BUREAU OF LAND MANAGEMENT

ACTION MEMORANDUM

Date: August 26, 2003

Subject: Request for a Time-Critical Removal Action at the Almeda Mine site, near Galice, OR (Grants Pass Resource Area)

To: District Manager

From: Ron Laber, Medford District Office

I. PURPOSE:

This Action Memorandum is a decision document by the District Manager that records the basis and rationale for a decision to conduct a time critical removal action at the Almeda Mine site pursuant to authorities established by the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) which have been delegated to the BLM. The basis and rationale supporting the decision is based on human health and environmental risk. The time critical action consists of removing contaminated acid mine drainage (AMD) and stabilizing waste rock dump as described in the Removal Site Inspection Report for Almeda Mine.

II. SITE CONDITIONS AND BACKGROUND:

A. SITE DESCRIPTION:

The site is located in Josephine County, within the BLM Medford District, Grants Pass Resource Area, approximately 3 miles north of the town of Galice and 30 miles from Grants Pass in Township T34S, Range R7W, sections 7 and 18 and T34S, R8W sections 12 and 13 of the Willamette Meridian. Approximate coordinates are 42° 36' 15.3" north latitude and 123° 36' 12.6" west longitude. Figure 1 presents the location of the site as shown on the USGS Galice, Oregon 7.5' quadrangle map (1998). Access is via the Merlin-Galice Road to the north bank road turnoff at the east end of the ridge immediately below the mouth of Hellsgate Canyon. From this junction, at least ten miles via a series of logging roads leads to the site, the last portion of which is 4WD. During winter, this access is closed periodically due to landslides. The site is situated near the north bank of the Rogue River. Alternatively, near Galice, the site may be accessed via boat on the Rogue River and may be crossed from upstream of the site.

The annual average precipitation at Grants Pass is 33.5 inches, and the average annual temperature is 54 degrees F. Two-thirds of the precipitation occurs from November to March. Surface water in the area consists of the Rogue River, located within 200 feet of the site.

The Site is located in the Recreation corridor of the National Rogue Wild and Scenic River and just upstream of the Wild Section. Both river segments are important for their rafting, scenic and fishing values. The Bureau of Land Management is undertaking this action in part to meet the objectives of the National Wild and Scenic Rivers Act (Public Law 90-542, October 2, 1968), and particularly the protection of the three outstandingly remarkable values (ORVs) that led to the Rogue River's congressional designation. The ORVs are: National Scenic Qualities, Fisheries Resource, and Recreation Opportunities Resource.

The collapsed River Level adit (also called the 520 adit and Seep-1) has an altitude of approximately 685 feet above sea level, and topography surrounding the site consists of steep canyon walls. Mine adit 620 (also referred to as "A" adit on mine maps) is the next higher opening that is situated near the access road and rock dumps and is at an elevation of 776 feet. The lower extent of the site is located at river channel at approximately 658 feet on February 4, 2002. The site has been surveyed and a topographic map developed, Figure 1.

The River Level adit is situated in the sulfides of the Rogue Formation and seeps at a rate of about 6-12 gpm from the Mine across the flood plain bedrock in a braided manner and into the Rogue River. Two smaller seasonal seeps emanate from below the rock dumps and join the flow from the River Level Adit, a collapsed adit that is stoped near the opening according to mine maps. The other seasonal seeps located nearby immediately east appear to be in the Galice Formation and have a estimated collective flow rate of about 5-10 gpm. BLM sampled the seeps quarterly on May 10, 2001, November 10, 2001, February 6, 2002 and June 18, 2002. The results showed high metals and sulfate loading at a very low/acidic pH, typical of acid mine drainage (AMD). Naturally occurring heavy metals in mine workings, waste ore, and waste rock are released from mining sites through several pathways. The primary mechanism is sulfide mineral oxidation from the action of oxygen and water contacting the mineral surfaces. The major chemical reactions are represented in general by the oxidation of iron sulfide (FeS_2), one of the most common sulfides. Other metals are also dissolved by the low pH caused by release of hydrogen ions.

$$FeS_2 + 7/2\ 0_2 + H_2O \text{-->} Fe^{2+} + 2SO_4^{2-} + 2H^+$$

Rogue River flood frequencies at the Almeda Mine were determined to estimate elevation of the water surface for floods of various recurrence intervals. Several stream gages are operated by the U.S. Geological Survey on the Rogue River; however, none are near the Almeda Mine location. The nearest upstream gage is located in Grants Pass, where the contributing watershed drainage area is 2459 square miles, while the nearest downstream gage is near Agness, Oregon, where the contributing drainage area is 3939 square miles. Total watershed area at the mine site is approximately 3500 square miles. Flow levels in the Rogue River at the mine are regulated somewhat by upstream reservoirs on both the Rogue and the Applegate River, a major tributary to the Rogue.

For the Rogue River, flood magnitudes were estimated for three sites (at Grants Pass, at Almeda Mine, and near Agness) using regional regression equations. Equation-based flood estimates for

the gaged sites were then compared to statistical estimates derived from gage records to determine if the equations systematically under- or over-predict flood magnitudes in the Rogue River. Figure 1 also shows the elevation contours for various flood intervals. Most of the site below the rock dump is within the 2-5 year flood frequency.

The mine was discovered as part of the Big Yank Lode in 1874 by prospectors who formed the Almeda Mining Company (AMC). Major commodities were gold, silver and copper. The main production occurred in 1905-1917 by the same AMC. Approximately 23,000 tons of ore worth $123,000 were shipped to the Tacoma or Choanocyte Smelters. In 1908 AMC built a 100 ton smelter and matting furnace. After much inactivity, a small amount of production of 287 tons of ore were shipped in 1942. The site was explored several times since being shut down in 1942. Libbey wrote much on the structural analysis by Kay in 1967 and the Homestake Mining Company and the Texasgulf Western, Inc. looked at the sites' volcanic and strata-bound characteristics in the 1970's. They also conducted underground drilling and geochemical sampling. The Almeda Mine is an example of the large-capitalization mining enterprises that were active in southwestern Oregon during the late nineteenth and early twentieth centuries. During the main period of this mine's operation (1903 - 1917), the physical features included a low water log bridge across the Rogue River, a number of wooden buildings and structures (mill, smelter, water tank, residences), adits, and waste piles.

Currently, all the wooden buildings and structures have been removed. In fact, the wooden bridge was washed away by the flood of 1927. The remaining features include adits, waste piles, a few large pieces of smelting equipment, cement foundations, and scattered pieces of machinery. The essential physical features, i.e. wooden mill, smelter, water tank, and bridge, that made up its characteristics during its period of operation are no longer retained. The Almeda Mine site lacks this type of integrity, and is therefore not eligible for the National Register under Criteria A. The Almeda Mine site is eligible for the National Register under Criteria D. The mine site, in particular Features 1 and 2 (the habitation flat and the smelter area), have the potential to yield archeological information concerning potential Native American use of the area, domestic residence pattern, and a more complete understanding of the technology employed at the on-site smelter.

1. Removal Site Evaluation:

Water: All water samples were analyzed by Neilson Laboratory of Medford, Oregon. Review of analytical results shows that over the course of the year May 2001 to June 2002, concentrations of metals increased, pH decreased and flows decreased. The precipitation pattern for the area suggests that flow rates would increase in winter and spring and decline in summer and fall. The area has been in a drought for several years and 2001 was extremely dry, so these quarterly results may not be entirely representative.

Seep-1 is characterized by high iron and zinc concentrations and acid pH (2.7). Cadmium, copper, lead, silver and zinc were detected in the samples. The Galice seep concentrations show a yellow color and differing chemistry from the River Level (Seep-1) seep water. The Galice

seeps show higher hardness (calcium and magnesium), and much lower iron concentrations than one might expect from the volcanic massive sulfides of the Rogue Formation. This is consistent with the seeps' location in the Galice shale formation and not from the iron pyrite-rich Rogue Formation massive sulfide ore body.

Upstream and downstream water samples were collected from the Rogue River. The analytical results are very similar, however the upstream location has slightly higher metals concentrations than downstream of the Site. Neither sample exceeds Rogue River water quality standards.

Mining Waste: The table below presents the average analytical results for the waste rock grid points within the site compared to risk management criteria (RMC) for campers. The metals principally elevated are iron, lead, arsenic, and zinc.

	Mean (ppm)	RMC-Camper (ppm)
Iron	127,396	not available
Lead	537	1000
Arsenic	410	20
Zinc	462	40000

The average thickness of the waste material ranges typically from several inches to three feet in depth. The waste rock covers an area of approximately 50,000 square feet and the smelter slag is about 2,000 square feet. The estimated volumes of waste rock and slag are 5,600 cubic yards and 250 cubic yards, respectively. Synthetic Precipitation Leaching Procedure (SPLP) results derived from the composite waste rock of the Almeda massive sulfides show that leachable concentrations of cadmium, copper and zinc in excess of Rogue River water quality standards are potentially produced by the waste rock. However, waste rock leachate concentrations are about an order of magnitude less than the seep concentrations This suggests that the waste rock dumps are not an important source of the acid rock drainage seeps below the rock dumps. SPLP results are also less than Oregon cleanup levels for metal leachate in soil.

As expected from a volcanic massive sulfide material, Acid Base Accounting results show the waste rock is moderately acid generating, with a value of 69 tons of limestone/kiloton of waste, and a lime requirement of 32 mtons/hectare. No net neutralization capacity is present as one would expect with higher calcium and magnesium in the Galice seeps. Due to the steepness of the waste rock dumps and their minor importance in acid rock generation, application of a liquid stabilization reagent such as lime in water ($Ca(OH)_2$ at pH 12) or similar product would neutralize the rock dumps if trickle sprayed so as to maximize infiltration and minimize runoff. This treatment will also reduce leaching and bioavailability.

Aquafix Treatment Unit: A field pilot test was performed using the Aquafix lime dispensing

unit. The Aquafix was placed near the adit enabling AMD to be fed gravity. A granular calcium oxide lime was supplied to the bin. Problems were encountered over the next two months with accumulation of the granular lime below the dispenser. Bridging of the lime up into the dispenser occurred, thus halting dispensing of the lime. Aquafix-treated water concentrations were observed to be less than chronic aquatic life water quality standards for the Rogue River. Results from the Aquafix pilot project demonstrate that the Aquafix unit is capable of effectively reducing the major loading metals and other trace metals in acid mine drainage by 95% and achieving water quality standards if the pH is greater than 9.5. However, modification of the unit is needed to handle the low flows encountered at this site. In addition, the unit would have to be operated in the 2 year flood plain and it would be are risk of losing it in a flood.

Open Limestone Channels Test: An alternative limestone technology is open limestone channels (OLC), where the AMD is directed through a channel filled with limestone. OLC can remove metals depending on the contact time and degree of mixing caused by vertical gradients. A disadvantage of OLC is that the limestone will become armored or covered with iron hydroxides and the neutralization effect becomes diminished over 1-2 years and eventually has to be replaced. A jar test was performed to evaluate the ability of OLC to neutralize acidity and precipitate the metals from the AMD at the site. A sample of AMD water from Seep-1 was collected and transported to Neilson Laboratories for a treatment test with three limestone products. Equal volumes of AMD water and limestone gravel were mixed for one hour to simulate the flow of AMD down a constructed OLC to the River. The test shows that most metals, except zinc, are reduced to less than water quality standards. The pH of each mixture did not exceed 7.0. Had the pH exceeded 9.0, zinc precipitation would probably have been accomplished, based on results from the Aquafix unit. A mixture of limestone and lime (calcium oxide) is that delivers water of pH>9.0 will better accomplish the zinc removal.

Underground Assessment: Saguaro GeoServices, Inc.(SGSI) was tasked by BLM to conduct a surface and underground assessment of the abandoned Almeda Mine, for the purpose of determining the feasibility of installing bulkheads to plug the acid mine drainage (AMD) flow and the feasibility of segregating neutral water flows from AMD. The assessment included a site inspection of mine openings and seep areas outside the mine as well as a review of supplied drawings and reports. The underground assessment included specific water quality tests, identification of sources of flow and estimation of flow volumes.

According to SGSI, the available hydrologic and underground mine data do not support specific designs or rankings of remediation approaches. Therefore, a phased program of continuing investigation, measurement of underground conditions is recommended. The program should have as its immediate goals the partial sealing of the 520 and No. 0 levels. For this reason, BLM will assess of the feasibility of installing a partial bulkhead seal in the 520 level so that the point of acid drainage discharge could be raised higher, allowing the lime dosage operation to take place out of the river flood plain. Raising the mine pool so that the point of discharge is away from the active river channel would be desirable if feasible. However, the rock conditions and the proximity of open stopes close to the 520 level portal, coupled with the presence of the No. 0 portal, indicate that installation of a bulkhead seal in the 520 level adit probably will not be

successful by itself in backing up the drainage to the 620 level where it could most effectively be handled. In addition, the installation of such a bulkhead would be complicated by any need to remove material from the 520 portal area to directly access a bulkhead site. Finally, installation of any bulkhead seal must be between the presumed 520 portal area and the first stope 120 ft inside the portal and therefore would be in rock with low ground pressures and likely elevated permeability, and would therefore need to be supported by a fairly comprehensive pressure grouting program which may or may not prove feasible.

2. Physical Location and Site Characteristics:

The site is located within one mile of two developed Rogue River recreation sites, including Almeda County Park and the BLM Smullin Visitor Center at Rand. The adit and seep discharges spread out over the bedrock covering an area of 1-2 acres are highly accessible to boaters. The flood plain was evaluated by BLM for width and return frequency of 100 years. As shown in Figure 4, most of the site is within the 100 year flood plain. The location of the Aquafix unit during the pilot test was in an area of the 2-5 year flood plain.

In the following discussion, a distinction is made between groundwater and water in the mine pool (which is also groundwater). Groundwater at the lower terrace is from 0-12 feet below ground surface and is the source of the water emanating from the seeps. This range is due to the fact that emanation of groundwater from the mine workings raises the water table near the seeps, whereas groundwater near the potential repository location was found to be greater than 12 feet. The site is mostly covered by bedrock, and the limited soil in the area has a medium permeability. Despite the bedrock, communication of contaminants from the mine pool groundwater into the bedrock Rogue and Galice Formations groundwater is likely, however the bedrock appears to have limited vertical permeability. This is why the acidic groundwater pools or seeps onto the exposed bedrock in the flood plain. The Rogue River appears to be a gaining stream in the area because of the seeps.

Soil for the site is classified as Brockman Variant very gravelly loam by USDA Soil Conservation Service. The surface layer is about 12 inches thick of dark, reddish brown very gravelly loam. The next 23 inches of subsoil are yellowish red, dark reddish brown and strong brown gravelly clay loam and gravelly loam. The only soil profiles near the site likely to show this thickness are to the west above the 700' elevation. To the depth of 60 inches is a dark brown very gravelly loam. The soil is approximately 35% rock fragments. The soil has a moderate permeability with a slow water runoff and water erosion hazard is slight. The available water capacity is about 6.5 to 10.5 inches and water supplying capacity is 18 to 23 inches. The permeability of the soil is moderate at 0.6 - 2.0 in/hr.

The ore body of the Almeda Mine is located in volcanic massive sulfide materials of the Rogue Formation, itself a member of the Big Yank Lode. The rock mainly consists of basaltic to rhyoltic, fine-to medium-grained rocks. The rocks are closely related to calc-alkalic rocks. Sulfide lies over lava domes and formations and is in contact with the Galice Formation, deep-marine sediments which are also exposed on the flood plain. The contact bisects the center of

the site and is visible. Past exploration constructed a vertical shaft 435 feet beneath the River level. The Almeda Mine consists of a series of adits and stopes, connected by crosscuts and raises, driven in the hillside from elevations over 300 feet above and, reportedly over 400 feet below the Rogue River level. Mine maps of uncertain accuracy are available. The adits have various nomenclatures from various published sources, however, the lowest flowing adit is called the River Level adit or the 520 adit; a collapsed adit just above the 520 adit is called the 0 adit; the open adit at the access road level is called the 620 Adit and one upper adit is referred to as the 794 Adit, for a total of four adits. These numbers are thought to refer to elevations, but are off by more than 100 feet and are not true elevations, based on BLM surveys. The River Level adit and many feet of mine works are submerged underwater. These have been drained of water and explored several times, however there are few published data.

Waste rock dumps and smelter slag are situated on the canyon wall down to the flood plain. They are yellowish/tan in color. Brownish-orange iron oxide covers much of the flood plain. The steep waste rock dumps cover an area of approximately 50,000 square feet and average about three feet in depth. The smelter slag pile covers about the 2,000 square feet and has about the same depth. This area is within 200 feet of a favorite lunch and fishing spot along the bank below the Almeda riffle for many rafters and kayakers. There are a few remnants of old mining structures, but most are hidden in the vegetation.

3. Release or Threatened Release into the Environment of a Hazardous Substance, or Pollutant, or Contaminant:

As described above, the source of the release is AMD emanating from the 520 adit and the Galice seeps. The flow rate is relatively small, about 6-12 gallons per minute, but the AMD pools on the flood plain bedrock before draining into the Rogue River. Iron is by far, the largest metal loading to surface water. While iron is not a hazardous substance, it does contribute to the acidity problem which leads to releases of cadmium, copper, lead, manganese, and zinc.

The site is also visited frequented by recreational users. Arsenic is a human carcinogen and lead has a variety of toxic effects to humans. Recreational users may come into contact with the mine waste by several exposure pathways. Adults and children may conceivably ingest acid mine drainage; they may accidently ingest soil by hand-to-mouth activities including eating, drinking and smoking; and small children may ingest larger amounts of soil than adults.

BLM uses a reference document, “Risk Management Criteria for Metals at BLM Mining Sites.” Using a risk assessment approach, the document cites concern levels for various metals and for various human and ecological receptors. Of the metals detected in waste rock, only arsenic is a concern for human health with a risk management criterion of 20 ppm for a 14 day camper. However, the areas of exceedance are situated on a steep rock dump wall and at a small area near Seep-1 and are not likely to attract visitors, nor is the arsenic likely to be very bioavailable based on SPLP results. Concentrations of lead, arsenic, and zinc are found on the rock dump and are mostly of low risk. Arsenic, lead and zinc are toxic to some plants and terrestrial animals at concentrations greater than 275 ppm, 125 ppm and 307 ppm, respectively

and site concentrations are generally less than or slightly exceed these levels. The BLM reference indicates that if the criteria is exceeded by 1-10 times the ecological criteria, the site is moderate risk and if >100 times the criteria, the site is extremely high risk.

Exceedances of EPA ambient water quality criteria are noted for the six metals listed above.

4. NPL Status:

The site is not currently on the National Priorities List (NPL) and BLM does not expect it to be nominated to the NPL.

5. Maps, Pictures, and Other Graphic Representations:

See attached.

B. OTHER ACTIONS TO DATE:

1. Previous Actions:

BLM has installed an adit gate at the upper adit for physical safety purposes. BLM has tested the Aquafix unit and conducted other site characterization as described in the RSI.

2. Current Actions:

C. STATE AND LOCAL AUTHORITIES' ROLES:

1. State and Local Actions to Date:

Under contract, DEQ has reviewed and commented on the RSI.

2. Potential for Continued State and Local Response:

None.

III. THREATS TO PUBLIC HEALTH OR WELFARE OR THE ENVIRONMENT, AND STATUTORY AND REGULATORY AUTHORITIES:

A. THREATS TO PUBLIC HEALTH OR WELFARE:

Conditions exist on the public lands at the site which, if not addressed by implementing the removal actions described in this memorandum, present an imminent and substantial threat to public health and welfare or the environment. The following sections describe these threats to public health and the environment and demonstrate that conditions at the site meet the criteria for a removal action as stated in the National Contingency Plan (NCP), CFR 300.415.

1. *Actual or potential exposure to nearby human populations, animals or the food chain from hazardous substances, pollutants or contaminants*: The site is located within 200 feet of the Rogue River and is within 1 mile downstream from two developed recreation sites and the National Rogue Wild and Scenic River. The Rogue River is an important salmon and steelhead fishery. There is a release of hazardous substances within the meaning of CERCLA into the soil and water.

2. *Actual or potential contamination of drinking water supplies or sensitive ecosystems*: The Rogue River has Wild and Scenic designation and is an important salmon and steelhead fishery. While water quality standards are not exceeded in the Rogue River, hazardous substances are being released that may possibly affect aquatic life on a localized basis.

3. *Hazardous substances or pollutants, or contaminants in drums, barrels, tanks or other bulk storage containers that may pose a threat of release*: No storage containers on site.

4. *High levels of hazardous substances, pollutants or contaminants in soils largely at or near the surface that may migrate*: The site contains mine waste in the form of rock dumps and slag the former of which may leach or erode contaminants into surface water drainage. The site contains mine waste with moderate concentrations of arsenic, lead and zinc that have migrated slightly over the years into site drainages.

5. *Weather conditions that may cause hazardous substances, pollutants or contaminants to migrate or be released*: Rain and flood erosion only. Much of the site below Seep-1 is located in the 100 year flood plain and contaminants are periodically washed away. The site is subject to periodic inundation from flooding which entrains contaminants into the Rogue River.

6. *Threat of fire or explosion*. Not applicable.

7. *Availability of other appropriate federal or state response mechanisms to respond to the release*. The Oregon Department of Environmental Quality has been notified, however BLM is acting as the lead agency under CERCLA.

8. *Other situations or factors that may pose threats to public health or welfare or the environment.* The source area receives recreational visitors with access via boating the Rogue River. The site is surrounded by rough terrain.

B. THREATS TO THE ENVIRONMENT:

Threats to human health are not as significant as threats to the environment because human use of the site is limited to casual visitors. Visitors are not likely to drink the AMD at the site because of its discolored appearance nor to camp at the site because of the AMD. However, the AMD runs directly into the Rogue River where it could present a potential ecological problem to receptors in the immediate mixing zone in the River.

Based on concentration, zinc is the principal contaminant of concern at the site to aquatic life. Zinc is of low toxicity to humans, but toxic to fish. In general, zinc toxicity is greater under the following conditions: to embryos and juveniles more so than adults, to starved animals, at elevated temperatures, in the presence of cadmium, in the absence of chelating agent, at reduced salinities, under conditions of marked oscillations in ambient zinc concentrations, at decreased water hardness and alkalinity, and at low dissolved oxygen concentrations. Zinc toxicosis affects freshwater fish by destruction of gill epithelium and consequent tissue hypoxia.

IV. ENDANGERMENT DETERMINATION:

Actual or threatened releases of metals from this site, if not addressed by implementing the response action selected in this Action Memorandum, may present an imminent and substantial endangerment to public health, welfare, or the environment.

V. PROPOSED ACTIONS AND ESTIMATED COSTS:

The RSI presents a study of the nature and extent of contamination at Almeda Mine, removal action objectives and action levels, a brief risk assessment and various alternatives to remedy the health risks. The alternatives were screened based on effectiveness in reducing risk, implementability and cost.

A. PROPOSED ACTIONS:

1. Proposed Action Description:

The following alternatives were considered as removal actions:

1. No Action. The least expensive alternative is to not take any action. However, this alternative does not meet ARARs and does nothing to reduce onsite exposure or release of hazardous substances to the soil, and to surface water.

2. Fence and Sign. Fencing and signing the site are used to prevent or minimize exposure. This alternative is not very effective because of the proximity to the Rogue River, theft and vandalism. Nor does the fence stop water migration into drainages which is necessary to attain ARARs. Posting signs may reduce the amount of trespassers, but past experience suggests that many people would not be stopped by signs nor fences, and signs are frequently stolen. The site has been posted warning people not to drink the AMD water.

3. Water Treatment Options.

A. Option A - Aquafix. Migration of metals from the Almeda seep into the River could be significantly reduced by using the Aquafix to raise the pH of the seepage water and precipitate the metals into a settling pond. The Galice acidic seeps would be conveyed to the Aquafix unit for treatment. An important disadvantage is that due to topography, the unit may have to

be located in 2-5 year flood plain. Based on flood plain modeling, the unit would be inundated every five years or so. If such a flood causes loss of the unit, replacement cost is about $17,000, so replacement costs every five years may be a reasonable expense compared to other alternatives.

B. Option B - Constructed wetland. A constructed anaerobic wetland may be able to treat the seep water, reduce acidity and precipitate most metals. Such a system would require low operation and maintenance (if not flooded) and would have low visual impact. It is doubtful that this technology could meet all water quality ARARs, but could reduce loadings substantially. Using design criteria for acidity and flow loading, it would require approximately 1.5 acres based on acidity loading. There are three significant disadvantages to this option. First, the system would have to be built in shallow groundwater at the site and it would be nearly impossible to exclude groundwater. Bedrock would also have to be blasted and removed. Second, the location of a wetland is severely restricted due to topography. A system requiring 1 acre near the seeps would be located in the 1-2 year flood plain. It would be impossible to protect the system against regular flood events. Finally, the capital cost of such a system (estimated to be more than $100,000) would preclude the reconstruction of the system every two years.

C. Option C - Open Limestone Channels. In this option, a ditch would be constructed from the River Adit to the Galice seeps and thence to the River. If hydraulic controls (see #4 below) can raise the discharge to the 620 adit, this would more than double the potential ditch length and gradient. Crushed limestone rock and lime would be spread into the ditch. As water travels over the ditch, acidity is neutralized by the limestone and metals precipitated in an insoluble form. This option relies on length of channel and gradient to promote mixing and neutralization and to reduce armoring of the rock. The advantages include initial low cost, low routine maintenance and minimal aesthetic impact. These are very compelling advantages considering disadvantages of other options. The limestone will need replacement every few years based on loss of limestone due to flooding every few years, or armoring or sludge accumulation. Jar tests indicate that limestone may not meet zinc water quality standards (although this can be corrected by a mix of lime and limestone).

4. Hydraulic Controls. This alternative would involve: (1) run-on controls to divert precipitation and runoff water away from the mine workings to avoid contamination and to reduce seep flow, and (2) closure of the River Level (520) adit. This would involve sealing the lower seep. If successful, it would cause the water in the mine pool to rise to the upper 620 adit where the Aquafix could be more safely located, directing the treated water through a recommended longer channel to a settling pond. Adit closure can be a difficult and risky procedure due to danger of a blowout. Raising the mine pool may increase the flow at other seeps, which would not be productive. Further underground studies are required to determine the feasibility of closing the River Level (520) adit.

5. Treat Rock Dumps with Stabilization Reagent. The rock dumps are not a major source of acid rock drainage and do not exceed Oregon cleanup levels except for total (but not

leachable) metals. Because of the steep angle of repose and slope stability concerns, it is not necessary nor recommended to remove this material. Instead, the rock dumps could be sprayed with a lime or stabilizing reagent to neutralize acidity, reduce acid rock drainage and to reduce bioavailability. The amount of lime required can be calculated from the ABA tests. This alternative would be used in conjunction with a water treatment option. BLM will also provide additional riprap to armor the toe of the waste rock.

2. Contribution to Remedial Performance:

The proposed time-critical removal action to reduce the metals loading would be consistent with any likely long-term remedy at the site.

3. Description of Alternative Technologies:

See V.A.1 above.
Conceptual designs were developed for each of the four removal alternatives, and an opinion of probable cost was prepared for each. A comparison of the estimated present value cost for the alternatives is provided in Table 1 below.

4. Costs

Table 1. Summary of estimated present value costs for preliminary removal action alternatives

Alternative	Description	Estimated Present Value Cost ($)
1	No Action	$0
2	Fence and Sign	$10,000
3a	Aquafix	$20,000
3b	Constructed Wetland	>$100,000
3c	Open Limestone Channels	$15,000
4	Hydraulic Controls	$unknown
5	Stabilize Rock Dump	$5,000

The preferred alternative, based on screening according to the CERCLA criteria of protectiveness, feasibility and cost, is a combination of alternatives 3c, 4, and 5. Open limestone channels should effectively treat the acid mine drainage and, unlike the Aquafix unit, can be easily reconstructed if damaged by flooding. Lime treatment of the waste rock dump is expected to reduce leaching and bioavailability of metals in the rock dump. Additional investigations will be needed to determine if alternative 4 is feasible.

5.ARARs:

ARARs are applicable or relevant and appropriate requirements contained in federal or more

stringent state laws and regulations. State requirements concerning air and water quality will be attained by the selected removal action to the extent required by the NCP.

6. Project Schedule:

It is anticipated that the project construction will be completed for alternatives 3a and 5 during the summer, 2003.

VI.EXPECTED CHANGE IN THE SITUATION SHOULD ACTION BE DELAYED OR NOT TAKEN:

If no action is chosen, both offsite and onsite risks will continue per III.A above.

VII. OUTSTANDING POLICY ISSUES:

A Notice of Intent to Sue has been filed by a party that believes BLM should get a discharge permit pursuant to the Clean Water Act.

VIII. ENFORCEMENT:

BLM will continue to search for viable potentially responsible parties (PRPs) at the Site.

IX. RECOMMENDATION:

This decision document represents the selected removal action for the site, developed in accordance with CERCLA as amended, and with the National Contingency Plan. This decision is based on the administrative record for the site.

(Approval) _____

(Disapproval) _____