United States
Environmental Protection
Agency

Office of
Emergency and
Remedial Response

EPA/ROD/R08-92/059
June 1992

EPA

Superfund Record of Decision:

Silver Bow Creek/Butte Area, MT

50272-101

REPORT DOCUMENTATION PAGE	1. REPORT NO. EPA/ROD/R08-92/059	2.	3. Recipient's Accession No.

4. Title and Subtitle SUPERFUND RECORD OF DECISION Silver Bow Creek/Butte Area, MT Second Remedial Action - Interim	5. Report Date 06/30/92
	6.
7. Author(s)	8. Performing Organization Rept. No.
9. Performing Orgainization Name and Address	10. Project/Task/Work Unit No.
	11. Contract(C) or Grant(G) No. (C) (G)
12. Sponsoring Organization Name and Address U.S. Environmental Protection Agency 401 M Street, S.W. Washington, D.C. 20460	13. Type of Report & Period Covered 800/000
	14.

15. Supplementary Notes

PB93-964412

16. Abstract (Limit: 200 words)

The Silver Bow Creek/Butte Area site is a mining and processing area located 7 miles east of Anaconda in the Upper Clark Fork River Basin, Deer Lodge County, Montana. One part of the site is the Warm Springs Pond inactive area, which covers approximately 2,500 acres of open pond water and interspersed wetlands just above the beginning of the Clark Fork River. Several onsite creeks (Warm Springs, Silver Bow, Mill, Willow) and a stream by-pass (Mill-Willow By-pass) serve as principal headwaters to Clark Fork River. Three settling ponds, an area between the northern-most pond (Pond 1) and the Clark Fork River's beginning point, and a series of wildlife ponds are located in proximity to the creeks. Site contamination is the result of over 100 years of mining and process operations in the area. Until the early 1970's, mining, milling, and smelting wastes were dumped directly into Silver Bow Creek and transported downstream. Three settling ponds were constructed in the early 1900's by Anaconda Copper Mining Company to allow wastes that were deposited in Silver Bow Creek to settle out before discharging to the Clark Fork River. Approximately 19 million cubic yards of tailings and metal-contaminated sediment and sludge have collected in the ponds and 3 million

(See Attached Page)

17. Document Analysis a. Descriptors

Record of Decision - Silver Bow Creek/Butte Area, MT
Second Remedial Action - Interim
Contaminated Media: soil, sediment, gw, sw
Key Contaminants: metals (arsenic, chromium, lead), inorganics

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report) None	21. No. of Pages 126
	20. Security Class (This Page) None	22. Price

(See ANSI-Z39.18) *See Instructions on Reverse* OPTIONAL FORM 272 (4-77) (Formerly NTIS-35) Department of Commerce

Abstract (Continued)

cubic yards of contaminated tailings remain upstream of the ponds along the banks of Silver Bow Creek. Principal threats from the site include the possibility of pond berm failure attributed to flood and earthquake damage that could release millions of cubic yards of tailings and sediment into the river. Several removal actions that occurred during 1967 and 1989 have been or will be implemented at the site, including the Mill-Willow By-pass removal, Travona Mine Shaft Control, and residential soil cleanups. A 1990 ROD addressed an interim action for the Warm Springs Ponds area, which included Ponds 1, 2, and 3, but deferred the decision on the area below Pond 1 for a year. When it was recognized that a decision on Pond 1 and the area below it might delay the remedy for Ponds 2 and 3, in 1991 EPA wrote an ESD that divided the Warm Springs Pond area into two operable units: the Active area, composed of Ponds 2 and 3, as OU4; and the Inactive area, composed of Pond 1 and the area below it, as OU12. This ROD addresses an interim remedy for all media at OU12. The primary contaminants of concern affecting the soil, sediment, ground water, and surface water in the Inactive area are metals, including arsenic, chromium, and lead; and inorganics.

The selected remedial action for this site includes excavating all tailings and contaminated soil from the by-pass channel and the area below Pond 1 not planned for wet-closure, and consolidating the wastes over existing dry tailings within the western portion of Pond 1; placing a cover of lime, fill, and soil over the dry tailings and revegetating; modifying the by-pass channel to safely route potential flood flows; using soil and gravel that meet geotechnical requirements and have copper levels of less than 500 mg/kg to raise and strengthen existing berms; constructing new berms; raising and strengthening the north-south aspect of the Pond 1 berm, and stabilizing the east-west aspect of the Pond 1 berm to withstand a maximum credible earthquake for this area; extending and armoring the north-south aspect of the Pond 1 berm; relocating the lowermost portion of the by-pass channel, converting the present channel into a ground water interception trench; installing pumps to allow for a pump-back system to transport ground water and surface water to the active area for treatment, if levels exceed specified standards; constructing wet-closure berms to enclose the submerged tailings and contaminated sediment; chemically fixing tailings and sediment with lime, and flooding the wet-closure cells with water with a pH of greater than 8.5; constructing a run-off interception system along the east side of the Inactive area and toe drains, and installing a collection manifold for both the Active and Inactive areas; and implementing ecological monitoring and institutional controls, including deed, ground water, and land use restrictions. The total present worth cost for this remedial action is $18,100,000, which includes an annual O&M cost of $67,200 for 30 years.

PERFORMANCE STANDARDS OR GOALS:

Soil at final excavation grade for this interim action will exhibit concentrations of metals within the range of the following concentrations: arsenic 8.4-42.1 mg/kg; cadmium 0.8-4 mg/kg; lead 8.4-45.5 mg/kg; copper 0.6-287 mg/kg; and zinc 0.4-573. Chemical-specific interim ground water clean-up goals, which are based on state drinking water criteria, include arsenic 50 ug/l; cadmium 10 ug/l; copper 1,000 ug/l; lead 50 ug/l; manganese 50 ug/l; zinc 5,000 ug/l; and iron 300 ug/l. Final soil, sediment, ground water, and surface water action levels for the various contaminants are not identified in this ROD and will be determined based on ongoing risk assessment work at other OUs within the Clark Fork Basin.

RECORD OF DECISION

Warm Springs Ponds Inactive Area Operable Unit (OU 12)
Silver Bow Creek/Butte Area NPL Site (original portion)
Clark Fork River Basin, Montana

United States Environmental Protection Agency

Region VIII

June 1992

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

LIST OF FIGURES

LIST OF TABLES

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

RECORD OF DECISION

PART I: THE DECLARATION

Warm Springs Ponds Inactive Area Operable Unit (OU 12)
Silver Bow Creek/Butte Area NPL Site (original portion)
Clark Fork River Basin, Montana

United States Environmental Protection Agency

Region VIII

June 1992

Printed on Recycled Paper

RECORD OF DECISION

PART I

THE DECLARATION

Warm Springs Ponds Inactive Area Operable Unit (OU 12)
Silver Bow Creek/Butte Area NPL Site (original portion)
Upper Clark Fork River Basin, Montana

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected interim remedial action for the Warm Springs Ponds Inactive Area Operable Unit which is part of the Silver Bow Creek/Butte Area National Priorities List (NPL) Site. The selected remedial action was developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (CERCLA), 42 USC Sec. 9601, et. seq. and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300. This decision is based on the administrative record for the Inactive Area and Active Area operable units of the Warm Springs Ponds, Silver Bow Creek/Butte Area NPL Site.[1]

All determinations reached in this Record of Decision were made in consultation with the Montana Department of Health and Environmental Sciences, Solid and Hazardous Waste Bureau (hereafter referred to as the State or MDHES), which conducted the remedial investigation for the Warm Springs Ponds and participated fully in the selection of the remedy and the development of this decision document. The State of Montana is in agreement with the EPA concerning the selected remedy. A copy of the State's letter of concurrence with the selected remedy is attached to Part III.

[1]The administrative record index and copies of key site documents are available for public review at the University of Montana Library, the Montana Tech Library on West Park Street in Butte, and other information repositories in the Clark Fork Basin. The complete administrative record may be reviewed at the offices of the U.S. EPA, 301 South Park, Federal Building, Helena, MT.

ASSESSMENT OF THE SITE

Actual and threatened releases of hazardous substances from the Inactive Area Operable Unit of the Warm Springs Ponds, if not significantly reduced or eliminated by implementation of the response action selected and described in this Record of Decision, may present an imminent and substantial endangerment to the public health, welfare, or the environment.

DESCRIPTION OF THE SELECTED REMEDY

The Warm Springs Ponds are located in Deer Lodge County, approximately seven miles east of Anaconda, near the historic confluence of Silver Bow, Willow, Mill and Warm Springs creeks. These streams are principal headwaters of the Clark Fork River, which begins approximately one-quarter mile north of the Inactive Area Operable Unit boundary.

The Warm Springs Ponds are comprised of three settling ponds, the area below (north of) Pond 1, a series of wildlife ponds, and the Mill-Willow Bypass (see Figure 1).

In 1991, the Warm Springs Ponds were divided into two operable units:

a) Active Operable Unit (OU No. 4 of the Silver Bow Creek/Butte Area site), including Ponds 2 and 3, their inlet and outlet channels, their associated water treatment facilities, the wildlife ponds and the upper bypass channel (Mill-Willow Bypass); [2] and

b) Inactive Operable Unit (OU No. 12 of the Silver Bow Creek/Butte Area site), including Pond 1, the historic Silver Bow Creek channel and some uncontaminated grassland and wet meadows below Pond 1, and the lower bypass channel, which contains not only Mill and Willow creeks, but also outflows from Pond 2 (see Figures 2A and 2B).

---

[2] The interim remedy for the Active Area Operable Unit was described in the September 1990 Record of Decision, as modified by the June 1991 Explanation of Significant Differences including its errata sheet.

The selected interim remedy for the Inactive Area Operable Unit includes means for controlling contamination associated with submerged and exposed tailings, soils, pond bottom sediments, and ground and surface water. The selected remedy may be summarized as follows:

1. Remove all tailings and contaminated soils from the adjacent portion of the bypass channel and from the area below Pond 1 not planned for wet-closure. Consolidate the wastes over existing dry tailings within the western portion of Pond 1.

2. Modify, or enlarge if necessary, the adjacent portion of the bypass channel to safely route flood flows up to 70,000 cubic feet per second (cfs) which is one-half the estimated probable maximum flood (PMF) for the combined flows of Silver Bow, Willow and Mill creeks. Soils and gravels that have copper concentrations below 500 mg/kg and meet geotechnical requirements will be used for raising and strengthening the existing berms and constructing new berms.

3. Raise, strengthen and armor with soil cement the north-south aspect of the Pond 1 berm. In accordance with specified state safety standards for high hazard dams and for the protection of human health and the environment, the reconstructed berm must withstand the estimated maximum credible earthquake (MCE) for this area. In addition, the reinforced berm must be constructed to withstand flood flows up to 70,000 cfs (0.5 PMF) in the enlarged bypass channel.

4. Stabilize the east-west aspect of the Pond 1 berm. The reconstructed berm must withstand a maximum credible earthquake for this area, thus protecting against the movement of contained pond bottom sediments or tailings into the uncontaminated or wet closed areas below Pond 1 in accordance with specified state dam safety standards, and for the protection of human health and the environment.

5. Extend and armor the north-south aspect of the Pond 1 berm approximately 2,400 feet in a north-northeasterly direction. This extended berm will be constructed to provide maximum credible earthquake protection and the ability to withstand one-half the estimated probable maximum flood (70,000 cfs) in the adjacent bypass channel.

6. Relocate the lowermost portion of the bypass channel and convert the present channel into a ground water interception trench. The relatively straight reach of the bypass channel, from the apex of the existing Pond 1 berm to the historic Silver Bow Creek channel, will be relocated north of the extended berm. The entire reach of the bypass channel that is adjacent to the inactive area will be reconstructed, reclaimed and restored to a more natural, meandering condition. Other excavated areas will be reclaimed and restored to their natural condition.

7. The converted ground water interception trench will be deepened and pumps will be installed to allow for a pump-back system. Intercepted water that fails to meet specified standards will be pumped back to the active area for treatment. Monitoring wells and surface water quality monitoring stations will be placed at strategic locations.

8. Construct wet-closure berms to enclose the submerged and partially submerged tailings and contaminated soils. Within the eastern portion of Pond 1 and along the historic Silver Bow Creek channel below Pond 1, these smaller berms will create a series of cells, which when flooded will vary in depth from a minimum of one foot to a maximum of six feet.

9. Chemically fix (immobilize) the tailings and contaminated soils, now enclosed by smaller berms, by incorporating lime and lime slurry onto or into them.

10. Flood the wet-closure cells with water adjusted to a pH greater than 8.5 and maintain proper water surface elevations in the wet-closure cells.

11. Cover the dry tailings and contaminated soils within the western portion of Pond 1 with 2 inches of limestone, 12 inches of fill, and 6 inches of a suitable soil cap. This dry-closed area will be contoured to control runoff and seeded with native vegetation.

12. Construct a runoff interception system along the east side of the inactive area. This system will prevent floods originating in the eastern hills from entering the wet-closure cells. It will be designed to intercept one-half the probable maximum flood, which is estimated to be 8,500 cfs at its peak. A collection system or other

engineered solution will be constructed to prevent excessive sediments from entering the Clark Fork River immediately below.

13. Install toe drains along the armored berms and construct a collection manifold for both the active and inactive areas. The water collected will be pumped to the active area for treatment if it exceeds final point source discharge standards specified in Attachment 5 to the Warm Springs Ponds Active Area Unilateral Administrative Order.

14. Implement long-term ecological monitoring. By means of an unbiased set of measurements, this monitoring effort will concentrate on the effects of biological systems living in contact with metals in the water and substrate of ponds and wetlands environments. The results will validate or invalidate the decision to chemically fix, wet-close and contain in place the exposed and submerged tailings and contaminated soils.

15. Implement institutional controls to prevent residential development, domestic well construction, disruption of dry-closure caps, and swimming.

The selected remedy is an interim response action; however, not in the usual sense. Interim actions usually address only portions of site cleanups, or may not intend to utilize permanent solutions to the maximum extent practicable. Thus, they are usually not intended to be the final response action for a particular site or set of circumstances.

This interim response action utilizes permanent solutions to the maximum extent practicable, and the EPA believes that subsequent final evaluations will demonstrate the effectiveness of the interim remedy. It is an interim remedy for the following reasons:

1. Hazardous substances will remain on site;

2. The selected remedy employs innovative methods for reducing or eliminating threats to human health and the environment, which will require monitoring over time to evaluate its effectiveness; and

3. Contaminated source areas upstream and upgradient have direct implications on the effectiveness and permanence of any remedy selected for this area.

While every reasonable effort was made to assure that this remedy will be protective of human health and the environment, the measure of its protectiveness, effectiveness and permanence requires time and a watchful eye. Clearly, when compared to the 10 other remedies examined in the feasibility study, the remedy selected affords the most reasonable balance of objectives and it offers the greatest potential for becoming a final remedy. Thus, the selected remedy presented in this Record of Decision attempts to permanently remediate the principal threats posed by contamination within the Inactive Area Operable Unit.

Additionally, the selected remedy is acceptable to a majority of interested Clark Fork River Basin residents and local government officials. Several public scoping meetings were held throughout the basin as the EPA and State examined feasible alternatives. Individuals and special interest groups requested more studies with respect to totally removing the contaminated materials from the historic flood plain and consumptive water usage estimates for the various alternatives. The EPA responded with additional studies and followup meetings were conducted prior to issuing the proposed plan. While no remedy can be expected to receive unanimous public support, the remedy selection process in this instance was carried out with full public participation and the remedy selected is broadly supported.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action unless a statutory waiver is invoked, and is cost-effective. Although the remedy is an interim remedy which will be reevaluated in a final remedy decision for the Warm Springs Ponds active and inactive areas, the remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable and satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element.

Because this remedy will result in hazardous substances remaining on site, above health based and environmental-based levels, a review will be conducted within five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment. Additionally, the remedy selected by this Record of Decision will be subject to a separate public review once cleanup work at other operable units and NPL sites that affect this operable unit is completed.

Signed this 30th day of June, 1992.

Jack W. McGraw
Acting Regional Administrator
United States Environmental Protection Agency
Region VIII

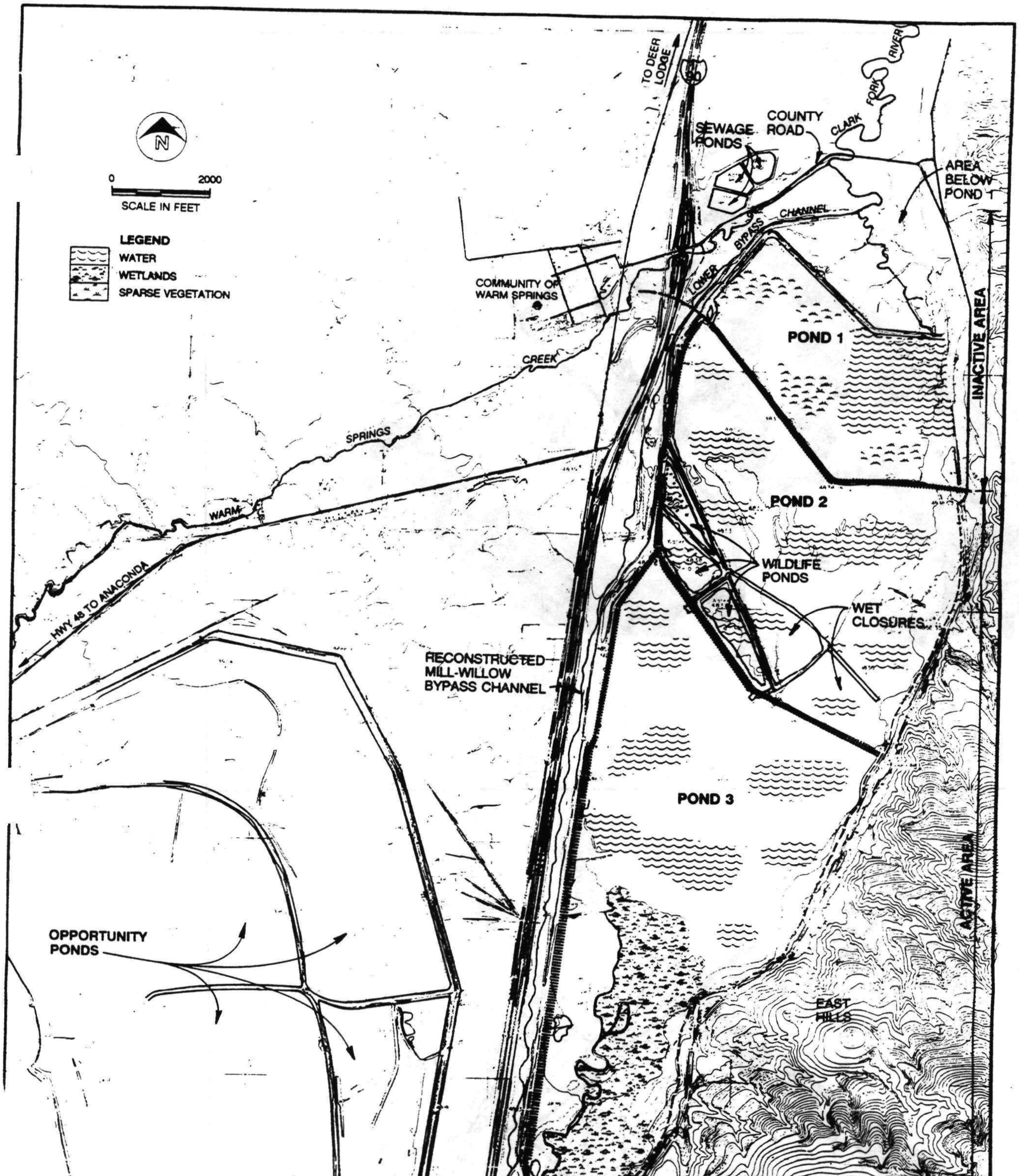

FIGURE 1
WARM SPRINGS PONDS SYSTEM
INACTIVE AREA

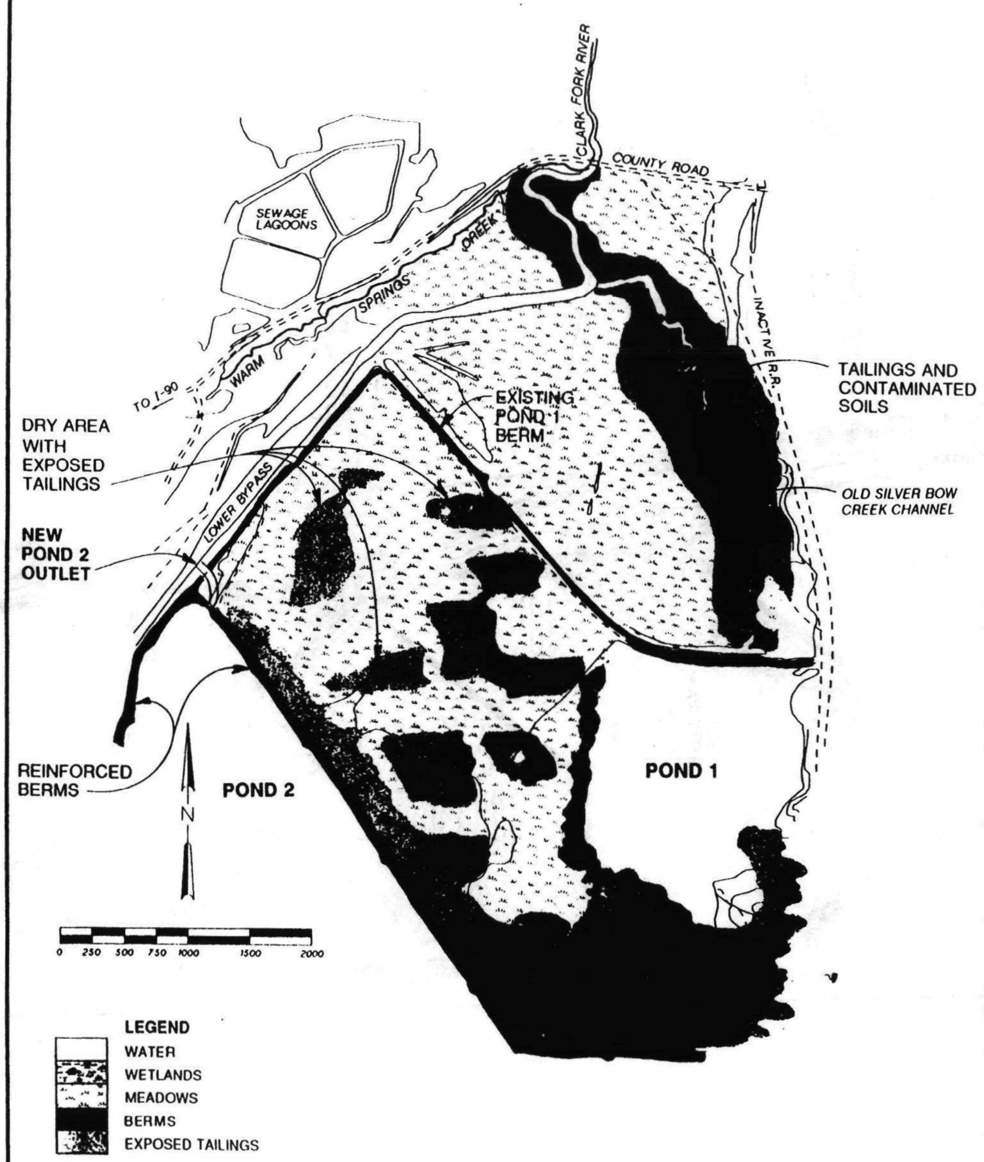

FIGURE 2A

INACTIVE AREA
PRESENT CONDITION
WARM SPRINGS PONDS

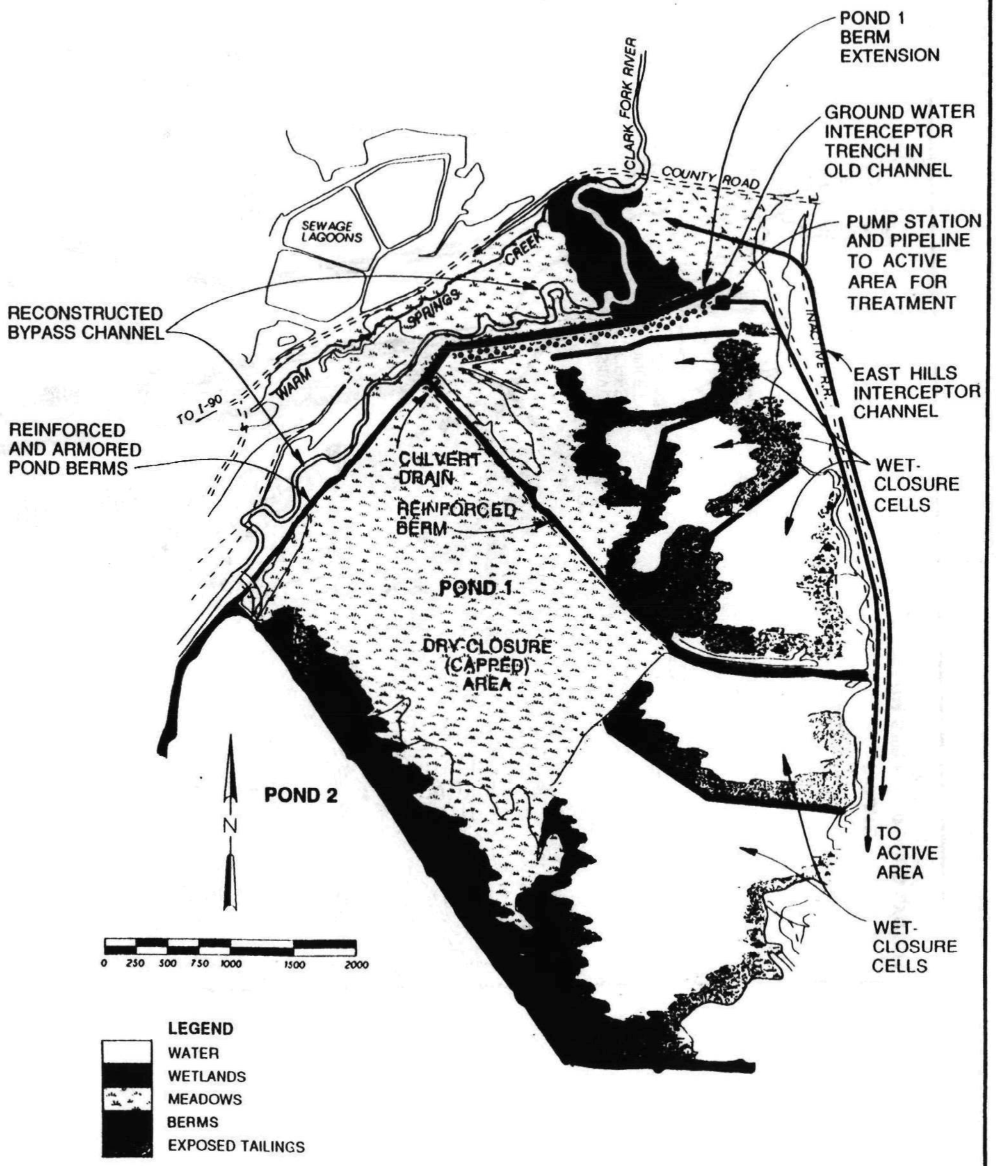

FIGURE 2B

INACTIVE AREA
SHOWING COMPONENTS OF REMEDY
WARM SPRINGS PONDS

RECORD OF DECISION

PART II: THE DECISION SUMMARY

Warm Springs Ponds Inactive Area Operable Unit (OU 12)
Silver Bow Creek/Butte Area NPL Site (original portion)
Upper Clark Fork River Basin, Montana

United States Environmental Protection Agency

Region VIII

June 1992

Printed on Recycled Paper

RECORD OF DECISION

PART II

THE DECISION SUMMARY

Warm Springs Ponds Inactive Area Operable Unit (OU 12)
Silver Bow Creek/Butte Area NPL Site (original portion)
Upper Clark Fork River Basin, Montana

1.0 SITE NAME, LOCATION AND DESCRIPTION

The Warm Springs Ponds are located in southwestern Montana, at the lower end of Silver Bow Creek, approximately 27 miles downstream of Butte. The pond system is a series of three sediment settling ponds that were constructed over a span of about 60 years. Pond 1 was constructed around 1911; Pond 2 around 1916; and Pond 3 during the late 1950s. They were constructed by the Anaconda Copper Mining Company in an effort to prevent tailings and other sediments from entering the Clark Fork River, which begins approximately one-half mile below Pond 1 (see Figure 1).

Ponds 2 and 3 have been retained as settling ponds. Tailings and other sediments from Silver Bow Creek physically settle to the bottom as the velocity of the incoming water decreases. The addition of lime near the inlet to Pond 3, a practice that began some 20 years ago, also makes it possible to actively treat the dissolved metals, or cause them to precipitate out of solution and settle to the bottom. Historically, lime has been added only during the late fall, winter, and early spring.

Pond 1 was never involved in the active treatment of water from Silver Bow Creek by the addition of lime, and it no longer plays a role in settling sediments. This inactive area, and the area below Pond 1, are essentially isolated from the active treatment portion of the pond system. The relatively small volume of water contained within this inactive area is present due to seepage from the ponds above.

Willow and Mill creeks, which historically joined with Silver Bow Creek in the area above the present pond system, were diverted away from Silver Bow Creek and around the pond system in the late 1960s. Figure 1 shows the current configuration of these streams, as well as the three ponds, bypass channel, wildlife ponds, and the old Silver Bow Creek channel below Pond 1. The entire system is approximately four miles long and one mile wide, covering approximately 2,500 acres of open pond water and interspersed wetlands and tailings deposits.

The Warm Springs Ponds are divided into two operable units. The Active Area Operable Unit includes Ponds 2 and 3, their inlet and outlet channels, their treatment facilities, the adjacent portion of the Mill-Willow Bypass, and the wildlife ponds. The Inactive Area Operable Unit includes Pond 1, the old Silver Bow Creek channel below Pond 1, an uncontaminated grassland and wet meadow below Pond 1, and the adjacent lower bypass channel.

The September 1990 Record of Decision for the Warm Springs Ponds, as modified by the June 1991 Explanation of Significant Differences and its errata sheet, described the remedy for the Active Area Operable Unit. A major modification of the Explanation of Significant Differences was to divide the entire Warm Springs Ponds area into two operable units. As a result, remedial design and remedial action have proceeded as planned for the active area, but at the same time, more time was allowed for the selection of an appropriate remedy for the inactive area. The final remedial design report for the Active Area Operable Unit, which was submitted by the potentially responsible party, the Atlantic Richfield Company (ARCO), has been approved by the EPA and remedial action construction will begin in July 1992.

In July 1990, the EPA and ARCO entered into an Administrative Order on Consent for the Mill-Willow Bypass Removal Action. This work is completed and is an integral part of the two remedial actions planned for the Warm Springs Ponds system. Briefly, this action involved the following work:

- removal of 436,000 cubic yards of tailings and contaminated soils from the bypass and disposal in a dry portion of Pond 3,

- reinforcing and armoring the Pond 2 and 3 berms (an additional 1 million cubic yards of uncontaminated fill dirt was excavated from the bypass for this purpose); and

- construction of improved inlet and outlet structures and a divider dike between Silver Bow Creek and Willow and Mill creeks.

1.1 THE INACTIVE AREA OPERABLE UNIT

The Inactive Area Operable Unit (Pond 1 and the area below Pond 1) contain about 3.4 million cubic yards of contaminated sediments, tailings and soils.

Approximately 475,000 million cubic yards of these materials are contained within the area below Pond 1. They are overbank deposits that settled out along Silver Bow Creek prior to the construction of Pond 1. This area is similar to the streamside tailings deposits above the ponds, and to a limited degree similar to the overbank tailings deposits, or "slickens" found along the Clark Fork River. The area below Pond 1 is different from these other areas in respect to the fact that water no longer flows freely through this now-isolated channel.

Approximately 2.9 million cubic yards of contaminated sediments, tailings and soils are contained within Pond 1. They settled out of Silver Bow Creek over a short period after Pond 1 was constructed in about 1911. Pond 2 was constructed approximately 5 years later. The tailings and sediments contain some 20 or more contaminants; however, the contaminants of primary concern are arsenic, cadmium, copper, lead and zinc.

The metals-contaminated deposits contained within the inactive area reach depths of 8 to 12 feet. Within the eastern portion of Pond 1 and in the old Silver Bow Creek channel below Pond 1, the deposits are largely submerged under standing water that has seeped from the ponds above. The underlying marsh deposits and other naturally deposited silts and soils, as well as the shallow ground water, have been contaminated by the downward movement of dissolved metals from the overlying tailings and pond bottom sediments.

The remaining two-thirds of Pond 1 (middle and western portions) contains tailings that appear dry on the surface, but are generally in contact with the ground water. That portion of the area below Pond 1 which lies outside of the old flood plain is uncontaminated meadow on the surface; however, the underlying shallow ground water has been affected by seepage from the ponds (see Figures 2A and 2B).

2.0 SITE HISTORY AND SUMMARY OF ENFORCEMENT ACTIVITIES

The discovery of gold along Silver Bow Creek, in 1864, opened the door for mining and its ancillary activities in the upper Clark Fork River basin. Within a few years the gold was depleted, but copper and silver ores were found to be plentiful and of a high grade. Within a span of less than 20 years after the first prospectors found gold in the area's streams and gulches, more than 300 copper and silver mines, numerous ore processing mills, and at least eight open air smelters were operating in Butte alone. Many of the mines, mills and smelters were owned and operated by the Anaconda Copper Mining Company or related companies. The Atlantic Richfield Company is the successor to Anaconda and is the current owner of some of the upstream facilities and the Warm Springs Ponds area.

These early mining, milling, and smelting activities resulted in extensive damage to the Silver Bow Creek drainage basin. First, gold mining in the stream channel devastated its banks and riparian vegetation. The mines, mills and smelters that followed dumped their wastes directly into Silver Bow Creek. As the city of Butte grew, raw sewage was added to the wastes entering the stream. These wastes completely choked off flow in Silver Bow Creek at times, but still had little difficulty finding their way into the Clark Fork River, which alternately carried them and deposited them along its entire length of over 250 miles. Lake Pend Oreille (pronounced Ponderay) in Idaho received some of these wastes before Milltown Dam and the Warm Springs Ponds began to collect them.

Early newspaper accounts and photographs from the turn of the century document the devastation. About 1911, the Anaconda Copper Mining Company built the first settling pond on Silver Bow Creek in an attempt to prevent wastes from entering the Clark Fork River. This is now known as Pond 1 of the Warm Springs Ponds system. Pond 1, and Pond 2 which was built about 5 years later, experienced various breaches and overflows which led to contamination in the Warm Springs Ponds inactive area and the Clark Fork River below.

The direct discharge of mining, milling and smelting wastes into Silver Bow Creek continued until the early 1970s. Altogether, over 19 million cubic yards of tailings and sediments have settled in the Warm Springs Ponds and an additional 3 million cubic yards reside along the banks of Silver Bow Creek above the ponds. Leaching and run off from upstream sources continue to degrade Silver Bow Creek and add contamination to the ponds.

The volume of waste in the three ponds, if removed and transferred to another location, would cover an area equal to 100 football fields, 90 feet deep. In addition to the extraordinary volume of waste present, their moisture content and their ability to retain moisture for many decade, after being removed from a wet environment present difficulties with respect to moving and containing them.

The sources of hazardous substances, pollutants, and contaminants at the Warm Springs Ponds inactive area are varied. The several smelters and mills that were established and operated in Butte, from approximately 1880 until 1940, disposed their mining wastes in Silver Bow Creek. Tailings and other mine wastes are still located at these former facilities, and they continue to leach contaminants into Silver Bow Creek. Additionally, mine water and discharges from the Weed Concentrator were discharged into Silver Bow Creek for several years. The Anaconda Smelter operations also contributed waste to the Warm Springs Ponds area, through various ditches and conveyances. All of these sources led to the migration of substantial quantities of mine wastes downstream to, among other places, the Warm Springs Ponds inactive area.

The land uses in this area are principally agriculture and tourism. The adjacent community of Warm Springs grew up around a major state facility for mental rehabilitation. The small community of Opportunity and a few rural homes are located within a few miles of the ponds. The nearest city is Anaconda, about 7 miles to the west.

The Opportunity tailings ponds are located less than one mile west of the Warm Springs Ponds. The Opportunity tailings ponds cover over 4,600 acres and are mostly dry, exposed tailings deposits. This area is part of the Anaconda Smelter Superfund Site.

The Silver Bow Creek site was listed on the NPL in 1983. The site was expanded to include large areas in and around Butte, in 1987. EPA, through a cooperative agreement with MDHES, conducted a site wide remedial investigation-the Phase I investigation-which was released in 1987. MDHES also conducted a Phase II investigation, which focused on the Warm Springs Ponds area specifically, was released in 1989. A feasibility study, which included a risk assessment for the Warm Springs Ponds area, was released in 1989. Following public comment on a proposed plan for the entire Warm Springs Ponds area, EPA issued a Record of Decision in 1990. The Record of Decision was changed in an Explanation of Significant Differences and its errata sheet, which limited EPA's cleanup decision to the active area only, and reserved further decisions for the inactive area for a future Record of Decision. Under EPA oversight, ARCO conducted an analysis of remediation alternatives for the inactive area. The alternatives analysis was released in 1991. EPA issued a proposed plan for the inactive area in March 1992.

ARCO, the successor-in-interest to the Anaconda Minerals Company and other smelter and mill operators in Butte, is the current owner of the Warm Springs Ponds inactive area.

MDHES, through its Water Quality Bureau, issued an order in 1967 which required the Anaconda Minerals Company to prevent the introduction of heavy metal salts from the Warm Springs Ponds into the Clark Fork River by, among other things, pumping back contaminated water from below Pond 1 to the treatment system above. In 1989, MDHES, again through its Water Quality Bureau, issued an order to ARCO requiring berming below the Warm Springs Ponds to prevent migration of tailings and other contaminated material which were causing fish kills in the Clark Fork River.

In 1990, pursuant to CERCLA Section 106, EPA ordered ARCO to remove all tailings and soils contaminated with heavy metals from the Mill-Willow Bypass. This work is essentially completed and to some extent is incorporated into this Record of Decision and the September 1990 Record of Decision for the active area. In 1991, EPA ordered ARCO to implement the Warm Springs Ponds active area remedy, again pursuant to CERCLA Section 106. ARCO will begin remediation of the active area in July 1992.

3.0 HIGHLIGHTS OF PUBLIC PARTICIPATION

In 1983, the initial community relations plan for the Silver Bow Creek site (the site name has since been changed to include the Butte area) designated the Butte-Silver Bow County Health Department as the focal point for community involvement and included the formation of a local citizens' advisory committee. The committee assisted the State in the selection of a contractor for the Phase I remedial investigations of the site. A significant portion of the Phase I study characterized the contamination present at the Warm Springs Ponds.

In 1985, a review of the community relations plan by the EPA brought about several improvements, including a toll-free telephone number, fact sheets and updates, and an increase in the number of informal meetings with the public. These improvements were put in place by the State over a period of about two years.

The Phase II remedial investigation, followed by a feasibility study, began in 1986 at what was then a single Warm Springs Ponds operable unit. The RI/FS continued through 1989 as a State-lead effort. During that time, MDHES and EPA staff provided information about the Warm Springs Ponds activities at public meetings and through fact sheets and progress reports. These reports were distributed to people on a mailing list in November 1986, November 1987, May 1988, July 1988, August 1988, October 1988, June 1989, September 1989, and May 1990. The mailing list grew from 271 individuals in 1987 to about 800 individuals in 1990. Special interest groups that indicated concern about the site included the Clark Fork Coalition, Butte Chapter of Trout Unlimited, Skyline Sportsmen of Anaconda, the Deer Lodge Chapter of Trout Unlimited, George Grant Chapter of Trout Unlimited, Anaconda Sportsmen's Club, Pintlar Audubon, and Upper Clark Fork Chapter of Trout Unlimited.

The Warm Springs Ponds Feasibility Study and proposed plan were released for public review in October 1989. The MDHES held public informational meetings in Butte, Anaconda, and Missoula during October 1989 and formal public hearings in the same cities in December. The public comment period for the feasibility study and proposed plan was open from October 1989 until the end of January 1990.

Toward the close of the public comment period in January 1990, the EPA became the lead agency for the Silver Bow Creek site. Overwhelming opposition to an impoundment proposed for the Opportunity area caused the EPA to reject much of the proposed plan for the Warm Springs Ponds remedy and combine the elements of other alternatives examined in the feasibility study in order to devise a remedy that was both acceptable to the majority of the public and adequately protective of human health and the environment.

Although the record shows there was considerable effort put forth by the agencies to involve the public, many commenters expressed dissatisfaction with the level of public involvement in the process of selecting a remedy for the Warm Springs Ponds. That perception, more than any other consideration, influenced the EPA to defer a decision with respect to Pond 1 and the area below Pond 1, examine feasible alternatives more carefully, and involve the public fully in the selection of a remedy. Thus, EPA divided the Warm Springs Ponds into two operable units.

The Record of Decision (ROD) for the Warm Springs Ponds was signed in September 1990. The ROD included Pond 1, but deferred the decision on the area below Pond 1 for a year. By May 1991, EPA and the State realized that a decision for Pond 1 (and the area below) would involve more time and effort, and would delay the remedy for Ponds 2 and 3. EPA wrote an Explanation of Significant Differences (ESD) which laid out the rationale for splitting Warm Springs Ponds into two operable units: the Active Area (Ponds 2 and 3) and the Inactive Area (Pond 1 and the area below), as well as documenting some changes to the active area remedy. Using this division, EPA could proceed with the active area remedy and yet give sufficient time and effort to deciding on an appropriate remedy for the inactive area.

The EPA endeavored for over a year to involve all affected parties before arriving at a recommended remedial action plan for the inactive area. Five public scoping meetings were held throughout the basin and numerous briefings and individual contacts were conducted during 1991 and early part of 1992. In response to concerns expressed at these meetings, particularly by Deer Lodge and Missoula residents, the EPA ordered or conducted supplemental feasibility studies. A fact sheet outlining the EPA's plans for both the inactive and active areas was issued in July 1991 to residents of the basin.

The proposed plan for the Inactive Area Operable Unit was issued in March 1992 and two final public hearings were held in Anaconda and Missoula before the close of the public comment period. While no single remedy preferred by the EPA ever seems to be unanimously favored by all parties concerned, this remedy selection process was carried out under intense public scrutiny and the selected remedy is favored by a clear majority of the affected public.

Information repositories, containing key site studies, indexes and reports, are presently maintained at the following locations: University of Montana Library in Missoula, National Park Service Main Office in Deer Lodge, Hearst Free Library in Anaconda, Montana Tech Library in Butte, and the Butte EPA office. The complete administrative record is maintained in microfilm at the University of Montana and Montana Tech, and in hard copy at the EPA's offices in the Helena Federal Building, 301 South Park.

4.0 SCOPE AND ROLE OF OPERABLE UNIT WITHIN SITE STRATEGY

The Silver Bow Creek/Butte Area Superfund Site, because of its complexity and size, has been separated into several remedial operable units. They are:

OU1 Streamside Tailings (Silver Bow Creek from the Colorado Tailings to the Warm Springs Ponds; RI/FS underway)

OU3 Mine Flooding/Berkeley Pit (RI/FS underway; ROD expected in 1994)

OU4 Warm Springs Ponds Active Area (Remedial Action begins in 1992; Mill-Willow Bypass Removal Action completed)

OU7 Rocker (Removal of 1,000 cu yds completed in 1989; RI/FS underway)

OU8 Butte Priority Soils (RI/FS began in 1992)

OU12 Warm Springs Ponds Inactive Area (Record of Decision in 1992; Remedial Action begins in 1993; Remedial Action completion expected in 1994).

OU13 Butte Non Priority Soils Operable Unit (RI/FS and ROD pending)

OU14 Butte Active Area (RI/FS and ROD pending)

OU15 Final Evaluation of the Warm Springs Ponds (following upstream cleanup)

In addition, several removal actions have been or will be implemented at the site, including the Mill-Willow Bypass removal, Travona Mine Shaft Control, residential soils cleanups, and the Lower Area One cleanup.

The site and its operable units are part of the larger and more encompassing Clark Fork River Basin Superfund Complex, which consists of three additional NPL sites and their approximately 17 operable units. They are the Montana Pole, Anaconda Smelter, and Milltown Reservoir NPL sites.

The studies and actual cleanup activities being conducted at each site vary greatly. The Clark Fork River Basin Master Plan established priorities among the sites and operable units, based upon their relative importance in terms of risks to human health and the environment. The Warm Springs Ponds ranked very high in terms of environmental risks.

The remedial investigations (Phase I and II), public health and environmental assessment, and initial feasibility study for the Warm Springs Ponds were conducted with a single, comprehensive remedy intended. The decision to divide the pond system into two operable units was made late in the process. The rationale for that decision is adequately discussed in previous sections. It is emphasized here in order to point out that for the inactive area, the characterization of the nature and extent of contamination, the identification of risks, the definition of problems, and the development of possible remedies were largely the product of a single, comprehensive study that made no distinction between the active and inactive areas. That fact has not necessarily complicated the remedy selection process for the inactive area; it has simply made it necessary to discuss the active area throughout much of this decision document.

The selected remedial action for the inactive area is the third, and possibly the last, response action planned for the Warm Springs Ponds. It follows the Mill-Willow Bypass Removal Action and it will dove-tail with the remedial action for the active area. In fact, a few components of the active area remedy must await initiation of remedial action construction for the inactive area. For example, the final excavation of a flood channel in the portion of the bypass adjacent to Ponds 2 and 3 cannot be carried out until work begins on Pond 1. The excavated fill material will be used to raise and strengthen the Pond 1 berms and the newly proposed extended berm.

Once completed, the inactive area will be an important buffer area between the Clark Fork River and the active portion of the ponds. The inactive area will also, when completed, provide much improved fish and waterfowl habitat. Wetlands areas will be greatly enhanced.

The Warm Springs Ponds, as a whole, are an initial safety net for the Clark Fork River. Until contaminated areas upstream are remediated, the ponds are necessary for water treatment and protection in the event of floods or earthquakes.

The interim nature of the remedy selected for the inactive area, as is the case for the active area, is an expression of the fact that no remedy here can be considered final until the upstream sources of contamination have been eliminated and the decisions to leave wastes in place at the ponds have been monitored and fully evaluated.

Although tailings and contaminated sediments will be left in place by the selected remedy, they will be confined behind berms that will meet stringent flood and earthquake protection requirements and they will be rendered less mobile and less toxic by chemical fixation and wet-closure. Therefore, the selected remedy will conform with the statutory preference for reducing toxicity and mobility as a principal element of the remedy. It will not reduce the volume; however, it will immobilize the waste in a permanent manner, as opposed to transferring this extraordinary volume of waste to another area in the basin, which would raise difficult implementability and safety issues.

5.0 SUMMARY OF SITE CHARACTERISTICS

5.1 SURFACE HYDROLOGY

The Warm Springs Ponds Inactive Area Operable Unit consists of Pond 1, the area below Pond 1 north to approximately one-quarter mile above the Clark Fork River, and the downstream portion of the Mill-Willow bypass (lower bypass). The bypass channel in this area carries the combined flows of Mill, Willow, and Silver Bow creeks, the last of which flows through Ponds 3 and 2 before joining the bypass (Figure 1). The lower bypass combines with Warm Springs Creek north of the inactive area to form the Clark Fork River. The bypass was constructed during the late 1960s to route the relatively uncontaminated Mill and Willow creeks around the pond system. The average flow of Silver Bow Creek is 73 cfs, and the combined flows of Mill and Willow creeks average 27 cfs.

The total average flow of 100 cfs in the lower bypass is augmented by the average flow of 47 cfs in Warm Springs Creek north of the inactive area to form the Clark Fork River. Warm Springs Creek occasionally exhibits elevated levels of metals, due to past milling and smelting activities in the Anaconda area, west of the Warm Springs Ponds. It is being addressed as part of the Anaconda Smelter Superfund site cleanup.

5.2 GROUND WATER HYDROLOGY

The shallow ground water system in the inactive area is complex, due to the heterogeneity of the surface geology in the area. The site is in a ground water discharge area for the upper Deer Lodge Valley, typified by shallow ground water tables and swamps. The presence of the Warm Springs Ponds affects shallow ground water elevations and ground water movement within the area.

Shallow aquifers occur along present-day stream channels, but do not extend laterally throughout the area. Deeper aquifers are associated with Tertiary-age valley fill and thick deposits of glaciofluvial material. These aquifers generally exhibit moderate to low permeabilities and are probably connected on a regional scale, although fine-grained interbeds tend to confine the deeper aquifers locally.

The uppermost aquifer at the site is a 10- to 15-feet-thick sand and gravel unit, which is typically present approximately 10 feet below ground surface. This sand and gravel aquifer appears to be present throughout most of the area. Ground water movement through the area is generally from south to north.

No domestic wells are located within the inactive area. Several wells are located within a mile to the east of the inactive area, but these wells are completed in bedrock aquifers that do not appear to be affected by the pond system. The town of Warm Springs, to the west of the inactive area, derives its water from supply wells constructed in unconsolidated Tertiary deposits, from depths of approximately 200 feet. These wells appear to be supplied with water derived from ground water resources west of and hydraulically isolated from the inactive area.

5.3 NATURE AND EXTENT OF CONTAMINATION

Sediments, surface water, soils, and ground water are all affected by contaminants in the inactive area. Four contaminated media have been identified for the operable unit: pond bottom sediments, surface water, ground water, and tailings deposits and contaminated soils. The patterns of contamination of each of these environmental media are the result of migration of the contaminants within and between them. The media are discussed in the following sections. Table 1 presents a breakdown of the areas and volumes for ground water, pond bottom sediments, exposed tailings and contaminated soils.

5.3.1 Sediments, Tailings, and Contaminated Soils

Two of the media–the pond bottom sediments, and the tailings deposits and contaminated soils–contain the majority of the contaminants in the inactive area. These materials are typically fine to coarse sand and generally contain metals associated with the sulfide ore body present near Butte. Pond bottom sediments are also comprised of precipitated hydroxides and oxyhydroxides resulting principally from the addition of lime to treat the water entering the pond system and from biologically mediated precipitation.

The exposed (unsubmerged) sediments, tailings deposits and contaminated soils in the inactive area cover approximately 135 acres. Thicknesses of these deposits range from about

Table 1 Summary of Areas and Volumes of Contaminated Media			
	Area (acres)	**Volume (acre-feet)**	**Volume (cubic yards)**
Pond Bottom Sediments			
Pond 1			
Exposed Sediments	59	455	734,000
Vegetated/Submerged Sediments	225	1,340	2,156,000
Total Pond Bottom Sediments	**284**	**1,795**	**2,890,000**
Tailings Deposits and Contaminated Soil			
Area Below Pond 1			
Exposed Tailings	17	48	77,400
Vegetated Tailings & Contaminated Soil	59	246	397,000
Total Tailings Deposits and Contaminated Soil	**76**	**294**	**474,400**
Ground water*			
Area of contaminated aquifer beneath and downgradient of Pond 1	180		
*Exceedences of primary maximum contaminant levels for arsenic and cadmium.			

Source: CH2M HILL, 1989

an inch to several feet. The submerged sediments in Pond 1 cover an area of approximately 225 acres and range in thickness from less than one foot to approximately 13 feet. (See Table 1.)

The tailings and associated soils below Pond 1 occur primarily within and adjacent to the old channel of Silver Bow Creek and were likely deposited before the ponds were constructed. The estimated area and volume of tailings and associated soils between the Pond 1 berm and the existing lower bypass ranges from 63 acres and 390,600 cubic yards[1]

---

[1] CH2M HILL, 1989

to 70 acres and 283,000 cubic yards[2]. The average depth of tailings and associated soils is about 2.5 feet. Natural fine-grained soils are present beneath the tailings and associated soils to an average depth of five feet, where the sand and gravel aquifer unit is encountered. An additional 10,000 cubic yards of metals-bearing bottom sediments are estimated to be present within man-made channels below Pond 1.

Figure 3 shows the extent of tailings and pond bottom sediments within the inactive area. The differentiation between tailings and pond bottom sediments is not distinct because the material types associated with each are similar. Figure 3 shows pond bottom sediments that are or were historically submerged. Tailings are those metals-enriched materials that are generally located adjacent to the old Silver Bow Creek channel. These materials are often mixed with native soils and are present both in exposed areas and in areas that are partially to well vegetated. Calculations indicate that 2.9 million in-place cubic yards of pond bottom material has accumulated in Pond 1.

Tailings along the lower bypass are visible within the active channel and along the first terrace adjacent to the channel. Contaminated soils are present between visible tailings deposits and mixed with tailings.

Metallic salts are commonly present during summer months along the bypass at the surface of the tailings deposits. These salt deposits are derived from slow oxidation of the metal sulfides in the tailings deposits, which then wick to the surface during dry periods as soluble salts. These salts form crystalline deposits that dissolve during rainstorms and wash into the bypass. This phenomenon is probably responsible for the fishkills that occurred in the past along the bypass and in the upper Clark Fork River. The majority of these tailings deposits were located along the upper bypass channel, which was cleaned up in 1990 and 1991 under an Administrative Order on Consent.

Pond bottom sediments were sampled at six sites throughout Pond 1. At each site, multiple samples were taken with depth in the sediment profile. The samples were analyzed for total metals, common ions, cyanide, and percent solids. Average concentrations of arsenic, cadmium, copper, lead, manganese, and zinc in Pond 1 sediments are present above reported background levels (Table 2).

---

[2]ESA, 1991

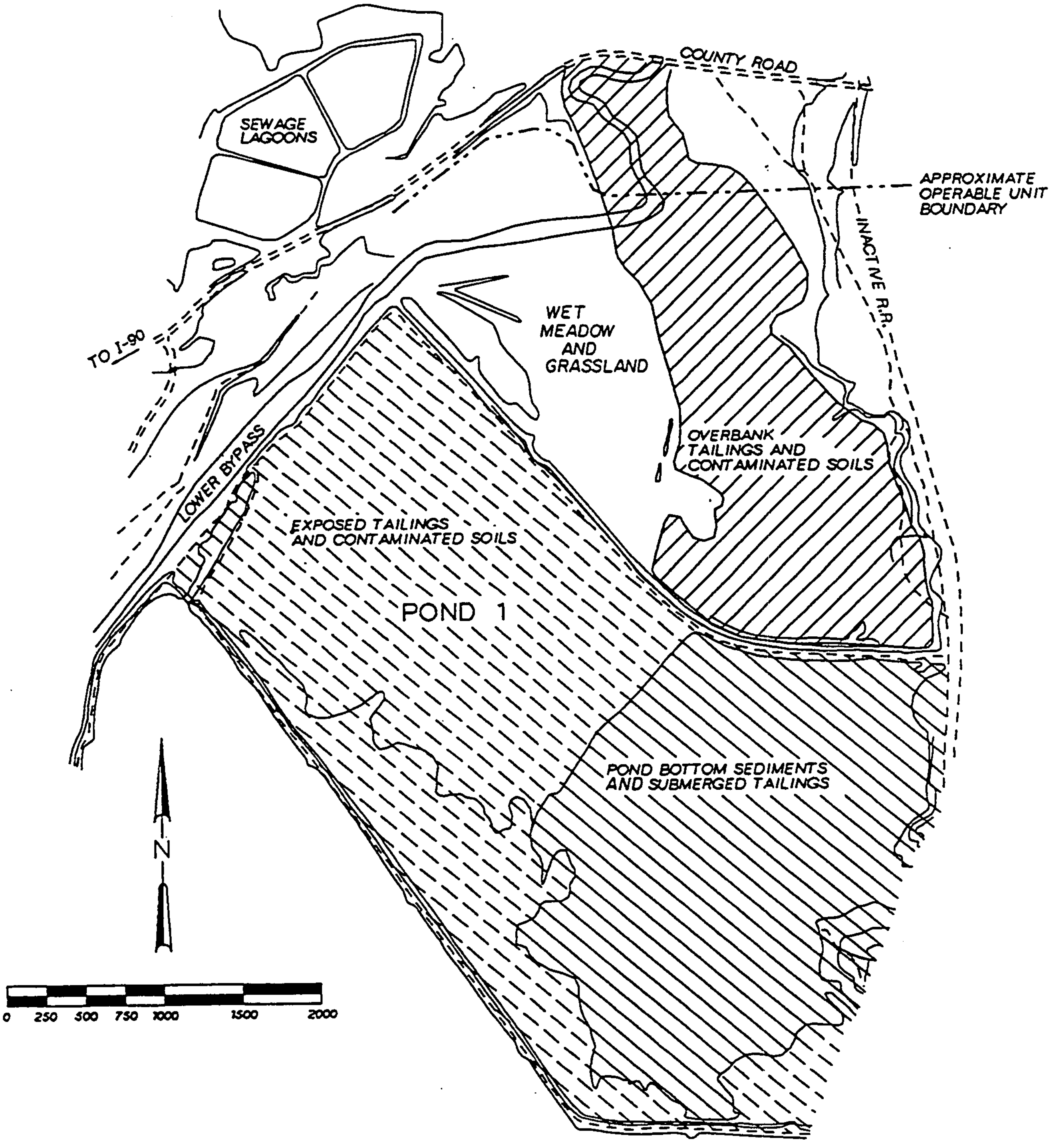

FIGURE 3

POND BOTTOM SEDIMENTS, TAILINGS, AND CONTAMINATED SOILS

WARM SPRINGS PONDS INACTIVE AREA

BO168059.E5.RD

18-Jun-1992 13:34:26 68059-C.DGN

Table 2
Maximum, Minimum and Average Values
Pond 1 Bottom Sediments

Parameters	No. of Samples	Minimum[a]	Maximum[a]	Average[a]	Background[b]
Aluminum	28	3,190	20,300	9,174	–
Antimony	28	7	17	10	–
Arsenic	28	6	1,850	408	10
Barium	28	47	287	199	–
Beryllium	28	0	2	1	–
Cadmium	28	1	66	10	0.4
Calcium	28	1,690	198,000	37,318	–
Chromium	28	5	76	29	–
Cobalt	28	2	19	5	–
Copper	28	19	9,390	2,886	35
Iron	28	4,880	119,000	51,012	–
Lead	28	8	1,920	670	25
Magnesium	28	1,230	27,700	5,864	–
Manganese	28	120	9,320	2,717	250
Mercury	28	0	6	2	–
Nickel	28	3	50	10	–
Potassium	28	928	3.210	2,040	–
Selenium	28	0	11	3	–
Silver	28	1	26	11	–
Sodium	28	326	1,120	512	–
Thallium	28	0	1	1	–
Vanadium	28	6	63	33	–
Zinc	28	70	7,900	2,212	60
Cyanide	28	1	1	1	–
% Solids (wt. %)	28	37.4	92.1	64.8	–
Specific Conductance (umho/cm)	28	555.0	4180.0	1522.8	–
pE (mV)	28	-160.0	510.0	40.2	–
pH (pH units)	28	2.3	8.3	5.6	–

[a]All units are mg/kg unless otherwise noted.
[b]From Moore, 1985.

NOTES: Undetected parameters are assumed to be at the detection limit. Statistics are computed from the results from natural samples.

SOURCE: CH2M HILL, 1989.

5.3.2 Surface Water

Surface water in the inactive area includes Pond 1, standing water below Pond 1, and the lower bypass channel. Pond 1 currently collects seepage from Pond 2. This water is pumped back into Pond 2 periodically (see Table 3). Water seeping from below the Pond 1 berm is also pumped back into Pond 1 periodically. Seepage water pumped back into Pond 1 has historically been treated with lime slurry, although no observations of this practice were made during the remedial investigation.

The data obtained during the remedial investigation characterize the surface water for near-average bypass flow rates. Few data are available to characterize the surface water quality during higher flows because of drier-than-normal conditions in the area experienced during the remedial investigation. No opportunity was available during the sampling period to collect flow and contamination data during one of the high runoff events that caused Silver Bow Creek to flow around the pond system, through the bypass.

Surface water samples were collected at seven sampling points in and adjacent to the inactive area during the Phase I remedial investigation. Although metals concentrations are reduced in the pond system upstream of the inactive area, Montana's chronic ambient water quality standards for copper, lead, and zinc were occasionally exceeded in the lower bypass, particularly in winter months.

Surface water quality data also indicate that Montana primary drinking water standards for arsenic (0.05 mg/l) were exceeded in the lower bypass during the two highest measured flow events, and the arsenic standard was regularly exceeded in surface water pumped from below Pond 1.

5.3.3 Ground Water

Ground water quality data were generated through sampling of 14 monitoring wells on two occasions (January and May, 1988). Figure 4 shows the locations of the monitoring wells within the area. Table 4 summarizes ground water quality data for these monitoring wells. With one exception, all detected exceedences of the primary maximum contaminant levels for metals (arsenic and cadmium) were north of the Pond 1 berm. Ground water quality downgradient of Pond 1 is generally of poorest quality immediately north of the berm; most

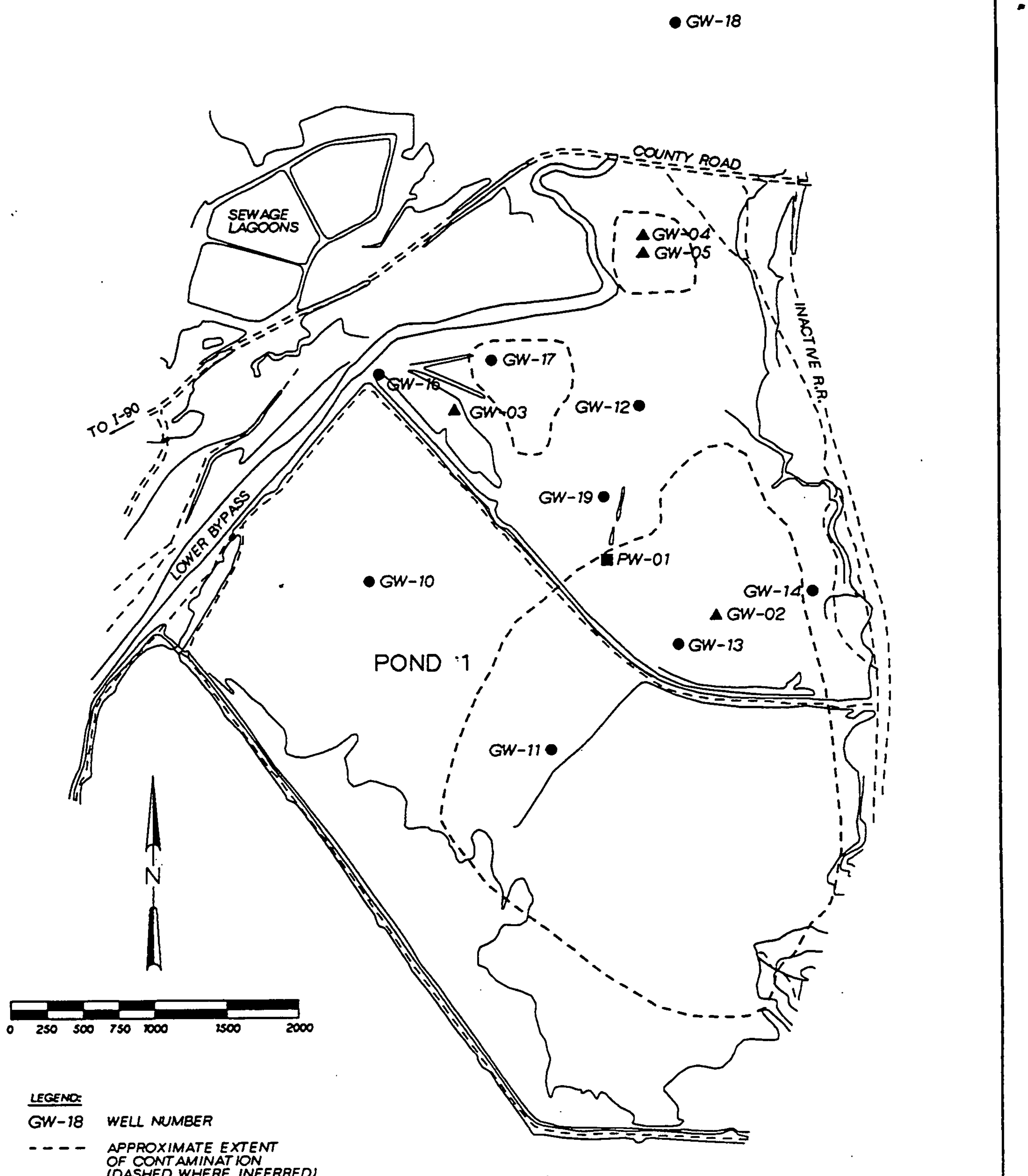

FIGURE 4

MONITORED WELL LOCATIONS AND EXTENT OF GROUNDWATER EXCEEDING PRIMARY MCL FOR CADMIUM AND ARSENIC

WARM SPRINGS PONDS INACTIVE AREA

BO168059.E5.RD

18-Jun-1992 13:34:26 68059-C.DGN

metal contaminants decrease to the north, or downgradient of the pond system (see Table 4). Concentrations of most metals also decrease with depth. Only one sample obtained from monitoring wells located adjacent to the bypass exceeded maximum contaminant levels (MCLs) for primary drinking water standards. The sample was obtained from the area just north of the northwest corner of Pond 1. This sample contained a cadmium concentration of 11.7 μg/l which is slightly in excess of the standard for cadmium of 10.0 μg/l.

Highest concentrations of metals are generally associated with the shallow sand and gravel aquifer in the area immediately below the Pond 1 berm. Calculations of ground water discharge from the area below Pond 1 into the Clark Fork River indicate that the ground water system contributes very little flow to the river because of the relatively low permeability and low gradient of the shallow aquifer. Under average conditions, the flow in the Clark Fork River is approximately 137 cfs, while the ground water discharge to the river is approximately 1.0 cfs. Nevertheless, the exceedences of the maximum contaminant levels for arsenic and cadmium in the ground water constitute a violation of the drinking water standards.

Table 3
Summary of Surface Water Quality Data
Pond 1

Parameter[a]	Average	Maximum	Minimum
Flow (cfs)	12.1	2.2	0.40
Temperature (°C)	10.9	25	1.0
pH (s.u.)	7.4	8.1	6.5
SC (μmhos/cm @ 25°C)	1489	1740	1130
TSS	12	19	2
SO_4	741	998	425
Nitrate	2.00	4.20	0.48
Alkalinity	132	192	95
Hardness	779	988	499
As (T)	0.004	0.012	[b]
Cd (T)	[b]	[b]	[b]
Cu (T)	0.014	0.055	[b]
Cu (D)	[b]	[b]	[b]
Pb (T)	0.001	0.0086	[b]
Fe (T)	2.32	7.99	0.047
Fe (D)	1.16	5.34	[b]
Zn (T)	0.056	0.135	0.016
Zn (D)	0.105	0.127	[b]

[a]Values in mg/l unless otherwise noted; (T) is total; (D) is dissolved.
[b]Parameter not analyzed.

Source: CH2M HILL, 1989

Table 4
Ground water Quality Data Summary
Warm Springs Ponds Inactive Area

Parameter	Maximum Concentration[a]	Minimum Concentration[a]	Average Concentration[a]	Number of Samples	Maximum Contaminant Level[a] (Montana Ground water Regulations)
Downgradient of Pond 1 (Shallow Wells)					
Arsenic	197.0	<2.0	28.0	14	50[b]
Cadmium	12.7	<5.0	3.6	14	10[b]
Copper	15.9	<6.0	5.8	14	1,000[c]
Lead	<2.0	<1.0	2.0	14	50[b]
Manganese	31,600	309	10,297	14	50[c]
Zinc	253	16.3	89.0	14	5,000[c]
Iron	80,900	45	16,220	14	300[c]
Sulfate (mg/L)	1,620	250	950	14	250[c]
Downgradient of Pond 1 (Deep Wells)					
Arsenic	<3.0	<2.0	1.0	13	50[b]
Cadmium	8.4	<5.0	4.3	13	10[b]
Copper	<8.0	<6.0	3.5	13	1,000[c]
Lead	<2.0	<1.0	0.8	13	50[b]
Manganese	4,460	3.0	577	13	50[c]
Zinc	43	6.2	19.8	13	5,000[c]
Iron	409	<15	52	13	300[c]
Sulfate (mg/L)	1,150	<55	531	13	250[c]

[a]All values in ug/l unless otherwise noted.
[b]Primary standard (based on health criteria).
[c]Secondary standard (based on suitability criteria).

NOTES
1. Shallow wells are generally less than 15 feet deep; deep wells are generally 25 to 40 feet deep.
2. Shallow wells downgradient of Pond 1 include WSP-GW-02S, 03S, 05, 12S, 13S, 14S, and 19S.
3. Deep wells downgradient of Pond 1 include WSP-GW-02D, 03D, 04, 12D, 13D, 14D and 19D.
4. Average values calculated using one-half detection limit, when applicable. January and May 1988 data.
5. Additional maximum contaminant levels are: mercury and compounds: 2; nitrate: 10,000; selenium and compounds: 10; and silver 50.

Source: CH2M HILL, 1989

5.3.4 Exposure

The types and characteristics of contaminants with respect to toxicity, carcinogenicity, and mobility are covered in Section 6.0 (Summary of Public Health and Environmental Assessment). Discussion of contaminant migration pathways and potential effects on humans and environmentally sensitive areas is also presented in this section.

6.0 SUMMARY OF HUMAN HEALTH AND ENVIRONMENTAL RISKS

A public health and environmental assessment (PHEA) was conducted by the Montana Department of Health and Environmental Sciences in support of the Warm Springs Ponds Feasibility Study. As noted earlier, the feasibility study, and likewise the public health and environmental assessment, were prepared with the intent of a single, comprehensive remedy for the Warm Springs Ponds. Although the ponds were later divided into two separate operable units, the EPA believes that the human health and environmental risks characterized by the comprehensive risk assessment clearly establish endangerment not only for the pond system as a whole, but for each operable unit by itself.

The subsections that follow will:

- Identify the contaminants present in the inactive area;
- Briefly review concentrations of the contaminants of primary concern for human health;
- Summarize the human exposure assessment and human toxicity assessment;
- Characterize the migration pathways and associated human health risks (both carcinogenic and noncarcinogenic risks);
- Summarize the effects of the contaminants on plants, fish and wildlife, including endangered species; and
- Summarize the potential catastrophic risks associated with dam failure.

6.1 IDENTIFICATION OF CONTAMINANTS

Section 5.0, Summary of Site Characteristics, identifies the contaminants present in the inactive area, describes their nature and extent, and discusses pathways of migration. The media affected are surface water, ground water, pond bottom sediments, exposed and submerged tailings deposits, and soils. These media are affected by elevated concentrations of some 20 or more elements, each of which is defined as a hazardous substance when present at the concentrations found in the inactive area. Table 2 (see Sec.5.0, Summary of Site Characteristics) lists these elements and their maximum and average concentrations as measured in the pond bottom sediments of Pond 1. Other tables show contaminants present in the other media. (See Tables 3 and 4).

The elements of primary concern, or indicator chemicals, were selected from the entire list of elements in order to focus on those which pose the greatest risks to human health and the environment. Based on their potential to promote or cause adverse effects in humans, arsenic, cadmium, and lead were selected as indicator chemicals. These three elements, together with copper and zinc, were also selected as indicator chemicals based on their potential to promote or cause adverse environmental effects. Copper and zinc are particularly harmful to many aquatic organisms.

The average concentration of arsenic in Pond 1 bottom sediments is 408 mg/kg, and in tailings and soils below Pond 1 arsenic averages 593 mg/kg. These average concentrations are more than one order of magnitude greater than background. The maximum concentration of arsenic measured in Pond 1 bottom sediments was 1,850 mg/kg, or roughly two orders of magnitude greater than background.

The shallow ground water in the area below Pond 1 averages 0.028 mg/l arsenic, with a maximum concentration measured as 0.197 mg/l. The maximum contaminant level (MCL) for arsenic is 0.05 mg/l.

The average concentration of copper in Pond 1 bottom sediments is 2,886 mg/kg, and in tailings below Pond 1 averages 18,147 mg/kg. The maximum copper concentration measured in Pond 1 bottom sediments is 9,390 mg/kg, and the maximum copper concentration measured in tailings below Pond 1 was over 66,000 mg/kg. The background concentration of copper for this area is about 35 mg/kg.

The concentrations of the remaining contaminants of concern--cadmium, lead and zinc--in tailings and pond bottom sediments of the inactive area show significant enrichment over background levels as well, as shown in the tables of Section 5.0, Summary of Site Characteristics.

Briefly, other parameters indicative of the presence of metals, such as pH and specific conductance, are noteworthy. Porewater from Pond 1 bottom sediments, for example, was found to be very acidic (pH as low as 2.3) and very high in terms of specific conductance (as high as 4,180 umho/cm). These extreme conditions do not depict the average; however, aquatic organisms are very susceptible to low pH levels.

6.2 SUMMARY OF HUMAN EXPOSURE ASSESSMENT

A thorough human exposure assessment is presented in the 1989 Warm Springs Ponds Feasibility Study Report (Section 3.0 and Appendix A). The human exposure assessment combines contaminant concentrations of the various media with known or suspected mechanisms by which humans may be exposed to these media. Figure 5, Pathways of Exposure, depicts the mechanisms by which people who recreate or work at the Warm Springs Ponds and people who reside nearby may be exposed.

The ponds are a favorite fishing and hunting spot for many residents of Anaconda, Deer Lodge, Butte, and surrounding areas. These recreational users and year around workers, such as fish and wildlife biologists or employees of ARCO, frequently come into contact with the surface water, exposed tailings, and pond sediments. Their direct contact with these contaminated media (incidental ingestion and dermal absorption), and their indirect contact by inhalation of wind-entrained tailings and soils, constitute exposure.

Residents of the small community of Warm Springs are exposed by means of inhalation of wind-entrained tailings and soils. (See Figure 6, Source Areas and Receptors of Wind-Entrained Contaminants.)

No direct human exposure to contaminated ground water has been identified, therefore no current pathway exists for the contaminants dissolved in ground water. However, potential pathways are possible if the ground water contamination is not contained and the ground water is used. The ground water also flows into nearby surface water, which has recreational, wildlife, and public uses.

The exposure assessment calculated the quantity of contaminated media that a human receptor ingests, inhales, or absorbs (dermal contact). The incidental ingestion of

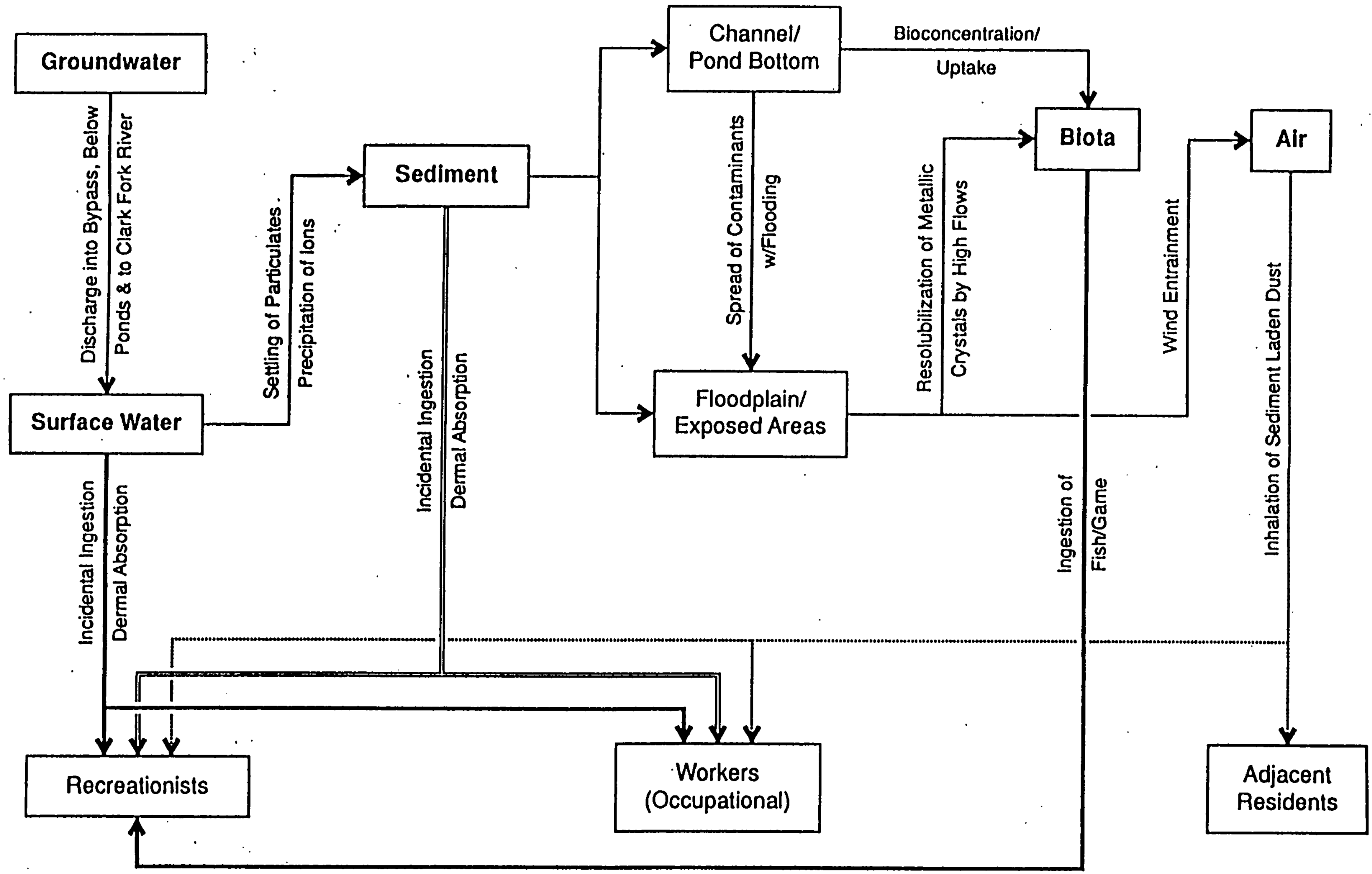

FIGURE 5

PATHWAYS OF EXPOSURE
WARM SPRINGS PONDS

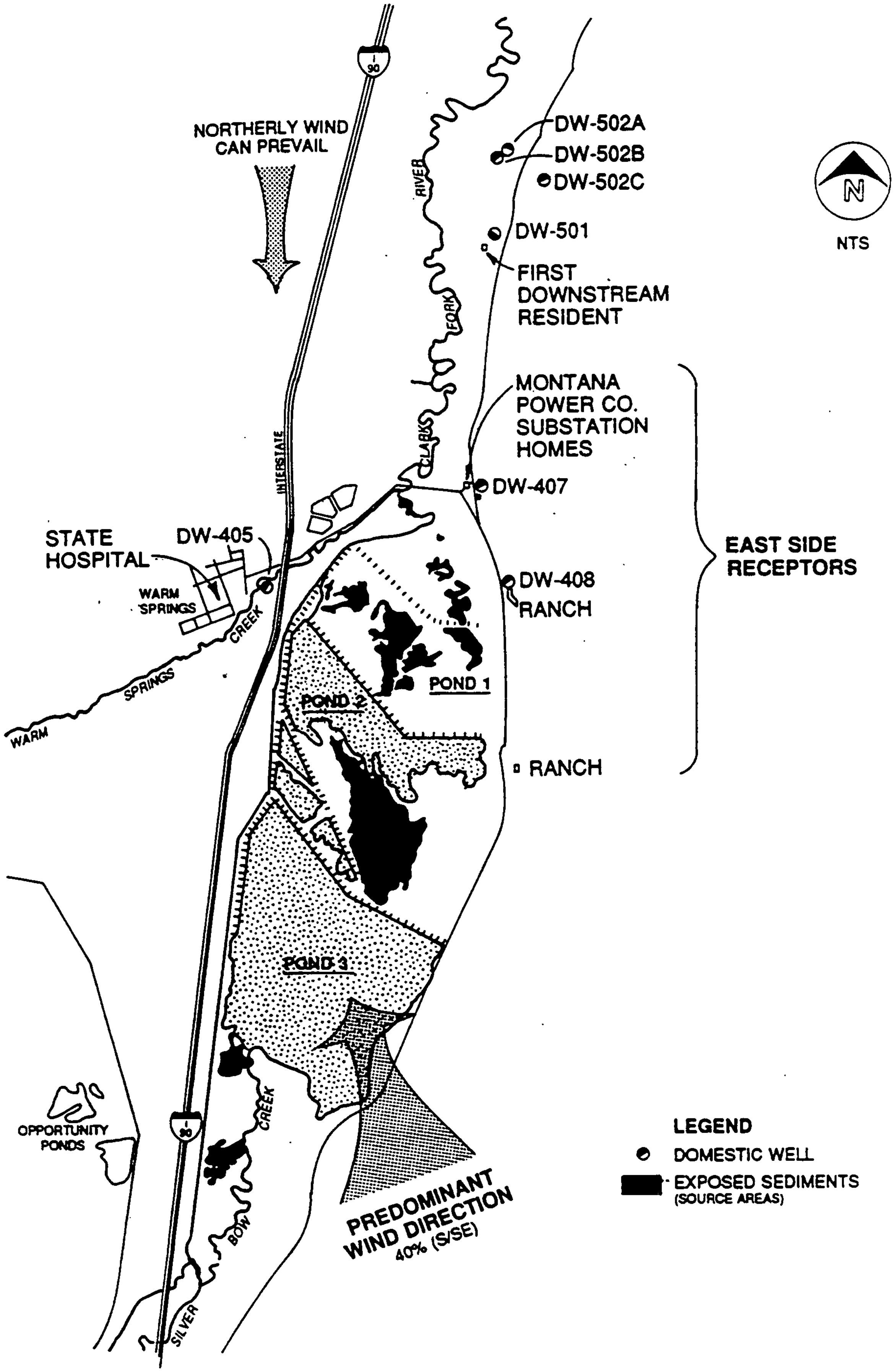

FIGURE 6

LOCATION OF SOURCE AREAS AND RECEPTORS

WARM SPRINGS PONDS SYSTEM

contaminated sediments by a year around worker, for example, was based on a daily intake estimate of 10-50 mg/day. After factoring the receptor's age and weight, the lifetime daily intake estimate was calculated to be 0.04 to 0.21 mg/kg/day.

One additional mechanism for exposure is noteworthy. Failure of the Pond 1 berms due to a flood or earthquake is not an unlikely scenario. The berms do not meet current dam safety standards. Should either a flood or earthquake occur, of sufficient magnitude to cause dam failure, contaminated surface water, bottom sediments and tailings would move down the Clark Fork River, creating not only a brief catastrophic risk of loss of life, but also a broader area of contamination than exists within Pond 1 at present.

Finally, future residential exposure and the risks posed by this scenario were examined in the feasibility study; however, the likelihood of residences being constructed in this area is so remote that future residential risks do not deserve further discussion. Institutional controls will assure this does not occur.

6.3 SUMMARY OF HUMAN TOXICITY ASSESSMENT

The toxicity assessment describes the potential human health effects that have been shown, through toxicological studies, to be identified with the contaminants of concern. As noted earlier, more than 20 individual hazardous substances (metals and arsenic) have been characterized in the various media. The following discussion summarizes the major toxic effects of the contaminants of primary concern.

Arsenic is a known human carcinogen which causes lung cancer when inhaled and skin cancer when ingested in sufficient quantities over time. Incidental ingestion may cause other internal tumors. Acute oral exposure can cause muscle reactions, gastrointestinal damage, liver or kidney damage, and vascular collapse that may lead to death. Inhalation of arsenic can also cause severe irritation of the nasal lining and respiratory tract.

Cadmium is a known human carcinogen when inhaled. Lung cancer and increased incidents of prostate cancer have been documented in workers exposed to cadmium by the inhalation pathway. There is no evidence of carcinogenicity as a result of chronic oral exposure. Acute exposure to cadmium by means of oral exposure, however, produces nausea, salivation, spasms, drops in blood pressure, loss of consciousness and collapse. Acute exposure by inhalation can cause coughing, acute chemical pneumonitis and pulmonary edema. Respiratory and renal toxicity are major effects in workers.

Copper is beneficial to humans at very low doses. Excessive doses can cause gastrointestinal irritation, hemolysis, liver necrosis, kidney failure, tachycardia, and convulsions. Copper is believed to be strictly noncarcinogenic.

Lead is a suspected human carcinogen; however, the noncarcinogenic effects of lead exposure are of great concern to toxicologists and physicians. Low levels of exposure to lead, over relatively brief periods, can irreversibly injure the nervous system. Young children, infants and fetuses are particularly susceptible. Epidemiological studies indicate that chronic lead exposure is associated with hypertension in adults.

Zinc is beneficial to humans at very low doses. The recommended dietary allowance (RDA) for zinc is about 12-15 mg/day. Excessive amounts of zinc (10-15 times the RDA, or more), taken by means of ingestion or inhalation of zinc-laden soils or dust, can cause stomach cramps and digestive system disorders. Excessive zinc may interfere with the body's immune system and with the body's ability to absorb and metabolize other essential trace elements.

6.4 SUMMARY OF HUMAN RISK CHARACTERIZATION

The risk assessment calculated and evaluated human health risks associated with exposure to both carcinogenic and noncarcinogenic contaminants.

Contaminants known to cause cancer in humans were assigned a cancer potency factor. The cancer potency factor was derived by applying the upper 95-percent confidence limit on the slope of a dose-response curve obtained from human epidemiological studies. Potency factors use conservative assumptions, thus they are less likely to underestimate actual carcinogenic risk.

The excess lifetime cancer risk was calculated using the cancer potency factor, lifetime daily intake, and exposure point concentration (the concentration of each contaminant in a specific medium where there is contact by a human receptor). Carcinogenic risks were presented for each exposure scenario (recreational, occupational and residential) and for each pathway that was possible to quantify (ingestion, inhalation, dermal absorption). Risks resulting from exposure to multiple media were added together.

For contaminants known to produce noncarcinogenic health effects, the dose estimated for each exposure scenario and pathway was compared to a dose level believed to be safe which is termed the reference dose (RfD).

Table 5 summarizes the carcinogenic and noncarcinogenic health effects for the current human exposure scenarios at the Warm Springs Ponds.

Due to day-to-day contact with contaminated tailings, sediments, and water, people who work year around at the ponds (occupational scenario) face greater increased cancer risks than people who live nearby or who use the area for recreation. Workers are faced with cancer risks being increased over normal cancer risks by 2 chances in 10,000. People who use the ponds for recreation face an estimated increase of eight chances in 100,000.

Residents of the nearby community of Warm Springs and rural areas east and north of the ponds face some estimated increase in cancer risk due to inhalation and ingestion of wind-entrained contaminants, which originate from the exposed tailings and contaminated soils. The increase is estimated to be about one chance in 100,000.

With respect to noncarcinogenic risks, none of the estimated doses was greater than the reference doses. Therefore, except for lead, these risks are considered acceptable.
There is no agreed upon reference dose for lead. The EPA believes there is no safe level of lead.

6.5 ENVIRONMENTAL RISKS

Our understanding of the environmental risks present at the Warm Springs Ponds is limited and strictly qualitative. Early site studies of algae, fish, aquatic insects, and waterfowl, taken from the ponds and the Clark Fork River immediately downstream, were conducted primarily to determine whether edible fish and waterfowl are accumulating metals to the extent that humans who consume them might be at risk. While the risks to humans were found to be negligible, the studies showed that metals and arsenic accumulate in the plants

TABLE 5

SUMMARY OF RISKS FOR CURRENT HUMAN EXPOSURE SCENARIOS[1]

MEDIA	RECREATIONAL	OCCUPATIONAL	RESIDENTIAL
GROUNDWATER	None	None	None
SURFACE WATER			
Incidental Ingestion	Maximum excess lifetime cancer risk of 6 x 10^{-7} and average risk[2] of 5 x 10^{-8}. No risk identified from exposure to non-carcinogenic compounds.	Maximum excess lifetime cancer risk of 2 x 10^{-5} and average risk of 2 x 10^{-7}. Highest contribution from pond outflow. No risk identified from exposure to non-carcinogenic compounds.	None
Dermal Contact	No data with which to evaluate carcinogenic risk.[3] No risk from exposure to dissolved concentration of non-carcinogenic compounds was identified. Hazard index = 0.00000009 (9E-8).[4]	Data available to evaluate cancer risk during high flow events only. Maximum excess lifetime cancer risk of 4 x 10^{-9} from arsenic. No risk from exposure to dissolved concentration on non-carcinogenic compounds was identified. Hazard index = 0.00058 (5.8E-4).	No data with which to evaluate downstream residential contact.
SEDIMENT			
Incidental Ingestion	Maximum excess lifetime cancer risk of 4 x 10^{-5} and average risk of 3 x 10^{-6}. Most probable CDI or maximum plausible CDI of non-carcinogenic compounds did not indicate a risk.	Maximum excess lifetime cancer risk of 2 x 10^{-4} and average risk of 2 x 10^{-5}. Maximum plausible CDI and most probable CDI of non-carcinogenic compounds did not indicate a risk.	None
Dermal Contact	Not quantified. Anticipated that additional risk from this pathway would be minimal, see dermal contact with surface water.	Not quantified. Anticipated that additional risk from this pathway would be minimal, see dermal contact with surface water.	None
AIR			
Inhalation	Maximum excess lifetime cancer risk of 1 x 10^{-7} and average risk of 5 x 10^{-8} driven by arsenic and cadmium. Maximum plausible and most probable CDIs did not exceed acceptable intake values.	o Maximum excess lifetime cancer risk of 2 x 10^{-6} and average risk of 9 10^{-7} driven by arsenic and cadmium. Maximum plausible and most probable CDIs did not exceed acceptable intake values.	o At the town of Warm Springs, modeled dust emissions from the pond system result in an excess lifetime cancer risk of 6 x 10^{-4}. No risk was identified from exposure to noncarcinogenic compounds for any age group. o At the town of Warm Springs, AMC PM10 data on air contaminants (1983 data) results in an excess lifetime cancer risk of 10^{-4}. o At residences east of the ponds, excess lifetime cancer risks ranges from 0 to 7 x 10^{-4}. Wind direction/duration were roughly included in the conversion of modeled dust concentration from 1-hr maximums to 24 hr values and annual values. However, results may overestimate actual risks due to topographic chances and its effect of dust dispersion. o No risk was identified from exposure to non-carcinogenic compounds for any age group.
Ingestion	Ingestion as a result of inhalation of wind-blown sediment may lead to an excess lifetime cancer risk of 2 x 10^{-8} for maximum inhalation rates and 7 x 10^{-9} for most probable inhalation rates. No risk was identified from exposure to non-carcinogenic compounds.	o Ingestion as a result of inhalation of wind-blown sediment may lead to an excess lifetime cancer risk of 4 x 10^{-7} for maximum inhalation rates and 2 x 10^{-7} for most probable inhalation rates. No risk was identified from exposure to non-carcinogenic compounds.	o At the town of Warm Springs, modeled emissions results in an excess life time cancer risk of 1 x 10^{-4} through ingestion from inhalation. Using ingestion from inhalation. Using AMC air data the resulting risk is 2 x 10^{-4}. No risk was identified from exposure to non-carcinogenic compounds for any age group. o For those residences east of the ponds, the excess lifetime cancer risk ranger is 1 x 10^{-4} to 8 x 10^{-7}. No risk was identified from exposure to non-carcinogenic compounds for any age group.
TOTAL MULTIMEDIA RISK	1 X 10^{-4} excess lifetime cancer risk associated with assumed maximum plausible chronic daily intake (CDI)[5]. Potential threat from non-carcinogenic compounds was not identified.	2 x 10^{-4} excess lifetime cancer risk associated with assumed maximum plausible chronic daily intake (CDI) driven by ingestion.	Multimedia exposures not considered for this scenario. Exposures could includes those from either recreational use of the area or from working at the ponds or both.

1 See Appendix A of FS for a complete discussion of potential risk.
2 The terms 'maximum' and 'average' in relation to risk are modifiers meant to indicate the use of maximum and average intakes and concentrations and is not meant to imply that risk is anything other than upper bound estimates.
3 No dissolved concentrations of constituents assumed to be carcinogenic through dermal exposure. Compounds exhibiting carcinogenicity through dermal exposure assumed to be those that are carcinogenic through ingestion.
4 Hazard index is a method of determining potential health risk from total exposure to non-carcinogenic compound through a single exposure route and media.
5 CDI is a term that combines the assumed intake rate and the concentration of the contaminant in a specific media.

and animals examined. In addition, there are clear indications that certain life stages of aquatic vertebrates and invertebrates, such as the eggs and developing young of sensitive fish species, are affected by the contaminants.

On the other hand, there are clear indications of productive wetlands and healthy populations of waterfowl, invertebrates and terrestrial and aquatic wildlife, in the inactive and active areas alike. Fish are found in Ponds 2 and 3, the wildlife ponds, and the entire length of the bypass; however, there are no fish in Pond 1 or the old Silver Bow Creek channel immediately below Pond 1. The surface water of Pond 1 and the area below Pond 1 is significantly more degraded than the surface water of Ponds 2 and 3 or the wildlife ponds.

Copper is particularly toxic to aquatic organisms, even at moderately elevated concentrations. Zinc is also toxic to aquatic organisms. The state's standards for the protection of aquatic life are .012 mg/l (chronic) and 0.018 mg/l (acute) for copper, and 0.11 mg/l (chronic) and 0.12mg/l (acute) for zinc. Surface water samples (grab samples) from Pond 1, which receives pumped-back water from the area below Pond 1, show total copper concentrations in the range of 0.014-0.055 mg/l and total zinc concentrations in the range of 0.016-0.135 mg/l.

As in the case of human health risks, the catastrophic risks associated with dam failure, due to floods or earthquakes, are important to note as environmental risks as well. In the event of dam failure, as much as 3.4 million cubic yards of tailings and contaminated sediments could be moved into the Clark Fork River. This could devastate a valuable river resource which is improving over time, but remains stressed due to metals loading, overbank tailings, and severe agricultural dewatering.

As noted, the public health and environmental assessment was completed for the entire pond system. Characterizing risks for the inactive area alone would be possible, but hardly necessary. It is likely that such an exercise would demonstrate that there are less severe human health risks and more severe environmental risks in the inactive area than in the active area or the pond system as a whole. Workers and recreational users spend far more of their time in the active area than the inactive area. Additionally, the overall quality of the water is poorer, and the accessibility to exposed tailings deposits is greater in the inactive area than in the active area.

6.6 THREATENED AND ENDANGERED SPECIES

Two species of birds protected under the Endangered Species Act (16 USC § 1651 et seq.), the bald eagle and peregrine falcon, are occasionally observed at the ponds. No quantitative data are available; however, fish and waterfowl tissue analysis show that elevated metals levels are present in their kidneys and livers. It is reasonable to conclude that raptors could bioaccumulate metals if their diet includes significant amounts of fish and waterfowl from the ponds. The effects over time are unknown. There is no evidence of acute exposure effects.

6.7 ACTIONS REQUIRED

The actions required by this Record of Decision are necessary and appropriate to significantly reduce or eliminate the principal risks identified in this section. Clearly endangerment has been established with respect to both human health and the environment. In order to effectively carry out the reduction or elimination of principal risks, however, criteria are necessary for the identification of contaminated tailings and soils. The criteria to be applied for soils were developed and successfully implemented during the Mill-Willow Bypass Tailings Removal Action. The performance standards are specified in Attachment 2 to Part II.

1) Tailings and associated contaminated soils will be identified by color. These materials are readily identified by their discoloration, as compared to the natural color of uncontaminated soils.

2) Borrow, or fill materials are suitable, if after excavation of the discolored materials, the concentration of copper is less than 500 mg/kg as measured by a properly calibrated X-ray fluorescence (XRF) analyzer. These materials will be used to construct or strengthen the berms specified as elements of the remedial action.

3) Soils at final excavation grade, following removal of tailings and associated soils, and borrow materials, will exhibit concentrations of metals within the range of concentrations shown in Column 4 of Table E-1 of the Soils Removal Report, Mill-Willow Bypass Removal Action, March 1991.

4) In contaminated areas where excavation is not conducted, a combination of color identification and confirmation sampling will be used to establish the boundaries for wet-closure or dry-closure of contaminated areas. Soils remaining outside of the boundaries of wet-closure or dry-closure cells will exhibit concentrations of metals within the range of concentrations shown in Column 4 of Table E-1 of the Soils Removal Report, Mill-willow Bypass Removal Action, March 1991.

A complete removal and closure protocol for tailings and associated contaminated soils in the inactive area of the Warm Springs Ponds will be developed in the remedial design phase, and will closely follow the protocol presented in appendix B of the Mill-Willow Bypass Tailings Removal Work Plan.

The expected remaining concentration of contaminants, after excavation or wet -or dry-closure, will be within the following ranges for the following indicator elements:

	Concentration (mg/kg)		
Indicator Element	**Minimum**	**Maximum**	**Mean**
Arsenic	8.4	42.1	14.8
Cadmium	0.8	4	1.1
Lead	8.4	45.5	16.3
Copper	0.6	287	64.7
Zinc	0.4	573	124.4

7.0 DESCRIPTION OF ALTERNATIVES

Objectives for remediation of the Warm Springs Ponds Operable Unit Inactive Area were identified in the feasibility study and in the Draft Evaluation of Alternatives–Pond 1 Area and Below (ARCO, 1991). These objectives were developed from the identification of the environmental and human health problems, utilizing ARARs and site-specific human health and environmental protectiveness standards identified through the public health and environmental assessment.

Following the identification of the remediation objectives, potential remedial technologies and process options were identified and evaluated for use at the site. All of the technologies and process options were screened based on effectiveness, implementability, and cost to reduce the list of potential technologies.

The technologies remaining following the second screening were combined to form media-specific actions addressing the remedial objectives identified for each of the media. The media-specific actions were developed to the conceptual design level in the Draft Evaluation of Alternatives–Pond 1 Area and Below.

Six comprehensive remedial action alternatives were assembled in the Draft Evaluation of Alternatives by combining one or more media-specific actions for each of the affected media into an overall remediation package. The action alternatives were assembled from 14 media-specific actions. In addition, a "no-action" alternative was added to the range of alternatives and evaluated with the action alternatives as required by the National Contingency Plan. The seven alternatives developed in the Draft Evaluation of Alternatives cover a range of possible combinations for onsite remediation of the pond bottom sediments and tailings.

Following public comments received at public workshops and meetings in October 1991, the EPA decided to evaluate options for removal of all of the contaminated soils and tailings within Pond 1 and in the area below Pond 1. A technical memorandum (CH2M HILL, 1992) was prepared to investigate removal alternatives. The technical memorandum went through the steps of screening of technologies, combining technologies to form media-specific actions, then assembling of media-specific actions to form alternatives. Based upon this technical memorandum, four additional alternatives were added to the seven alternatives identified by ARCO in the Draft Evaluation of Alternatives. These removal alternatives are numbered 8 through 11. All of the alternatives are described below.

7.1 ALTERNATIVE 1 (DRY CLOSE POND 1, REMOVAL BELOW POND 1)

Alternative 1 would consist of the following:

- Drain the wet areas in the eastern portions of Pond 1, regrade the dry areas in the western portions of Pond 1, then cap/cover (dry-close) with 2 inches of crushed limestone, 12 inches of fill, 6 inches of topsoil, then revegetate with native species.

- Construct a ground water dewatering/interception trench system within Pond 1 and below Pond 1 to intercept contaminated ground water and pump it back to Pond 3 for treatment.

- Upgrade and armor the north-south berm of Pond 1 for protection against the maximum credible earthquake (MCE) and one-half the probable maximum flood (0.5 PMF).

- Construct a flood interception channel to the east of Pond 1 to protect against floods up to the 0.5 PMF in the East Hills.

- Modify the east-west portion of the Pond 1 dike to protect against a maximum credible earthquake (MCE).

- Remove all tailings and contaminated soils in the area below Pond 1 and transport them to Pond 1 prior to dry closure of Pond 1.

The estimated present worth cost for Alternative 1 is $29,100,000.

7.2 ALTERNATIVE 2 (DRY CLOSE POND 1, WET CLOSE BELOW POND 1)

This alternative would include the following actions:

- Dry close the wet and dry areas of Pond 1 similar to Alternative 1.

- Modify the east-west portion on the Pond 1 dike to stabilize the dike up to a full MCE.

- Construct low dikes in the area below Pond 1 to provide for flooding of all contaminated soils and tailings. The soils and tailings would be treated with lime prior to flooding and the water in the wet-closed areas would be kept at an elevated pH (above 8.5) to immobilize the metals within the soil matrix by maintaining a reducing environment.

- Construct an interceptor channel to the east of Pond 1 and the area below Pond 1 to protect against floods in the east hills up to a 0.5 PMF.

- Upgrade and armor the north-south berm of Pond 1 for protection against the maximum credible earthquake (MCE) and one-half the probable maximum flood (0.5 PMF).

- Construct an extension of the Mill-Willow Bypass flood protection dike north of Pond 1 to protect the wet-closed area below Pond 1. The dike would be designed for the 0.5 PMF in the combined Mill-Willow-Warm Springs Creeks and would include soil-cement armoring to protect against scour.

- Construct a ground water interception system that would include a trench on the upgradient side of the flood protection dike. This trench would intercept any contaminated ground water remaining following remediation. The ground water would be pumped through a pipeline back to Pond 3 for treatment.

- Construct a new channel to replace the portion of the existing Mill-Willow channel utilized during construction of the ground water interceptor trench.

The estimated present worth cost for Alternative 2 is $27,500,000.

7.3 ALTERNATIVE 3 (DRY CLOSE POND 1,DRY CLOSE BELOW POND 1)

This alternative would dry close all of Pond 1 similar to Alternative 1, but would dry close the area below Pond 1.

All of the elements to dry close Pond 1 would be included, plus the following elements would be added for the dry closure below Pond 1:

- Drain the wet areas below Pond 1, regrade the dry areas, then cover the area with 2 inches of limestone, 12 inches of fill, 6 inches of topsoil, and revegetate with native species.

- Upgrade and armor the north-south berm of Pond 1 for protection against the maximum credible earthquake (MCE) and one-half the probable maximum flood (0.5 PMF).

- Construct a northern extension of the Mill-Willow Bypass flood protection dike to protect the dry-closed area below Pond 1. The dike would be armored and designed to protect against the 0.5 PMF.

- Construct a ground water interception system on the upgradient side of the flood protection dike. The system would include a trench along the toe of the dike plus pumping and piping to transport the contaminated ground water to Pond 3 for treatment.

- Extend the East Hills flood interception channel to protect the dry-closed area below Pond 1. The channel would be sized for the 0.5 PMF in the East Hills.

- Replace those portions of the existing lower by-pass channel used to construct the ground water interceptor trench.

The total present worth cost for Alternative 3 is estimated to be $28,000,000.

7.4 ALTERNATIVE 4 (WET/DRY CLOSE POND 1, REMOVE TAILINGS BELOW POND 1)

This alternative would dry close the western portions of Pond 1 and would wet close the eastern portions. The tailings below Pond 1 would be removed and deposited in the dry-closure area of Pond 1 prior to capping, similar to Alternative 1. The specific elements included in Alternative 4 are:

- Regrade the dry areas of Pond 1, then cap/cover with 2 inches of limestone, 12 inches of fill, 6 inches of topsoil, and then revegetate with native species.

- Construct low dikes in the wet areas of Pond 1 to provide for flooding of all contaminated soils and tailings. The soils and tailings would be treated with lime prior to flooding and the water in the wet-closed areas kept at an elevated pH (above 8.5) to immobilize the metals within the soil matrix by maintaining a reducing environment.

- Upgrade and armor the north-south berm of Pond 1 for protection against the maximum credible earthquake (MCE) and one-half the probable maximum flood (0.5 PMF).

- Stabilize the east-west dike of Pond 1 to withstand the MCE.

- Construct a flood interception channel to the east of Pond 1 to protect against floods up to the 0.5 PMF in the East Hills.

- Construct a ground water interceptor system along the lower bypass to prevent contaminated ground water from reaching the Clark Fork River. The system would include a trench to intercept the ground water and a pump and piping system to transport the ground water to Pond 3 for treatment. The system would also include a berm between the lower bypass and the interceptor trench to keep smaller flood flows (up to the 100-year event) out of the interceptor trench.

- Remove all tailings and contaminated soils in the area below Pond 1 and transport them to the dry areas of Pond 1 prior to dry closure of Pond 1.

The estimated present worth cost for Alternative 4 is $21,200,000.

7.5 ALTERNATIVE 5 (WET/DRY CLOSE POND 1, WET CLOSE BELOW POND 1)

This alternative would involve wet closure of the eastern portions of Pond 1 and dry closure of the western portions of Pond 1. The elements required to remediate Pond 1 are similar to those listed for Alternative 4. The area below Pond 1 would be wet closed and would include the same elements listed under Alternative 2. The required elements include:

- Regrade the dry areas of Pond 1, then cap/cover with 2 inches of limestone, 12 inches of fill, 6 inches of topsoil, then revegetate with native species.

- Construct low dikes in the wet areas of Pond 1 to provide for flooding of all contaminated soils and tailings. The soils and tailings would be treated with lime prior to flooding and the water in the wet-closed areas kept at an elevated pH (above 8.5) to immobilize the metals.

- Upgrade and armor the north-south berm of Pond 1 for protection against the maximum credible earthquake (MCE) and one-half the probable maximum flood (0.5 PMF).

- Stabilize the east-west dike of Pond 1 to withstand the MCE.

- Construct low dikes in the area below Pond 1 to provide for flooding of all contaminated soils and tailings. The soils and tailings would be treated with lime prior to flooding and the water in the wet-closed areas kept at an elevated pH (above 8.5) to immobilize the metals within the soil matrix by maintaining a reducing environment.

- Construct an interceptor channel to the east of Pond 1 and the area below Pond 1 to protect against floods in the east hills up to a 0.5 PMF.

- Construct an extension of the flood protection dike north of Pond 1 to protect the wet-closed area below Pond 1. The dike would be designed for the 0.5 PMF and would include soil-cement armoring to protect against scour.

- Construct a ground water interception system. This would include a trench on the upgradient side of the flood protection dike. This trench would intercept any contaminated ground water remaining following remediation. The ground water would be pumped through a pipeline back to Pond 3 for treatment.

- Construct a new channel to replace the portion of the existing bypass channel utilized during construction of the ground water interceptor trench.

The estimated present worth cost for Alternative 5 is $18,100,000.

7.6 ALTERNATIVE 6 (WET/DRY CLOSE POND 1, DRY CLOSE BELOW POND 1)

Alternative 6 would be essentially a combination of the various elements of Alternatives 4 and 3. The Pond 1 area would be wet and dry closed similar to Alternative 4. The area below Pond 1 would be dry closed and would include the elements of Alternative 3 specified for below Pond 1.

The estimated present worth cost for Alternative 6 is $18,800,000.

7.7 ALTERNATIVE 7 (NO-ACTION)

Alternative 7 is the no-action alternative required by the National Contingency Plan (NCP) and is used as a baseline against which the action alternatives can be evaluated.

Since there would be no remediation associated with Alternative 7, the present worth cost is $0.00.

7.8 ALTERNATIVE 8 (REMOVAL OF POND 1 AND AREA BELOW POND 1; EAST HILLS REPOSITORY)

This alternative would include excavating wet and dry areas of Pond 1, excavating wet and dry areas below Pond 1, and truck transport of excavated materials to the repository site in the east hills. The dry areas of Pond 1 and below Pond 1 would be excavated using a combination of conventional excavation equipment including bulldozers, backhoes, front-end loaders, and scrapers. Excavated dry material would be loaded onto trucks for transport. The wet areas of Pond 1 and below would be excavated using either mechanical dredging (clamshells or draglines) or hydraulic dredging (cutter-head suction dredge) depending upon conditions. Excavated material from the mechanical dredging would be loaded onto trucks for transport. The excavated material from the hydraulic dredging would be pumped to a centrally located gravity thickener. Underflow from the gravity thickener would be pumped directly into trucks for transport. The trucks would have to be modified utilizing liners or other methods to handle the wet materials without spillage or leakage. For the east hills repository, it was assumed that off-road haulers with capacities up to 60 cubic yards would be utilized over specially constructed haul roads.

Two sites were required for the east hills repository to contain all of the wastes–Cook Creek and Whitcraft Gulch. Each is capable of storing approximately one-half of the wastes. Dams near the mouths of the existing drainages would be constructed approximately 120 feet high. Grout curtains would be constructed beneath the dams to reduce seepage. Construction of these repositories in existing drainages would require that surface runoff be diverted, either through a piped system or diversion channels to avoid erosion of the tailings and pond bottom sediments. This diversion system would be designed to handle up to a 100-year event, with the dams designed to be able to contain and hold surface runoff flows exceeding the 100-year event (up to the 0.5 PMF). A ground water collection system would also be required downgradient of the dams. The ground water collection system would include trench drains to intercept any ground water contaminated by seepage from the tailings and pond bottom sediments. The collected ground water would be pumped back to Pond 3 for treatment. Following deposition and drying of all materials, the repository would be capped with 2 inches of limestone, 12 inches of fill, 6 inches of topsoil, and revegetated with native species.

A ground water interception system would still be required to prevent the existing contaminated ground water from reaching the Clark Fork River. The system would include a trench to intercept the ground water and a pump and piping system to transport the ground water to Pond 3 for treatment. The system would also include a berm between the Mill-Willow Bypass and the interceptor trench to keep smaller flood flows (up to the 100-year event) out of the interceptor trench. The ground water interceptor system could be taken out of service once the ground water no longer exceeded MCLs.

The estimated present worth cost of Alternative 8 is $50,500,000.

7.9 ALTERNATIVE 9 (REMOVAL OF POND 1 AND AREA BELOW POND 1; POND 3 REPOSITORY)

This alternative would include removal of all materials in Pond 1 and the contaminated materials below Pond 1 using the same combination of excavation techniques as listed for Alternative 8. The materials would be transported by off-road haulers to the repository at the south end of Pond 3.

The area at the south end of Pond 3 above the high waterline was selected as a repository option. Use of this location would represent a consolidation of the wastes within the pond system and would minimize construction period risks and impacts since the wastes would be handled and transported mainly within the pond system. To provide sufficient area for disposal of all wastes, it was assumed that the repository would extend to the south of the existing Pond 3 berm. The western berm of the repository in this area would be constructed similar to the Pond 3 berms with soil-cement armoring on the west side to protect against erosion of up to the 0.5 PMF in Silver Bow Creek. The remainder of the berms would be constructed similar to the east-west Pond 3 berm with protection against the Maximum Credible Earthquake. The berms would have to be approximately 30 feet high to contain all of the wastes. The berms would be constructed either from onsite materials or from selected materials excavated from the west half of Pond 1. Following deposition and drying of all materials, the repository would be capped using 2 inches of limestone, 12 inches of fill, 6 inches of topsoil, then revegetated with native species.

A ground water interceptor system below Pond 1 similar to that specified for Alternative 8 would be required until the ground water was cleaned up.

The estimated present worth cost for Alternative 9 is $50,000,000.

7.10 ALTERNATIVE 10 (REMOVAL OF POND 1 AND AREA BELOW POND 1; OPPORTUNITY PONDS REPOSITORY)

This alternative is identical to Alternatives 8 and 9, except for the transport of excavated materials. All excavated materials (both wet and dry) would be trucked or pumped, as appropriate, to a centrally located materials processing/conditioning facility. This facility would include a gravity thickener (for hydraulically dredged materials), a mixing facility, and a pug mill to mix the wet and dry materials in the proper proportions to allow efficient transportation by conveyor. It was assumed that a 48-inch belt conveyor with a capacity of approximately 1,000 tons/hour would be required to transport the materials to the Opportunity Ponds repository.

The Opportunity Ponds site was considered for a waste repository because it is relatively close to the WSP inactive site (approximately 4 miles average distance), and already contains similar waste materials. It was assumed for cost estimating purposes that berms would be constructed within the Opportunity Ponds on top of the existing tailings. The berms would be constructed from selected materials excavated from the west half of Pond 1. The berms would be necessary to differentiate materials, limit capping requirements, and control the free water remaining after disposal. These berms would be approximately 20 feet high. Following deposition and drying of all materials, the repository would be capped using 2 inches of limestone, 12 inches of fill, 6 inches of topsoil, then revegetated with native species.

As with Alternatives 8 and 9, the ground water interceptor system below Pond 1 would be required until the ground water was able to meet MCLs.

The estimated present worth cost of Alternative 10 is $49,500,000.

7.11 ALTERNATIVE 11 (REMOVAL OF POND 1 AND AREA BELOW POND 1; ANACONDA PONDS REPOSITORY)

This alternative is similar to Alternative 10, except that transport of excavated materials would be by slurry pipeline. All excavated materials would be trucked or pumped, as appropriate, to a centrally located materials handling facility. This facility would include a pug mill, a sizing facility, and a mixing facility to size and mix the wet and dry materials and add water in the proper proportions to allow transportation in a slurry pipeline. It was assumed that the materials would be pumped at approximately 30 percent solids (by weight). This would require pumping at approximately 2,200 gpm (two shifts) to move all the materials within a 3-year time frame. The slurry pipeline would transport the materials to the repository site within the Anaconda Ponds.

It was assumed for cost estimating purposes that berms would be constructed within the Anaconda Ponds on top of the existing tailings. The berms would likely be constructed from onsite materials. The berms would be necessary to differentiate materials, limit capping requirements, and control the free water remaining after disposal. These berms would be approximately 20 feet high.

The Anaconda Ponds repository would have a different configuration from the other total removal alternatives. It would likely be composed of multiple cells (four to eight cells) to allow for efficient deposition and handling of slurry materials. After all tailings have been transported to the repository, the materials would be allowed to dry out through evaporation. If allowed by regulatory agencies, the drying process could be speeded up by decanting free water to the surface of the Anaconda Ponds outside the repository. Even with decanting, it would likely require several years until the surface would be stable enough to support equipment. The repository would then be capped using a geomembrane, followed by limestone, soils, and native vegetation. The geomembrane would be required to allow capping within a reasonable period of time.

As with the other total removal alternatives (Alternatives 8, 9, and 10), the ground water interceptor system would be required below Pond 1 until the shallow ground water achieved MCLs.

The estimated present worth cost of Alternative 11 is $50,700,000.

8.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

The alternatives presented in the previous section were evaluated against each other according to nine criteria established by CERCLA [40 CFR §300.515(e)(9)(iii): §300.515(f)(l)(i)]. The criteria are:

1. ***Overall Protection of Human Health and the Environment*** addresses how the alternative, as a whole, will protect human health and the environment. This includes an assessment of how public health and environmental risks are properly eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

2. ***Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)*** addresses whether or not a remedy complies with all state and federal environmental and public health laws and requirements that apply or are relevant and appropriate to the conditions and remediation options at a specific site. If an ARAR cannot be met, the analysis of the alternative must provide the grounds for invoking a statutory waiver.

3. ***Long-term effectiveness and Permanence*** refers to the ability of an alternative to maintain reliable protection of human health and the environment over time once the remediation goals have been met.

4. ***Reduction of Toxicity, Mobility, or Volume*** are three principal measures of the overall performance of an alternative. The 1986 amendments to the Superfund statute emphasize that, whenever possible, EPA should select a remedy that uses a treatment process to permanently reduce (1) the level of toxicity; (2) the spread of contaminants away from the source of contamination; and (3) the volume, or amount of contamination at the site.

5. ***Short-term Effectiveness*** refers to the likelihood of adverse impacts on human health or the environment that may be posed during the construction and implementation of an alternative until remediation goals are achieved.

6. *Implementability* refers to the technical and administrative feasibility of an alternative, including the availability of materials and services needed to implement the alternative.

7. *Cost* includes the capital (upfront) cost of the implementing an alternative, the cost of operating and maintaining the alternative over the long term, and the net present worth of capital and operation and maintenance costs.

8. *State Acceptance* addresses whether, based on its review of the Remedial Investigation/Feasibility Study (RI/FS), the FS supplement, and proposed plan, the State concurs with, opposes, or has no comment on the alternative EPA is proposing as the remedy for the site.

9. *Community Acceptance* addresses whether the public concurs with EPA's Proposed Plan. Community acceptance of this proposed plan will be evaluated based on comments received at the upcoming public meeting and during the public comment period.

Two of the criteria are threshold criteria–the remedy must be protective of human health and the environment and must comply or result in compliance with applicable, or relevant and appropriate requirements (ARARs), unless a specific ARAR is waived.

Five of the criteria are primary balancing criteria–long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost.

The two remaining criteria are modifying criteria–state and community acceptance.

This section of the Record of Decision (ROD) analyzes the various alternatives against each of these criteria and weighs the advantages and disadvantages of each alternative relative to the other alternatives. Table 6 is a Summary of Comparative Analysis of Alternatives.

The evaluation is presented using the nine evaluation criteria as headings. Under each heading, the alternatives are discussed according to the various factors that constitute that criterion. The comparative evaluation is summarized in Table 6.

Table 6
Summary of Comparative Analysis of Alternatives

Overall Protectiveness	Compliance with ARARs	Long-Term Effectiveness	Reduction of Toxicity Mobility and Volume	Short-Term Effectiveness	Implementability	Cost	State Acceptance	Community Acceptance
All action alternatives protect human health and the environment. Dry and wet closures under Alternatives 1 through 6 will prevent human and environmental contact, and decrease migration of the contaminated material to groundwater. Complete removal below Pond 1 (Alternatives 1 and 4) would reduce the area of potential human or environmental contact. Alternatives 2, 3, 5, and 6 (wet and dry closures of Pond 1 and below would involve leaving contaminated material below Pond 1 and would therefore be less protective to wildlife. Alternatives 8 through 11 are protective in terms of human health and permanence of the remedial action. Removal of tailings from Pond 1 and below reduces site risk of direct exposure to tailings and other contaminated materials, and removes the source of groundwater contamination.	All action alternatives comply with federal and state ARARs for the site or have appropriate basis for ARARs waivers.	Complete removal below Pond 1 (Alternatives 1 and 4) does not reduce the overall residual risks compared to either dry closure (Alternatives 3 and 6) or wet closure (Alternatives 2 and 5). With either wet or dry closure, no significant risks remain relative to the potential for migration of the contaminants. Offsite migration of groundwater exceeding MCLs will be prevented. Alternatives 8 through 11 have long-term effectiveness, as a result of the removal of the tailings. This removal reduces the potential for direct contact and future exposure to contaminated materials left in place. Alternative 9 may be impacted by future remediation efforts requiring that all contaminated materials be removed from Pond 3.	Toxicity will be reduced by implementation of Alternatives 2, 4, 5, and 6, by chemically fixing dissolved or soluble metals in a less soluble state through lime treatment and maintenance of a high pH environment. The potential for mobilizing the tailings and associated soils and pond bottom sediments due to wind, floods or earthquakes is reduced to insignificant levels for Alternatives 1 through 6.	Alternatives 1, 4, 8, 9, 10, and 11 which include the complete removal of tailings and associated soils below Pond 1, pose risk to the surrounding community and environment through potential contamination of shallow aquifers during the removal process. Alternatives 2, 3, 5, and 6 do not include removal and would therefore pose less short-term risk.	The majority of components proposed for the alternatives are well developed technologies and are expected to be easily implemented at the Warm Springs Ponds site. This includes excavation activities involving draglines, bulldozers, front-end loaders, scrapers, and other conventional excavation equipment. For Alternatives 1, 4, and 8 through 11, dredging excavation and conveyor transport may involve potential implementation difficulties. Dredging may be hindered by submerged debris including logs and brush. Dredged materials would require mixing in proper proportion with dry materials prior to belt-conveyor transport. Dredging would require expertise and trained personnel not locally available. Alternatives 10 and 11 may be relatively difficult to implement politically. Residents near the Anaconda and Opportunity repository sites are concerned that large volumes of potentially hazardous waste would be located near their homes.	The present worth costs for the eleven action alternatives are as follows: Alternative 1 $29,100,000 Alternative 2 $27,500,000 Alternative 3 $28,000,000 Alternative 4 $21,200,000 Alternative 5 $18,100,000 Alternative 6 $18,800,000 Alternative 7 $0 Alternative 8 $50,500,000 Alternative 9 $50,000,000 Alternative 10 $49,500,000 Alternative 11 $50,700,000	The State of Montana, Department of Health and Environmental Sciences, agrees with the EPA selected remedy.	There is general community acceptance of Alternative 5, the preferred alternative, as an interim remedy.

Table 6
Summary of Comparative Analysis of Alternatives

Overall Protectiveness	Compliance with ARARs	Long-Term Effectiveness	Reduction of Toxicity Mobility and Volume	Short-Term Effectiveness	Implementability	Cost	State Acceptance	Community Acceptance
Removal below Pond 1 (Alternatives 1 and 4) would substantially reduce mobilization of contaminated materials to groundwater for the area below Pond 1, whereas wet or dry closure would reduce the risk to minimal levels.		A degree of monitoring would be required with all alternatives at the repository sites.	Alternatives 8 through 11 reduce the potential mobility of contaminants by removing them from the flood plain. Alternatives 8 and 9 are susceptible to potential contaminant mobility resulting from floods greater than one-half PMF. Alternatives 10 and 11 may be susceptible to contaminant mobility resulting from floods less than 1/2 PMF and earthquakes less than the MCE. Excavation and removal (Alternatives 1, 4, 8, 9, 10, and 11) would increase waste volume through "bulking" of soil during excavation. None of the alternatives would change the toxicity or persistence of contaminants associated with solid materials. Metal contaminants are not amendable to being destroyed or changed into relatively inert substances.	Alternatives 1 through 6 can be fully implemented over a 2-year construction period. However, Alternatives 1 and 4 would require a significantly higher level of activity during the construction period to accomplish the complete removal of tailings and associated soils from below Pond 1. Alternatives 8 through 11 would require 3 to 4 years to complete because of the large volume of material to be removed. Some time may be required to obtain the necessary permits and fulfill the political requirements associated with remediation. All alternatives affect the communities of Warm Springs and Opportunity during implementation. It is likely that construction and excavation activities would result in some local airborne releases of the material. The removal alternatives may impact water quality as a result of remediation work in or adjacent to the bypass and stream beds.				

Table 6
Summary of Comparative Analysis of Alternatives

Overall Protectiveness	Compliance with ARARs	Long-Term Effectiveness	Reduction of Toxicity Mobility and Volume	Short-Term Effectiveness	Implementability	Cost	State Acceptance	Community Acceptance
Alternatives 1, 4, 8, 9 10, and 11 will develop ponds and eventually create wetlands. Alternatives 1, 2, and 3 would result in the loss of existing wetlands by draining the area and placement of an earthen cap. Alternatives 1 and 3, which propose dry closure of all of Pond 1 coupled with removal or dry closure below Pond 1, result in the greatest loss of wetlands. Alternative 5 maximizes the area of enhanced wetlands both within and below Pond 1. Alternatives 4 and 6 expand and enhance waterfowl habitat and improve the value of existing wetlands in the eastern third of Pond 1, while Alternative 6 does the same below Pond 1. All of the action alternatives would create a positive environment impact by establishing grassland habitat in the presently unvegetated areas of exposed tailings or pond bottom sediments in the western portion of Pond 1.				Alternative 8 would require purchase of property in the East Hills and may be subject to land use requirements. Excavation Alternatives 1, 4, 8, 9, 10, and 11 would include removal of the wetlands below Pond 1. However, wetlands around the excavation perimeter would develop over time. Remediation contractors would have to be protected against dermal and inhalation threats while working in areas containing tailings and contaminated soils. These threats could be controlled using masks and protective clothing. This applies to all alternatives.				

8.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

All of the action alternatives are protective of human health and the environment. There are minor differences among the alternatives, especially in terms of ancillary effects on the environment, including risks of exposure to aquatic organisms and creation/destruction of wetlands.

Dry and wet closures of tailings and contaminated soils discussed in Alternatives 1 through 6 will prevent human contact, either through a cap or through flooding. The dry-closed/capped portions of these alternatives will reduce the migration of contaminants into the ground water by reducing the source for the ground water. The wet-closed portions will also reduce the migration of contaminants to the ground water by creating and maintaining a reducing environment in the contaminated materials. The wet-closed portions do not alleviate the slight risk of continued exposure of contaminants to the environment, either through the uptake of metals by plants or direct ingestion by aquatic organisms. The existing contaminated shallow ground water would be precluded from reaching the Clark Fork River under all alternatives. The interceptor trench and ground water pumping system to be constructed between the reconstructed lower bypass channel and the area below Pond 1 would effectively eliminate migration of the shallow ground water out of the inactive area. The interceptor trench would also serve to intercept any sediments generated during construction, thereby minimizing sediment contamination of the Clark Fork River.

Removal below Pond 1 (Alternatives 1 and 4) and total removal (Alternatives 8 through 11) are protective in terms of human health and permanence of the remedial action. Removal of tailings from the operable unit reduces onsite risks of direct exposure to tailings and other contaminated materials and removes the source of ground water contamination. It also removes chances of catastrophic failure due to flooding. However, risk of direct exposure and risk to ground water would occur at the waste repository site. These risks would be minimized through proper design at the repository site. The repository would include a cap to reduce direct exposure to humans and the environment, plus ground water controls (drainage systems or cutoff systems) if these were deemed necessary.

Alternatives 1, 4, 8, 9, 10, and 11 would result in excavation below existing ground water. For Alternatives 1 and 4, Pond 1 seepage would require a second interception trench along the toe of the Pond 1 berm. Pumping from this trench would dewater the excavated area below Pond 1 and would result in reduced wetlands. Such an interception trench would not likely be necessary in the case of total removal alternatives because seepage from Pond 2 is not as contaminated as seepage from Pond 1. Therefore, more extensive wetlands would likely be created by Alternatives 8-11.

Dry closure by draining the area and covering it with an earthen cap would result in the loss of existing wetlands. Implementation of Alternatives 1 and 3, which propose dry closure of Pond 1 coupled with removal or dry closure below Pond 1, would result in the greatest loss of wetlands.

The wet closures associated with Alternatives 4, 5 and 6 in the eastern third of Pond 1 and in the area below Pond 1 would result in an expansion of waterfowl habitat. The wet-closed areas would be shallow ponds resembling the existing Wildlife Ponds. The wet-closed areas would change the nature of the existing wetlands in these areas by increasing water depths and expanding the potential for development of shallow marshy areas.

The no-action alternative (Alternative 7) would not alter the site and, therefore, would not provide for protection of human health and the environment.

8.2 COMPLIANCE WITH ARARs

All of the action alternatives would comply with ARARs. Alternatives 2 and 3 entail dry closure within Pond 1 and either dry closure or removal below Pond 1, so mitigation would be required under those alternatives to offset wetland losses in order to meet the wetlands ARAR.

Alternative 7, the no-action alternative, would not achieve compliance with many of the identified ARARs.

EPA believes that all inplace alternatives comply with solid waste disposal requirements, because the reinforced and added berms change the floodplain and remove the materials from the floodplain. If the area within the berms is found to be within the floodplain, EPA believes an ARAR waiver is justified as described in the ARARs attachment. EPA also has waived surface water standards for all options for mercury and arsenic and pH but has established conservative replacement standards.

8.4 LONG-TERM EFFECTIVENESS AND PERFORMANCE

All of the alternatives incorporate a ground water interception trench adjacent to the lower bypass and, thus, prevent offsite migration of ground water that exceeds the maximum contaminant levels. The removal alternatives (Alternatives 1, 4, and 8 through 11) have slightly greater long-term effectiveness because they remove the tailings that are the source of the contaminated ground water. The wet-closure alternatives (Alternatives 2 and 5) will also substantially eliminate the tailings as a source of contamination by providing a reducing environment to immobilize the metals. Thus, for the removal and wet-closure alternatives, it is likely that the ground water interception and pumping system (to Pond 3 for treatment) can eventually be dismantled once the existing contaminated ground water has been removed.

The dry-closure alternatives (Alternatives 3 and 6) will likely require that the ground water pumping and treatment continue for longer than the other alternatives. This is because the dry-closure, although effective at reducing infiltration from precipitation, would not substantially change the chemistry of the high ground water table in the area below Pond 1. Thus, the metals would continue to serve as a source for the ground water contamination of the shallow aquifer.

The residual risk for all alternatives is low. The alternatives that include wet or dry closure below Pond 1 (Alternatives 2, 3, 5, and 6) will have less risk of recontamination from floods in Silver Bow Creek than the other alternatives. This is due to the nature of the flood protection dike along the lower bypass below Pond 1. For Alternatives 2, 3, 5, and 6, this dike would be designed to protect against the 0.5 PMF flood in the lower bypass. For all other alternatives, the required protection level for this dike would be considerably lower. Since the contaminated materials would be either removed or capped, flood protection would be needed only to protect the engineering structures associated with the ground water cutoff and pumping system. This level has been established as the 100-year event. Flow in excess of the 100-year event in the bypass channel could breach the protection dike and spread into the area below Pond 1. Until the upstream reaches of Silver Bow Creek are cleaned up, these flows would likely contain transported tailings. The tailings could likely settle out and recontaminate the area below Pond 1.

Residual risk differences among removal alternatives are related to repository site location. Alternatives 1 and 4 would have very low residual risk because disposal of the excavated materials could be within Pond 1 prior to capping or wet-closure. The Pond 1 area would be protected to 0.5 PMF flood and the Maximum Credible Earthquake (MCE) under these alternatives. The alternative utilizing the Opportunity Pond repository (Alternative 10) may not be as protective as other alternatives. This is because this repository site is within the berms of the Opportunity Ponds, which may be subject to failure during a major earthquake or major flood in Silver Bow Creek. A failure of the Opportunity Pond berms might lead to a failure of the repository berms. However, the Opportunity Pond berms will be studied as part of the Opportunity Pond feasibility study, and the area is likely to be remediated in a manner that will achieve long-term stability of the berms. For similar reasons, the Anaconda Pond repository (Alternative 11) may not be as protective as other repository sites, but it is also likely to undergo remediation in the future, which would improve the long-term stability of the berms.

Alternatives 8 through 11 have long-term effectiveness as a result of complete removal of the tailings and contaminated soils. This removal eliminates the potential at the site for any direct contact; however, those risks could be subsequently transferred to the repository site where the contaminants would be placed. The direct contact risk could be minimized through proper design of caps at the repository sites.

The no-action alternative (Alternative 7) would have the lowest long-term effectiveness since it would involve no remedial actions.

8.3 REDUCTION OF TOXICITY, MOBILITY, AND VOLUME

Alternatives 1, 4, and 9 would reduce the potential mobility of contaminants by removing them from the historic flood plain below Pond 1 and depositing them in areas protected up to the 0.5 PMF and the full MCE.

Alternatives 2, 3, 5, and 6 would leave contaminants within the historic flood plain below Pond 1 but would protect them up to the 0.5 PMF and the MCE through construction of the flood protection dikes along the Mill-Willow Bypass. This would also effectively reduce mobility.

The alternatives using the Opportunity and Anaconda repositories (Alternatives 10 and 11) may be susceptible to contaminant mobility resulting from floods less than 0.5 PMF and earthquakes less than the maximum credible earthquake since they are placed on waste deposits not currently protected from these types of events. The Opportunity Ponds will be studied as part of the Opportunity Ponds FS and this area will likely be remediated in a manner that will achieve long-term stability of the berms. Similarly, it is likely that the Anaconda Ponds will be remediated in the future to improve their stability.

The excavation and removal alternatives (Alternatives 1, 4, 8, 9, 10, and 11) would increase waste volume during excavation. This is due to the natural tendency of soils to increase in volume (bulking) during excavation. The greatest increase in volume would be for Alternative 11 because the slurry option requires that water be added to transport the materials.

None of the alternatives would change the toxicity or persistence of contaminants associated with solid materials. Metal contaminants are not amendable to being destroyed or easily changed into relatively inert compounds through treatment. Alternatives 2, 4, 5, and 6, which in part use wet closure (flooding/chemical fixation), would reduce the mobility of most contaminants by placing them in a reducing environment. The chemical fixation process involves the addition of lime, an alkaline material, into the wet closures. The alkaline system prevents the oxidation of sulfide metals in the tailings and prevents the formation of acid waters. At high pH conditions, most metals will not dissolve and therefore are not transported into the ground water system. The dry-closure alternatives do not retard the mobility of metals, particularly in a system such as this, where the tailings are generally in contact with the ground water. Capping the tailings (dry-closure) alone would not create the reducing condition needed to immobilize the metals.

The potential for mobilizing the tailings and associated soils and pond bottom sediments because of wind, flood, or earthquakes would be reduced to low levels for all action alternatives except 10 and 11. Once the Opportunity and Anaconda Pond berms are stabilized and protected, the risk of this type of mobilization would be reduced to low levels.

The no-action alternative would not result in any reduction of toxicity, mobility, or volume.

8.5 SHORT-TERM EFFECTIVENESS

All alternatives will affect the nearby community of Warm Springs to some extent during remediation. The generation of construction dust, noise, and traffic are the primary impacts. The alternatives with the least impact include Alternatives 2, 3, 5, and 6 because they would not require removal of materials. The minor amount of dust generated can be controlled through proper dust control measures. The onsite excavation alternatives (Alternatives 1 and 4) would have the potential for generation of considerably more construction dust, but proper control techniques would minimize this impact. Alternatives 8 and 9 would have similar impacts to Alternatives 1 and 4. This is because the haul roads for the excavated materials would be on the east side of the pond system, away from Warm Springs. Alternatives 10 and 11 would have some impact because they would require construction and operation of either a conveyor or slurry pipelines outside of the Warm Springs Ponds.

None of the proposed action alternatives involves any activities that present significant health risks to workers. Those alternatives that require the most handling of contaminated materials obviously pose the highest risks relative to worker exposure. However, none of the alternatives have unacceptably high risks associated with them. Workers will be protected using appropriate protective equipment and will be required to have 40-hour health and safety training prior to beginning work on the site, and otherwise comply with the Occupational Health and Safety Act.

The actual construction of Alternatives 1 through 6 can be accomplished over a 2-year construction period. The alternatives that include dry closure of the eastern third of Pond 1 may require more time to fully implement. This is because the existing tailings and contaminated soils in this area are saturated and may require considerable time (potentially several years) to adequately drain prior to construction of a dry closure cap. The complete removal alternatives (Alternatives 8 through 11) would require 3 to 4 years to implement because of the large quantity of materials involved. Alternative 11 (the slurry pipelines) would likely require several additional years after actual removal operations are completed to allow the deposited materials to drain and dry sufficiently to allow capping of the repository.

The implementation of the complete removal alternatives may require additional time beyond actual construction to obtain necessary permits. This could be significant for Alternative 8 (East Hills repository) because of potential land use restrictions. Alternatives 10 and 11 (Opportunity and Anaconda repositories) could also encounter significant delays because of permitting required to construct a conveyor or a pipeline across the I-90 and railroad rights-of-way, and along existing county roads.

All of the action alternatives will involve some alteration or disturbance of existing wetlands. The alternatives involving wet closure below Pond 1 (Alternatives 2 and 5) would have the least impacts to the existing wetlands below Pond 1. The raising of the water surface in this area would alter and displace the existing wetlands, but over time the existing functions and values would likely be reestablished in the shallow areas and on the edges of the wet-closure ponds. Similarly, the alternatives including wet closure of the eastern third of Pond 1 (Alternatives 4, 5, and 6) would result in altering and displacing the existing wetlands in this area. Eventually, these wetlands could also be expected to reestablish themselves.

The alternatives that include dry closure in the eastern third of Pond 1 or the area below Pond 1 (Alternatives 1, 2, 3, and 6) would result in permanent, irreversible loss of the existing wetlands in the these areas.

The alternatives involving removal below Pond 1 (Alternatives 1, 4, and 8 through 11) would result in removal and varying degrees of loss of wetlands because the existing high ground water would be lowered by the ground water interception trench or trenches. Depending upon the alternative, some of the functions and values of the existing wetlands could be expected to become reestablished or improved over time.

All of the action alternatives would result in an increase in grassland habitat in the presently unvegetated areas of exposed tailings in the dry areas within Pond 1.

The no-action alternative (Alternative 7) would not result in any short-term impacts upon the community or the existing environment.

8.6 IMPLEMENTABILITY

Most of the components proposed as part of the alternatives are well-developed technologies, used to some extent in either the hazardous waste, materials handling, or standard civil engineering disciplines. The technical feasibility of these components appears to be good. Nevertheless, some alternatives are more easily implemented than others. Alternative 5 is the most easily implemented. For the alternatives requiring dredging (Alternatives 1, 4, and 8 through 11), there are potential difficulties in implementation. The most prevalent difficulty would involve operating a hydraulic dredge in areas containing logs and other debris. Removing, or working around larger logs, brush, and debris may be necessary by other methods such as clamshell, dragline, or backhoe. Another potential difficulty could involve operating and transporting the mechanical dredging equipment in the soft foundation conditions prevalent in the area. An additional concern would be increased risk of turbid discharges to the bypass during dredging operations.

The alternatives requiring dry closure of the eastern portions of Pond 1 or the area below Pond 1 (Alternatives 1, 2, and 3) would be difficult to implement because of saturated, soft, soil conditions present. The tailings are completely saturated so that surface access and trafficability by conventional construction equipment will be impossible. Special equipment will be required to undertake the excavation and redistribution of the excavated materials.

From an administrative feasibility standpoint, all of the alternatives are about equal except for disposal and land acquisition considerations. The disposal of excavated tailings, pond bottom sediments, and contaminated soil outside of the Ponds area may be difficult to implement. The transport of approximately 3.4 million cubic yards of untreated waste is administratively undesirable from both a transportation and disposal point of view. The onsite disposal option (Alternative 9) would likely be easier to implement because the wastes would be transported to Pond 3 and thus remain within the operable unit. Alternative 8 would require the acquisition of approximately 180 acres in the east hills for construction of the east hills repository. This could make Alternative 8 difficult to implement, depending upon the willingness of the existing landowners to sell their properties. Alternatives 9 and 10, involving disposal at the Anaconda and Opportunity Ponds, would likely encounter public resistance.

None of the action alternatives presents any special operational problems. All of the alternatives include ground water interception, which requires pumping the intercepted water to Pond 3 for treatment. The pumping plant and pipeline would require regular operation, inspection, and maintenance under all action alternatives to ensure that the system functions as intended. Operation of the wet-closure cells under Alternatives 2, 4, 5, and 6 would require control of flow through the cells to ensure that the ponds remain at the proper operating level. The pH of the water in the wet-closure cells would have to be monitored (and adjusted, if necessary) to assure that the pH remains elevated (above 8.5). Regular inspection and periodic maintenance would be performed to ensure proper operation.

Construction equipment and services required to implement any of the action alternatives are readily available. The equipment required for the removal alternatives (Alternatives 1, 4, and 8 through 11) is somewhat specialized and may not be available locally. It is likely that the hydraulic dredging and materials handling equipment (and potentially the skilled operators) would have to be imported from outside the local area.

The no-action alternative (Alternative 7) would not require any implementation.

8.7 COSTS

The capital (construction), operation and maintenance, and present worth costs are presented in Table 7. Alternative 5 is the most cost-effective, both in initial construction costs and from a total present-worth standpoint.

TABLE 7

COST SUMMARY TABLE

	TOTAL CONSTRUCTION COST	OPERATION AND MAINTENANCE	PROJECT PRESENT WORTH
Alternative No. 1	$28,435,218	$ 671,800	$29,100,000
Alternative No. 2	26,219,725	1,320,500	27,500,000
Alternative No. 3	26,872,495	1,157,500	28,000,000
Alternative No. 4	20,338,998	851,700	21,200,000
Alternative No. 5	17,115,069	1,033,100	18,100,000
Alternative No. 6	17,921,020	870,100	18,800,000
Alternative No. 7	0	0	0
Alternative No. 8	49,592,025	860,900	50,500,000
Alternative No. 9	49,261,412	773,300	50,000,000
Alternative No. 10	48,769,448	773,300	49,500,000
Alternative No. 11	49,866,473	790,200	50,700,000
NOTE: Present worth is calculated by amortizing the Operation and Maintenance cost over 30 years at a 5 percent discount rate.			

8.8 STATE ACCEPTANCE

The State of Montana, acting through the Department of Health and Environmental Sciences, has been consulted throughout the process of evaluating potential remedies and is in agreement with the EPA concerning the selected remedy. A copy of the State's letter of concurrence with the selected remedy is attached to Part III.

8.9 COMMUNITY ACCEPTANCE

The public, which includes citizens and elected officials from Silver Bow, Deer Lodge, Granite, Powell, and Missoula counties, has been involved in the decision-making process for the inactive area of the Warm Springs Ponds since the inception of the operable unit in

1991. While many people have indicated reservations about the selected remedy, there are others who fully support EPA's selection of Alternative 5. The majority of those who expressed reservations are willing to accept the selected remedy as an interim solution.

9.0 THE SELECTED REMEDY

9.1 INTRODUCTION

After evaluating alternatives with respect to each other and the nine required criteria, the EPA and MDHES have identified Alternative 5 as the selected remedy for this Warm Springs Pond Inactive Area Record of Decision (ROD). Alternative 5 provides protectiveness that equals or exceeds the other alternatives considered, offers the potential for being a permanent remedy, is supported by the public, is implementable, is cost-effective, and provides the greatest environmental benefits that can be practically achieved. The primary components of Alternative 5 involve measures to safely allow the contaminated pond bottom sediments and tailings to remain in place. These measures include:

1. Remove all tailings and contaminated soils from the adjacent portion of the bypass channel and from the area below Pond 1 not planned for wet-closure. Consolidate the wastes over existing dry tailings within the western portion of Pond 1.

2. Modify, or enlarge if necessary, the adjacent portion of the bypass channel to safely route flood flows up to 70,000 cubic feet per second (cfs) which is one-half the estimated probable maximum flood (PMF) for the combined flows of Silver Bow, Willow and Mill creeks. Soils and gravels that have copper concentrations below 500 mg/kg and meet geotechnical requirements will be used for raising and strengthening the existing berms and constructing new berms.

3. Raise, strengthen and armor with soil cement the north-south aspect of the Pond 1 berm. In accordance with specified state safety standards for high hazard dams and for the protection of human health and the environment, the reconstructed berm must withstand the estimated maximum credible earthquake (MCE) for this area. In addition, the reinforced berm must be constructed to withstand flood flows up to 70,000 cfs (0.5 PMF) in the enlarged bypass channel.

4. Stabilize the east-west aspect of the Pond 1 berm. The reconstructed berm must withstand a maximum credible earthquake for this area, thus protecting against the movement of contained pond bottom sediments or tailings into the uncontaminated

or wet closed areas below Pond 1 in accordance with specified state dam safety standards, and for the protection of human health and the environment.

5. Extend and armor the north-south aspect of the Pond 1 berm approximately 2,400 feet in a north-northeasterly direction. This extended berm will be constructed to provide maximum credible earthquake protection and the ability to withstand one-half the estimated probable maximum flood (70,000 cfs) in the adjacent bypass channel.

6. Relocate the lowermost portion of the bypass channel and convert the present channel into a ground water interception trench. The relatively straight reach of the bypass channel, from the apex of the existing Pond 1 berm to the historic Silver Bow Creek channel, will be relocated north of the extended berm. The entire reach of the bypass channel that is adjacent to the inactive area will be reconstructed, reclaimed and restored to a more natural, meandering condition. Other excavated areas will be reclaimed and restored to their natural condition.

7. The converted ground water interception trench will be deepened and pumps will be installed to allow for a pump-back system. Intercepted water that fails to meet specified standards will be pumped back to the active area for treatment. Monitoring wells and surface water quality monitoring stations will be placed at strategic locations.

8. Construct wet-closure berms to enclose the submerged and partially submerged tailings and contaminated soils. Within the eastern portion of Pond 1 and along the historic Silver Bow Creek channel below Pond 1, these smaller berms will create a series of cells, which when flooded will vary in depth from a minimum of one foot to a maximum of six feet.

9. Chemically fix (immobilize) the tailings and contaminated soils, now enclosed by smaller berms, by incorporating lime and lime slurry onto or into them.

10. Flood the wet-closure cells with water adjusted to a pH greater than 8.5 and maintain proper water surface elevations in the wet-closure cells.

11. Cover the dry tailings and contaminated soils within the western portion of Pond 1 with 2 inches of limestone, 12 inches of fill, and 6 inches of a suitable soil cap. This dry-closed area will be contoured to control runoff and seeded with native vegetation.

12. Construct a runoff interception system along the east side of the inactive area. This system will prevent floods originating in the eastern hills from entering the wet-closure cells. It will be designed to intercept one-half the probable maximum flood, which is estimated to be 8,500 cfs at its peak. A collection system or other engineered solution will be constructed to prevent excessive sediments from entering the Clark Fork River immediately below.

13. Install toe drains along the armored berms and construct a collection manifold for both the active and inactive areas. The water collected will be pumped to the active area for treatment if it exceeds final point source discharge standards specified in Attachment 5 to the Warm Springs Ponds Active Area Unilateral Administrative Order.

14. Implement long-term ecological monitoring. By means of an unbiased set of measurements, this monitoring effort will concentrate on the effects of biological systems living in contact with metals in the water and substrate of ponds and wetlands environments. The results will validate or invalidate the decision to chemically fix, wet-close and contain in place the exposed and submerged tailings and contaminated soils.

15. Implement institutional controls to prevent residential development, domestic well construction, disruption of dry-closure caps, and swimming.

9.2 REMEDIATION AND PERFORMANCE STANDARDS

Alternative 5 will effectively meet the remediation goals established for the inactive area. These remediation goals were established by EPA and MDHES as part of the Feasibility Study (FS) process and the active area ROD selection, and were based primarily upon a Public Health and Environmental Assessment prepared for the original Warm Springs Ponds Operable Unit. A summary of the remediation goals and the measures that Alternative 5 will employ to meet those goals is outlined below. The goals are categorized according to the media identified in the FS. A full description of required performance standards is contained in Attachment 2 to this section.

9.2.1 Pond Bottom Sediments

The remediation goal for pond bottom sediments is to prevent release of contaminated sediments during earthquakes and major floods. Alternative 5 will meet this goal by: stabilizing and armoring the north-south berm, reinforcing the east-west Pond 1 berm and other berms against the MCE; constructing an extension of the north-south flood control berm to protect the wet-closed area below Pond 1 from up to a 0.5 PMF in the bypass channel; and constructing a channel along the entire eastern side of Pond 1 and the area below to protect against floods of up to the 0.5 PMF from the east hills.

9.2.2 Surface Water

There are two primary remediation goals dealing with surface water. The goals include:

- Meet the State of Montana's ambient water quality standards for arsenic, cadmium, lead, mercury, copper, iron, and zinc at the compliance point Alternative 5 will have no discharge of water to the Clark Fork River. Normal operation procedures for the wet-closure cells will require a small flow of water through the ponds to maintain high pH and prevent stagnation. Since the source for this water will be Pond 2 effluent, and since the wet-closure cells will provide additional treatment, any water that exits the wet-closure cells is expected to meet ambient water quality standards, but in any case, will not be discharged beyond the interception trench. All water in the interception trench will be pumped back to the active area until such time as it is demonstrated that a pump-back system here is no longer needed.

- Prevent ingestion of water above the standards for arsenic, cadmium, lead, mercury, copper, iron, and zinc, as specified by the Montana Public Water Supply Act. Another goal is to prevent ingestion of water containing arsenic in concentrations that would increase cancer risks to greater than 1 in 10,000. Alternative 5 will meet these goals through institutional controls that will prevent use of the surface waters within the inactive area as a source for drinking water, and operation of the interception trench and pump back system.

9.2.3 Tailings Deposits and Contaminated Soils

The goal for remediation is to substantially reduce the potential for direct contact, inhalation, and ingestion of contaminated soils and tailings. Alternative 5 will meet this goal by isolating the contaminated soils and tailings, either through capping or covering in the dry-closed areas or chemical fixation and flooding by means of wet-closure.

9.2.4 Ground Water

The remediation goal for ground water is to prevent offsite migration of ground water with contaminant concentrations in excess of Montana ground water maximum contaminant levels. This goal will be met by means of chemical fixation and wet-closure, backed up by construction of the ground water interception trench, which will prevent offsite migration of all ground water from the shallow aquifer.

9.3 QUANTITIES AND COST ESTIMATE

The detailed listing of the components of Alternative 5, and their associated costs, are included in Table 8. Annual operation and maintenance costs and present worth costs are presented in Table 9.

It should be noted that these costs may change because of changes made during remedial design and remedial construction. These changes are a result of modifications generally required as more site-specific information is developed during detailed design.

Table 8
Detailed Cost Estimates
Alternative 5

Description	Quantity	Units	Unit Cost ($)	Amount ($)
Dike Improvements, East-West Dike of Pond 1				
Clearing and Stripping	12	AC	7,500.00	90,000
Foundation Excavation	10,000	CY	7.80	78,000
Gravel Fill	10,000	CY	9.00	90,000
Embankment	34,000	CY	4.50	153,000
Gravel Surfacing	3,400	CY	10.00	34,000
Subtotal				445,000
East Hills Flood Interceptor Channel–Pond 1				
Clearing and Stripping	13	AC	7,600.00	98,800
Channel Excavation	80,000	CY	6.84	547,200
Geofabric	42,000	SY	4.50	189,000
Riprap	14,000	CY	30.00	420,000
Subtotal				1,255,000
Dry Closure of Pond 1–Western Portion				
Finish Grading	175	AC	1,520.00	266,000
Geogrid	847,000	SY	2.28	1,931,160
2" Limestone Cap	70,000	TONS	13.00	910,000
Random Fill	340,000	CY	6.00	2,040,000
6" Soil Cover	140,000	CY	5.00	700,000
Phosphate Fertilizer	90	TONS	325.00	29,250
Seeding	175	AC	1,000.00	175,000
Riprap	600	CY	30.00	18,000
Subtotal				6,069,410

Table 8
Detailed Cost Estimates
Alternative 5

Description	Quantity	Units	Unit Cost ($)	Amount ($)
Wet Closure/Chemical Fixation of Pond 1–Eastern Portion				
Lime Conditioning	115	AC	4,000.00	460,000
Wet Closure Dikes	20,000	CY	10.00	200,000
Geogrid Foundations	15,000	SY	4.00	60,000
Soil Cement Overflows	500	CY	50.00	25,000
Riprap	600	CY	30.00	18,000
Siphon From Pond 2	1	LS	20,000.00	20,000
Subtotal				783,000
Pond 1 Dike Extension–Area Below Pond 1				
Embankment	75,000	CY	5.00	375,000
Foundation Excavation	20,000	CY	10.00	200,000
Underdrain	2,400	LF	10.00	24,000
Soil Cement Erosion Protection	15,000	CY	30.00	450,000
Subtotal				1,049,00
East Hills Flood Interceptor Channel–Area Below Pond 1				
Clearing and Stripping	5	AC	7,500.00	37,500
Channel Excavation	110,000	CY	6.84	752,400
Geofabric	15,000	SY	4.50	67,500
Riprap	5,000	CY	30.00	150,000
Subtotal				1,007,400
Wet Closure/Chemical Fixation–Area Below Pond 1				
Lime Conditioning	74	AC	4,000.00	296,000
Wet-Closure Dikes	20,000	CY	10.00	200,000
Geogrid	17,000	SY	4.00	68,000
Soil-Cement Overflows	1,000	CY	50.00	50,000
Riprap	1,000	CY	30.00	30,000
Siphon from Pond 2	1	LS	40,000.00	40,000
Tailings/Soils Removal	50,000	CY	12.00	600,000
Habitat Enhancement	30,000	CY	8.00	240,000
Subtotal				1,524,000

Table 8
Detailed Cost Estimates
Alternative 5

Description	Quantity	Units	Unit Cost ($)	Amount ($)
Groundwater Interception and Pumpback System–Below Pond 1				
Interceptor Excavation	55,000	CY	6.00	330,000
Tailings Removal	5,000	CY	7.00	35,000
Pump Station	1	LS	250,000.00	250,000
Pipeline	15,000	LF	35.00	525,000
Subtotal				1,140,000
Mill-Willow Bypass Channel Replacement				
Channel Excavation	25,000	CY	4.00	100,000
Tailings Removal	5,000	CY	7.00	35,000
Subtotal				135,000
Basic Construction Cost				13,407,810
Division 1 Costs (11%)				1,472,790
Contingency (15%)				2,186,400
Total Construction Cost				17,067,000
Operation and Maintenance*				1,033,000
Total Present Worth				18,100,000

*See Table 10-2 for details of Operation and Maintenance Costs.

Table 9
Operation and Maintenance Cost
Alternative 5

Description	Yearly Cost ($)
East-West Dike—Pond 1	2,200
East Hills—Flood Interceptor Channel—Pond 1	2,100
Dry Closure of Pond 1—Western Portion	2,800
Wet Closure of Pond 1—Eastern Portion	4,200
Pond 1 Dike Extension—Below Pond 1	1,500
East Hills Flood Interceptor Channel—Below Pond 1	3,200
Wet Closure—Below Pond 1	4,200
Groundwater Interceptor System	
Operation and Maintenance	10,600
Power[a]	12,800
Equipment Replacement Sinking Fund	7,000
Monitoring	12,600
5-Year Review[b]	4,000
Total Yearly Cost	67,200
Present Worth Factor[c]	15.374
Total Present Worth	1,033,100

[a]Assumes power @ $0.07/kWh.
[b]Assumes $20,000 every 5 years.
[c]Assumes 5 percent discount rate for 30 years.

10.0 STATUTORY DETERMINATIONS

Under its legal authorities, EPA's primary responsibility at Superfund sites is to undertake remedial actions that achieve adequate protection of human health and the environment. In addition, section 121 of CERCLA establishes several other statutory requirements and preferences. These specify that when complete, the selected remedial action for this site must comply with applicable or relevant and appropriate environmental standards (ARARs) established under federal and state environmental laws unless a statutory waiver is justified. These two criteria are threshold criteria that every remedy must meet. The selected remedy also must be cost-effective and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. Finally, the statute includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as their principal element. The following sections discuss how the selected remedy meets these statutory requirements.

10.1 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The selected remedy will prevent direct exposure to contaminated soils and tailings within the operable unit by covering those areas with lime and water in the case of wet closure areas, or with limestone and a dry soil cap, in the case of dry closure areas. Institutional controls to prevent residential development or disruption of the closures are also required, and are described in Attachment 1 Part II. This will cause the current exposure risks to be reduced to levels within EPA's range of acceptable exposure levels. Contamination within the lower bypass area will be excavated and consolidated into the closure areas, which will prevent unacceptable risks of on-site exposure or downstream migration.

Human and environmental exposure to contaminated ground water, either through further spread of the contamination in the aquifer or migration of the plume, will be controlled through chemical fixation and wet-closure, backed up by the construction of an interception trench at the waste unit boundary. ARAR requirements for ground water outside of the waste unit boundary and the interception trench, described below and in Attachment 2 to Part II, are established by this Record of Decision and must be met.

Risks to human health and the environment from earthquake damage and floods, which may cause migration of waste materials from the ponds, including the inactive area, will be controlled by appropriate berm construction and strengthening. The construction of an interception system along the east side of the inactive area, and the construction of adequate capacity for the entire bypass channel will also ensure flood protection. ARARs related to these requirements are explained and described below and in Attachment 2 to Part II.

Environmental risks other than those discussed in the previous paragraphs will be addressed through the wet closure and dry closure cells, which will prevent significant exposure pathways to the environment. Ecological monitoring of the area will aid in EPA's continual evaluation of environmental conditions at the site. Environmental enhancement will occur through the reconstruction and restoration of the bypass channel, and creation of wetlands. Surface water ARARs, described below and in Attachment 2 to Part II, must be met for instream ambient standards at the designated point of compliance. Compliance with those ARARs will ensure environmental protection for surface waters downstream from the inactive area, including the Clark Fork River.

Short term risks posed by the selected alternative can be controlled through effective site safety plans and other means.

10.2 COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

The selected remedy will comply with all applicable or relevant and appropriate requirements (ARARs), except for those appropriately waived. A detailed description of ARARs, appropriate waivers, and replacement standards is contained in Attachment 2 to Part II. The most significant ARARs are highlighted and described in the section above.

10.3 COST-EFFECTIVENESS

The selected alternative is the lowest cost alternative examined in the proposed plan, except for the no action alternative. The selected remedy is cost-effective because it provides overall protectiveness proportional to its costs. Alternatives involving total removal of contaminants (Alternatives 8 through 11) cost significantly more than the selected alternative, and yet did not provide significant additional overall protection of human health and the environment than the selected alternative. In fact, alternatives involving total removal presented unacceptable risks in terms of human safety because the removed material would have to be transported by heavy equipment and placed at another location. This type of activity has inherent safety risks.

10.4 UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES OR RESOURCE RECOVERY TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE

Because the selected alternative will provide for extensive berming to prevent flood and earthquake damage and release, it has a high degree of long term effectiveness and permanence. To ensure this, clear operation and maintenance requirements will be invoked for the inactive area, to ensure that the berms remain protective and the wet closures and ground water interception system work as designed.

Resource recovery technologies are not feasible for this site. Alternatives involving resource recovery, examined in the original Warm Springs Ponds feasibility study, were high in cost and would not remove all contaminants of concern from the waste material found at the site. Use of chemical fixation and wet-closure cover is an alternative treatment technology, and its effectiveness at this site will be monitored for possible use at other mining sites and Clark Fork Basin operable units.

The selected alternative provides the best balance of tradeoffs in terms of long term effectiveness and permanence, reduction in toxicity, mobility, or volume through treatment, short term effectiveness, implementability, cost, and the statutory preference for treatment as a principal element. Total removal options may be more permanent and effective over the long term, but these factors do not outweigh the relatively high costs, implementability problems, and human safety risks associated with them. Partial removal options also exhibit implementability problems, and do not provide significantly higher overall protectiveness, long term effectiveness, or cost reduction from the selected remedy.

The State of Montana concurs with EPA concerning the selected remedy for the inactive area. While many community members have indicated reservations about the selected remedy, there are others who fully support EPA's selection of Alternative 5. The majority of those who expressed reservations are willing to accept the selected remedy as an interim solution.

10.5 PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

The selected remedy utilizes lime addition to many areas of contamination within the inactive area. Lime addition, followed by wet-closure will reduce the mobility of the contamination, and thus the remedy utilizes treatment as a principal part of the remedy. In addition, standard treatment of contaminated ground water will be accomplished through the pump-back system, which will return the contaminated ground water to the active area. Therefore, the statutory preference for remedies that employ treatment as a principal element is satisfied.

As explained above, other forms of treatment were examined in the feasibility study and were determined to be infeasible and impracticable for the contamination found at the site.

The EPA is directed to follow the NCP (National Oil and Hazardous Substances Pollution Contingency Plan, 55 Fed. Reg. 8665-8865, March 8, 1990) and is obligated to rely on Superfund guidance in the selection of remedies. One major purpose of this section is to lay out provisions of the NCP and pertinent parts of guidance documents that played important roles in the process of selecting this remedy. In part, it is an attempt to trace the rationale for selecting a remedy that will not remove the tailings and dispose of them outside of the historic flood plain.

Although the majority of the basin's residents who participated in the remedy selection process accept the remedy chosen, many residents of the lower basin feel strongly that the tailings should be totally removed and they have presented strong arguments for their position. Numerous scoping meetings and briefings were conducted prior to the EPA's selection of the remedy. Most of the discussions focused on issues such as implementability, permanence and costs. The EPA and State seldom paused to discuss what the NCP and Superfund guidance have to say about situations of this sort.

The NCP directs the EPA to "use treatment to address the principal threat posed by a site, whenever practicable" and to "use engineering controls, such as containment, for waste that poses a relatively low long term threat or where treatment is impracticable" (55 Fed. Reg. 8846).

Recent guidance (OSWER Publ. 9380.3-06FS, November 1991) offers the following definitions of principal threat and low level threat wastes:

> Principal threat wastes are those materials considered to be highly toxic or highly mobile and generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. Where toxicity and mobility of the source material combine to pose a risk of 1 X 10^{-3} (one excess cancer per 1000 individuals) or greater, treatment alternatives should be evaluated.
>
> Low level threat wastes are those source materials that generally can be reliably contained and would present only a low risk in the event of release. They include source materials that exhibit low toxicity, low mobility in the environment, or are near health-based levels.

Although NCP expectations are to use treatment technologies when there is a principal threat, and containment or some other engineered solution when there is a low level threat, categorizing the threat of waste at a site does not always render a perfect fit. Often it becomes necessary to characterize the source material, which is the reservoir of hazardous substances, pollutants, or contaminants from which there is migration of the contamination to ground water, surface water, or air, or from which there is a source of direct exposure.

In characterizing source materials, highly mobile or highly toxic materials, such as liquids and volatile organic compounds, generally are regarded as principal threats. Relatively immobile source materials of low to moderate toxicity generally are regarded as low level threat wastes. It is important to note that contaminated ground water is not usually considered to be a source material.

The NCP recognizes that in some situations the wastes will not be readily classifiable as either a principal threat or low level threat waste. Thus, a combination of treatment and containment methods may be appropriate to achieve protection of human health and the environment. Additionally, institutional controls such as access restrictions, water use restrictions, or deed limitations will be used to aid containment or treatment remedies.

The final point that is pertinent with respect to principal threat wastes versus low level threat wastes is that the NCP recognizes there are situations where wastes identified as a principal threat simply cannot be treated (55 FR at 8703, March 8, 1990). Some situations that may limit or preclude the use of treatment methods include:

a) The extraordinary volume of materials or the complexity of the site render treatment technologies impracticable;

b) Implementation of a treatment-type remedy would result in greater overall risk to human health or safety due to risks posed to workers or the surrounding community during implementation; and

c) Implementation of a treatment-type remedy would result in severe effects across environmental media (OSWER Publ. 9380.3-06FS, November 1991).

With these directives and guidance in mind, where do the 3.4 million cubic yards of tailings, sediments and soils within the inactive area of the Warm Springs Ponds fall out? In other words, are the source materials a principal threat waste or a low level threat waste? Is treatment the appropriate remedy? Or, is containment, removal, or some other engineered solution the appropriate remedy? Is a combination of treatment and containment appropriate? What is the primary threat? In light of the extraordinary volume of source materials present in the inactive area, does this factor become the overriding consideration and render treatment technologies impracticable?

The EPA and State carefully considered all of these questions. Following are the conclusions reached.

- The source material at issue does not exhibit high mobility. Ground water monitoring wells located between the Pond 1 berm and the Clark Fork River show that the metals and arsenic meet drinking water standards just a few hundred feet down gradient.

- The source material can be reliably contained. Evidence of this is present throughout the Warm Springs Ponds system, where less than adequate berms and liming methods have for decades contained the source material rather effectively. Unquestionably, higher standards for dam safety and water treatment are needed; however, these improvements are already components of the remedy for the active area, and as components of the remedy for the inactive area these improvements can reliably contain the source material.

- The risks posed by the source material are above health-based levels. People who work year around at the ponds (occupational scenario) face increased cancer risks of 2 chances in 10,000. Direct contact with exposed tailings, contaminated pond water and contaminated pond bottom sediments account for this increased risk.

- The source material is highly toxic to the aquatic environment. This is the most controversial aspect of categorizing the threat of waste present in the inactive area. On one hand, it can be argued that fish and wildlife already live in contact with these materials throughout the pond system. On the other hand, releases of wastes from the Mill-Willow Bypass into the upper Clark Fork River, which are identical to the source materials at issue here, have in past years caused massive, repeated fishkills.

- There is an extraordinary volume of materials present. Often, this makes the implementation of treatment technologies impracticable and limits the possibilities. More significantly, however, the sheer volume of materials makes one of the alternatives to treatment—specifically removal—impracticable. Attempting to remove the materials and dispose of them in another location, outside of the pond system, would result in greater overall risks to the environment and human safety during implementation. The EPA is not willing to take these risks.

After carefully considering the questions raised by the NCP and guidance requirements, the EPA and State believe that the 3.4 million cubic yards of tailings, contaminated sediments and soils residing in the inactive area of the Warm Springs Ponds, and the contaminated ground water underlying this area, are best suited to a combination of treatment technologies, engineering controls, and institutional controls. Institutional controls are expected to be needed to a very limited degree.

By so concluding, a second tier of NCP requirements and guidance comes into play. Whenever treatment is an element of the selected remedy, the NCP encourages the development and implementation of innovative treatment technologies. (40 CFR Section 300.430(a)(1)(iii)(E))

Innovative treatment technologies are defined as new or emerging methods for reducing or eliminating the toxicity, mobility or volume of waste; methods which have limited data in support of their performance in terms of constructability, effectiveness and costs.

The EPA has taken steps nationwide to promote the implementation of innovative technologies, particularly for contaminated soils and ground water. These steps include the creation of incentives for participating potentially responsible parties (PRPs) and the affected public. These steps also include a willingness to explore promising new technologies with the recognition that there is some risk of failure, some risk of a false start, or the need sometimes for a second attempt at solving the problems.

The EPA is willing to take the risks that come with applying innovative treatment technologies because their potential for comparable or superior performance, less severe impacts, and reduced costs is very promising as compared to the proven technologies (OSWER Publ. No. 9380.3-05FS, February 1991; OSWER Dir. 9380.0-17, June 1991).

Immobilization is one such innovative treatment technology that has shown promising results. Immobilization is a term used in connection with any of the various technologies that limit the solubility or mobility of contaminants. The term "fixation" is a synonym for immobilization (OSWER Publ. No. 9380.3-07FS, February 1991).

The various immobilization, or fixation technologies limit contaminant solubility or mobility with or without a change in the physical characteristics of the matrix. Immobilization may involve physical or chemical processes, or a combination of them, to accomplish the objective. It is not a destructive technique; rather, it prohibits or impedes the mobility of the contaminants.

Immobilization has proven effective for many inorganic contaminants, particularly metals. Thus, immobilization will generally constitute treatment of wastes to reduce toxicity, mobility or volume when metals are the contaminant of concern and there are compelling reasons for selecting this technology over removal, destruction, or more conventional treatment technologies (OSWER Publ. No. 9380.3-07FS, February 1991).

The remedy selected for the inactive area includes, as a major component, the chemical fixation (or immobilization) of metals contained in the tailings, pond bottom sediments and contaminated soils. Tailings, a by-product of milling processes, contain unrecovered amounts of metals—principally metal sulfides. In the current environment, the metal sulfides begin to oxidize due to contact with air and water. This oxidation process generates acid waters and solubilizes the metals which then contaminate surface and ground waters. This chemical fixation process involves the incorporation of lime, which is an alkaline material, over and into the contaminated materials. In addition, a lime slurry (lime dissolved in water) can also be added to the already dry materials to carry the lime deeper into the contaminated soil horizon. Once the contaminated area is chemically fixed, it will be flooded and the water level will be maintained.

By maintaining an alkaline dominant system over and within the tailings, the oxidation of the metal sulfides can be prevented. Hence, the metals are immobilized since they cannot dissolve and enter the underlying or overlying water. Any metals already dissolved in the pore waters within the saturated tailings, will precipitate as insoluble metal hydroxides and thus be immobilized. Excess lime will be added to exceed the acid generation potential of the metal sulfides in the tailings so that the fixation process becomes permanent.

Wet closure and chemical fixation with lime is not a suitable mechanism for controlling arsenic. In fact, addition of the lime enhances the mobility of arsenic. Fortunately, within the inactive area, there is a relatively low concentration of arsenic available. Its release and movement are not expected to be substantial; however, if that expectation proves to be inaccurate, the interception trench will collect all contaminated water and a pump-back system will prevent contaminants from entering the Clark Fork River and the ground water beyond the interception trench.

The additional benefits associated with wet closure and chemical fixation are the wetlands that will be formed and enhanced. The neutralized tailings will permit vegetative growth, the flooded areas will provide waterfowl habitat, and the ground water flowing from the system is expected to improve to the point that interception, pumping and treatment will no longer be necessary. The EPA expects such an improvement to occur over a period of a few years, not decades.

ATTACHMENT 1 TO PART II

INSTITUTIONAL CONTROLS
FOR THE
WARM SPRINGS PONDS INACTIVE AREA OPERABLE UNIT (OU 12)
SILVER BOW CREEK/BUTTE AREA NPL SITE (original portion)
UPPER CLARK FORK RIVER BASIN, MONTANA

1. Implementation of a conservation easement with restrictive covenants by ARCO for the Inactive Area, to ensure that future development will not include residential use, and will not cause disruption of disposal areas or waste ponds.

2. Implementation of a permit development system, in cooperation with Anaconda/Deer Lodge County and ARCO, which will prevent residential development at the Warm Springs Ponds. The permit system includes the development of a master plan, which will designate the ponds as a wildlife refuge.

3. Implementation of a water well ban for the Inactive Area. The water well ban shall prohibit water wells within the waste units at the Inactive Area permanently or until such time as ARARs are achieved for the ground water.

4. Implementation of a ban on swimming in the ponds of the Inactive Area, to be accomplished through the posting of appropriate signs.

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, STANDARDS, CONTROLS, CRITERIA, OR LIMITATIONS AND OTHER PERFORMANCE STANDARDS FOR THE WARM SPRINGS PONDS INACTIVE AREA OPERABLE UNIT SILVER BOW CREEK/BUTTE AREA NPL SITE (original portion) UPPER CLARK FORK RIVER BASIN, MONTANA

Section 121(d) of CERCLA, 42 U.S.C. Section 9621(d), certain provisions of the current National Contingency Plan (the NCP), 40 CFR Part 300 (1990), and guidance and policy issued by the Environmental Protection Agency (EPA) require that remedial actions taken pursuant to Superfund authority shall require compliance with substantive provisions of applicable or relevant and appropriate standards, requirements, criteria, or limitations from State environmental and facility siting laws, and from federal environmental laws (commonly referred to as ARARs) at the completion of the remedial action, and/or during the implementation of the remedial action, unless a waiver is granted. These requirements are threshold standards that any selected remedy must meet. The Feasibility Study for the Warm Springs Ponds operable unit proposed a set of such requirements, and gave justification for identifying the proposed requirements. After consideration of public comments on the proposed requirements, and further review of applicable guidance and standards including the NCP, ARARs for the Warm Springs Ponds area were further refined in the Warm Springs Ponds Active Area Record of Decision (EPA, 1990) and its Explanation of Significant Differences and Errata Sheet (EPA, 1991). The following list of ARARs for the Warm Springs Ponds Inactive Area operable unit is based on the Active Area ARARs and further refinements learned by EPA as it implements various cleanups throughout the Clark Fork Basin Superfund Sites.

Each ARAR or group of related ARARs is identified by a specific statutory or regulatory citation, and a compliance description which addresses how and when compliance with the

ARAR will be measured (some ARARs will govern the conduct of the implementation of the remedial action, some will govern the measure of success of the remedial action, and some will do both). Contaminant specific ARARs are followed by a description of the point of compliance, which describes where compliance with the ARAR will be measured.

Also contained in this list are references to lists of policies, guidances or other sources of information which are "to be considered" during the selection and implementation of the ROD. Although not enforceable requirements, these documents are important sources of information which EPA and the State of Montana Department of Health and Environmental Sciences (MDHES) referred to during selection of the remedy, especially in regard to the evaluation of public health and environmental risks; or which will be referred to as appropriate during evaluation and approval of various activities during the ROD implementation.

Finally, this list contains other legal provisions or requirements which should be complied with during the implementation of this ROD.

The portions of the original Warm Springs Ponds Feasibility Study (FS) which address ARARs (primarily Chapter 3 and Appendix B), the portions of the Warm Springs Ponds Active Area ROD, as amended, which address ARARs (primarily Part II, Section 5, and Part III, Subpart A, Section 2.3, and Subpart B, Section 3.0), and applicable EPA guidance, policy, regulation, and statutory authority, form the basis for the final selection of ARARs contained in this list. Responses to new comments on ARARs received during the Inactive Area comment period are contained in Part III of this Record of Decision.

ARARs are divided into contaminant specific, location specific, and action specific requirements, as described in the new NCP and EPA guidance. Each category contains both federal and State ARARs. For contaminant specific ARARs, ARARs are listed according to the appropriate media.

Contaminant specific ARARs address chemical or physical characteristics of compounds or substances on sites. Contaminant specific ARARs generally set health or risk based numerical values or methodologies which, when applied to site-specific conditions, result in the establishment of numerical values. These values establish the acceptable amount or concentration of a chemical that may be found in, or discharged to, the ambient environment.

Location specific ARARs are restrictions placed on the concentration of hazardous substances or the conduct of cleanup activities because they are in specific locations. Location specific ARARs relate to the geographic or physical position of the site, rather than to the nature of the contaminants at sites.

Action specific ARARs are usually technology or activity based requirements or limitations on actions taken with respect to hazardous substances. For action specific ARARs, certain provisions pertain to the entire cleanup action and are so indicated. Other ARARs pertain to specific portions of the cleanup, and are so indicated.

Only substantive portions of the listed requirements are ARARs. Administrative and procedural requirements are not ARARs, and need not be attained during or after site cleanups. Administrative and procedural requirements are those which involve consultation, issuance of permits, documentation, reporting, recordkeeping, and enforcement. The CERCLA program has its own set of administrative procedures which assure proper implementation of CERCLA. The application of additional or conflicting administrative or procedure requirements could result in delay and confusion. The only exception to this involves the application of State of Montana water use law to activities contemplated at the site. Because the substantive provisions of those laws are closely tied to procedural rights, EPA has recommended that the potentially responsible party, ARCO, apply for any necessary water right permit or otherwise comply with State water right law, where water rights are implicated by the cleanup activities contemplated by this ROD. This is a narrow exception to the general principle described above, and EPA has reserved its right to review this decision if significant delay is caused by separate water rights proceedings.

CERCLA authorized actions which are conducted on-site are exempt from permit requirements, pursuant to section 121(e) of CERCLA, 42 U.S.C. s'§ 9621(e). This exemption applies to all activities contemplated by this Record of Decision. However, as noted in the paragraph above, EPA has recommended to the potentially responsible party that a narrow exception to this rule be observed for water rights issues.

Many requirements listed here are promulgated as identical or near identical requirements in both federal and State law, usually pursuant to delegated environmental programs administered by EPA and the States, such as the requirements of the federal Clean Water Act and the Montana Water Quality Act. The preamble to the new NCP states that such a situation results in citation to the State provision as the more stringent standard, but treatment of the provision as a federal requirement.

The scope of this Interim Record of Decision

EPA guidance establishes that interim actions, such as removal actions or interim remedial actions, need not meet all ARARs potentially implicated at an operable unit. Rather, removals or interim actions must comply with ARARs which address the specific scope of the removal or interim action.

The Warm Springs Ponds Inactive Area Remedial Action is an interim action, in that it will be reviewed after implementation of upstream cleanup activities and cleanup activities at the Ponds. Nevertheless, the action is meant to be a permanent action which addresses site conditions comprehensively. Accordingly, all of the ARARs listed here are within the scope of this interim action.

Final action levels in soils and contaminated materials for protection of human health and the environment for the various contaminants found at the Warm Springs Ponds Inactive Area are not identified in this Record of Decision. Ongoing risk assessment work at other operable units within the Clark Fork Basin will determine those action levels. Compliance with a final action level is expected to be achieved with this cleanup (refer to Part II, Section 6.7). This issue will be reviewed before a final cleanup is selected or declared for the entire Warm Springs Ponds area.

1. <u>CONTAMINANT SPECIFIC ARARS AND PERFORMANCE STANDARDS</u>

I. Groundwater

A. Maximum Contaminant Limits and non-zero Maximum Contaminant Limit Goals for contaminants of concern at the site, promulgated pursuant to the Safe Drinking Water Act, 42 U.S.C. s'§s'§ 300f <u>et seq.</u> and the Montana Public Water Supplies Act, MCA s'§s'§ 75-6-100 <u>et seq.</u> Regulations establishing specific limits are found at 40 CFR s'§s'§ 141.11 - .16 and ARM s'§s'§ 16.20.203 - .205, .1002, .1003, and .1011. These standards in part are also required by the Resource Conservation and Recovery Act, 42 U.S.C. § 6901 <u>et seq.</u> and 40 CFR s'§ 264.94, and corresponding State of Montana statutes and regulations.

Specific limits are:

Arsenic	0.050 milligrams per liter (mg/l)
Cadmium	0.010 mg/l
Chromium	0.050 mg/l
Lead	0.050 mg/l
Mercury	0.002 mg/l
Nitrate (as N)	10.000 mg/l

These standards must be met immediately north of the ground water interception trench, outside of the wet closure cells below Pond 1, after implementation of the remedial action. Compliance with these standards will also achieve compliance with the State of Montana non-degradation standard for ground water, ARM s'§ 16.20.1011.

B. Ground water well construction criteria, certain provisions of MCA s'§ 85-2-505 which are described below (the Montana Water Use Act).

Additional contamination of ground water through construction of ground water wells is prohibited. Ground water wells must be constructed and maintained so as to prevent waste, contamination, or pollution of ground water. Activities cannot result in the degradation of ground water, in accordance with ARM s'§s'§ 16.20.203, .204, .206, .207, .1002, .1003, and .1011.

II. Surface Water

A. Ambient Standards

State of Montana surface water quality standards and federal water quality criteria, or appropriate replacement values for those standards and criteria which are waived, must be met for in-stream ambient water at or near the site (that is, water within the reconstructed Lower Bypass, and the water entering the Clark Fork River). These standards are enacted pursuant to the section 304 of the Clean Water Act, 42 U.S.C. s'§ 1314 and the "Gold Book" (aka Water Quality Criteria for Water, 1986); and the Montana Water Quality Act, MCA s'§s'§ 75-5-101 et seq. and ARM s'§s'§ 16.20.618(2) and 16.20.622(2). The Clark Fork River is a Class C-2 river and the Mill and Willow creeks are Class B-1 streams - see ARM s'§s'§ 16.20.604, .618, and .622.)

Specific limits are:

	Acute	Chronic
Arsenic (III)	0.36 mg/l	0.19 mg/l
Arsenic (V)	0.85 mg/l	0.048 mg/l
Arsenic (Total)	--	0.02 mg/l*
Cadmium	0.0039 mg/l**	0.0011 mg/l**
Copper	0.018 mg/l**	0.012 mg/l**
Iron	-	1.0 mg/l
Lead	0.082 mg/l**	0.0032 mg/l**
Mercury	-	0.2 ug/l*
Zinc	0.12 mg/l**	0.11 mg/l**

* Indicates that the standard is a replacement standard for a standard which is waived, pursuant to section 121(d)(4)(A) and (C) of CERCLA. See Warm Springs Ponds Active Area Record of Decision (EPA, 1990).

** The value identified is based on an assumed hardness of 100 mg/l. The actual standard will be based on measured hardness at the compliance point.

Dissolved Oxygen - Dissolved oxygen concentration may not be reduced below 7.0 mg/l.

pH - Induced variation of pH within the range of 6.5 to 9.5 must be less than 0.5 pH unit. Natural pH outside this range must be maintained without change. Natural pH above 7.0 must be maintained above 7.0.

Turbidity - The maximum allowable increase above naturally occurring turbidity is 5 nephelometric turbidity units except for short-term construction or hydraulic projects, game fish population restoration, as allowed in ARM s'§ 16.20.633.

Temperature - A 1 degree F maximum increase above naturally occurring water temperature is allowed within the range of 32 degrees to 66 degrees F; within the naturally occurring range of 66 degrees F to 66.5 degrees F, no discharge is allowed which will cause the water temperature to exceed 67 degrees F; and where the naturally occurring water temperature is 66.5 degrees F or greater, the maximum allowable increase in water temperature is 0.5 degrees F. A 2 degree F-per-hour maximum decrease below naturally occurring water temperature is allowed when the water temperature is above 55 degrees F, and a 2 degree F maximum decrease below naturally occurring water temperature is allowed within the range of 55 degrees F to 32 degrees F.

Sediment, etc. - No increase is allowed above naturally occurring concentrations of sediment, settleable solids, oils, or floating solids which will or are likely to create a nuisance or render the waters harmful, detrimental, or injurious to public health, recreation, safety, welfare, livestock, wild animals, birds, or other wildlife.

Color - True color must not be increased more than 5 units above naturally occurring color.

These standards must be met at the point of compliance, which will be within the reconstructed bypass channel upstream of the confluence with Warm Springs Creek. This point will be further defined in design documents developed for implementation of the Warm Springs Ponds Inactive Area remedy. These standards must be met at the conclusion of this remedial action implementation, or at the conclusion of the Active Area remediation including the shakedown period, whichever comes later.

Appropriate in-stream monitoring must be implemented to measure in-stream values, if such monitoring is not already implemented as part of the Active Area remediation or the Clark Fork Basin monitoring effort.

If exceedences of the in-stream standards can be demonstrated by the potentially responsible party to be caused by contamination which is unrelated to the Warm Springs Ponds Active and Inactive Area operable units, these ARARs and Performance Standards will not be considered to be violated.

Compliance with these standards will constitute compliance with the State of Montana's non-degradation standards, promulgated pursuant to the Montana Water Quality Act, MCA s'§ 75-5-303, and ARM s'§ 16.20.702.

III. Air Standards

Standards related to air pollution are promulgated pursuant to the Clean Air Act, 42 U.S.C. s'§s'§ 7401 et seq. and the Clean Air Act of Montana, MCA s'§s'§ 75-2-102 et seq., more specifically the standards identified below.

A. ARM s'§ 16.8.1401(2), (3), and (4). Airborne particulate matter. There shall be no production, handling, transportation, or storage of any material, use of any street road or parking lot, or operation of a construction site or demolition project unless precautions are taken to control emissions of airborne particles. Emissions shall not exhibit an opacity exceeding 20% or greater averaged over 6 consecutive minutes. This provision must be complied with at the site during remedial action implementation activities.

B. ARM s'§ 16.8.1404(2). Visible Air Contaminants. Emissions into the outdoor atmosphere shall not exhibit an opacity of 20% or greater averaged over 6 consecutive minutes. This provision must be complied with at the site during remedial action implementation activities.

C. ARM s'§ 16.8.1427. Nuisance or odor bearing gases. Certain gases (excluding diesel gases from vehicles), vapors, and dusts must be controlled such that no public nuisance is caused. This provision must be complied with at the site during remedial action implementation activities. Compliance with this provision at the site will assure that no public nuisance occurs.

D. ARM s'§ 26.4.761. Fugitive dust control. Practicable fugitive dust control measures must be planned, through description of appropriate measures in design documents subject to EPA approval, and implemented during excavation activities.

E. ARM s'§ 16.8.815. Lead. The concentration of lead in ambient air shall not exceed a 90 day average of 1.5 micrograms per cubic meter of air. This provision must be complied with at the conclusion of the remedial action implementation.

F. ARM s'§ 16.8.818. Settled particulate. Settled particulate shall not exceed a 30 day average of 10 grams per square meter. This provision must be complied with at the conclusion of the remedial action implementation.

G. ARM s'§ 16.8.821. PM-10. The concentration of PM-10 in ambient air shall not exceed a 24 hour average of 150 micrograms per cubic meter of air and an annual average of 50 micrograms per cubic meter of air. This provision must be complied with at the conclusion of the remedial action implementation.

IV. Soils and Contaminated Material and Mining Waste

Contaminated soils and other mining waste found within the Warm Springs Ponds Inactive Area will be remediated through dry closure and capping, excavation, and chemical fixation and wet closure, as described in the ROD text. All such material which meets or exceeds the following criteria shall be addressed through the Warm Springs Pond Inactive Area remediation, in a manner consistent with the Warm Springs Ponds Inactive Area ROD and as approved by EPA.

Color shall be used as the primary criterion. Discolored materials shall be remediated. Discolored materials are readily identified visually by discoloration compared to the natural color of adjacent materials.

Texture shall be used as a secondary criterion for remediation. Soils or waste materials which are fine grained shall be remediated. Fine grained materials can be distinguished from coarse grained materials by identifying coarse sand, gravel, or cobbles (Refer to section 2.1 of the Mill-Willow Bypass Removal Work Plan).

Following remediation of the above identified materials, the contaminant concentrations of soils and waste material remaining after remediation are expected to exhibit the range of concentrations shown in the table addressing this issue in Part II, Section 6.7. If this range is not exhibited, remediation shall continue until the range is exhibited, in a manner to be approved by EPA.

2. LOCATION SPECIFIC ARARS AND PERFORMANCE STANDARDS

I. Floodplain and Floodway Management Act Standards

A. Structures such as parks and wildlife management areas are permitted within floodplains, in accordance with the substantive provisions of MCA s'§ 76-5-402.

B. Flood control works are permitted in the floodplain and floodway, if they are protective to the 100 year flood frequency flow, in accordance with the substantive provisions of ARM s'§ 36.15.606.

C. Construction and remediation activities must minimize potential harm to the floodplain and improve natural and beneficial values of the floodplain, in accordance with the substantive provisions of 40 CFR s'§ 6.302(b) and Executive Order No. 11,988.

D. The Inactive Area facilities must be designed, constructed, operated, and maintained to avoid washout to the 100 year floodplain, in accordance with ARM s'§16.44.702, as that section incorporates 40 CFR s'§ 264.18(a) and (b).

II. Natural Streambed and Land Preservation Act Standards

A. Soil erosion and sedimentation to Montana rivers must be kept to a minimum, in accordance with MCA s'§s'§ 75-7-102, -104, -105, and -111, and ARM s'§36.2.404. This ARAR is particularly important during construction activities, and must be met through adequate design and implementation practices.

III. Historic Preservation Standards

A. Identified or eligible cultural resources shall be identified and the impact of the Warm Springs Ponds Inactive Area remediation on those resources must be avoided or mitigated. Performance Standards for notification and documentation of cultural and historic resources are those procedures established by the Programmatic Agreement, in accordance with the substantive provisions of 40 CFR s'§ 6.301(b) and 36 CFR Part 800.

B. If significant scientific, prehistorical, historic, or archaeologic data is found at the Warm Springs Ponds Inactive area, it must be preserved in an appropriate manner, in accordance with the substantive provisions of 40 CFR s'§ 6.301(c).

IV. Wetlands Protection Standards

An inventory of wetlands at the Warm Springs Ponds Inactive area as they existed prior to any cleanup activities must be compiled and approved. Activities must be conducted so as to avoid or minimize destruction of wetlands. If destruction is not avoidable, wetlands must be replaced and/or restored to ensure that no net loss of wetlands will occur as a result of the cleanup activities (past and present) at the Warm Springs Ponds Inactive area, in accordance with the substantive provisions of 40 CFR s'§ 6.302(a) and 40 CFR Part 6, Appendix A and Executive Order No. 11,990.

It has been noted by EPA and the consulting agencies that cleanup activities within the Mill Willow Bypass and other areas of the Warm Springs Ponds Active Area, have exhibited adverse impacts on wetlands habitat. Therefore, all efforts directed toward reconstruction, reclamation and restoration, or other similar activities planned by the potentially responsible party must be done as part of the remedial action implementation process, to ensure compliance with this standard.

V. Endangered Species Protection Standards

Bald eagles and peregrine falcons have been identified as users of the Warm Springs Ponds Inactive Area. Appropriate mitigative measures during construction activities must be followed, and additional biological surveys or other studies may be required, in accordance with the substantive provisions of the Endangered Species Act, 16 U.S.C. s'§ 1531 et seq., and 50 CFR Parts 17 and 402, and 40 CFR s'§ 6.302(h).

VI. Fish and Wildlife Coordination

In accordance with the Fish and Wildlife Coordination Act, 16 U.S.C. s'§ 1531 et seq., and 40 CFR s'§ 6.302(g), remediation activities at the Warm Springs Ponds Inactive Area shall provide adequate protection of fish and wildlife resources. This requirement must be met during implementation of the remedial activities and at the conclusion of the remedial action activities. EPA will consult with the U.S. Fish and Wildlife Service and the Montana Department of Fish, Wildlife and Parks to ensure that design plan and remedial activities comply with this ARAR.

VII. Waste Disposal Siting Restrictions

Relevant and appropriate RCRA siting requirements, found at ARM s'§ 16.44.702, which incorporates by reference 40 CFR s'§ 264.18(a) and (b), prohibit disposal of wastes within 200 feet of a fault, and impose certain conditions on waste disposed of within a flood plain. Relevant and appropriate solid waste siting requirements, found at ARM s'§s'§ 16.14.505 and .523, prohibit disposal of solid waste within the 100 year flood plain. Because the berming and other remedial activities will ensure that the Pond 1 area and the wetlands closure area below Pond 1 will be outside of a re-engineered flood plain, these ARARs are satisfied through implementation of the Record of Decision activities, and through appropriate design, construction, operation, and maintenance of the remediated area. If it is determined that the remediated areas are within the flood plain, EPA invokes an ARAR waiver pursuant to section 121(d)(4)(A) of CERCLA, 42 U.S.C. s'§ 9621(d)(4)(A) which applies to ARM s'§16.14.505(c).

3. ACTION SPECIFIC ARARS AND PERFORMANCE STANDARDS

The remedy for the Warm Springs Ponds Inactive Area requires the excavation and reconstruction, reclamation, and restoration of the Lower Bypass Channel, which includes creation of a new channel in the lower portion of the bypass, creation of wet closure cells which will function as wetlands within Pond 1 and below Pond 1, creation of a dry closure cell for the western portion of Pond 1, strengthening of existing pond berms and construction of a new berm, development of a ground water interception system at the northern boundary of the area below Pond 1, and implementation of necessary surface water and ground water monitoring. Following are ARARs and Performance Standards for these aspects of the remedial action.

I. Reconstruction/Reclamation/Restoration of the Lower Bypass Channel

The Warm Springs Ponds Inactive Area remediation will include the excavation and reconstruction, reclamation, and restoration of the bypass channel from the Pond 2 discharge point to the current northern end of the bypass. (The bypass from its southern boundary to Pond 2 discharge point is addressed in the Warm Springs Ponds Active Area action). In addition to the contaminant specific and location specific standards identified above, further cleanup work in the Bypass and any following reconstruction, restoration, and/or reclamation work must comply with the following requirements:

A. Substantive provisions of the dredge and fill requirements must be met, in accordance with 40 CFR Parts 230 and 231 and 33 CFR Parts 323 and 330.

B. Reclaimed drainages must be designed to emphasize channel and floodplain dimensions that will blend with the undisturbed drainage above and below the area to be reclaimed. The channel must be restored to a more natural configuration with geomorphically acceptable gradient. Reclamation must provide for long-term stability of the landscape, establishment or restoration of the stream to include a diversity of aquatic habitats (generally a meandering series of riffles and pools), and restoration enhancements, or maintenance of natural riparian vegetation, in accordance with the substantive provisions of ARM s'§ 26.4.634.

C. Temporary diversion structures at the Bypass or nearby creeks must be constructed to safely pass the peak run-off from a precipitation event with a 10-year, 24-hour recurrence interval. Channel lining must be designed using standard engineering practices such as riprap, to safely pass designed velocity. Free board must be no less than 0.3 feet, all in accordance with the substantive provisions of ARM s'§ 26.4.636.

D. Reclamation and revegetation requirements described below in Section III. must be met.

As noted above, reconstruction, reclamation, and restoration measures are required for the Lower Bypass area pursuant to this action, in part to ensure compliance with the standards regarding no net loss of wetlands at the Warm Springs Ponds.

II. General Reclamation and Revegetation Standards

The Warm Springs Ponds Inactive Area remediation requires excavation of contaminated areas at the existing Lower Bypass channel and possibly in the area below Pond 1, and the consolidation and dry capping of contaminated areas, which will result in the creation and maintenance of a disposal area within the Pond 1 berm. All of these areas must be reclaimed and revegetated. For those activities, the following standards apply:

A. The disposal unit and other reclaimed areas must be covered with clean soil and revegetated in an appropriate manner, consistent with the Timber Butte removal action and work plan, in accordance with the substantive provisions of 30 CFR s'§ 816.111.

B. Revegetation of any excavated, capped in place area, disposal area, or other land area disturbed or addressed by this action must comply with the substantive standards of ARM s'§s'§ 26.4.501(3)(a), .501(A)(1)(a), .520(4), .631, .638, .640(1), .644(1), and .761, and MCA s'§s'§ 82-4-231 and -233.

III. Dry Disposal Area within Pond 1 Standards.

The Warm Springs Ponds Inactive Area remediation requires the creation and maintenance of a dry disposal area within the Pond 1 berm. The construction and maintenance of these areas must comply with the following standards:

A. All waste placed within the disposal areas must be drained of free liquids, and stabilized appropriately, in accordance with the substantive provisions of 40 CFR s'§ 264.228(a)(2)(i), which is incorporated by reference into ARM s'§ 16.44.702.

B. Closure of the disposal areas must be done in such a manner as to minimize the need for further maintenance and to control, minimize, or eliminate, to the extent necessary to protect public health and the environment, post-closure escape of hazardous substances, hazardous constituents, leachate, contaminated run-off or hazardous substance decomposition products to the ground water or surface waters or to the atmosphere, all in accordance with the substantive provisions of 40 CFR s'§ 264.111, which is incorporated by reference into ARM s'§ 16.44.702. This standard does not require an impermeable cap or liners.

C. Disposal facility covers for the unit must function with minimum maintenance, promote drainage, and minimize erosion or abrasion of the final cover, and accommodate settling and subsidence, in accordance with 40 CFR s'§ 264.228(a)(2)(iii)(B), (C), and (D), and 40 CFR s'§ 264.251(c),(d), and (f) which are incorporated by reference into ARM s'§ 16.44.702.

D. The potentially responsible party must submit to the local land use or zoning authority a survey plat indicating the location and dimensions of waste disposed of in each unit. Additionally, the Respondent must record a deed restriction, in accordance with State law, that will in perpetuity notify potential purchasers that the property has been used for waste disposal and that its use is restricted, in accordance with the substantive provisions of 40 CFR s'§s'§ 264.116 and .119, which is incorporated by reference into ARM s'§ 16.44.702.

E. The disposal area must be constructed in such a manner so as to comply with the general handling, storage, and disposal requirements of 40 CFR s'§s'§ 257.3-1(a), 257.3-2, 257.3-3, and 257.3-4, which are incorporated by reference into ARM s'§ 16.44.702..

F. The potentially responsible party's waste can be disposed of on its own property, but the disposal areas must not create a nuisance or a public hazard. Additionally, the waste must be disposed of outside of the 100 year flood plain, must be disposed of in a manner which prevents pollution of the ground or surface water, must contain adequate drainage structures, and must prevent run-off from entering disposal areas; and waste must be transported to the disposal areas in such a manner as to prevent its discharge, dumping, spillage, or leaking, in accordance with the substantive provisions of ARM s'§s'§ 16.14.505 and .523, and MCA s'§ 75-10-214.

IV. Wet closure cell standards

A. The wet closure cells must be designed and operated so as to comply with the structural integrity requirements of 40 CFR s'§ 264.221(g), which are incorporated by reference into ARM s'§ 16.44.702.

B. The potentially responsible party must submit to the local land use or zoning authority a survey plat indicating the location and dimensions of waste disposed of in each unit. Additionally, the Respondent must record a deed restriction, in accordance with State law, that will in perpetuity notify potential purchasers that the property has been used for waste disposal and that its use is restricted, in accordance with the substantive provisions of 40 CFR s'§s'§ 264.116 and .119, which is incorporated by reference into ARM s'§ 16.44.702.

C. The disposal area must be constructed in such a manner so as to comply with the general handling, storage, and disposal requirements of 40 CFR s'§s'§ 257.3-1(a), 257.3-2, 257.3-3, and 257.3-4.

D. The potentially responsible party's waste can be disposed of on its own property, but the disposal areas must not create a nuisance or a public hazard. Additionally, the waste must be disposed of outside of the 100 year flood plain, must be disposed of in a manner which prevents pollution of the ground or surface water, must contain adequate drainage structures, and must prevent run-off from entering disposal areas; and waste must be transported to the disposal areas in such a manner as to prevent its discharge, dumping, spillage, or leaking, in accordance with the substantive provisions of ARM s'§s'§ 16.14.505 and .523, and MCA s'§ 75-10-214.

V. Berm Strengthening Standards

The berms within the Warm Springs Ponds Inactive Area will be remediated by strengthening the berms against floods and earthquakes. The berm strengthening actions must comply with the following standards:

A. The North South berm adjacent to Pond 1 and the new berm extension.

1. The berm, which is an integral element of a high hazard dam system, must comply with the criteria given in ARM s'§ 36.14.501, including compliance with the Maximum Credible Earthquake standards.

2. The berm, which is an integral element of a high hazard dam system, must be able to withstand the calculated design flood (0.5 Probable Maximum Flood) in accordance with the substantive provisions of ARM s'§ 36.14.502. The

reconstructed lower bypass channel adjacent to this berm must be designed to safely pass the design flood.

B. The Existing East-West aspect of the Pond 1 Berm

1. The berm must store water and contaminated sediments in a secure, thorough, and substantial and safe manner, in accordance with the substantive provisions of MCA s'§s'§ 85-15-207 and 208.

2. The berm, which is an integral element of a high hazard dam system, must comply with the criteria given in ARM s'§ 36.14.501, including compliance with the Maximum Credible Earthquake standards.

VI. Ground Water Monitoring Standards

The Warm Springs Ponds Inactive Area remediation requires the monitoring of ground water at the ground water interception trench, to ensure compliance with the ground water standards described in the Contaminant Specific ARARs and Performance Standards Section. Such activities must comply with the following standards:

A. Standards established in 40 CFR s'§ 264.97, which is incorporated by reference into ARM s'§ 16.44.702, must be complied with. Only contaminants for ground water identified in this ROD must be monitored.

VII. Surface Water Monitoring Standards

Ambient surface water standards are required to be met by this remedial action, in the manner described above. Adequate surface water monitoring, to the extent such monitoring does not exist as part of the Active Area monitoring program or the Clark Fork Basin monitoring program, must be implemented to measure compliance with those standards.

4. OTHER LAWS

In addition to the environmental or siting standards identified above, the State of Montana has identified a list of other State laws which should be complied with during the conduct of site remediation and maintenance activities. These are:

I. To the extent applicable, noise levels for protection of on-site workers must be met, as described in ARM s'§ 16.42.101.

II. The Occupational Health and Safety Act, 20 U.S.C. s'§s'§ 651 - 678, and implementing regulations must be complied with. Particularly, 29 CFR Part 1926 and 29 CFR s'§s'§ 1910.120 and .132 must be complied with. The Respondent is required to submit and follow a site specific Health and Safety Plan for conduct of activities at the Warm Springs Ponds Inactive Area.

III. To the extent it is applicable, substantive provisions of the Montana Safety Act, MCA s'§ 50-71-201 must be complied with.

IV. To the extent applicable, the Employee and Community Hazardous Chemical Information Act must be complied with, in accordance with the substantive provisions of MCA s'§s'§ 50-78--202, -203, -204, and -305.

Ground Water Well Drilling and Monitoring

V. If ground water wells are determined to be necessary, well drillers must be licensed and registered as stated in ARM s'§s'§ 36.21.402, .403, .405, .406, .411, .701, and .703.

VI. Ground water wells must be logged and reported to the Department of Natural Resources Conversation, as stated in MCA s'§ 85-2-516.

Water use rights

VII. To the extent applicable, any remedial activities at the Warm Springs Ponds Inactive Area must comply with the substantive provisions of MCA s'§s'§ 85-2-301, -306, -311, and -402, and MCA s'§s'§ 75-7-104 and 87-5-506, and implementing regulations found at ARM s'§s'§ 36.16.104 - .106, and 26.4.648.

5. TO BE CONSIDERED

A list of documents which EPA, in consultation with the State, relied on in assessing potential risk at the Warm Springs Ponds area, or which may be relied on in reviewing and approving Warm Springs Ponds Inactive Area actions is included in the Warm Springs Ponds Active Area Record of Decision, and is incorporated by reference. EPA reserves the right to supplement this list at any time.

／
DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES

STAN STEPHENS, GOVERNOR

FAX # (406) 443-7312

STATE OF MONTANA

OFFICE LOCATION: Steamboat Block, 616 Helena Avenue, Rm. 302, Telephone: (406) 449-4067

MAILING ADDRESS: Cogswell Building, Helena, MT 59620

June 17, 1992

Mr. John F. Wardell
U.S. Environmental Protection Agency
Drawer 10096, Federal Building
301 South Park
Helena, Montana 59626-0096

Dear Mr. Wardell:

Subject: MDHES Concurrence with Selected Remedy, Silver Bow Creek/Butte Area NPL Site, Warm Springs Ponds Inactive Area

By this letter, the State of Montana, acting through the Department of Health and Environmental Sciences (MDHES), indicates its concurrence with EPA's selected remedy for the Inactive Area of the Warm Springs Ponds Operable Unit, Silver Bow Creek/Butte Area NPL Site. We expect to be able to provide concurrence with the Warm Springs Ponds Inactive Area Record of Decision, but have not to date received a full draft document to review. We will need to review the final published document prior to concurrence with the ROD.

At this time we are specifically concurring with the selection of Alternative 5, as described in the Warm Springs Ponds Inactive Area Proposed Plan (March 1992), as the selected remedy for this site. The components of the selected remedy include:

- Dry closure of the presently dry western portion of Pond 1;
- Wet closure of the presently wet eastern portion of Pond 1;
- Stabilization of the east-west berm of Pond 1 for maximum credible earthquake (MCE) protection;
- Upgrade of the north-south berm of Pond 1 for MCE protection and 0.5 probable maximum flood (PMF) protection;
- Wet closure of the tailings located below Pond 1, by construction of a series of low dikes, lime addition, and flooding;
- Groundwater interception by use of a trench in the existing Mill-Willow Bypass channel at the lower end of the wet closed area, with associated pumping equipment to return intercepted groundwater to Pond 3 for treatment;
- Extension of the 0.5 PMF flood-protection dike along the Mill-Willow Bypass;
- Construction of a new Mill-Willow Bypass channel to the west of the extended flood-protection dike;
- Construction of a new channel to intercept flood runoff from the hills east of Pond 1 and the area below Pond 1; and
- Implementation of a biological monitoring program to establish a means to evaluate long-term recovery of the pond ecosystem.

MDHES has made this concurrence after careful consideration of all 11 alternatives that were evaluated in detail. Several key considerations were weighed in our evaluation and decision. They included environmental impacts associated with removal of saturated tailings, the ability of wet closure to prevent metals mobility in groundwater, specific site conditions, such as the volume and quality of groundwater discharge to lower Silver Bow Creek, and the potential impact of wet closure on resident and migrant species using the ponds.

Based on our review, the following conclusions were drawn. First, those alternatives involving total removal of both Pond 1 and the area below Pond 1 were rejected as causing short-term environmental damage, having considerable uncertainties associated with the implementability and the effectiveness of removal of contamination, and being excessively expensive. A decision regarding total removal of Pond 1 and below is more appropriately tied to the final decision regarding ultimate disposition of the entire Warm Springs Ponds system. Second, those alternatives involving dry closure of presently-wet areas of Pond 1 and below were rejected because of loss of wetlands habitat, the difficulty of constructing that portion of the remedy, and uncertainties related to the resulting mobility of metals in the saturated tailings to be dry closed. Third, the two alternatives utilizing wet and dry closure of Pond 1 and either removal (Alternative 4) or wet closure (Alternative 5) were considered to be relatively equal in terms of overall protectiveness and compliance with ARARs. The final selection of Alternative 5 was based on the following rationale.

We concur with EPA and its consultants that, in this specific situation, wet closure offers an equal reduction in contaminant mobility in comparison with removal. Although we believe that certain uncertainties attach to either the wet-closure or the removal option, we are convinced that, in this instance, wet closure involves less uncertainty than removal. Uncertainties associated with the removal option include the difficulty of construction in the saturated materials, the degree to which contaminated materials can be cleaned out of the system using dredging approaches, the manner in which cleanup would be confirmed once the removal is complete, the oxidation of presently-reduced acid-generating materials and potential associated increase in metals mobility in the groundwater, the type of surface conditions that would remain at the site once the removal was complete, and the extent of short-term destruction of existing wetlands habitat.

Wet closure of the area below Pond 1 also has some uncertainties attached to it. Although we are relatively sure that copper and zinc mobility can be effectively controlled by maintenance of high pH water in the wet-closure system, considerable question remains as to the reaction of arsenic to this new system. Data from our Streambank Tailings and Revegetation Studies (STARS) indicate that the more toxic form of arsenic (Arsenic V) can become quite mobile at pH in the range of 7.5 to 8. As the remedy is implemented we will need to observe closely both the pathway for transport and potential receptors of arsenic contamination within the Inactive Area. Wet closure is also thought to be a less irreversible alternative than removal; if future monitoring indicates that wet closure is not working adequately, then another approach may be possible at that time.

MDHES' belief that wet closure can be an effective remediation in this instance is largely dependent on the specific site conditions of the Inactive Area. These conditions include the facts that a very limited amount of groundwater appears to be discharging to the lower Mill-Willow Bypass (and therefore the upper Clark Fork River) in this area, minor amounts of groundwater contamination are found below Pond 1 relative to what might be expected beneath the tailings, and ARCO has proposed to install and operate perpetually a groundwater interception trench downgradient from the wet closures. MDHES specifically emphasizes that the acceptance of wet-closure approaches in this instance should not be considered precedent setting. Other sites may exhibit larger or more direct connection between the groundwater and surface water, greater groundwater contamination, or other site-specific conditions that may require other remediation approaches for saturated tailings, including removal.

MDHES concurrence on this selected remedy is contingent upon satisfactory adherence to conditions identified in the Proposed Plan and to be placed on ARCO by EPA in the Record of Decision and subsequent RD/RA orders. These conditions include the following:

1. Biological monitoring of the site needs to continue while the wet closures are in place until presently-unanswered questions about the long-term effect of contamination on the ecology of the resident wetlands species can be answered. MDHES supports the development of a monitoring program that is directed to answer specific research and decision-making objectives and is well coordinated with similar efforts underway on the Clark Fork River and at other basin Superfund sites. We insist that both MDHES and the Department of Fish, Wildlife and Parks be fully involved in the development and implementation of that biological monitoring program.

2. The reconstruction of the lower portion of the Mill-Willow Bypass should be undertaken in a manner to enhance fishery habitat. That effort should be consistent with what will be undertaken this summer in the upper Bypass, and should be coordinated with both MDHES and DFWP. We'd like to reiterate our comment on the Active Area Final Remedial Design document noting that individuals with appropriate expertise should be on site during channel reconstruction to assure that appropriate fisheries habitat features are incorporated.

3. The evaluation of alternatives and the Proposed Plan were based, in part, on the provision that the existing east-west berm of Pond 1 will be strengthened to provide protection from the maximum credible earthquake. The ARAR for earthquake protection in the initial WSP ROD requires MCE protection for all Pond system berms. ARCO apparently now questions the need to upgrade the Pond 1 east-west berm and proposes to rely on the new berm below Pond 1 to provide the required earthquake protection for the tailings contained within Pond 1. MDHES believes it essential to retain the MCE protectiveness requirement for the Pond 1 east-west berm, so that the buffer zone between the tailings in Pond 1 and the Clark Fork River can be maintained. That buffer, including the groundwater interception trench downgradient of the wet closures, would be lost in the event of earthquake failure of the Pond 1 berm. The groundwater interception trench is critical to the success of Alternative 5 in handling groundwater contamination. MDHES would likely evaluate differently the effectiveness of Alternative 5 relative to Alternative 4 if the probability for failure of the Pond 1 east-west berm and migration of Pond 1 tailings to the north were increased.

MDHES concurrence with the selected remedy is additionally contingent upon EPA satisfactorily addressing the concerns of MDHES and the Department of Fish, Wildlife and Parks in its final issuance of the Inactive Area ROD and the development of the RD/RA consent or unilateral order. These concerns include the following:

1. Since the remedy selected in this action will require long-term maintenance to assure that it provides continuing protection of human health and the environment, EPA must

include conditions in the implementing orders that will assure that adequate financial resources are available for any future monitoring and maintenance necessary, for as long as the remedy remains in place.

2. The design, construction, and operation of the new Mill-Willow Bypass and the east hills flood interception channel should be done in such a manner as to minimize sediment deposition in the upper Clark Fork River. Sediment loading due to construction over the past two years has been considerable. To minimize future sediment loading, every feasible, prudent sediment reduction construction technique should be employed.

3. The draft Inactive Area Record of Decision that we have reviewed does not discuss compliance monitoring for the ambient surface water quality ARAR. EPA technical staff has suggested that compliance cannot be required because upstream sources from Mill and Willow Creek surface waters or Opportunity Ponds groundwater may be the cause of noncompliance. EPA has indicated that the only monitoring required would be for the Pond 2 discharge and the Inactive Area groundwater. MDHES disagrees with that approach. Compliance with the ambient surface water quality ARAR, presumably after completion of the Active Area shakedown period, is fundamental to implementation of both the Active Area and the Inactive Area RODs. It was our understanding that monitoring for ambient water quality ARAR compliance was deferred in accordance with the Active Area ESD, but would be picked up under the Inactive Area action. We believe it essential that compliance monitoring for ambient surface water quality, at the downstream boundary of the operable unit, be required at the conclusion of the shakedown period. To understand the reasons for any exceedences of the ambient surface water quality ARAR, it would also be prudent to monitor potential pertinent source inputs to the system. These include Mill and Willow Creeks, the Pond 2 discharge, groundwater from the Opportunity Ponds, groundwater from the Inactive Area, and groundwater from the Active Area. Without monitoring for ambient surface water quality compliance, we have no way of knowing for sure whether surface water leaving the operable unit meets the ARAR. Without monitoring the additional inputs listed above, especially the three potential groundwater inputs, we will not know the sources of exceedences.

4. Although ARCO has committed verbally to some sort of demonstration remediation work in the area between the Inactive Area and the Governor's Clark Fork River Demonstration Project, the draft ROD is silent on this matter. As we have consistently stated in our comments regarding the Inactive Area, acceptance of Alternative 5 as the selected remedy is contingent upon implementation of demonstration remediation work downstream of the newly defined operable unit boundary, in a timely manner, to avoid impacts from storm-event runoff on the upper Clark Fork River near the Governor's project. We believe that such a commitment should be made in writing by both EPA and ARCO and an appropriate mechanism set up to design, approve, conduct and oversee the selected project.

MDHES concurrence in the selected remedy will not extend to alterations or modifications that may be made in the Record of Decision without consultation with and the consent of MDHES. MDHES concurrence also does not extend to EPA decisions during the design, implementation, enforcement and review phases of subsequent remedial actions at the Warm Springs Ponds Inactive Area unless such decisions are made with MDHES consent.

MDHES appreciates the opportunity to work with EPA in the development and implementation of a remedy for the Warm Springs Ponds Inactive Area. We look forward to working with you during remedial design and remedial action. If you have any questions regarding this letter, please feel free to call me.

Sincerely,

Dennis Iverson, Director

cc: Glenn Phillips, DFWP
Duane Robertson, SHWB
Neil Marsh, SHWB