Proposed Plan for Cleanup

Columbia Falls Aluminum Company Superfund Site

Columbia Falls, Montana

June 2023

This Proposed Plan identifies the U.S. Environmental Protection Agency's (EPA) Preferred Alternative for cleanup of the Columbia Falls Aluminum Company Superfund Site in Columbia Falls, Montana. It provides the rationale used to select the Preferred Alternative and includes summaries of the site history, contamination, risk, and cleanup alternatives evaluated.

Release of this Proposed Plan starts the 60-day public comment period (**June 1 to July 31, 2023**). The comment period includes a public meeting where EPA will present the details of the Preferred Alternative and will take oral and written comments. **Information on how to provide comments or questions to EPA is provided on page 30 along with site contacts and public meeting details.**

At the end of the comment period, EPA will review and consider all comments provided and, in consultation with the Montana Department of Environmental Quality (DEQ), will move forward with the Preferred Alternative, modify it, or select another of the alternatives presented in this plan. The Selected Alternative will be documented in a formal Record of Decision that will include a responsiveness summary to address comments received. The Record of Decision will be followed by design and construction of the remedy.

EPA has issued this Proposed Plan as part of its public participation responsibilities under section 300.430(f)(2) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The Proposed Plan follows EPA guidance for decision documents (EPA 1999) and summarizes information that can be found in greater detail in the remedial investigation and feasibility study reports (Roux Environmental Engineering and Geology, DPC [Roux] 2020 and 2021, respectively) and other documents contained in the Administrative Record.

Inside

Understanding the Superfund Process

EPA is the lead agency for ensuring investigation and cleanup are done in accordance with federal Superfund law. EPA and its contractors oversee field activities, review documents, and ensure cleanup progress is achieved. DEQ is the state support agency for the site and has substantial and meaningful involvement in EPA investigation and cleanup activities. Columbia Falls Aluminum Company, LLC (CFAC) and Atlantic Richfield Company are the potentially responsible parties. CFAC performed the remedial investigation and feasibility study under EPA oversight pursuant to a 2015 Administrative Order on Consent between EPA and CFAC, which is complete.

About the CFAC Site

This Proposed Plan is part of a process that starts with discovery and ends with cleanup and, ultimately, deletion from Superfund's National Priorities List (Exhibit 1).

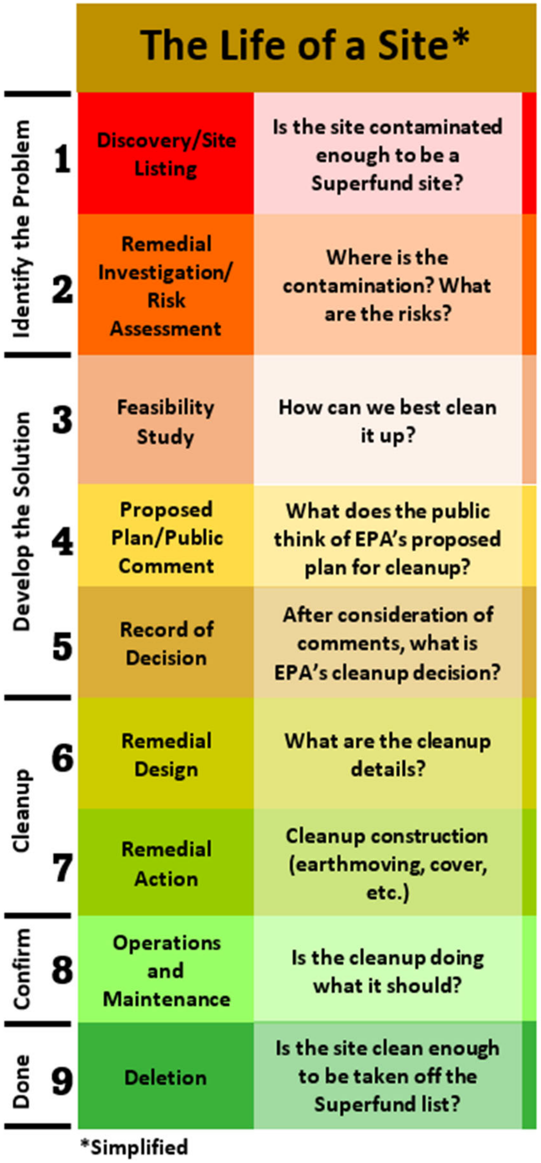

Exhibit 1. The Superfund Process

Site History and Background

Facility Ownership and Operations

Exhibit 2 shows the history of operations and ownership of the facility from construction in the 1950s through demolition in the late 2010s. The Hungry Horse Dam provided the inexpensive and ready source of electricity needed for production of aluminum. Originally opened by Anaconda Copper Co., the primary aluminum reduction facility operated from 1955 until 2009, under different owners and operators. Aluminum production was suspended in 2009 and CFAC announced the permanent closure of the facility in 2015, after operating the facility since acquiring it in 1985.

Waste Generation

- **Spent Pot Liner.** Aluminum production generated several waste products, most notably spent potliner, a carbon layer bonded to brick containing fluoride, sodium, aluminum, and cyanide. Cyanide and fluoride in spent pot liner can leach into groundwater. Initially, spent pot liner was disposed of on-site at the West Landfill, Center Landfill, and East Landfill. After 1990, spent pot liner was taken offsite for disposal.
- **Air Emissions.** Air emissions included particulate fluoride, hydrogen fluoride, and polycyclic aromatic hydrocarbons (PAHs) from the paste plant and aluminum reduction facility. Wet scrubbers, an air pollution control device that uses a liquid to remove contaminants from air emissions, removed pollution from smelting until 1976, when they were replaced by dry scrubbers.
- **Sludge**. Wastewater from the paste plant wet scrubber was discharged to the North Percolation Ponds. The aluminum reduction facility wet scrubbers were replaced with dry scrubbers in 1976, and sludge analysis showed

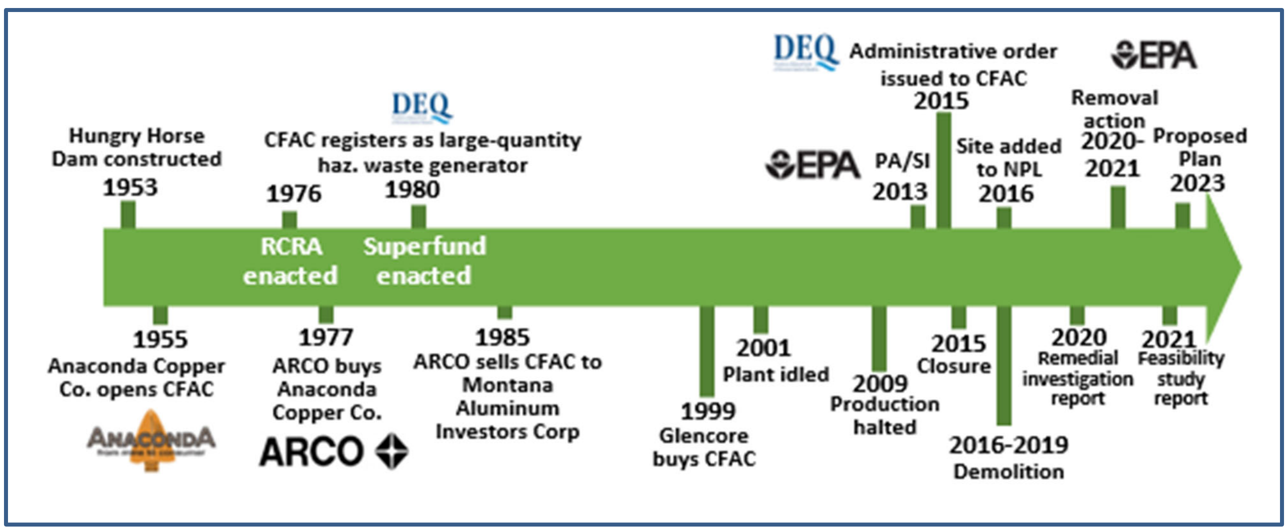

Exhibit 2. Site History

the makeup was approximately 80 percent (%) calcium fluoride and also contained calcium oxide, magnesium oxide, sodium oxide, and iron oxide. The sludge was landfilled on-site at the Wet Scrubber Sludge Pond. The West Landfill and Wet Scrubber Sludge Pond area are the primary sources of contaminants to groundwater. Ecological and human health contaminants of concern are shown on pages 6 and 7.

- **Liquid waste.** Liquid waste from the aluminum reduction process and stormwater was discharged to several percolation ponds. Wastewater was discharged indirectly to groundwater under a state-issued permit.

Site Setting, Buildings, and Land Use

The site is on the north side of the Flathead River, immediately east of Columbia Falls, Montana (population 5,651) in the northwestern portion of the state. Glacier National Park is 20 miles to the northeast and Kalispell, Montana (population 26,500) is 20 miles to the south.

The site and surrounding area to the west and south slope south-southwest toward the Flathead River. The East Landfill is the highest site feature. To the east and north are Teakettle Mountain and the mountains of Glacier National Park beyond. The tracks of the Burlington Northern Santa Fe Railroad run between the site buildings and the river.

Buildings

Buildings and industrial facilities associated with former operations included offices, warehouses, laboratories, mechanical shops, paste plant, coal tar pitch tanks, pump houses, casting garage, and the potline facility. Decommissioning of industrial facilities was completed in 2019, leaving the administration building, main warehouse, two ancillary warehouses, and a fabrication shop.

The Main Plant Area included buildings historically used for production of aluminum and various support buildings, warehouses, and storage areas, specifically:

- Potline buildings where aluminum was smelted.
- Casting house, mechanical shops, paste plant, rod mill, and warehouses adjacent to the potlines.
- Rectifier yards.

Landfills

There are seven closed landfills and one open landfill that had not been used since 2009, until an EPA-authorized 2020-2021 Superfund removal action. The landfills accepted a variety of wastes from 1955 to 2009. Locations are shown in Exhibit 3 and in the description of alternatives.

- **West Landfill** (7.8 acres and 13 feet above grade on the east side and over 20 feet on the west). Used for disposal of spent pot liner and other wastes. Closed in 1980 (although spent pot liner disposal reportedly ended in 1970) and capped in 1994. Unlined. Depth to groundwater ranges seasonally from 36 to 87 feet (high- and low-season, respectively). The West Landfill is one of two primary sources of contaminants to groundwater.
- **Wet Scrubber Sludge Pond** (10.8 acres with 15-foot berm). Depth to groundwater ranges seasonally from 60 to 105 feet. Received waste from wet scrubbers at the reduction plant from 1955 to 1980. Capped with an earthen cap in 1981 and vegetated. The Wet Scrubber Sludge Pond is the other primary source of contaminants to groundwater.
- **Center Landfill** (1.8 acres and 15 feet above grade). Operated from 1970 to 1980 for disposal of spent pot liner. Depth to groundwater ranges seasonally from 57 to 139 feet. Unlined. Closed in 1980 and capped with clay cap and fill. A potentially secondary source of contaminants to groundwater based on a one-time exceedance of total cyanide in 2017. Impacted material likely does not extend to groundwater.
- **East Landfill** (2.4 acres and 30 feet above grade). Operated from 1980 to 1990 for disposal of spent pot liner. Depth to groundwater ranges seasonally from 109 to 130 feet. Clay liner. Closed in 1990 and capped with clay, synthetic membrane, and a vegetated till cover. Two Hypalon-lined, leachate-collection ponds received stormwater and leachate. The North Leachate Pond (0.6 acres) was connected to the Wet Scrubber

Sludge Pond by a drainage pipe and was closed in 1994. The South Leachate Pond (0.9 acres) was emptied in 1990, then dried, capped, and closed in 1993.

- **Industrial Landfill** (12.4 acres and 10 to 20 feet high). Received non-hazardous waste and debris from the 1980s to 2009, then used to dispose South Percolation Ponds sediment and soil in 2020 to 2021. Currently inactive with a temporary soil cover. Depth to groundwater ranges seasonally from 19 to 31 feet. Not a groundwater contamination source. Depth of material and presence of a liner is unknown.
- **Sanitary Landfill** (3.8 acres). Operated in the early 1980s for garbage disposal. Depth to groundwater ranges seasonally from 23 to 94 feet. Clay-lined. Covered with clean fill and vegetated. Cap in good condition. Not a source of contamination to groundwater.
- **Asbestos Landfills**. Four small landfills built late-1970s/early-1980s. Used from 1993 to 2009 to dispose of on-site, asbestos-containing construction materials. Natural soil cover overlies disposed materials. Deepest asbestos is 4.5 feet. No evidence of engineered caps or liners. Not a source of groundwater contamination.

The general area of the landfills described above is referred to as the Central Landfills Area.

Percolation Ponds

Water from site operations and stormwater was discharged to several percolation ponds (Exhibit 3).

- **North-East Percolation Pond**. 2 acres. Built in 1955 and still in use for stormwater control. Not a continuing groundwater source.
- **North-West Percolation Pond**. 8 acres. Built in early 1970s to accept overflow from the North-East Pond. A 1,440-foot-long unlined ditch connects the North-East and North-West ponds. Not a continuing groundwater source, but a source of soil contamination.
- **South Percolation Ponds**. Three ponds built in the 1960s along the Flathead River. Addressed in a 2020-2021 Superfund removal action. Not a continuing groundwater source.

Land use

Historically site use has been industrial or commercial, although there are currently no ongoing manufacturing or commercial activities. CFAC keeps a limited on-site staff for maintenance of the remaining buildings and infrastructure, including the existing landfills.

The Flathead River is used for recreational activities, such as boating, floating, kayaking, hunting, fishing, and bird-watching. Trespassers are known to access portions of the site for recreational purposes, including all-terrain vehicle riding, hunting, and fishing.

The nearest residences are adjacent to the southwest site boundary, approximately 0.8 miles west of the historical footprint of site operations, in a neighborhood referred to as Aluminum City. The nearest wells used for drinking water are in that neighborhood.

Local authorities have not adopted a future land use plan for the site. In the absence of a definitive local plan, the feasibility study identifies potential future uses such as commercial, industrial, and recreational. Based on the location, flat land, and remaining post-decommissioning infrastructure, the foreseeable future use of the Main Plant Area is industrial or commercial. Landfills would remain industrial. Areas near the river likely would remain recreational. Land use decisions fall within the purview of local permitting and zoning authorities, as well as the private property owner.

Groundwater

The coarse-grained glacial outwash and alluvial deposits above the glacial till are known as the upper hydrogeologic unit. Bedrock marks the bottom of the hydrogeologic system. Groundwater levels fluctuate seasonally. Near Teakettle Mountain and the Central Landfills Area, average water levels fluctuated by 25 feet during the remedial investigation, with the lowest levels occurring in October and the highest in June. In the center of the site, average water levels fluctuated by 17 feet. In the southern area of the site, average water levels fluctuated by approximately 18 feet, with the lowest levels in March and the highest in June.

Groundwater typically flows southwest away from Teakettle Mountain toward the Central Landfills Area. From the Central Landfills Area, flow continues to the southwest until it reaches the relatively flat site center, before flowing south toward the Flathead River. In the Western Undeveloped Area (includes roadways and mixed vegetation in the western third of the site and historically had no operational activities) groundwater flows southeast, away from the adjacent Aluminum City, and toward the Flathead River. Production wells provided groundwater for industrial operations and for potable water. Power to these wells was terminated during decommissioning, rendering on-site wells non-operational.

Surface Water

The site has four primary surface water bodies: 1) Flathead River, 2) Cedar Creek, 3) Cedar Creek Reservoir Overflow Ditch, and 4) the Northern Surface Water Feature. Surface water features specific to the Flathead River include 1) the Seep Area, 2) Backwater Seep, and 3) Riparian Area.

The Remedial Investigation

The remedial investigation examined potential contaminant sources: landfills, percolation ponds, plant drainage systems, the former drum storage area, underground and above ground storage tanks, and waste and raw materials storage and handling areas. It evaluated the four potential exposure pathways: groundwater, surface water and sediments, porewater, and soil.

The remedial investigation was conducted in two phases:

- **Phase I (2016 and 2017)**. Included soil gas samples, geophysics, Geoprobe samples, monitoring wells, sediment and surface water samples, and groundwater samples.
- **Phase II (2018 and 2019)**. Included soil borings, wells, sediment samples, sediment porewater samples, surface water samples, and groundwater samples. A background study was conducted of off-site soil, sediment, and surface water.

The remedial investigation report (Roux 2020) documented that:

- Fluoride and cyanide are present in groundwater and the primary sources are the West Landfill and Wet Scrubber Sludge Pond. The East Landfill is a secondary contributing source.
- PAHs are present in shallow soils at the North Percolation Ponds, Effluent Ditch, and Main Plant Area.
- Metals are present in shallow soils at the North Percolation Ponds, Main Plant Area, and all landfills.
- Contamination is present in the percolation ponds, Backwater Seep, and Riparian Area.
- Contaminants of concern in the Flathead River were mostly non-detect or similar to background concentrations due to the volume of water in the river.

Decision Units

Five decision units (DUs) were created in the remedial investigation, based on the results of the risk assessments. The feasibility study divided the original Landfills DU into two parts based on potential sources for groundwater contamination, for a total of six DUs (Exhibit 3). The six DUs are listed below and described in detail in the feasibility study.

- **Landfills DU1**. West Landfill, Wet Scrubber Sludge Pond, Center Landfill. This DU includes the primary sources of contaminants to groundwater (West Landfill, Wet Scrubber Sludge Pond). DU1 contains an estimated 1.2 million cubic yards of waste.
- **Landfills DU2**. East Landfill, Industrial Landfill, Sanitary Landfill, Asbestos Landfills. This DU includes a secondary source of contaminants to groundwater (East Landfill).
- **Soil DU3**. Main Plant Area, soil sampling grid area, and areas surrounding the waste management units in the Central Landfills Area, including the Former Drum Storage Area.
- **North Percolation Pond DU4**. North-East Percolation Pond and its influent ditch, the North-West Percolation Pond, and the approximately 1,440-foot-long overflow ditch.
- **River Area DU5**. Soil, sediment, sediment porewater, and surface water in the South Percolation Ponds, Backwater Seep Sampling Area, and Riparian Area Channel.
- **Groundwater DU6**. Groundwater in the upper hydrogeologic unit beneath the site.

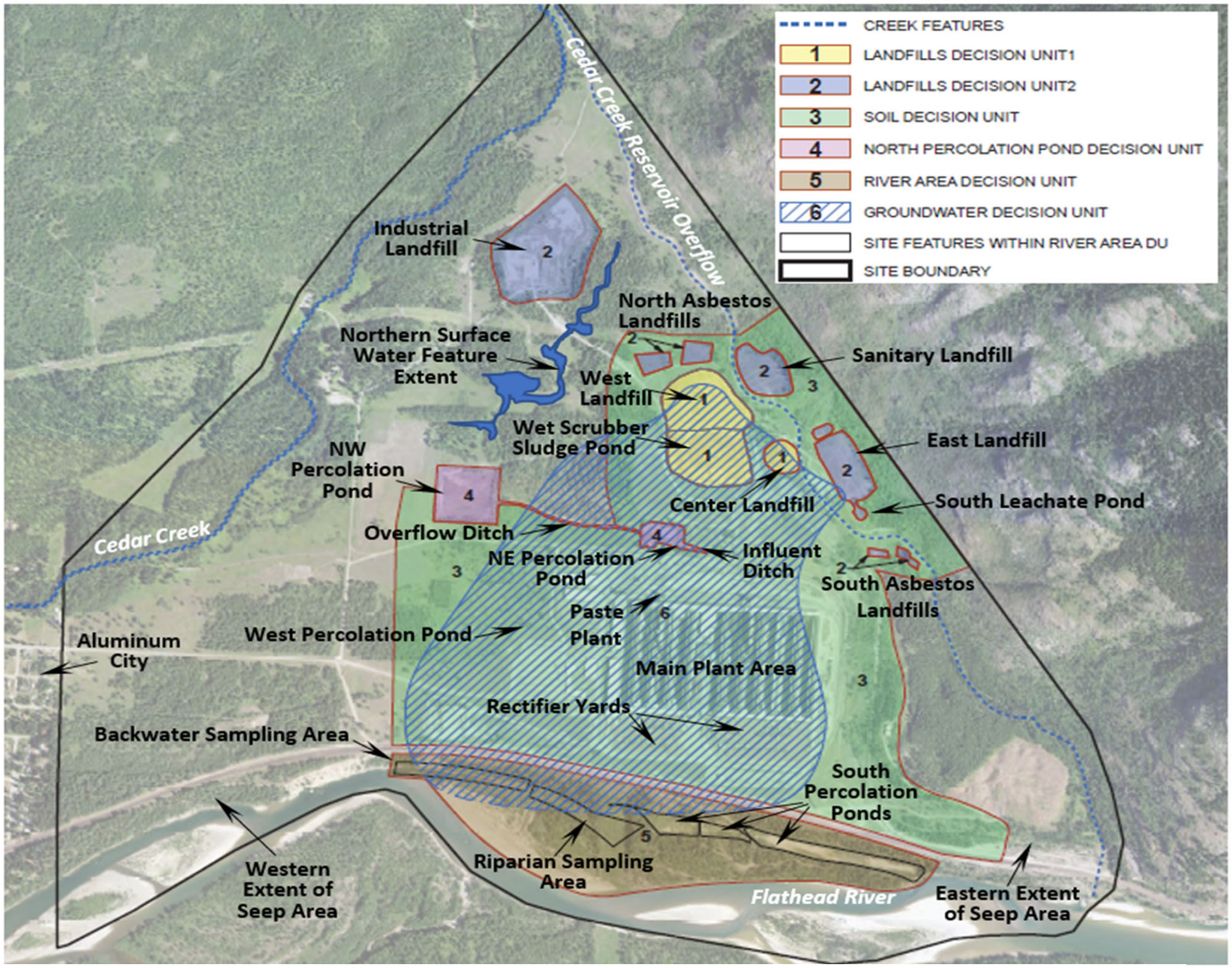

Exhibit 3. Decision Units at the Site

Summary of Site Risks

Ecological Risks

The baseline ecological risk assessment (EHS Support LLC 2019b) shows that potential adverse ecological effects exist in parts of all three exposure areas:

- **Terrestrial Exposure Area**. Main Plant Area, Central Landfills Area, and soil sampling grid area.
- **Transitional Exposure Area**. North Percolation Pond and South Percolation Ponds.
- **Aquatic Exposure Area**. Flathead River Riparian Area Channel and Backwater Seep Sampling Area.

Ecological contaminants of concern are shown in Exhibit 4.

Contam-inant of Concern	Decision Unit				
	DU1	DU2	DU3	DU4	DU5
Aluminum				SW	SW
Barium				Soil Sed SW	Soil SW Sed PW
Cadmium				Sed SW	
Copper	Soil	Soil	Soil	SW	SW Sed PW
Cyanide					SW Sed PW
Fluoride				SW	
Iron					SW
Lead				Sed	
Nickel	Soil	Soil	Soil	Soil Sed	
Selenium			Soil	Soil Sed	
Thallium				Soil	
Vanadium		Soil		Soil Sed	
Zinc			Soil	Sed SW	
PAHs	Soil	Soil	Soil	Soil, Sed SW	

Sed = sediment, SW = surface water, PW = sediment porewater, PAHs = polycyclic aromatic hydrocarbons

Exhibit 4. Ecological Health Contaminants of Concern

Human Health Risks

The baseline human health risk assessment report (EHS Support, LLC 2019a) identifies potential receptors on-site and associated with the Flathead River based on potential exposure to affected soil, groundwater, surface water, and sediment (current and future use). Potential receptors vary by specific exposure area.

- Current potential receptors are trespassers and recreationists.
- Potential future receptors include industrial or commercial workers, construction workers, residents, trespassers, and recreationists (such as hunters and fishers).

Default exposure assumptions were used for residential scenarios. Site-specific exposure assumptions were used for trespassers, industrial workers, construction workers, and recreationists. Human health contaminants are shown in Exhibit 5. The risk assessment concludes that most exposure areas do not pose an excess lifetime cancer risk above *de minimis* levels or potential for non-cancer health effects. Exceptions are the North Percolation Pond Area, Main Plant Area, Central Landfills Area, and Industrial Landfill Area. Groundwater in the plume core poses risk to hypothetical future residential drinking water users. PAHs, cyanide, and fluoride are the primary risk dirvers.

Contam-inant of Concern	Decision Unit				
	DU1	DU2	DU3	DU4	DU6
Arsenic	Soil	Soil	Soil	Soil, Sed	GW
Cyanide (total)					GW
Cyanide (free)					GW
Fluoride					GW
PAHs	Soil	Soil	Soil	Soil, Sed	

Sed = sediment, GW = groundwater, PAHs = polycyclic aromatic hydrocarbons

Exhibit 5. Human Health Contaminants of Concern

Risks are summarized below as the potential number of excess lifetime cancers for a given exposure group that might result from prolonged exposure to contaminants in th ese locations. Excess lifetime cancer risks are described as additional lifetime cancers for a given number of exposed people. Where more than one risk value exists, the most conservative number is presented.

- Main Plant Area.
  - Trespasser. 2 per 1,000,000 people
  - Industrial worker. 2 per 100,000 people
  - Construction worker. 2 per 1,000,000 people
- North Percolation Ponds Area.
  - Stormwater worker. 1 per 10,000 people
  - Trespasser. 5 per 100,000 people
- Central Landfills Area.
  - Trespasser. 2 per 1,000,000 people
  - Landfill worker. 1 per 100,000 people
- Industrial Landfills Area.
  - Trespasser. 2 per 1,000,000 people
  - Landfill worker. 1 per 100,000 people
- Groundwater Plume Core Area.
  - Future resident. 2 per 10,000 people

Elevated non-cancer risks are primarily due to exposure to groundwater in the plume core.

Remedial Action Objectives

Remedial action objectives describe what cleanup is intended to accomplish. Remedial action objectives can be specific to certain contaminants, environmental media, and exposure pathways and receptors. They consider current and anticipated future land use, as well as groundwater and surface water beneficial use designations. The remedial action objectives are based on the human and ecological risk assessments and on reasonable anticipated future use. The Montana standards (Exhibit 6) are referenced in the bullets.

Preliminary remedial goals for soils and sediments are shown in Exhibit 7.

Contaminant of Concern	Montana DEQ-7 Standard (µg/L)		
	Aquatic Life - Surface Water		Human Health – Ground water
	Chronic	Acute	
Aluminum	87 (D)	750(D)	NA
Arsenic	NA	NA	10 (D)
Barium	None	None	NA
Cadmium	0.25 (T,H)	0.49 (T,H)	NA
Copper	2.85 (T,H)	3.79 (T,H)	NA
Cyanide, total	5.2	22	200
Fluoride	None	None	4,000
Iron	1,000 (T)	None	NA
Zinc	37 (T,H)	37 (T,H)	NA

D = dissolved, H = Hardness dependent (calculated at a hardness of 25 mg/L), NA = not applicable (not a COC), T= total recoverable

Source: Circular DEQ-7 MT Numeric Water Quality Standards June 2019

Exhibit 6. State of MT Standards/Preliminary Remedial Goals for Contaminants of Concern in Water

Solid Media

- Prevent ingestion, direct contact, and inhalation of contaminated soils and sediments that would result in unacceptable risk from PAHs under reasonably anticipated future land uses.
- Eliminate exceedences of Montana DEQ-7 (DEQ 2019) groundwater standards by reducing migration of arsenic, cyanide, and fluoride from contaminated soils and wastes.
- Eliminate exceedences of Montana DEQ-7 aquatic life criteria in surface water and porewater by reducing migration of metals, cyanide, fluoride, and PAHs from contaminated soils, sediments, and wastes.
- Eliminate unacceptable risk for terrestrial and transitional ecological receptors by reducing ingestion of and direct contact with elevated concentrations of metals and PAHs from contaminated surficial and shallow soils.
- Eliminate ingestion and direct contact that would result in unacceptable risk for aquatic and semi-aquatic ecological receptors by reducing contact with metals, cyanide, and PAHs from contaminated surficial and shallow soils and sediments.

Groundwater

- Reduce cyanide, fluoride, and arsenic concentrations in groundwater in the upper hydrogeologic unit that exceed Montana DEQ-7 standards, prevent further degradation of groundwater, and prevent expansion of the groundwater plume into groundwater that meets Montana DEQ-7 standards.
- Prevent ingestion of, or direct contact with, groundwater contaminated with arsenic, cyanide, and fluoride in excess of Montana DEQ-7 standards.
- Eliminate exceedances of Montana DEQ-7 aquatic life criteria in surface water and porewater by reducing migration of cyanide in groundwater.

Surface Water

- Reduce metals, cyanide, fluoride, and PAH concentrations in River Area DU surface water and sediment porewater to the aquatic life criteria identified in Montana DEQ-7 as applied to State of Montana B-1 class waters.

Preliminary Remedial Goals

Preliminary remedial goals are target concentrations used to develop, evaluate, and select remedial alternatives. They are the numbers used to measure whether the remedial action objectives are being met. Ideally, a remedy that achieves the preliminary remedial goals will comply with state and federal Applicable Relevant and Appropriate Requirements (ARARs) and reduce risk to levels that satisfy the NCP requirements for protection of human health and the environment. Risk-based preliminary remedial goals were developed for soils and sediments in the feasibility study to be protective of the most sensitive receptor in a given exposure area based on current and likely future use.

Chemical-specific ARARs (Montana DEQ-7 standards) were identified as preliminary remedial goals for groundwater, surface water, and sediment porewater (Exhibit 6).

Exhibit 7 provides the human and ecological preliminary remedial goals developed in the risk assessments and used in the feasibility study for soil and sediments. Apart from barium, preliminary remedial goals for groundwater and surface water are the same as those presented earlier in Exhibit 6, and therefore, they are not repeated in Exhibit 7. Barium is a contaminant of concern in surface water and sediment porewater and has no DEQ-7 aquatic life standard, so the preliminary remedial goal for barium in those media is based on site-specific ecological risk and is 220 micrograms per liter (µg/L) (chronic) and 2000 µg/L (acute).

Contaminants	Human Health PRG - Soils							
	Main Plant Area		North Percolation Pond Area		Central Landfills Area		Industrial Landfills Area	
	1E-06	1E-05	1E-06	1E-05	1E-06	1E-05	1E-06	1E-05
Metals								
Arsenic	NA	NA	20	200	4	40	4	40
PAHs								
Benzo(a)anthracene	28	280	140	1400	28	280	NA	NA
Benzo(a)pyrene	2.8	28	14	140	2.8	28	2.8	28
Benzo(b)fluoranthene	28	280	140	1400	28	280	NA	NA
Dibenzo(a,h)anthracene	2.8	28	14	140	2.8	28	2.8	28
Indeno(1,2,3-c,d)pyrene	28	280	140	1400	28	280	NA	NA

Contaminants	Human Health PRG - Sediments	
	North Percolation Pond Area	
	1E-06	1E-05
Metals		
Arsenic	20	200
PAHs		
Benzo(a)pyrene	14	140
Benzo(b)fluoranthene	140	1400
Dibenzo(a,h)anthracene	14	140
Indeno(1,2,3-c,d)pyrene	140	1400

Contaminants	Ecological PRGs – Soils		
	PRG	Basis	Applicable Exposure Areas
Metals			
Barium	1,000	Terrestrial plants	North and South Percolation Ponds
Copper	490	Terrestrial plants	Central Landfill and Grid Area
Nickel	140	Short-tailed shrew	North Percolation Pond, Central Landfills, and Industrial Landfill
Selenium	3.4	Terrestrial plants	North Percolation Pond and Grid Area
Thallium	.5	Terrestrial plants	North Percolation Pond
Vanadium	80	Terrestrial plants	North Percolation Pond and Industrial Landfill
Zinc	810	Terrestrial plants	Grid Area
PAHs			
LMW PAHs	175	Soil invertebrates	Main Plant, North Percolation Pond, Central Landfills, and Grid Area
HMW PAHs	69	American Woodcock	Main Plant, North Percolation Pond, Central Landfills, Industrial Landfills, and Grid Area
PCBs			
Aroclor 1254	1.2	Short-tailed shrew	Central Landfills

Contam-inants	Ecological PRGs – Sediments		
	PRG	Basis	Applicable Exposure Areas
Metals			
Barium	300	BTV	North and South Percolation Ponds and Flathead River
Cadmium	4.9	Benthic invertebrates	North Percolation Pond
Lead	120	Benthic invertebrates	North Percolation Pond
Nickel	48	Benthic invertebrates	North Percolation Pond
Selenium	1.38	BTV	North Percolation Pond
Vanadium	38	American Dipper	North Percolation Pond
Zinc	450	Benthic invertebrates	North Percolation Pond
PAHs			
LMW PAHs	196	American Dipper	North Percolation Pond
HMW PAHs	28.2	American Dipper	North Percolation Pond

PAHs = polyaromatic hydrocarbons (low and high molecular weight)
PCBs = polychlorinated biphenyls
BTV = background threshold value
All concentrations are in milligrams per kilograms.

10E-6 = 1,000,000
10E-5 = 100,000

Exhibit 7. Human Health and Ecological Preliminary Remedial Goals for Soils and Sediment

Evaluation and Elimination of Off-Site Disposal

Initial cleanup approaches at a Superfund site include consideration to excavate and haul wastes to an off-site disposal facility. However, this is often not the best approach to address the contamination and exposure to receptors at and near the site. Hazardous waste can only be disposed off-site at a licensed Resource Conservation and Recovery Act (RCRA) Subtitle C landfill. At the CFAC site, transporting excavated wastes to an off-site waste disposal facility would involve hauling an estimated 1.2 million cubic yards of waste.

Off-site waste disposal options were screened out in the feasibility study's initial technology screening phase where effectiveness, implementability, and cost are used to assess the technology's ability to meet remedial action objectives.

The feasibility study details numerous reasons for screening out off-site waste disposal options, which are summarized below.

- **Distance**. The nearest RCRA Subtitle C landfill is located out-of-state in Arlington, Oregon, ***nearly 500 miles away***.
- **Pre-treatment.** The spent pot liner-mixed waste from the West Landfill and the Wet Scrubber Sludge Pond would require pre-treatment before disposal in an off-site landfill. Pre-treatment needs would vary and likely would take time to perform and therefore extend the remediation timeframe. Pre-treatment of spent pot liner-mixed waste is extremely difficult and increases the total volume of waste that ultimately will need to be handled and disposed.
- **Volume**. The estimated 1.2 million cubic yards of waste from Landfills DU1 roughly result in 60,000 trucks/rail containers needed for off-site disposal.
- **Logistics**. Wastes would need to be dewatered and then packed in clean, leak-proof, vented containers and transported by truck or rail. Transportation would be in accordance with regulations of a licensed hazardous waste hauler with appropriate manifests, permits, training, equipment, insurance, and financial responsibility. The significant volume of waste for off-site disposal requires significant level of effort and time.
- **Carbon Footprint.** The carbon footprint and air emissions associated with 60 million total truck/rail miles would be significant.
- **Quality of Life Impacts**. Over 30 neighboring communities and communities enroute would have an estimated 70 trucks and/or trains per day passing through for four to five years with associated noise, dust, congestion, traffic issues, and delays from railroad crossings. Trucks and trains would pass through the City of Spokane and the Tri-Cities (Hanford, Pasco, and Kennewick) region of Washington.
- **Long-term, Intense Disruption**. Impacts would be longer and more intense than those for previous removal activities during demolition (70 trucks/rail cars per day over four to five years versus an average of 4 trucks per day over one year).
- **Health Risks to Workers.** Risks to workers loading and unloading trucks are significant. Spent pot liner can react with water to produce toxic and explosive gases. Cyanide gas is poisonous if inhaled, and cyanide-contaminated dust can be toxic if ingested.
- **Traffic Accidents**. Transportation risks exist. For transportation alone, 35 persons could potentially be injured, including one fatality, based on Federal Highway Administration statistics. The likelihood of injuries and contaminant releases is increased, as 130 miles of two-lane road (some along Flathead River and Flathead Lake) must be driven before reaching the interstate. Rail lines also follow lakes and rivers. A release of spent pot liner waste to water could be catastrophic.
- **High Costs**. Disposal fees and transportation costs are generally very high. The volume and nature of waste from Landfills DU1 makes offsite disposal extremely expensive and is as protective as the containment approach.

Based on the EPA-approved feasibility study, off-site disposal would negatively impact neighborhoods (local and remote) and the environment over a significant period while increasing the potential for traffic accidents, injuries, and inadvertent contaminant releases during transport. Off-site disposal was screened out as a remedial or cleanup alternative in the feasibility study because on-site disposal options can achieve similar effectiveness with lower levels of risk, disruption, and cost, as explained in the Summary of Remedial Alternatives.

Summary of Remedial Alternatives

Proven remedial technologies and process options are used in the feasibility study to develop remedial alternatives for cleanup at the six DUs. Many remedial technologies to address site groundwater contamination were reviewed (Section 4 of the 2021 feasibility study report). Screened groundwater technologies included in-situ treatment, ex-situ treatment, and containment (extraction wells, slurry walls, covers/caps, grout curtains, and sheet piling).

In-situ refers to technologies used in place (in source areas or in a migration pathway). Ex-situ technologies are used away from the original place, generally when paired with groundwater extraction and treatment (pump and treat).

Cost Presentation

- Capital costs are upfront construction costs.
- Operation and maintenance costs are cumulative and ongoing (like treatment or monitoring) over 30 years.
- Total cost is present value (PV), which is the cost in today's dollars (calculated for the feasibility study in 2020). The total is less than the other costs added together because it discounts the operation and maintenance costs.

Cost estimates are used only to compare alternatives and are expected to be accurate within a range of +50 to -30%.

Results of the in-situ technology screening analysis for groundwater are detailed in the feasibility study (pages 90 to 96) and are briefly summarized in the box at right, *Groundwater Treatment Technology Screening*.

Screening also eliminated certain soil technologies that were determined to be infeasible or impracticable, such as offsite disposal (described on the previous page).

Technologies that were not screened out were used to develop remedial alternatives for further evaluation. Those alternatives are presented in this summary of remedial alternatives, using data and analyses from the feasibility study report. EPA used this information and the NCP criteria to develop a Preferred Alternative for public comment. After considering public comments, EPA will select a remedy in a Record of Decision that will include specific details on how the selected remedy will be implemented. Evaluation of the treatment technology including bench and/or pilot scale treatability studies may be needed before design.

Groundwater Treatment Technology Screening

Four in-situ technologies were screened: monitored natural attenuation (MNA), permeable reactive barriers (PRBs), chemical oxidation, and enhanced bioremediation.

- **Two technologies were screened out**. Chemical oxidation is complex and cost-prohibitive for large areas that must achieve low-concentration goals. It is not effective for fluoride. Enhanced bioremediation is not effective for fluoride and for the complexed cyanide found at the CFAC site.
- **Two treatment technologies moved forward and were incorporated into remedial options**. PRBs are limited to the River Area (where cyanide is the only COC) as they cannot treat the combination of fluoride and cyanide found elsewhere. MNA was renamed performance monitoring.

Seven ex-situ technologies were screened.

- Alkaline hydrolysis was screened out as it is not effective for fluoride and requires high pressure and temperature.
- **Six treatment technologies moved forward and were retained for potential use.** They are adsorption, coagulation/flocculation/ precipitation, ion exchange, reverse osmosis, photolysis (ferrocyanide only), and constructed wetlands.
- **In joint DU1/DU6, Alternatives 5A and 5B use traditional ex-situ treatment** with a combination of one or more of the retained technologies (to be finalized in design). Flow rates for Alternatives 5A and 5B are too high for constructed wetlands. However, wetlands were included for use where occasional pumping was needed to maintain an inward gradient within a slurry wall (Alternatives 4A, 4B, and 4C).

Landfills DU1/Groundwater DU6

Because DU1, with an estimated 1.2 million cubic yards of contaminated waste, is the primary source of groundwater contamination in DU6, these two DUs and their proposed remedies strongly influence each other. Accordingly, DU1 and DU6 are addressed jointly and have the most remedial alternatives (12 collectively). Exhibit 8 presents the components of each alternative in a format that allows comparison of common elements and differences. Most alternatives share one or more common elements.

Remedy Component	Alternative											
	1	2	3			4			5			6
			A	B	C	A	B	C	A	B	C	
No further action	●											
Containment by capping		●	●	●	●	●	●	●	●	●	●	●
Monitored natural attenuation		●	●	●	●	●	●	●	●	●	●	●
Institutional and engineering controls		●	●	●	●	●	●	●	●	●	●	●
Upgradient slurry wall			●	●	●							
Downgradient PRB				●			●					
Downgradient extraction					●			●		●	●	
Fully encompassing slurry wall						●	●	●				
Hydraulic control at source area									●		●	
Excavation with on-site consolidation												●

Exhibit 8. DU1/DU6 Alternatives Comparison

All remedial alternatives (excluding Alternatives 1 and 6) would use institutional controls and engineering controls to prevent exposure to human and ecological receptors. Examples of institutional controls and engineering controls are provided below. For all alternatives except Alternative 1, institutional controls would be used to prevent or minimize human exposure to impacted groundwater until preliminary remedial goals are achieved.

Treatment of extracted groundwater is included in several alternatives and would use one or more technologies (such as adsorption, coagulation/ flocculation/ precipitation, constructed wetlands, photolysis, electrocoagulation, ion exchange, and/ or reverse osmosis). Treatment decisions would be made in the design phase, as approved by EPA.

Alternative 1: No Action

- No action.

Est. Capital Costs: $0
Est. Operation and Maintenance Costs: $1,859,250 (30 yr) and $769,050 (PV)
Est. Total Alternative Cost (PV): $769,050

The Superfund law requires EPA to retain a no further action alternative as a baseline for comparison to other alternatives. Costs are for inspection and maintenance of existing caps on the West Landfill, the Wet Scrubber Sludge Pond, and the Center Landfill and maintenance of existing fencing.

Alternative 2: Containment via Capping and Groundwater Performance Monitoring

- Low-permeability caps.
- Groundwater performance monitoring.
- Institutional and engineering controls.

Est. Capital Costs: $11,478,683
Est. Operation and Maintenance Costs: $6,537,000 (30 yr) and $2,703,930 (PV)
Est. Total Alternative Cost (PV): $14,182,613

In-Place Capping

A low-permeability membrane cap or geosynthetic clay liner would be installed at the Wet Scrubber Sludge Pond and the Center Landfill to prevent the infiltration of water (Exhibit 9). All caps, including the existing cap at the West Landfill, would be inspected and maintained.

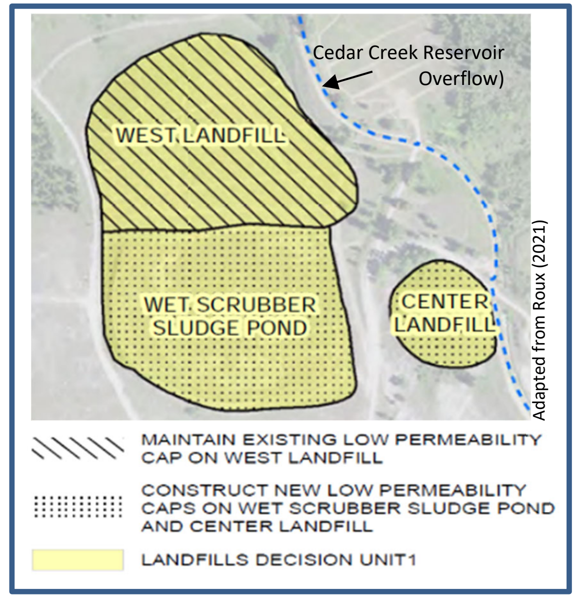

Exhibit 9. DU1/DU6 Alternative 2

Groundwater Performance Monitoring

Groundwater performance monitoring will be conducted to evaluate how well attenuation processes such as dilution and adsorption reduce contaminant concentrations after source control measures have been constructed. Monitoring at or around each waste management unit will be conducted for contaminants of concern and other parameters and would assess remedy performance. Monitoring would occur in June and October for the first five years to document high- and low-water conditions, with a potential for annual monitoring thereafter. Monitoring would continue until the remedial action objectives are achieved or for a minimum of 30 years.

<u>Institutional Controls and Engineering Controls</u>

Landfill institutional controls would include property restrictions for the Landfills DU1 waste management units to prevent activities that could compromise the function or integrity of the caps/containment systems or result in potential exposure to receptors. Engineering controls would include fencing and signage around waste management perimeters to restrict access to human receptors and some ecological receptors.

Groundwater institutional controls would include property restrictions to prohibit water use and might include designation of a Controlled Groundwater Area to prevent potable use of the contaminated groundwater.

<u>Five-Year Reviews</u>

Reviews would be conducted every five years to ensure continued performance of the remedy, consistent with Superfund requirements.

Alternative 3A: Containment via Capping and Upgradient Slurry Wall

- Low-permeability caps.
- Upgradient slurry wall.
- Groundwater performance monitoring and institutional and engineering controls (as for Alternative 2).

Est. Capital Costs: $25,012,360
Est. Operation and Maintenance Costs: $6,537,000 (30 yr) and $2,703,930 (PV)
Est. Total Alternative Cost (PV): $27,716,290

This alternative is identical to Alternative 2, except for the addition of a slurry wall immediately upgradient of the West Landfill and Wet Scrubber Sludge Pond (Exhibit 10) to divert uncontaminated groundwater and surface water runoff around the source area, thereby preventing contamination of additional material.

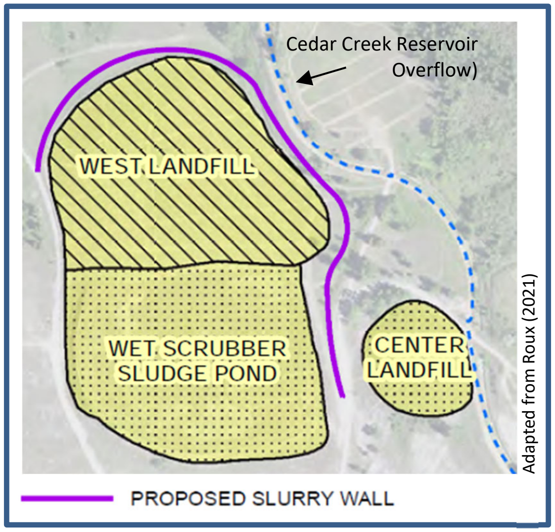

Exhibit 10. DU1/DU6 Alternative 3A

These waste management units are the primary sources of contaminants to groundwater. The Center Landfill would not be included in the footprint of the slurry wall because wells associated with the landfill meet preliminary remedial goals. The slurry wall would be placed at depths of 100 to 125 feet in a location upgradient of the waste management units.

Alternative 3B: Containment via Capping and Upgradient Slurry Wall with Downgradient Permeable Reactive Barrier

- Low-permeability caps.
- Upgradient slurry wall.
- Downgradient permeable reactive barrier.
- Groundwater performance monitoring and institutional and engineering controls (as for Alternative 2).

Est. Capital Costs: $75,093,899
Est. Operation and Maintenance Costs: $6,837,000 (30 yr) and $2,828,020 (PV)
Est. Total Alternative Cost (PV): $77,921,920

This alternative is identical to Alternative 3A, except for the addition of a permeable reactive barrier (Exhibit 11) north of the Burlington Northern Santa Fe rail tracks to treat cyanide in groundwater before it can discharge to River Area seeps and porewater. The permeable reactive barrier would be about 3,785 feet long, 24 to 36 inches wide, and would span the downgradient extent of the cyanide plume where concentrations exceed the preliminary remedial goal of 200 µg/L. It would be 60 to 130 feet below land surface and have a design life of 30 years.

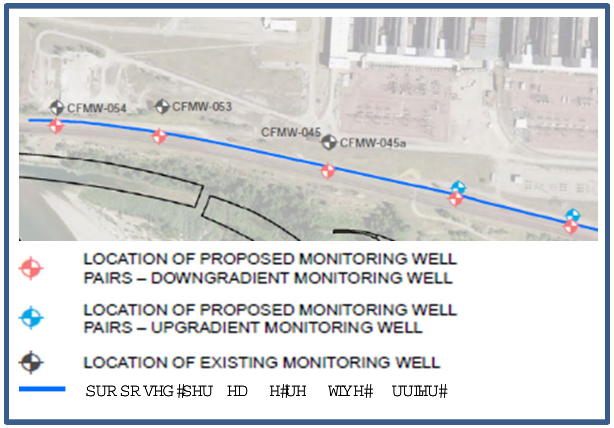

Exhibit 11. Downgradient Component of DU1/DU6 Alternatives 3B, 4B, and 5B

Alternative 3C: Containment via Capping, Upgradient Slurry Wall, and Downgradient Extraction

- Low-permeability caps.
- Upgradient slurry wall.
- Downgradient groundwater extraction and treatment of cyanide.
- Groundwater performance monitoring and institutional and engineering controls (as for Alternative 2).

Est. Capital Costs: $36,981,109
Est. Operation and Maintenance Costs: $61,110,600 (30 yr) and $25,277,465 (PV)
Est. Alternative Cost (PV): $62,258,574

This alternative is identical to Alternative 3A, except for the addition of extraction wells (Exhibit 12) north of the Burlington Northern Santa Fe rail tracks to treat cyanide in groundwater before it can discharge to River Area seeps and porewater. Groundwater would be pumped to an aboveground treatment system where it would be treated by physical and chemical processes. Treated groundwater would be recharged back to the hydrogeologic system using infiltration basins in accordance with federal and state standards.

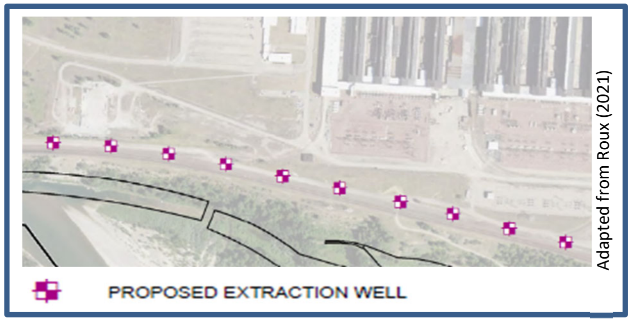

Exhibit 12. Downgradient Component of DU1/DU6 Alternatives 3C, 4C, and 5C

Alternative 4A: Containment via Capping and Fully Encompassing Slurry Wall

- Low-permeability caps.
- Fully encompassing slurry wall.
- Groundwater performance monitoring and institutional and engineering controls (as for Alternative 2).

Est. Total Capital Costs: $38,999,937
Est. Operation and Maintenance Costs: $16,059,000 (30 yr) and $6,642,560 (PV)
Est. Total Alternative Cost (PV): $45,642,497

This alternative is identical to Alternative 2 with the addition of a slurry wall (Exhibit 13). The slurry wall *fully encompasses* the West Landfill and Wet Scrubber Sludge Pond, creating a containment cell and containing contaminated groundwater at the source area.

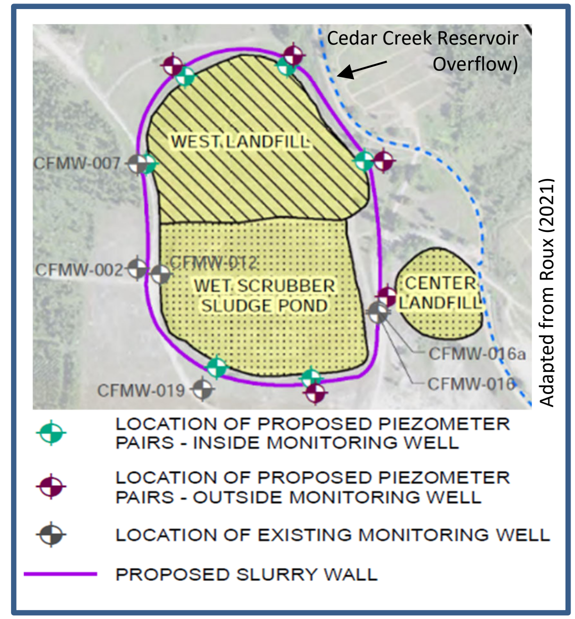

Exhibit 13. DU1/DU6 Alternative 4A

Groundwater levels would be monitored to assess direction of groundwater flow across the barrier. An inward flow would show that contaminated groundwater has no potential to migrate out of the cell. Lacking that, the potential for groundwater movement and contaminant migration would be closely monitored and evaluated to ensure that contamination does not migrate out of the cell. If necessary, wells inside the slurry wall could provide groundwater extraction. Pumping required to maintain an inward gradient, if any, is expected to be periodic and minimal given that the cell would be designed and constructed in a manner to prevent entry of water. Extracted groundwater would be treated and discharged.

Alternative 4B: Containment via Capping, Fully Encompassing Slurry Wall, and Downgradient Permeable Reactive Barrier

- Low-permeability caps.
- Fully encompassing slurry wall.
- Downgradient permeable reactive barrier.
- Groundwater performance monitoring and institutional and engineering controls (as for Alternative 2).

Est. Capital Costs: $89,081,476
Est. Operation and Maintenance Costs: $16,059,000 (30 yr) and $6,642,560 (PV)
Est. Total Alternative Cost (PV): $95,724,036

This alternative is identical to Alternative 4A, except for the addition of a permeable reactive barrier north of Burlington Northern Santa Fe rail tracks to treat cyanide in groundwater prior to discharge at the Seep, as described and shown in Alternative 3B (Exhibit 11).

Alternative 4C: Containment via Capping, Fully Encompassing Slurry Wall, and Downgradient Extraction

- Low-permeability caps.
- Fully encompassing slurry wall.
- Downgradient groundwater extraction and treatment of cyanide.
- Groundwater performance monitoring and institutional and engineering controls (see Alternative 2).

Est. Capital Costs: $49,025,609
Est. Operation and Maintenance Costs: $61,110,600 (30 yr) and $25,277,465 (PV)
Est. Total Alternative Cost (PV): $74,303,074

This alternative is identical Alternative 4A, except for the addition of extraction wells north of the Burlington Northern Santa Fe rail tracks to treat cyanide in groundwater prior to discharge at the Seep. Extracted groundwater would be treated and discharged as described and shown for Alternative 3C (Exhibit 12).

Alternative 5A: Containment via Capping and Hydraulic Control at the Source Area

- Low-permeability caps.
- Hydraulic control at the source area. through extraction of groundwater.
- Groundwater extraction and treatment of cyanide.
- Groundwater performance monitoring and institutional and engineering controls (as for Alternative 2).

Est. Capital Costs: $38,582,066
Est. Operation and Maintenance Costs: $69,351,000 (30 yr) and $28,685,981 (PV)
Est. Total Alternative Cost (PV): $67,268,047

This alternative has no slurry walls and is the same as Alternative 2 with the addition of hydraulic control at the source area (Exhibit 14) to capture contaminated groundwater prior to migration. Extraction wells would be installed immediately downgradient of DU1. Lessening the migration of contaminants from the source area would reduce the rate of contaminant loading to the hydrogeologic system.

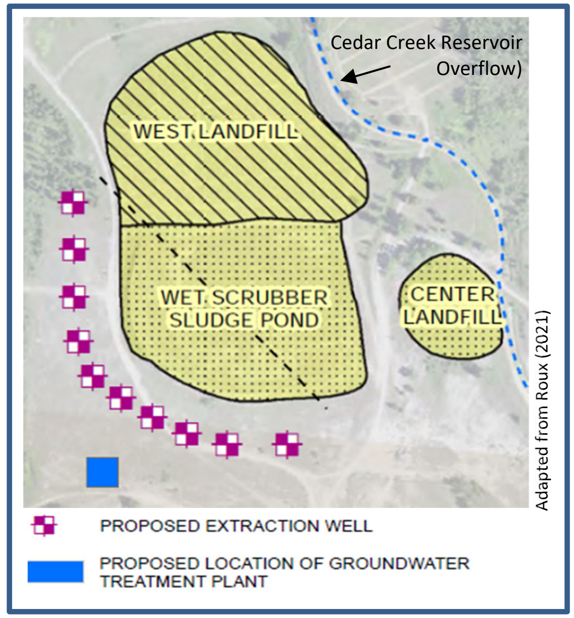

Exhibit 14. DU1/DU6 Alternative 5A

Groundwater performance monitoring and other monitoring would document contaminant concentrations in groundwater, surface water, and porewater. Extracted groundwater would be treated and disposed (similar to Alternative 3C).

Additional investigation of aquifer characteristics, vertical extent of cyanide and fluoride, pump tests, and numerical modeling would be needed to finalize the number, locations, configurations, and pumping rates of the extraction wells.

Alternative 5B: Containment via Capping and Downgradient Hydraulic Control

- Low-permeability caps.

- Downgradient hydraulic control and treatment of cyanide in extracted groundwater.
- Groundwater performance monitoring and institutional and engineering controls (as for Alternative 2).

Est. Capital Costs: $23,447,432
Est. Operation and Maintenance Costs: $61,110,600 (30 yr) and $25,277,465 (PV)
Est. Total Alternative Cost (PV): $48,724,897

This is identical to Alternative 5A, except that the extraction wells are located farther downgradient (north of the Burlington Northern Santa Fe rail tracks) as described for Alternative 3C (Exhibit 12). There are no wells near DU1.

Alternative 5C: Containment via Capping and Hydraulic Control at the Source Area and Downgradient

- Low-permeability caps.
- Hydraulic control at source area *and* downgradient.
- Treatment of extracted groundwater.
- Groundwater performance monitoring and institutional and engineering controls (as for Alternative-2).

Est. Capital Costs: $47,986,164
Est. Operation and Maintenance Costs: $122,082,000 (30 yr) and $50,497,352 (PV)
Est. Total Alternative Cost (PV): $98,483,516

This alternative combines alternatives 5A and 5B, with extraction wells in two locations: immediately downgradient of DU1 (Exhibit 14) and farther downgradient (north of the Burlington Northern Santa Fe rail tracks) (Exhibit 12).

Alternative 6: Excavation with On-Site Consolidation

- Excavate contaminated waste and soil and consolidate on-site.
- Low permeability cap on center landfill.
- Groundwater performance monitoring and institutional and engineering controls (as for Alternative 2).

Est. Capital Costs: $157,765,708
Est. Operation and Maintenance Costs: $18,918,000 (30 yr) and $7,825,141 (PV)
Est. Total Alternative Cost (PV): $165,590,849

This is the only alternative for DU1/DU6 to include excavation of contaminated waste and soil (Exhibit 15)**.** Source material from DU1, including wastes and underlying soils contributing to groundwater contamination, would be excavated and consolidated in a newly constructed on-site repository meeting substantive RCRA Subtitle C requirements for modern hazardous waste impoundments.

Excavated areas would be backfilled and compacted to restore the grade and topography. Fill material could be sourced on-site, imported, or a combination of the two. The areas would be revegetated. Disposal volumes are estimated at 820,000 cubic yards for the West Landfill and 575,000 cubic yards for the Wet Scrubber Sludge Pond.

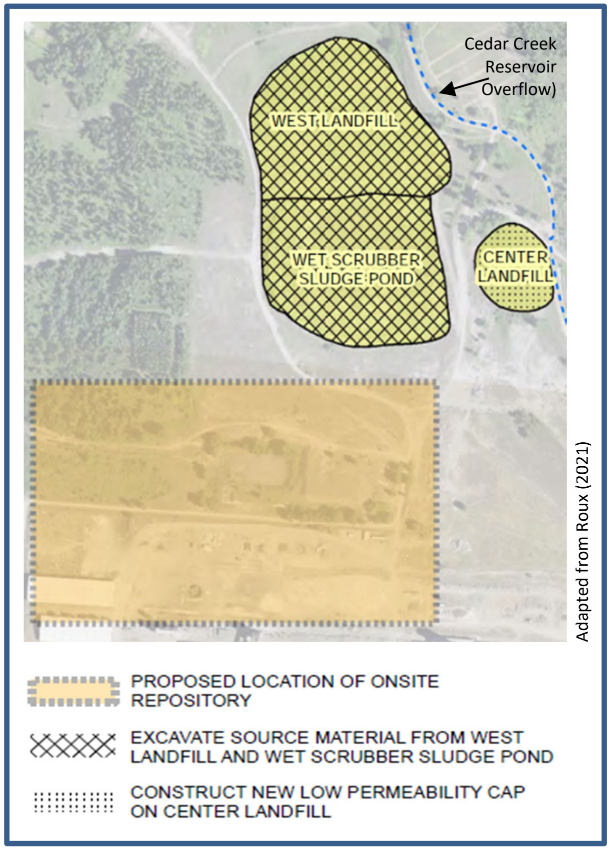

Exhibit 15. DU1/DU6 Alternative 6

If excavation does not include the Center Landfill, a low-permeability membrane cap or geosynthetic clay liner cap would be installed there. Groundwater Performance Monitoring and five-year reviews would be as for Alternative 5A. Institutional and engineering controls would be used for the Center Landfill and the newly constructed repository.

Landfills DU2

The two alternatives evaluated for DU2 are shown in Exhibit 16.

Remedy Component	Alternative 1	Alternative 2
No further action	●	
Containment by capping		●
Institutional and engineering controls		●

Exhibit 16. DU2 Alternative Comparison

Alternative 1: No Action

- No action.

Est. Capital Costs: $0
Est. Operation and Maintenance Costs: $1,928,550 (30 yr) and $797,715 (PV)
Est. Total Alternative Cost (PV): $797,715

No further action would be taken. Costs are for maintenance of the existing caps on the East Landfill and Sanitary Landfill, maintenance of the existing soil covers on the Asbestos Landfills, and maintenance of existing fences to limit access.

Alternative 2: Containment via Capping

- Maintain existing caps on East Landfill and Sanitary Landfill.
- Cap the Industrial Landfill.
- Improve existing soil covers at the Asbestos Landfills.
- Institutional and engineering controls.

Est. Capital Costs: $6,169,608
Est. Operation and Maintenance Costs: $1,928,550 (30 yr) and $797,715 (PV)
Est. Total Alternative Cost (PV): $6,967,323

A low-permeability membrane cap or geosynthetic clay liner cap would be installed at the Industrial Landfill after grading and on-site consolidation of excavated materials from other DUs (Exhibit 17). Existing soil cover at the Asbestos Landfills would be improved and the existing cap at Sanitary Landfill would be maintained.

Institutional controls would include deed restrictions for the waste management units to prevent activities that could compromise the function or integrity of the caps/containment systems or result in potential exposure to receptors. Agricultural or residential use would be prohibited on waste management units. Engineering controls such as fencing and signage around the perimeter of the would restrict access to human receptors and some ecological receptors. Reviews would be conducted once every five years to ensure continued performance of the remedy.

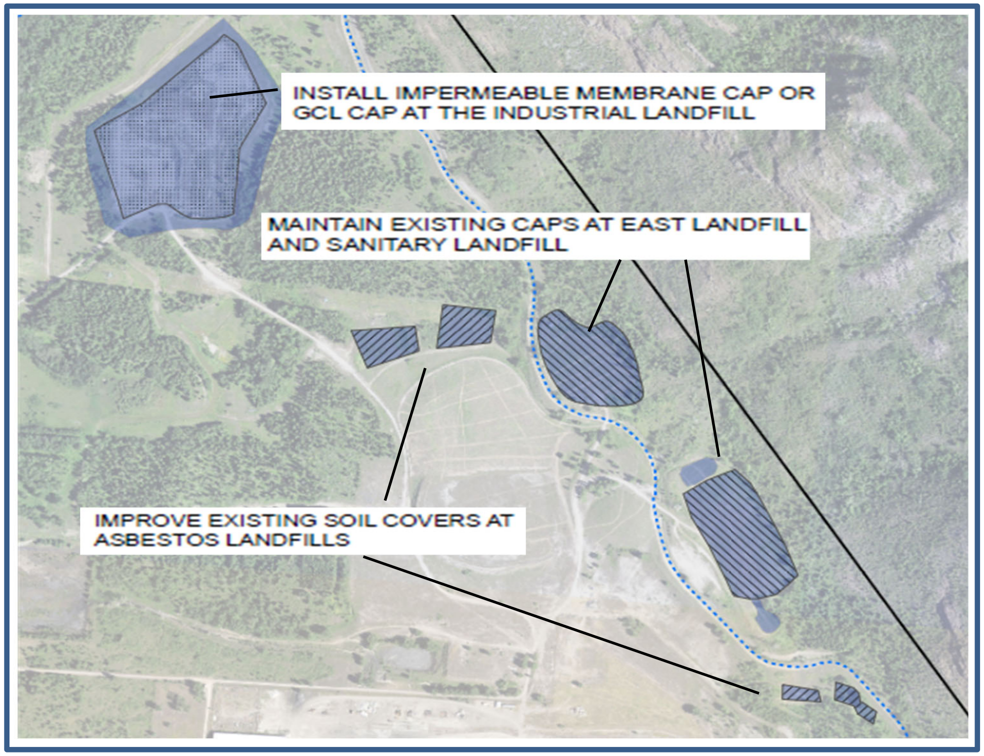

Exhibit 17. DU2 Alternative 2

Soils DU3

The four alternatives evaluated for DU3 are shown in Exhibit 18. Differences between the alternatives are essentially what to cover, excavate, or phytoremediate. There are seven areas of concern with impacted surficial and shallow soils within DU3. The estimated area and volume of impacted soil in Areas of Concern A through G are 7.6 acres and 25,670 cubic yards, respectively. The exact extents of the areas of concern will be delineated during remedial design.

Remedy Component	Alternative			
	1	2	3	4
No action	●			
Covers with hot spot excavation		●	●	
In situ phytoremediation			●	
Excavation with on-site consolidation				●
Institutional and engineering controls		●	●	

Exhibit 18. Soils DU Alternative Comparison

Alternative 1: No Action

- No action.

Est. Capital Costs: $0
Est. Operation and Maintenance Costs: $0
Est. Total Alternative Cost (PV): $0

Alternative 2: Covers with Hot Spot Excavation

- Covers with hot spot excavation.
- Institutional and engineering controls.

Est. Capital Costs: $1,267,440
Est. Operation and Maintenance Costs: $819,240 (30 yr) and $338,866 (PV)
Est. Total Alternative Cost (PV): $1,606,306

A soil cover would be installed for select areas (Areas of Concern C through E) to prevent contact with impacted soil (Exhibit 19). Institutional controls in cover areas would ensure that covers are maintained, or acceptable alternative covers (such as buildings or pavement) are constructed as part of any future development. Discontinuous and isolated soil hot spots outside of cover footprints would be excavated as needed. Excavated materials could be consolidated underneath the covers, if appropriate, or disposed at the Industrial Landfill or Wet Scrubber Sludge Pond.

Impacted material in the Former Drum Storage Area (B) (roughly 2,800 cubic yards) would be excavated and disposed of at the Wet Scrubber Sludge Pond below its low-permeability cap.

Impacted material in Areas of Concern A, F, and G (approximately 2,800 cubic yards) would be excavated and disposed of at the Industrial Landfill or Wet Scrubber Sludge Pond or consolidated within Areas of Concern C through E underneath a soil cover.

Engineering controls encompassing the footprints of the soil covers would prevent intrusive activities and damage to the covers. Institutional controls may include deed restrictions to ensure future development is consistent with and does not compromise the effectiveness of the remedy. Construction of acceptable alternative covers (such as buildings or pavement) as part of future development would be consistent with this alternative.

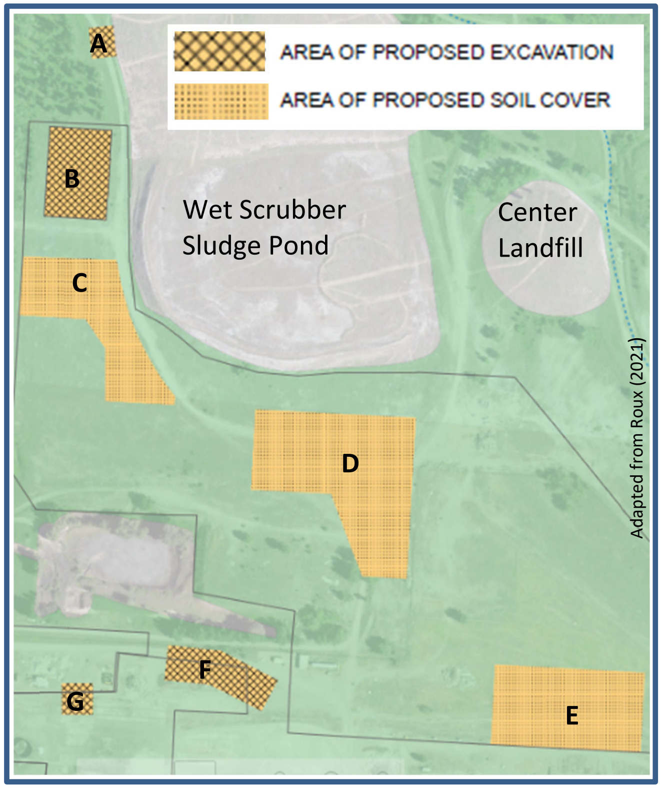

Exhibit 19. DU3 Alternative 2

Alternative 3: In-Place Phytoremediation with Hot Spot Excavation

- Covers with hot spot excavation.
- Phytoremediation in place.
- Institutional and engineering controls.

Est. Capital Costs: $775,851
Est. Operation and Maintenance Costs: $563,953 (30 yr) and $396,097 (PV)
Est. Total Alternative Cost (PV): $1,171,948

PAH-impacted material in Areas of Concern C through E would be treated in place by phytoremediation (Exhibit 20). Discontinuous or isolated soil hotspots outside of the treatment footprints would be excavated, as needed. Excavated materials would be consolidated within treatment areas, if appropriate, or disposed at the Industrial Landfill or Wet Scrubber Sludge Pond. Institutional and engineering controls would be used to protect phytoremediation areas until treatment is complete.

Alternative 4: Excavation with On-Site Consolidation

- Excavate contaminated soils.
- Consolidate soils on-site.

Est. Capital Costs: $1,237,989
Est. Operation and Maintenance Costs: $0
Est. Total Alternative Cost (PV): $1,237,989

All impacted material exceeding small range receptor preliminary remedial goals and/or resulting in exceedances of preliminary remedial goals would be excavated (roughly 25,000 cubic yards) and disposed of at the Industrial Landfill or Wet Scrubber Sludge Pond (Exhibit 20). Excavated soils from the Former Drum Storage Area would be disposed of at the Wet Scrubber Sludge Pond.

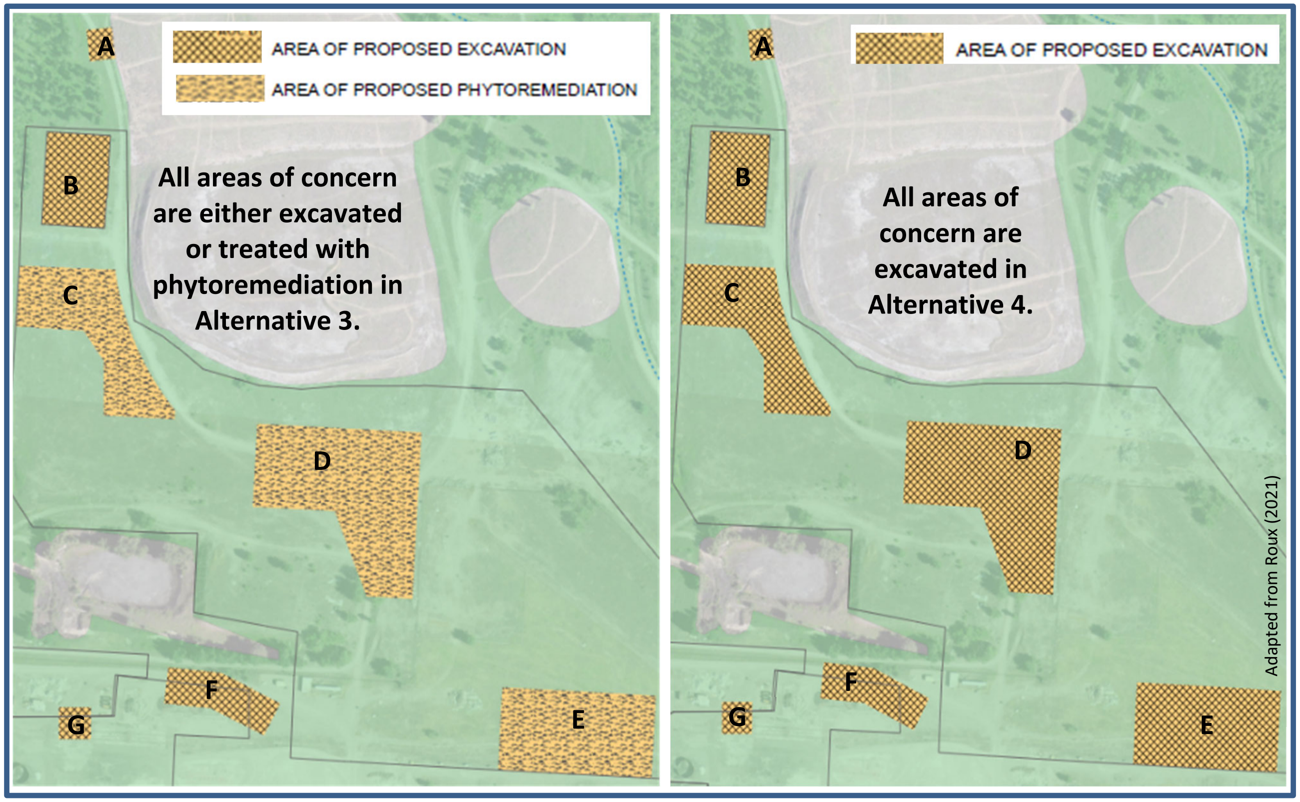

Exhibit 20. DU3 Alternatives 3 and 4

North Percolation Ponds DU4

The four alternatives evaluated for this DU are shown in Exhibit 21. The primary differences are the amount of excavation.

Remedy Component	Alternative 1	Alternative 2	Alternative 3	Alternative 4
No action	●			
Limited excavation with covers		●		
Excavation with cover			●	
Excavation with on-site consolidation				●
Institutional and engineering controls		●	●	

Exhibit 21. DU4 Alternative Comparison

Alternative 1: No Action

- No action.

Est. Capital Costs: $0
Est. Operation and Maintenance Costs: $0
Est. Alternative Cost (PV): $0

Alternative 2: Limited Excavation with Covers

- Limited excavation with covers.
- Institutional and engineering controls.

Est. Capital Costs: $2,493,668
Est. Operation and Maintenance Costs: $1,536,000 (30 yr) and $635,343 (PV)
Est. Total Alternative Cost (PV): $3,129,010

Stormwater pipes leading to the North Percolation Pond system would be decommissioned and contaminated material in the ditches flowing to and from the ponds would be excavated and consolidated in the North-East Percolation Pond (Exhibit 22). Soil covers would be installed at both percolation ponds to prevent contact with impacted material. Physical solidification of sludge and sediment may be needed to support the soil covers.

Deed restrictions would restrict development and fencing would prevent exposure to human receptors and some ecological receptors. A commercial use designation would reflect assumptions in the risk assessments.

Alternative 3: Excavation with Cover

- Excavation with cover.
- Institutional controls and engineering controls.

Est. Capital Costs: $1,972,829
Est. Operation and Maintenance Costs: $902,400 (30 yr) and $373,264 (PV)
Est. Total Alternative Cost (PV): $2,346,093

This alternative is identical to Alternative 2 except that **impacted material in the North-West Percolation Pond would be excavated** (Exhibit 21). Material would be consolidated in the North-East Percolation Pond which would receive a soil cover.

Alternative 4: Excavation with On-Site Consolidation

- Excavation.
- On-site consolidation.

Est. Capital Costs: $2,286,195
Est. Operation and Maintenance Costs: $0
Est. Total Alternative Cost (PV): $2,286,195

Alternative 3 is identical to Alternative 2 except that ***all*** **impacted material that exceeds preliminary remedial goals (about 35,180 cubic yards) would be excavated** (Exhibit 21) and consolidated at the Wet Scrubber Sludge Pond (in DU1) prior to capping. This includes the ditches and both percolation ponds. To eliminate the influx of contaminants of concern, stormwater influent pipes from to the North Percolation Pond system would be decommissioned.

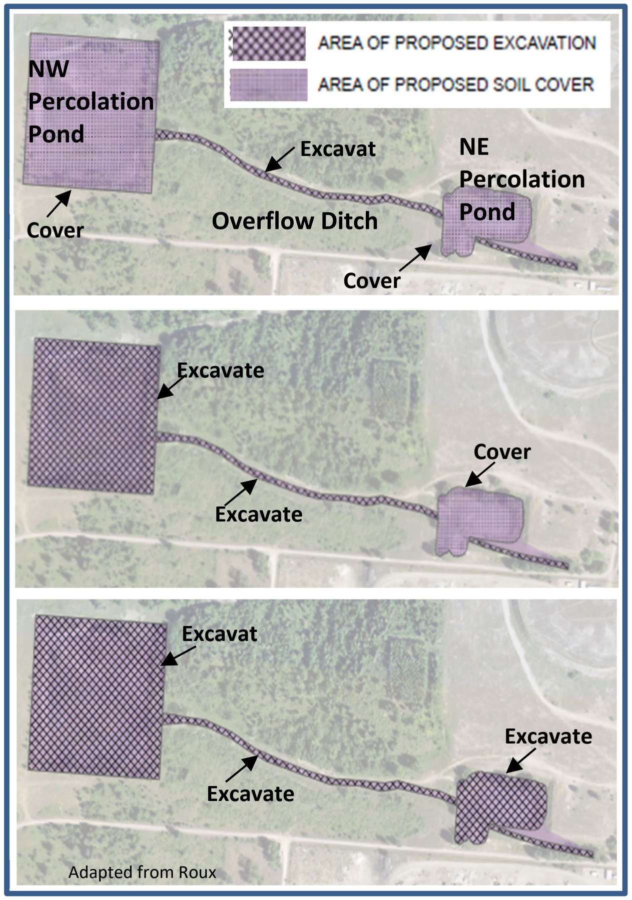

Exhibit 22. DU4 Alternatives 2, 3, and 4 (from top to bottom)

River Area DU5

The Superfund removal action at the South Percolation Ponds that is referenced in the feasibility study report (Roux 2021) was completed in 2021 and cost approximately $1,660,000. The pipe that transported stormwater into the South Percolation Pond system was decommissioned, and impacted sediment in the South Percolation Ponds was excavated and disposed at an existing on-site repository.

Long-term monitoring would be conducted for River Area DU5 to document the reduction of total cyanide concentrations in surface water and free cyanide concentrations in porewater (Exhibit 23). The decrease in cyanide concentrations will depend on the effectiveness of groundwater remediation (DU1/DU6 alternatives previously described). Initial monitoring would also include surface water metal contaminants of concern that exceed preliminary remedial goals (aluminum, barium, copper, and iron) to demonstrate that the South Percolation Pond removal action eliminated the source of aluminum and other metals to surface water in River Area DU5.

Other metals (arsenic, lead, mercury, and thallium), fluoride, and PAHs, which have exceeded the Montana DEQ-7 surface water standards for human health in at least one sample, would be monitored until agency approval to stop is granted.

Long-term monitoring would be performed in June and October for the first five years to document high- and low-water conditions. The frequency of monitoring may then be reduced to an annual basis. Monitoring would continue until the remedial action objectives are achieved or for a minimum of 30 years. Details would be identified in remedial design.

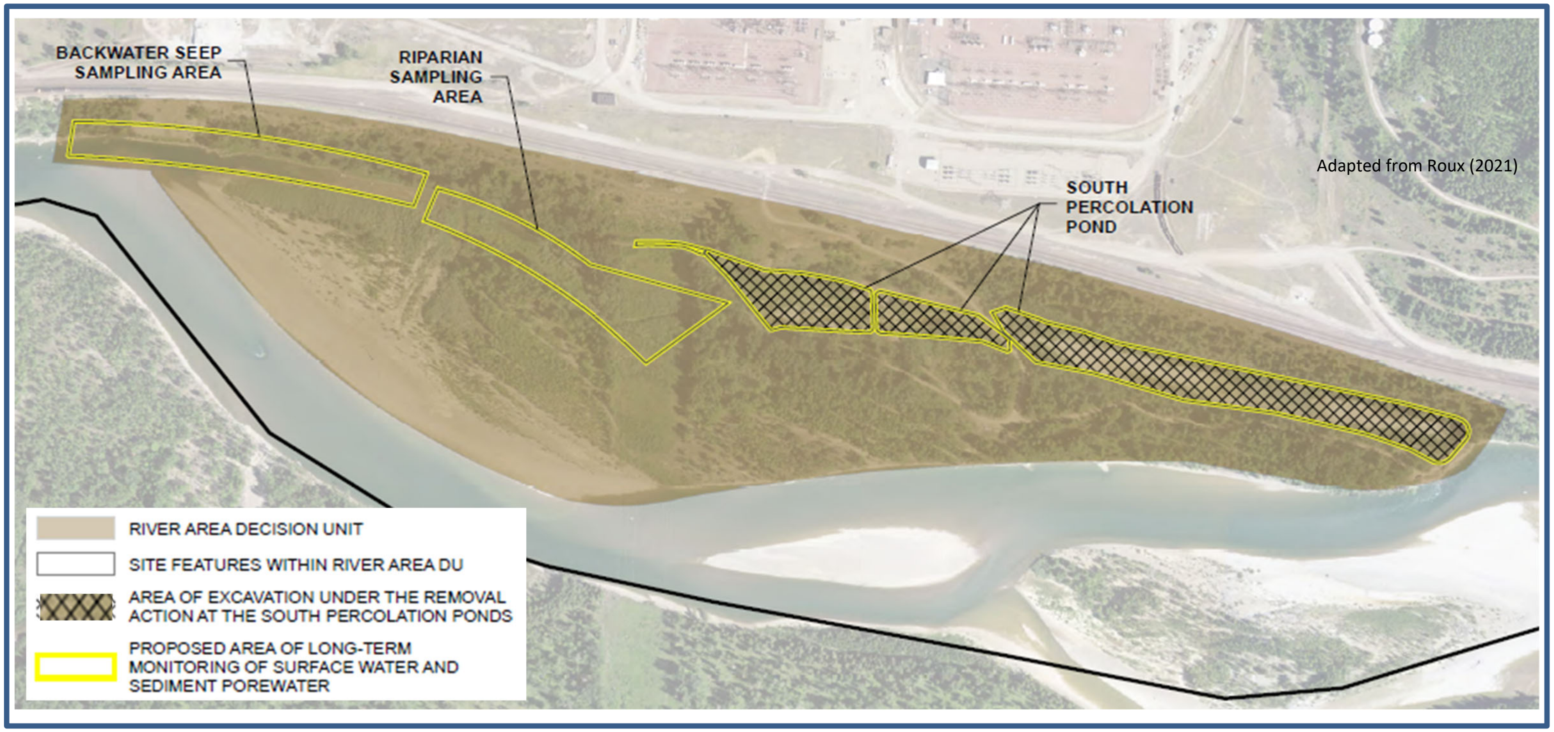

Exhibit 23. Depiction of River Area DU5

Evaluation of Alternatives

The Superfund law provides nine criteria by which to compare remedial alternatives in the feasibility study. The criteria fall into three groups:

- Threshold Criteria
- Primary Balancing Criteria
- Modifying Criteria

Each remedial alternative (except No Action) *must* meet the Threshold Criteria. The Primary Balancing Criteria are used to weigh major trade-offs among alternatives. The Modifying Criteria are state and public acceptance and can be fully evaluated only after public comment is received on this Proposed Plan. As a result, the remedial alternatives were evaluated with respect to seven of the nine evaluation criteria (Exhibit 24). The Modifying Criteria will be evaluated after the public comment period for the Proposed Plan closes. However, the state generally concurs with EPA's Preferred Alternative in this plan, subject to public comment.

The results of the detailed evaluation of the Threshold and Primary Balancing criteria in the feasibility study report (Roux 2021) are summarized below and shown in Exhibits 25 and 26.

Landfills DU1/Groundwater DU6

To identify the most viable candidates for comparative analysis, the feasibility study rescreened the 12 remedial alternatives based on consideration of effectiveness, implementability, and relative cost. Alternatives 2, 3B, 4B, 5A, and 5C were removed from further consideration and scoring.

The rationale for the removal of these alternatives is as follows:

- Alternative 2 does not address soils under the West Landfill that likely contribute to groundwater contamination, nor does it include groundwater treatment to mitigate impacts to ecological receptors in River Area DU5. As such, it may not satisfy the threshold criteria.
- Alternatives 3B and 4B include a downgradient permeable reactive barrier and there are concerns with the effectiveness and implementability of that technology at the depth and scale that would be needed.
- Alternatives 5A and 5C include hydraulic control at the source area and/or downgradient at the BNSF tracks and there are effectiveness and implementability concerns relating to the treatment of cyanide, fluoride, and arsenic in groundwater. Given the very high and seasonally variable flow rates, the treatment system would be very large, complex, and difficult to operate effectively.

	Criteria	Description
Threshold	**Overall protection of human health and the environment**	Does an alternative eliminate, reduce, or control threats to public health and the environment through controls or treatment?
	Compliance with ARARs	Does an alternative meet federal, state, and tribal environmental statutes, regulations, and other requirements, or is a waiver is justified?
Primary Balancing	**Long-term effectiveness and permanence**	Can an alternative maintain protection of human health and the environment over time?
	Reduction through treatment	Is treatment used to reduce harmful effects, a contaminant's ability to migrate and the amount of contamination remaining after remedy implementation?
	Short-term effectiveness	How much time is needed to implement an alternative and what risks are posed to workers, residents, and the environment during that time?
	Implement-ability	Is the alternative technically and administratively feasible, (are materials and services readily available)?
	Cost	What are estimated costs?
Modifying	**State acceptance**	Does the state agree with EPA's analyses and recommendations?
	Community acceptance	Does the community agree with EPA's analyses and Preferred Alternative? *Comments received are an important indicator of community acceptance.*

Exhibit 24. Evaluation Criteria

Alternative	Protection of Human Health and the Environment	Compliance with ARARs	Long term Effectiveness and Permanence	Treatment	Short term Effectiveness	Implementability	Cost	Score
	Threshold Criteria		Balancing Criteria					
			Overall Effectiveness			Implementability		
Landfills DU1/Groundwater DU6								
1 No action	No	No	0	0	0	20	20	NA
3A Containment (capping and upgradient slurry wall)	Yes	Yes	15	9	10	16	16	66
3C Containment (capping, upgradient slurry wall, and extraction)	Yes	Yes	15	12	16	10	12	65
4A Containment (capping and fully encompassing slurry wall)	Yes	Yes	18	14	16	15	14	77
4C Containment (capping, fully encompassing slurry wall, and extraction)	Yes	Yes	18	16	20	10	10	74
5B Containment (capping and hydraulic control)	Yes	Yes	10	10	12	14	14	60
6 Excavation w/on-site consolidation	Yes	Yes	20	12	5	5	0	42
Landfills DU2								
1 No action	No	No	Not ranked in the feasibility study					NA
2 Containment (capping)	Yes	Yes	Not ranked in the feasibility study					NA
Soils DU3								
1 No action	No	Yes	0	0	0	20	20	NA
2 Covers with hot spot excavation	Yes	Yes	10	12	20	12	10	64
3 In-Place phytoremediation with hot spot excavation	Yes	Yes	20	20	5	8	13	66
4 Excavation w/on-site consolidation	Yes	Yes	20	15	15	15	12	77
North Percolation Ponds DU4								
1 No action	No	No	0	0	0	20	20	NA
2 Limited excavation w/covers	Yes	Yes	10	10	20	10	10	60
3 Excavation with cover	Yes	Yes	15	15	18	12	13	73
4 Excavation w/on-site consolidation	Yes	Yes	20	20	15	15	13	83
River Area DU5								
1 No action	No	No	Not ranked in the feasibility study					NA
2 Performance monitoring of surface water and sediment porewater	Yes	Yes	Not ranked in the feasibility study					NA

No Action alternatives fail the Threshold Criteria and are not ranked and Landfills DU2 and River Area DUs are not ranked as there is only one alternative beyond No Action for each

Exhibit 25. Comparative Analysis Ranking of Alternatives from the Feasibility Study

Decision Unit	Alt Number	Alternative	Volume	Construction years	Years to achieve RAOs	O&M 30yrs	PV Estimated Cost
Landfills DU1/Groundwater DU6							
	1	No action	0	0	0	$1,859,250	$769, 050
	3A	Containment (capping and upgradient slurry wall)	2,301 CY	1	4 years	$6,537,000	$27,716,290
	3C	Containment (capping, upgradient slurry wall, and extraction)	2,301 CY	1	4 years	$61,110,600	$62,258,574
	4A	Containment (capping and fully encompassing slurry wall)	3,859 CY	2	4 years	$16,059,000	$45,642,497
	4C	Containment (capping, fully encompassing slurry wall, and extraction)	3,859 CY	2	4 years	$61,110,600	$74,303,074
	5B	Containment (capping and hydraulic control)	0	1	4 years	$61,110,600	$48,724,897
	6	Excavation w/on-site consolidation	1,400,000 CY	5	4-5 years	$18,918,000	$165,590,849
Landfills LDU2							
	1	No action	0	0	0	$1,928,550	$797,715
	2	Containment via capping	0	1	2 years	$1,928,550	$6,967,323
Soils DU3							
	1	No action	0	0	0	$0	$0
	2	Covers with Hot Spot excavation	3,500 CY	1	2 years	$819,240	$1,606,306
	3	In-place Phytoremediation with Hot Spot Excavation	9,540 CY	1	10 years	$563,953	$1,171,948
	4	Excavation w/on-site consolidation	32,100 CY	1	2 years	$0	$1,237,989
North Percolation Ponds DU4							
	1	No action	NA	0	NA	NA	NA
	2	Limited Excavation w/covers	15,620 CY	1	2 years	$1,536,000	$3,129,010
	3	Excavation with cover	35,020 CY	1	2 years	$902,400	$2,346,093
	4	Excavation w/on-site consolidation	56,715 CY	1	2 years	$0	$2,286,195
River Area DU5							
	1	No action	NA	NA	NA	NA	NA
	2	Performance Monitoring of Surface Water and Sediment Porewater	0	0	0	$3,388,800	$1,401,725

Exhibit 26. Summary of Relevant Volumes, Time Frames, and Costs for Alternatives Evaluated

Threshold Criteria

Alternative 1 (no action) is not protective of human health and the environment and is not retained. All other retained alternatives would satisfy the two threshold criteria (Exhibit 25).

The retained alternatives are protective of human health and the environment based on current land and groundwater use as well as reasonably expected future uses. Similarly, all retained remedial alternatives would comply with state and federal chemical-specific ARARs identified in the feasibility study report (Roux 2021). They would be designed to comply with action- and location-specific ARARs, as applicable.

Primary Balancing Criteria

Consistent with EPA guidance, the overall effectiveness of the five remaining alternatives is determined by evaluating the first three balancing criteria: 1) long-term effectiveness and permanence; 2) reduction of toxicity, mobility, or volume through treatment; and 3) short-term effectiveness. Relative performance was evaluated in the feasibility study. The scores have no independent value and are only meaningful when compared to other alternatives. The total possible score is 100 with a range of 0 to 20 for each criterion. Alternatives 3C, 4A, and 4C have the greatest overall effectiveness. Alternatives 3A, 5B, and 6 are not as effective overall because of limited source control measures (Alternatives 3A and 5B) or the potential for adverse impacts to human health and the environment during remedial action implementation that limit its short-term effectiveness (Alternative 6).

Implementability is greatest for Alternatives 3A, 4A, and 5B. It is anticipated that these alternatives would be sufficiently implementable given adequate lead time (Exhibit 25). Alternatives 3C and 4C are expected to be more difficult to implement than Alternatives 3A and 4A due to the increased construction complexity from adding another component in addition to a slurry wall (downgradient groundwater extraction and a treatment system). Additionally, downgradient extraction and treatment would not address contaminant mobility beneath the site. Groundwater treatment without a source control technology such as containment also would require a large complex treatment plant with storage facilities to address the seasonally variable groundwater flow to treat an estimated 500 gallons per minute year-round, and as such scored lower than the containment alternatives. Alternative 6 would be the least technically feasible and is expected to be much less implementable than the other alternatives.

Alternatives 3A, 4A, and 5B are the least expensive, while Alternatives 3C, 4C, and 6 are significantly more expensive (Exhibit 27). Costs for Alternative 6 dwarf costs for the other alternatives in joint DU1/DU6 and all other DUs.

The NCP requires that the selected remedial action be cost-effective and proportional to overall effectiveness. Alternative 6 (on-site excavation and consolidation) does not meet this requirement as it costs more than twice the next most expensive alternative and exceeds the least expensive retained alternative by a factor of six. Alternative 6 is also less effective than Alternatives 3C, 4A, and 4C. Thus, Alternative 6 is the least cost-effective alternative.

Alternative 4A uses capping and a fully encompassing slurry wall to prevent future percolation of water through the source areas (West Landfill and Wet Scrubber Sludge Pond) and to contain the existing contaminated groundwater. Alternative 4A has the highest overall score of the seven retained alternatives when evaluating overall effectiveness, implementability, and reduction of contaminant mobility.

Landfills DU2

Threshold Criteria

Alternative 1 (no action) would not be protective of human health and the environment and is not retained. Alternative 2 (containment via capping) would satisfy the two threshold criteria and would be protective of human health and the environment based on current land use as well as reasonably expected future uses. It also would satisfy ARARs. There are no chemical-specific ARARs for soil; however, Alternative 2 would meet remedial action objectives and would be designed to comply with action- and location-specific ARARs, as applicable.

Primary Balancing Criteria

Alternative 2 would protect human health and the environment by capping impacted material, which is an adequate and reliable method to eliminate the direct contact exposure pathway and its associated risks (Exhibit 26).

Alternative 2 would be technically and administratively feasible. All activities would be conducted on-site, and treatability/pilot studies would not be needed. Development of off-site sources of fill material for cover would be coordinated with the appropriate agencies. The estimated total cost for Alternative 2 is approximately $7 million (Exhibit 27).

Soils DU3

Threshold Criteria

Alternative 1 (no action) would not be protective of human health and the environment and is not retained (Exhibit 25). The three remaining alternatives would satisfy the two threshold criteria. They are protective of human health and the environment based on current land use and reasonably expected future uses. There are no chemical specific ARARs for soil; however, all active alternatives would meet the remedial action objectives. In addition, the alternatives would be designed to comply with action- and location-specific ARARs, as applicable.

Primary Balancing Criteria

Alternatives 3 (in-place phytoremediation with hot spot excavation) and 4 (excavation with on-site consolidation) have the greatest overall effectiveness. In comparison, Alternative 2 (covers with hot spot excavation) is not as effective overall.

Alternative 4 would be the most implementable (Exhibit 25). While Alternative 3 ranked highest for the reduction of toxicity, mobility, or volume, it ranked lower for short-term effectiveness (expected to take 10 years) and implementability (need to import materials and may require pilot study). Alternative 3 is also more costly than Alternative 4 because of the 10-year implementation period.

Comparative Cost (ranked by highest to lowest total cost)			
	Capital	O&M	Total
Landfills DU1/Groundwater DU6			
1	$0	$769,050	$769,050
3A	$25,012,360	$2,703,930	$27,716,290
4A	$38,999,937	$6,642,560	$45,642,497
5B	$23,447,432	$25,277,465	$48,724,897
3C	$36,981,109	$25,277,465	$62,258,574
4C	$49,025,609	$25,277,465	$74,303,074
6	$157,765,708	$7,825,141	$165,590,849
Landfills DU2			
1	$0	$797,715	$797,715
2	$6,169,608	$797,715	$6,967,323
Soils DU3			
1	$0	$0	$0
3	$775,851	$396,097	$1,171,948
4	$1,237,989	$0	$1,237,989
2	$1,267,440	$388,866	$1,606,306
North Percolation Ponds DU4			
1	$0	$0	$0
4	$2,286,195	$0	$2,286,195
3	$1,972,829	$373,264	$2,346,093
2	$2,493,668	$635,343	$3,129,010
River Area DU5			
1	$0	$0	$0
2	$0	$1,401,725	$1,401,725

O&M - operation and maintenance costs.

Exhibit 27. Comparative Costs for Retained Alternatives

The costs of each active alternative are comparable, although Alternatives 3 ($1,171,948) and 4 ($1,237,989) are expected to cost less than Alternative 2 ($1,606,306) (Exhibit 27). Alternative 4 (excavation with on-site consolidation) maximizes performance relative to the balancing criteria and would permanently eliminate exposure pathways in DU3 within a few years, without the need for long-term controls. By excavating the contaminated material and disposing of it on site, Alternative 4 scores the highest for overall effectiveness and implementability.

North Percolating Ponds DU4

Threshold Criteria

All active remedial alternatives (except no action) would satisfy the two threshold criteria. The no action alternative would not be protective of human health and the environment and is not retained. The three remaining alternatives are protective under current and reasonably expected future uses. Based on the remedial investigation report, DU4 is not a current source of groundwater contamination. Thus, all alternatives would ultimately result in groundwater meeting chemical-specific ARARs.

Chemical-specific ARARs for surface water would be met under all alternatives by:

- Preventing direct contact of standing water with impacted surface soil/sediment by covering or removing the impacted materials.
- Eliminating the influx of contaminants of concern by decommissioning the influent pipes from which stormwater enters the system.

There are no chemical-specific ARARs for soil or sediment; however, all active alternatives would meet site remedial action objectives. The alternatives would be designed to comply with action- and location-specific ARARs, as applicable.

Primary Balancing Criteria

The overall effectiveness of the remaining remedial alternative is evaluated using three balancing criteria: long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; and short-term effectiveness (Exhibit 25). Alternatives 3 (excavation with cover) and 4 (excavation with on-site consolidation) have the greatest overall effectiveness. Alternative 2 (limited excavation with covers) is less effective.

Alternative 4 would be the most implementable of the three alternatives. Alternatives 2 and 3 are expected to be more difficult to implement due to the need to import materials for cover. Alternative 2 would require significantly more material than 3 and would be the most difficult to implement.

The estimated costs of each alternative (Exhibit 27) are comparable, though Alternatives 3 ($2,346,093) and 4 ($2,286,195) are less expensive than Alternative 2 ($3,129,010). Alternative 4 maximizes performance relative to the balancing criteria and would permanently eliminate exposure pathways in DU4 within a few years, without the need for long-term controls.

River Area DU5

Threshold Criteria

The no action alternative would not be protective of human health and the environment and is not retained (Exhibit 25). It would not monitor cyanide in surface water and sediment porewater and would not demonstrate that concentrations of cyanide are decreasing over time in response to implementation alternative.

Alternative 2 (long-term monitoring of surface water and sediment porewater) would satisfy the two threshold criteria. It would be protective of human health and the environment, based on current land use as well as reasonably expected future uses, and it would satisfy ARARs. Under current and reasonably expected future uses, DU5 does not pose a contamination risk to human health. There are no chemical-specific ARARs for soil or sediment; however, long-term monitoring of surface water and sediment porewater would meet the remedial action objectives. Long-term monitoring of surface water and sediment porewater would be designed to comply with action- and location-specific ARARs, as applicable.

Primary Balancing Criteria

The 2021 Superfund removal action to remove contaminated sediment from the South Percolation Ponds was designed to be protective of human health and the environment. The routine sampling and analysis of surface water and sediment porewater would demonstrate progress toward achieving remedial action objectives. Long-term monitoring of surface water and sediment porewater satisfies the balancing criteria for River Area DU5. The removal action minimized potential exposure to impacted soil/sediment material resulting in exceedances of preliminary remedial goals. Long-term monitoring of surface water and sediment porewater would protect ecological receptors by monitoring surface water and sediment porewater over time to ensure continued reductions of cyanide concentrations. Long-term monitoring of surface water and sediment porewater has no additional construction, so impacts to workers, residents, and the environment are very low.

Long-term monitoring of surface water and sediment porewater would be easily implementable. All activities would be conducted on-site, and treatability/pilot studies would not be required. The estimated total cost for long-term monitoring of surface water and sediment porewater is approximately $1.4 million.

On-Site Disposal

Wastes are disposed of safely and effectively at hundreds of Superfund sites nationwide where offsite disposal has been shown to be impracticable and even dangerous.

EPA has procedures in place to ensure that the wastes are managed appropriately in engineered facilities with provisions made for appropriate monitoring and maintenance for the foreseeable future.

EPA's Preferred Alternative for cleanup at the CFAC site is shown for each DU in Exhibit 28. The rational for selecing the each alternative and the components of the Preferred Alternative follow.

Landfills DU1/ Groundwater DU6/ River Area DU5	• Alternatives 4A (modified) and 2 (River Area)
Landfills DU2	• Alternative 2
Soils DU3	• Alternative 4
North Percolation Ponds DU4	• Alternative 4

Exhibit 28. EPA's Preferred Alternative

Landfills DU1/Groundwater DU6/River Area DU5

DU1/DU6 Modified Alternative 4A and DU5 Alternative 2: Containment via Capping, Fully Encompassing Slurry Wall, Interior Extraction, and Monitoring

Modified Alternative 4A is EPA's Preferred Alternative for DU1/DU6 and ranks highest of the seven alternatives evaluated (Exhibit 25). The alternative in this Proposed Plan differs slightly from that presented in the feasibility study report in that interior wells installed during construction are assumed to be needed for long-term groundwater extraction and treatment.

This alternative incorporates River Area DU5 Alternative 2, because the primary objective of the DU5 monitoring is to evaluate whether decreases in groundwater contamination from DU1/DU6 remedial actions are effective in achieving surface water standards at the DU5 seeps.

The wells will be used initially for monitoring and, if the slurry wall is not effective in stopping migration of the groundwater plume, they will be used to extract groundwater for treatment. If treatment is determined to be necessary, it would be seasonal and require much less volumes of groundwater to be treated compared to the downgradient extraction alternatives.

Costs for this alternative are relatively low compared to the other alternatives, but do not include the potential for extraction and treatment of groundwater. This joint DU (with an estimated 1.2 million cubic yards waste) accounts for approximately 79% of estimated present value cleanup costs for the site.

The remedy would:

- **Construct low-permeability caps** on the Wet Scrubber Sludge Pond and Center Landfill and maintain the West Landfill cap.
- **Construct a fully encompassing slurry wall** around the West Landfill and Wet Scrubber Sludge Pond to depths that key into the underlying low-permeability, glacial till layer (typically between 100 and 125 feet). If dewatering is needed, treat captured groundwater in a treatment plant and return effluent to groundwater via infiltration basins.
- **Install eight pairs of extraction/monitoring wells** (one within and one outside of the slurry wall) downgradient of the Wet Scrubber Sludge Pond, but interior to the slurry wall, with another series of monitoring wells downgradient of the slurry wall.
- **Construct a groundwater treatment facility** to treat cyanide, fluoride, and arsenic, with infiltration basins for discharge of treated effluent back to groundwater. The facility will be used during construction of the slurry wall for dewatering and will be retained for use after construction is completed. If pumping is needed because groundwater elevations in the interior and downgradient monitoring wells indicate that the slurry wall is not performing as designed, the groundwater extracted from the interior of the slurry wall will be treated and then discharged into infiltration basins.
- **Implement groundwater, surface water, and sediment porewater performance monitoring** of the groundwater plume using existing and newly installed monitoring wells and at seeps and other floodplain areas within River Area DU5.

The Preferred Alternative is consistent with EPA's presumptive strategy for landfill sites as containment remedies are preferred over treatment remedies, while extraction and treatment of groundwater is retained if necessary.

Landfills DU2

Alternative 2: Containment via Capping

Alternative 2 is EPA's Preferred Alternative for DU2. The alternative was not ranked because it is the only alternative other than no action for DU2. The components of the alternative are effective and permeant and easily implementable and would have few impacts on the community.

Present value costs for this alternative are moderate and represent only about 12% of the total estimated costs for the site.

Under Alternative 2, the remedy would:

- **Continue to maintain existing caps** on the East Landfill and Sanitary Landfill.
- **Install a low-permeability cap** on the Industrial Landfill.
- **Improve existing soil covers** at the Asbestos Landfills.

Soils DU3

Alternative 4: Excavation with On-Site Consolidation

Alternative 4 is EPA's Preferred Alternative for DU3 and ranks highest of the four alternatives evaluated (Exhibit 25). Alternative 4 receives the top score for long-term effectiveness and permanence while still scoring highly for short-term effectiveness and implementability.

Present value costs for this alternative are the lowest of the three active alternatives for DU3. They represent only about 2% of the total estimated costs for the site.

Under Alternative 4, the remedy would:

- **Excavate** approximately 32,500 cubic yards of impacted soil.
- **Consolidate excavated materials** with disposal on-site at the Industrial Landfill or an Agency-approved new, on-site engineered repository.

North Percolation Ponds DU4

Alternative 4: Excavation with On-Site Consolidation

Alternative 4 is EPA's Preferred Alternative and ranks highest of the four alternatives evaluated for DU4. It receives the top score for long-term effectiveness and permanence while still scoring highly for short-term effectiveness and implementability.

Present value costs for this alternative are moderate and represent approximately 4% of the total estimated costs for the site.

Under Alternative 4, the remedy would:

- **Excavate** approximately 35,180 cubic yards of impacted material from the North-East Percolation Pond, North-West Percolation Pond, influent ditch, and effluent ditch.
- **Consolidate excavated materials** with disposal on-site at the Industrial Landfill or an Agency-approved new, on-site engineered repository.

Remedial Design Details and Activities

Details to be determined in remedial design include but are not limited to:

- Detailed surveying, geotechnical and hydrogeologic investigations, and bench scale studies to design the slurry wall.
- Location, number, depth, and diameter of monitoring wells and groundwater analytes (contaminants of concern and indicator parameters).
- Location and design of a new on-site repository.
- Groundwater treatment technologies (technologies evaluated may include adsorption, coagulation/ flocculation/ precipitation, constructed wetlands, photolysis, electrocoagulation, ion exchange, and/or reverse osmosis).
- Performance standards to evaluate slurry wall operation to ensure it operates as designed to maintain an interior gradient, based on groundwater levels from interior and exterior monitoring wells.
- Quantities and locations of cover soil and common fill needed, length of fencing, and number and placement of signs.

Treatability and bench scale studies and demonstrations may be conducted to help determine the technologies for the treatment and discharge into infiltration basins.

Site-Wide Components

Institutional controls and engineering controls will be used site-wide to prevent or minimize exposure to human and ecological receptors and prevent activities that could compromise function or integrity of the caps/containment systems.

- Property restrictions on access to the landfill waste management units.
- Prohibitions or restrictions to groundwater use, including potential designation of a state-administered Controlled Ground Water Area to prevent potable use.
- Fencing and signage of the landfill waste management units.
- Locally adopted land use restrictions of the former plant area for commercial/industrial use only.
- EPA five-year reviews to ensure continued performance of the remedy, consistent with Superfund requirements.

Time to Complete

- Design: 6 to 12 months.
- Construction: One to two construction seasons.
- Groundwater monitoring: 30 years or until groundwater quality meets the preliminary remedial goals.
- Maintenance: Ongoing.
- Reviews: Every five years.

	Present Value Costs		
	Capital	O&M	Total
Landfills DU1/Groundwater DU6/River Area DU5			
4A*	$ 38,999,937	$ 8,044,285	$ 47,044,222
Landfills DU2			
2	$ 6,169,608	$ 797,715	$ 6,967,323
Soils DU3			
4	$ 1,237,989	$ -	$ 1,237,989
North Percolation Ponds DU4			
4	$ 2,286,195	$ -	$ 2,286,195
Total			
	$ 48,693,729	**$ 8,842,000**	**$ 57,535,729**

*modified

Public Comment and Additional Information

Public Meeting

EPA will provide a short presentation about the Proposed Plan at a public meeting. Please join us. It's a great opportunity to learn more about the details and comment on the Proposed Plan.

Proposed Plan Public Meeting
June 28, 2023
6:30 to 8:30 pm
Council Chambers
130 6th Street W., Columbia Falls, MT

Submitting Written Comments

The public comment period for the Proposed Plan runs from June 1 to July 31, 2023, and may be extended 30 days with a formal request to EPA. You can submit a comment in writing (by mail, email, or at the public meeting).

The mailing and email addresses for written comments are:

- Missy Haniewicz, U.S. EPA, Region 8, 1595 Wynkoop Street, Denver, CO 80202-1129
- haniewicz.melissa.m@epa.gov

Related Documents

All public project reports and documents are available for viewing at EPA's website or at one of the document repositories. These are also excellent sources for additional project information (fact sheets, brochures, etc.).

www.epa.gov/superfund/columbia-falls

Contacts

If you have questions or need additional help, please feel free to contact the following representatives:

EPA

Amanda Bartley, Remedial Project Manager, 406-465-8830, bartley.amanda@epa.gov

Matthew Dorrington, Remedial Project Manager, 406-594-9959, dorrington.matthew@epa.gov

Missy Haniewicz, Community Involvement Coordinator, 303-312-6899, haniewicz.melissa.m@epa.gov

Montana DEQ

Dick Sloan, Project Officer, 406-444-6442, rsloan@mt.gov

Kevin Stone, Public Affairs Officer, 406-841-6469, kevin.stone@mt.gov

Glossary

Administrative Record. Superfund requires that administrative records be compiled at Superfund sites where remedial or removal responses are planned, or are occurring, or where EPA is issuing a unilateral order or initiating litigation to track enforcement case budget funds used for activities led by a Responsible Party.

Applicable Relevant and Appropriate Regulations (ARARs). A legally applicable or relevant and appropriate standard, requirement, criterion, or limitation under federal environmental law, or promulgated under state environmental or facility siting law that is more stringent than the federal law. ARARs are divided into three categories: chemical-specific, action-specific, and location-specific standards.

Areas of Concern. Areas of impacted surficial and shallow soils (A through G) in the Soils DU. Estimated at 7.6 acres and 25,670 cubic yards. Exact extents will be delineated in remedial design.

Capital Costs. Fixed, one-time expenses incurred on the purchase of land, buildings, construction, and equipment used in the production of goods or in the rendering of services.

Circular DEQ-7 (Montana DEQ-7). Contains numeric water quality standards for Montana's surface and ground waters. The standards were developed in compliance with section 75-5-301, Montana Code Annotated of the Montana Water Quality Act and section 303(c) of the Federal Clean Water Act.

Comprehensive Environmental Response Compensation and Liability Act. The federal Superfund law, officially the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, established the federal Superfund program, administered by the Environmental Protection Agency.

Contaminants of Concern. Chemicals identified during site studies that need to be addressed by cleanup because they pose a potential threat to human health or the environment.

Decision Unit (DU). Areas with common elements or conditions that were established in the feasibility study to evaluate and address contaminants of concern specific to an environmental media and/or area of the site. Six DUs were defined to encompass the exposure areas.

Engineering Controls. Engineered and constructed physical barriers (such as soil capping, subsurface venting systems, mitigation barriers, fences) to contain and/or prevent exposure to contamination on a property.

Exposure Areas. The area used to quantitatively evaluate exposure to chemicals at a site in the risk assessment. Considers spatial distribution of chemical concentrations relative to the exposure scenario defined in the conceptual site model.

Feasibility Study. A study of a hazardous waste site intended to evaluate alternative remedial actions from technical, environmental, and cost effectiveness perspectives; recommend the cost-effective remedial action; and prepare a conceptual design, cost estimate, and preliminary construction schedule.

Five-Year Review. Reviews required by Superfund when hazardous substances remain on-site above levels which permit unrestricted use and unlimited exposure. They evaluate the implementation and performance of a remedy to determine if it remains protective of human health and the environment.

Groundwater Decision Unit (GW DU6). Groundwater in the upper hydrogeologic unit under the site. It was evaluated due to potential human health risks associated with the hypothetical drinking water scenario, as well as discharge to the River Area DU resulting in potential ecological risk and exceedances of surface water ARARs.

Institutional Controls. Non-engineered tools, such as administrative and/or legal controls, that help minimize the potential for human exposure to contamination and/or protect the integrity of a remedy by limiting land or resource use (for example, deed restrictions).

Landfills Decision Unit 1 (DU1). The West Landfill, Wet Scrubber Sludge Pond, Center Landfill, and surficial and shallow soils in their footprints. The pond and landfills are sources of groundwater contamination, although the Center Landfill contributes to a lesser degree.

Landfills Decision Unit 2 (DU2). The remaining waste management units in the Central Landfills Area and Industrial Landfill Area exposure areas and the surficial and shallow soil in their footprints. Includes East Landfill, Industrial Landfill, Sanitary Landfill, and Asbestos Landfills. They are not sources of groundwater contamination.

North Percolation Ponds Decision Unit 4 (DU4). Includes an influent ditch, two percolation ponds, and the approximately 1,440-foot-long overflow ditch.

Operations and Maintenance. Site activities associated with a remedy that must be performed after the completion of a remedial action. Examples include (but are not limited to) monitoring, maintenance of storm water controls, inspections of caps and covers, and operation of groundwater treatment plants.

Permeable Reactive Barrier. A passive, below-grade wall containing an engineered treatment zone with chemically active material that reacts with groundwater contaminants as they pass through the barrier. The treatment zone is placed perpendicular to the direction of groundwater flow, allowing impacted groundwater to flow through. Contaminants are retained or degraded in the reactive wall.

Phytoremediation. The use of green plants and the associated microorganisms, along with proper soil amendments and agronomic techniques to either contain, remove, or render toxic environmental contaminants harmless.

Polycyclic Aromatic Hydrocarbons (PAHs). A subset of aromatic hydrocarbons. Found in coal and in oil deposits and also produced by the combustion of organic matter (e.g., in engines and incinerators or when biomass burns in forest fires).

Preliminary Remedial Goals. Target concentrations to be used to develop, evaluate, and select remedial alternatives. Ideally, a remedy that achieves these goals will both comply with ARARs and reduce risk to levels that satisfy the legal requirements for protection of public health and the environment.

Present Value (PV) Costs. The total cost of an alternative over time in terms of today's dollar value.

Proposed Plan. Presents the evaluation of cleanup alternatives and provides a recommendation for the Preferred Alternative. This document is made available for public review and comment.

Potentially Responsible Party. Any individual or company--including owners, operators, transporters, or generators--potentially responsible for, or contributing to a spill or other contamination at a Superfund site. Whenever possible, EPA requires Potentially Responsible Parties to clean up hazardous sites they have contaminated.

Remedial Design. The phase in Superfund site cleanup where the technical specifications for cleanup remedies and technologies are designed.

Remedial Investigation. An investigation intended to gather data to determine the nature and extent of problems at the site, establish cleanup criteria, identify preliminary alternative remedial actions, and support the technical and cost analyses of the alternatives.

Record of Decision. A public document that explains which cleanup alternative(s) will be used at National Priorities List sites.

Remedial Action Objectives. Qualitative statements that describe what a remedial action is intended to accomplish. May be specific to contaminants, environmental media, or exposure pathways and receptors to be protected. Objectives consider current and future land use, as well as groundwater and surface water beneficial use designations.

Resource Conservation and Recovery Act (RCRA). The federal law that creates the framework for the proper management of hazardous and non-hazardous solid waste.

RCRA Subtitle C Landfill. An engineered facility designed for the disposal of hazardous waste as determined under RCRA that has met certain design criteria, such as double liners and double leachate collection and removal systems.

River Area Decision Unit 5 (DU5). The soil, sediment, sediment porewater, and surface water in the South Percolation Ponds, Backwater Seep Sampling Area, and Riparian Area Channel.

Slurry Wall. A physical barrier to isolate contaminated media below ground and restrict its migration. A vertically excavated trench is filled with a low-permeability material to create a wall that provides a low-permeability barrier with chemical resistance.

Soils Decision Unit 3 (DU3). The soil within the Main Plant Area, the ISM Grid Area, and areas surrounding the waste management units in the Central Landfills Area exposure area (including the Former Drum Storage Area).

Spent Potliner. Generated in the aluminum production process. Spent pot liner consists of a thick layer of carbon bonded to a brick layer containing fluoride, sodium, aluminum, and small amounts of cyanide. Cyanide and fluoride have been shown to contaminate groundwater. Spent pot liner was previously disposed of on-site at the West Landfill, Center Landfill, and East Landfill.

Waste Management Units. A term adopted in the feasibility study to represent subsets of decision units where wastes were stored or disposed. Some were identified in the remedial investigation as a source of groundwater contamination. Examples include surface impoundments, waste piles, land treatment areas, landfills, and container storage areas.

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