Superfund Records Center
SITE: Ely Copper Mine
BREAK: 5-4
OTHER: 494709

# U.S. ENVIRONMENTAL PROTECTION AGENCY
# EPA NEW ENGLAND

# RECORD OF DECISION

## OPERABLE UNIT 1

## ELY COPPER MINE SUPERFUND SITE

September 2011

SDMS DocID 494709

## TABLE OF CONTENTS

### PART 1: THE DECLARATION

A. SITE NAME AND LOCATION.....1
B. STATEMENT OF BASIS AND PURPOSE.....1
C. ASSESSMENT OF THE SITE.....1
D. DESCRIPTION OF THE SELECTED REMEDY.....1
E. STATUTORY DETERMINATIONS.....4
F. SPECIAL FINDINGS.....4
G. ROD DATA CERTIFICATION CHECKLIST.....5
H. AUTHORIZING SIGNATURES.....6

### Part II: THE ROD DECISION SUMMARY

A. SITE NAME, LOCATION AND BRIEF DESCRIPTION.....1
B. SITE HISTORY AND ENFORCEMENT ACTIVITIES.....1
1. History of Site Activities.....1
2. History of Federal and State Investigations and Removal and Remedial Actions.....2
3. History of CERCLA Enforcement Activities.....3
C. COMMUNITY PARTICIPATION.....4
D. SCOPE AND ROLE OF OPERABLE UNIT OR RESPONSE ACTION.....5
E. SITE CHARACTERISTICS.....6
1. Remedial Investigation Summary.....6
2. General Site Characteristics.....7
a. Regional Bedrock Geology.....8
b. Regional Surface Water Hydrology.....9
c. Site Hydrogeology.....9
d. Wetland Resources.....11
e. Historic Resources.....11
3. Nature and Extent of Contamination.....12
a. OU1 Source Areas.....13
b. Surface Water and Sediment Contamination in OU1 Area.....26
c. Air Contamination in OU1 area.....32
4. Conceptual Site Model.....32
F. CURRENT AND POTENTIAL FUTURE LAND AND RESOURCE USES.....33
G. SUMMARY OF SITE RISKS.....34
1. Human Health Risk Assessment.....35
2. Ecological Risk
Assessment.....433
a. Identification of Contaminants of Concern.....44
b. Exposure Assessment.....47
c. Ecological Effect Assessment.....54
d. Ecological Risk Characterization.....58

e. Summary of Aquatic and Terrestrial BERAs for OU1.....64
3. Overall Risk Assessment Conclusion—Basis for Response Action .....65
H. REMEDIATION OBJECTIVES.....65
I. DEVELOPMENT AND SCREENING OF ALTERNATIVES.....66
1. Statutory Requirements/Response Objectives.....66
2. Technology and Alternative Development and Screening.....67
J. DESCRIPTION OF ALTERNATIVES.....67
K. SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES.....755
L. THE SELECTED REMEDY.....866
1. Summary of Rationale for the Selected Remedy.....86
2. Selected Remedy.....87
3. Summary of the Estimated Remedy Costs.....96
4. Expected Outcome of the Selected Remedy.....98
a. Soil Cleanup Levels.....98
b. Sediment Cleanup Levels.....99
c. Surface Water Cleanup Levels.....99
M. STATUTORY DETERMINATIONS.....999
1. The Selected Remedy is Protective of Human Health and the Environment
2. The Selected Remedy Complies With ARARs
a. Location-specific ARARs and TBCs.....100
b. Chemical-specific ARARs and TBCs.....103
c. Action-specific ARARs and TBCs.....103
3. The Selected Remedy is Cost-Effective.....104
4. The Selected Remedy Utilizes Permanent Solutions and Alternative Treatment or Resource Recovery Technologies to the Maximum Extent Practicable.....104
5. The Selected Remedy Does Not Satisfy the Preference for Treatment Which Permanently and Significantly Reduces the Toxicity, Mobility or Volume of the Hazardous Substances as a Principal Element.....105
6. Five-Year Reviews of the Selected Remedy are Required.....105
N. DOCUMENTATION OF NO SIGNIFICANT CHANGES.....105
O. STATE
ROLE.....1066

**APPENDICES**

Appendix A: ARAR Tables and Figures
Appendix B: State of Vermont DEC Letter of Concurrence
Appendix C: Responsiveness Summary
Appendix D: Administrative Record Index

# DECLARATION FOR THE RECORD OF DECISION

## A. SITE NAME AND LOCATION

**Ely Copper Mine Superfund Site**
**Vershire, Orange County, Vermont**
**VTD988366571**
**Site ID No: 0102065**
**Operable Unit 1**

## B. STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for Operable Unit 1 (OU1) at the Ely Copper Mine Superfund Site (the Site) in Vershire, Vermont. The remedy was chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended (CERCLA), 42 U.S.C. § 9601 *et seq.*, and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 C.F.R. Part 300, as amended. The Director of the Office of Site Remediation and Restoration (OSRR), United States Environmental Protection Agency New England Region 1 (EPA) has been delegated the authority to approve this Record of Decision (ROD).

This decision is based on the Administrative Record, which has been developed in accordance with Section 113(k) of CERCLA, and which is available for review at the Vershire Town Office and at the United States Environmental Protection Agency (EPA) Region 1 OSRR Records Center in Boston, Massachusetts. The Administrative Record Index (Appendix D to the ROD) identifies each of the items comprising the Administrative Record upon which the selection of the remedial action is based.

The Vermont Department of Environmental Conservation (VT DEC) concurs with the selected remedy (Appendix B).

## C. ASSESSMENT OF THE SITE

The response action selected in this ROD is necessary to protect the public health and welfare or the environment from actual or threatened releases of hazardous substances into the environment.

## D. DESCRIPTION OF THE SELECTED REMEDY

This ROD sets forth the selected remedy for OU1 at the Site. This will be the first response action for the Site. Upon completion of the Operable Unit 2 (OU2) Remedial Investigation and Feasibility Study (RI/FS), EPA may identify the need for additional response actions as part of OU2 or additional operable units at the Site.

The selected remedy for OU1 was identified as "Alternative SC3-Waste containment in the West Cell and in the Ore Roast Bed (ORB)" in the OU1 Feasibility Study and in the OU1 Proposed Plan. The selected remedy is a comprehensive approach for this operable unit that addresses all current and potential future risks caused by contaminated soil, waste rock, tailings, surface water, and sediment in the OU1area of the Site. Specifically, this remedial action includes: the excavation of about 107,000 cubic yards of contaminated waste rock, soil, and sediment from the Upper Waste Area (UWA), Lower Waste Area (LWA), Ely Brook, including the contaminated riparian soils adjacent to Middle and Lower Ely Brook, the tributaries of Ely Brook, Pond 4, and Pond 5 with the consolidation of this material under a cover system in an on-site containment cell located west of Ely Brook (the West Cell); and the excavation of about 4,000 cubic yards of contaminated tailings from the Tailings Area (TA) and consolidation under a cover system to be installed over the ORB. These remedial measures will remove and isolate OU1 sources of acid rock drainage (ARD) and eliminate direct contact and incidental ingestion of cobalt, copper and iron within the soil, waste rock, tailings, and sediment in OU1. It should be noted that while site groundwater will be addressed in OU2, significant improvement in groundwater quality is anticipated from the cleanup of OU1 areas, which are the major contributing sources to the groundwater contamination.

The selected remedy for OU1 includes the following major components:

- Pre-design investigations and studies;
- Clearing and grading of the work area and haul road, including an additional lay-down area for the temporary stockpiling of clean earthen materials removed to create the West Cell (approximately 12 acres), as well as the construction of the haul roads;
- Potential mining of an estimated undeveloped 7.5 acres to obtain the necessary on-site stone and borrow material needed for developing the containment cells, stream stabilization, and restoring barren areas;
- Restoration of the mined areas when the removal is completed (unless all of the required material can be obtained from the clearing and development of the West Cell area);
- Installation of surface water and shallow groundwater diversions as necessary to prevent the flow of surface water or groundwater into the West Cell or ORB cell;
- Installation of a bottom containment liner below the West Cell, if necessary, to ensure that groundwater and surface water are not adversely impacted by residual drainage from the waste material;
- Excavation of waste rock and soil exceeding soil RGs of the UWA and LWA and consolidation in the West Cell;
- Treatment of any water generated from the excavation activities, including the dewatering of sediments, saturated soil/waste, or residual drainage from the soil/waste using pH neutralization to create a neutral pH and filtration and or settling ponds/tanks to remove the metals – discharge of the treated water back to surface waters;
- Dewatering of Ponds 4 and 5 if necessary;
- Excavation of all contaminated sediment exceeding the sediment RG and any waste/soil that may be generating ARD from the Ponds 4 and 5 area and disposal of the sediment, with dewatering if required, into the West Cell;

- Restoration of Ponds 4 and 5 area as native wetland habitat;
- Construction of surface water drainage features to convey water from Ponds 4 and 5 and for the tributaries of Ely Brook that will be excavated;
- Use of minimally invasive extraction methods such as vacuum or hand removal sediments exceeding the sediment RG in Upper Ely Brook;
- Restoration of Upper Ely Brook;
- Monitoring of the Upper Ely Brook to confirm that the sediment RG is achieved;
- Construction of a temporary surface water diversion to allow excavation of sediments above the sediment RG in Middle and Lower Ely Brook;
- Excavation of the sediments above the sediment RG in Middle and Lower Ely Brook, including adjacent the riparian soils that exceed the sediment RG;
- Consolidation of excavated sediment, with dewatering and discharge to Ely Brook if required, with the waste rock and soil in the West Cell;
- Reconstruction of Middle Ely Brook, possibly as a rip-rap armored channel due to the expected slope of the channel;
- Restoration of Lower Ely Brook as a natural stream corridor;
- Installation of a low-permeability cover system on the West Cell that meets relevant and appropriate mine reclamation regulations and risk-based standards to contain and isolate the waste rock, soil, and sediment;
- Excavation of the TA and layering of tailings on the ORB to create the ORB Cell;
- Construction of the ORB Cell with a low permeability cover system and surface water diversions that meets applicable Vermont Solid Waste standards;
- Collection of leachate from the West Cell and ORB Cell, as necessary, and on-site treatment through treatment wetlands and/or settling basins and discharge to surface waters;
- Protection, to the extent practicable, of the historic retaining wall that is adjacent to the ORB, as well as other historic resources present within the Site;
- Restoration of the disturbed areas within the UWA, LWA, ORB, and TA;
- Endangered bat habitat mitigation measures, as required;
- Historic resource assessment and documentation via photographs, mapping, drawing, archaeological data recovery, construction monitoring/recordation, and/or other measures, as required;
- Additional investigation of potential prehistoric features within the Site, as required;
- Installation of monitoring wells to monitoring groundwater around the ORB Cell and West Cell;
- Long-term O&M;
- Use of institutional controls to prevent exposure to contamination within the OU1 area, protect the response action and prevent exposure to contaminants contained in the ORB Cell and West Cell;
- Environmental monitoring to evaluate the performance of the cleanup action and at least yearly compliance monitoring to ensure compliance with the institutional controls; and
- 5-year reviews

The estimated present value cost of the selected remedy for OU1 is $18 million.

## E. STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action (unless justified by a waiver), is cost-effective, and utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable.

The selected remedy is not able to achieve the statutory preference for treatment as a principal element of the remedy (i.e., reduce the toxicity, mobility, or volume of materials comprising principal threats through treatment) due to site conditions and the balancing of all the CERCLA criteria for selecting remedial alternatives, although there will be some minor treatment of dewatering water and possibly leachate. No principal threat wastes were identified at the Site.

Because this remedy will result in hazardous substances remaining on-site above levels that allow for unlimited use and unrestricted exposure, a review will be conducted within five years after initiation of remedial action and, at a minimum, every five years after that date, to ensure that the remedy continues to provide adequate protection of human health and the environment.

## F. SPECIAL FINDINGS

In accordance with Section 404 of the Clean Water Act (CWA) 33 U.S.C. § 1344 and Executive Orders 11990 (Protection of Wetlands) and 11988 (Protection of Floodplains), as incorporated under Federal Emergency Management Agency (FEMA) regulations 44 C.F.R. § 9 that are relevant and appropriate to the cleanup, EPA has determined that there may be unavoidable adverse impacts to wetlands and aquatic resources. To the extent that federally regulated wetlands and aquatic resources are located in OU1, these wetlands may be removed and/or altered as part of the cleanup actions. Wherever possible, wetland areas and aquatic habitats will be restored. There is no federally identified floodplain within OU1 and the cleanup will be conducted so that it does not pose any risk to downstream floodplain resources. EPA has evaluated the requirements of the applicable regulations, including Section 404 of the Clean Water Act and identified the selected remedy as the least environmentally damaging practicable alternative to protect federally regulated floodplain, wetland, and aquatic resources from exposure to contaminated sediments, soil and surface water. In its OU1 Proposed Plan, EPA solicited public comment on the alteration of wetlands and potential impacts to downstream floodplain during the course of the proposed remediation. EPA received support for this finding from the VT DEC and the United States Fish and Wildlife Service (USFWS) and did not receive any comments in opposition to the finding (*See* Appendices B and C).

Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended (16 U.S.C. 470f), requires EPA to take into account the effects of all actions on historic properties that have been determined to be eligible for the National Register of Historic Places. EPA has determined that the Site is eligible for the National Register of Historic Places. EPA has also

determined that the construction activities required to implement the selected remedy would have unavoidable direct and indirect impacts on historic features at the Site, but that these impacts are necessary to protect human health and the environment. Although no prehistoric resources have been identified to date, additional investigations may be required as part of remedial design. The design of alternative components will determine if any further documentation of prehistoric or historic resources is necessary prior to the disturbance of these resources, as well as the extent of data recovery, construction monitoring, or other measures may be needed to address protected resources. EPA will consult with the State Historic Preservation Officer and other stakeholders regarding any mitigation that may be necessary to address unavoidable adverse effects on prehistoric or historic resources at the Site.

## G. ROD DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary section of this Record of Decision. Additional information can be found in the Administrative Record file for this Site.

1. Chemicals of concern (COCs) and their respective concentrations.
2. Baseline risk represented by the COCs.
3. Cleanup levels established for COCs and the basis for the levels.
4. How source materials constituting principal threats are addressed.
5. Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of groundwater used in the baseline risk assessment and ROD.
6. Potential land and groundwater use that will be available at the Site as a result of the selected remedy.
7. Estimated capital, operation and maintenance (O&M), and total present worth costs; discount rate; and the number of years over which the remedy cost estimates are projected.
8. Key factor(s) that led to selecting the remedy (i.e., a description of how the selected remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria under the NCP, highlighting criteria key to the decision).

## H. AUTHORIZING SIGNATURES

Issuance of this ROD embodies specific determinations made by the Director of the Office of Site Remediation and Restoration pursuant to CERCLA and Section 404 of the Clean Water Act.

This ROD documents the selected remedy for OU1 at the Ely Copper Mine Superfund Site. This remedy was selected by EPA with concurrence of the VT DEC.

Concur and recommend for immediate implementation:

U.S. Environmental Protection Agency

By: _____ Date: 9/28/11

James T. Owens III, Director
Office of Site Remediation and Restoration
EPA New England, Region 1

# RECORD OF DECISION SUMMARY

## A. SITE NAME, LOCATION AND BRIEF DESCRIPTION

**Ely Copper Mine Superfund Site**
**Vershire, Orange County, Vermont**
**VTD988366571**
**Site ID No: 0102065**
**Operable Unit 1**

The Ely Copper Mine Superfund Site (the Site) is an abandoned copper mine located in Vershire, Orange County, Vermont and encompasses approximately 350 acres where historic mining activities took place, including about 30 acres of waste material containing an estimated 172,000 tons of waste rock, tailings, ore roast beds, slag heaps, and smelter wastes. The Site also includes over 3,000 linear feet of Underground Mine Workings along with the associated shafts and adits. No buildings remain at the Site. Remnant foundations, pads, and stone walls, including a 1,400 foot long smoke flue, demark the location of former Site structures including a former flotation mill and the smelter plant. The Site has been determined to be eligible for listing in the National Register of Historic Places by EPA in consultation with the State Historic Preservation Officer (SHPO). The location of the Site and study area for the Remedial Investigation and Feasibility Study (RI/FS) is shown in Figure 1.

The Site was added to the EPA National Priorities List in September 2001 due to environmental impacts from acid rock drainage from the Site on Ely Brook and Schoolhouse Brook (SHB) (47583 – 47591 Federal Register / Vol. 66, No. 178 / Thursday, September 13, 2001 Rules and Regulations). Site coordinates are 43° 55' 9.264" north latitude and 72° 17' 10.6434" west longitude.

A more complete description of the Site can be found in Section 1 of the OU1 Remedial Investigation (RI) Report and Section 1 of the OU1 Feasibility Study (FS) Report.

## B. SITE HISTORY AND ENFORCEMENT ACTIVITIES

### 1. History of Site Activities

The Ely Copper Mine is one of three major historic copper mines, the Elizabeth, Ely, and Pike Hill Mines, located within Besshi-type ore deposits within a 20 mile long area from south to north that comprise the Vermont Copper Belt. Ely Copper Mine was among the top ten copper producing operations in the United States for a period of its history, with an average annual production of 500 tons of ingot copper and an estimated total copper production of 20,000 tons.

The Ely Cooper Mine ore body was discovered in 1813 and explored in the 1830s. Significant mine activities began in 1853 by the Vermont Copper Mining Company (VCMC) led by Thomas Pollard and lasted until 1905. In 1864, after a period of sporadic output of the mine due to the segmented and overlapping lens-like nature of the ore body, Smith Ely collaborated

with Mr. Pollard to relocate the ore body and successfully boost production. In 1866, tramway roads were built to carry ore down the valley, the main alignment of which is still apparent today. The Tram construction was immediately followed by the development of the ORB and the initial construction of the smelter in 1867. The roast bed area extended 900 ft, bounded by a stone wall on the west and serviced by an elevated trestle. Roasting the ore reduced the sulfur content prior to smelting. By 1868, four smelter furnaces were in operation. Mine operations experienced a boom between 1872 and 1880 when the Ely Village expanded and the Town of Vershire grew to a population of about 1,900 in contrast to today's population of about 630 people. By 1876, sulfur fumes from the roast beds and smelter had eliminated the vegetation in the valley, and ore-roasting kilns were added to the smelter facility. In an attempt to mitigate the smelter fumes, a stone slab flue approximately ¼ mi long was built from the smelter up the eastern side of the valley, but reportedly never functioned effectively in transporting fumes away from the village. By 1877, the smelter building was 300 ft long with 14 furnaces, and was expanded in 1879 to a length of 700 ft with 24 furnaces to accommodate ore from the Pike Hill Mines. During this time the smelter slag pile was expanding south of the building toward SHB. Political events and falling copper prices in the early 1880s led to a worker revolt known as the Ely War in 1883 and collapse of the VCMC. Between 1883 and the close of the mine in 1905, ownership changed hands several times and production was sporadic.

In 1900, George Westinghouse upgraded mine equipment to rejuvenate copper production to support the Westinghouse Electric Company but was unsuccessful due to multiple factors including the lack of ore at the 3,500 ft downdip limit of the mine and low copper prices. In 1905, equipment was stripped from the Ely Copper Mine by Mr. Westinghouse and buildings were sold, moved, or demolished. In 1917, the Ely-Copperfield Association of New York, NY attempted to recover copper from the mine dumps with construction of a flotation separation mill which operated for a short period until the end of World War I, when the price of copper fell, closing the operation. In 1949-50, attempts were made to recover copper from the mine waste piles and 60,000 tons of waste rock/ore assayed at about 1 percent (%) copper was transported to the Elizabeth Mine for processing. Prospect drilling was also completed in the mid-1950s by Appalachian Sulphides, Inc. Total copper output of the mine was estimated between 30 and 40 million pounds. Since 1950, the Site has been used for timber management and recreational activities, including hunting, snowmobile riding, and horseback riding. The Site is often visited by those interested in the remnants of the mining activities or the Site geology. All-terrain vehicle tracks are observed on several of the waste piles. Figure 2 shows the remnant historic features at the Site. A more detailed description of the Site history can be found in Section 2 of the OU1 RI Report.

### 2. History of Federal and State Investigations and Removal and Remedial Actions

With the exception of the RI/FS, no prior removal or remedial response actions have taken place at the Site. EPA began the RI/FS at the Site in 2001. The key findings of the OU1 RI/FS are presented in Section E of this ROD. The OU1 RI/FS was completed prior to the issuance of the OU1 Proposed Plan for this ROD in July 2011. The OU2 RI/FS is ongoing.

The Site is undergoing investigation and clean-up activities pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act, as amended (CERCLA), 42 USC § 9601 *et seq.*, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 Code of Federal Regulations (CFR) Part 300. The Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) identification number for the Site is VTD988366571.

The US Bureau of Mines (USBM), Vermont Department of Environmental Conservation (VT DEC), and the United States Geological Survey (USGS) have all performed studies at the Site. The USBM, in conjunction with the VT DEC, performed evaluations of acid mine drainage (AMD) and ARD impacts at the Site between 1993 and 1995. In spring 1995, these evaluations included testing of an experimental limestone-based passive treatment system along Ely Brook to determine whether a passive technology was feasible to address the large-scale acidic drainages at the Site. The USBM's field-scale passive treatment system consisted of limestone and a sulfate reducing bioreactor cell that received and treated redirected discharges from Site drainages. Based on the data obtained, the USBM concluded that the passive treatment system improved the overall water quality of the mine drainage by removing metals and increasing the pH.

The VT DEC inventoried fish species and evaluated the aquatic benthic macroinvertebrate and fish communities in SHB in 1988 and in 1991. They determined that the aquatic benthic macroinvertebrate and fish communities in SHB were impacted by mine drainage due to copper concentrations. Preliminary evaluations of surface water and mine wastes from the Site were conducted by USGS between 1998 and 2002, prior to the RI-associated investigations. The USGS research primarily focused on mine wastes (i.e., waste ore, tailing, and slag) and their effects on site surface water. As part of these early investigations, the USGS evaluated bulk geochemistry, mineralogy, distribution of trace elements, and reactivity of waste materials. Based on these early investigations, the USGS concluded that the mine waste at the Ely Copper Mine is a combination of host rock and discarded ore, some of which has undergone various stages of metallurgical processing, including roasting, milling, and smelting. The USGS confirmed that the mine waste tends to be acid generating from the presence of sulfides (i.e., jarosite and efflorescent sulfate salts). The dominant trace Target Analyte List (TAL) metals leached from the mine waste are copper, cadmium, cobalt, nickel, and zinc. All of these metals were found to leach from waste materials at concentrations that may adversely impact soils and streams and have a deleterious effect on the environment. The USGS also concluded that the mine waste at the Ely Copper Mine is geochemically similar to the historic mine waste at the nearby Elizabeth Mine, which is located approximately 10 miles southeast of the Site.

### 3. History of CERCLA Enforcement Activities

To date, enforcement activities have been limited at the Site. Determining liability for the Site is complicated by more than 50 years that have passed since the closure of the Ely Mine in 1950. The former owners and operators of the Site are deceased or defunct. EPA continues to investigate whether potentially liable and viable successors to the now defunct former operators may exist. The majority of the Site is owned by one entity, Ely Mine Forest, Inc. This entity did

not participate in any of the mining activities and purchased the Site property after mining activities ceased. EPA has recently reached a settlement with Ely Mine Forest, Inc. Through the settlement the landowner will provide access to EPA to implement the OU1 remedy on their land, and has also agreed to implement institutional controls to ensure the long-term protection of the remedy.

## C. COMMUNITY PARTICIPATION

The OU1 Proposed Plan, along with the OU1 RI Report and OU1 FS Study were made available to the community in July 2011. These documents, and others relating to the Site, can be found in the Administrative Record file, which is available at the following information repositories: the Vershire Town Office and the EPA Region 1 OSRR Records Center in Boston, MA. The notice of the availability of the OU1 RI/FS, Proposed Plan, and Administrative Record was published in the Valley News on Saturday July 23, 2011 and Sunday July 24, 20011. A public comment period was held from July 28, 2011 to August 27, 2011. An extension to the public comment period was not requested. Prior to the release of the Proposed Plan, EPA met with the community in December 2010 and May 2011 to update the community regarding the investigations and findings of the OU1 RI/FS. In addition, EPA held a public meeting on July 27, 2011 to present the OU1 Proposed Plan to the community and a public hearing on August 25, 2001 to accept comment regarding the Proposed Plan. Notice of the July 27, 2011 meeting, August 25, 2011 public hearing, and the availability of the OU1 Proposed Plan was also included in the July 23 and 24 public notices, on the Town of Vershire website, and on a meeting notice mailed to all Vershire and West Fairlee postal patrons. EPA sent 187 copies of the OU1 Proposed Plan by mail to residents of Vershire and West Fairlee who live in close proximity to the Site. The OU1 Proposed Plan was also available at the information repository, July 27 public meeting, and was posted on the EPA website for the Ely Copper Mine Superfund Site.

EPA has worked with concerned and interested members of the community. While there has been a low/moderate level of community interest, the local historical society has been very interested in the Site activities. EPA has kept the community and other interested parties apprised of Site activities through informational meetings, fact sheets, press releases and public meetings. Below is a brief chronology of public outreach efforts.

- EPA released a public information fact sheet and met with the community in 2001 to discuss the placement of the Site on the NPL and the plans for the RI/FS;
- Meetings between EPA and the local community to discuss the implementation and findings of the OU1 RI/FS were held in December 2007, December 2010, and May 2011;
- EPA released public information fact sheets to update the OU1 RI/FS activities in May 2002, August 2006, December 2010, and May 2011;
- EPA released a fact sheet summarizing the key findings of the OU1 RI in December 2010 and May 2011;
- EPA met with the community to discuss the OU1 RI in December 2010 and May 2011;

- EPA held a public information meeting to present and release the OU1 RI/FS and Proposed Plan to the public on July 27, 2011;
- EPA provided a public comment period from July 28, 2011 to August 27, 2011 to accept public comments regarding the OU1 Proposed Plan;
- As part of the public comment period, EPA held a public hearing on August 25, 2011 to accept public comment regarding the OU1 Proposed Plan; and

EPA's response to the comments received during the comment period is included in the Responsiveness Summary, which is Appendix C to this ROD. The comments received as part of the public comment period were mixed. Many of the comments expressed concern regarding the cost of the cleanup. There were also concerns raised regarding the potential impact on the bat community and the historic resources. A few comments were in support of the cleanup.

## D. SCOPE AND ROLE OF OPERABLE UNIT OR RESPONSE ACTION

The cleanup action presented in this ROD for OU1 will be the first cleanup action for the Site. EPA often creates operable units (OUs) to enable cleanup actions to move forward on certain areas of a site while allowing additional investigation in other areas of a site. For the Site, EPA is creating two Operable Units.

OU1 for the Site will target the areas that are the primary source of the surface water and sediment contamination that is responsible for the ecological impacts to Ely Brook, Pond 4, Pond 5, and SHB. These areas are also the major source of soil and groundwater contamination within the OU1 area. The OU1 areas of the Site, which are shown in Figure 3, include:

- Lower Waste Area (LWA) and Upper Waste Area (UWA)- waste rock (sulfide ore-bearing rock) that did not contain enough copper to process.
- Tailings Area (TA)- tailings (finely ground sulfide ore) that were left behind from copper extraction processes at the flotation mill.
- Ore Roast Bed (ORB)- waste rock from ore roasting, a process that makes it easier to remove the copper from the rock.
- Sediment of Ely Brook, its tributaries, and Pond 4 and Pond 5- eroded mine waste from the Site has built up as bottom sediment, where it leaches metals into the water.

Operable Unit 2 (OU2) will address all other areas and media at the Site where risks to human health or the environment are present that are not addressed by OU1. The OU2 areas, which are shown in Figures 3 and 4, include:

- Smelter/Slag Area- waste rock, oxidized ore, slag and building demolition debris, most of which are associated with on-site smelting operations.
- Underground Mine Workings- contaminated groundwater and leachate (water that passed through contaminated soil and now contains some of the contaminants) can fill underground mine tunnels and shafts, some of which eventually drain to Ely Brook.
- Sediment of SHB and East Branch of Ompompanoosuc River (EBOR) - eroded mine waste from the Site has built up as bottom sediment, where it leaches metals into the

water (a limited area of SHB at its confluence with Ely Brook will be addressed under OU1).

- Site Groundwater- groundwater contaminated by metals and acids that have leached from waste source areas at the Site.
- Surface water – surface water contaminated by metals and acids that have leached from waste source areas at the Site.

It should be noted that while the surface water of SHB and EBOR and Site groundwater will be addressed in OU2, significant improvement to both surface water and groundwater quality is anticipated from the cleanup of OU1 areas, which are the major contributing sources to the surface water and groundwater contamination. The remediation of Ely Brook under OU1 is also expected to significantly improve the ecological health of SHB and downstream waterways prior to the waterways being addressed under OU2. The OU2 RI/FS will determine the need for any response actions other that the OU1 remedial action.

EPA will be implementing an Early Action for OU2 in addition to the OU1 Remedial Action, as described in a separate OU2 CERCLA decision document. The OU2 Early Action will prevent exposure to contamination identified in the Site Human Health Risk Assessment (HHRA) within the OU2 area using land use restrictions that will prevent residential development and the installation of wells for any use other than the monitoring or implementation of a response action.

## E. SITE CHARACTERISTICS

Chapter 1 of the OU1 Feasibility Study Report contains an overview of the OU1 RI. The significant findings of the OU1 Remedial Investigation Report are summarized below.

### 1. Remedial Investigation Program

Since 1998, a considerable amount of data has been generated as the result of various investigation programs conducted at the Site. At various periods of time, EPA has retained the U.S. Army Corps of Engineers (USACE), the USGS, URS Corporation, Inc. (URS), and Nobis Engineering, Inc. (Nobis) to perform work at the Site. Additional information has been contributed from studies performed by the State of Vermont. In 2002, the USACE, in cooperation with the USGS, completed a study of spring runoff from the Site to characterize the geochemical diversity of water sources in the Ely Brook Watershed, which included sampling from seeps in mine waste areas, Ely Brook and tributaries, SHB, and the East Branch of the Ompompanoosuc River (EBOR). This study documented highly acidic and highly metal-laden runoff from the mine areas.

From 2005 through 2008, URS, in conjunction with the USACE and EPA, completed extensive field studies, including a habitat characterization study of the Site. Field investigations included test pits, borings, monitoring well installations, and the collection of surface water and sediment (over 30 locations), surface and subsurface soil (over 150 locations), and groundwater samples (approximately 30 wells) from the Site. URS evaluated surface and subsurface soil

samples from waste areas and transition zones around waste areas, including off-site background soil metals concentrations. These data have been incorporated directly into the RI/FS analytical database for the Site.

In 2006 and 2007, the USGS, in conjunction with the EPA RI/FS, conducted a detailed characterization of surface water, sediment, porewater, and fish and macroinvertebrate communities in Ely Brook, SHB, and the EBOR in support of the Aquatic Baseline Ecological Risk Assessment for the Site. These studies included toxicity tests of surface water, sediment and porewater form each surface water reach.

In 2009, Nobis completed extensive supplemental field investigations to complete the RI. Investigations included sampling of surface/subsurface soil (over 80 samples), groundwater (2 rounds from over 40 wells), surface water (2 rounds over 30 locations, including 4 vernal pools), porewater (7 locations), sediment (16 locations) and small mammal and invertebrate biota sampling along 12 transects. Residential drinking water samples were also collected from 6 locations near the Site. Overburden, shallow, and deep bedrock well installations were completed, along with packer testing and borehole geophysical characterization of the deep bedrock at the Site. Soil sampling included on-site laboratory X-ray fluorescence (XRF) analysis of over 340 soil samples from an extensive network of 26 sample transects.

Sediment sampling of the Lower Reach of Ely Brook included detailed evaluation of three sediment transects to assess the vertical distribution of waste rock sediment in the brook. Investigations included the collection of soil and sediment samples for geotechnical analyses to document the physical characteristics of waste materials and support the OU1 FS. Biota sampling to support the terrestrial Baseline Ecological Risk Assessment (BERA) included 8 composite samples of invertebrates and 107 small mammals from five transects in select transition zone areas.

Figure 5 shows the location of the soil samples collected as part of the RI. Figure 6 shows the location of the surface water samples collected in the OU1 area of the RI. Figure 7 shows the sediment samples collected in the OU1 area of the RI. Figure 8 shows the monitoring wells that were installed as part of the RI.

### 2. General Site Characteristics

EPA performed a series of investigations to develop an understanding of the nature and extent of contamination at the Site. A brief summary of the area wide characteristics is presented followed by a more specific discussion of the Site source areas along with the nature and extent of contamination. Only the media and areas that relate to the OU1 remedial action are discussed in this ROD. The information pertaining to other media and areas of the Site can be found in the OU1 Remedial Investigation Report, which is part of the Administrative Record.

The Site landscape is a combination of barren open areas and patches of birch and evergreen trees. The surface mine wastes lie within the watershed of Ely Brook, which flows south to join SHB on the south side of South Vershire Road. SHB borders the southern margin

of the Site adjacent to a smelter slag waste pile, and flows eastward approximately 1.75 miles to its confluence with the EBOR. SHB and the EBOR are used for recreational purposes and contain fisheries. Site topography is dominated by Dwight Hill extending from an elevation of approximately 1,600 feet down to an elevation of approximately 940 feet at SHB; some 660 feet of relief. The main shaft and several adits leading to the underground workings are located along the steep, upper portion of this slope at the head of the valley, while the mine wastes are located within the more gently sloping, lower portions of the valley. North-south trending ridges to the west and east of the mine areas define two smaller upland valleys that merge into an open U-shaped valley that faces south-southwest, defining the Ely Brook watershed. The headwaters of Ely Brook are located in the western tributary valley, northwest of the mine areas. The eastern tributary to Ely Brook drains from a former reservoir and a series of beaver ponds located east of the mine areas.

### a. Regional Bedrock Geology

The Vermont Copper Belt lies within a group of Silurian-Devonian rocks comprising the western portion of the Connecticut Valley-Gaspé Trough, which extends from Massachusetts to Quebec, Canada. Stratigraphic units in east-central Vermont include (from oldest to youngest), the Northfield Formation, Waits River Formation, Standing Pond Volcanics, and the Gile Mountain Formation (Slack and others, 2001). The massive sulfide deposits of the Elizabeth Mine and Ely Copper Mine lie within the Gile Mountain Formation of Devonian age, while the deposit at Pike Hill lies within the Waits River Formation of Silurian age. These rocks have been deformed during three stages of folding and amphibolite-grade metamorphism during the Devonian Acadian Orogeny.

The bedrock at the Site is exposed at many locations in the upper elevations of Dwight Hill and is composed primarily of siliciclastic metasedimentary rock (pelite and graywacke) representing a turbidite protolith, with minor mafic metavolcanic rocks (amphibolite). The main belt of Gile Mountain rocks lies to the east of the Waits River Formation and is comprised primarily of metamorphosed siliciclastic rocks (graphitic pelite and quartzose granofels) representing a quartz-rich turbidite protolith. The Amphibolites of the Standing Pond Volcanics typically occur along the contact between the Waits River and Gile Mountain Formations, and locally within the uppermost Waits River Formation, representing a suite of primarily thin metabasalts. The variations in the stratigraphic position of the Standing Pond Volcanics suggest that the contact between the Waits River and Gile Mountain Formations is time transgressive. The ore body at the Site had an elongated shape extended over 3,000 feet inclined at approximately 25 degrees and formed along the crest of a fold in the bedrock layering along a trend of approximately N40E. The mineralogy of the ore at the Site is similar to that at the Elizabeth Mine and Pike Hill Mines. The ore is dominated by pyrrhotite and chalcopyrite, with minor sphalerite and pyrite. The dominant minerals in the host rock are quartz, feldspar, and muscovite.

### b. Regional Surface Water Hydrology

Ely Brook is a first order stream and the primary drainage pathway from the Site. Its watershed encompasses approximately 0.42 square miles ($mi^2$) with the highest elevation above 1,350 ft. Ely Brook descends over 380 ft from the headwater to its confluence with SHB at an elevation of 970 ft. The brook flows approximately 1 mi from its headwaters along the southern slope of Dwight Hill to the confluence with SHB. Ely Brook is fed on the east by three significant tributary streams referred to as the Ely Brook Tributary 1 (EBT1), Ely Brook Tributary 2 (EBT2), and Ely Brook Tributary 4 (EBT4) that divide Ely Brook into four reaches referred to as the Ely Brook Headwaters, the Ely Brook – Upper Reach (EB-UR), Ely Brook-Middle Reach (EB-MR), and the Ely Brook-Lower Reach (EB-LR). Ely Brook Tributary 3 (EBT3) combines with EBT2 prior to reaching Ely Brook.

SHB originates south of Vershire Center and has a drainage area encompassing 9.73 $mi^2$. SHB drops approximately 886 ft in elevation from its headwaters to its confluence with the EBOR. Ely Brook joins SHB at the base of the Ely Brook valley along the south side of South Vershire Road. Below the confluence, SHB forms the southern margin of the Site adjacent to the Slag Pile Area and flows 1.75 mi before its confluence with the EBOR. USGS descriptions of stream reaches developed using flow characteristics and stream bottom composition show that a majority of the stream is characterized by cobble bottom with limited depositional areas for fine sediment to accumulate.

The EBOR is one of two main branches that meet to form the 23-mi long Ompompanoosuc River system, whose drainage area encompasses 136 $mi^2$. The EBOR headwaters are located in the northwest corner of Vershire; the river then flows east and south into Thetford. The confluence of the EBOR and the West Branch of the Ompompanoosuc River (WBOR) is just upstream of the Union Village Dam in Thetford. A USGS gauging station is maintained just below the dam. The Ompompanoosuc River then flows southeast to its confluence with the Connecticut River in Norwich, Vermont.

### c. Site Hydrogeology

The conceptual model of site-wide groundwater flow based upon August 2009 flow conditions is illustrated through overburden and shallow bedrock (upper 20 feet) groundwater flow maps (Figures 9 and 10, respectively) and a generalized conceptual flow model diagram shown in Figure 11. Due to the moderate slopes at the Site, natural soil overlying bedrock is relatively thin (less than 10 ft) and, as such, has a limited capacity to store groundwater. The majority of the natural soil overburden in the upper part of the Ely Brook valley is glacial till with a relatively low hydraulic conductivity (i.e. water does not move easily through it). The till beneath waste areas is typically groundwater-saturated. The waste materials overlying the till are generally more permeable and only locally saturated with groundwater in the lowermost portions of the areas. A thicker alluvial deposit overlies the till in the lower part of the valley in the Smelter/Slag Area. Groundwater in the bedrock is largely stored in open fractures. The shallow bedrock at the Site appears to have a hydraulic conductivity similar to the overburden. Based on groundwater sample results from two well clusters (MW-19 and MW-21) shallow bedrock

groundwater has been contaminated by ARD leaching from the OU1 and OU2 source areas. Deeper bedrock contamination has only been observed beneath the UWA. Observations from packer tests and geophysical logging of the deep bedrock boreholes suggest that the deeper bedrock has a relatively low density of significant water-bearing fractures. The flooded Underground Mine Workings form a unique reservoir of groundwater, which is an important consideration in interpreting the subsurface hydrology of the northern portion of the Site. Based on the projection of fractures observed in deep bedrock well (MW-19D), located relatively close to the southern limit of the mine pool, the detected impact in this well is correlated to a surface mine waste source and does not indicate any significant direct impact from the mine pool to bedrock groundwater on the south side of Dwight Hill. However, results from analyses of groundwater discharge from three mine openings (Main Adit, Lower Adit, and Shaft No 4) confirm that water from the Underground Mine Workings does have an impact on the surface water quality at the Site.

The upper slope of Dwight Hill, above the UWA, is an area of groundwater recharge, such that precipitation will tend to infiltrate downward through the overburden and into the bedrock. However, during large rain storms and snow melt events, significant volumes of overland flow are directed to the lower portions of the valley due to the steep topography, the thin overburden and the limited infiltration capacity of the bedrock in these areas as evidenced by the flashy nature of Ely Brook. In areas overlying the Underground Mine workings, groundwater may be intercepted and flow through the open areas of the mine, eventually reaching the mine pool level. The mine pool surface elevation documented in White and Eric (1944) is consistent with the elevation of the Main Adit. The Main Adit represents the outlet for the mine pool and creates a drain feature that regulates the hydraulic head of groundwater in bedrock in the vicinity of the mine. As a result, bedrock groundwater at shallow depths in the vicinity of the mine may migrate toward the mine pool during periods of significant recharge.

On the south side of Dwight Hill, shallow groundwater flows south and southwest beneath the UWA, where the lowermost foot of the waste rock was observed to be periodically saturated due to the slight mounding of groundwater above the glacial till. A greater degree of mounding is anticipated in the waste rock areas during high flow periods such as spring snowmelt and high precipitation periods. Impacted overburden groundwater discharges at the downslope margin of the piles within the UWA to form surface seeps and tributary streams that lead to Ely Brook. Further downslope, the LWA and TA have significant saturated thicknesses as a result of the coalescence of shallow groundwater and tributary streams converging on Ely Brook. The LWA and TA lie within an area of groundwater discharge where slope gradients are somewhat gentler and multiple groundwater seeps occur. The base flow of the seeps, tributary streams, and Ely Brook are generally fed by the discharge of groundwater from the shallow overburden, and to a lesser extent, shallow bedrock groundwater moving through the overburden. The exception to this recharge from groundwater is in the lowermost portions of the Ely Brook and SHB Valleys, where thicker, less permeable, glacial till inhibits such flow.

Groundwater data indicates that the mine waste rock significantly impacts shallow groundwater locally and more directly affects the quality of overland flow in the Ely Brook Valley. The discharge of shallow groundwater and upward bedrock groundwater gradients in the

lower portions of the valley preclude the potential impact to deeper groundwater in those areas. Results from on-site monitoring wells indicate a localized impact to the uppermost 20 feet of shallow bedrock groundwater beneath the UWA and LWA. Results from residential drinking water sources near the Site do not indicate any impact to deep bedrock groundwater from surface mine waste source areas at the Site. The impacts to groundwater from the OU1 source areas will be addressed as part of the OU1 remedy, the complete assessment of groundwater and the evaluation of cleanup options for contaminated groundwater are components of the OU2 RI/FS.

#### d. Wetland Resources

A preliminary wetland assessment to identify State and Federal jurisdictional wetlands was performed as part of the RI/FS. Based on the State of Vermont classification system, there are no State Class I wetlands in Orange County, Vermont. State Class II wetlands are those defined by the National Wetlands Inventory (NWI) maps for the State of Vermont (published by the USFWS) and all wetlands contiguous to such mapped wetlands, with some exceptions. The NWI quadrangle map for the Site (dated October 1977) depicts one wetland feature present at the Site. Pond 1 was listed as a permanently flooded Palustrine with an unconsolidated bottom (PUBH). This wetland is by definition a State Class II wetland unless a finding is made that the functional values of the wetland are not significant enough to warrant a classification. Federal jurisdictional wetlands on Site are more extensive, occurring as areas vegetated with wetland plant species, growing in wetland soils, and located along waterways and waterbodies located within the Site. The full extent of federal jurisdictional wetlands will be identified as part of remedial design. The preliminary wetland delineation is shown on Figure 12.

#### e. Historic Resources

As part of the RI/FS, EPA completed a historic resources assessment of the Site as part of compliance with the National Historic Preservation Act. The Ely Copper Mine is eligible for listing in the National Register of Historic Places under Criterion A at the local, state and national levels for its contributions to the history of Vershire, the State of Vermont and the United States. These areas of significance include commerce, economics, engineering, industry, invention, and labor. At its peak the Ely Copper Mine was the largest single copper producing mine east of the Mississippi River. It was the largest copper mine working in sulfide ores for a long period of time in which most of the rest of U.S. copper production came from native copper ores. Its only other close rival was the Union Consolidated Mining Co. at Ducktown, TN, which produced 1 million lbs annually during Ely's period of operation, but often from several smaller mines rather than just one shaft as at Ely. During the second half of the nineteenth century, the Ely Mine easily outstripped the copper production at the Elizabeth Mine at South Strafford. The Ely Copper Mine was among the top ten producing U.S. copper mines between 1866 and 1881. The Ely Copper Mine was the only copper mine in New England, and one of a handful east of the Rocky Mountains, where all technological aspects of refined pig copper production, from mining of raw ore to smelting of refined copper, were successfully integrated on a large scale. The Ely Copper Mine was the site of a major early eastern U.S. copper smelting plant that was second in output next to the more productive Michigan copper district for a time during the late nineteenth century. The Ely Copper Mine was the scene of experiments that may have

contributed incrementally to the development of the copper converter, one of the most important developments in early twentieth-century copper metallurgy. During its approximately 130-year life the mine became a seat of political power, and spawned and supported the growth of a sizeable rural industrial community. The Ely Copper Mine was significant as a regionally anomalous extractive industrial mono-economy that supported a community akin to a Western mining boom town, with its only near rivals the contemporaneous, but smaller and shorter-lived Blue Hill, ME, copper and Ammonoosuc, NH, gold mining booms. It was the scene of labor unrest during the 1882 "Ely War."

Remnants of the former copper mining operations occur throughout the Site, although no standing buildings still exist (see Figure 2). A more detailed description of the Site history and description of existing historic structures within OU1 can be found in Section 2 of the OU1 RI Report. Investigations to date have not identified any prehistoric sites within OU1. However, as part of remedial design, additional archeological surveys will be conducted within areas that have not been evaluated to date.

### 3. Nature and Extent of Contamination

The major issue at the Site is ARD, which occurs when sulfide mineral-bearing rock and ore are exposed to oxidizing conditions through natural weathering processes. ARD occurs in response to the oxidation of waste rock, waste ore, tailings, slag, and roasted ore. The contaminated water that flows from the underground adits and shafts is more commonly referred to as AMD. The geochemical reactions responsible for the oxidation of sulfide minerals, such as pyrrhotite, are driven by the availability of atmospheric oxygen and water. These geochemical reactions produce sulfuric acid, which results in the generation of low-pH (typically less than 4.0 standard units) leachate. At low pH, many of the metals that were bound in the ore and native soil become soluble and dissolve into the leachate. The leachate from the Site often contains elevated levels of aluminum, cadmium, cobalt, copper, iron, manganese, and zinc that are likely from the locally mined ore. Aluminum and manganese are also contributed by the leaching of metals in the native soil. In addition to the oxidation of the sulfide-bearing minerals, the cyclic formation and subsequent dissolution of evaporative metal salts on exposed waste ore and tailings also contributes to ARD at the Site. Metal salts form on the surfaces of the tailings and waste ore piles as metal-containing acidic moisture evaporates. The metals stored in these salts are dissolved and remobilized during subsequent rainfall events. This run-off eventually is conveyed to receiving streams resulting in an increase in the metals concentration and load.

Metals associated with ARD at the Site have been detected at elevated concentrations in groundwater, surface water, soil, and sediment. ARD directly affects both groundwater and surface water quality at the Site by lowering the pH and contributing elevated concentrations of metals to these media. This also occurs at the outlet of the adits where impacted mine waters discharge directly to the ground surface as AMD. In addition, the tailings, weathered waste ore, roasted ore, and byproducts generated from the smelting process (*i.e.*, slag) have been transported from the original areas of deposition by erosion and re-distributed nearby, causing elevated concentrations of metals in the soil adjacent to the waste areas. Some of these materials have been conveyed by overland flow, resulting in elevated concentrations of metals in sediment

along these Site drainage ways, including: Ely Brook, four tributaries to Ely Brook, SHB, and the EBOR.

### a. Nature and Extent of Contamination in OU1 Source Areas:

The four primary source areas (UWA, LWA, TA, and ORB) identified within the OU1 areas are responsible for the majority of the surface water, soil, sediment, and groundwater contamination at the Site. These areas are shown in Figure 13. In addition, the Lower Ely Brook and its associated riparian soils contain significant quantities of mine waste. Table 1 below summarizes the area and volume for each of the OU1 source areas at the Site.

Table 1

| **Area and Volume of OU1 Waste Rock, Tailings, and Soil above Soil RGs** | | | | |
|---|---|---|---|---|
| | Average Thickness (feet) | Area (acres) | | Volume (cubic yards) |
| Upper Waste Area (UWA) | Varies | 8.5 | | 72,763 |
| Lower Waste Area (LWA) | Varies | 6.4 | | 28,620 |
| Tailings Area (TA) | Varies | 0.7 | | 3,600 |
| Ore Roast Bed | Varies | 2.2 | | 10,330 |
| Estimated volumes of waste rock, tailings, and soil above RGs | | | | 115,313 |
| **Area and Volume of Sediment above Sediment RG** | | | | |
| | Average Thickness (feet) | Length (feet) | Width (feet) | Volume (cubic yards) |
| Upper Ely Brook | 0.5 | 1,700 | 6 | 190 |
| Middle Ely Brook | 2.0 | 660 | 12 | 580 |
| Lower Ely Brook | 2.0 | 1,200 | 12 | 3,950 |
| Pond 4 and Pond 5 | 3.0 | 60 | 80 | 378 |
| Estimated volume of sediment above the RG, including riparian soil | | | | 5,088 |
| **Area and Volume of Sediment and Waste Material in Ely Brook Tributaries** | | | | |
| | Average Thickness (feet) | Length (feet) | Width (feet) | Volume (cubic yards) |
| Ely Brook Tributary 1 | 2 | 500 | 12 | 445 |
| Ely Brook Tributary 2 | 2 | 530 | 12 | 471 |
| Ely Brook Tributary 3 | 2 | 773 | 12 | 1,618 |
| Ely Brook Tributary 4 | 2 | 650 | 12 | 687 |
| Estimated volume of Sediment and Waste Material above the soil RGs and the sediment RG | | | | 3,221 |
| Total Estimated Volume of Contaminated Material in OU1 Area | | | | 123,622 |
| Material that will be consolidated into West Cell includes: UWA, LWA, Lower Ely Brook, Middle Ely Brook, Ponds 4 and 5 (the volume for EBT1, EBT2,EBT3,and EBT4 is included in the volume for the UWA, LWA, and Tailings Area) | | | | 106,471 |

A description of each of the OU1 source areas and the associated soil, waste and groundwater contamination is presented in the following subsections. The remediation goals (RGs) presented in the tables of this section are based on the based on the HHRA andBERA. The soil/waste RGs for cobalt, copper, and iron are listed in Table 45 of this ROD and the RG for sediment is listed in Table 46 of this ROD. The extent of soil/waste contamination above the OU1 soil RGs is shown in Figure 14 and the extent of sediment contamination above the RG is shown in Figure 15 as the area of aquatic impairment. The extent of groundwater contamination associated with the OU1 source areas was delineated using the preliminary remediation goals (PRGs) developed in the RI Report and is shown in Figure 16.

**Upper Waste Area (UWA)** – The UWA covers an area of approximately 8.5 acres and is comprised of a series of terraced, overlapping mine waste rock piles of varying thickness in the upper portion of the Ely Brook Valley on the south side of Dwight Hill. The UWA sits just downslope of the Main Shaft for the underground workings. A series of six shafts and two adits are found within and adjacent to the UWA and a series of ponds (Pond 1 through Pond 5) define the downslope extent of the UWA. The UWA waste piles are up to 22 ft thick. Native soil underlies portions of the UWA, but some of the waste sits directly on bedrock. The primary limits of the UWA were defined by the physical presence of mine waste. This delineation generally coincides with areas where cobalt, copper, and iron exceed soil/waste RGs and contains about 73,000 cubic yards (cy) of mine waste. Groundwater extends into the lower portion of the piles, particularly during spring snowmelt and after periods of substantial rain. Water coming into contact with the mine waste creates an acidic leachate containing high levels of contamination that drains from the UWA into groundwater and several tributaries of Ely Brook (EBT2, EBT3, and EBT4). Average surface soil copper concentrations in the UWA are over 2.7 times greater than soil RGs and 39 times greater than the maximum background concentration for copper.

Off-site laboratory results from 94 surface soil samples from 58 locations across the UWA were evaluated as part of the combined soil database for the Site. Samples were collected during Site investigations conducted by the USGS, URS, and Nobis from both the non-vegetated portion of the waste rock piles ("barren area") and the surrounding transitional vegetation zone ("transition zone") that exists between barren areas and healthy, vegetated forest. Soil XRF field screening results are provided in Table 6-19 of the RI and a detailed description and evaluation of the XRF soil field screening investigation is included in the Nobis Data Evaluation Report (Appendix C of the RI, Section 5.0). Laboratory analytical results for all surface soil TAL metals are provided in Table 6-6 of the RI. A statistical summary of UWA surface soil/waste contaminants of concern (COC) results is shown in Table 2 and Table 3 below.

**Table 2**
**UWA Surface Soil/Waste (Barren Source Area)**

| Contaminants of Concern | Ave (mg/Kg) | Max (mg/Kg) | 95% UCL | Detection Frequency | Samples Exceeding RGs | RGs (mg/Kg) | Background Max (mg/Kg) |
|---|---|---|---|---|---|---|---|
| Cobalt | 27 | 325 | 36 | 86/86 | 22 | 24 | 16 |
| Copper | 1,731 | 12,000 | 2,160 | 86/86 | 54 | 629 | 45 |
| Iron | 97,740 | 456,000 | 110,939 | 86/86 | 59 | 44,800 | 31,000 |

Notes:
UCL – 95% Upper Confidence Limit of the Mean
RGs – Remediation Goals
Ave – Average Concentration
Max – Maximum Detected Concentration
mg/kg – milligram per kilogram (parts per million)

**Table 3**
**UWA Surface Soil/Waste (Transition Zone)**

| Contaminants of Concern | Ave (mg/Kg) | Max (mg/Kg) | 95% UCL | Detection Frequency | Samples Exceeding RGs | RGs (mg/Kg) | Background Max (mg/Kg) |
|---|---|---|---|---|---|---|---|
| Cobalt | 12 | 18.7 | 14 | 17/17 | 0 | 24 | 16 |
| Copper | 368 | 940 | 476 | 17/17 | 3 | 629 | 45 |
| Iron | 39,041 | 160,000 | 53,781 | 17/17 | 5 | 44,800 | 31,000 |

Analyses for paste pH, paste conductivity, acid base accounting (ABA), and synthetic precipitation leaching procedure (SPLP) metals were also conducted to evaluate the characteristics of the material in the UWA. These analyses evaluated the material's potential for acid generation or neutralization and the potential for metals leaching. Soil sample paste pH, paste conductivity, and ABA results are presented in Table 6-20 of the RI. SPLP results and comparisons to surface water and groundwater criteria are presented in Table 6-21of the RI. Copper concentrations correlate inversely with paste pH and ABA results in waste rock samples exceeding approximately 300 mg/Kg copper, which is consistent with the high acid-generating potential of the sulfide ore waste. Copper concentrations in glacial till soil samples do not correlate well with ABA results as this soil tends to have acid neutralizing capacity despite locally elevated copper concentrations. Results from SPLP testing of surface soil samples in the UWA confirm that moderately high levels of metals, including aluminum, cadmium, copper, iron, manganese, nickel, and zinc, are leached from waste rock in this area.

Subsurface soil samples have been collected in the UWA from soil borings, monitoring wells, and test pit locations during work conducted by USGS, URS, and Nobis to confirm the characteristics and thickness of waste rock and native overburden soils. These investigations documented the presence of non-stratified waste of variable thicknesses. Maximum waste rock thicknesses of up to 22 ft were observed.

Soil x-ray fluorescence (XRF) field screening results are provided in Table 6-19 of the RI and a detailed description and evaluation of the XRF soil field screening investigation is included in the Nobis Data Evaluation Report (Appendix C of the RI, Section 5.0). Laboratory analytical results for all UWA subsurface soil TAL metals are provided in Table 6-7 of the RI. A statistical summary of UWA subsurface soil COC results is shown in Table 4 below. These ranges of COCs concentrations in subsurface soils are consistent with observations from surface soil samples. Lower metal concentrations were observed in native soil underlying the waste rock.

**Table 4**
**UWA – Subsurface Soil/Waste (Barren Source Area)**

| Contaminants of Concern | Ave (mg/Kg) | Max (mg/Kg) | 95% UCL | Detection Frequency | Samples Exceeding RGs | RGs (mg/Kg) | Background Max (mg/Kg) |
|---|---|---|---|---|---|---|---|
| Cobalt | 41 | 193 | 64 | 16/16 | 8 | 24 | 16 |
| Copper | 814 | 4,250 | 1,267 | 16/16 | 5 | 629 | 45 |
| Iron | 71,113 | 190,000 | 92,422 | 16/16 | 10 | 44,800 | 31,000 |

Results show paste pH values of subsurface waste rock to be generally less than 4 units with ABA values less than zero indicating the acid-generating potential of this material (see Table 6-20 of the RI). Results from SPLP testing of subsurface waste rock confirm that the waste rock is susceptible to leaching moderately high levels of metals, including aluminum, copper, manganese, selenium, silver, and zinc (Table 6-21 of the RI).

The UWA is also a source of surface water and groundwater contamination. The impact on surface water will be discussed later in this section. Although groundwater is a focus of the OU2 RI, Table 5 below provides documentation that the groundwater beneath the UWA exceeds federal and state drinking water and groundwater standards, along with risk based standards, that were used as the specific preliminary remediation goals (PRGs) in the OU1 RI.

**Table 5**
**UWA Shallow Overburden Groundwater**

| Parameter | | Ave (µg/L) | Max (µg/L) | 95% UCL | Detection Frequency | Samples Exceeding PRG | PRG (µg/L) | Background Max (µg/L) |
|---|---|---|---|---|---|---|---|---|
| Aluminum | D | 15,243 | 62,366 | 20,107 | 19/25 | 17 | 1,248 | 290 |
| | T | 16,491 | 64,456 | 21,492 | 21/25 | 18 | 1,248 | 2,000 |
| Cadmium | D | 10 | 36.8 | 13.0 | 19/25 | 18 | 5 | 2.5 |
| | T | 10 | 36.5 | 13.0 | 18/25 | 17 | 5 | 2.5 |
| Cobalt | D | 188 | 665 | 239 | 20/25 | 18 | 5 | 25 |
| | T | 187 | 668 | 238 | 20/25 | 18 | 5 | 25 |
| Copper | D | 9,334 | 49,117 | 12,805 | 21/25 | 18 | 588 | 12.5 |
| | T | 9,405 | 49,581 | 12,957 | 22/25 | 18 | 588 | 12.5 |
| Iron | D | 295 | 4,900 | 626 | 17/25 | 1 | 556 | 310 |
| | T | 1,105 | 9,600 | 1,869 | 22/25 | 7 | 556 | 2,200 |
| Manganese | D | 1,369 | 3,461 | 1,692 | 25/25 | 19 | 300 | 43.6 |
| | T | 1,365 | 3,506 | 1,692 | 25/25 | 19 | 300 | 85.6 |
| | T | 4 | 52.4 | 7.4 | 4/25 | 1 | 40 | 2.5 |
| Nickel | D | 90 | 385 | 118 | 23/25 | 12 | 100 | 20 |
| | T | 97 | 402 | 131 | 23/25 | 1 | 100 | 20 |
| Zinc | D | 1,132 | 3,797 | 1,452 | 20/25 | 17 | 465 | 30 |
| | T | 1,140 | 3,867 | 1,466 | 20/25 | 17 | 465 | 175 |

| | Min (su) | Max (su) | Ave (su) | Background Min (su) |
|---|---|---|---|---|
| pH | 4.0 | 7.1 | 5.2 | 6.5 |

Notes:
"T" - total metals fraction
"D" - dissolved metals fraction (<45 um)
ug/l – micrograms per liter (parts per billion)
PRG –preliminary remediation goal for groundwater developed for the OU1 RI
su – standard units
Max – maximum detected concentration
Min - minimum detected concentration
UCL – Upper 95% Confidence Limit of the Mean

**Lower Waste Area (LWA)** – The LWA occupies approximately 6.4 acres in the central portion of the Site, below the UWA and the foundation of the former Flotation Mill, and between the ORB and Ely Brook. There are no distinct piles in the LWA. The waste material is relatively thin, typically on the order of 5 ft thick, in contrast to the thicker waste piles in the UWA. A relatively thin layer of native soil with variable thickness underlies the LWA. It is possible that some of the waste sits directly on or in close proximity to bedrock. The primary limits of the LWA were defined by the physical presence of mine waste. This delineation

generally coincides with areas where cobalt, copper, and iron exceed soil/waste RGs and contains an estimated 29,000 cy of waste rock. Two major Site surface water features, the Ely Brook Tributaries 2 and 3 (EBT2 and EBT3), dissect and drain portions of the LWA. EBT3 merges into EBT2 prior to Ely Brook and the combined flow represents one of the most significant tributaries to Ely Brook. Groundwater extends well into the waste within the LWA. Water coming into contact with the mine waste creates an acidic leachate containing high levels of contamination that drains from the LWA into groundwater and several tributaries of Ely Brook (EBT2, EBT3, and EBT5). These tributaries run across the waste within the LWA. Average surface soil copper concentrations in the LWA are over 2.9 times greater than RGs and 40 times greater than the maximum background concentration for copper.

Fixed laboratory analytical results from 52 surface soil samples taken at 48 locations across the LWA were evaluated. Samples were collected during Site investigations conducted by the USGS, URS, and Nobis from barren areas, transition zones, and healthy, vegetated locations. Soil XRF field screening results are provided in Table 6-19 of the RI and a detailed description and evaluation of the XRF soil field screening investigation is included in the Nobis Data Evaluation Report (Appendix C of the RI, Section 5.0). Laboratory analytical results for all LWA surface soil TAL metals are provided in Table 6-6 of the RI. A statistical summary of LWA surface soil COC results is shown in Table 6 and Table 7 below.

**Table 6**
**LWA – Surface Soil/Waste (Barren Source Area)**

| Contaminants of Concern | Ave (mg/Kg) | Max (mg/Kg) | 95% UCL | Detection Frequency | Samples Exceeding RGs | RGs (mg/Kg) | Background Max (mg/Kg) |
|---|---|---|---|---|---|---|---|
| Cobalt | 17 | 200 | 24 | 52/52 | 6 | 24 | 16 |
| Copper | 1,811 | 23,000 | 2,586 | 52/52 | 37 | 629 | 45 |
| Iron | 86,400 | 196,000 | 100,423 | 52/52 | 35 | 44,800 | 31,000 |

The highest concentrations of copper were detected in a surface soil sample collected from the waste material southwest of MW-21A, near the confluence of EBT2 and EBT3. Similar to surface soil in the UWA, concentrations of iron correlate strongly with the elevated levels of copper which are observed in waste areas.

**Table 7**
**LWA – Surface Soil (Transition Zone)**

| Contaminants of Concern | Ave (mg/Kg) | Max (mg/Kg) | 95% UCL | Detection Frequency | Samples Exceeding RGs | RGs (mg/Kg) | Background Max (mg/Kg) |
|---|---|---|---|---|---|---|---|
| Cobalt | 9 | 18 | 12 | 12/12 | 0 | 24 | 16 |
| Copper | 155 | 292 | 201 | 12/12 | 0 | 629 | 45 |
| Iron | 18,582 | 33,500 | 23,316 | 12/12 | 0 | 44,800 | 31,000 |

Surface soil samples collected from transition zone areas exhibited lower concentrations of all metals compounds identified. The highest concentrations of Site contaminants identified in transition zones were detected in samples collected from the forested area to the west of the access road to the UWA.

Analyses for paste pH, paste conductivity, ABA, and SPLP metals were conducted to evaluate the potential for acid generation or neutralization, and leachability of metals from the mine waste. Results for pH, paste conductivity, and ABA are presented in Table 6-20 and SPLP results are presented in Table 6-21 of the RI. Copper concentrations appear to correlate inversely with paste pH and ABA values in those waste rock samples exceeding approximately 300 mg/Kg copper, consistent with the acid-generating potential of these wastes. Paste pH concentrations of waste rock are generally less than 4 standard units (su) and ABA values are negative, signifying its acid-generating potential. Results for glacial till samples (i.e., deep overburden) are variable. This variability may be due to a higher acid-neutralizing capacity within the till despite locally elevated copper concentrations.

Subsurface investigations in the LWA have included soil borings, test pits, and monitoring well installations conducted by URS and Nobis to confirm the characteristics and thickness of waste rock and native overburden soils. These investigations documented the presence of non-stratified waste of variable thicknesses ranging from 4 ft to 7.5 ft, with up to 12.5 ft of glacial till underlying waste rock.

Soil XRF field screening results are provided in Table 6-19 of the RI and a detailed description and evaluation of the XRF soil field screening investigation is included in the Nobis Data Evaluation Report (Appendix C of the RI, Section 5.0). Laboratory analytical results for all LWA subsurface soil TAL metals are provided in Table 6-7 of the RI. A statistical summary of LWA subsurface soil COC results from both the barren waste area and transition zone is shown in Table 8 and Table 9 below.

**Table 8**
**LWA – Subsurface Soil/Waste (Barren Source Area)**

| Contaminants of Concern | Ave (mg/Kg) | Max (mg/Kg) | 95% UCL | Detection Frequency | Samples Exceeding RGs | RGs (mg/Kg) | Background Max (mg/Kg) |
|---|---|---|---|---|---|---|---|
| Cobalt | 366 | 1,500 | NA | 6/6 | 3 | 24 | 16 |
| Copper | 11,663 | 36,000 | NA | 6/6 | 4 | 629 | 45 |
| Iron | 113,250 | 191,000 | NA | 6/6 | 4 | 44,800 | 31,000 |

**Table 9**
**LWA – Subsurface Soil (Transition Zone)**

| Contaminants of Concern | Ave (mg/Kg) | Max (mg/Kg) | 95% UCL | Detection Frequency | Samples Exceeding RGs | RGs (mg/Kg) | Background Max (mg/Kg) |
|---|---|---|---|---|---|---|---|
| Cobalt | 36 | 78.3 | NA | 4/4 | 2 | 24 | 16 |
| Copper | 996 | 2,230 | NA | 4/4 | 2 | 629 | 45 |
| Iron | 31,275 | 55,100 | NA | 4/4 | 1 | 44,800 | 31,000 |

The LWA is also a source of surface water and groundwater contamination. The impact on surface water will be discussed later in this section. Although groundwater is a focus of the OU2 RI, Table 10 below provides documentation that the groundwater beneath the LWA exceeds federal and state drinking water and groundwater standards, along with risk based standards, that were used as the specific PRGs in the OU1 RI.

**Table 10**
**LWA – Shallow Overburden Groundwater**

| Parameter | | Ave (µg/L) | Max (µg/L) | 95% UCL | Detection Frequency | Samples Exceeding PRG | PRG (µg/L) | Background Max (µg/L) |
|---|---|---|---|---|---|---|---|---|
| Aluminum | D | 15,991 | 32,818 | 22,036 | 10/12 | 1 | 1,248 | 290 |
| | T | 18,238 | 36,000 | 24,690 | 11/12 | 1 | 1,248 | 2,000 |
| Cadmium | D | 10 | 22.4 | 14.0 | 9/12 | 8 | 5 | 2.5 |
| | T | 10 | 17.2 | 13.0 | 10/12 | 9 | 5 | 2.5 |
| Cobalt | D | 201 | 315 | 258 | 10/12 | 1 | 5 | 25 |
| | T | 200 | 318 | 256 | 10/12 | 1 | 5 | 25 |
| Copper | D | 7,343 | 11,600 | 9,311 | 10/12 | 1 | 588 | 12.5 |
| | T | 7,585 | 12,400 | 9,714 | 10/12 | 1 | 588 | 12.5 |
| Iron | D | 28,269 | 90,678 | 49,903 | 9/12 | 4 | 556 | 310 |
| | T | 29,740 | 85,401 | 50,574 | 11/12 | 7 | 556 | 2,200 |
| Manganese | D | 1,379 | 2,540 | 1,873 | 12/12 | 1 | 300 | 43.6 |
| | T | 1,398 | 2,645 | 1,905 | 12/12 | 1 | 300 | 85.6 |
| Nickel | D | 78 | 135 | 98.0 | 10/12 | 4 | 100 | 20 |
| | T | 81 | 191 | 105 | 10/12 | 3 | 100 | 20 |
| Zinc | D | 1,067 | 2,290 | 1,517 | 11/12 | 9 | 465 | 30 |
| | T | 1,082 | 2,310 | 1,517 | 10/12 | 9 | 465 | 175 |

| | Min (su) | Max (su) | Ave (su) | Background Min (su) |
|---|---|---|---|---|
| pH | 4.3 | 5.2 | 4.8 | 6.5 |

**Note:**
1. "T" = total metals fraction, "D" = dissolved metals fraction (<45 um).

**Tailings Area (TA) –** The Tailings Area is located within the northwest portion of the LWA and encompasses approximately 0.7 acres. The tailings waste is a remnant of the operation of the former Flotation Mill and is a fairly uniform fine sand/silt material produced from mined ore. There is no well-defined tailings pile, but EBT3 has cut a channel that exposes this waste. A relatively continuous layer of glacial till approximately 10 ft thick is interpreted to underlie the Tailings Area, the fine-grained nature of which may limit impact to groundwater beneath the tailings pile.

The primary limits of the Tailings Area were defined by the physical presence of tailings and contain about 3,600 cy of mine waste. Similar to the LWA, the Tailings Area is saturated with groundwater and portions of this waste source material form the watershed of EBT3. Water coming into contact with the tailings creates an acidic leachate containing high levels of contamination that drains from the Tailings Area into groundwater and EBT3. Average surface

soil copper concentrations in the Tailings Area are over 1.5 times greater than RGs and 20 times greater than the maximum background concentration for copper.

Off-site laboratory results from 8 surface soil samples from 7 locations across the Tailings Area were evaluated as part of the combined soil database for the Site. Samples were collected during Site investigations conducted by the USGS, URS, and Nobis. Soil XRF field screening results are provided in Table 6-19 of the RI and a detailed description and evaluation of the XRF soil field screening investigation is included in the Nobis Data Evaluation Report (Appendix C of the RI, Section 5.0). Laboratory analytical results for all Tailings Area surface soil TAL metals are provided in Table 6-6 of the RI. A statistical summary of Tailings Area surface soil COCs results is shown in Table 11 below.

**Table 11**
**Tailings Area – Surface Soil/Waste (Barren Source Area)**

| Contaminants of Concern | Ave (mg/Kg) | Max (mg/Kg) | 95% UCL | Detection Frequency | Samples Exceeding RGs | RGs (mg/Kg) | Background Max (mg/Kg) |
|---|---|---|---|---|---|---|---|
| Cobalt | 15 | 25.3 | NA | 8/8 | 2 | 24 | 16 |
| Copper | 924 | 2,240 | NA | 8/8 | 4 | 629 | 45 |
| Iron | 68,238 | 160,000 | NA | 8/8 | 3 | 44,800 | 31,000 |

Results from SPLP testing of Tailings Area surface soil indicates that copper is leachable from these materials at an order of magnitude higher than any of the other waste materials at the Site.

Based on evaluations conducted by the USGS, the unoxidized flotation-mill tailings have the highest potential to produce metal-laden, acidic water. The results of tailings paste pH, paste conductivity, and ABA analyses were among the most extreme observed at the Site.

Subsurface soil samples have been collected in the Tailings Area from soil borings, test pits, and one monitoring well installation during work conducted by USGS, URS, and Nobis to confirm the characteristics and thickness of waste rock and native overburden soils. Tailing thickness observed in borings advanced in this area ranged from 4 ft to 7.5 ft with up to 12.5 ft of glacial till underlying the tailings. The observed tailing waste is distinctly more fine-grained (sand to silt-sized) than waste rock observed in the UWA and LWA.

Laboratory analytical results for all Tailings Area subsurface TAL metals are provided in Table 6-7 of the RI. A statistical summary of Tailings Area subsurface soil COCs results is shown in Table 12 below.

**Table 12**
**Tailings Area – Subsurface Soil/Waste (Barren Source Area)**

| Contaminants of Concern | Ave (mg/Kg) | Max (mg/Kg) | 95% UCL | Detection Frequency | Samples Exceeding RGs | RGs (mg/Kg) | Background Max (mg/Kg) |
|---|---|---|---|---|---|---|---|
| Cobalt | 423 | 1,040 | NA | 5/5 | 5 | 24 | 16 |
| Copper | 12,268 | 25,600 | NA | 5/5 | 5 | 629 | 45 |
| Iron | 130,300 | 190,000 | NA | 5/5 | 5 | 44,800 | 31,000 |

The highest concentration of copper detected in the Tailings Area was identified in a sample collected by the USGS in 2002 from the former Flotation Mill at a concentration of 25,600 mg/kg. This sample was collected from the black, unoxidized, pyrrhotite-rich layer present within the tailings in this area of the waste pile.

The Tailings Area is also a source of surface water and groundwater contamination. The impact on surface water will be discussed later in this section. Although groundwater is a focus of the OU2 RI, Table 13 below provides documentation that groundwater beneath the Tailings Area exceeds federal and state drinking water and groundwater standards, along with risk based standards, that were used as the site specific PRGs in the OU1 RI.

**Table 13**
**Tailings Area – Shallow Overburden Groundwater**

| Parameter | | Ave (µg/L) | Max (µg/L) | 95% UCL | Detection Frequency | Samples Exceeding PRG | PRG (µg/L) | Background Max (µg/L) |
|---|---|---|---|---|---|---|---|---|
| Aluminum | D | 12,102 | 15,483 | NA | 2/2 | 2 | 1,248 | 290 |
| | T | 12,050 | 15,029 | NA | 2/2 | 2 | 1,248 | 2,000 |
| Cadmium | D | 4 | 5.8 | NA | 2/2 | 1 | 5 | 2.5 |
| | T | 2 | 2.9 | NA | 2/2 | 0 | 5 | 2.5 |
| Cobalt | D | 41 | 45.4 | NA | 2/2 | 2 | 5 | 25 |
| | T | 40 | 44 | NA | 2/2 | 2 | 5 | 25 |
| Iron | D | 65,513 | 72,225 | NA | 2/2 | 2 | 556 | 310 |
| | T | 64,186 | 69,372 | NA | 2/2 | 2 | 556 | 2,200 |
| Manganese | D | 1,988 | 2,166 | NA | 2/2 | 2 | 300 | 43.6 |
| | T | 1,907 | 2,053 | NA | 2/2 | 2 | 300 | 85.6 |

| | Min (su) | Max (su) | Ave (su) | Background Min (su) |
|---|---|---|---|---|
| pH | 3.5 | 4.0 | 3.8 | 6.5 |

**Note:**

1. "T" = total metals fraction, "D" = dissolved metals fraction (<45 um).

**Ore Roast Bed (ORB)** – The ORB is located abutting the eastern margin of the access road, southeast of the LWA and covers a 2.2 acre area that is approximately 900 ft long and 200 ft wide. The ORB was the primary location for the roasting of ore excavated from the Ely Copper Mine.

The ORB waste is about 8 ft thick and contains approximately 10,330 cy of roasted ore. The western limit of the ORB is demarked by a high stone slab retaining wall. The sparsely vegetated ORB soils are distinguishable from soils in the adjacent LWA by the deep red color of the hematite-rich soil. A small tributary to Ely Brook, EBT1, crosses the roast beds and the access road at a location where the retaining wall has collapsed. An abandoned exploratory shaft is located along the northeast margin of the ORB. The roasted ore in this area still contains significant levels of metals, but the waste material does not produce acidic leachate and appears to be a much less significant source of contamination than the UWA, LWA, and Tailings Area. Average surface soil copper concentrations in the ORB are over 1.2 times greater than RGs and 17 times greater than the maximum background concentration for copper.

Laboratory analytical results from 23 surface soil samples taken at 14 locations across the ORB were evaluated. Samples were collected during Site investigations conducted by the USGS, URS, and Nobis from barren areas, transition zones, and healthy, vegetated locations. Soil XRF field screening results are provided in Table 6-19 of the RI and a detailed description and evaluation of the XRF soil field screening investigation is included in the Nobis Data Evaluation Report (Appendix C of the RI, Section 5.0). Laboratory analytical results for all ORB surface soil TAL metals are provided in Table 6-6 of the RI. A statistical summary of ORB surface soil COCs results is shown in Table 14 and Table 15 below.

**Table 14**
**ORB – Surface Soil/Waste (Barren Source Area)**

| Contaminants of Concern | Ave (mg/Kg) | Max (mg/Kg) | 95% UCL | Detection Frequency | Samples Exceeding RGs | RGs (mg/Kg) | Background Max (mg/Kg) |
|---|---|---|---|---|---|---|---|
| Cobalt | 15 | 50 | 19 | 23/23 | 4 | 24 | 16 |
| Copper | 783 | 2,200 | 1,016 | 23/23 | 8 | 629 | 45 |
| Iron | 64,914 | 196,000 | 84,554 | 23/23 | 12 | 44,800 | 31,000 |

**Table 15**
**ORB – Surface Soil (Transition Zone)**

| Contaminants of Concern | Ave (mg/Kg) | Max (mg/Kg) | 95% UCL | Detection Frequency | Samples Exceeding RGs | RGs (mg/Kg) | Background Max (mg/Kg) |
|---|---|---|---|---|---|---|---|
| Cobalt | 8 | 13.5 | NA | 3/3 | 0 | 24 | 16 |
| Copper | 508 | 1,350 | NA | 3/3 | 1 | 629 | 45 |
| Iron | 37,067 | 89,000 | NA | 3/3 | 1 | 44,800 | 31,000 |

Analyses for paste pH, paste conductivity, ABA, and SPLP metals were conducted to evaluate the characteristics of the material in the ORB. These analyses evaluated the material's potential for acid generation or neutralization and the potential for metals to be leached. Paste pH, paste conductivity, and ABA results are presented in Table 6-20 of the RI and SPLP results are present in Table 6-21 of the RI. Paste pH, paste conductivity, and ABA results indicate that the material present in the ORB is primarily non-acid-generating. Paste pH values for most samples collected from the ORB were greater than 4 su with positive ABA results indicating an acid neutralizing potential for the material. However, one sample collected in the vicinity of MW-23A identified paste pH at 3.9 su with an ABA result of approximately -38 t $CaCO_3$/1000t, indicating that a limited volume of material in the ORB may have acid-generating potential. Results from SPLP testing of surface soil samples in the ORB indicate a relatively low susceptibility for metals, including aluminum and copper, to be leached from this waste area.

The acid-generating potential and leachability of ORB waste is generally an order of magnitude less than other Site waste source areas. For example, samples from the UWA and LWA each exhibited ABA values less than -200 t$CaCO_3$/1000t and paste pH values below 3 su, in contrast to the values measured in the ORB and discussed above.

Subsurface investigations by Nobis and URS in the ORB have included five soil borings and/or monitoring well installations. The results of these borings indicated that the ORB waste thickness ranges from 2 to 8 ft. Based on the subsurface investigations conducted in this area, the material behind the retaining wall consists of waste material and reworked fill resting atop the native till formation. Based on surface and subsurface observations, the estimated volume of waste material in the ORB is 10,330 cy, covering a surface area of approximately 2.2 acres.

Soil XRF field screening results are provided in Table 6-19 of the RI and a detailed description and evaluation of the XRF soil field screening investigation is included in the Nobis Data Evaluation Report (Appendix C of the RI, Section 5.0). Laboratory analytical results for all ORB subsurface TAL metals are provided in Table 6-7 of the RI. A statistical summary of ORB subsurface soil COCs results is shown in Table 16 below.

**Table 16**
**ORB – Subsurface Soil/Waste (Barren Source Area)**

| Contaminants of Concern | Ave (mg/Kg) | Max (mg/Kg) | 95% UCL | Detection Frequency | Samples Exceeding RGs | RGs (mg/Kg) | Background Max (mg/Kg) |
|---|---|---|---|---|---|---|---|
| Cobalt | 18 | 28 | NA | 7/7 | 1 | 24 | 16 |
| Copper | 847 | 1,800 | NA | 7/7 | 4 | 629 | 45 |
| Iron | 60,686 | 130,000 | NA | 7/7 | 3 | 44,800 | 31,000 |

The overburden monitoring well MW-23A was installed in the vicinity of EBT1, an intermittent tributary that transects the area. The observed thickness of the ORB material at this location was 8 ft, underlain by 6.5 ft of gray glacial till. Water levels observed in this well indicate that the lowermost 1 ft of the ORB material is saturated with groundwater in this area, with only minor water table fluctuation observed between the summer and fall of 2009. Copper concentrations detected in the ORB at this location ranged from 156 mg/kg to 517 mg/kg, with the underlying till having a concentration in the same range at 466 mg/kg. These concentrations are significantly lower than those observed in other areas of the Site.

Paste pH, paste conductivity, and ABA results from the subsurface ORB material were similar to the underlying glacial till, suggesting that the roast bed soils are not acid-generating. Paste pH values from subsurface soils are greater than 5.5 su, and ABA results are positive, ranging from approximately 27 to 36 t $CaCO_3$/1000t. SPLP analysis of the surface and subsurface soil in the ORB shows that the metals aluminum and copper may be susceptible to leaching from this area but at relatively low concentrations that are not likely to significantly impact groundwater or surface water.

**b. Nature and Extent of Surface Water and Sediment Contamination in OU1 Area:**

Sampling of surface water between 2000 and 2009 has documented the extent of ARD impacts to Ely Brook (including its tributaries, riparian areas and ponds), SHB, and the EBOR. SHB and EBOR are within the OU2 area of the Site. Results for the surface water and sediment within the OU1 area are discussed in the sections below. The subareas of Ely Brook and the tributaries are shown on Figure 3. The sediment RG for copper that was developed based on the ecological risk assessment is listed in Table 46. Surface water RGs were developed based on federal and state water quality standards and are listed in Table 47. The EB-LR and EB-MR contain significant accumulations of waste rock alluvium that has eroded from the UWA, LWA, and Tailings Area. The waste is up to 3.5 ft thick within the stream channel and portions of the riparian areas. The estimated volume of waste material within the banks of EB-MR is 580 cy, encompassing an area of <0.5 acres. The estimated volume of waste material in EB-LR, including the riparian area, is 3,950 cy, encompassing an area of 2.5 acres. The waste rock alluvium within Ely Brook contains concentrations of cobalt, copper, and iron that may also be a contributing source to the surface water impacts. Table 17 below provides a summary of the

copper concentrations in sediment that were detected within Ely Brook, its tributaries, and the ponds. Table 18 provides a summary of the copper concentrations in surface water that were detected within Ely Brook, its tributaries, and the ponds as compared to the copper surface water RG. Copper is the primary COC in surface water. Figure 15 shows the extent of ecological impacts in the OU1 area. A more detailed discussion of each reach of Ely Brook, the individual tributaries, and the ponds is provided in the following subsections.

**Table 17**
**Copper in Sediment – Ely Brook**

| Parameter | Ave (mg/Kg) | Max (mg/Kg) | 95% UCL | Detection Frequency | Samples Exceeding RG | RG (mg/Kg) | Background Max (mg/Kg) |
|---|---|---|---|---|---|---|---|
| Ely Brook Headwaters (above waste areas) | 34 | 50 | NA | 3/3 | 0 | 149 | 50 |
| Ely Brook Upper Reach | 1,358 | 5,320 | 1,951 | 20/20 | 15 | 149 | 50 |
| Middle Reach | 3,457 | 11,000 | 4,491 | 22/22 | 22 | 149 | 50 |
| Lower Reach | 2,243 | 7,120 | 2,773 | 35/35 | 35 | 149 | 50 |
| EBT1 | 1,460 | 3,100 | 2,199 | 6/6 | 6 | 149 | 50 |
| EBT2 | 1,658 | 4,000 | 2,134 | 15/15 | 15 | 149 | 50 |
| EBT3 | 1,856 | 3,100 | 2,472 | 9/9 | 8 | 149 | 50 |
| EBT4 | 1,271 | 2,200 | 1,634 | 8/8 | 8 | 149 | 50 |
| EBT5 | 2,879 | 5,210 | 7,208 | 3/3 | 2 | 149 | 50 |
| Ponds 4 and 5 | 1,653 | 3,540 | 2,782 | 6/6 | 6 | 149 | 50 |
| Ponds 1,2,3 | 77 | 88 | 93 | 5/5 | 0 | 149 | 50 |

**Table 18**
**Copper in Surface Water – Ely Brook**

| Parameter | Ave (mg/Kg) | Max (mg/Kg) | 95% UCL | Detection Frequency | Samples Exceeding RG | Surface water RG (mg/Kg) | Background Max (mg/Kg) |
|---|---|---|---|---|---|---|---|
| Ely Brook Headwaters (above waste areas) | 0.8 | 1.2 | NA | 1/1 | 0 | 8.6 | 1.2 |
| Ely Brook Upper Reach | 290 | 8,070 | 642 | 25/27 | 15 | 8.6 | 1.2 |
| Middle Reach | 2,677 | 7,540 | 3,414 | 18/18 | 18 | 8.6 | 1.2 |
| Lower Reach | 2,331 | 7,540 | 2,599 | 60/60 | 60 | 8.6 | 1.2 |
| EBT1 | 759 | 3,520 | 1,306 | 15/15 | 13 | 8.6 | 1.2 |
| EBT2 | 5,615 | 33,178 | 7,034 | 68/68 | 63 | 8.6 | 1.2 |
| EBT3 | 13,813 | 91,800 | 18,738 | 42/42 | 41 | 8.6 | 1.2 |
| EBT4 | 2,625 | 7,240 | 3,435 | 19/19 | 19 | 8.6 | 1.2 |
| EBT5 | 30 | 66 | 41 | 11/11 | 9 | 8.6 | 1.2 |
| Ponds 4 and 5 | 380 | 1,890 | 616 | 16/18 | 15 | 8.6 | 1.2 |

**Ely Brook** – Ely Brook is fed on the east by three significant tributary streams referred to as the EBT1, EBT2, and EBT4. Three tributaries, EBT1, EBT2, and EBT4, divide Ely Brook into three reaches referred to as the Upper, Middle, and Lower reaches. EBT3 merges with EBT2 and becomes EBT2 prior to reaching Ely Brook.

**Ely Brook Headwaters** – The Ely Brook Headwaters begin at the headwaters of Ely Brook and extends 1,800 ft in length to a road crossing that is in close proximity to an access road to the UWA. This reach is characterized by a steep gradient with little sediment deposition and essentially no impact from Site sources. The biological assessment of the Upper Reach indicated good ecological health, suggesting that Ely Brook does have the potential to support aquatic life if mine-related impacts are abated. Surface water quality was generally good, with only a few instances of concentrations above water quality standards and those were found in unfiltered samples that may have contained particulate matter. Sediment and surface water concentrations in Ely Brook Headwaters were below levels considered to be harmful to aquatic life.

**EB-UR** – The EB-UR begins at the same location where the Ely Brook Headwaters ends and extends about 1,700 ft to the confluence with tributary EBT2. This reach has a moderate gradient and relatively low sediment deposition. The biological assessment of the Upper Reach indicated a severely impacted ecological community. The benthic community failed Vermont criteria for biological integrity. The benthic community contains 98% fewer organisms and suffered a 75% reduction in diversity as a result of the contamination from tributary EBT4. Testing of the sediments in the Upper Reach confirmed that they were toxic to aquatic life. Average Upper Reach surface water copper concentrations are 33 times greater than the copper RG and 236 times greater than the maximum concentration detected in background. Aluminum was also detected above its RG in more than 20% of Upper Reach surface water samples. Average Upper Reach sediment copper concentrations are 9 times greater than the RG and 27 times greater than the maximum background concentration for copper.

**EB-MR** – The EB-MR begins at the confluence with tributary EBT2 and extends about 660 ft to the confluence with the southernmost Ely Brook Tributary, EBT1. This reach has a moderate gradient and relatively low sediment deposition below the confluence with EBT2. The biological assessment of the Middle Reach also indicated that this section of Ely Brook had a severely impacted ecological community and failed Vermont criteria for biological integrity. Similar to the Upper Reach, the Middle Reach contains 98% fewer organisms and suffered a 90% reduction in diversity as a result of the combined contamination from the Upper Reach and tributary EBT2. Average Middle Reach surface water copper concentrations are 143 times greater than the copper RG and 1,024 times greater than maximum concentration detected in background. Aluminum, cadmium, copper, iron, and zinc were also detected above RGs in more than 20% of Middle Reach surface water samples. Average Middle Reach sediment copper concentrations are 23 times greater than the RG and 69 times greater than the maximum background concentration for copper. The central portion of the channel contained sediment comprised of waste material up to 3.5 ft thick. Observations of the lateral and vertical limits of waste defined by surface sediments and hand-augered borings indicate the Middle Reach contains an estimated 580 cy of waste rock alluvium.

**EB-LR** – The EB-LR begins at the confluence with tributary EBT1 and extends about 1,200 ft to the confluence with SHB. This reach has a relatively low gradient, with significant sediment depositional areas, including waste rock, and a significantly broader riparian area than the upper reaches. The Lower Reach riparian area is broad in a portion of the stream that has low banks and a poorly-defined channel, resulting in a somewhat braided character to the stream. Along the lowermost section of the Lower Reach, which flows along the western margin of the Smelter Area, the channel is partially bermed on the eastern bank, in part with slag waste, as far down as South Vershire Road. The biological assessment of the Lower Reach also indicated that this section of Ely Brook had a severely impacted ecological community and failed Vermont criteria for biological integrity. Similar to the Middle Reach, the Lower Reach contains 98% fewer organisms and suffered a 90% reduction in diversity as a result of the combined contamination from the Middle Reach and tributary EBT2. Average Lower Reach surface water copper

concentrations are 271 times greater than the copper RG and 1,943 times greater than maximum concentration detected in background. Aluminum, cadmium, copper, iron, and zinc were also detected above RGs in more than 20% of Lower Reach surface water samples. Average Lower Reach sediment copper concentrations are 15 times greater than the RG and 45 times greater than the maximum background concentration for copper. The Lower Reach contains significant accumulations of waste material (up to 3.5 ft thick) within the stream channel and portions of the riparian area. Observations of the lateral and vertical limits of waste defined by surface sediments and hand-augered borings indicate the Lower Reach contains an estimated 3,950 cy of waste rock (based on an average of a 2 ft thickness) alluvium, covering 2.5 acres of stream channel and riparian area.

**Ely Brook Tributaries** – Ely Brook is fed from the east by three significant tributary streams, EBT1, EBT2 (which also includes EBT3, EBT5, and the outflow from Ponds 1 through 5), and EBT4, as shown on Figure 3. Surface water metal concentrations in Ely Brook increase at each tributary confluence. The most significant increase in metal concentrations occurs at EBT2, with aluminum and iron increasing by a factor of 15, copper increasing by a factor of 6, and zinc increasing by a factor of 9.

**EBT1** – EBT1 shows metal concentrations only slightly above criteria along the downstream margin of the ORB, with concentrations farther downstream at two orders of magnitude higher than above the access road. As a result of the disparity between concentrations at these two parts of EBT1, the high metal concentrations downstream are attributable to waste rock used along the roadbed. Average EBT1 surface water copper concentrations are 90 times greater than the copper RG and 646 times greater than maximum concentration detected in background. Aluminum, cadmium, copper, iron, and zinc were also detected above RGs in more than 20% of EBT1 surface water samples. Average EBT1 sediment copper concentrations are 10 times greater than the RG and 29 times greater than the maximum background concentration for copper.

**EBT2 (and EBT3)** - Tributary EBT2, which includes EBT3, carries the majority of the metal and sulfate load from the waste pile areas to Ely Brook. ARD/AMD-impacted discharge from the Lower Adit and groundwater discharge along the eastern margin of Ponds 4 and 5 contribute to significant metals and sulfate loading of surface water in Pond 5 and to a lesser extent, Pond 4, both of which also drain to EBT2. Average EBT2 surface water copper concentrations are 423 times greater than the copper RG and 3,032 times greater than maximum concentration detected in background. Aluminum, cadmium, chromium, copper, iron, nickel, and zinc were also detected above RGs in more than 20% of EBT2 surface water samples. Average EBT2 sediment copper concentrations are 11 times greater than the RG and 33 times greater than the maximum background concentration for copper.

EBT3 emanates from the western portion of the UWA and merges with EBT2 prior to discharging to Ely Brook. Average EBT3 surface water copper concentrations are 880 times greater than the copper RG and 6,304 times greater than maximum

concentration detected in background. Aluminum, cadmium, chromium, copper, iron, nickel, and zinc were also detected above RGs in more than 20% of EBT3 surface water samples. Average EBT3 sediment copper concentrations are 13 times greater than the RG and 37 times greater than the maximum background concentration for copper.

**EBT4** – Tributary EBT4 receives water draining from Shaft No.4 and a seep at the base of the UWA. Average EBT4 surface water copper concentrations are 334 times greater than the copper RG and 2,394 times greater than maximum concentration detected in background. Aluminum, cadmium, copper, mercury, and zinc were also detected above RGs in more than 20% of EBT4 surface water samples. Average EBT4 sediment copper concentrations are nine times greater than the RG and 25 times greater than the maximum background concentration for copper.

An estimate of the relative contribution of contamination from the tributaries was performed as part of the RI. EBT2 contributes about 92% of the load to Ely Brook, of which about 40% is attributed to the contribution from EBT3, which flows into EBT2 prior to joining Ely Brook. Meanwhile, EBT4 contributes less than 8% of the copper load to Ely Brook. Downstream of the EBT2 confluence, surface water metals concentrations are relatively stable to the confluence with SHB. This indicates that fluctuations in the copper load due to surface water mixing reactions, sorption, and dissolution from stream sediment, or groundwater discharge appear to be minor relative to these upstream tributaries. Sediment copper concentrations in EBT2, EBT3, EBT4, and Ponds 4 and 5 are above the RG.

**Ponds 1-6 -** A series of beaver ponds forms the surface water drainage for the southeastern margin of the UWA and are the headwaters for the northeastern portion of the Ely Brook drainage and EBT2. The ponds are designated from the upgradient pond to the downgradient pond as Pond 1 through 6. Ponds 1, 2, and 3 are did not show any water quality degradation from the mine site. Pond 1 was used as background location for the assessment of the ponds. Copper was not detected in the surface water above the copper RG nor was it detected in the sediment above the RG. Ponds 4 and 5 receive outfall from Pond 3 and are located along the main stem of EBT2 outside the limits of the LWA. Pond 5 also receives discharge from an intermittent tributary draining the Lower Adit (i.e., the UWA). Pond 6 was reportedly destroyed during a spring flood event in 2007 and is no longer within the EBT2 drainage. It currently exists within the limits of the LWA as a small depression at the location of a former exploratory shaft surrounded by a small circle of trees.

**Pond 4 -** Pond 4 sediment concentrations for copper demonstrate a 3- to 5-fold increase from upstream results in Ponds 1-3. A sediment sample collected from a small intermittent tributary on the north side of Pond 4 (Location SD-71) also contained copper at concentrations exceeding the sediment RG, indicating ARD impacts upstream of identified Site sources in EBT2 and Ponds 4, 5, and 6. This contamination may be attributable to runoff from the UWA during spring snow melt or periodic storm water discharge.

**Pond 5 -** Pond 5 sediment shows slightly higher copper concentrations than Pond 4. The surface water sampling performed as part of the RI program identified a seasonal discharge from

the Lower Adit to Pond 5. Based on this data, the Lower Adit, which is within the OU2 area of the Site, is inferred to be the primary source of surface water contamination to Pond 5.

Based on the surface water data collected as part of the RI, the surface water in Ponds 4, 5, and 6 (which no longer exists) was characterized by concentrations of aluminum, copper, and zinc above surface water RGs. Surface water contamination was observed at every location in Ponds 4, 5, and 6. These results demonstrate surface water ARD and metals impacts at locations upstream of LWA wastes, indicating the downgradient transport of UWA contaminants via overland surface water runoff, Lower Adit discharge, or groundwater plume migration.

**c: Nature and Extent of Air Contamination in OU1 Area:**

Due to the nonvolatile nature of the contaminants at the Site, the primary focus of the investigation and sampling has been on the soil, surface water, and groundwater pathways. The air pathway was assessed as part of the HHRA in consideration of the potential impact of wind-blown particulates that might affect human and ecological receptors that frequent the Site. The large barren areas of mine waste, in particular the UWA and LWA, are prone to wind erosion due to their larger open areas and, in the case of the UWA, the steeper topography. However, relative to water erosion and transport, wind erosion is considered to have a very minor effect on contaminant migration at the Site, as described in Section 7.2.1 of the RI. In addition, the RI confirmed that the concentration in soil drops dramatically in a very short distance from the source area, strongly suggesting very limited transport of contamination by wind erosion.

### 4. Conceptual Site Model

The Conceptual Site Model (CSM) is a diagram of the sources of contamination, release mechanisms and exposure pathways to receptors for the contaminated media at the Site, as well as other site-specific factors. The CSM is a three-dimensional "picture" of Site conditions that illustrates contaminant sources, release mechanisms, exposure pathways, migration routes and potential human and ecological receptors. It documents current and potential future Site conditions and shows what is known about human and environmental exposure through contaminant release and migration to potential receptors. Site receptors include individuals and organisms that may come into contact with contaminated soils/waste; ingest contaminated soil/waste; consume the groundwater; come into contact with or ingest surface water, sediment interstitial (pore) water or sediment; or consume organisms that have accumulated contamination. The risk assessment and response action for the Site are based on this CSM. Figure 17 shows the CSM developed for the HHRA and Figure 18 shows the CSM for the terrestrial ecological risk assessment and Figure 19 shows the CSM for the aquatic ecological risk assessment.

As part of the CSM, any principal threat wastes at the Site are identified. Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be contained in a reliable manner or would present a significant risk to human health or the environment should exposure occur. The manner in which principal threats are addressed generally will determine whether the statutory preference for treatment as a principal element is

satisfied. Wastes generally considered to be principal threats are liquid, mobile and/or highly-toxic source material.

Low-level threat wastes are those source materials that generally can be reliably contained and that would present only a low risk in the event of exposure. Wastes that are generally considered to be low-level threat wastes include non-mobile contaminated source material of low to moderate toxicity, surface soil containing chemicals of concern that are relatively immobile in air or ground water, low leachability contaminants, or low toxicity source material.

No principal threat wastes were identified in the OU1 area of the Site. The wastes within the OU1 area of the Site are low-level threat wastes that are causing ARD or represent a wide spread hazard to individuals or biota.

## F. CURRENT AND POTENTIAL FUTURE LAND AND RESOURCE USES

The former Site is currently abandoned and unoccupied. Access is unrestricted, and the Site property is used for recreation (e.g., hiking, rock collecting, and ATV riding). Land use in the vicinity of the Site is rural residential and open space. The land surrounding the Site includes residences and forested. Adjacent land cover types consist mostly of mixed hardwood and softwood and softwood-dominated woodlands sloping to towards Ely Brook. There is no use of, or exposure to, groundwater within the Site. There is no current development within the Site property, although future residential use of portions of the Site property is possible. Table 19 provides a summary of the Site use assumptions and future use after cleanup.

Based on a review of the Vershire Town Plan, adopted in 2006, land use areas in the Town were divided into three main categories: the Village Center, Open Space, and Rural Residential. The Site is located in the Rural Residential District, where primary development for permanent residences is limited to main roadways. The residents surveyed for the plan overwhelmingly indicated that significant development should be limited to the Village Center in order to preserve the rural character of the Town. The plan emphasizes the preservation of the areas outside the Village Center for forestry-related activities such as timber harvesting. As a result, uses of the Site and surrounding area could include limited residential development, but also will likely include timber harvesting from the surrounding forested land as the primary land use. Furthermore, the steep topography, rural location, stable population, and lack of utilities in the vicinity of the Site will limit significant future development. Neither communication between EPA and local officials nor the Vershire Town Plan indicates any specific, significant plans for targeted development of the Site. Potential future use could also include solar energy generation in the open space areas on the Site. Restoration of the Site is more likely to attract users in the local population who are primarily interested in the Site's history and open space, and as such, might engage in passive recreational activities like walking, hiking, horseback riding, spelunking, or all-terrain vehicle (ATV) use. There are physical hazards to the Site as a result of the presence of the shafts and adits associated with the underground workings. The features attract those interested in exploration, evaluating the bat population, and viewing the

historic mine features. A recent fatality cause by an individual falling into one of the open former mine holes further emphasizes the physical hazards.

Evidence of recreational and general public access to, and use of, the mine area is apparent. These areas are accessed by foot and by ATV by recreational visitors to the area, and by geology enthusiasts. Area residents, sportsmen, and visitors to the area may access the adjacent forested areas by foot or by ATV. There has been interest in residential development for some portions of the Site. The land use of the Site within OU1 is not expected to change in the future.

Community and stakeholder input was sought and incorporated through active outreach during the OU1 RI/FS. EPA also solicited the views of the Potentially Responsible Parties (PRPs).

**Table 19**
**Current and Future Potential use of Site**

| | Current On-Site Use | Current Adjacent Use | Reasonable Potential Beneficial Use of Site | Basis for Potential Beneficial Use of Site | Time Frame to Achieve Potential Beneficial Use |
|---|---|---|---|---|---|
| **Land Source Areas** | Undeveloped property with recreational uses (walking, horseback riding, ATV riding, historic mine viewing, rock collecting, scenic views) | Undeveloped forest and rural residential | Limited residential and passive recreational use along with historic resource viewing and interpretation. Former shafts and adits could be important habitat for bats. | Town Plan and knowledge of Site developed during RI. | Upon cleanup of the waste piles, the Site surface areas outside the containment cells will be safe for unrestricted use. The groundwater contamination will remain and will be addresses as part of OU2. |
| **Surface Water** | Limited since Ely Brook is shallow and not suitable for recreational use. Primary value is ecological habitat. | SHB may be used for wading and limited fishing at downstream locations and is ecological habitat. | Ely Brook restoration for ecological habitat value. | Physical constraints at Site. | Upon completion of OU1 cleanup action, Ely Brook should begin to recover its ecological health. |
| **Groundwater – Bedrock** | There is no groundwater use within the source areas. | Drilled wells for water supply. These wells have not been impacted by the Site. | Some areas of the Site may be suitable for installation of water supply wells. Most areas will not have clean groundwater until decades after completion of cleanup action. | No current groundwater use on the Ely Copper Mine property. No zoning restrictions preventing water supply wells. Groundwater use will be restricted as part of an OU2 early action until a final OU2 remedy is selected. | Completion of source area cleanup and future OU2 cleanup. |

## G. SUMMARY OF SITE RISKS

A baseline risk assessment for OU1 was performed to estimate the probability and magnitude of potential adverse human health and environmental effects from exposure to contaminants associated with the Site assuming no remedial action was taken. Although the baseline risk assessment for OU1 evaluated the entire Site, only the OU1 focus areas will be discussed in this ROD. The focus areas for OU1 include the LWA, UWA, Tailings Area, Ore

Roast Bed, Ely Brook, and Ponds. Soil/waste for the Smelter/Slag Area of the Site, along with groundwater throughout the entire Site, will be addressed as part of OU2. The baseline risk assessment for OU2 will also estimate the probability and magnitude of potential adverse human health and environmental effects from exposure to contaminants associated with the Site after the implementation of OU1.

The results of the human health risk assessment (HHRA) provide the basis for taking action and identify the contaminants and exposure pathways that need to be addressed by the remedial action. The human health and ecological risk assessments followed a four step process: (1) hazard identification, which identified those hazardous substances which, given the specifics of the Site, were of significant concern; (2) exposure assessment, which identified actual or potential exposure pathways, characterized the potentially exposed populations and determined the extent of possible exposure; (3) effects assessment, which considered the types and magnitude of adverse effects associated with exposure to hazardous substances; and (4) risk characterization and uncertainty analysis, which integrated the three earlier steps to summarize the potential and actual risks posed by hazardous substances at the Site, including carcinogenic and non-carcinogenic risks and a discussion of the risk at background levels of contamination and the uncertainty in the risk estimates.

The Risk Assessments, both human health and ecological, for the Site were based on the data collected in support of the OU1 RI/FS program. Data collected for the OU1 RI were selected for use in the HHRA using the criteria established by USEPA in "Guidance for Data Usability in Risk Assessment" (USEPA, 1992). The data presented in the OU1 RI and selected for use in the HHRA were a product of laboratory analyses performed in accordance with USEPA Region 1 methods and associated Quality Assurance/Quality Control (QA/QC) procedures, as described in the Quality Assurance Project Plan (QAPP). The majority of data for the Site were developed through the RI field programs. The data validation process confirmed that the available data were suitable for use in risk assessment. Sample quantitation limits (SQLs) were generally below risk-based screening values (used for Contaminants of Potential Concern (COPC) selection), indicating that analytical methods were sensitive enough to detect concentrations that could be a potential concern from a health risk perspective. In addition, the principal contaminants at the Site are metals, and most metals were detected in nearly all the samples within each data set. Therefore, overall, detection limits do not have a substantial effect on the data sets.

A summary of those aspects of the human health risk assessment that support the need for remedial action is provided below, followed by a summary of the ecological risk assessment. The entire HHRA is available as part of the Administrative Record.

### 1. Human Health Risk Assessment

The OU1 RI and HHRA evaluated all Site media, including source area soil/waste, surface water, sediment, ambient air, biota tissue, and groundwater. For the OU1 areas, the only pathways that were identified as having an unacceptable risk were current and future exposure to soil/waste from a current and future residential use scenario for a child. Current and future

exposure to soil/waste by an adult resident was not identified as representing a threat to human health. Exposures to surface water, sediment, and biota for a child and adult were not identified as representing a threat to human health based on the data and assumptions in the OU1 RI and HHRA. In addition, recreational exposure to the soil/waste was not determined to have an unacceptable human health risk. Although the non-cancer hazard index was above 1 for the construction worker exposed to soil/waste via direct incidental ingestion and dust inhalation, the individual hazard quotients were at or below one, so were not above unacceptable risk standards. The final evaluation of groundwater across the entire Site and sediment/soil/surface water/waste outside OU1 areas will be included as part of the OU2 RI and HHRA.

Sixteen of the more than 25 chemicals detected in the soil at the Site were selected for evaluation in the HHRA as COPCs for soil/waste in the source area. The COPCs were selected to represent potential site related hazards based on toxicity, concentration, frequency of detection, and mobility and persistence in the environment. The COPCs for all Site areas can be found in Tables 4-1 thru 4-7 of the Human Health Risk Assessment of the OU1 RI. From this, a subset of the chemicals were identified in the OU1 RI/FS as presenting a significant current or future risk and are referred to as the contaminants of concern (COCs) in this ROD and summarized in Tables 20 - 21 below. These Tables contain the exposure point concentrations used to evaluate the reasonable maximum exposure scenario (RME) in the baseline risk assessment for the chemicals of concern. Estimates of average or central tendency exposure concentrations, maximum concentrations, and the 95% Upper Confidence Limit (UCL) of the arithmetic mean for the COCs and all COPCs can be found in Tables 7-6 thru 7-11 of the Human Health Risk Assessment of the OU1 RI.

**Table 20**
**Summary of Chemicals of Concern and**
**Medium Specific Exposure Point Concentrations**
**Current and Future Exposure to Source Area Surface Soil/Waste**

| Exposure Point | Chemical of Concern | Concentration Detected (mg/kg) | | Concentration Detected (mg/kg) | | Frequency of Detection | Exposure Point (EPC) Concentration | EPC units | Statistical Measure |
|---|---|---|---|---|---|---|---|---|---|
| Source Area Surface Soil/Waste | | Min | Max | Avg | UCL | | | | |
| | Cobalt | 1.8 | 200 | 18 | 25 | 270/270 | 25 | mg/kg | 95% UCL |
| | Copper | 7.5 | 23,000 | 964 | 1,086 | 270/270 | 1,086 | mg/kg | 95% UCL |
| | Zinc | 2,400 | 300,000 | 53,810 | 66,914 | 270/270 | 66,914 | mg/kg | 95% UCL |

Key:
Min: Minimum concentration
Max: Maximum concentration
Avg: Arithmetic average concentration
UCL: 95% Upper Confidence Limit on the arithmetic mean
Mg/kg: milligram per kilogram which is also parts per million

This table presents the chemicals of concern (COCs) and exposure point concentrations for each COC detected in surface soil (i.e., the concentration that will be used to estimate the exposure and risk from each COC in soil). The depth of soil was from 0 to 1 foot. The table includes the range of concentrations detected for each COC, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at the Site), the exposure point concentration (EPC), and how the EPC was derived. The table indicates that cobalt, copper and iron were all frequently detected at the Site. The 95% UCL on the arithmetic mean was used as the exposure point concentration for cobalt, copper, and iron.

**Table 21**
**Summary of Chemicals of Concern and**
**Medium Specific Exposure Point Concentrations**
**Current and Future Exposure to Source Area Subsurface Soil/Waste**

| Exposure Point | Chemical of Concern | Concentration Detected (mg/kg) | | Concentration Detected (mg/kg) | | Frequency of Detection | Exposure Point (EPC) Concentration | EPC units | Statistical Measure |
|---|---|---|---|---|---|---|---|---|---|
| Source Area Surface Soil/Waste | | Min | Max | Avg | UCL | | | | |
| | Cobalt | 1.8 | 1,500 | 28 | 50 | 348/348 | 50 | mg/kg | 95% UCL |
| | Copper | 7.7 | 36,000 | 1,200 | 1,887 | 348/348 | 1,887 | mg/kg | 95% UCL |
| | Zinc | 2,400 | 300,000 | 55,835 | 67,413 | 348/348 | 67,413 | mg/kg | 95% UCL |

Key:
Min: Minimum concentration
Max: Maximum concentration
Avg: Arithmetic average concentration
UCL: 95% Upper Confidence Limit on the arithmetic mean
Mg/kg: milligram per kilogram which is also parts per million

This table presents the chemicals of concern (COCs) and exposure point concentrations for each COC detected in soil (i.e., the concentration that will be used to estimate the exposure and risk from each COC in soil) from a depth of 0 – 10 feet. This range was used to considered soil that may be exposed during future construction or other soil disturbance activities at the Site. The table includes the range of concentrations detected for each COC, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at the Site), the exposure point concentration (EPC), and how the EPC was derived. The table indicates that cobalt, copper and iron were all frequently detected at the Site. The 95% UCL on the arithmetic mean was used as the exposure point concentration for cobalt, copper, and iron.

Potential human health effects associated with exposure to the COPCs were estimated quantitatively or qualitatively through the development of several hypothetical exposure pathways. These pathways were developed to reflect the potential for exposure to hazardous substances based on the present uses, potential future uses, and location of the Site. The current and future potential use of the Site is discussed in Section F of this ROD. The exposure pathways evaluated as part of the OU1 RI/FS are summarized below. A more thorough description of all exposure pathways evaluated in the risk assessment including estimates for an average exposure scenario, can be found in Section 4 of the Human Health Risk Assessment. Tables 7-1 and 7-5 of the HHRA present the exposure factors for the exposure pathways evaluated in the HHRA.

- Current/future recreational visitors (adolescent and adult) – soil exposure to the recreational visitors was based on riding all-terrain vehicles (ATVs), since this is a common recreational activity at the Site that could result in an intensive level of soil/waste contact. It was assumed that the recreational visitors would come into contact with the on-site piles and the surface soil surrounding the Site. The incidental soil/waste ingestion, the dermal contact and absorption, and the inhalation pathways were evaluated for these receptors. The recreational visitors were assumed to be exposed to Site soil/waste for 8 months of the year (April through November). The visitors are not

expected to contact the soil/waste during January, February, March, and December. The reasonable maximum exposure frequency was assumed to be 3 days/week (assumes 4.33 weeks per month), which equates to approximately 104 days/year. The incidental soil/waste ingestion rate was assumed to be 100 mg/day.

- Current/future swimmers/waders (adolescent and adult) – the swimmers/waders were assumed to come into contact with the surface water and sediment while engaging in recreational activities in Ely Brook, the ponds, and the downstream water bodies. Ely Brook and the ponds are not sufficiently deep to support swimming. The incidental ingestion and the dermal contact and absorption pathways were evaluated for wading within Ely Brook and swimming and wading downstream.

- Future residents and adjacent residents (young child and adult) - It is possible that the Site could be used for residential purposes in the future. Future residents were assumed to come into contact with the surface and subsurface soil/waste as a result of soil mixing as a result of future excavation and construction activities. The soil/waste ingestion, the dermal contact and absorption, and the inhalation pathways were evaluated for residential receptors. The total exposure duration for the reasonable maximum exposure was 30 years (6 years for young child and 24 years for adult) with an exposure frequency of 350 days/year. The soil ingestion rate used was 100 mg/day for the adult and 200 mg/day for the child.

- Future construction workers (adult) – the Site may undergo some type of construction activity at some point in the future, which may result in contact with surface and subsurface soil/waste (top 10 feet assumed). The incidental soil/waste ingestion, the dermal contact and absorption, and the inhalation pathways were evaluated for these future receptors. The duration of intensive contact with the Site soil/waste during construction activities such as excavation is expected to be short. The adult construction worker was assumed to be exposed for 60 days/year (i.e. 5 days/week for 12 weeks) for 8 hours per day with a soil ingestion rate of 330 mg/day.

The HHRA was conducted using an exposure point concentration (EPC) for each COPC. Each EPC represents the concentration of a COPC to which a receptor was assumed to be continuously exposed while in contact with an environmental medium. For soil, sediment, and surface water exposure, the EPC was generally defined as the 95 percent UCL of the mean concentration and was calculated using USEPA's ProUCL software (Version 4.00.05, USEPA 2010 a, b, c).

Excess lifetime cancer risks were determined for each exposure pathway by multiplying a daily intake level by the chemical specific cancer potency factor. Cancer potency factors have been developed by EPA from epidemiological or animal studies to reflect a conservative "upper bound" of the risk posed by potentially carcinogenic compounds. That is, the true risk is unlikely to be greater than the risk predicted. The resulting risk estimates are expressed in scientific notation as a probability (e.g., $1 \times 10^{-6}$ for 1/1,000,000) and indicate using this example

that an average individual is not likely to have greater that a one in a million chance of developing cancer over 70 years as a result of site-related exposure (as defined) to the compound at the stated concentration. All risks estimated represent an "excess lifetime cancer risk" – or the additional cancer risk on top of that which we all face from other causes such as cigarette smoke or exposure to ultraviolet radiation from the sun. The chance of an individual developing cancer from all other (non-site related) causes has been estimated to be as high as one in three. EPA's generally acceptable risk range for site related exposure is $10^{-4}$ to $10^{-6}$. Current EPA practice considers carcinogenic risks to be additive when assessing exposure to a mixture of hazardous substances. Because none of the final COCs for OU1 have cancer potency factors the cancer risk summary tables are not included.

In assessing the potential for adverse effects other than cancer, a hazard quotient (HQ) is calculated by dividing the daily intake level by the reference dose (RfD) or other suitable benchmark. Reference doses have been developed by EPA and they represent a level to which an individual may be exposed that is not expected to result in any deleterious effect. RfDs are derived from epidemiological or animal studies and incorporate uncertainty factors to help ensure that adverse health effects will not occur. An HQ $\leq$ 1 indicates that a receptor's dose of a single contaminant is less than the RfD, and that toxic noncarcinogenic effects from that chemical are unlikely. The Hazard Index (HI) is generated by adding the HQs for all chemical(s) of concern that affect the same target organ (e.g. liver) within or across those media to which the same individual may reasonably be exposed. An HI $\leq$ 1 indicates that toxic noncarcinogenic effects are unlikely. Unlike other non-carcinogens, the noncarcinogenic risks from exposure to lead are evaluated using the Integrated Exposure and Uptake Biokinetic (IEUBK). The IEUBK lead model was used to evaluate the hazard potential posed by lead exposure of young children less than 7 years of age as the most sensitive receptor group. It is EPA policy to protect 95% of the sensitive population against blood lead levels in excess of 10 ug/dl (deciliter) blood. The IEUBK model used was IEUBK win v1.0 build 264. The IEUBK model was run to assess exposure to lead contaminated soil using default assumptions for ingestion and concentration inputs for drinking water, air, and diet. A summary of the noncarcinogenic toxicity data relevant to the chemicals of concern is presented in Table 22.

**Table 22**

**Non-Cancer Toxicity Data Summary**

**Pathway: Ingestion, Dermal**

| Chemical of Concern | Chronic / Subchronic | Oral RfD Value | Oral RfD Units | Dermal RfD | Dermal RfD Units | Primary Target Organ | Combined Uncertainty / Modifying Factors | Sources of RfD: Target Organ | Dates of RfD: Target Organ |
|---|---|---|---|---|---|---|---|---|---|
| Cobalt | Chronic | 0.0003 | Mg/kg-day | 0.0003 | Mg/kg-day | Thyroid | 3000 | PPRTV | 8/25/2008 |
| Copper | Chronic | 0.04 | Mg/kg-day | 0.04 | Mg/kg-day | Gastrointestinal | | HEAST | 1997 |
| Iron | Chronic | 0.7 | Mg/kg-day | 0.7 | Mg/kg-day | Gastrointestinal | 1.5 | PPRTV | 9/11/2006 |

**Pathway: Inhalation**

| Chemical of Concern | Chronic / Subchronic | Inhalation RfC | Inhalation RfC Units | Inhalation RfD | Inhalation RfD Units | Primary Target Organ | Combined Uncertainty /Modifying Factors | Sources of RfC: RfD: Target Organ | Dates |
|---|---|---|---|---|---|---|---|---|---|
| Cobalt | Chronic | 0.000006 | Mg/m3 | | | Respiratory tract | 300 | PPRTV | 8/25/2008 |

**Key**
—: No information available
IRIS: Integrated Risk Information System, U.S. EPA
HEAST – Health Effects Assessment Summary Tables
PPRTV – Provisional Peer-Reviewed Toxicity Value
RfD: Reference Dose
Mg/kg: milligram per kilogram
REL: California Environmental Protection Agency February 2005

**Summary of Toxicity Assessment:** This table provides non-carcinogenic risk information which is relevant to the contaminants of concern in soil. The COCs have toxicity data indicating their potential for adverse non-carcinogenic health effects in humans. The chronic toxicity data available all three for oral exposures, have been used to develop oral reference doses (RfDs). As was the case for the carcinogenic data, dermal RfDs can be extrapolated from the oral RfDs applying an adjustment factor as appropriate. At this time, inhalation reference concentrations are only available for cobalt.

Only those exposure pathways deemed relevant to the remedy are discussed in detail in this ROD. Readers are referred to Section 4 of the HHRA in the OU1 RI for a more comprehensive risk summary of all exposure pathways evaluated for all COPCs and for estimates of the central tendency risk. Tables 23 and 24 list the non-carcinogenic risk summary for the COCs in soil evaluated to reflect current and potential future direct contact and incidental ingestion of contaminated soil by a child corresponding to the reasonable maximum exposure (RME) scenario. As shown below in Table 23 and 24, only the current adjacent and future residential child exposure scenarios indicated a potential threat to human health from exposure to the contaminants at the Site. There were not any carcinogenic contaminants of concern for any of the exposure pathways evaluated in the HHRA.

The HHRA evaluation of the current and future exposure of an adult resident and a future construction work scenario did not document a cancer or non-cancer risk to these receptors. The HI was 0.17 for the current adult adjacent resident and 0.49 for the future adult resident under the reasonable maximum exposure scenario. The HI for the construction worker under the reasonable maximum exposure scenario was 2.3. The maximum tissue specific HI was 1.1 and was based on exposure to aluminum and manganese below levels found in soil samples obtained from background locations. The HI for cobalt was 0.99 and the HI for copper and iron was 0.1. The HHRA concluded that there was not a threat to a construction worker from Site specific contaminants.

**Table 23**

**Risk Characterization Summary – Non-Carcinogens**

**Scenario Timeframe:** Current
**Receptor Population: Adjacent Resident**
**Receptor Age:** Child (1-6 years old)

| Medium | Exposure Medium | Exposure Point | Chemical of Concern | Primary Target Organ | Non-Carcinogenic Hazard Quotient | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Soil/ waste | Soil/waste | Source Area Soil/ Waste | Cobalt | Thyroid | 1.0 | 0.0006 | | 1.0 |
| | | | Copper | Gastrointestinal | 0.35 | | | 0.4 |
| | | | Iron | Gastrointestinal | 1.2 | | | 1.2 |
| | | | | | | | **Soil Hazard Index Total =** | 2.6 |
| | | | | | | | **Maximum Tissue-Specific Hazard Index (gastrointestinal) =** | 1.6 |
| | | | | | | | **Maximum Tissue-Specific Hazard Index (thyroid) =** | 1.0 |

**Key**
— : Toxicity criteria are not available to quantitatively address this route of exposure.
N/A: Route of exposure is not applicable to this medium.
CNS/PNS: Central Nervous System/Peripheral Nervous System
NOEL: No Observed Effect Level

**Risk Characterization**

This table provides hazard quotients (HQs) for each route of exposure and the hazard index (sum of hazard quotients) for all routes of exposure. The Risk Assessment Guidance (RAGS) for Superfund states that, generally, a hazard index (HI) greater than 1 indicates the potential for adverse noncancer effects. The estimated HI of 2.6 indicates that the potential for non-cancer effects could occur from exposure to contaminated soil containing cobalt, copper, or iron.

## Table 24

**Risk Characterization Summary – Non-Carcinogens**

**Scenario Timeframe:** Future
**Receptor Population:** Resident
**Receptor Age:** Child (1-6 years old)

| Medium | Exposure Medium | Exposure Point | Chemical of Concern | Primary Target Organ | Non-Carcinogenic Hazard Quotient | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Soil/ waste | Soil/waste | Source Area Soil/ Waste | Cobalt | Thyroid | 2.1 | 0.00128 | | 2.1 |
| | | | Copper | Gastrointestinal | 0.6 | | | 0.6 |
| | | | Iron | Gastrointestinal | 1.2 | | | 1.2 |
| | | | | | | | Soil Hazard Index Total = | 3.9 |
| | | | | | | | Maximum Tissue-Specific Hazard Index (thyroid)= | 2.1 |
| | | | | | | | Maximum Tissue-Specific Hazard Index (gastrointestinal)= | 1.8 |

**Key**
— : Toxicity criteria are not available to quantitatively address this route of exposure.
N/A: Route of exposure is not applicable to this medium.
CNS/PNS: Central Nervous System/Peripheral Nervous System
NOEL: No Observed Effect Level

**Risk Characterization**
This table provides hazard quotients (HQs) for each route of exposure and the hazard index (sum of hazard quotients) for all routes of exposure. The Risk Assessment Guidance (RAGS) for Superfund states that, generally, a hazard index (HI) greater than 1 indicates the potential for adverse noncancer effects. The estimated HI of 3.9 indicates that the potential for non-cancer effects could occur from exposure to contaminated soil containing cobalt, copper, or iron.

The HHRA for OU1 at the Ely Copper Mine identified the following areas with estimated cancer, non-cancer, and/or lead exposure risks in excess of USEPA risk management criteria (excess lifetime cancer risk greater than $10^{-4}$, hazard index (HI) greater than 1, and/or 5 percent or more of exposed population with a geometric mean blood lead level of 10 micrograms per deciliter [μg/dl] or greater) at the following areas:

- Surface and subsurface soils/waste in the OU1 area contain levels of cobalt, copper, and iron that could represent an unacceptable threat to human health for children residing on and near the Site and coming into contact with the contamination 350 days per year.

Human exposure to surface water, sediment, or recreation exposure to the surface soil would not represent a threat to human health. Human health threats from exposure to groundwater throughout the Site and the soil/waste in Smelter/Slag Area will be addressed as part of OU2. A summary of all estimated cancer and non-cancer risks evaluated in the HHRA is presented in Figure 20. Figure 14 shows the extent of the OU1 area that exceeds the soil cleanup levels for cobalt, copper, and iron.

## 2. Ecological Risk Assessment

The objective of the ecological risk assessment was to identify and estimate the potential ecological impacts associated with the COCs at the Site. A Baseline Ecological Risk Assessment (BERA) was prepared to more fully evaluate the potential threats to ecological receptors using, whenever possible, multiple lines of evidence.

The technical guidance for the aquatic BERA and terrestrial BERA came primarily from two sources, namely: Ecological risk assessment guidance for Superfund: Process for designing and conducting ecological risk assessments, EPA/540/R-97/006; and Guidelines for ecological risk assessment, EPA/630/R-95/002F.

The aquatic BERA evaluated four small ponds (Ponds 2 to 5) along with the main stem of Ely Brook across and downstream from the lower mine waste piles at the Site. The terrestrial BERA evaluated the transition zone (represented by disturbed habitat between the barren mine tailings or waste rock areas and the surrounding undisturbed forest) and four Vernal Pools (VPs) (VP-1 will be addressed under OU2) used as breeding habitats by amphibians in the spring.

**Table 25 and 26** summarize the receptor groups, Lines of Evidence (LOEs), endpoints, and Exposure Units (EUs) evaluated in the OU1 BERAs.

**Table 25**

Table G.1: Receptor groups, endpoints, lines of evidence, and exposure units evaluated in the OU1 aquatic BERA

| Aquatic Receptor Group | Assessment Endpoints | Lines of Evidence | Measurement Endpoints | Exposure Units | |
|---|---|---|---|---|---|
| | | | | The Ponds | Main Stem Ely Brook |
| Benthic invertebrates | A stable and healthy benthic invertebrate community | bulk sediment chemistry | compare chemistry to sed benchmarks | v | v |
| | | pore water chemistry | compare chemistry to SW benchmarks | -- | v |
| | | AVS-SEM chemistry | compare AVS-SEM to tox thresholds | -- | v |
| | | bulk sediment toxicity testing | evaluate responses statistically | -- | v |
| | | pore water toxicity testing | evaluate responses statistically | -- | v |
| | | community survey | compare indices to reference thresholds | -- | v |
| water column invertebrates | A stable and healthy water column invertebrate community | surface water chemistry | compare chemistry to SW benchmarks | v | -- |
| fish | A stable and healthy fish community | surface water chemistry | compare chemistry to SW benchmarks | -- | v |
| | | surface water toxicity testing | evaluate responses statistically | -- | v |
| amphibians | Stable and healthy amphibian populations | surface water chemistry | compare chemistry to SW benchmarks | v | -- |
| | | surface water toxicity testing | evaluate responses statistically | v | -- |
| | | *in-situ* toxicity testing | evaluate responses qualitatively | v | -- |

AVS-SEM - acid volatile sulfides-simultaneously extracted metals
SW = surface water
v = evaluated
-- = not evaluated

## Table 26

| Table G.2: Receptor groups, endpoints, lines of evidence, and exposure units evaluated in the terrestrial BERA | | | | | | |
|---|---|---|---|---|---|---|
| Target Receptor Group | Representative Species | Assessment Endpoints | Line of Evidence | Measurement Endpoints | Exposure Units | |
| | | | | | Transition Zone | Vernal Pools |
| Terrestrial Transitional Zone | | | | | | |
| terrestrial plants | generic | a functioning plant community | soil chemistry | compare chemistry to plant benchmarks | v | -- |
| soil invertebrates | generic | a functioning soil invertebrate community | soil chemistry | compare chemistry to soil invertebrate benchmarks | v | -- |
| herbivorous birds | song sparrow | a functioning herbivorous bird community | food chain modeling | calculate EDDs & compare them to TRVs | v | -- |
| invertivorous birds | American robin | a functioning invertivorous bird community | food chain modeling | calculate EDDs & compare them to TRVs | v | -- |
| carnivorous birds | American kestrel | a functioning carnivorous bird community | food chain modeling | calculate EDDs & compare them to TRVs | v | -- |
| herbivorous mammals | deer mouse | a functioning herbivorous mammal community | food chain modeling | calculate EDDs & compare them to TRVs | v | -- |
| invertivorous mammals | short-tailed shrew | a functioning invertivorous mammal community | food chain modeling | calculate EDDs & compare them to TRVs | v | -- |
| carnivorous mammals | mink | a functioning carnivorous mammal community | food chain modeling | calculate EDDs & compare them to TRVs | v | -- |
| Vernal Pools | | | | | | |
| VP aquatic life | generic | a functioning aquatic life community | surface water chemistry | compare chemistry to surface water benchmarks | -- | v |
| VP larval amphibians | generic | a functioning amphibian community | surface water chemistry | compare chemistry to ampibian tox data | -- | v |

v = evaluted

-- = not evaluated

### a. Identification of Contaminants of Concern

**Aquatic habitats**

Data were organized by EU to identify Chemicals of Potential Ecological Concern (COPECs) in sediment, surface water, and pore water. A metal became a COPEC if its maximum concentrations (or the maximum detection limit for non-detects) exceeded its screening benchmark, or if a benchmark was not available.

**Tables 27 and 28** summarize the COPECs for the four ponds and the main stem of Ely Brook, respectively. Only key COPECs were included in those tables for the sake of brevity. The benchmark sources are provided as footnotes. The 2010 Aquatic BERA report summarized all the COPECs in Tables 4.1 to 4.4 (pond sediment), Table 4.5 (Ely Brook sediment), Table 4.9 (Ely Brook pore water), Tables 4.13 to 4.16 (pond surface water) and 4.17 (Ely Brook surface water).

## Table 27

| Table G.3: Key COPECs in sediment and surface water from the four ponds on the east branch of Ely Brook | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Analyte | Frequency of Detection | Minimum Detect* | flag | Maximum Detect | flag | Concentration Used for Screening | Benchmark | Benchmark Source | Hazard Quotient |
| **Pond 2 Sediment (mg/kg, dw)** | | | | | | | | | |
| Copper | 1 / 1 | 87.6 | | 87.6 | | 87.6 | 31.6 | (1) | 2.8 |
| Manganese | 1 / 1 | 769 | | 769 | | 769 | 630 | (2) | 1.2 |
| Zinc | 1 / 1 | 131 | | 131 | | 131 | 121 | (1) | 1.1 |
| **Pond 3 Sediment (mg/kg, dw)** | | | | | | | | | |
| Copper | 1 / 1 | 81.7 | | 81.7 | | 81.7 | 31.6 | (1) | 2.6 |
| Manganese | 1 / 1 | 3130 | | 3130 | | 3130 | 630 | (2) | 5.0 |
| Zinc | 1 / 1 | 127 | | 127 | | 127 | 121 | (1) | 1.0 |
| **Pond 4 Sediment (mg/kg, dw)** | | | | | | | | | |
| Copper | 2 / 2 | 380 | | 400 | | 400 | 31.6 | (1) | 12.7 |
| Manganese | 2 / 2 | 920 | J | 2410 | | 2410 | 630 | (2) | 3.8 |
| Zinc | 2 / 2 | 316 | | 320 | J | 320 | 121 | (1) | 2.6 |
| **Pond 5 Sediment (mg/kg, dw)** | | | | | | | | | |
| Copper | 1 / 1 | 3540 | | 3540 | | 3540 | 31.6 | (1) | 112 |
| Manganese | 1 / 1 | 1430 | | 1430 | | 1430 | 630 | (2) | 2.3 |
| Zinc | 1 / 1 | 507 | | 507 | | 507 | 121 | (1) | 4.2 |
| **Pond 2 surface water (dissolved metal, ug/L)** | | | | | | | | | |
| Copper | 6 / 6 | 1.5 | | 41.8 | | 41.8 | 9.0 | (3) | 4.6 |
| Manganese | 6 / 6 | 20.0 | | 1400 | | 1400 | 120 | (4) | 11.7 |
| Zinc | 6 / 6 | 5.5 | | 171 | | 171 | 120 | (3) | 1.4 |
| **Pond 3 surface water (dissolved metal, ug/L)** | | | | | | | | | |
| Copper | not a surface water COPEC | | | | | | | | |
| Manganese | 1 / 1 | 444 | | 444 | | 444 | 120 | (4) | 3.7 |
| Zinc | not a surface water COPEC | | | | | | | | |
| **Pond 4 surface water (dissolved metal, ug/L)** | | | | | | | | | |
| Copper | 8 / 10 | 3.7 | | 64.0 | | 64.0 | 9.0 | (3) | 7.1 |
| Manganese | 10 / 10 | 31.0 | | 212 | | 212 | 120 | (4) | 1.8 |
| Zinc | 8 / 10 | 6.8 | | 186 | | 186 | 120 | (3) | 1.5 |
| **Pond 5 surface water (dissolved metal, ug/L)** | | | | | | | | | |
| Copper | 4 / 4 | 240 | | 670 | | 670 | 9.0 | (3) | 74.4 |
| Manganese | 4 / 4 | 90.0 | | 425 | | 425 | 120 | (4) | 3.5 |
| Zinc | 4 / 4 | 224 | | 376 | | 376 | 120 | (3) | 3.1 |

**Benchmark sources:**

1. USEPA. 2003. Region V Ecological Screening Levels. www.epa.gov/RCRIS-region-5/ca/ESL.pdf

2. Buchman, M.F. 1999. NOAA Screening Quick Reference Tables, NOAA HAZMAT Report 99-1, Coastal Protection Division, National Oceanic and Atmospheric Administration. 12 pp.

3. U.S. EPA. 2006. National Recommended Water Quality Criteria: 2006.

4. Suter, G.W. and C.L. Tsao. 1996. Toxicological benchmarks for screening potential contaminants of concern for effects on aquatic biota: 1996 revision. ES/ER/TM-96/R2. Oak Ridge National Laboratory

## Table 28

| Table G.4: Key COPECs in sediment, surface water, and pore water from the main stem of Ely Brook | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Analyte | Frequency of Detection | Minimum Detect* | flag | Maximum Detect | flag | Concentration Used for Screening | Benchmark | Benchmark Source | Hazard Quotient |
| **Sediment (mg/kg)** | | | | | | | | | |
| Cobalt | 32 / 32 | 5.8 | | 140 | | 140 | 50 | (1) | 2.8 |
| Copper | 32 / 32 | 310 | | 6600 | | 6600 | 31.6 | (1) | 209 |
| Iron | 32 / 32 | 57000 | | 400000 | | 400000 | 188400 | (2) | 2.1 |
| Manganese | 32 / 32 | 5.6 | | 2080 | | 2080 | 630 | (2) | 3.3 |
| Zinc | 32 / 32 | 39.0 | | 410 | | 410 | 121 | (1) | 3.4 |
| **Pore water (dissolved metal; ug/L)** | | | | | | | | | |
| Cobalt | 6 / 6 | 2.2 | | 95.0 | | 95.0 | 24 | (4) | 4.0 |
| Copper | 6 / 6 | 0.77 | | 131 | | 131 | 9.0 | (3) | 15 |
| Iron | not a pore water COPEC | | | | | | | | |
| Manganese | 6 / 6 | 17.0 | | 6590 | | 6590 | 120 | (5) | 55 |
| Zinc | 6 / 6 | 0.87 | | 126 | | 126 | 120 | (3) | 1.1 |
| **Surface water (dissolved metal; ug/L)** | | | | | | | | | |
| Cobalt | 35 / 35 | 1.7 | | 664 | | 664 | 24 | (4) | 28 |
| Copper | 35 / 35 | 12.6 | | 6628 | | 6628 | 9.0 | (3) | 736 |
| Iron | 32 / 35 | 42.0 | | 74600 | | 74600 | 1000 | (3) | 75 |
| Manganese | 35 / 35 | 20.0 | | 3100 | | 3100 | 120 | (5) | 26 |
| Zinc | 34 / 34 | 16.9 | | 1213 | | 1213 | 120 | (3) | 10 |

**Benchmark sources:**

1. USEPA. 2003. Region V Ecological Screening Levels. www.epa.gov/RCRIS-region-5/ca/ESL.pdf
2. Buchman, M.F. 1999. NOAA Screening Quick Reference Tables, NOAA HAZMAT Report 99-1, Coastal Protection Division, National Oceanic and Atmospheric Administration. 12 pp.
3. U.S. EPA. 2006. National Recommended Water Quality Criteria: 2006.
4. USEPA.2003. Region V Ecological Screening Levels. www.epa.gov/RCRIS-region-5/ca/ESL.pdf
5. Suter, G.W. and C.L. Tsao. 1996. Toxicological benchmarks for screening potential contaminants of concern for effects on aquatic biota: 1996 revision. Oak Ridge National Laboratory. ES/ER/TM-96/R2.

## Terrestrial transition zone and vernal pools

Analytical data from the transition zone and the VPs were used to identify COPECs in surface soil, small mammals, soil invertebrates, and surface water. A metal became a COPEC if it's maximum concentration (or the maximum detection limit for non-detects) exceeded its screening benchmark, or if a benchmark was not available. Any contaminant detected in at least one sample of soil invertebrates or small mammals was automatically retained as a COPEC by virtue of its presence.

**Tables 29 and 30** summarize the key terrestrial BERA COPECs by medium, in the transition zone and the VPs, respectively. Only key COPECs are included in those tables for the sake of brevity. The benchmark sources are provided as footnotes. The 2011 terrestrial BERA report summarized all the COPECs in Table 2.3 (surface soil), Table 2.7 (soil invertebrates), Table 2.9 (small mammals), and Table 2.11 (vernal pools).

## Table 29

| Table G.5: Key COPECs in soil, soil invertebrates and small mammals from the terrestrial transition zone | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Analyte* | Freq. of *Detect* | Minimum *Detect* | *Flag* | Maximum *Detect* | *Flag* | Concentration used for *Screening* | Soil Benchmark *(mg/kg)* | Benchmark *Source* | *Basis* | Hazard *Quotient* |
| **Soil (mg/kg, dw)** | | | | | | | | | | |
| Chromium | 170/170 | 2.50 | | 440 | | 440 | 26 | (1) | Bird | 17 |
| Copper | 170/170 | 16.0 | | 7850 | | 7850 | 28 | (1) | Bird | 280 |
| Selenium | 154/169 | 0.420 | | 83 | | 83 | 0.52 | (1) | Plant | 160 |
| Zinc | 170/170 | 24.0 | | 1500 | | 1500 | 46 | (1) | Bird | 33 |
| **Soil Invertebrates (mg/kg, ww)** | | | | | | | | | | |
| Chromium | 2/5 | 1.70 | | 2.90 | | not applicable | -- | -- | -- | -- |
| Copper | 5/5 | 16.0 | | 43.0 | | not applicable | -- | -- | -- | -- |
| Selenium | not a soil invertebrate COPEC | | | | | | | | | |
| Zinc | 5/5 | 47.0 | | 95.0 | | not applicable | -- | -- | -- | -- |
| **Small mammals (mg/kg, ww)** | | | | | | | | | | |
| Chromium | 3/30 | 1.00 | | 3.70 | | not applicable | -- | -- | -- | -- |
| Copper | 30/30 | 3.20 | | 12.0 | | not applicable | -- | -- | -- | -- |
| Selenium | not a small mammal COPEC | | | | | | | | | |
| Zinc | 30/30 | 26.0 | | 46.0 | | not applicable | -- | -- | -- | -- |

**Benchmark source:**

1 = Lowest of the available Ecological Soil Screening Levels (Eco-SSLs).

## Table 30

| Table G.6: Key surface water COPECs in the vernal pools[1] | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Benchmark | Vernal Pool 1 | | | Vernal Pool 2 | | | Vernal Pool 3 | | | Vernal Pool 4 | | |
| Analyte (µg/L) | Source | Conc. | BM | HQ | Conc. | BM | HQ | Conc. | BM | HQ | Conc. | BM | HQ |
| Barium | (1) | 24.3 | 4.0 | 6.1 | 12.6 | 4.0 | 3.2 | 13.8 | 4.0 | 3.5 | 16.1 | 4.0 | 4.0 |
| Copper | (2) | 145 | 3.9 | 37.2 | 4.70 | 3.7 | 1.3 | 1.50 | 3.2 | 0.5 | 2.00 | 2.7 | 0.7 |
| Zinc | (2) | 77.6 | 52 | 1.5 | 13.6 | 49 | 0.3 | 68.9 | 43 | 1.6 | 31.5 | 36 | 0.9 |

**Benchmark sources:**

(1) Buchman, M.F. 2008. NOAA Screening Quick Reference Tables, NOAA OR&R Report 08-1, Seattle WA, Office of Response and Restoration Division

(2) EPA. 2009. National Recommended Water Quality Criteria. Office of water Science and Technology

BM - benchmark (hardness adjusted for copper and zinc)

[1]Only one surface water sample was collected from each vernal pool.

### b. Exposure Assessment

**Ecological setting**

The ponds are located in a small, poorly-drained, swampy valley. Pond 1, the most upstream of the five, is the largest (about 0.94 acres) and is the source for the east branch of Ely Brook. The four other ponds are downstream of each other and are all hydraulically connected.

- Pond 1 (max depth: 5 ft) supplied water to the mining facilities. It is spring-fed and not impacted by past mining activities.
- Ponds 2 and 3 are more ephemeral and less well defined.
- Pond 4 (max depth: 4 ft) has an active beaver dam; it is impacted by Acid Mine Drainage (AMD).
- Pond 5 is shallow (< 3 ft) and impacted by AMD from a waste rock pile located next to the pond.

Ely Brook is a small high-gradient stream (max width: 5-7 ft) which is the major drainage feature at the Site. The main stem is the lower half of the 0.9 mile-long brook. Several small, highly-impacted tributaries, including the east branch, flow into it from the Site. The surface

water in the main stem has pH < 4.0 and Cu levels 100-1000 times above the chronic benchmark. The main stem appears visually to be devoid of living organisms. The substrate is entirely mine-derived waste and has an orange-red color from metal precipitation.

The terrestrial transition zone represents disturbed habitat between the barren mine tailings/waste rock areas and the surrounding forest. It is characterized by mine wastes which are partially covered by patches of mosses and grasses, or stunted birches, white pine, red spruce and aspen species. The transition zone is considered marginal wildlife habitat because it provides limited cover or forage for wildlife.

Four VPs were identified across the Site during a May 2009 survey. The four pools contained one or more egg masses from wood frogs, gray tree frogs, and/or spotted salamanders. VP-1, located in the southeast corner of the former smelter area, also contained a heavy iron floc (VP-1 is part of OU2).

**Complete exposure pathways**

**Aquatic habitats**

Aquatic invertebrates, fish, and/or amphibians exposed to metals in sediment, pore water, and surface water were the receptors of concern in the ponds and Ely Brook. Exposure Point Concentrations (EPCs) were calculated in terms of Reasonable Maximum Exposures (RMEs) and Central Tendency Exposures (CTEs). RMEs were either the maximum detected value or the 95% Upper Confidence Limit (UCL) of the mean, depending on the structure of the data set. Arithmetic means were used as CTEs.

**Tables 31 to 33** summarize the aquatic EPCs for sediment, pore water, and surface water, respectively. The 2010 Aquatic BERA report summarized all the EPCs in Tables 5.1 to 5.5 (pond sediment, plus reference), Tables 5.6 and 5.7 (Ely Brook sediment, plus reference), Table 5.12 and 5.13 (Ely Brook pore water, plus reference), Tables 5.18 to 5.22 (pond surface water, plus reference), and Tables 5.23 and 5.34 (Ely Brook surface water, plus reference).

## Table 31

| Table G.7: Sediment EPCs for the key COPECs in the ponds and Ely Brook | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| COPECs (mg/kg, dw) | Freq. of Detect. | Arithmetic Mean | Maximum Detect | 95% UCL of mean | | | EPC | |
| | | | | Value | Distribution | Method | RME | CTE |
| **Reference Pond 1 (total metals)** | | | | | | | | |
| Copper | 2 / 2 | 65.3 | 86.6 | not calculated | | | 86.6 | 65.3 |
| Manganese | 2 / 2 | 339 | 527 | not calculated | | | 527 | 339 |
| Zinc | 2 / 2 | 88.0 | 126 | not calculated | | | 126 | 88.0 |
| **Pond 2 (total metals)** | | | | | | | | |
| Copper | 1 / 1 | 87.6 | 87.6 | not calculated | | | 87.6 | 87.6 |
| Manganese | 1 / 1 | 769 | 769 | not calculated | | | 769 | 769 |
| Zinc | 1 / 1 | 131 | 131 | not calculated | | | 131 | 131 |
| **Pond 3 (total metals)** | | | | | | | | |
| Copper | 1 / 1 | 81.7 | 81.7 | not calculated | | | 81.7 | 81.7 |
| Manganese | 1 / 1 | 3130 | 3130 | not calculated | | | 3130 | 3130 |
| Zinc | 1 / 1 | 127 | 127 | not calculated | | | 127 | 127 |
| **Pond 4 (total metals)** | | | | | | | | |
| Copper | 2 / 2 | 390 | 400 | not calculated | | | 400 | 390 |
| Manganese | 2 / 2 | 1665 | 2410 | not calculated | | | 2410 | 1665 |
| Zinc | 2 / 2 | 318 | 320 | not calculated | | | 320 | 318 |
| **Pond 5 (total metals)** | | | | | | | | |
| Copper | 1 / 1 | 3540 | 3540 | not calculated | | | 3540 | 3540 |
| Manganese | 1 / 1 | 1430 | 1430 | not calculated | | | 1430 | 1430 |
| Zinc | 1 / 1 | 507 | 507 | not calculated | | | 507 | 507 |
| **Reference Ely Brook (total metals)** | | | | | | | | |
| Copper | 13 / 13 | 343 | 1230 | 693 | G | 95% Approx Gamma | 693 | 343 |
| Manganese | 13 / 13 | 789 | 2200 | 1667 | NP | 95% Chebyshev | 1667 | 789 |
| Zinc | 12 / 13 | 66.8 | 139 | 85.4 | G | 95% KM (BCA) | 85.4 | 66.8 |
| **Main Stem of Ely Brook (total metals)** | | | | | | | | |
| Copper | 32 / 32 | 3101 | 6600 | 3873 | G | 95% Approx Gamma | 3873 | 3101 |
| Manganese | 32 / 32 | 298 | 2080 | 1249 | NP | 99% Chebyshev | 1249 | 298 |
| Zinc | 32 / 32 | 110 | 410 | 132 | LN | 95% Modified-t | 132 | 110 |

*Distribution*

NP - non parametric

LN - lognormal

N - normal

## Table 32

| Table G.8: Surface water EPCs for the key COPECs in the ponds | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| COPECs (ug/L) | Freq. of Detect. | Arithmetic Mean | Maximum Detect | 95% UCL of mean | | | EPC | |
| | | | | Value | Distribution | Method | RME | CTE |
| **Reference Pond 1 (dissolved metals)** | | | | | | | | |
| Copper | 2 / 8 | 39.2 | 4.6 | not calculated | | | 4.6 | 39.2 |
| Manganese | 2 / 8 | 9.9 | 10.1 | not calculated | | | 10.1 | 9.9 |
| Zinc | 5 / 8 | 92.8 | 199 | not calculated | | | 199 | 92.8 |
| **Pond 2 (dissolved metals)** | | | | | | | | |
| Copper | 6 / 6 | 10.6 | 41.8 | not calculated | | | 41.8 | 10.6 |
| Manganese | 6 / 6 | 533 | 1400 | not calculated | | | 1400 | 533 |
| Zinc | 6 / 6 | 66.8 | 171 | not calculated | | | 171 | 66.8 |
| **Pond 3 (dissolved metals)** | | | | | | | | |
| Copper | 1 / 1 | 1.7 | 1.7 | not calculated | | | 1.7 | 1.7 |
| Manganese | 1 / 1 | 444 | 444 | not calculated | | | 444 | 444 |
| Zinc | 1 / 1 | 7.18 | 7.18 | not calculated | | | 7.18 | 7.18 |
| **Pond 4 (dissolved metals)** | | | | | | | | |
| Copper | 8 / 10 | 29.6 | 64.0 | not calculated | | | 64.0 | 29.6 |
| Manganese | 10 / 10 | 98.3 | 212 | not calculated | | | 212 | 98.3 |
| Zinc | 8 / 10 | 89.9 | 186 | not calculated | | | 186 | 89.9 |
| **Pond 5 (dissolved metals)** | | | | | | | | |
| Copper | 4 / 4 | 446 | 670 | not calculated | | | 670 | 446 |
| Manganese | 4 / 4 | 194 | 425 | not calculated | | | 425 | 194 |
| Zinc | 4 / 4 | 318 | 376 | not calculated | | | 376 | 318 |

## Table 33

| Table G.9: Surface water and pore water EPCs for the key COPECs in Ely Brook | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| COPECs (ug/L) | Freq. of Detect. | Arithmetic Mean | Maximum Detect | 95% UCL of mean | | | EPC | |
| | | | | Value | Distribution | Method | RME | CTE |
| **Reference Ely Brook surface water (dissolved metals)** | | | | | | | | |
| Cobalt | 4 / 10 | 2.0 | 0.14 | not calculated | | | 0.14 | 2.0 |
| Copper | 8 / 10 | 7.7 | 29.5 | not calculated | | | 29.5 | 7.7 |
| Iron | 8 / 10 | 17.9 | 30.0 | not calculated | | | 30.0 | 17.9 |
| Manganese | 10 / 10 | 23.6 | 136 | 175 | NP | 99% Chebyshev | 136.0 | 23.6 |
| Zinc | 10 / 10 | 50.0 | 137 | 77.6 | N | 95% Student's-t | 77.6 | 50.0 |
| **Main stem Ely Brook surface water (dissolved metals)** | | | | | | | | |
| Cobalt | 35 / 35 | 98.4 | 664 | 334 | NP | 99% Chebyshev | 334 | 98 |
| Copper | 35 / 35 | 2532 | 6628 | 5530 | NP | 99% Chebyshev | 5530 | 2532 |
| Iron | 32 / 35 | 9762 | 74600 | 39994 | NP | 99% KM Chebyshev | 39994 | 9762 |
| Manganese | 35 / 35 | 562 | 3100 | 1034 | LN | 95% H-UCL | 1034 | 562 |
| Zinc | 34 / 34 | 496 | 1213 | 588 | N | 95% Student's-t | 588 | 496 |
| **Reference Ely Brook pore water (dissolved metals)** | | | | | | | | |
| Cobalt | 2 / 3 | 2.0 | 0.55 | not calculated | | | 0.55 | 2.0 |
| Copper | 3 / 3 | 3.6 | 6.2 | not calculated | | | 6.2 | 3.6 |
| Iron | 1 / 3 | 162.0 | 436.0 | not calculated | | | 436.0 | 162.0 |
| Manganese | 3 / 3 | 1019 | 3000 | not calculated | | | 3000 | 1019 |
| Zinc | 3 / 3 | 5.6 | 12.8 | not calculated | | | 12.8 | 5.6 |
| **Main stem Ely Brook pore water (dissolved metals)** | | | | | | | | |
| Cobalt | 6 / 6 | 32.5 | 95.0 | NC | | | 95.0 | 32.5 |
| Copper | 6 / 6 | 45.6 | 131 | NC | | | 131 | 45.6 |
| Iron | 5 / 6 | 174 | 747 | NC | | | 747.0 | 174.0 |
| Manganese | 6 / 6 | 1782 | 6590 | NC | | | 6590 | 1782 |
| Zinc | 6 / 6 | 31.6 | 126 | NC | | | 126 | 31.6 |

*Distribution*
NP - non parametric
LN - lognormal
N - normal

## Terrestrial habitats

The terrestrial BERA evaluated plants, soil invertebrates, birds, mammals, and VP aquatic life, including larval amphibians. Soil was collected from the transition zone and the reference location, and a single surface water sample was obtained from each VP. Exposure was further quantified by analyzing soil invertebrates and small mammals collected from the transition zone and the off-site reference location. Finally, the concentration of COPECs in plants was estimated using literature-derived Plant-to-Soil Accumulation Factors (PSAFs) and soil EPC data. Hence, the media of concern to the terrestrial BERA were (a) surface soil for direct contact by terrestrial plants and soil invertebrates, (b) surface water in the VPs for direct contact with aquatic life, and (c) soil, soil invertebrates, plants, and small mammals for ingestion by wildlife receptors.

## Terrestrial EPCs

Exposure was estimated based on analyses of soil, soil invertebrates and small mammals collected from the transition zone, and surface water samples collected from the VPs. Food chain modeling was used to calculate Estimated Daily Doses (EDDs) for six wildlife receptor species based on modeled residues for plants and measured residues in soil, soil invertebrates and small mammals. The EPCs were provided as RMEs and CTEs, except for the VPs which were characterized by only a single surface water sample.

**Table 30** provides the EPCs for the key COPECs in the four VPs (note: the concentrations used to select the COPECs were identical to the EPCs because only a single surface water sample was collected from each VP). **Table G.33** provides the EPCs for key COPECs and the target media of interest to the terrestrial BERA. The 2011 terrestrial BERA report summarized all the EPCs in Tables 3.1 and 3.2 (surface soil from the transition zone and reference location), Tables 3.3 and 3.4 (soil invertebrates from the transition zone and reference location), Tables 3.5 and 3.6 (small mammals from the transition zone and reference location), and Table 3.9 (terrestrial plants).

## Table 33

| Table G.10: EPCs for the key terrestrial COPECs in the transition zone | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Arthimetic | Maximum | 95% UCL of mean | | | EPC | |
| COPECs (mg/kg, dw) | Mean | Detect | Value | Distribution[a] | Method | RME | CTE |
| **Reference soil (mg/kg, dw)** | | | | | | | |
| Chromium | 20.4 | 32.0 | 32.7 | not discernable | 95% Chebyshev (Mean, Sd) UCL | 32.0 | 20.4 |
| Copper | 15.3 | 45.0 | 20.2 | gamma | 95% Approximate Gamma UCL | 20.2 | 15.3 |
| Selenium | 1.77 | 2.90 | 2.04 | normal | 95% Student's-t UCL | 2.04 | 1.77 |
| Zinc | 42.8 | 86.0 | 52.3 | normal | 95% Student's-t UCL | 52.3 | 42.8 |
| **Transition zone soil (mg/kg, dw)** | | | | | | | |
| Chromium | 38.0 | 440 | 50.8 | not discernable | 95% Chebyshev (Mean, Sd) UCL | 50.8 | 38.0 |
| Copper | 665 | 7850 | 772 | gamma | 95% Approximate Gamma UCL | 772 | 665 |
| Selenium | 10.7 | 83.0 | 15.9 | not discernable | 95% KM (Chebyshev) UCL | 15.9 | 10.7 |
| Zinc | 118 | 1500 | 163 | not discernable | 95% Chebyshev (Mean, Sd) UCL | 163 | 118 |
| **Reference terrestrial vegetation (mg/kg, ww)** | | | | | | | |
| Chromium | 1.19 | 0.76 | not calculated | | | 1.19 | 0.76 |
| Copper | 5.8 | 5.2 | not calculated | | | 5.8 | 5.2 |
| Selenium | 0.07 | 0.06 | not calculated | | | 0.07 | 0.06 |
| Zinc | 45.9 | 41.0 | not calculated | | | 45.9 | 41.0 |
| **Transition zone terrestrial vegetation (mg/kg, ww)** | | | | | | | |
| Chromium | 1.89 | 1.41 | not calculated | | | 1.89 | 1.41 |
| Copper | 24.3 | 22.9 | not calculated | | | 24.3 | 22.9 |
| Selenium | 0.53 | 0.36 | not calculated | | | 0.53 | 0.36 |
| Zinc | 87.9 | 73.3 | not calculated | | | 87.9 | 73.3 |
| **Reference soil invertebrates (mg/kg, ww)** | | | | | | | |
| Chromium | not detected | | | | | | |
| Copper | 15.0 | 14.5 | not calculated | | | 15.0 | 14.5 |
| Selenium | not detected | | | | | | |
| Zinc | 51.0 | 50.5 | not calculated | | | 51.0 | 50.5 |
| **Transition zone soil invertebrates (mg/kg, ww)** | | | | | | | |
| Chromium | 2.90 | 1.52 | not calculated | | | 2.90 | 1.52 |
| Copper | 43.0 | 28.0 | not calculated | | | 43.0 | 28.0 |
| Selenium | not detected | | | | | | |
| Zinc | 95.0 | 64.0 | not calculated | | | 95.0 | 64.0 |
| **Reference small mammals (mg/kg, ww)** | | | | | | | |
| Chromium | 1.41 | 1.50 | 1.44 | not discernable | 95% KM (t) UCL | 1.44 | 1.41 |
| Copper | 3.73 | 5.90 | 4.29 | normal | 95% Student's-t UCL | 4.29 | 3.73 |
| Selenium | not detected | | | | | | |
| Zinc | 31.3 | 36.0 | 33.6 | normal | 95% Student's-t UCL | 33.6 | 31.3 |
| **Transition zone small mammals ( mg/kg, ww)** | | | | | | | |
| Chromium | 1.10 | 3.70 | 1.29 | normal | 95% KM (t) UCL | 1.29 | 1.10 |
| Copper | 5.03 | 12.0 | 5.64 | not discernable | 95% Student's-t UCL | 5.64 | 5.03 |
| Selenium | not detected | | | | | | |
| Zinc | 30.6 | 46.0 | 32.0 | not discernable | 95% Student's-t UCL | 32.0 | 30.6 |

## Modeling assumptions to calculate EPCs for wildlife feeding in the transition zone

Herbivores (i.e., the song sparrow and deer mouse) were assumed to feed 100% on plants from the transition zone. The EDDs for the two herbivores were calculated as follows:

$$EDD = [(FIR * BSAF * C_{soil} * P_{TP} * F_{TP} * AF_{bio\text{-}diet}) + (SIR * C_{soil} * P_S * AF_{bio\text{-}s})]/BW$$

Where:

EDD = estimated daily dose (mg/kg BW-day)
FIR = food ingestion rate (kg/day ww)
BSAF = biota-to-soil accumulation factor for terrestrial plants (unitless; COPEC specific)

$C_{soil}$ = COPEC concentration in soil (mg/kg dw)
$P_{TP}$ = proportion of terrestrial plants that is contaminated (unitless)
$F_{TP}$ = fraction of diet consisting of terrestrial plants (unitless)
$AF_{bio\text{-}diet}$ = bioaccessibility adjustment factor from diet to receptor (unitless)
SIR = soil ingestion rate (kg/d dw)
$P_S$ = proportion of ingested soil that is contaminated (unitless)
$AF_{bio\text{-}S}$ = bioaccessibility adjustment factor from soil to receptor (unitless)
BW = species-specific body weight (kg)

Invertivores (i.e., American robin and short-tailed shrew) were assumed to feed 100% on soil invertebrates in the transition zone. The EPCs were calculated using field-collected organisms. The EDDs for the two invertivores were calculated as follows:

$$EDD = [(FIR * C_{INV} * P_{INV} * F_{INV} * AF_{bio\text{-}diet}) + (SIR * C_{soil} * P_S * AF_{bio\text{-}s})]/BW$$

Where (note: only those acronyms not already defined are included below):

$C_{INV}$ = COPEC concentration measured in soil invertebrates (mg/kg ww))
$P_{INV}$ = proportion of soil invertebrates that is contaminated (unitless)
$F_{INV}$ = fraction of diet comprised of soil invertebrates (unitless)

Carnivores were assumed to feed either on a 50:50 mix of soil invertebrates and small mammals (i.e., American kestrel), or 100% on small mammals (i.e., mink) from the transition zone. The EPCs were calculated from COPEC levels measured in field-collected organisms. The EDDs for the avian carnivore (American kestrel) were calculated as follows:

$$EDD = [(FIR * C_{INV} * P_{INV} * F_{INV} * AF_{bio\text{-}diet}) + (FIR * C_{SM} * P_{SM} * F_{SM} * AF_{bio\text{-}diet})]/BW$$

Where (note: only those acronyms not already defined are included below):

$C_{SM}$ = COPEC concentration measured in small mammals (mg/kg ww)
$P_{SM}$ = proportion of small mammals that is contaminated (unitless)
$F_{SM}$ = fraction of diet comprised of small mammals (unitless)
The EDDs for the mammalian carnivore (mink) were calculated as follows:

$$EDD = (FIR * C_{SM} * P_{SM} * F_{SM} * AF_{bio\text{-}diet})/BW$$

**Table 34** summarizes the wildlife receptor exposure factors to calculate EDDs based on ingesting soil and food items.

**Table 34**

| Table G.11: Exposure parameters used in the terrestrial wildlife food chain modeling | | | | | | |
|---|---|---|---|---|---|---|
| | | Diet Composition | | | Food Ingestion Rate (kg ww/kg.d) | Soil Ingestion Rate (kg dw/kg.d) |
| Target Receptor | Body Weight (kg) | Terrestrial Plants | Soil invertebrates | Small Mammals | | |
| song sparrow | 0.02 | 100% | -- | -- | 1.2 | 0.092 |
| American robin | 0.077 | -- | 100% | -- | 0.66 | 0.008 |
| American kestrel | 0.119 | -- | 50% | 50% | 0.48 | 0 |
| deer mouse | 0.0179 | 100% | -- | -- | 0.61 | 0.011 |
| short-tailed shrew | 0.015 | -- | 100% | -- | 0.53 | 0.0046 |
| mink | 1.0 | -- | -- | 100% | 0.11 | 0 |

**Table 35** provides the wildlife RME and CTE EDDs for the key COPECs.in the transition zone. The 2011 terrestrial BERA report summarized all the wildlife EDDs in Tables 3.19 to 3.22.

**Table 35**

| Table G.12: Key COPECs estimated daily doses for wildlife receptors feeding in the transition zone | | | | | | |
|---|---|---|---|---|---|---|
| COPEC | Song Sparrow | American Robin | American Kestrel | Deer Mouse | Short-Tailed Shrew | Mink |
| **Reference RME estimated daily dose (mg/kg.day)** | | | | | | |
| Chromium | 1.55 | 0.0108 | 0.344 | 0.0772 | 0.00618 | 0.01 |
| Copper | 0.916 | 5.32 | 2.45 | 3.63 | 7.99 | 0.472 |
| Selenium | 0.271 | 0.0163 | ND | 0.0650 | 0.00936 | ND |
| Zinc | 7.01 | 34.1 | 20.3 | 28.6 | 27.3 | 3.69 |
| **Transition zone RME estimated daily dose (mg/kg.day)** | | | | | | |
| Chromium | 2.46 | 1.93 | 1.01 | 0.123 | 0.142 | 0.0122 |
| Copper | 31.9 | 17.8 | 6.19 | 18.6 | 24.4 | 0.621 |
| Selenium | 2.10 | 0.127 | ND | 0.498 | 0.0732 | ND |
| Zinc | 19.2 | 64.0 | 30.5 | 55.4 | 51.1 | 3.52 |
| **Reference CTE estimated daily doses (mg/kg-day)** | | | | | | |
| Chromium | 0.990 | 0.00686 | 0.338 | 0.0493 | 0.00394 | 0.0133 |
| Copper | 0.705 | 5.13 | 2.32 | 3.23 | 7.72 | 0.410 |
| Selenium | 0.236 | 0.0142 | ND | 0.0566 | 0.00814 | ND |
| Zinc | 5.90 | 33.7 | 19.6 | 25.5 | 27.0 | 3.44 |
| **Transition zone CTE estimated daily doses (mg/kg.day)** | | | | | | |
| Chromium | 1.84 | 1.02 | 0.630 | 0.0918 | 0.0766 | 0.0104 |
| Copper | 27.5 | 12.2 | 4.20 | 17.2 | 16.2 | 0.553 |
| Selenium | 1.41 | 0.0853 | ND | 0.335 | 0.0490 | ND |
| Zinc | 14.4 | 43.2 | 22.7 | 46.0 | 34.5 | 3.37 |

ND - not detected

### c. Ecological Effects Assessment

Sediment samples from the main stem of Ely Brook and its reference section were tested for toxicity using juvenile amphipods (*Hyalella azteca*) for 28 days, and juvenile midges (*Chironomus dilutus*) for 10 days. Amphipod survival and growth dropped significantly in two of the three Ely Brook sediment samples. The lack of toxicity in the third sample was unexpected because it had high copper levels (5,950 mg/kg in bulk sediment and 2,140 µg/L in

filtered pore water). It was suspected that the laboratory renewal water (pH of 8.2 and alkalinity of 100 mg/L as $CaCO_3$) may have increased the pore water pH, thereby causing the dissolved metals to precipitate out and become non-bioavailable. Midge survival was not statistically different in Ely Brook sediment. One reason may be because survival in the reference sample was only 63.8% and fell below the Test Acceptability Criterion (TAC). However, growth was significantly lower in two of the three samples. Growth was unaffected in the sample with the highest Cu levels, presumably due to chemical changes caused by the renewal water, as discussed above.

Pore-water samples were collected from Ely Brook using a push-point sampler. These samples were tested undiluted under static conditions using juvenile amphipods and midges to assess survival after 96 hours. All three pore water samples from the main stem of Ely Brook were acutely toxic to the amphipods, but not to the midges.

One surface water sample was collected each from Pond 4, Pond 5, and the main stem of Ely Brook, plus one reference sample. All samples were tested for seven days undiluted using larval fathead minnows (*Pimephales promelas*). The test water was renewed daily. The results showed significant mortality and reduced growth in the samples from both ponds and the main stem of Ely Brook. The fathead minnow larvae exposed to the surface water from the ponds (both of which are fishless) were used as laboratory surrogates for amphibian tadpoles.

Fertilized eggs of the wood frog (*Rana sylvatica*) were exposed in floating cages *in-situ* for eight days in Ponds 1 (on-Site reference), 4, and 5. The eggs came from an off-Site pond. Hatching success in the on-Site ponds did not differ from that in the off-Site pond. However, all but one tadpole died in Pond 5 shortly after hatching, whereas tadpole survival within 48 hrs of hatching (= end of the field exposure) in the other two on-Site ponds was unaffected. The gelatinous eggs protected the embryos from the toxic surface water in Pond 5, but the tadpoles died quickly when exposed to ambient conditions.

The survival, growth, and development of a fresh batch of wood frog tadpoles exposed in floating cages *in-situ* was tracked in Ponds 1, 4, and 5 for up to four weeks. The test was compromised by persistent reference mortality which may have resulted from poor surface water quality due to excessive feeding and inadequate water circulation in the cages. The early trends in the data, however, confirmed that Pond 5 was highly toxic, with 0% tadpole survival after 8 days. Survival in Pond 4 dropped to 37.5% after 8 days versus 87.5% in Pond 1. The data from Pond 4 showed severe toxicity to tadpoles. This trend was ultimately inconclusive, however, because survival in the on-site and off-site reference ponds also declined over time. Only the results from the first eight days were used qualitatively in the risk characterization.

Ely Brook was occasionally assessed by the State of Vermont, the USGS, and others for macroinvertebrate community health starting in 1987. The counts were used to calculate metrics which were compared to values from VT reference streams. The data showed severe stress to the benthic community in Ely Brook.

Finally, six mine waste soil samples were tested for toxicity using the earthworm *Eisenia foetida*. The program started with a 14-day pilot study (two replicates; no feeding) using three soil samples, followed by a 28-day definitive test (three replicates; weekly feeding) using three new soil samples. The pH of each test soil was adjusted to 4.0 to avoid toxicity from low pH. Mortality and growth were the endpoints of interest. The surviving worms at the end of the test were weighed, depurated, dried, and analyzed for metals. No significant mortality was observed at the end of the 14-day pilot study, even though all worms (including those from both reference soils) lost much weight. Significant mortality was observed at the end of the 28-day definitive test, including in the reference soil. All surviving worms also showed substantial weight loss, in spite of the weekly feeding. The definitive test was compromised by worms of poor quality due to a mite infestation in the worm culture. The soil toxicity results were not used quantitatively due to the limitations of the data. Instead, they were used qualitatively to comment on the low bioavailability of metals in the mine waste soils.

The toxicity benchmarks for the key COPECs discussed in the risk characterization are provided in **Table 36** (sediment and surface water/pore water in the ponds and Ely Brook) and **Table 37** (soil invertebrates, terrestrial plants, and wildlife receptors in the transition zone). **Table 36** also provides the chronic surface water benchmarks for the key COPECs in the vernal pools. The 2010 aquatic BERA report summarized all the toxicity benchmarks in Exhibits 6.1 (sediment benchmarks) and 6.2 (surface water benchmarks). The 2011 terrestrial BERA summarized all the toxicity benchmarks in Tables 3.23 (plants), 3.24 (soil invertebrates), 3.25 (aquatic receptors), 3.26 (larval amphibians), 3.28 (birds), and 3.29 (mammals).

## Table 36

| Table G.13: Toxicity values for the key COPECs evaluated in the OU1 aquatic BERA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| COPECs | Sediment Benchmarks (mg/kg) | | | | Surface Water and Pore Water Benchmarks (ug/L) | | | |
| | "No Effect" | Source | "Effect" | Source | Acute | Source | Chronic | Source |
| Cobalt | 50 | (1) | NA | -- | 1500 | (6) | 24 | (1) |
| Copper | 31.6 | (1) | 149 | (3) | 13 | (5) | 9.0 | (5) |
| Iron | 188400 | (2) | 40000 | (4) | NA | -- | 1000 | (5) |
| Manganese | 630 | (2) | 1100 | (4) | 2300 | (6) | 120 | (6) |
| Zinc | 121 | (1) | 459 | (3) | 120 | (5) | 120 | (5) |

**Sources:**

(1) USEPA. 2003. Region V Ecological Screening Levels. www.epa.gov/RCRIS-region-5/ca/ESL.pdf

(2) Buchman, M.F. 1999. NOAA Screening Quick Reference Tables, NOAA HAZMAT Report 99-1, Coastal Protection Division, National Oceanic and Atmospheric Administration. 12 pp.

(3) MacDonald, D.D., C.G. Ingersoll, and T.A. Berger. 2000. Development and evaluation of concensus-based sediment quality guidelines for freshwater ecosystems. Arch. Environ. Contam. Toxicol. 39:20-31.

(4) Persaud, D., R. Jaagumagi and A. Hayton. 1993. Guidelines for the protection and management of aquatic sediment quality in Ontario. Ontario Ministry of Environment and Energy.

(5) U.S. EPA. 2006. National Recommended Water Quality Criteria: 2006.

(6) Suter, G.W. and C.L. Tsao. 1996. Toxicological benchmarks for screening potential contaminants of concern for effects on aquatic biota: 1996 revision. ES/ER/TM-96/R2. Oak Ridge National Laboratory.

## Table 37

| Table G.14: Toxicity values for the key COPECs evaluated in the terrestrial BERA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Chemical | Plant Benchmarks (mg/kg) | | Soil Invertebrate Benchmarks (mg/kg) | | Wildlife Toxicity Reference Values (mg/kg-day) | | | | | |
| | | | | | Birds | | | Mammals | | |
| | No Effect | Source | No Effect | Source | No Effect | Effect | Source | No Effect | Effect | Source |
| Chromium | 0.018 | (1) | 0.2 | (1) | 37.7 | 75.4 | (3) | 8.8 | 44.2 | (7) |
| Copper | 70 | (2) | 80 | (2) | 33 | 62 | (4) | 11.7 | 15.1 | (8) |
| Selenium | 0.52 | (2) | 4.1 | (2) | 0.4/1.6 | 0.8/3.2 | (5) | 0.35 | 1.05 | (9) |
| Zinc | 160 | (2) | 120 | (2) | 54.4 | 131 | (6) | 160 | 320 | (10) |

(NA)= Not available

**Benchmark sources:**

(1) EPA, 1999a. Screening-level ecological risk assessment protocol for hazardous waste combustion facilities. EPA-30-D-99-001C.

(2) EPA's EcoSSLs for Cu (OSWER Directive 9285.7-68), selenium (OSWER Directive 9285.7-72), and zinc (OSWER Directive 9285.7-73).

(3) Final BERA report for the Elizabeth Copper Mine Superfund Site, VT (Meluzzi et al., 1996. Feeding hens diets supplemented with heavy metals chromium, nickel, and lead. Archiv Fuer Gefluegelkunde 60:119-125).

(4) Final BERA report for the Elizabeth Copper Mine Superfund Site, VT (Mehring et al., 1960 as interpreted by Sample et al., 1996. Toxicological benchmarks for wildlife: 1996 revision. Oak Ridge National Laboratory. ES/ER/TM-86/R3).

(5) Final BERA report for the Elizabeth Copper Mine Superfund Site, VT (Heinz et al., 1989. Impaired reproduction of mallards fed an organic form of selenium. J. Wildl. Manag. 53:418-428).

(6) Final BERA report for the Elizabeth Copper Mine Superfund Site, VT (NOAEL from the National Academy of Sciences. 1994. Nutrient requirements of laboratory animals. National Academy Press, NY; LOAEL from Stahl et al., 1990. Breeding hen and progeny performance when hens are fed excessive dietary zinc. Poult. Sci. 69:259-263).

(7) Final BERA report for the Elizabeth Copper Mine Superfund Site, VT (Anderson et al., 1997. Lack of toxicity of chromium chloride and chromium picolinate in rats. J. Am. Coll. Nutr. 16:273-279).

(8) Final BERA report for the Elizabeth Copper Mine Superfund Site, VT ( Aulerich et al., 1982. Effects of supplemental copper on growth, reproductive performance and kit survival of standard dark mink and acute toxicity of copper on mink. Anim. Sci. 55:337-343).

(9) Final BERA report for the Elizabeth Copper Mine Superfund Site, VT ( Rosenfeld and Beath, 1954. Effects od selenium on reproduction in rats. Proc. Soc. Exp. Biol. Med. 87:295-297).

(10) Final BERA report for the Elizabeth Copper Mine Superfund Site, VT (Schlicker and Cox, 1968. Maternal dietary zinc and development, and zinc, iron, and copper content of the rat fetus. J. Nutr. 95:289-294).

### d. Ecological Risk Characterization

## Introduction

Hazard Quotients (HQs) were used to determine risk at OU1 in (a) aquatic receptors from direct exposure to surface water, pore water, sediment, and soil, and (b) wildlife receptors from exposure to soil and terrestrial food items. An HQ shows how much a COPEC exceeds its benchmark or Toxicity Reference Value (TRV). Risk is possible if an HQ is above 1.0. HQs were calculated as follows:

HQ = estimated exposure level /benchmark or TRV

The BERA also distinguished between risks from Site-related versus background-related COPEC levels. Incremental Risk (IR) was calculated for each EU, receptor group, and COPEC by subtracting the background HQs from the Site HQs, as follows:

IR = site HQ - background HQ

The risk tables present the IRs next to the HQs. An IR above 1.0 quantifies the extent to which a background-adjusted site exposure to a COPEC exceeds that COPEC's benchmark.

The aquatic toxicity tests did not lend themselves to an HQ analysis. Instead, the responses were compared statistically to their reference samples to determine significance.

A weight-of-evidence analysis was used to evaluate how well the measurement endpoints represented their assessment endpoints. This analysis integrated all the BERA findings to help determine the potential for risk by: 1) assigning a weight (between "low" and "high") to all measurement endpoints; 2) evaluating the magnitude of risk with respect to each measurement endpoint; and 3) determining the concurrence among the measurement endpoints used to answer the questions posed by the assessment endpoint.

## Aquatic habitats

## Benthic invertebrate community

Risk to the benthic community was assessed using up to six measurement endpoints, depending on the target habitat (see **Table 25**).

- ***The ponds on the east branch of Ely Brook***

Bulk sediment chemistry was the only LOE available to assess risk to benthic invertebrates in the ponds. **Table 38** summarizes the HQs and IRs for the key sediment COPECs in each pond. Severe risk to the benthic community was expected in Pond 5, based on high Cu levels. Ponds 3 and 4 could experience minor risk from small exceedances of Mn (Pond 3) and Cu (Pond 4). No risk was expected in Pond 2. The reliability of these findings was low because

it was based on only one semi-quantitative endpoint. Tables 7.1 to 7.9 in the 2010 aquatic BERA report summarized the risk for all the sediment COPECs in the ponds.

**Table 38**

| Table G.15: Incremental Risk for the key COPECs in the ponds | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SEDIMENT | | | | | | | | | | | | |
| | No Effect Scenario | | | | | | Effect Scenario | | | | | |
| | Hazard Quotient | | | | Incremental Risk* | | Hazard Quotient | | | | Incremental Risk* | |
| COPEC | Site-RME | Site-CTE | REF-RME | REF-CTE | RME | CTE | Site-RME | Site-CTE | REF-RME | REF-CTE | RME | CTE |
| **Pond 2 sediment** | | | | | | | | | | | | |
| Copper | 2.8 | 2.8 | 2.7 | 2.1 | <1 | <1 | all HQs < 1 | | | | <1 | <1 |
| Manganese | 1.2 | 1.2 | 0.8 | 0.5 | <1 | <1 | all HQs < 1 | | | | <1 | <1 |
| Zinc | 1.1 | 1.1 | 1.0 | 0.7 | <1 | <1 | all HQs < 1 | | | | <1 | <1 |
| **Pond 3 sediment** | | | | | | | | | | | | |
| Copper | 2.6 | 2.6 | 2.7 | 2.1 | <1 | <1 | all HQs < 1 | | | | <1 | <1 |
| Manganese | 5.0 | 5.0 | 0.8 | 0.5 | 4.1 | 4.4 | 2.8 | 2.8 | 0.5 | 0.3 | 2.4 | 2.5 |
| Zinc | 1.0 | 1.0 | 1.0 | 0.7 | <1 | <1 | all HQs < 1 | | | | <1 | <1 |
| **Pond 4 sediment** | | | | | | | | | | | | |
| Copper | 13 | 12 | 2.7 | 2.1 | 9.9 | 10 | 2.7 | 2.6 | 0.6 | 0.4 | 2.1 | 2.2 |
| Manganese | 3.8 | 2.6 | 0.8 | 0.5 | 3.0 | 2.1 | 2.2 | 1.5 | 0.5 | 0.3 | 1.7 | 1.2 |
| Zinc | 2.6 | 2.6 | 1.0 | 0.7 | 1.6 | 1.9 | all HQs < 1 | | | | <1 | <1 |
| **Pond 5 sediment** | | | | | | | | | | | | |
| Copper | 112 | 112 | 2.7 | 2.1 | 109 | 110 | 24 | 24 | 0.6 | 0.4 | 23 | 23 |
| Manganese | 2.3 | 2.3 | 0.8 | 0.5 | 1.4 | 1.7 | 1.3 | 1.3 | 0.5 | 0.3 | <1 | <1 |
| Zinc | 4.2 | 4.2 | 1.0 | 0.7 | 3.1 | 3.5 | 1.1 | 1.1 | 0.3 | 0.2 | <1 | <1 |
| SURFACE WATER | | | | | | | | | | | | |
| | Acute Scenario | | | | | | Chronic Scenario | | | | | |
| | Hazard Quotient | | | | Incremental Risk* | | Hazard Quotient | | | | Incremental Risk* | |
| COPEC | Site-RME | Site-CTE | REF-RME | REF-CTE | RME | CTE | Site-RME | Site-CTE | REF-RME | REF-CTE | RME | CTE |
| **Pond 2 surface water** | | | | | | | | | | | | |
| Copper | 3.2 | 0.8 | 0.4 | 3.0 | 2.9 | <1 | 4.6 | 1.2 | 0.5 | 4.4 | 4.1 | <1 |
| Manganese | all HQs < 1 | | | | <1 | <1 | 11.7 | 4.4 | 0.08 | 0.08 | 12 | 4.4 |
| Zinc | 1.4 | 0.6 | 1.7 | 0.8 | <1 | <1 | 1.4 | 0.6 | 1.7 | 0.8 | <1 | <1 |
| **Pond 3 surface water** | | | | | | | | | | | | |
| Copper | not a COPEC | | | | | | not a COPEC | | | | | |
| Manganese | all HQs < 1 | | | | <1 | <1 | 3.7 | 3.7 | 0.08 | 0.08 | 3.6 | 3.6 |
| Zinc | not a COPEC | | | | | | not a COPEC | | | | | |
| **Pond 4 surface water** | | | | | | | | | | | | |
| Copper | 4.9 | 2.3 | 0.4 | 3.0 | 4.6 | <1 | 7.1 | 3.3 | 0.5 | 4.4 | 6.6 | <1 |
| Manganese | all HQs < 1 | | | | <1 | <1 | 1.8 | 0.82 | 0.08 | 0.08 | 1.7 | <1 |
| Zinc | 1.5 | 0.7 | 1.7 | 0.8 | <1 | <1 | 1.5 | 0.7 | 1.7 | 0.8 | <1 | <1 |
| **Pond 5 surface water** | | | | | | | | | | | | |
| Copper | 52 | 34 | 0.4 | 3.0 | 51 | 31 | 74 | 50 | 0.5 | 4.4 | 74 | 45 |
| Manganese | all HQs < 1 | | | | <1 | <1 | 3.5 | 1.6 | 0.08 | 0.08 | 3.5 | 1.5 |
| Zinc | 3.1 | 2.6 | 1.7 | 0.8 | 1.5 | 1.9 | 3.1 | 2.6 | 1.7 | 0.8 | 1.5 | 1.9 |

* - The incremental risk is the Site HQ minus the reference HQ.

- ***The main stem of Ely Brook***

All six measurement endpoints showed risk to benthic invertebrates in the main stem of Ely Brook. The reliability of the risk conclusion was high because it was based on multiple LOEs, including toxicity testing and community surveys. **Table 39** summarizes the HQs and IRs for the key sediment and pore water COPECs in Ely Brook. Tables 7.10 to 7.12, and Tables 7.19 to 7.21, in the 2010 aquatic BERA report summarized the risk for all the sediment and pore water COPECs, respectively, in Ely Brook.

## Table 39

| Table G.16: Incremental Risk for the key COPECS in Ely Brook | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SEDIMENT | | | | | | | | | | | | |
| | No Effect | | | | | | Effect | | | | | |
| | Hazard Quotient | | | | Incremental Risk* | | Hazard Quotient | | | | Incremental Risk* | |
| COPEC | RME | CTE | REF-RME | REF-CTE | RME | CTE | RME | CTE | REF-RME | REF-CTE | RME | CTE |
| Cobalt | both site HQs < 1 | | | | <1 | <1 | -- | -- | -- | -- | -- | -- |
| Copper | 123 | 98 | 22 | 11 | 101 | 87 | 26 | 21 | 4.6 | 2.3 | 21 | 19 |
| Iron | both site HQs < 1 | | | | <1 | <1 | 3.5 | 3.1 | 0.5 | 0.4 | 3.0 | 2.7 |
| Manganese | 2.0 | 0.5 | 2.6 | 1.3 | <1 | <1 | 1.1 | 0.3 | 1.5 | 0.7 | <1 | <1 |
| Zinc | 1.1 | 0.9 | 0.7 | 0.6 | <1 | <1 | both site HQs < 1 | | | | <1 | <1 |
| PORE WATER | | | | | | | | | | | | |
| | Acute Scenario | | | | | | Chronic Scenario | | | | | |
| | Hazard Quotient | | | | Incremental Risk* | | Hazard Quotient | | | | Incremental Risk* | |
| COPECs | Site-RME | Site-CTE | REF-RME | REF-CTE | RME | CTE | Site-RME | Site-CTE | REF-RME | REF-CTE | RME | CTE |
| Cobalt | both site HQs < 1 | | | | <1 | <1 | 4.0 | 1.4 | 0.02 | 0.1 | 3.9 | 1.3 |
| Copper | 10 | 3.5 | 0.5 | 0.3 | 9.6 | 3.2 | 15 | 5.1 | 0.7 | 0.4 | 14 | 4.7 |
| Iron | both site HQs < 1 | | | | <1 | <1 | both site HQs < 1 | | | | <1 | <1 |
| Manganese | 2.9 | 0.8 | 1.3 | 0.4 | 1.6 | <1 | 55 | 15 | 25 | 8.5 | 30 | 6.4 |
| Zinc | 1.1 | 0.3 | 0.1 | 0.05 | <1 | <1 | 1.1 | 0.3 | 0.1 | 0.05 | <1 | <1 |
| SURFACE WATER | | | | | | | | | | | | |
| Cobalt | both site HQs < 1 | | | | <1 | <1 | 14 | 4.1 | 0.01 | 0.09 | 14 | 4.0 |
| Copper | 425 | 195 | 2.3 | 0.6 | 423 | 194 | 614 | 281 | 3.3 | 0.9 | 611 | 281 |
| Iron | -- | -- | -- | -- | -- | -- | 40.0 | 9.8 | 0.03 | 0.02 | 40 | 9.7 |
| Manganese | both siteHQs < 1 | | | | <1 | <1 | 8.6 | 4.7 | 1.1 | 0.20 | 7.5 | 4.5 |
| Zinc | 4.9 | 4.1 | 0.6 | 0.4 | 4.3 | 3.7 | 4.9 | 4.1 | 0.6 | 0.4 | 4.3 | 3.7 |

* - The incremental risk is the Site HQ minus the reference HQ.

## Water column invertebrate community

Risk to water column invertebrates was assessed by comparing dissolved COPECs in surface water to benchmarks, but only in the ponds (see **Table 25**) because they represented the only lentic habitat at the Site.

**Table 38** summarizes the HQs and IRs for the key surface water COPECs in the four ponds. This LOE showed some risk in Ponds 2 and 3 due to Mn, but high risk in Pond 5 due mainly to Cu. Some risk was also found in Pond 4 due to Cu. The reliability of this conclusion was low because it was based on only one semi-quantitative endpoint. Tables 7.30 to 7.38 in the 2010 aquatic BERA report summarized the risk for all the surface water COPECs in the ponds.

### Fish

Both measurement endpoints identified risk to fish in the main stem of Ely Brook. **Table 39** summarizes the HQs and IRs for the key surface water COPECs in Ely Brook. The reliability of the risk conclusion was high because it included a subchronic laboratory toxicity test using sensitive fathead minnow larvae. Tables 7.40 to 7.42 in the 2010 aquatic BERA report summarized the risk for all the surface water COPECs in the ponds.

### Amphibians

Risk to amphibians was assessed only in the four ponds using up to three measurement endpoints (depending on the pond) (see **Table 25**), as follows:

- Compare dissolved COPECs in surface water to benchmarks (Ponds 2 to 5).

- Measure toxicity in fathead minnows exposed seven days to surface water (Ponds 4 and 5 only).
- Evaluate hatching and survival of wood frog eggs and tadpoles (Ponds 4 and 5, only).

Only the first measurement endpoint was assessed in all four ponds. The HQs and IRs for the key surface water COPECs in the ponds were presented previously in **Table 38** (see also Tables 7.30 to 7.38 in the 2010 aquatic BERA report). The tables showed some potential risk in Ponds 2 and 3 due to manganese concentration above screening criteria, but high risk in Pond 5 (due mainly to Cu). The HQs in Pond 4 were lower than Pond 5 but were above 1 and suggest a significant potential for risk.

The two remaining measurement endpoints used in Ponds 4 and 5 identified high risk to tadpoles. The surface water was toxic to fathead minnow larvae and to wood frog tadpoles (but not wood frog eggs) in both Ponds 4 and 5. The tadpole study was compromised due to persistent mortality at the reference locations. The reliability of the risk conclusion was medium, even though it was based on multiple lines of evidence, including laboratory and field toxicity tests. The reason was that the tadpole study gave only partial results.

## Terrestrial habitats

### Terrestrial Plant Community

Risk to the terrestrial plant community was assessed using one measurement endpoint, i.e., comparing soil chemistry to soil screening benchmarks for plants (see **Table 26**).

**Table 40** summarizes the HQs and IRs for the terrestrial plants in the transition zone. High risk from the key COPECs was identified for terrestrial plants due to (in decreasing order of importance) Cr, Se, and Cu. The reliability of this conclusion was low because it was based on only one, semi-quantitative endpoint

**Table 40**

| Table G.17: Plant and soil invertebrate incremental risk for the key COPECs in the transition zone | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No Effect | | | | | | Effect[a] | | | | | |
| | Hazard Quotient | | | | Incremental Risk* | | Hazard Quotient | | | | Incremental Risk* | |
| COPEC | RME | CTE | REF-RME | REF-CTE | RME | CTE | RME | CTE | REF-RME | REF-CTE | RME | CTE |
| TERRESTRIAL PLANTS | | | | | | | | | | | | |
| Chromium | 2822 | 2114 | 1778 | 1134 | 1044 | 980 | | | | | | |
| Copper | 11 | 9.5 | 0.3 | 0.2 | 11 | 9.3 | | | | | | |
| Selenium | 31 | 21 | 3.9 | 3.4 | 27 | 17 | | | | | | |
| Zinc | 1.0 | 0.7 | 0.3 | 0.3 | <1 | <1 | | | | | | |
| SOIL INVERTEBRATES | | | | | | | | | | | | |
| Chromium | 254 | 190 | 160 | 102 | 94 | 88 | | | | | | |
| Copper | 9.6 | 8.3 | 0.3 | 0.2 | 9.4 | 8.1 | | | | | | |
| Selenium | 3.9 | 2.6 | 0.5 | 0.4 | 3.4 | 2.2 | | | | | | |
| Zinc | 1.4 | 1.0 | 0.4 | 0.4 | <1 | <1 | | | | | | |

* The incremental risk is the site HQ minus the reference HQ

[a] Effect HQs and IRs could not be calculated because "effect-based" benchmarks for plants and soil invertebrates were not available

**Soil Invertebrate Community**

Risk to the soil invertebrate community was assessed using one measurement endpoint, i.e., comparing soil chemistry to screening benchmarks for soil invertebrates (see **Table 26**).

**Table 40** summarizes the HQs and IRs for the soil invertebrates in the transition zone. High risk from the key COPECs was identified for soil invertebrates due mainly to (in decreasing order of hazard quotients) Cr, Cu, and Se. The reliability of this conclusion was low because it was based on one, semi-quantitative endpoint.

**Wildlife receptors**

**Table 41** summarizes the HQs and IRs for the key food chain modeling COPECs in the six wildlife species. Tables 4.5 to 4.8 in the 2011 terrestrial BERA report summarized the risk for all the soil COPECs evaluated in the wildlife food chain models.

**Table 41**

| Table G.18: Terrestrial wildlife incremental risk for the key COPECs in the transition zone | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No Effect | | | | | | Effect | | | | | |
| | Hazard Quotient | | | | Incremental Risk* | | Hazard Quotient | | | | Incremental Risk* | |
| COPECs | Site-RME | Site-CTE | Ref-RME | Ref-CTE | RME | CTE | Site-RME | Site-CTE | Ref-RME | Ref-CTE | RME | CTE |
| HERBIVOROUS BIRDS (SONG SPARROW) | | | | | | | | | | | | |
| Chromium | both site HQs < 1 | | | | <1 | <1 | both site HQs < 1 | | | | <1 | <1 |
| Copper | both site HQs < 1 | | | | <1 | <1 | both site HQs < 1 | | | | | |
| Selenium | **5.2** | **3.5** | 0.7 | 0.6 | **4.6** | **2.9** | **2.6** | **1.8** | 0.3 | 0.3 | **2.3** | **1.5** |
| Zinc | both site HQs < 1 | | | | <1 | <1 | both site HQs < 1 | | | | | |
| INVERTIVOROUS BIRDS (AMERICAN ROBIN) | | | | | | | | | | | | |
| Chromium | both site HQs < 1 | | | | <1 | <1 | both site HQs < 1 | | | | <1 | <1 |
| Copper | both site HQs < 1 | | | | <1 | <1 | both site HQs < 1 | | | | <1 | <1 |
| Selenium | both site HQs < 1 | | | | <1 | <1 | both site HQs < 1 | | | | <1 | <1 |
| Zinc | **1.2** | 0.8 | 0.6 | 0.6 | <1 | <1 | both site HQs < 1 | | | | <1 | <1 |
| CARNIVOROUS BIRDS (AMERICAN KESTREL) | | | | | | | | | | | | |
| Chromium | both site HQs < 1 | | | | <1 | <1 | both site HQs < 1 | | | | <1 | <1 |
| Copper | both site HQs < 1 | | | | <1 | <1 | both site HQs < 1 | | | | <1 | <1 |
| Selenium | both site HQs < 1 | | | | <1 | <1 | both site HQs < 1 | | | | <1 | <1 |
| Zinc | both site HQs < 1 | | | | <1 | <1 | both site HQs < 1 | | | | <1 | <1 |
| HERBIVOROUS MAMMALS (DEER MOUSE) | | | | | | | | | | | | |
| Chromium | both site HQs < 1 | | | | <1 | <1 | both site HQs < 1 | | | | <1 | <1 |
| Copper | **1.6** | **1.5** | 0.3 | 0.3 | **1.3** | **1.2** | **1.2** | **1.1** | 0.2 | 0.2 | <1 | <1 |
| Selenium | **1.4** | 0.96 | 0.2 | 0.2 | **1.2** | <1 | both site HQs < 1 | | | | <1 | <1 |
| Zinc | both site HQs < 1 | | | | <1 | <1 | both site HQs < 1 | | | | <1 | <1 |
| INVERTIVOROUS MAMMALS (SHORT-TAILED SHREW) | | | | | | | | | | | | |
| Chromium | both site HQs < 1 | | | | <1 | <1 | both site HQs < 1 | | | | <1 | <1 |
| Copper | **2.1** | **1.4** | 0.7 | 0.7 | **1.4** | <1 | **1.6** | **1.1** | 0.5 | 0.5 | **1.1** | <1 |
| Selenium | both site HQs < 1 | | | | <1 | <1 | both site HQs < 1 | | | | <1 | <1 |
| Zinc | both site HQs < 1 | | | | <1 | <1 | both site HQs < 1 | | | | <1 | <1 |
| CARNIVOROUS MAMMALS (MINK) | | | | | | | | | | | | |
| Chromium | both site HQs < 1 | | | | <1 | <1 | both site HQs < 1 | | | | <1 | <1 |
| Copper | both site HQs < 1 | | | | <1 | <1 | both site HQs < 1 | | | | <1 | <1 |
| Selenium | both site HQs < 1 | | | | <1 | <1 | both site HQs < 1 | | | | <1 | <1 |
| Zinc | both site HQs < 1 | | | | <1 | <1 | both site HQs < 1 | | | | <1 | <1 |

* - The incremental risk is the Site HQ minus the reference HQ.

Some risk was identified in herbivorous birds (represented by the song sparrow) from Se under both the no effect and effect scenarios. The exceedances, however, were relatively small

and unlikely to cause long-term impairment. The remaining key COPECs did not result in risk to this receptor group. The reliability of this conclusion was low-medium because it was based on unmeasured plant residues which were estimated using generic PSAFs (plant soil accumulation factor) and simplistic food chain modeling assumptions.

No risk from the key COPECs was identified for invertivorous birds (represented by the American robin) feeding in the transition zone. The reliability of this conclusion was medium because it was based on measured soil invertebrate residues but used simplistic food chain modeling assumptions.

No risk from the key COPECs was identified for carnivorous birds (represented by the American kestrel) feeding in the transition zone. The reliability of this conclusion was medium because it was based on measured soil invertebrate and small mammal residues but used simplistic food chain modeling assumptions.

Minor risk was identified for herbivorous mammals (represented by the deer mouse) from Cu and Se under the no effect scenario (i.e. based on NOEC TRVs), but with no risk remaining for any of the key COPECs in the effect scenario (i.e. based on LOEC TRVs). The reliability of this conclusion was low-medium because it was based on unmeasured plant residues which were estimated using generic PSAFs and simplistic food chain modeling.

Minor risk was identified for invertivorous mammals (represented by the short-tailed shrew) from Cu in the no effect and effect scenarios. The risk from Cu in both scenarios was small and unlikely to cause long-term impairment. The remaining key COPECs did not result in risk to this receptor group. The reliability of this conclusion was medium because it was based on measured soil invertebrate residues but used simplistic food chain modeling assumptions.

No risk from the key COPECs was identified for carnivorous mammals (represented by the mink) feeding in the transition zone. The reliability of this conclusion was medium because it was based on measured soil invertebrate and small mammal residues but used simplistic food chain modeling assumptions.

**Vernal pool organisms**

**Table 42** summarizes the HQs and IRs for aquatic life and larval amphibians in the four VPs. VPs 2-4 are part of OU1. VP1 is within the OU2 area of the Site. Cu was the major risk driver in VP1, resulting in unacceptable conditions for both receptor groups. The lack of surface water data from a reference VP made it difficult to determine if the low risk associated with Ba and Zn in the other three VPs was site-related. Regardless, the risk levels for these other COPECs were relatively small and unlikely to result in significant long-term effects. The reliability of this conclusion was low because it was based on comparing surface water concentrations from single samples to generic benchmarks.

## Table 42

| Table G.19: Incremental risk for aquatic receptors in the four vernal pools | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hazard Quotient | | | | | | | | | Incremental Risk* | | | | | | | |
| | VP1 | | VP2 | | VP3 | | VP4 | | | VP1 | | VP2 | | VP3 | | VP4 | |
| COPEOs | Acute | Chronic | Acute | Chronic | Acute | Chronic | Acute | Chronic | Reference | Acute | Chronic | Acute | Chronic | Acute | Chronic | Acute | Chronic |
| AQUATIC LIFE | | | | | | | | | | | | | | | | | |
| Barium | <1 | 6.1 | <1 | 3.2 | <1 | 3.5 | <1 | 4.0 | NA | <1 | 6.1 | <1 | 3.2 | <1 | 3.5 | <1 | 4.0 |
| Copper | 27 | 37 | <1 | 1.3 | <1 | <1 | <1 | <1 | NA | 27 | 37 | <1 | 1.3 | <1 | <1 | <1 | <1 |
| Zinc | 1.5 | 1.5 | <1 | <1 | 1.6 | 1.6 | <1 | <1 | NA | 1.5 | 1.5 | <1 | <1 | 1.6 | 1.6 | <1 | <1 |
| LARVAL AMPHIBIANS | | | | | | | | | | | | | | | | | |
| | "No Effect" | | "No Effect" | | "No Effect" | | "No Effect" | | Reference | "No Effect" | | "No Effect" | | "No Effect" | | "No Effect" | |
| Barium | no benchmark | | | | | | | | NA | no benchmark | | | | | | | |
| Copper | 7.3 | | <1 | | <1 | | <1 | | NA | 7.3 | | <1 | | <1 | | <1 | |
| Zinc | <1 | | <1 | | <1 | | <1 | | NA | 0.8 | | <1 | | <1 | | <1 | |

note 1: CTEs and RMEs could not be calculated because only one sample was collected from each VP

note 2: acute and chronic presents HQs calculated by dividing the surface water concentration by the acute or chronic benchmarks for aquatic life

note 3: "no effect" presents HQs calculated by dividing the surface water concentration by the no effect benchmark derived for larval amphibians

* incremental risk = site HQ - reference HQ; incremental risk equals site risk because no samples were collected from a reference VP

### e. Summary of Aquatic and Terrestrial BERAs for OU1

- The Aquatic BERA documented that severe ecological impacts have occurred as a result of the release of ARD with toxic levels of metals from the Site waste areas into the surface water and sediment within the OU1 area including: Ely Brook, the tributaries of Ely Brook, and Pond 4 and Pond 5. The upstream (reference) areas of the Ely Brook headwaters and Pond 1 supported healthy populations of benthic invertebrates, further documenting that the Site is a significant source of ecological impairment. The measurement endpoint risk characterization is summarized in Tables 1-5 through 1-11 of the FS.
- The only significant terrestrial ecological threat in the OU1 area is the impairment of the plant and soil invertebrate communities in the barren areas of the Site. Although concentrations of metals detected in the vegetated (non-barren) areas at the Site were higher than plant and soil invertebrate benchmarks, field observations suggest that the toxicity of the Site material is substantially reduced when the waste is incorporated into a natural soil. Areas along the fringe of the barren waste areas have concentrations of metals comparable to the barren waste areas yet these areas support a plant community and soil invertebrates. Other factors, such as the highly acidic porewater and acid salts within the waste which could make the contaminants of concern more geochemically available to the Site biota along with the absence of any organic matter to support vegetation are likely to be more significant factors in the absence of a plant community on the barren areas. When a soil horizon forms and provides organic matter, the plant community appears to be able to exist. As a result, a clear chemical-specific threat to the plant or soil invertebrate community is not identified for OU1 of the Site. The general Terrestrial BERA conclusion for OU1 is that the Site conditions, primarily the acidic waste material and associated acid salts and pore water have created barren areas which represent a local, yet significant, ecological harm to the plant and soil invertebrate

community resulting in a loss of the critical ecological support functions including nutrient cycling, habitat, food, and soil stabilization to limit erosion.

- No significant ecological risk was identified for the other terrestrial receptors within the OU1 area. The hazard quotients were generally low for the mammal and bird receptors. In addition, the biota sampling suggested that most metals (particularly selenium and zinc) were not accumulating in tissue. Only copper was detected at concentrations that were statistically different from reference biota tissue samples, although individual samples suggested that some accumulation of aluminum and iron may occur.
- No significant ecological threat was identified for the ecological receptors in VP2, VP3, or VP4.

OU2 will address the ecological risk associated with SHB, EBOR, VP1 and the Smelter/Slag area as well as any ecological risk associated with the underground mining workings. In particular, OU2 will assess the potential threat to insectivorous birds and mammals, particularly bats.

The extent of the OU1 area where aquatic and terrestrial ecological threats, including the barren areas, were identified is shown in Figure 15.

### 3. Overall Risk Assessment Conclusion—Basis for Response Action

The baseline HHRA for OU1 documented that an unacceptable human health risk would exist for children residing on or adjacent to the Site as a result of ingestion and direct contact with cobalt, copper, and iron contaminated soil in the OU1 area of the Site.

The aquatic BERA documented that an unacceptable ecological risk to aquatic receptors (invertebrates, fish, amphibians) in Ely Brook, its tributaries, Pond 4 and Pond 5 as a result of the release of contamination from the OU1 source areas.

The terrestrial BERA documented that an unacceptable risk to terrestrial receptors (plant and soil invertebrate community) as a result of the elevated metals and acidic conditions within the barren OU1 waste areas.

As such, actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

## H. REMEDIATION OBJECTIVES

Based on preliminary information relating to the types of contaminants, environmental media of concern and potential exposure pathways, response action objectives (RAOs) were developed to aid in the development and screening of alternatives. These RAOs were developed to mitigate, restore and/or prevent existing and future potential threats to human health and the environment.

EPA develops Remedial Action Objectives (RAOs) for each cleanup action. The RAOs developed for this ROD are summarized below:

- Control the release of ARD and AMD from the waste rock and tailings source areas (UWA, LWA, TA, and ORB) to allow Ely Brook to achieve the numerical and biological criteria for a Class B surface water in Vermont and to achieve Class B numerical criteria in Ponds 4 and 5. The numerical remedial goals for surface water are listed in Table 47.
- Protect Human Health by preventing direct contact with or incidental ingestion of soil within the OU1 source areas containing levels of cobalt, copper, or iron above the remediation goals specified in Table 45.
- Restore the sediment quality of Ely Brook and its tributaries and Ponds 4 and 5 to concentrations below the sediment remediation goal for copper specified in Table 46 and achieve biological integrity for these surface water bodies as demonstrated through compliance with Vermont Water Quality Criteria (VTWQC), National Recommended Water Quality Criteria (NRWQC), and biological measures of recovery. Recovery will be measured by benthic and fish metrics achieving populations comparable with upstream and/or reference values and a finding of the sediment being non-toxic to aquatic organisms in toxicity tests.
- Restore the surface water quality of Ely Brook and its tributaries, and Ponds 4 and 5 to achieve biological integrity for these surface water bodies as demonstrated through compliance with VTWQC, NRWQC, and biological measures of recovery. Recovery will be measured by benthic and fish metrics achieving populations comparable with upstream and/or reference values and a finding of the surface water being non-toxic to aquatic organisms in toxicity tests. The numerical remedial goals for surface water are listed in Table 47.
- Restore the acid-impacted barren areas containing mine waste to create a functional ecological habitat with respect to the plant and soil invertebrate communities.
- Restore wetland and aquatic habitats altered as a result of the implementation of the cleanup action, as required.
- Minimize any impact from the cleanup action on threatened or endangered bat populations.

## I. DEVELOPMENT AND SCREENING OF ALTERNATIVES

### 1. Statutory Requirements/Response Objectives

Under its legal authorities, EPA's primary responsibility at Superfund sites is to undertake remedial actions that are protective of human health and the environment. In addition, Section 121 of CERCLA establishes several other statutory requirements and preferences, including: a requirement that EPA's remedial action, when complete, must comply with all Federal environmental and more stringent State environmental and facility siting standards, requirements, criteria or limitations, unless a waiver is invoked; a requirement that EPA select a remedial action that is cost-effective and that utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and a preference for remedies in which treatment which permanently and significantly reduces the

volume, toxicity or mobility of the hazardous substances is a principal element over remedies not involving such treatment. Response alternatives were developed to be consistent with these statutory mandates.

### 2. Technology and Alternative Development and Screening

CERCLA and the NCP set forth the process by which remedial actions are evaluated and selected. In accordance with these requirements, a range of alternatives were developed for the Site. The OU1 RI/FS developed a limited number of remedial alternatives that attain Site cleanup levels within different time frames using different technologies, as well as a no-action alternative.

As discussed in Section 2 of the OU1 Feasibility Study Report, technology options were identified, assessed and screened based on implementability, effectiveness and cost. The sediment screening process identified only one sediment technology as appropriate for sediment remediation. Section 3 of the OU1 Feasibility Study Report presented the remedial alternatives, developed by combining the technologies identified in the previous screening process, that fit the alternative categories identified in Section 300.430(e)(3) of the NCP. The purpose of the initial screening was to narrow the number of potential remedial actions for further detailed analysis while preserving a range of options. Each alternative was then evaluated in detail in Section 4 of the OU1 Feasibility Study Report.

## J. DESCRIPTION OF ALTERNATIVES

EPA considers a full range of alternatives to clean up a Superfund site before selecting a remedy. Many options are screened out early in the process because site-specific conditions render them ineffective and/or technically or administratively infeasible. Others are eliminated because they are cost-prohibitive to implement. Under CERCLA and the NCP, EPA must consider a no action alternative to compare with alternatives where remedial action will be taken, even though a no action alternative does not meet the screening criteria. The cleanup alternatives that survived the initial screening were subject to a detailed evaluation and comparative analysis in the OU1 FS.

This Section provides a brief, narrative summary of each alternative that was evaluated for OU1 at the Site. A more complete, detailed presentation of each alternative can be found in Sections 3 and 4 of the OU1 Feasibility Study Report.

The source control alternatives analyzed for OU1 of the Site include:

- Alternative SC1 – No Action Alternative
- Alternative SC2 – Waste containment in the LWA Cell and in the Ore Roast Bed
- Alternative SC3 – Waste containment in the West Cell and in the Ore Roast Bed
- Alternative SC4 – Off-site disposal and waste containment in the Ore Roast Bed

These cleanup alternatives are summarized below. The costs for each alternative include the estimated capital costs, the estimated annual operation and maintenance (O & M) cost, and the present value of the combined capital and maintenance costs based on a 30-year time period and 7% discount rate.

**Alternative SC1 – No Action**

Alternative SC1, the No Action alternative, does not include RA components to reduce, control, or eliminate potential risks from exposure to contaminants in source-area soil/waste. No action will be taken to reduce ARD generation or the migration of ARD-impacted groundwater or seeps to Ely Brook or its tributaries and Ponds 4 and 5 where it may contribute to surface water exceedances of NRWQC and State water quality standards and exceedances of sediment RGs. Alternative SC1 would not implement an environmental monitoring program to assess long-term changes in contaminant concentrations in soil in order to protect human health and the environment. Alternative SC1 would include statutorily-required five-year reviews. Since CERCLA and the NCP requires that the No Action alternative be evaluated to establish a baseline for comparison to other remedial alternatives, Alternative SC1 was not evaluated according to screening criteria and passed through screening to be evaluated during the detailed analysis in the FS.

**Alternative SC2 – Waste Containment in the LWA Cell and in the Ore Roast Bed**

Alternative SC2 would involve the excavation of the UWA and LWA, Ely Brook and its tributaries, and Ponds 4 and 5 and consolidation of the material in a containment cell located in the area of the LWA (LWA Cell), constructing surface water diversions to redirect the surface water around the LWA cell, installation of a low permeability cover system to contain and isolate the waste rock, installation of a continuous full-bottom containment liner below the waste and installation of a horizontal underdrain system to maintain the groundwater elevation to a level below the waste and liner.

Several tributaries to Ely Brook are located within the UWA and LWA; these tributaries will be excavated as a source of surface water contamination and consolidated with the waste rock in the containment cell. The sediments located in Ponds 4 and 5, Middle Ely Brook and Lower Ely Brook exceeding the sediment RG will be excavated and disposed in the LWA Cell. The sediments in Upper Ely Brook will be removed by either flushing the sediments into the lower reaches prior to the removal of sediment from these areas or via vacuum extraction. Monitoring of Upper Ely Brook will be performed to assess whether all contaminated sediment was successfully removed and whether the sediment RG is met. Temporary diversions or damming of Ely Brook and Ponds 4 and 5 would be used to enable dry working conditions. Some dewatering of sediments may be required and, if so, dewatered liquid would be treated if necessary to meet discharge standards into Ely Brook. After excavation/dredging, restoration would be performed for Ely Brook. Middle Ely Brook would be restored as a rip-rap armored channel to prevent erosion in this steep graded section of stream; Lower Ely Brook would be restored as a natural channel; and Ponds 4 and 5 as either a rip-rap armored channel from Pond 3 downstream to Ely Brook near the confluence with EBT2 or restored to native aquatic habitat as part of wetland mitigation.

Alternative SC2 also includes excavation of the TA and creation of the ORB Cell by layering of the tailings on the ORB, construction of a low-permeability cover system over the material, and construction of surface water diversions to redirect the surface water from the areas upgradient of the ORB around the cover system. If required, a leachate collection and treatment system will also be installed to address any short-term release of leachate from the ORB Cell.

Restoration of the excavated areas will consist of grading the slopes to allow for adequate surface water drainage, minimize soil erosion, and establish native vegetation. An approximately 15 acre borrow site will be developed in the NW corner of the Site, outside of the OU1 remediation area, that will supply native material for covering the cells and restoring the Site. Once it is no longer needed, the borrow site will also be restored. Additional components include institutional controls, environmental monitoring, and five-year reviews.

This alternative would consist of the following key components:

- Pre-design investigations and studies;
- If on-site material is used for the containment cell, timber clearing and grading of an approximate 15-acre area west of Ely Brook to obtain borrow material for the containment cells, stream stabilization, and restoring barren areas;
- Excavation of the material and restoration of the associated disturbed areas;
- Excavation and consolidation of acid generating waste rock and soil exceeding soil RGs from the UWA and LWA within a containment cell in a subarea of the LWA;
- Construct a temporary staging area with a liner and leachate collection system for LWA waste rock that needs to be stockpiled until the LWA Cell is constructed;
- Construction of a low permeability cover system for the LWA Cell with surface water diversion measures;
- Installation of a continuous full-bottom containment liner and horizontal underdrain beneath the containment cell in the LWA to maintain separation between the waste material and surface water/groundwater;
- Flushing of sediment from the Upper Ely Brook to remove contaminated sediment exceeding sediment RGs;
- Monitoring of the Upper Ely Brook to confirm that all sediment RG is achieved;
- Temporary dewatering of waterways and excavation of sediments exceeding the sediment RG from Middle and Lower Ely Brook, the EBTs within the UWA and LWA, and Ponds 4 and 5;
- Dewatering of the excavated sediment and treatment of the dewatering water, if required, with discharge to Ely Brook;
- Consolidation of the excavated and dewatered sediment in the LWA Cell;
- Excavation of the TA and placement of the tailings on the ORB;
- Construction of the ORB Cell with a low-permeability cover system over the ORB/tailings material with surface water diversion;
- Short-term operation of a leachate collection and treatment system, discharging to surface water, for the ORB and LWA cells;
- Installation of monitoring wells;

- Use of institutional controls to prevent exposure to contamination within the OU1 area, protect the response action and prevent exposure to contaminants contained in the ORB and LWA Cells;
- Long-term operation and maintenance;
- Environmental monitoring;
- Restoration of waterways, wetlands, and wildlife habitat, as required;
- At least yearly institutional control inspections; and
- Five-year reviews.

A map showing the major construction components of this alternative is included as Figure 21.

The containment of the waste rock, soil, and sediment exceeding the sediment RG in the LWA using a low permeability cover system and a horizontal underdrain system will minimize the potential for these acid generating materials to come in contact with surface water and/or groundwater, thereby minimizing the potential for ARD to occur. These activities will reduce human contact with metals above the soil RGs, attain surface water RGs, improve groundwater quality by reducing the sources of contamination, and comply with ARARs.

The capping of the tailings and ORB within the ORB Cell will reduce human contact with metals above the soil RGs. The tailings and ORB do not contribute a significant impact to the groundwater or surface water. The excavation of source material will, in addition to controlling direct exposure risks, reduce leaching and erosion that contribute to exceedances of surface water RGs within the OU1 waterways.

**Alternative SC3 – Waste Containment in the West Cell and in the Ore Roast Bed**

Alternative SC3 includes excavation of mine waste and soil exceeding RGs from the UWA and LWA and consolidation of the material into a containment cell located in an on-site area to the west of Ely Brook (West Cell); clearing and grading the work area for the West Cell (12 acres), removing sufficient borrow material for cover and restoration material, and creating a construction lay-down area (it is expected that sufficient borrow material can be obtained from the work area for the West Cell – so no, or minimal, additional clearing will be required); construction of surface water diversions to redirect the surface water from seeps/runoff around the cell; and installation of a low-permeability cover system to contain and isolate the waste rock. If required, a leachate collection and treatment system will be installed.

Several tributaries to Ely Brook are located within the UWA and LWA; these tributaries will be excavated as a source of surface water and sediment contamination and consolidated with the waste rock in the West Cell. The sediments located in Ponds 4 and 5, Middle Ely Brook and Lower Ely Brook exceeding the sediment RG will be excavated and disposed of in the West Cell. The sediments in Upper Ely Brook will be removed by either flushing the sediments into the lower reaches prior to the removal of sediment from these areas or via vacuum extraction. Monitoring of Upper Ely Brook will be performed to assess whether all contaminated sediment was successfully removed and whether the sediment RG is met. Temporary diversions or

damming of Ely Brook and Ponds 4 and 5 would be used to enable dry working conditions. Some dewatering of sediments may be required and, if so, dewatered liquid would be treated if necessary to meet discharge standards into Ely Brook. After excavation/dredging, restoration would be performed for Ely Brook. Middle Ely Brook would be restored as a rip-rap armored channel to prevent erosion in this steep graded section of stream; Lower Ely Brook would be restored as a natural channel; and Ponds 4 and 5 as either a rip-rap armored channel from Pond 3 downstream to Ely Brook near the confluence with EBT2 or restored to native aquatic habitat as part of wetland mitigation.

Alternative SC3 also includes excavation of the TA and creating of the ORB Cell by layering of the tailings on the ORB, construction of a low-permeability cover system over the material, and construction of surface water diversions to redirect the surface water areas upgradient of the ORB around the cover system. If required, a leachate collection and treatment system will also be installed to address any short-term release of leachate from the ORB Cell.

Restoration of the excavated areas will consist of grading the slopes to allow for adequate surface water drainage, minimize soil erosion, and establish native vegetation. Additional components include institutional controls, environmental monitoring, and five-year reviews.

This alternative would consist of the following key components:

- Pre-design investigations and studies;
- Clearing and grading of the work area and haul road, including an additional lay-down area for the temporary stockpiling of clean earthen materials removed to create the West Cell (approximately 12 acres), as well as the construction of the haul roads;
- Potential mining of an estimated undeveloped 7.5 acres to obtain the necessary on-site stone and borrow material needed for developing the containment cells, stream stabilization, and restoring barren areas;
- Restoration of the mined areas when the removal is completed (unless all of the required material can be obtained from the clearing and development of the West Cell area);
- Installation of surface water and shallow groundwater diversions as necessary to prevent the flow of surface water or groundwater into the West Cell or ORB cell;
- Installation of a bottom containment liner below the West Cell, if necessary, to ensure that groundwater and surface water are not adversely impacted by residual drainage from the waste material;
- Excavation of waste rock and soil exceeding soil RGs of the UWA and LWA and consolidation in the West Cell;
- Treatment of any water generated from the excavation activities, including the dewatering of sediments, saturated soil/waste, or residual drainage from the soil/waste using pH neutralization to create a neutral pH and filtration and or settling ponds/tanks to remove the metals – discharge of the treated water back to surface waters;
- Dewatering of Ponds 4 and 5 if necessary;
- Excavation of all contaminated sediment exceeding the sediment RG and any waste/soil that may be generating ARD from the Ponds 4 and 5 area and disposal of the sediment, with dewatering if required, into the West Cell;

- Restoration of Ponds 4 and 5 area as native wetland habitat;
- Construction of surface water drainage features to convey water from Ponds 4 and 5 and for the tributaries of Ely Brook that will be excavated;
- Use of minimally invasive extraction methods such as vacuum or hand removal sediments exceeding the sediment RG in Upper Ely Brook;
- Restoration of Upper Ely Brook;
- Monitoring of the Upper Ely Brook to confirm that the sediment RG is achieved;
- Construction of a temporary surface water diversion to allow excavation of sediments above the sediment RG in Middle and Lower Ely Brook;
- Excavation of the sediments above the sediment RG in Middle and Lower Ely Brook, including adjacent the riparian soils that exceed the sediment RG;
- Consolidation of excavated sediment, with dewatering and discharge to Ely Brook if required, with the waste rock and soil in the West Cell;
- Reconstruction of Middle Ely Brook, possibly as a rip-rap armored channel due to the expected slope of the channel;
- Restoration of Lower Ely Brook as a natural stream corridor;
- Installation of a low-permeability cover system on the West Cell that meets relevant and appropriate mine reclamation regulations and risk-based standards to contain and isolate the waste rock, soil, and sediment;
- Excavation of the TA and layering of tailings on the ORB to create the ORB Cell;
- Construction of the ORB Cell with a low permeability cover system and surface water diversions that meets applicable Vermont Solid Waste standards;
- Collection of leachate from the West Cell and ORB Cell, as necessary, and on-site treatment through treatment wetlands and/or settling basins and discharge to surface waters;
- Protection, to the extent practicable, of the historic retaining wall that is adjacent to the ORB, as well as other historic resources present within the Site;
- Restoration of the disturbed areas within the UWA, LWA, ORB, and TA;
- Endangered bat habitat mitigation measures, as required;
- Historic resource assessment and documentation via photographs, mapping, drawing, archaeological data recovery, construction monitoring/recordation, and/or other measures, as required;
- Additional investigation of potential prehistoric features within the Site, as required;
- Installation of monitoring wells to monitoring groundwater around the ORB Cell and West Cell;
- Long-term O&M;
- Use of institutional controls to prevent exposure to contamination within the OU1 area, protect the response action and prevent exposure to contaminants contained in the ORB Cell and West Cell;
- Environmental monitoring to evaluate the performance of the cleanup action and at least yearly compliance monitoring to ensure compliance with the institutional controls; and
- 5-year reviews

An alternative remedy map showing the major construction components of this alternative is included as Figure 22.

The containment of the waste rock, soil, and sediment exceeding soil and sediment RGs in the West Cell using a low permeability cover system will minimize the potential for the acid-generating material to come in contact with surface water and/or groundwater, thereby minimizing the potential for ARD to occur. These activities will reduce human contact with metals above the soil RGs, attain surface water RGs and improve groundwater quality by reducing the sources of contamination, and comply with ARARs.

The capping of the tailings and ORB within the ORB cell will reduce human contact with metals above the soil RGs. The tailings and ORB do not contribute a significant impact to the groundwater or surface water. The excavation of source material will, in addition to controlling direct exposure risks, reduce leaching and erosion that contribute to exceedances of surface water RGs.

**Alternative SC4 – Off-Site Disposal and Waste Containment in the Ore Roast Bed**

Alternative SC4 includes excavation of waste rock and soils that exceed RGs from the UWA and LWA, with off-site disposal of the material and construction of surface water diversions to redirect the surface water from Ponds 4 and 5. Several tributaries that act as a source of surface water contamination to Ely Brook are located within the UWA and LWA. These tributaries will be excavated and consolidated with the waste rock transported for off-site disposal. The sediments located in Ponds 4 and 5, Middle Ely Brook and Lower Ely Brook that exceed the RG will be excavated and disposed of off-site with the waste rock. The sediments in Upper Ely Brook will be removed by either flushing the sediments into the lower reaches prior to the removal of sediment from these areas or via vacuum extraction. Monitoring of Upper Ely Brook will be performed to assess whether all contaminated sediment was successfully removed and whether the sediment RG is met. Temporary diversions or damming of Ely Brook and Ponds 4 and 5 would be used to enable dry working conditions. Some dewatering of sediments may be required and, if so, dewatered liquid would be treated if necessary to meet discharge standards into Ely Brook. After excavation/dredging, restoration would be performed for Ely Brook. Middle Ely Brook would be restored as a rip-rap armored channel to prevent erosion in this steep graded section of stream; Lower Ely Brook would be restored as a natural channel; and Ponds 4 and 5 as either a rip-rap armored channel from Pond 3 downstream to Ely Brook near the confluence with EBT2 or restored to native aquatic habitat as part of wetland mitigation.

Alternative SC4 also includes excavation of the TA and layering of the tailings on the ORB, construction of the ORB Cell with a low permeability cover system over the material, and surface water diversions to redirect the surface water areas upgradient of the ORB around the cover system.

Restoration of the excavated areas will consist of grading the slopes to allow for adequate surface water drainage, soil erosion, and establish native vegetation. Borrow material will be brought in from off-site to use for Site restoration and covering of the ORB Cell. Additional components include institutional controls, environmental monitoring, and five-year reviews.

This alternative would consist of the following key components:

- Pre-design investigations and studies,
- Excavation and off-site disposal of waste rock and soil exceeding RGs from the UWA and LWA,
- Flushing of sediment from the Upper Ely Brook to remove contaminated sediment exceeding the sediment RG;
- Monitoring of the Upper Ely Brook to confirm that the sediment RG is achieved;
- Temporary dewatering of waterways and excavation of sediments exceeding the RG from Middle and Lower Ely Brook, the EBTs within the UWA and LWA, and Ponds 4 and 5;
- Dewatering of the excavated sediment and treatment of the dewatering water, if required, with discharge to Ely Brook;
- Off-site disposal of the excavated and dewatered sediment;
- Excavation of the TA and placement of the tailings on the ORB,
- Construction of the ORB Cell with a low-permeability cover system over the ORB/tailings material and surface water diversion;
- Short-term operation of a leachate collection and treatment system for the ORB Cell;
- Installation of monitoring wells;
- Use of institutional controls to prevent exposure to contamination within the OU1 area, protect the response action and prevent exposure to contaminants contained in the ORB Cell;
- Long-term operation and maintenance,
- Environmental monitoring,
- Restoration of waterways, wetlands, and wildlife habitat, as required;
- Transporting off-site borrow material to the Site to use for restoration and covering of the ORB Cell.
- At least yearly institutional control inspections, and
- Five-year reviews

An alternative remedy map showing the major construction components of this alternative is included as Figure 23.

The removal of the waste rock, soil, and sediment exceeding Rgs levels will minimize the potential for the acid generating material to come in contact with surface water and/or groundwater, thereby minimizing the potential for ARD to occur. These activities will reduce human contact with metals above the soil RGs, achieve surface water RGs in the OU1 waterways and improve groundwater quality by reducing the sources of contamination, and comply with ARARs.

The capping of the tailings and ORB in the ORB Cell will reduce human contact with metals above the RGs. The tailings and ORB do not contribute a significant impact to the groundwater or surface water. The excavation of source material will, in addition to controlling

direct exposure risks, reduce leaching and erosion that contribute to exceedances of surface water RGs.

## K. SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

Section 121(b)(1) of CERCLA presents several factors that, at a minimum, EPA is required to consider in its assessment of alternatives. Building upon these specific statutory mandates, the NCP articulates nine evaluation criteria to be used in assessing the individual remedial alternatives.

A detailed analysis was performed on the alternatives using the nine evaluation criteria in order to select a site remedy. The following is a summary of the comparison of each alternative's strengths and weaknesses with respect to the nine evaluation criteria. These criteria are summarized as follows:

Threshold Criteria

The two threshold criteria described below must be met in order for the alternatives to be eligible for selection in accordance with the NCP:

1. Overall protection of human health and the environment addresses whether or not a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced or controlled through treatment, engineering controls, or institutional controls.

2. Compliance with applicable or relevant and appropriate requirements (ARARs) addresses whether or not a remedy will meet all Federal environmental and more stringent State environmental and facility siting standards, requirements, criteria or limitations, unless a waiver is invoked.

Primary Balancing Criteria

The following five criteria are utilized to compare and evaluate the elements of one alternative to another that meet the threshold criteria:

3. Long-term effectiveness and permanence addresses the criteria that are utilized to assess alternatives for the long-term effectiveness and permanence they afford, along with the degree of certainty that they will prove successful.

4. Reduction of toxicity, mobility, or volume through treatment addresses the degree to which alternatives employ recycling or treatment that reduces toxicity, mobility, or volume, including how treatment is used to address the principal threats posed by the Site.

5. Short-term effectiveness addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period, until cleanup goals are achieved.

6. Implementability addresses the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.

7. Cost includes estimated capital and Operation and Maintenance costs, as well as present-worth costs.

Modifying Criteria

The modifying criteria are used as the final evaluation of remedial alternatives, generally after EPA has received public comment on the RI/FS and Proposed Plan:

8. State acceptance addresses the State's position and key concerns related to the preferred alternative and other alternatives, and the State's comments on ARARs or the proposed use of waivers.

9. Community acceptance addresses determining which components of the alternatives interested persons in the community support, have reservations about, or oppose based on the public's response to the alternatives described in the RI/FS and Proposed Plan.

Following the detailed analysis of each individual alternative, a comparative analysis, focusing on the relative performance of each alternative against the nine criteria, was conducted. This comparative analysis can be found in Section 5 of the OU1 Feasibility Study Report.

The section below presents the nine criteria and a brief narrative summary of the alternatives and the strengths and weaknesses according to the detailed and comparative analysis. Only those alternatives that satisfied the first two threshold criteria were balanced and modified using the remaining seven criteria.

## Comparative Analysis of Alternatives

Each alternative is evaluated in detail using the two threshold and five balancing criteria as part of the FS. After completion of the detailed evaluation of alternatives, a comparative analysis of the alternatives was performed to identify the alternative that satisfies the two threshold criteria of protection of human health and the environment and compliance with ARARs. Then the alternatives are assessed to determine which is the best option based on the five balancing criteria. The comparative analysis from the OU1 FS is summarized below. Finally the modifying criteria of State and Community Acceptance are assessed based on

comments received and responded to in the Responsiveness Summary to this ROD (Appendix C) and the State Letter of Concurrence (Appendix B).

## Threshold Criteria

### 1. Overall Protection of Human Health and the Environment.

According to CERCLA, this criterion must be met for a remedial alternative to be chosen as a final site remedy. Alternative SC1, the No Action Alternative, would not eliminate, reduce, or control source areas or potential future exposure to contaminants exceeding cleanup levels and would not meet RAOs or RGs. Therefore, this alternative is not protective of human health and the environment and cannot be chosen as a final remedy.

Alternatives SC2, SC3, and SC4 would each be protective of human health and the environment. Each of the alternatives would eliminate the direct contact and incidental ingestion risks from cobalt, copper and iron within the waste rock, soils, tailings, as well as the ecological risk posed by copper in sediment areas and metals/acidity in surface water through removal or capping of these contaminated materials.

The removal of the UWA and LWA source material and containment in either the LWA Cell (SC2) or the West Cell (SC3) or off-site disposal (SC4) would remove and/or control the most significant sources of sediment and surface water contamination by preventing the formation of ARD and the erosion of mine waste, as well as addressing human health risks posed by the material. Restoration of the areas formerly occupied by the waste material would also eliminate the barren soil that was toxic to plants and soil invertebrates.

Capping of the tailings within the ORB Cell under SC2, SC3, and SC4 would prevent this material from acting as a source of sediment and surface water contamination and address human health risks posed by the material. Also, removal of acutely toxic sediments from Ely Brook, its tributaries, and Ponds 4 and 5 and consolidating them in the LWA Cell (SC2) or the West Cell (SC3) or transporting them off site for disposal (SC4) would eliminate that threat to the ecological system of OU1. Each of the alternatives would implement institutional controls to prevent residential exposure throughout OU1 until the remedy is implemented and prevent site use that could damage the components of the cleanup after implementation.

Alternatives SC2, SC3, and SC4 are very similar in the degree to which they achieve protection of human health and the environment. SC3 would be more protective than SC4 because the waste material would be isolated in a containment cell that is specifically engineered to prevent direct contact and ARD generation for the Site specific waste. The off-site disposal location chosen under SC4, because the waste material is not a regulated solid waste, could have less protective cover system. The location of the West Cell makes SC3 more protective than SC2 since SC2 would create the LWA Cell in a location that is more susceptible to infiltration by groundwater and surface waters from the adjacent waterway. In addition, the LWA Cell would potentially be susceptible to uncontrolled discharges from the Underground Mine Workings (OU2). Each of the alternatives includes components that result in direct and indirect impacts to

wetlands and aquatic habitat. SC4 would have a smaller short-term environmental impact to wetlands because it would not require clearing for staging areas, borrow areas, or for construction of the West Cell (SC-3) or LWA Cell (SC-2). If on-site materials are utilized, SC2 would require an estimated 15 acres of forest clearing, while SC3 would only require 12 acres, all of which is in the footprint of the West Cell and staging area. The relative ranking of protectiveness is SC3 > SC4 > SC2>SC1 (i.e., SC3 is more compliant than SC4 which is more compliant than SC2, while SC1 is non-compliant).

**2. Compliance with ARARs.**

CERCLA requires that a selected alternative must also meet a second threshold criterion of compliance with ARARs, or a waiver must be obtained if the criterion cannot be met. According to CERCLA, this criterion must be met for a remedial alternative to be chosen as a final remedy. The ARARs identified for each alternative are identified in the OU1 FS in Table 4-1 (SC1), Tables 4-3 through 4-5 (SC2), Tables 4-7 through 4-9 (SC3), Tables 4-11 through 4-13 (SC4).

**Location-Specific ARARs.**

Alternative SC1 – No Action does not include any actions, therefore this alternative does not trigger location-specific ARARs.

Alternatives SC2, SC3, and SC4 would be designed and implemented to comply with regulations related to wetlands, historical preservation, land use and development, stream flow, fish and wildlife habitat, endangered species, floodplains, and wetlands. Each of the alternatives includes components that result in unavoidable direct and indirect impacts to both wetlands and historic resources, but these impacts can be mitigated. EPA has determined that SC3 is the least environmentally damaging practicable alternative for protecting wetland resources as called for under Section 404 of the federal Clean Water Act 33 U.S.C. § 1344 and Executive Orders 11990 (Protection of Wetlands) and 11988 (Protection of Floodplains), as incorporated under Federal Emergency Management Act (FEMA) regulations, 44 C.F.R. § 9, that are relevant and appropriate to the cleanup, and is therefore more ARAR compliant than SC2 and SC4. This finding was made because SC3 will permanently contain Site contamination outside of the LWA and UWA areas, where long-term impacts to wetland resources will be minimized in comparison with SC2, which would locate the LWA Cell adjacent to Site waterways in an area with a high groundwater table. Under SC3 Site cleanup measures will be taken to minimize the destruction, loss, or degradation of wetlands/waterways and preserve and enhance their natural and beneficial values. While there is no federally identified floodplain within OU1, the cleanup will be conducted so that it does not pose any risk to downstream floodplain resources. While SC4 permanently removes a large volume of contamination from the Site, including from wetlands and waterways, the operation to ship such a large volume of waste is less practicable than SC3's on-site option.

EPA has determined that Ely Copper Mine and its associated on-site historic structures are eligible for the National Register of Historic Places. EPA has also determined that the

construction activities required to implement SC2, SC3, and SC4 would have unavoidable direct and indirect impacts on historic features at the Site, but that these impacts are necessary to protect human health and the environment. Under SC2 and SC3 additional surveys for protected resources may be required to assess areas (primarily associated with borrow development) not previously addressed. EPA will consult with the State Historic Preservation Officer and other stakeholders regarding any mitigation that may be necessary to address unavoidable adverse effects on historic resources at the Site.

Under SC2, SC3, and SC4 USEPA will consult with federal and state wildlife officials to determine what measures may be required to mitigate for impacts to endangered bat habitat on Site.

All other identified location-specific ARARs can be satisfied by SC2, SC3, and SC4, except that SC4 does not satisfy Vermont Act 250 criterion regarding energy conservation and public investment due to the large amount of trucking, and resulting damage to local infrastructure (roads) and energy consumption the alternative requires. The relative ranking of location-specific ARAR compliance is SC3 > SC4> SC2.

**Chemical-Specific ARARs.**

Alternative SC1 would not attain protective concentrations for Site contaminants in soil or sediment and would not comply with chemical-specific ARARs and TBCs.

SC2, SC3, and SC4 would each result in effective containment or removal of the waste rock, sediment, and tailings sources exceeding RGs developed based on chemical-specific ARARs and risk-based standards derived from federal TBCs. Each would achieve equal compliance with chemical-specific ARARs and TBCs, therefore, the relative ranking of chemical-specific ARAR compliance is SC2 = SC3 = SC4>SC1.

**Action-Specific ARARs.**

Because Alternative SC1 does not include any actions, the alternative does not trigger action-specific ARARs.

Alternatives SC2 and SC3 would construct a containment cell for the waste rock (which is not regulated as solid waste in Vermont) and sediments and therefore meet relevant and appropriate mine closure and risk-based standards (SC2 can achieve these standards only if implementability issues with siting the LWA contaminant cell in an area of high groundwater adjacent to Site waterways can be addressed). Alternative SC4 will meet these standards by removing all of the material and disposing of it off-site. All three alternatives will consolidate and permanently cap tailings and ORB in the ORB Cell in compliance with Vermont Solid Waste standards. The substantive requirements under these rules regulate the tailing wastes and roast bed material that were produced as part of the beneficiation of ore at the Site, but the rules do not apply to unprocessed waste rock. Section 6-1301(f) of the rules permits the waiver of technical and siting requirements provided there is a response action under CERCLA to a release

or threatened release of hazardous substances or materials; and the proposed response action will not adversely affect public health, safety or the environment; and the technical and siting requirements will be complied with to the extent practical in light of the overall objectives of the response. In order for the ORB Cell to comply with the Solid Waste Rules, liner requirements for disposal areas under § 1305(c)(2)(D) and (F) are waived under the VTSWMR. The remainder of § 6-1305 establishes the closure and post-closure performance standards that are applicable to the three alternatives that would create the ORB Cell. That is, all facilities subject to closure requirements must be closed in a manner that: (a) Minimizes the need for further maintenance related to the waste facility; and (b) Controls, minimizes, or eliminates, to the extent necessary to prevent threats to public health and safety and the environment, including post-closure emission or discharge of waste, waste constituents, leachate, contaminated runoff, and/or waste decomposition products to the groundwater or surface waters or the atmosphere. Any leachate generated after the containment areas are completed will be collected and treated to meet standards for discharge to surface waters.

Alternatives SC2, SC3, and SC4 are equally compliant with respect to action-specific ARARs regarding long-term monitoring of the waste management areas that would include federal and state drinking/groundwater standards for monitoring groundwater, as well as federal and State surface water quality standards for monitoring Site waterways. The remediation of OU1 sediments under all three alternatives would meet TBC standards under USEPA contaminated sediment guidance. The three alternatives would also meet State erosion control TBC guidance standards. Therefore, the relative ranking of action-specific ARAR compliance is. SC3 =SC4>SC2.

**Balancing Criteria**

**3. Long-term Effectiveness and Permanence.**

This criterion evaluates the magnitude of residual risk and the reliability of controls after response objectives have been met. Alternative SC1 would not eliminate, reduce, or control source areas or potential future exposure to contaminants exceeding RGs and would not provide long-term effectiveness at protecting human health and the environment.

Alternatives SC2, SC3, and SC4 would each provide similar actions to control exposure risk for the waste rock and sediments in OU1. These actions would provide good long-term effectiveness and permanence. Alternatives SC2, SC3, and SC4 each take actions to cap the tailings on the ORB, excavate the source areas, and either consolidate waste materials in containment cells (SC2 and SC3) or dispose of them off-site (SC4), thereby controlling the generation of ARD at these source areas. For Alternative SC2, excavated material would be removed and isolated in the LWA Cell. For Alternative SC3, excavated material would be transferred and isolated by consolidation and capping in the West Cell.

Alternatives SC2, SC3, and SC4 would reduce ecological risk from exposure to contaminated sediments exceeding the sediment RG and surface water exceeding RGs by

excavating/dredging the reaches of Ely Brook and Ponds 4 and 5 and then isolating the excavated sediments in the containment cells or at an off-site location.

Consolidation of source material in the LWA as part of Alternative SC2 is considered a long-term solution. However, because the LWA Cell footprint is located within the low point of the Ely Brook drainage area, below the existing water table, significant engineering controls will be required to divert surface water and groundwater discharge from the cell. The requirement to construct an underdrain that isolates waste from groundwater and surface water may require additional long-term maintenance and repairs. Because this closure cell design is atypical and non-ideal, it creates greater uncertainty regarding the long-term effectiveness and permanence relative to SC3 and SC4. Long-term maintenance and repair of the SC2 underdrain system is expected to be more problematic than maintenance of the SC3 cell, which is more effectively isolated from surface water and groundwater.

In comparison, Alternative SC3 would be constructed in an area isolated from low-lying wet areas and would utilize standard design and construction components. Based on its reliance on proven technology, SC3 is considered to be more implementable and have greater long-term effectiveness and permanence than Alternative SC2.

Alternative SC4 includes excavating the waste material and transporting it to an off-site location for permanent disposal. Since Alternative SC4 does not rely on an on-site engineering control for the waste rock and sediments it is considered to have slightly more long-term effectiveness and permanence than SC3, which is more effective and permanent than SC2, provided the off-site facility places the unregulated material beneath a cover system of equal performance to the cover system to be installed for SC2 or SC3. If a less substantial cover system is used to cover the waste at the off-site facility, then SC2 and SC3 would have greater long-term effectiveness.

The relative ranking of long-term effectiveness, therefore, is SC4 > SC3 > SC2>SC1, due to the long-term effectiveness of disposing of the waste off-site rather than on-site.

**4. Reduction of Toxicity, Mobility, or Volume through Treatment.**

This criterion evaluates whether the alternatives meet the statutory preference for treatment under CERCLA. The criterion evaluates the reduction of toxicity, mobility, or volume of contaminants, and the type and quantity of treatment residuals.

Alternative SC1 does not contain any components to reduce the toxicity, mobility, or volume of contaminants through treatment. Alternatives SC2, SC3, and SC4 all may have limited treatment components pertaining to treatment of dewatering liquid and the potential use of limestone in settling ponds, drainage channels, or in streams to reduce the toxicity and mobility of ARD. SC2 and SC3 may include added treatment processes for leachate generated from the LWA and West Cells, respectively. SC4 may include limited stabilization of contaminated sediments prior to off-site shipment.

The relative ranking of the alternatives at reducing the toxicity, mobility, or volume of contaminants through treatment is SC3 = SC2 > SC4 >= SC1.

**5. Short-term Effectiveness.**

CERCLA requires that potential adverse short-term effects to workers, the surrounding community, and the environment be considered during implementation of an RA and until response objectives have been met. Under this criterion, the time period to achieve protectiveness is also evaluated. Alternative SC1 does not lead to any exposure risks and, therefore, results in no short-term effects; however, it never achieves protectiveness of human health or the environment and therefore is not effective in the short-term.

Each of the alternatives would use on-site materials and resources to reduce short-term risks to the community from construction traffic to and from the Site. In the event that sufficient on-site sources for earthen materials are not identified, SC2 and SC3 would need to rely on imported materials. The construction of SC2 would require an estimated 93,000 cy of stone, borrow, and topsoil, resulting in approximately 5,150 truck loads. The construction of SC3 would require an estimated 52,000 cy of stone, borrow, and topsoil, resulting in approximately 2,901 truck loads, significantly less than the trucking required for SC2. As a result, SC2 would have a larger short-term environmental footprint than SC3.

In the event that sufficient on-site sources for earthen materials are identified, SC2 and SC3 would generate earthen materials from previously undisturbed areas. Based on an estimated yield of 7,000 cy per acre, the construction of SC2 could potentially require 15 acres of land to be cleared, while the construction of SC3 would require 12 acres, all of which may potentially be within the footprint of the SC3 West Cell construction and staging area. As a result, SC2 would have a larger short-term environmental footprint than SC3.

Under both alternatives SC2 and SC3, the areas where waste is removed will be reclaimed to the extent practical. Some area may be left as exposed rock, whereas areas with clean soil remaining after waste removal will be restored to establish native vegetation, including wetland habitat that will dramatically decrease the environmental footprint of the Site when compared to current conditions. The surface of the containment cells will also be vegetated.

For the other common components of SC2 and SC3, there would also be similar short-term impacts resulting from truck traffic importing the necessary materials to the Site for the remediation activities, including the restoration of Ely Brook and the Ponds 4 and 5 Area, as well as the construction of containment cell cover systems.

Alternative SC4 would include significantly higher short-term impacts related to the estimated 7,400 to 9,500 truck loads required to transport the waste material to an off-site facility. Some of these would be offset by the significantly fewer loads coming to the Site with needed materials for construction of containment cells; however, the ORB cap and restoration

work included in SC4 will require material deliveries. In total, assuming that all needed borrow materials can be found on site, SC2 and SC3 result in an estimated 5,333 fewer truck trips on local roads. Due to the distance to the off-site disposal facility, SC-4 would have a substantially greater overall environmental impact as there are no disposal facilities in close proximity to the Site. The nearest licensed solid waste facility in VT is 50 miles away, resulting in a 100 mile round trip for trucks to bring material from the Site to the landfill. If the waste material required substantial processing (due to size restrictions or pre-treatment requirements to reduce acid generating potential) additional cost and short-term impacts would arise.

SC2 would also require that LWA waste rock be removed and placed in a temporary stockpile area. This is necessary for the construction of the underdrain system, as well as to provide some dewatering of these wastes prior to placement in the closure cell. This stockpile area would be located in an area previously altered to minimize short-term impacts to wetlands and terrestrial habitats. Although temporary, the construction of the LWA relocation stockpiles would require some features typical of the final closure cells, such as surface water diversions, groundwater interceptor trenches, leachate collection systems, and covers to provide protection from erosion and stormwater discharge.

Alternatives SC2, SC3, and SC4 would all result in construction-related concerns (e.g., blasting, noise, and dust) and would result in some short-term effects to the community from truck traffic to deliver equipment and materials.

Both SC2 and SC3 would result in short-term impacts to known wetland areas and aquatic habitats (Ely Brook and floodplain, Ponds 4 and 5). Some permanent loss of these areas may occur depending on the need for engineered structures to protect the cover systems. The areas that are not subject to permanent loss are expected to fully recover and achieve a higher level of function and value post-cleanup with the removal of the site contaminants. There would be short-term impacts to Ely Brook, Ponds 4 and 5, and areas subject to dredging or excavation as part of SC2, SC3, and SC4. Besides the wetland areas destroyed to excavate the waste material, no other unaltered wetlands areas would be impacted due to activities associated with Alternative SC4.

At this time it has not been determined how each alternative may impact endangered bat habitat. USEPA will consult with federal and state wildlife authorities to determine if any of the components of the proposed alternatives poses significant negative impacts on endangered bats at the Site.

For Alternatives SC2, SC3, and SC4, the time period to achieve the RGs is estimated to be 2 to 4 years after the source control and sediment activities are completed.

Because SC2 creates a larger environmental footprint under both an off-site material import and an on-site material generation scenario, SC3 ranks higher than SC2 with respect to short-term effectiveness. Based on the overall impacts to the community and increased traffic hazards resulting from the significant truck loads required to transport waste off-site, both SC2 and SC3 rank higher than SC4 with respect to short-term effectiveness. SC2 and SC3 are equal

in terms of short-term impacts and in time needed to achieve protection and SC4 results in significant short-term impacts to the local community regarding heavy truck traffic on local roads.

The relative ranking of the alternatives with respect to short-term effectiveness is SC3 > SC2 > SC4>SC1.

**6. Implementability.**

This criterion evaluates each alternative's ease of construction and operation, and availability of services, equipment, and materials to construct and operate the alternative. Also evaluated is the ease of undertaking additional RAs and administrative feasibility.

Alternative SC1 does not include any actions, other than Five-Year Reviews, and, therefore, would be technically easy to implement. No permits would be required, and administrative feasibility would be high.

Services and equipment are available to implement Alternatives SC2, SC3, and SC4. Waste removal from the UWA, LWA, Ely Brook and tributaries, and the Ponds 4 and 5 Area, as well as the construction of the tailings cover over the ORB is similar for each alternative.

SC2 is considered less implementable than SC3 and SC4 based on its location in the center and low point of the Ely Brook drainage. The LWA Cell (SC2) relies on a location partially within the groundwater table at the lowest point in a steep-sided topographic drainage. This setting presents distinct engineering challenges for the construction of an effective waste containment cell whose primary objective is to separate waste rock and tailings from interacting with water. The construction the LWA Cell on a high-transmissivity underdrain and drainage barrier is more complicated engineering design and has a greater dependence on the successful performance of the maintenance activities.

The LWA Cell footprint is also the current location of the LWA waste rock. Therefore the LWA waste will need to be excavated and relocated twice. LWA would also require the construction of a temporary staging area that is constructed with a liner and leachate collection system to prevent residual saturation in the waste and sediments from draining to groundwater and surface water. Lastly, long-term maintenance and repair of the SC2 underdrain system is expected to be more problematic than maintenance of the SC3 cell, which is more effectively isolated from surface water and groundwater.

In comparison, the construction of the West Cell (SC3) relies on proven methods and technologies and could be sequenced in a manner that would eliminate the need for a temporary lay-down area and leachate collection system for waste. The West Cell's location on the side-slope of the Ely Brook drainage would also allow for surface water diversions that are sized for significantly smaller flows than would be required for SC2. Therefore, SC3 is considered to be more implementable than SC2.

For the implementation of SC4, South Vershire Road would require improvements to safely handle the heavy truck traffic. In addition nearly 1,000 waste characterization samples would be required to meet the disposal facility requirements. Despite these difficulties, SC4 is considered easily implementable from a technical perspective because it does not include the design and construction of a geosynthetic cap.

The administrative feasibility of Alternatives SC2 and SC3 is equally high since neither requires off-site permits or approvals. The administrative process to obtain institutional controls to protect the remedy components (caps, stream restoration, monitoring wells) for SC2, SC3, and SC4 are readily implementable. SC4 could experience substantial implementability issues with respect to the off-site disposal of the waste material. There is limited capacity at many regional facilities within a reasonable haul distance. If the facility with sufficient capacity were a substantial distance from the Site, the cost could be significantly higher. Also, there could be substantial delays in the implementation of the SC4 associated with obtaining approval for the off-site disposal. While each of the alternatives is implementable, the relative ranking of the alternatives for implementability is SC1>SC3 > SC4 > SC2.

### 7. Cost.

Of the three alternatives that would protect human health and the environment and comply with ARARs, the selected remedy is the less expensive one that meets these threshold criteria.

**Table 43**
**Costs for Alternatives**

| Cost Category | SC1 | SC2 | SC3 Selected Remedy | SC4 |
|---|---|---|---|---|
| Capital Costs | $0 | $18,402,286 | $16,446,057 | $29,754,186 |
| Annual O&M | $8,050 | $74,907 | $74,907 | $27,753 |
| Total Non-Discounted Cost | $241,000 | $20,713,786 | $18,757,557 | $30,586,786 |
| Total Present Worth (30 yrs @ 7 percent) | $113,015 | $19,428,508 | $17,472,278 | $30,123,830 |

## Modifying Criteria

### 8. State Acceptance.

The evaluation of this criterion is based on the input from the State throughout the evaluation process to develop a remedy for the Site. EPA has addressed the State's questions and comments raised during the public comment period within the Responsiveness Summary (Appendix C). The alternatives presented in the OU1 Feasibility Study Report, OU1 Proposed

Plan, and this ROD reflects the dialogue among EPA, VT DEC, and other State agencies and officials.

VT DEC has actively participated in the planning, implementation, and assessment of the OU1 RI/FS and the development of the cleanup plan presented in this ROD. VT DEC has notified EPA that it concurs with the cleanup approach as called for in this ROD (Appendix B).

**9. Community Acceptance.**

EPA has worked closely with the community during the entire OU1 RI/FS. Throughout the remedy selection process there has been a relatively low level of community interest in the cleanup plan. A series of public meetings were held to provide the community with advance notice and information pertaining to the cleanup action. EPA actively sought public comment on the Proposed Plan during the public comment period. The comments received during the public comment period expressed a concern regarding the cost of the cleanup action during the current difficult fiscal setting. There were also comments regarding the lack of a perceived threat to human health or the environment. These comments are addressed in the Responsiveness Summary to this ROD (Appendix C). In summary, although EPA understands the concerns raised with respect to the fiscal challenges facing the state and federal government, EPA considers the Ely Copper Mine to represent a significant ecological threat which should be addressed. The Superfund program is the only entity in a position to respond to this ecological threat. EPA has a process by which all cleanup actions are evaluated and prioritized to make sure that the most significant threats to human health are the highest priority for funding.

## L. THE SELECTED REMEDY

### 1. Summary of the Rationale for the Selected Remedy

This subsection describes the selected remedy, identified as Alternative SC3 in the OU1 Feasibility Study and Proposed Plan. The selected remedy will prevent human contact with soil/waste in the OU1 area that is above soil RGs, prevent ARD formation within the UWA, LWA, and TA that is significantly impairing water quality in Ely Brook and SHB, and eliminate the toxic effect of the waste within the UWA and LWA on the plant and soil communities which has created barren areas throughout OU1. Ecological risks will be addressed by achieving the surface water RGs through control of the ARD and removal of sediments exceeding the sediment RG. RAOs would be achieved by isolating the soil/waste/sediment in two confined cells (the West Cell and ORB Cell). The West Cell would be located to the west of Ely Brook, north of the historic mining village, and west of wetlands adjacent to Ely Brook. The West Cell will have sufficient capacity to include the LWA, UWA, sediments from Ely Brook, its tributaries, and Ponds 4 and 5. Disturbed areas outside of the West Cell will be stabilized and restored. A low-permeability cover system that will prevent contact of water and oxygen with the waste will be installed over the waste within the West Cell along with channels to divert water around the cell. The cell will have a bottom liner, if necessary, to prevent residual water within the waste from causing groundwater or surface water to exceed standards. The capping of the tailings and ORB

within the ORB cell will reduce human contact with metals above the RGs. The excavation of source material will, in addition to controlling direct exposure risks, reduce leaching and erosion that contribute to exceedances of surface water RGs.

### 2. The Selected Remedy

The selected remedy includes excavation of mine waste and soil exceeding RGs from the UWA and LWA and consolidation of the material into a containment cell located in an on-site area to the west of Ely Brook (West Cell); clearing and grading the work area for the West Cell , removing sufficient borrow material for cover and restoration material, and creating a construction lay-down area; construction of a surface water diversions to redirect the surface water from seeps/runoff around the cell; and installation of a low-permeability cover system to contain and isolate the waste rock. If required, a leachate collection and treatment system will be installed. The selected remedy will also excavate sediments exceeding the sediment RG, with consolidation of the excavated sediments into the West Cell. The tailings from the TA will be consolidated onto the ORB and the ORB Cell will be capped with a low-permeability cover system.

It is likely that some changes to the components described below will be required as a result of the performance of the remedial design. The primary elements of this alternative are listed below and shown in Figure 22:

- Pre-design investigations and studies;
- Clearing and grading of the work area and haul road, including an additional lay-down area for the temporary stockpiling of clean earthen materials removed to create the West Cell (approximately 12 acres), as well as the construction of the haul roads;
- Potential mining of an estimated undeveloped 7.5 acres to obtain the necessary on-site stone and borrow material needed for developing the containment cells, stream stabilization, and restoring barren areas;
- Restoration of the mined areas when the removal is completed (unless all of the required material can be obtained from the clearing and development of the West Cell area);
- Installation of surface water and shallow groundwater diversions as necessary to prevent the flow of surface water or groundwater into the West Cell or ORB cell;
- Installation of a bottom containment liner below the West Cell, if necessary, to ensure that groundwater and surface water are not adversely impacted by residual drainage from the waste material;
- Excavation of waste rock and soil exceeding soil RGs of the UWA and LWA and consolidation in the West Cell;
- Treatment of any water generated from the excavation activities, including the dewatering of sediments, saturated soil/waste, or residual drainage from the soil/waste using pH neutralization to create a neutral pH and filtration and or settling ponds/tanks to remove the metals – discharge of the treated water back to surface waters;
- Dewatering of Ponds 4 and 5 if necessary;

- Excavation of all contaminated sediment exceeding the sediment RG and any waste/soil that may be generating ARD from the Ponds 4 and 5 area and disposal of the sediment, with dewatering if required, into the West Cell;
- Restoration of Ponds 4 and 5 area as native wetland habitat;
- Construction of surface water drainage features to convey water from Ponds 4 and 5 and for the tributaries of Ely Brook that will be excavated;
- Use of minimally invasive extraction methods such as vacuum or hand removal sediments exceeding the sediment RG in Upper Ely Brook;
- Restoration of Upper Ely Brook;
- Monitoring of the Upper Ely Brook to confirm that the sediment RG is achieved;
- Construction of a temporary surface water diversion to allow excavation of sediments above the sediment RG in Middle and Lower Ely Brook;
- Excavation of the sediments above the sediment RG in Middle and Lower Ely Brook, including adjacent the riparian soils that exceed the sediment RG;
- Consolidation of excavated sediment, with dewatering and discharge to Ely Brook if required, with the waste rock and soil in the West Cell;
- Reconstruction of Middle Ely Brook, possibly as a rip-rap armored channel due to the expected slope of the channel;
- Restoration of Lower Ely Brook as a natural stream corridor;
- Installation of a low-permeability cover system on the West Cell that meets relevant and appropriate mine reclamation regulations and risk-based standards to contain and isolate the waste rock, soil, and sediment;
- Excavation of the TA and layering of tailings on the ORB to create the ORB Cell;
- Construction of the ORB Cell with a low permeability cover system and surface water diversions that meets applicable Vermont Solid Waste standards;
- Collection of leachate from the West Cell and ORB Cell, as necessary, and on-site treatment through treatment wetlands and/or settling basins and discharge to surface waters;
- Protection, to the extent practicable, of the historic retaining wall that is adjacent to the ORB, as well as other historic resources present within the Site;
- Restoration of the disturbed areas within the UWA, LWA, ORB, and TA;
- Endangered bat habitat mitigation measures, as required;
- Historic resource assessment and documentation via photographs, mapping, drawing, archaeological data recovery, construction monitoring/recordation, and/or other measures, as required;
- Additional investigation of potential prehistoric features within the Site, as required;
- Installation of monitoring wells to monitoring groundwater around the ORB Cell and West Cell;
- Long-term O&M;
- Use of institutional controls to prevent exposure to contamination within the OU1 area, protect the response action and prevent exposure to contaminants contained in the ORB Cell and West Cell;
- Environmental monitoring to evaluate the performance of the cleanup action and at least yearly compliance monitoring to ensure compliance with the institutional controls; and

- 5-year reviews.

Investigations and studies that may be necessary to support the remedial design would consist of the following items:

- Topographic surveys of waste areas and sediment areas;
- Exploratory borings and/or test pits to determine depth to groundwater and bedrock west of Ely Brook and to determine suitability of soils as cover materials and identify the best location for the West Cell;
- Test pit surveys and a drilling program to determine the quantities and suitability of on-site materials for construction materials (e.g. stone, common fill), and the dewatering, and surface water and groundwater diversion requirements for temporary waste stockpiles;
- Analytical modeling for stormwater drainage design;
- Wetland delineation for federal and State jurisdictional wetlands and an assessment of wetland mitigation requirements and design options;
- Geotechnical pre-design investigation(s), including an assessment of the structural integrity of the ORB retaining wall using test pits to determine the geometry of the wall and global stability analysis to determine the structural integrity of the ORB retaining wall and retaining wall near Ely Brook;
- Borings within the LWA and ORB to characterize physical properties and spatial variability of in-situ soils in cut/fill areas (excavations, construction traffic, settlement, dewatering, etc.);
- Assessment of erosion control/habitat restoration options for the Middle Reach of Ely Brook;
- Historic/prehistoric resource assessments to evaluate the areas targeted for the West Cell and borrow area;
- Assess bat habitat mitigation measures, if required;
- Pre-excavation sampling to refine estimates of the extent of mine-related waste rock and tailings contamination exceeding soil RGs; and
- Pre-dredge sampling to refine estimates of the extent of sediment contamination exceeding the sediment RG.

The following describes the primary elements of the selected remedy in more detail below:

A staging/lay-down area will be required to temporarily stockpile the clean earthen materials and construction material during the construction of the West Cell. The staging area, which will be approximately 3.5 acres in area and is located adjacent to the former village southeast of the West Cell location, will be cleared of trees and brush and graded to slope away from the West Cell, toward Lower Ely Brook. The 8.5 acre area for the West Cell will also be cleared of trees and brush. The approximate location of the West Cell is shown on Figure 24.

An area of about 7.5 acres would need to be cleared and excavated to generate an estimated 50,000 cubic yards of soil for the cover system for the West Cell, ORB Cell, and Site

restoration. If possible, this material will be acquired within the footprint of the West Cell to minimize the overall environmental impact of the cleanup. If the area is located outside of the limits of the West Cell, the area will be restored.

Any surface water and shallow groundwater that could flow into the West Cell will be intercepted and conveyed around the West Cell by surface water channels or groundwater interceptor trenches. The current assumption is that a 1,025-linear-foot groundwater interceptor trench will be constructed along the upgradient boundary of the cell and along with approximately 1,480 linear feet of surface water diversion swales. These diversion measures may be integrated with the toe details surrounding the containment. Any federal jurisdictional wetlands impacted as a result of the construction of the West Cell will be mitigated.

The remedial design will determine whether the bottom of the West Cell would include a liner to minimize groundwater intrusion into the waste material or to reduce the potential for leachate to percolate into the overburden or bedrock aquifers. It is possible that only a portion of the West Cell may need a liner if only a small percent of the waste material is expected to contain sufficient residual moisture to present a threat to surface water or groundwater.

The waste material within the UWA and LWA containing contaminant levels above the soil/waste RGs and/or that is considered a source of ARD will be excavated and transported to the West Cell. An estimated 73,000 cubic yards of material will be removed from the UWA. An additional 29,000 cubic yards will be excavated and transported from the LWA. These volumes include material within the 5,000 linear feet of Ely Brook tributaries within the UWA and LWA. If possible, the excavated material will be brought directly to the West Cell to limit the handling of the material. If some of the material is too wet for placement, it may be mixed with material containing less moisture or set in a staging area within the West Cell that would be designed to manage/dewater excessively wet material. Dewatered liquid may also be treated and discharged to surface waters. The material from Ponds 4 and 5 along with the sediments of Ely Brook will also be excavated and placed in the West Cell, as described below. Mine openings that are within the excavation area or exposed as a result of the excavation will be secured to protect public and worker safety. The design of any measures associated with the mine openings will minimize any potential impact on bats.

A temporary cover system may be used to limit the infiltration of water into the waste once placed within the West Cell until the final cover system is completed. The final low-permeability cover system for the West Cell will be designed to limit the infiltration of waster and oxygen and prevent contact with the material. A conceptual cross-section of the West Cell is shown in Figure 25. The components of the cover system are expected to include:

- A subgrade layer that would act as a buffer between the waste material and the geosynthetic cover. A minimum of six inches of a uniform fine grained sand or similar material is typically used for this layer. The subgrade is shaped to create an overall grade for the cover system that would cause water to run off the cover system to the perimeter channels and toe drains.

- The barrier layer would be a geosynthetic membrane, assumed to be a 60 mil LDPE geomembrane or other suitable geosynthetic material as determined during the design.
- Above the geomembrane will be a drainage layer, assumed to be a drainage geocomposite or 12 inch sand layer or other suitable geosynthetic material as determined during the design. This layer will allow the water that is intercepted by the barrier layer to flow to the outside of the West Cell.
- To protect the geosynthetic layers, an approximate 18 inches of vegetative support soil VSS and 6 inches of topsoil will be placed over the geosynthetic layers. The topsoil will be seeded to promote vegetation, enhance slope stability, and reduce erosion.

Calculations based on porosity, saturated waste volume, and effective moisture content indicate that the drainage of saturated contaminated soil, waste rock, and sediments could generate up to 825,000 gallons of leachate after placement of this material within the West Cell. Based on the measured geotechnical soil parameters and hydraulic conductivity of the waste rock, it is estimated that residual saturation in the cell waste would drain within the first two years after placement within the West Cell, resulting in an average discharge rate of 0.8 GPM. The design will evaluate whether this water could degrade the groundwater below the West Cell or violate water quality standards if discharged to Ely Brook. The leachate could be acidic and contain elevated levels of metals. If necessary to further prevent adverse impacts to the groundwater and surface water within OU1, a leachate collection system would be installed along the downgradient toe edge of the cell to capture water draining from the waste. The collected leachate would then be treated using a pH adjustment and settling or filtration to remove the metals after pH adjustment. It is possible that a limestone-lined channel and treatment wetland or settling pond could also be used to treat the leachate before being discharged to Ely Brook.

An estimated 400 cubic yards of contaminated sediment will be removed from Ponds 4 and 5 and placed in the West Cell and covered along with the UWA and LWA material. Ponds 4 and 5 will drained by diverting the flow from Ponds 1-3 around Ponds 4 and 5 and using mechanical pumps to physically remove the water from Ponds 4 and 5. The areas formerly occupied by Ponds 4 and 5 will be restored a native wetland habitat. Downstream of this new wetland habitat, a natural channel will be installed to carry the flow to Ely Brook. Some portion of the channel may require a culvert to allow for an access road and may contain rip rap if the slope is steep.

The contaminated sediment within Upper Ely Brook will be removed by the least intrusive method possible to promote the maintenance of the existing natural channel and bottom substrate. Upper Ely Brook is a relatively high-energy depositional environment and contains a small volume of contaminated sediments, with less than 200 cy of contaminated sediments over 1,700 linear feet of stream channel. Rather than relying on bulk excavation, sediments in this reach will be removed using minimally invasive procedures such as vacuum extraction, hand-digging, or artificial flushing. Given the relatively small volume of contaminated sediments that require removal, this approach will greatly reduce impacts and disturbance to the natural drainage features and will provide for a more effective ecological restoration than would be possible with bulk excavation. After the removal of the contaminated sediment, Upper Ely

Brook will be surveyed to determine if sections require restoration. It is possible that clean sediment may be added, if necessary, to prevent channel destabilization. Monitoring of the Upper Ely Brook will be conducted to confirm that the sediment RG is achieved.

The channels for the Middle and Lower sections of Ely Brook are filled with waste material and only physical excavation can remove the material. Surface water will be diverted around the section being excavated to minimize downstream transportation of sediment and reduce the water content of the excavated material. Check dams, coffer dams, mechanical pumps, and culverts may be used to convey the water from above the work zone to a suitable location downstream of the work zone during excavation and restoration work. Once the impacted sediment areas are dewatered, heavy equipment will be used to excavate the impacted sediment. The channel section would then be restored and the water will then be returned to the newly restored channel section. Work zones will be sequenced in a manner that ensures that upstream source areas are excavated initially and that work progresses downstream to the confluence with SHB, thereby eliminating the potential for recontamination from mobilized upstream sediments. The remedial design will consider alternate work sequences that will allow for minimal surface water diversion structures.

Middle Ely Brook is likely to be reconstructed as an armored rip-rap channel due to the relatively high-energy environment through this reach. The design will evaluate whether a more natural channel, with habitat restoration would be possible.

Due to the low-energy depositional environment along Lower Ely Brook, it will be restored to a habitat hospitable to aquatic life and features typical of a New England cold water stream, such as pools, runs, riffles, cascades, and woody debris.

The waste material with the TA containing contaminant levels above the soil/waste RGs and/or that is considered a source of ARD will be excavated and transported to the ORB to create the ORB Cell. The tailings will be placed over the in-place ORB material. The design will determine optimal location within the ORB for the placement of the tailings. The FS assumed that the tailings will be placed within a discreet, 2-foot-thick zone that is approximately 60 feet long and 30 feet wide. A temporary cover system may be used to limit the infiltration of water into the waste once placed within the ORB Cell. The final low-permeability cover system for the ORB Cell will be designed to limit the infiltration of water and oxygen and prevent contact with the material and comply with the cover required in the applicable Vermont Solid Waste Management Rules for a mining waste. The approximate location of ORB Cell is shown in Figure 26 and a conceptual cross-section of the ORB cell is shown in Figure 27. The components of the cover system are expected to include:

- A subgrade layer that would act as a buffer between the waste material and the geosynthetic cover. A minimum of six inches of a uniform fine grained sand or similar material is typically used for this layer. The subgrade for the ORB Cell could be tailings. The subgrade is shaped to create an overall grade for the cover system that would cause water to run off the cover system to the perimeter channels and toe drains.

- The barrier layer would be a geosynthetic membrane, assumed to be a 60 mil LDPE geomembrane or other suitable geosynthetic material as determined during the design.
- Above the geomembrane will be a drainage layer, assumed to be a drainage geocomposite or 12 inch sand layer or other suitable geosynthetic material as determined during the design). This layer will allow the water that is intercepted by the barrier layer to flow to the outside of the ORB Cell.
- To protect the geosynthetic layers, an approximate 18 inches of vegetative support soil VSS and 6 inches of topsoil will be placed over the geosynthetic layers. The topsoil will be seeded to promote vegetation, enhance slope stability, and reduce erosion.
- The cap will join the top of the existing retaining wall where exposed and key into the natural grade elsewhere.

A surface water diversion in the form of an interceptor trench (approximately 1,300 linear feet) will be constructed around the upslope edges of the cap to convey runoff around the cap and toward Lower or Middle Ely Brook.

The areas within the UWA, LWA, and TA subject to excavation will be restored to minimize erosion of disturbed soil and promote ecological recovery of the area. Locations that are excavated to bedrock may be left as exposed bedrock. For other areas where the excavations terminate in glacial till, a 6-inch layer of topsoil or other amendment will be placed over the disturbed area and then seeded with an appropriate native seed mix.

A new access road would be required to access the West Cell during long-term monitoring (LTM). The existing access road would be retained and connected with the required haul roads after excavation of the LWA to provide construction, maintenance, and long-term inspection/monitoring access to the area and the ORB Cell.

Replacement/installation of a select number of shallow bedrock and overburden monitoring wells will be required to evaluate the competency and protectiveness of the West Cell and ORB Cell. Existing OU1 monitoring wells damaged during remedial activities will be replaced if they are needed for long-term monitoring purposes (wells needed for OU2 that are damaged by the OU1 remedial action will also be replaced).

To the extent the implementation of the cleanup has an adverse impact on historic resources a mitigation plan will be developed to address these impacts. For historic resources, the remedial design will determine if further assessment and documentation will be necessary prior to implementation of the cleanup action. It is also possible that data recovery may be necessary for certain archaeological resources. Construction monitoring may also be included in the implementation plan. Additional survey work to assess potential historic/prehistoric resources may be required for areas of the OU1 cleanup area not previously assessed. Post-cleanup mitigation measures could include the development of interpretive reports and development of public information. The Area of Potential Effect to historic resources is shown on Figure 28.

To the extent the cleanup results in a permanent loss of State Class II or federal jurisdictional wetlands, a mitigation plan will be developed to create new wetland to compensate for the loss. The extent of potential impacts to wetlands is shown on Figure 28. The remediation will be designed and implemented so as to not increase risks of downstream flooding from the Site.

The remedial design and implementation of the cleanup will also take into consideration any potential impact on bats. The cleanup plan will be developed and implemented to minimize and adverse impact on bats and to maintain any bat habitat to the extent possible. If adverse impacts are anticipated, then mitigation measures would be developed, in consultation with federal and state wildlife agencies, to off-set the potential impacts.

The selected remedy would require minimal long-term O&M. Active operation of remedial facilities would not be required. Anticipated maintenance activities would be expected to include: periodic inspections; mowing and general upkeep erosion control; maintenance of surface water diversions and drainage structures to prevent/repair erosion damage; possible addition of media to the drainage swales to promote continual pH buffering; and repair/replacement of damaged monitoring wells. The management of the residual leachate from the excavated waste material is expected to be completed by the time the O&M period begins.

Environmental monitoring would be conducted during the waste rock and tailings excavations to document that all material that exceeds soil RGs and that may represent an ARD hazard have been removed. Monitoring of the Upper Ely Brook will be conducted to confirm that the sediment RG is achieved. The monitoring will also be used to document that construction measures are successfully protecting Ely Brook and SHB from erosion. Long-term environmental monitoring would also include collection of groundwater and surface water samples site-wide and biological monitoring to assess the containment of the closure cells and the effectiveness of the remedy. Groundwater elevation data would be collected at the time of sample collection to allow interpretation of the direction of groundwater flow. Field parameter measurements for dissolved oxygen, oxidation-reduction potential, pH, temperature, turbidity, and specific conductance would be made prior to sample collection. Details of the monitoring program, including target monitoring wells, analytes, and QA/QC protocols, would be specified in the OU1 LTM Plan.

Institutional Controls will be developed to protect the cleanup action. After implementation of the cleanup action land-use restrictions will be developed that prohibit any land use that could damage or reduce the effectiveness of the West Cell, ORB cell or the wetland restoration, including the restored stream channels. Other components of the remedy, including stormwater controls and monitoring wells, would be protected. Interim land use restrictions will be implemented to prevent exposure to the soil and waste above RGs during the period prior to the implementation of the cleanup action. The land use restrictions will incorporated/referenced within the title for the property(ies) and will be recorded in a manner that meets State recordings standards for environmental restrictions. Land use restrictions would also be implemented as part of an OU2 Early Action, independent of the OU1 ROD, to prevent groundwater use in

throughout the areas of the Site where groundwater exceeds PRGs and residential use in OU2 areas of the Site that exceed residential risk standards.

An institutional control monitoring plan would be prepared as part of the OU1 LTM program. The plan would include a checklist of elements to be assessed during regularly scheduled on-site inspections. At a minimum, annually scheduled inspections would be performed to confirm that land--use restrictions are implemented and adhered to as required to prevent disturbance of the components of the remedy.

**Five-Year Reviews**

Under Section 121(c) of CERCLA, 42 U.S.C. § 9621(c), any remedial action that results in contaminants remaining on-site at concentrations above those allowing unlimited exposure and unrestricted use must be reviewed at least once every five years. Five-year reviews will be performed to determine whether the implemented OU1 remedy continues to be protective of human health and the environment, or whether the implementation of additional remedial action is appropriate. The start of the first five-year review period is the start of the remedial action for the first operable unit at the Site.

### 3. Summary of Estimated Remedy Costs

The total costs for the cleanup action is presented in Table 44 below. Detailed cost estimates for capital and long-term costs are presented in Table 4-10 and Appendix A of the OU1 Feasibility Study Report.

**Table 44**
**Estimated Cost of the Selected OU1 Remedy**

| ITEM | COST |
|---|---|
| Pre-Design Studies | $285,000 |
| Temporary Facilities | $142,500 |
| Haulage Way Construction | $365,000 |
| Mobilization / Demobilization | $152,000 |
| Upgrade of Existing Access Roads | $147,820 |
| Erosion and Sediment Control | $190,000 |
| Staging Area | $32,400 |
| Surface Water Diversions | $279,300 |
| UWA, LWA, TA Waste Material Excavation, Transport, and Stockpiling | $1,386,000 |
| Ely Brook, Ponds, Tributary Excavations and Restoration | $1,772,740 |
| Waste Area Tribs and Seeps | $212,594 |
| West Containment Cell and Cap Construction | $3,407,624 |
| ORB Containment Cell Construction | $776,976 |
| UWA and LWA Restoration | $472,165 |
| Staging Area Restoration | $30,400 |
| Cultural/Historical Preservation | $195,000 |
| Wetland and Habitat Mitigation | $290,000 |
| Institutional Controls | $95,000 |
| Long-Term Monitoring Plan | $57,000 |
| Monitoring Well Installations | $80,000 |
| Direct Cost Subtotal | $10,369,519 |
| Contingency Cost (@30 Percent) | $3,110,856 |
| Direct and Contingency Cost Subtotal | $13,480,374 |
| Indirect Capital Costs (Engineering, Const. Mgmt., Proj. Mgmt., etc.) | $2,965,682 |
| **TOTAL CAPITAL COSTS** | **$16,446,057** |
| Site Inspections, Sampling, and Reporting | $36,000 |
| Routine Site Maintenance, Repairs, etc. | $24,000 |
| Annualized Five-Year Review Cost | $7,000 |
| Contingency (10%) and Project Management (5%) | $10,050 |
| Annual O&M Subtotal[3] | $77,050 |
| **TOTAL LONG-TERM OPERATION, MAINTENANCE, AND MONITORING** | |
| **PRESENT VALUE COSTS, 30-YEARS, 7% (See Note 1)** | **$1,026,221** |
| | **$17,472,278** |

The information in Table 44 is based on the best available information regarding the anticipated scope of the remedial alternative. A 7% discount rate was used to estimate present worth for the selected remedy. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. Major changes may be documented in the form of a memorandum in the Administrative Record file, an Explanation of Significant Difference (ESD), or a ROD amendment. Based on EPA guidance, A Guide to Developing and Documenting Cost Estimates During the Feasibility Study -- OSWER No. 9355.0-75 -- July 2000,this is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost.

### 4. Expected Outcomes of the Selected Remedy

Removal of the waste in the LWA, UWA, and Tailings Area will eliminate a major source of surface water and groundwater contamination. The source control measures should attain surface water RGs in the OU1 waterways and cause a reduction in the concentrations of contaminants in the groundwater. It is expected that Ely Brook, Pond 4, and Pond 5 will be recolonized by benthic and aquatic species and achieve biological integrity comparable to the reference locations that were not impacted by the Site. The removal and containment of the mine waste that poses a human health risk will also allow for future unrestricted use of the OU1 area that is outside of the West Cell and ORB Cell. The OU2 RI/FS will evaluate whether this initial source reduction will be sufficient to accomplish the cleanup of the groundwater and surface water throughout the Site or if other response actions are necessary as part of an OU2 remedy.

The selected remedy for OU1 will also result in the removal of the mine waste with high concentrations of copper from Ely Book, its tributaries, Pond 4 and Pond 5. This material is a threat to the benthic community and fish. Removal of this material will result in the achievement of surface water RGs and an immediate improvement to the Site biota as the contact and ingestion of this material was a primary basis for the threats to the benthic community and birds.

EPA's new Cancer Guidelines and Supplemental Guidance (March 2005) will be used as the basis for EPA's analysis of all new carcinogenicity risk assessments, along with other TBC risk guidance identified in Table 49. If updated carcinogenicity risk assessments become available, EPA will determine whether an evaluation should be conducted as part of the remedial design to assess whether adjustments to the target cleanup levels for this remedial action are needed in order for this selected remedy to remain protective of human health. Once the remedy is completed any revised risk or ARAR standards will be evaluated through the Five-Year Review process and may require the issuance of additional CERCLA decisions documents to modify the remedy established under this ROD.

### a. Soil Cleanup Levels

For the Residential Use Area of the Site, the soil/waste cleanup levels (also known as the soil/waste remediation goals- RGs) were set at a level that will be acceptable for residential exposure for the OU1 cleanup areas within the Site.

**Table 45**
**Clean Levels for Soil/Waste**

| Analyte | 95% UCL Concentration (mg/kg) | Calculated Risk Level in Human Health Risk Assessment for OU1 | Cleanup Level | Risk at Cleanup Level HQ/ ILCR | Basis | Background Concentration - Maximum (Average) (mg/kg) |
|---|---|---|---|---|---|---|
| Residential | | | | | | |
| Cobalt | 50 | HI = 2.1 (thyroid effects) | 24 | 1 | Residential exposure that would result in a HI of no greater than one for a child or adult | 16 (6.6) |
| Copper | 1,887 | HI = 1.8 (HQ for copper = 0.6) (gastrointestinal effects) | 629 | 0.2 | Residential exposure that would result in a HI of no greater than one for a child or adult based on an exposure to both iron and copper. Both iron and copper have the same target endpoint (gastrointestinal). | 45 (15) |
| Iron | 67,413 | HI=1.8 (HQ for iron = 1.2) (gastrointestinal effects) | 44,800 | 0.8 | Residential exposure that would result in a HI of no greater than one for a child or adult based on an exposure to both iron and copper. Both iron and copper have the same target endpoint (gastrointestinal). | 31,000 (13,852) |

**Notes:**
All concentrations = mg/kg
HI = hazard index,
HQ = hazard quotient;
ELCR = excess lifetime cancer risk

### b. Sediment Cleanup Levels

The sediment cleanup levels (also known as the sediment remediation goal – RG) was set at a level that will be protective of the Site biota based on the OU1 RI and BERA.

**Table 46**
**Sediment Cleanup Level**

| Chemical of Concern | Cleanup Level | Basis |
|---|---|---|
| Copper | 149 | Site specific sediment toxicity testing and Probable Effects Concentration |

Notes:
All concentrations = mg/kg

### c. Surface Water Cleanup Levels

The cleanup level for surface water will be the federal Clean Water Act National Recommended Water Quality Criteria and Vermont Water Quality Standards for a Class B surface water. These standards contain both numerical and biological criteria that should be met when the cleanup is complete. The numerical remediation goals are listed below in Table 47. The remediation goals that are based on hardness adjusted values (cadmium, copper, lead, nickel, and zinc) will be re-calculated based on the hardness of each receiving waterbody at the time when EPA seeks to confirm that the remediation goals have been met.

**Table 47**
**Surface Water Cleanup Levels**

| Contaminant of Concern | Remediation Goal (ug/l) | Basis |
|---|---|---|
| Aluminum | 87 | NRWQC |
| Cadmium | 1.13* | Vermont Water Quality Standards |
| Copper | 8.6* | Vermont Water Quality Standards |
| Iron | 1,000 | Vermont Water Quality Standards |
| Lead | 3.18* | Vermont Water Quality Standards |
| Nickel | 52* | Vermont Water Quality Standards |
| Selenium | 5 | Vermont Water Quality Standards |
| Zinc | 106* | Vermont Water Quality Standards |

* Denotes COC whose cleanup level is based on the hardness of the receiving water. The cleanup levels are based on a hardness of 100 mg/l. If the hardness of the receiving water is greater than 100 mg/l, the cleanup level will be adjusted accordingly, as allowed by the regulation. Vermont Water Quality Standards, Appendix C (Nat. Res. Brd, Water Res. P. 12-004-052)

NRWQC = National Recommended Water Quality Criteria. 2009.

## M. STATUTORY DETERMINATIONS

The remedial action for OU1 selected for implementation at the Ely Copper Mine Superfund Site is consistent with CERCLA and, to the extent practicable, the NCP. The selected remedy is protective of human health and the environment, will comply with ARARs, except for when waived, and is cost-effective. In addition, the selected remedy utilizes permanent solutions and alternate treatment technologies or resource recovery technologies to the maximum extent practicable. The selected remedy is not able to achieve the statutory preference for treatment as a principal element of the remedy (i.e., reduce the toxicity, mobility, or volume of materials comprising principal threats through treatment) due to site conditions (the absence of any principal threat waste) and the balancing of all of the CERCLA criteria for selecting remedial alternatives. Some limited treatment of materials will occur as a result of the use of a limestone or other measures to treat the discharge from de-watering activities, as well as potential treatment of leachate generated from the containment cells.

### 1. The Selected Remedy is Protective of Human Health and the Environment

The selected remedy for OU1 at this Site will adequately protect human health and the environment by eliminating, reducing or controlling exposures to human and environmental receptors through treatment, engineering controls, monitoring, and institutional controls (i.e., land use restrictions).

The selected remedy will reduce potential human health risk levels such that they do not exceed EPA's acceptable risk range of $10^{-4}$ to $10^{-6}$ for incremental carcinogenic risk, and such that the non-carcinogenic hazard is below a level of concern. It will reduce potential human health risk levels to protective ARARs levels for unrestricted use of all of OU1 except for the area of the West Cell and ORB Cell. Implementation of the selected remedy will not pose any unacceptable short-term risks or cause any cross-media impacts.

The selected remedy will protect human health by preventing direct contact or incidental ingestion of soil or waste containing cobalt, copper, or iron above levels acceptable for unlimited human exposure. The excavation and isolation of waste rock, tailings, partially-roasted ore, and soil above the OU1 soil RGs the West Cell and ORB Cell with multi-layer low-permeability caps will effectively prevent human contact with these waste materials in OU1 areas of the Site. After completion of this remedy, direct contact and incidental ingestion of metals will no longer be an unacceptable threat to human health.

The selected remedy will also protect the environment by eliminating the major sources of ARD and copper in the sediment that exceed the ecological sediment RG for copper, as well as surface water RGs developed to protect ecological receptors. The excavation of UWA and LWA source material, followed by its consolidation and containment in a capped closure cell will prevent the interaction of water and oxygen with those mine wastes, thereby eliminating the discharge of ARD and metals to groundwater and surface water. The ultimate effect of this waste containment remedy will be the restoration of OU1 surface water RGs and sediment COC concentrations to levels below the RG. The restoration of OU1 surface water will also prevent

migration of COCs to downgradient (OU2) sediment in SHB and the EBOR. The capping of the TA, in conjunction with surface drainage improvements at the ORB within the ORB Cell will prevent the leaching of metals from the tailings into groundwater or surface water.

The selected remedy will address the severe ecological risk to the benthic invertebrate community that exists due to OU1 sediments and degraded surface water quality. The sediment component of the selected remedy will protect the benthic invertebrate community in Ely Brook and Ponds 4 and 5 by removing metals contamination above the OU1 sediment RG, arranging for proper disposal of this material beneath a low-permeability cap in the West Cell, and restoring the habitats with clean materials to create a more hospitable environment.

To ensure the protectiveness of the selected remedy, interim institutional controls will be implemented to prevent residential development throughout OU1 until the ROD remedy is implemented. After implementation, institutional controls will prevent future use within the OU1 remedy area that would disturb the two capped cells, wetland treatment areas (if required), surface water diversion systems, monitoring wells, and any other components of the remedy.

### 2. The Selected Remedy Complies With ARARs

The selected remedy will comply with all Federal and any more stringent State ARARs that pertain to the remedial actions (see Tables 48 – 50). In making this determination, EPA has made the following specific findings:

a. Location-specific ARARs and TBCs for the selected remedy are presented in Table 48.

In accordance with Section 404 of the federal Clean Water Act and federal Executive Order 11990, entitled "Protection of Wetlands," (as promulgated in relevant and appropriate regulations at 44 C.F.R. § 9) USEPA has determined that the selected remedy would result in unavoidable adverse impacts to federal jurisdictional wetlands and aquatic resources. The selected remedy would require the permanent disturbance of approximately 0.92 acres of wetland habitat including middle Ely Brook and any wetlands located within the footprint of the West Cell. The exact amount of federal jurisdictional wetland disturbed will be determined during Remedial Design. The permanent disturbance is required in order to protect the environment from the release of contamination at the Site. Middle Ely Brook was found to be toxic and unable to support aquatic life. The alternative will remove the contamination and restore Ely Brook and Ponds 4 and 5 to achieve Vermont Class B water quality standards. The Ely Brook tributaries have been historically altered as part of the mine development. To the extent possible, the tributaries will be restored as aquatic habitat. For the selected remedy, it is possible that some portions of EBT3 and EBT2 will be restored in kind in the LWA. The selected remedy may also result in some temporary impacts to wetlands that may require disturbance to implement this RA (sections of Ely Brook and its tributaries and Ponds 4 and 5). These areas will be restored to natural conditions after the removal of contaminated sediment. Every effort will be made to avoid impacts to State and federal jurisdictional wetlands. The Remedial Design will include a detailed wetland assessment prior to any Site clearing activities.

Impacted areas of Ely Brook will be reconstructed in kind (Lower Ely Brook) or as rip-rap armored channels (Middle Ely Brook and discharge from Pond 5). Upper Ely Brook will require minimally invasive work and reconstruction will include replacement of fine-grain sediment with similarly sized sand. Ponds 4 and 5 will be restored as native wetland habitat. A new channel will be constructed from the outfall of Pond 5 to Ely Brook. A temporary staging/lay-down area will need to be constructed; however, it is anticipated that the area can be located outside of existing wetland areas. OU1 wetland areas at the Site are shown in Figure 12 and potential areas of the selected remedy wetland impacts are shown in Figure 28.

EPA has evaluated the requirements of Section 404(b) of the Clean Water Act to identify the proposed actions that are the least environmentally damaging practicable alternatives to protect federally regulated wetland and aquatic resources from exposure to contaminated sediments and contaminated surface water. The selected remedy meets the substantive standards of the Clean Water Act and it has been determined to be the least environmentally damaging practicable alternative since it will consolidate all of the Site contamination from the UWA, LWA, and waterways in predominantly upland areas that are not immediately adjacent to Site waterways.

In accordance with federal Executive Order 11988, entitled "Floodplain Management," (as promulgated in relevant and appropriate regulations at 44 C.F.R. § 9) EPA has determined that the selected remedy can be implemented in a manner that will protect downstream floodplain resources. The standards will be achieved through the use of best management practices to address Site contaminant remediation, stream alterations, stormwater controls, and long-term O&M of the remedial components adjacent to the Site's waterways.

Design and implementation of the selected remedy will also address measures that may be required to protect habitat for State and federally-listed endangered bat species in compliance with State and federal Endangered Species Acts and the federal Fish and Wildlife Coordination Act (which also requires coordination with federal and state officials concerning the alteration of endangered species/wetland habitat resources).

Section 106 of the NHPA of 1966, as amended (16 USC 470f), requires EPA to take into account the effects of all actions on historic properties, including archaeological sites that have been determined to be eligible for the National Register of Historic Places. EPA has determined that the Site is eligible for listing in the National Register of Historic Places. EPA has also determined that the construction activities required to implement this RA will have unavoidable direct and indirect impacts on historic features, including archaeological sites, at the Site, but that these impacts are necessary to protect human health and the environment. The preliminary Area of Potential Effect (APE), as defined under the NHPA for direct effects is shown in Figure 28. Additional site assessment work may be required for areas of OU1 where cleanup actions are proposed that have not been previously assessed. The APE will be further defined to address indirect effects, cumulative effects and other effects as part of the design. EPA will work with the Vermont SHPO and other consulting parties to address minimize and mitigate any adverse effects to historic resources and archaeological sites.

State land use control and development standards under Vermont Act 250 would be met in the design and implementation of the SC3 alternative regarding regulated activities, including water and air pollution, protection of headwaters, waste disposal, floodways, streams, wetlands (including Vermont Class 3 wetlands not regulated under the Vermont Wetland Rules), soil erosion, historic sites, endangered species, and extraction of earth resources, energy conservation, and protecting public investments..

To the extent that remedial activities affect other protected resource areas, the location-specific ARARs in Table 48 will apply.

b. Chemical-specific ARARs and TBCs associated with the selected remedy are presented in Table 49.

The chemical specific ARARs are the Vermont Water Pollution Control Act, 10 VSA Chapter 47; Vermont Water Quality Standards, Ch. 1, 2, and 3 and Appendix C and D and the Federal Clean Water Act, National Recommended Water Quality Criteria (NRWQC), 40 CFR Part 122.44. The ARARs define the numerical criteria that will be used to evaluate whether the cleanup has been successful. The remedial goals based on these criteria are listed in Table 47. Chemical-specific TBCs consisting of EPA human and ecological risk guidances were used to develop risk-based cleanup standards for soil and sediment throughout OU1and, specifically, to create risk-based standards to maintain the protectiveness of the West Cell. This alternative would attain chemical-specific ARARs and TBCs.

c. Action-specific ARARs and TBCs that are associated with the selected remedy are listed in Table 50.

It is expected that all activities can be designed and implemented to comply with action-specific ARARs, regarding the containment of OU1 contaminants, stormwater controls, water treatment/discharge standards, leachate collection and on-site treatment/discharge, Site monitoring, and institutional controls. Because the West Cell would only contain non-beneficiated waste rock, the cell would be exempt from Vermont Solid Waste Regulation requirements, but instead would be capped under federal Mine Reclamation and risk-based standards. Meanwhile, all of the flotation mill tailings and the partially-roasted ore, which are defined as beneficiated waste under the VTSWMR would be contained within the ORB Cell that would comply with the applicable regulations. The substantive requirements under these rules regulate the tailing wastes and roast bed material that were produced as part of the benefication of ore at the Site, but the rules do not apply to unprocessed waste rock. Section 6-1301(f) of the VTSWMR permits the waiver of technical and siting requirements of these rules provided there is a response action under CERCLA to a release or threatened release of hazardous substances or materials; and the proposed response action will not adversely affect public health, safety or the environment; and the technical and siting requirements will be complied with to the extent practical in light of the overall objectives of the response. For the ORB Cell to comply with the VTSWMR, liner requirements for disposal areas under § 1305(c)(2)(D) and (F) are waived under the VTSWMR. The remainder of § 6-1305 establishes the closure and post-closure performance standards that are applicable to the ORB Cell. The ORB Cell will be subject to closure

requirements that require that a facility be closed in a manner that: (a) Minimizes the need for further maintenance related to the waste facility; and (b) Controls, minimizes, or eliminates, to the extent necessary to prevent threats to public health and safety and the environment, including post-closure emission or discharge of waste, waste constituents, leachate, contaminated runoff, and/or waste decomposition products to the groundwater or surface waters or the atmosphere.

Any leachate generated after the containment areas are completed will be collected and treated to meet standards for on-site treatment and discharge to surface waters. Long-term monitoring of the waste management areas will include federal and state drinking/groundwater standards for monitoring groundwater, as well as federal and State surface water quality standards for monitoring Site waterways. The remediation of OU1 sediments would meet TBC standards under USEPA contaminated sediment guidance. Remediation throughout OU1 would meet State erosion control TBC guidance standards.

### 3. The Selected Remedy is Cost-Effective

In EPA's judgment, the selected remedy for OU1 is cost-effective because the remedy's costs are proportional to its overall effectiveness (see 40 C.F.R. § 300.430(f)(1)(ii)(D)). This determination was made by evaluating the overall effectiveness of those alternatives that satisfied the threshold criteria (i.e., that are protective of human health and the environment and comply with all Federal and any more stringent State ARARs, or as appropriate, waive specific ARARs). Overall effectiveness was evaluated by assessing three of the five balancing criteria – long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness – in combination. The overall effectiveness of each alternative then was compared to the alternative's costs to determine cost-effectiveness. The relationship of the overall effectiveness of the remedial alternative selected in this ROD was determined to be proportional to its costs, thereby representing a reasonable value for the money to be spent. The alternative selected for Remedial Action for OU1 is the least cost alternative among the alternatives considered that met the primary criteria.

### 4. The Selected Remedy Utilizes Permanent Solutions and Alternative Treatment or Resource Recovery Technologies to the Maximum Extent Practicable

Once the Agency identified those alternatives that attain or, as appropriate, waive ARARs, and that are protective of human health and the environment, EPA identified which alternative utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. This determination was made by deciding which one of the identified alternatives provides the best balance of trade-offs among alternatives in terms of: (1) long-term effectiveness and permanence; (2) reduction of toxicity, mobility or volume through treatment; (3) short-term effectiveness; (4) implementability; and (5) cost. The balancing test emphasizes long-term effectiveness and permanence and the reduction of toxicity, mobility and volume through treatment, and considers the preference for treatment as a principal element, the bias against off-site land disposal of untreated waste, and community and

State acceptance. The selected remedy for OU1 provides the best balance of trade-offs among the alternatives.

The selected remedy for OU1 provides the best balance of the five balancing criteria and other factors taken into consideration. It is the least expensive alternative that achieves protection of public health and the environment and complies with ARARs. None of the alternatives considered used treatment as a primary element to achieve any reduction of toxicity, mobility, or volume, although some limited treatment will occur through the use of treatment to address dewatering liquid and leachate from the containment cells. There were no principal threat wastes identified at the Site. Containment of the waste was determined to be the most cost-effective approach to achieve long-term effectiveness and permanence, and treatment was not practical for the large quantity of low level threat waste present within OU1. Short-term impacts associated with wetland resources, as well as community input regarding truck traffic, were taken into consideration. The long-term monitoring and five-year reviews will document that the protectiveness standards are being met. Maintenance of the remedial components along with monitoring and institutional controls will provide the long-term effectiveness.

### 5. The Selected Remedy Does Not Satisfy the Preference for Treatment Which Permanently and Significantly Reduces the Toxicity, Mobility or Volume of the Hazardous Substances as a Principal Element

The major components of the remedy are source control measures for large volumes of low level threat wastes, which is consistent with EPA guidance. There were no principal threat wastes identified at the Site. The treatment of water from dewatering of sediment and other media, as well as the treatment of any leachate that may be generated from the West Cell and OMB Cell would achieve some level of reduction in toxicity, mobility, and volume through treatment measures taken to achieve discharge standards

### 6. Five-Year Reviews of the Selected Remedy are Required

Because this remedy will result in hazardous substances remaining on-site above levels that will not allow for unlimited use and unrestricted exposure, a review will be conducted within five years after initiation of the remedial action, and every five years thereafter, to ensure that the remedy continues to provide adequate protection of human health and the environment. The five-year review period starts at the initiation of remedial action for the first operable unit at a site. The OU1 Remedy will be the first remedial action initiated at the Site.

## N. DOCUMENTATION OF NO SIGNIFICANT CHANGES

On July 27, 20011, EPA presented the OU1 Proposed Plan that described the cleanup proposal for the Ely Copper Mine Superfund Site. EPA reviewed all written and verbal comments submitted during the public comment period, which was open from July 28 to August 27, 2011. It was determined, after reviewing the comments received that no significant changes to the remedy, as originally identified in the Proposed Plan, were necessary (See Appendix C)..

## O. STATE ROLE

The State of Vermont Department of Environmental Conservation has reviewed the various alternatives and has indicated its support for the selected remedy. The State has also reviewed the OU1 Remedial Investigation, Risk Assessment and Feasibility Study with respect to the Site to determine whether the selected remedy is in compliance with applicable or relevant and appropriate State environmental and facility siting laws and regulations. The State of Vermont concurs with the selected remedy for OU1 for the Ely Copper Mine Superfund Site. A copy of the declaration of concurrence is attached as Appendix B.

ELY COPPER MINE
OU1 RECORD OF DECISION

APPENDIX A

ARAR TABLES AND FIGURES

**Table 48**
**Location-Specific ARARs and TBCs for OU1 Remedial Action (Alternative SC3)**
**Ely Copper Mine Superfund Site**
**Vershire, Vermont**


| REQUIREMENT | STATUS | REQUIREMENT SYNOPSIS | ACTION TAKEN TO COMPLY WITH ARARs |
|---|---|---|---|
| | | **STATE ARARs and TBCs** | |
| Vermont's Land Use and Development Law (Act 250), 10 VSA Chapter 151 | Applicable | Issues to be addressed in assessing compliance with Act 250 include substantive environmental and facility siting requirements associated with:<br>• will not result in undue water and air pollution (including construction-related dust) (criterion 1);<br>• protection of headwaters (criterion 1(A));<br>• will meet all standards for disposal of wastes (criterion 1(B));<br>• floodways (criterion 1(D));<br>• streams (criterion 1(E));<br>• impact on state-regulated wetlands (Class One, Two, and Three; (criterion 1(G));<br>• erosion control (criterion 4);<br>• impact on historic sites (criterion 8(A));<br>• endangered species (criterion 8(B)); and<br>• extraction of earth resources (criterion 9(E))<br>• energy conservation (criterion 9(F)); and<br>• public investments (roads) (criterion 9(K)).. | The OU1 remedial action (SC3) will be designed to minimize impacts on protected resources under the Act's criteria, as appropriate. The EPA has determined that unavoidable impacts to wetlands (primarily Class Three), and historic resources are necessary to abate the release of ARD. Furthermore, the OU1 remedial action development of the West Containment Cell will be located away from waterways resulting in less impact on streams and floodways. The OU1 remedial action will be designed to minimize energy consumption and impacts on pubic investments (roads) by obtaining material for the cover system from on-site sources to the extent practical. Measures to minimize impacts from the extraction of earth resources (soil and rock) will be implemented. Site work needs to be managed to minimize impacts to potential endangered species habitat onsite. |
| Vermont Wetlands Act, 10 VSA Ch. 37; Vermont Wetland Rules (Nat. Res. Brd., Water Res. P. 12-004-056) | Applicable | These standards establish criteria for delineating Class One and Class Two wetlands, which are considered significant wetlands, and set forth allowed and conditional uses for these wetlands. Jurisdiction under the Rules includes within a 50 foot buffer zone to Class Two wetlands. The uses must not have undue adverse impacts on the significant functions of the wetland. Class Three wetlands are defined, but are not protected under these rules (they are addressed under Title 10 V.S.A. Chapter 151, above). | No Class One wetlands occur onsite and Class Two wetlands are limited to the Pond 1 area on the east side of the Site. Alteration of any Class Two wetlands will be mitigated, as required, to restore ecological functions and values. Class Three wetlands will also be disturbed but are not regulated under the Act. |
| Vermont Regulation of Stream Flow, 10 VSA Chapter 41 | Applicable | Regulates and permits activities in streams to protect against damage to fish life or wildlife, prevent creation of flood hazards, and protect from damaging the rights of riparian owners. | Permanent alteration of the streams (permanent or intermittent ephemeral) during the completion of OU1 remedial action will occur as an unavoidable consequence of the activities required to restore the stream to meet Vermont Class B Water Quality Standards within OU1. |
| Vermont Obstruction of Streams, 10 VSA Chapter 111, § 1407 | Applicable | Regulation of obstructions that the prevent the passing of fish in a stream or the outlet or inlet of a natural or artificial pond on a public stream, by means of a rack, screen, weir or other obstruction, | Remedial work in streams will be conducted to permit the passage of fish through the waterways once water quality is restored to support fish populations in the applicable portions of the streams. |
| Vermont ANR Guidance on Riparian Buffers (December 5, 2005) | To Be Considered | This guidance provides technical information on the functions and values of riparian buffers, as well as describing acceptable activities within buffer zones. It recommends the establishment of 100 foot buffer zones to streams under circumstances where there is an increased risk of erosion and/or potential for overland flow of pollutants. Where Class II wetlands are contiguous to a waterbody, buffer widths of greater than 50 feet may be recommended based on case-specific application of this Guidance. This Guidance will also be used to recommend buffers for Class III wetlands contiguous to waterbodies, as necessary to maintain the functions and values of the riparian area. | The OU1 remedial action, particularly the West Containment Cell to be sited within riparian buffer zone, will be implemented and maintained to protect the Site's riparian buffer zone resources and protect the water quality of the adjacent waterways. |

**Table 48**
**Location-Specific ARARs and TBCs for OU1 Remedial Action (Alternative SC3)**
**Ely Copper Mine Superfund Site**
**Vershire, Vermont**


| REQUIREMENT | STATUS | REQUIREMENT SYNOPSIS | ACTION TAKEN TO COMPLY WITH ARARs |
|---|---|---|---|
| | | **STATE ARARs and TBCs (cont.)** | |
| Vermont Historic Preservation Law, 22 VSA §§ 743(4), 761, 763, and 767. | Relevant and Appropriate | Places controls on actions conducted by the state that may impact historic, scientific, or archaeological sites and data. | EPA has determined that unavoidable adverse impacts will occur to historic resources at the Site. The OU1 remedial action would result in the damage of former building foundations as well as covering the ORB and potentially the retaining wall. EPA will consult with the SHPO and the community regarding the loss of historic resources. Additional investigation will be required for any areas to be developed as an onsite borrow source. |
| Vermont Endangered Species Law, 10 VSA, Chapter 123 | Applicable for Listed Species | This Vermont statute outlines the definition of endangered and threatened, the procedure for obtaining permits to take endangered or threatened species, and the species listed as endangered or threatened. The statute prohibits the taking, possession or transport of wildlife or plants that are members of an endangered or threatened species without a permit, and sets forth fines for violators. Three bat species that may be present on the Site are specifically listed as threatened or endangered species in Vermont: the Small-footed Bat, Northern Long-eared Bat, and the Little Brown Bat. | The OU1 remedial action will be managed to prevent disturbance to any potential rare bat habitat. |
| | | **FEDERAL ARARs and TBCs** | |
| Floodplain Management and Protection of Wetlands, 44 C.F.R. 9 | Relevant and Appropriate | Remedial alternatives that may cause alteration within a 500-year floodplain/cause negative impacts to downstream floodplain or that will cause alteration of federal jurisdictional wetlands/aquatic habitats will be implemented in compliance with these relevant and appropriate FEMA standards (which promulgate requirements under Executive Order 11988 (Floodplain Management) and Executive Order 11990 (Protection of Wetlands)). Prohibits activities that adversely affect a federally-regulated wetland unless there is no practicable alternative and the proposed action includes all practicable measures to minimize harm to wetlands that may result from such use. Requires soliciting public comment on any disturbance of floodplains or federally-regulated wetlands. | There will be unavoidable impacts to federally-regulated wetlands during the implementation of the remedy which would occur in order to abate the ongoing impacts to the wetlands and surface water surrounding the waste rock and tailings. Wetlands mitigation will be conducted, as required. A wetlands delineation would will be implemented as a component of the design for the OU1 remedial action. The EPA solicited public comment in the Proposed Plan regarding the potential impacts to wetlands at the Site and to floodplain resources downstream. No comments were received. EPA received support from the VT DEC and the United States Fish and Wildlife Service (USFWS) for its finding that the remedy is the least damaging practicable alternative for protecting wetland resources. EPA did not receive any comments in opposition to the finding. The remedial action will be managed to prevent any downstream flooding impacts." |

**Table 48**
**Location-Specific ARARs and TBCs for OU1 Remedial Action (Alternative SC3)**
**Ely Copper Mine Superfund Site**
**Vershire, Vermont**


| REQUIREMENT | STATUS | REQUIREMENT SYNOPSIS | ACTION TAKEN TO COMPLY WITH ARARs |
|---|---|---|---|
| Federal Clean Water Act, Section 404, 33 USC § 1344; 40 CFR Part 230; 33 CFR Parts 320-323 | Applicable | Prohibits the discharge of dredge or fill material into a federally-regulated aquatic ecosystem if a practicable alternative with lesser effects is available. For any alternative selected that may dredge or fill a water of the U.S., a finding that No Practicable Alternative was available and that the general prohibitions in 40 CFR 230.10 and the factual determinations of 40 CFR 230.11 were unavoidable is required. Under these standards EPA must solicit public comment on its finding that one of the alternatives is the Least Environmentally Damaging Practicable Alternative. | The OU1 remedial action will include potential dredge and fill activities associated with the removal of contaminated sediments from Ely Brook and its tributaries and ponds, the construction of the West Containment Cell, the excavation and re-location of UWA and LWA, and the consolidation of the tailings at the ORB Cell. The implementation would use BMPs to minimize the impacts of the cleanup, particularly on downstream surface water resources. EPA solicited public comment in the Proposed Plan as to its finding that OU1 remedial action (SC3) is the Least Environmentally Damaging Practicable Alternative to protect wetland resources at the Site. There were no comments received regarding that determination. EPA received support from the VT DEC and the United States Fish and Wildlife Service (USFWS) for its finding and did not receive any comments in opposition to the finding. |

**Table 48**
**Location-Specific ARARs and TBCs for OU1 Remedial Action (Alternative SC3)**
**Ely Copper Mine Superfund Site**
**Vershire, Vermont**


| REQUIREMENT | STATUS | REQUIREMENT SYNOPSIS | ACTION TAKEN TO COMPLY WITH ARARs |
|---|---|---|---|
| | | **FEDERAL ARARs and TBCs (cont.)** | |
| Federal Fish and Wildlife Coordination Act; 16 USC 661 *et seq*., as amended | Applicable | Consultation with the U.S. Fish and Wildlife Service and appropriate state wildlife agency is required for modification of a body of water or federally- listed endangered or threatened species habitat. Consultation is required to develop measures to prevent, mitigate, or compensate for the loss of fish and wildlife or federally-listed endangered or threatened species habitat. | The implementation of the design and cleanup for the OU1 remedial action will be coordinated with the U.S. Fish and Wildlife Service and State wildlife officials. |
| Federal Endangered Species Act of 1973 (ESA), 16 USC 1531 *et seq*.; 33 CFR Part 320 | To Be Considered | The purpose of the ESA is to "conserve the ecosystems upon with threatened and endangered species depend" and to conserve and recover listed species. Federal agencies must consult with the U.S. Fish and Wildlife Service to ensure that the actions they authorize, fund, or carry out will not jeopardize listed species. The law provides for critical habitat designations for listed species. Critical habitat designations affect Federal agency actions and federally funded or permitted activities. The Small-footed Bat, which may occur on the Site, is proposed to be *federally-listed* as a threatened or endangered species. | EPA will consult with federal and state wildlife officials to identify measures to prevent disturbance to any potential rare bat habitat. |
| National Historic Preservation Act (NHPA), Section 106, 16 USC 470 *et seq*., 36 CFR Part 800 | Applicable | Section 106 of the NHPA of 1966 requires EPA to take into account the effect of all of its actions on historic properties. In consultation with the State Historic Preservation Officer (SHPO), a determination has been made that the Ely Mine Site is eligible for the National Register. The consultation is to identify potential adverse effects on historic properties and seek ways to avoid, minimize or mitigate any such effects on historic properties. | EPA has determined that unavoidable adverse impacts will occur to historic resources at the Site. The OU1 remedial action will result in the damage of former building foundations as well as covering the ORB and potentially the retaining wall. EPA will consult with the SHPO and the community regarding the loss of historic resources. Additional investigations will be required for any areas on Site that may be developed, such as the West Containment Cell area, that has not been previously investigated. |
| Archeological and Historic Preservation Act, 16 USC 469 *et seq*., 36 CFR, Part 65 | Applicable | This standard requires that, whenever any federal agency finds or is made aware that its activity in connection with any construction project or federally licensed project, activity, or program may cause irreparable loss or destruction of significant scientific, pre-historical, historical, or archeological data such agency shall undertake the recovery, protection, and preservation of such data or notify the Secretary of the Interior. The undertaking could include a preliminary survey (or other investigation as needed) and analysis and publication of the reports resulting from such investigation. | Preliminary surveys have identified significant archaeological data that may be located in the area subject to disturbance. The design will identify any significant scientific, pre-historic, or archaeological data that may suffer irreparable loss or destruction and develop plans for appropriate data recovery. Additional investigations may be required for any areas on Site that may be altered for the remedy and have not been previously investigated. |

**Table 49**
**Chemical-Specific ARARs and TBCs for OU1 Remedial Action (Alternative SC3)**
**Ely Copper Mine Superfund Site**
**Vershire, Vermont**


| REQUIREMENT | STATUS | REQUIREMENT SYNOPSIS | ACTION TAKEN TO COMPLY WITH ARARs |
|---|---|---|---|
| **STATE ARARs and TBCs** | | | |
| Vermont Water Pollution Control Act, 10 VSA Chapter 47; Vermont Water Quality Standards, Ch. 1, 2, and 3 and Appendix C and D | Applicable | Establishes water quality standards for Class B cold water streams and aquatic health standards for warm waterbodies. The standards apply to remedial actions that call for achieving water quality standards for surface water bodies on Site. | Alternative SC3 will achieve these water quality standards in OU1's cold water streams and warm water aquatic habitats by consolidation and capping (establishment of the West and ORB containment cells) eliminating the source of OU1 contaminants migrating to Site waterways. Within the cold water streams in OU1 Class B waters standards will be achieved upon the completion of the remedy. Ponds/warm water habitats within OU1 will acheive these aquatic health standards for warm waters upon completion of the remedy. |
| **FEDERAL ARARs and TBCs** | | | |
| Federal Clean Water Act, National Recommended Water Quality Criteria (NRWQC), 40 CFR Part 122.44 | Relevant and Appropriate | Establishes water quality standards for Class B cold water streams and aquatic health standards for warm waterbodies. The standards apply to remedial actions that call for achieving water quality standards for surface water bodies on Site. | Alternative SC3 will achieve these water quality standards in OU1's cold water streams and warm water aquatic habitats by consolidation and capping (establishment of the West and ORB containment cells) eliminating the source of OU1 contaminants migrating to Site waterways. Within the cold water streams in OU1 Class B waters standards will be achieved upon the completion of the remedy. Ponds/warm water habitats within OU1 will acheive these aquatic health standards for warm waters upon completion of the remedy. |
| EPA Risk Reference Doses (RfDs) | To Be Considered | Risk reference doses (RfDs) are estimates of daily exposure levels that are unlikely to cause significant adverse non-carcinogenic health effects over a lifetime. | This alternative will achieve cleanup standards based on this guidance, since the actions taken will address site risks through consolidation and capping, along with long-term institutional controls and monitoring, of site contamination that poses a non-cancer human health risk. |
| EPA Carcinogen Assessment Group, Cancer Slope Factors (CSFs) | To Be Considered | CSFs are used to compute the incremental cancer risk from exposure to contaminants and represent the most up-to-date information on cancer risk from EPA's Carcinogen Assessment Group. | This alternative will achieve cleanup standards based on this guidance, since the actions taken will address site risks through consolidation and capping, along with long-term institutional controls and monitoring, of site contamination that poses a carcinogenic human health risk. |
| Guidelines for Carcinogen Risk Assessment EPA/630/P-03/001F (March 2005) | To Be Considered | Guidance for assessing cancer risk. Used to establish risk-based standards for managing waste rock at the Site. | This alternative will achieve cleanup standards based on this guidance, since the actions taken will address site risks through consolidation and capping, along with long-term institutional controls and monitoring, of site contamination that poses a carcinogenic human health risk. |

**Table 49**
**Chemical-Specific ARARs and TBCs for OU1 Remedial Action (Alternative SC3)**
**Ely Copper Mine Superfund Site**
**Vershire, Vermont**


| REQUIREMENT | STATUS | REQUIREMENT SYNOPSIS | ACTION TAKEN TO COMPLY WITH ARARs |
|---|---|---|---|
| Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens EPA/630/R-03/003F (March 2005) | To Be Considered | Guidance of assessing cancer risks to children. Used to establish risk-based standards for managing waste rock at the Site. | This alternative will achieve cleanup standards based on this guidance, since the actions taken will address site risks through consolidation and capping, along with long-term institutional controls and monitoring, of site contamination that poses a carcinogenic human health risk to children. |
| *Proposed Guidelines for the Clean-Up of Contaminated Sites in Ontario* (Ministry of Environment and Energy of Ontario [MOE], 1994) | To Be Considered | This guidance document lists surface water and sediment criteria that are considered protective for aquatic organisms. | This alternative will achieve cleanup standards based on this guidance, since the actions taken will address site risks through consolidation and capping, along with long-term institutional controls and monitoring, of site contamination that poses an ecological risk. |
| *Preliminary Remediation Goals for Ecological Endpoints*, Efroymson et al., August 1997 | To Be Considered | This technical memorandum was prepared to present recommended preliminary remediation goals (PRGs) for surface water, sediment and soil for ecological endpoints for risk assessments and decision making at CERCLA sites. | This alternative will achieve cleanup standards based on this guidance, since the actions taken will address site risks through consolidation and capping, along with long-term institutional controls and monitoring, of site contamination that poses an ecological risk. |

**Table 50**
**Action-Specific ARARs and TBCs for OU1 Remedial Action (Alternative SC3)**
**Ely Copper Mine Superfund Site**
**Vershire, Vermont**


| REQUIREMENT | STATUS | REQUIREMENT SYNOPSIS | ACTION TAKEN TO COMPLY WITH ARARs |
|---|---|---|---|
| | | **STATE ARARs and TBCs** | |
| Vermont Water Pollution Control Act, 10 VSA Chapter 47; Vermont Water Quality Standards, Ch. 1, 2, and 3 and Appendix C and D | Applicable | Establishes water quality standards for surface waters and applies to alternatives that call for monitoring surface water bodies on and off of the Site. | These standards will be used to monitor the water quality of the OU1 waterways to assess the success of the OU1 remedial action in eliminating the source of OU1 contaminants migrating to Site waterways and achieving surface water RGs. Within the cold water streams Class B waters standards will be used for monitoring. Ponds/warm water habitats on the Site will be monitored to assess whether the waterways meet aquatic health standards for warm waters. In addition, long-term monitoring will ensure that source control remedies at the Site are preventing metals and ARD from migrating to surface waters and exceeding the waterways' water quality standards. |
| Vermont National Pollutant Discharge Elimination System (NPDES) Regulations Ch. 13 (Nat. Res. Brd., Water Res. P. 12-004-052) | Applicable | The regulations stipulate requirements for discharges to surface waters, compliance with NPDES standards, and meeting stormwater management requirements. Groundwater and stormwater removed from excavations and dewatering liquid from dewatering soil and sediment may require treatment prior to discharge. | Water generated from remedial activities will be treated to meet discharge standards. Site disturbance will be conducted in compliance with stormwater management standards. |
| Vermont Stormwater Management Act, 10 VSA § 1263 and §1264; Vermont Stormwater Management Rule, Env. Prot. R. Ch. 18 | Applicable | This rule applies to discharges of regulated stormwater runoff to waters that are not listed on the EPA-approved Vermont 303(d) List of Waters as being impaired principally due to stormwater runoff. The rule establishes a state permit program for post-construction management of stormwater runoff; establishes permitting thresholds for discharges; sets forth treatment standards; provides for the issuance of individual and general permits; specifies application requirements; and amends the Vermont Stormwater Management manual.<br><br>The rule generally applies to stormwater discharges from construction activities greater than or equal to one-acre. | The OU1 remedial action will include measures to comply with these requirements through the design of measures to mitigate the release of stormwater from disturbed areas of the Site. |
| Vermont Groundwater Protection Act, 10 VSA §§ 1390-94; Vermont Groundwater Protection Rule and Strategy, Env. Prot. Ch. 12-702 and 703 | Applicable | Establishes standards for groundwater quality. Management criteria for each groundwater class are established as well as primary and secondary standards for groundwater protection. These are the primary groundwater standards if they are more stringent than federal standards. Within the compliance boundary for any waste management unit these standards are used as monitoring standards. | These standards will be used for monitoring groundwater within and outside of the compliance boundary for the waste management area established for the Site to make sure that contaminants do not migrate from the West Containment Cell and the Ore Roast Bed Cell into the groundwater. |
| Vermont Department of Health Drinking Water Guidance (October 2000). | To Be Considered | Lists the Vermont Health Advisories (VHAs) for chemicals of concern in drinking water. Vermont Health Advisories are researched and calculated concentrations of chemicals in drinking water in instances where the chemicals do not have a promulgated federal or state standard, or more stringent federal risk-based standard. Within the compliance boundary for any waste management unit these standards are used as monitoring standards. | These standards will be used for monitoring groundwater within and outside of the compliance boundary for the waste management area established for the Site to make sure that contaminants do not migrate from the West Containment Cell and the Ore Roast Bed Cell into the groundwater. |

**Table 50**
**Action-Specific ARARs and TBCs for OU1 Remedial Action (Alternative SC3)**
**Ely Copper Mine Superfund Site**
**Vershire, Vermont**

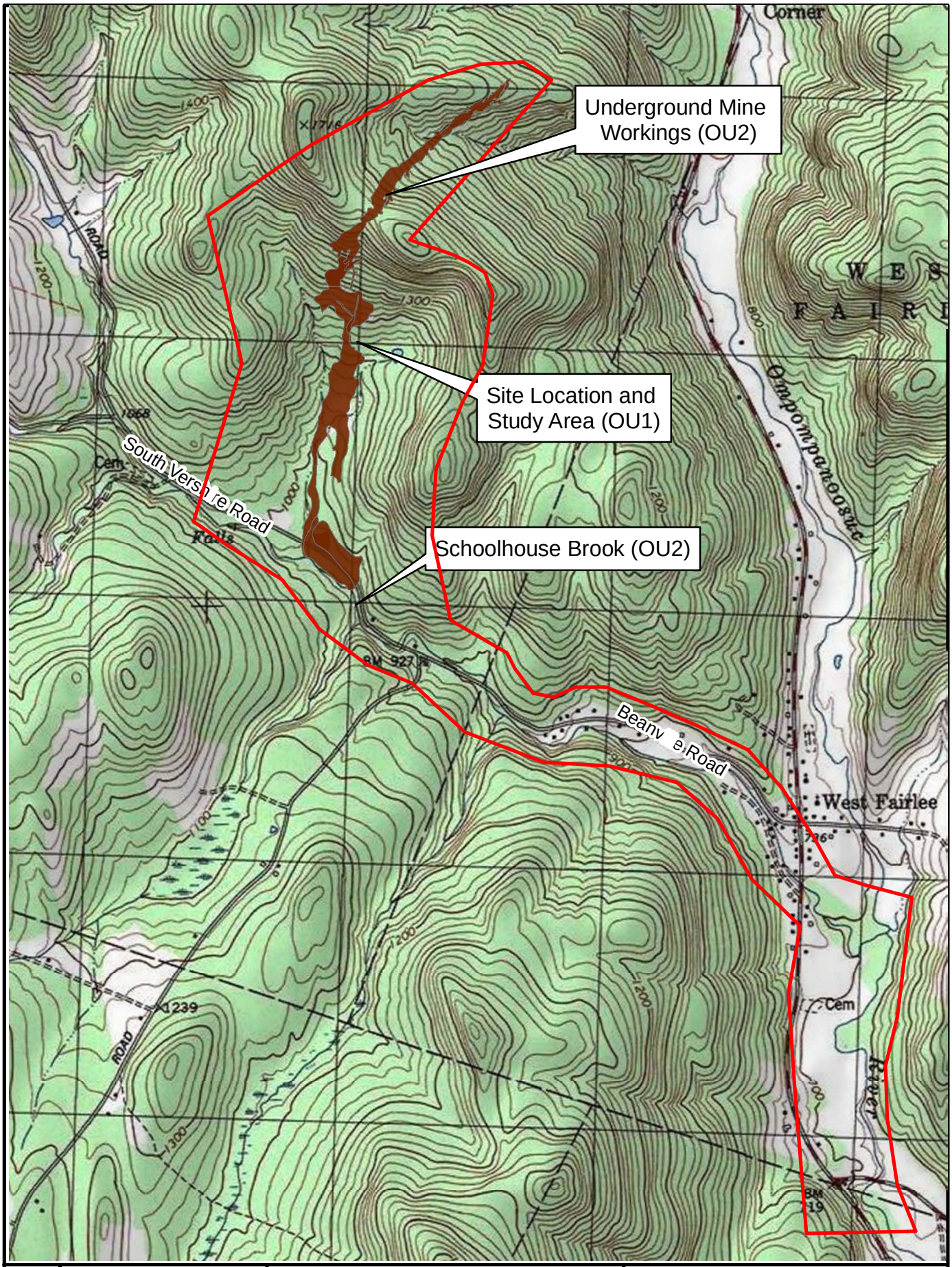

| REQUIREMENT | STATUS | REQUIREMENT SYNOPSIS | ACTION TAKEN TO COMPLY WITH ARARs |
|---|---|---|---|
| | | **STATE ARARs and TBCs (cont.)** | |
| Vermont Solid Waste Management Rules (VSWMR), Management of Mining and Mineral Processing Waste, Env. Prot. R. Ch. 6, Subchapter 13 | Applicable | These substantive requirements under these rules regulate the tailing wastes and roast bed material that were produced as part of the benefication of ore at the Site, but the rules do not apply to unprocessed waste rock. However, Section 6-1301(f) permits the waiver of technical and siting requirements of these rules provided there is a response action under CERCLA to a release or threatened release of hazardous substances or materials; and the proposed response action will not adversely affect public health, safety or the environment; and the technical and siting requirements will be complied with to the extent practical in light of the overall objectives of the response. In particular, liner requirements for disposal areas under § 1305(c)(2)(D) and (F) are waived. The remainder of § 6-1305 establishes the closure and post-closure performance standards that are applicable to the remedial action. That is, all facilities subject to closure requirements must be closed in a manner that: (a) Minimizes the need for further maintenance related to the waste facility; and (b) Controls, minimizes, or eliminates, to the extent necessary to prevent threats to public health and safety and the environment, including post-closure emission or discharge of waste, waste constituents, leachate, contaminated runoff, and/or waste decomposition products to the groundwater or surface waters or the atmosphere. | This Alternative will meet these standards, except for standards that have been waived regarding liner requirements under § 1305(c)(2)(D) and (F), for the management, consolidation, and capping of tailings and roasted ore that are regulated under these regulations. Waiver of liner requirements will not adversely affect public health, safety, or the environment. |
| Vermont Waste Management Act, 10 VSA Chapter 159 and Hazardous Waste Management Regulations, Env. Prot. R. Ch. 7 | Applicable | Establishes requirements for the identification and management of hazardous waste. These regulations apply to solutions having pH less than 2 or contaminated media that exceeds toxicity standards under these regulations. Treatment media or any other wastes that are disposed of off-site will be tested to determine if it exceeds the standards to be managed and disposed of as hazardous waste. Incorporates requirements of the federal Resource Conservation and Recovery Act regulations, 40 CFR 264. | Wastes generated by the remedial action for off-site disposal will be tested for hazardous waste characteristics. If the wastes exceed these standards they will be handled under the requirements of these regulations. |
| Vermont Slash Removal, 10 VSA § 2648 | Applicable | Forest growth may only be cut if all slash adjoining the right-of-way of any public highway, or the boundary lines of woodlots owned by adjoining property owners, is removed for a distance of 50 feet from the right-of-way of any public highway or from the boundary lines of woodlots owned by adjoining property owners. Furthermore, main roads through cut-over areas must be kept free from slash so that there is unobstructed access for fire fighting equipment and fire suppression crews. | Wooded debris produced from clearing wooded areas for borrow development and other remedial actions will be managed so as not to pose a fire or site access risk. |
| Vermont Air Pollution Control Act, 10 VSA Chapter 23 and Air Pollution Control Regulations, Env. Prot. R. Ch. 5 | Relevant and Appropriate | Establishes authority for a coordinated statewide program of air pollution prevention, abatement and control. Lists prohibited activities affecting air quality and establishes primary and secondary ambient air quality standards for sulfur oxides, particulate matter, carbon monoxide, ozone, nitrogen dioxide, and lead. The secondary standard for particulate matter is 150 micrograms per cubic meter, 24 hour average, not to be exceeded more than once per year. | The OU1 remedial action will be designed to comply with these requirements. Cleanup actions and long term maintenance of the capped cells will be designed and implemented to meet these requirements by limiting particulate matter emissions. |

**Table 50**
**Action-Specific ARARs and TBCs for OU1 Remedial Action (Alternative SC3)**
**Ely Copper Mine Superfund Site**
**Vershire, Vermont**


| REQUIREMENT | STATUS | REQUIREMENT SYNOPSIS | ACTION TAKEN TO COMPLY WITH ARARs |
|---|---|---|---|
| **STATE ARARs and TBCs (cont.)** | | | |
| Vermont Handbook for Erosion Prevention and Sediment Control, Working Interim Document, Released in 2003 (VTDEC, 2003) | To Be Considered | A compilation of information from various sources released by the Vermont Department of Environmental Conservation for use in developing the erosion prevention and sediment control plans required for construction-related stormwater discharge permitting. | The manual will be used as guidance in the development of measures to prevent erosion and sedimentation from remedial activities at the Site. |
| **FEDERAL ARARs and TBCs** | | | |
| Federal Clean Water Act, Section 402 – National Pollution Discharge Elimination System (33 USC 1342; 40 CFR 122-135, 131) | Applicable | The CWA contains discharge limitation, monitoring requirements, and best management practices (BMPs) for discharges into navigable waters, i.e., surface waters. These regulations would be applicable to remedial strategies involving discharge to surface waters. Groundwater and stormwater removed from excavations and dewatering liquid from dewatering soil and sediment may require treatment prior to discharge. | Water generated from remedial activities will be treated to meet discharge standards. Site disturbance will be conducted in compliance with stormwater management standards. |
| Federal Clean Water Act – Stormwater Requirements for Construction Sites; 40 CFR 122.26(b)(15), (c)(1) | Applicable | Applicable to construction activity including clearing, grading and excavation, except operations that result in the disturbance of one acre or more of total land area. | Construction activities and long-term maintenance will use best management practices to comply with these requirements. |
| Safe Drinking Water Act, 42 U.S.C. §300f *et seq.*; Maximum Contaminant Levels (MCLs), National primary drinking water regulations, 40 C.F.R. 141, Subparts B and G | Relevant and Appropriate | Establishes MCLs for common organic and inorganic contaminants applicable to public drinking water supplies. Used as relevant and appropriate standards for aquifers and surface water bodies that are potential drinking water sources. | These standards will be used for monitoring groundwater within and outside of the compliance boundary for the waste management area established for the Site to make sure that contaminants do not migrate from the West Containment Cell and the Ore Roast Bed Cell into the groundwater. |
| Safe Drinking Water Act, 42 U.S.C. §300f *et seq.*; Maximum Contaminant Level Goals (MCLGs), National Primary Drinking Water Regulations, 40 CFR Parts 141, Subpart F | Relevant and Appropriate for non-zero MCLGs only; MCLGs set as zero are To Be Considered | Establishes maximum contaminant level goals (MCLGs) for public water supplies. MCLGs are health goals for drinking water sources. These unenforceable health goals are available for a number of organic and inorganic compounds. Used as relevant and appropriate standards for aquifers and surface water bodies that are potential drinking water sources. | These standards will be used for monitoring groundwater within and outside of the compliance boundary for the waste management area established for the Site to make sure that contaminants do not migrate from the West Containment Cell and the Ore Roast Bed Cell into the groundwater. |
| Resource Conservation and Recovery Act, 42 USC §§ 6901-6992; 40 CFR Part 264 | Applicable | Vermont is delegated to implement these standards through its Hazardous Waste Management Regulations (see above). | Wastes generated by the remedial action for off-site disposal will be tested for hazardous waste characteristics. If the wastes exceed these standards they will be handled under the requirements of these regulations. |

**Table 50**
**Action-Specific ARARs and TBCs for OU1 Remedial Action (Alternative SC3)**
**Ely Copper Mine Superfund Site**
**Vershire, Vermont**


| REQUIREMENT | STATUS | REQUIREMENT SYNOPSIS | ACTION TAKEN TO COMPLY WITH ARARs |
|---|---|---|---|
| **FEDERAL ARARs and TBCs (cont.)** | | | |
| Federal Clean Water Act, National Recommended Water Quality Criteria (NRWQC), 40 CFR Part 122.44 | Relevant and Appropriate | These standards are used to develop numerical and biological water quality standards for monitoring surface water quality. | These standards will be used to monitor the water quality of the OU1 waterways to assess the success of the OU1 remedial action in eliminating the source of OU1 contaminants migrating to Site waterways and achieving surface water RGs . Within the cold water streams Class B waters standards will be used for monitoring. Ponds/warm water habitats on the Site will be monitored to assess whether the waterways meet aquatic health standards for warm waters. In addition, long-term monitoring will ensure that source control remedies at the Site are preventing metals and ARD from migrating to surface waters and exceeding the waterways' water quality standards. |
| Contaminated Sediment Remediation Guidance for Hazardous Waste Sites (EPA-540-R-05-012 OSWER 9355.0-85 December 2005) | To Be Considered | Guidance for making remedy decisions for contaminated sediment sites. Specific sections of the guidance address dredging and disposal of contaminated sediments. | Removal of contaminated sediments from ponds and waterways and containment in the West Cell will comply with standards identified in this guidance. |
| Federal Surface Mining Control and Reclamation Act of 1977, 30 USC §§ 1201-1328; 30 CFR 816 and 817 | Relevant and Appropriate | Provides closure guidelines for coal sites. Design criteria for the closure of tailing at coal sites are relevant and appropriate for construction and closure of containment cells at this Site. | The OU1 selected remedy will be designed to minimize the exposure through consolidation of the waste within containments cells with a low permeability cover system. Areas of exposed mine material will be revegetated to achieve reclamation standards. |




N

APPROXIMATE SCALE
0 400 800 1,600 Feet

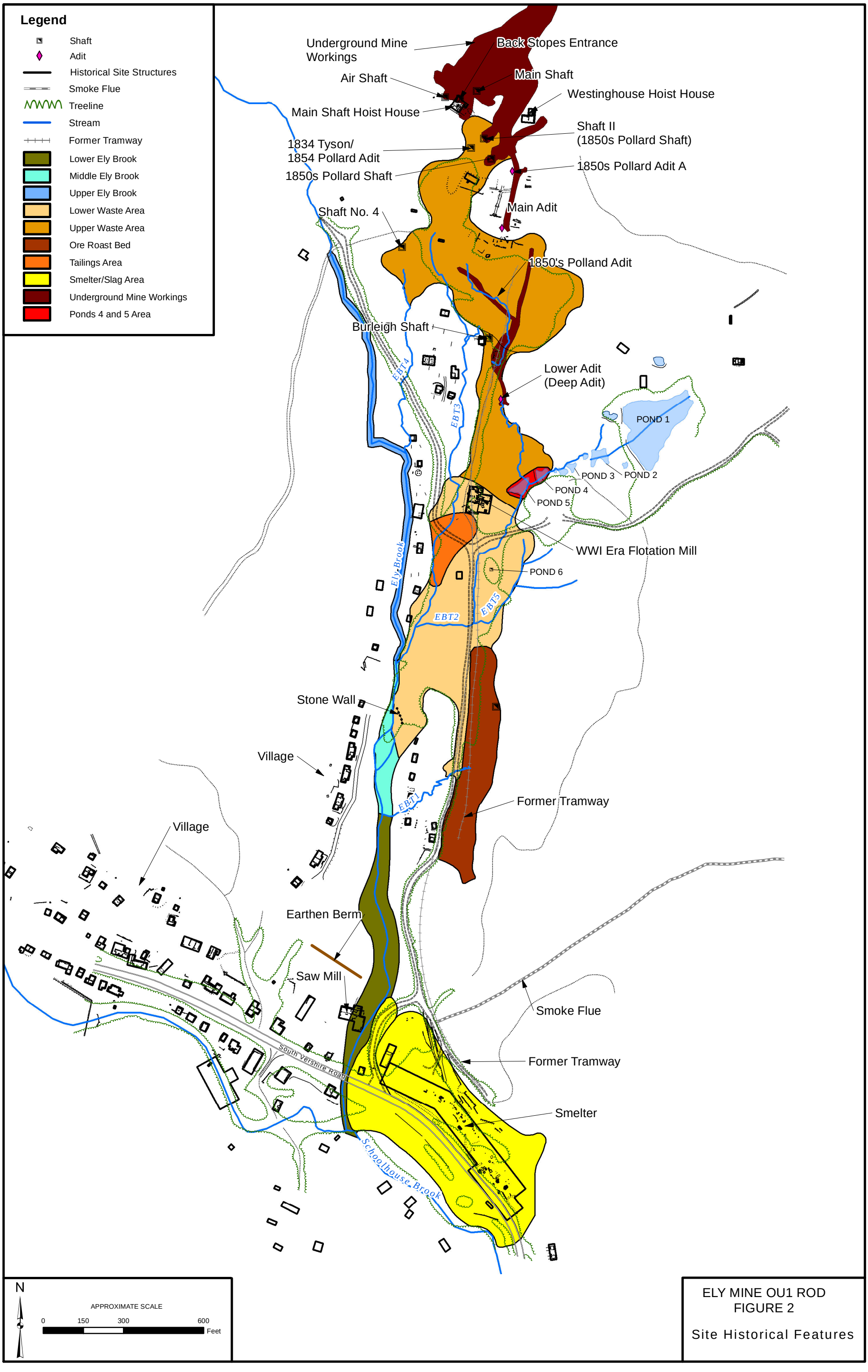
Quadrangle Location

USGS TOPOGRAPHIC MAP

VERSHIRE, VERMONT
1981; (Photo-inspected 1983)

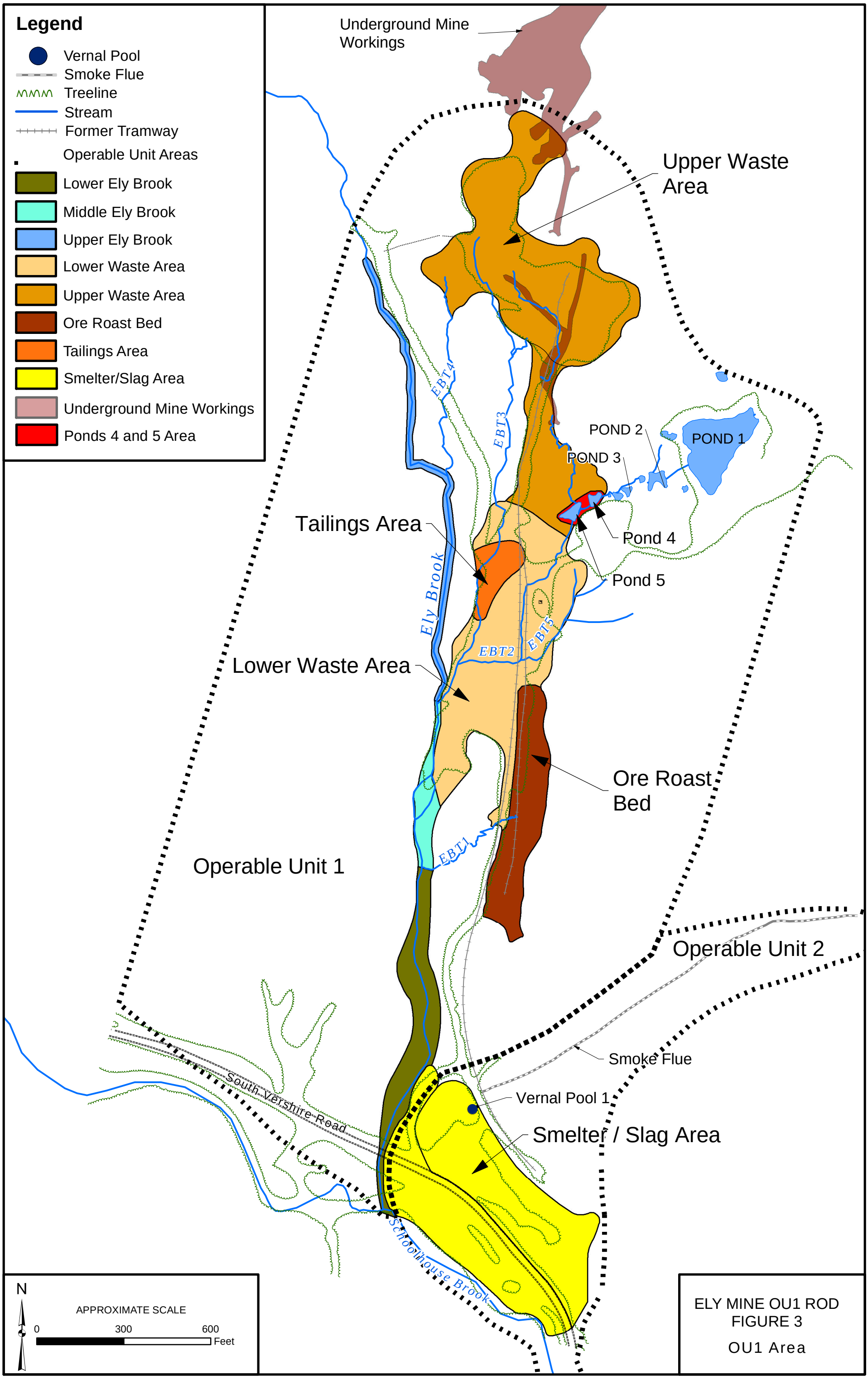
ELY MINE OU1 ROD
FIGURE 1

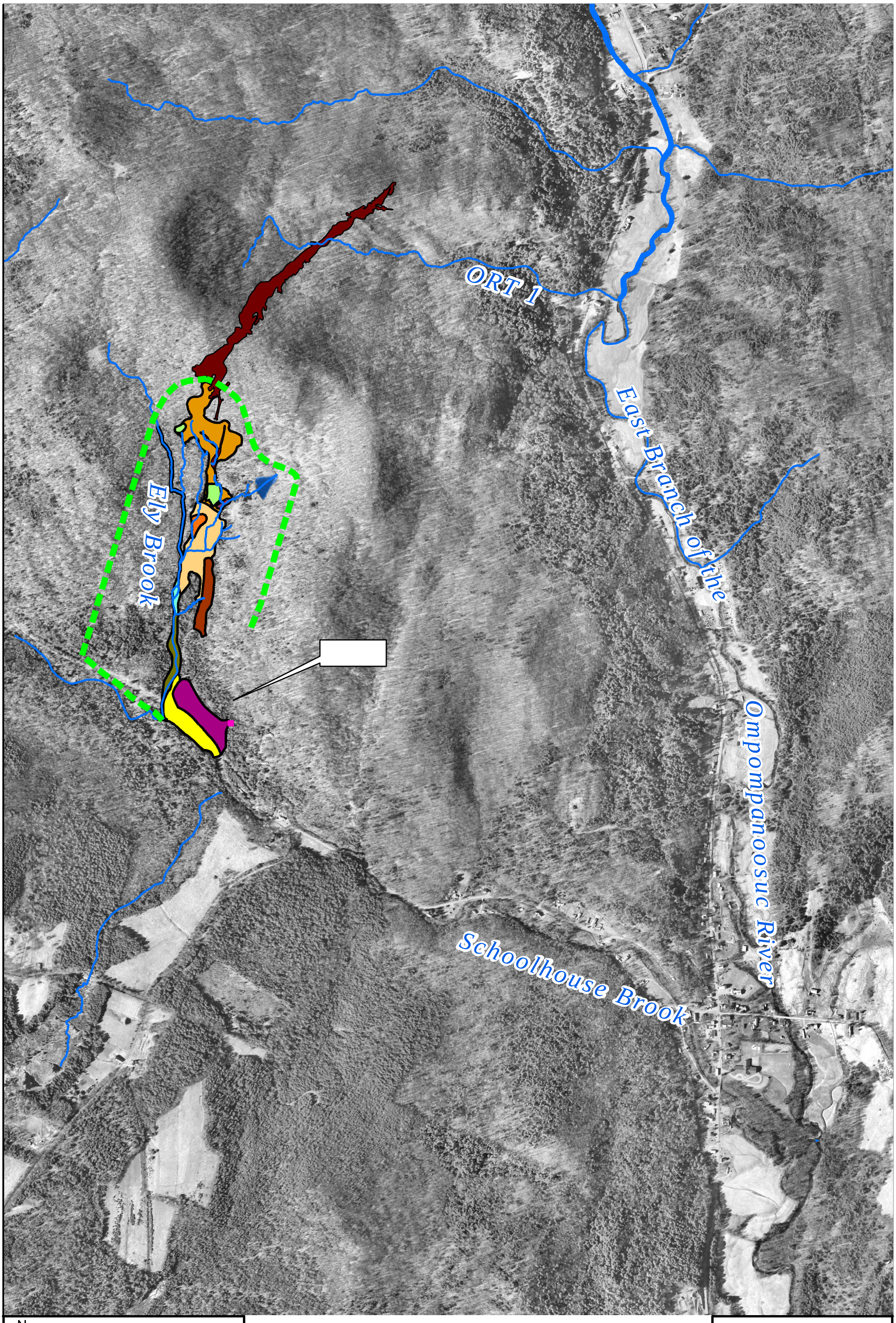
Site Study Area and Location




ELY MINE OU1 ROD
FIGURE 2

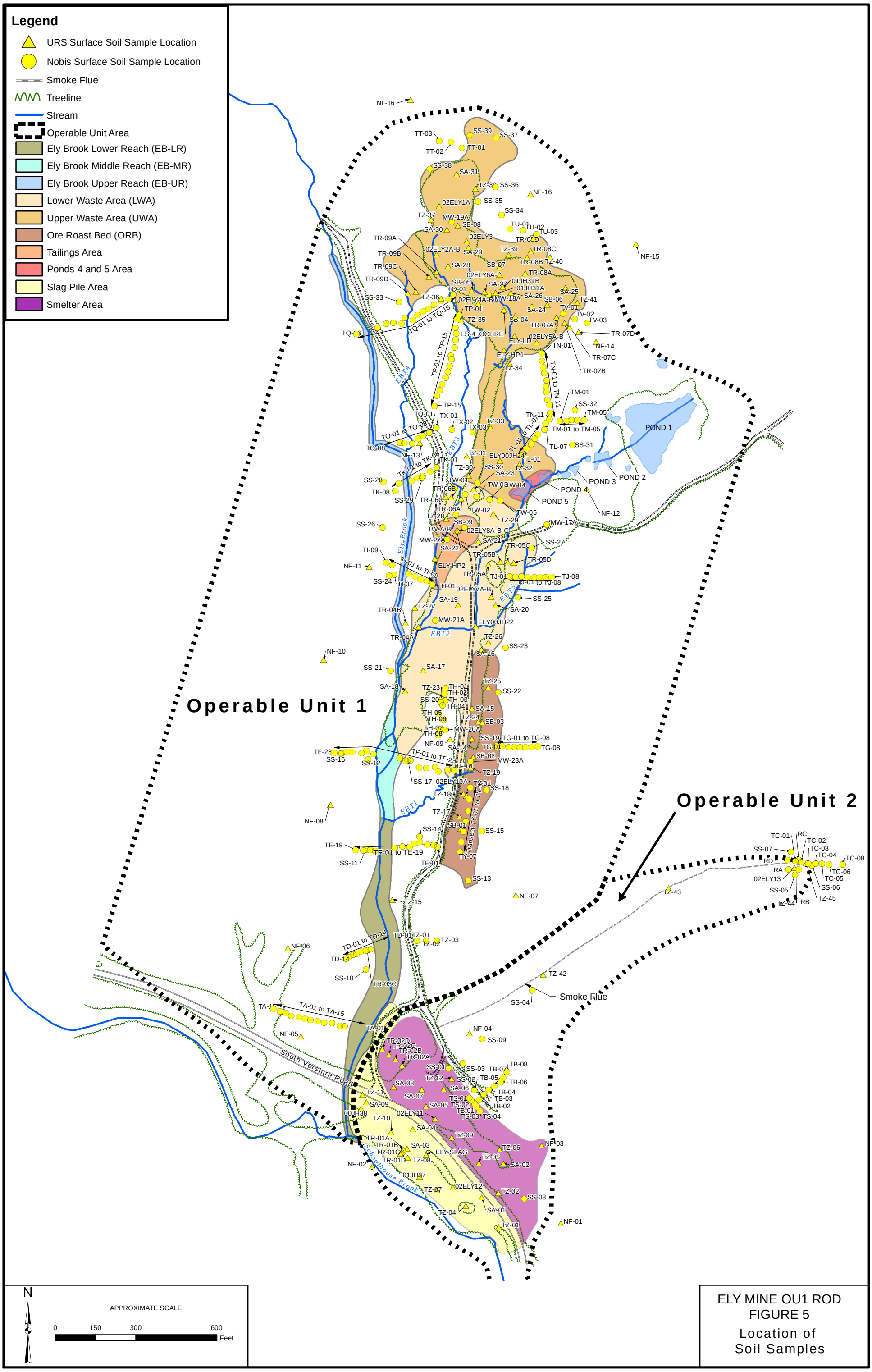
Site Historical Features


Legend
Vernal Pool
Smoke Flue
Treeline
Stream
Former Tramway
Operable Unit Areas
Lower Ely Brook
Middle Ely Brook
Upper Ely Brook
Lower Waste Area
Upper Waste Area
Ore Roast Bed
Tailings Area
Smelter/Slag Area
Underground Mine Workings
Ponds 4 and 5 Area
Underground Mine Workings
Upper Waste Area
POND 2
POND 1
POND 3
Pond 4
Pond 5
Tailings Area
Ely Brook
EBT4
EBT3
EBT2
EBT5
EBT1
Lower Waste Area
Ore Roast Bed
Operable Unit 1
Operable Unit 2
Smoke Flue
Vernal Pool 1
Smelter / Slag Area
South Vershire Road
Schoolhouse Brook
N
APPROXIMATE SCALE
0
300
600
Feet
ELY MINE OU1 ROD
FIGURE 3
OU1 Area

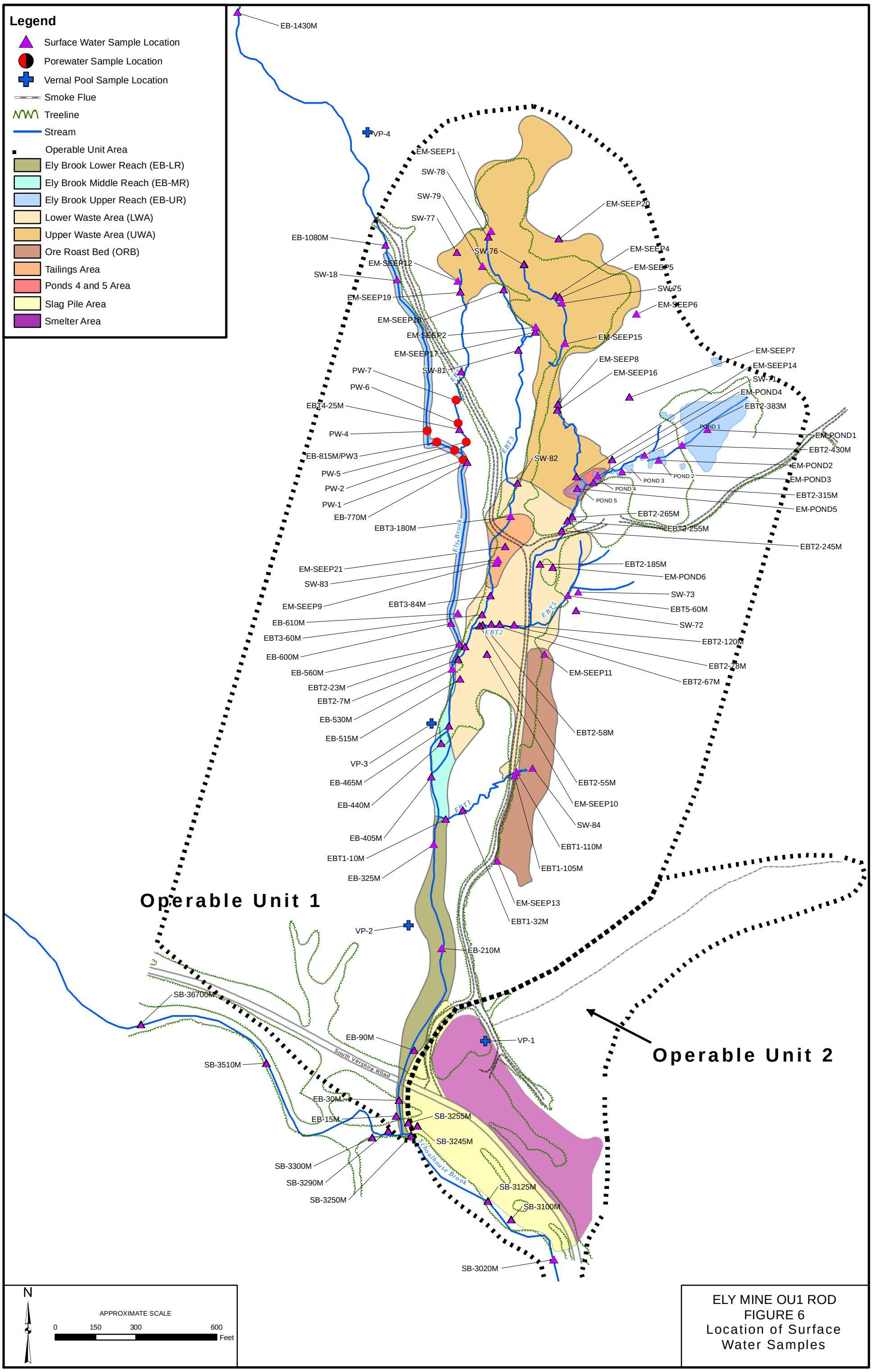



ELY MINE OU1 ROD
FIGURE 4

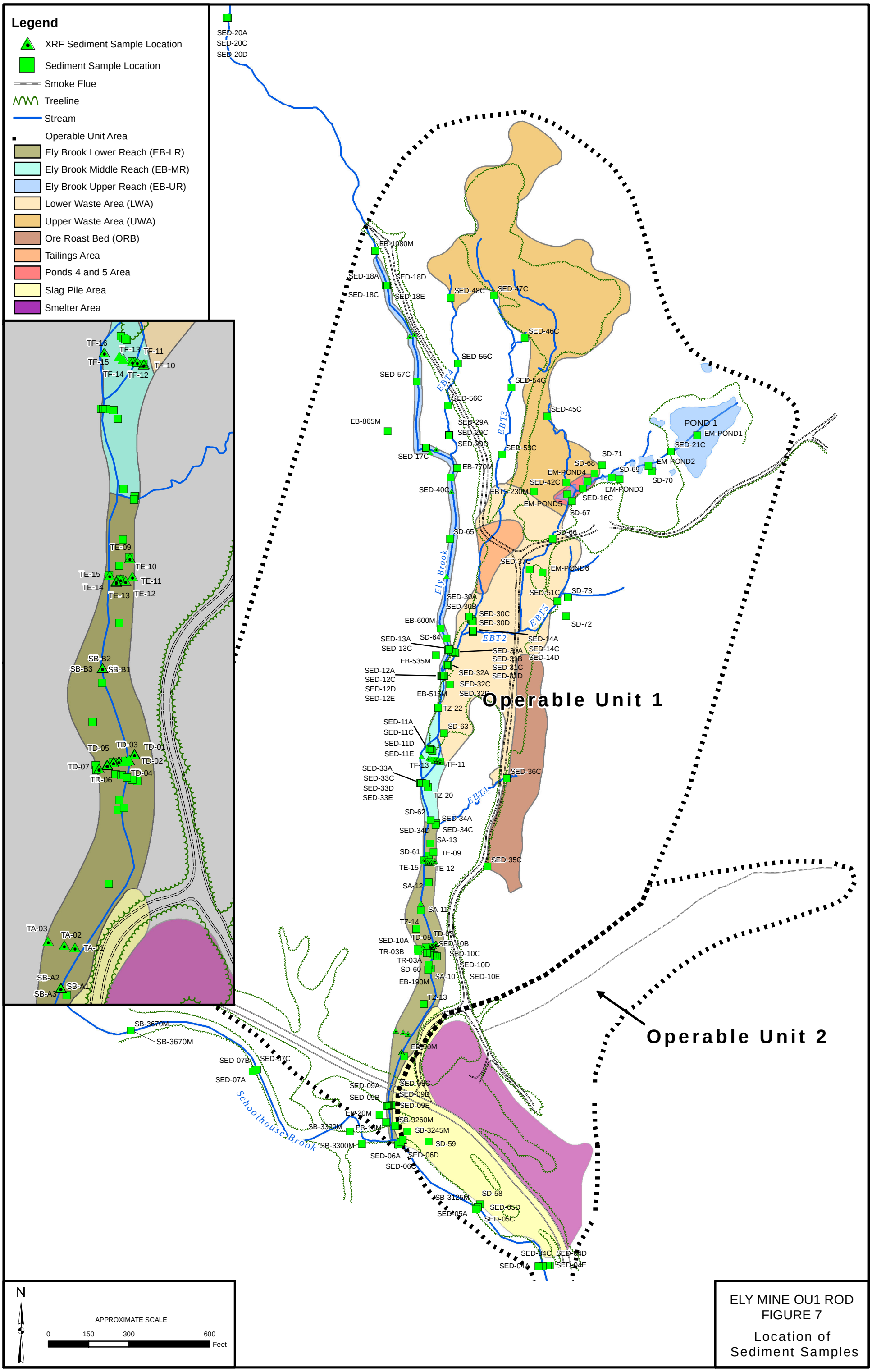
OU2 Area




ELY MINE OU1 ROD
FIGURE 5
Location of
Soil Samples

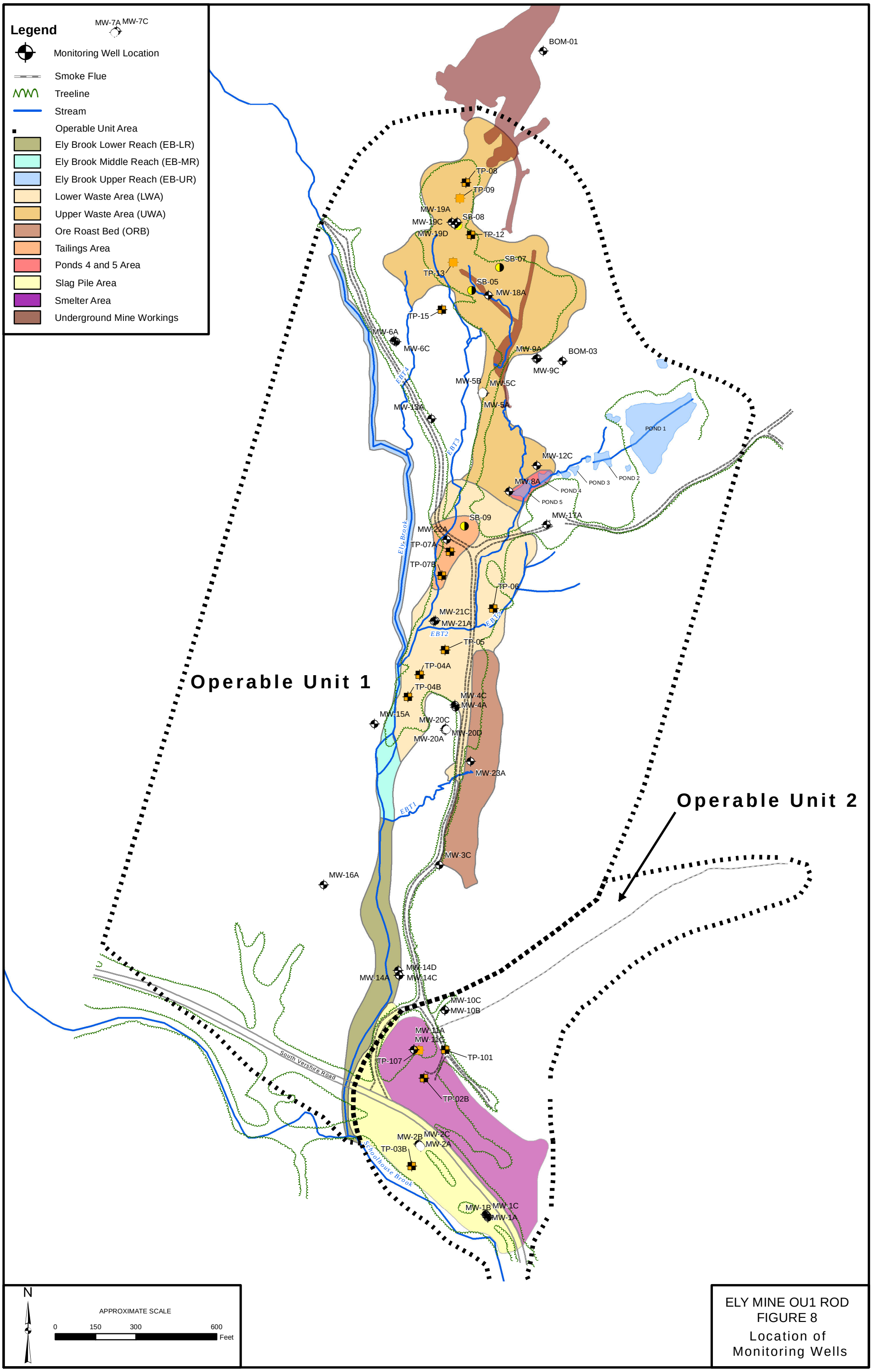



ELY MINE OU1 ROD
FIGURE 6
Location of Surface Water Samples

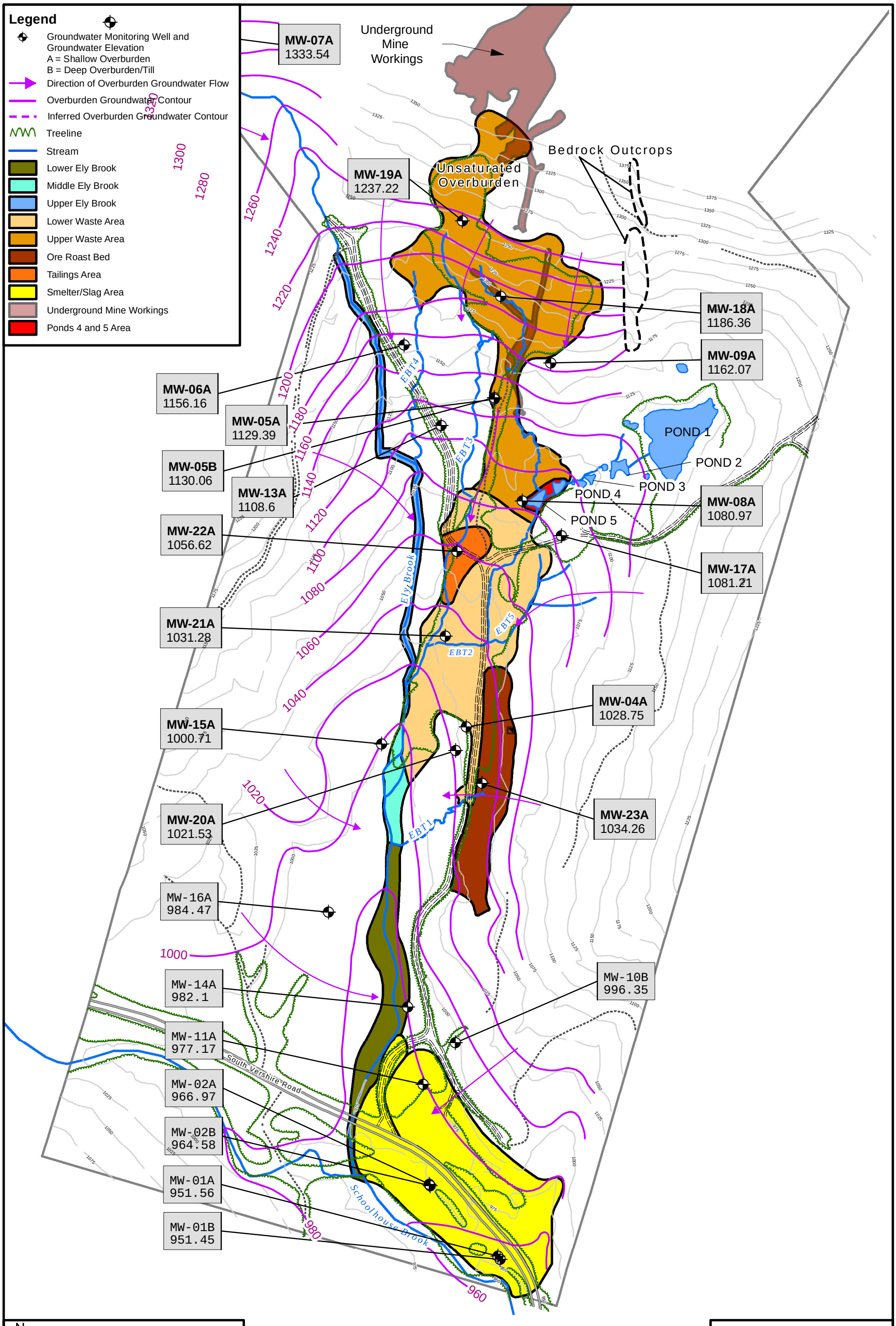



ELY MINE OU1 ROD
FIGURE 7

Location of Sediment Samples

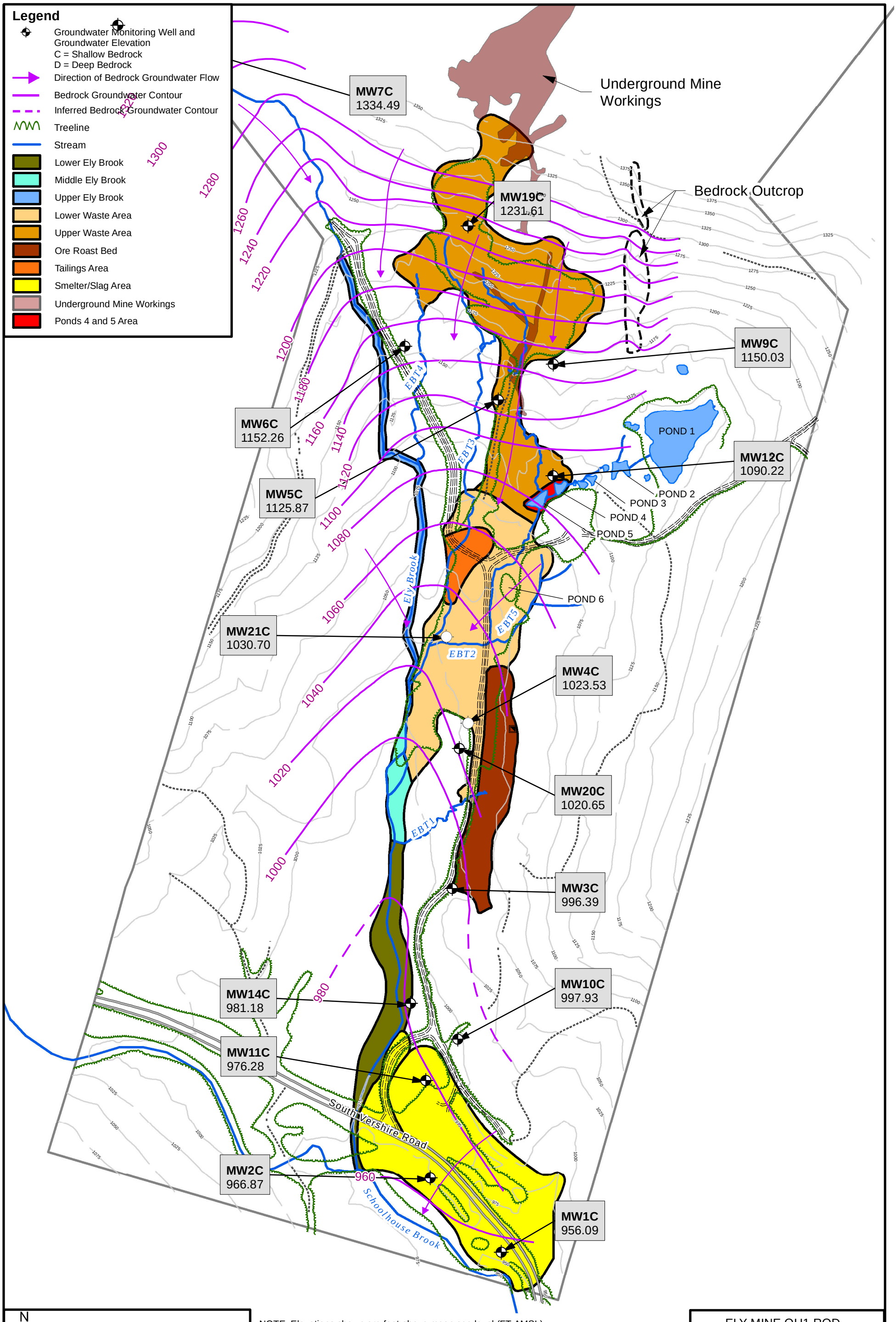



ELY MINE OU1 ROD
FIGURE 8
Location of Monitoring Wells




ELY MINE OU1 ROD
FIGURE 9

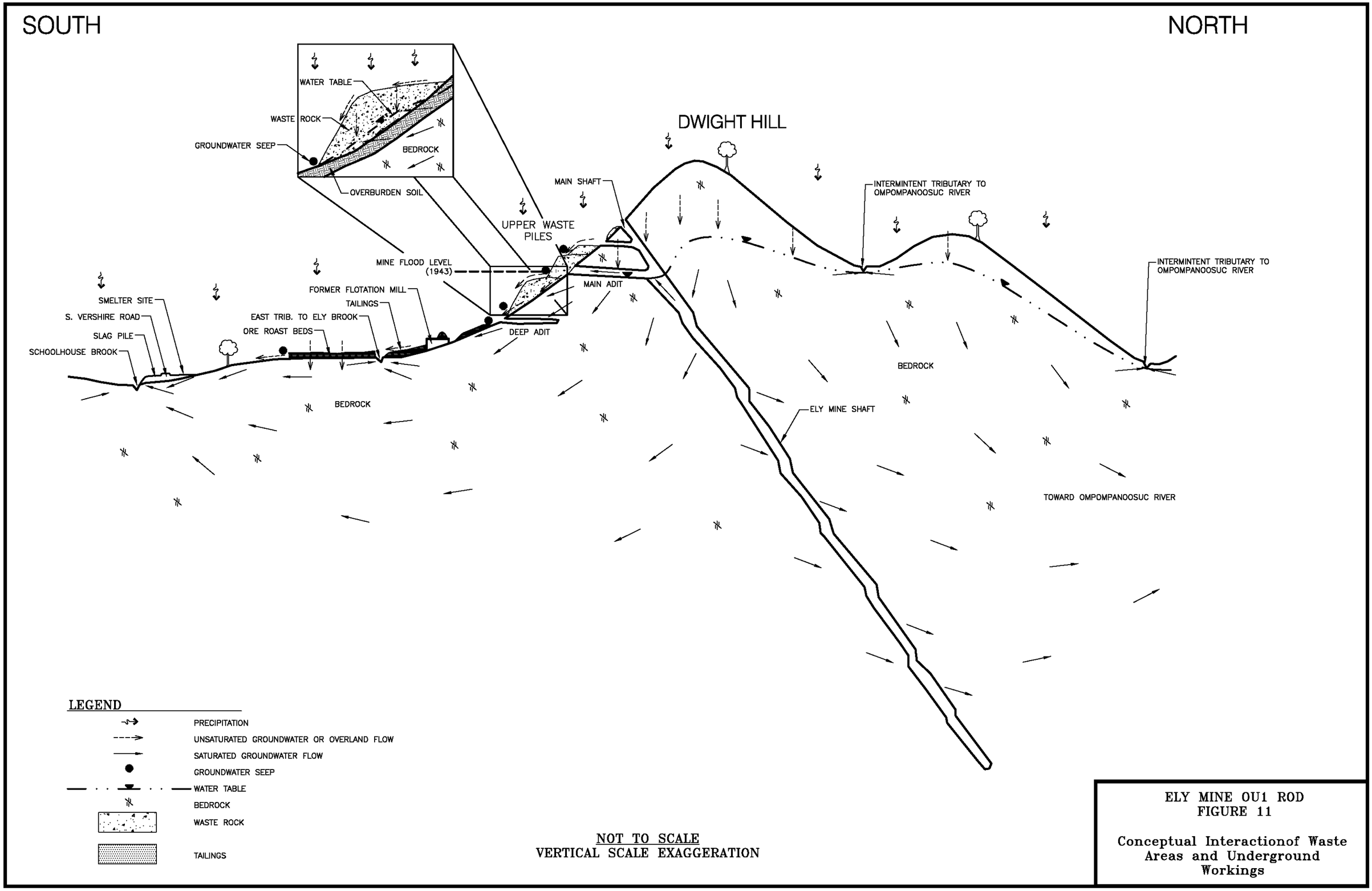
Shallow Groundwater Flow




NOTE: Elevations shown are feet above mean sea level (FT-AMSL) measured by Nobis Engineering, Inc. in August 2009.

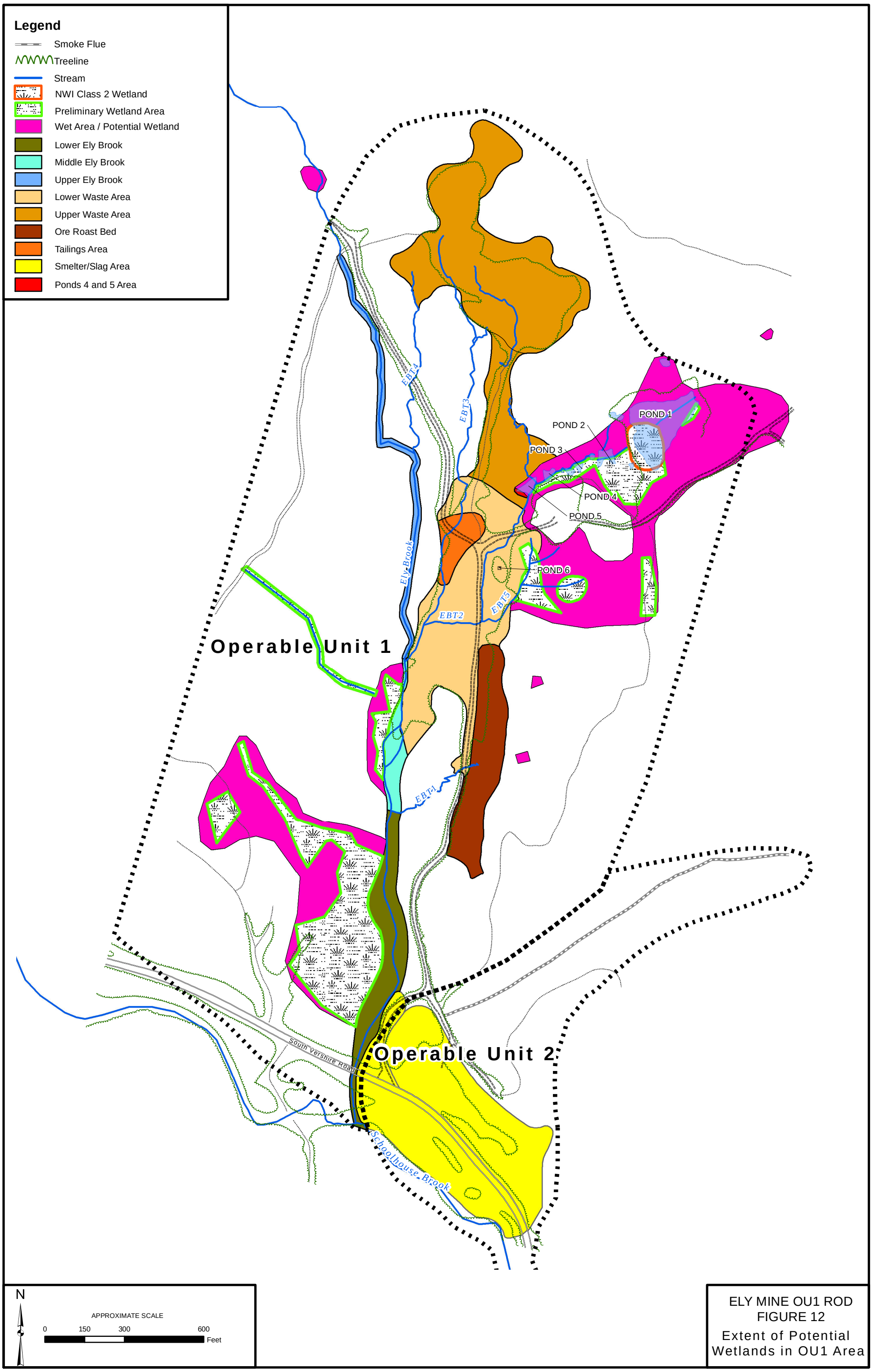
ELY MINE OU1 ROD
FIGURE 10

Bedrock Groundwater Flow

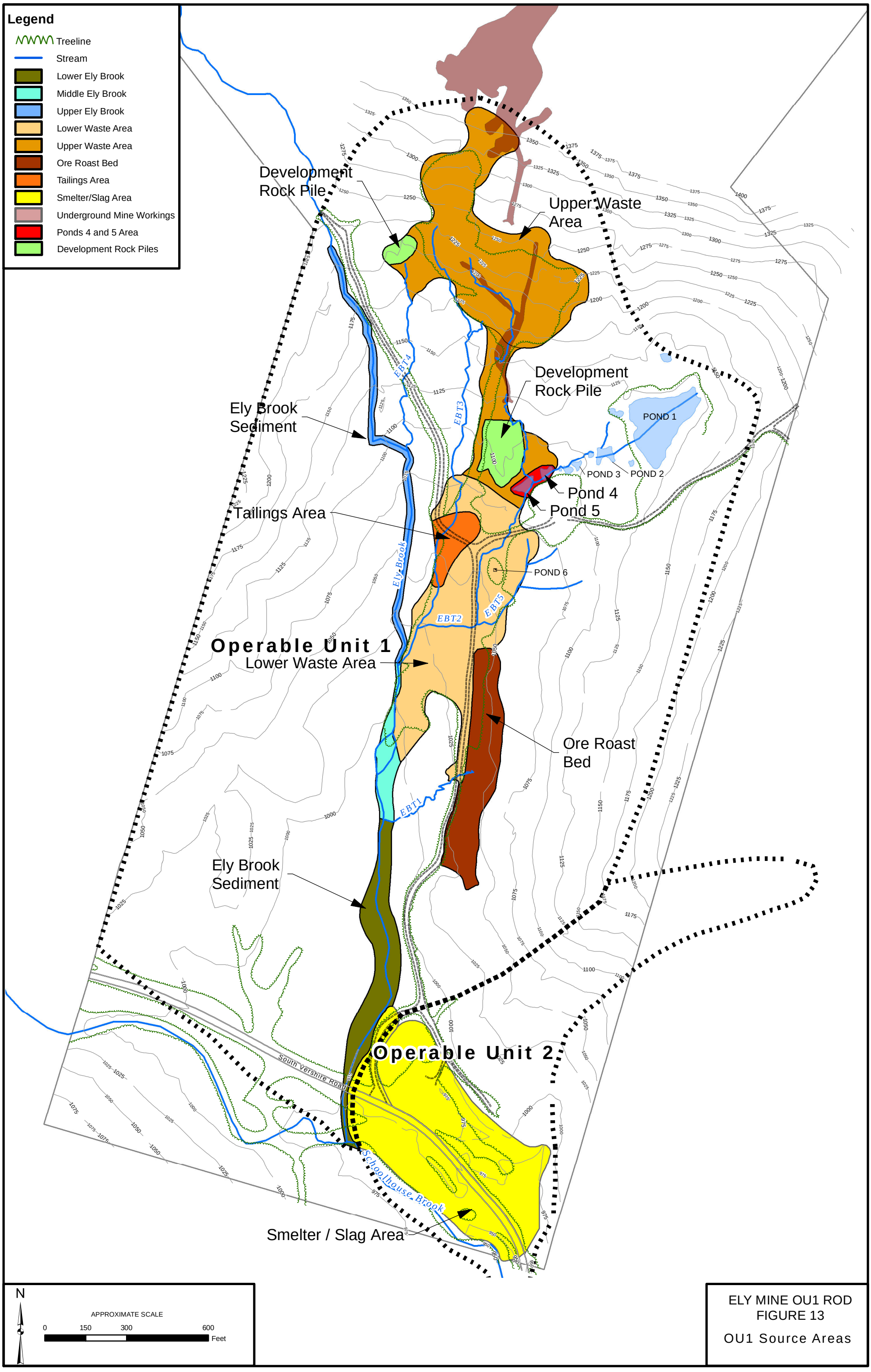



ELY MINE OU1 ROD
FIGURE 11

Conceptual Interactionof Waste Areas and Underground Workings

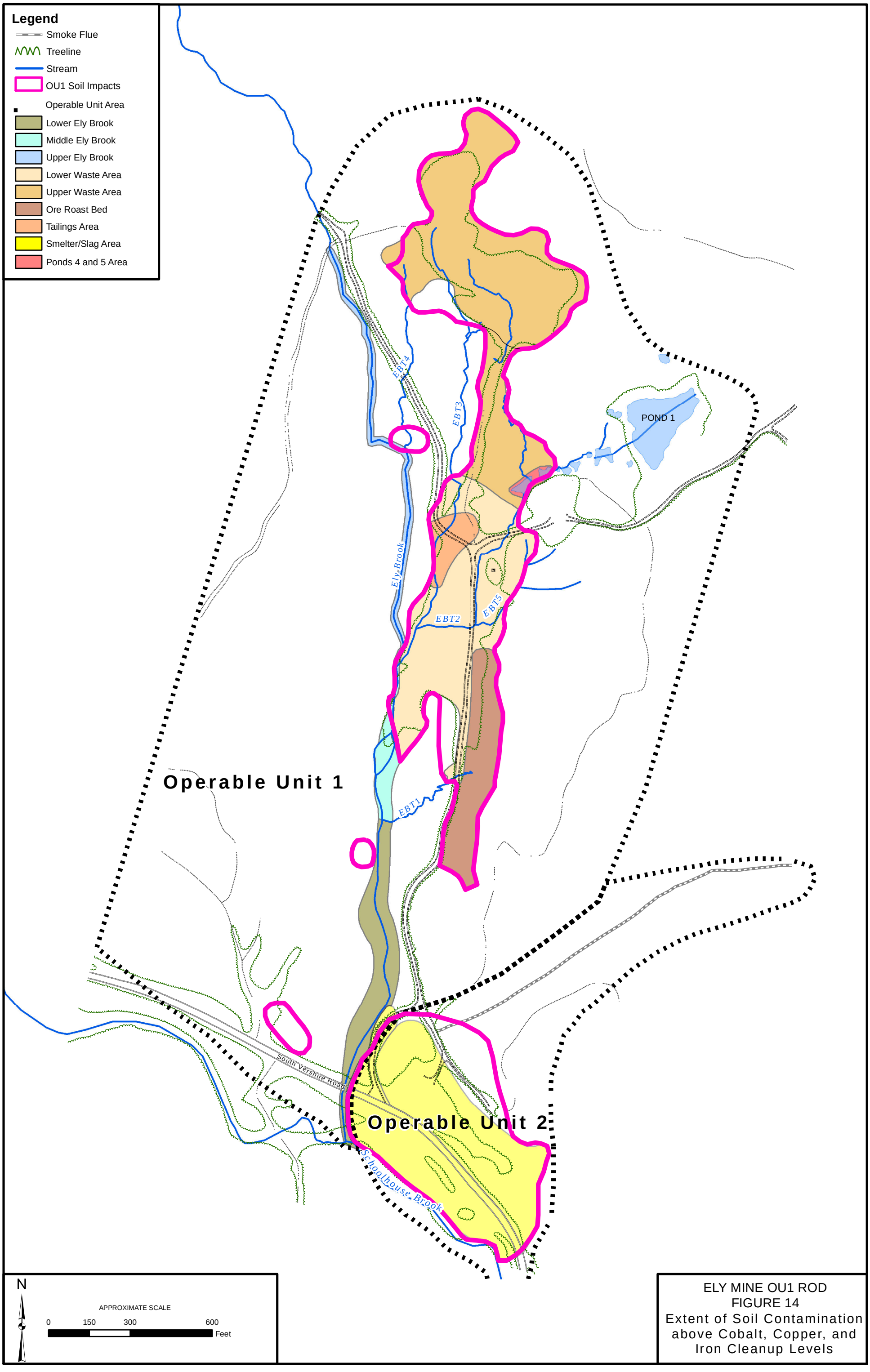



ELY MINE OU1 ROD
FIGURE 12
Extent of Potential Wetlands in OU1 Area

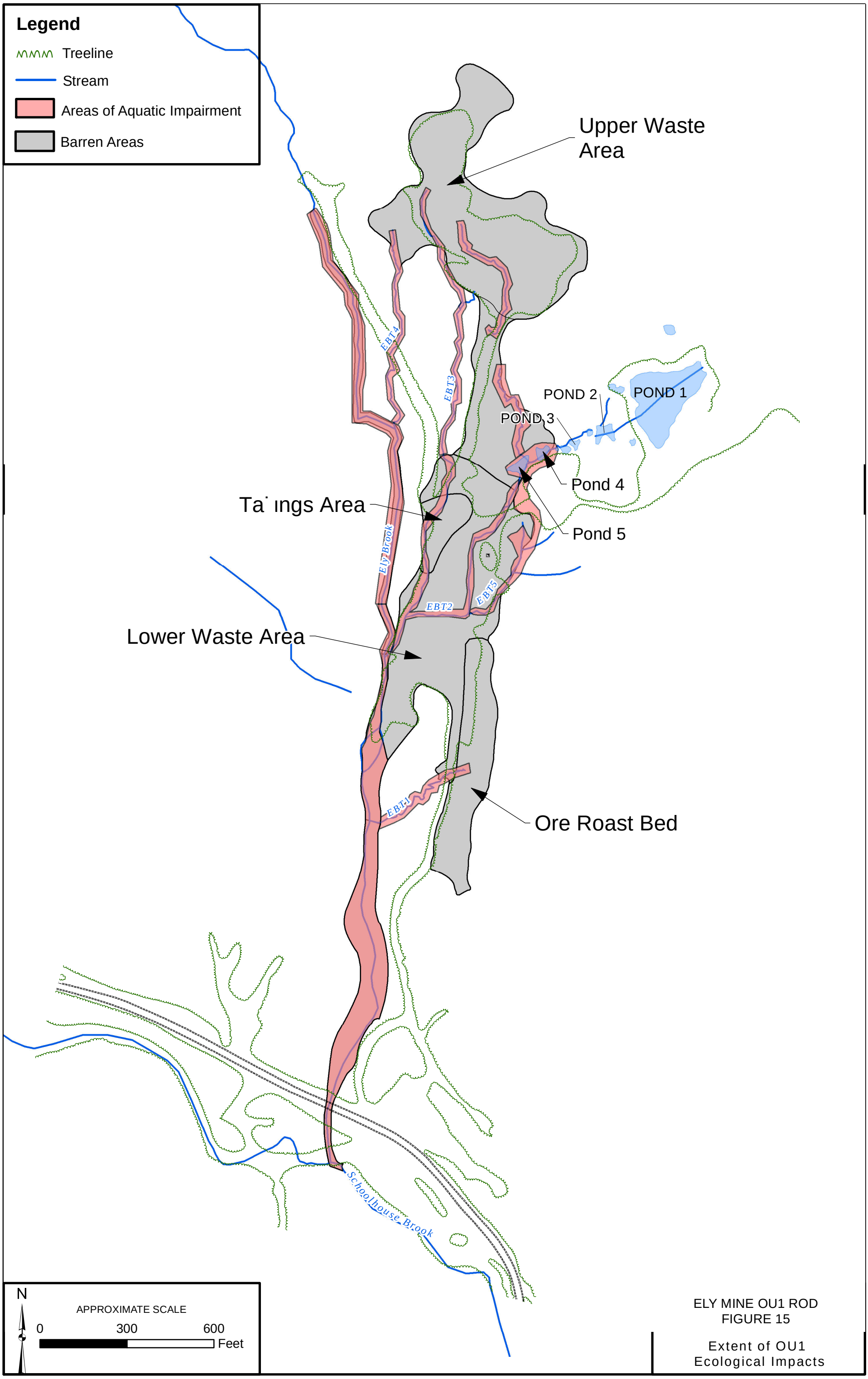



ELY MINE OU1 ROD
FIGURE 13

OU1 Source Areas

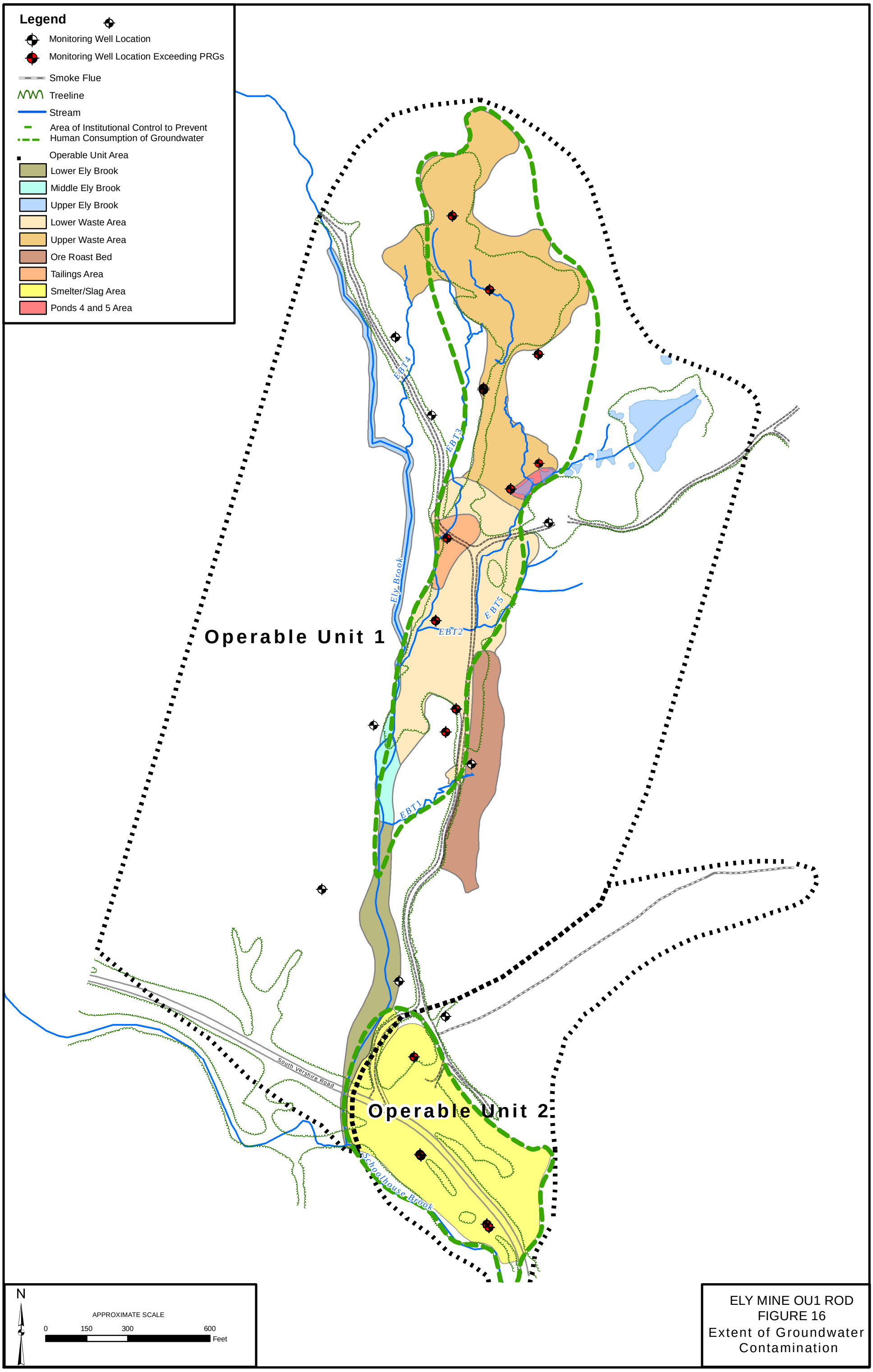



ELY MINE OU1 ROD
FIGURE 14
Extent of Soil Contamination above Cobalt, Copper, and Iron Cleanup Levels



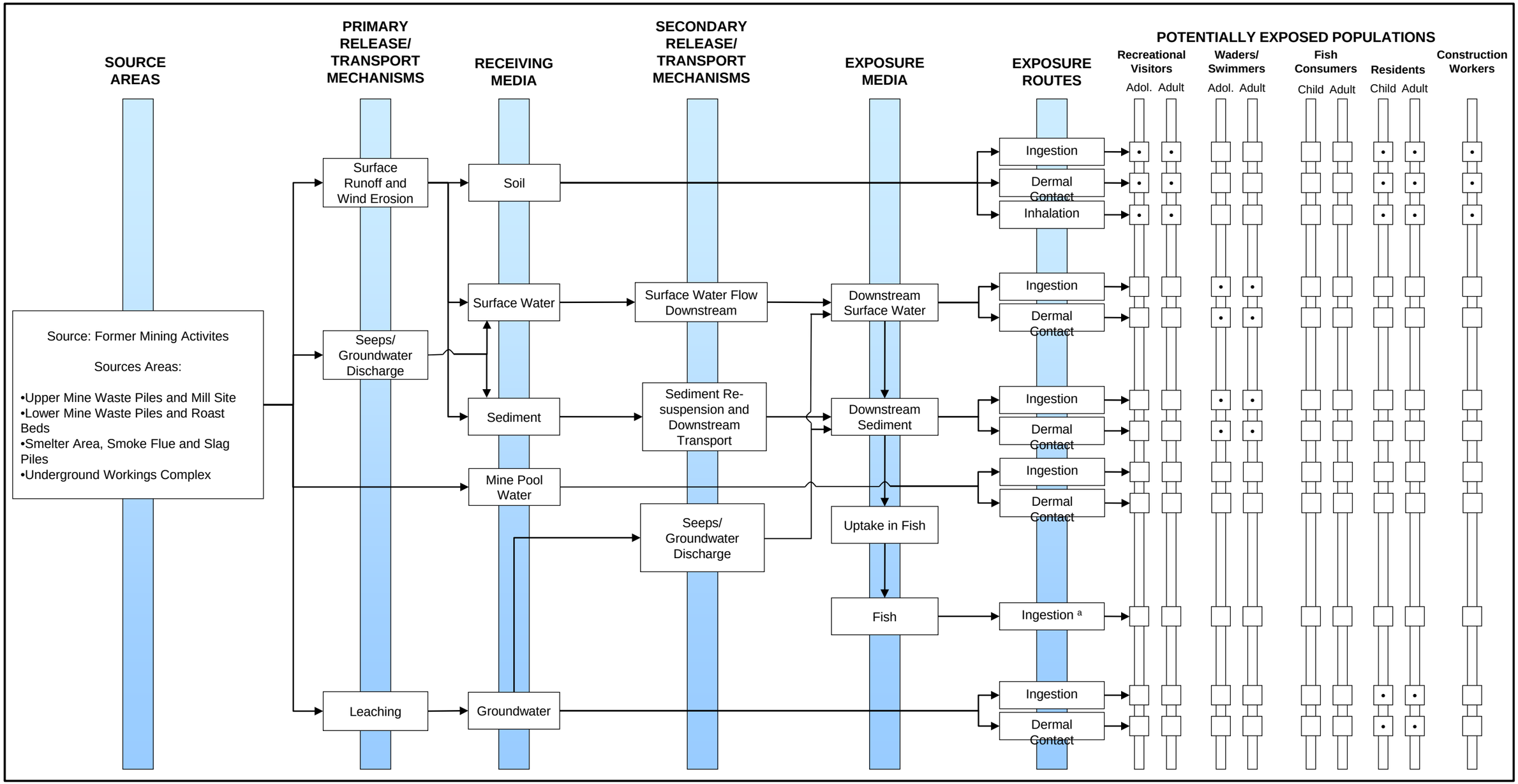

ELY MINE OU1 ROD
FIGURE 15

Extent of OU1
Ecological Impacts




ELY MINE OU1 ROD
FIGURE 16
Extent of Groundwater Contamination

**ELY MINE OU1 ROD**
**FIGURE 17**
**HUMAN HEALTH RISK ASSESSMENT CONCEPTUAL SITE MODEL**

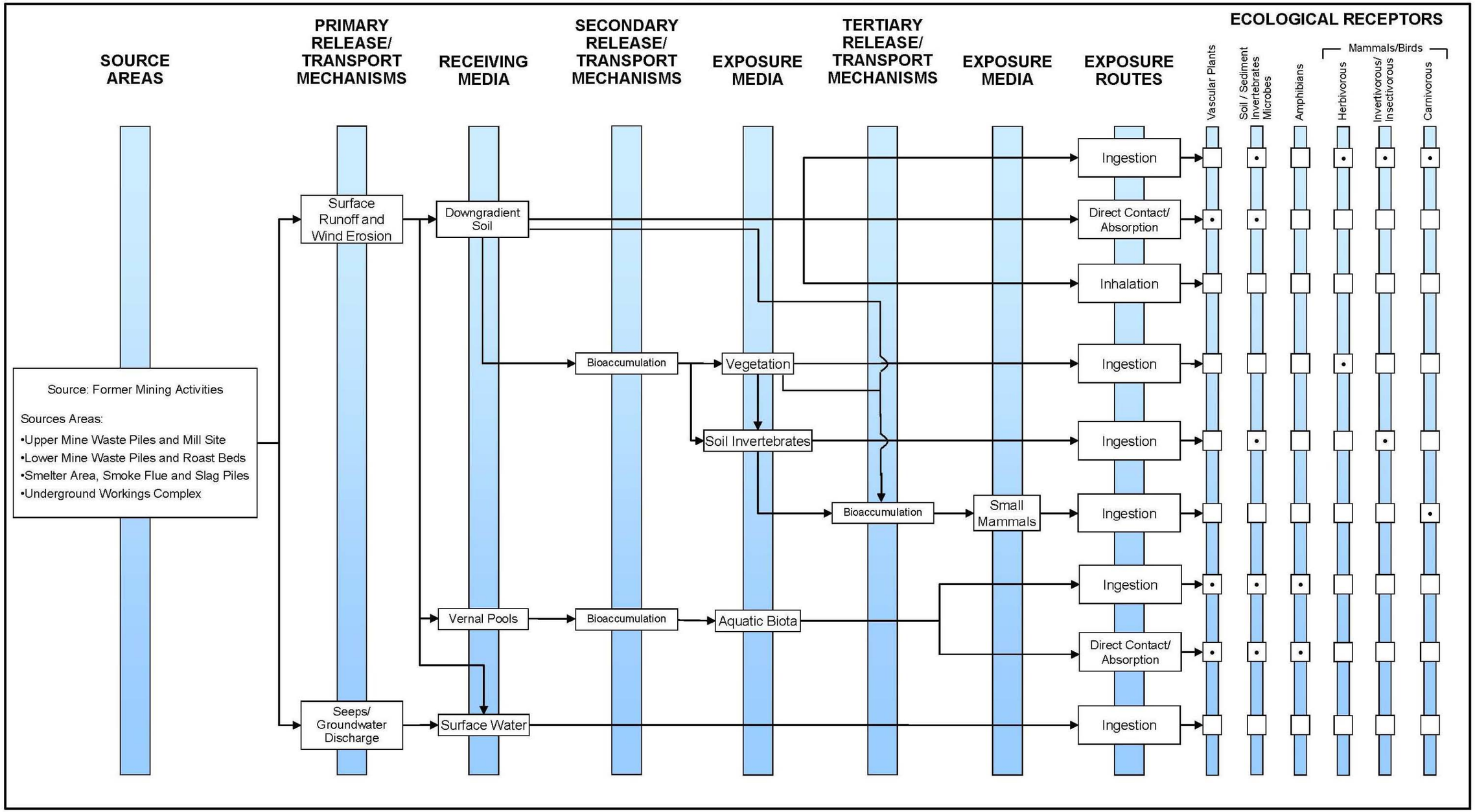



• = Complete exposure pathway

= Incomplete exposure pathway

[a] The ingestion of fish pathway was eliminated from consideration in the HHRA in the COPC selection process (see Section 5.5).

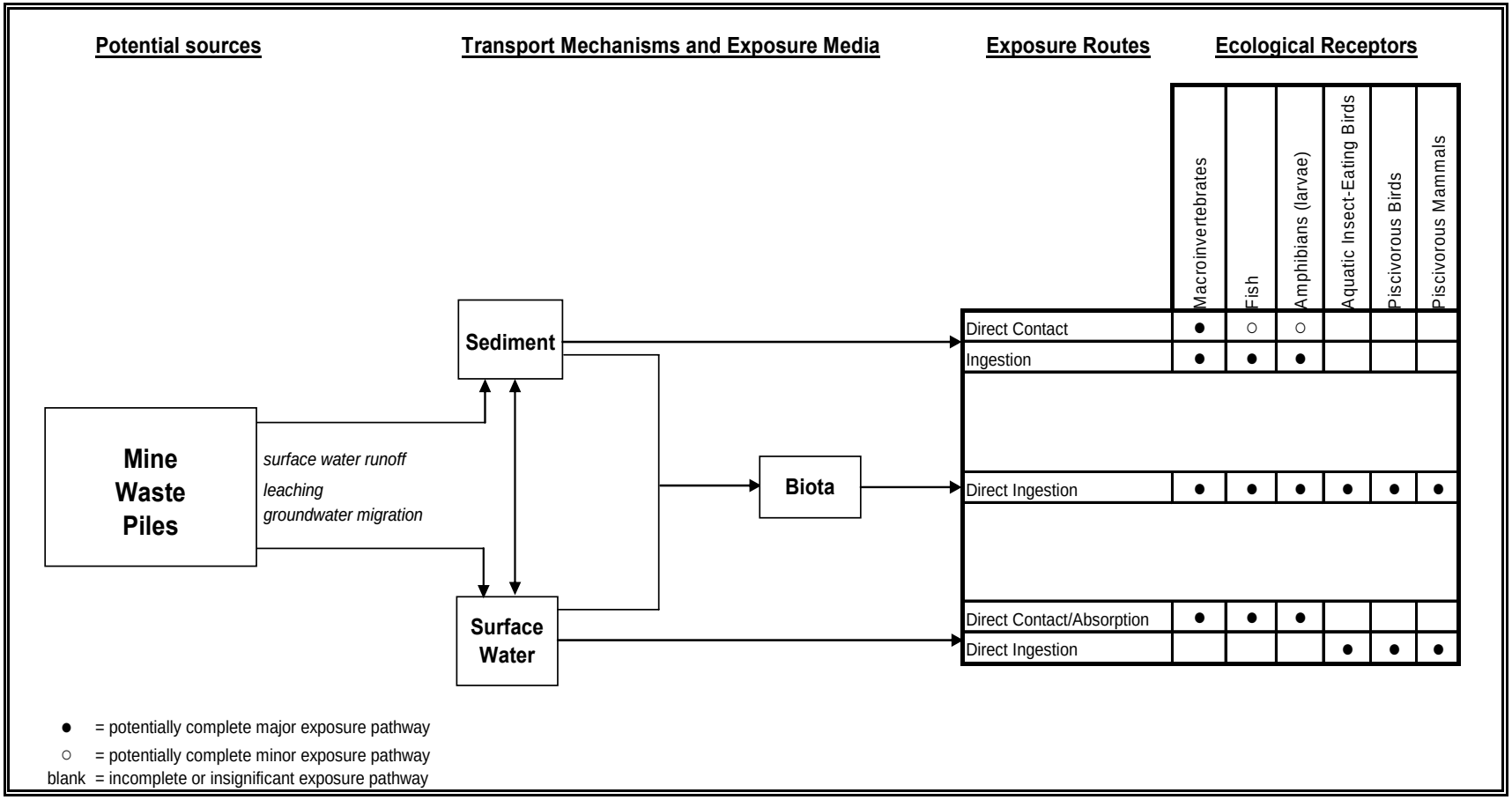
**ELY MINE OU1 ROD**
**FIGURE 18**
**ECOLOGICAL RISK ASSESSMENT CONCEPTUAL SITE MODEL**




• = Complete exposure pathway.

= Incomplete or insignificant exposure pathway.

**Figure 19: Site conceptual model for aquatic habitats and receptors at the Ely Copper Mine**



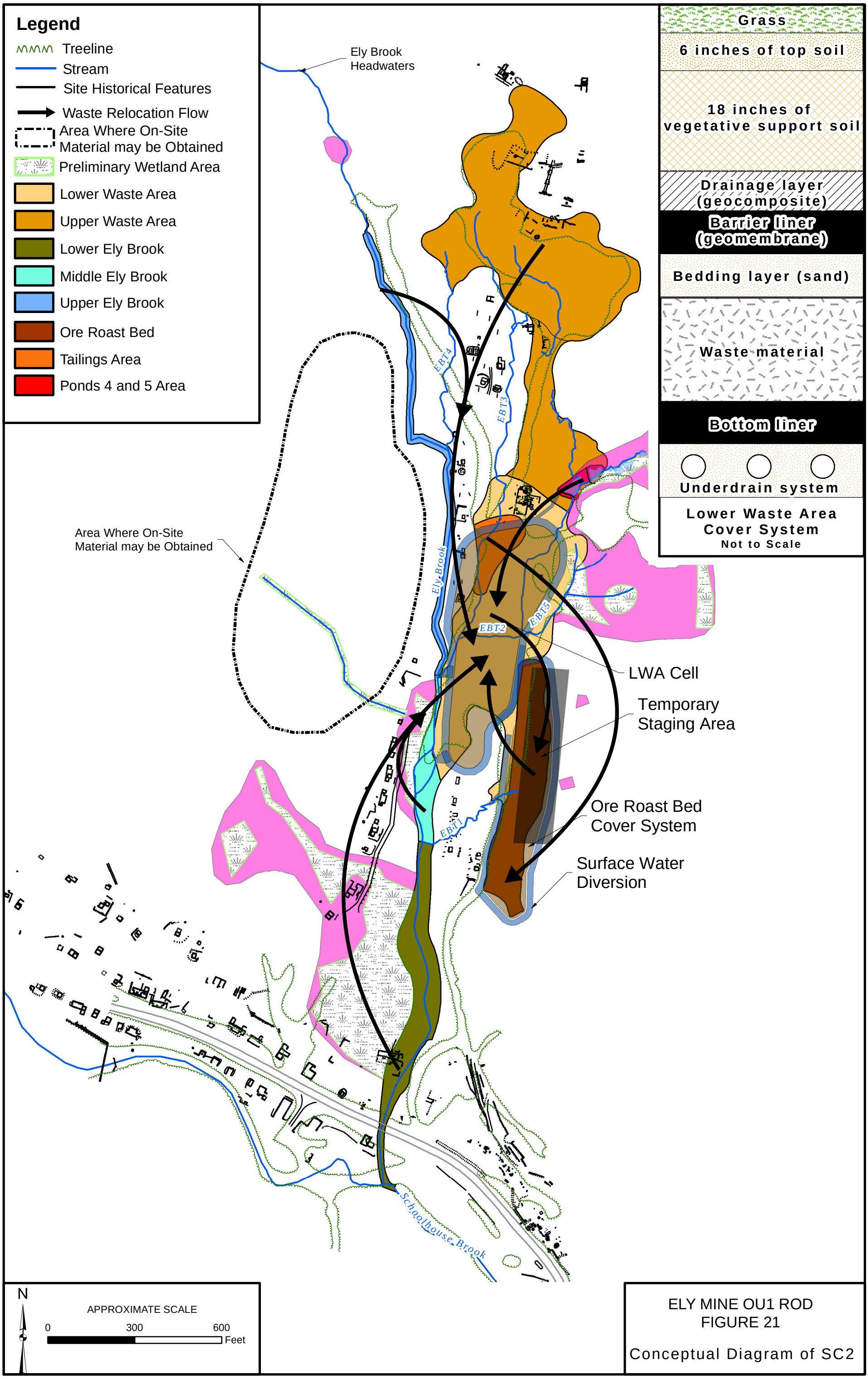
**ELY MINE OU1 ROD**
**FIGURE 20**
**HUMAN HEALTH RISK ASSESSMENT SUMMARY**

| Exposure Point | RME | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Current | | | | Future | | | | | | Current/Future | | | | | | | |
| | Resident | | | | Construction Worker | | Resident | | | | Recreational Visitor | | | | Swimmer/Wader | | | |
| | Child | | Adult | | Adult | | Child | | Adult | | Adolescent | | Adult | | Adolescent | | Adult | |
| | ILCR | HI | ILCR | HI | ILCR | HI | ILCR | HI | ILCR | HI | ILCR | HI | ILCR | HI | ILCR | HI | ILCR | HI |
| Ely Copper Mine Surface Soil | 4.9E-06 | 3.1<br>GI HI = 1.6 (Fe = 1.2); Thyroid HI = 1.0 (Co) | 2.2E-06 | 0.34 | | | | | | | 6.7E-07 | 0.32 | 1.8E-06 | 0.29 | | | | |
| Ely Copper Mine Total Soil | | | | | 7.4E-07 | 2.3<br>Nervous system HI = 1.1<br>(Mn = 0.85) | 4.1E-06 | 4.5<br>Thyroid HI = 2.1 (Co);<br>GI HI = 1.8 (Fe = 1.2) | 1.9E-06 | 0.49 | | | | | | | | |
| Ely Brook Sediment | | | | | | | | | | | | | | | 1.1E-07 | 0.050 | 2.7E-07 | 0.037 |
| Ely Brook Surface Water | | | | | | | | | | | | | | | 6.3E-09 | 0.12 | 1.5E-08 | 0.098 |
| Schoolhouse Brook Sediment | | | | | | | | | | | | | | | 4.4E-08 | 0.021 | 1.0E-07 | 0.015 |
| Schoolhouse Brook Surface Water | | | | | | | | | | | | | | | NC | 0.0074 | NC | 0.0059 |
| Ompompanoosuc River Sediment | | | | | | | | | | | | | | | 1.6E-07 | 0.019 | 3.7E-07 | 0.015 |
| Ompompanoosuc River Surface Water | | | | | | | | | | | | | | | NC | 0.00041 | NC | 0.00035 |
| Overburden Groundwater | | | | | | | 6.3E-05 | 274 (see table below) | 1.1E-04 (due to arsenic) | 117 | | | | | | | | |
| Shallow Bedrock Groundwater | | | | | | | 4.0E-05 | 141 (see table below) | 6.9E-05 | 60 | | | | | | | | |
| Deep Bedrock Groundwater | | | | | | | 2.2E-05 | 55 (see table below) | 3.8E-05 | 24 | | | | | | | | |
| Residential Groundwater | | | | | | | NC | 0.32 | NC | 0.13 | | | | | | | | |

**Notes:**
Geometric mean blood lead levels were below 10 µg/dL for all exposure points.
ILCR = Incremental lifetime cancer risk.
GI = gastrointestinal
HI = Hazard index.
NC = No carcinogens evaluated for this exposure point.

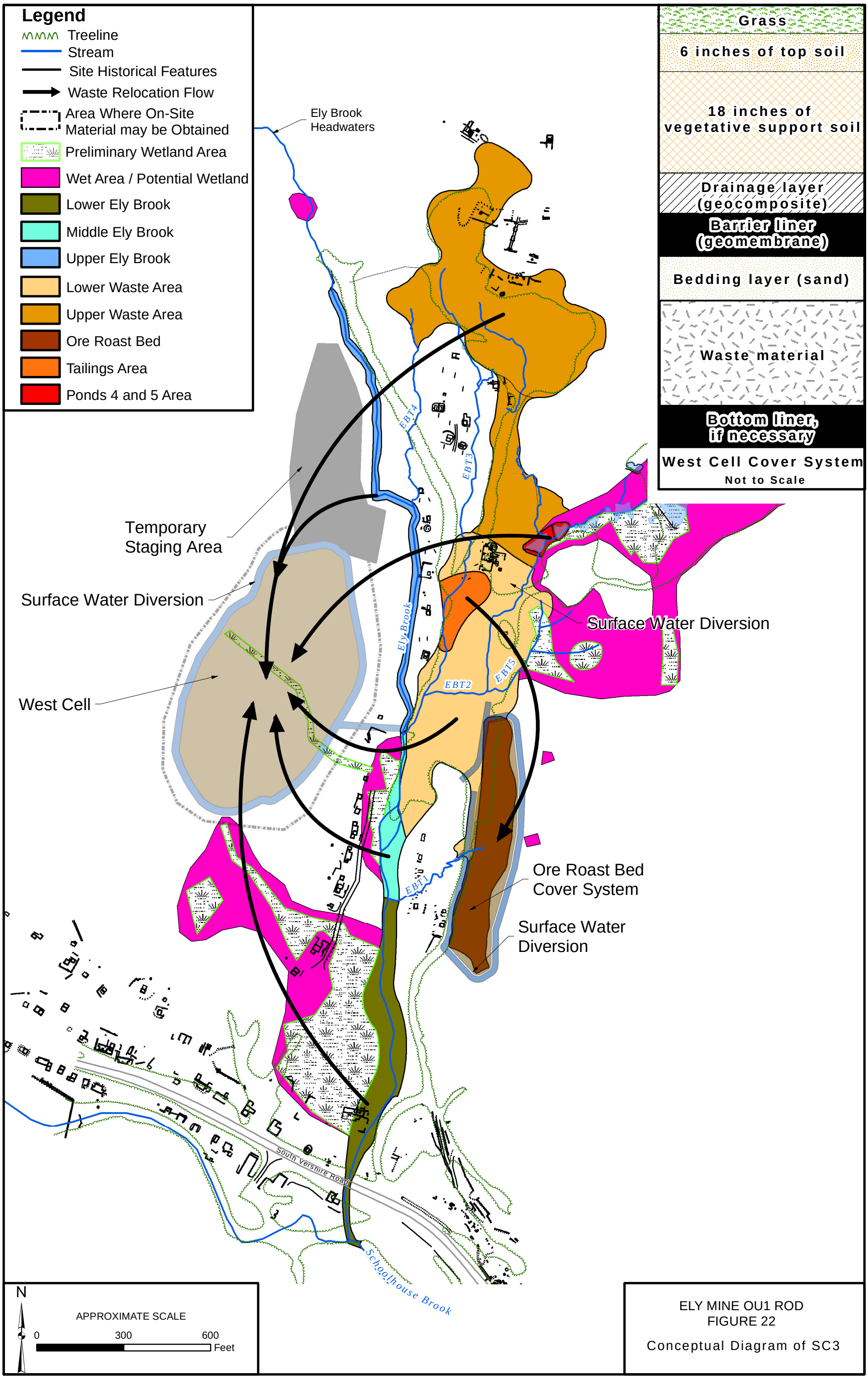
| **Total Overburden HI = 274** | **Total Shallow Bedrock HI = 141** | **Total Deep Bedrock HI = 55** |
|---|---|---|
| Thyroid HI = 142 (Co) | Thyroid HI = 57 (Co) | Thyroid HI = 33 (Co) |
| GI HI = 98 (Cu = 80) | GI HI = 46 (Fe = 28) | GI HI = 16 (Cu = 14) |
| Nervous system HI = 22 (Mn = 12) | Nervous system HI = 32 (Al = 23) | Nervous system HI = 4.9 (Mn = 4.4) |
| Kidney HI = 6.4 (Cd = 5.3) | Kidney HI = 3.1 (Cd = 1.9) | |
| Skin HI = 1.6 (As) | Blood HI = 1.1 (Sb = 0.72) | |
| Systemic HI = 1.3 (Ni) | Skin HI = 1.0 (As) | |

Green shading indicates ILCR less than 1E-06 and/or HI less than 1.
Blue shading indicates ILCR between 1E-06 and 1E-04.
Red shading indicates ILCR greater than 1E-04 and/or target organ HI greater than 1.



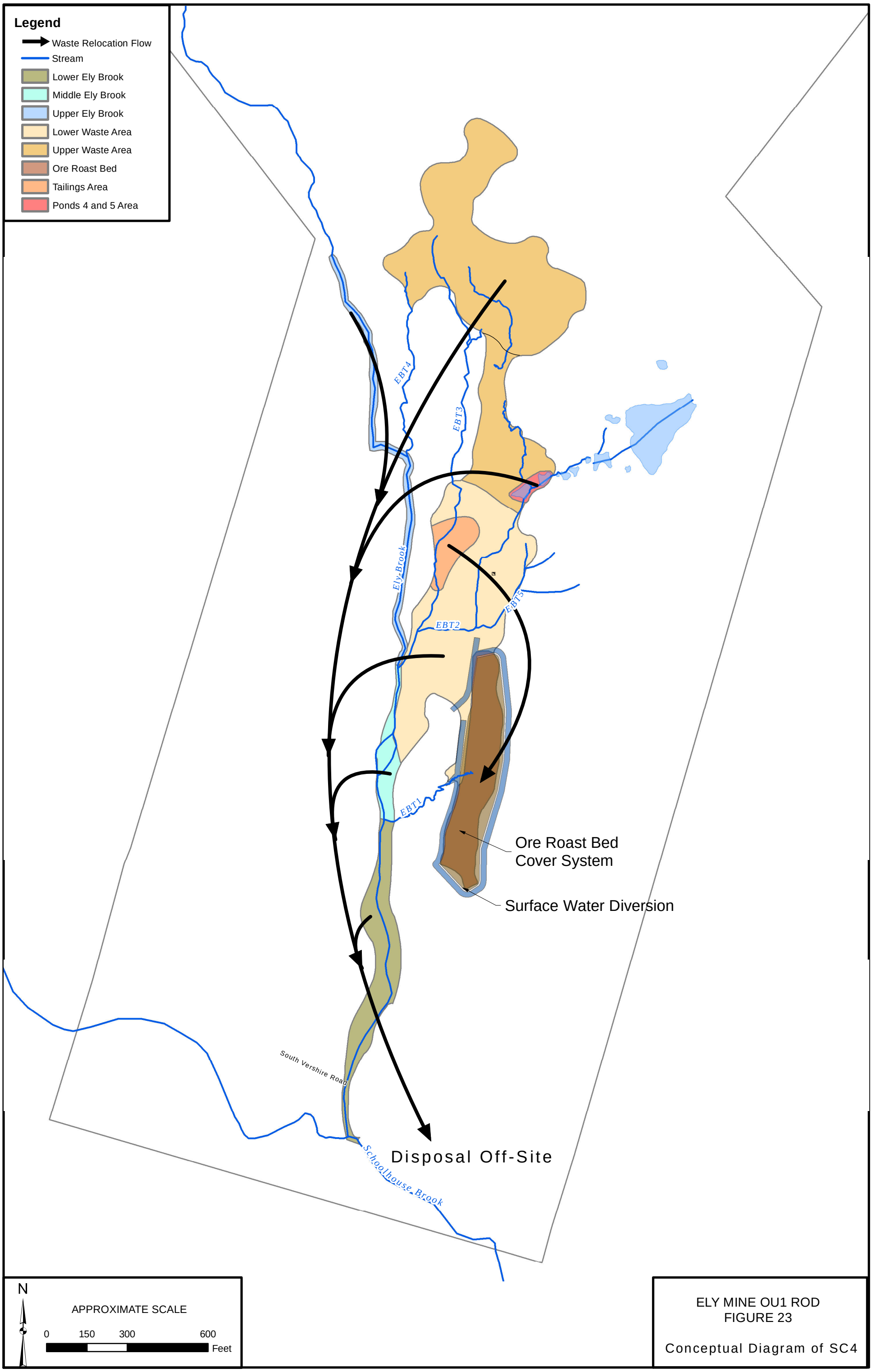

ELY MINE OU1 ROD
FIGURE 21

Conceptual Diagram of SC2



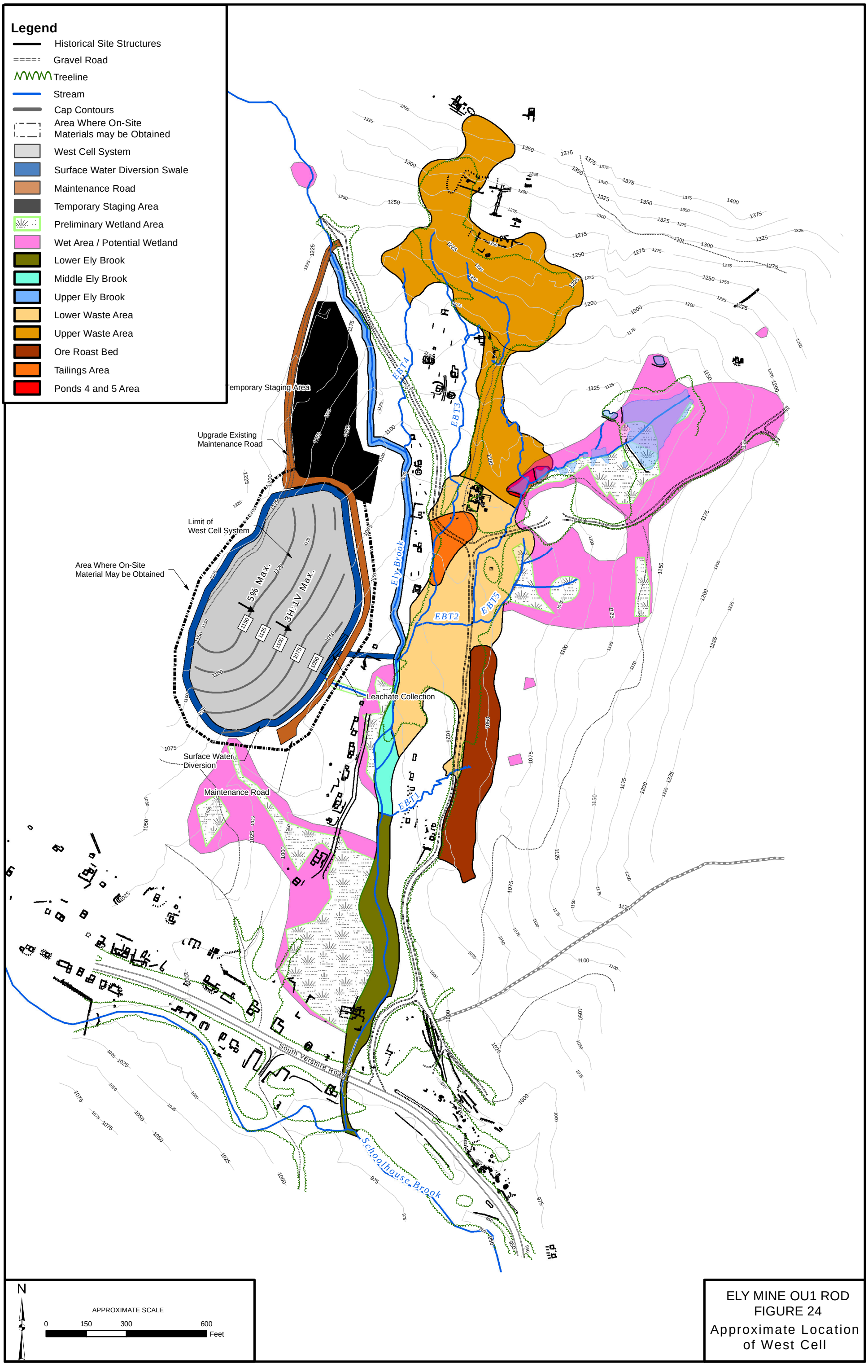

ELY MINE OU1 ROD
FIGURE 22

Conceptual Diagram of SC3

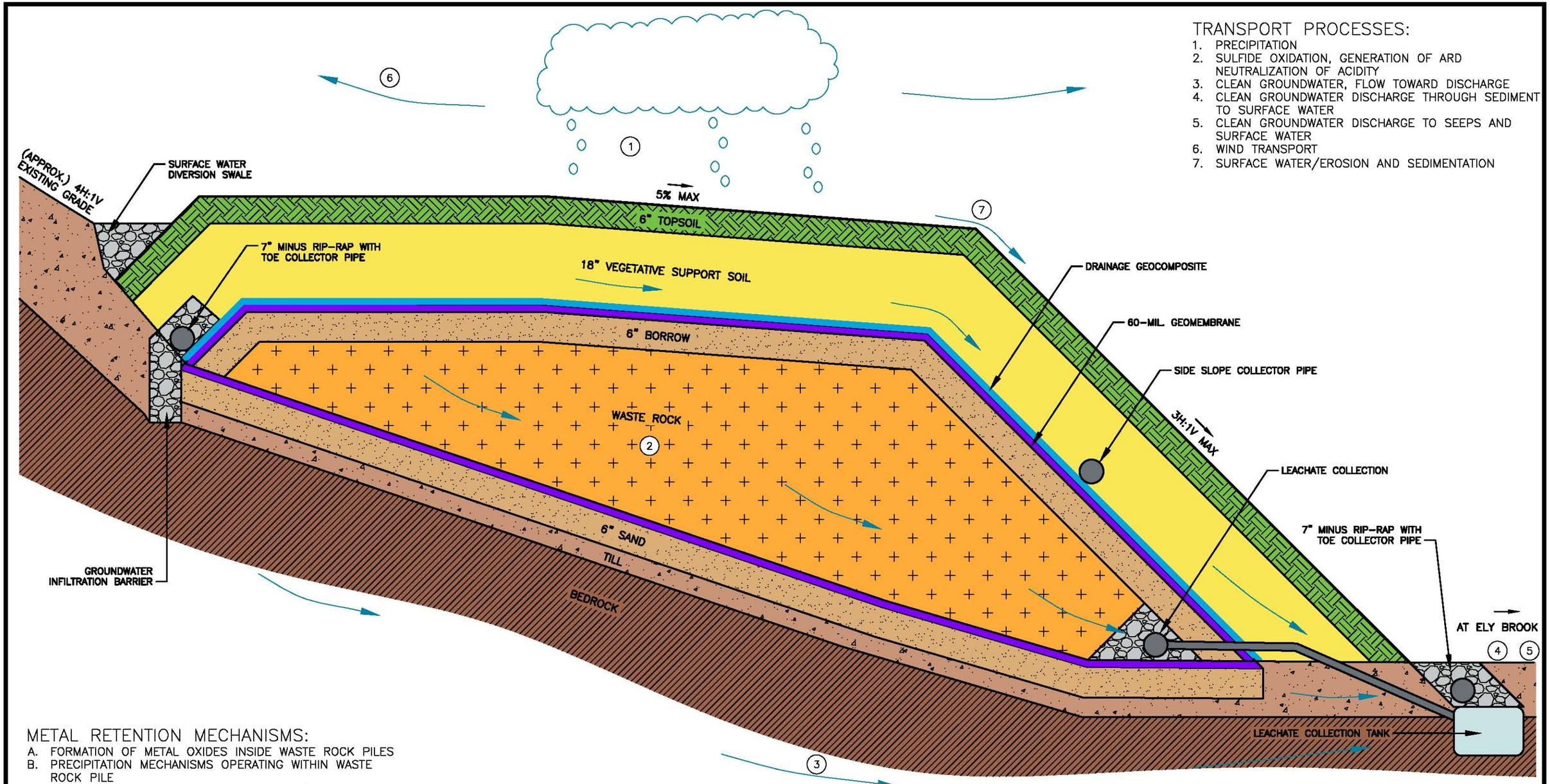



ELY MINE OU1 ROD
FIGURE 23

Conceptual Diagram of SC4




ELY MINE OU1 ROD
FIGURE 24
Approximate Location of West Cell




TRANSPORT PROCESSES:

1. PRECIPITATION
2. SULFIDE OXIDATION, GENERATION OF ARD NEUTRALIZATION OF ACIDITY
3. CLEAN GROUNDWATER, FLOW TOWARD DISCHARGE
4. CLEAN GROUNDWATER DISCHARGE THROUGH SEDIMENT TO SURFACE WATER
5. CLEAN GROUNDWATER DISCHARGE TO SEEPS AND SURFACE WATER
6. WIND TRANSPORT
7. SURFACE WATER/EROSION AND SEDIMENTATION

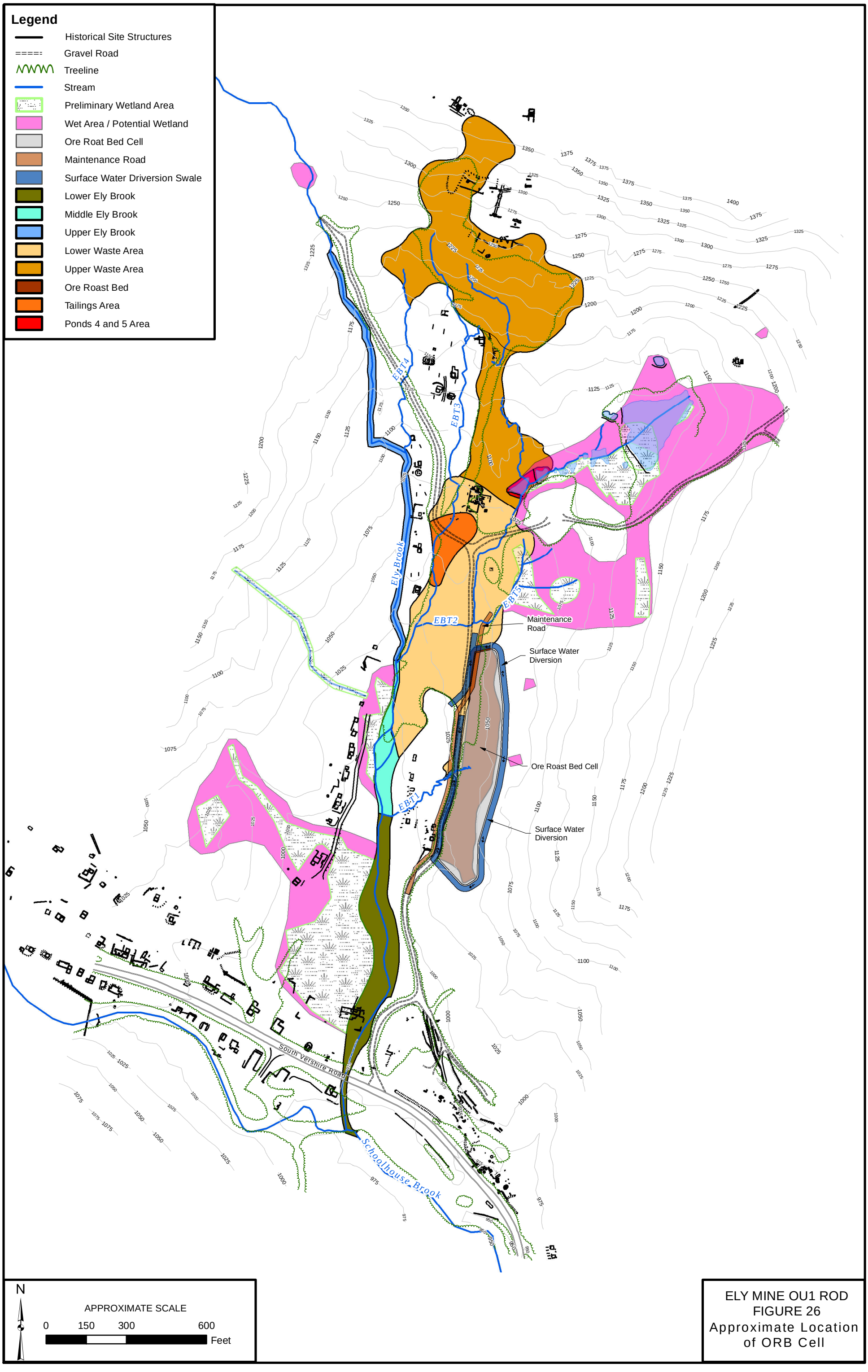
METAL RETENTION MECHANISMS:

A. FORMATION OF METAL OXIDES INSIDE WASTE ROCK PILES
B. PRECIPITATION MECHANISMS OPERATING WITHIN WASTE ROCK PILE
C. MINERAL PRECIPITATES IN SURFACEWATER/SEEP DISCHARGE AREAS
D. METALS IN GROUNDWATER; DISCHARGED TO AND RETAINED BY SEDIMENTS
E. METALS RETAINED IN "MINE WASTE" LAYER SEDIMENT

NOT TO SCALE

ELY MINE OU1 ROD
FIGURE 25

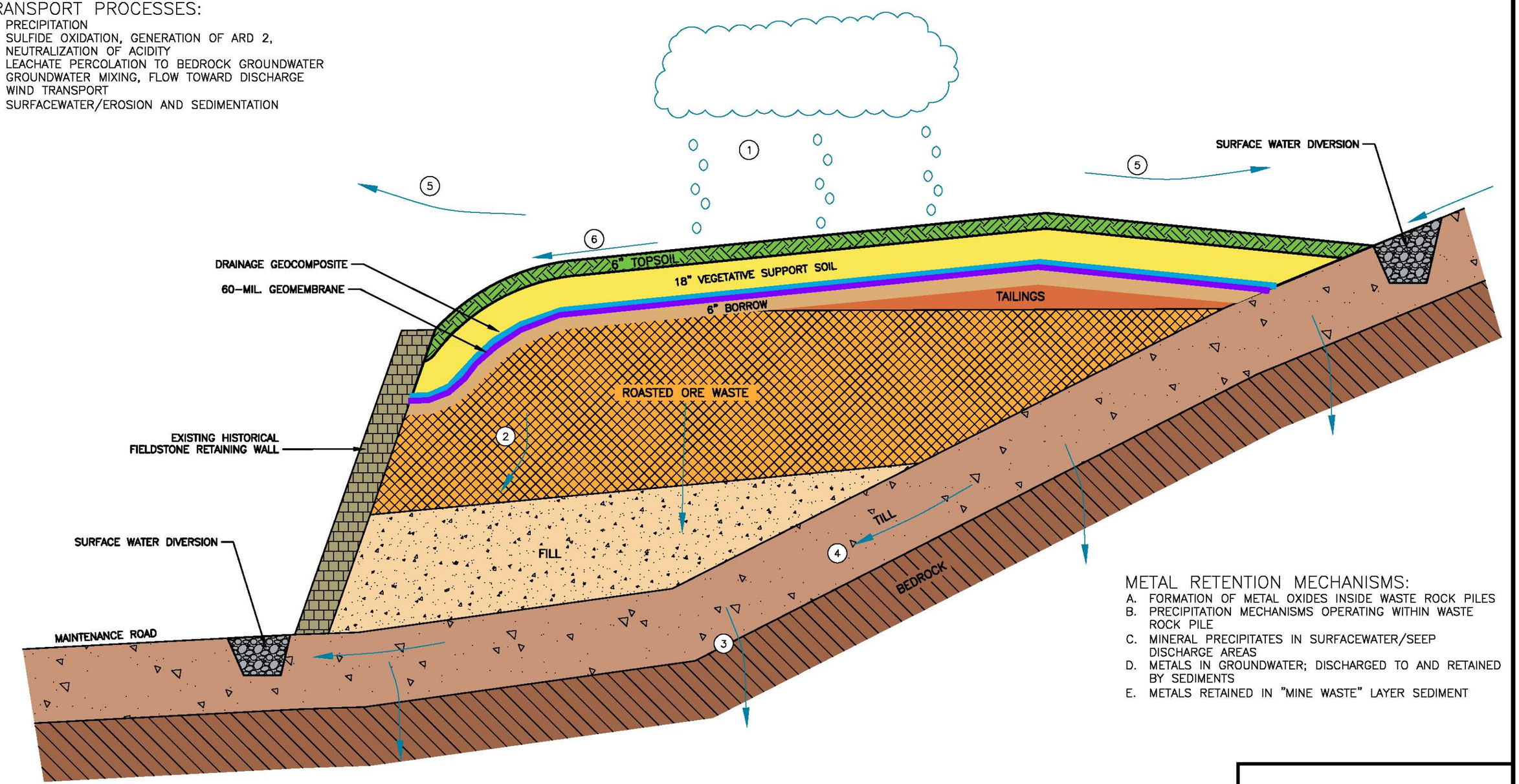
Conceptual Cross-Section of West Cell




ELY MINE OU1 ROD
FIGURE 26
Approximate Location of ORB Cell

TRANSPORT PROCESSES:

1. PRECIPITATION
2. SULFIDE OXIDATION, GENERATION OF ARD 2, NEUTRALIZATION OF ACIDITY
3. LEACHATE PERCOLATION TO BEDROCK GROUNDWATER
4. GROUNDWATER MIXING, FLOW TOWARD DISCHARGE
5. WIND TRANSPORT
6. SURFACEWATER/EROSION AND SEDIMENTATION



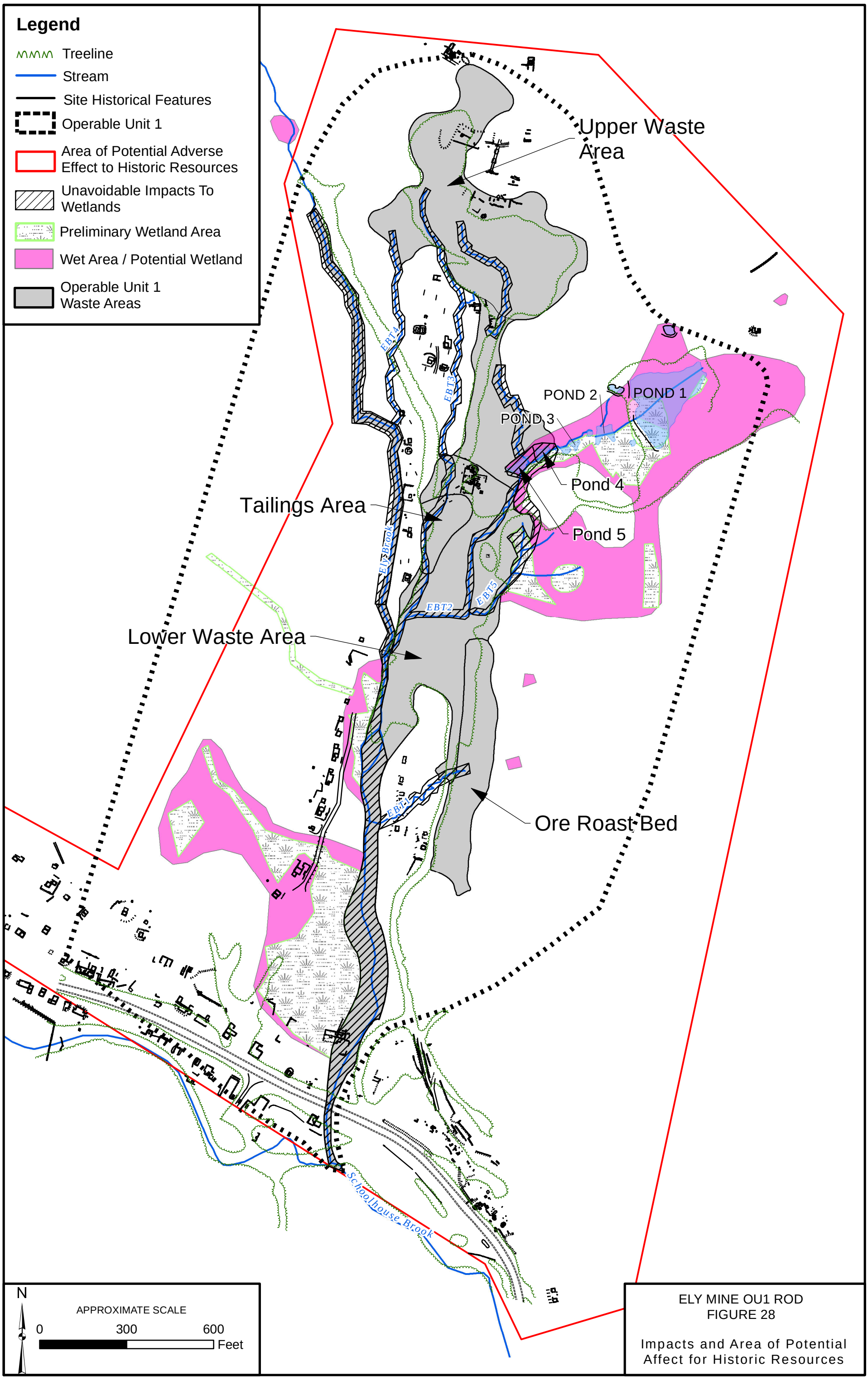

METAL RETENTION MECHANISMS:

A. FORMATION OF METAL OXIDES INSIDE WASTE ROCK PILES
B. PRECIPITATION MECHANISMS OPERATING WITHIN WASTE ROCK PILE
C. MINERAL PRECIPITATES IN SURFACEWATER/SEEP DISCHARGE AREAS
D. METALS IN GROUNDWATER; DISCHARGED TO AND RETAINED BY SEDIMENTS
E. METALS RETAINED IN "MINE WASTE" LAYER SEDIMENT

NOT TO SCALE

ELY MINE OU1 ROD
FIGURE 27

Conceptual Cross-Setion
of ORB Cell




ELY MINE OU1 ROD
FIGURE 28

Impacts and Area of Potential Affect for Historic Resources

ELY COPPER MINE
OU1 RECORD OF DECISION

APPENDIX B

LETTER OF CONCURRENCE FROM THE STATE OF VERMONT

VERMONT

**Vermont Department of Environmental Conservation**
Commissioner's Office
103 South Main Street, 1 South [phone] 802-241-3808
Waterbury, VT 05671-0401 [fax] 802-244-5141

*Agency of Natural Resources*

September 27, 2011

Ed Hathaway, Project Manager
US EPA ME/VT/CT Superfund Section
5 Post Office Square, Suite 100
Mailcode: HBT
Boston, MA 02109-3912

RE: Proposed Cleanup Plan and Record of Decision for the Ely Copper Mine Superfund Site
Vershire, VT (SMS Site#7700

Dear Mr. Hathaway:

The State of Vermont, Department of Environmental Conservation (VTDEC) has reviewed the 2011 Proposed Plan and the Record of Decision, dated September 11, 2011, to clean up the Ely Copper Mine Superfund Site. The VT DEC concurs with the preferred response actions outlined in the proposed plan and ROD, which consists of the following:

- Excavation of about 107,000 cubic yards of contaminated waste rock, soil and sediment from the Upper Waste Area, Lower Waste Area, Ely Brook, and Ponds 4 and 5, and consolidation within a containment cell with a low permeability cover system to be constructed west of Ely Brook within the Site (the West Cell);
- Excavation of about 4,000 cubic yards of contaminated tailings from the Tailings Area, and consolidation within a containment cell with a low permeability cover system to be constructed over the Ore Roast Bed.
- Land use restrictions to protect the engineered structures and restored areas along with long-term monitoring and periodic reviews of the cleanup performance.

The approximate cost of this proposed plan is $18 million. The VT DEC recognizes that the State will be financially responsible for ten percent (approximately $1.8M) of the capital cost and responsible for the operation and maintenance in perpetuity. The VT DEC estimates O&M for the proposed remedial actions to be approximately $50,000 per year *(EPA contractor has estimated $70,000.)*

This concurrence is predicated on obtaining the necessary funds from the Legislature. The VT DEC is committed to work with the Legislature to establish the required level and system of funding to meet the financial obligation at this site. The Legislature has been informed of this upcoming financial obligation at the Ely Mine and other Superfund sites in Vermont. The VT DEC intends to fulfill its obligations under CERCLA to the best of its abilities, given the funding constraints that may exist over the life of the project.

The VT DEC looks forward to its continued partnership with EPA and the successful implementation of this project.

Sincerely,

David K. Mears
DEC Commissioner

cc: Chuck Schwer, VTDEC
Linda Elliott, VT DEC

ELY COPPER MINE
OU1 RECORD OF DECISION

APPENDIX C

RESPONSIVENESS SUMMARY

# APPENDIX C
# ELY COPPER MINE SUPERFUND SITE
# OU1 RECORD OF DECISION
# RESPONSIVENESS SUMMARY
# September 28, 2011

## PREFACE:

The purpose of this Responsiveness Summary is to document EPA's responses to the questions and comments raised during the public comment period. EPA considered all of the comments summarized in this document before selecting a final remedial alternative to address contamination at the Site. Attachment A to the Responsiveness Summary contains a copy of the transcript from the public hearing held on Thursday, August 25, 2011 at the Vershire Town Center Building in Vershire, Vermont. All of the original comments submitted during the comment period are included in the Administrative Record.

This Responsiveness Summary addresses comments pertaining to the OU1 Proposed Plan, the OU1 Feasibility Study Report, the EPA finding regarding the Least Environmentally Damaging Practicable Alternative for the wetlands at the Site, the finding regarding unavoidable adverse effects on historic resources, and the Administrative Record for the Ely Copper Mine Superfund Site that were received by EPA during the comment period from July 28 to August 27, 2011. Federal and State agencies, local officials, and several members of the community submitted comments to EPA either in writing or at the public hearing. The State of Vermont and the US Fish and Wildlife Service expressed support for the cleanup action as did one member of the community. One individual expressed a concern that the cleanup did not harm the bat population, given the impact of the white nose fungus on their wintering population at the Site. The majority of the comments did not support the cleanup. The individuals were primarily concerned with the cost relative to other government funding priorities and the lack of a perceived need for the cleanup.

Several comments were provided as opinions regarding the cleanup actions at the nearby Elizabeth Mine. As the purpose of the hearing and comment period was to accept and evaluate comments regarding the cleanup proposal for the Ely Copper Mine, EPA has not developed a response to the comments regarding the Elizabeth Mine.

## SUMMARY OF COMMENTS FROM FEDERAL, STATE AND LOCAL AGENCIES AND OFFICIALS, AND FROM INDIVIDUALS

### Comments from State or Local Government or other federal agencies:

<u>Comment from Vermont Department of Environmental Conservation:</u>

The VT DEC commented that they had reviewed the proposed plan and supporting documents for the OU1 cleanup. Based on this information the VT DEC concurs with the EPA's cleanup proposal. The VT DEC recognizes that the State will be financially responsible for 10 percent (or approximately $1.8 million) of the capital costs for the remedy and for operational and maintenance costs in perpetuity. At this time the State's contribution for the proposed cleanup

# APPENDIX C
# ELY COPPER MINE SUPERFUND SITE
# OU1 RECORD OF DECISION
# RESPONSIVENESS SUMMARY
# September 28, 2011

## PREFACE:

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has not been approved by the Vermont legislature. However, the legislature is aware that there are financial commitments associated with the cleanup actions at the Ely Copper Mine, and the VT DEC is committed to work diligently with the legislature to establish the required level and system of funding to meet the State's financial obligation at the Site.

> *Response: EPA and the State of Vermont have worked as partners at the Ely Copper Mine. The continued support of Vermont DEC is appreciated and noted for the record. EPA understands that future expenditures must be addressed through the state budgetary processes.*

Comments from Vershire Selectboard:

A representative from the Vershire Selectboard, Mark McKee, commented that there does not appear to be any local concern regarding the Ely Mine.

> *Response: While the lack of local concern regarding the threat represented by the Ely Copper Mine is noted as a comment, it does not change the finding of the remedial investigation and feasibility study which documented significant ecological impacts associated with the release of toxic metals from the Site. It is acknowledged that there is not a current human health threat at the Site based on the current land use. There would be a potential for an unacceptable threat to human health if someone were to install a water supply well and ingest the contaminated groundwater or if a child were to reside on the property and come into regular contact with the waste and soil contaminated with cobalt, copper, and iron. EPA's cleanup decision is based on these unacceptable current ecological and future human health risks.*

The representative from the Vershire Selectboard also inquired whether the project could be left unfinished if EPA was terminated as a government agency.

> *Response: Prior to the initiation of any cleanup action at the Ely Copper Mine, EPA will fully consider how to stabilize the Site in the event of an unexpected shut down of the project for any reason or period of time.*

The representative from the Vershire Selectboard also commented that there are local infrastructure needs that would be a higher priority to the Town of Vershire than the cleanup of the Ely Copper Mine, particularly the stabilization of the river bank near the Vershire Town Center Building which is also the designated Red Cross emergency shelter.

> *Response: EPA acknowledges that the Town of Vershire has many town-related projects that are a higher priority for the Town in terms of the expenditure of funds than the Ely Copper Mine. The expenditure of federal EPA Superfund remedial action cleanup money is limited to only those projects that have been listed on the federal National Priorities List, such as the Ely Copper Mine Superfund Site.*

State Representative Mark MacDonald:

State Representative MacDonald expressed his support for those who advocate not to cleanup the Ely Copper Mine, based on a concern for the difficult financial circumstances facing the State of Vermont and the federal government. He notes that he fully supports federal assistance for projects that will help Vermont in the future.

> *Response: The Representative's support for the opinions of his constituents is noted. EPA believes that the cleanup of the Ely Copper Mine and the restoration of Schoolhouse Brook and Ely Brook is a project that will help Vermont in the future by improving the overall environmental quality of the area and will permit the productive reuse of the Site to the benefit of the local community. As noted in the response to the previous comment, EPA cannot spend federal Superfund remedial action cleanup money on projects or priorities outside of the projects that have been listed on the National Priorities List.*

United States Fish and Wildlife Service (USFWS):

The USFWS provided the following comments: We are in support of EPA's Proposed Plan for remedial actions on Operable Unit 1 which includes consolidation and isolation of AMD-generating and erosion-prone waste and restoration of remediated areas to productive habitat. We realize that wetland impacts will occur due to removal and consolidation activities, and expect that they will be avoided or minimized to the greatest extent practicable. Wetland mitigation is required for loss of wetland habitat. We are interested in consulting with EPA and VT Department of Natural Resources (DNR) on appropriate onsite mitigation alternatives and other aspects of remedial and restoration design. As EPA is aware, Ely Mine workings support bat populations of several different species, including the state-listed eastern small-footed bat (*Myotis leibii*). Currently, as documented by VT DNR and FWS, species declines have occurred at Ely Mine due to white-nose syndrome. Protection of all known bat hibernacula is very important due to precipitous regional species declines from this disease. Currently, no federally listed bat species utilize Ely Mine workings; however, continued declines of common species, some of which are present at Ely Mine, may lead to federal protection in the future. EPA should consult with VT DNR and FWS to avoid or minimize potential impacts from remedial actions to bat species utilizing Ely Mine habitat. In summary, remedial and restoration actions proposed will significantly improve terrestrial and riparian migratory bird and associated species habitat, as well as amphibian, benthic and fish community habitat. These areas have been severely impacted for decades, will continue to be impaired without action, and deserve to be remediated and restored to their full habitat potential. We look forward to working with EPA on remedial and restoration aspects of the Ely Mine Site.

> *Response: EPA appreciates the support of the USFWS regarding the cleanup plan for OU1 and the confirmation that this cleanup will significantly improve ecological habitat at the Site. EPA will be working with the appropriate state and federal stakeholders, including VT DEC and USFWS, regarding the design and implementation of the selected remedy. In particular, EPA will consult with the appropriate state and federal agencies*

*regarding design and implementation issues relating to wetlands impacts and mitigation and minimizing potential impacts of the remedial action to protected bat species and habitat.*

**Comments from Individuals:**

Comment: One individual expressed support of the cleanup of the Ely Copper Mine.

*Response: EPA agrees that the cleanup should be implemented and appreciates the support.*

*Comment:* One individual expressed a concern that the cleanup could harm the recovery of the bat population.

*Response: As noted in the response to the comments from the USFWS, EPA will coordinate with the state and other federal agencies to minimize impact to the bat population. EPA is well aware of, and equally concerned, about the serious decline in the bat populations. The design will focus on efforts to minimize any impact to the bat population, particularly wintering habitat within the mine structures. This could include limiting construction activities to the non-winter months when the bats are not present in the mine shafts and adits.*

*Comment:* One individual expressed a concern that the cleanup actions not adversely impact the snowmobile trail that runs through the Site.

*Response: EPA will work with the property's owner, local community and snowmobile clubs to identify the land used for the trails. At this time EPA does not expect an interruption in the use of the snowmobile trail due to the Site cleanup. The West Cell and ORB Cell will be located to avoid the snowmobile trail if possible, or relocate the trail if not (if permitted by the property's owner). In addition, the majority of the cleanup work is likely to occur when there is no snow at the Site. The long-term Superfund land use restrictions that will be implemented at the Site would not prevent the continued use of the snowmobile trail.*

*Comment.* A commenter expressed a strong concern that the historic resources be protected and that EPA work with the local historical society.

*Response: EPA agrees that the design and implementation activities should take into consideration the historic resources at the Site. While there will be some changes to the landscape resulting from the removal of the waste piles, the shafts, adits, roast bed wall, stone flue, and smelter will all remain intact based on the OU1 selected remedial action. EPA is required, by the National Historic Preservation Act, to avoid impacts to historic resources when possible and minimize the impact to the extent possible. The design will attempt to achieve the balance of avoiding and minimizing impact while also achieving the other cleanup requirements. EPA has made an official finding that there will be an unavoidable permanent impact to certain historic resources at the Site. EPA has*

*completed a substantial amount of historic resource documentation. The report with this documentation is included in the administrative record. The title of the Report is: Final Historic/Archaeological Mapping and Testing, Ely Mine Site. Public Archaeological Laboratory (PAL) January 2005. EPA has through the remedy selection process, and will continue to consult with the State Historic Preservation Office and interested stakeholders concerning historical preservation issues. As part of remedial design, additional investigations may be required to evaluate areas not previously assessed, particularly in the vicinity of the proposed West Cell.*

*Comment:* Several commenters expressed opinions that the cleanup was not necessary, too expensive given the perceived lack of impacts, and not well justified. There was also a concern that only human health risks should be resolved using Superfund money and that land use restrictions or partial cleanup actions should be considered.

*Response: EPA does not agree that the environmental impacts are relatively minor. The ecological impairment caused by the release of hazardous substances, pollutants, or contaminants from the Site is causing an unacceptable threat to the ecology of Ely Brook and Schoolhouse Brook. In addition, the groundwater at the Site is contaminated and the soil would be unhealthful for residential exposure by children.*

*The Aquatic Baseline Ecological Risk Assessment, Ely Copper Mine Superfund Site, Vershire, Vermont, August 2008 and United States Geological Survey Aquatic Assessment of the Ely Copper Mine Superfund Site, Vershire, Vermont 2010, both provide substantial documentation of the severe ecological impacts that are ongoing within Ely Brook and Schoolhouse Brook as well as Pond 4 and Pond 5. Both of these documents are contained in the administrative record for OU1 at the Ely Copper Mine. For example, when EPA exposed fish to the water of lower Ely Brook, 100% of the fish died within 48 hours. When the water from Schoolhouse Brook below the confluence with the Ely Copper Mine was used for testing, 97% of the fish died within 7 days. In contrast, 90% of the fish were still alive after 7 days when water from Schoolhouse Brook upstream from the Ely Copper Mine was used for testing. Biological quality testing of the benthic community demonstrated a greater than 90% reduction in the species of benthic macroinvertebrates in Lower Ely Brook when compared with the section of Ely Brook upstream of the mine impacts.*

*In addition, EPA is required to comply with the Superfund Law and the implementing regulations. The goals and expectations of the law and those regulations are summarized in the EPA Guidance: RULES OF THUMB FOR SUPERFUND REMEDY SELECTION EPA 540-R-97-013 OSWER 9355.0-69 PB97-963301 August 1997:*

*Program Goal (40 CFR 300.430(a)(1)(i)) The national goal of the remedy selection process is to select remedies that are protective of human health and the environment, that maintain protection over time, and that minimize untreated waste.*

*Program Expectations (40 CFR 300.430(a)(1)(iii)(A-F)) EPA generally shall consider the following expectations in developing appropriate remedial alternatives:*

- *EPA expects to use treatment to address the principal threats posed by a site, wherever practicable.*
- *EPA expects to use engineering controls, such as containment, for waste that poses a relatively low long-term threat or where treatment is impracticable.*
- *EPA expects to use a combination of methods, as appropriate, to achieve protection of human health and the environment.*
- *EPA expects to use institutional controls, such as water use and deed restrictions, to supplement engineering controls as appropriate for short- and long-term management to prevent or limit exposure to hazardous substances, pollutants or contaminants.*
- *EPA expects to consider using innovative technology when such technology offers the potential for comparable or superior treatment performance or implementability, fewer or lesser adverse impacts than other available approaches, or lower costs for similar levels of performance than demonstrated technologies.*
- *EPA expects to return usable ground waters to their beneficial uses wherever practicable, within a timeframe that is reasonable given the particular circumstances of the site.*

*The Superfund law does not support cleanups that only use institutional controls to address Site risks when cost effective measures to control the waste are available. Since the waste at the Ely Mine is classified as long-term threat waste, engineering controls, such as the containment cells, are consistent with the requirements of the Superfund law and its accompanying regulations.*

*Comment:* One commenter expressed a concern that the risk assessment assumptions were not realistic. In particular, the commenter took exception to the assumption that children would be exposed at the Site 350 days per year, every day, for 24 hours at the Site. The commenter suggested that they may be there for a half an hour, at best, for two or three days.

*Response: The human health risk assessment evaluates a number of current and future land use scenarios. The current land use is best characterized as having adjacent low density rural residential use with on-Site activity limited to occasional use by those visiting the Site for various reasons (historic resource viewing, rock collecting, ATV use, or horse riding). EPA is required to consider a reasonable maximum exposure scenario. For the Ely Copper Mine, there are no current restrictions that would prevent future residential development. EPA has been approached by one couple with a strong interest in acquiring and constructing a home on the Site property. As a result, a future residential use, while it may be low density, is a viable possible future land use. EPA is also required to specifically evaluate the potential threats to children. Based on the best currently available toxicity information, the human health risk assessment concluded that if the contamination was left exposed at the Site, a child residing on the Site was at risk for thyroid and gastrointestinal health effects. Even though the ground in Vermont may be frozen for several months per year, the human health risk assessment assumes that the dust within the home could be a source of exposure during the winter months. The documentation regarding the human health risk assessment, including exposure assessments and risk calculations can be found in the administrative record document:*

*Final Human Health Risk Assessment. Ely Copper Mine Superfund Site, Vershire, Vermont. May 2011.*

Comment: The previous commenter was supportive of the implementation of land use restrictions.

*Response: The cleanup plan for OU1 includes land use restrictions that would protect the containment cells, monitoring wells, and other cleanup infrastructure from damage once the waste rock has been capped.*

*EPA does not, however, intend to prohibit all re-use of the entire property, including residential use. The Superfund law requires that EPA use permanent solutions to the extent possible. It is not sufficiently protective of human health to rely solely on land use restrictions when engineering measures can provide a much higher degree of protection and long-term effectiveness.*

Comment: Another commenter suggested that the cleanup be implemented in phases and allowed to stop when the funding is not available or the cost/benefit ratio declines.

*Response: EPA often implements large projects in phases. The Ely Copper Mine cleanup is being implemented in phases. The selected remedy is for the first phase, known as Operable Unit 1. This phase targets the source areas that are responsible for the majority of the ecological impact to Ely Brook and Schoolhouse Brook and the human health risks to future residential development. EPA must complete the cleanup as called for in this Record of Decision or revisit and potentially revise as required the cleanup plan. This includes complying with the applicable or relevant and appropriate regulatory requirements. While the Superfund law and its regulations provide procedures for reevaluating cleanups, cost is only one criterion out of nine that are considered as part of the process.*

*Comment.* Another commenter expressed concern that the cleanup may cause more harm due to truck traffic and land disturbance. This commenter also stated the site would achieve restoration without any cleanup actions.

*Response: While the areas adjacent to the waste piles have become re-forested, the waste areas remain a source of toxic acid rock drainage and remain degraded as a barren landscape over a century after the operations ceased at the Site. The barren area covers about 30 acres and represents the area that nature has not been able to heal. Natural processes are not able to overcome the acid generating potential of sulfide waste rock left at the Site from the historical mining operations. The acid generating potential would likely continue for a period of time longer than has already passed. Unless the cycle of acid generation is interrupted and the waste properly isolated and controlled, the restoration of the Site is not likely to happen. Since the acid rock drainage is created by the natural interaction of precipitation and sulfide waste, there is no reason to expect the natural conditions that generate the acid rock drainage to stop.*

*There would be a period of time with increased truck traffic which would be a nuisance issue for those living in the area. EPA picked a remedy with significantly less truck traffic required than other potential alternatives evaluated in the FS. It is very unlikely that any significant amount of dust would impact adjacent residents. There will be air monitoring during any cleanup actions and dust control measures will be used to limit the generation of dust. EPA has a policy to minimize the environmental footprint of its actions and reduce greenhouse gases to the extent practical. EPA will look at ways to minimize the need for off-site materials in order to reduce truck traffic. When the cleanup is completed and the area restored, the Site will have a much smaller adverse environmental footprint.*

## THE SELECTED REMEDY'S CHANGES TO THE PROPOSED PLAN MADE BASED UPON PUBLIC COMMENTS

There have been no significant changes to the selected remedy from the OU1 Proposed Plan as a result of public comments. The State of Vermont and USFWS expressed support for the OU1 Proposed Plan. There was only a limited response from the local community regarding the OU1 Proposed Plan. The majority of the public comments expressed a concern that the cleanup was too expensive and unnecessary. A few members of the local community did express support for all or parts of the OU1 cleanup. Both the USFWS and one member of the community expressed a strong opinion that the cleanup should not have an adverse impact on bat species that may reside at the Site.

ATTACHMENT A

TRANSCRIPT FROM AUGUST 25, 2011 PUBLIC HEARING

ATTACHMENT A

TRANSCRIPT FROM AUGUST 25, 2011 PUBLIC HEARING

**ENVIRONMENTAL PROTECTION AGENCY**
**ELY COPPER MINE**
**SUPERFUND SITE PUBLIC HEARING**

Public Hearing, held on August 25, 2011, at Vershire Town Center Building, 27 Vershire Center Road, Vershire, Vermont, commencing at 7:00 p.m., before Marilee J. Young, a Notary Public in and for the State of Vermont.

**HEARING**

**APPEARANCES:**

HEARING OFFICER: EDWARD HATHAWAY, RPM
ME/VT/CT Superfund Section
5 Post Office Square, Suite 100
Boston, MA 02109-3912

**ALSO PRESENT:**

From Vermont Department of
Environmental Conservation:
LINDA ELLIOTT, Project Manager
CHUCK SCHWER, Section Chief
ANDY BOECKELER, Consultant to EPA,
NOBIS ENGINEERING, INC.
DAVE GORHAN, Consultant to EPA, NOBIS
ENGINEERING, INC.

**HEARING**

**HEARING**

**AUGUST 25, 2011**

THE HEARING OFFICER: With that, Welcome. We're here for a public hearing tonight, so it's a little different format, a little different type of presentation. We have a stenographer here tonight, so the event will be recorded. So I'm going to do a brief introduction and then we provide for context, we provide an overview of the cleanup proposal, a very short one. Then we open up the hearing for public comment, and I'll describe more about that in a second. Then we'll close the hearing, and then, after the hearing, if you want to have an informal question-and-answer session, that's fine. The reason we're here tonight is to provide an opportunity to speak comments into the record, and as far as additional I will explain what to do with the comments. So this hearing has a formal structure. There's a presentation. I'm also the hearing officer, I'm opening the hearing tonight, so we're going to open the hearing at this time.

Once again, I will provide a brief summary of the cleanup proposal. The structure does not allow a discussion during both the presentation or the comment session, to allow a chance for comments to be provided. We will announce the start of the comment session at the end of the presentation, at which time we would ask anyone that has a comment to raise their hand. I will identify you one at a time. Stand up, speak your name and your affiliation for the record, so we can have that on there. The goal is speak -- basically, loudly and clearly enough so that the stenographer can hear you and record your comments accurately. What we would ask is that, if you have multiple comments, provide them one at a time, so everybody gets a chance. If you have a comment, make a comment. Then we'll give someone else a chance. Then, if you have more comments at the end, we'll be happy to hear you out.

Be as specific as possible, because the goal is to understand what your question,

concern, or issue is, so we can respond to it. And, once again, we cannot engage in a dialogue with you during the hearing part, so we will not be responding. Once there are no further comments, we'll close the hearing and, once again, we'll be available to answer questions. So the goal tonight is to talk about our proposed cleanup action for the Ely Mine. We've broken the site up into two phases. The cleanup proposal is for Operable Unit 1. It includes these areas outlined on the map, which are the Lower Waste Area, the Upper Waste Area, the Ore Roast Bed, and the Sediments of Ely Brook and its tributaries, as well as two of the five ponds, Ponds 4 and 5. It does not include a cleanup proposal for the smelter/slag area, the underground mine workings, the sediment of Schoolhouse Brook, or the site groundwater.

Other than the proposed land use restriction, early action for those. So the areas we're talking about shown on this map, probably the one area is essentially the waste areas. The areas remaining to be

1 HEARING
2 studied include the underground tunnels and
3 the sediments of Schoolhouse Brook. A quick
4 summary of our investigation program, so what
5 we found is there are levels of cobalt,
6 copper, and iron which are found above levels
7 that would not be safe for residential
8 exposure, so the levels of cobalt, copper,
9 and iron at the site, if the was
10 residential, which is 350 days a year of
11 exposure, it would be unhealthful. However,
12 for recreational exposure, for occasional
13 visits, there would be no risk, so this is
14 really in that residential scenario that
15 would of concern. The major sources of the
16 acid rock drainage, that's what impacting
17 streams, are the waste areas, the Upper Waste
18 Area, the Lower Waste area, and the very
19 small Tailings area. The surface water and
20 associated aquatic organisms in Ely Brook,
21 which is the brook that runs through the
22 site, as well as the tributaries of Ely
23 Brook, two of the five ponds along the
24 Schoolhouse Brook are severely impaired by
25 the acid rock drainage, and the sediments of

Ely Brook is toxic, it contains the mine waste. One of the reasons we split it up into phases not only is not only is the Smelter/Slag area a significant historic resource, it's also not clear to what extent it's a significant source of contamination.

We're going to study it more to see if maybe we can do less to disturb that area. The private water supplies in the area have not been impacted, we sampled them, several of them, they all turned up clean. The groundwater at the site is pretty much limited to the areas beneath the waste areas immediately adjacent to the waste areas. The groundwater does contain levels of cadmium, cobalt, copper, iron, and manganese that would be unsafe for consumption, and the groundwater in the tunnels basically moving away under the hill are subject to future study. We don't have a final conclusion on those yet. So we developed a feasibility study, cleanup approach. The objectives are to prevent the formation of acid rock drainage. We want to stop the acid release

into the brook so that we restore the brook and the habitat. We want to prevent individuals from coming into contact with levels of cobalt, copper, and iron that are above levels safe for residential use. We want to prevent aquatic organisms from coming into contact with sediments containing copper above safe levels for those ecological receptors. We want to restore the barren areas of site to promote healthy plant and invertebrate communities. As a guideline for that, the level of copper that we would deem acceptable for long- term exposure, cobalt would be 24 milligrams per kilogram, copper would be 629, the iron would be 44,800, and the sediments of copper level would be a 149 milligrams per kilogram. At this site there were several factors that we had to take into consideration in developing the cleanup.

The large volume of waste make most treatment options impractical. The shallow groundwater in the Upper Waste Area, the Tailings Area, and Lower Waste Area do not allow successful cleanup if waste were left

in place. The waste within the Lower Waste Area, in particular, is partially saturated; the groundwater is right up in the waste, which creates a challenge. Impacts to the clean wetlands must be minimized, and contaminated wetlands should be restored as functional habitats, adverse impacts to historic resources should be minimized, and we also want to avoid any adverse impacts to threaten or endangered bat species. We evaluated four cleanup options: No action; waste containment in the Lower Waste Area Cell so we would bring all the waste, consolidate it in this area here, waste containment in a West Cell, which would be constructed on this side, and we did look just matter of course of this, excavating all the material and hauling it off-site. The cleanup proposal that we have presented to the community for consideration is Option 3, which is waste containment in what we call the West Cell and also at the Ore Roast Bed. What that would involve is excavating the Upper Waste Area, the Lower Waste Area, and

all the contaminated sediments and placing them in an about eight acre or so area on the west side of the brook and then covering that with a cap.

The Ore Roast Bed, which is right here, and the tailing would be moved to the Ore Roast Bed and that would be capped in place. What that would allow to us do is leave the, historic wall, in place, cap on top of it, and, therefore, create some of preservation of the current resource. So there's about 107,000 cubic yards of contaminated waste rock and sediments from those areas that would go in the West Cell and there's about 4,000 yards of tailing would be moved to the Ore Roast Bed. The cleanup also includes land use restrictions to protect, such as the cap and the structures that are installed.

The estimated cost is $18 million. The main reasons we recommend this are obviously to protect the public health and environment by isolating the waste from contact and isolating the waste from water

and oxygen so there's no more acid rock drainage. That's the least impact to the environment, including the wetlands, and it avoids the technical and maintenance issues that would be associated with trying to build a cell in the area where the groundwater is the shallow and waste saturated and avoid the hauling issue associated with, well, of course, transporting material off site via truck.

Two disclosures that we're required by law to provide for further comment and consideration, we have determined this is the least environmentally-damaging practicable alternative for protecting wetlands and flood plains; contaminated wetlands and flood plains need to be impacted in order to restore them; and we will minimize any impact on non-contaminated wells. We also got a determination there will be unavoidable impacts to historic resources. In addition to that, we are proposing what is called an early action for the Operable Unit 2 two area, which essentially involves the gray

area at the bottom. Okay, what we want to do is make sure that no one develops the Smelter/Slag area for residential use until we have a final cleanup decision or anytime in the future and to prevent groundwater consumption under the Smelter/Slag Area. So that would be added to the land use restriction that would part of the primary cleanup action. This is an interim action. In the future, when we're ready to have a final cleanup decision for Operable Unit 2 we will incorporate this to it or may be the only cleanup necessary. So, once again, the green area shows the extent of land use restrictions for groundwater that may be put in place for both OU1 and OU2, and it shows a very large area that will be adjusted based on the final location of the West Cell and refinement of the groundwater contamination area. Any land use for areas outside the limits of the early action OU1 will be basically be land that's subject to local zoning regulations. So, moving forward, we had our public information

meeting on July 27, the public comment period ends on August 27, the hearing is tonight, and all the comments we receive by whatever media we will certainly consider it and develop a response to those comments as public record of decision. If you do not have a copy of the cleanup proposal and would like more information, the cleanup record is available at the Vermont DEC the Vershire Town Office, the EPA Records Center, and also on our website. By the end of this week, on August 27, the public comment period will end. At that time you can comment by either speaking your comments tonight into the record, you can send a letter or fax, as long as it's dated no later than the end of the day on the 27th, or you can send an e-mail, to any of those -- any of those mechanisms are equally acceptable, and we will respond to all comments. This is the contact information for the general site contacts as well as, once again, the EPA website and my e-mail address. So at this time the presentation

is over. Do you have a process question? We're almost ready.

FROM THE FLOOR: We're going to be able to ask any questions about the presentation you just gave?

THE HEARING OFFICER: After the hearing. This is a public hearing. The information meeting was July 27. This is only a comment hearing. That's the way the administrative proceedings are. So at this point we're going to open the public comment session. We will allow those who wish to provide a comment. We do invite any local or state representatives, select board members, or state officials to make comments first; and, after that, as I said, if you raise your hand, I will call on you one by one and give you a chance to provide your comment. Is there anyone from any of the local select boards that would like to make a comment?

MR. MCKEE: Hi, I'm Mark McKee, local select board. Before I make a comment, I need to ask a question. Did you

say there are no questions in the comment part?

THE HEARING OFFICER: Yes, we do not engage in a question-answer. We will have a question-answer session afterwards.

MR. MCKEE: Okay then maybe I should take a minute and think about my comment.

FROM THE FLOOR: Will there be an additional comment period after question-and-answer session?

THE HEARING OFFICER: No, the structure of this is that, once again, the proposed plan was released almost thirty days ago, there's been almost thirty days' opportunity to review the record, there was a meeting on July 27, which was the purpose of that meeting was to provide the information to allow people to come tonight and make comments. The purpose of tonight is to allow people to make those comments for the record. The reason we do not engage in a question-and-answer session is that it tends to use up the time available for questions. At the close of the hearing we would be

happy to basically answer questions that people didn't have a chance to ask at the last meeting.

MR. SCHWER: Then there's two days to comment.

THE HEARING OFFICER: A comment made by e-mail, mail, or fax has no different weight or bearing than the comments spoken tonight so, if in the formal session, if you home and you want to write out a comment, didn't have a chance to speak it into the record, you have a chance to do so, it will be in the public record just as what is spoken tonight is. Would the State like to make a comment?

MR. SCHWER: Sure. My name is Chuck Schwer. I work for the Department of Environmental Conservation. I'm a section chief there, and it's our section that provides oversight of any EPA plans for these type of superfund sites. So, for the record, the Vermont Department of Environmental Conservation has reviewed the 2011 proposed plan and supporting documents.

Based on this information the Vermont DEC concurs with the EPA's cleanup proposal. The Vermont DEC recognizes that the State will be financially responsible for 10 percent or approximately 1.8 million of the capital costs and for operational and maintenance costs in perpetuity. At this time the State's contribution for the proposed cleanup has not been sanctioned by the Vermont legislature. However, the legislature is aware that there are financial commitments associated with the cleanup actions at the Ely Copper Mine, and the Vermont DEC is committed to work diligently with the legislature to establish the required level and system of funding to meet the financial obligation at the site.

THE HEARING OFFICER: Once again, is there any select board members that would like to seek? If not, we will open the floor to anyone else that would like to provide a comment.

MR. FREITAG: My name is John Freitag. Superfund was written in response

to a chemical waste dump known as "Love canal." Our own Vermont Senator Bob Stafford was a co-sponsor of this legislature designed for our nation's most toxic and hazardous waste sites. It was not written for an abandoned copper mine that was abandoned a hundred years ago and that, according to Bureau of Mine studies on an EPA website, only slightly impacts Ely Brook. Ten years ago, when this project was first proposed, the government was running a budget surplus. Now we're facing massive deficits, and both the federal government and the State have to make hard decisions and cut back services. To spend $18 million, $1.8 million dollars of which comes from the State of Vermont, on this relatively minor problem is Vermont's equivalent of Alaska's "Bridge to Nowhere." For the last twenty years I've been the certified operator of a public water system in Strafford, Vermont. An EPA-funded organization, Vermont Rural Water, has provided technical expertise and training. Last year their budget was cut and staff

reduced, and it's going to get worse. At the same time east branch of the Ompompanoosuc has been identified as having E. coli problems and have violated water quality standards there. Yet, no money is available from the State to deal with these real problems with human health. As a nation and as a state we must in this time of limited resources make wise decisions.

Going forward with this overly-large and expensive solution to a relatively minor problem would be a mistake and take money away from other worthy projects. I strongly urge that this project not be funded and simpler, less-expensive alternatives to addressing the runoff be explored.

THE HEARING OFFICER: Okay. Anyone else want to make a comment?

MR. TREBITZ: I'm Heinz Trebitz. I live in Thetford Center. I've been living here for about twenty years, so I'm familiar with the Elizabeth Mine cleanups, and, of course, we all saw it coming that this Ely Mine cleanup would also be on the program.

Maybe I can ask a question to whoever is here how many people are here from West Fairlee? Just two people. Okay, interesting. If I take what you just showed us and told us about the impact of the Copper Mine to the public health, there is a number of questions that arise. No. 1 is, if you talk about protecting public health and at the same time you talk about a 350-day exposure to cobalt, copper, and iron, I question whether there's anybody in West Fairlee who ever gets that kind of exposure.

That exposure in West Fairlee is much, much less than that. To extend it further, if you say we need to protect children from that kind of exposure, obviously children will not play 350 days a year, every day, for 24 hours at that site. They may be there for half an hour, at best for two or three days, but other than that they will not be in there. So you kind of wonder what extent of public health protection this costly cleanup will provide. You mentioned that you might protect bat

species. I'm wondering whether this is just a convenient argument in favor of a cleanup. I think anybody who has been up there in the area knows that there have been bats around, and I don't think that anybody will really relate the Copper Mine to the recent demise of bats by the gray nose disease. So it's very doubtful whether the supposed protection of health that comes from EPA proposed really is there. Now, in all credit to give to EPA, I think the idea to prevent development of the immediate area of the Ely site, I think that is a very good idea. We should not go into another Love Canal situation or so, and that can be easily done, but anything else EPA is proposing, I think, it's a big money waste. Thank you.

THE HEARING OFFICER: Okay. Any other comments?

MR. COFFIN: My name is Edmund Coffin. I come from Strafford. I'm fairly familiar with the Ely Mine and, like John, I've taken the liberty of preparing a short formal statement which I would like to read.

I can give a copy to you directly. Our experience in Strafford has not been happy in several respects. First, EPA never proved that the waste presented any threat to human health. On the contrary, it was later proven to present no such threat, only a violation of Vermont water quality standards.

Second, for a variety of reasons, including correction of faulty original designs, the cost has risen from first 6 million, then 12 million, and now 50 million, and we're not yet through.

Third, no environmental impact study was made initially; none has yet been made, but we can be certain that serious environmental damage has resulted from chewing up and transporting more than 10,000 truckloads of rocks and fill from Lebanon and elsewhere, and serious damage has been done to the roads between the quarries and Strafford. These costs are not included in the 50 million. Some people beared them.

Fourth, although EPA intended to cover a hundred percent of the cost leaving

1 the State with a complete cleanup at no
2 cost, it is now clear that the State will
3 have significant ongoing maintenance costs at
4 the site.
5 Fifth and finally, despite all these
6 expenditures, EPA admits the project will
7 still not meet clean water standards at the
8 point of compliance, and EPA probably will
9 further admit that the highest percentage of
10 cleanup could have been achieved at a
11 fraction of the $50 million. I would add,
12 however, that EPA, under Ed Hathaway's
13 supervision, did a very clean operation, it
14 was not squalid, everything was cleaned up
15 good, it was neatly done, very
16 professionally; but, as a result of our
17 experience in Strafford, I would like to make
18 three sort of charges to EPA and the State
19 of Vermont officials concerned with this
20 project. The first is, if you have not
21 irrefutable proof that the mine presents a
22 threat to human safety, it really should not
23 be -- it should not go ahead with it,
24 because, if not, there are thousands of toxic
25

1 dumps around the country that everybody knows
2 very clearly do present a present and serious
3 threat to human beings. And, if we take
4 some of those funds for here for something
5 that isn't really toxic and seriously toxic,
6 it really is unconscionable on Vermont's part
7 to do so. The second is, if there is no
8 irrefutable evidence that the project, when
9 completed, will meet Vermont's Clean Water
10 Act standards, wouldn't it be sensible to
11 carry it out in a series of stages with the
12 option of calling it quits when it seems
13 likely funds, EPA funds, will no longer be
14 available or the cost/benefit ratio begins to
15 decline sharply. And, finally, and this I
16 address to the representative from the State
17 of Vermont, how can the State take -- what
18 steps can the State take now -- how can the
19 State is a bad question. Can the State take
20 steps now that will guarantee that its total
21 commitment will be no low -- no hire than
22 1.8 million. I think all of us in this
23 country, including Vermont state officials,
24 have been guilty of treating federal money as
25

if it were free, and we're now paying the consequences. If this project doesn't represent a real toxic threat to human safety, the Tea Party will have a fine example of wasteful spending, and I want no part of it. That's why I'm here.

THE HEARING OFFICER: Any other comments? Back?

MS. M. FRENCH: Melanie French. I'm one of the people that's right near the mines. My family's been living there for generations, I believe since before the mines were there; and my concerns are -- I have many more health concerns about the process of cleanup and the perpetual care that has to go on there and what that's going to do to the environment than I -- than my concerns right now and the way that it's been for my whole lifetime and generations before me. We don't have any proof that this caused any harm to humans or that it's going to, from what I can see, but I do have concerns that it's going to affect our living standards with trucks in and out of

there, dust and things dug up that have been healing for a hundred years, suddenly out in the environment, and then the nature that's been trying to heal itself for a hundred years being damaged and having to start all over, as well as the wildlife, and the fact that we're going to have to control a lot of that wildlife for part of this perpetual care when it's now their environment again. So my concerns are more about the cleanup. I think that we should leave alone, let nature continue to do its healing, and let things lay as they are.

THE HEARING OFFICER: Gary?

MR. G. GOODRICH: My name is Gary Goodrich. I'm a taxpayer here in Vershire; I've lived here for 28 years. I'm also the president of the Vershire Historical Society, and I'm going to speak for the Vershire Historical Society first. It's our -- it's our outlook or prospective to try to retain the historical value of that site, because it played a very important part in the history of this town, and I'll, just for record, the

300 acres that encompasses the Ely Mines all are located in Vershire, Vermont. There are no parts of it in that are in West Fairlee. West Fairlee played an important role and I wish that some of the selectmen and some of their historical society had been here tonight, but to get back, even though there are a bunch of foundations and retaining walls and stuff, the seventy years that the mines were in progress and the mining was taking place there, but fifty years really when it got going, saw a big growth economically to this town. We went from a thousand people to 2,100 to 2,500 at its peak. Later, when the mines closed, this town went to nothing, that was in 1960, there was only 269 people in this town, but it still played a very important role, and I would like to see that preserved and I'm also willing to work with the EPA as a contact person or a person of interest that they ask questions upon, you know, if they have to take something down, then we'll try to do it with the most minimal damage to the

site. I think it's worth preserving, and I would just like to see it preserved. Thank you.

THE HEARING OFFICER: Anyone else like to have a comment?

MR. MCKEE: Mark McKee, on the select board. I've been on the select board for four plus years, and in the four years, to my memory, no one has ever come to the select board with a real concern about the issue of cleaning up the mine. So that's one. And to -- I think I'll echo Ed Coffin's comment about the Tea Party, in the current national political climate I wonder if a project of this nature might be left unfinished should the EPA be dissolved or, you know, just terminated as a part of our government. I wonder, that seems more possible day by day. And, three, of a greater concern to me at the moment is the eroding river bank right out that window that threatens a utility pole and the future site of the emergency generator that we are installing for this building, and because

this building is not only a major resource to the town of Vershire but it's also entered into an agreement with the Red Cross designating it as an emergency shelter, and I think a loss of -- that's part of this property -- to a flood or a water emergency would be more serious to this town than whatever potential problems are done at the site. Thanks.

MS. R. FRENCH: I'm Rita French; I'm also on the select board. Ed knows that I'm totally against this project anyway. I'm against it for any number of reasons. I don't feel it's necessary. I think nature left to itself, it's been healing. If it hadn't been logged off three times, it would have healed a lot more, at least three times that I know of, but I'm -- I am concerned that the Government wants to spend $18 million for no reason that I can see. It's -- it just seems you're throwing money away. And I'm also concerned that the State is going to have to spend indefinitely to keep this the way the Government says it's

supposed to be, and the cost is only going to go up, I've never seen anything go down, if the Government's got anything to do with it. So that's -- I'm on the record as totally against it. I think it's unnecessary.

THE HEARING OFFICER: Any other questions or comments? John?

MR. FREITAG: Yeah. I would just like to add, regards to your comment about potentially making it worse, the experience at the Elizabeth Mine was, it was -- it was made worse. Terry Libby over in Chelsea, friend of mine, we're both facility managers, and he has this phrase, "If you kick a turd, it's going to smell." And what happened at the Elizabeth Mine, the work there caused a massive iron spike, and the EPA, to their credit, they came in and they built a treatment plant to deal with the problems they created. And, the fact is, that, when you stir all this stuff up, you're not working with nature, you're working against nature, and the likelihood of it becoming

worse before it becomes better is highly likely, and so I think your concerns are valid based on experience in Stafford. The river was turned orange for four miles. I don't know if you remember that, but you can't help -- you can't help it, when you tear all this stuff up, you're going to make it worse before you make it better.

THE HEARING OFFICER: Any further comments?

MR. MACDONALD: I represent the district legislature, and I watched the Elizabeth Mine process, and it ballooned over the years, during times when we had plenty of money coming from the feds. The legislature is struggling right now with waste being stored down in Brattleboro at the nuclear plant, and there is no place to send that, and there is inadequate funding for that one. I know you have no power to take the $18 million and put it to use on preventing future things that might have to be cleaned up. I do not oppose spending federal money in Vermont to do things that

help Vermont in the future, such as building roads, building bridges, and rehabbing our infrastructure; but, with the pressing needs that we have, I think the folks have already spoken, showing that proper yankee view of how federal money should be spent, and I hope you heed their advice. Mark MacDonald, and I live in Williamstown. I represent towns in this county in the Vermont Senate.

THE HEARING OFFICER: Any further comments? At this point we're going to close the hearing.

MS. PEARSON: Ed, I guess I need to speak out of sense of conscious. Peet Pearson, I live here in Vershire. Because we're not voting here tonight and because we really have no power beyond making comment, I at least want to go on the public record saying that, when we determine the quality of the world we're going to have on the basis of limited money, we're using an incredible amount of limited imagination. The reason we have limited money is because we spend it on all kinds of things that destroy us so that,

in the long run, we've got a whole lot of reprioritizing to do, and I realize that even $1.8 million from us in Vermont is a lot of money, 18 million from us in federal taxes is a lot of money, but I at least want somebody in this gathering to go on record saying that, given the fact I have been to your meetings before, I don't think this place is getting cleaned up naturally, I think it does require some kind of effort.

The statistics do not show that it is, in fact, going to be clear on its own. I'm not sure now is the time to make this big an investment, but I certainly hope that our imagination encompasses a much, much better world than we've lived in or that we are going to give to our children and that the reason we don't have the money is our own dam stupidity getting us in this mess in the first place with bad priorities and spending it for non-human-enhancing and earth-enhancing kinds of costs.

THE HEARING OFFICER: Did you want to comment? It would have to be a comment,

not a dialogue, but.

MS. R. FRENCH: I agree with some of the things she said; I disagree with others. If she's seen a picture of that place with the mine was going on, I think she would have to admit that it has done a remarkable amount of healing; and, as I said before, if it hadn't been logged every time you turn around, a lot of it -- I can remember going up there blueberrying when the area above that long wall was completely covered with blueberry bushes, they went in and logged, they cleared it all off for a landing, so now -- and it had to start all over again. I mean, the pictures when it was - the mine was operating, there weren't any trees anywhere around there, up as far as where I live, there was loss of foliage.

So I think it is doing a lot of healing and, left to itself, will do a lot more.

THE HEARING OFFICER: Are there any other comments? Then at this time we will close the hearing. Thank you all for making

your comments; they will be fully considered.

We're done for the recorded part. If you do have questions, I would be happy to engage a question discussion.

**(Whereupon, The hearing adjourned at 7:34 p.m.)**

**HEARING**

**CERTIFICATE**

I, Marilee J. Young, Court Reporter and Notary Public, hereby certify that the foregoing pages numbered 2 through 31, inclusive, are a true and accurate transcription of my stenographic notes of the Environmental Protection Agency Public Hearing held on August 25, 2011, in Vershire, Vermont, starting at 7:00 p.m., and transcribed by me with use of computer-aided transcription and produced under my supervision for use in the matter of Ely Copper Mine Superfund Site Public Hearing.

Marilee J. Young

My commission expires

February 10, 2015

A

**abandoned** 18:7,7
**able** 14:5
**acceptable** 8:14 13:21
**accurate** 36:6
**accurately** 4:16
**achieved** 23:11
**acid** 6:16,25 7:24,25 11:2
**acre** 10:3
**acres** 27:2
**Act** 24:11
**action** 5:9,22 9:12 11:24 12:10,10,22
**actions** 17:13
**add** 23:12 30:11
**added** 12:8
**addition** 11:22
**additional** 3:20 15:10
**address** 13:25 24:17
**addressing** 19:17
**adjacent** 7:15
**adjourned** 35:6
**adjusted** 12:18
**administrative** 14:11
**admit** 23:10 34:7
**admits** 23:7
**adverse** 9:8,10
**advice** 32:8
**affect** 25:24
**affiliation** 4:12
**Agency** 1:5 36:8
**ago** 15:15 18:8,11
**agree** 34:3
**agreement** 29:4
**ahead** 23:24
**Alaska's** 18:19
**allow** 4:4,5 8:25 10:9 14:13 15:19 15:21
**alternative** 11:16
**alternatives** 19:16
**amount** 32:23 34:8
**ANDY** 2:14
**announce** 4:7
**answer** 5:7 15:11 16:2
**anybody** 20:12 21:4,6
**anytime** 12:5
**anyway** 29:13
**APPEARANCES** 2:2
**approach** 7:23
**approximately** 17:6
**aquatic** 6:20 8:7
**area** 5:13,14,18,24 6:18,18,19 7:5,10 7:11 8:23,24,24 9:3,13,15,25,25 10:3 11:7,25 12:2 12:4,7,15,18,21 21:5,13 34:12
**areas** 5:12,23,25,25 6:17 7:14,14,15 8:11 10:15 12:21
**argument** 21:3
**associated** 6:20 11:6 11:9 17:13
**August** 1:11 3:3 13:3 13:13 36:9
**available** 5:7 13:10 15:24 19:7 24:15
**avoid** 9:10 11:8
**avoids** 11:5
**aware** 17:12

B

**back** 18:15 25:9 27:8
**bad** 24:20 33:21
**ballooned** 31:14
**bank** 28:22
**barren** 8:10
**based** 12:19 17:2 31:4
**basically** 4:14 7:19 12:23 16:2
**basis** 32:21
**bat** 9:11 20:25
**bats** 21:5,8
**beared** 22:23
**bearing** 16:9
**becoming** 30:25
**Bed** 5:14 9:23 10:6,8 10:17
**begins** 24:15
**beings** 24:4
**believe** 25:13
**beneath** 7:14
**best** 20:20
**better** 31:2,9 33:17
**beyond** 32:18
**big** 21:18 27:13 33:15
**blueberry** 34:13
**blueberrying** 34:11
**board** 14:15,24 17:20 28:8,8,11 29:12
**boards** 14:21
**Bob** 18:3
**BOECKELER** 2:14
**Boston** 2:7
**bottom** 12:2
**branch** 19:3
**Brattleboro** 31:18
**Bridge** 18:19
**bridges** 32:3
**brief** 3:10 4:2
**bring** 9:14
**broken** 5:10
**brook** 5:15,20 6:3,20 6:21,23,24 7:2 8:2 8:2 10:4 18:10
**budget** 18:12,25
**build** 11:6
**building** 1:12 28:25 29:2 32:2,3
**built** 30:20
**bunch** 27:9
**Bureau** 18:9
**bushes** 34:13

C

**cadmium** 7:16
**call** 9:22 14:18
**called** 11:23
**calling** 24:13
**canal** 18:3 21:15

**cap** 10:5,10,19
**capital** 17:6
**capped** 10:8
**care** 25:16 26:9
**carry** 24:12
**caused** 25:22 30:18
**cell** 9:14,16,23 10:15 11:7 12:19
**Center** 1:12,12 13:11 19:21
**certain** 22:16
**certainly** 13:5 33:15
**CERTIFICATE** 36:2
**certified** 18:21
**certify** 36:4
**challenge** 9:5
**chance** 4:6,19,21 14:19 16:3,12,13
**charges** 23:19
**Chelsea** 30:14
**chemical** 18:2
**chewing** 22:17
**chief** 2:13 16:20
**children** 20:17,18 33:18
**Chuck** 2:13 16:18
**clean** 7:12 9:6 23:8 23:14 24:10
**cleaned** 23:15 31:24 33:10
**cleaning** 28:12
**cleanup** 3:12 4:3 5:9 5:11,17 7:23 8:20 8:25 9:12,20 10:18 12:5,10,12,14 13:8 13:9 17:3,9,13 19:25 20:24 21:3 23:2,11 25:16 26:11
**cleanups** 19:23
**clear** 7:6 23:3 33:13
**cleared** 34:14
**clearly** 4:15 24:3
**climate** 28:15
**close** 3:15 5:6 15:25 32:13 34:25
**closed** 27:16
**cobalt** 6:5,8 7:17 8:5,14 20:11
**Coffin** 21:21,22
**Coffin's** 28:14
**coli** 19:5
**come** 15:19 21:22 28:10
**comes** 18:17 21:10
**coming** 8:4,7 19:24 31:16
**commencing** 1:12
**comment** 3:13 4:5,7 4:10,20,20 11:13 13:2,13,15 14:10 14:12,14,20,22,25 15:2,8,10 16:6,7 16:11,16 17:23 19:19 28:6,14 30:11 32:18 33:25 33:25
**comments** 3:19,21 4:6 4:16,18,22 5:6 13:4,6,15,22 14:16 15:20,21 16:9 21:20 25:9 30:9 31:11 32:12 34:24 35:2
**commission** 36:18
**commitment** 24:22
**commitments** 17:12
**committed** 17:15
**communities** 8:12
**community** 9:21
**complete** 23:2
**completed** 24:10
**completely** 34:12
**compliance** 23:9
**computer-aided** 36:11
**concern** 5:2 6:15 28:11,21
**concerned** 23:20 29:19,23
**concerns** 25:14,15,19 25:24 26:11 31:3
**conclusion** 7:21
**concurs** 17:3
**conscious** 32:15
**consequences** 25:3
**Conservation** 2:11 16:19,24
**consider** 13:5
**consideration** 8:20 9:21 11:14
**considered** 35:2
**consolidate** 9:15
**constructed** 9:17
**Consultant** 2:14,16
**consumption** 7:18 12:7
**contact** 8:4,8 10:25 13:22 27:22
**contacts** 13:23
**contain** 7:16
**containing** 8:8
**containment** 9:13,16 9:22
**contains** 7:2
**contaminated** 9:7 10:2,14 11:17
**contamination** 7:7 12:21
**context** 3:11
**continue** 26:13
**contrary** 22:6
**contribution** 17:9
**control** 26:8
**convenient** 21:3
**copper** 1:6 6:6,8 7:17 8:5,8,13,15 8:17 17:14 18:7 20:7,11 21:7 36:14
**copy** 13:8 22:2
**correction** 22:10
**cost** 10:21 22:11,25 23:3 30:2
**costly** 20:24
**costs** 17:7,8 22:22 23:4 33:23
**cost/benefit** 24:15
**country** 24:2,24
**county** 32:10

**course** 9:18 11:10 19:24
**Court** 36:3
**cover** 22:25
**covered** 34:13
**covering** 10:4
**co-sponsor** 18:4
**create** 10:11
**created** 30:22
**creates** 9:5
**credit** 21:11 30:20
**Cross** 29:4
**cubic** 10:13
**current** 10:12 28:15
**cut** 18:15,25

D

**dam** 33:20
**damage** 22:17,20 27:25
**damaged** 26:6
**dated** 13:17
**DAVE** 2:16
**day** 13:18 20:19 28:20,20
**days** 6:10 15:14,15 16:5 20:18,21
**deal** 19:7 30:21
**DEC** 13:10 17:2,4,14
**decision** 12:5,12 13:7
**decisions** 18:15 19:10
**decline** 24:16
**deem** 8:13
**deficits** 18:13
**demise** 21:7
**Department** 2:10 16:18,23
**describe** 3:14
**designating** 29:5
**designed** 18:4
**designs** 22:11
**despite** 23:6
**destroy** 32:25
**determination** 11:21
**determine** 32:20
**determined** 11:14
**develop** 13:6
**developed** 7:22
**developing** 8:20
**development** 21:12
**develops** 12:3
**dialogue** 5:4 34:2
**different** 3:6,7 16:8
**diligently** 17:15
**directly** 22:2
**disagree** 34:4
**disclosures** 11:12
**discussion** 4:4 35:5
**disease** 21:8
**dissolved** 28:17
**district** 31:13
**disturb** 7:9
**documents** 16:25
**doing** 34:20
**dollars** 18:16
**doubtful** 21:9
**drainage** 6:16,25 7:25 11:3
**dug** 26:2
**dump** 18:2
**dumps** 24:2
**dust** 26:2

E

**E** 19:5
**early** 5:22 11:24 12:22
**earth-enhancing** 33:23
**easily** 21:16
**east** 19:3
**echo** 28:13
**ecological** 8:9
**economically** 27:14
**Ed** 23:13 28:13 29:12 32:14
**Edmund** 21:21
**EDWARD** 2:4
**effort** 33:11
**eight** 10:3
**either** 13:15
**Elizabeth** 19:23 30:13,18 31:14
**ELLIOTT** 2:12
**Ely** 1:6 5:9,15 6:20 6:22 7:2 17:14 18:10 19:24 21:13 21:23 27:2 36:13
**emergency** 28:24 29:5 29:7
**encompasses** 27:2 33:16
**endangered** 9:11
**ends** 13:3
**engage** 5:3 15:5,22 35:5
**ENGINEERING** 2:15,17
**entered** 29:4
**environment** 10:24 11:4 25:18 26:4,10
**environmental** 1:5 2:11 16:19,24 22:14,17 36:8
**environmentally-d...** 11:15
**EPA** 2:14,16 13:11,24 16:21 18:9 21:10 21:12,17 22:4,24 23:7,9,13,19 24:14 27:21 28:17 30:19
**EPA's** 17:3
**EPA-funded** 18:22
**equally** 13:20
**equivalent** 18:19
**eroding** 28:22
**essentially** 5:24 11:25
**establish** 17:16
**estimated** 10:21
**evaluated** 9:12
**event** 3:9
**everybody** 4:19 24:2
**evidence** 24:9
**example** 25:6
**excavating** 9:18,24
**expenditures** 23:7

**expensive** 19:12
**experience** 22:3 23:18 30:12 31:4
**expertise** 18:24
**expires** 36:18
**explain** 3:21
**explored** 19:17
**exposure** 6:8,11,12 8:14 20:11,13,14 20:17
**extend** 20:15
**extent** 7:6 12:15 20:23
**e-mail** 13:19,24 16:8

F

**facility** 30:15
**facing** 18:13
**fact** 26:7 30:22 33:8 33:13
**factors** 8:19
**Fairlee** 20:4,13,14 27:4,5
**fairly** 21:22
**familiar** 19:22 21:23
**family's** 25:12
**far** 3:20 34:18
**faulty** 22:10
**favor** 21:3
**fax** 13:17 16:8
**feasibility** 7:22
**February** 36:19
**federal** 18:14 24:25 31:25 32:7 33:5
**feds** 31:16
**feel** 29:15
**Fifth** 23:6
**fifty** 27:12
**fill** 22:19
**final** 7:21 12:5,12 12:19
**finally** 23:6 24:16
**financial** 17:12,17
**financially** 17:5
**fine** 3:17 25:5
**first** 14:17 18:11 22:4,11 23:21 26:21 33:21
**five** 5:16 6:23
**flood** 11:16,17 29:7
**floor** 14:4 15:9 17:22
**foliage** 34:19
**folks** 32:5
**foregoing** 36:5
**formal** 3:22 16:10 21:25
**format** 3:6
**formation** 7:24
**forward** 12:25 19:11
**found** 6:5,6
**foundations** 27:9
**four** 9:12 28:9,9 31:5
**Fourth** 22:24
**fraction** 23:12
**free** 25:2
**Freitag** 17:24,25 30:10
**French** 25:10,10 29:11,11 34:3
**friend** 30:15
**fully** 35:2
**functional** 9:8
**funded** 19:15
**funding** 17:17 31:20
**funds** 24:5,14,14
**further** 5:6 11:13 20:16 23:10 31:10 32:11
**future** 7:20 12:6,11 28:23 31:23 32:2

G

**G** 26:16
**Gary** 26:15,16
**gathering** 33:7
**general** 13:23
**generations** 25:13,20
**generator** 28:24
**getting** 33:10,20
**give** 4:21 14:19 21:11 22:2 33:18
**given** 33:8
**go** 10:15 21:15 23:24 25:17 30:3,3 32:19 33:7
**goal** 4:14,25 5:8
**going** 3:9,25 7:8 14:4,12 19:2,11 25:17,23,24 26:8 26:20 27:13 29:24 30:2,17 31:8 32:12 32:21 33:13,18 34:6,11
**good** 21:14 23:16
**Goodrich** 26:16,17
**GORHAN** 2:16
**government** 18:12,14 28:19 29:20,25
**Government's** 30:4
**gray** 11:25 21:8
**greater** 28:21
**green** 12:15
**groundwater** 5:20 7:13,16,19 8:23 9:4 11:7 12:6,16 12:20
**growth** 27:13
**guarantee** 24:21
**guess** 32:14
**guideline** 8:12
**guilty** 24:25

H

**habitat** 8:3
**habitats** 9:8
**half** 20:20
**hand** 4:10 14:18
**happened** 30:17
**happy** 4:23 16:2 22:3 35:4
**hard** 18:15
**harm** 25:22
**HATHAWAY** 2:4
**Hathaway's** 23:13
**hauling** 9:19 11:9
**hazardous** 18:5

**heal** 26:5
**healed** 29:18
**healing** 26:3,13 29:16 34:8,21
**health** 10:23 19:8 20:7,9,23 21:10 22:6 25:15
**healthy** 8:11
**hear** 4:16,23
**hearing** 1:6,11 2:4 3:2,4,5,13,15,16 3:22,23,24,25 5:4 5:6 13:3 14:7,8,8 14:10 15:4,12,25 16:7 17:19 19:18 21:19 25:8 26:15 28:5 30:8 31:10 32:11,13 33:24 34:23,25 35:6 36:8 36:14
**heed** 32:8
**Heinz** 19:20
**held** 1:11 36:9
**help** 31:7,7 32:2
**Hi** 14:23
**highest** 23:10
**highly** 31:2
**hill** 7:20
**hire** 24:22
**historic** 7:5 9:9 10:10 11:22
**historical** 26:19,21 26:23 27:7
**history** 26:24
**home** 16:11
**hope** 32:8 33:15
**hour** 20:20
**hours** 20:19
**human** 19:8 22:5 23:23 24:4 25:4
**humans** 25:22
**hundred** 18:8 22:25 26:3,5

I

**idea** 21:12,14
**identified** 19:4
**identify** 4:11
**imagination** 32:23 33:16
**immediate** 21:13
**immediately** 7:15
**impact** 11:3,19 20:6 22:14
**impacted** 7:11 11:18
**impacting** 6:16
**impacts** 9:5,8,10 11:22 18:10
**impaired** 6:24
**important** 26:24 27:5 27:19
**impractical** 8:22
**inadequate** 31:20
**include** 5:17 6:2
**included** 22:22
**includes** 5:12 10:18
**including** 11:4 22:10 24:24
**inclusive** 36:6
**incorporate** 12:13
**incredible** 32:22
**indefinitely** 29:24
**individuals** 8:4
**informal** 3:16
**information** 12:25 13:9,22 14:9 15:18 17:2
**infrastructure** 32:4
**initially** 22:15
**installed** 10:20
**installing** 28:25
**intended** 22:24
**interest** 27:22
**interesting** 20:5
**interim** 12:10
**introduction** 3:10
**invertebrate** 8:12
**investigation** 6:4
**investment** 33:15
**invite** 14:14
**involve** 9:24
**involves** 11:25
**iron** 6:6,9 7:17 8:5 8:16 20:11 30:19
**irrefutable** 23:22 24:9
**isolating** 10:24,25
**issue** 5:2 11:9 28:12
**issues** 11:5

J

**J** 1:13 36:3
**John** 17:24 21:23 30:9
**July** 13:2 14:9 15:17

K

**keep** 29:24
**kick** 30:16
**kilogram** 8:15,18
**kind** 20:13,17,22 33:11
**kinds** 32:25 33:23
**know** 27:23 28:18 29:19 31:6,21
**known** 18:2
**knows** 21:5 24:2 29:12

L

**land** 5:21 10:18 12:8 12:15,21,23
**landing** 34:15
**large** 8:21 12:18
**law** 11:13
**lay** 26:14
**leave** 10:10 26:12
**leaving** 22:25
**Lebanon** 22:19
**left** 8:25 28:16 29:16 34:21
**legislature** 17:11,11 17:16 18:4 31:13 31:17
**less-expensive** 19:16
**letter** 13:17
**level** 8:13,17 17:16
**levels** 6:5,6,8 7:16

8:5,6,9
**Libby** 30:14
**liberty** 21:24
**lifetime** 25:20
**likelihood** 30:25
**limited** 7:14 19:10 32:22,23,24
**limits** 12:22
**LINDA** 2:12
**little** 3:6,7
**live** 19:21 32:9,16 34:19
**lived** 26:18 33:17
**living** 19:21 25:12 25:25
**local** 12:24 14:14,21 14:24
**located** 27:3
**location** 12:19
**logged** 29:17 34:9,14
**long** 8:14 13:17 33:2 34:12
**longer** 24:14
**look** 9:17
**loss** 29:6 34:19
**lot** 26:8 29:18 33:2 33:4,6 34:10,20,21
**loudly** 4:14
**Love** 18:2 21:15
**low** 24:22
**Lower** 5:13 6:18 8:24 9:2,13,25

M

**M** 25:10
**MA** 2:7
**MacDonald** 31:12 32:8
**mail** 16:8
**main** 10:22
**maintenance** 11:5 17:7 23:4
**major** 6:15 29:2
**making** 30:12 32:18 34:25
**Manager** 2:12
**managers** 30:15
**manganese** 7:17
**map** 5:13,23
**Marilee** 1:13 36:3
**Mark** 14:23 28:7 32:8
**massive** 18:13 30:19
**material** 9:19 11:10
**matter** 9:18 36:13
**McKee** 14:23,23 15:7 28:7,7
**mean** 34:16
**mechanisms** 13:20
**media** 13:5
**meet** 17:17 23:8 24:10
**meeting** 13:2 14:9 15:17,18 16:4
**meetings** 33:9
**Melanie** 25:10
**members** 14:16 17:20
**memory** 28:10
**mentioned** 20:25
**mess** 33:20
**ME/VT/CT** 2:5
**miles** 31:5
**milligrams** 8:15,18
**million** 10:21 17:6 18:16,16 22:12,12 22:12,23 23:12 24:23 29:21 31:22 33:4,5
**mine** 1:6 5:10,19 7:2 17:14 18:7,9 19:23 19:25 20:7 21:7,23 23:22 28:12 30:13 30:15,18 31:14 34:6,17 36:14
**mines** 25:12,13 27:2 27:11,16
**minimal** 27:25
**minimize** 11:19
**minimized** 9:6,9
**mining** 27:11
**minor** 18:18 19:12
**minute** 15:8
**mistake** 19:13
**moment** 28:21
**money** 19:6,13 21:18 24:25 29:22 31:16 31:25 32:7,22,24 33:5,6,19
**moved** 10:7,17
**moving** 7:19 12:24
**multiple** 4:18

N

**name** 4:12 16:17 17:24 21:21 26:16
**nation** 19:9
**national** 28:15
**nation's** 18:5
**naturally** 33:10
**nature** 26:4,12 28:16 29:15 30:24,25
**near** 25:11
**neatly** 23:16
**necessary** 12:14 29:15
**need** 11:18 14:25 20:16 32:14
**needs** 32:4
**never** 22:4 30:3
**NOBIS** 2:15,16
**non-contaminated** 11:20
**non-human-enhancing** 33:22
**nose** 21:8
**Notary** 1:13 36:4
**notes** 36:7
**nuclear** 31:19
**number** 20:8 29:14
**numbered** 36:5

O

**objectives** 7:23
**obligation** 17:18
**obviously** 10:23 20:18
**occasional** 6:12
**Office** 2:6 13:11
**officer** 2:4 3:4,23 14:7 15:4,12 16:7

17:19 19:18 21:19 25:8 26:15 28:5 30:8 31:10 32:11 33:24 34:23
**officials** 14:16 23:20 24:24
**off-site** 9:19
**Okay** 12:2 15:7 19:18 20:4 21:19
**Ompompanoosuc** 19:4
**once** 4:2 5:3,5,7 12:14 13:24 15:13 17:19
**ongoing** 23:4
**open** 3:13,25 14:12 17:21
**opening** 3:24
**Operable** 5:11 11:24 12:12
**operating** 34:17
**operation** 23:14
**operational** 17:7
**operator** 18:21
**opportunity** 3:19 15:16
**oppose** 31:24
**option** 9:21 24:13
**options** 8:22 9:12
**orange** 31:5
**order** 11:18
**Ore** 5:14 9:23 10:6,8 10:17
**organisms** 6:20 8:7
**organization** 18:23
**original** 22:10
**outlined** 5:12
**outlook** 26:22
**outside** 12:22
**OU1** 12:17,22
**OU2** 12:17
**overly-large** 19:11
**oversight** 16:21
**overview** 3:11
**oxygen** 11:2

**P**

**pages** 36:5
**part** 5:4 12:9 15:3 24:7 25:7 26:9,24 28:18 29:6 35:3
**partially** 9:3
**particular** 9:3
**parts** 27:4
**Party** 25:5 28:14
**paying** 25:2
**peak** 27:16
**Pearson** 32:14,16
**Peet** 32:15
**people** 15:19,21 16:3 20:3,4 22:23 25:11 27:15,18
**percent** 17:5 22:25
**percentage** 23:10
**period** 13:2,14 15:10
**perpetual** 25:16 26:9
**perpetuity** 17:8
**person** 27:22,22
**phases** 5:11 7:4
**phrase** 30:16
**picture** 34:5
**pictures** 34:16
**place** 9:2 10:9,10 12:17 27:12 31:19 33:10,21 34:6
**placing** 10:2
**plains** 11:17,17
**plan** 15:14 16:25
**plans** 16:21
**plant** 8:11 30:21 31:19
**play** 20:18
**played** 26:24 27:5,19
**plenty** 31:15
**plus** 28:9
**point** 14:12 23:9 32:12
**pole** 28:23
**political** 28:15
**ponds** 5:16,16 6:23
**possible** 4:24 28:20
**Post** 2:6
**potential** 29:9
**potentially** 30:12
**power** 31:21 32:18
**practicable** 11:15
**preparing** 21:24
**present** 2:9 22:7 24:3,3
**presentation** 3:7,23 4:5,8 13:25 14:6
**presented** 9:20 22:5
**presents** 23:22
**preservation** 10:12
**preserved** 27:20 28:3
**preserving** 28:2
**president** 26:19
**pressing** 32:4
**pretty** 7:13
**prevent** 7:24 8:3,7 12:6 21:12
**preventing** 31:23
**primary** 12:9
**priorities** 33:21
**private** 7:10
**probably** 5:24 23:9
**problem** 18:18 19:13
**problems** 19:5,8 29:9 30:21
**proceedings** 14:11
**process** 14:2 25:15 31:14
**produced** 36:12
**professionally** 23:17
**program** 6:4 19:25
**progress** 27:11
**project** 2:12 18:11 19:15 23:7,21 24:9 25:3 28:16 29:13
**projects** 19:14
**promote** 8:11
**proof** 23:22 25:21
**proper** 32:6
**property** 29:7
**proposal** 3:12 4:3 5:11,18 9:20 13:8 17:3
**proposed** 5:9,21 15:14 16:25 17:9

18:11 21:10
**proposing** 11:23 21:17
**prospective** 26:22
**protect** 10:19,23 20:16,25
**protecting** 11:16 20:9
**protection** 1:5 20:24 21:9 36:8
**proved** 22:4
**proven** 22:7
**provide** 3:10,11,18 4:2,18 11:13 14:14 14:19 15:18 17:23 20:24
**provided** 4:6 18:24
**provides** 16:21
**public** 1:6,11,13 3:5 3:13 10:23 12:25 13:2,7,13 14:8,12 16:14 18:21 20:7,9 20:23 32:19 36:4,8 36:14
**purpose** 15:17,20
**put** 12:16 31:22
**p.m** 1:12 35:7 36:10

**Q**

**quality** 19:6 22:8 32:20
**quarries** 22:21
**question** 4:25 14:2 14:25 20:2,12 24:20 35:5
**questions** 5:8 14:5 15:2,24 16:2 20:8 27:23 30:9 35:4
**question-and** 15:10
**question-and-answer** 3:17 15:23
**question-answer** 15:5 15:6
**quick** 6:3
**quits** 24:13

**R**

**R** 29:11 34:3
**raise** 4:10 14:18
**ratio** 24:15
**read** 21:25
**ready** 12:11 14:3
**real** 19:8 25:4 28:11
**realize** 33:3
**really** 6:14 21:6,10 23:23 24:6,7 27:12 32:18
**reason** 3:18 15:22 29:21 32:23 33:19
**reasons** 7:3 10:22 22:9 29:14
**receive** 13:4
**receptors** 8:10
**recognizes** 17:4
**recommend** 10:22
**record** 3:20 4:13,16 13:7,10,16 15:16 15:22 16:13,14,23 26:25 30:5 32:19 33:7
**recorded** 3:9 35:3
**Records** 13:11
**recreational** 6:12
**Red** 29:4
**reduced** 19:2
**refinement** 12:20
**regards** 30:11
**regulations** 12:24
**rehabbing** 32:3
**relate** 21:7
**relatively** 18:18 19:12
**release** 7:25
**released** 15:14
**remaining** 5:25
**remarkable** 34:8
**remember** 31:6 34:11
**Reporter** 36:3
**represent** 25:4 31:12 32:9
**representative** 24:17
**representatives** 14:15
**reprioritizing** 33:3
**require** 33:11
**required** 11:12 17:16
**residential** 6:7,10 6:14 8:6 12:4
**resource** 7:6 10:12 29:2
**resources** 9:9 11:22 19:10
**respects** 22:4
**respond** 5:2 13:21
**responding** 5:5
**response** 13:6 17:25
**responsible** 17:5
**restore** 8:2,10 11:18
**restored** 9:7
**restriction** 5:22 12:9
**restrictions** 10:18 12:16
**result** 23:17
**resulted** 22:17
**retain** 26:22
**retaining** 27:9
**review** 15:16
**reviewed** 16:24
**right** 9:4 10:6 25:11 25:19 28:22 31:17
**risen** 22:11
**risk** 6:13
**Rita** 29:11
**river** 28:22 31:5
**Road** 1:12
**roads** 22:21 32:3
**Roast** 5:14 9:23 10:6 10:8,17
**rock** 6:16,25 7:24 10:14 11:2
**rocks** 22:19
**role** 27:5,19
**RPM** 2:4
**run** 33:2
**running** 18:12
**runoff** 19:17
**runs** 6:21

**Rural** 18:23

S

**safe** 6:7 8:6,9
**safety** 23:23 25:5
**sampled** 7:11
**sanctioned** 17:10
**saturated** 9:3 11:8
**saw** 19:24 27:13
**saying** 32:20 33:8
**says** 29:25
**scenario** 6:14
**Schoolhouse** 5:20 6:3 6:24
**Schwer** 2:13 16:5,17 16:18
**second** 3:14 22:9 24:8
**section** 2:5,13 16:19 16:20
**sediment** 5:19
**sediments** 5:15 6:3 6:25 8:8,17 10:2 10:14
**see** 7:8 25:23 27:20 28:3 29:21
**seek** 17:21
**seen** 30:3 34:5
**select** 14:15,21,24 17:20 28:8,8,11 29:12
**selectmen** 27:6
**Senate** 32:10
**Senator** 18:3
**send** 13:16,19 31:19
**sense** 32:15
**sensible** 24:11
**series** 24:12
**serious** 22:16,20 24:3 29:8
**seriously** 24:6
**services** 18:15
**session** 3:17 4:5,8 14:13 15:6,11,23 16:10
**seventy** 27:10
**severely** 6:24
**shallow** 8:22 11:8
**sharply** 24:16
**shelter** 29:5
**short** 3:12 21:24
**show** 33:12
**showed** 20:5
**showing** 32:6
**shown** 5:23
**shows** 12:15,17
**side** 9:17 10:4
**significant** 7:5,7 23:4
**simpler** 19:16
**site** 1:6 5:10,20 6:9 6:22 7:13 8:11,18 11:10 13:23 17:18 20:19 21:13 23:5 26:23 28:2,23 29:10 36:14
**sites** 16:22 18:6
**situation** 21:15
**slightly** 18:10
**small** 6:19
**smell** 30:17
**smelter/slag** 5:18 7:5 12:4,7
**society** 26:19,21 27:7
**solution** 19:12
**somebody** 33:7
**sort** 23:19
**source** 7:7
**sources** 6:15
**speak** 3:19 4:11,14 16:12 26:20 32:15
**speaking** 13:15
**species** 9:11 21:2
**specific** 4:24
**spend** 18:16 29:20,24 32:24
**spending** 25:6 31:24 33:22
**spent** 32:7
**spike** 30:19
**split** 7:3
**spoken** 16:9,15 32:6
**squalid** 23:15
**Square** 2:6
**staff** 18:25
**Stafford** 18:3 31:4
**stages** 24:12
**Stand** 4:11
**standards** 19:6 22:8 23:8 24:11 25:25
**start** 4:7 26:6 34:15
**starting** 36:10
**state** 1:13 14:15,16 16:15 17:4 18:14 18:17 19:7,9 23:2 23:3,19 24:17,18 24:19,20,20,24 29:23
**statement** 21:25
**State's** 17:9
**statistics** 33:12
**stenographer** 3:8 4:15
**stenographic** 36:7
**steps** 24:19,21
**stir** 30:23
**stop** 7:25
**stored** 31:18
**Strafford** 18:22 21:22 22:3,22 23:18
**streams** 6:17
**strongly** 19:14
**structure** 3:22 4:3 15:13
**structures** 10:20
**struggling** 31:17
**studied** 6:2
**studies** 18:9
**study** 7:8,21,23 22:14
**stuff** 27:10 30:23 31:8
**stupidity** 33:20
**subject** 7:20 12:23
**successful** 8:25
**suddenly** 26:3

**Suite** 2:6
**summary** 4:2 6:4
**superfund** 1:6 2:5 16:22 17:25 36:14
**supervision** 23:14 36:13
**supplies** 7:10
**supporting** 16:25
**supposed** 21:9 30:2
**sure** 12:3 16:17 33:14
**surface** 6:19
**surplus** 18:12
**system** 17:17 18:21

T

**tailing** 10:7,16
**Tailings** 6:19 8:24
**take** 8:19 15:8 19:13 20:5 24:4,18,19,20 27:24 31:21
**taken** 21:24
**talk** 5:8 20:9,10
**talking** 5:23
**taxes** 33:5
**taxpayer** 26:17
**Tea** 25:5 28:14
**tear** 31:8
**technical** 11:5 18:24
**Ten** 18:10
**tends** 15:23
**term** 8:14
**terminated** 28:18
**Terry** 30:14
**Thank** 21:18 28:3 34:25
**Thanks** 29:10
**Thetford** 19:21
**things** 26:2,13 31:23 31:25 32:25 34:4
**think** 15:8 21:4,6,12 21:14,17 24:23 26:12 28:2,13 29:6 29:15 30:6 31:3 32:5 33:9,11 34:6 34:20
**Third** 22:14
**thirty** 15:14,15
**thousand** 27:15
**thousands** 23:25
**threat** 22:5,7 23:23 24:4 25:4
**threaten** 9:11
**threatens** 28:23
**three** 20:21 23:19 28:20 29:17,18
**throwing** 29:22
**time** 3:25 4:9,11,19 13:14,25 15:24 17:8 19:3,9 20:10 33:14 34:9,24
**times** 29:17,18 31:15
**told** 20:6
**tonight** 3:6,8,18,24 5:8 13:3,16 15:19 15:20 16:10,15 27:8 32:17
**top** 10:11
**total** 24:21
**totally** 29:13 30:6
**town** 1:12 13:11 26:25 27:14,17,18 29:3,8
**towns** 32:10
**toxic** 7:2 18:5 23:25 24:6,6 25:4
**training** 18:24
**transcribed** 36:11
**transcription** 36:7 36:12
**transporting** 11:10 22:18
**treating** 24:25
**treatment** 8:22 30:21
**Trebitz** 19:20,20
**trees** 34:18
**tributaries** 5:15 6:22
**truck** 11:11
**truckloads** 22:19
**trucks** 25:25
**true** 36:6
**try** 26:22 27:24
**trying** 11:6 26:5
**tunnels** 6:2 7:19
**turd** 30:16
**turn** 34:10
**turned** 7:12 31:5
**twenty** 18:20 19:22
**two** 5:10,16 6:23 11:12,24 16:5 20:4 20:21
**type** 3:7 16:22

U

**unavoidable** 11:21
**unconscionable** 24:7
**underground** 5:19 6:2
**understand** 4:25
**unfinished** 28:17
**unhealthful** 6:11
**Unit** 5:12 11:24 12:12
**unnecessary** 30:7
**unsafe** 7:18
**Upper** 5:14 6:17 8:23 9:25
**urge** 19:15
**use** 5:21 8:6 10:18 12:4,8,15,21 15:24 31:22 36:11,13
**utility** 28:23

V

**valid** 31:4
**value** 26:23
**variety** 22:9
**Vermont** 1:12,14 2:10 13:10 16:23 17:2,4 17:10,14 18:3,17 18:22,23 22:8 23:20 24:18,24 27:3 31:25 32:2,10 33:4 36:10
**Vermont's** 18:18 24:7 24:10
**Vershire** 1:12,12,12 13:11 26:17,19,20

27:3 29:3 32:16 36:9
**view** 32:6
**violated** 19:5
**violation** 22:8
**visits** 6:13
**volume** 8:21
**voting** 32:17

**W**

**wall** 10:10 34:12
**walls** 27:10
**want** 3:16 7:25 8:3,7 8:10 9:10 12:2 16:11 19:19 25:6 32:19 33:6,24
**wants** 29:20
**waste** 5:13,14,25 6:17,17,18 7:3,14 7:15 8:21,23,24,25 9:2,2,4,13,13,14 9:15,22,25,25 10:14,24,25 11:8 18:2,6 21:18 22:5 31:18
**wasteful** 25:6
**watched** 31:13
**water** 6:19 7:10 10:25 18:21,23 19:5 22:8 23:8 24:10 29:7
**way** 14:10 25:19 29:25
**website** 13:12,24 18:9
**week** 13:13
**weight** 16:9
**Welcome** 3:5
**wells** 11:20
**went** 27:14,17 34:13
**weren't** 34:17
**west** 9:16,23 10:4,15 12:19 20:3,12,14 27:4,5
**wetlands** 9:6,7 11:4 11:16,17
**we'll** 3:15 4:20,22 5:6,7 27:24
**we're** 3:5,18,24 5:23 7:8 11:12 12:11 14:3,4,12 18:13 22:13 25:2 26:8 30:15 32:12,17,21 32:22 35:3
**we've** 5:10 33:2,17
**wildlife** 26:7,9
**Williamstown** 32:9
**willing** 27:21
**window** 28:22
**wise** 19:10
**wish** 14:13 27:6
**wonder** 20:23 28:15 28:19
**wondering** 21:2
**work** 16:18 17:15 27:21 30:18
**working** 30:24,24
**workings** 5:19
**world** 32:21 33:17
**worse** 19:2 30:12,14 31:2,9
**worth** 28:2
**worthy** 19:14
**wouldn't** 24:11
**write** 16:11
**written** 17:25 18:6

**Y**

**yankee** 32:6
**yards** 10:13,16
**Yeah** 30:10
**year** 6:10 18:25 20:19
**years** 18:8,10,20 19:22 26:3,6,18 27:10,12 28:9,9 31:15
**Young** 1:13 36:3

**Z**

**zoning** 12:24

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**10,000** 22:18
**100** 2:6
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**12** 22:12
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**18** 33:5
**1960** 27:17

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**2** 11:24 12:12 36:5
**2,100** 27:15
**2,500** 27:15
**2011** 1:11 3:3 16:25 36:9
**2015** 36:19
**24** 8:15 20:19
**25** 1:11 3:3 36:9
**269** 27:18
**27** 1:12 13:2,3,13 14:9 15:17
**27th** 13:18
**28** 26:18

**3**

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**300** 27:2
**31** 36:5
**350** 6:10 20:18
**350-day** 20:11

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**4,000** 10:16

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ENVIRONMENTAL PROTECTION AGENCY
ELY COPPER MINE
SUPERFUND SITE PUBLIC HEARING

Public Hearing, held on August 25, 2011, at Vershire Town Center Building, 27 Vershire Center Road, Vershire, Vermont, commencing at 7:00 p.m., before Marilee J. Young, a Notary Public in and for the State of Vermont.



APPEARANCES:

HEARING OFFICER: EDWARD HATHAWAY, RPM
ME/VT/CT Superfund Section
5 Post Office Square, Suite 100
Boston, MA 02109-3912

ALSO PRESENT:
From Vermont Department of Environmental Conservation:
LINDA ELLIOTT, Project Manager
CHUCK SCHWER, Section Chief
ANDY BOECKELER, Consultant to EPA, NOBIS ENGINEERING, INC.
DAVE GORHAN, Consultant to EPA, NOBIS ENGINEERING, INC.



HEARING
AUGUST 25, 2011

THE HEARING OFFICER: With that, Welcome. We're here for a public hearing tonight, so it's a little different format, a little different type of presentation. We have a stenographer here tonight, so the event will be recorded. So I'm going to do a brief introduction and then we provide for context, we provide an overview of the cleanup proposal, a very short one. Then we open up the hearing for public comment, and I'll describe more about that in a second. Then we'll close the hearing, and then, after the hearing, if you want to have an informal question-and-answer session, that's fine. The reason we're here tonight is to provide an opportunity to speak comments into the record, and as far as additional I will explain what to do with the comments. So this hearing has a formal structure. There's a presentation. I'm also the hearing officer, I'm opening the hearing tonight, so we're going to open the hearing at this time.



Once again, I will provide a brief summary of the cleanup proposal. The structure does not allow a discussion during both the presentation or the comment session, to allow a chance for comments to be provided. We will announce the start of the comment session at the end of the presentation, at which time we would ask anyone that has a comment to raise their hand. I will identify you one at a time. Stand up, speak your name and your affiliation for the record, so we can have that on there. The goal is speak -- basically, loudly and clearly enough so that the stenographer can hear you and record your comments accurately. What we would ask is that, if you have multiple comments, provide them one at a time, so everybody gets a chance. If you have a comment, make a comment. Then we'll give someone else a chance. Then, if you have more comments at the end, we'll be happy to hear you out.

Be as specific as possible, because the goal is to understand what your question,

Page 5

concern, or issue is, so we can respond to it. And, once again, we cannot engage in a dialogue with you during the hearing part, so we will not be responding. Once there are no further comments, we'll close the hearing and, once again, we'll be available to answer questions. So the goal tonight is to talk about our proposed cleanup action for the Ely Mine. We've broken the site up into two phases. The cleanup proposal is for Operable Unit 1. It includes these areas outlined on the map, which are the Lower Waste Area, the Upper Waste Area, the Ore Roast Bed, and the Sediments of Ely Brook and its tributaries, as well as two of the five ponds, Ponds 4 and 5. It does not include a cleanup proposal for the smelter/slag area, the underground mine workings, the sediment of Schoolhouse Brook, or the site groundwater.

Other than the proposed land use restriction, early action for those. So the areas we're talking about shown on this map, probably the one area is essentially the waste areas. The areas remaining to be

Page 6

studied include the underground tunnels and the sediments of Schoolhouse Brook. A quick summary of our investigation program, so what we found is there are levels of cobalt, copper, and iron which are found above levels that would not be safe for residential exposure, so the levels of cobalt, copper, and iron at the site, if the was residential, which is 350 days a year of exposure, it would be unhealthful. However, for recreational exposure, for occasional visits, there would be no risk, so this is really in that residential scenario that would of concern. The major sources of the acid rock drainage, that's what impacting streams, are the waste areas, the Upper Waste Area, the Lower Waste area, and the very small Tailings area. The surface water and associated aquatic organisms in Ely Brook, which is the brook that runs through the site, as well as the tributaries of Ely Brook, two of the five ponds along the Schoolhouse Brook are severely impaired by the acid rock drainage, and the sediments of

Page 7

Ely Brook is toxic, it contains the mine waste. One of the reasons we split it up into phases not only is not only is the Smelter/Slag area a significant historic resource, it's also not clear to what extent it's a significant source of contamination.

We're going to study it more to see if maybe we can do less to disturb that area. The private water supplies in the area have not been impacted, we sampled them, several of them, they all turned up clean. The groundwater at the site is pretty much limited to the areas beneath the waste areas immediately adjacent to the waste areas. The groundwater does contain levels of cadmium, cobalt, copper, iron, and manganese that would be unsafe for consumption, and the groundwater in the tunnels basically moving away under the hill are subject to future study. We don't have a final conclusion on those yet. So we developed a feasibility study, cleanup approach. The objectives are to prevent the formation of acid rock drainage. We want to stop the acid release

Page 8

into the brook so that we restore the brook and the habitat. We want to prevent individuals from coming into contact with levels of cobalt, copper, and iron that are above levels safe for residential use. We want to prevent aquatic organisms from coming into contact with sediments containing copper above safe levels for those ecological receptors. We want to restore the barren areas of site to promote healthy plant and invertebrate communities. As a guideline for that, the level of copper that we would deem acceptable for long- term exposure, cobalt would be 24 milligrams per kilogram, copper would be 629, the iron would be 44,800, and the sediments of copper level would be a 149 milligrams per kilogram. At this site there were several factors that we had to take into consideration in developing the cleanup.

The large volume of waste make most treatment options impractical. The shallow groundwater in the Upper Waste Area, the Tailings Area, and Lower Waste Area do not allow successful cleanup if waste were left

Page 9

in place. The waste within the Lower Waste Area, in particular, is partially saturated; the groundwater is right up in the waste, which creates a challenge. Impacts to the clean wetlands must be minimized, and contaminated wetlands should be restored as functional habitats, adverse impacts to historic resources should be minimized, and we also want to avoid any adverse impacts to threaten or endangered bat species. We evaluated four cleanup options: No action; waste containment in the Lower Waste Area Cell so we would bring all the waste, consolidate it in this area here, waste containment in a West Cell, which would be constructed on this side, and we did look just matter of course of this, excavating all the material and hauling it off-site. The cleanup proposal that we have presented to the community for consideration is Option 3, which is waste containment in what we call the West Cell and also at the Ore Roast Bed. What that would involve is excavating the Upper Waste Area, the Lower Waste Area, and

Page 10

all the contaminated sediments and placing them in an about eight acre or so area on the west side of the brook and then covering that with a cap.

The Ore Roast Bed, which is right here, and the tailing would be moved to the Ore Roast Bed and that would be capped in place. What that would allow to us do is leave the, historic wall, in place, cap on top of it, and, therefore, create some of preservation of the current resource. So there's about 107,000 cubic yards of contaminated waste rock and sediments from those areas that would go in the West Cell and there's about 4,000 yards of tailing would be moved to the Ore Roast Bed. The cleanup also includes land use restrictions to protect, such as the cap and the structures that are installed.

The estimated cost is $18 million. The main reasons we recommend this are obviously to protect the public health and environment by isolating the waste from contact and isolating the waste from water

Page 11

and oxygen so there's no more acid rock drainage. That's the least impact to the environment, including the wetlands, and it avoids the technical and maintenance issues that would be associated with trying to build a cell in the area where the groundwater is the shallow and waste saturated and avoid the hauling issue associated with, well, of course, transporting material off site via truck.

Two disclosures that we're required by law to provide for further comment and consideration, we have determined this is the least environmentally-damaging practicable alternative for protecting wetlands and flood plains; contaminated wetlands and flood plains need to be impacted in order to restore them; and we will minimize any impact on non-contaminated wells. We also got a determination there will be unavoidable impacts to historic resources. In addition to that, we are proposing what is called an early action for the Operable Unit 2 two area, which essentially involves the gray

Page 12

area at the bottom. Okay, what we want to do is make sure that no one develops the Smelter/Slag area for residential use until we have a final cleanup decision or anytime in the future and to prevent groundwater consumption under the Smelter/Slag Area. So that would be added to the land use restriction that would part of the primary cleanup action. This is an interim action. In the future, when we're ready to have a final cleanup decision for Operable Unit 2 we will incorporate this to it or may be the only cleanup necessary. So, once again, the green area shows the extent of land use restrictions for groundwater that may be put in place for both OU1 and OU2, and it shows a very large area that will be adjusted based on the final location of the West Cell and refinement of the groundwater contamination area. Any land use for areas outside the limits of the early action OU1 will be basically be land that's subject to local zoning regulations. So, moving forward, we had our public information

Page 13

meeting on July 27, the public comment period ends on August 27, the hearing is tonight, and all the comments we receive by whatever media we will certainly consider it and develop a response to those comments as public record of decision. If you do not have a copy of the cleanup proposal and would like more information, the cleanup record is available at the Vermont DEC the Vershire Town Office, the EPA Records Center, and also on our website. By the end of this week, on August 27, the public comment period will end. At that time you can comment by either speaking your comments tonight into the record, you can send a letter or fax, as long as it's dated no later than the end of the day on the 27th, or you can send an e-mail, to any of those -- any of those mechanisms are equally acceptable, and we will respond to all comments. This is the contact information for the general site contacts as well as, once again, the EPA website and my e-mail address. So at this time the presentation

Page 14

is over. Do you have a process question? We're almost ready.

FROM THE FLOOR: We're going to be able to ask any questions about the presentation you just gave?

THE HEARING OFFICER: After the hearing. This is a public hearing. The information meeting was July 27. This is only a comment hearing. That's the way the administrative proceedings are. So at this point we're going to open the public comment session. We will allow those who wish to provide a comment. We do invite any local or state representatives, select board members, or state officials to make comments first; and, after that, as I said, if you raise your hand, I will call on you one by one and give you a chance to provide your comment. Is there anyone from any of the local select boards that would like to make a comment?

MR. MCKEE: Hi, I'm Mark McKee, local select board. Before I make a comment, I need to ask a question. Did you

Page 15

say there are no questions in the comment part?

THE HEARING OFFICER: Yes, we do not engage in a question-answer. We will have a question-answer session afterwards.

MR. MCKEE: Okay then maybe I should take a minute and think about my comment.

FROM THE FLOOR: Will there be an additional comment period after question-and-answer session?

THE HEARING OFFICER: No, the structure of this is that, once again, the proposed plan was released almost thirty days ago, there's been almost thirty days' opportunity to review the record, there was a meeting on July 27, which was the purpose of that meeting was to provide the information to allow people to come tonight and make comments. The purpose of tonight is to allow people to make those comments for the record. The reason we do not engage in a question-and-answer session is that it tends to use up the time available for questions. At the close of the hearing we would be

Page 16

happy to basically answer questions that people didn't have a chance to ask at the last meeting.

MR. SCHWER: Then there's two days to comment.

THE HEARING OFFICER: A comment made by e-mail, mail, or fax has no different weight or bearing than the comments spoken tonight so, if in the formal session, if you home and you want to write out a comment, didn't have a chance to speak it into the record, you have a chance to do so, it will be in the public record just as what is spoken tonight is. Would the State like to make a comment?

MR. SCHWER: Sure. My name is Chuck Schwer. I work for the Department of Environmental Conservation. I'm a section chief there, and it's our section that provides oversight of any EPA plans for these type of superfund sites. So, for the record, the Vermont Department of Environmental Conservation has reviewed the 2011 proposed plan and supporting documents.

Page 17

Based on this information the Vermont DEC concurs with the EPA's cleanup proposal. The Vermont DEC recognizes that the State will be financially responsible for 10 percent or approximately 1.8 million of the capital costs and for operational and maintenance costs in perpetuity. At this time the State's contribution for the proposed cleanup has not been sanctioned by the Vermont legislature. However, the legislature is aware that there are financial commitments associated with the cleanup actions at the Ely Copper Mine, and the Vermont DEC is committed to work diligently with the legislature to establish the required level and system of funding to meet the financial obligation at the site.

THE HEARING OFFICER: Once again, is there any select board members that would like to seek? If not, we will open the floor to anyone else that would like to provide a comment.

MR. FREITAG: My name is John Freitag. Superfund was written in response

Page 18

to a chemical waste dump known as "Love canal." Our own Vermont Senator Bob Stafford was a co-sponsor of this legislature designed for our nation's most toxic and hazardous waste sites. It was not written for an abandoned copper mine that was abandoned a hundred years ago and that, according to Bureau of Mine studies on an EPA website, only slightly impacts Ely Brook. Ten years ago, when this project was first proposed, the government was running a budget surplus. Now we're facing massive deficits, and both the federal government and the State have to make hard decisions and cut back services. To spend $18 million, $1.8 million dollars of which comes from the State of Vermont, on this relatively minor problem is Vermont's equivalent of Alaska's "Bridge to Nowhere." For the last twenty years I've been the certified operator of a public water system in Strafford, Vermont. An EPA-funded organization, Vermont Rural Water, has provided technical expertise and training. Last year their budget was cut and staff

Page 19

reduced, and it's going to get worse. At the same time east branch of the Ompompanoosuc has been identified as having E. coli problems and have violated water quality standards there. Yet, no money is available from the State to deal with these real problems with human health. As a nation and as a state we must in this time of limited resources make wise decisions.

Going forward with this overly-large and expensive solution to a relatively minor problem would be a mistake and take money away from other worthy projects. I strongly urge that this project not be funded and simpler, less-expensive alternatives to addressing the runoff be explored.

THE HEARING OFFICER: Okay. Anyone else want to make a comment?

MR. TREBITZ: I'm Heinz Trebitz. I live in Thetford Center. I've been living here for about twenty years, so I'm familiar with the Elizabeth Mine cleanups, and, of course, we all saw it coming that this Ely Mine cleanup would also be on the program.

Page 20

Maybe I can ask a question to whoever is here how many people are here from West Fairlee? Just two people. Okay, interesting. If I take what you just showed us and told us about the impact of the Copper Mine to the public health, there is a number of questions that arise. No. 1 is, if you talk about protecting public health and at the same time you talk about a 350-day exposure to cobalt, copper, and iron, I question whether there's anybody in West Fairlee who ever gets that kind of exposure.

That exposure in West Fairlee is much, much less than that. To extend it further, if you say we need to protect children from that kind of exposure, obviously children will not play 350 days a year, every day, for 24 hours at that site. They may be there for half an hour, at best for two or three days, but other than that they will not be in there. So you kind of wonder what extent of public health protection this costly cleanup will provide. You mentioned that you might protect bat

Page 21

species. I'm wondering whether this is just a convenient argument in favor of a cleanup. I think anybody who has been up there in the area knows that there have been bats around, and I don't think that anybody will really relate the Copper Mine to the recent demise of bats by the gray nose disease. So it's very doubtful whether the supposed protection of health that comes from EPA proposed really is there. Now, in all credit to give to EPA, I think the idea to prevent development of the immediate area of the Ely site, I think that is a very good idea. We should not go into another Love Canal situation or so, and that can be easily done, but anything else EPA is proposing, I think, it's a big money waste. Thank you.

THE HEARING OFFICER: Okay. Any other comments?

MR. COFFIN: My name is Edmund Coffin. I come from Strafford. I'm fairly familiar with the Ely Mine and, like John, I've taken the liberty of preparing a short formal statement which I would like to read.

Page 22

I can give a copy to you directly. Our experience in Strafford has not been happy in several respects. First, EPA never proved that the waste presented any threat to human health. On the contrary, it was later proven to present no such threat, only a violation of Vermont water quality standards.

Second, for a variety of reasons, including correction of faulty original designs, the cost has risen from first 6 million, then 12 million, and now 50 million, and we're not yet through.

Third, no environmental impact study was made initially; none has yet been made, but we can be certain that serious environmental damage has resulted from chewing up and transporting more than 10,000 truckloads of rocks and fill from Lebanon and elsewhere, and serious damage has been done to the roads between the quarries and Strafford. These costs are not included in the 50 million. Some people beared them.

Fourth, although EPA intended to cover a hundred percent of the cost leaving

Page 23

the State with a complete cleanup at no cost, it is now clear that the State will have significant ongoing maintenance costs at the site.

Fifth and finally, despite all these expenditures, EPA admits the project will still not meet clean water standards at the point of compliance, and EPA probably will further admit that the highest percentage of cleanup could have been achieved at a fraction of the $50 million. I would add, however, that EPA, under Ed Hathaway's supervision, did a very clean operation, it was not squalid, everything was cleaned up good, it was neatly done, very professionally; but, as a result of our experience in Strafford, I would like to make three sort of charges to EPA and the State of Vermont officials concerned with this project. The first is, if you have not irrefutable proof that the mine presents a threat to human safety, it really should not be -- it should not go ahead with it, because, if not, there are thousands of toxic

Page 24

dumps around the country that everybody knows very clearly do present a present and serious threat to human beings. And, if we take some of those funds for here for something that isn't really toxic and seriously toxic, it really is unconscionable on Vermont's part to do so. The second is, if there is no irrefutable evidence that the project, when completed, will meet Vermont's Clean Water Act standards, wouldn't it be sensible to carry it out in a series of stages with the option of calling it quits when it seems likely funds, EPA funds, will no longer be available or the cost/benefit ratio begins to decline sharply. And, finally, and this I address to the representative from the State of Vermont, how can the State take -- what steps can the State take now -- how can the State is a bad question. Can the State take steps now that will guarantee that its total commitment will be no low -- no hire than 1.8 million. I think all of us in this country, including Vermont state officials, have been guilty of treating federal money as

Page 25

if it were free, and we're now paying the consequences. If this project doesn't represent a real toxic threat to human safety, the Tea Party will have a fine example of wasteful spending, and I want no part of it. That's why I'm here.

THE HEARING OFFICER: Any other comments? Back?

MS. M. FRENCH: Melanie French. I'm one of the people that's right near the mines. My family's been living there for generations, I believe since before the mines were there; and my concerns are -- I have many more health concerns about the process of cleanup and the perpetual care that has to go on there and what that's going to do to the environment than I -- than my concerns right now and the way that it's been for my whole lifetime and generations before me. We don't have any proof that this caused any harm to humans or that it's going to, from what I can see, but I do have concerns that it's going to affect our living standards with trucks in and out of

Page 26

there, dust and things dug up that have been healing for a hundred years, suddenly out in the environment, and then the nature that's been trying to heal itself for a hundred years being damaged and having to start all over, as well as the wildlife, and the fact that we're going to have to control a lot of that wildlife for part of this perpetual care when it's now their environment again. So my concerns are more about the cleanup. I think that we should leave alone, let nature continue to do its healing, and let things lay as they are.

THE HEARING OFFICER: Gary?

MR. G. GOODRICH: My name is Gary Goodrich. I'm a taxpayer here in Vershire; I've lived here for 28 years. I'm also the president of the Vershire Historical Society, and I'm going to speak for the Vershire Historical Society first. It's our -- it's our outlook or prospective to try to retain the historical value of that site, because it played a very important part in the history of this town, and I'll, just for record, the

Page 27

300 acres that encompasses the Ely Mines all are located in Vershire, Vermont. There are no parts of it in that are in West Fairlee. West Fairlee played an important role and I wish that some of the selectmen and some of their historical society had been here tonight, but to get back, even though there are a bunch of foundations and retaining walls and stuff, the seventy years that the mines were in progress and the mining was taking place there, but fifty years really when it got going, saw a big growth economically to this town. We went from a thousand people to 2,100 to 2,500 at its peak. Later, when the mines closed, this town went to nothing, that was in 1960, there was only 269 people in this town, but it still played a very important role, and I would like to see that preserved and I'm also willing to work with the EPA as a contact person or a person of interest that they ask questions upon, you know, if they have to take something down, then we'll try to do it with the most minimal damage to the

Page 28

site. I think it's worth preserving, and I would just like to see it preserved. Thank you.

THE HEARING OFFICER: Anyone else like to have a comment?

MR. MCKEE: Mark McKee, on the select board. I've been on the select board for four plus years, and in the four years, to my memory, no one has ever come to the select board with a real concern about the issue of cleaning up the mine. So that's one. And to -- I think I'll echo Ed Coffin's comment about the Tea Party, in the current national political climate I wonder if a project of this nature might be left unfinished should the EPA be dissolved or, you know, just terminated as a part of our government. I wonder, that seems more possible day by day. And, three, of a greater concern to me at the moment is the eroding river bank right out that window that threatens a utility pole and the future site of the emergency generator that we are installing for this building, and because

Page 29

this building is not only a major resource to the town of Vershire but it's also entered into an agreement with the Red Cross designating it as an emergency shelter, and I think a loss of -- that's part of this property -- to a flood or a water emergency would be more serious to this town than whatever potential problems are done at the site. Thanks.

MS. R. FRENCH: I'm Rita French; I'm also on the select board. Ed knows that I'm totally against this project anyway. I'm against it for any number of reasons. I don't feel it's necessary. I think nature left to itself, it's been healing. If it hadn't been logged off three times, it would have healed a lot more, at least three times that I know of, but I'm -- I am concerned that the Government wants to spend $18 million for no reason that I can see. It's -- it just seems you're throwing money away. And I'm also concerned that the State is going to have to spend indefinitely to keep this the way the Government says it's

Page 30

supposed to be, and the cost is only going to go up, I've never seen anything go down, if the Government's got anything to do with it. So that's -- I'm on the record as totally against it. I think it's unnecessary.

THE HEARING OFFICER: Any other questions or comments? John?

MR. FREITAG: Yeah. I would just like to add, regards to your comment about potentially making it worse, the experience at the Elizabeth Mine was, it was -- it was made worse. Terry Libby over in Chelsea, friend of mine, we're both facility managers, and he has this phrase, "If you kick a turd, it's going to smell." And what happened at the Elizabeth Mine, the work there caused a massive iron spike, and the EPA, to their credit, they came in and they built a treatment plant to deal with the problems they created. And, the fact is, that, when you stir all this stuff up, you're not working with nature, you're working against nature, and the likelihood of it becoming

Page 31

worse before it becomes better is highly likely, and so I think your concerns are valid based on experience in Stafford. The river was turned orange for four miles. I don't know if you remember that, but you can't help -- you can't help it, when you tear all this stuff up, you're going to make it worse before you make it better.

THE HEARING OFFICER: Any further comments?

MR. MACDONALD: I represent the district legislature, and I watched the Elizabeth Mine process, and it ballooned over the years, during times when we had plenty of money coming from the feds. The legislature is struggling right now with waste being stored down in Brattleboro at the nuclear plant, and there is no place to send that, and there is inadequate funding for that one. I know you have no power to take the $18 million and put it to use on preventing future things that might have to be cleaned up. I do not oppose spending federal money in Vermont to do things that

Page 32

help Vermont in the future, such as building roads, building bridges, and rehabbing our infrastructure; but, with the pressing needs that we have, I think the folks have already spoken, showing that proper yankee view of how federal money should be spent, and I hope you heed their advice. Mark MacDonald, and I live in Williamstown. I represent towns in this county in the Vermont Senate.

THE HEARING OFFICER: Any further comments? At this point we're going to close the hearing.

MS. PEARSON: Ed, I guess I need to speak out of sense of conscious. Peet Pearson, I live here in Vershire. Because we're not voting here tonight and because we really have no power beyond making comment, I at least want to go on the public record saying that, when we determine the quality of the world we're going to have on the basis of limited money, we're using an incredible amount of limited imagination. The reason we have limited money is because we spend it on all kinds of things that destroy us so that,

Page 33

in the long run, we've got a whole lot of reprioritizing to do, and I realize that even $1.8 million from us in Vermont is a lot of money, 18 million from us in federal taxes is a lot of money, but I at least want somebody in this gathering to go on record saying that, given the fact I have been to your meetings before, I don't think this place is getting cleaned up naturally, I think it does require some kind of effort.

The statistics do not show that it is, in fact, going to be clear on its own. I'm not sure now is the time to make this big an investment, but I certainly hope that our imagination encompasses a much, much better world than we've lived in or that we are going to give to our children and that the reason we don't have the money is our own dam stupidity getting us in this mess in the first place with bad priorities and spending it for non-human-enhancing and earth-enhancing kinds of costs.

THE HEARING OFFICER: Did you want to comment? It would have to be a comment,

Page 34

not a dialogue, but.

MS. R. FRENCH: I agree with some of the things she said; I disagree with others. If she's seen a picture of that place with the mine was going on, I think she would have to admit that it has done a remarkable amount of healing; and, as I said before, if it hadn't been logged every time you turn around, a lot of it -- I can remember going up there blueberrying when the area above that long wall was completely covered with blueberry bushes, they went in and logged, they cleared it all off for a landing, so now -- and it had to start all over again. I mean, the pictures when it was - the mine was operating, there weren't any trees anywhere around there, up as far as where I live, there was loss of foliage.

So I think it is doing a lot of healing and, left to itself, will do a lot more.

THE HEARING OFFICER: Are there any other comments? Then at this time we will close the hearing. Thank you all for making

Page 35

your comments; they will be fully considered.

We're done for the recorded part. If you do have questions, I would be happy to engage a question discussion.

(Whereupon, The hearing adjourned at 7:34 p.m.)

Page 36

CERTIFICATE

I, Marilee J. Young, Court Reporter and Notary Public, hereby certify that the foregoing pages numbered 2 through 31, inclusive, are a true and accurate transcription of my stenographic notes of the Environmental Protection Agency Public Hearing held on August 25, 2011, in Vershire, Vermont, starting at 7:00 p.m., and transcribed by me with use of computer-aided transcription and produced under my supervision for use in the matter of Ely Copper Mine Superfund Site Public Hearing.

My commission expires
February 10, 2015

ELY COPPER MINE
OU1 RECORD OF DECISION

APPENDIX D

ADMINISTRATIVE RECORD INDEX

# ELY COPPER MINE

Superfund Site

Administrative Record Index
Record of Decision (ROD)
Operable Unit 1(Source Area)

ROD Signed: September 28, 2011
Released on CD-ROM: September

Prepared by

EPA New England
Office of Site Remediation and Restoration

With Assistance from
ASRC Management Services
6301 Ivy Lane, Suite 300
Greenbelt, MD 20770

## Introduction to the Collection

This is the administrative record file for the Ely Copper Mine Superfund Site, Vershire, Vermont, Operable Unit 1 – (Source Area), Record of Decision (ROD), released September 2011. The file contains site-specific documents and a list of guidance documents used by EPA staff in selecting a response action at the site.

Documents within this Administrative Record also form the Administrative Record for the Ely Copper Mine Superfund Site, Operable Unit 2 Early Action. The primary documents for this Administrative Record are: OU1 Remedial Investigation Report, Site Human Health Risk Assessment, OU1 Feasibility Study and the OU1 Proposed Plan.

The administrative record file is available for review at:

EPA New England Office of
Site Remediation & Restoration
5 Post Office Square, Suite 100 (OSRR02-3)
Boston, MA 02109-3912
(by appointment)
617-918-1440 (phone)
617-918-0440 (fax)
www.epa.gov/region01/superfund/resource/records.htm

Town of Vershire
6894 Route 113
Vershire, VT 05079
(802) 685-2227 (phone)
admin@vershirevt.org

Town of West Fairlee
870 Route 113
Fairlee, VT 05045
(802) 333- 9696
www.westfairleevt.com

An administrative record file is required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA).

Please note that the compact disc(s) (CD) containing this Administrative Record may include index data and other metadata (hereinafter collectively referred to as metadata) to allow the user to conduct index searches and key word searches across all the files contained on the CD. All the information that appears in the metadata, including any dates associated with creation of the indexing data, is not part of the Administrative Record for the Site under CERCLA and shall not be construed as relevant to the documents that comprise the Administrative Record. This metadata is provided as a convenience for the user and is not part of the Administrative Record.

Questions about this administrative record file should be directed to the EPA New England site manager.

## Phase 01: SITE ASSESSMENT

**File Break: 01.02**

460897 **PRELIMINARY ASSESSMENT FOR ELY COPPER MINE VERSHIRE, VT**

# of Pages: 26
Doc Date: 01/18/1991

Author: LINDA GUERE-DEPARTMENT OF ENVIRONMENTAL SERVICES WASTE -US EPA REGION 1

Addressee:

Doc Type: PRELIMINARY ASSESSMENT ( REPORT

Access Type(s): REL

Bates #:

Weston #:

**File Break: 01.03**

291964 **SITE INSPECTION (SI)**

# of Pages: 10
Doc Date: 08/19/1992

Author: -VERMONT DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Addressee:

Doc Type: REPORT
SITE INSPECTION (SI)

Access Type(s): REL

Bates #:

Weston #:

## Phase 03: REMEDIAL INVESTIGATION (RI)

**File Break: 03.04**

**486505** **FINAL HISTORICAL/ARCHAEOLOGICAL MAPPING AND TESTING REPORT, VOLUME 1 AND 2**

**# of Pages:** 508
**Doc Date:** 01/01/2005

**Author:** SUZANNE CHERAU-PUBLIC ARCHEOLOGY LABORATORY INC
BEN FORD-PUBLIC ARCHAEOLOGY LABORATORY
MATTHEW KIERSTEAD-PUBLIC ARCHAEOLOGY LABORATORY

**Addressee:** US ARMY CORPS OF ENGINEERS

**Doc Type:** REPORT

**Access Type(s):** REL

**Bates #:**

**Weston #:**

**File Break: 03.06**

**461130** **DRAFT FINAL PHASE 1A REMEDIAL INVESTIGATION (RI) REPORT (02/23/2009 TRANSMITTAL LETTER ATTACHED)**

**# of Pages:** 201
**Doc Date:** 02/20/2009

**Author:** -URS CORPORATION

**Addressee:** US ARMY CORPS OF ENGINEERS

**Doc Type:** REMEDIAL INVESTIGATION (F REPORT

**Access Type(s):** REL

**Bates #:**

**Weston #:**

**473838** **DRAFT 2009 DATA EVALUATION REPORT FOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS)**

**# of Pages:** 981
**Doc Date:** 05/01/2010

**Author:** -NOBIS ENGINEERING INC

**Addressee:** US EPA REGION 1

**Doc Type:** REMEDIAL INVESTIGATION (F REPORT

**Access Type(s):** REL

**Bates #:**

**Weston #:**

## Phase 03: REMEDIAL INVESTIGATION (RI)

**File Break: 03.06**

**473839** **CONCEPTUAL SITE MODEL - TECHNICAL MEMORANDUM FOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS)**

**# of Pages:** 136
**Doc Date:** 07/01/2009

**Author:** ANDREW J BOECKELER-NOBIS ENGINEERING INC
PETER W DELANO-NOBIS ENGINEERING INC

**Addressee:** US EPA REGION 1

**Doc Type:** CORRESPONDENCE
MEMO

**Access Type(s):** REL

**Bates #:**

**Weston #:**

**490405** **REMEDIAL INVESTIGATION (RI) EXECUTIVE SUMMARY**

**# of Pages:** 44
**Doc Date:** 07/01/2011

**Author:** -NOBIS ENGINEERING INC

**Addressee:** US ENVIRONMENTAL PROTECTION AGENCY

**Doc Type:** REMEDIAL INVESTIGATION (I
REPORT

**Access Type(s):** REL

**Bates #:**

**Weston #:**

**490406** **FINAL REMEDIAL INVESTIGATION (RI) REPORT, ELY COPPER MINE, OPERABLE UNIT (OU) 1, VERSHIRE, VERMONT (TRANSMITTAL LETTER ATTACHED)**

**# of Pages:** 1946
**Doc Date:** 07/01/2011

**Author:** -NOBIS ENGINEERING INC

**Addressee:** US ENVIRONMENTAL PROTECTION AGENCY

**Doc Type:** REMEDIAL INVESTIGATION (I
REPORT

**Access Type(s):** REL

**Bates #:**

**Weston #:**

## Phase 03: REMEDIAL INVESTIGATION (RI)

**File Break: 03.10**

**454670** AQUATIC BASELINE ECOLOGICAL RISK ASSESSMENT (ERA)

# of Pages: 798
Doc Date: 06/01/2010

Author: -TECHLAW INC
Addressee: US EPA REGION 1
Doc Type: REPORT
RISK/HEALTH ASSESSMENT
Access Type(s): REL
Bates #:
Weston #:

**486502** FINAL HUMAN HEALTH RISK ASSESSMENT (HHRA) FOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS) (05/19/2011 TRANSMITTAL ATTACHED)

# of Pages: 544
Doc Date: 05/01/2011

Author: -NOBIS ENGINEERING INC
Addressee: US EPA REGION 1
Doc Type: REPORT
RISK/HEALTH ASSESSMENT
Access Type(s): REL
Bates #:
Weston #:

**490407** FINAL TERRESTRIAL ECOLOGICAL RISK ASSESSMENT (07/19/2011 TRANSMITTAL LETTER ATTACHED)

# of Pages: 464
Doc Date: 07/01/2011

Author: -NOBIS ENGINEERING INC
Addressee: US EPA REGION 1
Doc Type: REPORT
RISK/HEALTH ASSESSMENT
Access Type(s): REL
Bates #:
Weston #:

## Phase 04: FEASIBILITY STUDY (FS)

**File Break: 04.06**

**489533** FEASIBILITY STUDY (FS), ELY COPPER MINE, OPERABLE UNIT (OU) 1, VERSHIRE, VERMONT (07/21/2011 TRANSMITTAL LETTER ATTACHED)

# of Pages: 354
Doc Date: 07/01/2011

Author: ANDREW J BOECKELER-NOBIS ENGINEERING INC
DAVID W GORHAN-NOBIS ENGINEERING INC
-US EPA REGION 1

Addressee:

Doc Type: FEASIBILITY STUDY (FS) REPORT

Access Type(s): REL

Bates #:
Weston #:

**489534** FEASIBILITY STUDY (FS) EXECUTIVE SUMMARY (ES), ELY COPPER MINE, OPERABLE UNIT (OU) 1, VERSHIRE, VERMONT

# of Pages: 84
Doc Date: 07/01/2011

Author: -NOBIS ENGINEERING INC
-US EPA REGION 1

Addressee:

Doc Type: FEASIBILITY STUDY (FS) REPORT

Access Type(s): REL

Bates #:
Weston #:

**File Break: 04.09**

**489532** PROPOSED PLAN, OPERABLE UNIT (OU) 1

# of Pages: 20
Doc Date: 07/01/2011

Author: -US EPA REGION 1

Addressee:

Doc Type: PROPOSED PLAN PUBLIC INFORMATION REPORT

Access Type(s): REL

Bates #:
Weston #:

## Phase 04: FEASIBILITY STUDY (FS)

**File Break: 04.09**

**492969** **LETTER REGARDING COMMENT ON ELY COPPER EPA PROPOSAL**

**# of Pages:** 2
**Doc Date:** 08/27/2011

**Author:** ERIC DOWNING-LSC

**Addressee:** EDWARD HATHAWAY US EPA REGION 1

**Doc Type:** CORRESPONDENCE
LETTER
PUBLIC (AND OTHER) COMME

**Access Type(s):** REL

**Bates #:**

**Weston #:**

**492970** **COMMENT REGARDING PROPOSED PLAN**

**# of Pages:** 1
**Doc Date:** 08/17/2011

**Author:** STUART B BACON II-UPPER VALLEY SNOWPACKERS

**Addressee:** EDWARD HATHAWAY US EPA REGION 1

**Doc Type:** CORRESPONDENCE
LETTER
PUBLIC (AND OTHER) COMME

**Access Type(s):** REL

**Bates #:**

**Weston #:**

## Phase 05: RECORD OF DECISION (ROD)

**File Break: 05.01**

**494706** STATE CONCURRENCE LETTER REGARDING PROPOSED PLAN AND RECORD OF DECISION (ROD) OPERABLE UNIT (OU-1) FOR ELY COPPER MINE (09/28/2011 FAX TRANSMITTAL ATTACHED)

# of Pages: 2
Doc Date: 09/27/2011

Author: DAVID K MEARS-VERMONT DEPARTMENT OF ENVIRONMENTAL CONSERVATION
Addressee: EDWARD HATHAWAY US EPA REGION 1
Doc Type: CORRESPONDENCE
LETTER
Access Type(s): REL
Bates #:
Weston #:

**494707** EARLY ACTION RESPONSE MEMO FOR OPERABLE UNIT (OU-2) AT ELY COPPER MINE

# of Pages: 11
Doc Date: 09/28/2011

Author: LARRY BRILL-US EPA REGION 1
Addressee:
Doc Type: CORRESPONDENCE
MEMO
Access Type(s): REL
Bates #:
Weston #:

**File Break: 05.03**

**494705** APPENDIX C: RESPONSIVENESS SUMMARY FOR RECORD OF DECISION (ROD) OPERABLE UNIT (OU) 1

# of Pages: 66
Doc Date: 09/28/2011

Author: -US EPA REGION 1
Addressee:
Doc Type: REPORT
Access Type(s): REL
Bates #:
Weston #:

## Phase 05: RECORD OF DECISION (ROD)

**File Break: 05.04**

494709 **RECORD OF DECISION (ROD) OPERABLE UNIT 01, SOURCE AREA SIGNED 09/28/2011**

**# of Pages:** 252
**Doc Date:** 09/28/2011

| Author: | Addressee: | Doc Type: | Access Type(s): |
|---|---|---|---|
| -US EPA REGION 1 | | DECISION DOCUMENT<br>RECORD OF DECISION (ROD)<br>REPORT | REL<br><br>Bates #:<br>Weston #: |

## Phase 06: REMEDIAL DESIGN (RD)

**File Break: 06.04**

473837 **AQUATIC ASSESSMENT OF ELY COPPER MINE**

# of Pages: 144
Doc Date: 01/01/2010

Author: -US DEPARTMENT OF THE INTERIOR
-US GEOLOGICAL SURVEY

Addressee:

Doc Type: REPORT

Access Type(s): REL

Bates #:

Weston #:

473840 **GEOCHEMICAL CHARACTERIZATION OF SLAGS, OTHER MINE WASTE, AND THEIR LEACHATE FROM ELIZABETH AND ELY COPPER MINES (VERMONT), DUCKTOWN MINING DISTRICT (TENNESSEE), AND CLAYTON SMELTER SITE (IDAHO)**

# of Pages: 53
Doc Date: 01/01/2003

Author: PAUL H BRIGGS-USGS
JANE M HAMMARSTROM-USGS
ALLEN L MEIER-USGS
NADINE M PIATAK-USGS
ROBERT R SEAL II-USGS
-US DEPARTMENT OF THE INTERIOR

Addressee:

Doc Type: REPORT

Access Type(s): REL

Bates #:

Weston #:

## Phase 06: REMEDIAL DESIGN (RD)

**File Break: 06.04**

473841 **GEOCHEMICAL CHARACTERIZATION OF MINE WASTE AT THE ELY COPPER MINE SUPERFUND SITE**

**# of Pages:** 56
**Doc Date:** 01/01/2004

**Author:** PAUL H BRIGGS-USGS
JANE M HAMMARSTROM-USGS
JOHN C JACKSON -USGS
ALLEN L MEIER-USGS
TIMOTHY L MUZIK-USGS
NADINE M PIATAK-USGS
ROBERT R SEAL II-USGS
-US DEPARTMENT OF THE INTERIOR

**Addressee:**

**Doc Type:** REPORT

**Access Type(s):** REL

**Bates #:**

**Weston #:**

473842 **SEQUENTIAL EXTRACTION RESULTS AND MINERALOGY OF MINE WASTE AND STREAM SEDIMENTS ASSOCIATED WITH METAL MINES IN VERMONT, MAINE, AND NEW ZEALAND**

**# of Pages:** 38
**Doc Date:** 01/01/2007

**Author:** M ADAMS-USGS
Z A BROWN-USGS
P J LAMOTHE-USGS
NADINE M PIATAK-USGS
R F SANZOLONE-USGS
ROBERT R SEAL II-USGS

**Addressee:**

**Doc Type:** REPORT

**Access Type(s):** REL

**Bates #:**

**Weston #:**

**Phase 10: ENFORCEMENT/NEGOTIATION**

**File Break: 10.08**

448388 **PROPOSED SETTLEMENT AGREEMENT BETWEEN US EPA AND ELY MINE FOREST INC - DOCKET NO 01-2011-0012**

**# of Pages:** 83
**Doc Date:** 07/15/2011

**Author:** -STATE OF VERMONT
-US DEPT OF JUSTICE
-US EPA REGION 1
-VT AGENCY OF NATURAL RESOURCES

**Addressee:** ELY MINE FOREST INC

**Doc Type:** ENFORCEMENT & SETTLEMEI

**Access Type(s):** REL

**Bates #:**

**Weston #:**

## Phase 13: COMMUNITY RELATIONS

**File Break: 13.03**

**267851** **ARTICLE: US DEEMS VT MINE A SUPERFUND SITE [MARGINALIA]**

**# of Pages:** 2
**Doc Date:** 10/31/2001

**Author:** -ASSOCIATED PRESS
**Addressee:**
**Doc Type:** ARTICLE - NEWS/ PERIODICAI
NEWS CLIPPING
PUBLIC INFORMATION
**Access Type(s):** REL
**Bates #:**
**Weston #:**

**490452** **NEWS CLIPPING: RESIDENTS TOUR ELY MINE CLEANUP SITE**

**# of Pages:** 3
**Doc Date:** 07/31/2011

**Author:** AIMEE CARUSO-VALLEY NEWS
**Addressee:**
**Doc Type:** ARTICLE - NEWS/ PERIODICAI
NEWS CLIPPING
PUBLIC INFORMATION
**Access Type(s):** REL
**Bates #:**
**Weston #:**

**490453** **PUBLIC NOTICE: ELY COPPER MINE PUBLIC INFORMATION MEETING JULY 27, 2011 AND PUBLIC HEARING AUGUST 25, 2011**

**# of Pages:** 1
**Doc Date:** 07/23/2011

**Author:** -VALLEY NEWS
**Addressee:**
**Doc Type:** PUBLIC INFORMATION
**Access Type(s):** REL
**Bates #:**
**Weston #:**

## Phase 13: COMMUNITY RELATIONS

**File Break: 13.03**

**490454** **PUBLIC NOTICE: ELY COPPER MINE PUBLIC INFORMATION MEETING JULY 27, 2011 AND PUBLIC HEARING AUGUST 25, 2011**

**# of Pages:** 1
**Doc Date:** 07/24/2011

**Author:** -VALLEY NEWS
**Addressee:**
**Doc Type:** PUBLIC INFORMATION
**Access Type(s):** REL
**Bates #:**
**Weston #:**

**492310** **MEDIA ADVISORY: PUBLIC HEARING FOR ELY MINE SUPERFUND SITE IN VERSHIRE, VT**

**# of Pages:** 2
**Doc Date:** 08/23/2011

**Author:** -US EPA REGION 1
**Addressee:**
**Doc Type:** PRESS RELEASE
PUBLIC INFORMATION
**Access Type(s):** REL
**Bates #:**
**Weston #:**

**492971** **NEWS ARTICLE: MINE CLEANUP RAISES DOUBTS**

**# of Pages:** 2
**Doc Date:** 01/01/1111

**Author:** AIMEE CARUSO-VALLEY NEWS
**Addressee:**
**Doc Type:** ARTICLE - NEWS/ PERIODICAI
NEWS CLIPPING
PUBLIC INFORMATION
**Access Type(s):** REL
**Bates #:**
**Weston #:**

## Phase 13: COMMUNITY RELATIONS

**File Break: 13.03**

**492995** **NEWS CLIPPING: SUPERFUND ABUSE ADDS TO DEFICIT**

**# of Pages:** 1
**Doc Date:** 08/04/2011

**Author:** JOHN FREITAG-HERALD OF RANDOLPH
**Addressee:**
**Doc Type:** ARTICLE - NEWS/ PERIODICAI
NEWS CLIPPING
PUBLIC INFORMATION
**Access Type(s):** REL
**Bates #:**
**Weston #:**

**492996** **NEWS CLIPPING: RESIDENTS QUESTION EPA'S ELY MINE PLAN**

**# of Pages:** 1
**Doc Date:** 09/01/2011

**Author:** LAURA CRAFT -HERALD OF RANDOLPH
**Addressee:**
**Doc Type:** ARTICLE - NEWS/ PERIODICAI
NEWS CLIPPING
PUBLIC INFORMATION
**Access Type(s):** REL
**Bates #:**
**Weston #:**

**492997** **NEWS CLIPPING: HUH $18 MILLION**

**# of Pages:** 1
**Doc Date:** 07/28/2011

**Author:** -HERALD OF RANDOLPH
**Addressee:**
**Doc Type:** ARTICLE - NEWS/ PERIODICAI
NEWS CLIPPING
PUBLIC INFORMATION
**Access Type(s):** REL
**Bates #:**
**Weston #:**

## Phase 13: COMMUNITY RELATIONS

**File Break: 13.03**

**492998** NEWS CLIPPING: SUPERFUND PLANS $18 MILLION CLEANUP AT ELY MINE SITE

# of Pages: 1
Doc Date: 07/28/2011

Author: -HERALD OF RANDOLPH
Addressee:
Doc Type: ARTICLE - NEWS/ PERIODICAI
NEWS CLIPPING
PUBLIC INFORMATION
Access Type(s): REL
Bates #:
Weston #:

**File Break: 13.04**

**486503** HANDOUT FOR DECEMBER 2010 PUBLIC MEETING

# of Pages: 28
Doc Date: 12/16/2010

Author: -US EPA REGION 1
Addressee:
Doc Type: MEETING RECORD
PUBLIC INFORMATION
Access Type(s): REL
Bates #:
Weston #:

**486504** HANDOUT FOR MAY 25, 2011 PUBLIC MEETING

# of Pages: 18
Doc Date: 05/25/2011

Author: -US EPA REGION 1
Addressee:
Doc Type: MEETING RECORD
PUBLIC INFORMATION
Access Type(s): REL
Bates #:
Weston #:

## Phase 13: COMMUNITY RELATIONS

**File Break: 13.04**

**490421 PUBLIC MEETING FOR ELY COPPER MINE SUPERFUND SITE IN VERSHIRE, VERMONT**

**# of Pages:** 2
**Doc Date:** 07/25/2011

**Author:** -US EPA REGION 1
**Addressee:**
**Doc Type:** MEETING RECORD
PUBLIC (AND OTHER) COMME
**Access Type(s):** REL
**Bates #:**
**Weston #:**

**490450 PUBLIC INFORMATION MEETING**

**# of Pages:** 46
**Doc Date:** 07/27/2011

**Author:** -US EPA REGION 1
**Addressee:**
**Doc Type:** MEETING RECORD
PUBLIC INFORMATION
**Access Type(s):** REL
**Bates #:**
**Weston #:**

**494701 ELY COPPER MINE PUBLIC HEARING TRANSCRIPT AUGUST 25, 2011**

**# of Pages:** 57
**Doc Date:** 08/25/2011

**Author:** -US EPA REGION 1
**Addressee:**
**Doc Type:** MEETING RECORD
PUBLIC (AND OTHER) COMME
**Access Type(s):** REL
**Bates #:**
**Weston #:**

## Phase 13: COMMUNITY RELATIONS

**File Break: 13.04**

494704 **ELY COPPER MINE PUBLIC HEARING PRESENTATION AUGUST 25, 2011**

# of Pages: 23
Doc Date: 08/25/2011

Author: -US EPA REGION 1
Addressee:
Doc Type: PUBLIC INFORMATION
Access Type(s): REL
Bates #:
Weston #:

**File Break: 13.05**

31135 **COMMUNITY UPDATE # 1 MAY 2002 - EPA TO BEGIN INVESTIGATION AT ELY MINE SITE**

# of Pages: 4
Doc Date: 05/01/2002

Author: -US EPA REGION 1
Addressee:
Doc Type: FACT SHEET
PUBLIC INFORMATION
Access Type(s): REL
Bates #:
Weston #:

254076 **COMMUNITY UPDATE # 2: EPA INVESTIGATION PROGRAM CONTINUES AT THE SITE**

# of Pages: 4
Doc Date: 08/01/2006

Author: -US EPA REGION 1
Addressee:
Doc Type: FACT SHEET
PUBLIC INFORMATION
Access Type(s): REL
Bates #:
Weston #:

## Phase 13: COMMUNITY RELATIONS

**File Break: 13.05**

**485661** **FACT SHEET: SITE UPDATE**

**# of Pages:** 2
**Doc Date:** 12/01/2010

**Author:** -US EPA

**Addressee:**

**Doc Type:** FACT SHEET
PUBLIC INFORMATION

**Access Type(s):** REL

**Bates #:**
**Weston #:**

**485662** **FACT SHEET: SITE UPDATE**

**# of Pages:** 4
**Doc Date:** 05/01/2011

**Author:** -US EPA

**Addressee:**

**Doc Type:** FACT SHEET
PUBLIC INFORMATION

**Access Type(s):** REL

**Bates #:**
**Weston #:**

## Phase 16: NATURAL RESOURCE TRUSTEE

**File Break: 16.01**

**486556** LETTER REGARDING ADVISORY COUNCIL ON HISTORIC PRESERVATION (ACHP) REVIEW ON PROPOSED ELY MINE PROJECT

# of Pages: 1
Doc Date: 07/05/2011

Author: RAYMOND V WALLACE-ADVISORY COUNCIL ON HISTORIC PRESERVATION
Addressee: EDWARD HATHAWAY US EPA REGION 1
Doc Type: CORRESPONDENCE
LETTER
Access Type(s): REL
Bates #:
Weston #:

**486557** NOTIFICATION OF ADVERSE EFFECTS AT THE ELY MINE SUPERFUND SITE (WITH ATTACHMENT)

# of Pages: 7
Doc Date: 06/24/2011

Author: EDWARD HATHAWAY-US EPA REGION 1
Addressee: ADVISORY COUNCIL ON HISTORIC PRESERVATION
Doc Type: CORRESPONDENCE
LETTER
Access Type(s): REL
Bates #:
Weston #:

**489536** LETTER NOTIFYING NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA) OF EPA'S INTENT TO SEEK COMMENT ON PROPOSED PLAN FOR CLEANUP OF SITE FROM JULY 28, 2011 THROUGH AUGUST 27, 2011

# of Pages: 1
Doc Date: 07/25/2011

Author: LARRY BRILL-US EPA REGION 1
Addressee: KENNETH FINKELSTEIN US NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
Doc Type: CORRESPONDENCE
LETTER
Access Type(s): REL
Bates #:
Weston #:

## Phase 16: NATURAL RESOURCE TRUSTEE

**File Break: 16.01**

489537 **LETTER NOTIFYING DEPARTMENT OF INTERIOR (DOI) OF EPA'S INTENT TO SEEK COMMENT ON PROPOSED PLAN FOR CLEANUP OF SITE FROM JULY 28, 2011 THROUGH AUGUST 27, 2011**

**# of Pages:** 1
**Doc Date:** 07/25/2011

**Author:** LARRY BRILL-US EPA REGION 1
**Addressee:** ANDREW RADDANT US DEPT OF INTERIOR
**Doc Type:** CORRESPONDENCE
LETTER
**Access Type(s):** REL
**Bates #:**
**Weston #:**

492991 **COMMENTS LETTER FROM US FISH AND WILD LIFE SERVICES (USFWS) REGARDING PROPOSED PLAN**

**# of Pages:** 2
**Doc Date:** 08/26/2011

**Author:** THOMAS R CHAPMAN-US DEPT OF INTERIOR - FISH & WILDLIFE SERVICE
**Addressee:** EDWARD HATHAWAY US EPA REGION 1
**Doc Type:**
**Access Type(s):** REL
**Bates #:**
**Weston #:**

**Number of Documents in Administrative Record:** 50

# Selected Key Guidance Documents

EPA Guidance Documents may be reviewed at the OSRR Records and Information Center in Boston, MA

| DOCNUMBER | DOCDATE | TITLE | OSWEREPAID |
|---|---|---|---|
| 2018 | 01-Nov-89 | FEASIBILITY STUDY - DEVELOPMENT AND SCREENING OF REMEDIAL ACTION ALTERNATIVES [QUICK REFERENCE FACT SHEET] | OSWER #9355.3-01FS3 |
| 2019 | 01-Mar-90 | FEASIBILITY STUDY: DETAILED ANALYSIS OF REMEDIAL ACTION ALTERNATIVES [QUICK REFERENCE FACT SHEET] | OSWER #9355.3-01FS4 |
| 3002 | 08-Aug-88 | CERCLA COMPLIANCE WITH OTHER LAWS MANUAL (DRAFT) | OSWER #9234.1-01 |
| 3009 | 01-Dec-89 | CERCLA COMPLIANCE WITH OTHER LAWS MANUAL - CERCLA COMPLIANCE WITH STATE REQUIREMENTS [QUICK REFERENCE FACT SHEET] | OSWER #9234.2-05FS |
| 3013 | 01-Aug-89 | CERCLA COMPLIANCE WITH OTHER LAWS MANUAL PART II: CLEAN AIR ACT AND OTHER ENVIRONMENTAL STATUTES AND STATE REQUIREMENTS | OSWER #9234.1-02 |
| C058 | 17-Apr-89 | POLICY FOR SUPERFUND COMPLIANCE WITH THE RCRA LAND DISPOSAL RESTRICTIONS. | OSWER 9347.1-02 |
| C124 | 01-Jul-89 | SUPERFUND LDR GUIDE #1. OVERVIEW OF RCRA LAND DISPOSAL RESTRICTIONS (LDRS). DUPLICATE OF 2214. | OSWER 9347.3-01FS |
| C170 | 01-Oct-88 | INTERIM FINAL GUIDANCE FOR CONDUCTING REMEDIAL INVESTIGATIONS AND FEASIBILITY STUDIES UNDER CERCLA. DUPLICATE OF 2002. | OSWER 9355.3-01 |
| C177 | 01-Feb-91 | CONDUCTING REMEDIAL INVESTIGATIONS/FEASIBILITY STUDIES FOR CERCLA MUNICIPAL LANDFILL SITES. | OSWER 9355.3-11 |
| C214 | 25-Jun-93 | FINAL REVISIONS TO OMB CIRCULAR A-94 ON GUIDELINES AND DISCOUNT RATES FOR BENEFIT-COST ANALYSIS. | OSWER 9355.3-20 |
| C281 | 01-Sep-92 | ARAR'S FACT SHEET: COMPLIANCE WITH CLEAN THE CLEAN AIR ACT AND ASSOCIATED AIR QUALITY REQUIREMENTS | |
| C361 | 02-Jun-97 | ECOLOGICAL RISK ASSESSMENT GUIDANCE FOR SUPERFUND PROCESS FOR DESIGNING AND CONDUCTING ECOLOGICAL RISK ASSESSMENTS (EPA 540-R-97-006) | |
| C473 | 01-Aug-97 | RULES OF THUMB FOR SUPERFUND REMEDY SELECTION (EPA 540-R-97-013) | OSWER 9355.0-69 |
| C525 | 01-Jul-99 | GUIDE TO PREPARING SUPERFUND PROPOSED PLANS RECORDS OF DECISION AND OTHER REMEDY SELECTION DECISION DOCUMENTS | OSWER 9200.1-23P |

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| DOCNUMBER | DOCDATE | TITLE | OSWEREPAID |
|---|---|---|---|
| C526 | 01-Aug-00 | ABANDONED MINE SITE CHARACTERIAZTION & CLEANUP HANDBOOK (available on cd-rom) | PB2002-107421 |
| C539 | 01-Jun-03 | COMPREHENSIVE FIVE-YEAR REVIEW GUIDANCE | OSWER 9355.7-03B-P |
| C568 | 01-Nov-03 | ECOLOGICAL SOIL SCREENING LEVEL FOR ALUMINUM, INTERIM FINAL | OSWER 9285.7-60 |
| C582 | 01-Jul-00 | A GUIDE TO DEVELOPING AND DOCUMENTING COST ESTIMATES DURING THE FEASIBILITY STUDY | OSWER 9355.0-75 |
| C583 | 01-Jan-94 | METHODS FOR MEASURING THE MEASURING THE TOXICITY AND BIOACCUMULATION OF SEDIMENT-ASSOCIATED CONTAMINANTS WITH FRESHWATER INVERTEBRATES | |
| C584 | 01-Dec-96 | REGION I, EPA-NE DATA VALIDATION FUNCTIONAL GUIDELINES FOR EVALUATING ENVIRONMENTAL ANALYSES | |
| C594 | 01-Oct-02 | PRELIMINARY REMEDIATION GOALS TABLE REGION 9 TECHNICAL SUPPORT TEAM | |
| C596 | 01-Dec-02 | CALCULATING UPPER CONFIDENCE LIMITS FOR EXPOSURE POINT CONCENTRATIONS AT HAZARDOUS WASTE SITES | |
| C597 | 27-Dec-02 | NATIONAL RECOMMENDED WATER QUALITY CRITERIA | |
| C617 | 01-Jan-99 | DRAFT EQUILIBRIUM-PARTITIONING SEDIMENT GUIDELINES (ESGS) FOR THE PROTECTION OF BENTHIC ORGANISMS: METAL MIXTURES (CADMIUM, COPPER, LEAD, NICKEL, SILVER AND ZINC) | |
| C620 | 01-Oct-04 | EPA REGION 9 PRELIMINARY REMEDIATION GOALS TABLE | |
| C622 | 01-Nov-91 | A GUIDE TO PRINCIPLE THREAT AND LOW LEVEL THREAT WASTES | 9380.3-06FS |
| C627 | 01-Jun-01 | ECO UPDATE: THE ROLE OF SCREENING-LEVEL RISK ASSESSMENTS AND REFINING CONTAMINANTS OF CONCERN IN BASELINE RISK ASSESSMENTS | EPA 540/F-01/014 |
| C629 | 01-Dec-05 | CONTAMINATED SEDIMENT REMEDIATION GUIDANCE FOR HAZARDOUS WASTE SITES | EPA-540-R-05-012 |
| C630 | 01-Feb-05 | GUIDANCE FOR DEVELOPING ECOLOGICAL SOIL SCREENING LEVELS | OSWER 9285.7.5-55 |
| C663 | 01-Sep-96 | ROLE OF COST IN THE SUPERFUND REMEDY SELECTION PROCESS | EPA-540/F-96/018 |

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| DOCNUMBER | DOCDATE | TITLE | OSWEREPAID |
|---|---|---|---|
| C671 | 01-Jan-05 | PROCEDURES FOR THE DERIVATION OF EQUILIBRIUM PARTITIONING SEDIMENT BENCHMARKS FOR THE PROTECTION OF BENTHIC ORGANISMS | EPA-600-R-02-011 |
| C672 | 01-Jul-07 | ECOLOGICAL SOIL SCREENING LEVELS FOR SELENIUM, INTERIM FINAL | OSWER 9285.7-72 |
| C673 | 01-Jul-07 | ECOLOGICAL SOIL SCREENING LEVELS FOR ZINC, INTERIM FINAL | OSWER 9285.7-73 |
| C674 | 01-Apr-07 | ECOLOGICAL SOIL SCREENING LEVELS FOR MANGANESE, INTERIM FINAL | OSWER 9285.7-71 |
| C675 | 01-Feb-07 | ECOLOGICAL SOIL SCREENING LEVELS FOR COPPER, INTERIM FINAL | OSWER 9285.7-68 |
| C676 | 01-Mar-07 | ECOLOGICAL SOIL SCREENING LEVELS FOR NICKEL, INTERIM FINAL | OSWER 9285.7-76 |
| C677 | 01-Sep-06 | ECOLOGICAL SOIL SCREENING LEVELS FOR SILVER, INTERIM FINAL | OSWER 9285.7-77 |
| C678 | 01-Apr-05 | ECOLOGICAL SOIL SCREENING LEVELS FOR VANADIUM, INTERIM FINAL | OSWER 9285.7-75 |
| C679 | 01-Mar-05 | ECOLOGICAL SOIL SCREENING LEVELS FOR ARSENIC, INTERIM FINAL | OSWER 9285.7-62 |
| C680 | 01-Mar-05 | ECOLOGICAL SOIL SCREENING LEVELS FOR CADMIUM, INTERIM FINAL | OSWER 9285.7-65 |
| C681 | 01-Mar-05 | ECOLOGICAL SOIL SCREENING LEVELS FOR CHROMIUM, INTERIM FINAL | OSWER 9285.7- 66 |
| C682 | 01-Mar-05 | ECOLOGICAL SOIL SCREENING LEVELS FOR COBALT, INTERIM FINAL | OSWER 9285.7-67 |
| C683 | 01-Mar-05 | ECOLOGICAL SOIL SCREENING LEVELS FOR LEAD, INTERIM FINAL | OSWER 9285.7-70 |
| C684 | 01-Feb-05 | ECOLOGICAL SOIL SCREENING LEVELS FOR ANTIMONY, INTERIM FINAL | OSWER 9285.7-61 |
| C685 | 01-Feb-05 | ECOLOGICAL SOIL SCREENING LEVELS FOR BARIUM, INTERIM FINAL | OSWER 9285.7- 63 |
| C686 | 01-Feb-05 | ECOLOGICAL SOIL SCREENING LEVELS FOR BERYLLIUM, INTERIM FINAL | OSWER 9285.7- 64 |
| C687 | 01-Feb-05 | GUIDANCE FOR DEVELOPING ECOLOGICAL SOIL SCREENING LEVELS | OSWER 9285.7-55 |
| C688 | 01-Jan-06 | NATIONAL RECOMMENDED WATER QUALITY CRITERIA | |
| C689 | 12-Feb-02 | RESPONSE TO REGIONAL REQUEST REGARDING SEDIMENT CLEANUP AT MAY 2008 SUPERFUND DIVISION DIRECTORS MEETING | 9285.6-08, 9200.1-90 |
| C690 | 01-Aug-94 | FEASIBILITY STUDY ANALYSIS FOR CERCLA MUNICIPAL LANDFILL SITES | 9356.0-03 |
| C691 | 01-Aug-97 | CLARIFICATION OF THE ROLE OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS IN ESTABLISHING PRELIMINARY REMEDIATION GOALS UNDER CERCLA | OSWER 9200.4-23 |
| C692 | 19-Feb-92 | PERMITS AND PERMIT EQUIVALENCY PROCESSES FOR CERCLA ON-SITE RESPONSE ACTIONS | OSWER 9355.7-03 |

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| DOCNUMBER | DOCDATE | TITLE | OSWEREPAID |
|---|---|---|---|
| C693 | 01-Jul-91 | ARARS Q'S & A'S: GENERAL POLICY, RCRA, CWA, SDWA, POST-ROD INFORMATION AND CONTINGENT WAIVERS | 9234.2-01/FS-A |