	$0	$16,000	0.0016	$26
96	$0	$0	$16,000	$0	$16,000	0.0015	$24
97	$0	$0	$16,000	$0	$16,000	0.0014	$23
98	$0	$0	$16,000	$0	$16,000	0.0013	$21
99	$0	$1,388,000	$16,000	$55,000	$1,459,000	0.0012	$1,799
TOTALS:	$301,000	$11,097,000	$1,673,000	$1,100,000	**$14,171,000**		$10,459,330
TOTAL PRESENT VALUE OF ALTERNATIVE 4[5]							**$10,459,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since soils left beneath structures could have contaminant concentrations above RGs that would not allow for unlimited use and unrestricted exposure under the current and potential future land uses. However the period of analysis was assumed to be 100 years (Years 0 through 99).

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-4.

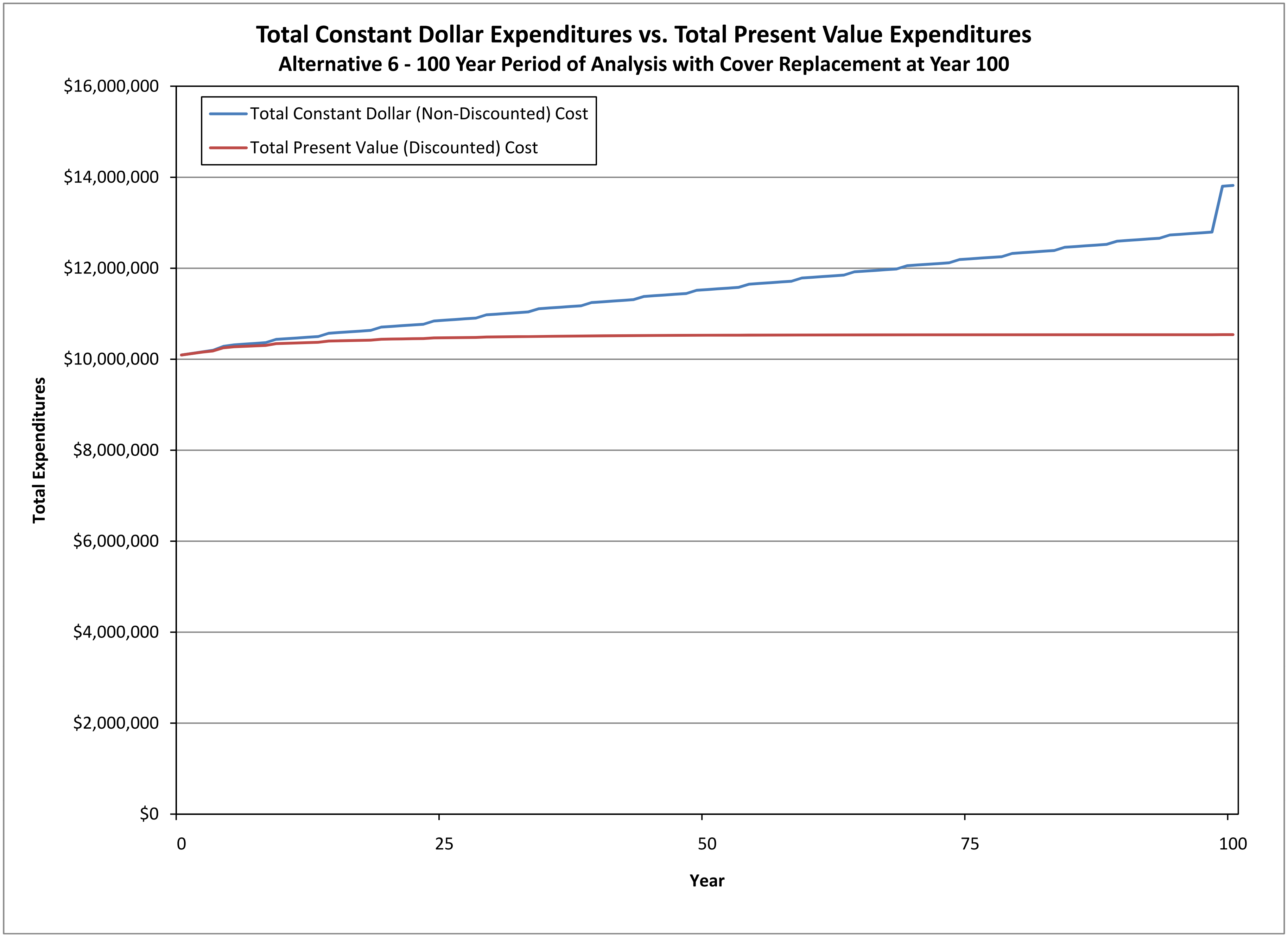
[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table PV-ADRFT for details.

[5] Total present value is rounded to the nearest $1,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.



Total Constant Dollar Expenditures vs. Total Present Value Expenditures
Alternative 6 - 100 Year Period of Analysis with Cover Replacement at Year 100
Total Constant Dollar (Non-Discounted) Cost
Total Present Value (Discounted) Cost
Total Expenditures
$16,000,000
$14,000,000
$12,000,000
$10,000,000
$8,000,000
$6,000,000
$4,000,000
$2,000,000
$0
0
25
50
75
100
Year

TABLE CSS-6

ALTERNATIVE COST SUMMARY

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Alternative 6	Total Constant Dollar (Non-Discounted) Cost	Total Present Value (Discounted) Cost
30 Year Analysis Period without Cover Replacement	$10,975,000	$10,489,000
100 Year Analysis Period without Cover Replacement	$12,865,000	$10,539,000
100 Year Analysis Period with Cover Replacement	$13,803,000	$10,540,000

Notes:

1 - Capital costs, annual costs, and periodic costs are presented on Table CS-6.

2 - Estimated remedial timeframes and associated present value analysis for each remedial alternative are provided on tables PV-6 (30yr) through PV-6 (100yr).

3 - The non-discounted total cost demonstrates the impact of a discount rate on the total present value cost and the relative amount of future annual expenditures. Non-discounted costs are presented for comparison purposes only and should not be used in place of present value costs in the CERCLA remedy selection process.

4 - Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for feasibility study level evaluation purposes.

5 - Present value is the total cost per year including a 7.0% discount factor for that year.

6 - Costs for replacement of cover includes the installation of a geosynthetic multi-layer cover system (including low permeability layer, drainage layer, barrier layer, and vegetative layer), amending topsoils, and hydro-seeding with fertilizer and hydromulch. It does not include replacement of surface drainage features such as riprap for drop chutes and perimeter drainage channel.

TABLE CS-6

Alternative 6

Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facility outside PMDA

COST ESTIMATE SUMMARY

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013
Date: January 31, 2013

Description: Alternative 6 includes excavation and disposal of mine materials, including EM tailings, at a proposed facility outside the PMDA. The tailings within the former water and tailings storage pond (approximately 19,000 CY) would be dewatered and treated as described for Alternative 4. Since the EM area will be excavated and disposed of rather than contained in place, the targeted disposal volume for the proposed facility outside of the PMDA would increase to 234,000 CY. Excavated areas or areas disturbed during construction that do not have mine materials would be restored or regraded and reclaimed with a rock armor or a vegetative layer, depending on the steepness of resulting slopes. Administrative controls involve administrative, legal, and/or informational, or physical measures intended to control or prevent present and future use or access to mine materials, and inform and warn of dangers associated with these materials. Monitoring would consist of visual inspections to document degree of protectiveness to human health and the environment and determine maintenance needs for the proposed facility and containment areas. Maintenance of the proposed disposal facility and containment areas would be performed as necessary to maintain protectiveness and integrity of the covers systems. Five-year site reviews would be performed since mine materials under covers would remain, however, the 5-year site reviews would not be required for OU1 within the PMDA once mine materials with contaminant concentrations above PRGs are no longer present.

INSTITUTIONAL AND ENGINEERED CONTROLS CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Institutional Controls	CW6-1	1	LS	$111,491	$111,491	
Engineered Controls	CW6-2	1	LS	$79,513	$79,513	
SUBTOTAL					$191,004	
Contingency (Scope and Bid)		20%			$38,201	10% Scope, 10% Bid (Low end of the recommended range).
SUBTOTAL					$229,205	
Project Management		8%			$18,336	Percentage from Exhibit 5-8 was used.
Remedial Design		15%			$34,381	Percentage from Exhibit 5-8 was used.
Construction Management		10%			$22,921	Percentage from Exhibit 5-8 was used.
TOTAL					$304,843	
TOTAL CAPITAL COST					**$305,000**	Total capital cost is rounded to the nearest $1,000.

EARTHWORK CAPITAL COSTS: (Assumed to be Incurred During Year 0)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Excavation of Mine Materials	CW6-4	1	LS	$436,336	$436,336	
Excavation of Borrow Areas	CW6-5	1	LS	$744,677	$744,677	
Transportation of Mine Materials	CW6-6	1	LS	$1,469,880	$1,469,880	
Transportation of Borrow Material	CW6-7	1	LS	$186,206	$186,206	
Revegetation of Reclamation Areas	CW6-8	1	LS	$369,187	$369,187	
Cement Stabilization of Mine Wastes	CW6-9	1	LS	$447,658	$447,658	
Excavation Area Reclamation	CW6-10	1	LS	$114,286	$114,286	
Lime and Organic Material for Topsoil and Subsoil Amendment	CW6-11	1	LS	$435,200	$435,200	
Surveying for Construction Control	CW6-12	1	LS	$71,406	$71,406	
Permanent Access Road	CW6-13	1	LS	$148,963	$148,963	
Construction of Repository outside PMDA	CW6-14	1	LS	$1,423,859	$1,423,859	
Erosion Control	CW6-15	1	LS	$373,580	$373,580	
Mobilization/Demobilization and Preparatory Work	CW6-16	1	LS	$69,284	$69,284	
Dewatering of Encapsulation Mound	CW6-21	1	LS	$284,619	$284,619	
Dust Control	CW6-22	1	LS	$274,827	$274,827	
Revegetation of Covers	CW6-23	1	LS	$3,424	$3,424	
SUBTOTAL					$6,853,392	
Contingency (Scope and Bid)		20%			$1,370,678	10% Scope, 10% Bid (Low end of the recommended range).
SUBTOTAL					$8,224,070	
Project Management		5%			$411,204	Percentage from Exhibit 5-8 was used.
Remedial Design		8%			$657,926	Percentage from Exhibit 5-8 was used.
Construction Management		6%			$493,444	Percentage from Exhibit 5-8 was used.
TOTAL					$9,786,644	
TOTAL CAPITAL COST					**$9,787,000**	Total capital cost is rounded to the nearest $1,000.

TABLE CS-6

Alternative **6**

Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facility outside PMDA

COST ESTIMATE SUMMARY

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013
Date: January 31, 2013

Description: Alternative 6 includes excavation and disposal of mine materials, including EM tailings, at a proposed facility outside the PMDA. The tailings within the former water and tailings storage pond (approximately 19,000 CY) would be dewatered and treated as described for Alternative 4. Since the EM area will be excavated and disposed of rather than contained in place, the targeted disposal volume for the proposed facility outside of the PMDA would increase to 234,000 CY. Excavated areas or areas disturbed during construction that do not have mine materials would be restored or regraded and reclaimed with a rock armor or a vegetative layer, depending on the steepness of resulting slopes. Administrative controls involve administrative, legal, and/or informational, or physical measures intended to control or prevent present and future use or access to mine materials, and inform and warn of dangers associated with these materials. Monitoring would consist of visual inspections to document degree of protectiveness to human health and the environment and determine maintenance needs for the proposed facility and containment areas. Maintenance of the proposed disposal facility and containment areas would be performed as necessary to maintain protectiveness and integrity of the covers systems. Five-year site reviews would be performed since mine materials under covers would remain, however, the 5-year site reviews would not be required for OU1 within the PMDA once mine materials with contaminant concentrations above PRGs are no longer present.

REPLACEMENT OF COVER FUTURE COSTS (Year 99)

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Replacement of Covers	CW6-24	1	LS	$620,682	$620,682	
SUBTOTAL					$620,682	
Contingency (Scope and Bid)		20%			$124,136	10% Scope, 10% Bid (Low end of the recommended range).
SUBTOTAL					$744,818	
Project Management		6%			$44,689	Percentage from Exhibit 5-8 was used.
Remedial Design		12%			$89,378	Percentage from Exhibit 5-8 was used.
Construction Management		8%			$59,585	Percentage from Exhibit 5-8 was used.
TOTAL					$938,470	
TOTAL ANNUAL COST					**$938,000**	Future cost is rounded to the nearest $1,000.

ANNUAL OPERATIONS AND MAINTENANCE (O&M) COSTS - Year 1

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Cover and Reclamation Maintenance (Year 1)	CW6-17	1	LS	$23,664	$23,664	
SUBTOTAL					$23,664	
Contingency (Scope and Bid)		20%			$4,733	10% Scope, 10% Bid (Low end of the recommended range).
SUBTOTAL					$28,397	
Project Management		10%			$2,840	Percentage from Exhibit 5-8 was used.
Technical Support		15%			$4,260	Middle value of the recommended range was used.
TOTAL					$35,497	
TOTAL ANNUAL COST					**$35,000**	Periodic cost is rounded to the nearest $1,000.

ANNUAL OPERATIONS AND MAINTENANCE (O&M) COSTS - Year 2

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Cover and Reclamation Maintenance (Year 2)	CW6-18	1	LS	$23,068	$23,068	
SUBTOTAL					$23,068	
Contingency (Scope and Bid)		20%			$4,614	10% Scope, 10% Bid (Low end of the recommended range).
SUBTOTAL					$27,682	
Project Management		10%			$2,768	Percentage from Exhibit 5-8 was used.
Technical Support		15%			$4,152	Middle value of the recommended range was used.
TOTAL					$34,602	
TOTAL ANNUAL COST					**$35,000**	Periodic cost is rounded to the nearest $1,000.

TABLE CS-6

Alternative **6**

Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facility outside PMDA

COST ESTIMATE SUMMARY

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013
Date: January 31, 2013

Description: Alternative 6 includes excavation and disposal of mine materials, including EM tailings, at a proposed facility outside the PMDA. The tailings within the former water and tailings storage pond (approximately 19,000 CY) would be dewatered and treated as described for Alternative 4. Since the EM area will be excavated and disposed of rather than contained in place, the targeted disposal volume for the proposed facility outside of the PMDA would increase to 234,000 CY. Excavated areas or areas disturbed during construction that do not have mine materials would be restored or regraded and reclaimed with a rock armor or a vegetative layer, depending on the steepness of resulting slopes. Administrative controls involve administrative, legal, and/or informational, or physical measures intended to control or prevent present and future use or access to mine materials, and inform and warn of dangers associated with these materials. Monitoring would consist of visual inspections to document degree of protectiveness to human health and the environment and determine maintenance needs for the proposed facility and containment areas. Maintenance of the proposed disposal facility and containment areas would be performed as necessary to maintain protectiveness and integrity of the covers systems. Five-year site reviews would be performed since mine materials under covers would remain, however, the 5-year site reviews would not be required for OU1 within the PMDA once mine materials with contaminant concentrations above PRGs are no longer present.

ANNUAL OPERATIONS AND MAINTENANCE (O&M) COSTS - Years 3 through 5

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Cover and Reclamation Maintenance (Years 3 through 5)	CW6-19	1	LS	$21,934	$21,934	
SUBTOTAL					$21,934	
Contingency (Scope and Bid)		20%			$4,387	10% Scope, 10% Bid (Low end of the recommended range).
SUBTOTAL					$26,321	
Project Management		10%			$2,632	Percentage from Exhibit 5-8 was used.
Technical Support		15%			$3,948	Middle value of the recommended range was used.
TOTAL					$32,901	
TOTAL ANNUAL COST					**$33,000**	Periodic cost is rounded to the nearest $1,000.

ANNUAL OPERATIONS AND MAINTENANCE (O&M) COSTS - Years 6 through Final Year of Evaluation Period

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Cover and Reclamation Maintenance (Years 6 through 29)	CW6-20	1	LS	$10,967	$10,967	
SUBTOTAL					$10,967	
Contingency (Scope and Bid)		20%			$2,193	10% Scope, 10% Bid (Low end of the recommended range).
SUBTOTAL					$13,160	
Project Management		10%			$1,316	Percentage from Exhibit 5-8 was used.
Technical Support		15%			$1,974	Middle value of the recommended range was used.
TOTAL					$16,450	
TOTAL ANNUAL COST					**$16,000**	Periodic cost is rounded to the nearest $1,000.

5-YEAR SITE REVIEW PERIODIC COSTS (Every 5 years after initiation of remedial action (Year 0))

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
5-Year Site Reviews	CW6-3	1	LS	$36,360	$36,360	
SUBTOTAL					$36,360	
Contingency (Scope and Bid)		20%			$7,272	10% Scope, 10% Bid (Low end of the recommended range).
SUBTOTAL					$43,632	
Project Management		10%			$4,363	The high end of the recommended range was used.
Technical Support		15%			$6,545	Middle value of the recommended range was used.
TOTAL					$54,540	
TOTAL PERIODIC COST					**$55,000**	Periodic cost is rounded to the nearest $1,000.

Notes:
Percentages used for indirect costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.

Abbreviations:
EA Each
QTY Quantity
LS Lump Sum

TABLE PV-6 (30yr)

PRESENT VALUE ANALYSIS

Alternative 6 (30 Year Analysis Period without Cover Replacement)

Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facility outside PMDA

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Earthwork)[2]	Annual O&M Costs	Periodic Costs	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$305,000	$9,787,000	$0	$0	$10,092,000	1.0000	$10,092,000
1	$0	$0	$35,000	$0	$35,000	0.9346	$32,711
2	$0	$0	$35,000	$0	$35,000	0.8734	$30,569
3	$0	$0	$33,000	$0	$33,000	0.8163	$26,938
4	$0	$0	$33,000	$55,000	$88,000	0.7629	$67,135
5	$0	$0	$33,000	$0	$33,000	0.7130	$23,529
6	$0	$0	$16,000	$0	$16,000	0.6663	$10,661
7	$0	$0	$16,000	$0	$16,000	0.6227	$9,963
8	$0	$0	$16,000	$0	$16,000	0.5820	$9,312
9	$0	$0	$16,000	$55,000	$71,000	0.5439	$38,617
10	$0	$0	$16,000	$0	$16,000	0.5083	$8,133
11	$0	$0	$16,000	$0	$16,000	0.4751	$7,602
12	$0	$0	$16,000	$0	$16,000	0.4440	$7,104
13	$0	$0	$16,000	$0	$16,000	0.4150	$6,640
14	$0	$0	$16,000	$55,000	$71,000	0.3878	$27,534
15	$0	$0	$16,000	$0	$16,000	0.3624	$5,798
16	$0	$0	$16,000	$0	$16,000	0.3387	$5,419
17	$0	$0	$16,000	$0	$16,000	0.3166	$5,066
18	$0	$0	$16,000	$0	$16,000	0.2959	$4,734
19	$0	$0	$16,000	$55,000	$71,000	0.2765	$19,632
20	$0	$0	$16,000	$0	$16,000	0.2584	$4,134
21	$0	$0	$16,000	$0	$16,000	0.2415	$3,864
22	$0	$0	$16,000	$0	$16,000	0.2257	$3,611
23	$0	$0	$16,000	$0	$16,000	0.2109	$3,374
24	$0	$0	$16,000	$55,000	$71,000	0.1971	$13,994
25	$0	$0	$16,000	$0	$16,000	0.1842	$2,947
26	$0	$0	$16,000	$0	$16,000	0.1722	$2,755
27	$0	$0	$16,000	$0	$16,000	0.1609	$2,574
28	$0	$0	$16,000	$0	$16,000	0.1504	$2,406
29	$0	$0	$16,000	$55,000	$71,000	0.1406	$9,983
TOTALS:	$305,000	$9,787,000	$553,000	$330,000	**$10,975,000**		$10,488,739
TOTAL PRESENT VALUE OF ALTERNATIVE 6[5]							**$10,489,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since soils under covers and structures would have contaminant concentrations above RGs that would allow for unlimited use and unrestricted exposure under the current and potential future land uses. However the period of analysis was assumed to be 30 years (Years 0 through 29).

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-6.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table PV-ADRFT for details.

[5] Total present value is rounded to the nearest $1,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE PV-6 (100yr)

PRESENT VALUE ANALYSIS

Alternative **6 (100 Year Analysis Period without Cover Replacement)**

Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facility outside PMDA

Site: **Formosa OU1**
Location: **Douglas County, Oregon**
Phase: **Feasibility Study**
Base Year: **2013**

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Earthwork)[2]	Annual O&M Costs	Periodic Costs	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
0	$305,000	$9,787,000	$0	$0	$10,092,000	1.0000	$10,092,000
1	$0	$0	$35,000	$0	$35,000	0.9346	$32,711
2	$0	$0	$35,000	$0	$35,000	0.8734	$30,569
3	$0	$0	$33,000	$0	$33,000	0.8163	$26,938
4	$0	$0	$33,000	$55,000	$88,000	0.7629	$67,135
5	$0	$0	$33,000	$0	$33,000	0.7130	$23,529
6	$0	$0	$16,000	$0	$16,000	0.6663	$10,661
7	$0	$0	$16,000	$0	$16,000	0.6227	$9,963
8	$0	$0	$16,000	$0	$16,000	0.5820	$9,312
9	$0	$0	$16,000	$55,000	$71,000	0.5439	$38,617
10	$0	$0	$16,000	$0	$16,000	0.5083	$8,133
11	$0	$0	$16,000	$0	$16,000	0.4751	$7,602
12	$0	$0	$16,000	$0	$16,000	0.4440	$7,104
13	$0	$0	$16,000	$0	$16,000	0.4150	$6,640
14	$0	$0	$16,000	$55,000	$71,000	0.3878	$27,534
15	$0	$0	$16,000	$0	$16,000	0.3624	$5,798
16	$0	$0	$16,000	$0	$16,000	0.3387	$5,419
17	$0	$0	$16,000	$0	$16,000	0.3166	$5,066
18	$0	$0	$16,000	$0	$16,000	0.2959	$4,734
19	$0	$0	$16,000	$55,000	$71,000	0.2765	$19,632
20	$0	$0	$16,000	$0	$16,000	0.2584	$4,134
21	$0	$0	$16,000	$0	$16,000	0.2415	$3,864
22	$0	$0	$16,000	$0	$16,000	0.2257	$3,611
23	$0	$0	$16,000	$0	$16,000	0.2109	$3,374
24	$0	$0	$16,000	$55,000	$71,000	0.1971	$13,994
25	$0	$0	$16,000	$0	$16,000	0.1842	$2,947
26	$0	$0	$16,000	$0	$16,000	0.1722	$2,755
27	$0	$0	$16,000	$0	$16,000	0.1609	$2,574
28	$0	$0	$16,000	$0	$16,000	0.1504	$2,406
29	$0	$0	$16,000	$55,000	$71,000	0.1406	$9,983
30	$0	$0	$16,000	$0	$16,000	0.1314	$2,102
31	$0	$0	$16,000	$0	$16,000	0.1228	$1,965
32	$0	$0	$16,000	$0	$16,000	0.1147	$1,835
33	$0	$0	$16,000	$0	$16,000	0.1072	$1,715
34	$0	$0	$16,000	$55,000	$71,000	0.1002	$7,114
35	$0	$0	$16,000	$0	$16,000	0.0937	$1,499
36	$0	$0	$16,000	$0	$16,000	0.0875	$1,400
37	$0	$0	$16,000	$0	$16,000	0.0818	$1,309
38	$0	$0	$16,000	$0	$16,000	0.0765	$1,224
39	$0	$0	$16,000	$55,000	$71,000	0.0715	$5,077
40	$0	$0	$16,000	$0	$16,000	0.0668	$1,069
41	$0	$0	$16,000	$0	$16,000	0.0624	$998
42	$0	$0	$16,000	$0	$16,000	0.0583	$933
43	$0	$0	$16,000	$0	$16,000	0.0545	$872
44	$0	$0	$16,000	$55,000	$71,000	0.0509	$3,614
45	$0	$0	$16,000	$0	$16,000	0.0476	$762
46	$0	$0	$16,000	$0	$16,000	0.0445	$712

TABLE PV-6 (100yr)							
PRESENT VALUE ANALYSIS							
Alternative	**6 (100 Year Analysis Period without Cover Replacement)**						
Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facility outside PMDA							
Site:	**Formosa OU1**						
Location:	**Douglas County, Oregon**						
Phase:	**Feasibility Study**						
Base Year:	**2013**						
Year[1]	**Capital Costs (Institutional Controls)[2]**	**Capital Costs (Earthwork)[2]**	**Annual O&M Costs**	**Periodic Costs**	**Total Annual Expenditure[3]**	**Discount Factor (7.0%)**	**Present Value[4]**
47	$0	$0	$16,000	$0	$16,000	0.0416	$666
48	$0	$0	$16,000	$0	$16,000	0.0389	$622
49	$0	$0	$16,000	$55,000	$71,000	0.0363	$2,577
50	$0	$0	$16,000	$0	$16,000	0.0317	$508
51	$0	$0	$16,000	$0	$16,000	0.0297	$474
52	$0	$0	$16,000	$0	$16,000	0.0277	$443
53	$0	$0	$16,000	$0	$16,000	0.0259	$414
54	$0	$0	$16,000	$55,000	$71,000	0.0242	$1,719
55	$0	$0	$16,000	$0	$16,000	0.0226	$362
56	$0	$0	$16,000	$0	$16,000	0.0211	$338
57	$0	$0	$16,000	$0	$16,000	0.0198	$316
58	$0	$0	$16,000	$0	$16,000	0.0185	$295
59	$0	$0	$16,000	$55,000	$71,000	0.0173	$1,225
60	$0	$0	$16,000	$0	$16,000	0.0161	$258
61	$0	$0	$16,000	$0	$16,000	0.0151	$241
62	$0	$0	$16,000	$0	$16,000	0.0141	$225
63	$0	$0	$16,000	$0	$16,000	0.0132	$211
64	$0	$0	$16,000	$55,000	$71,000	0.0123	$874
65	$0	$0	$16,000	$0	$16,000	0.0115	$184
66	$0	$0	$16,000	$0	$16,000	0.0107	$172
67	$0	$0	$16,000	$0	$16,000	0.0100	$161
68	$0	$0	$16,000	$0	$16,000	0.0094	$150
69	$0	$0	$16,000	$55,000	$71,000	0.0088	$623
70	$0	$0	$16,000	$0	$16,000	0.0082	$131
71	$0	$0	$16,000	$0	$16,000	0.0077	$123
72	$0	$0	$16,000	$0	$16,000	0.0072	$115
73	$0	$0	$16,000	$0	$16,000	0.0067	$107
74	$0	$0	$16,000	$55,000	$71,000	0.0063	$444
75	$0	$0	$16,000	$0	$16,000	0.0058	$94
76	$0	$0	$16,000	$0	$16,000	0.0055	$87
77	$0	$0	$16,000	$0	$16,000	0.0051	$82
78	$0	$0	$16,000	$0	$16,000	0.0048	$76
79	$0	$0	$16,000	$55,000	$71,000	0.0045	$317
80	$0	$0	$16,000	$0	$16,000	0.0042	$67
81	$0	$0	$16,000	$0	$16,000	0.0039	$62
82	$0	$0	$16,000	$0	$16,000	0.0036	$58
83	$0	$0	$16,000	$0	$16,000	0.0034	$54
84	$0	$0	$16,000	$55,000	$71,000	0.0032	$226
85	$0	$0	$16,000	$0	$16,000	0.0030	$48
86	$0	$0	$16,000	$0	$16,000	0.0028	$44
87	$0	$0	$16,000	$0	$16,000	0.0026	$42
88	$0	$0	$16,000	$0	$16,000	0.0024	$39
89	$0	$0	$16,000	$55,000	$71,000	0.0023	$161
90	$0	$0	$16,000	$0	$16,000	0.0021	$34
91	$0	$0	$16,000	$0	$16,000	0.0020	$32
92	$0	$0	$16,000	$0	$16,000	0.0019	$30
93	$0	$0	$16,000	$0	$16,000	0.0017	$28

TABLE PV-6 (100yr)

PRESENT VALUE ANALYSIS

Alternative 6 (100 Year Analysis Period without Cover Replacement)

Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facility outside PMDA

Site:	**Formosa OU1**
Location:	**Douglas County, Oregon**
Phase:	**Feasibility Study**
Base Year:	**2013**

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Earthwork)[2]	Annual O&M Costs	Periodic Costs	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
94	$0	$0	$16,000	$55,000	$71,000	0.0016	$115
95	$0	$0	$16,000	$0	$16,000	0.0015	$24
96	$0	$0	$16,000	$0	$16,000	0.0014	$23
97	$0	$0	$16,000	$0	$16,000	0.0013	$21
98	$0	$0	$16,000	$0	$16,000	0.0012	$20
99	$0	$0	$16,000	$55,000	$71,000	0.0012	$82
TOTALS:	$305,000	$9,787,000	$1,673,000	$1,100,000	**$12,865,000**		$10,538,783
TOTAL PRESENT VALUE OF ALTERNATIVE 6[5]							**$10,539,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since soils under covers and structures would have contaminant concentrations above RGs that would allow for unlimited use and unrestricted exposure under the current and potential future land uses. However the period of analysis was assumed to be 100 years (Years 0 through 99).

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-6.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table PV-ADRFT for details.

[5] Total present value is rounded to the nearest $1,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.

TABLE PV-6 (100yr with Cover Replacement)							
PRESENT VALUE ANALYSIS							
Alternative	**6 (100 Year Analysis Period with Cover Replacement)**						
Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facility outside PMDA							
Site:	**Formosa OU1**						
Location:	**Douglas County, Oregon**						
Phase:	**Feasibility Study**						
Base Year:	**2013**						
Year[1]	**Capital Costs (Institutional Controls)[2]**	**Capital Costs (Earthwork)[2]**	**Annual O&M Costs**	**Periodic Costs**	**Total Annual Expenditure[3]**	**Discount Factor (7.0%)**	**Present Value[4]**
0	$305,000	$9,787,000	$0	$0	$10,092,000	1.0000	$10,092,000
1	$0	$0	$35,000	$0	$35,000	0.9346	$32,711
2	$0	$0	$35,000	$0	$35,000	0.8734	$30,569
3	$0	$0	$33,000	$0	$33,000	0.8163	$26,938
4	$0	$0	$33,000	$55,000	$88,000	0.7629	$67,135
5	$0	$0	$33,000	$0	$33,000	0.7130	$23,529
6	$0	$0	$16,000	$0	$16,000	0.6663	$10,661
7	$0	$0	$16,000	$0	$16,000	0.6227	$9,963
8	$0	$0	$16,000	$0	$16,000	0.5820	$9,312
9	$0	$0	$16,000	$55,000	$71,000	0.5439	$38,617
10	$0	$0	$16,000	$0	$16,000	0.5083	$8,133
11	$0	$0	$16,000	$0	$16,000	0.4751	$7,602
12	$0	$0	$16,000	$0	$16,000	0.4440	$7,104
13	$0	$0	$16,000	$0	$16,000	0.4150	$6,640
14	$0	$0	$16,000	$55,000	$71,000	0.3878	$27,534
15	$0	$0	$16,000	$0	$16,000	0.3624	$5,798
16	$0	$0	$16,000	$0	$16,000	0.3387	$5,419
17	$0	$0	$16,000	$0	$16,000	0.3166	$5,066
18	$0	$0	$16,000	$0	$16,000	0.2959	$4,734
19	$0	$0	$16,000	$55,000	$71,000	0.2765	$19,632
20	$0	$0	$16,000	$0	$16,000	0.2584	$4,134
21	$0	$0	$16,000	$0	$16,000	0.2415	$3,864
22	$0	$0	$16,000	$0	$16,000	0.2257	$3,611
23	$0	$0	$16,000	$0	$16,000	0.2109	$3,374
24	$0	$0	$16,000	$55,000	$71,000	0.1971	$13,994
25	$0	$0	$16,000	$0	$16,000	0.1842	$2,947
26	$0	$0	$16,000	$0	$16,000	0.1722	$2,755
27	$0	$0	$16,000	$0	$16,000	0.1609	$2,574
28	$0	$0	$16,000	$0	$16,000	0.1504	$2,406
29	$0	$0	$16,000	$55,000	$71,000	0.1406	$9,983
30	$0	$0	$16,000	$0	$16,000	0.1314	$2,102
31	$0	$0	$16,000	$0	$16,000	0.1228	$1,965
32	$0	$0	$16,000	$0	$16,000	0.1147	$1,835
33	$0	$0	$16,000	$0	$16,000	0.1072	$1,715
34	$0	$0	$16,000	$55,000	$71,000	0.1002	$7,114
35	$0	$0	$16,000	$0	$16,000	0.0937	$1,499
36	$0	$0	$16,000	$0	$16,000	0.0875	$1,400
37	$0	$0	$16,000	$0	$16,000	0.0818	$1,309
38	$0	$0	$16,000	$0	$16,000	0.0765	$1,224
39	$0	$0	$16,000	$55,000	$71,000	0.0715	$5,077
40	$0	$0	$16,000	$0	$16,000	0.0668	$1,069
41	$0	$0	$16,000	$0	$16,000	0.0624	$998
42	$0	$0	$16,000	$0	$16,000	0.0583	$933
43	$0	$0	$16,000	$0	$16,000	0.0545	$872
44	$0	$0	$16,000	$55,000	$71,000	0.0509	$3,614
45	$0	$0	$16,000	$0	$16,000	0.0476	$762
46	$0	$0	$16,000	$0	$16,000	0.0445	$712

TABLE PV-6 (100yr with Cover Replacement)

PRESENT VALUE ANALYSIS

Alternative 6 (100 Year Analysis Period with Cover Replacement)

Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facility outside PMDA

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Earthwork)[2]	Annual O&M Costs	Periodic Costs	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
47	$0	$0	$16,000	$0	$16,000	0.0416	$666
48	$0	$0	$16,000	$0	$16,000	0.0389	$622
49	$0	$0	$16,000	$55,000	$71,000	0.0363	$2,577
50	$0	$0	$16,000	$0	$16,000	0.0317	$508
51	$0	$0	$16,000	$0	$16,000	0.0297	$474
52	$0	$0	$16,000	$0	$16,000	0.0277	$443
53	$0	$0	$16,000	$0	$16,000	0.0259	$414
54	$0	$0	$16,000	$55,000	$71,000	0.0242	$1,719
55	$0	$0	$16,000	$0	$16,000	0.0226	$362
56	$0	$0	$16,000	$0	$16,000	0.0211	$338
57	$0	$0	$16,000	$0	$16,000	0.0198	$316
58	$0	$0	$16,000	$0	$16,000	0.0185	$295
59	$0	$0	$16,000	$55,000	$71,000	0.0173	$1,225
60	$0	$0	$16,000	$0	$16,000	0.0161	$258
61	$0	$0	$16,000	$0	$16,000	0.0151	$241
62	$0	$0	$16,000	$0	$16,000	0.0141	$225
63	$0	$0	$16,000	$0	$16,000	0.0132	$211
64	$0	$0	$16,000	$55,000	$71,000	0.0123	$874
65	$0	$0	$16,000	$0	$16,000	0.0115	$184
66	$0	$0	$16,000	$0	$16,000	0.0107	$172
67	$0	$0	$16,000	$0	$16,000	0.0100	$161
68	$0	$0	$16,000	$0	$16,000	0.0094	$150
69	$0	$0	$16,000	$55,000	$71,000	0.0088	$623
70	$0	$0	$16,000	$0	$16,000	0.0082	$131
71	$0	$0	$16,000	$0	$16,000	0.0077	$123
72	$0	$0	$16,000	$0	$16,000	0.0072	$115
73	$0	$0	$16,000	$0	$16,000	0.0067	$107
74	$0	$0	$16,000	$55,000	$71,000	0.0063	$444
75	$0	$0	$16,000	$0	$16,000	0.0058	$94
76	$0	$0	$16,000	$0	$16,000	0.0055	$87
77	$0	$0	$16,000	$0	$16,000	0.0051	$82
78	$0	$0	$16,000	$0	$16,000	0.0048	$76
79	$0	$0	$16,000	$55,000	$71,000	0.0045	$317
80	$0	$0	$16,000	$0	$16,000	0.0042	$67
81	$0	$0	$16,000	$0	$16,000	0.0039	$62
82	$0	$0	$16,000	$0	$16,000	0.0036	$58
83	$0	$0	$16,000	$0	$16,000	0.0034	$54
84	$0	$0	$16,000	$55,000	$71,000	0.0032	$226
85	$0	$0	$16,000	$0	$16,000	0.0030	$48
86	$0	$0	$16,000	$0	$16,000	0.0028	$44
87	$0	$0	$16,000	$0	$16,000	0.0026	$42
88	$0	$0	$16,000	$0	$16,000	0.0024	$39
89	$0	$0	$16,000	$55,000	$71,000	0.0023	$161
90	$0	$0	$16,000	$0	$16,000	0.0021	$34
91	$0	$0	$16,000	$0	$16,000	0.0020	$32
92	$0	$0	$16,000	$0	$16,000	0.0019	$30
93	$0	$0	$16,000	$0	$16,000	0.0017	$28

TABLE PV-6 (100yr with Cover Replacement)

PRESENT VALUE ANALYSIS

Alternative 6 (100 Year Analysis Period with Cover Replacement)

Excavation, Stabilization/Solidification of Tailings, and Disposal of Mine Materials at Proposed Facility outside PMDA

Site: Formosa OU1
Location: Douglas County, Oregon
Phase: Feasibility Study
Base Year: 2013

Year[1]	Capital Costs (Institutional Controls)[2]	Capital Costs (Earthwork)[2]	Annual O&M Costs	Periodic Costs	Total Annual Expenditure[3]	Discount Factor (7.0%)	Present Value[4]
94	$0	$0	$16,000	$55,000	$71,000	0.0016	$115
95	$0	$0	$16,000	$0	$16,000	0.0015	$24
96	$0	$0	$16,000	$0	$16,000	0.0014	$23
97	$0	$0	$16,000	$0	$16,000	0.0013	$21
98	$0	$0	$16,000	$0	$16,000	0.0012	$20
99	$0	$938,000	$16,000	$55,000	$1,009,000	0.0012	$1,163
TOTALS:	$305,000	$10,725,000	$1,673,000	$1,100,000	**$13,803,000**		$10,539,864
TOTAL PRESENT VALUE OF ALTERNATIVE 6[5]							**$10,540,000**

Notes:

[1] The alternative is expected to require cost expenditures for perpetuity since soils under covers and structures would have contaminant concentrations above RGs that would allow for unlimited use and unrestricted exposure under the current and potential future land uses. However the period of analysis was assumed to be 100 years (Years 0 through 99).

[2] Capital costs, for purposes of this analysis, are assumed to be distributed as indicated on Table CS-6.

[3] Total annual expenditure is the total cost per year with no discounting.

[4] Present value is the total cost per year including a 7.0% discount factor for that year. See Table PV-ADRFT for details.

[5] Total present value is rounded to the nearest $1,000. Inflation and depreciation are excluded from the present value cost.

Costs presented for this alternative are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

They are prepared solely to facilitate relative comparisons between alternatives for FS evaluation purposes.