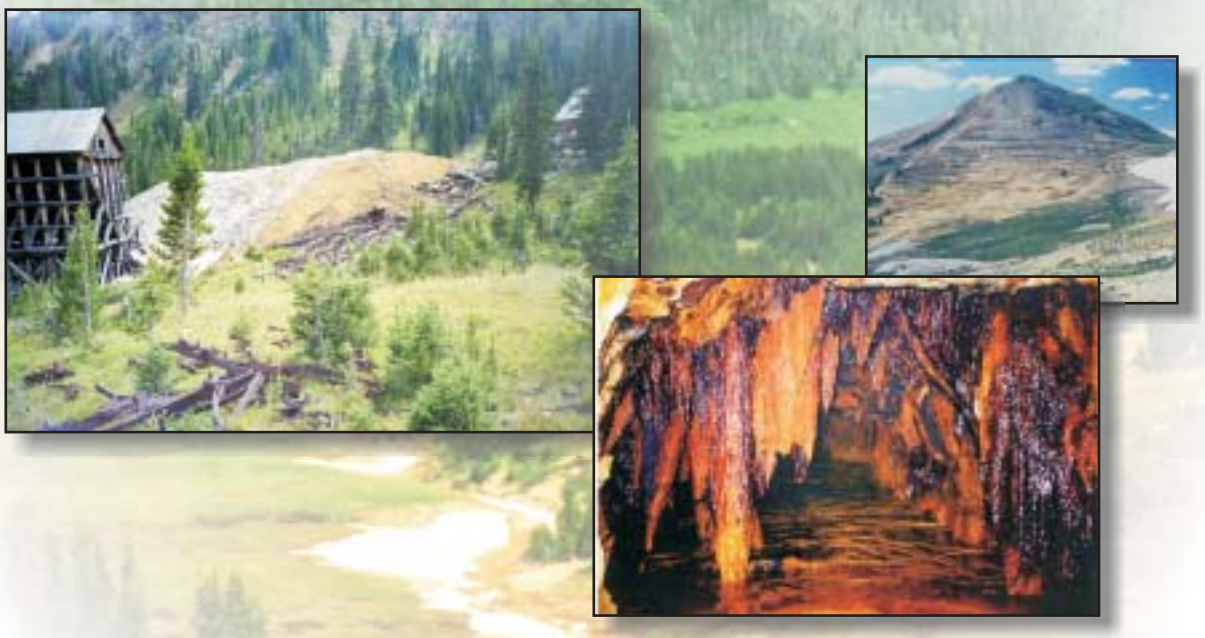
United States Department of Agriculture
Forest Service
Northern Region

FINAL

Como Basin/Glengarry Adit/Fisher Creek Response Action Engineering Evaluation/Cost Analysis



New World Mining District Response and Restoration Project

MAXIM TECHNOLOGIES INC®

Final

COMO BASIN, FISHER CREEK AND GLENGARRY ADIT RESPONSE ACTION ENGINEERING EVALUATION/COST ANALYSIS NEW WORLD MINING DISTRICT RESPONSE AND RESTORATION PROJECT

Prepared For:

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EXECUTIVE SUMMARY

This document is the Final Engineering Evaluation and Cost Analysis (EE/CA) for the Como Basin/Glengarry Adit/Fisher Creek Response Action, New World Mining District Response and Restoration Project. Maxim Technologies, Inc. (Maxim) prepared a Draft Response Action EE/CA for the United States Department of Agriculture Forest Service (USDA-FS) and released the Draft EE/CA to the public for comment on June 22, 2002.

Written comments on an internal review draft of the Como Basin/Glengarry Adit/Fisher Creek EE/CA were received from the EPA, Montana Department of Environmental Quality, and Department of Interior National Park Service. These comments were considered, modifications were made to the internal review draft based on these comments, and a public Draft EE/CA was prepared.

Comments on the public Draft EE/CA were received from the Greater Yellowstone Coalition, the Beartooth Alliance, the Center for Science in Public Participation, and one private citizen. One additional comment was received from the USDA project biologist regarding potential impacts to wildlife.

Comments received from the three organizations supported the selection of the preferred alternative. Comments received from the private citizen were concerned with disposal of drill cuttings in the Como Basin by the mining exploration company. Other concerns expressed by the parties in their comments included the following: a concern for the use of salvaged soil from the Como Basin as the soil cover because of elevated metals concentrations present in the salvaged soil; a concern for the consideration of a near-perennial snow bank and its effect on the capped area; a concern for cutting off runon so that runon does not infiltrate below the cap; a concern for establishing adequate runoff channel capacity after installing the cap; a concern for the undisturbed vegetation lying below the area in the Como Basin that will be capped; and, a concern for creation of wetland areas following removal of the Glengarry Dump. Other comments were also received on various aspects of the project. Comments received on the internal review draft and the public draft of the EE/CA are included in Appendix A to this final document, along with a response to each written comment received.

The Draft EE/CA released to the public does not require substantive changes based on the comments received. These comments did not affect the evaluations presented in the EE/CA or the selection of the preferred alternative. The Response to Comments (Appendix A) clarifies some of the discussion presented in the EE/CA and provides new information gathered since the release of the EE/CA.

This executive summary serves as the Final EE/CA for the proposed Response Action at the Como Basin, Glengarry Adit, and Fisher Creek Source Areas. The Draft EE/CA, which contains the detailed analysis of alternatives and supporting documentation, is incorporated by reference in this Final EE/CA. Some minor changes to the design of the Glengarry Adit preferred alternative, and some further detail regarding the Fisher Creek Source Area preferred alternative have become available since the release of the draft. These minor changes and additions are incorporated into the appropriate sections of this executive summary.

One change of note is the potential impact from the preferred alternative to wildlife. While there is not expected to be long-term impacts to threatened and endangered species from the proposed action, risk to grizzly bear mortality may be higher due to the increased use of the area, and displacement of wildlife species such as the grizzly bear may be increased by reclamation activities in the short-term.
The overall impact of response and restoration activities is neutral to beneficial to wildlife, although road improvements that are being done over the life of the project could have long-term impacts on wildlife due to increased traffic, increased traffic speeds, and increased use of the area.

This report presents an engineering evaluation and cost analysis of response alternatives for response and restoration work proposed for the Glengarry Adit, Como Basin, and remaining mine waste dumps in the Fisher Creek drainage. These historic mine sites are located in the New World Mining District (District), which is located in Park County, north of Cooke City, Montana. Figure ES-1 shows the location of these sites.

The primary environmental issues at these sites are associated with impacts from historic mining and more recent mineral exploration activities. Human health and environmental issues are related to elevated levels of base-metal contaminants present in mine wastes, disturbed soils, and acidic water discharging from mine openings.

The District is located at elevations ranging from 2,400 meters (7,900 feet) to over 3,200 meters (10,400 feet) above sea level and is snow-covered for much of the year. The District covers an area of about 100 square kilometers (40 square miles) with historic mining disturbances affecting about 20 hectares (50 acres). The topography of the District is mountainous, with the dominant topographic features created by glacial erosion. The headwaters of Fisher Creek are located at or near tree line.

This EE/CA was developed using the "non-time-critical removal" process that is outlined in the *Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)*, as amended in 1986, and the updated National Oil and Hazardous Substances Pollution Contingency Plan. The Como Basin/Glengarry Adit/Fisher Creek Response Action addresses the immediate threat to human health and the environment posed by metal-rich soils exposed during mineral exploration activity in the Como Basin, mine waste generated in the Fisher Creek drainage by historic mining, and contaminated discharge from the underground workings of the Glengarry mine. The Como Basin/Glengarry Adit/Fisher Creek Response Action represents the third response action proposed during this multi-year project. Previous response actions include the Selective Source Response Action and McLaren Pit Response Action.

The Glengarry Adit is ranked No. 15 and the Como Basin is ranked No. 27 in the priority listing of contaminated sites located on District Property. Existing data from surface water, groundwater, in-stream sediment, and metal-loading to surface waters were reviewed and summarized to plan response activities and evaluate risks to human health and the aquatic environment. In addition, material samples collected from numerous waste rock dumps in Fisher Creek and disturbed soils in the Como Basin were analyzed for heavy metals and acid-base characteristics. Heavy metals associated with these waste rock sources can affect human health through inhalation or ingestion. Metals may also be toxic to plant growth, preventing reestablishment of plant cover on waste rock. Soil material containing heavy metals can erode from mine waste, impacting surrounding land, and potentially entering surface water drainages. Water percolating through mine waste can carry dissolved concentrations of heavy metals into groundwater, which, in some areas, discharges to surface water. Percolation of water through sulfide-rich mine waste lowers pH, which promotes solubility of most metals.

A comparison of disturbed soils, waste rock, water, and in-stream sediment data with background concentrations and regulatory standards indicates several metals are contaminants of concern at this site: aluminum, cadmium, copper, iron, lead, and zinc. A human health risk evaluation found there to be no unacceptable risks to human health from these contaminants in the Como Basin and Fisher Creek based

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Fisher Creek Study Area

Spaulding Dumps
Scotch Bonnet Mtn.
Upper Tredennic Dumps
Sheep Mountain
Middle Tredennic Dumps
Como Basin
Glengarry Adit
Lower Tredennic Dumps
Fisher Mtn.
Daisy
Mclaren Pit
Gold Dust Mine and Dump
Fisher Creek
DC-2 Creek
Crown Butte Mtn.
Henderson Mtn.
Miller Creek
Custer National Forest
Gallatin National Forest

Tracer-6, Tracer-4, Tracer-5
EPA-11, EPA-12, MW-1, MW-8
FCSI-96-8, FCSI-99-1, FCSI-96-15, FCSI-96-6, FCSI-96-5
F-8R-0, F-8A-0, MW-9B, MW-9
SW-3, FCT-2, FCT-1
SB-16
MW-10, MW-10B, F-28
MW-11
M-1
MW-4, SW-4
MW-13
CFY-2

Source: Mine waste source areas from Gallatin National Forest Interagency Spatial Analysis Center (October 2001)
Topographic data from USGS 7.5 Cooke City Quad
Contour Interval = 40'
Spaulding, Tredennic, and Small Como (FCSI-96-9) dumps were removed and reclaimed in 2001.

N

0 Feet 1500
Scale 1:18,000

MAXIM 9902245.410

Mine Disturbance Area
Forest Boundary
District Boundary

Long-Term Surface Water Monitoring Station
Adit Sampling Station
Groundwater Sample Location

Fisher Creek Vicinity Map
New World Mining District
Response and Restoration Project
Cooke City Area, Montana
FIGURE ES-1

on a recreational use scenario. A comparison of metals levels to literature guidelines and State of Montana aquatic water quality standards indicates that aluminum, cadmium, copper, iron, lead, and zinc pose risk to organisms in the aquatic environment. In addition, arsenic, copper, and lead occur at phytotoxic levels in disturbed and metal-rich soils in the Como Basin and waste rock dumps in the Fisher Creek drainage.

Three separate source areas were evaluated in this study: the Como Basin Source Area, the Fisher Creek Source Area, and the Glengarry Adit Source area. The Como Basin and Fisher Creek source areas are similar in that they both contain metal-rich soils and/or mine waste rock deposits as a principal source of sulfide-bearing material that is oxidized to form an acidic, metal-laden leachate, which in turn is mobilized and impacts the quality of surface water and groundwater. These two areas differ in scale in that the Como Basin Source Area is a large area (2.23 hectares, 5.5 acres) that contains disturbed and metal-rich soils (as much as 190,174 cubic meters, or 249,000 cubic yards) in contact with an underlying massive sulfide mineral deposit. The Fisher Creek Source Area contains numerous small, scattered waste rock piles in the Fisher Creek drainage and other small, but locally severe erosional problems. Total volume of waste rock in the Fisher Creek Source Area is estimated to be 16,840 cubic meters (22,025 cubic yards) scattered over a combined area of about 2.9 hectares (7.1 acres). The Como Basin Source Area also includes the switchbacks on the Lulu Pass road as it climbs northward from the Glengarry Adit and through the Como Basin. This portion of the road exhibits severe erosion problems that expose mineralized soil and rock.

The third source area evaluated is the Glengarry Adit Source Area, where contaminated water flows into underground workings from four principal sources that combine and flow through the mine discharging contaminated surface water into the upper Fisher Creek watershed.

The objectives of the Como Basin/Glengarry Adit/Fisher Creek Response Action are:

- Minimize phytotoxicity resulting from high concentrations of metals and low pH in disturbed and metal-rich soils present in the Como Basin and outlying waste rock areas
- Prevent soluble metal contaminants or metals contaminated solid materials in the disturbed and metal-rich soils and mine waste from migrating into adjacent surface watercourses, to the extent practicable.
- Reduce or eliminate concentrated runoff and discharges that generate sediment and/or metals contamination to adjacent surface water and groundwater, to the extent practicable.
- Prevent potential exposure through the food chain to metal contaminants from acid discharges, waste rock, metal-rich soils and mineralized bedrock to the extent practicable.
- Mitigate, contain, or divert mine water inflows and consequent outflows to surface water.
- Prevent or limit future releases and mitigate the environmental effect of past releases of hazardous substances, pollutants or contaminants.
- Identify applicable or relevant and appropriate requirements (ARARs) for response actions and evaluate how each alternative complies with ARARs.
- Take into consideration the desirability of preserving the existing undeveloped character of the District and surrounding area when selecting response and restoration actions.

Cleanup goals were identified for metals posing risk at the site. Groundwater and surface water goals are the State of Montana water quality standards. Solid media goals are based on in-stream sediment and soil guidelines found in the literature.

After screening a variety of response technologies and process options, several alternatives were developed for detailed analysis. The alternatives were evaluated for effectiveness, implementability, and cost. Table ES-1 lists the Como Basin Source Area alternatives. Table ES-2 lists the Fisher Creek Source Area alternatives, and Table ES-3 lists the Glengarry Adit Source Area alternatives.

TABLE ES-1
RESPONSE ACTION ALTERNATIVES FOR THE COMO BASIN SOURCE AREA
New World Mining District Response and Restoration Project
Como Basin/Glengarry Adit/Fisher Creek Response Action

Alternative		Response Technology/Process Options
CB-1	No Action	None
CB-2A	In-Situ Treatment of Select Soil Material with Shallow Amendment	Regrading and compaction of disturbed and metal-rich soils in-situ, amendment of the upper 30 cm of the regraded surface with lime, and revegetation.
CB-2B	In-Situ Treatment of Select Soil Material with Deep Amendment	Regrading and compaction of disturbed and metal-rich soils in-situ, amendment of the upper meter of the regraded surface with lime, and revegetation.
CB-2C	In Situ Treatment of Metal-Rich Soil Material	Excavation of unconsolidated metal-rich soils, lime amendment of excavated materials, replacing and regrading amended soils, and revegetation.
CB-3A	In-Situ Treatment with Soil Cap	Regrading metal-rich soils in-situ, shallow amendment (upper 30 cm), constructing a soil cap, and revegetation
CB-3B	In-Situ Treatment with Geomembrane Liner and Amended Soil Cap	Regrading metal-rich soils in-situ, constructing a geomembrane liner with a drain layer and an amended soil cap, and revegetation.
CB-3C	In-Situ Treatment with Geomembrane Liner and Soil Cap	Regrading metal-rich soils in-situ, constructing a geomembrane liner with a drain layer and an imported soil cap, and revegetation.

Note: Except for No Action, all alternatives considered for the Como Basin include repairing the erosion problems in the channels below the Como Basin and the erosion problems associated with the switchbacks on the portion of the Lulu Pass Road that climbs from the Glengarry Adit through the Como Basin.

TABLE ES-2
RESPONSE ACTION ALTERNATIVES FOR THE FISHER CREEK SOURCE AREA
New World Mining District Response and Restoration Project
Como Basin/Glengarry Adit/Fisher Creek Response Action

Alternative		Response Technology/Process Options
FC-1	No Action	None
FC-2	In-Situ Treatment of Waste Rock with Shallow Amendment	Grading and compaction of waste rock in-situ, amendment of the upper 30 cm of the regraded surface with lime, and revegetation.
FC-3	Surface Controls	Grading waste rock in-situ, constructing runon and runoff controls.
FC-4	Total Removal and Disposal in an On-Site Repository	Total removal and disposal of waste rock in the SB-4B (B) repository.

TABLE ES-3
RESPONSE ACTION ALTERNATIVES FOR THE GLENGARRY ADIT SOURCE AREA
New World Mining District Response and Restoration Project
Como Basin/Glengarry Adit/Fisher Creek Response Action

Alternative		Response Technology/Process Options
GA-1	No Action	None
GA- 2	Grout Curtain Around Como Raise Collar; Backfill and Plug Como Raise	Drilling and pressure grouting around the collar of the Como Raise to construct a grout curtain; plugging and backfilling the raise. Eliminates or minimizes highly contaminated water flow from the Como Basin into the second Glengarry raise.
GA-3	Grout the Short Raise Above Bulkhead	Drilling and pressure grouting the structure at the top of the first raise to produce a grout curtain that eliminates or minimizes flow.
GA-4	Grout the 1050 Roof Leak	Drilling and pressure grouting of the roof leak to produce a grout curtain that eliminates or minimizes flow.
GA-5	Backfill Various Portions of the Glengarry Drift	Backfilling various portions of the Glengarry Mine with cemented backfill with a waste rock aggregate for structural support and strength needed to help protect grout curtains and reduce or minimize flow along a particular portion of the drift. ➢ 5A - backfilling the drift in the Fisher Mountain Porphyry only (fill will begin at the first plug and end at the portal plug). ➢ 5B - backfilling the drift in the Precambrian Granite only. ➢ 5C- backfilling the entire drift.
GA-6	Plug the Glengarry Drift at Critical Locations	Construct watertight concrete plugs within the Glengarry Drift and another plug near the portal.

COMO BASIN SOURCE AREA ALTERNATIVES

The seven alternatives evaluated for the Como Basin Source Area present a range of effectiveness. The overall effectiveness of the No Action alternative is poor. Under existing conditions, metals will continue

to migrate from metal-rich soils in the Como Basin into surface water and groundwater. While slopes are stable in the Como Basin as a result of Crown Butte Mines, Inc.'s (CBMI) reclamation, poorly vegetated metal-rich soils will continue to erode unabated into Fisher Creek. Vegetation condition and cover in the Como Basin will likely continue to decline over time as acidic conditions in the regraded and amended surface soil increase, causing a reduction in vegetation cover and vigor.

In terms of reducing contaminant seepage and migration from the Como Basin, Alternative CB-3C is the most effective of the alternatives evaluated. This is because practically all of the metal-rich soils of the basin would be capped by a geomembrane liner, and thereby protected from infiltrating waters. In this alternative, an imported soil cover placed over the liner promotes vegetation growth. Alternative CB-3B is as effective or only somewhat less effective than Alternative CB-3C, as most of the metal-rich soils are protected under the liner, and metal-rich soils are completely neutralized and amended to produce an amended soil cap. Alternative CB-3A is much less effective because the imported soil cap, although providing a substrate for vegetation reestablishment, does not decrease either the rate of infiltration nor substantially diminish risk of contaminant migration out of metal-rich soils.

Overall effectiveness of Alternative CB-2C may be as effective as CB-3B in controlling contaminant migration from metal-rich soils in the Como Basin. Under this alternative, seepage would not be eliminated but would be neutralized as it percolates through lime amended mineral rich and disturbed soils. However, Alternative CB-2C requires excavation, treatment, and replacement of a very large volume of material (190,174 cubic meters). Alternatives CB-2B and CB-2A are progressively less effective than CB-2C because smaller volumes of metal-rich soil material are amended, the seepage rate would remain about the same as existing conditions, and non-amended soils will likely still release contaminants to the environment. From this point of view, with the exception of the benefits of an imported soil cover, Alternative CB-3A will probably be only slightly more effective than Alternative CB-2A.

Based on a recreational use scenario, there are no unacceptable human health risks associated with the Como Basin metal-rich soils. The greatest risk to the environment comes from degraded surface and groundwater quality and its impact to aquatic life. The Como Basin alternatives involving a geomembrane as part of a composite cover will significantly reduce metal and acidity loading to Fisher Creek from tributaries draining the basin, particularly during high flow conditions.

None of the alternatives reduce the volume or toxicity of contaminants but all the alternatives, except No Action, reduce the mobility and loading of contaminants to some degree. Alternatives CB-2A, CB-2B, CB-2C, CB-3A, and CB-3B rely on treatment of soils with a neutralizing amendment to reduce mobility. Alternatives CB-3A and CB-3C also use an imported soil cover to reduce mobility. Alternatives CB-3B and CB-3C use a geomembrane liner as a part of a composite cover system to reduce mobility. Alternative CB-2C achieves the greatest reduction in mobility through treatment, but again this alternative requires moving and treating a very large volume of metal-rich soil. Reduction in plant toxicity through treatment or soil placement is achieved by all the alternatives except for No Action.

All the alternatives are implementable, and technically and administratively feasible. Essential project components such as equipment, materials, and construction expertise, although distant from the site, are available. However, there is the potential for incomplete mixing of neutralizing amendments for those alternatives where mixing is required for the alternative to be effective, especially Alternative CB-2C.

Total removal of the 190,174 cubic meters of disturbed and metals enriched soil in the Como Basin was not evaluated in detail, as this technology was screened from further consideration due to high cost. Total removal was evaluated in detail for the McLaren Pit Response Action, which has a similar amount of unconsolidated wastes; this alternative was not found to offer any distinct advantage over the other

alternatives evaluated due to the presence of a massive sulfide deposit that underlies waste rock in the McLaren Pit. Total removal was estimated to cost about three times more than the capping alternatives considered for the McLaren Pit, and the cost estimate for total removal of the Como Basin soils is expected to be the same as that estimated for the McLaren Pit analysis.

All of the alternatives evaluated provide some measure of mitigation to man-caused mining impacts. Given what is known about the source of metals impacts in Fisher Creek and the fact that natural sources contribute a considerable metals load to the creek via groundwater and surface water pathways, completely eliminating metals impacts from mining related sources will not be possible. However, Alternatives CB-3B and CB-3C would be the most effective at reducing mining-related acid and metals impacts, particularly with regards to loading. Each of these alternatives uses a geomembrane liner in a composite cover system to isolate metal-rich soil and reduce mobility of contaminants.

For Alternatives CB-3B and CB-3C, metals-rich soils would be protected from contact with surface water below a liner, and would likely minimize contaminant mobility and migration into Fisher Creek. Both Alternatives CB-3B and CB-3C will meet most project ARARs with the exception of surface water and groundwater quality. However, Alternative CB-3C will require both locating and developing a local source of soil material, or excavating and transporting borrow from the SB-4B repository site, both of which require disturbing an undisturbed area. Alternative CB-3B, on the other hand, should not present more difficulty in establishing vegetation, even though amended disturbed soils will be used as a plant growth medium. Procedures for revegetating acidic and metalliferous soils in high altitude environments have been established by the USDA-FS, and have been shown to be successful. Based on the relatively low level of contaminant concentrations present in disturbed soil in the Como Basin compared to the soils studied by the USDA-FS, revegetation for Alternative CB-3B is expected to be successful as well.

Metal-rich soil in the Como Basin is not the only source of contamination in the headwaters of Fisher Creek. It has been demonstrated that sulfide minerals in bedrock are a major, naturally occurring source of metals and acid rock drainage, and impact a surface water tributary flowing from the northeast flank of Fisher Mountain as well as the tributary flowing from the Como Basin. In addition, there is a significant (perhaps as much as 40%) contaminated groundwater component that enters Fisher Creek between the Glengarry mine and surface water-sampling Station SW-3 (Figure ES-1). Cleaning up or preventing seepage and impacted surface water flows from metal-rich soils of the Como Basin at the headwaters of Fisher Creek will significantly reduce the contribution of metal and acidity loading from mining and exploration related sources in the Como Basin. This is particularly true during high flow conditions when the component of contamination from these basin sources is the largest.

FISHER CREEK SOURCE AREA

The Fisher Creek Source area contains a number of small scattered waste rock dumps in the upper Fisher Creek drainage and other small, but locally severe erosional problems. Table ES-4 summarizes the status of the Fisher Creek mine dumps. Many of the small to intermediate size dumps that exhibited the greatest potential to impact surface water and groundwater in Fisher Creek were removed in 2001 as part of the Selective Source Response Action (Tredennic, Spaulding, and Small Como dumps; Table ES-4). Under existing conditions, metals migrate from outlying waste rock dumps at the headwaters of Fisher Creek into surface water and groundwater. While slopes are generally stable at many of the small outlying waste rock dumps, some of the larger, unvegetated waste rock dumps continue to erode unabated into Fisher Creek. The Glengarry and Gold Dust waste rock dumps are the two largest dumps in Fisher Creek, accounting for about 85% of the total mine waste remaining in the drainage.

Some of the same process options from the Como Basin analysis (Table ES-1) also apply to the remaining waste rock dumps in Fisher Creek (Table ES-2). The alternatives developed from these process options

are similar to those proposed for the Como Basin, with several exceptions. First, because the dumps are scattered over a wide area with difficult access to many of the sites, covering the small waste dumps with a geocomposite is not practical or cost effective. Therefore, the CB-3 alternatives are not considered for the Fisher Creek Source Area. Of the CB-2 alternatives (*in-situ* treatment), only shallow amendment with lime (CB-2A) is considered appropriate for the small, scattered waste rock dumps due to site constraints and access limitations (i.e. most of the sites are on steep slopes that constrains lime mixing with equipment). Total removal to the SB-4 repository is also considered appropriate for the Fisher Creek Source Area and was developed as an alternative.

One additional alternative was developed for the Fisher Creek Source Area, surface controls for surface water runon and runoff, as this alternative lends itself to being potentially effective at mitigating water quality impacts with a minimum impact to access roads and adjacent lands. Surface controls would include a variety of best management practices to reduce or eliminate surface water runon from flowing across mine waste, reduce or eliminate erosion generated in mine waste areas from moving to offsite areas, and reduce the amount infiltration from precipitation falling on waste dumps. Best management practices include constructing diversion ditches along the waste rock dump margins, constructing sediment basins downslope of waste dumps, and regrading waste rock to provide positive drainage. Surface controls could also include temporary measures such as installing silt fence and straw bale dikes to reduce or eliminated sediment produced from waste dumps.

Overall, *in-situ* treatment (Alternative FC-2) would be effective in providing suitable soil conditions for revegetation in the short-term, and a corresponding reduction in mobility of metal contaminants. However, because site conditions limit the depth of waste treatment, untreated wastes will remain at the dump sites. Under certain conditions, generally during moderate to extreme weather, untreated wastes could become saturated and release contaminants to the environment. There is also the potential for the treated surface of the waste to reacidify due to capillary rise of acid from underlying untreated wastes, resulting in a reduction in vegetation cover and vigor. Such a mechanism would likely cause the waste dump to revert to pre-treatment conditions.

TABLE ES-4

FISHER CREEK SOURCE AREA RANKING

New World Mining District Response and Restoration Project

Glengarry/Como/Fisher Creek Response Action

Site No.	Site Name	Other Name	Material Type	Volume (cubic meters)	Area (hectares)	Mine Drainage	Flow (GPM)	Ground Water Pathway	Surface Water Pathway	Air Pathway	Direct Contact Pathway	Total Score	Rank
FCSI-96-2A	Glengarry Dump	Lower Glengarry	waste	9880	0.43	adit, toeseep	20	30599.19	45272.86	10.94	34.50	0.7592	15
FCSI-99-1	Sheep Mountain Dump One		waste	140	0.05	adit, toeseep	10	27621.06	1077.57	1989.84	167.06	0.3086	21
FCSI-96-4	Glengarry Adit and Mill Site	Lower Glengarry	waste	380	0.23	adit, toeseep	5	7196.83	16535.51	488.62	40.22	0.2426	22
FCSI-96-8	Lower Spaulding Dump		reclaimed	2000	0.13	cladit	2	10910.38	10914.66	1262.51	49.89	0.2314	23
FCSI-96-1A	Gold Dust Mine and Dump	cultural / prospecting	waste	4330	0.22	adit, toeseep	15	14656.89	6223.54	60.29	5.27	0.2095	24
FCSI-96-5	Lower Trendennic Dump One		reclaimed	2610	0.16	cladit, toeseep	5	7581.55	6085.50	171.62	15.28	0.1385	26
FCSI-99-11	Como Basin	Lulu, Upper Lulu Adit	waste	22040	3.43	none	0	6314.86	5928.05	48.80	38.51	0.1233	27
FCSI-99-70	Henderson Mountain Dump Nine	Dozer cuts	waste	150	0.17	none	0	6231.53	158.64	2929.45	245.98	0.0957	31
FCSI-99-71	Henderson Mountain Dump Ten		waste	110	0.02	adit	1	9060.25	163.49	301.90	25.36	0.0955	32
FCSI-96-7	Upper and Middle Spaulding Dump	Upper Glengarry Mine	reclaimed	560	0.11	none	0	4561.46	3103.74	1219.43	69.53	0.0895	33
FCSI-99-74	Henderson Mountain Dump Fourteen	Elizabeth Mine	waste	90	0.28	none	0	6006.60	83.79	1547.28	130.20	0.0777	35
FCSI-96-15-2	Upper Trendennic Dump Two	Commonwealth #1	reclaimed	240	0.03	seep	1	4393.67	3027.49	157.65	8.86	0.0759	36
FCSI-99-101	Henderson Mountain Dump Nine-A		waste	80	0.08	none	0	3252.31	45.76	2816.60	234.99	0.0635	38
FCSI-99-53	Henderson Mountain Dump Four	Dozer cuts	waste	60	0.11	none	0	2558.21	47.59	2929.45	245.98	0.0578	40
FCSI-99-76	Sheep Mountain Shaft and Dump	Sheep Mountain Shaft	waste	50	0.04	none	0	4218.90	164.57	1012.96	85.06	0.0548	42
FCSI-99-62	Henderson Mountain Dump Six		waste	150	0.04	none	0	4461.58	82.87	153.03	12.87	0.0471	44
FCSI-96-6	Middle Trendennic Dump One	Manhattan	reclaimed	620	0.11	cladit, toeseep	2	1984.21	1728.76	467.99	39.99	0.0422	45
FCSI-96-18	East Henderson Pit	Schiller #1	waste	10	0.03	none	0	2741.85	51.04	942.50	79.09	0.0381	49
FCSI-99-68	Henderson Mountain Dump Seven	Fisher Creek No. 1	waste	210	0.04	adit	2	3466.95	63.62	117.48	10.00	0.0366	51
FCSI-99-102	Henderson Mountain Dump Seven-A		waste	50	0.04	none	0	3255.77	46.52	281.66	23.50	0.0361	53
FCSI-99-43	Homestake Mine Dump	cultural / prospecting	waste	140	0.23	none	0	2068.69	52.68	972.86	81.66	0.0318	54
FCSI-99-78	Sheep Mountain Dump Two		waste	20	0.01	none	0	1406.30	54.86	1012.96	85.06	0.0256	59
FCSI-99-18	Middle Trendennic Dump Two		waste	10	0.00	none	0	1406.30	274.28	101.30	8.51	0.0179	62
FCSI-99-20	Middle Trendennic Dump Three		waste	10	0.00	none	0	1406.30	274.28	101.30	8.51	0.0179	62
FCSI-99-77	Sheep Mountain Pit		waste	20	0.00	none	0	1406.30	54.86	101.30	8.51	0.0157	64
FCSI-99-104	Henderson Mountain Dump Eight-A		waste	20	0.08	none	0	1084.10	152.53	281.66	23.50	0.0154	65
FCSI-99-73	Henderson Mountain Dump Thirteen	Fisher Creek No. 1	waste	40	0.03	adit	6	1140.54	18.10	97.29	8.17	0.0126	66
FCSI-99-39	Henderson Mountain Dump Two	Silver Queen	waste	30	0.05	none	0	1001.42	25.58	157.48	13.18	0.0120	67
FCSI-99-103	Henderson Mountain Dump Five-A		waste	20	0.00	none	0	1084.10	15.25	28.17	2.35	0.0113	68
FCSI-96-15-1	Upper Trendennic Dump One	Commonwealth #1	reclaimed	80	0.02	adit, toeseep	1	439.81	303.31	157.65	8.86	0.0091	70
FCSI-96-17	Homestake Adit and Dump	cultural / prospecting	waste	320	0.11	none	0	702.62	19.18	118.05	9.25	0.0085	73
FCSI-96-15-4	Upper Trendennic Dump Four	Commonwealth #2	reclaimed	50	0.02	none	0	439.32	221.97	157.65	8.86	0.0083	74
FCSI-99-38	Henderson Mountain Dump One	cultural / prospecting	waste	20	0.01	none	0	333.81	8.53	157.48	13.18	0.0051	77
FCSI-96-16	Homestake Pit	cultural / prospecting	waste	80	0.08	none	0	379.35	9.94	61.18	4.99	0.0046	78
FCSI-96-15-3	Upper Trendennic Dump Three	Commonwealth #2	reclaimed	10	0.02	none	0	146.44	134.53	157.65	8.86	0.0045	79
FCSI-96-15-5	Upper Trendennic Dump Five	Commonwealth #2	reclaimed	10	0.03	none	0	146.44	134.53	157.65	8.86	0.0045	79
FCSI-99-69	Henderson Mountain Dump Eight	Kingfisher	waste	60	0.16	none	0	151.74	3.86	237.88	19.97	0.0041	82

Yellow - reclaimed sites; Grey - waste removal sites; Green - Fisher Creek Source Area work; Blue - cultural resource sites

TABLE ES-4

FISHER CREEK SOURCE AREA RANKING

New World Mining District Response and Restoration Project

Glengarry/Como/Fisher Creek Response Action

Site No.	Site Name	Other Name	Material Type	Volume (cubic meters)	Area (hectares)	Mine Drainage	Flow (GPM)	Ground Water Pathway	Surface Water Pathway	Air Pathway	Direct Contact Pathway	Total Score	Rank
FCSI-99-61	Henderson Mountain Dump Five	Schiller Lode #2	waste	10	0.05	none	0	283.08	5.27	97.29	8.17	0.0039	83
FCSI-99-24	Lower Trendennic Dump Two		waste	30	0.00	cladit, toeseep	1	253.58	9.49	5.84	0.51	0.0027	85
FCSI-99-59	Chicago Mill Site		ore/slag	30	0.52	none	0	48.74	10.11	186.78	6.84	0.0025	87
FCSI-99-75	Henderson Mountain Dump Twelve	International	waste	20	0.01	none	0	206.87	13.17	0.97	0.82	0.0022	89
FCSI-99-12	Scotch Bonnet Dump Two		waste	80	0.02	none	0	114.49	6.56	40.37	3.49	0.0016	91
FCSI-99-105	Sheep Mountain Dumps		waste	30	0.08	none	0	100.18	5.86	36.09	3.05	0.0015	92
FCSI-99-72	Henderson Mountain Dump Eleven		waste	20	0.06	none	0	59.51	1.51	27.94	2.35	0.0009	94
FCSI-99-49	Fisher Creek Dump One		waste	20	0.03	none	0	50.77	0.91	16.78	1.46	0.0007	95
FCSI-96-9	Small Como Dump		reclaimed	310	0.10	none	0	17.90	41.26	5.94	0.27	0.0007	96
FCSI-99-26	Fisher Creek Trench One		waste	40	0.01	none	0	32.90	10.72	0.66	0.04	0.0004	97
FCSI-99-52	Fisher Creek Dump Three		waste	0	0.02	none	0	15.23	2.73	16.78	1.46	0.0004	99
FCSI-99-35	Fisher Mountain Dump Three		reclaimed	0	0.49	nfv	0	4.25	0.01	12.71	11.18	0.0003	100
FCSI-99-36	Fisher Mountain Dump Four		reclaimed	0	0.67	nfv	0	4.25	0.01	12.71	11.18	0.0003	100
FCSI-99-23	Glengarry Trench		trench	0	0.01	none	0	21.35	0.03	3.33	2.59	0.0003	102
FCSI-99-54	Fisher Creek Dump Four		waste	0	0.04	none	0	5.08	0.91	16.78	1.46	0.0002	103
FCSI-96-14	Upper Glengarry Dump		waste	80	0.02	none	0	9.16	7.56	3.58	0.28	0.0002	104
FCSI-96-10	Fisher Mountain Trench One		reclaimed	0	0.53	nfv	0	0.35	0.01	10.25	9.08	0.0002	105
FCSI-99-29	Fisher Mountain Trench Two		reclaimed	0	0.06	nfv	0	4.25	0.01	1.27	1.12	0.0001	108
FCSI-99-32	Fisher Mountain Dump One		reclaimed	0	0.02	nfv	0	4.25	0.01	1.27	1.12	0.0001	108
FCSI-99-33	Fisher Mountain Dump Two		reclaimed	0	0.02	nfv	0	4.25	0.01	1.27	1.12	0.0001	108
FCSI-99-51	Fisher Creek Dump Two		native	0	0.01	none	0	4.25	0.08	0.97	0.82	0.0001	111
FCSI-96-11	Fisher Mountain Pit		reclaimed	0	0.02	nfv	0	0.50	0.01	1.52	1.33	0.0000	112
FCSI-99-65	Fisher Creek Trench Two		trench	0	0.06	none	0	0.00	0.00	0.00	0.27	0.0000	114
FCSI-99-8	Scotch Bonnet Dump One		natural	0	0.00	none	0	0.00	0.00	0.00	0.03	0.0000	117

Yellow - reclaimed sites; Grey - waste removal sites; Green - Fisher Creek Source Area work; Blue - cultural resource sites

Surface controls (Alternative FC-3) would be effective in reducing impacts that result from surface water runon encountering waste. Diversion of runon at dumps where this problem occurs is a simple, straightforward approach to reducing mobility of contaminants. However, maintenance of diversion structures over time would be required. Precipitation that falls directly on the dumps will continue to leach through the unvegetated dumps, creating the potential for contaminants to move off-site into area surface and groundwater. To some degree, regrading of the waste rock dumps can enhance surface water runoff.

Alternative FC-4, total removal, is the most effective and most costly of the alternatives considered. This alternative calls for moving the mine wastes to an on-site repository, part of which has been previously constructed. The No Action Alternative does not address surface water impacts, nor does it provide any controls on contaminant migration.

GLENGARRY ADIT SOURCE AREA

The third source area evaluated is the Glengarry Adit Source Area, where contaminated water flows into underground workings from four principal sources that combine and flow through the mine workings to the portal. Water discharged from the portal flows directly into Fisher Creek and also leaches through the Glengarry Dump, a sulfide-bearing waste rock dump located at the portal. Clean-up goals for the Glengarry Adit are all based on eliminating or minimizing contaminated inflows and outflows from the mine. Alternatives that use engineering controls to plug, contain, or divert water flows and eliminate or minimize contaminated discharges were developed to meet these goals.

The No Action Alternative involves leaving the Glengarry Mine in its existing condition. Overall effectiveness of no action is poor. Under existing conditions, acidic water, dissolved metals, and sediment will continue to flow from the mine portal and into Fisher Creek.

From the point of view of contaminant concentration and loading, the principal source of metals and low pH water inflow into the Glengarry Mine arises from water flowing along the colluvial/bedrock contact in the Como Basin that flows down the second, or Como raise (8 to 38 liters per minute). Alternative GA-2 effectively reduces the influx of metal-laden water into the Glengarry Mine and Fisher Creek by providing multiple barriers to contaminated water entering and flowing down the second raise. The grout curtain encircling the raise collar will provide a barrier to keep shallow subsurface water flowing along the colluvial/bedrock contact from entering the raise, and cement and bentonite plugs will provide a very tight seal within the raise and below the massive sulfide-bearing portion of the Meagher Limestone. Backfilling the raise will also act as a barrier to water movement, and will eliminate the chance of future collapse of rock around the grout curtain and plug areas that could result in leakage past the plugs or failure of the grout curtain.

Other significant sources of inflow are the flow from the top of the first raise (38 to 64 liters per minute) and flow from the 1050 fracture system (10 to 50 liters per minute). These two inflow sources contribute two orders of magnitude less metals concentrations than the Como raise, but contribute a considerable iron and zinc load and exceed water quality standards. Water leakage from both these structures would be considerably reduced or eliminated if Alternatives GA-3 (grouting of fracture system at the top of the first, short raise) and GA-4 (grouting of the 1050 Roof Leak) were implemented.

If grouting for Alternatives GA-3 and GA-4 are only partially successful, implementation of these two alternatives is still likely to be effective in substantially reducing flow into the mine. However, the effectiveness of Alternative GA-3 directly depends on the success of locating and sealing the fracture system above the first raise. If Alternatives GA-2 and GA-6 are selected, Alternative GA-3 becomes unnecessary.

Implementing Alternative GA-5 (backfilling various portions of the underground workings) ensures no further ground movement will occur in the rock surrounding the Glengarry workings. This alternative provides structural stability and support to areas grouted and plugged under Alternatives GA-4 and GA-6. The relative impermeability of backfill will also significantly reduce flow through the backfilled portions of the workings.

Alternative GA-6 is the most effective of the alternatives in that it seals the underground workings with a series of plugs. Water draining down the raises and entering the Glengarry drift will be stopped in the very dry and low permeability rock of the Precambrian granite. Another plug located near the portal will block Fisher Mountain Porphyry water that drains into the drift between the portal and the porphyry contact. This alternative should be very effective in eliminating or minimizing outflow from the mine and into Fisher Creek.

PREFERRED ALTERNATIVE

Loading analysis suggests that metals loading from the Glengarry Adit is most significant (more than 90 % of the total load as measured in Fisher Creek immediately below the mine site) during low flow conditions from September to late June. Metals loading from the Como Basin is most significant (about 20% of the total load in Fisher Creek immediately below the Glengarry mine) during high flow conditions in late June through August. Loading for many constituents during low flow is about 10 times lower than that during high flow. Metal loading from the tributary draining undisturbed ground on the northeast flank of Fisher Mountain contributes about 14% of the copper load to Fisher Creek during high flow conditions. This metal load is though to be the result of natural acid rock drainage. Based on this analysis, it would seem appropriate to complete the most desirable response action on both the Como Basin and Glengarry Adit Source Areas in order to minimize contaminant migration into Fisher Creek on a year-round basis. The combination of both should significantly and positively improve water quality, particularly with respect to metal and acidity loading, in the upper reaches of Fisher Creek, and will likely have some positive effects on groundwater.

A response action targeting the smaller waste rock dumps that remain in the Fisher Creek Source Area is of lower importance in terms of metals loading to Fisher Creek. Only the Glengarry waste rock dump appears from metals loading analyses to have a significant impact on water quality in Fisher Creek. Some water quality degradation from the Gold Dust waste rock dump in the form of increased acidity (pH of 5.5) has also been documented, primarily due to infiltration of water from the Gold Dust Adit through the waste rock dump. Although there are metal analyses available indicating seepage through the waste rock dump carries high metals concentrations and low pH, there is no identified metal impact to the tributary that flows past the Gold Dust above or below the dump site. There are no unacceptable residual risks to human health at these sites.

Because of the foregoing, the preferred alternative for the Como Basin/Glengarry Adit/Fisher Creek Response Action is a combination of the alternatives discussed for each of the separate source areas. Only by combining the alternatives will substantial improvements in water quality be realized in Fisher Creek. The preferred alternative for each of the three source areas is presented below. Table ES-5 summarizes response action work that will be done in the Como Basin and 11 sites in the Fisher Creek drainage.

COMO BASIN SOURCE AREA

All the alternatives evaluated for the Como Basin provide some measure of mitigation to man-caused mining impacts. Given what is known about the source of metals impacts in Fisher Creek and the fact

that natural sources contribute a considerable metals load to the creek via groundwater and surface water pathways, eliminating metals impacts from mining related activities will not allow achievement of State of Montana water quality standards. However, Alternatives CB-3B and CB-3C would be the most effective at reducing mining-related metals loading impacts to Fisher Creek. Each of these sub-alternatives uses a geomembrane liner in a composite cover system to confine and reduce the mobility of contaminants present in soils in the basin. Establishing vegetation under Alternative CB-3B should not be more difficult as compared to Alternative CB-3C, as long as revegetation procedures established by the USDA-FS are followed. Alternative CB-3C would require obtaining a local source of soil material, which involves disturbance and reclamation of a borrow site. For these reasons, Alternative CB-3B is the preferred alternative for the Como Basin Source Area. The total cost to implement this alternative is $1,918,000.

FISHER CREEK SOURCE AREA

Except for the Glengarry and the Gold Dust waste rock dumps, there appears to be little impact from the remaining waste rock dumps located in Fisher Creek. There are no identified human health risks, and environmental risks appear to be associated with waste rock that is in contact with surface water and/or groundwater. This is the case at the Glengarry Dump, where loading of contaminants was determined to make up nearly 15% of the load delivered to Fisher Creek during high flow conditions. Part of the reason for this is the location of the dump at the mouth of the Glengarry Adit, where flows discharging from the adit eventually infiltrate through the waste rock dump. Another reason is the location of the dump as a cross-valley fill in the Fisher Creek drainage, where it is prone to nearly constant contact with Fisher Creek and fluctuating groundwater levels that are influenced or controlled by Fisher Creek. The Glengarry Dump accounts for about 59% of the remaining waste rock in the Fisher Creek drainage.

The Gold Dust site is somewhat similar to the Glengarry Dump in that the Gold Dust waste rock sits at the mouth of the adit, and discharge from the adit flows across the dump before entering a tributary to Fisher Creek. The dump is also one of the larger remaining dumps in Fisher Creek, constituting 26% of the waste rock left in the remaining dumps. Together, the Glengarry and Gold Dust waste rock dumps contain 85% of the waste rock in the Fisher Creek drainage.

Other waste rock dumps and their associated mine sites lie topographically above the valley bottom and present little threat to surface or groundwater quality (except for a brief period during active snowmelt). Some of the sites, in addition to being high and dry, are also considered to be cultural or historic resources (e.g. Homestake Mine).

Because of the nominal nature of recognized impacts from remaining dumps in Fisher Creek, and because the Glengarry and Gold Dust waste dumps constitute 85% of the waste rock, the preferred alternative for the Fisher Creek Source Area is Alternative FC-3 for selected waste dumps except the

TABLE ES-5
PROPOSED RECLAMATION ACTIVITIES FOR THE FISHER CREEK SOURCE AREA
New World Mining District Response and Restoration Project
Como Basin/Glengarry Adit/Fisher Creek Response Action

Site No.	Site Name	Waste Volume (cubic meters)	Area (hectares)	Mine Drainage	Flow (gpm)	Access	Alternative Selected	Work Type	Rank
FCSI-96-2A	Glengarry Dump	9880	0.43	Adit, toe seep	20	Road	FC-4	Waste removal, regrade	15
FCSI-99-1	Sheep Mountain Dump One	140	0.05	Adit, toe seep	10	Road	FC-3	Move waste, divert flow	21
FCSI-96-4	Glengarry Adit and Mill Site	380	0.23	Adit, toe seep	5	Road	FC-4	Waste removal, regrade	22
FCSI-96-1A	Gold Dust Mine and Dump	4330	0.22	Adit, toe seep	15	Road	FC-4	Partial waste removal, regrade, portal closure	24
FCSI-99-11	Como Basin	22,040	3.43	None	0	Road	Como Source Area	Regrade, geomembrane	27
FCSI-99-70	Henderson Mountain Dump Nine	150	0.17	None	0	Road	FC-3	Regrade	31
FCSI-99-53	Henderson Mountain Dump Four	60	0.11	None	0	Road	FC-3	Regrade	40
FCSI-99-68	Henderson Mountain Dump Seven	210	0.04	Adit	2	Tracked but flat	FC-3	Move waste, divert flow	51
FCSI-99-73	Henderson Mountain Dump Thirteen	40	0.03	Adit	6	Tracked but flat	FC-3	Move waste, divert flow	66
FCSI-96-17	Homestake Adit and Dump	320	0.11	Open Portal	0	Road	FC-3	Portal Closure	73
FCSI-99-35	Fisher Mt Dump Three	regraded	0.49	none	0	Road and Tracked (steep)	FC-3	Regrade, construct drainage channel	100
FCSI-99-36	Fisher Mt. Dump Four	regraded	0.67	none	0	Road and Tracked (steep)	FC-3	Construct drainage channel	100

Note: All disturbed areas will be amended as necessary and seeded provided site conditions allow appropriate access for vehicles and equipment.

Glengarry and Gold Dust dumps. Alternative FC-4, total removal to the SB-4B(B) repository, is the preferred alternative for these two dumps (Table ES-5).

Alternative FC-3, surface controls, involves construction of runon controls at only those dumps that are in direct contact with a surface water drainage or where erosion processes are transporting mine wastes off-site. For most of the remaining waste rock dumps, the impacts of building roads and moving equipment onto the sites for removal or treatment would be greater than that of leaving them in place. Alternative FC-3, appears to be suitable for implementation at other waste rock dumps, where runon controls may be sufficient to reduce the majority of environmental impacts, especially with regard to surface water quality. The sites where Alternative FC-3 applies are shown in Table ES-5. For the remaining dumps in the Fisher Creek drainage (shown as unshaded rows in Table ES-4), No Action is selected as the preferred alternative.

In the draft EECA, Alternative FC-3 did not involve amending mine waste with lime, topsoil, organics, or fertilizer, and did not require revegetation. Work under Alternative FC-3 was limited to regrading and runon controls so that roads were not needed to haul amendments to a site. However, because existing road access is adequate to most of the sites selected for the FC-3 response action (Table ES-5), the Forest Service has determined that mine waste will be amended and disturbed areas seeded where possible.

GLENGARRY ADIT SOURCE AREA

The most effective means of closure for the Glengarry Mine involves a combination of alternatives that attempt to minimize mobility of contaminants as inflow and outflow from the mine. These alternatives are also selected for implementability, as they offer the most in terms of long-term effectiveness and permanence, and provide for the maximum protection of the environment. Although there is some need for backfilling intervals of the workings around grout curtains or plugs to ensure structural stability, the combination of the evaluated alternatives has been selected to minimize redundancy. For these reasons, the following alternatives have been selected:

- GA-2, a surface grout curtain around the raise collar with a concrete plug in the raise below the Meagher limestone and backfilling the raise.
- GA-4, a grout curtain around the 1050 roof leak.
- GA-5A, backfilling the drift with cemented backfill in the Fisher Mountain Porphyry portion of the drift, and
- GA-6, placement of watertight plugs and a portal plug in the Glengarry drift.

Alternative GA-3 has not been selected as it has the least chance for success, is the most dangerous to implement, and can be eliminated with plugs set in the Precambrian granite (Alternative GA-6). This will backup and confine water from the first raise into a very dry portion of the mine, and will keep water from the Precambrian granite from mixing with water from the Fisher Mountain Intrusive.

Closure of the Glengarry Mine will be executed as a two-year program that allows for testing and monitoring the success of the first season of work. Alternatives GA-2, GA-4, and part of Alternative GA-6 would be completed the first year, allowing monitoring of flow reductions during the winter and spring of the following year. Monitoring would allow for any adjustments to be made before the second season of work is done. Backfilling the drift (GA-5) and setting the remaining portal plug (GA-6) would be

completed during the second season of work. Estimated cost of the preferred alternative for the Glengarry Source Area is $2,666,000.

COMBINED ALTERNATIVE - IMPACTS TO LOADING

Upper Fisher Creek is characterized by highly variable flow with rapidly increasing flow rates and short periods of sustained flow during snowmelt. As much as 90% of Fisher Creek's discharge volume occurs between mid May and early August. Discharge rates near the upper reaches of Fisher Creek range from less than 0.3 m^3/s (1.0 cfs) in late winter to over 1.4 m^3/s (150 cfs) during peak runoff.

Metals loading investigations by Amacher (1998) and Kimball and others (1999) indicate that a few distinct surface water sources in the upper 500 meters of Fisher Creek supply the majority of the contaminant load to the creek. Results of Amacher's investigation indicate that the major sources of metals loading into Fisher Creek are:

- Outflow from the Glengarry Adit (F-8A)
- A tributary draining the northeastern flank of Fisher Mountain (FCT-12)
- A tributary draining the Como basin (FCT-11)
- Seepage from the Glengarry Adit waste rock dump (FC-2)

In general, loading studies agree about the major inflow sources that contribute metals to Fisher Creek. Roughly half of the sources contributing metal loading into the creek have been identified as surface sources, with estimates ranging from 40 to 60%; the remainder being groundwater or subsurface flows. Subsurface flows will prove difficult to remediate, as these flows do not seem to be associated with any particular mining-related activity, and could very well represent natural acidic drainage.

Amacher (1998) and Kimball and others (1999) noted that the relative contribution of the four major sources varied considerably from spring runoff to base flow conditions. The majority of contaminant loading to Fisher Creek occurs under peak flow conditions (by a factor of 10). Comparison of loads indicates that while the Glengarry Adit dominates water chemistry during low flow conditions, tributaries FCT-11 and FCT-12 contribute the majority of the annual load during high flow conditions.

In May, under base flow conditions, Glengarry Adit discharge (FC-2) accounts for most of the dissolved copper load to upper Fisher Creek. As snowmelt begins in June and proceeds into July, runoff from Fisher Mountain (FCT-12) and Como Basin (FCT-11) accounts for most of dissolved copper load. In the fall, the Glengarry Adit again accounts for the majority of copper load. Metals load contribution from groundwater is significant during spring runoff, but cannot be quantified with the available data.

Using copper and iron as examples, based on the combined predicted affect for the preferred alternative for each of three source areas (composite cover on Como Basin soils, closure of the Glengarry adit and removal of the Glengarry waste rock dump), copper loading to Fisher Creek could be reduced by as much as 90% during low flow at a point immediately below the present location of the Glengarry waste rock dump, and by a considerably smaller amount at SW-3. This is true because there is no or very little flow in the tributaries from Fisher Mountain or the Como Basin (or two other small tributaries) under base-flow conditions and approximately 90% of the load then comes from the Glengarry adit and seepage through the waste rock dump. The remaining load is from groundwater sources that report to surface water flow measured at SW-3. During these flow conditions, both Kimball and Amacher's studies indicate that groundwater inflow to Fisher Creek between the Glengarry Mine and SW-3 contributes at least 35 to 45% of the total load to SW-3.

The total estimated load reduction for the preferred alternative, using three estimates of adit closure efficiency of 100, 50 and 20%, show that copper removal will likely range from 8 to 40%, depending upon the amount of load rerouted by the adit closure into preexisting fractures that in turn report to Fisher Creek. Using the total annual load data for copper (2,132 lbs/year under high flow conditions or 149.4 lbs/year under low flow conditions), and assuming annual flow of 3 months per year at high flow and 9 months per year at low flow, the preferred alternative could remove as few as 18 pounds (20% efficiency) or as much as 146 pounds (100% efficiency) of copper per year. Similarly for iron loading, the calculated estimates show that iron removal will likely range from 8 to 49%, depending upon adit closure efficiency. Using the total annual load data for iron (8,876 lbs/year under high flow conditions or 1,255 lbs/year under low flow conditions), and assuming annual flow at 3 months per year at high flow and 9 months per year at low flow, the preferred alternative could remove as few as 94 pounds (20% efficiency) or as much as 1,462 pounds (100% efficiency) of iron per year.

COMBINED ALTERNATIVE COST

Table ES-6 presents the combined alternative cost for the preferred alternative. For Alternative FC-3 Modified, the cost of the removal and disposal of the Glengarry Dump in the SB-4B(B) repository was estimated to be 70% of the total estimated cost for Alternative FC-4, and then added to the FC-3 total cost.

TABLE ES-6
SUMMARY OF ESTIMATED COSTS FOR THE PREFERRED ALTERNATIVE
New World Mining District Response and Restoration Project
Como Basin/Glengarry Adit/Fisher Creek Response Action

Preferred Alternative	Cost
Como Basin Source Area – CB-3B	$ 1,918,000
Fisher Creek Source Area – FC-3 (Modified for removal of the Glengarry and Gold Dust Waste Rock Dumps)	$ 2,010,000
Glengarry Adit Source Area (Combination of GA-2, GA-4, GA-5A, and GA-6)	$ 2,666,000
TOTAL ESTIMATED RESPONSE ACTION COST	**$ 6,594,000**

APPENDIX A

RESPONSE TO COMMENTS RECEIVED ON THE DRAFT (June 2002) COMO BASIN/GLENGARRY ADIT/FISHER CREEK RESPONSE ACTION ENGINEERING EVALUATION/COST ANALYSIS

New World Mining District Response and Restoration Project

Response to Significant Comments
Como Basin/Glengarry Adit/Fisher Creek Response Action
Engineering Evaluation/Cost Analysis

Introduction

The following table presents the USDA Forest Service's response to comments received on the Como Basin/Glengarry Adit/Fisher Creek Response Action Engineering Evaluation/Cost Analysis (EE/CA). Comments were received on two drafts of the EE/CA. The first draft, an internal review draft, was released on May 10, 2002 to the New World Mining District Response and Restoration Project agency cooperators: the Department of Interior, represented by the National Park Service; the Environmental Protection Agency (EPA), represented by Region 8; and the Montana Department of Environmental Quality. Comments on the internal review draft were received in May and June 2002. These comments were considered, and the comments directly addressed in the subsequent public release of the draft EE/CA that was issued in June 2002.

Three organizations and one private citizen provided comments on the public draft document. One additional comment was received from the USDA project biologist regarding potential impacts to wildlife.

Since the comments received generally supported the information presented in the draft EE/CA, and because significant changes to the draft EE/CA would not be required as a result of these comments, the following response to significant comments represents substantiation of information presented in the public draft. The table presents the entire comment received from each organization and individual, with the comment presented in the left-hand side of the table, and the associated response presented in the right hand side of the table. The letters to the left of each comment/response are only used to index and track the comment and associated response. Comments received from the EPA on the internal review draft fully supported the document and do not have need of an associated response.

	Department of Environmental Quality Comments	*Response*
	June 11, 2002 Mary Beth Marks Gallatin National Forest P.O. Box 130 Bozeman, MT 59771 RE: DEQ Comments on internal draft Como/Glengarry/Fisher Creek EE/CA Dear Mary Beth: DEQ has reviewed the internal draft Como/Glengarry/Fisher Creek EE/CA and offers the following comments for your consideration. Comments are organized into general comments on the three source areas addressed in the draft EE/CA, followed by specific comments.	
A	**Como Basin Source Area:** Problems associated with Como Basin include barren mine waste and metal enriched soil, and the generation of metal rich acidic leachate that discharges to Fisher Creek. The alternatives developed should address solutions to these two problems: 1) Stabilizing and vegetating barren surface materials, and 2) Eliminating (to the greatest extent possible) the metal rich acidic leachate.	A Comment acknowledged.
B	The alternatives developed to treat these two problems are variations of two different approaches. The first set of options looked at treating the material with neutralizing amendments and establishing vegetation on the resulting neutral surface materials. The three soil treatment options examined differ mainly in the depth that amendments would be incorporated. Evaluation of the soil amendment alternatives concludes "alternative CB-2C achieves the greatest reduction in mobility through treatment". However, this alternative is dismissed because of the costs and difficulty associated with excavating, treating and replacing	B The volume of soil needing treatment to implement Alternative CB-2B was reported in the internal review draft. This volume can be found in the public draft on page 116, first paragraph. The volume needing treatment is 22,300 cubic meters or 11.7% of the metals-rich soils present in the basin.

	Department of Environmental Quality Comments	*Response*
	190,174 CM of mine waste. A lesser lime treatment alternative, alternative CB-2B would involve amending the mine waste in the Como Basin to a depth of 1-meter using deep tilling practices. The EE/CA does not calculate the volume of waste (or percentage of the total volume) of waste that would be treated under this alternative, nor does it calculate what effect treating less than the entire volume of waste would have on leachate generation. Without knowing how much of the 190,174 CM of waste would be treated by alternative CB-2B it is not possible to predict how effective this alternative would be in reducing mobility of metals through treatment.	
C	The second general approach to stabilizing barren surface and eliminating (to the extent possible) acidic metal rich leachate is to use capping and encapsulation technology to isolate the mine waste from exposure to surface water. The EE/CA concludes that the construction of a capped and/or lined waste impoundment to be the most effective alternatives for reducing the load to Fisher Creek, however, the analysis of the preferred alternative (CB-3B) does not address the issue of infiltration of groundwater under the proposed impermeable cap. This is a concern because the proposed cap is to be constructed in a topographic low. DEQ has concerns drainage from upslope areas which may find its way under the cap, saturate the waste, and then flow as metal rich acidic leachate to Fisher Creek. Without understanding to what exten[t] groundwater could infiltrate under the cap it is not possible to predict if alternative CB-3B will be any more effective that alternative CB 2A which the USFS rejected because surface liming and revegetation would not be effective in reducing metal rich acidic leachate. If alternative CB-2A was rejected because leachate would continue to be generated, then CB-3B should not be adopted until an evaluation has been made on the potential for this alternative to allow saturation of the waste which would also cause metal rich acidic leachate to be generated. Without an answer to this question, DEQ agrees with the USFS that "alternative CB-2C achieves the greatest reduction in mobility through treatment", and disagrees with USFS that CB-3B should	C This comment was discussed in several venues, including the New World Annual Technical Meeting conducted in Bozeman, Montana on January 23, 2002. The suggestion at that meeting was that piezometers should be installed to determine if saturation of metals-rich soils below the liner might be a problem in the Como Basin following capping. This task was added to the scope of work for 2002 investigation activities and the piezometers were installed in August 2002. Preliminary data show that only 6 of the 20 piezometers installed contained water at the bedrock/soil interface, and of these 6 piezometers, only two contained acidic water. To address this issue, the USDA Forest Service will key the liner at the upper (west) edge of the capped area to a depth of 1.5 meters below the existing ground surface into the bedrock formation, the Fisher Mountain intrusive. If monitoring of groundwater quality beneath the cap indicates that groundwater continues to seep into the metals-rich disturbed soils, the preferred Alternative CB-3B can be augmented with additional measures, such as a groundwater cutoff system. However, based on the small drainage area of the Como Basin (approximately 17 acres), and the low permeability of the Fisher Mountain Intrusive formation, it is the opinion of the USDA Forest Service that groundwater seepage beneath the cap will be minor.

	Department of Environmental Quality Comments	*Response*
	be the preferred alternative. DEQ has concerns about the construction of a mine waste cap that is not in an upland area, and where drainage from upslope areas may flow under the cap. Before settling on an alternative that does not achieve the greatest reduction in mobility through treatment, USFS should model the quantity and quality of leachate to be generated under the cap. This information should be compared to a model of the quality and quantity of the leachate to be generated by the various lime amendment options that were proposed and rejected. Without this information, DEQ believes that alternative CB-2C should be the preferred alternative for the Como Basin. DEQ also believes that maintenance will be less with alternative CB-2C and that by utilizing treatment the response action will be more permanent than the liner option selected as the preferred alternative.	There are other considerations when determining the feasibility of implementing Alternative CB-2C and comparing the cost and effectiveness of Alternative CB-2C and CB-3B. These considerations were analyzed in the EE/CA and include the following: • Wholly treating the wastes on-site would involve several logistical and constructibility difficulties that would likely add several years to the construction schedule. Logistical problems would include hauling and staging a large quantity of lime amendment in a secure location and manner that keeps the amendment dry and prevents the public from exposure to the amendment. • Excavating metals-rich soils to a depth of as much as 20 feet would be required, and stockpiling that soil so that it can be mixed and placed back in the excavation offers some construction sequencing issues. Intermediate construction controls would also be required to secure the site for winter shutdown during the several winters that the excavation would be open during the amendment process. • Alternative CB-2C is considerably more costly (75% more than CB-3B), and likely would not meet Montana's B-1 standards in Fisher Creek.
D	**Fisher Creek Source Area:** The major problems noted for the Fisher Creek Source Area is stated as "locally severe erosional problems" and the draft EE/CA notes that "unvegetated waste rock dumps will erode unabated into Fisher Creek". DEQ agrees that covering these many small dumps with geocomposite is not practical or cost effective. DEQ believes that with the exception of Gold Dust and Glengarry Adit dumps (which the USFS proposes to remove) that these dumps may be best treated in place. DEQ agrees that the selection of alternative FC 3 is an appropriate response for the Fisher Creek Source Area. DEQ has concerns that the treatment prescription	D The USDA Forest Service further evaluated each waste dump in the Fisher Creek Source Area in August 2002. A technical memorandum was written summarizing the results of this evaluation, and specific reclamation prescriptions were identified for 11 in the Fisher Creek Source Area. The technical memorandum, dated November 7, 2002, is titled "Proposed Reclamation Activities for the Fisher Creek Source Area", and is available on the project Website. The prescriptions specified for the 11 sites are included in the Final EE/CA and in the decision document written for the Response Action (Action Memorandum).

	Department of Environmental Quality Comments	*Response*
	be reviewed and defined so as to avoid the problems that CBMI had attempting to revegetate areas disturbed under their exploration permits. Prior to proceeding with this alternative DEQ recommends that the treatment prescription be refined for each dump based on soil analysis, slope and access considerations, and hydrological evaluation.	
E	**Glengarry Adit:** Correcting the discharge problems associated with the Glengarry Adit has baffled environmental scientists and mining engineers for decades. USFS appears to have arrived at a combination approach that should be effective at returning groundwater hydrology in the area of the Glengarry Adit to some semblance of pre-mining conditions. The suggested two-stage schedule proposed should allow for an iterative evaluation of the work as it progresses and the plan appears to be well thought out. DEQ has questions about the spacing of the grout boreholes to be placed in the area around the top of the raise, however, we assume that the borehole spacing will be modified as necessary to insure effective grout penetration.	E Grout spacing will be evaluated during construction with the monitoring of water seepage into the raise. If water seepage continues after the initial placement of grout, a second ring of tighter spaced borings will be installed and grout injected. Real-time monitoring of the seep will allow direct feedback to determine the optimum configuration of the grout curtain.
F	**Combined Alternative – Impacts To Loading** DEQ has concerns about the preferred alternative selected for the Como Basin and believes that additional evaluation should be done before a preferred alternative for that source area is selected. However, DEQ agrees that implementation of the selected alternatives should have a significant impact to the metal load to Fisher Creek and that aggressive response actions aimed at reducing metal loads to Fisher Creek are appropriate.	F Comment acknowledged.
G	**Specific Comments:** Page E-1, last paragraph, 4th sentence. Given the manner in which risk is calculated it is best to change the “no risks to human health” to “no unacceptable risks to human health”.	G Comment noted. This change was made in the public review draft of the EE/CA.

	Department of Environmental Quality Comments		*Response*
H	Page E-5, third par. Last sentence. Change to "…will probably be a little more…"	H	Comment noted. This change was made in the public review draft of the EE/CA.
I	Page E-5, 4th par. 1st sentence. Change to "Based on a recreational use scenario, there are no unacceptable human health risks…"	I	Comment noted. This change was made in the public review draft of the EE/CA.
J	Page 2, first bullet. DEQ has concerns about the use of descriptors such "…a massive near surface sulfide ore deposit…" which seem designed to give the reader the impression that the ore body is more to blame for environmental problems than the actual mining of that ore body. Neither DEQ not USFS knows what baseline conditions were in this area before human scratched the surface off the ore bodies, and burrowed into them. What is know[n] is, had the ore body not been the subject of mineral exploration and mining activities there would be no need to conduct any cleanup operations. This same comment is made regarding the conceptual model discussed on page 25.	J	Comment acknowledged. The term "ore" was removed from the text. The USDA Forest Service has provided references in the Como Basin/Glengarry Adit/Fisher Creek EE/CA that discuss the presence of natural occurrences of acid drainage in Fisher Creek prior to mining, indicating that baseline water quality conditions were likely acid and metals rich.
K	**2.3 Mining History** Siebel Wolle (Wolle 1963) appears to have been confused about the names for the different smelters in the Cooke City area. While a smelter was reportedly operating in the Cooke City area in the mid 1870's, this smelter was not the Republic smelter as the Republic smelter was constructed in 1883. The Montana State Mine Inspector notes in his 1889 Annual Report that 3 smelters (all inactive) where located near Cooke City. These were identified as a portable smelter located on Miller Creek, the Republic smelter, and the smelter of the Eastern Montana Mining and Smelting Company. The Eastern Montana Mining and Smelting Company's smelter was a separate facility from the Republic Smelter.	K	Comment noted. This correction was made in the public review draft of the EE/CA.
L	Page 12 2ed par. (Como Basin mining disturbances) A 1938 map prepared for the McLaren Gold Mining Company	L	Comment noted. This paragraph was revised to add the referenced mining disturbances in the public review draft of the EE/CA.

	Department of Environmental Quality Comments		*Response*
	(Henry Shovic has a copy) shows five sets of underground workings in the Como Basin in addition to the Glengarry raise. These include the Spaulding Tunnels (Scotch Bonnet workings) on the eastern side of the Basin, a drift associated with the "small Como dump" that was removed as part of the Selective Source Response Action, and three workings on the flanks of Fisher Mountain on the west side of Como Basin. These workings on the Flank of Fisher above Como Basic are labeled the "Cowboy Tunnel", the "Ice Tunnel", and the "Blacksmith Tunnel". In addition to these mine workings, this map also shows various exploration pits and prospect trenches, waste dumps, and 1938 era drill hole locations.		
M	**Conceptual Model:** Page 26. Discussion is made of how mineral deposits oxidize in the presence of oxygen. "When exposed to oxygen, in either mine workings, or in groundwater occupying bedrock fractures, these sulfide minerals oxidize…" This may be a true statement in that the reaction pathways are probably the same for these two scenarios, however, the rate of oxidization is much different (less) in a bedrock fracture filled with groundwater compared to the rate of oxidation for sulfide minerals in a mine workings that is open to the air and not completely filled with groundwater. Any comparison of these two scenarios should also consider the kinetics of the reaction as the reaction rate will be much higher in an air filled mine workings.	M	Comment acknowledged.
N	ARARS: DEQ legal staff has not reviewed the ARARs section of the *internal review draft EE/CA*. Comments on ARARs are not being submitted at this time. DEQ will submit any comments on ARARs prior to the deadline for public comments on the draft EE/CA. Thank you for providing an opportunity to comment on this document. With the exceptions noted, DEQ believes that the	N	Comment acknowledged.

	Department of Environmental Quality Comments		*Response*
	actions proposed are appropriate and necessary. If you have questions about any of these comments please contact me at (406) 444-4956. Sincerely, John Koerth DEQ Project Coordinator		

	National Park Service Comments		*Response*
A	L3023(YELL) Ms. Mary Beth Marks U.S. Forest Service Gallatin National Forest P.O. Box 130 Bozeman, Montana 59771 Dear Ms Marks: The National Park Service has reviewed the *May 2002 Internal Review Draft of the Como Basin, Fisher Creek and Glengarry Adit Response Action Engineering Evaluation/Cost Analysis, New World Mining District Response and Restoration Project.* We found the analysis to be comprehensive and the rationale for the preferred alternatives well documented. The excellent illustrations were very helpful for understanding the planned activities. We concur with your choice of preferred alternatives. The following comments are offered to help clarify a few areas of the document:	A	Comment acknowledged.
B	Page 43, Section 3.4.3 Loading Analysis: Please indicate the locations of the referenced tributaries on the vicinity map, Figure 3, e.g. FCT-11 and FCT-12.	B	This suggested change was made to the public review draft of the EE/CA.

	National Park Service Comments		*Response*
C	Page 75: Table 3-17 Summary of Help3 Model Input Parameters Selected for Soil Material: The waste rock hydraulic conductivities (saturated) used in this table appear to be unusually low for this material (1.8E-5 cm/sec) or equivalent to a loess material (Freeze and Cherry, 1978). Shouldn't this agree with the layer 1 values reported in Appendix A (0.9999 E-2 to 0.72 E-3) which seems a bit more realistic for waste rock?	C	The table value referred to was an error in the internal review draft. This table was revised to reflect the correct value.
D	Page 151, Section 7.5.2.2 Effectiveness, Short-Term Effectiveness, paragraph 2: This discussion could be miss-interpreted by the public. While the discharge from the Glengarry Adit would be almost completely eliminated under this alternative and is an appropriate goal, copper-contaminated flow from the Como Basin into Fisher Creek will continue as that flow moves along natural pathways. We suggest that an additional clarifying sentence be added to the end of the paragraph: "Copper-contaminated flow from Como Basin, however, will likely revert to natural pathways, and may still reach Fisher Creek".	D	Comment noted. The suggested change was made to the text in the public review draft of the EE/CA.
E	We appreciate the opportunity to comment on the *Internal Review Draft Como Basin, Fisher Creek and Glengarry Adit Response Action Engineering Evaluation/Cost Analysis New World Mining District Response and Restoration Project.* If you have any questions, please contact Mary Hektner, DOI Project Coordinator, New World Mining District Response and Restoration Project, at 307-344-2151. Sincerely, Suzanne Lewis Superintendent Cc: Bill Olsen, USFWS Bob Davis, USGS John Koerth, MT DEQ Jim Harris, EPA Michael Cormier, Maxim	E	Comments acknowledged.

	Greater Yellowstone Coalition Comments		*Response*
A	August 6, 2002 Mary-Beth Marks Gallatin National Forest P.O. Box 130 Bozeman, MT 59771 RE: Comments on Como Basin/Glengarry Adit/Fisher Creek Draft EE/CA Dear Mary Beth: The Greater Yellowstone Coalition concurs with the selection of the preferred alternatives: Como Basin Source Area - CB-3B; Fisher Creek Source Area - FC-3 (modified for removal of the Glengarry and Gold Dust waste rock dumps); and, Glengarry Adit Source Area (combination of GA-2,4,5 and 6). I have reviewed the Draft EE/CA and, along with impressions gained at the site tour on 8/5 offer the following brief comments on elements of the proposed work.	A	Comment acknowledged.
B	Dave Chamber's suggestion regarding soil stratification is sound advice. Como Basin soil material should be graded at removal so as to segment the upper layer (10 - 20 cm?) as the top layer growth medium for placement on the cap. This layer is probably less mineralized and contains some organic and amendment material from previous revegetation efforts. Mixing compost with in this growth horizon may have a significant benefit. The remaining soil cap would be treated as proposed in the preferred alternative.	B	The USDA Forest Service's current design guidelines for the Como Basin preferred alternative include salvaging and stockpiling the upper 30 centimeters of soil in the Como Basin, and using this salvaged soil as the final lift of soil that will be placed on the completed cap. This approach is practical from a reclamation perspective, and can be supported with recent laboratory analysis of soil properties for samples collected in 2002 from the upper three feet of soil in the Como Basin.
C	As we discussed on the site, the area of persistent snow deposition should be drilled to determine potential for ground water infiltration under the cap. This snow bank will extend on to the north portion of the cap for much of the already short growing	C	This suggestion was incorporated into the drilling work completed in the Como Basin in August 2002. For design purposes, the HDPE cover will be extended over the small channel at the base of the snow bank to act as a liner for the channel with the snow

	Greater Yellowstone Coalition Comments		*Response*
	season. Consideration should be made as to soil depth and revegetation strategies on this portion of the cap.		bank melting out on top of the soil covered liner, and thereby diverting its melt waters away from the deposit.
D	The west end of the Como deposit is subject to run-on from the east face of Henderson Mountain. Deepening erosion channels will wash mineralized (?) sediment into the diversion ditch at this portion of the cap. Sediment traps, rip-rap or other controls should be considered in these channels. Ditch armoring/sizing at the intersection points may prevent blow-out if a debris flow were generated. Perpetual ditch maintenance may be necessary. This problem should be closely looked at in context with the Como project.	D	The USDA Forest Service will consider these issues during the design process for the preferred alternative.
E	Construction activities in the Como Basin must be closely confined to the mineral deposit and disturbed area so as to avoid undisturbed vegetation and deep turf soils to the east of the mineral deposit. This should be part of the contract specification.	E	The USDA Forest Service will include this suggestion during the design process and specifications for avoidance and protection of this area will be included in the construction package.
F	The Glengarry waste dump footprint covers what may have been the upper portion of the wetland area at the original confluence of FCT-11 and 12 water courses. After waste removal, this area should be restored to wetland criteria.	F	The USDA Forest Service will consider this suggestion during the design process for the preferred alternative.
G	It should be noted that the Glengarry Adit area is in an avalanche runout zone which will preclude locating any permanent facilities and will require maintenance of fences around the revegetation area once the settling pond and dump is removed.	G	The USDA Forest Service is not proposing to use fencing following removal and reclamation of the Glengarry Dump. This is consistent with the reclamation practices followed for the dumps removed and reclaimed for the Selective Source Response Action.
H	The area below the Glengarry site down to where the Fisher Ck. channel enters the timber has been affected from a combination ferricrete development and surficial deposits of mine and mill wastes. This area will best recover/evolve without intervention.	H	Comment acknowledged.
I	The rip-rap placed at the temporary bridge to the Gold Dust site is obviously out of size specification. Once the mine waste is	I	Comment noted.

	Greater Yellowstone Coalition Comments		*Response*
	removed and the road rehabilitated, much of this material should be removed and/or reduced in size for a hardened stream crossing if this road is to remain open.		
J	Consideration should be given to the stabilization of the upper Homestake Mine structures which provide an interesting context to the Gold Dust site restoration.	J	Comment noted.
K	We're pleased to see the integration of the GNF travel management process with the NW project. Road closure and rehabilitation opportunities should be analyzed in this context. The portion of District Properties that lie on the Custer National Forest should be integrated into this process through administrative agreement between the GNF and CNF so as not to fragment District Property management. Thank you considering these comments. We continue to look forward to working with you on this project. Sincerely, Don Bachman On behalf of the Greater Yellowstone Coalition e-mail distribution to project working group	K	Comments acknowledged.

	Center for Science in Public Participation Comments		*Response*
A	July 1, 2002 TO: Mary Beth Marks Gallatin National Forest P.O. Box 130 Bozeman, MT 59771 RE: **Comments on Como Basin/Glengarry Adit/Fisher Creek Draft EE/CA** Mary Beth: I have only one comment on the EE/CA: **1. Preferred Alternative CB-3B for Como Basin** Alternatives CB-3B and CB-3C are essentially the same, with the exception that CB-3B utilizes metal-rich amended soils above the liner, while CB-3C uses imported cover soil. The cost of each alternative is also essentially the same – approximately $2 million each. My concern is that even if the metal-rich soil is amended to keep the pH in the positive-to-neutral range, there is still a significant amount of metal contamination in the soil that could affect revegetation. The Como material is essentially a mineral deposit. While soils in the Fisher Mountain area are admittedly poor, there is still reason to believe that they are not as heavily metal-laden as those materials in the Como deposit. Amending the Como material with lime to elevate the pH would not necessarily keep plants from being affected by the high metals in the soil. Recommendation: If the metal-rich Como soils are to be amended and utilized as soil on top of the Como liner, chemical soil testing should be done to compare the metal loads of this material with soils in the vicinity that have successfully supported local vegetation. If the amended Como material contains significantly	A	Soils data for the Como Basin was collected at five barren areas and one reference area in 1999 for long-term revegetation monitoring (*1999 Long-Term Revegetation Monitoring Report, Final, New World Mining District Response and Restoration Project, Prepared for the USDA Forest Service, Prepared by Maxim Technologies, Inc., March 7, 2000*). These data are tabulated in Table E-2, Appendix E of this report. Data indicate that generally only copper and aluminum have concentrations greater than a reference sample, and it is postulated in the report that the combination of high aluminum and copper concentrations with low pH was one explanation for a lack of vegetation. Data collected by Dr. Ray Brown of the USDA Forest Service demonstrates that native vegetation is capable of growing in these type soils if correctly amended with lime, fertilizer, and organic materials. The USDA Forest Service's current design guidelines for the Como Basin preferred alternative include salvaging and stockpiling the upper 30 centimeters of soil in the Como Basin, and using this salvaged soil as the final lift of soil that will be placed on the completed cap. This approach is practical from a reclamation perspective, and can be supported with recent laboratory analysis of soil properties for samples collected in 2002 from the upper three feet of soil in the Como Basin.

Center for Science in Public Participation Comments	*Response*
more metal, then the amended Como material should be: (1) augmented with contaminant-free soil until the overall metal content is similar to those soils that have successfully supported vegetation, or (2) replaced with soil material similar to that which has successfully supported local vegetation, as proposed in Alternative CB-3C. Thank you for considering this comment. Sincerely; David M. Chambers Cc: Don Bachman, GYC John Koerth, DEQ Mike Cormier, Maxim	

	Beartooth Alliance		*Response*
A	August 18, 2002 Mary Beth Marks, OSC Gallatin National Forest P.O. Box 130 Bozeman, MT 59771 Re. Como Basin/Glengarry Adit/Fisher Creek Response Action, Draft EE/CA Review. Dear Mary Beth; I have completed review [of] this draft plan on behalf of the Beartooth Alliance. We concur with the preferred alternatives selected for each of the three components of the response action.	A	Comment acknowledged.
B	The on-site review of the subject EE/CA draft on August 5th was very beneficial in facilitating the planning process. Several suggestions were made for considerations in the final design, which we trust, will be carried forward. Considerations deserving of careful special attention include the following. 1. Location of the run-on control ditch along the northwest side of the basin, relative to the location of the near-perennial snow bank, is critical to its proper function. Keep in mind that the snow bank is often more extensive that what we viewed on the 5th.	B	Comment noted. The USDA Forest Service will consider this suggestion during the design process for the preferred alternative and may cap the area to address the concern for run-on from this snowbank.
C	2. Design of the cap and run-on control facilities should consider the possibility of subsurface flow passing beneath the cap. A cutoff trench and/or impermeable lining in the ditches, in selective locations, may be advisable.	C	Comment noted. The USDA Forest Service will consider this suggestion during the design process for the preferred alternative and may line the run-on control ditches to prevent this occurrence.
D	3. The restoration work in the basin will, by design, change the surface runoff characteristics of the immediate area. The impermeable cap and run-on control measures will result in more rapid (flashier) runoff, stressing the hydraulic capacity	D	Comment noted. The USDA Forest Service will include this concern in the alternative design.

	Beartooth Alliance		*Response*
	and stability of the two first order tributaries that drain this area and flow past the Glengarry Adit. Special channel stabilization measures such as constructed drops may be necessary to prevent scouring, etc.		
E	While touring the area on August 5th, I made some observations which deserve your attention. The first concerning the short piece of road that departs the Lulu road and runs between the upper and lower Spaulding dumps that were removed last year. The first approximately 100 yards of the roadbed is experiencing considerable erosion. The road has been closed by signage only but no erosion control measures were applied.	E	Comment noted. It is likely that road closure for this road will be included in the Como Basin construction package.
F	On my July 19th visit to the area, I observed very deep equipment ruts in the Miller Creek road, a short distance off the main Daisy Pass road. It appeared that the ruts had resulted from moving a large wheel mounted water tank to the bank of Miller Creek and the ruts run downslope directly into the creek. I reported this observation but on August 5th found that nothing had been done to correct the damage.	F	Comment noted. This area was reshaped and reseeded by the contractor responsible for the roadwork following your July visit.
G	Finally, I stopped at the fuel tank that is located adjacent to the Fisher Creek Road a short distance below the repository. The basin constructed around the tank to contain spillage contained one foot of water. I am wondering whether that leaves adequate capacity in the basin to contain the contents of the fuel tank? We appreciate the opportunity to participate in the review process and look forward to working with you as plans for restoration of these source areas are implemented. Sincerely, Mike Whittington Email: Working group and Beartooth Alliance Board of Directors	G	Comment noted. The contractor responsible for managing the fuel tank pumped the basin for winter shutdown purposes and has left a minimum amount of fuel in the tank.

	USDA Forest Service, Marion Cherry, Wildlife Biologist		*Response*
A	NWM Reclamation, T&E comments, M. Cherry 11/18/02 Draft EECA, p. 119, paragraph 3 Listed species found on the Gallatin NF presently include the grizzly bear, bald eagle, Canada lynx and gray wolf. (add lynx, delete peregrine falcon from existing wording). You probably should note that this area lies within the Grizzly Bear Recovery Zone for the Yellowstone area.	A	The list of threatened and endangered species is incorporated into the Action Memorandum for the proposed Response Action and is mentioned in the Final Executive Summary of the Engineering Evaluation/Cost Analysis.
B	p. 120, last paragraph, see comments for p. 28 second paragraph, the document states no impact and then discusses increased traffic, etc. Long-term impacts are not addressed and need to be disclosed. Disagree that there will be no impact – reclamation activities themselves involve heavy equipment, noise, and improved roads, which influence disturbance and displacement. The roads that have been improved by gravel, grading, bridges and other modifications are now good enough for cars to drive the most of the loop up to Daisy and Lulu passes. The bridges are permanent structures that allow wheeled vehicular traffic to enter the road system earlier in the spring than usual. This road improvement brings in more traffic, all kinds of vehicles, and increases use of the area. Risk to grizzly bear mortality increases due to more people, more recreation, possible availability of food attractants, increased traffic speeds, etc. and disturbance to grizzly bear habitat. Displacement of wildlife species, such as the grizzly bear, is increased by disturbance. The overall impact of the land reclamation itself is neutral to beneficial to wildlife, however the modification of the transportation system in the area is currently having impacts and could have long- term impacts on wildlife, depending on what happens to the road system in the future. Pretty much the same for a number of other locations found in the document including the following: pp. 127, 129, 136, 137, 140, 146, 152, 159, 166, 173, 180	B	This comment has been incorporated into the Action Memorandum for the proposed Response Action and is mentioned in the Final Executive Summary of the Engineering Evaluation/Cost Analysis.

	Dan Stanley		*Response*
A	Drsnuworld@aol.com To: mmarks@fs.fed.us cc: bkirkpatrick@fs.fed.us 07/03/02 Subject: Glengarry Como EE/CA 12:17 PM Mary Beth, Although I have only read the executive summary of the Glengarry/Como EE/CA, and do not have a copy of the full report, there is one troubling item that concerns me. During the early 1990's, when Crown Butte was finishing up their exploration drilling, Allan Kirk authorized the disposal of circulatory drill cuttings from throughout the district in the Como basin. These drill wastes, and the plastic bags containing them, were dumped in the basin and bulldozed into the soil. I do not know if permits for this disposal were obtained or not, but given Allan's history with obtaining the necessary permits during his management of CBMI's operations, I suspect no permits were issued. The drill cuttings themselves are probably insignificant, as the material is unlikely to be much different than the material that was already there. The plastic bags may be a different matter. I have not seen any reference to testing for poly-chlorinated vinyles nor have I seen any assessment as to what effect the decomposition of these bags may have on the soil and water chemistry. Allan should know the character of the material dumped there, but to my knowledge he has not been forthcoming with that information.	A	In the late fall of either 1992 or 1993; a number of reverse circulation drill-cuttings samples were disposed of in the Como Basin. Reverse circulation drilling is an air rotary percussion drilling technique that produces rock chips and finer material as samples. These cuttings samples were composite samples, generally collected over five-foot intervals in the drill hole. All of the samples disposed of in the Como basin were only weakly mineralized or barren of sulfides, as all ore-grade and significantly mineralized samples were retained in the projects sample storage facility. Samples weighed between 1 and 20 pounds per sample, and there may have been as many as 5,000 samples that were disposed of in the Como basin. The samples were bagged (one for each 5 foot interval) in 10” x 15” plastic bags. Cuttings samples were placed in an approximately 10’ x 10’ x 15 foot deep hole excavated in the unconsolidated surficial material consisting of weathered in place massive sulfide, and sulfide-bearing rock in the Como Basin. Drill-cutting samples were trucked from Crown Butte Mine’s storage facility in Cooke City to the Como Basin excavation. Initially the plastic sample bags were slashed, the samples discarded into the excavation and the sample bags trucked back to Cooke City to be discarded. This was a very slow process and, with the weather becoming worse with snow at the end of the working season, the remaining 1,000 to 1,500 samples in plastic bags were placed into the excavation in the Como Basin. When all of the samples had been discarded, the excavation was backfilled, and the topography reshaped. No permits were obtained for sample disposal. With respect to the samples discarded, rock material is likely less of a problem (with respect to sulfide and metal content) than unconsolidated material that occurs naturally at the surface in the Como Basin. Plastic bags, although unstable when exposed to ultraviolet light in a weathering environment, are relatively stable in a buried subsurface environment. Degradation of plastic bags in modern day landfills has been shown to be minimal and this is expected to be the case

	Dan Stanley		*Response*
			in the Como Basin. With the capping of these materials by an impermeable high density polyethylene liner, the bags that were buried in the Como Basin are not expected to have any deleterious effects on the environment.
B	On a slightly different matter, I was to the Glengarry yesterday and the entire discharge from the FCT-11 drainage is flowing across the waste pile and into the sediment holding pond. The invert pipe on the discharge end is partly blocked with snow fence and debris from avalanches. There is no danger of the water over topping the pond berm, as a overflow channel had been constructed. The water from FCT-11 is, however, reacting with the mine waste contained in the pond which in all likelihood is resulting in increased loading of metals to Fisher Creek. The CMP pipe that was diverting the FCT-11 flow past the waste pile was damaged last year by IT when the FCT-11 drainage was dry. They were supposed to have replaced the damaged section before leaving the site but obviously did not do so. I though I would bring this to your attention. Dan Stanley	B	Comment appreciated.