

**Draft
Engineering Evaluation/
Cost Analysis
Red Devil Mine
Alaska**

Delivery Order Number: L09PD02160
Under General Services Administration Contract Number: 10F-0161J

February 2014

Prepared for:

**U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT**
Anchorage Field Office
4700 BLM Road
Anchorage, Alaska 99507

Prepared by:

ECOLOGY AND ENVIRONMENT, INC.
720 Third Avenue, Suite 1700
Seattle, Washington 98104

T able of Contents

Section	Page
Executive Summary	1
1 Introduction	1-1
2 Site Characterization	2-1
2.1 Site Description	2-1
2.2 Previous Investigations and Removal Actions.....	2-2
2.3 Physical Setting	2-2
2.3.1 Geology	2-3
2.3.2 Soils	2-4
2.3.3 Hydrogeology	2-5
2.3.4 Climate	2-6
2.3.5 Surface Water Hydrology and Sediment.....	2-6
2.3.6 Sensitive Species and Environments.....	2-7
2.4 Nature and Extent of Contamination.....	2-8
2.4.1 Red Devil Creek Surface Water	2-8
2.4.2 Red Devil Creek Sediment	2-8
2.4.3 Location of Contaminated Material	2-9
2.5 Basis for Early Action	2-11
3 Early Action Scope, Goals, and Objectives	3-1
3.1 Early Action Scope.....	3-1
3.2 Objectives of the Early Action	3-1
3.3 Applicable or Relevant and Appropriate Requirements.....	3-2
3.4 Early Action Schedule.....	3-3
4 Early Action Alternatives.....	4-1
4.1 Early Action Alternatives.....	4-1
4.1.1 Alternative 1: No Action	4-1
4.1.2 Alternative 2: Channelization and Line Creek with Solidifying Concrete Cloth.....	4-1
4.1.3 Alternative 3: Line Creek with Culvert.....	4-4

Table of Contents (cont.)

Section	Page
4.1.4 Alternative 4: Excavate Red Devil Creek Sediment	4-6
4.2 Common Components and Assumptions	4-8
5 Individual Analysis of Early Action Alternatives.....	5-1
5.1 Alternative 1: No Action	5-3
5.2 Alternative 2: Channelization of Red Devil Creek and Installation of Concrete Cloth Liner	5-4
5.3 Alternative 3: Installation of Culvert Liner along Red Devil Creek	5-6
5.4 Alternative 4: Excavation of Actively Eroding Sediment along Red Devil Creek	5-8
6 Comparative Analysis of Early Action Alternatives.....	6-1
6.1 Effectiveness	6-1
6.1.1 Overall Protection of Human Health.....	6-1
6.1.2 Compliance with ARARs/TBC Materials	6-2
6.1.3 Long-Term Effectiveness and Permanence.....	6-2
6.1.4 Reduction of Toxicity, Mobility, or Volume Through Treatment	6-3
6.1.5 Short-Term Effectiveness.....	6-3
6.2 Implementability	6-4
6.2.1 Technical Feasibility	6-4
6.2.2 Administrative Feasibility	6-5
6.2.3 Availability of Service and Materials.....	6-5
6.3 Cost.....	6-6
6.3.1 Cost Evaluation	6-6
6.4 Summary of Comparative Analysis	6-6
7 Recommended Early Action Alternative	7-1
8 References.....	8-1
A Analytical Data Summary Tables, 2013 RI Results	A-1
B RDM Site ARARs and TBCs	B-1
C Hydrologic and Hydraulic Report	C-1
D Cost Estimate	D-1

List of Tables

Table		Page
E-1	Summary of Alternatives Comparative Analysis for Effectiveness	3
E-2	Summary of Alternatives Comparative Analysis for Implementability	4
E-3	Summary of Alternatives Comparative Analysis for Cost	4
2-1	Red Devil Creek Discharges	2-12
2-2	Final Contaminants of Potential Concern, Red Devil Mine Site	2-12
5-1	Cost Estimate, Alternative 2 – Concrete Channel Construction	5-11
5-2	Cost Estimate, Alternative 3 – Culvert Construction.....	5-12
5-3	Cost Estimate, Alternative 4 – Excavation	5-13
6-1	Summary of Comparative Analysis, Draft Engineering Evaluation/Cost Analysis, Red Devil Mine.....	6-7
6-2	Summary of Individual Alternative Costs	6-8

L ist of Figures

Figure

1-1	Site Location Map.....	1-3
2-1	Main Processing Area Site Features	2-13
2-2	Outside Main Processing Area Site Features.....	2-14
2-3	Baseline SW Monitoring, Spring and Fall 2012.....	2-15
2-4	Red Devil Creek Arsenic, Antimony, and Mercury Sediment Sample Results.....	2-16
4-1	Plan View, Alternative 2 – Concrete Cloth Liner.....	4-9
4-2	Plan View, Alternative 3 – Culvert Liner	4-10
4-3	Plan View, Alternative 4 – Excavation of Contaminated Sediment Near Tailings Pile	4-11
4-4	Details 1 & 2, Alternative 2 – Concrete Cloth Liner	4-12
4-5	Details 3, 4 & 5, Alternative 3 – Culvert Liner & Headwall	4-13
4-6	Details 6, 7 & 8, Alternatives 2 & 3 Dissipation Pool Conceptual Design	4-14
4-7	Details 9, 10, 11, and 12 Typical Cross-Section Views, Alternative 4: Excavation of Contaminated Sediment.....	4-15

List of Abbreviations and Acronyms

%	percent
°F	degrees Fahrenheit
AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
ADNR	Alaska Department of Natural Resources
ARAR	applicable or relevant and appropriate requirement
AST	aboveground storage tank
BEI	Philips Burlington Environmental, Inc.
BLM	U.S. Department of Interior Bureau of Land Management
BMPs	best management practices
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
COCs	contaminants of concern
COPCs	contaminants of potential concern
DHSS	Alaska Department of Health and Social Services
E & E	Ecology and Environment, Inc.
EE/CA	Engineering Evaluation/Cost Analysis
EPA	United States Environmental Protection Agency
NAD	North American Datum
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
O&M	operation and maintenance
PAHs	polycyclic aromatic hydrocarbons

List of Abbreviations and Acronyms (cont.)

RAOs	removal action objectives
RDM	Red Devil Mine
RI	Remedial Investigation
SVOCs	semivolatile organic compounds
SWPPP	stormwater pollution plan
TBC	to-be-considered materials
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
XRF	x-ray fluorescence