5 Individual Analysis of Early Action Alternatives

This section presents an individual analysis of the alternatives based on the short- and long-term effectiveness of each alternative relative to reducing contaminated sediment discharges to surface waters and the Kuskokwim River as well as providing overall protection of public health and the environment. Three broad criteria—effectiveness, implementability, and cost—are used to evaluate each alternative against the scope of the early action, and these criteria are described below. The alternatives developed below address contamination associated with COCs (i.e., metals, specifically arsenic, antimony, and mercury) identified in sediment located along and within the Red Devil Creek, which have been determined to be actively eroding within the Main Processing Area at RDM. This early action analysis is intended to evaluate each alternative against the criteria with the understanding that additional removal actions will be required at RDM to address contamination identified in other media sources at the site.

Evaluation Criteria

Effectiveness

Effectiveness includes several evaluation factors, which are defined below.

Overall Protection of Human Health and the Environment: Assesses the ability of the alternative to be protective of human health and the environment under present and future land use conditions.

Compliance with ARARs: Identifies whether or not implementation of the alternative would comply with action-specific, and location-specific ARARs and TBC materials.

Long-term Effectiveness: Addresses the magnitude of residual risk remaining at the conclusion of early action activities; that is, addresses the adequacy and reliability of controls established by an early action alternative to maintain reliable protection of human health and the environment over time.

Reduction of Toxicity, Mobility, and Volume through Treatment: Identifies whether or not implementation of the alternative would reduce contaminant toxicity (e.g., reduction of metals contamination), mobility (e.g., preventing

contaminated soil from reaching human receptors), or actual volume of the hazardous substances.

Short-term Effectiveness: This criterion addresses the effects of an alternative during the construction and implementation phase until the early action objectives are met. This criterion includes the time with which the remedy achieves protective-ness and potential to create adverse impacts on human health and the environment during construction and implementation.

Implementability

Implementability is evaluated in accordance with the criteria defined below.

Technical Feasibility: Evaluates construction and operational considerations, as well as demonstrated performance/useful life.

Administrative Feasibility: Evaluates activities such as statutory limits, permitting requirements, easements/rights-of-way, and impact on adjoining property.

Availability of Service and Materials: Considers the availability of qualified contractors to handle site preparation, design, equipment, personnel, services and materials, excavation, disposal capacity, and transportation in time to maintain the early action schedule, as well as the availability of disposal facilities that are licensed to accept hazardous and non-hazardous liquid/solid waste.

Cost

Summaries of the alternatives' costs (except for the No Action alternative) are provided in Tables 5-1 through 5-3, and assumptions and references for the cost estimates are included in Appendix D. Each early action alternative was evaluated to determine its project cost. The cost estimates contain the capital cost and annual operational and maintenance costs for a period of 10 years. The cost estimate for each component of the proposed alternatives is based on assumptions provided in the early action alternative description presented in Section 4, this section, and in Appendix D.

Costs are based in part on the estimated extent of contaminated sediment along Red Devil Creek that is actively eroding within the Main Processing Area. Because of uncertainties about the exact amount of contaminated material and other uncertainties, actual cleanup costs may be expected to be in the range of -30 to +50%.

The present worth should be calculated for alternatives that will last longer than 12 months (EPA 1993). Under this EE/CA, early action alternatives 2, 3, and 4 will require approximately 3 months or less of operation (one construction season); however, 10 years of operation and maintenance (O&M) have also been incorporated into the cost estimate using present worth values.

5.1 Alternative 1: No Action

The No Action alternative was prepared and evaluated to provide a baseline with which other alternatives can be compared. Under this alternative, no action would be taken to reduce contaminant concentrations in affected Site media.

Effectiveness

This alternative does not remove or provide containment of COCs and will not meet the RAOs. Contaminant concentrations and the existing and future potential for off-site migration of sediment from Red Devil Creek would remain unchanged. Contaminated sediment would continue to discharge through Red Devil Creek and ultimately downstream to the Kuskokwim River.

Overall Protection of Human Health and the Environment: Under this alternative, no engineering or institutional controls will be implemented to address potential exposure pathways or to reduce contaminant concentrations in affected site media. As a result, there will be no measurable contaminant reduction or reduced exposure. Therefore, protection of human health and the environment is not provided.

Compliance with ARARs: ARAR compliance is not applicable to this alternative because chemical-specific ARARs are not evaluated in this EE/CA.

Long-Term Effectiveness and Permanence: This alternative would allow tailings to continue to migrate to the Kuskokwim River. The disposition of tailings within the designated excavation area at the site will not be altered. Therefore, long-term effectiveness and permanence is not provided.

Reduction of Toxicity, Mobility, or Volume through Treatment: This alternative provides no reduction of toxicity, mobility, or volume through treatment.

Short-Term Effectiveness: With no proposed construction activities, there will be no increase associated with exposure to contaminated media. Therefore, there are no short-term risks associated with this alternative.

Implementability

This alternative is readily implementable since there are no administrative or engineering actions to be implemented, administrative coordination is not required, and services or materials are not required.

Cost

There are no costs associated with this alternative.

5.2 Alternative 2: Channelization of Red Devil Creek and Installation of Concrete Cloth Liner

This alternative involves the channelization and installation of a concrete cloth liner along the channel bed for the portion of Red Devil Creek that flows through the Main Processing Area. The installation of the concrete cloth liner will be protective for industrial and/or occasional use by a recreational visitor that could potentially come in contact with contaminated sediment.

Effectiveness

Alternative 2 will not remove contamination from the RDM site but will reduce the potential for continuing migration of highly contaminated sediment to Kuskokwim River and ultimately reduce human and ecological receptor exposure to contaminated tailings observed along Red Devil Creek within the Main Processing Area. By increasing the stability of the creek banks and flow, the concrete cloth will significantly reduce the potential for erosion of the banks and channel bed of Red Devil Creek. Additionally, channelizing the stream will provide improved conveyance of the stream flow, reducing the potential for flooding of the contaminated tailings observed within the Main Processing Area. RAOs will be met under this alternative.

Overall Protection of Human Health and the Environment: Installation of the concrete cloth liner under Alternative 2 will reduce on-site potential risks to human health and the environment through the solidification of stream banks and channel bed of Red Devil Creek. The liner will provide sediment stabilization and reduction of potential erosion through the Main Processing Area, which has been identified as having the highest concentrations of contaminants of potential concern (COPCs) in sediment for RDM. Additionally, the liner would reduce the likelihood of human, animal, and aquatic biota coming in contact with contaminated sediment off site, by mitigating the potential for further sediment transport to the Kuskokwim River. Although the primary exposure pathways will be reduced under this alternative, most of the contaminated sediment identified within Red Devil Creek will remain in place and will be subject to continuing contact with groundwater during periods where high water tables have been observed.

Compliance with ARARs: This alternative can be implemented in compliance with all action-specific and location-specific ARARs.

Long-Term Effectiveness and Permanence: Under this alternative, the concrete cloth liner can remain in place until the full-scale remedy is implemented or approximately 25 years if properly installed. The concrete cloth, once installed, will be effective over the long term in reducing erosion and subsequent migration of Red Devil Creek sediment in the vicinity of the Main Processing Area, but will require annual inspection to determine if liner integrity has been compromised by environmental conditions (i.e., ice flow, beaver dams, etc.). This alternative is not

permanent as the concrete liner will need to be removed prior to implementing the final, full-scale remedial action.

Reduction of Toxicity, Mobility, or Volume: Since contaminated sediments would remain in place and not undergo treatment, the toxicity and volume of contaminants would not be reduced under Alternative 2; however, the mobility of contaminated sediment that occurs through erosion and suspension into Red Devil Creek waters would be reduced through the use of the concrete liner. The concrete liner will provide reduced contact between the creek flow and the contaminated sediments, thereby reducing the fluidization of sediments, which also reduces contaminant migration into the Kuskokwim River.

Short-Term Effectiveness: Given RDM's remote location, there is limited short-term risk associated with the local population. The potential for short-term impacts to workers and the surrounding environment would be addressed by engineering controls and BMPs. Workers would be subject to exposure to media containing elevated concentrations of arsenic, antimony, and mercury. The use of personal protective equipment and water sprays to reduce dust are two ways by which the short-term risks associated with working with metal-laden material can be reduced. Additionally, since there will be a limited amount of earthwork associated with the installation of the concrete cloth, there is reduced exposure to contaminated sediments, which equates to an increase in short-term effectiveness.

Excess excavation material that will result from channelization will require the use of erosion controls. Dewatering the construction areas will also help reduce potential suspension of contaminated sediment during construction. A stormwater pollution plan (SWPPP) will be developed prior to commencing work and will identify ways to prevent surface water runoff from leaching metals with subsequent migration and spreading of contamination. Potential environmental impacts such as erosion and sedimentation and fugitive dust would be addressed by BMPs, which may include bales and limited and temporary diversion channels.

Implementability

Channelization of Red Devil Creek and installation of the concrete cloth would utilize readily available equipment and services. Commonly used earth-moving equipment and site work procedures would be employed to excavate and re-grade the channel and stream banks, install the liner, and stabilize the stockpile storage areas that will be required for excess excavated sediment material. Therefore, Alternative 2 is technically implementable.

Administratively, Alternative 2 is implementable, but mobilization will be a major logistical concern. Heavy construction equipment will be required, including front end loaders, trucks, and other pieces of equipment, which will need to be barged to the site given the remote location of RDM. Additionally, the concrete cloth material will also need to be barged to the site. The majority of this equip-

ment and materials can be obtained in Bethel, Alaska or shipped directly to Bethel, Alaska to be transported up the Kuskokwim River by barge. Barges can only access the site during a very short period of the year (end of May through beginning of September) due to ice cover along the Kuskokwim River from October through mid to late May. All work, including mobilizing and demobilizing equipment and materials to the site, will need to be performed during this three-month construction period. While a relatively small window for construction is available, administrative and logistic efforts can be implemented provided they are planned well in advance of the construction season.

Additional administrative concerns associated with the work performed under this alternative within Red Devil Creek include coordination with BLM, EPA, ADEC, ADHSS, ADF&G, and ADNR. Sources of aggregate material will also need to be identified on site, or off-site sources must be identified, to obtain the necessary material to complete the dissipation pools prior to initiating construction of Alternative 2.

Cost
The estimated cost is $2,090,000 (Table 5-1).

5.3 Alternative 3: Installation of Culvert Liner along Red Devil Creek

Alternative 3 involves installing a culvert liner along the channel bed for the portion of Red Devil Creek that flows through the Main Processing Area. The culvert will be protective for industrial and/or occasional use by a recreational visitor who could potentially come in contact with contaminated sediment.

Effectiveness
Alternative 3 will not remove contamination from the RDM site but will reduce the potential for continuing migration of highly contaminated sediment to the Kuskokwim River and ultimately reduce human and ecological receptors' exposure to contaminated tailings observed along Red Devil Creek within the Main Processing Area.

By breaking the contact between the surface water and contaminated sediments observed within the Main Processing Area, the culvert will significantly reduce the potential for erosion of the banks and channel bed of Red Devil Creek that contains the highest levels of COCs. Additionally, installing the culvert will provide improved conveyance of the stream flow, reducing the potential for flooding of the contaminated tailings observed within the Main Processing Area. Under this alternative, the majority of contaminated sediment within and adjacent to Red Devil Creek will remain in place. RAOs will be met under this alternative.

Overall Protection of Human Health and the Environment: Installation of the culvert liner under Alternative 3 will decrease off-site risks to human health and

the environment by reducing the volume of tailings transported to the Kuskokwim River. The contaminated sediment identified within Red Devil Creek will remain in place and will be subject to continuing contact with groundwater; therefore, on-site risks to human health and the environment will remain but are limited.

Compliance with ARARs: This alternative can be implemented in compliance with all action-specific and location-specific ARARs.

Long-Term Effectiveness and Permanence: Under this alternative, the culvert can remain in place until the full-scale remedy is implemented. The culvert, once installed, will be effective over the long term in preventing erosion of Red Devil Creek sediment in the vicinity of the Main Processing Area, but will require annual inspection to evaluate the integrity and flow against impacts from environmental conditions (i.e., ice flow, beaver dams, etc.). This is not a permanent alternative as the culvert will be required to be removed prior to implementing the final full-scale remedial action.

Reduction of Toxicity, Mobility, or Volume: Since contaminated sediments would remain in place and not undergo treatment, the toxicity and volume of contaminants would not be reduced under Alternative 3; however, the mobility of contaminated sediment that occurs through erosion and suspension into Red Devil Creek waters would be significantly reduced through the use of the culvert. The culvert will provide a barrier between the creek flow and the contaminated sediments, thereby reducing the fluidization of sediments, which also reduces tailings migration into the Kuskokwim River.

Short-Term Effectiveness: Given RDM's remote location, there is limited short-term risk associated with the local population. The potential for short-term impacts to workers and the surrounding environment would be addressed by engineering controls and BMPs. Workers would be subject to exposure to media containing elevated concentrations of arsenic, antimony, and mercury. The use of personal protective equipment and water sprays to reduce dust are two ways by which the short-term risks associated with working with metal-laden material can be reduced. Additionally, since there will be a limited amount of earthwork associated with the installation of the culvert, there is reduced exposure to contaminated sediments, which equates to an increase in its short-term effectiveness.

Any excess excavation material that will result from channelization will be stored on site and will be subject to the use of erosion controls. Dewatering the construction areas will also help reduce potential suspension of contaminated sediment during construction. An SWPPP will be developed prior to commencing work and will identify ways to prevent surface water runoff from leaching metals with subsequent migration and spreading of contamination. Potential environmental impacts such as erosion and sedimentation and fugitive dust would be addressed by BMPs, which may include bales and limited/temporary diversion channels.

Implementability

Installing a culvert along Red Devil Creek will use readily available equipment and services. Commonly used earth-moving equipment and site work procedures would be employed to excavate and re-grade the channel and stream banks as necessary for the culvert base and dissipation pool, install the culvert liner, and stabilize the stockpile storage areas that will be required for any excess excavated sediment material. Therefore, Alternative 3 is technically implementable.

Administratively, Alternative 3 is implementable but mobilization will be a major logistical concern. Heavy construction equipment will be required, including front end loaders, trucks, and other pieces of equipment, which will need to be barged into the site given the remote location of RDM. Additionally, the culvert will also need to be barged to the site. The majority of this equipment and materials can be obtained in Bethel, Alaska or shipped directly to Bethel, Alaska to be transported to the site by barge. Barges can only access the site during a very short period of the year (end of May through beginning of September) due to ice jamming along the Kuskokwim River. All work, including mobilizing and demobilizing equipment and materials to the site, will need to be performed during this three-month construction period. While a relatively small window for construction is available, administrative and logistic efforts can be implemented provided they are planned well in advance of the construction season.

Additional administrative concerns associated with the work performed under Alternative 3 within Red Devil Creek include coordination with BLM, EPA, ADEC, ADHSS, ADF&G, and ADNR. Sources of aggregate material will also need to be identified on site, or off-site sources must be identified, to obtain the necessary material to complete the dissipation pools prior to initiating construction of Alternative 3.

Cost

The estimated cost is $2,110,000 (Table 5-2).

5.4 Alternative 4: Excavation of Actively Eroding Sediment along Red Devil Creek

This alternative involves the excavation of sediment within the portion of Red Devil Creek that extends through the Main Processing Area, which has been identified as actively eroding and containing COCs above cleanup objectives. It also involves regrading tailings on the south side of the creek in the Main Process Area to prevent future erosion. The excavated sediment will be deposited in an on-site stockpile to be included as part of the final, full-scale remedial action. No restoration of the excavated stream is proposed, but the toe of each stream bank of Red Devil Creek will be armored with gabions to prevent further degradation. A sediment trap will also be constructed downstream of the excavation closer to the

mouth of Red Devil Creek to help capture remnant material that may find its way into the creek.

Effectiveness

Alternative 4 will not remove contaminated sediment from the RDM site, but it has been designed to mitigate the potential of sediment migration off site into the Kuskokwim River. The alternative provides protection of human health and the environment from active erosion of Red Devil Creek within the Main Processing Area, which has been identified as containing the highest volume of metal-laden sediments along Red Devil Creek. Some contaminated sediment will remain in place but will be protected by regrading and armoring the stream banks to further reduce the potential for erosion. Excavated material from Red Devil Creek will be stored in an on-site stockpile, which will be addressed as part of the full-scale remedy. This alternative meets the early action RAOs.

Overall Protection of Human Health and the Environment: Excavating the tailings within the Main Processing Area that have been observed as actively eroding into Red Devil Creek waters will decrease risks to human health and the environment by reducing the potential for further erosion to surface water.

Although, the primary exposure pathways will be reduced under this alternative, some contaminated sediment within Red Devil Creek will remain in place, and will be subject to continuing contact with groundwater and surface water until a full-scale remedy is implemented.

Compliance with ARARs: This alternative can be implemented in compliance with all action-specific and location-specific ARARs.

Long-Term Effectiveness and Permanence: Under this alternative, excavation of Red Devil Creek will be effective over the long term in preventing erosion of tailings in the Main Processing Area. Annual inspection will be required to evaluate the integrity of the gabion toe armoring to determine whether contaminated sediment has become exposed. Excavation of Red Devil Creek as described for the early action is not designed to be permanent.

Reduction of Toxicity, Mobility, or Volume: The toxicity and volume of contaminants would not be reduced under Alternative 4. A portion of the tailings in the Main Process Area will be redistributed to another on-site location. The mobility of tailings through erosion and suspension into Red Devil Creek would be significantly reduced under this alternative.

Short-Term Effectiveness: Given RDM's remote location, there is limited short-term risk associated with the local population. The potential for short-term impacts to workers and the surrounding environment would be addressed by engineering controls and BMPs. Workers would be subject to exposure to media containing elevated concentrations of arsenic, antimony, and mercury. The use of

personal protective equipment and water sprays to reduce dust are two ways by which the short-term risks associated with working with metal-laden material can be reduced.

Excavated material will be stored on site and will require the use of erosion controls. Dewatering the construction areas will also help reduce potential suspension of contaminated sediment during construction. An SWPPP will be developed prior to commencing work and will identify ways to prevent surface water runoff from leaching metals with subsequent migration and spreading of contamination. Potential environmental impacts such as erosion and sedimentation and fugitive dust would be addressed by BMPs.

Implementability

Excavating Red Devil Creek will use readily available equipment and services. Commonly used earth-moving equipment and site work procedures would be employed to excavate and re-grade the channel and stream banks, as well as the sediment trap, install the gabion toe protection, and stabilize the stockpile storage areas that will be required for excavated sediment material. Administratively, Alternative 4 is implementable, but mobilization will be a major logistical concern. Heavy construction equipment will be required, including front end loaders, trucks, and other pieces of equipment, which will need to be barged into the site given the remote location of RDM. The majority of this equipment and materials can be obtained in Bethel, Alaska, or shipped directly to Bethel, Alaska to be transported by barge. Barges can only access the site during a very short period of the year (end of May through beginning of September) due to ice jamming along the Kuskokwim River. All work, including mobilizing and demobilizing equipment and materials to the site, will need to be performed during this three-month construction period.

Additional administrative concerns associated with the work performed under Alternative 4 within Red Devil Creek include coordination with BLM, EPA, ADEC, ADHSS, ADF&G, and ADNR. Sources of aggregate material will also need to be identified on site, or off-site sources must be identified, to obtain the necessary material to complete the sediment trap prior to initiating construction of Alternative 4.

Cost

The estimated cost is $2,140,000 (Table 5-3).

Table 5-1 Cost Estimate, Alternative 2 – Concrete Channel Construction Red Devil Mine Site, EE/CA Red Devil, Alaska

Direct Capital Costs					
Item	**Description**	**Quantity**	**Unit**	**Cost/Unit**	**Cost**
DCConCh1	Mobilization/Demobilization	1	lump sum	$675,896	$675,896
DCConCh2	Field Overhead and Oversight	3	month	$73,759	$221,277
DCConCh3	Site Preparation	1	lump sum	$7,902	$7,902
DCConCh5	Excavate Contaminated Materials	1	lump sum	$55,228	$55,228
DCConCh7	Stockpile Construction	1	lump sum	$10,464	$10,464
DCConCh8	Concrete Liner Construction	1	lump sum	$102,862	$102,862
DCConCh9	Construction Completion	1	lump sum	$15,391	$15,391
Total Direct Capital Costs (rounded to nearest $1,000)					***$1,089,000***
Total Direct Capital Costs with Location Factor of 1.198 (rounded to nearest $10,000)					***$1,300,000***
Indirect Capital Costs					
	Engineering and Design (5%)				$65,000
	Administration (5%)				$65,000
	Legal Fees and License/Permit Costs (7%)				$91,000
	3rd Party Construction Oversight (5%)				$65,000
Total Indirect Capital Costs					***$286,000***
Total Capital Costs					
	Subtotal Capital Costs				$1,586,000
	Contingency Allowance (20%)				$317,000
Total Capital Cost (rounded to nearest $10,000)					**$1,900,000**
Annual Direct Operation & Maintenance Costs					
Item	**Description**	**Quantity**	**Unit**	**Cost/Unit**	**Cost**
OM1	Operation and Maintenance Cost	1	annual	$15,100	$15,100
Total Annual Direct O&M Costs (Rounded to Nearest $1,000)					*$15,000*
Total Annual Direct O&M Costs with Location Factor of 1.198 (Rounded to Nearest $1,000)					*$18,000*
Annual Indirect O&M Costs					
	Administration	5%			$900
	Insurance, Taxes, Licenses	3%			$540
Total Annual Indirect O&M Costs (Rounded to Nearest $1,000)					*$1,000*
Total Annual O&M Costs					
	Subtotal Annual O&M Costs				*$19,000*
	Contingency Allowance	20%			$3,800
Total Annual O&M Cost (Rounded to Nearest $1,000)					$23,000
5 Year Cost Projection (Assume Discount Rate Per Year: 3.5%)					
Total Capital Costs					1,900,000
Present Worth of O&M assuming 3.5% Discount Factor (Rounded to Nearest $10,000)					$190,000
Total Present Worth Cost for Alternative (Rounded to Nearest $10,000)					**$2,090,000**

Table 5-2 Cost Estimate, Alternative 3 – Culvert Construction Red Devil Mine Site, EECA Red Devil, Alaska

Direct Capital Costs					
Item	**Description**	**Quantity**	**Unit**	**Cost/Unit**	**Cost**
DCCul1	Mobilization/Demobilization	1	lump sum	$693,415	$693,415
DCCul2	Field Overhead and Oversight	3	month	$73,759	$221,277
DCCul3	Site Preparation	1	lump sum	$5,702	$5,702
DCCul5	Excavated Contaminated Materials	1	lump sum	$49,713	$49,713
DCCul6	Backfill Low Areas	1	lump sum	$471	$471
DCCul7	Stockpile Construction	1	lump sum	$3,890	$3,890
DCCul8	Culvert Liner Installation	1	lump sum	$103,321	$103,321
DCCul9	Construction Completion	1	lump sum	$15,501	$15,501
Total Direct Capital Costs (rounded to nearest $10,000)					***$1,093,000***
Total Direct Capital Costs with Location Factor of 1.198 (rounded to nearest $10,000)					***$1,310,000***
Indirect Capital Costs					
	Engineering and Design (5%)				$66,000
	Administration (5%)				$66,000
	Legal Fees and License/Permit Costs (7%)				$92,000
	3rd Party Construction Oversight (5%)				$66,000
Total Indirect Capital Costs					***$290,000***
Total Capital Costs					
	Subtotal Capital Costs				$1,600,000
	Contingency Allowance (20%)				$320,000
Total Capital Cost (rounded to nearest $10,000)					**$1,920,000**
Annual Direct Operation & Maintenance Costs					
Item	**Description**	**Quantity**	**Unit**	**Cost/Unit**	**Cost**
OM2	Annual Operation and Maintenance Costs	1	annual	$15,100	$15,100
Total Annual Direct O&M Costs (Rounded to Nearest $1,000)					*$15,000*
Total Annual Direct O&M Costs with Location Factor of 1.198 (Rounded to Nearest $1,000)					*$18,000*
Annual Indirect O&M Costs					
	Administration	5%			$900.00
	Insurance, Taxes, Licenses	3%			$540.00
Total Annual Indirect O&M Costs (Rounded to Nearest $1,000)					*$1,000*
Total Annual O&M Costs					
	Subtotal Annual O&M Costs				*$19,000*
	Contingency Allowance	20%			$3,800
Total Annual O&M Cost (Rounded to Nearest $1,000)					$23,000
5 Year Cost Projection (Assume Discount Rate Per Year: 3.5%)					
Total Capital Costs					1,920,000
Present Worth of 30 Years O&M assuming 3.5% Discount Factor (Rounded to Nearest $10,000)					$190,000
Total Cost (Rounded to Nearest $10,000)					**$2,110,000**

Notes

1. Unit costs provided by Means were taken from *RS Means Heavy Construction Cost Data, 27th Ed., 2013.*
2. A 6 month work season and a 6 day work week were assumed.
3. One month for pre-construction and one month for post-construction activities were assumed.
4. A location factor of 1.198 (Anchorage, Alaska) was applied for all direct costs.

Table 5-3 Cost Estimate, Alternative 4 – Excavation Red Devil Mine Site, EECA Red Devil, Alaska

Item	Description	Quantity	Unit	Cost/Unit	Cost
Direct Capital Costs					
DCER1	Mobilization/Demobilization	1	lump sum	$673,853	$673,853
DCER2	Field Overhead and Oversight	3	month	$73,759	$221,277
DCER3	Site Preparation	1	lump sum	$17,108	$17,108
DCER5	Excavation of Contaminated Material	1	lump sum	$90,310	$90,310
DCER7	Stockpile Construction	1	lump sum	$28,588	$28,588
DCER9	Drop Structure/Sediment Trap Construction	1	lump sum	$61,417	$61,417
DCER10	Construction Completion	1	lump sum	$15,831	$15,831
Total Direct Capital Costs (rounded to nearest $10,000)					***$1,110,000***
Total Direct Capital Costs with Location Factor of 1.198 (rounded to nearest $10,000)					***$1,330,000***
Indirect Capital Costs					
	Engineering and Design (5%)				$67,000
	Administration (5%)				$67,000
	Legal Fees and License/Permit Costs (7%)				$93,000
	3rd Party Construction Oversight (5%)				$67,000
Total Indirect Capital Costs					***$294,000***
Total Capital Costs					
	Subtotal Capital Costs				$1,624,000
	Contingency Allowance (20%)				$325,000
Total Capital Cost (rounded to nearest $10,000)					**$1,950,000**
Annual Direct Operation & Maintenance Costs					
Item	**Description**	**Quantity**	**Unit**	**Cost/Unit**	**Cost**
OM2	Annual Operation and Maintenance Costs	1	annual	$15,100	$15,100
Total Annual Direct O&M Costs (Rounded to Nearest $1,000)					*$15,000*
Total Annual Direct O&M Costs with Location Factor of 1.198 (Rounded to Nearest $1,000)					*$18,000*
Annual Indirect O&M Costs					
	Administration	5%			$900.00
	Insurance, Taxes, Licenses	3%			$540.00
Total Annual Indirect O&M Costs (Rounded to Nearest $1,000)					*$1,000*
Total Annual O&M Costs					
	Subtotal Annual O&M Costs				*$19,000*
	Contingency Allowance	20%			$3,800
Total Annual O&M Cost (Rounded to Nearest $1,000)					$23,000
5 Year Cost Projection (Assume Discount Rate Per Year: 3.5%)					
Total Capital Costs					1,950,000
Present Worth of 30 Years O&M assuming 3.5% Discount Factor (Rounded to Nearest $10,000)					$190,000
Total Cost (Rounded to Nearest $10,000)					**$2,140,000**

Notes

1. Unit costs provided by Means were taken from *RS Means Heavy Construction Cost Data, 27th Ed., 2013.*
2. A 6 month work season and a 6 day work week were assumed.
3. One month for pre-construction and one month for post-construction activities were assumed.
4. A location factor of 1.198 (Anchorage, Alaska) was applied for all direct costs.