Libby Asbestos Superfund Site
The Former Screening Plant and Surrounding Properties
Operable Unit 2
Lincoln County, Montana

Operations and Maintenance Plan, Revision 1

USACE Contract No. W9128F-11-D-0023

Task Order No.: 0008
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August 2015

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Task Order No. 0008

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Acronyms

ABS	activity based sampling
ARD	Assessment and Remediation Division
ARAR	Applicable or Relevant and Appropriate Requirement
ARM	Administrative Rules of Montana
ARP	Asbestos Resource Program
bgs	below ground surface
CA	cooperative agreement
CDM Smith	CDM Federal Programs Corporation
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
COC	contaminant of concern
CWCCIS	Civil Works Construction Cost Index System
DEQ	Montana Department of Environmental Quality
EM	Engineering Manual
EPA	United States Environmental Protection Agency
ft^2	square feet
Grace	W.R. Grace Company
HASP	health and safety plan
IC	Institutional Control
ICIAP	Institutional Control Implementation and Assurance Plan
JSI	joint site inspection
KDC	Kootenai Development Corporation
LA	Libby Asbestos
MDT	Montana Department of Transportation
NCP	National Oil and Hazardous Substance Pollution Contingency Plan
O&F	Operational and Functional
O&M	Operations and Maintenance
OMB	Office of Management and Budget
OU	Operable Unit
OU2 site	Libby Asbestos Superfund Site Operable Unit 2
OSRTI	Office of Superfund Remediation and Technology Innovation
RA	Remedial Action
RAC	Response Action Contract
RAO	Remedial Action Objective
RD	remedial design
ROD	Record of Decision
ROW	right-of-way
RPM	remedial project manager
SSC	Superfund State Contract
Subarea 1	Screening Plant
Subarea 2	Flyway
Subarea 3	Privately-Owned Property
Subarea 4	Rainy Creek Road Frontages
USACE	U.S. Army Corps of Engineers

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Section 1
Introduction

This Operation and Maintenance (O&M) Plan presents the administrative, financial, and technical details and requirements for inspecting, operating, and maintaining the Libby Asbestos Superfund Site Operable Unit (OU) 2 (OU2 site) Remedial Action (RA) at the Libby Asbestos Superfund Site (the Site)(Comprehensive Environmental Response, Compensation, and Liability Information System [CERCLIS] # MT0009083840) in accordance with guidance developed by the United States Environmental Protection Agency (EPA) for *Operations and Maintenance in the Superfund Program* (EPA 2001a). An O&M Plan is required at OU2 of the Site because an engineered control is employed to address contamination remaining at various levels within the Site.

OU2 is the subject of this O&M Plan and includes areas impacted by contamination in place from the former Screening Plant. Exposure to vermiculite and Libby Asbestos (LA) was largely mitigated by removal of surface soils and the placement of extensive soil caps across OU2 (known as the former Screening Plant Site) during removal activities. This O&M Plan was prepared to monitor engineered controls associated with remaining vermiculite and LA present in subsurface soil on the OU2 site.

1.1 Site Location and Background

The Libby Asbestos Superfund Site is located in and around the City of Libby, Montana. Libby is the county seat of Lincoln County and is in the northwest corner of Montana, about 35 miles east of Idaho and 65 miles south of Canada.

OU2 is located approximately 5 miles northeast of the City of Libby on the east side of the Kootenai River and at the confluence of Rainy Creek and the Kootenai River (Figure 1-1). The OU2 site was historically owned and used by W.R. Grace Company (Grace) for stockpiling, staging, and distributing vermiculite and vermiculite concentrate to vermiculite processing areas and insulation distributors outside of the City of Libby. The OU2 site is known as the former Screening Plant and Surrounding Properties. The OU2 site has been separated into distinct impacted areas. As depicted in Figure 1-2, these areas include the former Screening Plant (Subarea 1), the Flyway (Subarea 2), a Privately-Owned Property (Subarea 3), and the Rainy Creek Road Frontages (Subarea 4). The Highway 37 right-of-way (ROW) adjacent to the OU2 site was included due to its proximity to the OU2 site and the known contamination in the ROW. For the purposes of this O&M Plan, the contaminated portion of the Highway 37 ROW is considered part of Subareas 1, 2, and 3 within the OU2 site. These subareas are described in more detail below.

Exposure to contamination was largely mitigated by removal of surface soils and the extensive cap placed across the OU2 site during removal activities prior to the Record of Decision (ROD), with the exception of two isolated locations within the Flyway (Subarea 2). Contamination in these two locations was addressed in 2010 during the RA for the OU2 site conducted in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986 and the National Oil and Hazardous Substance Pollution Contingency Plan (NCP) (EPA 1994). Details of investigation and removal activities in the OU2 Subareas are provided in the Final RA Report (CDM Smith 2012). Figure 1-3 depicts the OU2 site remedy components. Currently, vermiculite and LA are present in subsurface soil as depicted in Figures 1-4 through 1-7

1.1.1 Former Screening Plant (Subarea 1)

The former Screening Plant is located approximately 5 miles northeast of the City of Libby on the east side of the Kootenai River. The area is approximately 21 acres in size, and is bordered by Highway 37 to the northeast, the privately owned property to the southeast, the Flyway to the south, and the Kootenai River to the west. For the purpose of this O&M Plan, the Former Screening Plant area includes the Highway 37 ROW, which is adjacent to the west side of Highway 37. The ROW is used and maintained by the Montana Department of Transportation (MDT). The former Screening Plant property is currently privately owned and is being used for residential purposes. It is anticipated that the property will continue to be used for residential and/or commercial purposes.

The former Screening Plant has undergone extensive investigation and removal actions since the EPA began emergency response activities in the Libby area in 1999. Details of investigation and removal activities in the OU2 Subareas are provided in the Final RA Report (CDM Smith 2012).

1.1.2 Flyway (Subarea 2)

Currently owned by Kootenai Development Corporation (KDC) (a subsidiary of Grace), the area commonly referred to as the Flyway is comprised of approximately 19 acres northeast of the City of Libby, immediately south of the former Screening Plant and the privately-owned parcel. The Flyway is bounded by Highway 37 to the northeast, a residential subdivision (*River Runs through It*) to the south, the Kootenai River to the southwest, and the former Screening Plant and private property to the north. The Flyway is accessed through a gated entrance to the adjacent private property off Highway 37. For the purpose of this O&M Plan, the Flyway area includes the Highway 37 ROW, which is adjacent to the west side of Highway 37. The ROW is used and maintained by the MDT. The Flyway is currently undeveloped land and used for equipment storage. At this time, the owners have no plans to develop this property.

1.1.3 Private Property (Subarea 3)

The private property of Subarea 3 consists of an approximate 1-acre parcel situated between the former Screening Plant and the Flyway, and bordered by Highway 37 to the northeast. For the purpose of this O&M Plan, this private property includes the Highway 37 ROW adjacent to the west side of Highway 37. A continuation of the Flyway ROW, this ROW is used and maintained by the MDT. The private property is currently vacant, undeveloped land. At this time, the owners have no plans to develop this property. Details of investigation and removal activities in the OU2 Subareas are provided in the Final RA Report (CDM Smith 2012).

1.1.4 Rainy Creek Road Frontages (Subarea 4)

The Rainy Creek Road Frontages are currently privately owned and lie immediately north and south of Rainy Creek Road on the east (i.e., mine) side of Highway 37. Approximately 45,000 square feet (ft^2) of land comprises the north frontage; approximately 39,000 ft^2 comprises the south frontage. For a short period, numerous trees were stored at the south frontage for use during restoration at the former Screening Plant. The Rainy Creek Road Frontages are currently vacant, undeveloped land. It is anticipated that the property will remain as such.

1.2 Statement of Basis and Purpose

The purpose of this O&M Plan is to present the activities necessary for inspecting, operating, and maintaining the effectiveness of the OU2 RA including administrative, financial, and technical details and requirements.

1.2.1 Operations and Maintenance Objectives

The implementation and maintenance of the remedial measures in accordance with the O&M Plan are designed to meet the following remedial action objectives (RAOs):

- Break the exposure pathways for inhalation of LA fibers that would result in unacceptable cancer risk or non-cancer hazard.
- Control erosion of contaminated soil by wind and water from source locations to prevent exposures and the spread of contamination to un-impacted locations.
- Implement controls to prevent uses of the OU2 site that could pose unacceptable risks to human health or the environment or compromise the remedy.

The ROD lists OU2 site specific O&M objectives as the following:

- Maintain the integrity of the engineered controls and protective covers.
- Monitor, evaluate and update institutional controls (ICs) to ensure protectiveness. IC's for OU2 are detailed in the interim OU2 Institutional Control Implementation and Assurance Plan (EPA 2015c).
- Ensure that the protection of human health is maintained within the OU2 site.
- Prevent unrestricted use of the OU2 site (EPA 2010).

O&M and Five-Year Reviews will be conducted indefinitely throughout the life of the OU2 site because contaminants remain on the OU2 site at levels that do not allow for unrestricted use and unlimited exposure.

1.2.2 Summary of Long-Term Operation and Maintenance Activities

Long-term O&M (i.e., indefinite O&M efforts) will be performed to maintain the integrity of the remedy including protective covers and ICs. Prior to any work on the site, an O&M health and safety plan (HASP) will be developed or an existing HASP will be adapted to pertain to the work required. All O&M work will be performed in compliance with the HASP. This plan will include provisions for responding to and reporting accidents involving site personnel, operating emergencies, and other unusual events such as fires, floods, or weather damage (EPA 2010).

The following activities will be considered routine O&M activities:

- **Routine OU2 Site Inspections.** Routine non-intrusive visual site inspections will be conducted to ensure integrity of the covers and backfilled areas. OU2 site inspections will be performed at least annually. Routine OU2 site inspections are discussed in Section 2.
- **Cover Maintenance.** Damage to protective covers and backfilled areas observed during routine OU2 site inspections will be repaired to eliminate exposure of underlying contamination. Cover maintenance is discussed in Section 2.3, including issues that may arise with the covers during long-term O&M and contingency plans for such occurrences.
- **Institutional Control (IC) Evaluation and Updates.** ICs will be evaluated on at least an annual basis and updated if necessary to ensure protectiveness. Evaluation and updates for different types of ICs are discussed in Section 3.
- **Reporting.** Routine reports summarizing O&M activities will be prepared on an annual basis. Routine reporting also involves regular review and updates as necessary to the O&M HASP as

described in Section 2.2 and as-built drawings. Reporting requirements are discussed in detail under Section 4.

1.2.3 Summary of Five-Year Review Activities

Libby Amphibole Asbestos will remain onsite above levels which allow unrestricted use of OU2. Five-Year Site Reviews of OU2 will be required to evaluate the implementation and performance of the remedy, and to determine whether the remedy remains protective of human health and the environment. The EPA is responsible for performing and funding the Five-Year Reviews as long as they are required. The Five-Year Review process consists of six components: 1) community involvement and notification, 2) document review, 3) data review and analysis, 4) site inspection, 5) interviews, and 6) protectiveness determination (EPA 2003).

- Community involvement activities will include notifying the community that the Five-Year Review will be conducted, notifying the community that the Five-Year Review has been completed, and providing the results of the review.
- Document review involves a review of all relevant documents and data to obtain information to assess the performance of the response action. Documents for review include, but are not limited to the OU2 ROD (EPA 2010), annual O&M reports, and annual IC evaluations.
- Data review and analysis will involve a review of sampling and monitoring plans and results from monitoring activities.
- Site inspections will be conducted to gather information about the site's current status and to visually confirm and document the conditions of the remedy, the site, and the surrounding area.
- Interviews may be conducted as necessary with the site manager, site personnel, and people who live or work near the site to gather additional information about the site's status or identify remedy issues.

To determine the protectiveness of the remedy, the Five-Year Review will include a technical assessment to examine the following three questions to provide a framework for organizing and evaluating data and information and ensure that all relevant issues are considered.

1. Is the remedy functioning as intended by the decision documents?
2. Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?
3. Has any other information come to light that could call into question the protectiveness of the remedy (EPA 2001a)?

According to the OU2 ROD, the remedial components will be subject to continual re-evaluation as part of the Five Year Review to ensure protectiveness of the remedy into the future. This will include any re-evaluation based on possible improvements to the technology to detect LA in soils and any new information gained from on-going Libby Asbestos Superfund Site Action Plan investigations. The remedy will be re-evaluated in accordance with the review requirements of CERCLA Section 121(c).

As described in Section 4, routine reports summarizing the Five Year Review will be prepared by the EPA in accordance with the *Comprehensive Five-Year Review Guidance* (EPA 2001b).

1.3 Overview of Transition from Remedial Action to Operation and Maintenance

1.3.1 Schedule for Transition from Remedial Action to Operations and Maintenance

Table 1-1 presents a summary of the major events for transition from RA to O&M at the OU2 site and associated dates of these events. See Section 1.1 for a summary of all investigation and removal activities that occurred prior to the ROD.

Table 1-1
Summary of the Major Events for Transition from Remedial Action to Operations and Maintenance

Date	Event
May 10, 2010	ROD for OU2 Signed
July 28-30, 2010	Flyway Investigation
September, 2010	Remedial Design
September 27, 2010	Mobilization, site preparation & start of excavation
September 30, 2010	Remedial Excavation Complete
October 11, 2010	Remedial Restoration Complete
October 11, 2010	Final Restoration Inspection/Final Demobilization
November 3, 2010	Joint Site Inspection/Start of O&F Period
November 3, 2010	O&F Determination/Start of O&M Phase
November 10-11, 2010	Soil sampling to address action items identified during Joint Site Inspection
November 30, 2010	OU2 Joint Site Inspection Memorandum
February 4, 2011	Draft RA Report
February 4, 2011	Draft O&M Plan
April 20, 2012	Final RA Report
September 8, 2012	OU2 Post-Construction Risk Assessment Sampling
July 15, 2013	O&M Plan Approval
November 20, 2013	Institutional Control Implementation and Assurance Plan (ICIAP) Approval
February 19, 2014	OU2 Interim Post-Construction Risk Assessment Report
August 1, 2013	O&F Determination/Start of O&M Phase
October 24, 2013	First Annual O&M Site Inspection
March 2014	First Annual O&M Report
TBD (estimated Fall 2016)	OU2 Final Post-Construction Risk Assessment Report
June 22, 2015	First Five-Year Review

Annual O&M Site Inspections, Annual O&M Reporting, and Five-Year Reviews will be conducted indefinitely as long as contaminants remain on site at levels that call for limited uses and restricted exposure.

1.3.2 Access

Of the four OU2 subareas identified on Figure 1-2, only the former Screening Plant (Subarea 1) is actively used. All other subareas are undeveloped land with no current plans for future development. Subarea 1 is privately owned and used for residential purposes and it is anticipated that the property

will continue to be used for residential and/or commercial purposes. All subareas include Highway 37 embankments maintained by the MDT.

Access agreements for conducting long-term O&M have not been obtained with land owners except for Kootenay Development Company (owner of the flyway and MDT (publicly accessible property), but may be required with each property owner located within the OU2 boundary, if necessary. When access is required to conduct O&M at OU2, property owners will be notified and access will be obtained as necessary. An example of a legal instrument which can be used to obtain access is an easement that provides access rights to and from a property for the purpose of inspecting and monitoring the cover system. One way access can be obtained is through implementation of Proprietary Controls as described in Section 3.1.

When intrusive work is required within the ROW to Highway 37, a permitting process will be followed. An example of this process is the MDT Encroachment Permits. Permitting (a governmental control) is discussed further in Section 3.2.

1.3.3 Identification of Available Funding for Operation and Maintenance

Currently, a settlement fund is set up for the Libby Asbestos Superfund Site. From the settlement fund, 11 million dollars was placed into a separate interest-bearing account that will be used to help pay for future O&M for the entire Superfund site. Currently, the funds in that account are nearly $11.8 million. The cost of the O&M program will be evaluated through a probabilistic analysis of costs to help minimize the uncertainty of those costs. This effort will start now that the O&M costs have been finalized for the final site-wide feasibility study, and then routinely throughout the course of the remedial action on the remaining applicable OUs of the Superfund site.

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Section 2

Routine Site Inspection

Site inspections are conducted to provide information about a site's status and to visually confirm and document the conditions of the remedy, the site, and the surrounding area (EPA 2001a). The recommended annual O&M checklist is provided as Appendix B.

2.1 Routine Site Inspection Objectives

Consistent with the O&M objectives presented in Section 1.2.1, the objectives of routine OU2 site inspections include the following:

- Observe and maintain the integrity of the engineered controls and protective covers
- Evaluate the implementation of ICs to ensure protectiveness as described in Section 3
- Ensure that the protection of human health is maintained within the site through maintenance of engineered controls and protective covers
- Prevent unrestricted use of the site (EPA 2010b)

2.2 Observe Site Conditions

Monitoring protocol includes routine non-intrusive visual site inspections to ensure integrity of the covers, engineered controls, and changes or planned changes in land use. Site inspections will be performed annually as well as concurrently with Five-Year Site Review according to the proposed O&M schedule presented in Section 1.3.1.

2.2.1 Inspect the Integrity of Covers

A non-intrusive (surficial) visual inspection of the immediate ground surface at the site will be conducted during the annual site inspection to determine the presence or absence of asbestos containing material or debris. The types and location of the remedial covers found on the OU2 site are depicted in Figure 1-3. A portion of the site along the Kootenai River in the Former Screening Plant Subarea 1 is covered with rip rap as an erosion control measure. Most of the site was restored by backfilling excavations using clean soil brought from an offsite borrow source area outside the Libby valley. Above the backfill, topsoil was placed and hydro-seeded for erosion control. In certain areas including the Highway 37 embankments, erosion control blankets were used prior to the growth of vegetation.

Annual inspections will be performed every fall and will involve observing whether the covers and vegetation are intact and preventing exposure to asbestos containing material. Inspections will be conducted by persons properly trained in accordance with the Montana Department of Environmental Quality (DEQ) Administrative Rules of Montana (ARM) Rule 17.74.301-372. If asbestos containing material or debris is observed, the cover will be identified for repair as described in Section 2.3.

2.2.2 Inspect the Integrity of Engineered Controls

The selected remedy as described in the ROD includes a potential need for engineered controls, such as fencing and or warning signs to restrict access to the seasonally flooded portion of the Flyway Subarea 2. This proposed engineered control has been constructed. Effectiveness and results of

engineered controls are further discussed in the Former Screening Plant and Surrounding Properties, Operable Unit 2, Interim Post-Construction Human Health Risk Assessment (EPA 2014).

2.2.3 Other Site Features

The potable water well installed in Subarea 1, as described in Section 1.1.1, is not considered part of the OU2 site remedy. Therefore, the O&M of this well is the responsibility of the property owner.

2.3 Cover Maintenance Activities

Damage to protective covers could result from vandalism and/or unauthorized digging. In addition, flooding of the Kootenai River or Rainy Creek has the potential to result in surface exposure of LA from significant erosion of the covers in place. Damage to protective covers at the OU2 site can result in exposure to asbestos containing material that would result in unacceptable cancer risk or non-cancer hazard.

A minor breach of the protective cover can be repaired without additional excavation of contaminated soil. A major breach of the protective cover occurs when significant exposure to contaminated soil beneath the cover may result and additional excavation of contaminated materials would be required. Prior to implementation of any corrective action, a task-specific Activity Hazard Analysis or separate task specific HASP will be developed.

In general, if LA is encountered or suspected during inspection of the cover at OU2, the entity performing O&M will:

- Take necessary measures to secure the disturbed areas and to limit contaminant migration from inadvertent activities so that the protection of human health is maintained through restriction of access to the area.
- Contact the Asbestos Resource Program (ARP) or the entity responsible for O&M, who will manage any contamination encountered. Section 2.4 further describes the responsibilities of the ARP.
- Take corrective action to repair the protective cover, as further described in the following subsections.

2.3.1 Repair of Minor Breaches to Protective Covers

General wear and tear or erosion of protective covers may result in a minor breach of protective covers. If the protective cover can be repaired without additional excavation of contaminated soil, it is considered a minor breach of the protective cover. This type of breach to a protective cover may or may not result in the exposure of asbestos containing material or debris from below the cover. This determination is to be made with input from the ARP or entity responsible for O&M.

Repair of a minor breach of soil protective covers will follow the general steps described below:

- Obtain clean soil from an offsite borrow source, outside of the Libby valley, that is analyzed in accordance with the *Fill Material Quality Assurance Project Plan, Libby Asbestos Superfund Site* (CDM Smith 2015) to ensure that it is both within specifications for the respective fill type and that they are not contaminated with LA.
- Transport, place, and compact backfill and topsoil.
- Hydro-seed disturbed area as necessary.

As shown in Figure 1-3, excavations along at the Kootenai River were restored using rip rap. The disturbed areas were backfilled with common fill, then graded, and riprap was placed to prevent erosion of the creek and riverbanks during flood conditions. As necessary, repairs to minor breaches of rip rap protective covers will follow the general steps described above except that transportation and placement of rip rap will replace the transportation, placement, and compaction of topsoil and hydro-seeding.

The entity responsible for O&M will rely on current guidance documents for the procurement of borrow materials and methods for the repair of the damaged protective cover (CDM Smith 2015, EPA 2015a). In some cases, including the Highway 37 embankment erosion control blankets may be required until vegetation is established. In some cases, including the Highway 37 embankment, erosion control blankets may be required until vegetation is established.

2.3.2 Repair of Major Breaches to Protective Covers

A major breach of the protective covers will result in significant exposure to contaminated soil beneath the cover. Additional excavation of contaminated materials may be necessary to secure the disturbed areas so that the protection of human health is maintained and contaminant migration does not occur.

If a major breach of the protective covers occurs resulting from a latent design or construction defect, EPA may require the design or construction contractor to repair the remedy or provide restitution in some manner (EPA 2001a). Repairs or restitution of major breaches resulting from future construction will be borne by the construction contractor.

Contaminated soil exposed by a major breach will be excavated and disposed of at a DEQ-approved facility. Sampling and analysis will be conducted to confirm that contamination did not migrate outside of the breached area.

The entity responsible for O&M will rely on current guidance documents for the procurement of borrow materials and methods for the repair of the damaged protective cover.

2.4 Future Encounters with Contaminated Soil

If disturbance to the protective covers causes exposure, advice on how to address encounters with contaminated materials, will be obtained from the ARP or entity responsible for O&M. The ARP is a program currently staffed in Lincoln County, Montana and funded by the EPA developed to provide advice and instruction on managing contamination encountered.

ICs such as informational devices, as described in Section 3.4, will be used to inform the public of proper actions to avoid and how to handle future encounters with contaminated soil.

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Section 3
Monitor Institutional Controls

ICs are non-engineering measures designed to prevent or limit exposure to hazardous substances left in place at the OU2 site. As presented in the ROD Section 12.4.1, "ICs are considered an integral part of the remedy, so development and implementation of the ICs will be conducted as part of the RA." (EPA 2010).

EPA has developed an Interim Institutional Control Implementation and Assurance Plan (ICIAP) to ensure ICs applicable to OU2 are properly documented, implemented and operate effectively during their entire lifespan. In accordance with the interim final guidance, *Institutional Controls: A Guide to Planning, Implementing, Maintaining, and Enforcing Institutional Controls at Contaminated Sites*, the ICIAP identifies the objectives, performance goals, existing or anticipated enforcement documents and approaches for enforcement (EPA 2012, EPA 2015c).

The ICs will be evaluated and updated on an annual basis. The routine and critical evaluation of the ICs will assess:

1. Whether the selected IC instruments remain in place.
2. Whether the ICs are enforced such that they meet the stated objectives and performance goals and provide protection required by the response (EPA 2012).

The following sections present current ICs and maintenance procedures. ICs are more effective if they are layered, meaning the use of different types of ICs at the same location to enhance the protectiveness of the remedy (EPA 2000a). For example, where ICs must be effective for a long period, either proprietary or governmental controls will be considered because they generally run with the land and are enforceable. Also, the implementation of government controls might be considered a beneficial addition to information tools that may be forgotten over the long-term or an enforcement action that would be binding only on certain parties (EPA 2000a).

3.1 Proprietary Controls

Proprietary controls are created pursuant to state law to prohibit activities that may compromise the effectiveness of the response action or restrict activities or future resource use that may result in unacceptable risk to human health or the environment (EPA 2012).

3.1.1 Establish Proprietary Controls

Proprietary controls involve legal instruments placed in the chain of title of the site or property.

3.1.2 Evaluate and Update Proprietary Controls

Both the administrative/legal components of proprietary controls as well as the physical evidence will be evaluated. One method to evaluate the administrative components of proprietary controls is to perform a title search on the properties within the OU2 area and determine if the land or resource use restrictions are appropriately documented in the chain of title of the property. Proprietary controls can also be evaluated during site inspections through physical evidence of property encroachment or possible violations of land or resource use restrictions.

3.2 Governmental Controls

Governmental controls, such as MDT encroachment permits, impose restrictions on land use or resource use (EPA 2012).

3.2.1 Establish Governmental Controls

Local governments have a variety of land use government controls to limit land or resource use including zoning restrictions, ordinances, statutes, or building permits (EPA 2000a). However, once implemented, local and state entities often use traditional police powers to regulate and enforce the controls. Since this category of ICs is put in place under local jurisdiction, they may be changed or terminated with little notice, and the EPA generally has no authority to enforce such controls (EPA 2000a). An example of a government control active on the OU2 site is the requirement for MDT Encroachment Permits for intrusive work within the ROW to Highway 37.

3.2.2 Evaluate and Update Governmental Controls

Because land use and ownership changes can occur over a relatively short time, developers and other parties may not be fully aware of the ICs that have been put in place as part of a cleanup. Both the administrative/legal components of government controls will be updated. Government controls will be evaluated during site inspections to identify any changes in land use, including evaluations of the activities conducted within Highway 37 ROW and the MDT Encroachment Permit.

3.3 Enforcement and Permit Tools

Enforcement and permit tools are legal tools, such as administrative orders, permits, Federal Facility Agreements (FFAs) and Consent Decrees (CDs), that limit certain site activities or require the performance of specific activities (e.g., to monitor and report on an IC's effectiveness) (EPA 2012). The establishment of enforcement and permit tools is not anticipated at the time of the development of this O&M plan; therefore, the evaluation and updating of enforcement and permit tools is not addressed.

3.4 Informational Devices

Informational devices provide information or notification to local communities that residual or contained contamination remains on site (EPA 2012).

3.4.1 Establish Informational Devices

The EPA has recognized that an important IC at OU2 involves the agreement with the Montana one-call utility locate service, otherwise known as U-Dig. U-Dig is a local service that people call at no cost before digging at their property to locate underground utility hazards (e.g., electrical lines, waterlines). Utilizing the U-Dig system allows the ARP or entity responsible for O&M at the site to provide information of "known areas of contamination at OU2 within the utility corridors" to anyone conducing work on the property (EPA 2010b)

U-Dig calls and requests for information are currently fielded by ARP personnel. The ARP position is considered an informational device used to convey information to the public and is currently staffed by Lincoln County and funded by the EPA. The purpose of this position is to provide advice on how to address contamination. In addition to providing advice and instruction, the ARP manages any site contamination encountered. In addition, the EPA has recommended best management practices (BMPs) applicable to construction contractors and tradesman working in Libby. More information on

best management practice (BMP's) may be found on the EPA website (*http://www.epa.gov/region8/superfund/libby/*) (EPA 2015b).

The EPA Libby Asbestos Superfund Site website (*http://www.epa.gov/region8/superfund/libby/*) is also a source for information about the Libby Asbestos Superfund Site (EPA 2015b). The EPA currently manages the website, which provides a source for information to the public regarding current activities at the Libby Asbestos Superfund Site. If necessary, additional informational sources may be established and maintained including advertisements, handouts, and training classes.

3.4.2 Evaluate and Update Informational Devices

The effectiveness of websites and the U-Dig services will be evaluated and updated on an annual basis to improve accessibility, navigability, design, content, and technical functionality.

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Section 4

Reporting Requirements

As described in Section 1.2.3, Five-Year Review Reports will be completed by the EPA on a five year cycle with the initial schedule presented in Table 1-1 and in accordance with *Comprehensive Five-Year Review Guidance* (EPA 2001b). Reports on O&M activities will be generated by the DEQ on a routine basis and as required by unforeseen events (described below). The EPA will review the reports on an ongoing basis.

4.1 Routine Reports

Routine reports summarizing O&M activities will be prepared and submitted by the DEQ to the remedial project manager (RPM) on an annual basis.

Routine reports will include sections on results from routine inspections, listing of major repairs, breakdown of actual costs for the reporting period, budget for the next reporting period, regular updates of the Site Safety and Health Plan, O&M Manual and as-built drawings, community complaints and responses, and verification of the integrity of ICs.

These reports will assist the EPA in considering the adequacy of O&M, the frequency of repairs, costs at the site, and how these factors relate to determining and ensuring protectiveness of the remedy.

4.2 Special Reports

Special reports are required as needed due to unforeseen events or conditions. One example of a special report is an incident report. Incident reports are used to document the details of accidents involving site personnel, and other unusual events such as fires, floods, or weather damage as may be required by the O&M HASP. Another example of a special report is a record of modification or amendment to the O&M HASP. When accidents occur on-site, the O&M HASP may need to be updated depending on the type of incident and whether or not it is already covered in the plan. These special reports should be made available to the EPA and other interested parties in a timely manner (EPA 2001a).

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Section 5

Cost Estimate

As part of the O&M plan, costs are developed to estimate all the O&M activities as discussed in this report. The O&M cost estimate was primarily developed to provide EPA with a preliminary cost basis for routine and non-routine remedy maintenance, annual site inspections, and cost for Five-Year Reviews as described in this O&M plan report.

5.1 Purpose and Intended Uses

This O&M cost estimate reflects the annual and periodic costs for implementing the long-term O&M at the OU2 site.

The intended use of the O&M cost estimate is to support EPA in the development and preparation of the annual O&M budget for the OU2 site. The O&M cost estimate is also used to help the EPA understand the costs associated with implementing the long-term O&M at OU2 of the Site.

5.2 Methodology and Organization

The basis for the O&M cost estimate is the selected remedy cost estimate prepared in 2010 for the OU2 ROD. The selected remedy cost estimate was developed according to *A Guide to Developing and Documenting Cost Estimates during the Feasibility Study* (EPA 2000b).

The O&M cost estimate was prepared by using the same cost summary and cost worksheet templates used for the selected remedy cost estimate with following changes:

- The worksheets from the selected remedy estimate were modified to reflect the scope as presented in the OU2 O&M plan report.
- New worksheets were developed as necessary to reflect the major O&M components.
- The unit costs presented in the selected remedy cost estimate were escalated to the current (2012) dollars to reflect potential increases in cost due to inflation since 2009. Escalation indices from the yearly composite cost index (weighted average) from the U.S. Army Corps of Engineers (USACE) Civil Works Construction Cost Index System (CWCCIS), Engineering Manual (EM) 1110-2-1304, 31 March 2000, Revised as of 31 March 2012 was used.
- Labor rates was also updated using current wage reports from SalaryExpert.com and Davis-Bacon (General Decision Number: MT120001, 04/20/2012).
- Markup for RD cost was removed from the O&M estimate because RD/RA has already been completed by the EPA.
- Markup for contingency was reduced to 10% which includes 5% scope and 5% bid contingencies. The 10% bid contingency reflects the unknown costs associated with implementing the O&M; such as adverse weather conditions, materials costs, or unfavorable market conditions.

The O&M cost estimate consists of cost worksheets, a cost summary, and a present value analysis. The cost worksheets provide the costs for individual O&M components. The cost summary includes annual O&M costs and other periodic costs for the long-term O&M, it also includes contingencies, and professional/technical services costs (excluding RD costs). Present value analysis of the estimated O&M cost was also done. For this a period of 30-years was assumed, although the O&M will be conducted indefinitely throughout the life of the site.

Present value analysis is a method to evaluate expenditures, either capital or O&M, which occur over different time periods. The single cost figure, referred to as the present value, is the amount needed to be set aside at the initial point in time (base year) to assure that funds will be available in the future as they are needed, assuming certain economic conditions. Inflation was first applied to annual costs prior to the present value analysis. Inflation was based on the USACE CWCCIS yearly composite cost index (weighted average). Discount rate for present value analysis was based on the 10-year average of nominal 30-year treasury interest rates (Appendix C of Office of Management and Budget [OMB] Circular A-94, Revised 11/2011).

5.3 Cost Estimates Accuracy and Cost Uncertainty

The O&M cost estimate is developed to be as accurate as the current information allows and is based on the scope presented. The cost estimate is expected to have an accuracy of +50% to -30% of the actual costs. This cost accuracy range is consistent with EPA's Remedial Design/Remedial Action Handbook (EPA 1995) for preliminary development of O&M activities and responsibilities.. Currently this cost estimate is an *Opinion of Probable Cost* only, and further refinement of the cost estimate will be done after additional inputs are gained from the stakeholders.

The O&M cost estimate does not include costs associated with specific EPA contracting vehicles, like the response action contract (RAC). Typical costs include program management costs, general and administrative costs, subcontracting costs and fees.

5.4 O&M Cost Estimate

As stated above, this is a probable cost of O&M. The actual cost to EPA may be lower depending on whether cost efficiencies in implementing the O&M at OU2 of the Site can be found. Costs related to implementation of ICs are excluded from the O&M cost estimate.

The detailed cost estimate (cost worksheets, cost summary, and present value analysis) is presented in Appendix A of this O&M plan report. The following table presents the summary of the O&M cost estimates.

Table 5-1
Summary of Probable Operations and Maintenance Cost

O&M Component	Cost Type	Description	Cost
Cover Maintenance (Minor Breaches)	Annual O&M Cost	Includes annual cost for O&M of the OU2 remedy. Breached that can be repaired without additional excavation of contaminated soils are considered as Minor Breaches. Refer Section 2.3 for details.	**$8,000/year**
Routine Site Inspection	Annual O&M Cost	Includes annual site inspection to inspect the integrity of all the components of the remedy put in-place. It is assumed that annual O&M cost would be incurred annually from Year 2012. Refer Section 2 for details.	**$2,000/year**
Evaluating and Updating Institutional Controls	Annual O&M Cost	The cost includes annual evaluation and update of the implemented institutional controls at the OU2 site. Refer Section 3 for details.	**$2,000/year**
Cover Maintenance (Major Breaches)	Periodic O&M Cost	Includes periodic costs for repairing major breaches to the protective cover. It may include additional excavation of contaminated materials To secure the disturbed areas. Refer Section 2.3 for details.	**$21,000**

Note:
1. Detailed costs and backup are presented in Appendix A.
2. Costs are rounded to the nearest $1,000.
3. Costs based on 2012 prices.
4. Costs presented are expected to have accuracy between -30% to +50% of actual cost, based on the scope presented.

Table 5-2
Summary of Probable Operations and Maintenance Cost Incurred by EPA

O&M Component	Cost Type	Description	Cost
Five-Year Site Review	Periodic Cost	It includes costs for site visit and a five-year site review report and also includes setting up a community meeting to inform the local community about the status of the OU2 site. It is assumed that the five-year review cycle would start during Year 2015.	**$50,000**

Note:
1. Detailed costs and backup are presented in Appendix A.
2. Cost is rounded to the nearest $1,000.
3. Costs based on 2012 prices.
4. Costs presented are expected to have an accuracy between -30% to +50% of actual costs, based on the scope presented.

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Section 6
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Figures

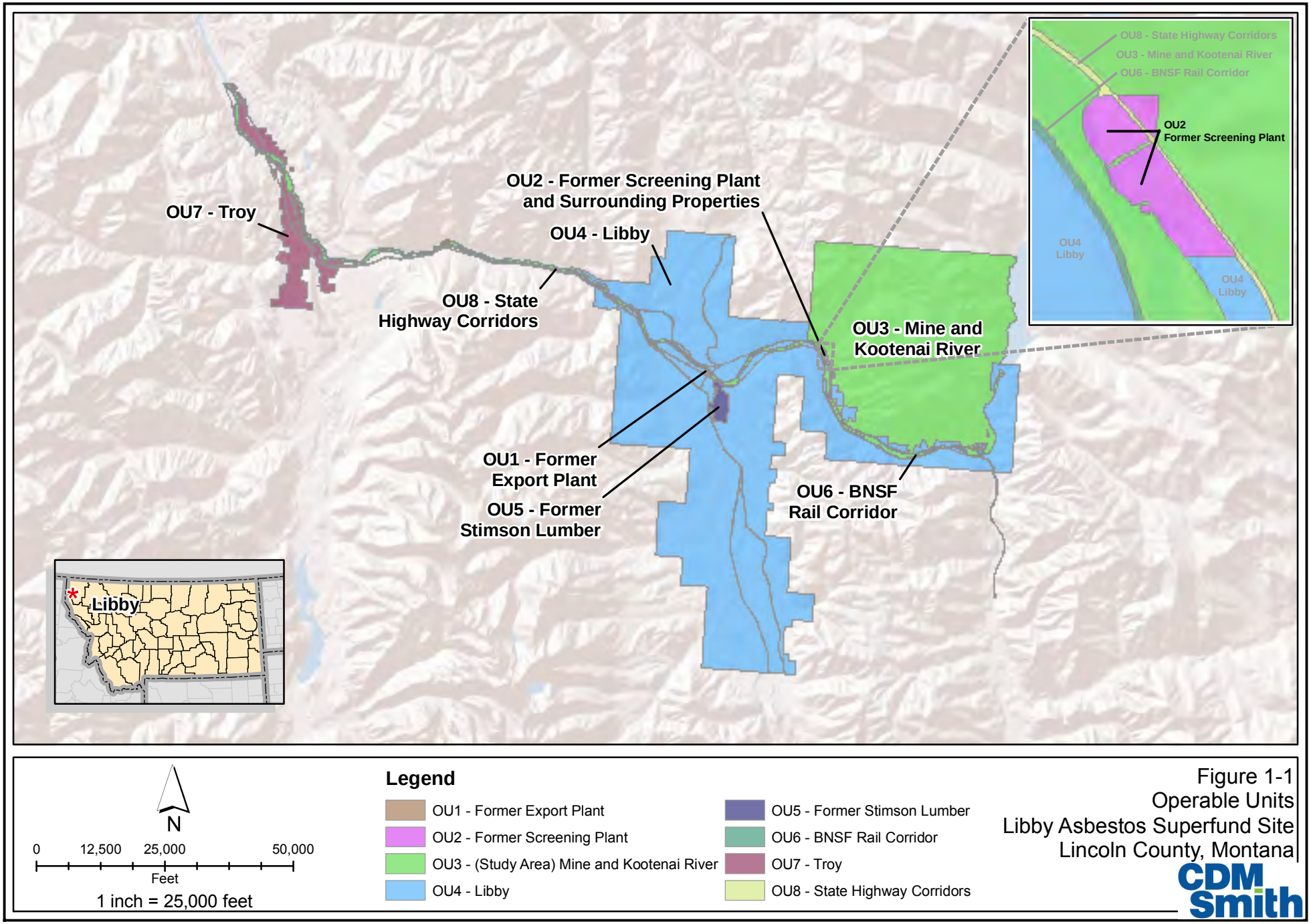
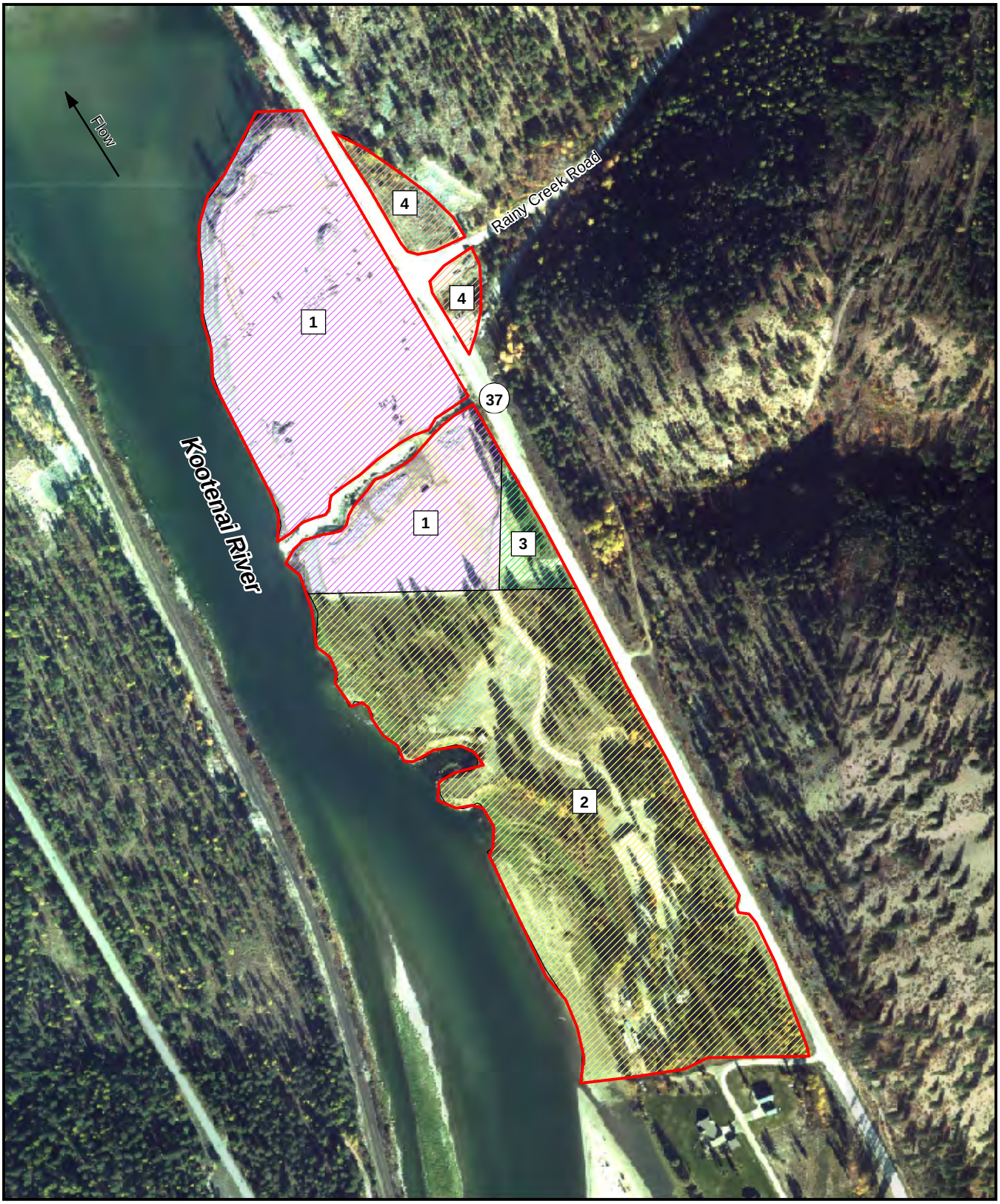


Figure 1-1
Operable Units
Libby Asbestos Superfund Site
Lincoln County, Montana

CDM Smith



Legend

- OU2 Boundary
- Subarea 1 - Former Screening Plant
- Subarea 2 - Flyway
- Subarea 3 - Private Property
- Subarea 4 - Rainy Creek Road Frontages

N

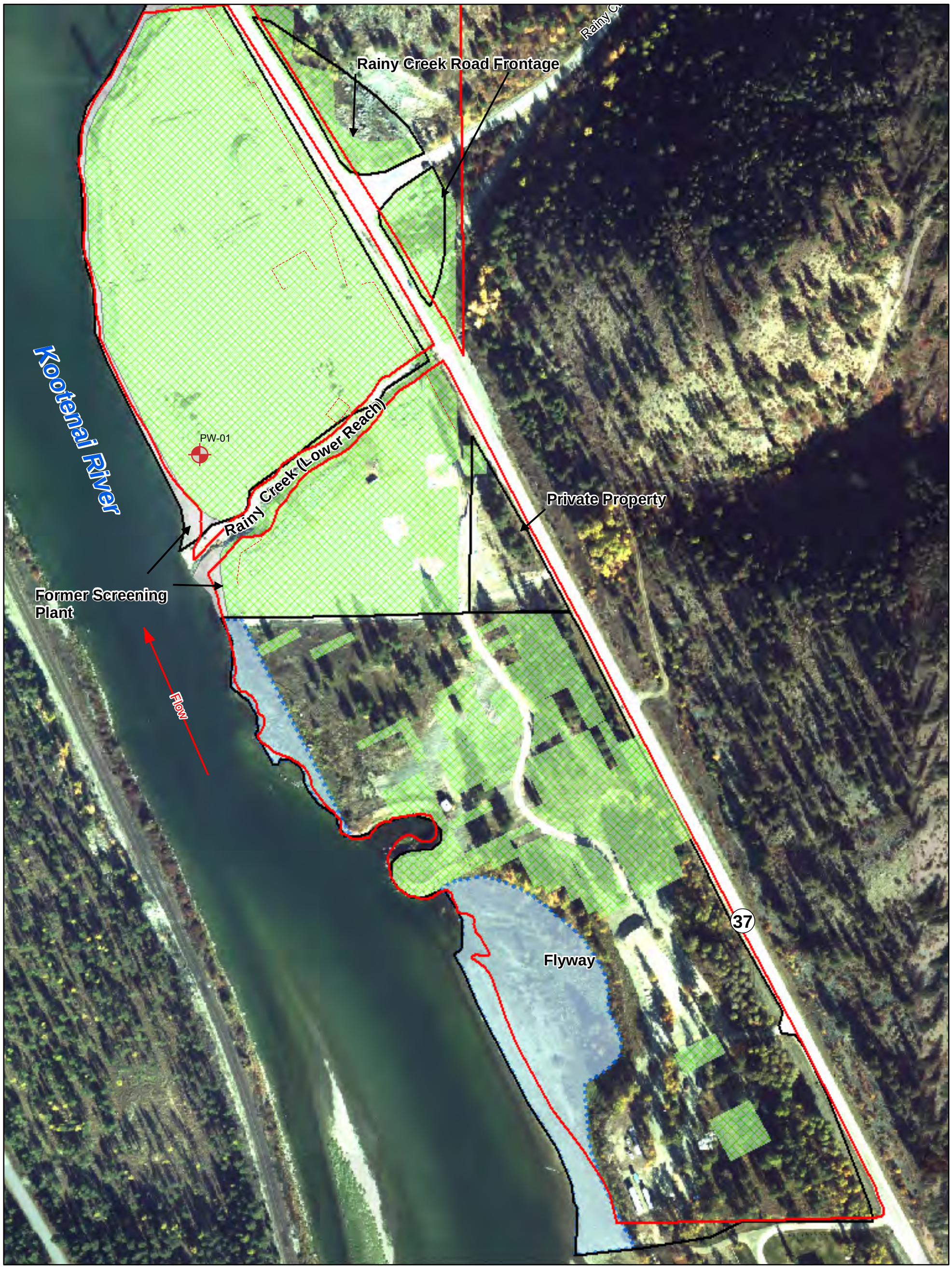
0 200 400 800

Feet

1 inch = 400 feet

Figure 1-2
OU2 Site Layout
Libby Asbestos Superfund Site
Lincoln County, Montana

CDM Smith



N

0 100 200 400

Feet

1 inch = 200 feet

Existing Soil Cover

Seasonally Flooded Areas

Riprap Cap

Well Location

OU2 Subareas

OU2 Boundary

Fence Line

Figure 1-3
Location of Protective Covers and Remedy Components at OU2
Libby Asbestos Superfund Site
Lincoln County, Montana

CDM Smith

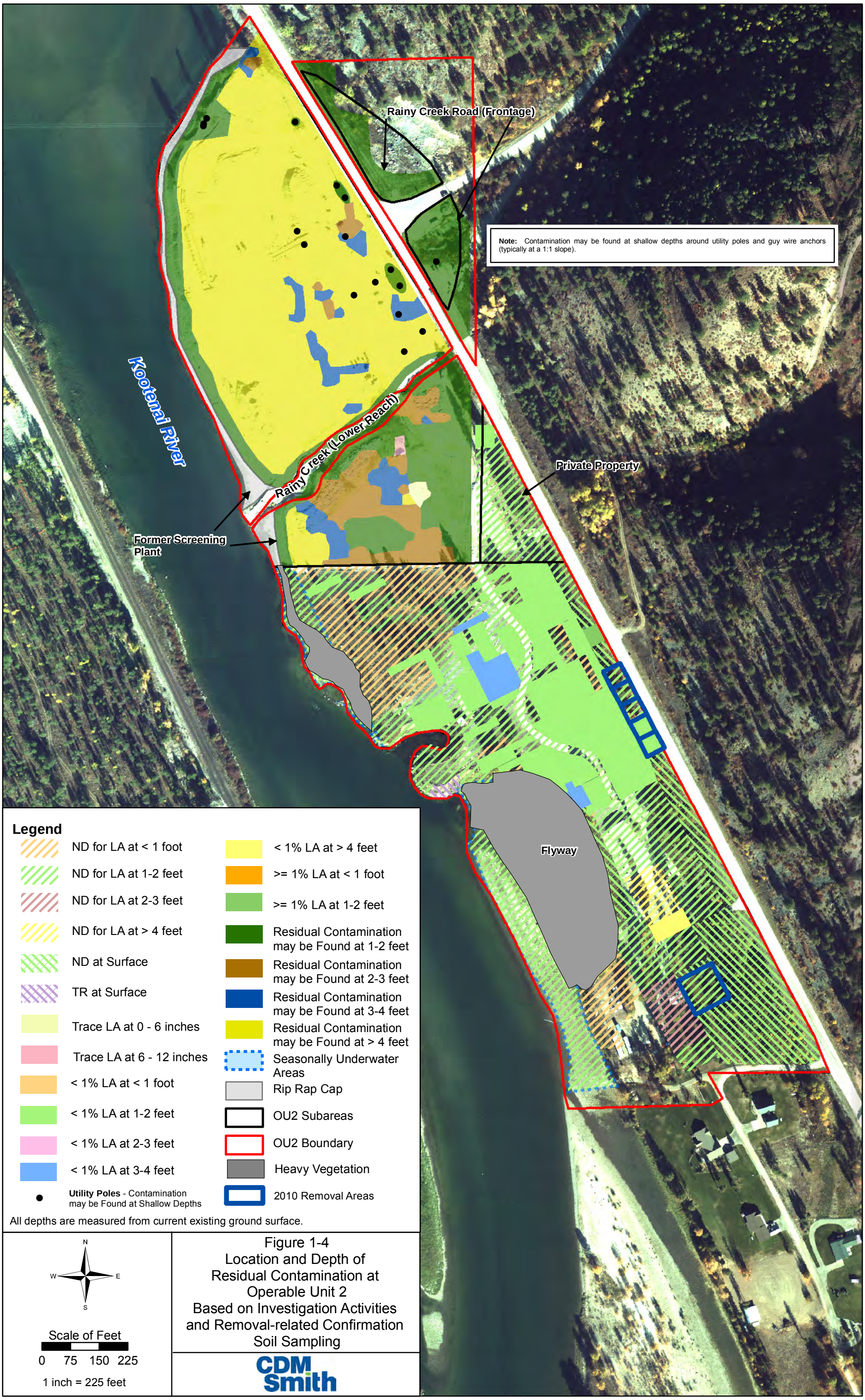


Figure 1-4
Location and Depth of
Residual Contamination at
Operable Unit 2
Based on Investigation Activities
and Removal-related Confirmation
Soil Sampling

CDM Smith

Figure 1-5
Location and Depth of Residual Contamination at OU2 - Parker Property Based on Investigation Activities and Removal-related Confirmation Soil Sampling
Libby Asbestos Superfund Site
Lincoln County, Montana

CDM Smith

N

0 80 160 320

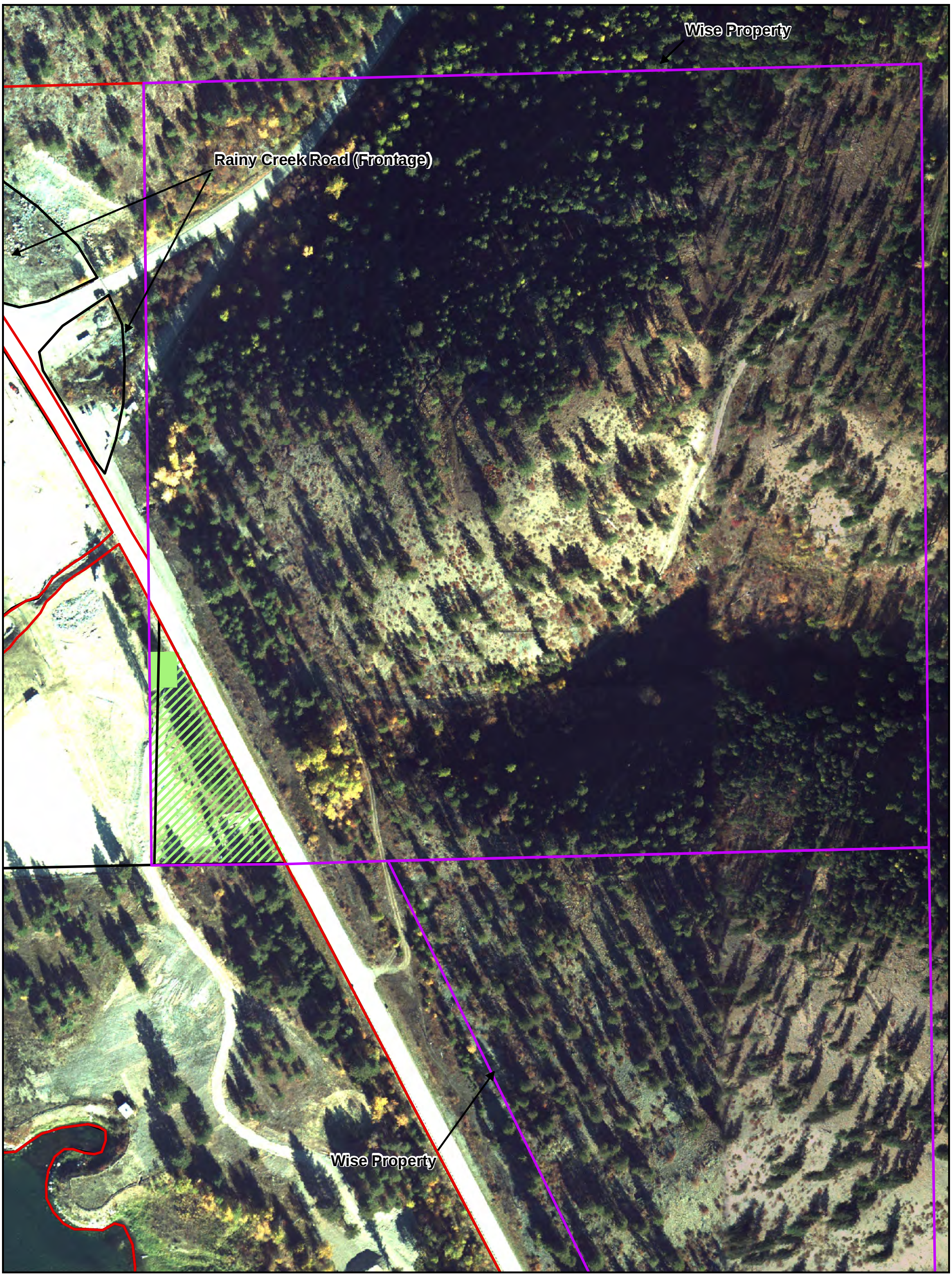
Feet

1 inch = 160 feet

ND for LA at < 1 foot
ND for LA at 1-2 feet
ND for LA at 2-3 feet
ND for LA at > 4 feet
ND at Surface
TR at Surface
< 1% LA at 1-2 feet
< 1% LA at 3-4 feet
< 1% LA at > 4 feet
WR Grace Property
OU2 Subareas
OU2 Boundary
Seasonally Underwater Areas
2010 Removal Areas
L Low Levels of Visual Vermiculite
Heavy Vegetation

Figure 1-6
Location and Depth of Residual Contamination at OU2 - WR Grace Property Based on Investigation Activities and Removal-related Confirmation Soil Sampling
Libby Asbestos Superfund Site
Lincoln County, Montana

CDM Smith



N

0 80 160 320

Feet

1 inch = 160 feet

Legend

- ND for LA at 1-2 feet
- < 1% LA at 1-2 feet
- Wise Property
- OU2 Subareas
- OU2 Boundary

Figure 1-7
Location and Depth of Residual Contamination at OU2 - Wise Property Based on Investigation Activities and Removal-related Confirmation Soil Sampling
Libby Asbestos Superfund Site
Lincoln County, Montana

CDM Smith

Appendix A

Detailed O&M Cost Estimate

Present Value Analysis

TABLE PV-O&M

PRESENT VALUE ANALYSIS

Opinion of Probable Cost
O&M Cost Estimate

Site: OU2 - Former Screening Plant and Surrounding Properties
Location: Lincoln County, Montana
Phase: Operations and Maintenance (O&M)
Base Year: 2012

Calendar Year[1]	Annual O&M Costs (Routine Site Inspection)	Annual O&M Costs (Cover Maintenance-Minor Breaches)	Annual O&M Costs (Evaluating and Updating ICs)	Periodic O&M Costs (Cover Maintenance - Major Breaches)	Periodic Costs (Five-Year Site Reviews)	Total Annual Expenditure (Undiscounted)[2]	Escalation Factor	Escalated Cost[3]	Discount Factor (5.0%)	Present Value (Discounted)[4]
2011	$0	$0	$0	$0	$0	$0	1.0000	$0	1.0000	$0
2012	$2,000	$8,000	$2,000	$0	$0	$12,000	1.0263	$12,315	0.9524	$11,729
2013	$2,000	$8,000	$2,000	$0	$0	$12,000	1.0439	$12,527	0.9070	$11,362
2014	$2,000	$8,000	$2,000	$0	$0	$12,000	1.0606	$12,728	0.8638	$10,994
2015	$2,000	$8,000	$2,000	$0	$50,000	$62,000	1.0797	$66,943	0.8227	$55,074
2016	$2,000	$8,000	$2,000	$21,000	$0	$33,000	1.0992	$36,272	0.7835	$28,419
2017	$2,000	$8,000	$2,000	$0	$0	$12,000	1.1189	$13,427	0.7462	$10,019
2018	$2,000	$8,000	$2,000	$0	$0	$12,000	1.1391	$13,669	0.7107	$9,715
2019	$2,000	$8,000	$2,000	$0	$0	$12,000	1.1596	$13,915	0.6768	$9,418
2020	$2,000	$8,000	$2,000	$0	$50,000	$62,000	1.1805	$73,188	0.6446	$47,177
2021	$2,000	$8,000	$2,000	$21,000	$0	$33,000	1.2017	$39,656	0.6139	$24,345
2022	$2,000	$8,000	$2,000	$0	$0	$12,000	1.2233	$14,680	0.5847	$8,583
2023	$2,000	$8,000	$2,000	$0	$0	$12,000	1.2454	$14,944	0.5568	$8,321
2024	$2,000	$8,000	$2,000	$0	$0	$12,000	1.2678	$15,213	0.5303	$8,068
2025	$2,000	$8,000	$2,000	$0	$50,000	$62,000	1.2906	$80,017	0.5051	$40,417
2026	$2,000	$8,000	$2,000	$21,000	$0	$33,000	1.3138	$43,356	0.4810	$20,854
2027	$2,000	$8,000	$2,000	$0	$0	$12,000	1.3375	$16,050	0.4581	$7,352
2028	$2,000	$8,000	$2,000	$0	$0	$12,000	1.3615	$16,339	0.4363	$7,128
2029	$2,000	$8,000	$2,000	$0	$0	$12,000	1.3861	$16,633	0.4155	$6,911
2030	$2,000	$8,000	$2,000	$0	$50,000	$62,000	1.4110	$87,483	0.3957	$34,617
2031	$2,000	$8,000	$2,000	$21,000	$0	$33,000	1.4364	$47,401	0.3769	$17,866
2032	$2,000	$8,000	$2,000	$0	$0	$12,000	1.4623	$17,547	0.3589	$6,298
2033	$2,000	$8,000	$2,000	$0	$0	$12,000	1.4886	$17,863	0.3418	$6,106
2034	$2,000	$8,000	$2,000	$0	$0	$12,000	1.5154	$18,184	0.3256	$5,921
2035	$2,000	$8,000	$2,000	$0	$50,000	$62,000	1.5426	$95,644	0.3101	$29,659
2036	$2,000	$8,000	$2,000	$21,000	$0	$33,000	1.5704	$51,824	0.2953	$15,304
2037	$2,000	$8,000	$2,000	$0	$0	$12,000	1.5987	$19,184	0.2812	$5,395
2038	$2,000	$8,000	$2,000	$0	$0	$12,000	1.6275	$19,530	0.2678	$5,230
2039	$2,000	$8,000	$2,000	$0	$0	$12,000	1.6568	$19,881	0.2551	$5,072
2040	$2,000	$8,000	$2,000	$0	$50,000	$62,000	1.6866	$104,568	0.2429	$25,399
2041	$2,000	$8,000	$2,000	$21,000	$0	$33,000	1.7169	$56,659	0.2314	$13,111
TOTALS:	$60,000	$240,000	$60,000	$126,000	$300,000	$786,000		$1,067,640		$495,864
					OPINION OF PROBABLE COST FOR O&M[5]	**$786,000**		**$1,068,000**		**$496,000**

Notes:

For cost estimating purposes, O&M costs are presented for a 30-year period after determination of O&F.

However O&M activities are assumed to be required for an indefinite period since OU2 involves a containment remedy.

Costs presented are expected to have an accuracy between +50% to -30% of actual costs based on the scope presented.

This cost accuracy range is consistent with EPA's Remedial Design/Remedial Action Handbook (EPA 1995) for preliminary development of O&M activities and responsibilities.

[1] Duration is assumed to be 30 years for present value analysis.

[2] Total annual expenditure is the total cost per year with no escalation or discounting.

[3] Escalation cost is the total cost per year including an escalation rate for that year. See Table PV-AERFT for details.

[4] Present value is the total cost per year including a 5.0% discount factor for that year. See Table PV-ADRFT for details.

[5] Total cost is rounded to the nearest $1,000. Depreciation is excluded from the present value cost.

TABLE PV-AERFT

ANNUAL ESCALATION RATE FACTORS TABLE

Site: OU2 - Former Screening Plant and Surrounding Properties
Location: Lincoln County, Montana
Phase: Operations and Maintenance (O&M)
Base Year: 2012

Year		Cost Index [1]	Escalation Factor	Year		Cost Index [1]	Escalation Factor
0	2011	756.48	1.0000	26	2037	1209.37	1.5987
1	2012	776.35	1.0263	27	2038	1231.14	1.6275
2	2013	789.71	1.0439	28	2039	1253.30	1.6568
3	2014	802.35	1.0606	29	2040	1275.86	1.6866
4	2015	816.79	1.0797	30	2041	1298.83	1.7169
5	2016	831.49	1.0992				
6	2017	846.46	1.1189				
7	2018	861.69	1.1391				
8	2019	877.20	1.1596				
9	2020	892.99	1.1805				
10	2021	909.07	1.2017				
11	2022	925.43	1.2233				
12	2023	942.09	1.2454				
13	2024	959.05	1.2678				
14	2025	976.31	1.2906				
15	2026	993.88	1.3138				
16	2027	1011.77	1.3375				
17	2028	1029.98	1.3615				
18	2029	1048.52	1.3861				
19	2030	1067.40	1.4110				
20	2031	1086.61	1.4364				
21	2032	1106.17	1.4623				
22	2033	1126.08	1.4886				
23	2034	1146.35	1.5154				
24	2035	1166.98	1.5426				
25	2036	1187.99	1.5704				

Notes:

[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.

TABLE PV-ADRFT

ANNUAL DISCOUNT RATE FACTOR TABLE

Site: OU2 - Former Screening Plant and Surrounding Properties
Location: Lincoln County, Montana
Phase: Operations and Maintenance (O&M)
Base Year: 2012

Discount Rate (Percent): 5.00% 10-year average of 30-year rates

Year	Discount Factor[1,2]	Year	Discount Factor[1,2]
0	1.0000	26	0.2812
1	0.9524	27	0.2678
2	0.9070	28	0.2551
3	0.8638	29	0.2429
4	0.8227	30	0.2314
5	0.7835		
6	0.7462		
7	0.7107		
8	0.6768		
9	0.6446		
10	0.6139		
11	0.5847		
12	0.5568		
13	0.5303		
14	0.5051		
15	0.4810		
16	0.4581		
17	0.4363		
18	0.4155		
19	0.3957		
20	0.3769		
21	0.3589		
22	0.3418		
23	0.3256		
24	0.3101		
25	0.2953		

Notes:

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

[2] The net present value will not be calculated with the real discount rate as recommended by EPA's *Guide to Developing and Documenting Cost Estimates during the Feasibility Study*; rather an inflation rate of 3 percent and a nominal discount (interest) rate of 5 percent (typical of city bonds) was applied separately in the determination of net present value.

TABLE PV-OMB

OMB NOMINAL TREASURY INTEREST RATES

Site: OU2 - Former Screening Plant and Surrounding Properties
Location: Lincoln County, Montana
Phase: Operations and Maintenance (O&M)
Base Year: 2012

Year	3-Year	5-Year	7-Year	10-Year	20-Year	30-Year
1992	6.1%	6.5%	6.7%	7.0%	N/A	7.1%
1993	5.6%	6.0%	6.3%	6.7%	N/A	6.8%
1994	5.0%	5.3%	5.5%	5.7%	N/A	5.8%
1995	7.3%	7.6%	7.7%	7.9%	N/A	8.1%
1996	5.4%	5.5%	5.5%	5.6%	N/A	5.7%
1997	5.8%	5.9%	6.0%	6.1%	N/A	6.3%
1998	5.6%	5.7%	5.8%	5.9%	N/A	6.1%
1999	4.7%	4.8%	4.9%	4.9%	N/A	5.0%
2000	5.9%	6.0%	6.0%	6.1%	N/A	6.3%
2001	5.4%	5.4%	5.4%	5.4%	N/A	5.3%
2002	4.1%	4.5%	4.8%	5.1%	N/A	5.8%
2003	3.1%	3.6%	3.9%	4.2%	N/A	5.1%
2004	3.0%	3.7%	4.2%	4.6%	5.4%	5.5%
2005	3.7%	4.1%	4.4%	4.6%	5.2%	5.2%
2006	4.7%	4.8%	4.9%	5.0%	5.3%	5.2%
2007	4.9%	4.9%	4.9%	5.0%	5.1%	5.1%
2008	4.1%	4.3%	4.4%	4.6%	4.9%	4.9%
2009	2.7%	3.3%	3.7%	4.2%	4.7%	4.5%
2010	2.3%	3.1%	3.5%	3.9%	4.4%	4.5%
2011	1.4%	1.9%	2.4%	3.0%	3.9%	4.2%
2012	1.6%	2.1%	2.5%	2.8%	3.5%	3.8%
20-year Ave.	**5.00%**	**5.00%**	**5.00%**	**7.50%**	**5.00%**	**7.50%**
10-year Ave.	**3.25%**	**3.75%**	**4.00%**	**4.50%**	**4.75%**	**5.00%**

Notes:

- Nominal Treasury interest rates were taken from the annual budget assumptions for the first year of the budget forecast
- Averages rounded to nearest quarter of a percent

N/A - No data is available prior to 2004 for the 20-year interest rate.

Cost Estimate Summary

TABLE CS-O&M

Opinion of Probable Cost
O&M Cost Estimate

COST ESTIMATE SUMMARY

Site: OU2 - Former Screening Plant and Surrounding Properties
Location: Lincoln County, Montana
Phase: Operations and Maintenance (O&M)
Base Year: 2012
Date: June-2012

ANNUAL OPERATIONS AND MAINTENANCE (O&M) COSTS

COVER MAINTENANCE (MINOR BREACHES) (Calendar Years 2012 through 2041)

DESCRIPTION	WORKSHEET	QUANTITY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization/Demobilization for Repair of Minor Breaches	CWOM-7A	1	EA	$696	$696	
Annual Cover Maintenance - Minor Breaches	CWOM-3	1	LS	$5,271	$5,271	Includes labor for cover, and remedy maintenance
SUBTOTAL					$5,967	
Contingency (Scope and Bid)		10%			$597	5% Scope, 5% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$6,564	
Project Management		10%			$656	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Technical Support		15%			$985	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$8,205	
TOTAL ANNUAL O&M COST					**$8,000**	Total O&M cost is rounded to the nearest $1,000.

ANNUAL OPERATIONS AND MAINTENANCE (O&M) COSTS

ROUTINE SITE INSPECTION (Calendar Years 2012 through 2041)

DESCRIPTION	WORKSHEET	QUANTITY	UNIT(S)	UNIT COST	TOTAL	NOTES
Annual Site Inspection	CWOM-4	1	LS	$1,495	$1,495	Includes annual site inspection
SUBTOTAL					$1,495	
Contingency (Scope and Bid)		10%			$150	5% Scope, 5% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$1,645	
Project Management		10%			$165	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Technical Support		15%			$247	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$2,057	
TOTAL ANNUAL O&M COST					**$2,000**	Total O&M cost is rounded to the nearest $1,000.

ANNUAL OPERATIONS AND MAINTENANCE (O&M) COSTS

EVALUATING AND UPDATING INSTITUTIONAL CONTROLS (Calendar Years 2012 through 2041)

DESCRIPTION	WORKSHEET	QUANTITY	UNIT(S)	UNIT COST	TOTAL	NOTES
Evaluating and Updating Institutional Controls	CWOM-1	1	LS	$1,729	$1,729	
SUBTOTAL					$1,729	
Contingency (Scope and Bid)		10%			$173	5% Scope, 5% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$1,902	
Project Management		10%			$190	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Technical Support		15%			$285	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$2,377	
TOTAL ANNUAL O&M COST					**$2,000**	Total O&M cost is rounded to the nearest $1,000.

TABLE CS-O&M

Opinion of Probable Cost
O&M Cost Estimate

COST ESTIMATE SUMMARY

Site: OU2 - Former Screening Plant and Surrounding Properties
Location: Lincoln County, Montana
Phase: Operations and Maintenance (O&M)
Base Year: 2012
Date: June-2012

PERIODIC COSTS

COVER MAINTENANCE (MAJOR BREACHES) (Assumed to be Incurred During Calendar Years 2016, 2021, 2026, 2031, 2036, and 2041)

DESCRIPTION	WORKSHEET	QUANTITY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization/Demobilization for Repair of Major Breaches	CWOM-7B	1	EA	$4,142	$4,142	
Contaminated Soil Excavation and Disposal - Major Breaches	CWOM-5B	1	LS	$2,566	$2,566	
Borrow Material Sampling	CWOM-8	1	LS	$1,974	$1,974	
Cover Maintenance - Major Breaches	CWOM-5A	1	LS	$2,782	$2,782	
Periodic Hydroseeding of Soil Cover - Major Breaches	CWOM-6	1	LS	$2,153	$2,153	
SUBTOTAL					$13,617	
Contingency (Scope and Bid)		10%			$1,362	5% Scope, 5% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$14,979	
Project Management		10%			$1,498	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Construction Management		15%			$2,247	Percentage from Exhibit 5-8 in EPA 540-R-00-002 was used.
Technical Support		15%			$2,247	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$20,971	
TOTAL CAPITAL COST					**$21,000**	Total capital cost is rounded to the nearest $1,000.

PERIODIC COSTS

FIVE-YEAR SITE REVIEW (Calendar Years 2015, 2020, 2025, 2030, 2035, and 2040)

DESCRIPTION	WORKSHEET	QUANTITY	UNIT(S)	UNIT COST	TOTAL	NOTES
Five-Year Site Reviews	CWOM-2	1	LS	$29,810	$29,810	Includes site inspection and 5-year review report
Community Awareness Activities During Five-Year Review	CWOM-9	1	LS	$6,698	$6,698	Includes public notification and meetings associated with 5-year site review
SUBTOTAL					$36,508	
Contingency (Scope and Bid)		10%			$3,651	5% Scope, 5% Bid (Low end of recommended range in EPA 540-R-00-002).
SUBTOTAL					$40,159	
Project Management		10%			$4,016	The high end of the recommended range in EPA 540-R-00-002 was used.
Technical Support		15%			$6,024	Middle value of the recommended range in EPA 540-R-00-002 was used.
TOTAL					$50,199	
TOTAL PERIODIC COST					**$50,000**	Total capital cost is rounded to the nearest $1,000.

Notes:
For cost estimating purposes, O&M costs are presented for a 30-year period after determination of O&F. However O&M activities are assumed to be required for an indefinite period since OU2 involves a containment remedy
Costs presented are expected to have an accuracy between +50% to -30% of actual costs based on the scope presented.
This cost accuracy range is consistent with EPA's Remedial Design/Remedial Action Handbook (EPA 1995) for preliminary development of O&M activities and responsibilities.
Percentages used for contingency and professional/technical services 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).
Abbreviations:
EA Each
LS Lump Sum

Cost Worksheets

TABLE CWOM-1

OU2 Operations and Maintenance (O&M) **Cost Worksheet: CWOM-1**
Capital Cost Sub-Element
Evaluating and Updating Institutional Controls

COST WORKSHEET

Site: OU2 - Former Screening Plant and Surrounding Pr
Location: Lincoln County, Montana
Phase: Operations and Maintenance (O&M)
Base Year: 2012

Prepared By: AS **Date:** 1/27/2011
Checked By: GH **Date:** 2/2/2011

Work Statement:
This sub-element involves annual evaluation and update of the implemented institutional controls at the site. The following cost includes labor and materials to revise legal documents for institutional controls and cost for document submission and recording.

Cost Analysis:
Cost for Evaluating and Updating 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
L6	Environmental Lawyer	4	HR	1.00	$47.46	$47.46	$0.00	$0.00	$0.00	$0.00	$47.46	$189.84	100%	9%	$414	SE SalaryExpert.com	
L15	Paralegal	8	HR	1.00	$36.24	$36.24	$0.00	$0.00	$0.00	$0.00	$36.24	$289.92	100%	9%	$632	SE SalaryExpert.com	
L3	Clerks, Typist, Bookkeeper & Receptionist	4	HR	1.00	$19.31	$19.31	$0.00	$0.00	$0.00	$0.00	$19.31	$77.24	100%	9%	$168	SE SalaryExpert.com	
M11B	Document Submission and Recording Allowance	1	LS	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$515.00	$515.00	$515.00	0%	0%	$515	A Allowance	
												TOTAL UNIT COST:			$1,729		

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 2010), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:

FACTOR:	NOTES:
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sep 2010.
Area Cost Factor	An AF of 0.96 is used for Montana, 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 CWOM-2

OU2 Operation and Maintenance (O&M) **Cost Worksheet: CWOM-2**
Capital Cost Sub-Element
Five-Year Site Reviews

COST WORKSHEET

Site: OU2 - Former Screening Plant and Surrounding Properties **Prepared By:** AS **Date:** 6/6/2012
Location: Lincoln County, Montana
Phase: Operations and Maintenance (O&M) **Checked By:** MS **Date:** 6/7/2012
Base Year: 2012

Work Statement:
This sub-element involves the site visit 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 Review (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
A6C	Site Inspection - 1 Person Crew	1	DY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$395.12	$395.12	$395.12	8%	9%	$465	MII MII Assemblies	
M57	Per Diem for 1 Person	1	DY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$126.69	$126.69	$126.69	0%	0%	$127	GSA www.gsa.gov	
L13	Project Manager	40	HR	1.00	$58.90	$58.90	$0.00	$0.00	$0.00	$0.00	$58.90	$2,356.00	100%	9%	$5,136	SE SalaryExpert.com	Hours for 5-year review report
L5	Environmental Engineer	80	HR	1.00	$38.85	$38.85	$0.00	$0.00	$0.00	$0.00	$38.85	$3,108.00	100%	9%	$6,775	SE SalaryExpert.com	Hours for 5-year review report
L7	Environmental Scientist	120	HR	1.00	$39.14	$39.14	$0.00	$0.00	$0.00	$0.00	$39.14	$4,696.80	100%	9%	$10,239	SE SalaryExpert.com	Hours for 5-year review report
L14	Quality Control Engineer	16	HR	1.00	$40.84	$40.84	$0.00	$0.00	$0.00	$0.00	$40.84	$653.44	100%	9%	$1,424	SE SalaryExpert.com	Hours for 5-year review report
L1	CAD Drafter	40	HR	1.00	$27.69	$27.69	$0.00	$0.00	$0.00	$0.00	$27.69	$1,107.60	100%	9%	$2,415	SE SalaryExpert.com	Hours for 5-year review report
L3	Clerks, Typist, Bookkeeper & Receptionist	40	HR	1.00	$19.31	$19.31	$0.00	$0.00	$0.00	$0.00	$19.31	$772.40	100%	9%	$1,684	SE SalaryExpert.com	Hours for 5-year review report
M10A	Copy and Shipping Allowance	1	LS	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1,545.00	$1,545.00	$1,545.00	0%	0%	$1,545	A Allowance	
												TOTAL UNIT COST:			$29,810		

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 2010), 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	All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sep 2010.
Area Cost Factor	An AF of 0.96 is used for Montana, 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 CWOM-3

OU2 Operation and Maintenance (O&M) **Cost Worksheet: CWOM-3**
Capital Cost Sub-Element
Annual Cover Maintenance - Minor Breaches

COST WORKSHEET

Site: OU2 - Former Screening Plant and Surrounding Properties **Prepared By:** AS **Date:** 6/6/2012
Location: Lincoln County, Montana
Phase: Operations and Maintenance (O&M) **Checked By:** MS **Date:** 6/7/2012
Base Year: 2012

Work Statement:
This sub-element involves O&M of minor breaches in covers placed during the remedial actions and backfilled areas. If the protective cover can be repaired without additional excavation of contaminated soil, it is considered a minor breach of the protective cover. The following cost includes costs for on-site labor, and O&M allowances for site maintenance.

Cost Analysis:
Cost for Soil Cover O&M (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
A7A	Operations and Maintenance Crew	6	DY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$454.57	$454.57	$2,727.42	8%	9%	$3,211	MII MII Assemblies	1 day per alternate month
M49	O&M Allowance	20.00	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$103.00	$103.00	$2,060.00	0%	0%	$2,060	A Allowance	Includes cost for cover maintenance, and erosion repair.
												TOTAL UNIT COST:			$5,271		

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 2010), 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	All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sep 2010.
Area Cost Factor	An AF of 0.96 is used for Montana, 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 CWOM-4

OU2 Operation and Maintenance (O&M) **Cost Worksheet: CWOM-4**
Capital Cost Sub-Element
Annual Site Inspection

COST WORKSHEET

Site: OU2 - Former Screening Plant and Surrounding Properties **Prepared By:** AS **Date:** 6/6/2012
Location: Lincoln County, Montana
Phase: Operations and Maintenance (O&M) **Checked By:** MS **Date:** 6/7/2012
Base Year: 2012

Work Statement:
This sub-element involves the annual site inspection to inspect the integrity of the all the components of the remedy put in place. It includes costs for on-site labor, equipment, materials.

Cost Analysis:
Cost for Annual Site Inspection (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
A6C	Site Inspection - 1 Person Crew	1	DY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$395.12	$395.12	$395.12	8%	9%	$465	MII MII Assemblies	1 day/year
M11	Site Inspection Report Allowance	1	LS	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1,030.00	$1,030.00	$1,030.00	0%	0%	$1,030	A Allowance	
												TOTAL UNIT COST:			$1,495		

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 2010), 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	All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sep 2010.
Area Cost Factor	An AF of 0.96 is used for Montana, 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 CWOM-5A

OU2 Operation and Maintenance (O&M) **Cost Worksheet: CWOM-5A**
Capital Cost Sub-Element
Cover Maintenance - Major Breaches

COST WORKSHEET

Site: OU2 - Former Screening Plant and Surrounding Properties **Prepared By:** AS **Date:** 6/6/2012
Location: Lincoln County, Montana
Phase: Operations and Maintenance (O&M) **Checked By:** MS **Date:** 6/7/2012
Base Year: 2012

Work Statement:
This sub-element involves the periodic repair of major breaches in the covers over contaminated areas. The orange construction fence is a visible marker layer to be placed below the repaired areas, if required. This sub-element includes cost for labor, equipment and material (soil from offsite borrow area).

Cost Analysis:
Cost for Cover Maintenance - Major Breaches (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
	Clean Fill (Subsoil) and Top Soil																
M45	Subsoil, Delivered	100	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$8.61	$0.00	$8.61	$861.00	8%	9%	$1,014	V Vendor Quote	Assume 4 truck loads, Includes purchase and delivery.
M45A	Topsoil Amended, Delivered	25	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$35.10	$0.00	$35.10	$877.50	8%	9%	$1,033	V Vendor Quote	Assume 1 truck loads, Includes purchase and delivery.
	Subsoil Placement Over Contaminated Soil																
A11A	Clean Fill Spreading/Grading	100	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.71	$2.71	$271.00	8%	9%	$319	MII MII Assemblies	
A22A	Clean Fill Compaction - Small Area	100	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.11	$2.11	$211.00	8%	9%	$248	MII MII Assemblies	
M39A	Orange Fence	250	SF	1.00	$0.00	$0.00	$0.00	$0.00	$0.09	$0.00	$0.09	$22.50	8%	9%	$26	V Vendor Quote	Includes purchase and delivery to the Site.
	Topsoil Placement for Cover																
A11A	Clean Fill Spreading/Grading	25	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.71	$2.71	$67.75	8%	9%	$80	MII MII Assemblies	
A22A	Clean Fill Compaction - Small Area	25	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2.11	$2.11	$52.75	8%	9%	$62	MII MII Assemblies	Assume 10% of total fill
												TOTAL UNIT COST:			$2,782		

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 2010), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:

FACTOR:	**NOTES:**
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sep 2010.
Area Cost Factor	An AF of 0.96 is used for Montana, 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 CWOM-5B

OU2 Operation and Maintenance (O&M) **Cost Worksheet: CWOM-5B**
Capital Cost Sub-Element
Contaminated Soil Excavation and Disposal - Major Breaches

COST WORKSHEET

Site: OU2 - Former Screening Plant and Surrounding Properties
Location: Lincoln County, Montana
Phase: Operations and Maintenance (O&M)
Base Year: 2012

Prepared By: AS **Date:** 6/6/2012
Checked By: MS **Date:** 6/7/2012

Work Statement:
This sub-element involves the periodic repair of a soil cover over contaminated areas. A major breach of the protective covers may result in significant exposure to contaminated soil beneath the cover and additional excavation of contaminated materials would be required to secure the disturbed areas so that the protection of human health is maintained and contaminant migration does not occur.

Cost Analysis:
Cost for Contaminated Soil Excavation and Disposal - Major Breaches (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
	Excavation of Contaminated Soil																
A8A	Excavation/Loading - Contaminated Soils	100	BCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9.61	$9.61	$961.00	8%	9%	$1,131	MII MII Assemblies	Assume 4 truck loads
	Hauling and Disposal																
A23A	Hauling Offsite - Former Libby Vermiculite Mine	100	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$6.19	$6.19	$619.00	8%	9%	$729	MII MII Assemblies	Assume 4 truck loads
S3A	Contaminated Soils Handling at the Mine	100	TN	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$6.00	$6.00	$599.50	8%	9%	$706	V Vendor Quote	
												TOTAL UNIT COST:			$2,566		

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 2010), 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.
Escalation to Base Year	MII assembly costs include HPF adjustments.
Area Cost Factor	All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sep 2010.
Subcontractor Overhead and Profit	An AF of 0.96 is used for Montana, except that an AF of 1.00 (national unmodified average) is used for MII assembly costs and local vendor quotes.
Prime Contractor 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.
	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 CWOM-6

OU2 Operation and Maintenance (O&M) **Cost Worksheet: CWOM-6**
Capital Cost Sub-Element
Periodic Hydroseeding of Soil Cover - Major Breaches

COST WORKSHEET

Site: OU2 - Former Screening Plant and Surrounding Properties
Location: Lincoln County, Montana
Phase: Operations and Maintenance (O&M)
Base Year: 2012

Prepared By: AS **Date:** 6/6/2012
Checked By: MS **Date:** 6/7/2012

Work Statement:
This sub-element involves the revegetation of the soil cover and excavation backfill area with hydroseeding. It includes costs for labor, material, and equipment.

Cost Analysis:
Cost for Periodic Hydroseeding of Soil Cover (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
	Hydroseeding																
A30A	Hydro-Seeding Crew	1.00	ACR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$86.69	$86.69	$86.69	8%	9%	$102	MII MII Assemblies	
M20	Seed, Hydromulch with Fertilizer	43,560	SF	1.00	$0.00	$0.00	$0.00	$0.00	$0.04	$0.00	$0.04	$1,742.40	8%	9%	$2,051	CW09 32 92 1914 3100	Includes material
												TOTAL UNIT COST:			$2,153		

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 2010), 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	All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sep 2010.
Area Cost Factor	An AF of 0.96 is used for Montana, 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 CWOM-7A

OU2 Operation and Maintenance (O&M) **Cost Worksheet: CWOM-7A**
Capital Cost Sub-Element
Mobilization/Demobilization for Repair of Minor Breaches

COST WORKSHEET

Site: OU2 - Former Screening Plant and Surrounding Properties
Location: Lincoln County, Montana
Phase: Operations and Maintenance (O&M)
Base Year: 2012

Prepared By: AS **Date:** 6/6/2012
Checked By: MS **Date:** 6/7/2012

Work Statement:
This sub-element involves mobilization and demobilization of all the required equipment to and from the site respectively.

Cost Analysis:
Cost for Mobilization/Demobilization (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
A37C	Mobilization and Demobilization - Small Equipment	2	EA	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$295.53	$295.53	$591.06	8%	9%	$696	MII MII Assemblies	
												TOTAL UNIT COST:			$696		

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 2010), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:

FACTOR:	NOTES:
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sep 2010.
Area Cost Factor	An AF of 0.96 is used for Montana, 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 CWOM-7B

OU2 Operation and Maintenance (O&M) **Cost Worksheet: CWOM-7B**
Capital Cost Sub-Element
Mobilization/Demobilization for Repair of Major Breaches

COST WORKSHEET

Site: OU2 - Former Screening Plant and Surrounding Properties
Location: Lincoln County, Montana
Phase: Operations and Maintenance (O&M)
Base Year: 2012

Prepared By: AS **Date:** 6/6/2012
Checked By: MS **Date:** 6/7/2012

Work Statement:
This sub-element involves mobilization and demobilization of all the required equipment to and from the site respectively.

Cost Analysis:
Cost for Mobilization/Demobilization (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
A37C	Mobilization and Demobilization - Small Equipment	2	EA	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$295.53	$295.53	$591.06	8%	9%	$696	MII MII Assemblies	
A37D	Mobilization and Demobilization - Self-Propelled Equipment	2	EA	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1,463.50	$1,463.50	$2,927.00	8%	9%	$3,446	MII MII Assemblies	
												TOTAL UNIT COST:			$4,142		

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:

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	All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sep 2010.
Area Cost Factor	An AF of 0.96 is used for Montana, 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 CWOM-8

OU2 Operation and Maintenance (O&M) **Cost Worksheet: CWOM-8**
Capital Cost Sub-Element
Borrow Material Sampling

COST WORKSHEET

Site: OU2 - Former Screening Plant and Surrounding Properties **Prepared By:** AS **Date:** 6/6/2012
Location: Lincoln County, Montana
Phase: Operations and Maintenance (O&M) **Checked By:** MS **Date:** 6/7/2012
Base Year: 2012

Work Statement:
This sub-element involves determining whether asbestos fibers are present in the borrow source. The following includes the labor, material and equipment cost, and shipping cost required for the borrow material sampling.

Cost Analysis:
Cost for Borrow Material Sampling (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
A4A	Sampling - 2 Person Crew	1	DY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$834.93	$834.93	$834.93	8%	9%	$983	MII MII Assemblies	
M50	Soil Sample Analysis (PLM-VE)	1	EA	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$27.25	$27.25	$27.25	8%	9%	$32	P Previous Work	
M50A	Soil Sample Analysis (Stereomicroscopy)	1	EA	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$27.25	$27.25	$27.25	8%	9%	$32	P Previous Work	
M54D	Sample Shipping Allowance	1	LS	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$515.00	$515.00	$515.00	8%	9%	$606	A Allowance	
M53D	Sampling/Other Supplies	1	LS	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$272.50	$272.50	$272.50	8%	9%	$321	P Previous Work	
												TOTAL UNIT COST:			$1,974		

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 2010), 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	All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sep 2010.
Area Cost Factor	An AF of 0.96 is used for Montana, 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 CWOM-9

OU2 Operation and Maintenance (O&M) **Cost Worksheet: CWOM-9**
Capital Cost Sub-Element
Community Awareness Activities During Five-Year Review

COST WORKSHEET

Site: OU2 - Former Screening Plant and Surrounding Properties **Prepared By:** AS **Date:** 6/6/2012
Location: Lincoln County, Montana
Phase: Operations and Maintenance (O&M) **Checked By:** MS **Date:** 6/7/2012
Base Year: 2012

Work Statement:
This sub-element involves setting up a community meeting to inform the local community about the status of Former Screening Plant site during 5-year reviews. The following includes the labor, material and other cost required for setting up the community awareness meeting which includes costs for renting a meeting hall, court reporter, and publishing and sending notices or informational flyers.

Cost Analysis:
Cost for Community Awareness Activities (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
L12	General Superintendent (P.M.)	16	HR	1.00	$59.56	$59.56	$0.00	$0.00	$0.00	$0.00	$59.56	$952.96	100%	9%	$2,077	SE SalaryExpert.com	8 hrs per day
L13	Project Manager	16	HR	1.00	$58.90	$58.90	$0.00	$0.00	$0.00	$0.00	$58.90	$942.40	100%	9%	$2,054	SE SalaryExpert.com	8 hrs per day
M56	Per Diem for 2 Person	2	DY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$253.38	$253.38	$506.76	0%	0%	$507	GSA www.gsa.gov	
M65	Community Awareness Activities Allowance	1	EA	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2,060.00	$2,060.00	$2,060.00	0%	0%	$2,060	A Allowance	1 meeting per 5-yr review.
												TOTAL UNIT COST:			$6,698		

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 2010), P (Previous Work), and FRTR (www.frtr.gov)

Cost Adjustment Checklist:

FACTOR:	**NOTES:**
H&S Productivity (labor and equipment only)	MII assembly costs include HPF adjustments.
Escalation to Base Year	All other costs are escalated based on the USACE CWCCIS, EM 1110-2-1304, Sep 2010.
Area Cost Factor	An AF of 0.96 is used for Montana, 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

Appendix B

Recommended Annual O&M Checklist

RECOMMENDED ANNUAL O&M /REMEDY EVALUATION CHECKLIST

Introduction and Purpose

Effective operation and maintenance (O&M) at Superfund sites generally is critical to ensure that remedies remain protective of human health and the environment.

The recommended Annual O&M Remedy Evaluation Checklist has been designed to help the Remedial Project Manager (RPM) capture data routinely collected during O&M in a way that can better evaluate the efficiency and effectiveness of the remedial action. This recommended checklist may also be used to evaluate an operating remedy prior to transferring the site to the State for O&M. In addition, remedy performance summarized using this recommended checklist can be used to communicate remedy progress to the local community, highlight potential issues before they become problems and help the RPM complete five-year reviews more efficiently.

The information that you collect using this recommended form should help you answer the following questions:

- Is the remedy achieving the remedial action objectives (RAOs), maintaining cleanup goals and/or achieving technology-specific performance goals?
- If the remedy is not achieving the established objectives and goals, what must I do to correct this and how can I document this?
- If the remedy is achieving the performance goals, objectives and performance standards, are there any opportunities to optimize the remedy to make it work more efficiently?

This recommended checklist is intended to be completed annually. It is recommended that any data that you use to complete this evaluation be attached to the checklist, as this will make completing the next year's evaluation easier.

This recommended checklist does not recommend the level of review carried out in the U.S. Environmental Protection Agency (EPA) five-year review process. However the recommended checklist contains review elements that are consistent with a five-year review process.

Instructions:

The recommended checklist is in Microsoft Word and was designed to be completed electronically. Most questions involve a short answer, yes/no response or simply checking the box. Questions that involve a short answer will have an expandable text box. For responses that ask to you to "select one," please double click on "select one" and choose the correct answer. If the information is not available for a particular question, please indicate this with a N/A. A site visit is strongly encouraged, but not required prior to completing the recommended checklist.

1. This evaluation is intended to be completed yearly once O&M activities have begun at a site and can be stored and maintained in an electronic format.
2. For large complex sites, consider completing a separate checklist for each Operable Unit (OU).
3. This evaluation should be based on information and documentation (e.g., O&M reports and monitoring data) that is readily available to the RPM.
4. Section VIII, "Technical Data and Remedy Performance," provides specific instructions regarding what data and information are important for this section. Data entered in Section VIII are used to evaluate the specific technology used in that remedial action (RA). Please note: *Section VIII, Appendix E, Other Remedy Types/Components* was designed to be used by the RPM for the annual review of O&M remedies and remedy components that are not addressed in Appendices A through D or by the separate *Recommended Annual O&M Remedy Evaluation Checklist for Contaminated Sediment Remedies*, OSWER #9355.0-118.
5. When you have completed the recommended checklist, please sign and date page 1 and place the completed document in the site file. Additionally, we recommend that you save the completed checklist electronically for use in completing the next year's evaluation.

Generally, including the Recommended Annual O&M/Remedy Evaluation Checklist in the site repository can provide the community with information about O&M status and remedy performance and can demonstrate that the Region is tracking performance to ensure that the remedy remains protective.

Acronym List			
AS	Air Sparging	PCOR	Preliminary Close Out Report
CSM	Conceptual Site Model	PRGs	Preliminary Remediation Goals
GAC	Granular Activated Carbon	PRP	Potentially Responsible Party
ICs	Institutional Controls	RAO	Remedial Action Objective
LEL	Lower Explosive Limit	ROD	Record of Decision
LTRA	Long-Term Response Action	RPM	Remedial Project Manager
MNA	Monitored Natural Attenuation	RSE	Remediation System Evaluation
NPL	National Priorities List	SVE	Soil Vapor Extraction
O&F	Operational and Functional	TI Waivers	Technical Impracticability Waivers
O&M	Operation and Maintenance	USACE	U.S. Army Corps of Engineers
OSHA	Occupational Safety and Health Administration	VEB	Vertical Engineered Barrier
OU	Operable Unit	VOCs	Volatile Organic Compounds

RECOMMENDED ANNUAL O&M /REMEDY EVALUATION CHECKLIST

Please save electronically and send this completed checklist and any attachments to the site file and site repository.

I. SIGNATURES AND APPROVALS					
RPM			**RPM (If appropriate)**		
Name:			Name:		
Telephone:			Telephone:		
Signature:		Date:	Signature:		Date:
State Contact (if appropriate)					
Name:					
Telephone:					
Signature:					Date:

II. GENERAL SITE INFORMATION			
Site Name:			
State:			
Period Covered:	to		EPA Site ID:
Site Lead:	(Select one)	Other, specify:	
Organization responsible for O&M operations:		(Select one)	
Other, specify:			
Site Remedy Components (ref. Section VIII):			
Preliminary Close Out Report (PCOR) date:			
Operational & Functional (O&F) date:			
Last five-year review date:			
NPL deletion date:			
Did you make a site visit during this review?	☐ Yes ☐ No		Date:
If no, why:			
Date of next planned checklist evaluation:			
Location of Administrative Record/Site Files:			
During the site visit, was monitoring equipment operational?			☐ Yes ☐ No ☐ N/A
Please elaborate:			
Has an Optimization Study been conducted at the site?	☐ N/A ☐ Yes ☐ No		Date:
If not, is one planned?			

List all site events since the last evaluation that impact or may impact remedy performance.
Chronology of events since last report (e.g., site visits, receipt of reports, equipment failures, shutdowns, vandalism, storm events):
Elaborate on significant site events or visits to site:

III. DOCUMENTS AND RECORDS Because these documents may be required for the five-year review, verify what documents are currently available on-site, or note off-site location:				
Document	**Required**	**Not required**	**On-site**	**Off-site (indicate where)**
O&M Manual	☐	☐	☐	☐
O&M Maintenance Logs	☐	☐	☐	☐
O&M Annual Reports	☐	☐	☐	☐
RA as-built drawings modified during O&M	☐	☐	☐	☐
Site-Specific Health and Safety Plan	☐	☐	☐	☐
Contingency/Emergency Response Plan	☐	☐	☐	☐
O&M/Occupational Safety and Health Administration (OSHA) Training Records	☐	☐	☐	☐
Settlement Monument Records	☐	☐	☐	☐
Gas Generation Records	☐	☐	☐	☐
Ground Water Monitoring Records	☐	☐	☐	☐
Surface Water/Sediment/Fish Monitoring Records**	☐	☐	☐	☐
Cap/Cover System Inspection Records	☐	☐	☐	☐
Leachate Extraction Records	☐	☐	☐	☐
Discharge Compliance Records	☐	☐	☐	☐
Institutional Controls (ICs) Review	☐	☐	☐	☐
Other(s) (Please name each)	☐	☐	☐	☐
	☐	☐	☐	☐
	☐	☐	☐	☐
	☐	☐	☐	☐
	☐	☐	☐	☐

** Note: A separate O&M checklist has been developed for surface water/sediment remedies. For completeness, answer this question regarding documentation requirements and availability, and enter more detailed information in the surface water/sediment checklist.

IV. ADMINISTRATIVE ISSUES Check all that apply:	Date Initiated:
☐ Explanation of Significant Differences in progress	
☐ Record of Decision (ROD) Amendment in progress	
☐ Site in O&F period	
☐ Long-Term Response Action (LTRA) in progress	
☐ LTRA Transition to O&M in progress	
☐ Notice of Intent to Delete site in progress	
☐ Partial Site Deletion in progress	
☐ Technical Impracticability (TI) Waivers in progress	
☐ Reuse Assessment or Reuse Plan in progress	
☐ Revised Risk Assessment in progress ☐ Ecological OR ☐ Human Health	
☐ Other administrative issues:	

VI. O&M COSTS The purpose of this section is to document what is known about O&M costs for this site. It is realized that not all cost information will be readily available, but to the extent possible, please provide the following information, as this will help identify cost increases and flag potential budget issues before they arise.	
What was the total annual O&M cost for the previous year?	
What is the expected total annual O&M cost for the upcoming year?	
Please provide an approximate breakout of the previous year's O&M costs below.	**Use either $ or %**
Analytical (e.g., lab costs):	
Materials (e.g., treatment chemicals, cap materials):	
Oversight (e.g., project management):	
Monitoring (e.g., ground water sampling):	
Utilities (e.g., electric, gas, phone, water):	
ICs (implementation and enforcement):	
Other (e.g., capital improvements, equipment repairs):	
Describe any unanticipated/unusually high or low O&M costs and potential future O&M funding issues.	

VII. INSTITUTIONAL CONTROLS (ICs)**

The purpose of the IC evaluation at the O&M phase is to determine if the ICs are implemented, effective and durable. The following references may be useful for completing this evaluation:

- *Institutional Controls Bibliography: Institutional Control, Remedy Selection, and Post Construction Completion Guidance and Policy* (OSWER 9355.0110, December 2005);
- *Supplement to the Comprehensive Five-Year Review Guidance; Evaluation of Institutional Controls* (OSWER 9355.7-12, working draft 3/17/05);
- *National IC Strategy to Ensure Institutional Controls Implementation at Superfund Sites* (OSWER 9355.0-106, September 2004); and
- *Institutional Controls: A Site Manager's Guide to Identifying, Evaluating and Selecting Institutional Controls at Superfund and RCRA Corrective Action Cleanup* (OSWER 9355.0-7-4FS-P, September 2000).

** Note: A separate O&M checklist has been developed for surface water/sediment remedies. For completeness, answer this question regarding ICs, and enter more detailed information in the surface water/sediment checklist.

Identify each IC (media, objective, and instrument) implemented/to be implemented at the site. Attach an extra sheet if necessary.	
Are the ICs adequate to minimize the potential for human exposure and protect the integrity of the remedy? If no, please explain.	☐ Yes ☐ No
Please identify the party responsible for compliance and enforcement of the IC.	
Please describe what the ICs are intended to accomplish, who they are designed to inform, the source document for the IC, and where the IC information is located.	
Please identify the date when the ICs were implemented. If the ICs have yet to be implemented, please identify the party responsible for implementing the ICs and the scheduled implementation date.	
If the ICs have been implemented, are they still in place? If the ICs remain in place, please identify whether there is a planned termination date and, if so, what it is.	
Are there reasons to clarify or modify the appropriate decision document(s) to improve the effectiveness and/or durability of the ICs? If yes, please explain and describe any plans to clarify/modify the document(s).	☐ Yes ☐ No

VIII. TECHNICAL DATA AND REMEDY PERFORMANCE

The purpose of this section is to help prompt questions about remedy performance over the past year, the adequacy of monitoring activities to assess remedy performance, and changes in field conditions or understanding that could affect the remedy. Specific sections also prompt questions about remedy optimization. Addressing these questions on an annual basis can help to flag opportunities and potential issues to watch in the coming year and help inform future improvements in remedy O&M. The collection of annual checklists can also serve as documentation of when a potential issue was first identified, what was done to address it, and when it was addressed. Thus, an annual checklist can be a useful, succinct source of information to help RPMs recount O&M history.

Questions for specific remedy types (e.g., ground water pump-and-treat) are contained in Appendices A through D at the end of the form. Appendix E contains general questions that can be used to document technical data and remedy performance for remedies and remedy components that do not fit within the specific categories identified in the remainder of this checklist. Identify the remedy types in Section VIII.A, below, and complete a copy of each appendix that is applicable to the site. If the site includes multiple remedies or remedy components of the same type, please complete a copy of the applicable appendix for each remedy/component (e.g., if the remedy includes two separately managed containment areas, complete two copies of Appendix C, one for each area). A separate O&M checklist has been developed for surface water/sediment remedies and remedy components. If the site includes a surface water/sediment remedy, note this below and complete the surface water/sediment checklist.

A. Please identify the type(s) of remedy(ies) this Annual O&M Remedy Evaluation Checklist addresses:

- ☐ Ground Water Pump-and-Treat (please complete Appendix A)
- ☐ Ground Water Monitored Natural Attenuation (MNA) (please complete Appendix B)
- ☐ Ground Water or Soil Containment (please complete Appendix C)
- ☐ Soil Vapor Extraction/Air Sparging (please complete Appendix D)
- ☐ Other Remedy Types (please complete Appendix E)

IX. RECOMMENDATIONS

New Recommendations, from this annual review:

Recommendation	Party Responsible	Milestone Date

APPENDICES

TECHNICAL DATA AND REMEDY PERFORMANCE ANNUAL O&M /REMEDY EVALUATION CHECKLIST

RECOMMENDED APPENDIX A. GROUND WATER PUMP-AND-TREAT REMEDIES

The following checklist is an abbreviated set of questions that could be used by an EPA RPM for annually reviewing the O&M of a ground water pump-and-treat remedy, including pump-and-treat remedies designed for hydraulic containment. This checklist was developed using concepts presented in EPA guidance, *Elements for Effective Management of Operating Pump and Treat Systems* (EPA 542-R-02-009, December 2002). This guidance is part of a series of fact sheets that EPA OSRTI has prepared as guidance to the ground water remediation community on effectively and efficiently designing and operating long-term ground water remedies. For more information, including the guidance *O&M Report Template for Ground Water Remedies (with Emphasis on Pump and Treat Systems)* (EPA 542-R-05-010, April 2005) and report *Pilot Project to Optimize Superfund-Financed Pump and Treat Systems: Summary Report and Lessons Learned* (EPA 542-R-02-008a), visit EPA's CLU-IN Website (www.cluin.org/).

A. Remedy Goals and Conceptual Site Model (CSM)

1. Review of the current remedy goals and measurements: Remedy goals may be expressed in terms of a broad, long-term purpose or intent specified in a decision document (e.g., cleanup to a specified concentration), a performance-based metric or milestone intermediate in duration (e.g., a 20% decrease in monthly influent concentrations within 24 months of operation); or a specific and short-term objective (e.g., demonstration of plume containment).

List the short-term objectives and intermediate system goals:	
List the final system goals:	
What metrics (performance criteria) are being implemented to measure project progress towards meeting each goal?	
What schedule has been established for measuring and reporting each metric?	
Based on new information or events since the last O&M review, is there a reason to re-evaluate the system goals? Note: this might be due to factors such as regulatory framework has been revised; better technology/strategy alternatives available; existing goals appear unrealistic; costs greater than originally anticipated; extent of plume has changed; new sources of contamination removed and/or discovered; or land use or ground water production near site has changed. If yes, identify the remedy goals that should be re-evaluated, the rationale, and any plans for re-evaluating the goals.	☐ Yes ☐ No

2. Review of changes to the CSM: The CSM is a combination of text and figures that describe the hydrogeologic system, the cause of the ground water impacts, and the fate and transport of the ground water contaminants. If monitoring data during active remediation do not agree with expectations, this could point to a gap in the conceptual model that should be addressed with a focused investigation. This does not imply a return to the "remedial investigation" phase. The CSM should evolve over time, including during active remediation, as more information about the site becomes available. The following questions may be used to evaluate the need for updating the CSM:

Since the last time you completed the O&M checklist for this system, have new contaminant sources been identified or have previously suspected contaminant sources been eliminated from further consideration? If yes, use this space to comment.	☐ Yes ☐ No
Since the last time you completed an O&M checklist for this system, have new contaminants been identified in the ground water that could affect remedy effectiveness? If yes, use this space to comment.	☐ Yes ☐ No
Based on your answers to the above questions, would it be useful to update the CSM at this time?	☐ Yes ☐ No

If yes, please describe any plans to update the CSM.	

B. Remedy Performance Assessment

1. Evaluate remedy effectiveness: The following questions are intended to review whether the ground water pump-and-treat remedy is performing as intended and whether there are opportunities for optimizing the remedy.

Plume Capture

When addressing these questions, it may be useful to refer to *A Systematic Approach for Evaluation of Capture Zones at Pump and Treat Systems* (EPA 600/R-08/003, January 2008).

Has a three-dimensional target capture zone been clearly defined? If no, use this space to explain why not.	☐ Yes ☐ No
If not clearly defined, describe plans to better define the target capture zone.	
What lines of evidence have been used to evaluate actual capture achieved (e.g., flow budget and/or capture zone width calculations, potentiometric surface maps, water elevation pairs, concentration trends at wells beyond the target capture zone, particle tracking in conjunction with ground water modeling, tracer tests)	

System Equipment/Structures (e.g., extraction wells, collection systems)

Since the last time you completed an O&M checklist for this system, has the downtime associated with non-routine operations and maintenance exceeded expectations? If yes, what systems have been responsible for unplanned downtime (e.g., extraction pumps, wastewater facilities)? If yes, what corrections have been or are being made to minimize downtime?	☐ Yes ☐ No
Since the last time you completed the O&M checklist for this remedy/remedy component, have any major repairs to the pump-and-treat system(s) been required? If yes, describe the repairs, their impact on progress toward remediation milestones, and actions taken to minimize similar repairs in the future.	☐ Yes ☐ No
Since the last time you completed an O&M checklist for this system, have the extraction/injection well rates changed significantly? If yes, describe the known/suspected source of the change, if identified. If yes, is the change reflective of a long-term condition and, if so, how will this be addressed in the O&M of the system?	☐ Yes ☐ No
Since the last time an O&M checklist was completed for this system, have air emissions from the system met permit requirements, if any? If not, what is being done to meet the permit requirements?	☐ Yes ☐ No ☐ N/A
Since the last time an O&M checklist was completed for this system, has effluent discharge met permit requirements? If not, what was (is) the problem and what was (or will be) done to correct it?	☐ Yes ☐ No

Optimization

Has an optimization study been conducted for this system?	☐ Yes ☐ No
If an optimization study has been conducted, have any of the optimization recommendations been implemented since the last time an O&M checklist was completed for this system?	☐ Yes ☐ No ☐ N/A
If optimization recommendations have been implemented (during this or prior review periods), describe any new results observed or conclusions drawn since the last time an O&M checklist was completed for this system.	
If optimization recommendations have not been implemented, why not?	

2. Evaluate collection and analysis of performance monitoring data	
Do the approaches used to interpret ground water monitoring data (e.g., concentration trend analyses, plume contour and/or bubble maps, plume cross-sections, potentiometric surface maps) provide adequate information to assess the performance of the pump-and-treat remedy? If no, describe plans, if any, to implement new approaches.	☐ Yes ☐ No
Based on information collected since the last O&M review, is there a need to re-evaluate the parameters, sampling methods, sampling frequency, and monitoring locations used to evaluate remedy performance?	☐ Yes ☐ No
Are ground water data managed electronically? If no, use this space to explain why not.	☐ Yes ☐ No
Are performance-monitoring reports of sufficient quality and frequency to evaluate the efficacy of the remedy and recognize protectiveness problems in time for effective action? If no, what actions, if any, have been taken or are planned to address this situation?	☐ Yes ☐ No
C. Cost Effectiveness	
Are actual parameters consistent with design parameters (based on process monitoring)? If not, how do they differ? (check all that apply) ☐ Influent rate to treatment plant ☐ Influent concentrations ☐ Mass loading to the system ☐ Removal efficiency for each treatment component ☐ Air to water ratio (air strippers) ☐ Materials usage (e.g., granular activated carbon (GAC), chemicals) ☐ Other (please explain)	☐ Yes ☐ No
Based on the above comparisons, have any above ground systems or process monitoring procedures been evaluated/implemented to reduce costs? If yes, please identify which of the following have been done to reduce costs. (check all that apply) ☐ Ensuring proper maintenance and efficiency of equipment ☐ Replacing treatment components with alternate technologies (e.g., replace UV/Oxidation with air stripping) or more appropriately sized components ☐ Eliminating unnecessary or redundant treatment components that are no longer needed (e.g., metals removal or GAC polishing system) ☐ Changing discharge ☐ Automating system to reduce labor ☐ Optimizing ground water extraction rates and/or locations ☐ Other (please explain)	☐ Yes ☐ No
D. Remedial Decisions: Indicate which of the following remedial decisions is appropriate at the present time and provide the basis for the decision.	
☐ No Change to the System ☐ Modify/Optimize System ☐ Modify/Optimize Monitoring Program ☐ IC Modifications ☐ Implementation of Contingency/Alternative Remedy	
Basis for decision:	

RECOMMENDED APPENDIX B. GROUND WATER MONITORED NATURAL ATTENUATION (MNA) REMEDIES

The following checklist is an abbreviated set of questions that could be used by an EPA RPM for annually reviewing the O&M of a MNA remedy for ground water. This MNA guidance checklist was developed using concepts presented in EPA guidance, *Performance Monitoring of MNA Remedies for* [volatile organic compounds] *(VOCs) in Ground Water* (EPA/600/R-04/027; April 2004). For some approaches, a more detailed remedy optimization study or remediation system evaluation (RSE) may be beneficial. For guidance on remedy optimization studies or RSEs, visit EPA's CLU-IN Website (www.cluin.org/) or the U.S. Army Corps of Engineers (USACE) Hazardous, Toxic and Radioactive Waste Center of Expertise RSE Website (www.environmental.usace.army.mil/)

A. Remedy Goals and Conceptual Site Model (CSM)	
1. Review of the current remedy goals and measurements: The remedy goals may be expressed in the ROD as remedial action objectives (RAOs) and preliminary remediation goals (PRGs). RAOs provide a general description of what the cleanup will accomplish (e.g., restoration of ground water). PRGs are the more specific statements of the desired endpoint concentrations or risk levels, for each exposure route, that are believed to provide adequate protection of human health and the environment.	
List the intermediate system goals (RAOs and PRGs).	
List the final system goals (RAOs and PRGs).	
What metrics (performance criteria) are being implemented to measure project progress towards meeting each goal?	
What schedule has been established for measuring and reporting each metric?	
Based on new information or events since the last review, is there a need to re-evaluate the remedy goals? Note: this might be due to factors such as whether the regulatory framework has been revised, whether existing goals appear realistic, and if there have been changes to land use or ground water production near the site. If yes, identify the remedy goals that should be re-evaluated, the rationale, and any plans for re-evaluating the goals.	☐ Yes ☐ No
2. Review of changes to the CSM: The CSM for natural attenuation is the site-specific qualitative and quantitative description of the migration and fate of contaminants with respect to possible receptors and the geologic, hydrologic, biologic, geochemical and anthropogenic factors that control contaminant distribution. Because the CSM provides the basis for the remedy and monitoring plan, it can be reevaluated as new data are developed throughout the lifetime of the remedy. The following questions may be used to evaluate the need for updating the CSM:	
Have new contaminant sources been identified or have previously suspected contaminant sources been eliminated from further consideration since the last time you completed the O&M checklist for this remedy? If yes, use this space to comment.	☐ Yes ☐ No
Has there been an increase or decrease in size of the plume since the last time you completed an O&M checklist for this remedy? Comments (e.g., what is the nature and magnitude of the change).	☐ Increase ☐ Decrease ☐ No change
Has there been an increase or decrease in vertical extents of the plume since the last time you completed an O&M checklist for this remedy? Comments (e.g., what is the nature and magnitude of the change).	☐ Increase ☐ Decrease ☐ No change
Has there been an increase or decrease in the maximum contaminant concentrations in the plume since the last time you completed an O&M checklist for this remedy? Comments (e.g., have maximum concentrations changed for all or a subset of contaminants, which ones, and by how much).	☐ Increase ☐ Decrease ☐ No change
What types of reaction zone(s) are present in the plume (aerobic, anaerobic, or both)?	

Based on information collected since the last O&M review, is there a need to re-evaluate the number and/or location of monitoring points in the reaction zone(s)? If yes, use this space to comment.	☐ Yes ☐ No
Based on information collected since the last O&M review, is there a need to re-evaluate the number and/or location of monitoring points in the target zones? If yes, use this space to comment.	☐ Yes ☐ No
Has there been a change in ground water flow rate or direction that may suggest monitoring frequency or locations may need to be reevaluated? If yes, use this space to comment.	☐ Yes ☐ No
Is there evidence of periodic pulses of residual contamination from the vadose zone that suggest new monitoring points should be added in the vadose zone? If yes, use this space to comment.	☐ Yes ☐ No
If there is reason to re-evaluate the number and location of monitoring points and/or monitoring frequency (as indicated in above responses), identify any plans for re-evaluating the monitoring program.	
Based on your responses to the above questions, would it be useful to update the CSM at this time? If yes, please describe any plans to update the CSM.	☐ Yes ☐ No

B. Remedy Performance Assessment

1. Review performance monitoring objectives. The OSWER Directive 9200.4-17P (U.S. EPA, 1999a) provides eight specific objectives for the performance-monitoring program of an MNA remedy.

For each of the following eight performance monitoring objectives, identify which are currently being met, which are currently being met but could benefit from further review, and which are currently not being met.

Objective	Status		
	Being met	*Benefit from review*	*Not being met*
1) Demonstrate that natural attenuation is occurring according to expectations	☐	☐	☐
2) Detect changes in environmental conditions that may reduce the efficacy of any of the natural attenuation processes	☐	☐	☐
3) Identify any potentially toxic and/or mobile transformation products	☐	☐	☐
4) Verify that the plume(s) is not expanding downgradient, laterally or vertically	☐	☐	☐
5) Verify no unacceptable impact to downgradient receptors	☐	☐	☐
6) Detect new releases of contaminants to the environment that could impact the effectiveness of the natural attenuation remedy	☐	☐	☐
7) Demonstrate the efficacy of ICs that were put in place to protect potential receptors	☐	☐	☐
8) Verify attainment of remediation objectives	☐	☐	☐

If any of these objectives are not being met or would benefit from review, please describe (e.g., in what way is the objective not being met, why might the objective benefit from further review).

Describe any plans to review and/or change the location, frequency or types of samples and measurements to meet this (these) objective(s).

2. Evaluate remedy effectiveness: The following questions are intended to review whether the MNA remedy is performing as intended, or whether there may be a need to implement a contingency remedy. A contingency remedy is a cleanup technology or approach that functions as a backup remedy in the event that the selected remedy fails to perform as anticipated.	
Since the last O&M review, have contaminant concentrations in soil or ground water at specified locations exhibited an increasing trend not originally predicted during remedy selection?	☐ Yes ☐ No
Since the last O&M review, have near-source wells exhibited large concentration increases indicative of a new or renewed release?	☐ Yes ☐ No
Since the last O&M review, have contaminants been detected in monitoring wells located outside of the original plume boundary or other compliance-monitoring boundary?	☐ Yes ☐ No
Since the last O&M review, have analyses concluded that the rate of decrease of contaminant concentrations may be inadequate to meet the remediation objectives?	☐ Yes ☐ No
Since the last O&M review, have changes in land and/or ground water use been suggested and or implemented that have the potential to reduce the protectiveness of the MNA remedy?	☐ Yes ☐ No
Since the last review, have contaminants been identified in locations that pose or have the potential to pose unacceptable risk to receptors?	☐ Yes ☐ No
If you answered yes to any of the above questions, did the information suggest the need for immediate action or is the condition being monitored to evaluate the need for future action? Use this space to comment.	☐ Immediate action ☐ Monitored for future ☐ N/A
Based on your answers to the above questions, is there reason to evaluate the need for a contingent remedy at this time? If yes, use this space to comment.	☐ Yes ☐ No
3. Evaluate collection and analysis of performance monitoring data	
What evidence has been used to evaluate actual plume dissipation (e.g., temporal trends in individual wells, estimation of mass reduction, comparisons of observed contaminant distributions with predictions and required milestones, comparison of field-scale attenuation rates)?	
Since the last O&M review, has it been necessary to modify the site-specific plans (e.g., Sampling and Analysis Plan, Quality Assurance Project Plan, Data Management Plan) to account for new information and/or unforeseen circumstances? If yes, use this space to comment.	☐ Yes ☐ No
Does information collected since the last O&M review suggest the need to evaluate whether field parameters that are critical to an MNA evaluation (e.g., dissolved oxygen, redox potential) are being collected at appropriate monitoring points? If yes, use this space to comment.	☐ Yes ☐ No
Do the approaches used to interpret ground water monitoring data (e.g., concentration trend analyses, plume contour and/or bubble maps, plume cross-sections, potentiometric surface maps) provide adequate information to assess the performance of the natural attenuation remedy? If no, describe plans, if any, to implement new approaches.	☐ Yes ☐ No
Does information collected since the last O&M review suggest the need to re-evaluate the ground water and soil-monitoring program to more accurately delineate and monitor the plume boundary? If yes, use this space to comment.	☐ Yes ☐ No
Since the last O&M review, has it been necessary to modify the data quality assessment, including statistical tests (if appropriate), regression analysis, scatter plots, etc. to account for new information and/or unforeseen circumstances? If yes, use this space to comment.	☐ Yes ☐ No
Are ground water data managed electronically? If no, use this space to explain why not.	☐ Yes ☐ No

If statistical tests are used, do the data meet the assumptions of the statistical test?	☐ Yes ☐ No
If no, does this suggest the need to change the monitoring program or re-evaluate the statistical approach? Use this space to comment.	☐ Evaluate monitoring program ☐ Evaluate statistical approach ☐ Neither
Is high variability in the data interfering with or preventing a meaningful interpretation of the data?	☐ Yes ☐ No
If yes, could this situation be mitigated by increasing the density or frequency of sampling? Use this space to comment.	☐ Yes ☐ No
Are performance-monitoring reports of sufficient quality and frequency to evaluate the efficacy of MNA as a remedy and recognize protectiveness problems in time for effective action? If no, what actions, if any, have been taken or are planned to address this situation?	☐ Yes ☐ No
Are techniques or models being used to evaluate adequacy/redundancy of individual wells in the monitoring network, and adequacy/redundancy of sampling frequency? Note that techniques may range from statistical trend analysis to application of ~~a~~ decision support tool.	☐ Yes ☐ No
If no, are there plans to evaluate the adequacy/redundancy of individual monitoring wells and/or sampling frequency? Use this space to comment.	☐ Yes ☐ No
C. Cost Effectiveness: Key considerations in looking at cost-effectiveness of an MNA remedy are the list of parameters for monitoring, as well as the frequency and location of monitoring. Decreases in monitoring parameters, frequency or locations may be appropriate and allow for reductions in project monitoring costs. For example, decreases in monitoring frequency for certain parameters may be warranted if the remedy is proceeding according to expectations and trends are stable after evaluation of data from a sufficient number of monitoring periods (e.g., many years). To support such a decision, the available data generally cover a time period sufficient to allow for an evaluation of seasonal trends and other long-term cycles and trends.	
Does information collected since the last O&M review suggest opportunities to eliminate monitoring points (e.g., because of redundancy, unreliability, or changes in program objectives)? If yes, use this space to comment.	☐ Yes ☐ No
Does information collected since the last O&M review suggest opportunities to replace current analytical and sampling methods with less expensive methods and still meet the data quality objectives? If yes, use this space to comment.	☐ Yes ☐ No
Can the analyte list be shortened to focus on the known contaminants of concern?	☐ Yes ☐ No
D. Remedial Decisions: Following data evaluation, decisions are routinely made regarding the effectiveness of the MNA remedy, monitoring program, and ICs, and the need for contingency or alternative remedies. The following remedial decisions are discussed in Section 4 of the EPA guidance document *Performance Monitoring of MNA Remedies for VOCs in Ground Water* (EPA/600/R-04/027; April 2004). Indicate which of the following remedial decisions is appropriate at the present time and provide the basis for the decision.	
☐ No Change to the Monitoring Program ☐ Modify/Optimize Monitoring Program ☐ IC Modifications ☐ Implementation of Contingency/Alternative Remedy ☐ Terminate Performance Monitoring and Initiate Verification Monitoring	
Basis for decision:	

RECOMMENDED APPENDIX C. CONTAINMENT REMEDIES

The following checklist is an abbreviated set of questions that could be used by a EPA RPMs for an annual review of the O&M of a containment remedy and associated off-gas treatment system. This checklist focuses on engineered containment remedies, including landfill caps, covers, and vertical engineered barriers (VEB). Containment by other means such as hydraulic control and in-situ sediment containment remedies are not addressed by this appendix. See separate surface water/sediment remedy checklist for sediment remedies. Although the checklist includes items for off-gas systems, it focuses on off-gas collection. The checklist does not address off-gas management using combustion systems because such systems are uncommon at Superfund sites.

A. Remedy Description, Goals and Conceptual Site Model (CSM)

1. Review of the current remedy

Identify the containment systems in place:

- ☐ Cap/cover
- ☐ VEB
- ☐ Liner
- ☐ Landfill gas collection
- ☐ Landfill gas management
- ☐ Leachate detection
- ☐ Leachate collection
- ☐ Leachate management
- ☐ Other (Describe:)

Identify the O&M components:

- ☐ Inspection
- ☐ Monitoring
- ☐ Testing
- ☐ Ground water monitoring
- ☐ Surface water monitoring
- ☐ Landfill gas monitoring
- ☐ Vapor intrusion monitoring
- ☐ Leachate monitoring
- ☐ Other (Describe:)

2. Review of the current remedy goals

Identify the remedy goals (RAOs):

- ☐ Prevent direct contact with a contaminant source
- ☐ Prevent migration of a contaminant source to:
  - ☐ A drinking water aquifer
  - ☐ Surface water
  - ☐ Soil or other solid media
  - ☐ Air (via wind-borne material)
  - ☐ Air (via volatilization)
  - ☐ Other (Describe:)
- ☐ Prevent migration of contaminated ground water
- ☐ Prevent vapor intrusion or indoor air exposure
- ☐ Control off-gas
- ☐ Other remedy goals (Describe:)

What metrics (performance criteria) are being implemented to measure project progress towards meeting each goal?

What schedule has been established for measuring and reporting each metric?

Based on new information or events since the last O&M review, is there a need to re-evaluate the remedy goals? This might be due to factors such as whether the regulatory framework has been revised, whether existing goals appear to be realistic, and whether there have been changes in land use or ground water production near the site. If yes, identify the remedy goals that should be re-evaluated, the rationale, and any plans for re-evaluating the goals.	☐ Yes ☐ No

3. Review of changes to the CSM: The CSM for a containment remedy is the site-specific, qualitative and quantitative description of the migration and fate of contaminants with respect to possible receptors and the geologic, hydrologic, biological, geochemical and anthropogenic factors that control contaminant distribution. Because the CSM provides the basis for the remedy and the post-closure maintenance plan or O&M plan, the model should be re-evaluated as new data are collected throughout the lifetime of the remedy.	
Does new information gathered or conclusions reached since the last time the O&M checklist was completed indicate a change in understanding about the sources, types, migration, and fate of contaminants? *Note that indicators could include (1) the remedy not functioning as designed, (2) unexpected contaminants or contaminant concentrations above the required levels at the point of compliance, (3) unexpected trends in contaminant concentrations, (4) unexpected changes in the flow rate or direction of ground water, (5) unexpected changes in off-gas characteristics, or (6) unexpected evidence of vapor intrusion in nearby structures.*	☐ Yes ☐ No
Based on new information and/or conclusions, would it be useful to update the CSM at this time? If yes, please describe any plans to update the CSM.	☐ Yes ☐ No
B. Remedy Performance Assessment This section contains a series of questions that can be used to help assess a containment remedy's effectiveness and evaluate the collection and analysis of performance monitoring data. For each potential problem identified, an analysis should be performed to determine what, if anything should be done.	
1. Evaluate remedy effectiveness: The following questions are intended to review whether the containment remedy is performing as intended or whether there is a need to implement a contingency remedy. A contingency remedy is a cleanup technology or approach that functions as a backup remedy in the event that the selected remedy fails to perform as anticipated. A contingency remedy may be considered if there is a "yes" answer to one or more of the following three questions. *Note that additional measures and methods for evaluating the effectiveness of containment remedies can be found in "EPA/USACE Draft Technical Guidance for RCRA/CERCLA Final Covers" (EPA 540-R-04-007) and "EPA Comprehensive 5-Year Review Guidance, Appendix D, Five-Year Review Site Inspection Checklist" (OSWER Directive 9355.7-03B-P).*	
Since the last O&M review, has inspection or testing of the cap, cover, liner, or VEB indicated that the system is failing or could eventually fail?	☐ Yes ☐ No
Since the last O&M review, have changes in land, surface water, or ground water use been suggested and or implemented that have the potential to reduce the protectiveness of the containment remedy?	☐ Yes ☐ No
Since the last O&M review, have contaminants been identified in new locations or at higher concentrations where they pose or have the potential to pose unacceptable risks to receptors?	☐ Yes ☐ No
If you answered yes to any of the above questions, did the information suggest the need for immediate action or is the condition being monitored to evaluate the need for future action? Use this space to comment. What actions, if any, have been taken and/or are planned in response to the new information?	☐ Immediate action ☐ Monitored for future ☐ N/A
For VEB Only: Note that additional measures and methods for evaluating VEB effectiveness can be found in "EPA Evaluation of Subsurface Engineered Barriers at Waste Sites".	
Have bulk integrity tests been performed since the last O&M review?	☐ Yes ☐ No

If bulk integrity tests have been performed since the last review, do test results indicate that need to evaluate possible breaches or excessive leakage in the VEB over the short and long terms? If yes, what actions have been taken and/or are planned in response?	☐ Yes ☐ No ☐ N/A
Based on information collected since the last O&M review, do contaminant concentrations upgradient of the VEB indicate the need to evaluate actions to prevent possible contaminant migration? If yes, what actions have been taken and/or are planned in response?	☐ Yes ☐ No
Does information collected since the last O&M review suggest the need to evaluate hydraulic controls as an additional measure to control possible contaminant migration around the VEB (answer N/A if hydraulic controls are already part of the remedy)? If yes, what actions have been taken and/or are planned in response?	☐ Yes ☐ No ☐ N/A
For Off-Gas Collection Management Only: Note that additional measures and methods for evaluating off-gas collection and management effectiveness can be found in "USACE Landfill Off-Gas Treatment, Thermal Oxidation Checklist".	
Since the last O&M review for this system, have off-gas volume and composition been consistently within equipment design parameters? If no, what actions have been taken and/or are planned in response?	☐ Yes ☐ No
Since the last O&M review for this system, have off-gas system operational characteristics, such as required temperatures and pressures, been maintained within system design parameters? If no, what actions have been taken and/or are planned in response?	☐ Yes ☐ No
Since the last time an O&M checklist was completed for this system, have off-gas emissions met all federal, state, and local regulatory requirements? If no, what is being done to meet these requirements?	☐ Yes ☐ No
Based on information collected since the last O&M review, is there any evidence of unacceptable vapor intrusion in nearby structures? If yes, what actions have been taken and/or are planned in response?	☐ Yes ☐ No
Based on information collected since the last O&M review, have concentrations of off-gases inside buildings or at the site fence line suggested the need to assess safety and human health threats? If yes, what actions have been taken and/or are planned in response?	☐ Yes ☐ No
2. Evaluate collection and analysis of performance monitoring data Note that more detailed information about performance parameters can be found in the following documents: ▪ "EPA/USACE Draft Technical Guidance for RCRA/CERCLA Final Covers" (EPA 540-R-04-007) ▪ "EPA Comprehensive 5-Year Review Guidance, Appendix D, Five-Year Review Site Inspection Checklist" (OSWER Directive 9355.7-03B-P) ▪ "USACE Landfill Off-Gas Treatment, Thermal Oxidation Checklist" ▪ "EPA Evaluation of Subsurface Engineered Barriers at Waste Sites" (EPA 542-R-98-005; August 1998).	
Since the last O&M review, has it been necessary to modify planned inspections, sampling events, and sample analyses, as reflected in the site post-closure maintenance plan or O&M plans, to account for new information and/or unforeseen circumstances? If yes, use this space to comment.	☐ Yes ☐ No
Has information collected since the last O&M review suggested the need to re-evaluate whether performance parameters that are critical to evaluation of the containment remedy are being collected at appropriate monitoring points? If yes, what actions have been taken and/or are planned in response?	☐ Yes ☐ No

Are ground water and off-gas system monitoring data managed electronically? If no, use this space to explain why not.	☐ Yes ☐ No
Since the last O&M review, have monitoring data been analyzed to identify trends and their significance? If no, use this space to explain why not.	☐ Yes ☐ No
Is high variability in the data interfering with or preventing a meaningful interpretation of the data?	☐ Yes ☐ No
If yes, could this situation be mitigated by increasing the density or frequency of data collection? Use this space to comment.	☐ Yes ☐ No
Are inspection and performance monitoring reports of sufficient quality and frequency to evaluate the efficacy of containment as a remedy and recognize protectiveness problems in time for effective action? If no, what actions, if any, have been taken or are planned to address this situation?	☐ Yes ☐ No
C. Cost-Effectiveness	
If off-gas is currently being treated, can it be vented to the atmosphere without treatment in compliance with all applicable federal, state, and local regulations?	☐ Yes ☐ No ☐ N/A
If yes, has the possibility of discontinuing off-gas treatment been explored? Use this space to comment.	☐ Yes ☐ No ☐ N/A
If leachate is currently being collected and treated, is operation of the leachate system necessary for proper functioning of the containment system?	☐ Yes ☐ No ☐ N/A
If no, has the possibility of discontinuing leachate collection and treatment been explored? Use this space to comment.	☐ Yes ☐ No ☐ N/A
If hydraulic controls are being used in conjunction with a VEB, would the VEB provide passive containment without these controls?	☐ Yes ☐ No ☐ N/A
If yes, has the possibility of discontinuing the hydraulic controls been explored? Use this space to comment.	☐ Yes ☐ No ☐ N/A
D. Remedial Decisions: Indicate which of the following remedial decisions is appropriate at the present time and provide the basis for the decision.	
☐ No change to the remedy ☐ Modify or optimize remedy ☐ Modify or optimize O&M ☐ Modify ICs ☐ Implement contingency or alternative remedy ☐ Terminate inspections or monitoring	
Basis for decision:	

RECOMMENDED APPENDIX D. SOIL VAPOR EXTRACTION/AIR SPARGING REMEDIES

- The following checklist is an abbreviated set of questions that EPA RPMs could use when conducting an annual review of the O&M of a soil vapor extraction (SVE), air sparging (AS), or combined SVE/AS remedy. This checklist does not represent the level of review used in EPA's five-year review process to determine whether the remedy is or will be protective of human health and the environment. However, the checklist does contain review elements regarding the performance of SVE and/or AS remedies that are consistent with the comprehensive five-year review process.

A. Remedy Description, Goals and Conceptual Site Model (CSM)

1. Review of the current remedy

Identify the current remedy:

- ☐ SVE
- ☐ AS

How many extraction wells or trenches are used for SVE (if applicable)?

How many injection wells are used for AS (if applicable)?

2. Review of the current remedy goals

List the remedy goals (RAOs):

- ☐ Prevent migration of a contaminant source to:
  - ☐ A drinking water aquifer
  - ☐ Surface water
  - ☐ Soil or other solid media
- ☐ Prevent migration of contaminated ground water
- ☐ Restore ground water
- ☐ Other (Describe:)

List the short-term objectives and intermediate system goals.

List the long-term soil and ground water cleanup goals.

What metrics (performance criteria) are being implemented to measure project progress towards meeting each goal?

What schedule has been established for measuring and reporting each metric?

Based on new information or events since the last O&M review, is there a reason to re-evaluate the remedy goals? Note that this might be due to factors such as whether the regulatory framework has been revised, whether existing goals appear to be realistic, and whether there have been changes in land or ground water use near the site. If yes, identify the remedy goals that should be re-evaluated, the rationale, and any plans for re-evaluating the goals.	☐ Yes ☐ No

3. Review of changes to the CSM: The CSM for a SVE/AS remedy is the site-specific, qualitative and quantitative description of the migration and fate of contaminants with respect to possible receptors and the geologic, hydrologic, biological, geochemical and anthropogenic factors that control contaminant distribution. Because the CSM provides the basis for the remedy and the O&M plan, the model should be re-evaluated as new data are collected throughout the lifetime of the remedy.	
Does new information gathered or conclusions reached since the last time the O&M checklist was completed indicate a change in understanding about the sources, types, migration, and fate of contaminants? *Note that indicators could include: (1) the remedy not functioning as designed, (2) unexpected contaminants or contaminant concentrations above the required levels at the point of compliance, (3) unexpected trends in contaminant concentrations, (4) unexpected changes in the flow rate or direction of ground water, (5) unexpected changes in off-gas characteristics, (6) unexpected evidence of vapor intrusion in nearby structures; or (7) identification of new sources.*	☐ Yes ☐ No
Based on new information and/or conclusions, would it be useful to update the CSM at this time? If yes, please describe any plans to update the CSM.	☐ Yes ☐ No
B. Remedy Performance Assessment This section contains a series of questions that can be used to help assess a SVE/AS remedy's effectiveness and evaluate the collection and analysis of performance monitoring data.	
1. Evaluate remedy effectiveness: The following questions are intended to review whether the SVE/AS remedy is performing as intended, or whether there is a need to implement a contingency remedy. A contingency remedy is a cleanup technology or approach that functions as a backup remedy in the event that the selected remedy fails to perform as anticipated. A contingency remedy may be considered if there is a "yes" answer to either of the following five questions.	
Based on information collected since the last O&M review, do monitoring data indicate that the system is failing or could eventually fail to meet remedy goals?	☐ Yes ☐ No
Since the last O&M review, has the areal extent of contamination (or plume) increased in a manner not originally predicted during remedy selection?	☐ Yes ☐ No
Since the last O&M review, have monitoring data exhibited trends indicative of a new or renewed release?	☐ Yes ☐ No
Since the last O&M review, have changes in land and/or ground water use been suggested and or implemented that have the potential to reduce the protectiveness of the SVE/AS remedy?	☐ Yes ☐ No
Since the last O&M review, have contaminants been identified in new locations or at higher concentrations where they pose or have the potential to pose unacceptable risks to receptors?	☐ Yes ☐ No
If you answered yes to any of the above questions, did the information suggest the need for immediate action or is the condition being monitored to evaluate the need for future action? Use this space to comment. What actions, if any, have been taken and/or are planned in response to the new information?	☐ Immediate action ☐ Monitored for future ☐ N/A
Based on your answers to the above questions, is there reason to evaluate the need for a contingent remedy at this time? If yes, use this space to comment.	☐ Yes ☐ No

Blowers and Piping	
Since the last O&M review for this system, has evidence of excessive corrosion of system components been observed? If yes, what actions have been taken and/or are planned in response?	☐ Yes ☐ No
Since the last O&M review, if blowers are operated intermittently, do VOC concentrations increase after they are shut off? How has this information been interpreted and what actions, if any, have been taken and/or are planned in response?	☐ Yes ☐ No ☐ N/A
Since the last O&M review, have blower operational characteristics, such as flow rate, pressure, and discharge temperatures, been consistently within equipment design parameters? If no, what actions have been taken and/or are planned in response?	☐ Yes ☐ No
Since the last O&M review, if water is manually removed from the extraction blower water separator, has water accumulation been observed that could adversely impact blower operation? If yes, what actions have been taken and/or are planned in response?	☐ Yes ☐ No ☐ N/A
Since the last O&M review, have all blowers, water separators, valves, and piping components been consistently operational?	☐ Yes ☐ No
Has the downtime associated with non-routine operations and maintenance of the blowers since the last time you completed an O&M checklist for this system exceeded expectations? If yes, what have been identified as the causes? If yes, what corrections have been or are being made to minimize downtime?	☐ Yes ☐ No
Does the operational history suggest that the preventative maintenance plan for the blowers needs to be re-evaluated? If yes, what actions have been taken and/or are planned in response?	☐ Yes ☐ No
Soil Vapor Extraction System	
Identify the SVE system characteristics, if any, that have deviated consistently/frequently from operational expectations since the last time an O&M checklist was completed for this system: ☐ Vapor flow rates at one or more extraction wells ☐ Vapor compositions (VOCs, CO_2, O_2) at one or more extraction wells ☐ Pressures at one or more extraction wells ☐ Flow at blower (prior to entry of any dilution air if used) ☐ Accumulation of water in the water separator	
Does this (do these) deviation(s) indicate a new condition since the last O&M review or an ongoing trend?	☐ New condition ☐ Ongoing trend ☐ N/A
What has been identified as the cause for this (these) deviation(s)?	
What actions, if any, have been or are being taken in response to this (these) deviation(s)?	
Based on information collected since the last O&M review, is there any evidence of unacceptable vapor intrusion in nearby structures? If yes, what actions have been taken and/or are planned in response?	☐ Yes ☐ No

Since the last O&M review, have gas concentrations in the blower discharge been running close enough to the lower explosive limit (LEL) or shown an increasing trend that suggests the need for action? *Note that specific compound LEL data are available in many chemistry texts as well as National Fire Protection Agency guidelines.* What actions, if any, have been taken and/or are planned in response to the new information?	☐ Yes ☐ No
Air Sparging System	
Since the last O&M review of the AS system, have flow rates at each injection well been consistently maintained within system design parameters? If no, what actions, if any, have been or are being taken in response?	☐ Yes ☐ No
Based on information collected since the last O&M review, have dissolved oxygen concentrations been maintained at a level sufficient to promote biological activity? If no, what actions, if any, have been or are being taken in response?	☐ Yes ☐ No
Since the last O&M review, are measured dissolved oxygen concentrations consistently indicative of good air/water contact rates (i.e., are concentrations near saturation)? If no, what actions, if any, have been or are being taken in response?	☐ Yes ☐ No
VOC Control System	
If the SVE system contains a VOC control device, has the device consistently met performance and compliance monitoring requirements (e.g., total VOC emission limits, specific compound limits, monitoring, air permit) since the last O&M review for this system? If no, what actions have been taken and/or planned in response?	☐ Yes ☐ No ☐ N/A
Since the last O&M review, has the VOC control system consistently meet required destruction and removal efficiencies? If no, what actions have been taken and/or planned in response?	☐ Yes ☐ No
Since the last O&M review, have any violations of air permits been reported? If yes, what has been or is being done to meet permit requirements?	☐ Yes ☐ No
Since the last time you completed an O&M checklist for this system, has the VOC control system been responsible for downtime associated with non-routine operations and maintenance? If yes, ▪ What was (were) the cause(s) for unplanned shutdown(s)? ▪ What has been done or is being done to minimize future downtime?	☐ Yes ☐ No
Thermal Oxidizers	
Since the last O&M review for this system, have the operational characteristics (e.g., LEL history of feed gas, operating temperature, inlet flow, oxygen level in flue gas, fuel use) been consistently within equipment design parameters? If no, what actions, if any, have been or are being taken in response?	☐ Yes ☐ No ☐ N/A
Since the last O&M review, has there been any indication of improper operation of flashback protection equipment (e.g., detonation arrestor, sealed drum)? If yes, what actions have been taken and/or planned in response?	☐ Yes ☐ No
Since the last O&M review, has there been any indication of improper operation of safety interlocks (e.g., high LEL, high oxidizer temperature, loss of flame, low fuel pressures)? If yes, what actions have been taken and/or planned in response?	☐ Yes ☐ No

If acid gases are present, have scrubber operations (e.g., scrubber liquid flow and pH, caustic use, scrubber blowdown and its treatment) been consistent with operational expectations since the last O&M review? If no, what actions have been taken and/or planned in response?	☐ Yes ☐ No
Carbon Adsorbers	
Does the unit have humidity controls?	☐ Yes ☐ No
Since the last O&M review for this system, have the operational characteristics (e.g., relative humidity data at adsorber inlet, adsorber operating temperature, carbon breakthrough, carbon change out history, operating velocity through adsorbers, adsorber discharge VOC data) been consistently within equipment design parameters? If no, what actions, if any, have been or are being taken in response?	☐ Yes ☐ No ☐ N/A
Other Control Devices	
Since the last O&M review for this system, have the operational characteristics (e.g., biofiltration media surface loading rate, temperature controls, nutrient addition rate) been consistently within equipment design parameters? If no, what actions, if any, have been or are being taken in response?	☐ Yes ☐ No ☐ N/A
2. Evaluate collection and analysis of performance monitoring data	
Since the last O&M review, has it been necessary to modify sampling frequency relative to the original O&M plan to account for new information and/or unforeseen circumstances? If yes, use this space to comment.	☐ Yes ☐ No
Does soil and/or ground water data collected since the previous O&M review (e.g., VOCs concentrations, ground water elevations) suggest the need to re-evaluate other aspects of the monitoring program (e.g., monitoring locations, test parameters) to account for new information/unforeseen circumstances? If yes, use this space to comment.	☐ Yes ☐ No
C. Cost Effectiveness: Key considerations in looking at cost-effectiveness are the O&M costs incurred relative to design and reduction in VOC removal rates. Opportunities to reduce costs can be potentially found in the following areas:	
Does information collected since the last O&M review suggest that flows could be redistributed to speed overall remediation (i.e., reduce or eliminate flow to/from wells where removals have reached near asymptotic conditions or where cleanup goals have been achieved)? Use this space to comment.	☐ Yes ☐ No
Does information collected since the last O&M review show evidence of diffusion-limited VOC movement?	☐ Yes ☐ No
If yes, has the idea of modifying operation to pulsing (intermittent) been considered to speed overall remediation? Use this space to comment.	☐ Yes ☐ No
Does information collected since the last O&M review show reduced VOC removal rates that might warrant a reduction in monitoring frequencies? Use this space to comment.	☐ Yes ☐ No
Does information collected since the last O&M review suggest that VOC recovery rates have been reduced to the extent that the VOC control device can be eliminated? Use this space to comment.	☐ Yes ☐ No ☐ N/A

Does information collected since the last O&M review suggest that an alternative, lower cost VOC control device could be used? Use this space to comment.	☐ Yes ☐ No
Does information collected since the last O&M review suggest that operation of the VOC control device could be modified to reduce costs, e.g., operate thermal oxidizer at lower temperatures or lower dilution air flows (e.g., when LEL basis no longer requires design flow) or use larger carbon beds to reduce carbon supplier charges for change outs? Use this space to comment.	☐ Yes ☐ No
Has maintenance history since the last O&M review identified high-maintenance equipment that could be replaced? Use this space to comment.	☐ Yes ☐ No

E. Remedial Decisions: Indicate which of the following remedial decisions are appropriate at the present time and provide a basis for each decision:

- ☐ Continue current remedy
- ☐ Goals have been achieved -- system can be shutdown in favor of MNA
- ☐ Modify/optimize remedial system(s) – use intermittent operation; optimize flows to/from wells to promote increased removals; increase use of sparging to promote biodegradation; add new wells if contaminant movement is indicated to areas currently not being influenced; implement cost reduction measures; conduct more detailed evaluation of the contaminated zone using a tool such as Pneulog.
- ☐ Modify/optimize O&M – increase monitoring to provide additional data for more definitive assessment at the next review
- ☐ Modify ICs
- ☐ Implement contingent or alternative remedy

Basis for decision:

RECOMMENDED APPENDIX E. OTHER REMEDY TYPES/COMPONENTS

The following checklist is a set of questions that may be used by EPA RPMs for an annual review of the O&M of remedies and remedy components that are not addressed in Appendices A through D or the separate surface water/sediment remedy O&M checklist. This could include remedies/components that involve a technology that is not covered in these other materials or remedies/components where the O&M can be more efficiently reviewed using the more streamlined questions below. If the site includes multiple remedy components that are not covered elsewhere, multiple copies of this appendix, each applying to a different component or related set of components, could be completed.

A. Remedy Description and Goals

1. Review of current remedy goals, and measurements

The following questions can be used to document basic information about the remedy and remedy goals to provide context for the remainder of the information in this appendix.

Identify the remedy component(s) and associated systems and technologies being covered on this form:	
What are the intermediate and final system goals?	
What metrics (performance criteria) are being implemented to measure project progress towards meeting each goal?	
What schedule has been established for measuring and reporting each metric?	
Based on new information or events since the last O&M review of this system/technology, is there a need to re-evaluate the remedy goals? If yes, identify the remedy goals that should be re-evaluated, the rationale, and any plans for re-evaluating the goals.	☐ Yes ☐ No

2. Review of changes to the CSM

The following questions ask about changes in contamination and other field conditions that could affect the monitoring program, system operations, and other aspects of O&M. They provide context for questions in subsequent sections that ask whether action should be taken to modify the O&M program.

Do monitoring data indicate trends/patterns that are inconsistent with the CSM (or similar conceptual understanding of site conditions) that was used as the basis for design of the remedy/remedial component(s)? If yes, use this space to comment.	☐ Yes ☐ No
Have there been changes in field conditions (e.g., change in land/water use) that differ significantly from the conditions incorporated in the CSM (or similar conceptual understanding of site conditions) that was used as the basis for design of the remedy/remedial component(s)? If yes, use this space to comment.	☐ Yes ☐ No
Have new contaminant sources been identified? If yes, please describe the new sources and how they are they being addressed:	☐ Yes ☐ No

B. Remedy Performance Assessment

This section contains a series of questions that can be used to help assess whether the monitoring program and remediation systems O&M should be adjusted.

1. Monitoring Program

Describe changes to the monitoring program that have been made since the last time you completed the O&M checklist for this remedy component.	
Are the baseline data and post-remedy data adequate to perform statistical comparisons and evaluate remedy performance? If no, what actions have been or are being taken in response?	☐ Yes ☐ No

Is high variability in the data interfering with or preventing a meaningful interpretation of the data?	☐ Yes ☐ No
If yes, could this situation be mitigated by increasing the density or frequency of data collection? Use this space to comment.	☐ Yes ☐ No
Based on changes in contamination or field conditions (see A.2 of this appendix), is there reason to modify the monitoring program? If yes, describe changes to the monitoring program that are most necessary.	☐ Yes ☐ No
Has the adequacy/redundancy and cost-effectiveness of the monitoring program been evaluated, including evaluation of sampling locations, frequency, sampling and analytical methods, monitoring parameters, and test methods? Use this space to comment.	☐ Yes ☐ No
Is there reason to modify the monitoring program to address inadequacies, remove redundancies, and/or improve its cost-effectiveness? If yes, describe changes to the monitoring program that would likely have the greatest impact.	☐ Yes ☐ No
Do you have adequate documentation (e.g., good quality O&M reports) and tools (e.g., software) to effectively manage and interpret monitoring data? If no, please explain how documentation and/or tools could be improved.	☐ Yes ☐ No
2. System Operations	
Describe changes to system operations that have been made since the last time you completed the O&M checklist for this remedy component.	
Is (are) the remedial system(s) covered under this appendix performing as expected relative to the remediation milestones and goal(s)? If no, what actions have been or are being taken in response?	☐ Yes ☐ No
Do monitoring data indicate trends/patterns that are consistent with remedial design expectations? If no, what actions have been or are being taken in response?	☐ Yes ☐ No
Based on observations regarding contamination or field conditions (see A.2 of this appendix and previous questions in this section), is there reason to modify systems operations to improve remedy performance? If yes, describe changes to system operations that are most necessary.	☐ Yes ☐ No
Has an optimization study been conducted for the remedy/remedy component(s)? Use this space to comment.	☐ Yes ☐ No
Has the downtime associated with non-routine operations and maintenance exceeded expectations? If yes, what actions have been or are being taken to minimize downtime?	☐ Yes ☐ No
Based on optimization and downtime considerations, is there reason to modify systems operations to improve remedy performance? If yes, describe changes to system operations that are most necessary.	☐ Yes ☐ No
3. Maintenance	
Are routine maintenance activities adequate to ensure the reliable operation of the remedial system(s)? If no, what changes to the maintenance program are most necessary?	☐ Yes ☐ No

Have any major repairs to the remedial system(s) been required since the last time you completed the O&M checklist for this remedy/remedy component? If yes, describe the repairs, their impact on progress toward remediation milestones, and actions taken to minimize similar repairs in the future.	☐ Yes ☐ No
C. Cost Effectiveness	
Does information collected since the last O&M review suggest opportunities to reduce costs associated with equipment operations and maintenance? If yes, use this space to comment.	☐ Yes ☐ No
Does information collected since the last O&M review suggest opportunities to reduce costs associated with the monitoring program? If yes, use this space to comment.	☐ Yes ☐ No
D. Remedial Decisions: Indicate which of the following remedial decisions is appropriate at the present time and provide the basis for the decision.	
☐ No Change ☐ Modify/Optimize System ☐ Modify/Optimize Monitoring Program ☐ Modify ICs ☐ Implement Contingency/Alternative Remedy	
Basis for decision:	